FERNS AND FERN-ALLIES OF NEPAL

Volume 1

C.R. Fraser-Jenkins
D.R. Kandel
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Government of Nepal
Ministry of Forests and Soil Conservation
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FOREWORD

It gives me immense pleasure to look into the comprehensive account of the *Ferns and Fern-allies of Nepal* written by a renowned pteridologist Mr. Christopher Roy Fraser-Jenkins. I feel very glad that the Department of Plant Resources has taken initiative to collaborate with the principal author and publish the book. The ministry has felt the need of updating the checklist of all flora and fauna of Nepal. That way the government would enrich its data on the biological resources of Nepal and fulfilling the international obligations such as the Convention on Biological Diversity 1992. I hope the publication of this type of book will certainly fill the gap of knowledge of scientific community as well as general readers.

The Department of Plant Resources has been engaged in studying and publishing books on the Nepalese flora since its establishment, with the major aim to complete the publication of the *Flora of Nepal* by 2020. Publication of *Ferns and Fern-allies of Nepal* is a step towards achieving the goal of completing the documentation of floral wealth of Nepal. A country like Nepal which is well known for its biodiversity, can boost its economy by developing proper technology and products concerning its biological resources. I urge the scientists and other management staff of the Department of Plant Resources to develop innovative technology based on fundamental scientific researches.

I express my appreciation to the authors of the book who have carried out this splendid work. I also appreciate the pioneering effort of Mr. Yam Bahadur Thapa, Director General of the Department of Plant Resources. The scientists who have contributed their valuable time and resources while collecting the herbarium specimens from many localities of Nepal deserve our special appreciation. I encourage the unceasing dedication of the team of National Herbarium and Plant Laboratories (KATH) to house and maintain thousands of specimens of ferns, mushrooms, and the flowering plants. This ministry continues to support such scientific works and publications. I hope the Department of Plant Resources will be able to liaise with outstanding plant scientists and produce a series of good publications which will enrich the domain of our knowledge.

April, 2015

Mahesh Acharya
Honourable Minister
Ministry of Forests and Soil Conservation

FOREWORD

Nepal harbours about 2.5 percent of the floral diversity of the World. The diversity presents us a great prospect in terms of biological diversity and its economic implications. The great prospect means the more work has to be accomplished to reach the goal of prosperity. The Department of Plant Resources is one of the five departments under the Ministry of Forests and Soil Conservations which is focused on the Research and Development of plant science and plant products. It also delivers service of plant identification and plant product certification. The government of Nepal has also envisaged a 2020 action plan under Nepal Biodiversity Strategy and Action Plan 2014-2020. Publication of all volumes of Flora of Nepal by 2020 is one of its implementation plans and activities.

Owing to its discipline, the Department has produced this important volume of *Ferns and Fern-allies of Nepal*. The great effort of Mr. Christopher Roy Fraser-Jenkins is a milestone work in this field of science. I think, this volume of book not only produces the account of pteridophytes of Nepal but also serves as a reference checklist of the ferns distributed in the Central Himalaya. I hope this volume of book also contributes to achieve the goal of 2020 goal of Flora of Nepal.

The indigenous communities all over the world have developed their own systems of utilizing the plants and animals. In the same way, Nepalese people also have a tradition of using the plants in various occasions in different ways. Young, uncurling fronds of several species of fern are used as vegetable in Nepal and are sold in markets. Some communities of Nepal also use them to treat various ailments. Further research on fern and fern allies of Nepal is therefore needed to explore the benefits from these plants. Such research works need on the accurate taxonomic identification as well as detail understanding about the ecology and other traits. I hope this book provides some of the fundamental objective of identification and localization of the pteridophytes of Nepal and adjoining regions of Central Himalaya.

I am really thankful to Mr. C. R. Fraser-Jenkins, who has voluntarily contributed the results of many years of his research, field based knowledge and expertise as a manuscript of this book. The co-authors Mr. Dhan Raj Kandel and Ms. Sagun Pariyar are also duly acknowledged for their contribution to prepare this book.

The credit of publication goes to Mr. Yam Bahadur Thapa, Director General of the Department of Plant Resources and the team of National Herbarium and Plant Laboratories (KATH). I am also looking forward to upcoming volumes of scientific works from the Department.

April, 2015

Sharad Chandra Paudel
Secretary
Ministry of Forests and Soil Conservation

FOREWORD

Nepal, with its varied climate, landscape and altitude due to its position along the central Himalayan chain, is remarkably rich in plant diversity. Intensive study both at home and abroad has been made of the different groups of animals and plants that make up its fascinating and important fauna and flora, adding greatly to our knowledge of the Earth's biodiversity. But certain groups of both animals and plants are still not known well, or have been largely misunderstood. Due to humankind's deleterious effect on the environment it may come about that some of these less known species may be lost by extinction before people are even aware of their identity and relations. Detailed study, group-by-group, is lacking for certain groups, yet we need to identify these plants precisely, both for their possible future utilisation and as well as for their protection as part of the natural heritage not only of our nation, but of all humanity. It is obvious that in complex groups such as the present one, without accurate taxonomic identification, research carried out in academic and applied branches of life sciences is confused and may be next to worthless.

Ferns and fern-allies, non-flowering vascular plants, are one of the overlooked groups about which imprecise knowledge and confusion has prevailed. But they constitute a large part of plant biomass, especially in our country's extensive forests and high Himalayan ranges, and are predominant and obvious to all who dwell here or come to visit. They are major components of the ecosystem and we should protect their diversity and understand which are rare and require habitat protection and which are common and widespread.

In the countryside, many of them are of domestic use, either as foodstuffs such as for spinach, *sag*, or as domestic animal bedding, or in the Florists' and horticultural trade. Many splendid ornamental ferns are found in Nepal, from several species of stately tree-ferns to attractive herbaceous plants. In addition a number of ferns are used traditionally in local medicine and need to be investigated scientifically to study effective compounds and sort out which are merely superstitious and symbolical usages and which really have genuine benefits. But since many of the genera are highly complex and critical, the possibility of confusion in identification and applying names has to be eliminated by detailed and accurate study and cataloguing. Full information about forest plants concerning their uses, ecology, distribution pattern and status is essential for their sustainable management and utilisation.

I hope that with this *Ferns and Fern-allies of Nepal*, people will no longer think "they all look the same" and may begin to see how different and distinct they all are. I believe it will be most helpful and has succeeded in casting much light on the correct identification of ferns and fern-allies of Nepal and thence of the whole Sino-Himalayan region. The book will be of much use to researchers, students, farmers, gardeners and forest-user groups as an authoritative guide to knowing and recognising these hitherto

rather neglected plants, and may generate awareness towards conserving them for their intrinsic value and usage.

I would like to thank Mr. Christopher Roy Fraser-Jenkins, Kathmandu, Mr. Dhan Raj Kandel, Assistant Research Officer of the National Herbarium and Plant Laboratories, Godawari, and Miss Sagun Pariyar, Deurali, Gorkha, for their parts in writing this book. I am also thankful to Mr. Sanjeev Kumar Rai, Deputy Director General of Department of Plant Resources, Mr. Ramesh Basnet, Chief of the National Herbarium and Plant Laboratories, Godawari, Dr. Keshab Raj Rajbhandari, Senior Taxonomist and Mr. Ganga Datt Bhatt, Assistant Research Officer of the National Herbarium and Plant Laboratories for their advice, support and cooperation towards the preparation and publication of this book.

I would like to express my gratitude for the financial support provided by the United States Agency for International Development (USAID) funded Hariyo Ban Program. I would also like to thank the consortium partners of the program – WWF Nepal, Cooperative for Assistance and Relief Everywhere (CARE) Nepal, Federation of Community Forestry Users, Nepal (FECOFUN) and National Trust for Nature Conservation (NTNC).

Yam Bahadur Thapa
Director General
Department of Plant Resources

AUTHOR'S FOREWORD

The fern flora of the west Himalaya and of Darjeeling and Sikkim, on either side of Nepal has been well known for a long time due initially to the collection and study of mainly British and subsequently Indian botanists over the last two centuries. But the ferns of Nepal remained relatively little known until more recent times and their distribution in between the western and eastern part of the Himalaya is often left as if a blank on the map. The first preliminary and small collections of ferns were made in 1802-3 by the Scottish Doctor and Surveyor, Francis Buchanan, later Francis Hamilton, and then from 1817-1819 and onward by the Hon. Edward Gardner, British Ambassador in Kathmandu, leading to Nathaniel Wallich's more extensive collections in 1820-1821 for the then Royal Botanic Garden, Calcutta, which were then distributed world-wide. A number of Nepalese ferns were thereby enabled to be included in David Don's (1824) *Prodromus Floræ Nepalensis* and others were published by Wallich and Sir William Hooker, of Glasgow and Kew. But even so, less than a quarter of Nepal's pteridophyte flora was known by the mid 20th Century.

In more modern times, detailed and extensive botanical collection was carried out first by Polunin, Stainton, Sykes and Williams and Dr. R.L. Fleming Sr., from 1949 to the 1970s, and then by the Japanese East Himalayan expeditions of the 1960s and 1970s, continuing to the present day. Numerous important collections were also made by the Department of Plant Resources, Godawari, Kathmandu, from the 1960s onwards. But since the Japanese publications (notably that of Iwatsuki 1988) dealt mainly with their own collections, the extensive pteridophyte collections from British and other expeditions and from the D.P.R. have largely been missed out and remained unpublished apart from in a few smaller works. The first comprehensive and critical account of Nepalese ferns was therefore not made until 2002 by Mr. Naresh Thapa, of the Department of Plant Resources, with the detailed help and collaboration of the present first-named author.

But the taxonomy of S. Asian and Indo-Himalayan ferns has been much revised since then, due largely to the research carried out by the present first-named author among others, who has studied ferns in Nepal for the last 30 years and has also worked through and reidentified them in all the main international herbaria. He has been been fortunate enough to have been personally acquainted with many well known collectors in Nepal during his work at the BM, including as colleagues the late Oleg Polunin, Adam Stainton and Dr. Bob Fleming, and subsequently in Japan. Not only their and others' collections in international herbaria, but also full details of the large and now fully re-identified and revised fern holdings in the National Herbarium of Nepal have become available due to the first authors' study, combined with his own detailed field collection and experience. It is therefore appropriate to present here a comprehensive and hopefully more definitive study of Nepal's rich pteridophyte flora, with a view to enthusing others and providing an accurate base-line for future fern study in Nepal and the whole Sino-Himalayan region

with which it is intimately connected. It is also intended to provide the otherwise lacking accurate specialist basis for the account of pteridophytes in the ongoing *Flora of Nepal*. It is our privilege to be able to join the long lineage of Botanists involved with the Nepalese Flora and we hope to fill the lacuna left by the exclusion of Pteridophytes from the *Enumeration of the Flowering Plants of Nepal* (Hara, Stearn, Williams & Chater 1978-1982).

Christopher Fraser-Jenkins
Kathmandu (chrisophilus@yahoo.co.uk), April, 2015

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He is also grateful to Dr. Mark F. Watson, RBGE, for his help with the application and administration of the grant from the Sibbald Trust and for his invitation to him to prepare the account of pteridophytes for the *Flora of Nepal*, for which the present work is intended to provide the much needed specialist basis for conversion into the format of the Flora account. He is grateful to Dr. K.R. Bhattarai, former Chief of the National Herbarium for his invitation to the senior author to engage in the present work, thus renewing his long-standing connection with the Department of Plant Resources which first started in 1989.

Detailed taxonomic work of this nature, requires not only great experience in the field and intimate familiarity with ferns leading to the ability to recognise all the species immediately, but must also entail much travel abroad to undertake essential herbarium study in all the main herbaria containing Nepalese ferns. Nowadays this involves expense well beyond the reach of most individuals, and with the almost total cutting and unavailability of institutional grants for taxonomy, especially for sufficiently knowledgeable and thus older workers, such essential study is almost impossible to put into practice. However apart from his own privately used funding in all aspects of the work, the senior author has been extremely fortunate to have been most generously supported along the way by both the private generosity of individuals, and by individuals belonging to various organisations pushing for rare financial support for his herbarium study. The latter have been mentioned above. Greatly appreciated individual help both in providing accommodation and in travel funding was most kindly given by Dr. Peter J. Edwards, Royal Botanic Garden, Kew, for a three month stay in 2012; Dr. Rebecca Pradhan, World Wildlife Fund, Thimphu, Bhutan, for a two week stay in 2011; Dr. Michael G. Price, University of Michigan herbarium, Ann Arbor for a three week stay in 2014 (in addition to the jewels of much taxonomic sharing and a copy of the Nepal list given him by Dr. Stewart); Dr. Sadamu Matsumoto, of the National Science Museum, Tokyo, for a two week stay in 2011; Professor Emeritus Dr. Peter Raven, of Missouri Botanic Garden,

St. Louis, for plane-fares for a month and a half stay in the U.S.A. 2014; Professor Alan Smith, University of California herbarium, Berkeley, for a two week stay in 2014; Professor Dr. Georg Miehe, Dr. Juergen Kluge and Dr. Phyo K. Khine (Myanmar), Fachbereicht fur Geographie, Universität Marburg, for plane-fares and a two week stay in 2014; Dr. B.S. Kholia, Botanical Survey of India, Himalayan Circle, Gangtok, for two week's stays in 2006 and 2012; the late Dr. H.C. Pande, Botanical Survey of India, Northern Circle, Dehra Dun, for several visits over the last 5 years; and Professor Emeritus S.C. Verma, Dept. of Botany, Panjab University, Chandigarh, for several weeks stay including enabling photographing all the pteridophyte holdings. In addition much help has been given during visits to herbaria by Professor S.P. Khullar, Dept. of Botany, Panjab University; Dr. Keshab R. Rajbandhari, National Herbarium, Godawari, Kathmandu; Dr. A.A. Ansari, Botanical Survey of India, Central Circle, Allahabad; Dr. D.K. Singh, Additional Director, Botanical Survey of India, Howrah, Kolkata; Dr. P. Venu, Curator of the herbarium, B.S.I., Kolkata; and Professor G.K. Srivastava, Botany Dept., Allahabad University.

The second author is highly grateful to Mr. Yam Bahadur Thapa, Director General of the Department of Plant Resources, for his support, encouragement and advice in the publication of this book. He is indebted to Mr. Sanjeev Kumar Rai, Deputy Director General, Department of Plant Resources and Mr. Ramesh Basnet, Chief of the National Herbarium and Plant Laboratories, Godawari, for their valuable suggestions and discussion concerning this book. He would also like to thank Dr. Sushim Ranjan Baral, Dr. Khem Raj Bhattarai and Mr. Sunil Kumar Acharya, former Chiefs of the National Herbarium, for their encouragement with the same, and is most grateful to Mr. Ganga Datt Bhatt and Dr. Keshab Raj Rajbhandari for most helpful information and assistance at various stages of this work. Dr. Rajbhandari has kindly availed us of his great experience and knowledge in finding the Districts for a number of difficult and obscure place-names which had left us floundering. He gratefully acknowledges the help of all concerned colleagues, staff of the National Herbarium, Godawari, and of Mr. Madhu Sudan Thapa Magar, Chief of the District Plant Resources Office, Kailali.

We gratefully acknowledge the help and assistance of the directors, curators and staff of the following herbaria, among others worked through by the senior author, K, BM, E, B, P, G, PHMR, KATH, TUCH, CAL, BSHC, BSD, BSA, PAN, THIM, PE, TAIF, TI, TNS, KYO, MICH and UC. In particular, Dr. A. Ebihara, of the National Museum of Nature and Science, Tsukuba, and Professor K. Iwatsuki, Tokyo, have most selflessly found time to look up and provide images or information concerning a number of important specimens at TI, TNS, TKB and KYO that we were unable to see apart from during earlier visits. Finally we are extremely grateful to Mr. Yam Bahadur Thapa, Director General, Mr. Sanjeev Kumar Rai, Deputy Director General of Department of Plant Resources and Mr. Ramesh Basnet, Chief of the National Herbarium, for their generous provision of facilities and publication of the present work undertaken at their request. We hope in our efforts we have been able to live up to expectations of the project.

CONTENTS

INTRODUCTION

A fully revised annotated checklist and critical account of 550 species and an additional 30 subspecies of pteridophytes, a total of 580 taxa, occurring in Nepal is presented here. It is based on specimens seen and reidentified by the first-named author in the main herbarium holdings from Nepal, which are preserved in K, BM, E, KATH, TUCH, CAL, TAIF, TI and MICH, with smaller holdings in other herbaria he has visited, in addition to his own extensive collections and field study of pteridophytes carried out throughout Nepal over the last 35 years since 1988. It also includes the very large collections made by Nepalese botanists of the Department of Plant Resources since the late 1950s at the National Herbarium, Godawari (KATH), which have been completely revised and critically reidentified by the first named author, as well as the large collections made by the pioneer pteridologist and ornithologist in Nepal, the late Dr. R.L. Fleming Sr., at MICH, KATH, DD (W.C. Nepal, 1949, see Raizada & Vaid (1952)), F and BM (and some earlier Fleming collections from Mussoorie from 1942 *etc.* are at US). Unfortunately funding has not been available to enable him to complete his recent partial study in E, or his earlier study in US, KYO, TNS, TKB and TI, and he has not visited KANA, TUS, TUAT, but images *etc.* of some of the most important specimens from TI and KYO have kindly been provided recently by Professor K. Iwatsuki, and via Dr. A. Ebihara, but in particular the still uncatalogued collections of Dr. Tabata (at KYO) have unfortunately not been possible to study in full.

The present work provides a definitive account of the taxonomy of Nepalese ferns and fern-allies as we now know them, along with precise descriptive diagnoses for their identification and detailed District-listing of their ranges in Nepal including indication of their range in adjacent Himalayan countries, all based on specimens seen and confirmed and determined by CRFJ in many herbaria to be available for beginners and students. It is thus helps to bridge the former gap in our knowledge of Indo-Himalayan pteridophytes where Nepal is concerned, as well as providing an accurate specialist-produced baseline, which he was invited to provide for the account of pteridophytes of the *Flora of Nepal* (Watson, Pendry & Ikeda 2011, Watson *et al.* 2011 etc.), and which would otherwise have been entirely lacking. Many new records have been made from the first author's collections and identifications. CRFJ's Nepalese herbarium collections of nearly 6000 numbers (out of a total of over 35,000 numbers of pteridophytes, all listed on computer), made from 1988 to the present day, have recently been entirely revised and re-listed by him and are either incorporated [BM, H, TAIF], or are being actively incorporated [E] in the four main herbaria holding them, BM, E (transferred from NMW), H and TAIF.

In the list a number of representative collections of every species or subspecies have been cited from many of the Districts under each major region (W., C. and E.) of Nepal. Rare, critical and interesting species have additional collections cited and every

species is classified phytogeographically and has some brief ecological information and where relevant, its threatened status for India and Nepal added. Photographs taken by the authors are also provided of selected less photographed or less well-known species.

Phytogeography of Nepalese pteridophytes

The pteridophyte flora of Nepal does not constitute a separate floristic group from that of the rest of the Indo-Himalaya, but consists mostly of eastern Himalayan species belonging to the Sino-Himalayan and S.E. Asian elements in the flora, extending and attenuating westwards towards the west Indo-Himalaya. There are three main floristic elements of pteridophytes in Nepal, along with a small fourth element (see Fraser-Jenkins 1986). It should be noted that many ferns show phytogeographical distribution patterns very well due to their light spores being able to blow anywhere. Thus their ranges often approach the maximum possible extent climatically and microclimatically - wherever they are capable of occurring they usually do. But though this applies to most, it evidently does not apply to all species as some remain very restricted and rare for reasons which are not understood despite a few recent artificial attempts to classify the causes of rarity mainly by Russian botanists.

Of the different geographical elements in Nepalese pteridophytes, first there is the relatively small number of **European elements** of Alpine and Mediterranean affinity which have reached the W. Indo-Himalaya (see Fraser-Jenkins 2014) a small number of which extend eastwards into N.W. and sometimes N.C. Nepal, typical examples being *Cystopteris montana*, *C. fragilis* subsp. *diaphana*, *Asplenium septentrionale*, *A. ruta-muraria* and a recent geographical vicariant, *Asplenium fontanum* subsp. *pseudofontanum*. More European elements are known from the far-west Indo-Himalaya (see Fraser-Jenkins 1992, 1993, 2013) in Pakistan and N.W. India.

Then the two major elements in the flora are the S.E. Asian (Malesian) and Sino-Himalayan elements, comprising some 80% of the fern-flora.

The **Malesian element**, which includes peripheral S.E. Asian species even if not known from the strictly Malesian area itself in a few cases, consists mostly of subtropical species, connected via Myanmar and Thailand to S.E. Asia, such species are mostly found at lower-mid to mid altitude in the Siwalik and Mahabharat ranges, which are the outer to mid-ranges of hills and mountains, south of the main Himalayan ranges. They include species such as *Selaginella ciliaris*, *Pteris biaurita*, *Microlepia rhomboidea* and *M. speluncae*, *Diplazium sikkimense*, *Dryopteris sparsa*, *Bolbitis heteroclita* and *Stenochlaena palustris*.

The **Sino-Himalayan elements** are mainly more temperate and montane species centred on upper-mid to higher altitude elevations and the southern slopes of the main Himalayan ranges. Their centre of distribution is in the East Himalaya of S.W. China, S.E. Tibet and N. Myanmar and a number of them also appear to have migrated eastwards along the stepping-stone ranges of south China to Taiwan and/or in some cases as far as

Luzon in the northern Philippines. Many of them do not extend as far east as the Sino-Japanese region of coastal E. China and Japan, though certain more widespread Sino-Himalayan species may do so. In addition the Sino-Himalayan element contains two extra subgroups - a high-altitude **Tibetan subtype** (Fraser-Jenkins 1986) that occurs near the uppermost biological levels of the main-ranges and in the high-altitude semi-arid zones behind the main ranges. Typical examples are *Notholaena delavayi*, *Asplenium nesii*, *Athyrium wallichianum*, *Woodsia lanosa*, *Dryopteris komarovii* and *Polystichum lachenense* and its other relatives in Sect. *Sorolepidium* and *Lepisorus clathratus* Then a second subtype is the small number of Sino-Himalayan species belonging to a local, partly endemic **West Himalayan subtype**, which extends eastward from the west Indo-Himalaya to W. and C. Nepal; typical examples are *Athyrium mackinnoniorum* and *Dryopteris stewartii*. Some West Himalayan species occur again in a bicentric distribution pattern further east, from Bhutan to Arunachal Pradesh and Tibet, in a second region of rather drier climate beyond the intense and very narrowly seasonal monsoonal climate of the central Himalaya (from Nepal to Sikkim).

Finally there is a much smaller but very interesting peninsular-Indian, or **Deccan element**, whose species are largely of Malesian connection, but interestingly often have African or Afro-Arabian connections instead, or are even African species, and have extended northwards through the hill-ranges of south India and managed to cross the Ganga valley to reach the Babhar and Siwalik foothills and some outer parts of the Mahabharat ranges. Quite a number of these species either do not reach China or are rare and restricted there. Examples of this small element are *Selaginella bryopteris* (both aristate and non-aristate leaved forms, the latter directly linked to the Afro-Arabian flora), *Aleuritopteris bicolor* and *Athyrium falcatum*, while there is one remarkable example of an African species that occurs nowhere else in Asia, *Actiniopteris semiflabellata*, known from several places in C. and E. Nepal. Another species, the beautiful and distinctive *Selaginella fulcrata*, has an extraordinary distribution, almost endemic to the lower foothills of central Nepal (though just extending over the border into northern Bihar, India), where it is abundant on shaded roadside banks etc. This distribution is difficult to relate to any of the known phytogeographical elements, but might perhaps fit best with the African and/or Deccan elements, if not with Malesian ones.

The majority of the typical Himalayan species from upper mid-altitude and N. Nepal are Sino-Himalayan elements, and most of the lower altitude and outer Himalayan or foothill and *terai* species are S.E. Asian elements. The recent discovery mainly by the first author of a number of supposedly East Nepalese or East Indo-Himalayan species extending westwards into Central or West Nepal, particularly in the anomalous wetter Pokhara enclave, emphasises that Nepal has a largely East-Himalayan pteridophyte flora. The zone with the greatest number of species dropping out (not extending further west in the Indo-Himalaya) lies in far West Nepal, near to or extending shortly beyond the western border of Nepal with Uttarakhand State of India. Far West Nepal also has the largest proportion of European elements, as would be expected, a number of which also extend

as far east as the drier, inner Himalayan Mustang District, or slightly further, in W. Central Nepal.

Within Nepal the region with the greatest number of species recorded is Central Nepal (consisting of the Central and Western Development Regions), even though Eastern Nepal is to be expected climatically to be richer in numbers. This is undoubtedly due to the greater density of collecting centred on Kathmandu, Langtang and Pokhara and undercollection in Western and Eastern Nepal. Western Nepal (the Mid-Western and Far-Western Development Regions) has the lowest number of species recorded, which is to be expected from its generally drier climate, despite the increased proportion of European elements there, as the number of S.E. Asian and Sino-Himalayan species gradually decreases westwards in the Indo-Himalaya (see Fraser-Jenkins, 2014). However it is clear that the figures for W. Nepal are artificially considerably lower than they should be, as there are some 82 species or subspecies which are known on either side of W. Nepal (*i.e*. from both C. or E. Nepal and the Western Indo-Himalaya in India, mainly in neighbouring Uttarakhand State), but are absent from W. Nepal. This is entirely due to undercollection, west Nepal long being the least collected region of the Country due to its remoteness and inaccessibility, though due to further recent collections in the west, east Nepal's richer biodiversity is probably now not far behind in terms of undercollection. Thus also for E. Nepal, some 53 species are known from either side, but are missing there and there are other species that approach closely towards Nepal in Sikkim and Darjeeling, which could well just extend into E. Nepal, but have not yet been found there. The general trend, though, remains the above-mentioned decrease in species numbers from east to west, with an anomaly around Pokhara, where the climate is unusually wet due to the Himalayan main ranges of Annapurna and Dhaulagiri being nearer the plains than elsewhere in Nepal, and due to the climatic dampness enhanced by its many lakes. Thus altogether the number of species and subspecies of pteridophytes occurring in C. and E. Nepal but not in West Nepal is shortly over 250, which would be reduced to 170 if the "missing" 82 species, which must presumably occur in W. Nepal, are allowed for, out of the present total of 580 taxa (species and subspecies) known from Nepal.

As should be expected from the floristic composition of its pteridophyte flora and the position of the country in the central Indo-Himalaya, well connected to further east, there are only two pteridophytes currently known to be endemic to Nepal and both of them may be considered as only "temporary endemics", to be expected to occur elsewhere in the Indo- or Sino-Himalaya, particularly to the east. These are *Polystichum annapurnicola* Fraser-Jenk. and *Polystichum centronepalense* Fraser-Jenk. The former is a diploid species (Fraser-Jenkins & Matsumoto 2014) and thus not a locally formed allopolyploid neo-endemic as was originally suspected from its somewhat "mixed" morphology, intermediate between other species. The latter remains cytologically unknown and also requires further comparison with related species in Tibet and S.W. China. A third almost endemic species is *Selaginella fulcrata* (D.Don) Spring, mentioned above.

Pteridophyte collections from Nepal

Plant collectors, their collections and publications from Nepal have been detailed most comprehensively by Sutton in Hara, Stearn & Williams (1978) and we mention here only those who provided important pteridophyte collections. They consist partly of older, historical collections, particularly those made by Francis Buchanan (later Hamilton) from 1802-3, the Hon. Edward Gardner, with Robert Stuart, Bharat Singh and Francis De Silva from 1817-1820 and later for Wallich, and Nathaniel Wallich from 1820-1821, which all contain very important material and types cited by D. Don, W.J. Hooker, T. Moore, R.H. Beddome, C.B. Clarke, C.W.W. Hope and others (see Fraser-Jenkins 2006), and also those of J.E. Winterbottom from Kathmandu Valley in 1841-2.

Following the earlier days, the country has been well covered since opening to foreigners in 1949 by many important and extensive modern collections, starting with the many fine pteridophyte collections at BM from the comprehensive and pioneering British and American expeditions, often overlooked in the later Japanese publications, of Oleg V. Polunin in 1949, Polunin, Bill Sykes & Len Williams in 1952 in further-West Nepal; Adam Stainton, Sykes & Williams in 1954 in W. Central Nepal (and Rukum in W. Nepal), Stainton in 1956, 1962, 1972 in C. and E. Nepal, specimens in BM, E, KATH and other herbaria; Col. D.G. Lowndes, with Tilman in Manang, Central Nepal, in 1950, specimens in BM; Dr. Bob (R.L.) Fleming's extensive collections (from 1949-1978) throughout Nepal (BM, KATH, DD, US, main early set in DD, later in MICH), determined for him by by C.V. Morton, R.R. Stewart, K.M. Vaid, D.B. Deb and CRFJ; A. Zimmermann's Geneva Conservatoire expeditions to Everest and Gaurishankar in 1952 and 1954, specimens in G, BM (see Zimmermann 1956, Alston & Bonner 1956); P.C. Gardner's New Zealand Himalayan Expedition in 1953, specimens in BM; A.H. Norkett's British Museum expedition to E. Nepal in 1961-2, specimens in BM; Dan H. Nicholson's Fulbright scholarship collections from 1966-1967 for the Smithsonian, specimens in US, KATH; the many extensive Japanese Himalayan expeditions, including the collections of the three East Himalayan reports and those of H. Tabata in W. and E. Nepal and particularly the pteridophytes of T. Nakaike in C. Nepal and Kathmandu valley, from 1960 to date throughout Nepal (see the list of expeditions by Rajbhandari 2002 and Rajbhandari & Ikeda 2010), specimens mainly in TI, KYO, TNS; R.S. Rao's small fern collection for the Botanical Survey of India on the Indian Cho Oyu expedition in 1960 (see Rao 1962), specimens in KATH, CAL; Rebecca Gay Troth ["Miss Gay" in KATH], of the University of Michigan in 1971, specimens from C. and E. Nepal in MICH, KATH; T. Wraber's E. Nepal collections in 1972, specimens in BM and Ljubljana University; the Edinburgh and Kew (KEKE) expeditions with C. Grey-Wilson, D.G. Long, R.J.D. McBeath, H.J. Noltie, D.A.H. Rae *et al.* in C. and E. Nepal in 1973, 1989 and 1991, specimens in K, E (see Grey-Wilson 1974, 1990); the G. and S. Miehe ecological collections from 1977-2001 from high altitudes in C. and E. Nepal (see Miehe 1967, 1987), specimens in BM and a few in UC, PHMR; J.F. Dobremez' ecological collections from E. Nepal for the University of Grenoble from 1970-1974, specimens in BM, GRM, G, KATH (see

Dobremez 1976 and Dobremez *et al.* 1967-2014); H.M. Emery, E.W. Cronin, H. & A. Foster & K. Brooks' E. Nepal Arun Valley collections from 1973-1974 (see Cronin 1979), specimens in BM, MICH; M.L. Banerji's mainly E. Nepalese collections from 1948-1967 (see Banerjee 1958, 1972), with specimens in KATH, A; Roy, Sinha & Sakya's C. Nepalese cytological collections in 1960 and 1970 (see Roy & Sakya 1963, Roy, Sinha & Sakya 1971), with specimens in BM (the set in Patna University was subsequently destroyed); Brian F.C. Sennitt's, of St. Xavier's School, C. Nepal collections from 1970-1974, specimens in KATH; the present first author, C.R. Fraser-Jenkins', extensive critical collections from W., C. and E. Nepal from 1988-2015, amounting to nearly 6000 numbers, including types and cytological vouchers, specimens in BM, E, H, US, TAIF and KATH, chronologically; and M. Watson, C.A. Pendry, K.K. Shrestha *et al*'s. small W. and E. Himalayan pteridophyte collections from 2009-2012 training various Nepalese students for the Darwin Foundation, specimens in E, KATH.

The largest and most far-ranging and extensive Nepalese pteridophyte collections are those of the many energetic Nepalese botanists, starting with Lieut., later Capt., then Major Lal Dhwoj (Sunawar) in the late 1920s to 1931 who collected for presentation to Britain, for the BM. Dhwoj first worked and trained at Lloyd Botanic Garden, Darjeeling, under George Cave, and then as a Lieutentant of the Royal Nepalese Army, was appointed in 1928 by the Nepal Govt. to start a botanical nursery on Shivapuri Hill, and to collect plants and seeds. He collected in Central Nepal in 1927 and 1928 and in 1929, accompanied Dr. Basant Lal Gupta and the F.R.I. collector, Bis Ram, from the Forest Research Institute, Dehra Dun (DD), to Khaptad in Doti District in S.W. Nepal, also collecting again in C. Nepal. In 1930 he collected in Dolakha and Solukhumbhu in E. Nepal, but died in 1931 while on his last expedition (see Parker 1932, Hay 1934, Stainton 1957 *ined*., Hara, Stearn & Williams 1978). His successor in Nepal was Prof. K.N. Sharma, though he only collected very few ferns. Following them and the early British and Japanese collections came the major collections from the Department of Plant Resources, Godawari from 1966-2014, preserved with nearly 15,000 pteridophyte sheets at KATH and with collection currently ongoing in W. and E. Nepal. These collections have been very largely overlooked by Japanese and other foreign publications and are drawn on here for the first time for pteridophytes. They include important collections of ferns by T.B. Shrestha, P.R. Shakya, D.P. Joshi, A.V. Uphadyaya, M.S. Bista, B. Roy, V.L. Gurung, M.M. Amatya, K.R. Rajbhandari, N.P. Manandhar, A.R. Sakya, T.K. Bhattacharya, M.N. Subedi, M.K. Adhikari and N. Thapa. Collections of some of the more prominent and common pteridophyte species, mainly in well known localities in C. Nepal, have also been made by botanists and students of Tribhuvan University, since *c.* 1995 and are preserved in TUCH herbarium, mostly identified by CRFJ, though the bulk are multiple re-collections by students from well known localities near Kathmandu, Pokhara and Langtang.

Only a few specialist pteridophyte collections, knowing the species in the field, have been made, mainly in C. and E. Nepal, first the extensive collections by Fleming, who had communicated in detail with Dr. R.R. Stewart and also sent lists and queries to

the present first-named author in the early 1980s. More recently the collections made by N. Thapa from 1995-2001 and identified mainly by the present author, and thirdly the collections made by the present first-named author from 1988-2015. An account of Nepalese pteridophyte collectors has been written by Fraser-Jenkins and Thapa in the introduction to Thapa (2002). Some help in finding some of the localities of collections, all too often given without District (though most have been written in in KATH) and often very difficult to locate in the case of Dhwoj, Polunin, Stainton, Sykes and Williams and Lowndes (see Tilman 1952, Polunin 1952, Shipton 1952, Williams 1953, Lowndes 1954, Sykes 1955-6, Bhatt 1964), is the Nepalese Plant Database produced by TI and BM, though pteridophyte entries are very few and much information remains missing; another database for spermatophytes only is the Flora Himalaya database of Dobremez *et al*. from the University of Grenoble. The itineraries of Polunin, Stainton, Sykes & Williams have been published in greater or less detail by Polunin (1950), Williams (1952), Sykes (1955-1956) and Stainton (1963, 1972), privately printed and manuscript itineraries of these expeditions are also held at BM and some copies at KATH library. The itineraries and localities of the main earlier Japanese expeditions are given in their three East Himalayan Expedition reports, and their later expeditions are similarly reported apart from those of Tabata *et al.*, of which there are no published accounts or list of collections and localities, which has created some difficuly. Further help in finding the Districts for localities may be obtained from the list of types given by Shrestha & Press (2000).

Publications on Nepalese pteridophytes are relatively few, apart from mention as part of various Indian species' range in classical works on the Indian subcontinent by Hooker, Beddome, Clarke and Hope. Earlier works include the pteridophytes given by Buchanan (Hamilton) (1805, *ined*.) and Wallich (1821, *ined*.) and the particularly important pteridophytes of Hamilton and Wallich studied by David Don (1824) in his *Prodromus Florae Nepalensis* (see Press & Shrestha 2000, Fraser-Jenkins 2006), a detailed account of the latter's pteridophytes, including lectotypification of all his pteridophyte species, is near completion by CRFJ and Wallich's pteridophytes are also under study by him. More modern works are by Raizada & Vaid (1952); Alston (1956); Stewart (1976 *ined*.) listed 358 taxa from the collections of Fleming and some Nepalese, Japanese and British collections, though often under wrong names and now very outdated; Tagawa (1955); Itô *et al.* (1966, 1971); Roy & Sakya (1963); Sakya (1968); Roy, Sinha & Sakya (1971); Nishida (1966, 1974); Banerji (1972); Vartak (1975); Iwatsuki (1975, 1988), the latter being a list of mainly Japanese E. Himalayan collections at TI made by that time (with a small number of the specimens from the BM also cited), rather than an enumeration of Nepalese pteridophyte species as titled; Gurung (1976-1997); Fleming (1984); Miehe (1987); Nakaike *et al.* (1982-1995); Matsumoto & Nakaike (1988, 1990); Manandhar (1996); Fraser-Jenkins & Thapa in Thapa (2002); and Fraser-Jenkins (1997, 2010). Only Stewart (1976 *ined.*), Gurung (1976, 1984); Fleming (1984); Fraser-Jenkins & Thapa in Thapa (2002); and Fraser-Jenkins (2010) have covered the pteridophytes of the whole country, though only the last two works could be considered comprehensive and near complete.

Classification used

Pteridophyte classification had previously been subjected to a large amount of over-splitting of genera and families in the 1970s (Pichi Sermolli 1977, Ching 1978). Although their detailed work was for the first time able to recognise and draw attention to critical groups usually now held to be subfamilies or subgenera and sections, many supposed genera and families were far too split up and minor to stand the test of time. However 10 years later a new system contributed to by many authors was put forward by Kramer & Green (1990), which combined many of the minor genera and families into more recognisable entities consisting of related taxa and introduced a new consensus of pteridophyte classification that has lasted in large part to the present day and has usually been supported by recent molecular work, excluding a few less accepted studies and anomalous cases. In particular the families Pteridaceae and Woodsiaceae as circumscribed by Kramer & Green made sense of what had previously been a mass of small and insignificant groups.

In the present checklist more modern families and genera have been used, according to the system of Kramer & Green (1990), modified by the valuable molecular work of Smith *et al.* (2006, 2008), with further taxonomic input from Fraser-Jenkins (2010 *etc.*). Most workers in the S. Asian region have either followed the older, much more splitting systems of Pichi Sermolli (1977) and Ching (1978), by an inclusive process of utilising nearly all recognised names that come to attention, or follow the above molecular classification of Smith *et al*. The older systems of the 1970s are no longer considered appropriate here and are generally understood now to be less meaningful. Smith's molecular classifications have generally been the most successful and have shown remarkable consistency with the purely morpho-taxonomic schemes of Kramer & Green. They have also shown several important areas where previous taxonomic schemes were either unclear or mistaken. The present scheme, which inputs slightly more morphotaxonomic factors into the Smithian classification is generally consistent with the latter, and in the cases where it does not agree due to major morphological concerns, it is noticeable that they are nearly, though not quite all alternatives which are hardly in contradiction with molecular evidence, apart from the unwarranted credence given by moleculologists to avoidance of paraphyly (see Brummitt (1997-2006) and references therein) and sometimes too strict adherence to apparent polyphyly. Usually they are questions of ranking where certain groups accepted rather arbitrarily as genera by Smith *et al.* are placed here at a subordinate rank as subgenera, but do not thereby go entirely against molecular cladonomic findings.

Unfortunately, however, serious proposed modifications to the Smithian scheme were subsequently put forward from molecular study by Christenhusz *et al.* (2011) and Sundue & Rothfels *et al.* (2013), while almost opposite conclusions were arrived at by Christenhusz & Chase (2014) just three years later. These post Smithian molecular-cladonomic systems contain more serious problems of unrecognisable and meaningless taxa, or inappropriate bedfellows, than even the old splitting schemes and have resulted

in many obviously rejectable anomalies. As a result it has become the situation that they have hardly been accepted by any other pteridologists internationally, including molecular workers. Their recent survey seeking after an imaginary "latest" consensus that does not exist, particularly concerning those particular publications, was little more than an attempt at self-approval, with carefully restricted choices that did not allow for inconvenient alternatives.

Problems in the molecular-cladonomic schemes appear to arise mainly through strict adherence to supposed molecular monophyly combined with a serious lack of morpho-taxonomic experience and input as a final step. But it is very obvious that the degree and rate of morphological divergence of groups, which, as always, remains the most important overriding consideration, is not directly related to the degree and rate of molecular diversity. The idea of molecular crypto genera and circumscription of clado-genera based on extremely minor and insignificant, often non-discrete characters, is next to meaningless. In addition over-strict and poorly thought out adherence to compulsorily monophyletic taxa, especially involving the unnecessary avoidance of paraphyletic taxa, has played havoc with the delimitation of genuine and distinct genera and families. Looking at the overall picture resulting from modern cladonomic papers it rapidly becomes obvious to a taxonomist that paraphyly is the leading disruptive artificial concept giving rise to blunders when attempting to convert molecular-cladistic results into taxonomic classification. It is evidently a factor of no importance in classification, even though many cladonomists are drilled from an early stage of their careers into unquestioning belief of its immutable sanctity. As a result, inappropriate or unrecognisably insignificant cladotaxa have often been set up from a purely molecular-cladonomic study bound by "the rules" being inappropriately converted directly into taxonomic classification by those unable, unwilling or just afraid to look outside of the box. It seems that with a few exceptions, many present moleculologists are currently less able, or more usually obligately unable to consider morphology, and either fear, or use the convenient excuse that even major distinctions might be apomorphic. But by which they mean features they suspect, guess, or would like to be secondary (particularly whenever they reveal the unworkability of their proposed classification), including merely surmised reversions, convergence and supposedly unimportant yet obvious and significant structural changes. Taxonomic common sense is no longer part of the equation, to the detriment of the resulting pseudo-classifications. What has begun to become increasingly clear in the last few years in pteridology is that molecular cladonomy alone does not "provide all the answers" as was at one time being thought, and morpho-taxonomic parameters must be considered as well. It no longer takes a botanical Einstein to observe that in a large number of cases MC - T = D, for disaster. There sometimes even seems to be a belief by certain botanists that whatever genera *etc*. are advocated in the latest molecular publication must by definition constitute the true and only acceptable classification and all alternatives are invalid and result from ignoring the cladistic evidential "proof". This simplistic delusion usually takes place in the more-or-less obvious absence of sufficient knowledge and experience of fern taxonomy and therefore a lack of ability to question the supposed authority of the

"silly bits" of moleculology. The result of a lack of wider understanding often look more akin to the fluster of a taxonomically beheaded chicken, than to genuine scientific (and combined intuitive) evaluation and needs to be understood for the shallow excuse for taxonomic inexperience and obdurate refusal to widen parameters that it undoubtedly is.

However the classification proposed by Smith *et al.* (2006, 2008) did involve an enlightening degree of taxonomic balance and was mainly, though not entirely appropriate and accurate taxonomically, resulting partly from his impressive and wide taxonomic expertise. By contrast a significant majority of the conclusions of the three later works mentioned above were largely unworkable and misguided, and have thus not been generally accepted by pteridologists of either pure taxonomic or molecular-cladonomic fields. In addition an attempted reclassification of Dryopteridaceae by Zhang *et al*. (2013) in which many distinct and well recognised generic groups were subsumed into a greater "*Dryopteris*" merely in order to avoid paraphyly, is a further good example of how too narrow parameters produced impractical and obviously inappropriate results. It cannot simply be ignored that the applicability of molecular cladonomy and its artificial cladistic principles or rules to taxonomic classification in the absence of traditional morphological input is now seriously questionable and must be held in doubt in a number of recent cases where taxonomy has not been able to flourish following the recent decades of abandonment of still essential morpho-taxonomic expertise and study

The classification of families and genera used in the present checklist, modified by input from a revised version of Fraser-Jenkins (2010) is intended to provide more of the essential, wider taxonomic balance than is currently conceivable by a number of moleculologists under their often less appropriate cladonomic attempts at systematics and classification.

It may be noted that we prefer to continue to refer to the vascular cryptogams as Pteridophytes or Pteridophyta, the established Divisional name, since the plants concerned obviously form a natural group, whether paraphyletic (as also in Bryophytes), or not. The Division Pteridophyta is based on ferns and has priority over other names and we prefer to treat the vascular cryptogams as a separate Division, not to be included with Spermatophytes, even if their genetic, but not morphological relationship is supposed to be perhaps closer to Spermatophytes than to Lycopods. Neither do we employ the illegitimate, highly contrived and meaningless clado-class name "monilophytes", which is not based on any known taxon or morphologically descriptive term, but merely on controversial N. American semantic propaganda.

As far as the clado-term, Lycophytes, is concerned, while agreeing that it is a useful name and concept as currently circumscribed, we find it fundamentally morphologically unacceptable to treat them as if a Division equivalent to Spermatophytes and ferns, and while understanding that their evolutionary separation is believed to have been more ancient than the other groups, we believe that they continue to be more appropriately treated as the Class Lycopsida within Pteridophyta. Similarly, though molecular-cladistic work has found that *Equisetum* is genetically more closely allied in origin to the class

Filicopsida (ferns) than to Lycopsida, it has rather obviously escaped the notice of cladonomists that horsetails are clearly not ferns and could never be said to be so, whatever type of classification one used, short of being deliberately or confusedly obtuse, virtual and out of touch with ground-reality. Their entirely distinctive morphology must not be ignored for the sake of adhering to a cladistic rule and a false belief that only genetic evolution is to be considered in classification. It has no bearing on classification whether these well understood and existing groups are paraphyletic, or even polyphyletic - they exist, therefore they are. We therefore treat Equisetopsida as another Class within Pteridophyta in the time-honoured, widely known, logical and nomenclaturally stable way. We also have no doubts or qualms in continuing to refer to them as fern-allies along with the Lycopods, even though class-wise they may be nearer Filicopsida; the wiring of the human mind and the situation in the natural world normally has no problem with "paraphyly". However as we deal only with the major and important necessary ranks of Division, Family, Genus, Species and Subspecies, we do not need to confirm further the wisdom of the great many previous world-wide generations of thinkers properly familiar with the plants concerned. Nor do we need to expound in further detail our rejection of these basic pseudo-conclusions arrived at only through the narrower thinking of dyed-in-the wool cladonomists.

We deal here with real or taxonomic classification and recognisable and genuine groups, and while certain molecular modifications have been made and the conclusions of the "latest" cladonomy have been taken into account, we are no slaves to a blinkered and less comprehensive view, or set of artificial principles, which were merely intended by their original author, the controversial and often dubious Ernst Haeckel, of Jena, to be useful general guidelines. We have unashamedly used intuitive taxonomic common-sense in our arrangement and are aware of the importance of taking account of both the haeccity of taxa, from families down to species and of the connecting similarities as well.

Furthermore we deplore a recent reprehensible tendency by some cladonomists and a handful of formerly respectable and scientific journals, lacking the benefit of specialist and unbiased pteridologists' advice on their editorial boards or among their usual reviewers, to attempt to impose a particular, and in the case of pteridophytes, highly inadequate and unworkable system of post-Smithian pseudoclassification on submitting authors, which is blatantly against the basic ethics and principles of scientific freedom of thought. The perpetrators of this unwarranted pressure, mistaking alternative views for opting for ignorance, have also failed to understand that many molecular conclusions in the latest works are still tentative, preliminary or insufficiently supported and are undeniably subject to change, thus engendering considerable instability. It is encouraging to see that most herbaria world-wide utilise a wise and considerable degree of caution before modifying their arrangements and most have decided not follow the later cladonomic arrangements post 2008.

The present work

The present checklist was largely compiled by the first-named author in 2008, with help and input from his sister-in-law, Miss Sagun Pariyar. This was then revised and further details added as a result of an invitation to the first-named author in 2011 by Dr. M.F. Watson, of the Royal Botanic Garden, Edinburgh, who had been given access to the earlier list, to produce the fern account for the *Flora of Nepal*. The Department of Plant Resources, Kathmandu, then kindly invited him to complete the project under their auspices. Unfortunately due to the misguided institutional and governmental policy world-wide of financially starvational wastage of taxonomy in recent decades there are now no other international or local specialists properly familiar with Nepalese or Himalayan pteridophytes and it was therefore important to preserve the information and knowledge built up by the first-named author to make it available in order for the *Flora of Nepal* to be able to treat pteridophytes accurately and comprehensively.

As part of the further work for the *Flora*, all the Nepalese collections at CAL, K, and BM were photographed and reidentified for cataloguing, though unfortunately due to lack of funding, only part of the material in TI could be seen (though much has been available as duplicates in other herbaria, including BM, K and KATH). The smaller collections at Edinburgh have also not been listed in full, though much has been seen on previous visits there, but a more serious lacuna is that material at KYO and CBM was last seen by CRFJ in Dec. 1992 before much of the present critical revision was done, and personal funding post retirement age could not allow a further visit. The whole collection at KATH and TUCH has been studied and reidentified by the first-named author. The majority of this work was funded privately by the first-named author, as was his extensive field-work and collection in Nepal over the years, and in addition recent research grants have enabled herbarium study abroad to be brought to completion. Since the majority of Nepalese pteridophyte collections held in world herbaria have been studied from a basis of detailed in-Country knowledge of the Nepalese pteridophytes, it is hoped that the present check-list is near to being comprehensive. It aims to provide accuracy and specialist input for a forthcoming redactive summary of pteridophytes for the *Flora of Nepal* and hopefully to provide a basis for revived future investigative cytotaxonomic research on groups of pteridophytes in the Himalayan region.

Two previous checklists, the later one amounting to 670 names of species of Nepalese pteridophytes were produced by Gurung (1976, 1985), but included much inaccurate (for the time) identification by the Botanical Survey of India, Calcutta, and Forest Research Institute, Dehra Dun, as well as species repeated up to three times under different genera, or names included of exotic species from Chinese, Malayan and some New World floras which have never been known from Nepal or India. They amounted to a real list of *c.* 350 species which are acually present in the country, about half under incorrect names (including for the time) but ± identifiable as to what was intended and 158 taxa said to be endemic to various parts of Nepal. More sound checklists based on actual collections, were made, though not published, by the late Dr. R.R. Stewart (1976 *ined.*), of Gordon

College, Rawalpindi, Pakistan, and Duarte, California, U.S.A., listing 358 species, based largely on the pioneering field-collection throughout the country by the late Dr. R.L. Fleming Sr. (see Fletcher 1964, Fleming 1985), of Leavensworth, Washington State, U.S.A., Kathmandu, Nepal, and later Phoenix, Arizona, U.S.A., whose collections (MICH [main set], KATH, BM, US) were partly identified for him by the present first-named author and have now been fully so identified.

The first scientifically based published list was the pioneering checklist produced by Iwatsuki (1988), listing 402 Nepalese species (excluding a further 53 guessed species "not actually seen" by him, or "not known from Nepal" and largely still not known), mainly from the Japanese collections in Nepal up to that date, and with a very few of the collections by others added from the BM. Following this the present first author and A.C. Jermy visited Nepal from the BM in 1989/1990 with funding available from the Natural History Museum, London, to conduct field-work and catalogue Nepalese pteridophytes comprehensively, with the cooperation of the Department of Medicinal Plants, now the Department of Plant Resources, KATH, and Tribhuvan University, TUCH.

In the meantime the present first author made long botanical collection-visits to Nepal from 1988 onward and then came came to reside there from 1994, studying the taxonomy of Nepalese pteridophytes and adding many species to the previous check-lists. Thereafter he worked first with the late Dr. V.L. Gurung, and then more extensively in cooperation with Mr. Naresh Thapa, of the Department of Plant Resources and National herbarium, Godawari, identifying the collections at KATH, and Thapa's collections, and providing Thapa with full details of his own findings and ongoing taxonomic and nomenclatural research. The result of this cooperation and part co-authorship was Thapa's (2002) account of Nepalese Pteridophytes, which was the first comprehensive listing and taxonomic revision of the 534 species and subspecies of Nepalese pteridophytes listed from their joint efforts at that time. Since then major taxonomic revision of Indian subcontinental pteridophytes has been carried out, largely by the present first-named author (see Fraser-Jenkins, 2008 *etc*.) and it has now been possible to apply that revision in detail here to the collections and taxonomy of Nepalese pteridophytes.

Over the last few decades a very large number of determinations of Indo-Himalayan species in many herbaria has been carried out at various stages of the research by CRFJ to assist others to recognise critical species and subspecies, among others, particularly in the following herbaria: US, MICH, UC, MO, A, K, BM, E, LIV, BR, P, G, GR, B, FR, H, PHMR, W, LJU, PR, RAW, ISL, KASH, PAN, PUN, Nainital Univ., Almora Univ., Pithoragarh P.G. College, DD, BSD, BSA, Allahabad Univ., LWG, BLAT, BSI, AHMA, MH, RHT, XCH, CALI, TBGT, KATH, TUCH, Biratnagar College, CAL, BSIS, BSHC, Lloyd Botanic Garden, Darjeeling, ASSAM, ARUN, PE, TI, TNS, TKB and KYO. Collections of many individuals throughout the region have also been identified, including recently by means of e-mail attached photographs (though these have to show the features

needed to be seen for identification according to the particular genus - all too often not the case).

Format of the taxonomic list

We now list 580 taxa of Nepalese pteridophytes (550 species and an additional 30 subspecies), based only on material seen and verified or reidentified by the first author. Only species and subspecies are treated as being taxonomically significant. Varieties have been revised in various works by the first author and have either been considered recognisable at a higher rank as significant biological entities, or have been sunk as part of the understood range of variation within the species and not worthy of taxonomic recognition. Of alien introductions, only genuinely naturalised adventive species have been treated (with an asterisk), not those that are merely cultivated and have not become established in the wild, even though these have sometimes been reported in the past as if constituents of the fern-flora, often without proper distinction of their non-natural status. Hybrids are listed at the end of each genus.

The name of each recognised taxon is given with the standard international name-authority abbreviations according to Pichi Sermolli (1996) and IPNI. References to all places of publication are not considered necessary to be re-listed as they can be found readily in *www.tropicos.org*, or in *www.ipni.org*, which have replaced *Index Filicum*, though the latter in particular is still very weak in its listing of Fern-Allies and many names remain missing from either. Widely known synonyms are given, but further references, which are often confusingly thrown into the synonymy in Indian publications, are avoided. Misapplied names and detailed explanatory nomenclatural notes are given when necessary due to the many nomenclatural complications.

This is then followed by a compact comparative description intended to enable workers with some basic knowledge of Asian ferns to arrive at the correct identification. The general distribution in Nepal is given by districts and the overall Indo-Himalayan and Tibetan distribution beyond Nepal is given by States, along with some perfunctory details of overall distribution, which is being listed in more detail by Gandhi, Fraser-Jenkins & Kholia (in prep.). The collections cited from different districts within Nepal have all been either seen in herbaria, or collected by the first-named author and all have been reidentified or confirmed by him, apart from in a few cases which have been so noted; the labels are cited as originally written and spelt.

Symbols in brackets show their Phytogeographical affinity and frequency and brief altitude and ecological habitat notes are given after them. The generalised altitudinal ranges mentioned under each species are as follows, though in reality the zones become slightly lower going from east to west:
Low altitude: 50-600 m.
Lower-mid altitude: 600-1000 m.
Mid altitude: 1000-1600 m.
Upper-mid altitude: 1600-2200 m.

Higher altitude: 2200-3000 m.
High Himalayan: 3000-5000 m. (*Cystopteris fragilis* has been collected at just over 5000 m. in Nepal).

Endemics to Nepal are noted. Threatened status in Nepal under IUCN categories is assessed anew here, and that for India is also listed according to Chandra *et al.* (2008) and Fraser-Jenkins (2012), but upgraded where necessary. Globally threatened species present in Nepal are indicated according to Fraser-Jenkins in Ebihara *et al.* (2012). Unfortunately current and previous listings for India by Dixit and others in Indian Red Data books (Jain 1984, Nayar & Sastry 1987, 1988, 1990) and for IUCN (1998, 2004) include common species not under threat, while most of the actual threatened species are omitted. Gurung (1988) also made a list of 124 proposed threatened species of Nepal, but including various unidentifiable synonyms, misapplied names, common species, species listed twice under different generic synonyms, 35 species not known from Nepal and a number of species not known from the Indian subcontinent. Over three quarters of the names listed were incorrect at the time, while most genuinely threatened species remained unlisted. Of the names and synonyms that can be identified and occur in Nepal, only 19 refer to species under some degree of threat as recognised here. She also mentioned 125 supposedly extinct species by adding up and thus largely duplicating all records of names of species not collected from various authors' works that were not listed in her lists. However these names were almost entirely due to misreports from confused localisation, misapplied names *etc*., or were simply species not seen by the authors concerned. We are not aware of any actual possible extinctions of ferns from Nepal at all; the more usual situation is understanding either that the species as so named was never present in Nepal, or finding newly recorded species in Nepal.

Near the end of each species entry the following symbols are given in brackets, referring to their suggested phytogeographical relationships and overall approximate frequency in the Indo-Himalaya:

M = Malesian/S.E. Asian element; S = Sino-Himalayan element (with a W = Sino-Himalayan element of the W. Himalayan subgroup; or T = Sino-Himalayan element of the Tibetan subgroup added in brackets); E = European element (as far as its origin in the Indo-Himalaya is concerned); H = Hindu-Lankan (Indian peninsular, Deccan) element [of various affinities, usually Malesian, or quite often African]; A = adventive. In addition C = common; Sc = scattered; R = rare; R(A) = Rare everywhere except Arunachal Pradesh. However it should be borne in mind that numerous common species become considerably rarer to the west, in Uttarakhand or further west. Total of species known from Nepal: 550 species plus 30 extra subspecies; including 4 adventive species established in the wild. Total number of Nepalese endemics (but may be expected to occur elsewhere): 2 (nearly 3). Percentages of different phytogeographical elements in the Nepalese pteridophyte flora:

8 European (1.3%), 358 Sino-Himalayan (62%), 140 Malesian (24%), 4 Hindu-Lankan (0.6%), 66 uncertain (11.5%), 4 adventive (0.6%).

List of species and subspecies of Nepalese pteridophytes

VOLUME 1.

Lycopodiaceae
Huperzia arunachalensis
Huperzia cavei
Huperzia hamiltonii
Huperzia herteriana
Huperzia javanica
Huperzia phlegmaria
Huperzia pulcherrima
Huperzia selago subsp. appressa
Huperzia serrata
Huperzia squarrosa
Lycopodiella cernua
Lycopodium annotinum subsp. alpestre
Lycopodium japonicum
Lycopodium veitchii

Isoetaceae
Isoetes coromandelina

Selaginellaceae
Selaginella adunca subsp. adunca
Selaginella aitchisonii
Selaginella bisulcata
Selaginella bryopteris
Selaginella chrysocaulos
Selaginella chrysorrhizos
Selaginella ciliaris
Selaginella emodi
Selaginella fulcrata
Selaginella helvetica
Selaginella involvens
Selaginella monospora
Selaginella pallida
Selaginella pallidissima
Selaginella pennata
Selaginella pulvinata
Selaginella remotifolia
Selaginella repanda
Selaginella reticulata
Selaginella semicordata
Selaginella subdiaphana
Selaginella tenuifolia
Selaginella vaginata

Equisetaceae
Equisetum arvense subsp. arvense
Equisetum arvense subsp. diffusum
Equisetum ramosissimum

Psilotaceae
Psilotum nudum

Ophioglossaceae
Botrychium daucifolium
Botrychium lanuginosum
Botrychium lunaria
Botrychium multifidum subsp. robustum
Botrychium simplex subsp. simplex
Botrychium ternatum
Botrychium virginianum
Helminthostachys zeylanica
Ophioglossum parvifolium
Ophioglossum petiolatum
Ophioglossum reticulatum

Marattiaceae
Angiopteris crassipes
Angiopteris helferiana

Osmundaceae
Osmunda claytoniana subsp. vestita
Osmunda japonica

Plagiogyriaceae
Plagiogyria euphlebia
Plagiogyria pycnophylla

Lygodiaceae
Lygodium flexuosum
Lygodium japonicum
Lygodium microphyllum
Lygodium salicifolium

Marsileaceae
Marsilea minuta

Salviniaceae
*Azolla filiculoides subsp. filiculoides. Adventive.
*Salvinia molesta. Adventive.
Salvinia natans.

Gleicheniaceae
Dicranopteris lanigera

Dicranopteris linearis
Dicranopteris splendida
Dicranopteris taiwanensis
Diplopterygium giganteum

Dipteridaceae
Dipteris wallichii

Hymenophyllaceae
Hymenophyllum badium
Hymenophyllum exsertum
Hymenophyllum simonsianum
Hymenophyllum tenellum
Trichomanes auriculatum
Trichomanes birmanicum
Trichomanes campanulatum
Trichomanes latealatum
Trichomanes parvifolium
Trichomanes saxifragoides
Trichomanes schmidianum
Trichomanes striatum

Cyatheaceae
Cyathea brunoniana
Cyathea gigantea
Cyathea henryi
Cyathea khasyana
Cyathea sollyana
Cyathea spinulosa

Dennstaedtiaceae
Dennstaedtia appendiculata
Dennstaedtia zeylanica
Hypolepis polypodioides
Microlepia firma
Microlepia hallbergii
Microlepia marginata
Microlepia nepalensis
Microlepia platyphylla
Microlepia rhomboidea
Microlepia setosa
Microlepia speluncae
Microlepia strigosa
Microlepia ?substrigosa
Microlepia trichocarpa
Monachosorum henryi
Pteridium revolutum

Lindsaeaceae
Lindsaea commixta
Lindsaea ensifolia
Lindsaea odorata
Odontosoria chinensis subsp. chinensis
Odontosoria chinensis subsp. tenuifolia

Pteridaceae
Actiniopteris semiflabellata
Adiantum capillus-veneris
Adiantum caudatum
Adiantum edgeworthii
Adiantum incisum subsp. incisum
Adiantum incisum subsp. indicum
Adiantum myriosorum
Adiantum pedatum subsp. pedatum
Adiantum philippense subsp. philippense
Adiantum philippense subsp. intermedium
Adiantum philippense subsp. teestae
*Adiantum raddianum. Adventive.
Adiantum tibeticum
Adiantum venustum
Adiantum wattii
Aleuritopteris albomarginata
Aleuritopteris anceps
Aleuritopteris argentea
Aleuritopteris bicolor
Aleuritopteris chrysophylla
Aleuritopteris dealbata
Aleuritopteris dubia
Aleuritopteris duthiei
Aleuritopteris formosana
Aleuritopteris grisea
Aleuritopteris leptolepis
Aleuritopteris rufa
Aleuritopteris stenochlamys
Aleuritopteris subdimorpha
Aleuritopteris tamburii
Anogramma reichsteinii
Ceratopteris thalictroides subsp. thalictroides
Ceratopteris thalictroides subsp. gaudichaudii
Cerosora microphylla
Cheilanthes belangeri
Cheilanthes nitidula
Cheilanthes subvillosa
Cheilanthes tenuifolia
Coniogramme affinis
Coniogramme fraxinea
Coniogramme intermedia
Coniogramme procera
Coniogramme pubescens
Coniogramme serrulata

Cryptogramma brunoniana subsp. brunoniana
Cryptogramma brunoniana subsp. raddeana
Cryptogramma stelleri
Doryopteris ludens
Notholaena borealisinensis
Notholaena delavayi
Notholaena dipinnata
Notholaena himalaica
Notholaena marantae
Onychium cryptogrammoides subsp. cryptogrammoides
Onychium cryptogrammoides subsp. fragile
Onychium kholianum
Onychium lucidum
Onychium moupinense
Onychium siliculosum
Onychium vermae
Pellaea calomelanos
*Pityrogramma calomelanos. Adventive.
Pteris alata
Pteris arisanensis
Pteris aspericaulis
Pteris assamica
Pteris biaurita subsp. fornicata
Pteris biaurita subsp walkeriana
Pteris cretica subsp. cretica
Pteris cretica subsp. laeta
Pteris dactylina
Pteris ensiformis
Pteris inaequalis
Pteris kathmanduensis
Pteris longipinnula
Pteris medogensis
Pteris normalis
Pteris pellucens
Pteris puberula
Pteris roseolilacina
Pteris scabririgens
Pteris spinescens
Pteris stenophylla
Pteris subindivisa
Pteris subquinata
Pteris terminalis
Pteris tibetica
Pteris venusta subsp. matsudae
Pteris vittata subsp. vittata
Pteris vittata subsp. emodi
Pteris vittata subsp. vermae
Pteris wallichiana

Vittariaceae
Antrophyum reticulatum
Antrophyum obovatum
Vittaria flexuosa
Vittaria linearifolia (?V. mediosora).
Vittaria sikkimensis
Vittaria taeniophylla

VOLUME 2.

Aspleniaceae
Asplenium amoenum (syn.: A. obliquissimum; misapplied name: "A. unilaterale" *sensu* Iwatsuki (1988) *p.p.*, which did not consist of only one taxon as stated)
Asplenium apogamum
Asplenium atuntzeense
Asplenium bullatum
Asplenium capillipes subsp. capillipes
Asplenium cheilosorum
Asplenium daghestanicum subsp. aitchisonii
Asplenium dalhousiae
Asplenium delavayi (Nepalese origin requiring confirmation).
Asplenium ensiforme
Asplenium excisum
Asplenium exiguum subsp. lushanense
Asplenium exiguum subsp. yunnanense (not a synonym of A. exiguum [subsp. exiguum] as long ago explained by Fraser-Jenkins to Reichstein and in several clear and unchanging accounts of this species complex, erroneously synonymised and mistreated by Viane (2000) and in Lin & Viane (2013)).
Asplenium finlaysonianum
Asplenium fontanum subsp. pseudofontanum (Dolpa, Suli Ghad, *J.F. Dobremez* 2832, 28.4.1974, KATH). Hope's locality of "W. Nepal, Kutti Valley, *J.R. Reid*" seems to have been eroded away from Darchula District into Uttarakhand.
[Asplenium griffithianum, listed by Iwatsuki (1988) but no specimens seen by him, nor by us; excluded]
Asplenium hondoense
Asplenium khullarii
Asplenium laciniatum subsp. laciniatum
Asplenium laciniatum subsp. kukkonenii
Asplenium laciniatum subsp. tenuicaule
Asplenium lacinioides (misapplied name: "A. laciniatum" *sensu* Iwatsuki (1988); "A.

gueinzianum" *sensu* Viane in Lin & Viane (2013) [= A. dregeanum Kunze, from Africa, where A. lacinioides does not occur]).

Asplenium magnificum

Asplenium nesii

Asplenium nidoides Fraser-Jenk. & Kandel, ***sp. nov.***, *planta similis ad A. nidus sed frons longior sori ad medium latitudine laminae extensi, frons nitida sori valde conferti, crescit in India boreale et Nepalia*. Holotypus: Nepal, Sankhuwasabha, "Asplenium nidus, Seduwa (Kasuwa khola) 2800 ft., *Dr.* [*M.L.*] *Banerjee, Upadhyay* & *Baskola* 3402, 6.5.1965", KATH (the greener frond of the two duplicate sheets; the costa is rounded beneath and the base of the rachis was curved outwards from its point of attachment. "*A. nidus*" was recorded by Clarke, but including *A. phylltidis*, and thence listed by Iwatsuki (1988) in error for that species. True *A. nidus* is not known from the Indian region, as shown by the work of Dr. R. Johns, even though its sterile type is effectively unidentifiable, but the present species is its equivalent in this region and does not occur in the further Malesian region, Philippines *etc*. None of the species known from the type area of *A. nidus* occur here). Two further narrow-fronded species, Asplenium salwinense (Ching) Fraser-Jenk., ***comb. nov.*** (basionym: Neottopteris salwinensis Ching, *Bull. Fan Mem. Inst. Biol.*, n.s. **1**(3): 304 (1949)) and Asplenium neohainanense Viane, though synonymised into the A. nidus "species complex" taken in an unclear, presumably misapplied sense, by Lin & Viane (2013), do not belong to the present species.

Asplenium nitidum (syn.: ?A. pseudolaserpitiifolium Ching; ?A. neolaserpitiifolium Tardieu & Ching, see Fraser-Jenkins (2008), the account by Viane in Lin & Viane (2013), with a pseudocount, overlooked the relationships of these taxa).

Asplenium normale (syn.: A. opacum).

Asplenium obscurum (syn.: *Hymenasplenium pseudobscurum* Viane; *H. bivalvatum* (B.K.Nayar & Geev.) Viane, doubling of the indusium varies from plant to plant and even frond to frond on the same plant).

Asplenium paucivenosum

Asplenium phyllitidis (*A. simonsianum* is a distinct species, as can readily be understood when familiar with it, including in the field; it is not a synonym of A. phyllitidis as thought by Viane in Lin & Viane (2013), perispore morphology often being poorly correlated to species identity and not indicating conspecificity).

[Asplenium prolongatum - reported by Dixit (1984) in error and thence by Thapa (2002), not present in Nepal]

Asplenium pseudofugax Fraser-Jenk. & Kandel, ***sp. nov***. *Planta similis ad A. capillipes sed frondes longiores, apices frondium attenuatiori lamina passim non prolifera lobi segmentorum divergentes*. Holotypus: W. Nepal, *c.* 3900 m., among rocks below white cliffs in sheltered, light Rhododendron forest, above top of Danphe Lagna pass on N.E. side, S.W. of and above Kali hamlet, N.E. of Jumla on path to Rara Lake [in Mugu District], Jumla District, *c.* 3900 m., *C.R. Fraser-Jenkins*, with *Min Bahadur Nepali* 35364, 4.6.2014, KATH, isotypes: ditto. (Jumla *CRFJ* 35201, TAIF; *CRFJ* 35364, KATH).

Asplenium ruta-muraria subsp. ruta-muraria

Asplenium sarelii subsp. pekinense

Asplenium septentrionale subsp. caucasicum (syn.: A. caucasicum (Fraser-Jenk. & Lovis) Viane; treating this taxon as a species (Viane in Lin & Viane 2013), without being able to recognise any morphological characters except spore size (reflecting only the cytotype) is not only against the work and considered conclusions of Lovis, Reichstein and most competent taxonomists, but lacks any sensible value or meaning, as with many other highly cryptic polyploids worked on by those authorities that Viane thought should be automatically ranked as species because of an outdated and artificial "biological species concept").

Asplenium septentrionale subsp. septentrionale (shown by Reichstein to be an autotetraploid derived from subsp. caucasicum).

Asplenium shimurae ("*A. opacum*" *sensu* Fraser-Jenkins (1997, 2008)). Mistakenly synonymised by Lin & Viane (2013) into A. normale, out of keeping with both Viane's self-proclaimed biological (cytological) species rule and the well known clear morphological as well as cytological difference between them, erroneously stating there was no correlation between them in opposition to the actual situation as well as to the more competent work published from Japan.

Asplenium sikkimbirii (Fraser-Jenkins 2008).

Taplejung, Tamrang khola, *A.H. Norkett* 7553, 27.11.1961, BM. This species also occurs in Sikkim and S.W. China, but was overlooked by Lin & Viane (2013) in the *Flora of China*.

Asplenium tenuifolium

Asplenium trichomanes subsp. trichomanes (*sensu* Lovis, requiring conservation with a conserved type).

Asplenium trichomanes subsp. quadrivalens

Asplenium viride, *nom. cons.*

Asplenium wuliangshanense (syn.: Hymenasplenium wuliangshanense (Ching) Viane & S.Y.Dong).

Asplenium yoshinagae subsp. indicum

Thelypteridaceae

Thelypteris arida (syn.: T. papyracea).

Thelypteris articulata (Itô 1966, Iwatsuki 1988).

Thelypteris auriculata (syn.: Cyclogramma himalayensis (C.Chr.) Tagawa.

Thelypteris aurita

Thelypteris cana (J.Sm.) Ching. Lin & Iwatsuki (2013) confused the name and authorities, which had been definitively elucidated by Fraser-Jenkins (1997, 2008).

Thelypteris clarkei (syn.: T. cylindothrix, incorrectly so named by Lin, Li & Iwatsuki (2013), though the correct name had been definitively elucidated by Fraser-Jenkins (1997, 2008)).

Thelypteris crinipes

Thelypteris decursivepinnata

Thelypteris dentata

Thelypteris erubescens

Thelypteris esquirolii

[Thelypteris falciloba - reported by Iwatsuki (1988), in error, based on *H. Kanai et al.* 725064A, 725086, in TI, but 725086 from Dhankuta, Hile (1900 m.) - Mure (2100 m.), *H. Kanai et al.*, 5.6.1972, KATH, is a specimen of T. esquirolii, the form commoner in N.E. India with hairy costae and veins, though no rhizome is present. T. falciloba, from syream-banks in N.E. India is not known or expected from Nepal.]

Thelypteris flaccida

Thelypteris glanduligera

Thelypteris interrupta

Thelypteris jaculosa (not related or at all similar to the Chinese endemic T. latipinna, nor to T. subpubescens as at some stages of study thought by Holttum).

Thelypteris lakhimpurensis

Thelypteris lebeufii

Thelypteris levingei

Thelypteris loyalii (?syn.: Cyclosorus angustipinnus (Ching) K.H.Shing).

Thelypteris mollissima

Thelypteris nudata

Thelypteris ornata

Thelypteris ornatipes

Thelypteris papilio

[Thelypteris parasitica - (reported by Iwatsuki (1988) based on *H. Kanai* 674982, in error; incorrectly reported from Nepal by Lin, Li & Iwatsuki (2013), who also gave also N. India in error for S. India, though already properly excluded from Nepal *etc.* by Fraser-Jenkins (1997, 2008), though it just reaches the furthest N.E. of India and Bangladesh.]

Thelypteris penangiana

Thelypteris phegopteris agg. Nepalese and Indian plants appear to correspond well with Thelypteris tibetica (Ching) Fraser-Jenk. & Pariyar, ***comb. nov***. (basionym: Phegopteris tibetica Ching, in C.Y. Wu (ed.), *Flor. Xizangica* **1**: 161 (1983)), in their smaller, narrower fronds than European T. phegopteris

Thelypteris procera (D.Don) Fraser-Jenk. (syn.: Cyclosorus procerus (D.Don) S.Linds. & Middlt.).

Thelypteris prolifera

Thelypteris pyrrhorhachis subsp. distans (syn.: Pseudophegopteris microstegia (Hook.) Ching (see Fraser-Jenkins 1997); misapplied names: Pseudophegopteris pyrrhorachis var. pyrrhorachis *sensu* Lin & Smith (2013) *p.p.* from Bhutan, N. India and Nepal, *non* (Kunze) Tagawa [= subsp. pyrrhorachis, from S. India and Sri Lanka])

Thelypteris pyrrhorhachis subsp. hirtirachis (rhizome short-creeping, not ascending; lamina coarsely lobed, axes hairy).

Thelypteris pyrrhorhachis subsp. laterepens, with long-creeping rhizome (syn.: Pseudophegopteris pyrrhorachis var. glabrata; misapplied name: "T. yunkweiensis" *sensu* Iwatsuki (1988), without rhizome, *non* Ching, with thick, erect rhizome [? = T. paludosa (Blume) K.Iwats.]).

Thelypteris rectangularis

Thelypteris probably siamensis ("T. hispidula" of the Indo-Himalaya, requiring a cytological

count. True T. hispidula (syn.: T. parasitica subsp. manickirudorum Fraser-Jenk. & Benniamin) occurs in S. India, Sri Lanka and S.E. Asia).

Thelypteris squamaestipes (syn.: Thelypteris khasiensis Ching; Cyclogramma tibetica Ching & S.K.Wu) - T. squamaestipes was suprisingly misplaced by Lin & Iwatsuki (2013) in the *Flora of China* as if a synonym of the very different species T. auriculata.

Thelypteris subpubescens - reported by Iwatsuki (1988), based on specimens 16694 and 8.12.1963, in TI, presumably in error for T. jaculosa; we have not seen any T. subpubescens from Nepal, though it occurs nearby in the Darjeeling *terai* near Sevoke, becoming common in N.E. India and Bangladesh at low altitude.

Thelypteris tenera (syn.: T. ciliata, T. sericea).

Thelypteris torresiana

Thelypteris tylodes

Blechnaceae

Blechnum orientale

Stenochlaena palustris

Woodwardia unigemmata (syn.: W. himalaica Ching & S.K.Wu).

Woodsiaceae

Acystopteris tenuisecta

Athyrium anisopterum (syn.: A. woodsioides Christ, *nom. superfl.*; A. kumaonicum Holttum *ex* Punetha, reidentified by CRFJ following study of the type at Pithoragarh P.G. College in 1990 and 1994. A. kumaonicum is merely a larger specimen of A. anisopterum).

Athyrium atkinsonii (this species is not related to Polypodium foliolosum Wall., *nom. nud.*, as suggested by Wang & Kato (2013), the which belongs to A. foliolosum, as clarified by Fraser-Jenkins (1995 *ined.* copy given to Wang; 2008)).

Athyrium attenuatum (syn.: A. dentigerum; A. pseudofilixfemina Ching, both merely representing larger grown plants of A. attenuatum, as shown by Fraser-Jenkins & Khullar (1982), Fraser-Jenkins (1995 *ined.*, 1997, 2008)). The conspecificity of the two was overlooked by Iwatsuki (1988) and misleadingly continued to be ignored by Wang & Kato (2013), despite personal explanation, who treated them as if two different species, but incorrectly thought A. attenuatum might perhaps be a different ecotype. A. attenuatum merely represents smaller grown individuals in more exposed places which are fertile, as can be seen by cultivating them, analagous to such plants well known in the European *A. filix-femina*; misapplied name: "A. filix-femina" sensu Iwatsuki (1988). As also shown by Fraser-Jenkins (1995 *ined.*, copies to Ching and Wang, 1997, 2008), Ching misapplied the name A. multidentatum to Chinese A. sinense, the type being *A. filix-femina* from Baden, Baden, Germany).

[Athyrium brevisorum Bedd. [not "(Wall. *ex* Hook., 1860) T.Moore (1859)" of Wang & Kato (2013), *nec* Asplenium brevisorum Mett. (1859)] - reported in a wide error from Nepal and Pakistan by Wang & Kato (2013) for an unidentified species or more than one species; as found by Fraser-Jenkins (1995 *ined.*, 2008), it is a synonym of A. niponicum (syn.: Anisocampium niponicum (Mett.) Y.C.Liu, W.C.Chiou & M.Kato), from far N.E. India (only), Myanmar and S.W. China, which is an obvious and normal Athyrium species, inappropriately treated by them under Anisocampium as if a different, but taxonomically insignificant cladogenus, instead of a section]).

Athyrium clarkei

Athyrium contingens (syn.: A. tarulakaense, A. nudifrons Ching, A. adscendens Ching *etc.*, studied and synonymised by Fraser-Jenkins (1995 *ined.*, 2008) which was overlooked by Wang & Kato (2013)).

Athyrium cuspidatum (syn.: Kuniwatsukia cuspidata, properly synonymised into Athyrium by Kato, confirmed by Fraser-Jenkins (1997 *etc.*); Anisocampium cuspidatum (Bedd.) Y.C.Liu, W.C.Chiou & M.Kato).

Athyrium davidii (syn.: A. duthiei, synonymised by Fraser-Jenkins (1984 *etc.*), overlooked by Iwatsuki (1988)).

Athyrium devolii

[Athyrium dissitifolium - reported by Iwatsuki (1988) and Wang & Kato (2013) in error for A. drepanopterum; A dissitifolium is not known from Nepal).

Athyrium distans (as found by Fraser-Jenkins (1995

ined.) and informed to Wang, A. nyalamense Y.T.Hsieh & Z.R.Wang, A. frangulum Tagawa and A. imbricatum Christ are synonyms of A. distans, which species was ignored by Wang & Kato (2013).)

Athyrium drepanopterum, neotype (Fraser-Jenkins 2008) from Kathmandu, Nepal (syn.: A. exindusiatum Ching; A. dissitifolium "var. dissitifolium" and "var. kulhaitense" *sensu* Wang & Kato (2013) *p.p.* Nepal, Bhutan, N. India; the name A drepanopterum has continued to be misapplied to A. eburneum by Wang & Kato (2013), despite being definitively treated by Fraser-Jenkins (1995 *ined.*, 1997, 2008) and discussed with both Ching & Wang).

Athyrium dubium (syn.: A. rubricaule, whose wide and well reported Indian region range was overlooked by Wang & Kato (2013)).

Athyrium sp. near dubium ("A. dubium" *sensu* Fraser-Jenkins (2008); "A. filix-femina var retusum" *sensu* Iwatsuki (1988), *non* (Decne.) C.B.Clarke [= Cystopteris fragilis, see Fraser-Jenkins (1997, 2008)]. This species is common from C. Nepal eastwards through Sikkim to Tibet and S.W. China and CRFJ is working though the many still much confused and effectively unidentified, randomly named related specimens from China in order to identify it and its synonymy).

Athyrium eburneum (syn.: Asplenium eburneum J.Sm. *ex* Mett., *Abhandl. Senckenb. Naturf. Ges.* **3**(1): reprint pg. 194 (1859), lectotype, here designated: "Aspidium eburneum Wall. Cat. 389, Nepal, Wallich, 1828, Herbarium of John Smith, purchased 1866, Asplenium (Athyrium) J.Sm. Cat. 1857, Lastrea eburnea J.Sm. Cat." (BM), determined on sheet as lectotype by CRFJ, Jan. 2013, excluding other sheets of Smith so named but without saying Wall. Cat. 389, although Smith had included a mixture of A. drepanopterum and the present species under the name, the present species is the only one that complies with Mettenius's description of indusia; misapplied names: "A. drepanopterum" *sensu* Iwatsuki (1988), Wang & Kato (2013), see Fraser-Jenkins (1997, 2008); "A. woodsioides" *sensu* Fraser-Jenkins (2008), *nom. superfl.* for A. anisopterum).

Athyrium falcatum (misreported from Nepal by Alston & Bonner (1956) and Iwatsuki (1975, 1988) in error for A. rupicola). Discovered in Surkhet Distr., W. Nepal, by CRFJ.

Athyrium fangii (syn.: A. sikkimense Ching, *non* (Bir) Á.Löve & D.Löve [= A. spinulosum]; A. paranigripes X.C.Zhang, *nom. nov.*). A. sikkimense Ching belongs here rather than to the related A. distans as stated by Fraser-Jenkins (1997) and remaining uncorrected by Fraser-Jenkins (2008), this error arose because he did not until later recognise A. fangii as genuinely distinct from the realated A. distans.

Athyrium fimbriatum (syn.: A. bucahwangense Ching). Formerly confused and erroneously called "A. foliolosum" in India until Fraser-Jenkins (1995 *ined.*, 1997, 2008) found that the name had been misapplied there, and was correctly identified with what had until then been called "A. puncticaule", *non* (Blume) T.Moore.

Athyrium flabellulatum

Athyrium foliolosum (syn.: A. austroyunnanense Ching; misapplied name: "A. puncticaule" *sensu* Iwatsuki (1988), *non* (Blume) T.Moore [from far N.E. India eastwards and south-eastwards].

Athyrium himalaicum

Athyrium mackinnoniorum (syn.: A. caudipinna Ching). As explained by Fraser-Jenkins (1997), this species does not have setae above the pinnule-midribs as misstated by Wang & Kato (2013), most of whose records from China are misidentifications, and it is not present in Thailand, nor does it contain any varieties.

Athyrium sp. near mackinnoniorum, but a rather smaller species, from Nepal, Bhutan and China, more toothed and lobed, somewhat towards A. vidalii. It remains to be precisely identified.

Athyrium mehrae ("A. nephrodioides" *sensu* Fraser-Jenkins (2008) and Fraser-Jenkins & Pangtey (2005), very closely similar to A. mehrae and equally or more tapered below, but indusia larger; found to be distinct by Zhang, and so treated by Wang & Kato (2013), accepted here).

Athyrium mengtzeense (?misapplied name: A. roseum *sensu* Fraser-Jenkins (2008); from Sinuwa, Chomrong, Kaski, *CRFJ & G.B. Tamang* 32425 (FN 72), 29.11.2006, TAIF; also Dodhrey to Palmajua, Darjeeling, *CRFJ* 27421 (FN 3398), 17.10.1998, H, BM). Axes glandular.

Athyrium micropterum (overlooked from China within A. anisopterum by Wang & Kato (2013)).

[Athyrium nakanoi - reported from Nepal by Wang & Kato (2013) in error for small A. foliolosum and with A. macrocarpum var. unipinnatum C.B.Clarke [small plants of A. puncticaule] given in its synonymy in error. A. nakanoi is not known from Nepal.]

Athyrium pectinatum

Athyrium repens

Athyrium rupicola

Athyrium schimperi subsp. biserrulatum

Athyrium schizochlamys

Athyrium setiferum (misapplied name: "A. nigripes" *sensu* Wang & Kato (2013), see Fraser-Jenkins (1997: 5, 2008) both names remain misunderstood in the *Flora of China*, where A. setiferum (T.Moore *ex* R.Sim) C.Hope, the correct authorities, has been erroneously synonymised within A. strigillosum (in contrast to Ching 1983), and A. nigripes, endemic to Indonesia, has been misreported from China in error for *A. setiferum*. Although Fraser-Jenkins' (1995 *ined*.) revision, *Himalayan athyrioid ferns*, was distributed to various workers in India and China, including Ching and Wang, it has not yet been published, but the relevant part is now included as an Appendix to this volume to explain the correct application of these names. A. setiferum is not A. strigillosum as erroneously figured for Asplenium tenellum by Hope (but not indicated by his citations) and thought by Wang & Kato (2013).

Athyrium silvicola (the "A. praetermissum" of the Indo-Himalaya listed by Sledge).

Athyrium spinulosum (syn.: Athyrium subtriangulare, see Fraser-Jenkins 2008, not separate species as treated by Wang & Kato (2013)).

Athyrium strigillosum

Athyrium vermae

Athyrium wallichianum

Cornopteris badia (syn.: C. quadripinnatifida).

Cornopteris banajaoensis

Cornopteris decurrentialata

Cystopteris fragilis subsp. fragilis. Contains a cryptic 4x and 6x cytotype.

Cystopteris fragilis subsp. diaphana (syn.: C. altaiensis Gureyeva). A tetraploid and hexaploid subspecies. A number of veins terminate in notches or flat lobe-apices, but not all do; spores with densely crowded, blunt spines.

Cystopteris fragilis subsp. dickieana (syn.: C. sikkimensis Bir). Spores rugose, this subspecies (4x, 6x, ?8x) was shown to have one genome different from subsp. fragilis. The echinate or rugose spore-ornamentation is not variable as thought in the USA and erroneously repeated by Wang & Haufler (2013), which arose due to failure to recognise semi-mature spores, but is consistent between the subspecies. The N. American, Himalayan, Chinese and European plants are the same subspecies and are distinct from subsp. fragilis, which was misunderstood by Wang & Haufler. The type population is merely a local foliose population of this subspecies from Scotland of no taxonomic significance, though its status has frequently been misunderstood, such forms also occur occasionally elsewhere (*e.g.* Chinghai, Maqin Shan, *T.N. Ho, B. Bartholomew & M. Gilbert* 816, 6.8.1993, BM) and in India.

Cystopteris fragilis subsp. kansuana (C.Chr.) Fraser-Jenk., ***comb. nov***. (basionym: Cystopteris kansuana C.Chr., *J. Wash. Acad. Sci.* **17**: 499 (1927)). This subspecies is usually fairly well demarcated from subsp. fragilis and is a small, narrow-fronded, high altitude member of the C. fragilis complex with pinna lobes fusing towards the pinna-apices to make a ± rectangular pinna-apical segment and a tendency for some veins to terminate in notches, though not all do; as in the other subspecies, the stipe often becomes dark brown later in the season; the spores may be smaller than in subsp. fragilis, but this has not yet been studied systemtically, they have similar acute, slightly spaced out spines to those in subsp. fragilis and not crowded, blunt spines as in subsp. diaphana. It urgently needs cytological investigation. It occurs in the high Himalaya in C. and E. Nepal (Kaski, Gorkha, Rasuwa, Sankhuwasabha, Taplejung), also in Sikkim, Bhutan, Tibet and China.

Cystopteris montana

Cystopteris moupinensis

Deparia allantodioides. As already pointed out by Fraser-Jenkins (2008) following careful study of the type, this species is not at all a hybrid as thought by Wang (1999); the spores are merely young, but good in the slightly more mature most basal part of frond. This was unfortunately

overlooked by He, Wang & Kato (2013) and arose due to lack of experience in studying spores and not restudying the type.

Deparia boryana subsp. boryana

Deparia concinna (discovered by Nakaike & Gurung (1995)).

[Diplazium donianum was misreported from Nepal by Wang & Kato (2013); it occurs in N.E. India and further east].

Deparia heterophlebia

Deparia japonica subsp. japonica

Deparia lancea

Deparia petersenii subsp. petersenii

[Deparia subfluvialis - was listed by Iwatsuki (1988) as "not actually collected from Nepal", but it is not known there or from the whole Indian subcontinent, unless, as thought by He, Wang & Kato (2013) it is a synonym of D. boryana]

Deparia probably subsimilis (probable syn.: D. acuta, see Fraser-Jenkins (2008: 239-241). D. subsimilis appears to be the same as D. acuta, but may require further study in the type locality in Hupeh. He, Wang & Kato (2013) followed Wang in synonymising it into a rather dubious taxon, D. giraldii, as are many taxa recognised in this section of the genus in China.

Diplazium bellum (syn.: D. axillare, see Fraser-Jenkins (2008); mistakenly identified and treated as a separate species by He & Kato (2013)).

Diplazium dilatatum

Diplazium doederleinii

Diplazium esculentum. Common weedy species, variably pubescent axes, including "var. pubescens".

Diplazium forrestii

Diplazium himalayense (He & Kato (2013) called this species D. axillare in error).

Diplazium javanicum

Diplazium kawakamii (reported by Iwatsuki (1988) and by He & Kato (2013) under the mistaken identity of *D. muricatum*, though already reidentified and commented on by Fraser-Jenkins (2008)).

Diplazium latifolium (He & Kato (2013) continued to misapply this name as a synonym of D. dilatatum in error, see Fraser-Jenkins (2008)).

Diplazium laxifrons

Diplazium longifolium T.Moore (July 1859) (syn.: D. lobulosum (Sept. 1859), a later name used by He & Kato (2013), overlooking the definitive explanation by Morton (1973) endorsed by Fraser-Jenkins (2008)).

Diplazium maximum (syn.: D. frondosum*;* the synonyms D. viridissimum and D. giganteum continued to be used as if separate species by He & Kato (2013) despite their detailed reidentification from study of the types and of variation in the field by Fraser-Jenkins (2008) and were reported by them as if separate species from Nepal *etc.*).

Diplazium medogense (*non sensu* Fraser-Jenkins (1997) [= D. laxifrons], see Fraser-Jenkins 2008).

Diplazium sikkimense (misapplied name: "D. polypodioides", which has been much confused with D. sikkimense, has been mistakenly called D. asperum by He & Kato (2013), apparently being unaware of Sledge's elucidation of these names, endorsed by Fraser-Jenkins (2008)).

Diplazium spectabile (He & Kato (2013) continued to call this species D. multicaudatum in error, misidentifying the name D. spectabile and overlooking all previous Indian work and Fraser-Jenkins' (1995 *ined.*, 1997 and 2008) treatment. In addition to He's citing the wrong basionym and erroneously repeating Mehra's (1939) combination of the epithet multicaudatum in Diplazium (see Fraser-Jenkins 2008), they misapplied the name D. spectabile to a species with adpressed ovate scales, which might perhaps be D. kawakamii, but cannot be readily identified from their confused account).

Diplazium squamigerum

Diplazium stoliczkae (He & Kato (2013) continued to separate the synonym D. hirsutipes in error despite previous explanations by Fraser-Jenkins and others).

Diplazium succulentum

Gymnocarpium fedtschenkoanum (we do not accept the idea by Sarvela *et al.* that this is synonymous with G. jessoense)

Gymnocarpium jessoense (see Fraser-Jenkins, 2008).

Gymnocarpium oyamense

Matteuccia intermedia (syn.: Pentarhizidium intermedium; misapplied name: "M. orientalis", "Pentarhizidium orientale"). A cryptic cladogenus, Pentarhizidium, accepted by Xing, Wang & Kato (2013), with non-exclusive indusial characters is not considered here to be

of sufficient taxonomic significance to be recognised as a genus.

[Woodsia alpina, across northern Pakistan and N.W. India (Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Pakistan), unknown to Zhang, Kato & Shmakov (2013), but not known from Nepal].

Woodsia andersonii

Woodsia cycloloba

Woodsia elongata (syn.: Cheilanthopsis elongata).

Woodsia glabella (its Indian and Nepalese range was reported by Fraser-Jenkins (2008), but omitted by Zhang, Kato & Shmakov (2013), though Nepalese material was given to X.C. Zhang by CRFJ in 2011).

Woodsia hancockii

Woodsia lanosa

Woodsia sp. *indet.* near lanosa (blackish stipes, longer, lobed pinnae, Jumla, Danphe Lagna pass, *CRFJ* 35205, 35366, in 2014).

Dryopteridaceae

Arachniodes aristata

Arachniodes assamica

Arachniodes coniifolia

Arachniodes cornucervi

Arachniodes henryi

[Arachniodes nipponica was reported by Thapa (2001, 2002) from Panchtar, Palamtar, *R.L. Fleming* 2563, 29.9.1978, KATH, but the specimen is A. coniifolia.]

Arachniodes rhomboidea

Arachniodes superba

Ctenitis apiciflora (all four species of the erstwhile Dryopsis were misplaced clado-molecularly by Zhang *et al.* (2012) and Dong & Christenhusz (2013) in Dryopteris)

Ctenitis clarkei

Ctenitis nidus (syn.: Nephrodium nidus (C.B.Clarke *ex* Baker) C.B.Clarke (1876), see Christensen (1905), as well as L.B. Zhang's generically challenged problem, this species was synonymised within the much later name, "Dryopteris transmorrisonense [*sic*]" [*i.e.* transmorrisonensis] by Dong & Christenhusz (2013) without taking account of basic nomenclatural date-priority and its well known synonymy).

Ctenitis manipurensis (Bandukey Bhanjyang, Ilam, *R.L. Fleming Sr.*, 26.9.1978, BM, det. CRFJ). The previous record by Wallich is of dubious origin, as was a recent report from Pithoragarh, Uttarakhand, by Kholia & Bhakuni (2010).

Cyrtomium anomophyllum

Cyrtomium caryotideum

[Cyrtomium fortunei was reported by Iwatsuki (1988), based on Suehiro 1030, 1031, KYO, without further details. It is known as a considerable rarity from further eastern Bhutan, Arunchal Pradesh and Manipur, but its presence in Nepal would be surprising. The report might more probably have referred to a smallish C. anomophyllum, but we have not yet been able to see the specimens for confirmation.]

Cyrtomium macrophyllum

Dryopteris acutodentata

Dryopteris alpestris

[Dryopteris angustifrons - listed by Lu *et al.* (2013) from Nepal was due to mislocalisation by Wallich of a specimen from Myanmar; the "D. pteridoformis", *i.e.* pteridiiformis, they listed from India etc. was in error for D. camusiae, as explained by Fraser-Jenkins (1997).]

Dryopteris atrata (a related, but distinctive species, D. microlepis Baker, has turned up in Arunachal Pradesh (Siang, Mechuka, *A.K. Baishya* 91420, 11.1986, ASSAM, det. CRFJ, 21.3.2012), but is not expected in Nepal).

Dryopteris barbigera

Dryopteris basisora

Dryopteris blanfordii subsp. blanfordii. A species related to D. blanfordii was noticed by CRFJ in 1977 and given a nick-name, "the Gund species" (see details in Fraser-Jenkins 1989: 388), then named as D. kashmiriana following confirmation of its distinctness from its different combination of phloroglucide chemistry (Widén *et al.* 1999, though initially misreported in error as the same as D. blanfordii by Fraser-Jenkins (1989) due to a slip of memory). But due to other ongoing work it has not yet been published in all this time, but following further study by CRFJ it does not appear to correspond with any Chinese species, so is validated here as Dryopteris kashmiriana Fraser-Jenk. & Widén, ***sp. nov.*** *Planta similaris ad D. blanfordii sed pinnulis minore lobatis et rhachidis frondis costisque pinnularum fibrillosis distinguitur. Sporae plerumque bene evolutae, non-abortivae. Cytotypus triploideus* (Gibby 1985). Holotypus: India, Jammu & Kashmir, "S. side of Sind valley, 3 km. R. of

Gund hamlet, Sonamarg - Ganderbal, N.E. of Srinagar, Pinus forest, by roadside, 2400 m., *C.R. Fraser-Jenkins* 6596, 27.3.1977, E; isotype in herb. T. Reichstein, ?Z, or ?taken to GENT (as *TR* 4562) and in PE, given to Prof. R.C. Ching by CRFJ. Paratypes: ditto, *CRFJ* 6594, 6595, 6597, 6598, 6599 (E, BM, PE, herb. T. Reichstein). Also revisited, 13.8.1978, *CRFJ* 7401-7406 (BM, H, E), chemically analysed, and 7403 and 7404 triploid at root-apex mitosis, 2*n* = *c.* 123, det. M. Gibby. This species is somewhat intermediate between D. blanfordii and D. edwardsii, but is not that hybrid as they are all three apomicts. It also formed two or three large populations over several km. Its morphology remains constant in cultivation in Britain (at Chelsea Physic Garden and at CRFJ's father's house in S. Wales, Newcastle House, Bridgend) This species also occurs in Uttarakhand, but has not as yet been found in Nepal.

Dryopteris carolihopei

Dryopteris chrysocoma (syn.: D. alpicola Ching & Z.R.Wang; D. chrysocoma var. squamosa, merely a young frond of D. chrysocoma).

Dryopteris cochleata. A closely related species similar to a consistently small, non-dimorphic D. cochleata was found in Meghalaya, India, by CRFJ in 1998, and has subsequently turned up in Manipur, further N.E. India and Myanmar. Some similarly non-dimorphic plants were reported by Fraser-Jenkins (1989) from S. India and SE Asia (Bali) and perhaps belong to the same taxon, Dryopteris subcochleata Fraser-Jenk. & K.C., ***sp. nov.*** *Planta similis ad D. cochleatam sed minor ad* 20 *cm. alta*; *frondes deltatae steriles et fertiles similares non dimorphae*. *Holotypus*: India, Meghalaya: "rocky, forested slope on N.W. side of bottom of gorge of Wah Umkhrah river, below Beadon Fall, near Mawlai, N.W. side of Shillong town, Khasi Hills, *C.R. Fraser-Jenkins* & *Rajkumar K.C.* 27603 (FN 3580), 22.11.1998, H; paratype: *ditto*, 27604 (FN 3581), H. It is not known from Nepal.

Dryopteris conjugata

Dryopteris costalisora

Dryopteris edwardsii (misapplied name: "D. yigongensis" *p.p. Ind.*, *sensu* Wu, Xiang, Lu, Wang, Xing, Dong, He, Zhang, Barrington & Christenhusz (2013). Too many cooks and foreign apprentices may not have been able to investigate the name D. yigongensis properly in its type locality. It was initially accepted by Fraser-Jenkins (1989), but the small type-specimen is very difficult to recognise and Fraser-Jenkins (1997, 2008) subsequently separated D. edwardsii and D. pauliae, though further evidence concerning D. yigongensis would be welcome. These two species, explained in the protologue were not studied by the *Flora of China* multiauthorship, nor was information sought. about them.

Dryopteris flemingii

Dryopteris fructuosa

Dryopteris gamblei (this is not a synonym of D. stenolepis, as mistakenly placed by Wu *et al.* (2013), not having assimilated the literature).

Dryopteris juxtaposita

Dryopteris khullarii

Dryopteris komarovii

Dryopteris lepidopoda

Dryopteris marginata

Dryopteris nigropaleacea (not present in China, as suggested by Lu *et al.* (2013)).

Dryopteris panda

Dryopteris pauliae

Dryopteris pulvinulifera

Dryopteris ramosa

Dryopteris redactopinnata (sect. Fibrillosae). The type with its broad brown scales and many fibrils, which I studied in detail and identified in CAL now appears to be lost there.

Dryopteris scottii

Dryopteris serratodentata

Dryopteris sparsa subsp. sparsa (the subspecies of D. sparsa were incorrectly synonymised without understanding by Lu *et al.* (2013)). D. hasseltii is not a member of Acrorumohra, but of Dryopteris sect. Nephrocystis; Sect. Indusiata S.G.Lu is a synonym of Sect. Erythrovariae, while D. amurensis was entirely misplaced in Sect. Variae by Lu *et al.* (2013) and is a typical member of Sect. Lophodium as placed by Fraser-Jenkins (1986).

Dryopteris sparsa subsp. rectipinnula

Dryopteris sparsa subsp. viridescens

Dryopteris splendens

Dryopteris stenolepis

Dryopteris stewartii

Dryopteris subimpressa

Dryopteris sublacera

Dryopteris tingiensis (Solukhumbhu, verest region, Dole, 4160 m., *G.* & *S. Miehe* 961, 8.9.1982, BM).

Dryopteris wallichiana subsp. wallichiana (this species along with D. rosthornii [recently discovered N. of Thimphu, Bhutan by CRFJ and Sagun Pariyar], D. lepidopoda and "D. neorosthornii" were incorrectly placed in Sect. Dryopteris by Zhang in Wu *et al*. due to misinterpreting chloroplast molecular results in allopolyploid taxa and ignoring morphology. The subspecies were entirely ignored, apart from misapplication of the name D. neorosthornii to unspecified plants from India, Nepal and Bhutan).

Dryopteris wallichiana subsp. bhutanica Fraser-Jenk. & Pariyar, ***subsp. nov.*** *Planta similaris ad D. wallichianam subspec. wallichianam sed frondes minorae stipes longiorus paleae stipitis latiorae valde anthracinae, basis laminae valde truncata, lobi pinnorum* (*pinnulae*) *superne glabri nitidi valde rectangulariter truncatae dentes acuminati*. *Cytotypus ignotus.* Holotype: Bhutan, Thimphu, "below Dochu La on Lamperi trail, 27° 29.50', 89° 45.62', 2880 m., *T. Wangdi*, *N. Gyeltshen*, *R. Yangzom* & *S. Matsumoto* 13, 1.3.2005 (THIM)". Fronds smallish (to *c.* 60 cm. tall), stipe long, stipe and rachis densely furnished with stiff, all black, exserted scales, though those on the upper stipe may have brown apices, scales narrow and attenuated at their apices, but obviously wider throughout most of their length than in subsp. *wallichiana*, but not ovate-lanceolate as in *D. zayuensis*; lamina rigid, glabrous and glossy above, pinnules with markedly square-truncate apices and acute teeth which taper abruptly to acuminate apices, those at the corners of the pinnule often longer, the lowest basiscopic pinnule on lower pinnae usually with a short lobe at their basiscopic base. This subspecies is scattered but not uncommon in Arunachal Pradesh, Bhutan (e.g. below Phajudin Gompa above Taksin Park, *C.R. Fraser-Jenkins* & *Sagun Pariyar* 35 (FN 111), 8.12.2003 (THIM, TAIF), and W., C. and E. Nepal (less common, *e.g.* Bajhang, *H. Ikeda et al.* 20915088; Solukhumbhu, near Junbesi, *T. Nakaike* 3629, both in KATH) and also occurs in Yunnan, S.W. China; it normally occurs at around 2500 m. altitude or more.

Dryopteris wallichiana subsp. himalaica

Dryopteris wallichiana subsp. nepalensis

Dryopteris woodsiisora

Dryopteris xanthomelas (not the same as D. rosthornii, as stated by Wu *et al.* (2013), while still referring to this single species under two of its synonyms, D. pulcherrima and D. sinofibrillosa, as explained by Fraser-Jenkins (1989, 1997, 2008 *etc*.) after detailed study of the types, other material and in the field).

Dryopteris yoroii

Dryopteris zayuensis Ching & S.K.Wu (this is the correct name for the species, not the simultaneously published D. squamifera Ching & S.K.Wu, misused by Wu *et al.* (2013), which was first synonymised under D. zayuensis by Fraser-Jenkins (1992, 1997, 2008; the other simultaneously published synonyms of D. zayuensis are D. discreta Ching & S.K.Wu, D. incisolobata Ching, D. nyalamensis Ching & S.K.Wu and its var. angustipinnata Ching & S.K.Wu, D. fibrillosissima Ching and D. qandoensis "qamdoensis" Ching).

Hypodematium crenatum subsp. crenatum

Hypodematium crenatum subsp. loyalii (syn.: H. hirsutum (D.Don) Ching).

Hypodematium crenatum subsp. mehrae

Nothoperanema hendersonii (both species of Nothoperanems were misplaced by Zhang (2012) and Wu *et al.* (2013) in Dryopteris).

Nothoperanema squamiseta

Peranema aspidioides (syn.: Dryopteris pseudocaenopteris (Kunze) L.B.Zhang; Dryopteris hookeriana (T.Moore) L.B.Zhang; all three species were misplaced by Zhang (2012) and Wang *et al*. (2013) in Dryopteris and erroneously in two different sections, with unnecessary new names or combinations made).

Peranema cyatheoides (syn.: Dryopteris peranema L.B.Zhang).

Peranema paleolata (syn.: Dryopteris paleolata (Pic.Serm.) L.B.Zhang).

Pleocnemia submembranacea (Dong & Christenhusz (2013) impossibly used the later syonym, P. winitii, for this species and placed P. submembranacea in its synonymy, ignoring nomenclatural date-priority due to lack of taxonomic experience and knowledge).

Polystichum acutidens

Polystichum annapurnicola. Endemic to Nepal as so far known.

Polystichum atkinsonii

[Polystichum attenuatum (syn.: P. mannii C.Hope *ex* Fraser-Jenk., CRFJ has found from Thai material kindly made available by Dr. S. Lindsay for determination in 2011 that P. mannii is a synonym of P. attenuatum. It has not been collected in Nepal, though it is common from Darjeeling and Sikkim eastwards).]

Polystichum bakerianum

Polystichum centronepalense. Endemic to Nepal as so far known.

Polystichum cyclolobum. Recently found by CRFJ in Jumla District, W. Nepal.

Polystichum discretum (P. fuscopaleaceum Alston is certainly not a synonym, or similar to P. discretum as mistakenly guessed by Zhang & Barrington (2013), but as explained by Fraser-Jenkins (2008: 331) is a tetraploid species close to P. yunnanense and P. woronowii).

Polystichum duthiei. Recently found by CRFJ in Jumla District, W. Nepal, and occurs as a high Himalayan rarity in N.C. Nepal.

Polystichum glaciale. Recently found by CRFJ in Jumla District, W. Nepal.

Polystichum hookerianum (syn.: Phanerophlebiopsis hookeriana). Fraser-Jenkins 1991, 1997, 2008) used what in hindsight is clearly the wrong genus for this species, Phanerophlebiopsis, also for Polystichum polyodon and P. balansae, which latter has been collected in Arunachal Pradesh (Siang, Yapik, *A.K. Baishya* 90709, 1.11.1986, ASSAM, det. CRFJ), but with a subapical proliferous bulbil. Although it could be recognised as a new genus, related to Cyrtomidictyum, we tentatively accept here to place it in Polystichum).

?Polystichum inayatii

Polystichum jamunae

Polystichum lachenense

Polystichum lentum (probable synonyms: P. chunii; P. bigemmatum, degree of lobing and number of gemmae are both highly variable in P. lentum).

Polystichum longipaleatum

Polystichum luctuosum (syn.: P. tsus-simense, synonymised by Fraser-Jenkins (1991 *etc.*); triploid apomict from Pithoragarh, not tetraploid, as mistakenly reported by Punetha, Kholia & Sen (1988), recounted by Matsumoto (Fraser-Jenkins & Matsumoto 2015, in press).

[Polystichum makinoi - mistakenly reported from Bhutan and Nepal by Zhang & Barrington (2013) in error for P. piceopaleaceum. Despite earlier reports by Fraser-Jenkins (1991) in error for P. yunnanense, later corrected, one collection of apparently genuine P. makinoi has been collected in the Indian subcontinent (Bhutan, lower Yangri Chu, N. of Tergang, 2560 m., *S. Miehe* & *D.B. Gurung* 00-474-13, 13.1.2001, UC, det. CRFJ, 2014), not seen by Zhang & Barrington. It is not known from Nepal).]

Polystichum manmeiense

Polystichum mehrae (P. acanthophyllum was misreported from N. India and Nepal by Zhang & Barrington (2013) misunderstanding that as explained by Fraser-Jenkins & Khullar (1986), Fraser-Jenkins (1997 *etc.*) Indian records of P. acanthophyllum were all in error for P. mehrae).

Polystichum mucronifolium

Polystichum neolobatum (syn.: P. garhwalicum, as previously stated by Fraser-Jenkins (1997, 2008), not a distinct species as treated by Zhang & Barrington (2013)).

Polystichum nepalense

Polystichum obliquum

Polystichum piceopaleaceum (pinnules with aristate teeth. Zhang & Barrington (2013) were unable to understand that intersectional allopolyploids are not properly indicated by chloroplast DNA study and thus thought there was a dilemma for them as to where to place the European allopolyploid P. aculeatum, the straightforward solution of a mixed-origin Sect. Hypopeltis shown by Fraser-Jenkins (1991), and similarly for intersectional allopolyploid Dryopteris in Sect. Remotae, by Fraser-Jenkins (1986) apparently not being understood by them. It is incomprehensible why they thought that they must misplace P. aculeatum together with Sect. Metapolystichum, since chloroplast DNA is not by itself a basis for classification, particularly in all the multitude of genera containing allopolyploids. But they therefore misplaced this and other species of Sect. Metapolystichum within the Sect. Hypopeltis in error. Hypopeltis does not become the correct name for Sect. Metapolystichum as they stated).

Polystichum prescottianum (syn.: P. castaneum, scale colour and laminar width are continuously

variable in P. prescottianum; syn.: P. moupinense, the type (P!) made available to CRFJ by F. Badré is a small P. prescottianum as explained by Fraser-Jenkins (1991 *etc*.). In addition, completely anomalously and against logic Zhang & Barrington (2013) entirely misplaced P. prescottianum and several related species (and synonyms, the earlier ones already sunk by Fraser-Jenkins (1991)) within Sect. Hypopeltis, by which they meant mainly Sect. Metapolystichum, but its synonym, P. castaneum, was placed correctly in Sect. Sorolepidium, in a confused attempt at molecular pseudo-taxonomy).

Polystichum pseudotsus-simense

Polystichum punctiferum

Polystichum scariosum (misreported by Zhang & Barrington (2013) in the *Flora of China* from S. India and Sri Lanka, where it does not occur, due to continued confusion with P. anomalum, since Ching erroneously referred to P. scariosum by the name P. eximium, a synonym of P. anomalum (from S. India and Sri Lanka). Despite its correction by Sledge (1973) and in more detail by Fraser-Jenkins (1991, 1997, 2008, 2010), with its range clearly given as N.E. India, Myanmar and China (and now also Poiyim, Burjung khola, Kaski, Nepal, *CRFJ* 34282 (FN 85), 12.9.2009, TAIF), the authors of the Flora still entirely omitted its range in the Indian subcontinent and raised mistaken doubts re the cytotype *etc*., presumably due to not having seen the material concerned. The occurrence of P. grandifrons, in the same section, in Nagaland, as reported by Fraser-Jenkins (1991), Chandra *et al*. (2008) was prematurely guessed to be doubtful by Zhang & Barrington (2013), without studying the specimen, which is P. grandifrons as stated).

Polystichum semifertile (syn.: P. lomgipinnulum, mistakenly treated as a separate species by Zhang & Barrington (2013) and given a misleadingly hypothetical but unreal range including Nepal, India, Myanmar and Thailand, despite having been studied in detail and definitively identified by Fraser-Jenkins (1991)).

Polystichum shensiense

Polystichum sinense

Polystichum squarrosum

Polystichum stenophyllum

Polystichum stimulans

Polystichum thomsonii (syn.: *P. longidens* and probably some other more recently described doubtful taxa from China; P. capillipes, the latter was placed in a different "subgenus" from P. thomsonii by Zhang & Barrington (2013), but it is unclear in what sense they took the name, as all material from Bhutan, N.W. India and Nepal, which countries they listed for it, is certainly just immature, sometimes precociously fertile P. thomsonii into which such plants entirely merge as growth stages, also observed in cultivation. The type of P. capillipes also appears to be the same as this, but some of the synonyms listed in the *Flora of China* may belong elsewhere and might perhaps have led to their otherwise surprising conclusion).

Polystichum woodsioides (misapplied name: "P. moupinense" *sensu auct. Sin.*, *non* (Franch.) Bedd. [= P. prescottianum], as shown by Fraser-Jenkins (1991), though P. woodsioides was still treated under the name P. moupinense by Zhang & Barrington (2013)).

Polystichum yunnanense (correctly lectotypified in accordance with the protologue and ICBN by Fraser-Jenkins & Khullar (1985) and not contrary to any recommendations as misstated by Zhang in Zhang & Barrington (2013), although the application of the name had been misunderstood by Zhang & Kung (1996) and Zhang & He (2009), see Fraser-Jenkins (2008: 331) where their error is corrected).

Tectaria coadunata (including a more glabrous plant, perhaps separate, but which is not "T. dubia" as previously misidentified tentatively by Fraser-Jenkins (2008). This genus and Pleocnemia are maintained here in Dryopteridaceae).

[Tectaria decurrens was erroneously listed for Nepal by Xing, Yan & Christenhusz (2013) without any basis given, but is excluded here.]

[Tectaria dissecta was misreported from India by Dixit (1984) and without details by Xing *et al*. (2013) in error for T. fuscipes]

[Tectaria dubia was misreported from Uttarakhand by Chandra (2000), from Nepal (tentatively) by Fraser-Jenkins & Benniamin (2010) in error for more glabrous T. coadunta, and from Nepal and Bhutan by Xing *et al.* (2013). It is probably a synonym of T. griffithii, pending further study.]

Tectaria fuscipes (misapplied name: "Nephrodium

membranifolium" *sensu Clarke et auct. Ind., non* C.Presl [= T. dissecta from S. India and S.E. Asia]).

Tectaria heterocarpa (syn.: T. heterosora).

[Tectaria impressa (syn.: T. variolosa) was misreported from Nepal by Xing *et al.* (2013), but is excluded here.]

[Tectaria multicaudata was found by both Fraser-Jenkins and Knapp (*ined*.) and Ding, Chao & Dong (2013) to be distinct from T. griffithii (Baker) C.Chr., but is not known as far west as Nepal, though it occcurs nearby in Darjeeling.]

Tectaria polymorpha

[The report by Fraser-Jenkins & Benniamin (2010) of T. ternifolia (a synonym of T. siifolia) from Bhutan and Arunachal Pradesh was in error for an undescribed species, T. pseudosiifolia Fraser-Jenk. & Wangdi, ***sp. nov***. *Planta similaris ad T. morsei sed stipes stramineus, lobi basali pinnarum obtusiori, costae pinnarum dense fusco-pubescentae et sori parvi, exindusiati. Ad T. polymorpham affinis sed frons tripartita vel pares duo pinnarum, pinna basalis plerumque sine lobis basiscopicis vel minimis sive praesentibus.* Holotypus: S.E. Bhutan, "Steep, forested, rocky bank of small stream gorge, 3 km. above and north of Samdrup Jongkhar, to east side of main road north towards Tashigang, *c.* 2 km. S. of Pinchinang Check Post, Samdrup Jongkhar District, *C.R. Fraser-Jenkins, T. Wangdi, S. Lungten* & *T. Dorji* 33930 (FN 16), 20.5.2009", TAIF; isotype: THIM. Although baby plants of T. polymorpha can appear similar they do not have the dense rufous hairs on the axes and the pinnae and lobes if present are more rounded and obtuse; the lamina is also a brighter green colour. It remains constant in cultivation. Of similar species it is not T. subpedata [? = T. polymorpha], nor T. morsei, which has larger, indusiate sori and narrower basal lobes and a sterile-fertile subdimorphic, slightly smaller fertile frond, with dark stipes. Nor is it T. siifolia, which is proliferous, which T. pseudosiifolia never is, nor a small T. angulata. T. pseudosiifolia also occurs in Arunachal Pradesh (opposite and above Seinki Park, Itanagar, *CRFJ* 33726 (FN 189), 16.2.2009, ARUN, and in Myanmar. Not known from Nepal.]

Elaphoglossaceae

Bolbitis asplenifolia (misapplied name: "B. appendiculata" auct., *p.p., non* (Willd.) K.Iwats. [from N.E. and S. India eastwards]). This species is cytologically and morphologically distinct from T. appendiculata (Fraser-Jenkins 2008). The related B. nodiflora from Bangladesh, Myanmar *etc*., see Fraser-Jenkins (1997, 2008), was treated under the name B. hookeriana by Xing, Wang & Iwatsuki (2013) in error).

Bolbitis angustipinna (Hayata) Nakai *ex* H.Itô (syn: Acrostichum crispatulum var. contaminans C.B.Clarke; Bolbitis contaminans (C.B.Clarke) Ching, *non* Poecilopteris contaminans Bedd. (1868), *nec* Gymnopteris contaminans (Bedd.) Bedd. (1876)). Beddome first validated Wallich's epithet contaminans in 1868 as Poecilopteris contaminans, based, as he said, on the fern illustrated by him (1864) in the *Ferns of Southern India*. He had (Beddome 1864: 68) initially misidentified this plant as P. repanda (Blume) Bedd., with various synonyms given, but in 1868 stated that it should instead be called P. contaminans Wall., excluding P. repanda. He had supplied his own detailed description of this S. Indian fern in 1864. He therefore validated Wallich's epithet in 1868, not as a superfluous name for B. repanda or any other name, but purely by reference to the 1864 description and illustration with magnified analysis he made of his plant. The plant concerned is unequivocally B. semicordata (Baker) Ching, and not the same as Wallich's north Indian plant (*Num. List* no. 22) of B. angustipinna, but fortunately the name B. contaminans is preoccupied by B. contaminans (C.B.Clarke) Ching, so does not replace B. semicordata. The lectotype, here designated of Poecilopteris contaminans Bedd., *Ferns Brit. India*: 270 (1868), is the illustration with analysis in Beddome, *Ferns S. India*: *t.* 202 (1864). B. angustipinna occurs in the low foothills of C. and E. Nepal.

Bolbitis costata

[Bolbitis crispatula - appears not to have been collected in Nepal. The type is labelled as from Kumaon, Uttarakhand, *R. Blinkworth* in Wallich Num. List no 24, K-W (!), and seems to be probably correctly labelled. A further report of it or perhaps a related species (Hope 1903) is from Bhainskil, near Parewa, Kotah range, Garhwal, [Uttarakhand], 6000 ft., *Inayat Khan*,

14.6.1902, DD (reported by Khullar (2000) under the name B. virens, but specimen drawn from Castle Rock, Karnataka, being B. semicordata), but it is otherwise known only from Meghalaya and Bangladesh, so its occurrence in the W. Himalaya might require further investigation.]

Bolbitis deltigera. S.C. and S.E. Nepal.

Bolbitis heteroclita

Bolbitis longiaurita F.G.Wang & F.W.Xing, described by Xing *et al.* (2013) as if a local Chinese species, apparently unaware of its full wide range (syn.: *B. costulata* (Hook.) Fraser-Jenk. (Fraser-Jenkins 2008), who was not at that time aware of its chance description from China as a new species).

Bolbitis major. C. and E. Nepal.

Bolbitis ?repanda (Blume) Schott, a further S.E. Asian species, thus doubtfully identified here for the present species which is very similar in its lobing, anastomosing veins (as in B. repanda, but not the same as in the also rather similar B. quoyana), short, deltate frond and attenuated apex. It was found in an undisturbed natural habitat in W.C. Nepal in a small population, rocky slopes beside waterfall in forested khola in upper Chiso Khola, S. of Yamdi Khola, going up from S.W. of Yamdi village, on N.E. side of and below top of Sarangkot Hill, *c*. 4 km. N.W. of Bogar, N.W. Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *Krishna Neupane* & *Kodananda* ["*Umesh*"] *Pongali* 25930-25932 (FN 1908-1910), 11.1.1998, BM, H.

Bolbitis tibetica (misapplied name: "B. angustipinna" *sensu* Fraser-Jenkins (1997: errata 3), with note re morphological difference). Fraser-Jenkins in Thapa (2002) and Fraser-Jenkins (2008) reported this species from Nepal, though omitted by Xing *et al.* (2013).

[Bolbitis virens - reported by Itô (1966) and as "var. virens" with key by Iwatsuki (1988) from a specimen from Ilam, "Ghorwa - Sanichare, *H. Hara, H. Kanai, S. Kurosawa, G. Murata* & *M. Togashi* 6305228, 10.12.1963, TI, photo kindly sent by Prof. K. Iwatsuki, 3.2015, of fertile fronds, which appear to be typical true B. virens, yet sterile fronds 6305227 from the same locality are normal and definite B. heteroclita, which suggests the fertile fronds might perhaps be abnormally narrow-pinna'd B. heteroclita. Hennipman (1977), followed by Xing *et al.* (2013), reported B. virens (as "var. virens") only from China, Bangladesh, Myanmar and Thailand. Also reported from Nepal by Thapa (2002) but including, or referring only to B. deltigera.]

Elaphoglossum marginatum

Elaphoglossum stelligerum (syn.: E. yunnanense). Xing, Wang & Mickel (2013) separated E. yunnanense, long treated as a synonym of the Indian E. stelligerum, which they did not mention, and cited it from India but omitted its well known occurrence in Nepal and Bhutan. We are not yet aware of the grounds for their novel treatment which were not explained.

[Lomagramma sorbifolia (syn.: L. matthewii (Ching) Holttum; Bolbitis nagalandensis R.R.Rao & Jamir). As shown by Fraser-Jenkins (2008), L. sorbifolia is the correct name rather than its Chingian synonym, L. matthewii, utilised by Xing, Wang & Kato (2103) in the *Flora of China*, but with the much earlier name L. sorbifolia impossibly given in its synonymy. Though untenable, their incorrect treatment ignoring priority yet not edited out, shows that they agreed its identity, even if Holttum was not sure and followed the old notion of *nomina dubia*. It occurs in far N.E. India, but is not known or expected in Nepal.]

Nephrolepidaceae

Nephrolepis cordifolia, *nom. et typ. cons.*

Nephrolepis undulata (syn.: N. delicatula).

Nephrolepis radicans. A specimen reported by Hope from Nainital (BM unincorporated cupboard) is this species but is surely due to a transposed locality. It occurs in the further south-eastern Nepal *terai* and lowland N.E. India *etc.*

Oleandraceae

Oleandra pistillaris. This common species in the region was separated from O. neriiformis by all botanists concerned with India and China following Holttum (1954, 1968) and others. But a recent, rather weakly informative outline monograph by Hovenkamp & Ho (2012) stressed the fact that the species of this genus are taxonomically difficult, as long known. They therefore decided the easiest course for a simple answer would be to unite in exemplary Leiden

style all related species wherever slight overlap is caused by variability, which was generally taken to mean conspecificity for the purpose of completion of the remaining fern parts of *Flora Malesiana*. However several of the species evidently require more detailed and considered study. We do not follow here the rather drastic synonymisation of O. pistillaris into the Philippine O. neriiformis as decided by Hovenkamp & Ho without discussion or even mention of factors concerning their widely accepted treatment as separate species. However at least our Indian subcontinental plant, and in Malaysia does not appear to be the same species as O. neriiformis.

Oleandra undulata - this species is near O. wallichii but has dense, slightly spreading, lanceolate brown, vaguely bicolorous rhizome scales and the articulation point is relatively further up the stipe, the stipe varying from short to long, with the soral lines not as closely adjacent to the costa as in that species. It occurs in further N.E. India (Manipur, Nagaland, Meghalaya, Mizoram), Myanmar, Arunachal Pradesh and Nepal (Syangja, Andhi khola, *R.L. Fleming* 860, BM; *ditto*, *R. Nirola* & *N. Pradhan* 54/179, KATH; Kaski, Pokhara, *J.D.A. Stainton* 7103, BM, *ditto* (Raniban), *C.R. Fraser-Jenkins* 18099, 23.1.1991, E; Sunsari (Sangure, *P.R. Shakya* & *M. Ohsawa* 1087, KATH), but has been overlooked in Nepal until now. O. whangii Ching and O. intermedia Ching, were placed by Hovenkamp & Ho (2012) as synonyms of O. musifolia and O. cumingii respectively, but at least the former appears closer to the present plant ftom material seen at BM.

Oleandra wallichii

Davalliaceae

Araiostegiella hookeri (Nooteboom (2002) was entirely and obviously mistaken in synonymising the very distinct A. perdurans within A. hookeri, under the mistaken name A. clarkei, that name unfortunately also used by Kato & Tsutsumi (2008)).

Davallia bullata (not conspecific with D. trichomanoides (syn.: D. mariesii T.Moore *ex* Baker], which has much more ciliate scales and a slightly distinct lamina morphology. The generic names Humata and Pachypleuria are clearly synonyms of Davallia).

Davallodes membranulosa

Davallodes multidentata

Katoella beddomei (the three species formerly treated as if "typical" Araiostegia species in the region are not related to Copeland's unfortunately chosen type of the genus, A. hymenophylloides, a species with narrow scales and segment-lobes, which is both morphologically and, as shown by Kato & Tsutsumi (2008), molecularly distinct from them and is a species of Davallodes. The remnant species form a small genus of their own, here named with a brief diagnosis as a new genus, Katoella Fraser-Jenk., ***gen. nov.***, *ad Davallodi affine sed paleis rhizomatis ovatis peltatis, axibus frondium glabris distinguitur*. Holotype species: *Katoella beddomei* (C.Hope) Fraser-Jenk., Kandel & Pariyar, ***comb. nov.***, basionym: Davallia beddomei C.Hope, *J. Bombay Nat. Hist. Soc.* **12**(3): 527-528 (1899). It is difficult for those who know this very distinctive, utterly discrete and most beautiful higher Himalayan species in the field to understand how it could ever have been thought by Nooteboom (1992) to have been a synonym of K. pulchra. Even more surprising is its continuing to be so treated by Xing, Wang & Nooteboom (2013) instead of being editorially picked up on. This was despite the clear correction of this blunder by Fraser-Jenkins (2008), his communication of the same to Nooteboom, and its long history of correct recognition in India from Hope's admirable account to Khullar's (2000) equally clear account, by all who knew what they were talking about. As a result this fine species is now quite overlooked in China and Tibet. Alhough Khullar (2000) treated it as if it constituted two species, the second under the name A. delavayi, in error, the existence of only the one was clarified by Fraser-Jenkins (1997), but synonymising A. delavayi (in Khullar's sense) into A. beddomei, while explaining that he had not seen the type of A. delavayi from China. The scion of Leiden, did, however, get one thing right, the identification of the type of the true A. delavayi as being conspecific with A. pulchra, though preferring only to recognise a single genus of Davalliaceae. Xing *et al*. (2013) also did not realise that the type species of Araiostegia, A.

hymenophylloides is a rather typical species of Davallodes (a genus they stated they were unable to recognise) and used the defunct Chinese genus Paradavallodes they preferred nationally, even though admitting it was a later name and ignoring that it has long been synonymised outside of China.

Katoella pulchra (D.Don) Fraser-Jenk., Kandel & Pariyar, ***comb. nov.***, basionym: Davallia pulchra D.Don, *Prodr. Flor. Nepal*.: 11 (1824), syn.: Araiostegia pseudocystopteris. Taken by Hope, Indian botanists and Fraser-Jenkins (1992, 1997) to be the species now called K. squamata, but Don's type is the same as what used to be called A. pseudocystopteris in India (see Fraser-Jenkins 2008).

Katoella squamata (Decne.) Fraser-Jenk., Kandel & Pariyar, ***comb. nov.***, basionym: Cystopteris squamata Decne., in Jacquemont, *Voyage V. Jacquemont Inde* **4**, Bot.: 178 (1844). A difficult species due to the variable and slightly overlapping frond morphology of both this and K. pulchra (see Fraser-Jenkins (2008), though the rhizome of K. squamata is thicker and has less pseudopodia than in K. pulchra. Its long separation in India was ignored by Xing *et al.* (2013) and its presence in China was thus overlooked.

Leucostegia truncata (almost certainly belongs to Davalliaceae, not Dryopteridaceae as suggested molecularly, or the erroneous family Hypodematiaceae, but like Rumohra is apparently near the borderline between the two families).

Polypodiaceae

Arthromeris himalovata Fraser-Jenk. & Kandel, ***sp. nov***. *Planta aliquantum similaris ad A. lehmannii sed rhizoma glauca, paleae rhizomatis rubro-brunneae valde dispersae saepe fere absenti praeter ad apices, bases palearum ovatae subito angustatae in apices attenuatos*; *pinnae sessiles late-ovatae ad cm. quattuor in latitudine, apices anguste caudato-attenuatae, leviter pubescentae. Sori numerosi tres vel quattuor inter venas laterales verticale dispersi.* Holotypus: E. Nepal, "Ilam District, densely forested gully of upper Tungne khola, just W. of Lamidura, S. of Mekma, N. of Chitray Gompa monastery, N. of and above Manebhanjyang and Pashupatinagar, on S.W. side of Singalilla ridge, near the Nepalese border with India, N.E. of Ilam, *C.R. Fraser-Jenkins* 29719 (FN 5694), 25.10.2001", H. (syn.: Polypodium venustum var. niphoboloides C.B.Clarke; Arthromeris himalayensis var. niphoboloides (C.B.Clarke) S.G.Lu; misapplied name: "A. himalayensis" *sensu auct. Ind. et Sin.*, *non* (Hook.) Ching [= A. lehmannii]). Although this species occasionally has fairly densely hairy undersurfaces, as part of its range of variation ("forma niphoboloides"), which led Fraser-Jenkins (2008) to synonymise A. tomentosa W.M.Chu as well, in error, it is fully distinct from A. tomentosa from further N.E. India, Bhutan and China, as confirmed by Fraser-Jenkins & Benniamin (2010), overlooked by Lu & Hovenkamp (2013) in the *Flora of China*. Yet again we are obliged to introduce a novelty due to the inaccuracy of Sir William Hooker in misidentifying the name Pleuridium venustum and misapplying his unnecessary *nomen novum superfluum*, Polypodium himalayense, to the present species. But it is hoped that stability will now result. This species occurs from E. Nepal eastwards and is not present in Uttarakhand whence it was misreported in error for an abnormal lobed "sport" of A. lehmannii with wider pinnae.

Arthromeris lehmannii (Mett.) Ching (syn.: Pleuridium venustum J.Sm. (validated in the key); A. venusta (J.Sm.) J.Sm.; A. himalayensis (Hook.) Ching, *non sensu auct. Ind. et Sin.* [= A. himalovata], *nom. nov. superfl.* for A. venustum (J.Sm.) J.Sm.; Polypodium venustum (J.Sm.) C.B.Clarke, *non* Desv., *nec* Blume; Arthromeris jarrettiae ["jarrettii"] Sastry & H.J.Chowdhery (an abnormal population); Arthromeris tibetana Ching).

Arthromeris mairei (Brause) Ching, excluding Zhang (2012: t. 583) (syn.: A. proteus (Copel.) Tagawa; A. repandula Ching; A. intermedia Ching; A. tsayuensis Ching & Y.X.Lin; A. gamblei S.R.Ghosh; A. indica S.R.Ghosh; A. wallichiana var. biserialis (C.B.Clarke) Ching, repeated by S.R.Ghosh; A. repandula var. nainitalensis P.C. Pande, H.C. Pande & P.Joshi; misapplied name or ?synonym: "A. lungtauensis" *sensu auct. Ind.*, *non* Ching). Lu & Hovenkamp (2013) continued to report A.

lungtauensis from Nepal, having apparently overlooked its correction by Fraser-Jenkins (1997, 2008). The correct name for this species might be A. moulmeinensis (Bedd.) Fraser-Jenk., but that requires further investigation in the type locality (Daun a Toung, Moulmein, S. Myanmar) and may perhaps be a mixed collection.

[Arthromeris notholaenoides Rawat & Fraser-Jenk. in Fraser-Jenkins (2008) photographs were sent to Beijing in 2007 for identification, with the reply that it was unknown, but the species was subsequently published as A. cyrtomioides S.G.Lu & C.D.Xu a year prior to A. notholaenoides, which is thus synonymised here into A. cyrtomioides. Both names were for some reason rather obviously erroneously listed by Lu & Hovenkamp (2013) even though with entirely inclusive key-characters. It is not present in Nepal.]

Arthromeris tatsienensis (syn.: A. lungtauensis var. sikkimensis S.R.Ghosh). C. Nepal, Sikkim (several collections), Darjeeling, Bhutan, Arunachal Pradesh, China.

Arthromeris wallichiana (syn.: A. x purohitii P.C.Pande & H.C.Pande).

[Arthromeris wardii (syn.: A. medogensis Ching & Y.X.Lin; ?A. salicifolia Ching & Y.X.Lin, known only from the type-collection without rhizome; A. caudata Ching & Y.X.Lin; A. longipinna Ching & Y.X.Lin). A. wardii was recorded from Nepal in error by Iwatsuki (1975, 1988), from Taplejung, Bir Gaon (1600 m.) - Saju khola (1400 m.), 873274 - 873273, *H. Kanai et al.* 725433, 1.7.1972, TI, with a description of it as being different from the type, but the duplicate 873274 in KATH is A. mairei, as suspected from Iwatsuki's description. Although again recorded from Nepal by Lu & Hovenkamp (2013) following this record A. wardii is not known and not expected from Nepal.]

Drynaria coronans (the main feature distinguishing Aglaomorpha from Drynaria, of monomorphic versus dimorphic fronds, breaks down in Drynaria parishii, and maintenance of a separate genus Aglaomorpha (syn.: Pseudodrynaria) is an artificial exercise of little purpose or use).

Drynaria mollis

Drynaria propinqua (Wall. *ex* Mett.) J.Sm. *ex* Bedd. X.C.Zhang & Gilbert (2013) gave the combining authority as Smith (1841), dated 16 years prior to Mettenius' basionym.

Drynaria quercifolia

Goniophlebium argutum (syn.: Polypodiastrum argutum and var. angustum Ching & S.K.Wu, the latter a common growth form in exposed conditions, thus there are no varieties in G. argutum. Maintenance by mandate of Ching's erroneous genus Polypodiastrum for part of this genus by Lu & Hovenkamp (2013) is an unwanted national intrusion into science and is not meaningful botanically, both from a morphological and molecular point of view as there is no difference at all between them).

[Goniophlebium mengtzeense (syn.: Polypodium argutum forma khasianum C.B.Clarke; misapplied name: "G. subauriculatum" *sensu auct. Ind.*, *non* (Blume) C.Presl, from China and S.E. Asia.) was reported from Nepal by Lu & Hovenkamp (2013), based on Rödl-Linder (1990) where Nepal was listed without citation, but no Nepal specimens were cited in the list of collections and it was omitted from Nepal in the map - it is thus presumed to be an error and no specimens cited by her, or of anyone else's were found by Hovenkamp (pers. comm.) or are present in any herbaria visited by CRFJ. Thapa's (2002) report of the name was based on Rödl-Linder, but his description of free veins was partly imaginary and partly of Polypodiodes manmeiense, not known from Nepal. Despite reports of G. mengtzeense from Arunachal Pradesh (Ghosh *et al.* 2004) and from Darjeeling (Thapa *et al.* 2013, photos sent!), specimens are G. argutum and it is apparently not known from the Indo-Himalaya, but only in far N.E. India in our region. Occasional plants of G. argutum may abnormally develop very slightly auriculate pinna-bases, so have been confused, but do not have the longer rhizome-apex scales of G. mengtzeense.]

Gymnogrammitis dareifomis (the molecular finding by Smith *et al*. enabled its true relations in Polypodiaceae and not Davalliaceae to be definitively understood).

Lemmaphyllum carnosum (syn.: L. carnosum var. longifolium S.Rahman & T.Sen). The related L. microphyllum was recorded from Arunachal Pradesh as at risk and vulnerable (VU) by Chandra *et al.* (2008) and Fraser-Jenkins (2012), but is not known or expected from Nepal. The

specimens correspond to "var. obovatum" listed by Lin, Hoevenkamp & Gilbert (2013), but that "variety" is not of taxonomic significance and merges completely into "var. microphyllum", so is synonymsed here into L. microphyllum without any varieties.

Lemmaphyllum rostratum (syn.: L. diversum (Rosenst.) Tagawa, a scattered developmental form with some coenosori and slightly narrower fertile fronds, also occurring in N.C. and N.E. India, where it was redescribed in Lepidogrammitis, as L. sikkimensis S.R.Ghosh).

Lepisorus bicolor (syn.: L. kashyapii Mehra, *nom. nud.*, see L. mehrae, below). L. bicolor has similar laminar scales, superficial rhizomes and stiff stilt-roots to L. mehrae, but with distinctive dark, almost black scales with contrasting very pale edges, and a longer, narrower, straighter rhizome than both that and L. morrisonensis. It was previously thought to be a rather doubtful species by Fraser-Jenkins (2008) due to occasional confusion with L. morrisonensis, but is certainly a good species, occurring in Himachal Pradesh, Uttarakhand, Nepal, Darjeeling, Sikkim, Bhutan, Tibet and China, but misreported by Ghosh *et al.* (2004) in error for L. contortus, and by Singh & Panigrahi (2005) in error for L. morrisonensis).

Lepisorus clathratus (syn.: L. albertii (Regel) Ching; L. nepalensis K. Iwats.; Platygyria variabilis; P. waltonii, P. inaequibasis, and all other "Platygria" species; Lepisorus waltonii (Ching) S.L.Yu. The defunct genus Platygyria, was first understood to be all one species and to belong to L. clathratus by Fraser-Jenkins (1997, 2008), but though now partly so revised by Qi, X.C.Zhang *et al.* (2013), the disposition of Ching's Platygyria still remains to be completed in China by their agreeing the synonymisation of P. waltonii, which merely represents abnormal, lobed populations of L. clathratus).

Lepisorus contortus (syn.: ?L. tenuicauda Ching (type to be seen again); L. nyalamensis Ching & S.K.Wu, placed by Qi, Zhang, Lin, Gilbert & Hovenkamp (2013) within a taxon named L. lineariformis Ching & S.K.Wu, near to L. thunbergianus, and reported from India and Nepal, but the type of L. nyalamensis (PE!) has the typical shorter, wider scales with reddish solid central bands, of L. contortus (Christ) Ching and is synonymised here. The identity of L. lineariformis needs reassessment and the reports from Nepal and India need reidentification, particularly because Qi *et al.* explained that they found it very difficult to distinguish the very different L. contortus and L. thunbergianus which are in reality easy to separate. Fraser-Jenkins (2008) had misplaced L. tibeticus as a synonym of L. contortus, which was actually referring to the sense the name had been taken in in India, but the species is a synonym of L. thunbergianus, which varies continuously in length and width of the lamina).

Lepisorus henryi (Hieron. *ex* C.Chr.) L.Wang, (syn.: Belvisia henryi). The morphology and molecular findings fit together well in revealing that the genus Belvisia is congeneric with Lepisorus, which was conserved against Belvisia. The existence of some intermediate species such as L. sinensis also shows their close affinity).

Lepisorus jakonensis Ching (misapplied name: "L. pseudonudus" *sensu* Fraser-Jenkins (1997, tentatively so named, 2008) and thence also misreported from Bhutan, India and Nepal by Qi *et al.* (2013), L. pseudonudus has thicker, stiffer fronds than L. jakonensis and is confined to China, while L. jakonensis is a common epiphyte from Himachal Pradesh eastwards, including Nepal, Bhutan, N. Arunachal Pradesh and Tibet).

Lepisorus loriformis (syn.: L. tenuicauda Ching; L. stenistis (C.B.Clarke) Y.X.Lin, which is not a separate "variety" as treated by Qi *et al.* (2013), but merely a growth and development form quite common in the Indo-Himalaya along with every intermediate and the two extremes, despite supposed molecular findings by Wang *et al.* (2010), the identity of whose material needs confirmation).

[Lepisorus macrosphaerus (syn.: L. asterolepis (Baker) Ching *ex* S.X.Xu) was reported from Nepal and S. India by Qi *et al.* (2013), but while it could be present in Nepal, we have seen no specimens and no previous reports from this country. S. India must obviously be an error for N.E. India, where both the above forms occur, while it is completely absent from the south. Although Qi *et al.* (2013) separated L. asterolepis and did not admit the presence of L. macrosphaerus in the Indo-Himalaya, we have

observed all forms without interruption between the one extreme and the other. Their separation appears to be artificial and mistaken.]

Lepisorus mehrae Fraser-Jenk. (this is the sense in which the name L. kashyapii, *nom. nud*., was being taken by Bir, Khullar *et al.* at PAN, with brown scales, but the type specimen of L. kashyapii, "Polypodium kashyapii nov., Mussoorie Hills, 7000 ft. *P.N. Mehra*, Sept. 1938" (BM) has turned out to be the black/bicolorous-scaled, long-rhizomed L. bicolor, redet. CRFJ 2015, and not L. mehrae at all; syn. of L. mehrae: L. krameri P.C. Pande & H.C. Pande, *nom. nud.*, the type of L. krameri (LWG) has the typical zig-zag tipped laminar scales and brown rhizome-scales of L. mehrae, not L. scolopendrium as thought by Fraser-Jenkins (1997, 2008)), this widespread species was not mentioned by Qi *et al.* (2013), but is likely to be present in China, and to lie overlooked within L. scolopendrium there).

Lepisorus morrisonensis (misapplied name "L. bicolor" *sensu* Iwatsuki (1988), *non* (Hayata) H.Itô - a high-altitude species with many pseudopodia on the rhizome and dark, bicolorous scales).

Lepisorus nudus (syn.: L. leiopteris, not merely "claimed to belong here" by Fraser-Jenkins (Qi *et al.* 2013), but indisputably found by Fraser-Jenkins to be so, including as illustrated by Kunze, the L. scolopendrium group also not being distributed in S. India; L. sesquipedalis, *nom. superfl., non sensu* Fraser-Jenkins (1992, 1997), corrected by Fraser-Jenkins (2008) who found the present correct name and authorities for L. scolopendrium and that L. sesquipedalis is not a synonym of it as still confusingly and mistakenly listed by Qi, Zhang *et al.* (2013), with incorrect authorities for both names).

Lepisorus scolopendrium (Ching) Mehra & Bir (syn.: L. virescens Ching & S.K.Wu). P. scolopendrium Buch.-Ham. *ex* D.Don (1824) cannot be used as the basionym (nor as "Buch.-Ham. *ex* Ching" as mistakenly given by Qi, X.C.Zhang *et al.* (2013) in the *Flora of China* despite citing Fraser-Jenkins) as it is certainly a highly confusable later homonym of P. scolopendria Burm.f. It is derived from different cases of the same word, unlike examples cited by the ICBN which involved similar-looking but quite different words of different meaning (J. McNeill, pers. com., 12.2014). Misappplied name: L. kuchenensis *sensu* Bir *et auct. Ind.*, *non* (Y.C.Wu) Ching [from China]).

[Lepisorus subconfluens is a very distinct and well marked, but rare species with very narrow fronds and bicolorous scales that was reported from Nepal by Iwatsuki (1988) in error for specimens of L. thunbergianus; it is not known or expected from Nepal.]

Lepisorus sublinearis

[Lepisorus suboligolepidus was reported from Nepal by Iwatsuki (1988) in error for specimens of L. thunbergianus, and is not expected to be present. It was similarly misreported from Bhutan by Iwatsuki (1975) in error for L. thunbergianus and its presence in N. India (Qi *et al.* 2013) is doubtful. The species is very close to the Chinese L. oligolepidus and is doubtfully separate.]

Lepisorus thunbergianus (syn.: L. angustus Ching; L. tibeticus Ching & S.K.Wu; L. niger Ching & S.K.Wu; L. stewartii Ching).

Leptochilus decurrens subsp. decurrens

Leptochilus decurrens subsp. hemionitideus (syn.: Colysis diversifolia W.M.Chu; Colysis x beddomei Manickam & Irud; Leptochilus x beddomei (Manickam & Irud.) X.C.Zhang & Nooteboom). As explained by Fraser-Jenkins (2008) this species exists as two subspecies, one with reduced fertile fronds and one without, though some plants have intermediate fronds, as well as normal unreduced ones. An equally appropriate treatment would otherwise be to sink the subspecies and so-called hybrid names altogether. Their relationship was misunderstood by Nooteboom (1997) along with many fanciful and untenable ideas about hybridisation and two taxa on one rhizome, but as shown by Fraser-Jenkins (2008: 63-66), ignored by Zhang & Nooteboom (2013), hybridisation is not involved and the spores are not abortive. However Zhang & Nooteboom (2013) in the *Flora of China* continued the mythology, applying x-signs and guessing the intermediate plants to be a hybrid (yet treated in the *Flora*'s format of a species), though Manickam & Irudayaraj had not produced any "good case" at all for hybridisation as they said, as there was not a single piece of evidence for it. The occasional intermediate

plants usually have some normal fronds and some narrower, but not usually completely linear fronds. They can be found from time to time and place to place in otherwise normal populations and due to the presence of some normal, wider fronds it is not difficult to understand that they belong most appropriately to subsp. hemionitideus, which is simply a species that has a slight tendency to produce half-narrowed fronds. This phenomenon also occurs with less to do in some Selliguea species. Similarly unsupported and erroneous hybridisation ideas were put forward by Zhang & Nooteboom (2013) for two occasional irregular forms of Leptochilus pedunculatus, whose occurrence again seems to have caused surprising confusion and application of unwarranted x-signs for plants with normal non-abortive spores (sunk below) and no evidence or even likelihood of hybridity.

Leptochilus ellipticus (syn.: L. ellipticus var. flexilobus (Christ) X.C.Zhang; L. ellipticus var. longipes (Ching) Noot.; L. ellipticus var. pentaphyllus (Baker) X.C.Zhang & Noot.). Just two actual species have been included as five "varieties" placed in L. ellipticus by Zhang & Nooteboom (2013), due to the Leiden reluctance to recognise any species which approach each other or slightly overlap, which was turned into a blanket principle by Van Steenis of sinking any difficult and critical species - the well known "Leiden lumping syndrome". One of the two species has had its very obvious synonym placed under two different varieties. However the situation had already been definitively elucidated and clearly illustrated by Fraser-Jenkins (2008), correcting a previous erroneous account of the then prevailing Indian view by Fraser-Jenkins (1997). While the other "varieties" are simply L. ellipticus and are synonymised here without recognition of infraspecific taxa, the second distinct species is L. pothifolius, below, which was completely misunderstood by Zhang & Nooteboom, who misapplied the name as a "variety" to specimens of L. ellipticus again (in the old and erroneous Indian sense of "C. pothifolius"), but placed its obvious synonym, C. latiloba Ching, under a different "variety".

Leptochilus insignis (syn.: Microsorum insigne (Blume) Copel., as obviously misplaced, along with L. insignis and L. hemionitideus, by X.C. Zhang & Nooteboom (2013); Kaulinea insignis (Blume) X.C.Zhang). The molecular data does not dictate the separation of this species and L. pteropus from either Leptochilus or Microsorum, and using a separate and defunct microgenus, Kaulinea, does not provide a valid answer, but on the balance of its morphological relations to other species it is maintained here in Leptochilus.

Leptochilus pedunculatus (syn.: L. macrophyllus (Blume) Noot. var. pedunculatus (Hook. & Grev.) Noot. [L. macrophyllus being a distinct S.E. Asian species, see Fraser-Jenkins (2008), now fortunately accepted by Zhang & Nooteboom (2013)]; L. x hemitomus (Hance) Noot.; L. x shintenensis (Hayata) X.C.Zhang & Noot.). Reported from Nepal by Iwatsuki (1988), without citing a specimen, but based on Clarke's (1880), who should normally have been reliable, and Beddome's (1883), mentioning Nepaul, enhanced by Thapa (2002).

Leptochilus pothifolius (syn.: L. ellipticus var. pothifolius (Buch.-Ham. *ex* D.Don) X.C.Zhang, *non sensu* Zhang (2012), the photograph being L. ellipiticus, *nec sensu* Zhang & Nooteboom (2013) *p.p. quoad syn. heterotyp. mult.*; Colysis latiloba Ching). The photograph of the holotype in BM given by Fraser-Jenkins (2008) should be seen as it explains the misapplications of the recent and not so recent past. What Indian botanists formerly called "Colysis pothifolius" is L. ellipticus, as also is Zhang & Nooteboom's concept.

Leptochilus pteropus subsp. pteropus (syn.: Kaulinea pteropus, Microsorum pteropus). Fraser-Jenkins (2008) has recognised the cytologically and morphlogically distinct subsp. minor, which does not occur in Nepal or the north, though of course simply lobed subsp. pteropus may occur in poor conditions or when juvenile.

[Loxogramme acroscopa (Christ) C.Chr. (syn.: L. lankokiensis). Although separated by Zhang & Gilbert (2013) and L. acroscopa tentatively suggested to belong to L. chinensis, Dr. M.G. Price (pers. comm. 2014-5) has found that L. acroscopa is conspecific with and the correct name for L. lankokiensis. Fraser-Jenkins (2008) pointed this out, but erroneously thought that the Indian collections of the species were just small L. grammitoides. L. acroscopa is a very small

species that occurs in Bhutan and Arunachal Pradesh (inc. Deban, *CRFJ* 20611) and has been confused by several authors with L. grammitoides, which latter is also present in the Indo-Himalaya, but neither have been recorded and they are not expected in Nepal.]

Loxogramme chinensis (syn.: L. avalanchia R.D.Dixit; misapplied names by Dixit *et al.*: "L. parallela", "L. lanceolata", "L. salicifolia", "L. subecostata", "L. linearis", "L. elevata", "L. assimilis", "L. duclouxii", small specimens identified as the latter from NE India due to their having darkened stipes are not like the type of L. duclouxii).

Loxogramme cuspidata (syn.: L. duclouxii Christ; L. tibetica; names misapplied to L. cuspidata by Dixit *et al.*: "L. carinata", "L. remotefrondigera", "L. wallichiana", and Dixit also reported L. duclouxii in this sense as well as referring to L. chinensis). L. cuspidata is not at all similar to L. involuta as stated by X.C. Zhang & Gilbert (2013) in an unclear sense, and was quite mistakenly keyed out as with a short rhizome (and thus separated from "L. duclouxii"). It has an obvious long-creeping rhizome (often broken apart between fronds in herbarium-collections), with fronds arising separately, not closely as stated; fronds narrower, with a long, narrow basal half, much darker stipe-base scales and sori more steeply angled; costa raised with a single ridge on the top surface. It occurs from Nepal eastwards and also replaces L. involuta in S. India, despite erroneous reports of L. involuta from there. It has been reported from Nepal and N.E. India under the name L. duclouxii by Iwatsuki (1975, 1988) and Dixit (1984 *etc*.).

[Loxogramme duclouxii - reported by Iwatsuki (1988) referring to L. cuspidata.]

Loxogramme involuta (syn.: L. mussooriana R.D.Dixit & S.Das). Fronds crowded, stipe-base scales broad, paleish brown; costae rounded to raised into a single ridge on the top surface.

Loxogramme porcata (misapplied name: "L. avenia" *sensu auct. Ind.* Fronds crowded, stipe-base scales narrowly lanceolate, dark; costae raised into two ridges (rectangular in cross-section) on the top surface, not flat as stated by Zhang & Gilbert (2013).

Microsorum membranaceum (syn.: M. indicum Ching; Lepidomicrosorium hymenodes (Kunze) L.Shi & X.C.Zhang, Bosman (1991) showed that Ching had mistypified the name Polypodium hymenodes Kunze and was then followed by Chinese botanists and by Ghosh *et al*. (2004), who continued to misapply it to Tricholepidium subhemionitideum (Christ) Fraser-Jenk., which has been treated by Zhang & Nooteboom (2013) in another insignificant Chingian microgenus, Lepidomicrosorium).

Microsorum punctatum

[Microsorum zippelii (syn.: Neocheiropteris zippelii (Blume) Bosman; Neolepisorus zippelii (Blume) L.Wang). This species has surely been very uncomfortably misplaced recently, by L. Wang and X.C. Zhang & Nooteboom (2013) among species of Neocheiropteris (syn.: Neolepisorus) and is a normal Microsorum. It was reported from Nepal by Dixit (1984) as a guess because of its occurrence in the W. Himalaya as well, and thence elaborated by Thapa (2002), but we have seen no collections from Nepal and it is excluded here).].

[Neocheiropteris fortunei (T.Moore) Bosman *ex* Fraser-Jenk., Pariyar & Kandel, ***comb. nov.*** (basionym: Drynaria fortunei T.Moore, Gard. Chron., n.s., **14**: 708 (1855); syn.: Neolepisorus fortunei (T.Moore) L.Wang, the genus Neolepisorus belongs in Neocheiropteris). Drynaria fortunei was surprisingly given by Thapa (2002) along with some other names as if a synonym of a species he reported as "Neocheiropteris superficialis" from E. Nepal, but without specifying any collection. We have not seen any material of N. fortunei from Nepal, and although Iwatsuki (1988) listed it, he cited no collection from Nepal, but only from Bhutan. It is therefore excluded here from Nepal. The larger, related but distinct species, Neocheiropteris chinensis (Mett. *ex* Kuhn) Fraser-Jenk., Pariyar & Kandel, ***comb. nov.*** (basionym: Polypodium chinense Mett. *ex* Kuhn, *J. Bot.* **1868**: 270 (1868); syn.: Microsorum chinense (Mett. *ex* Kuhn) Fraser-Jenk.) was erroneously synonymised within "Neolepisorus" fortunei by Zhang & Nooteboom (2013)).

Neocheiropteris ovata (syn,.: Drynaria ovata Fée; Pleopeltis ovata (Fée) Bedd.; Neolepisorus ovatus (Fée) Ching). Retained in Ching's dubious microgenus Neolepisorus by X.C. Zhang & Nooteboom (2013), and with an

erroneous basionym of "Wall. *ex* Bedd.", which should not have been attributed to Wallich, who did not use the genus Pleopeltis, and overlooking Fée's basionym shown by Fraser-Jenkins (1997, 2008). As also explained by Fraser-Jenkins the lobed forms of this species in China are analagous to the unusual pseudoradiate leaf form of the Chinese N. palmatopedata. The Chinese genus, Neolepisorus Ching, belongs within Neocheiropteris Christ, though still maintained in the *Flora of China*.

Phymatosorus cuspidatus (syn.: P. lucidus (Copel.) Pic.Serm.). The S. Indian plant is a distinct subsp. beddomei (S.R.Ghosh) Fraser-Jenk., or if preferred a species, P. beddomei.

Pichisermollodes ebenipes (syn.: Selliguea ebenipes (Hook.) S.Linds.). Lu, Hovenkamp & Gilbert (2013) in the *Flora of China* synonymised the distinct species P. subebenipes here, presumably due to unfamiliarity with it, but it can easily be recognised in the field and herbarium as a genuinely distinct entity.

Pichisermollodes erythrocarpa (syn.: Himalayaopteris erythrocarpa (Mett. *ex* Kuhn) W.Shao & S.G.Lu). The monotypic genus Himalayopteris was not properly justified when published, and for those who know the species in the field and in detail, its position within Pichisermollodes is rather obvious. Characters distinguishing the species are clearly not generic characters and the comment by Lu in Lu & Gilbert (2013) that its extensive generic synonymy indicates problems in placing it in a genus is without basis since all the genera concerned have been applied to the majority of species listed in the Flora under Selliguea, particularly due to Ching's previous misapplications of genera. The main problem is merely that it was overlooked that it belongs in Pichisermollodes, from which it was placed far apart in the Flora, and a local "genus" of less taxonomic significance was accepted as appropriate for the local Flora.

Pichisermollodes glaucopsis (Franch.) Fraser-Jenk., **comb. nov**. (basionym: Polypodium glaucopsis Franch., *Bull. Soc. Bot. France* **32**: 29 (1885); syn.: Selliguea glaucopsis (Franch.) S,G.Lu, Hovenkamp & M.G.Gilbert). Often confused with the closely related and similar P. nigrovenia but with less dark scales, the lamina glabrous on both surfaces and without the lateral veinlets darkened beneath. C. Nepal.

Pichisermollodes malacodon (syn.: Selliguea malacodon (Hook.) S.G.Lu; Crypsinus cartilagineoserratus (Ching & S.K.Wu) Nakaike; ?Selliguea albidoglauca (C.Chr.) S.G.Lu, Hovenkamp & M.G.Gilbert). This species is the type of the genus. Although Pichisermollodes was stated by Lu *et al.* (2013) not to have been accepted by Christenhusz *et al.*, as is also the case for a number of genera recognised in the *Flora of China*, none of today's well known specialist molecular or taxonomic workers internationally accept Christenhusz & Chase's (2014) classification, indeed much of Christenhusz, Zhang & Schneider's (2011) previous classification unacceptably recognised meaningless microfamilies, though it was followed in the Flora.

Concerning this species, one of the very rare cases of editorial confusion in the *Flora of China* escaped the impressively thorough, Herculean and almost unprecedentedly vast task of editing by Gilbert (without which the Flora would have been largely incomprehensible), the more remarkable, since not himself a specialist in Indo-Chinese pteridophytes. From the haste of the local account, it appears as if P. malacodon is confined to Tibet, since its Indo-Himalayan range was omitted. Furthermore it appears as if it is replaced elsewhere, including India, Bhutan and Nepal, as listed, by a species newly combined as Selliguea albidoglauca. In the comment we read that the albidoglauca differs by its lack of the aristate teeth characteristic of malacodon, yet in the descriptions and key S. albidoglauca is said to have 2 mm. aristate teeth as opposed to malacodon with merely sharply pointed teeth. In fact it is P. malacodon that has long been known to occur throughout, and was described from the Indo-Himalaya (also present in Tibet) and has the long, aristate teeth, while presumably albidoglauca from China, Tibet and ? (if so, newly reported here) from the Indo-Himalaya, has the shorter teeth. We cannot comment on "S. albidoglauca", but Fraser-Jenkins (2008) had studied and sank the Tibetan Phymatopteris cartilagineoserrata into P. malacodon, as now agreed, it being just one more of the great many erroneous and almost random

redescriptions of pteridophytes that so flawed the misleading *Flora Xizangica* - its rather obtuse pinna-apices with long teeth occur commonly in P. malacodon in Nepal, Bhutan and elsewhere, indeed sometimes quite without teeth except a few at the apices. A number specimens of otherwise normal P. malacodon throughout its range have shorter to almost no teeth, and can then be confusing and difficult to identify if the herbarium-sample is too small; but they do not represent a different species, merely individual variation within P. malacodon. We hope that is not what was meant under S. albidoglauca, especially from the Indo-Himalaya, if that distribution was not misplaced there.

Pichisermollodes nigrovenia. Lamina slightly pubescent beneath, lateral veinlets darkened beneath..

Pichisermollodes quasidivaricata (syn.: Crypsinus stracheyi (Ching) Panigrahi & Patnaik; Selliguea quasidivaricata (Hayata) H.Ohashi & K.Ohashi; Selliguea stracheyi (Ching) S.G.Lu, Hovenkamp & M.G.Gilbert). Agreeing with previous Japanese and Taiwanese botanists, Fraser-Jenkins (1997, 2008) also synonymised the Indo-Himalayan "Phymatopteris" stracheyi into the Taiwanese "Phymatopteris" or "Pichisermollia" quasidivaricata, following study-collection and comparison in Taiwan. Lu *et al.* (2013) separated them again as having the margin in quasidivaricata "notched or serrulate" and in stracheyi "margin serrulate, not or only shallowly notched". In our experience plants in both regions vary slightly in the prominence of the notch and teeth, and there is no real difference between them, with many plants exactly matching between the two, which must therefore be one.

Pichisermollodes stewartii (syn.: Selliguea stewartii (Bedd.) S.G.Lu, Hovenkamp & M.G.Gilbert). Following study of good material from Kachin, Myanmar, collected by Phyo Kaye Khine and Georg Miehe and identified by CRFJ at PHMR, we agree that Pichisermollodes nigropaleacea (Ching) Fraser-Jenk., Khine & G.Miehe, ***comb. nov***. (basionym: Phymatopsis nigropaleacea Ching, *Act. Phytotax. Sinica* **9**: 196 (1964); syn.: Selliguea nigropaleacea (Ching) S.G.Lu, Hovenkamp & M.G.Gilbert) is obviously a good separate species related to P. stewartii, but with more, and shorter pinnae and longer teeth. It is not a synonym of P. stewartii as misplaced by Fraser-Jenkins (2008).

Pichisermollodes subebenipes (syn.: Crypsinus nepalensis Nakaike; Selliguea ebenipes var. oakesii (C.B.Clarke) S.G.Lu, Hovenkam & M.G.Gilbert)). As detailed by Fraser-Jenkins (2008), Nakaike's type of this distinct species is a much better collection than that of P. subebenipes, which is rather small and has partly bicolorous scales, but the latter still has the tapering pinnae and dense russett hairs on the scale margins of the present species, even though described at random by Ching. The type of var. oakesii is also a specimen of the present species. Lu's choosing oakesii as a "variety" instead of either of the two important names that had been described at specific rank, while incorrectly synonymising Pichisermollodes subebenipes and C. nepalensis, can only be seen as somewhat obtuse, and the important scale and pinna-shape of this species were ignored in his inadequate description, suggesting inadequate knowledge of the species. Altering the *status quo* was therefore uncalled for without presenting further findings.

Pichisermollodes tibetana (Sankhuwasabha, *D. Karkee* 51, 22.9.1999, KATH, det. CRFJ). Stipe-base scales not abruptly narrowed, dark brown with vaguely paler edges.

Polypodiodes amoena (syn.: Goniophlebium amoenum (Wall. *ex* Mett.) Bedd.). The very hairy taxon intimately related to P. amoena, Polypodiodes yunnanensis (Franch.) Fraser-Jenk. (syn.: Polypodiodes chinensis (Christ) S.G.Lu; Polypodium bonatianum Brause; Polypodiodes paramoena Ching & Y.X.Lin) is difficult to understand, Fraser-Jenkins (2008) initially thought it just a hairy form of P. amoena (of which young plants are hairy), but Fraser-Jenkins & Benniamin (2010) recognised it as a species, P. yunnanensis. Lu & Hovenkamp (2013), however, separated P. chinensis, confined to China, from P. yunnanensis, based on rhizome width and slightly darker scales, which is possible, but seems perhaps rather unlikely, especially as they then misplaced the hairy P. yunnanensis and P. bonatianum within a glabrous "var. amoena" while separating a hairy "var. pilosa" (and an effectively unidentified

"var. duclouxii"), which can only suggest a degree of confusion or error. On balance we are inclined to think the hairy taxon must be a distinct species, which should be called P. yunnanensis, occurring also in N.E. India, Bhutan and Nepal, but its final status remains to be seen.

Polypodiodes fieldingiana (Kunze *ex* Mett.) Fraser-Jenk., Kandel & Pariyar, ***comb. nov.*** (basionym: Polypodium fieldingianum Kunze *ex* Mett., *Abhandl. Senckenb. Naturf. Ges.* **2** Farngatt. 1: Polypodium: 75 (no. 114) (1857); synonym: Polypodiodes microrhizoma (C.B.Clarke *ex* Baker) Ching; Metapolypodium microrhizoma (C.B.Clarke *ex* Baker) S.G.Lu & L.H.Yang). Clarke (1880) himself later found that the lectotype of P. fieldingianum, here designated, Mettenius' original specimen with his writing of the name P. fieldingianum on it (B) was his P. microrhizoma, but did not at that stage wish to change the name he had given for this species after much study in the Himalaya that had already been published by Baker. Ching's microgenus Metapolypodium was rendered indefinable by Lu & Hovenkamp's placement of this species within it, but is anyway of no taxonomic significance.

Polypodiodes hendersonii (syn.: Polypodiodes atkinsonii (C.Chr.) Ching, *nom. superfl.*).

Polypodiodes lachnopus

Polypodiodes manmeiensis (syn.: Metapolypodium manmeiense). The treatment by Lu & Hovenkamp (2013) of this species and even P. microrhizoma, with its anastomosing veinlets, under an artificial Chingian genus, Metapolypodium, by definition or mandate, is obviously inappropriate. This species has very narrow rhizomes, segments and narrow attenuated frond apex, the weakly developed venation is free and the sori are rather deeply immersed, usually appearing as raised pouches on the top surface. It is very similar to Thylacopteris papillosa, which has been reported from N.E. India (Arunachal Pradesh and Meghalaya) in error for it. Thylacopteris is apparently distinct molecularly, but must certainly be considered very close and the significance of the molecular difference should perhaps be reappraised taxonomically and in the light of the geographical difference to be expected. If the two were congeneric, then Thylacopteris would replace Polypodiodes as the correct genus for all species of the latter, though fortunately not for all the wider Goniophlebium of Leiden molecular lumpage. P. manmeiensis occurs in E.C. Nepal (Dolakha, Tamba Koshi, Totlabari - Jagat - Chhetchhit - Simigaon, 1100-1950 m., *H. Ohba et al.* 8331596, 29.8.1983, BM, redet. CRFJ 2012).

Polypodiodes subamoena. Often confused with, but very distinct from a small P. amoena.

Polypodiodes yunnanensis (see above *sub* P. amoena).

Pyrrosia adnascens. Fortunately Lin, Zhang & Hovenkamp (2013) have now agreed the distinctiveness of this species and P. nuda from P. lanceolata, as concluded by Fraser-Jenkins (2008), and for P. nuda Fraser-Jenkins 1997, 2008). Singh & Panigrahi's (2005) report of P. longifolia from India (in N.E. Arunachal Pradesh) was in error for this species, though the specimen has not been revealed for study since being moved to various herbaria and homes.

Pyrrosia costata. Specimens with a stipe, usually short in this species, have long been misidentified as P. stigmosa in India by Bir *et al.* (repeated by Lin *et al.* 2013), but that species has a much longer stipe which is as long as or even longer than the lamina, and once seen (as in Thailand *etc.*) could never be confused with stalked fronds of P. costata.

Pyrrosia flocculosa

Pyrrosia heteractis

Pyrrosia lanceolata

Pyrrosia mannii. Often confused with P. porosa, but rhizome short with an apical tuft of fronds.

Pyrrosia nuda. A good, distinct species, though finalising the correct name for it might require restudy of the types of Cyclophorus glaber Desv., and Niphobolus varius Kaulf., synonymised by Hovenkamp (1986) into a broad Leidenised concept of P. lanceolata. It occurs throughout S.E. Asia to the Philippines *etc*., not just in the Himalaya as shown by Lin *et al.* (2013).

Pyrrosia porosa (syn.: P. stictica; misapplied name: "P. mollis" *sensu* Iwatsuki (1988) *et auct. Ind.*). Rhizome creeping, fronds close, but slightly apart.

Pyrrosia stenophylla (syn.: P. nayariana Ching & P.Chandra). The existence of occasional rather

elongated and narrowish, difficult plants of P. porosa does not make P. stenophylla a synonym of P. porosa.

Selliguea griffithiana (syn.: Phymatopsis integerrima Ching, as shown in detail by Fraser-Jenkins (2008)). S. majoensis from Bhutan, N.E. India, Myanmar, China and Thailand is a separate species and not a variety of S. griffithiana as suggested by Hovenkamp in Lu, Hovenkamp & Gilbert (2013). We have seen no material of S. majoensis from Nepal, as reported there, and exclude it from Nepal here.

Selliguea oxyloba. Absent from S India.

Tricholepidium normale. It is very likely that the characteristic bristles at the rhizome-scale bases, from which Ching described this genus and by which character it has subsquently been constricted are merely a character of specific significance, rather than a generic one, as put forward by Fraser-Jenkins (2008). While the type and Nepalese collections all have the sori scattered in two or more irregular rows each side of the costa, populations in further N.E. India (not the Indo-Himalaya) consistently seem to have the sori in a single line each side of the costa, both forms occurring from Bhutan eastwards, in the eastern Indo-Himalaya. Though Ching's rash of species seem to have been very properly synonymised in China and India (but not in the new records of Ghosh (2004), it should probably be re-investigated as to whether there might not be a second species with just single soral lines each side, unrecognised due to variation obscuring the distinction.

Tricholepidium subhemionitideum (syn.: Neocheiropteris subhemionitidea (Christ) Fraser-Jenk., clearly the wrong genus, in hindsight; misapplied name: "Microsorum hymenodes" *sensu* Iwatsuki (1988)

[Tricholepidium superficiale (Blume) Fraser-Jenk., Kandel & Pariyar, ***comb. nov.*** (basionym: Polypodium superficiale Blume, *Enum. Plant. Javae* **2**: 123 (1828); syn.: Lepidomicrosorium superficiale (Blume) L.Wang). Misreported from E. Nepal by Thapa (2002) *sub* Microsorum and again from Nepal by Zhang & Nooteboom (2013), though this species is not known from Nepal and we have seen no specimens. But it is difficult to work out what species was being thought of by Thapa as it might have referred to Iwatsuki's (1988) record of Neocheiropteris fortunei, but not from Nepal, which he gave in the synonymy, or more likely to Nakaike, Matsumoto & Gurung's (1990) erroneous record of "Microsorum brachylepis *sens. lat.*" from Phulchowki, *T. Nakaike* 396, but which locality is in C. Nepal, also cited in the synonymy by Thapa. M. brachylepis (Baker) Nakaike is a synonym of N. superficiale, while Nakaike must have been referring to T. subhemionitideum (frequently misapplied name: "M. buergerianum", which he gave in synonymy), only known in C. Nepal from Phulchowki. We have not seen *TN* 396, which must be either in TNS or (unlabelled) in T.U. Nat. Hist. Mus. Nakaike *et al.* (1990) also listed M. hymenodes, in error for T. normale, which name they omitted.]

Grammitidaceae

There is no actual need to subsume this easily and widely recognisable family into Polypodiaceae as was too literally done by Zhang and the *Flora of China*, but is not done in the world's herbaria, nor now by Smith at UC, nor here. They can also be maintained as a separate family allied to Polypodiaceae without breaking the molecular "rules" that weaker taxonomists are often so afraid of.

Micropolypodium sikkimense

Tomophyllum donianum

The considerable degree of confusion of many of the species known from India in many of the advanced complex genera in the *Flora of China*, due largely to lack of familiarity with the flora and Indian literature by both Chinese and foreign co-authors, has been briefly corrected or commented on here, or in the main text, in order to avoid further misunderstanding. Other errors are due to a remnant conservatism apparent in decisions overriding foreign co-authors and favouring the confused application of names once put foward by Ching or others locally, particularly in the acceptance of several of

Ching's genera widely accepted to be defunct. These mistakes have been revised more precisely, with corrections to the omission of much Indo-Himalayan distribution, in the script of the next volume of the present work, but a great many Chinese species-names described there and recognised in the *Flora* by default cannot be properly assessed as being either accepted or synonymised when they are not known outside of China. This important and gradual process will have to await proper investigative and cytotaxonomic study in China, which more often seems to have been subsumed into the production of impressive seeming, but badly flawed Floras. In addition the results from several molecular works carried out there as an attempted shortcut to taxonomic classification have often not been properly interpreted due to lack of taxonomic experience or even deliberate but misguided avoidance of taxonomic input and it is clear that further major revision is due as a result. Combined with the much greater complexity of the Chinese flora and the larger number of taxa that have never been investigated or properly assessed with wider taxonomic knowledge, the task of at least assimilating the relevant parts of Chinese taxonomy into an Indo-Himalayan context is certainly a large and ongoing one with many pitfalls, but one that we hope will be pursued with taxonomic vigour and not only uncontextual and partial molecular studies in China.

TAXONOMIC ACCOUNTS

LYCOPODIACEAE

Huperzia (9 species).

This genus includes *Phlegmariurus*, which, as circumscribed in the *Flora of China*, only differs in growth-habit (erect versus pendent), which is inconstant.

1. ***Huperzia arunachalensis*** (D.D.Pant & P.S.Pandey) Fraser-Jenk., ***comb. nov.*** (basionym: *Lycopodium arunachalense* D.D.Pant & P.S.Pandey, *Phyta Monogr.* **3**: 11-13, *t*. 3A (1985); syn.: *Huperzia rubricaulis* ["*rubicaulis*"] S.K.Wu & X.Cheng, *non* (Alderw.) Holub; *Huperzia sahnii* D.D.Pant & P.S.Pandey; misapplied names: "*H. vernicosa*" *sensu* Nessel (1939), and *sensu* J.M. Beitel in herb. BM, from Khasia, *non* (Grev. & Hook.) Trevis. [from S. India]; "*Huperzia ceylanica*" *sensu auct. bor. Ind. et* Fraser-Jenkins (2012), *non* (Spring) Trevis. [from S. India and Sri Lanka]; "*Lycopodium selago*" *sensu* Iwatsuki (1988), *non* L.).

   A small to very small species (to *c*. 6 cm. tall), stems erect, crowded and equal in length, with the leaves slightly stiffly exserted or sometimes becoming slightly deflexed, becoming more compact at higher altitudes, leaves narrowly elliptical, untoothed, becoming sporophylls further up, which usually have very small teeth, especially those nearer the branch-apices. The higher altitude populations of this E. Himalayan species are similar to, but smaller and more compact, sometimes markedly so, than *H. ceylanica* from S. India and Sri Lanka and thus approach *H. somae* (Hayata) Ching, from E. China, Taiwan and Japan in appearance.

   Nepal:

   C: **Rasuwa** [Chilime Kharka, on mossy humps in wet part of meadow, 13,000 ft., *O. Polunin* 1436, 7.1949, BM, det. A.H.G. Alston as "*L. ceylanicum* or ?*L. selago* forma", cited from information supplied by CRFJ by Mondal & Ghosh (1995) *sub* "*H. dixitiana*"].

   E: **Sankhuwasabha** [Bharate Himal, Barun valley, near the Ne pasture, mossy rocks in shady Abies spectabilis forest, 3800 m., *T. Wraber* 435, 10.10.1972, BM; Dulegairhi, Henwakhola, Jaljale Pokhari - Tin Pokhari, 4050 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955114, 9.8.1999, KATH, *sub* "*Huperzia selago*" in error, cited by Thapa (2000) *sub* "*H. selago*" in error; [Selap -] Lamo Pokhari (2900 m.) - Gupha Pokhari (2800 m.), along path in open place, 2860 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725178 (and ditto, *P.R. Shakya* 1427), 10.6.1972, BM, KATH, TI *sub* "*Lycopodium selago*" in error, cited by Iwatsuki (1975, 1988) and by Mondal & Ghosh (1995) *sub* "*H. dixitiana*" in error], **Taplejung** [Jaljale Himal, entre Tin Pokhari et Jaljale Pokhari, E. Nepal, 4050 m., *M. Farille* & *G. Lachard* 847473, 7.1985, G, identity requires rechecking]. Fraser-Jenkins' (2012) E. Nepal report of this species *sub H. ceylanica* erroneously cited a non-existent collection by Zimmermann, from faulty memory.

Himalayan distribution: China; Tibet; Arunachal Pradesh; Sikkim; Darjeeling; Nepal. Meghalaya; Tripura. (S, R). A rare terrestrial species of higher to high Himalayan altitude in open meadows and on banks among grasses and low vegetation.

Indian threatened status: **VU**.

Nepalese threatened status: **VU**.

2. ***Huperzia cavei*** Fraser-Jenk. & B.S.Kholia, ***sp. nov***. *Planta parva* (*ad* 3 *cm*. *alta*) *similis ad H. selago subsp. appressa sed foliis late-ovatis apicibus plus minusve acutis non acuminatis et apices parum minute denticulatis distinguitur*. Holotypus: India, Sikkim: "Eumtso La (Pass) Sikkim, on rocks & in stony bare ground, 15,000', *G.H. C*[*ave*] 188, 21.7.[19]06" CAL (3 plants on the sheet); isotype: *ditto* (6 plants on the sheet), det. B.S. Kholia 30.6.2010 as "*H. selago* subsp. *arctica*", in error. Determined by CRFJ 2012, as "This is an entirely different species from the type of *H. dixitiana* - with ovate leaves with some teeth near the apex. I don't know what species this is - but undoubtedly one of the Chinese/Tibetan ones. If perchance it had *not* been named there [but I'm sure it will have been], then it ought to be '*H. cavei*" after the remarkable George Cave of Lloyd Bot. Garden. But I will study in Beijing to identify it. C.R. Fraser-Jenkins (CRFJ) 9.3.2012".

As pointed out by Fraser-Jenkins (1997, 2008) the paratypes of "*Huperzia dixitana*" P.Mondal & R.K.Ghosh belong to a different species from the holotype, which Fraser-Jenkins (1997) initially thought to be a small *H. herteriana*, but later (2008) identified it as an undescribed species and determined it on the sheet in CAL, while determining the holotype as "*H. selago* subsp. *arctica*", as he then called subsp. *appressa*, mentioning that the paratype, "Cave 188 is an unidentified species", and Tosa, 14,500 ft., *W.W. Smith* 4040, 2.8.[19]10, CAL has "ovate leaves, not *selago*".

Shi, Zhang & Iwatsuki (2013) in the *Flora of China*, referred to *H. cavei* from China and Tibet by the name "*H. dixitiana*", having overlooked its identification by Fraser-Jenkins, and Iwatsuki's (1975, 1988) reports of "*H. selago*" from E. Nepal have now been found by CRFJ from photographs kindly sent by Prof. K. Iwatsuki in 3.2015 to refer to *H. cavei*.

A very small (to *c.* 5+ cm.), compact species similar to *H. selago* subsp. *appressa*, though the leaves, especially in the mid to lower stem are less adpressed and often become horizontally subtended; leaf-shape obovate with an abrupt, rather wide, pointed leaf-apex, markedly wider than in *H. selago*, leaf-margins often slightly reflexed and the apices very sparsely and weakly sub-toothed in the upper sporophylls.

Nepal:

E: **Sankhuwasabha** [E. Nepal, Thudam (3400 m.) - Kipudonsu (4200 m.) - Kipuphu (4500 m.), 873275, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725269, 26.6.1972, TI *sub "L. selago*" in error, photo sent by Prof. K. Iwatsuki, 3.2015].

Total distribution: China; Tibet; N. Myanmar [Adung valley, 12,000 ft., *F. Kingdon Ward* 9987 *p.p.*, 30.8.1931, BM, cited by Mondal & Ghosh (1995) *sub* "*H. dixitiana*" in error]; Sikkim; Nepal.

(S(T), R). A very rare high Himalayan species of open stony and grassy slopes, flat spaces between scree-rocks or in grassy tussocks below cliffs *etc*. Only known from a single collection from Nepal.

Indian threatened status: **EN**.

Nepalese threatened status: **CR**.

3. ***Huperzia hamiltonii*** (Spreng.) Trevis. (syn.: *Lycopodium hamiltonii* Spreng., in L., Syst. Veg. ed. 5: 129, 148, 429 (1828); *Phlegmariurus hamiltonii* (Spreng.) Á.Löve & D.Löve, repeated by L.B.Zhang and so cited in error by L.B. Zhang & Iwatsuki (2013) in the *Flora of China*, also with the basionym authorities of "Spreng. *ex* Grev. & Hook." (1831); *Lycopodium obtusifolium* Buch.-Ham. *ex* D.Don, *non* (P.Beauv.) Sw. [= *H. obtusifolia* (P.Beauv.) Rothm. from the Mascarenes and Madgascar]; *Huperzia aloifolia* (Wall. *ex* Grev. & Hook.) Trevis. [from S. India, though taller and with more ovate leaves, is only a slight and non-discrete geographical variant, rather than a distinct species as thought by Fraser-Jenkins (2008)]; *Lycopodium empetrifolium* Dalzell; *Lycopodium hamiltonii* var. *petiolata* C.B.Clarke; *Huperzia petiolata* (C.B.Clarke) R.D.Dixit; misapplied name: "*H. fordii*" *sensu* Dixit (1984, 1987), *p.p.* from mainland India, *non* (Baker) R.D.Dixit [from China, Japan, Thailand *etc*.], referring to the "*petiolata* form" of *H. hamiltonii*).

   Stems erect (to *c*. 15 cm. tall), becoming pendent when longer, one or two in a loose bunch, branching loosely from shortly above the base; leaves variably ovate, from widely so to more narrowly lanceolate, untoothed, often with the margin a little turned down and usually at right angles to the stem, though often slightly variably orientated, usually rather thick and stiff; sporangia borne in the axils of unmodified leaves. Plants with narrower-elliptical leaves, rarely approaching towards the narrowness of *H. pulcherrima*, have often been separated as a species, *H. petiolata* (C.B.Clarke) R.D.Dixit. But every intermediate occurs, even on the same plant, and they are understood here to represent individual plants' leaf-width variation within the species, occurring throughout its range and of no taxonomic significance. Occasionally plants seem to have small separate shoots of what looks like juvenile *H. pulcherrima* growing from the basal rhizoid-mass, but are depauperate *H. hamiltonii*.

   Nepal:

   W: **Dadeldhura** [Ghanteswor, Dadeldhura, epiphytic on Oak tree, 1900 m., *K.R. Rajbhandari, P.M. Regmi* & *K.J. Malla* 5421, 16.8.1980, KATH], **Dailekh** [in remnant Quercus and Rhododendron forest, on rocky banks or on epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c.* 40 km. N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins* 25597 (FN 1575),

26.9.1997, H].

C: **Baglung** [Gaja Lekh, epiphytic, 2500 m., *D.P. Joshi* & *M.M. Amatya* 73/1137, 2.12.1973, KATH], **Parbat**, **Kaski** [Chiplar, north of Pokhara, mossy tree trunk in wet Rhododendron forest, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4912, 18.4.1954, BM], **Manang**, **Gorkha** [near by Philim, epiphytic on mossy tree trunk, *c.* 1500 m., *S.H. Bhattarai* 950, 30.9.2012, KATH], **Makawanpur** [forested stream below road, between Daman and Simbhanjyang, on S. side of pass, S. of Naubise on Hetauda road, S. of Kathmandu, Makawanpur District, *c.* 2100 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.* 26470 (FN 2448), 11.8.1998, H], **Nuwakot**, **Rasuwa** [forest and rocks beside road, *c.* 2 - 6 km. N. of Ramche on road to Dhunche, Trisuli Bazaar (and Langtang), N. of Trisuli Bazaar, *C.R. Fraser-Jenkins* 21366 (FN 33), 28.9.1994, E], **Kathmandu** [dense forest by path on N.E. side of Sheopuri [Shivapuri] mountain, near Bagdwar temple, above and to N.W, of Nagi Gompa nunnery, N. of Buddhanilkantha and Kathmandu, *c.* 7500 ft., *C.R. Fraser-Jenkins, A.C. Jermy* & *Rajkumar K.C.* 19487 (FN 372), 16.1.1993, E], **Lalitpur** [Tinpani, Lalitpur, *R.L. Fleming* 1555, 10.9.1958, KATH; Godawari (1600 m.) - Phulchauki (2500 m.), Kathmandu, *H. Kanai, G. Murata, H. Ohashi* & *T. Yamazaki s.n.*, 23.6.1967 and 26.6.2967, BM; Godawari, S.E. of Kathmandu, *K. de B. Codrington* 109, in 1956, BM], **Bhaktapur**, **Sindhupalchok** [Chipling, on the rock, 7410 ft., *S.B. Malla* 16068, 21.8.1969, KATH; Bhrati, *B.F.C. Sennitt* 71223, 19.10.197*, KATH], **Dolakha** [Jiri, Dolakha, *T. Nakaike* 3078, 4.10.1988, TNS, KATH "*petiolata*" form], **Ramechap** [Those to Shibalaya, epiphytic on cut tree, 1700 m., *K.R. Rajbhandari* & *B. Roy* 2169, 9.8.1977, KATH].

E: **Dhankuta** [forested N.W.-facing slope just below top of ridge (on Dhankuta District side, to W.) and narrow, rocky stream-gully at bottom of slope, *c.* 1 km. (by zig-zag road) W. of and above Basantapur [in Tehrathum District, to E. of ridge], N. of Hile and Dhankuta, on road to Tehrathum and Sankhuwasabha, Dhankuta District, *c.* 1900 m., *C.R. Fraser-Jenkins* 28785 (FN 4760), 23.3.2001, H], **Ilam** [near Ilam, 1500-2000 m., *T. Nakaike*, with *M. Watanabe, H. Hagiwara, S. Matsumoto, T. Iwashina, M. Haga, S. Saito, M. Kakishima, M. Higuchi, L.R. Sharma* & *M.K. Adhikari* 3665, 5.11.1988, KATH], **Panchtar** [Mehlajan, 26° 51, 87° 34', 7800 ft., *L.H.J. Williams* 194, 26.5.1969, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]. N.E., C., S. and S.W. India; Sri Lanka; Thailand; Vietnam. This species is not only present in the Himalaya as thought by L.B. Zhang & Iwatsuki (2013), who thus anomalously placed *H. aloifolia* from S. India and Sri Lanka as a synonym, even though it is so accepted here.

(S, C). A common, usually epiphytic species of mid to upper-mid altitude forests, growing on mossy tree-branches, or sometimes on moss-covered rocks.

4. ***Huperzia herteriana*** (Kümmerle) T.Sen & U.Sen (syn.: *Lycopodium sikkimense* Herter, *non* Müll.Hal.; misapplied name: "*Lycopodium lucidulum*" *sensu auct. Ind.*, *non*

Michx. [= *H. lucidula* (Michx.) Trevis., from N. America]).

Stems erect, up to 20 cm. tall, often slightly crowded, forming a loose tussock, leaves elongated-elliptical, exserted, loosely arranged, entire and deflexed, degree of deflection characteristically in slightly vaguely defined annual zones down the stem. Plants become smaller with more crowded leaves at higher altitude.

Nepal:

C. Thapa (2002) gave C. Nepal in its distribution, but we have not seen any collections or reports and doubt its occurrence there. Iwatsuki (1988) cited 12 specimens from Nepal, probably all from E. Nepal, unless *Tabata et al.* 13242 was from C. Nepal, but localities were not given.

E: **Sankhuwasabha** [Mumbuk - Yangle, on mossy rock under deep shade of Rhododendron shrubs, 10,200 ft., *P.R. Shakya & M. Ohsawa* 955, 3.10.1971, KATH], **Tehrathum** [East Nepal, Bilbatay Bhanjyang - Tinjuray - Hati Sar, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 5431, 27.10.1963, KATH], **Ilam** [forested gully of upper Tungne khola, just W. of Lamidura, S. of Mekma, N. of and above Pashupatinagar, *C.R. Fraser-Jenkins* 29718 (FN 5693), 25.10.2001, H], **Taplejung** [E. Nepal, Satbhaiya, 27° 28', 88° 13', 14,000 ft., *L.H.J. Williams* 797, 21.6.1969, BM; E. Nepal, Mul Pokhari (2900 m.) - Lamo Pokhari (2900 m.), 872272 - 873272, along path in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725166, 8.6.1972, BM; Lamo Pokhari (2900 m.) - Gupha Pokhari (2800 m.), 873272 - 872273, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725177, 10.6.1972, BM; between Ghunsa and Tamo La, 27° 38', 87° 57', very shady, mossy rocks, 3800 m., *C. Grey-Wilson, S. Zmartzy, M. Sinnott, D.G. Long, R.J.D. McBeath, H.J. Noltie* & *M.N. Subedi* 661, 15.9.1989, KATH; Gupha Pokhari, 2900 m., *Y. Omori, N. Acharya, K. Fujikawa, M. Munemasa, M. Okada, R.H. Ree, M. Tateno* & *N. Thapa* 9955064, 4.8.1999, KATH; Kopinkharka - Guphapokhari, 3112 m, *H. Ikeda, D.R. Kandel, R. Chhetri, H. Uchiyama, K. Akai, H. Taneda, O. Yano, N. Yamamoto, K. Miyata* & *M. Nakaji* 1228052, 30.8.2012, KATH].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal.

(S, Sc). An uncommon (in Nepal) terrestrial species of upper-mid to high Himalayan altitude open forests and meadows, growing on mossy boulders or on the ground.

5. ***Huperzia javanica*** (Sw.) Fraser-Jenk. (syn.: *Lycopodium serratum* var. *javanicum* (Sw.) Makino; *Huperzia indica* S.R.Ghosh, this latter has toothed leaf-apices and is not *H. herteriana* as originally determined by Fraser-Jenkins (2008)).

An apparently distinct medium-sized species (branches to *c.* 20 cm tall), close to *H. serrata* with stiff, erect stems and long, uncrowded, exserted, often less prominently toothed, elliptical leaves (to *c.* 1.2 cm. long), borne at *c.* 90° to the stem, but leaves longer-petioled, longer, less toothed, and usually rather narrower, with teeth mainly

towards their apices.

Nepal:

C: **Kathmandu** [C. Nepal, Manichur, 7000 ft., *Dr. P.N. Suwal* & party 128, 28.3.1961, CAL; Sundarijal, Kathmandu, in shady rather arid place, 1700 m., *H. Kanai* 41, 13.2.1969, TI, also reported by Iwatsuki (1988) *sub* "*L. serratum*", photo sent by Prof. K. Iwatsuki 3.2015; Bhangeri, Kathmandu, *T. Nakaike* 2277, 2.10.1986, KATH], **Lalitpur** [Sakhu, Kathmandu, *c.* 1400 m., *T. Nakaike* 1062, 24.8.1986, KATH; Mahadev Khola, above Khatripahar hamlet, S.W. of Sankhu, *C.R. Fraser-Jenkins* 22368 (FN 275), 29.7.1995 [2052.5.13], E].

Himalayan distribution: China; ?Tibet; Myanmar; Arunachal Pradesh; Meghalaya; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; S.E. Asia.

(M, Sc). A fairly common terrestrial species of mid- to upper-mid altitude semi-open forests on the flat forest floor or on slopes.

6. ***Huperzia phlegmaria*** (L.) Rothm. (syn.: *Phlegmariurus phlegmaria* (L.) Holub).

A long-pendent (branches to *c.* 50 cm. long), epiphytic species, with a thin stem, broad, exserted, often slightly diamond-shaped, acute-apexed leaves, and the stem branching dicotomously towards its apex; stem-apices abruptly reduced to narrow, once or twice dichotomously branching fertile spikes, with small, compact, adpressed sporophylls, occasionally with abnormal, irregularly positioned sterile regions within the spike or apically.

Nepal:

C: **Kaski** [deep, rocky ravine just E. of "Nature's Home" restaurant at Anadu, *c.* 2 km. W. of Fishtail Lodge, Raniban forest, S. side of Phewa Tal (also on the lake temple island), *C.R. Fraser-Jenkins* 25119 (FN 1098), 1.1.1997, H, BM, KATH; E. shore of Begnas Tal, N. of Begnas, *C.R. Fraser-Jenkins*, with *Ranil Rajapaksha* (Peradeniya, Sri Lanka) 34222, 13.7.2009, TAIF]. Iwatsuki (1988) reported this species from Nepal citing "Wallich", but none of Wallich's 7 collections of *L. phlegmaria* L., *Num. List*: no. 133 were from Nepal, though Clarke (1880) had recorded it from Nepal without mentioning the collector.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim [rare]; Darjeeling [rare]; Nepal. N.E. India; S.E. Asia.

(M, Sc). A very rare (in Nepal) epiphytic species of lower-mid altitude forests, hanging from tree-branches.

Nepalese threatened status: **EN**.

7. ***Huperzia pulcherrima*** (Wall. *ex* Hook. & Grev.) Pic.Serm. (syn.: *Lycopodium setaceum* Buch.-Ham. *ex* D.Don, *non* Lam. [= *Huperzia verticillata* (L.f.) Trevis., from Africa and the Mascarenes]; *H. subulifolia* (Wall. *ex* Hook. & Grev.) Trevis.; *Phlegmariurus pulcherrimus* (Wall. *ex* Hook. & Grev.) Á.Löve & D.Löve). Mention of *H. subulifolia* was omitted in error by Zhang & Iwatsuki (2013) in the *Flora of China*.

Stems branching and somewhat divergent, either forming a shortish (*c.* 10 cm.), loose, spreading tussock on the ground or on rocks, or becoming long (to *c.* 50 cm. +) and pendent when growing epiphytically on tree-branches; bearing many linear, more-or-less keeled, acutely pointed, untoothed leaves (to *c.* 5 mm. long), with or without the bases twisted, leaves varying from exserted during the rainy season to rather closely adpressed around the stem during the drier-season or when pendent and epiphytic, fertile area extending well down the stem from the apex, sporophylls similar to leaves, sporangia nephroid with a variably wide or deep sinus, Tagawa & Iwatsuki (1971) stated that they are deeper and narrower in *subulifolia*. By applying the name *H. pulcherrima* to terrestrial plants with less narrowly acute and more exserted leaves, and *H. subulifolia* to pendent epiphytic ones with more obviously twisted leaf-bases and when in drier state, more adpressed leaves, it initially seems possible to distinguish two species. However the characters of twisted leaf-bases, leaf-exsertion, and narrowly pointed leaves break down entirely with every intermediate occurring between them, partially independent of habit, as does the distinction between the habits of the plant, while the sporangial distinction may not hold true as it is not always correlated with the other characters. It therefore appears that *subulifolia* is just the epiphytic growth form of *H. pulcherrima*. This species varies somewhat in leaf-width, but when full grown both forms have narrow, very acute leaves.

Nepal:

W: **Dadeldhura** [Telia Lekh, Dadeldhura, 1800 m., *P.R. Shakya, L.R. Sharma* & *K.R. Amatya* 6195, 27.6.1981, KATH], **Dailekh** [in remnant Quercus and Rhododendron forest, on rocky banks or on epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c.* 40 km. N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins* 25598 (FN 1576), 26.9.1997, H], **Jajarkot** [Kuiyapani, Jajarkot, hanging on tree trunk of Quercus, 720 m., *N.P. Manandhar* 677-91, 3.3.1991, KATH, "forma *pulcherrima*" and "forma *subulifolia*" in same collection].

C: **Parbat**, **Kaski** [nr. Khare, on watershed between Yangdi khola and Marse khola, N.W. of Pokhara, epiphyte in Rhododendron arboreum/Quercus forest, *c.* 5600 ft., *C.D. Sayers* 2368, 30.5.1975, BM], **Mustang**, **Manang** [Thonje, Manang, 28° 37', 84° 19, 1500 m., *J.F. Dobremez* 679, 29.11.1970, KATH, BM], **Lamjung** [between Ghanpokhara and Lamjung, hanging from mossy tree trunk, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5147, 2.5.1954, BM], **Makawanpur** [Chitlang phedi, south-east facing slope, 2300 m., *D.P. Joshi, K.R. Rajbhandari* & *M.K. Ghimire* 75/221, 10.1.1975, KATH], **Dhading**, **Rasuwa** [Ramche to Dhunche, 1800-2000 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 830/79, 15.9.1979, KATH], **Nuwakot**, **Kathmandu** [Sundarijal, Kathmandu, 6400 ft., *R.L. Fleming* 1370, 21.8.1957, KATH; Chilaune, Kathmandu, *c.* 1700 m., *N. Dabadi* & *S. Dahal* 23/79, 6.8.1979, KATH], **Lalitpur** [Phulchowki, N. slope, Naudar to summit, 1828 m., *B.F.C. Sennitt* 71158, 11.10.1971/2, KATH], **Bhaktapur**, **Sindhupalchok**,

Dolakha [Thari à Gonga, 1300 m., *A. Zimmermann* 1247, 14.9.1954, G, BM, *sub* "*H. ceylanica*", det. J. Dostál 1964, in error], **Ramechap**.

E: **Bhojpur** [Dingla, 3500 ft., *Dr.* [*M.L.*] *Banerjee* [*Banerji*], [*A.V.*] *Uphadhyay* [*Uphadyaya*] & [*B.B.*] *Baskola* 3227, 26.4.1965, KATH], **Solukhumbhu**, **Sankhuwasabha** [Walung, Murmudanda, epiphytic on tree trunk, 4600 ft., *P.R. Shakya* & *M. Ohsawa* 913, 23.9.1971, KATH; Fururu (2050 m.) - Mure (2100 m.) - Num (1600 m.), *H. Ohashi, H. Kanai, H. Ohba* & *Y. Tateishi* 771743, 29.7.1977, BM], **Dhankuta**, **Sunsari** [Songuri Bhanjyang, Chulachuli region, *T.B. Shretha* & *T.K. Bhattacharya* 72/389, 3.10.1972, KATH], **Taplejung** [Ghatte - Khebang, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 5426, 19.11.1963, KATH, TI]. Nepal, *M.L. Banerjee* 417, 576, CAL.

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]. N.E. India; Thailand.

(S, C). A common species of upper-mid altitude forests and banks, usually epiphytic and hanging from mossy tree-branches, but also occurring terrestrially when more erect, on banks, or often on mossy rocks.

8. ***Huperzia selago*** (L.) Bernh. *ex* Schrank & M.Martens subsp. ***appressa*** (Bach.Pyl. *ex* Desv.) D.Löve, *Bot. Notis*. **109**: 164 (1956). (syn.: *H. appressa* (Bach.Pyl. *ex* Desv.) Á.Löve & D.Löve; *H. selago* subsp. *arctica* (Tolm.) Á.Löve & D.Löve (1961); *H. arctica* (Tolm.) Sipliv.; *H. dixitiana* P.Mondal & R.K.Ghosh [holotype only]. The holotype of *H. dixitiana* is the present subspecies with markedly adpressed, entire, acute-apexed, narrow leaves, but the paratypes belong to *H. cavei* Fraser-Jenk. & B.S.Kholia (above). *H. dixitiana* was confused both by its authors and by Shi, Zhang & Iwatsuki (2013) in the *Flora of China*, though its identity was pointed out by Fraser-Jenkins (1997, 2008).

A very small (usually *c.* 2 (-4) cm. tall), erect taxon from high altitude with a few stem-branches, short, narrowly lanceolate, long-acute, compact and adpressed, entire leaves and occasionally a few vegetative, leaf-like bulbils between the leaves in the upper part of the stem.

Nepal:

W: Thapa (2002) reported it from W. Nepal, but probably in error, though it could well be present but we have seen no specimens or reports from there.

E: **Sankhuwasabha** [very rare, Bharate Himal, Barun valley, above the Ripu pasture, 4500 m., *T. Wraber* 440, 13.9.1972, BM, one plant of which was det. as "abortive-spored hybrid, *L. delavayi* x ? (*somai*?)", by J.M. Beitel, 1983, in error; E. Nepal, Lamo Pokhari, 873272, on moist grass land, 2900 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725174, 9.6.1972, TI, photo sent by Prof. K. Iwatsuki, 2.2015]. Reported from Sankhuwasabha (*M. Tateno et al.* 9955114, cited above *sub H. arunachalensis*) by Thapa (2000, 2002) in error for *H. arunachalensis*. A specimen labelled, "Nepal, *N. Wallich*, 1820," BM, is a

mislocalised labelling of a specimen of subsp. *selago* from Europe as the specimen is large and similar to Eurpean ones.

Himalayan distribution: China; Tibet; Myanmar [Adung valley, 12,000 ft., *F. Kingdon Ward* 9987 *p.p.*, 30.8.1931, BM, cited by Mondal & Ghosh (1995) *sub* "*H. dixitiana*" in error]; Bhutan; Sikkim; Nepal; Uttarakhand [Rahlam valley, *W. Koelz* 20229, US]; Jammu & Kashmir [rare]; Pakistan [rare]. Circumboreal sub-Arctic.

(E and/or S(T), R). A very rare terrestrial species of high Himalayan open meadows, usually among scattered small rocks.

Indian threatened status: **EN**.

Nepalese threatened status: **EN**.

9. ***Huperzia serrata*** (Thunb.) Trevis. (syn.: *Lycopodium serratum* Thunb., and *sensu* D.Don; *Lycopodium khasianum* ["*khasiana*"] D.D.Pant & P.S. Pandey; *H. serrata* forma *longipetiolata* (Ching) H.M.Chang & J.C.Wang).

Stems erect, up to *c*. 20 cm. +, rigid, branching to form individual clumps here and there, the branch-apices with an attractive layered rosette of leaves around them; leaves borne at 90° to the stem, large (to *c*. 2 x 0.6 cm.), elliptic to narrowly obovate, somewhat rigid, margins usually undulate, leaf-stalks short or becoming long (up to *c*. 5 mm.), apices ending in an acute tooth; teeth prominent at the margins, especially towards the leaf-apex; fertile throughout most of the branch, sporophylls and leaves alike.

Nepal:

C: **Kaski** [Panchase Lekh, 2300 m., *D.P. Joshi* & *M.M. Amatya* 73/1173, 13.12.1973, KATH], **Kathmandu** [Katmandu, Sheopuri Lekh, on shady banks by stream, 6000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 6933, 19.8.1954, BM; Mahadev Khola, Khatripakhar village, above Sanagaon, W. of Sankhu, N.E. of Kathmandu, *c.* 1400m., [*C.R. Fraser-Jenkins* &] *N. Thapa* K9/98, 1.2.1998, KATH], **Lalitpur**, **Bhaktapur** [Nagarkot, Bhaktapur, 2100m., *D.P. Joshi* & *K.R. Rajbhandari* 75/465, 11.3.1975, KATH].

?**E**. Thapa reported it as occasional in E. Nepal, but we have seen no specimens or other reports from there.

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. and S. India; S.E. and E. Asia *etc.*

(M, Sc). A rather uncommon species of mid altitude, semi open forests on the forest floor or on slopes.

10. ***Huperzia squarrosa*** (G.Forst.) Trevis. (syn.: *Phlegmariurus squarrosus* (G.Forst.) Á.Löve & D.Löve; *Phlegmariurus ulicifolius* (Vent. *ex* Sw.) S.R.Ghosh; *Lycopodium hookeri* Wall. *ex* Hook. & Grev.; *Lycopodium lohitense* ["*lohitensis*"] D.D.Pant & P.S.Pandey).

A large and robust species, usually pendent from trees, with several well-spaced dichotomous branchings; stems thick and stiff when not dessicated, up to *c.* 1 m. + long; surrounded by slightly spaced, stiff, exserted, linear, untoothed, acutely pointed leaves with decurrent bases, usually borne at a slightly variable oblique angle or approaching 90°, but often lying closer to the stem during the dry season; branch-apices becoming fertile and somewhat narrower, the sporophylls wider and borne at a closer angle to the stem. This species can occasionally be confused with the "*subulifolia* form" of *H. pulcherrima* when plants are small and juvenile, but has longer, more spread out leaves and thus wider branches, and adult plants can usually be found in the vicinity.

Nepal:

C: **Parbat** [subtropical forest between Hile and Sudame, N. of Birethanthi on way to Ghorepani and Poon Hill, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c.* 1300 m., *C.R. Fraser-Jenkins*, with *Keshab Pariyar* ["*Nepali*"] *s.n.*, 15.6.2010 plant seen, along with *Vittaria flexuosa*, *CRFJ* 34556 (FN 60), 15.6.2010, but not collected as too scarce], **Kaski** [Pokhara, "W. Nepal", 3000 ft., *R.L. Fleming* 868, 3.1.1950, DD; Phewa Tal, hanging down from tree trunks, 2500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5276, 8.5.1954, BM, CAL; Nepal, Pokhara, 3000 ft., *V. Puri* [with *Stainton*, *Sykes* & *Williams*] 33, 13.4.1954, CAL; Bhadaure, Kaski, 1200m., *D.P. Joshi* & *M.M. Amatya* 73/1194, 14.12.1973, KATH], **Lamjung** [Bahunbesi, Lamjung, sur Schima wallichii, 28° 19, 84° 19', 750 m., *J.F. Dobremez* 653, 26.11.1970, BM, KATH]. C. Nepal:]

E: **Sankhuwasabha** [Num track, on tree, 8600 ft., *Major T. Spring-Smythe* for *A.H. Norkett* 8258, 25.12.1961, BM; near Arun river bridge, Num V[illage] D[evelopment] C[ommittee], 932 m., *D.R. Kandel*, with *D.R. Luitel* & *K. Nepali* 201457, 6.5.2014, KATH], **Ilam** [Jog Mai - Ranga Pani, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi & T. Tuyama* 5446, 8.12.1963, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India, S.E. Asia.

(M, Sc). An uncommon (in Nepal) epiphytic species of lower-mid altitude forests, hanging from upper trunks and large branches.

Nepalese threatened status: **NT**.

Lycopodiella (1 species).

11. ***Lycopodiella cernua*** (L.) Pic.Serm. Lectotype from S. India (syn.: *Palhinhaea cernua* (L.) Franco & Vasc.; *Lycopodium sikkimense* Müll.Hal.; *Lycopodiella cernua* var. *sikkimensis* (Müll.Hal.) Panigrahi & Sarn.Singh).

An attractive species with an erect main stem (to *c.* 50 cm. tall) bearing radiating horizontal side-branches very similar to a miniature, pale-green "Christmas Tree" or *Abies*; stems bearing many small hairs between the leaves; short, sessile fertile cones point downwards at the tips of side-branches; the base of the plant bears an

arching leafy stolon, giving rise to a group of short, white, rather thick-apexed rhizoids, with a V.A.M. mycorrhizal association, and to a subsidiary erect stem. Plants from further north in China differ from the type in having non-hairy stems and were mistakenly taken by L.B. Zhang & Iwatsuki (2013) in the *Flora of China* to represent a "forma *cernua*", while the hairy plant, represented by the lectotype from S. India and reaching S. China, was incorrectly named as "forma *sikkimensis*" [*comb. ined.*].

Nepal:

W: Thapa (2002) listed it as abundant in W. Nepal, but we have seen no specimens or reports from W. Nepal, though it should be present there.

C: **Syangja** [N. facing slope, 4 miles S. of Ramdi, 33 miles N. of Butwal on road to Pokhara, S. of Pokhara, Syangja District, 800 m., *C.R. Fraser-Jenkins* 18053, 20.1.19991, E], **Parbat** [Tribeni, 27° 45', 80° 58', 1500 m., *J.F. Dobremez* 1791, 10.4.1975, KATH], **Kaski** [Karanha, near Pokhara, *T. Nakaike* 3739, 9.11.1988, KATH], **Lamjung** [Jagat to Bahun Danda, Lamjung, 1420-1430m., *D.P. Joshi* & *M.M. Amatya* 73/814, 26.71973, KATH], **Tanahun**, **Gorkha** [deep, rocky forested stream-gorge of Chisopani Darrah Khola, *c.* ½ km. above and N.E. of Komale hamlet, *c.* 1 km. below and S.W. of Deurali, above and N.E. of Markichowk (Marsyangdi) reservoir and Gopling, N.W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 25061 (FN 1040), 30.12.1996, H], **Makawanpur**, **Nuwakot** [Kakani, *c.* 2000 m., *T. Nakaike* 1969, 29.9.1986, KATH], **Dhading**, **Kathmandu** [Jamacok, *T. Nakaike* 2536, 11.10.1986, KATH], **Lalitpur**, **Bhaktapur** [Nagarkot, *c.* 1800 m., *T. Nakaike* 1537, 16.9.1986, KATH].

E: **Jhapa** [Jal-Thal Forest, near Ranga Danda, Jhapa, 100 m., *N. Thapa*, *G.D. Bhatt* ["*Bhatta*"] & *S. Khatri* 2013, 24.1.2003, KATH], **Ilam** [Mai Majhuwa, Ilam, 2500 m., *R.R. Parajuli* 77, 8.12.2012, KATH], **Taplejung** [Mul Pokhari - Gorzu Kosir - Nissim - Dumhan, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 5438, 30.10.1963, KATH, TI].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. Abundant throughout N.E., C. and S. India, Bangladesh, Sri Lanka, S.E. Asia and more widespread throughout much of the Old and New World.

(M, C). A very common species of lower-mid and mid-altitude open banks, often on compact clay-soil banks of paths or soil banks of fields.

Lycopodium (3 species).

12. ***Lycopodium annotinum*** L. subsp. ***alpestre*** (Hartm.) Á.Löve & D.Löve (syn.: *L. zonatum* Ching; *L. alticola* Ching; *L. neopungens* H.S.Kung & L.B.Zhang).

Very similar to and apparently a high-altitude ecotype of the circumboreal subsp. *annotinum*, with a long-creeping, semi-subterranean main stem (to *c.* 1.5 m. long),

giving rise to erect, branching branches (to *c.* 15 cm. tall) on each side, with the leaves divided into zones along them due to each season's growth, leaves narrow, entire, without an apical arista; the fertile "cones" sessile and without any stalks, borne singly at the tips of branches and consisting of compact specialised, wide sporophylls with sporangia. The plant is smaller in all its parts than full-sized European subsp. *annotinum* and the leaves more compact, and untoothed; molecular differences studied in China do not constitute sufficient reason in themselves to separate this taxon as a species as suggested by L.B. Zhang & Iwatsuki (2013) in the *Flora of China* under the later Chingian name *L. alticola*.

Nepal:

W: **Darchula** [Western Nepal, Nampa Gadh in Nepal, 12-13000 ft., *J.F. Duthie* 6308, 25.7.1886, BM, DD].

C: **Gorkha** [above Samagaun, N. Gorkha, 29° 39.85', 85° 61.43', 4000 m., *S.H. Bhattarai* 1610, 9.10.2002, KATH, *sub* "*L. veitchii*" in error].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh [rare]; Bhutan [rare]; Sikkim [rare]; Nepal; Uttarakhand [rare]. N.E. India; Europe; N. America.

(S(T), R). A very rare species of open high Himalayan meadows growing among grasses and low scrub vegetation.

Indian threatened status: **EN**.

Nepalese threatened status: **EN**. Globally threatened.

13. ***Lycopodium japonicum*** Thunb. (syn.: *L. pseudoclavatum* Ching; *L. centrochinense* Ching; misapplied name: "*L. clavatum*" *sensu auct. Ind.*, *non* L. [a circumboreal species]).

Very long, creeping, or hanging basal stems (to *c.* 3 m. long), bearing alternate, short, semi-erect lateral branches (up to *c.* 25 cm.); branches surrounded by linear, radially attached leaves with long, scarious aristate apices; fertile branch-tips bearing long, stiff, narrow stalks with small, spaced out leaves, terminating in a panicle of 3-6 stalked, club-shaped, pale yellow, compact sporangiophores. Widely, but unsustainably used commercially in Nepal and Bhutan to make welcome arches during weddings and at Army Camp gates.

Nepal:

W: **Darchula**, **Jajarkot** [Jumato, Jajarkot Distr., 2950 m., *N.P. Mamandhar* & *D.P. Joshi* 6557/81, 2.8.1981, KATH].

C: **Baglung** [south side of Dhar Khola below Lumsum, wooded gulley above river, *c.* 7200 ft., *A.R. Vickery* 478, 25.3.1974, BM], **Myagdi** [Thulo khola, Dhulagiri, S. face, 8800 ft., *G.* & *S. Miehe* A 69, 5.1.1977, BM], **Parbat**, **Kaski** [Panchase Lekh, 2100 m., *D.P. Joshi* & *M.M. Amatya* 73/1165, 12.12.1973, KATH], **Gorkha**, **Makawanpur** [Rikheshwor - Gairi Bhanjyang, 2490 m., *G.D. Bhatt* ["*Bhatta*"] & *D.B. Karkee* 802, 19.10.2003, KATH], **Dhading**, **Rasuwa** [rocks in forest by stream,

on N.E. side of and below Khurpudara [Khurpudanda] ridge, above Army Headquarters, E. of Somdang, W. of Langtang, above and to the west of Syabrubense and Gatlang, N. of Dhunche, Trisuli Bazaar and Kathmandu, Rasuwa District, *c.* 13,000 ft., *C.R. Fraser-Jenkins* 15692, 10.11.1989, E], **Nuwakot** [Rupchet, Nuwakot, 3000 m., *N.P. Manandhar* 5016, 18.11.1979, KATH], **Kathmandu** [Shivapuri, *c.* 2500 m., *T. Nakaike* 3874, 23.11.1988, KATH], **Lalitpur** [Nagarkot, 7000 ft., *F.M. Bailey's collectors s.n.*, 5.7.1935, BM], Godawari, 1600 m., *B. Roy* 9972/76, 3.8.1976, KATH], **Bhaktapur**, **Sindhupalchok** [Helumbu Gorge, C. Nepal, *R.L. Fleming* 1783, 18-23.7.1965, MICH], **Dolakha** [Sivalaya to Jiri, Dolakha, *T. Nakaike* 3525, 24.10.1988, KATH], **Ramechap [**Shiwalaya, 2500 m., *C.M. Joshi* J.1585562, 20.7.1995, KATH].

E: **Okhaldhunga** [Lamche Danda, 27° 16', 86° 27', 2600 m., *J.F. Dobremez* 258, 25.6.1970, KATH], **Solukhumbu** [Ninterma, Junbesi, *c.* 2800 m., *T. Nakaike* 3419, 19.10.1988, KATH], **Sankhuwasabha** [Gogane - Chichila, under the shade of Lyonia and Castanopsis trees, 1890 m., *M.N. Subedi* 300, 8.7.1988, KATH], **Tehrathum** [Basantapur - Chauki, 2200 m., *H. Ikeda*, *D.R. Kandel*, *R. Chhetri*, *H. Uchiyama*, *K. Akai*, *H. Taneda*, *O. Yano*, *N. Yamamoto*, *K. Miyata* & *M. Nakaji* 1228003, 8.8.2012, KATH], **Ilam**, **Taplejung** [Tamur valley, Mewa Khola, on steep bank, 7000 ft., *J.D.A. Stainton* 1298, 8.8.1956, BM, KATH].

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. N.E., C. and S. India; Sri Lanka; Bangladesh; E. and S.E. Asia.

(S, C). A very common and widepread species of upper-mid to higher altitude by semi-open roadside-banks, or slopes, often hanging down over small rocks.

14. ***Lycopodium veitchii*** Christ (syn.: *L. malacophyllum* Hand.Mazz.; misapplied name: "*Diphasiastrum alpinum*" *sensu auct. Ind., non* (L.) Holub [from boreal Europe and N. America *etc*.]).

A rather shorter-creeping (stems to *c.* 60 cm. long), low growing club-moss with short, crowded clumps of lateral branches (to *c.* 7 cm. tall), bearing spirally arranged, compact and adpressed, short, lanceolate leaves; fertile cones small, almost sessile to usually rather shortly pedicellate, borne singly at the tips of the branches.

Nepal:

E: **Sankhuwasabha** [Barun valley, Yangle pasture, on mossy rocks, 3700 m., *T. Wraber* 352, 2.10.1972, BM; Thulo Pokhari to Mumbuk, Sankhuwasabha, 12,100 ft., *P.R. Shakya* & *M. Ohsawa* 949, 1.10.1971, KATH], **Tehrathum** [Iwatsuki (1988) cited "Suke - Hile Chowk, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725180, in 1972, TI", presumably reliably, though we have not seen the specimen.

Himalayan distribution: China; Tibet; Myanmar; Bhutan; Sikkim; Darjeeling [rare]; Nepal. Taiwan.

(S(T), R). A very rare, high Himalayan meadow species, growing on turf among short grasses.

Indian threatened status: **NT**.

Nepalese threatened status: **EN**.

ISOETACEAE

Isoetes (1 species).

Many local forms have been described as a large number of species from India, but the majority of them appear to represent minor variants within four, or doubtfully five, main taxa or species, including the present widespread species. Much further investigation and clarification is required before a more final assessmsent of the number of genuine species present in India can be arrived at, but fortunately the single collection of *Isoetes* from Nepal is uncontroversial.

15. ***Isoetes coromandelina*** L.f. subsp. ***coromandelina*** Numerous controversial synonyms have been described from India as if separate species (see Fraser-Jenkins 2008).

An aquatic species growing at the bottoms of lakes as a tuft of long (up to 30 cm.), erect, fragile, simple, linear, dark-green, hollow leaves arising from a basal corm surrounded by flat, widened leaf-bases containing a capsule of small white, trilete megaspores, visible separately to the naked eye, with, in the present species, papillate surfaces, while mostly inner leaves contain a capsule of minute microspores.

Nepal:

E: **Sunsari** [Mahendranagar village, Ramdhuni forest, near Salban, seasonally wet habitat, *c*. 120 m., *T.P. Gautam, K.P. Bhattarai* & *N. Thapa* 102, 15.8.1998, KATH, the only Nepalese collection (see Thapa *et al.* 1999)].

Peri-Himalayan distribution: Myanmar; Assam; W. Bengal plains; Nepal; Uttar Pradesh; C. and S. India: Myanmar; Thailand; Vietnam; Australia (the latter as a separate subspecies).

(H of Malesian affinity, R). A very rare [in Nepal] low-altitude species growing at the bottom of ponds and lakes in the eastern *terai* region.

Nepalese threatened status: **CR**. Only known from a single collection.

SELAGINELLACEAE

Selaginella (23 species).

16. ***Selaginella adunca*** A.Braun *ex* Hieron. subsp. ***adunca*** (misapplied name: "*S. yemensis*" *sensu* Duthie (1906), *non* (Spring) Baker [from Arabia and N.E. Africa]).

Clumps of stiff, hard, erect, often red-coloured, fine, narrow stems without rhizoids except at their bases, bearing narrow, more leafy branches above with very small, simple, acute leaves close to the stem, leaves with scarious white distal margins,

lateral leaves with strongly ciliate auricles overlying the stem; strobili narrow, rather vaguely quadrangular, sporophylls isomorphic, microspores red.

Nepal:

W: **Kalikot** [Kiurithanu, Karnali river, growing on vertical rocks, 4000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 797, 21.4.1952, BM, E; between Kairkot and Lapha, Karnali valley, crevices of dry cliff, 4500ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3984, 26.4.1952, BM, E], **Dolpa** [between Phulchangi and Chong, near Tibrikot, among stones on on hot, dry open slopes, 8000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3323, 11.9.1952, BM, E; Tallon, Dolpa, 28° 53', 82° 30', rochers secs, 1100 m., *J.F. Dobremez* 2689 and *N.P. Manandhar* 74-318, 22.4.1974, KATH *sub* "*S. jacquemontii*", det. CRFJ and N. Thapa 1998, in error].

Himalayan distribution: Nepal; Uttarakhand; Himachal Pradesh.

(S(W), R). Subspecies endemic to N.W. India and W. Nepal. A scattered and local, or very rare (in Nepal) upper mid-altitude species of open semi-dry stony areas. Nepalese threatened status: **NT**.

Subsp. *albidocincta* (Ching) Fraser-Jenk. occurs in S.W. China and Tibet.

17. ***Selaginella aitchisonii*** Hieron. (syn.: *S. sanguinolenta* (L.) Spring forma *aitchisonii* (Hieron.) Alston; misapplied name: "*S. sanguinolenta*" *sensu* Alston (1945), Iwatsuki (1988) and Zhang (2013) *p.p.* in the *Flora of China*, *non* (L.) Spring [from boreal Asia and China]).

Forms pendent clumps of stiff, hard, very narrow, terete to quadrangular, often reddish-based branches bearing equal-sized, strongly adpressed, acute leaves and slightly wider, apical, quadrangular strobili with isomorphic sporophylls, microspores orange-red. Occasional bilateral branches produced at the bases of plants in damper conditions with exserted lateral leaves are much smaller, narrower and more delicate than the branches of *S. jacquemontii*. The branches of *S. aitchisonii* are narrower and more spindly than in the boreal Asian *S. sanguinolenta*, with which it was confused by Zhang *et al*. (2013) in the *Flora of China* and despite the variation present in *S. sanguinolenta*, the present taxon appears to represent a discrete separate species. Alston (1945) had also confused and combined the two because both can bear occasional bilateral branches.

Nepal:

W: **Humla** [Langu Khola, Humla, mossy rocks, 2650 m., *P.R. Shakya* & *B. Roy* 5629, 13.6.1980, KATH; Phal Ko Odar to Pipling, on mossy stone, 2600 m., *P.R. Shakya* & *B. Roy* 5514, 6.6.1980, KATH]; **Mugu** [between Chuteko Lekh and Dolphu, Mugu Distr., rocky place, S.W. facing grassland slope, 3200 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 22090, 4.8.1983, KYO].

Himalayan distribution: Nepal; Jammu & Kashmir [6 collections seen]; Pakistan [inc. N.-facing cliffs *c*. 3-4 km. up on the S. side of Jalband valley, upper Swat

Valley, 3100 m., *C.R. Fraser-Jenkins* 16990-16993, 16.10.1990, E]; Afghanistan; Tien Shan; Sinkiang.

(S(W), R). A very rare, high-altitude to high Himalayan species of semi-dry cliffs and large boulders.

Indian and Nepalese threatened status: **VU**. Globally threatened.

18. ***Selaginella bisulcata*** Spring

Frequently confused with *S. monospora*, but quite distinct in its larger and markedly dimorphic sporophylls. Plants tall, rather robust with erect, slightly succulent branches arising from a prostrate main stem, stems drying with deep grooves at the sides; lateral leaves large rather distant apart from towards branch-apices, bearing a few or almost no distant cilia on their acroscopic margin, median leaves with long aristae; strobili at branch-apices wide with large, crowded megasporophylls and smaller, but wide, ciliate central microsporophylls, microspores olive-brown.

Nepal:

W: **Rolpa** [Jinawang - Nimrigaon, moist slope of Pine forest, 1555-1079 m., *D.P. Joshi* & *M.M. Amatya* W311/82, 22.1.1982, KATH, small, sterile, juvenile plants, difficult to identify].

C: **Manang** [Pundi Dolea to Palin Sanghu, Manang, *D.P. Joshi* & *M.M. Amatya* 73/247, 5.7.1973, KATH, very young and sterile specmen], **Syangja** [roadside rocks, cliffs & banks, shortly south of Chiuri village, south towards towards Gallyang ("Golleng"), on E. side of and above Andhi Khola river, N. of Butwal on main road S. from Syangja and Pokhara towards Waling, Syangja District, *C.R. Fraser-Jenkins* 31017, 3.1.2005, TAIF], **Parbat** [above Ulleri, 7800 ft., *V. Puri* [with *Stainton*, *Sykes* & *Williams*] 600, 21.5.1954, CAL sterile plants, *sub* "*S. monospora*" in error; dense forest by streams and stream gorge, between Banthanthi and Nangethanthi, above Ulleri on way up to Ghorepani, N. of Birethanthi, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c.* 2200-2700 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang* & *Philip McCormack* 34496, 34497 (FN 1, FN 2), 13.6.2010, TAIF], **Kaski** [near Siklis, 7000 ft., *V. Puri* [with *Stainton, Sykes* & *Williams*] 159, 19.4.1954, CAL sterile material, identity not certain, *sub* "*S. monospora*" in error; Panchase Lekh, Kaski, 2330 m., *D.P. Joshi* & *M.M. Amatya* 73/1170, 12.12.1973, KATH], **Nuwakot** [forest by road, *c.* 10 km. below and south of Ranipowa, between Kakani (and Kathmandu) and Trisuli Bazaar, N.W. of Kathmandu, Nuwakot District, *C.R. Fraser-Jenkins* 15616, 8.11.1989, E], **Kathmandu** [Shivpuri Lekh, S. of Borlang Bhanjyang, *c.* 7800 ft., *B.F.C. Sennitt* 81112, 25.10.1981, KATH; Shivpuri, *H. van T.* & *I. Cotter et al.* N 20, 28.4.1985, KATH], **Kabhrepalanchok**, **Sindhupalchok** [Lamosanghu to Baharbise, *S. Matsumoto* SM08/31-24, 31.8.1988, KATH immature plant], **Dolakha** [Tandi, entre Risingo et Charikot, bois près du col, 1500 m., *A. Zimmermann* 1132, 9.9.1954, BM, G].

E: **Dhankuta** [Dhankuta, *N. Thapa* 14002, 14.12.1994, KATH], **Tehrathum**

[Thakchang Hill, S. of Hang Pang, Koshi Zone, *B.F.C. Sennitt* 7326, 17.1.1973, KATH], **Ilam** [Mai Majuwa - Mai Pokhari - Dhara Pani, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 4.12.1963, BM; wooded slopes with Cryptomeria trees, *c*. ½ km. W. of Pashupatinagar, above main road to Ilam, E.N.E. of Ilam, Ilam District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 29431 (FN 5405), 8.10.2001, H], **Taplejung** [Mewa khola - Dongen, 9000 ft., *A.H. Norkett* 9257, 22.6.1962, BM; Shewaden (2600 m.) - Mewa Khola (2100 m.) - Papung (2000 M.), 873274, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725350A, 29.6.1972, BM *sub* "*S. pennata*" and "*S. monospora*" in error].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. The published type-locality of "Gorval" [Garhwal, Uttarakhand] was in error for Meghalaya. N.E. India; Thailand; S.E. Asia.

(S, C). A fairly common (more especially in E. Nepal), mid-altitude species of shaded banks in light forests.

19. ***Selaginella bryopteris*** (L.) Baker (syn.: *Lycopodium circinale* L. (in Murray 1774); *S. imbricata* (Forssk.) Spring).

Fronds medium-small, with a stiff, unbranched basal stalk with scattered clasping leaves, xeromorphic, curling up strongly during the dry season, reviving during the monsoon or Winter rains, mature lamina compact, often coppery brown above, yellowish-cream coloured beneath, often with brown bands in main-stem leaves; sporophylls isomorphic, grouped in short tetragonal fertile apices, with long-aristate apices; microspores pale orange. This species appears to have two forms, but with intermediates, in the Indian region. Most, though not all of the Himalayan foothill plants, including Nepalese and Bhutanese collections, have leaves and sporophylls with rounded to acute apices, or lower ones with a ± insignificant short awn at their apices, identical to "*S. imbricata*" from Arabia and Africa, while peninsular and S. Indian plants, representing the type, have longer aristae, but intermediates are frequent in the Indo-Himalayan region at least.

Nepal:

W: **Darchula** [Maikholi to Sipti, Darchula, 1810-1660 m., *M.M. Amatya* & *P.M. Regmi* W586/82, 30.8.1982, KATH]], **Doti** [Doti - Silgurhi, 804291, 1000 m., *M.S. Bista* & *D.P. Joshi* 125, 30.7.10972, KATH], **Bajhang** [Chainpur, Bajhang, on the slope bank of Seti, 1300 m., *K.R. Rajbhandari* 15547 (FN 1247), 24.8.1991, KATH], **Salyan** [Sallyana, dry earth bank, 5000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 667 29.3.1952, BM, E].

C: **Chitawan** [Jugi Danda, Chitwan Distr., W. exp. rock under Schima wallichii, 1000 m., *K. Wesche* 2/14, 6.1994, BM, *sub "S. subdiaphana"* in error], **Makawanpur** [in dry state, on steep earth surfaces under cliff, beside main road, *c.* 5 km. S. of Mugling on road to Narayanghad, Makawanpur District, *C.R. Fraser-Jenkins*, with *J.C.B. Fraser-Jenkins* & *Sagun Pariyar*, 35085 (FN 362), 7.6.2012,

TAIF, photographs of dry and expanded state illustrated by Fraser-Jenkins (2010)], **Kabhrepalanchok** [Rosi river, Kabre Distr., 2600 ft., *sin.* coll. 3043, 2021.6.26 [Nepalese calendar], KATH], **Sindhuli** [Makot, Singhuli, *N.P. Manandhar* 12323, KATH].

E: **Udayapur** [Siwalik, de la Banaoüra Khola à Balaute, S. de Manebhanjyang, rochers, 400 m., *A. Zimmermann* 2077, 6.11.1954, BM, E, G], **Okhaldhunga** [Bhadaure, en descendant sur la Sun Khosi, entre Manebhanjyang et Balaute, 800 m., *A. Zimmermann* 881, 22.6.1952, BM, G]; **Sankhuwasabha** [Tumlingtar, Sabhaya river, 1800 ft., *A.H. Norkett* 8091C, 20.12.1961, BM; locality near Dhupu to Wana, *sin. loc. etc.*, *M.L. Banerji* 545, CAL], **Dhankuta** [above Mangmaya khola, on dry red soil, semi shade as well as on dry slope, 400 m., *P.R. Shakya* & *M. Ohsawa* 807, 30.8.1971, KATH, CAL].

Himalayan distribution: Assam; Bhutan; Darjeeling; Nepal; Uttarakhand. N.E., C. & S. India. Arabia; N. Africa. Replaced in China, Japan and the far-east by the very similar, but usually larger and darker coloured, presumably close vicariant species, *S. stauntoniana* Spring.

(H (with African connections) Sc to C). A rather local, but usually abundant lower-mid altitude species covering huge areas where it occurs terrestrially on exposed rocky banks that dry up almost entirely during the Winter. It is fairly often exploited as the medicinal herb, *Sanjeevani* (but see *sub S. pulvinata*), but given its large populations and ready vegetative reproduction from the rhizome-runners this does not seem to constitute much of a threat as yet.

20. ***Selaginella chrysocaulos*** (Hook. & Grev.) Spring (syn.: *S. hypnoides* Spring; *S. philippina* Spring var. *khasiensis* Baker; *S. rosenstockii* Hieron.; misapplied name: "*S. repanda*" *sensu* Iwatsuki (1988) *p.p.*, Nakaike & Gurung (1995), from higher altitude in Pokhara, Kathmandu (Phulchowki) and E. Nepal, *non* (Desv. *ex* Poir.) Spring).

Delicate, erect stems, growing from a single small, basal tuberous bulbil, which is up to *c*. 5 mm. long (though often broken off if not carefully collected), forming very small new bulbils at the stoloniferous tips of lower branches in Autumn before dying down completely, and new plants arising from the bulbils in Spring; leaves become further apart towards the base of the stem, lateral leaves minutely denticulate acroscopically, without a fan of cilia at their basal acroscopic edge, which is only weakly auriculate, not becoming narrowed and sloping or peg-like at the stem-bases, median leaves aristate; sporophylls dimorphic with exserted, slightly apart megasporophylls, sometimes becoming isomorphic when exposed; microsporophylls forming a narrow central region; microspores scarlet.

Nepal:

W: **Darchula** [N.W. facing rocks in forest below cliffs, *c*. 2 km. S. of Dorpatta village (opposite Lamari and S. of Buddhi in India), *c*. 12 km. N. of Dumling, west

side of Api Himal, N. of Darchula, E. side of Kali river (border with India), Darchula District, *c.* 1850 m., *C.R. Fraser-Jenkins*, with *Amar Magar Thapa* & *Bikram Pariyar* 21621 (FN 288), 21.11.1994, E], **Jajarkot**, **Dailekh** [in remnant Quercus and Rhododendron forest, on rocky banks or on epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c.* 40 km N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins*, with *K. Neupane* & *K. Pongali* 25599 (FN 1577), 26.9.1997, H], **Jumla** [Poyora, on mossy banks on Pinus covered slopes, 9500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 338, 28.7.1952, BM; Kaigaon, Jumla District, *S. Einarsson, L. Skärby* & *B. Wetterhall* 3747, 25.8.1973, KATH], **Mugu** [Tun, 2320 m., *T.B. Shrestha* & *N.P. Manandhar* 262, 15.10.1975, KATH], **Dolpa** [Rohagaon, Suli Gad, moist deciduous forest, 9500 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3365, 13.9.1952, BM].

C: **Baglung** [Lumsum, abundant upon exposed walls and terrace banks, 7000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4311, 8/9/1954, BM], **Mustang** [Lete, S. of Tukucha, Kali Gandaki, beneath trees in wood, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7877, 16.9.1954, BM], **Palpa**, **Parbat** [Ulleri, Parbat, *V.L. Gurung,* KATH *sub* "*S. subdiaphana*" in error], **Kaski** [light forest between Deurali Lodge and Himalaya View Lodge, below "MBC" Machapuchare Base Camp, above and N. of Ghundruk, above Naya Pul, East of Baglung on way to "ABC" Annapurna Base Camp, Kaski District, *Ganesh B. Tamang*, with *E.J.S. Gaarder* in *C.R. Fraser-Jenkins* 32201, 5.8.2006, TAIF], **Gorkha** [Gapsya, 28.5582°, 84.7760°, damp and shady place, 2200m., *S.H. Bhattarai* 57/11, 5.6.2012, KATH], **Makawanpur**, **Rasuwa** [Syarpagaon, damp shady banks, 9500 ft., *O. Polunin* 1875, 23-31.8.1949, BM], **Nuwakot** [Kakani, 7-8000 ft., *H. Scott*, in *O. Polunin* 2011, 1-8.9.1949, BM; roadside bank at top of pass just E. of Ranipauwa, N.W. of Kathmandu, beyond the Kakani turn, between Kathmandu and Trisuli Bazaar, Nuwakot District, *c.* 1900 m., *C.R. Fraser-Jenkins*, with *R. Khatri Chhetri, Ramesh Kharki* & *B. Pariyar* 21352 (FN 19), 27.9.1994, E], **Kathmandu** [banks of path from Sanagaon to Khatripakhar, above and north of Khulaltar village, S.W. of Sankhu, N.E. side of Kathmandu valley, Kathmandu District, *c.* 1500 m., *C.R. Fraser-Jenkins* & *Rajkumar K.C. Khatri* 21343 (FN 10), 20.9.1994, E], **Lalitpur** [forest floor, Naudhara, above Godawari School, *B.F.C. Sennitt* 7112, 18.9.1971, BM; Godawari School, Lalitpur, *B.F.C. Sennitt* 7292 *p.p.*, 19.10.1972, KATH], **Bhaktapur** [Nagarkot, 7000 ft., *F.M. Bailey's collectors s.n.*, 5.7.1935, BM; Nagarkot, 1800 m., *T. Nakaike* 1533, 16.9.1982, KATH *sub* "*S. repanda*" (also so published by Nakaike & Gurung (1995) in error)], **Sindhupalchok** [Chilimagaon - Khola Kharka, mossy rocks and banks, 6-7500 ft., *O. Polunin* 1025, 13.7.1949, BM], **Dolakha** [Sikri, Dolakha, *Dr.* [*M.L.*] *Banerjee, T.B. Shrestha* & [*A.V.*] *Uphadyay* 2850, 21.9.1964, KATH], **Ramechap**.

E: **Okhaldhunga** [Torki à Okhaldunga, 2000 m., *A. Zimmermann* 1991, 2.11.1954, BM], **Solukhumbhu** [de Namche Bazar en direction de la Dudh Khosi (Monjo), 2900 m., *A. Zimmermann* 1735, 17.10.1954, G, KATH], **Sankhuwasabha** [Arun

valley, Hatiar, N. of Num, in forest, 7000 ft., *J.D.A. Stainton* 1434, 26.8.1956, BM; Seduwa to Tashigaon, Sankhuwasabha, 1900 m., *M.N. Subedi* 380, 12.7.1988, KATH; Guphapokhari to Ghurmise, 2784 m, *H. Ikeda, D.R. Kandel, R. Chhetri, H. Uchiyama, K. Akai, H. Taneda, O. Yano, N. Yamamoto, K. Miyata* & *M. Nakaji* 1228060, 2.9.2012, KATH; Arun Valley, Hatiar, N. of Num, in forest, 7000 ft., *J.D.A. Stainton* 1434, 26.8.1956, BM, KATH], **Dhankuta** [Dhankuta (1300 m.) - Nigale (1600 m.), 872271, on open mountain slope, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725057, 4.6.1972, BM], **Tehrathum**, **Ilam** [Cryptomeria-forested slopes and streams between Tashigaon and Chitregaon, *c.* 2 - 3 km N. E. of Pashupatinagar, on footpath to Manebhanjyang, near Indian border, N.E. of Ilam, Ilam District, *C.R. Fraser-Jenkins* 29578 (FN 5553), 23.10.2001, H], **Taplejung** [Eastern Nepal, Milke Danda above Lukuwa, under rocks near path, *c.* 7250 ft., *A.H. Norkett* 5812, 7.10.1961, BM; Ghatte - Khebang, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 19.11.1963, BM; Shewaden (2600 m.) - Mewa khola (2100 m.) - Papung (2000 m.), 873274, along path in light shade, *c.* 2200 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725351, 29.6.1972, BM, *sub* "*S. vaginata*" in error]. Nepal [*sin.* loc., *Dr. J. Scully s.n.*, in 1881, CAL].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir (misidentified from Poonch by Dixit (1992) as "*S. nepalensis*"); Pakistan. N.E. India; Thailand, S.E. Asia. The locality of Wallich's type specimen, written at E as Penang, Malaya, was in error for Nepal. A specimen labelled from Parbat, "Ulleri, 8000 ft., *V. Puri* [with *Stainton, Sykes* & *Williams*] 638, 22.5.1954", CAL *sub* "*S. chrysocaulos*" in error, is a leafy liverwort.

(S, C). The commonest upper-mid to higher-altitude *Selaginella* often forming large colonies on banks in the open.

21. ***Selaginella chrysorrhizos*** Spring (syn.: *S. lakkidiana* Nisha, Nampy & Joby; misapplied name: ?"*S. minutifolia*" *sensu* (Dixit (1984, 1992), ?*non* Spring [from Myanmar and S.E. Asia]; "*S. kurzii*" *sensu* Iwatsuki (1975, 1988) *p.p.*, Nakaike & Gurung (1995), Thapa (2002), *non* Baker).

A small, delicate, erect species growing on rocks and path-sides during the monsoon, older plants with several closely contiguous fans of deltate fronds, each arising from the single basal point, but no bulbil; leaves small, pale green, lateral leaves with minute denticulations, or approaching small cilia, median leaves obviously aristate, both types of leaves often with a very narrow whitish-scarious margin, visible in bright light, but not always evident; strobili wider, at the tips of branches, sometimes becoming long in older plants, sporophylls strongly dimorphic, the megasporophylls obviously longer than the central microsporophylls, the latter being variably long- or short-ciliate at their bases, microspores scarlet (not pale-brown as stated by Dixit (1992)). This species regrows from spores during the monsoon, but

rapidly dies away and turns pale-brown at the onset of the dry season, soon disappearing.

Nepal:

W: **Dang** [damp, steep, N. facing clay road-bank of main East-West Highway, in extensive "babar" mixed Sal (Shorea robusta) forest, *c*. 5 km. east of Lamahi, Dang District, *c*. 200 m., *C.R. Fraser-Jenkins* & *Sagun Pariyar* 35127 (FN 1), 20.9.2013, TAIF].

C: **Rupandehi** [N. facing cliff by small temple, *c*. 2 miles N. of Butwal on road to Syangja and Pokhara, S. of Pokhara, Rupandehi District, 300 m., *C.R. Fraser-Jenkins* 18009, 20.1.1991, E], **Palpa** [Palpa, Dovan, on shady and moist rock, 300 m., *D.P. Joshi* & *M.M. Amatya* 73/974, 24.11.1973, KATH], **Syangja**, **Kaski** [Raniban forest, S. side of Phewa Tal, S. of Pokhara, *C.R. Fraser-Jenkins* 25447 (FN 1425), 17.8.1997, BM, H], **Tanahun**, **Gorkha** [banks of path in forest, shortly above Komale Khola, *c*. 1½ km. below and S.W. of Chanku Deurali, above and N.E. of Markichowk and Marsyangdi Dam reservoir, *c*. 7 km. W. of Anbu Khaireni, W. of Mugling, Gorkha District, *C.R. Fraser-Jenkins*, with *Ganesh* [*Ramchandre*] *Pariyar* & *Bikram Pariyar* 21345 (FN 12), E], **Makawanpur** [1 mile N. of Tirkande Swar Mahadev Shiva temple, on "Rajpath Road", *c*. 5 miles N. of Hetauda, Hetauda to Daman and Kathmandu, roadside cliff with bushes, *c*. 3000 ft., *C.R. Fraser-Jenkins* 15578, 19.10.1989, E], **Nuwakot [**roadside bank at top of pass just E. of Ranipauwa, N.W. of Kathmandu, beyond the Kakani turn, between Kathmandu and Trisuli Bazaar, Nuwakot District, *c*. 1900 m., *C.R. Fraser-Jenkins*, with *R. Khatri Chhetri*, *Ramesh Kharki* & *B. Pariyar* 21353 (FN 20), 27.9.1994, E], **Dhading**, **Kathmandu** [Chobhar Gorge, *B.F.C. Sennitt* 7125 *p.p.*, 20.9.1971, BM; near Pashuptinath, Kathmandu, 1340 m., *T. Nakaike* 115, 5.10.1979, TNS, also published by Nakaike & Gurung (1995) as "*S. kurzii*" in error; near Tribhuvan Airport, 1300 m., *T. Nakaike* 1493, 15.9.1986, TNS, also published by Nakaike & Gurung (1995) as "*S. kurzii*" in error; Gokarna Ban, 1350 m., *T. Nakaike* 3551, 3556, 29.11.1988, TNS, also published by Nakaike & Gurung (1995) as "*S. kurzii*" in error], **Bhaktapur** [Surjebinayak, 1400 m., *T. Nakaike* 1725, 21.9.1986, TNS, also published by Nakaike & Gurung (1995) as "*S. kurzii*" in error].

E: **Solukhumbhu**, **Sankhuwasabha** [Seduwa, on rock cliff under semi-shade, *P.R. Shakya* & *M. Ohsawa* 909, *sin.* date, CAL, marked by V.L. Gurung "to be returned please"; Telok, Sankhuwasabha Distr., *D.P. Joshi* 190, 5.10.1971, KATH det. N. Thapa 1998 as "*S. kurzii*" in error], **Dhankuta**, **Taplejung** [Tamrang khola path, deep shade beneath shrubs, 6250 ft., *A.H. Norkett* 6915, 31.10.1961, BM]. Nepal [Nepal, *C. Maries s.n.*, 1.12.1882, CAL, with a fragment of *S.* ?*fulcrata* above].

Himalayan distribution: ?China (?overlooked); Myanmar; Arunachal Pradesh; Bhutan, Sikkim; Darjeeling; Nepal. N.E., C. and S. India; Bangladesh; Thailand; Vietnam.

(S, C). A common or locally abundant, lower-mid to mid-altitude species of paths,

banks and on large stones.

22. ***Selaginella ciliaris*** (Retz.) Spring (syn.: *S. exigua* Spring).

A delicate, small, sometimes in dry regions minute species, becoming taller when among damp grass, similar in habit to *S. chrysorrhizos*, but rather more robust, preferring more open habitats and with larger leaves and megasporophylls and obviously wider fertile strobili than that species; plant prostrate and with a slightly creeping basal stem, but with erect side-branches, often forming an erect rosette; leaves very pale whiteish or yellowish green, lateral leaves bearing long cilia at their bases, medians long-aristate; sporophylls strongly dimorphic, both large and small sporophylls with long cilia towards their bases; microspores orange-red. This species normally has both megaspores and microspores in India in contrast to Zhang's (2013) statement in the *Flora of China*. Plants die down rapidly in the dry season and regrow from spores the next season.

Nepal:

W: **Kanchanpur** [by spring in Sal forest, *c.* ½ km. below Betkot, N. of Chaile and Daiji on path to Lipna over the Churria Ghats, *c.* 15 km. N.E. of Mahendranagar on S. side of ghats, *C.R. Fraser-Jenkins* 24936 (FN 914), 30.10.1996, H], **Surkhet**.

C: **Kaski** [Phewa Tal, Pokhara, banks of paddy fields, *B.F.C. Sennitt* 71479, 11.12.1971, BM], **Gorkha**, **Makawanpur** [Hetauda, *c.* 450 m., *T. Nakaike* 1905, 24.9.1986, KATH], **Dhading** [Bagaltar, Neelakantha Village Development Committee, terrestrial, bank of paddy field, 530 m., *N. Thapa* & *Mahesh Pudasaini* 45/95, 16.10.1995, KATH], **Kathmandu** [banks of path from Sanagaon to Khatripakhar, above and north of Khulaltar village, S.W. of Sankhu, N.E. side of Kathmandu valley, Kathmandu District, *c.* 1500 m., *C.R. Fraser-Jenkins* & *Rajkumar K.C. Khatri* 21341 (FN 8), 20.9.1994, E], **Lalitpur** [edge of Bagmati, Jawalakhel, sandy bank close to paddy field, cut over by grass cutters, *B.F.C. Sennitt* 71176, 12.10.1971, BM, KATH], **Sindhupalchok** [Chaakhola, at crossing of "jeepable road" to Melamchi, banks of paddy fields, *B.F.C. Sennitt* 71248, 22.10.1971, BM KATH].

E: **Siraha** [among bushes at edge of fields beside East-West Highway, 1 km. E. of Golbazaar, E.of Dhalkebar, W. of Lahan and Koshi Dam, E. of Hetauda on road to Biratnagar, Siraha District, *C.R. Fraser-Jenkins*, with *R. Boruwal*, *R. Pariyar*, K. ["*U.*"] Pongali ["*Chhetri*"], *S.B. Sunchuri* & *Rajkumar K.C.* 26505 (FN 2483), 12 Aug. 1998, H], **Morang** [Morang, Bahuni, *N. Thapa* M 12/97, 16.12.1997, KATH], **Taplejung** [Sanghu, below camp, Tamrang khola path, 5750 ft., *A.H. Norkett* 6798, 28.10.1961, BM].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]; also Bihar and Uttar Pradesh. N.E., C. and S. India; Andamans; Sri Lanka; Bangladesh; S.E. Asia to Australasia.

(M, C). A common low to mid altitude species on the banks of rice-fields, damp

roadside banks, or earth-banks in *Sal* (*Shorea robusta*) forests.

Nakaike & Gurung's (1995) "*S. ciliaris*" from Kathmandu valley, Swayembhunath, 1400 m., *T. Nakaike* 2429, 7.10.1986, KATH, and Nagarjun, 1400 m., *T. Nakaike* 1102, 1139, 26.8.1986, KATH, are *S. vaginata*.

[***Selaginella delicatula*** (Desv.) Alston - reported in error by Iwatsuki (1988), a specimen collected by Wallich and labelled as from Nepal (in K), was one of the many confused localities written on Wallich specimens in Kew general herbarium, the locality probably guessed wrongly by Hooker.]

23. ***Selaginella emodi*** Fraser-Jenk., ***sp. nov.*** *Species parva prostrata e turma S. rupestris, folia spiraliter disposita, setis parvis ad marginem instructis, apices foliorum gradatim angustati in aristam terminanti, strobilis fertilis laxis cylindricis ad apices ramulorum non valde distinctis, microsporis rubris*. Holotype: Central Nepal, Rasuwa District, on path leading up from Dhunche to Chandanbari and Gossainkund, *c.* 3 km above and E. of Dhunche, N. of Trisuli Bazaar, Rasuwa District, N. of Kathmandu, rocky pathside tussocks of grasses etc. beneath cliff, *C.R. Fraser-Jenkins* 30915, 2 Dec. 2004, with *G. Stevenson* & *R. Hailey* (i-to-i volunteers), TAIF. (syn.: *Selaginella rupestris* "forma indica" Milde, *nom. inval.*, a geographical category, not a botanical name; *S. indica* (Milde) R.M.Tryon, *nom. inval.*; misapplied name: "*Selaginella longipila*" *sensu* Alston (1945), Fraser-Jenkins (2008), *non* Hieron. [= *S. densa* Rydb., from N. America]; "*S. vardei* [or *longipila*]" *sensu* Fraser-Jenkins (1997), non Lév.). Unfortunately, as found by Tryon (1955) and in contrast to Alston (1945) and Fraser-Jenkins (1997, 2008), the two original syntype-specimens of *S. longipila* cited and described by Hieronymus at B (mislabelled "Bhotan, Griffith" and "Himalaya *sin. coll*, 1239", both *ex* Kew, with small duplicates sent back from Berlin to K) are both the N. American species, *S. densa* Rydb., with very different, compact, strongly quadrangular fertile spikes, almost fimbriate sporophylls and narrowed bases to the arista at the apices of the leaves. As was frequently the case with older and especially Griffith collections they were confused in locality at Kew, often by Hooker, and there is no possibility that Hieronymus was decribing any material of the Indian plant. But Tryon did not realise that though described and everything written in Latin, the categories under the heading "forma" of Milde are not formal botanical names, except in a few cases where he gave his name as an authority after them, but merely geographical categories indicating parts of the range of the species. This has been pointed out by Fraser-Jenkins (1977), with the agreement of A.C. Jermy, J.A. Crabbe, A.O. Chater, W.T. Stearn, N. Robson and others consulted about it at the BM. They are thus invalid as is any attempted combination based on them, so the present species has unfortunately remained without a name until now.

A small prostrate species with narrow leaves spirally arranged around the short side-branches, branches nearly twice as wide and shorter than in the similar, but

distinct *S. vardei* Lév. from Tibet, growing tips of branches somewhat dorsiventrally flattened with flatter brown leaves beneath, leaves bearing slightly distant small cilia at their edges and tapering at their apices to a long arista up to a third of the length of the leaf; fertile spikes not markedly distinct, short, rather weakly quadrangular, with somewhat loosely arranged isomorphic sporophylls, larger and with longer aristae than the leaves; microspores red.

Nepal:

W: **Darchula** [*c.* 2 km. N. of Dumling, N. of Darchula, *c.* 1800 m., *C.R. Fraser-Jenkins* 21681 (FN 348), 22.11.1994, E].

C: **Gorkha** [Buri Gandaki, 21 miles above Arughat, dense mats on boulders, 4500 ft., *P.C. Gardner* 323, 17.4.1953, BM; Gapsya, Nubri Valley, Manaslu Conservation Area, 2200 m., *S.H. Bhattarai* 871, 1.10.2012, KATH], **Rasuwa** [Syabrubensi, Trisuli Khola, rocks, 5000 ft., *O. Polunin* 1478, 7.1949 (BM); ditto, *R.L. Fleming*; ditto, *C.R. Fraser-Jenkins* 21199 (FN 1447), 13.6.1994, E, and others].

Reported from E. Nepal by Thapa (2002), but presumably in error as no specimens have been seen by the present authors in any herbaria.

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. N.E., C. and S. India.

(S, R). A rare and very scattered species (occasionally locally common in the eastern part of the W. Indo-Himalaya), occurring at upper-mid altitude on open dry rocky slopes among grasses, or forming clumps on mossy rocks.

Nepalese threatened status: **NT**.

24. ***Selaginella fulcrata*** (Buch.-Ham. *ex* D.Don) Spring. (syn.: *Lycopodium fulcratum* Buch.-Ham. *ex* D.Don). Don's locality of "*Nepaliae alpibus*" was incorrect concerning the "*alpibus*" part and was not written on either the lectotype of Lycopodium fulcratum, Buch.-Ham. *ex* D.Don, *Prodr. Flor. Nepal*.: 17 (1824), here designated, "*Lycopodium fulcratum* Ham. D. Don Prod Fl. Nep. p.17. Napaul. *Dr. Buchanan*", BM (top of sheet), nor the syntype, "*Lycopodii* spec. Hab. in Napaulia rupibus lectum Januaria 1818. Nomen *Cooshea* [in the Newari language], [*E. Gardner* for *Wallich*], BM. The other syntype is labelled "Katmandu, Nepal, [*Gardner* for] *Wallich*, 1819", LINN, but in error as the species is a lower altitude one not occurring in Kathmandu Valley.

An attractively feathery, large species up to 30 cm. tall, with an erect "frond" arising from a stiff unbranched, erect stalk; side branches "bipinnate" to "tripinnate", widely triangular-ovate, delicate, with rather lax, obtuse-apexed, pale yellowish-green, thin lateral leaves and obtuse median leaves, leaves with a fan of prominent long, stiff cilia, sticking up from the axil with the pale-coloured stem at their bases, leaf-bases overlying the stem; strobili small, narrow, terete, sporophylls isomorphic, small, compact, ovate with a small arista, microspores olive-brown. Leaves die down to white, broken off skeleton-leaves in Winter, apart from an occasional one surviving

in a damp corner.

Nepal:

W: **Surkhet** [near Kuepani, [Beri River], Siwalik Hills, 1000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5920, 27.10.1952, BM], **Dang** [between Kurpani and Ghorai, on damp sheltered earth banks, 4000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 1332, 4.9.1952, BM, E; Ghorahi, Dang, 650 m., *Keshav Shrestha* NHMTU-6B-00419, 16.3.2043 (Nepali date), TU Nat. Hist. Mus.].

C: **Gulmi** [Gundi Khola, Kali Gandaki river, 2500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8929, 13.10.1954, BM], **Palpa** [Dovan, on shady and moist place, 300 m., *D.P. Joshi* & *M.M. Amatya* 73/937, 24.11.1973, KATH], **Syangja** [Andhi Khola, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8718, 2.10.1954, BM; N. facing slope, 4 miles S. of Ramdi, 33 miles N. of Butwal on road to Pokhara, S. of Pokhara, Syangja District, 800 m., *C.R. Fraser-Jenkins* 18054, 20.1.1991, E; roadbank at Golleng (Galyang) village, S. of Walling, N. of Tansen, on road between Pokhara and Butwal, S. of Pokhara, Syangja District, *C.R. Fraser-Jenkins*, with *B.R.T. Chhetri* (of Golleng) 25578 (FN 1556), 25.9.1997, H], **Kaski**, **Chitwan** [Chitawan, Churia hills, *Shorea* forest undergrowth, 2000 ft., *A. Laurie* 77, 146.1975, K], **Bara**, **Makawanpur** [Nepal, *Mr. C. Maries*, 12.1882/recd. 15.10.1884/brought from Nepal by Mr. C. Maries and grown by him at Durbunga [Bihar], 1889, CAL, cited by Dixit (1992) as ?cult. from Bihar; Pisulin [*i.e.* Fishling] - Muglin, *T. Nakaike* 3842, 12.11.1988, KATH; forested ridges and cliffs of the Churiya Ghats, N. of Bagmati Bridge (*c.* 13 km. E. of Chandranigarpur) on path to Bogaon ("Bogar"), on W. side of Bagmati river, E. of Hetauda, Makawanpur District, *C.R. Fraser-Jenkins*, with *S.B. Sunchuri* 25724 (FN 1702), 21.10.1997, H, KATH], **Dhading**, **Sindhuli** [banks on slopes of N. side of Churiya Ghats ridge, S.E. of Duarde village, on path down to Bagmati Bridge, S.E. of Raigaon, on E. side of Bagmati river, Sindhuli District, *C.R. Fraser-Jenkins*, with *Lok Bhdr. Tamang, Jeet Bhdr. Pariyar, Rajendra Boruwal, K. Pongali, S.B. Sinchure* & *Dawa Lama* 25750 (FN 1728), 23.10.1997, H]. Nepal, [data not written by the Nat. Hoist. Mus.] [*T. Nakaike*] 448, T.U. Nat. Hist. Mus.].

E: **Siraha** [entre Belsot et Sogaret, S.-exposition, *A. Zimmermann* 2153, 9.11.1954, BM, G], **Udayapur** [apres le camp de Sukhchauri, 400 m., *A. Zimmermann* 938, 24.6.1952, BM].

Total Distribution: Nepal; Bihar [Rajpur Soharia Forests, [Champaran], *H.H. Haines* 1975, 3.1904, K; ravines, Sameshwar Hills, Champaran, *H.H. Haines* 5386, 11.1916, K, both of natural occurrence near the northern border with Nepal, but cultivated elsewhere and in Maharashtra and in nurseries at Kalimpong, W. Bengal]. Misreported by Kumari & Srivastava (2008) from Jharkhand (along with some other obviously erroneous misidentifications) in error for *S. involvens*.

(?M, H (or ?African in origin) Sc to C, local). A locally common, even abundant species of low to lower-mid altitude, forming extensive colonies on damp, bushy

slopes and road-banks in sheltered places. Rather surprisingly confined to a small region of S.C. Nepal and just over the bordering area of India despite occurring abundantly in many places and being easy to cultivate. It is effectively almost **endemic** to S.C. Nepal apart from a couple of collections shortly over the border with northern Bihar, which is a most unusual if not unique distribution pattern and might suggest ancient African connections if it is not Malesian.

Nepalese threatened status: **LC** (not under threat).

25. ***Selaginella helvetica*** (L.) Spring (?syn.: *S. tibetica* Ching & S.K.Wu). Fraser-Jenkins (1997) initially thought this species was a small plant of *S. pallidissima* in error, and subsequently (Fraser-Jenkins 2008) inadvertently omitted it.

Close to *S. pallidissima*, but an obviously smaller, miniature species at higher altitude and more green than yellow, without the red older stems of the latter; branches narrow, delicate, with symmetrical and acutely pointed lateral leaves; strobili erect, one at the apex of each fertile branch, becoming tall (to *c.* 1 cm.), sporophylls dimorphic, the small sporophylls lying beneath the larger ones, microspores orange-red.

Nepal:

W: **Jumla**, **Mugu** [Langu khola, Mugu, on mossy stone, sheltered by big rock, 2650 m., *P.R. Shakya* & *B. Roy* 5632, 13.6.1980, KATH], **Dolpa** [between Rohagaon and Lulo Khola, Suli Gad, moist shady bank in mixed forest, growing among moss, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3403, 15.9.1952, BM, E, G; Barbung Khola near Tachungaon, 11,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 1070, 4.6.1952, BM].

C: **Mustang** [among rocks above and S. of Ranipauwa village, above and S. of Muktinath temple, E. of Kagbeni, *c.* 4000 m., *C.R. Fraser-Jenkins*, with *J.C.B. Fraser-Jenkins* [son] & *S. Pariyar*, 34722 (FN 1), 1.6.2011, TAIF], **Kaski** [among mossy rocks, N. of Himalaya Lodge, N. of Chomrong, on way to Annapurna Base Camp, *c.* 3600 m., *C.R. Fraser-Jenkins* 32548 (FN 194), 30.11.2006, TAIF].

Himalayan distribution: China; Tibet; Nepal; Uttarakhand [Shyalek pass, Buddhi to Garbyang, Pithoragarh, 3350 m., *C.R. Fraser-Jenkins* 21612 (FN 279), 21.11.1994, E]; Himachal Pradesh [Brachmore Kul Forest, 2400 m., *B.M. Wadhwa* 53374, 23.6.1974, BSD].

(E and/or S(T), Sc). A scattered, sometimes locally abundant, higher altitude to high Himalayan species of shaded cliffs and damp rocky slopes in upper-level conifer forest and on mossy boulders above the tree-line, dying down in Winter, but regrowing in Spring from minute branch-apices surviving the Winter among moss beneath the snow. This miniature species was first identified in the Himalayan region by Alston in the collections of Polunin, Sykes and Williams in Nepal, but as it came to notice later than his monograph of Indian subcontinent *Selaginella* (Alston 1945), it was not included by Dixit's (1984, 1992) reworking of the same, so has

been largely overlooked in the Indo-Himalaya.

Nepalese threatened status: **NT**.

26. ***Selaginella involvens*** (Sw.) Spring (syn.: *S. caulescens* (Wall. *ex* Hook. & Grev.) Spring; misapplied name: "*Lycopodium circinale*" *sensu* D.Don *p.p., non* L. [= *S. bryopteris*]; "*S. argentea*" *sensu auct. Ind., non* (Blume) Spring).

A prominently stalked, often quite large species with a tall, stiff basal stalk and pinna-like, dark-green branches above; plant xeromorphic, fronds curling up in the dry Winter and reviving during rains; lamina bright to dark-green above, slightly glaucous beneath; lateral leaves ovate with a short apical arista, each with two obvious false-veins, spikes quadrangular, variable in length, sporophylls isomorphic; terrestrial or epiphytic/lithophytic; microspores red.

Nepal:

W: **Dadeldhura**, **Darchula** [Paribagar - Makarigad, 1171-1439 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yano, N. Yamamoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216022, 9.7.2012, KATH], **Baitadi** [near Barail, on mossy vertical rock, 1400 m., *P.R. Shakya, L.R. Sharma* & *K.R. Amatya* 6410, 18.7.1981, KATH], **Kailali**, **Doti** [near Barail, on mossy vertical rock, 1400 m., *P.R. Shakya, L.R. Sharma* & *K.R. Amatya* 6410, 18.7.1981, KATH], **Mugu** [Mugu, Karnali valley, between Mangri and Lumra, on wet vertical cliff face, in shade, 7000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3045, 26.8.1952, BM].

C: **Baglung** [Bhurungdi khola, on mossy tree trunk, 7500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5374, 21.5.1954, BM, CAL], **Myagdi** [nr. Khibang, epiphyte on trees in north facing ravine, 7000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2874, 26.5.1954, BM], **Mustang** [Jarkot, along the road, 1100 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* & *Y. Konno* 6290, 11.10.1976, KATH], **Palpa**, **Parbat** [between Tatopani and Sikha, on the rock in Schima zone, 1300 m., *H. Tabata, K.R. Rajbhandari, K. Tsuchiya* & *Y. Konno* 6564, 16.10.1976, KATH], **Kaski** [Pokhara, on shady cliff face, 3500 ft., *J.D. Stainton, W.R. Sykes* & *L.H.J. Williams* 6743, 11.8.1954, CAL; C. Nepal, Valley of Rodi khola., 4000 ft., *V. Puri* [with *Stainton, Sykes* & *Williams*] 599, 714, 29.5.1954, CAL; Khare, E. of Lumle, mossy boulders, *c.* 1700 m., *C. Grey-Wilson* & *B. Phillips* 293, 17.7.1973, KATH], **Lamjung** [Jagat, 1350 m., *N.P. Manandhar* 9574, 10.8.1983, KATH], **Gorkha**, **Rasuwa** [on way to Ramche, 1230-1800 m., *V.L. Gurung, T.K. Rajbhandari, N.P. Manandhar* & *A. Karki* 77/612, 29.9.1977, KATH], **Makawanpur** [roadside cliff, 1 mile N. of Tirkande Swar Mahadev temple, *c.* 5 miles N. of Hetauda on road to Daman and Kathmandu, *C.R. Fraser-Jenkins* 15575, 19.10.1989, E], **Dhading**, **Kathmandu** [Chobar, shaded rocks on side of gorge, *Sanandan Eksira*, in *B.F.C. Sennitt* 71380, *sin.* date, BM; wooded path above and to N.E. of Sundarijal village up stream-valley and shortly beyond waterfall, *c.* 15 km. N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins*, with *Rajkumar K.C.* & *Ganesh B. Tamang*

18752, 4.1.1992, E], **Lalitpur** [Tinpani Bhanjyang, Kathmandu vy., rocks, 7400 ft., *R.L. Fleming* 1546, 10.9.1958, MICH], **Dolakha** [Lamabagar to Hum, on mossy trunk, 2200 m., *K.R. Rajbhandari* & *B. Roy* 1468, 16.7.1977, KATH], **Ramechap** [between Shivalaya and Bhandar, 1800-2500 m., *T. Nakaike* 3114, 6.10.1988, KATH].

E: **Solukhumbhu**, **Sankhuwasabha** [Seduwa, *M.L. Banerjee*, *A.V. Uphadyay* & *B.B. Baskola* 3406, 6.5.1965, KATH], **Dhankuta** [near Basantapur, District Dhankuta, *c.* 2240 m., *R.G. Troth* 89, 16.7.1971, MICH; Sinduwa (2100 m.) - Bhalukhop (2400 m.), 872271, on muddy rock in light shade, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725089, 5.6.1972, BM, KATH], **Tehrathum** [Olane Hill, Hang Dang, Koshi Zone, *B.F.C. Sennitt* 739, 11.1.1973, KATH], **Ilam**, **Taplejung** [Mewa khola, on dripping cliffs by bridge, *c.* 8750 ft., *A.H. Norkett* 9510, 24.1.1962, BM; Hangdewa, on north facing huge mossy stone, *N. Thapa* T2, 28.7.2001, KATH]. Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. N.E., C. and S. India; Sri Lanka; S.E. Asia.

(S, C). A common and widespread, upper-mid altitude species, either terrestrial or often epiphytic in damp forests or on mossy boulders and cliffs at upper-mid altitude.

[***Selaginella jacquemontii*** Spring (syn.: *S. borealis* (Kaulf.) Spring "forma indica" Milde, *nom. inval.*, a geographical category, not a botanical name; *S. sanguinolenta* (L.) Spring forma *indica* (Milde) Alston, *nom. inval.*; *Selaginella kashmiriana* R.D.Dixit).

A tussock-forming species similar to *S. aitchisonii* but markedly more robust, with wider consistently bilateral branches and not connected by intermediates; stems stiff, wiry, often reddish, upper branches bilateral with small, ± ovate leaves, terminating in a short mucro, the lateral leaves slightly larger and longer than the dorsal median leaves; strobili weakly tetragonal, with isomorphic sporophylls, microspores red.

It was reported from W. Nepal by Thapa (2002), but the specimen identified by CRFJ and Thapa in 1998 as *S. jacquemontii* (Tallon, Dolpa, *J.F. Dobremez* 2689, 22.4.1974, KATH) was reidentified by CRFJ in 2012 as *S. adunca*. There is no material of *S. jacquemontii* at K, BM, MICH, or KATH, and it is therefore excluded here from Nepal, though it occurs nearby in Pithoragarh.

Total distribution: Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. Endemic to the W. Indo-Himalaya.

(S(W), C). An example of the W. Himalayan subtype of Sino-Himalayan element, common in the W. Indo-Himalaya. Occurs at upper mid altitude on open, dry, rocky slopes, or rooting in crevices in rocks.

If it is subsequently collected from Nepal, its Nepalese threatened status would presumably be **EN** or **CR**, depending on population size *etc*.]

[***Selaginella kurzii*** *sensu* Iwatsuki (1975, 1988), Nakaike & Gurung (1995) was suggested by Fraser-Jenkins in Thapa (2002) to be more likely to be *S. chrysorrhizos*, which is partly confirmed here, at least for Nakaike's Kathmandu collections, while others of his are *S. reticulata*; most specimens Iwatsuki cited are small *S. pennata*. True *S. kurzii* Baker occurs from Myanmar to Malaya, with one collection known from India in the Lushai tribal hills of Tripura, and is a taller, more robust species, with much more strongly ciliate bases to the lateral leaves and very crowded microsporophylls forming a rectanguloid line in the strobilus.]

27. ***Selaginella monospora*** Spring (syn.: *S. gorvalensis* Spring, after restudying the type at K in 2012, the senior author now confirms Alston's view that this name belongs to the normal form of *S. monospora*; *S. microclada* Baker).

A rather large, robust species with fairly stiff branches, bearing long, rather thin, but stiff rhizophores along much of their length and large, rounded-pointed lateral leaves bearing a few scattered, small cilia or teeth (more so when exposed at higher altitude), median leaves oval, strongly keeled, abruptly aristate with a long arista, slightly ciliate at their bases; lamina usually dark or blueish green or sometimes pinkish or coppery; fertile spikes narrowed, much more so than in *S. bisulcata*, varying from having isomorphic sporophylls (as in the type) to weakly dimorphic ones (as in the Griffith type collection of *S. gorvalensis*, mistakenly localised from Garhwal, Uttarakhand, in error for Khasia), to a rather distinctive form, common in E. Nepal and further east, with lax, more flabellate, less pointed branches and obviously strongly dimorphic sporophylls which Fraser-Jenkins (2008) had mistakenly referred to "*S. gorvalensis*". But intermediates of variously mixed morphology occur and they all appear to represent a single species rather than two species as initially thought by Fraser-Jenkins (2008). Microspores orange-red. Plants from higher altitude become smaller with more ciliate leaves and can then be confused with *S. subdiaphana*, but have a stiffer "frond" with a longer half-dead basal stem.

Nepal:

C: **Kathmandu** [Napalia, [*F.*] *Buchanan* [*Hamilton*], K]; **Kabhrepalanchok** [Liping Bridge, shortly S. of Tatopani, N.E. of Banepa towards Tibetan border, mossy cliff-slopes, *c.* 1300 m., *C.R. Fraser-Jenkins* 34743 (FN 22), 12.7.2011, TAIF]. A report from Dhorpatan, Baglung District, 3000 m., by Basnet *et al.* (2013) has not been verified by us so might refer to another species more common in W. Central Nepal.

E: **Udayapur**, **Solukhumbhu** [Namuche to Rukam, *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Uphadyay* & [*B.B.*] *Baskola* 3422, 10.5.1965, KATH], **Sankhuwasabha** [Seduwa, on rock cliff under semi-shade, 1870 m., *P.R. Shakya* & *M. Ohsawa* 904, *sin*. date, CAL, marked "to be returned please" by V.L. Gurung], **Tehrathum** [Tehrathum Distr., Chauki (2650 m.) - Tute (2480 m.) - Basantapur (2300 m.), 27° 12' 35", 87° 28' 01" - 27° 07' 00", 87° 26' 00", Tinjure, on deep shade of dense forest facing

north, 2800 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955140, 17.8.1999, KATH], **Jhapa**, **Ilam**, **Taplejung** [Shewaden - Mewa khola - Papung, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725350A, 29.6.1972, KATH]. E. Nepal: [Nepal, *Dr. J. Scully* 311, in 1876, CAL].

Himalayan distribution: China, Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Thailand; Vietnam.

(S, C). Rare in C. Nepal, but common at upper-mid to higher altitudes from E. Nepal eastwards, growing in semi-open areas among bushes, or on path-banks in the forest, or commonly on road-banks.

28. ***Selaginella pallida*** (Hook. & Grev.) Spring (syn.: *S. nepalensis* Spring, see Fraser-Jenkins (1997: 235-236)); *Lycopodium tenellum* D.Don, *non* (P.Beauv.) Desv. [= *S. albonitens* Spring, from C. America]; misapplied name: "*S. repanda*" *sensu* Iwatsuki (1988) *p.p. max., non* (Desv.) Spring).

A smallish-medium sized plant with long, narrow, prostrate, rooting, sometimes slightly hanging, semi-crispaceous, winter-green shoots, with narrow apices and short alternate side-branches borne further back and fine rhizoids borne singly at intervals throughout the stem, leaves dark-green, lateral leaves symmetrical about their axes, not sloping, with a slight apical point, denticulate, median leaves ovate with a long arista; spikes narrow, quadrangular, sporophylls isomorphic, rather long-acute, microspores red.

Nepal:

W: Reported from W. Nepal by Thapa (2002) by extrapolation and thence Fraser-Jenkins (2010), but no specimens have been seen by the present authors in any herbaria, though it is sure to be present there, being common on either side.

C: **Palpa**, **Syangja** [Andhi khola, 18 mi. N.E. of Tansing, W. Nepal, 2000 ft., *R.L. Fleming* 859, 8.1.1950, BM], **Parbat** [subtropical forest between Hile and Sudame, N. of Birethanthi on way to Ghorepani and Poon Hill, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c.* 1300 m., *C.R. Fraser-Jenkins* & *Keshab Pariyar* ["*Nepali*"] 34553 (FN 58a), 15.6.2010, TAIF], **Kaski** [Phewa Tal, *T. Nakaike* 487, 13.11.1979, KATH; Pokhara, 900 m., *H. Kanai, G. Murata, H. Ohashi* & *T. Yamazaki* 26128, 18.6.1967, BM, *sub* "*S. repanda*" in error], **Tanahun** [rocks and forested slope below waterfall, in next gorge, *c*. ½ km. above Chowti Bara Temple gorge, *c*. 6 km. S. of Damauli, E. of Pokhara, W. of Mugling and Anbu Khaireni, Tanahun District, *C.R. Fraser-Jenkins* 25327 (FN 1306), 23.3.1997, H], **Gorkha** [stream gulley of Chisopani Darrah Khola, in patch of natural mixed forest on south-west side of ridge between Deurali village and Komale hamlet, *c*. ½ km. below Hattiya Deurali village, between the main Gorkha and Pokhara roads, above and N.E. of Goplinghat village and Markichowk, west of Anbu Khaireni and Mugling, Gorkha District, *c.* 900 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.*, *Sarasthi Adhikari* & *Ramchandre* ["*Ganesh*"] *Pariyar* 20864 (FN 1112), 16.2.1994,

E], **Makawanpur** [road-bank, *c.* 3 km. above and N. of Aghor, on road to Simbhanjyang, N. of Hetauda [Hetaura], on "Rajpath Road" to Naubise and Kathmandu, Makawanpur District, *C.R. Fraser-Jenkins* 16150, 4.3.1990, E], **Dhading** [rocks in forested stream gulley above track around mountain on N.W. side of Jamachok mountain, in from Gate no. 2 at Mureko, Nagarjun Forest, beyond N.W. side of Kathmandu Valley, off road to Kakani and Trisuli Bazaar, Dhading District, *c.* 6000 ft., *C.R. Fraser-Jenkins* 15889, 31.10.1989, E; *ditto, CRFJ* & *Sagun Pariyar* 34964 (FN 242), 4-8.12.2011, TAIF, diploid, 2*n* = *c.* 20, det. S. Matsumoto, 9.2011 (Fraser-Jenkins & Matsumoto 2015 in press)], **Rasuwa** [in forest, Domen to Bompu, S. side of Langtang river, between Syabrubensi and bridge below Lama Hotel, Lower Langtang valley, Rasuwa District, 1600-2200 m., *C.R. Fraser-Jenkins* & *G.B. Tamang* 29194 (FN 5169), 21.8.2001, H], **Kathmandu** [Chobhar Gorge, *B.F.C. Sennitt* 7125 *p.p.*, 20.9.1971, BM; Pharpare Danda, Sundarijal, 4800 ft., *M.M. Amatya*, *R. Shrestha* & *I. Sharma* 203-76, 20.5.1976, KATH], **Lalitpur** [Naudhara, Godawari, along walls, 5500 ft., *B.F.C. Sennitt* 71271, 29.10.1971, KATH], **Bhaktapur** [forested stream gully just above and behind temple at Surjebinayak, S.E. side of Bhaktapur, E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins et al.* 24067 (FN 45), 16.7.1996, H], **Kabhrepalanchok** [forested stream-gully facing N.W., with footpath going up along it, across rice-fields, on W. side of ridge opposite Town Council office of Dhulikel town, E.N.E. of Kathmandu, Kavrepalanchok District, *C.R. Fraser-Jenkins*, with *Nirmala Fraser-Jenkins*, *Chandre Kumari Pariyar* & *Insp.* (*retd.*) *Indra Shrestha* 28763 (FN 4738), 10.2.2001, H], **Sindhupalchok** [Melamchi khola, W. side, bank of paddy field, *B.F.C. Sennitt* 71243, 21.10.1971/2, KATH; on rocks and below or on trees in remnant forest in gorge below Bungy-jumping bridge ("Jacob's Ladder"), below Listikot village and across to W. side of gorge from Palang village, *c.* 2 km. S. of Chaku village, S. of Tatopani, in Bhote Khosi river gorge, N. of Dolaghat and Dhulikel, N.N.E. of Kathmandu, Sindhupalchok District, *C.R. Fraser-Jenkins*, with *N. Fraser-Jenkins*, *J.C.B. Fraser-Jenkins*, *Sagun Pariyar*, *S. Khanal*, *D. Jonker et al.* 31187, 7.5.2005, TAIF], **Dolakha** [between Shivalaya and Jiri, 1800-2000 m., *T. Nakaike* 3526, 24.10.1988, KATH], **Ramechap** [De Those à Chyangma, 1750 m., *A. Zimmermann* 182, 6.4.1952, BM]. C. Nepal [Nepal, *Dr. J. Scully* 56, [in 1876], CAL].

E: **Bhojpur** [E. Nepal, Dingla (1000 m.) - Dobhan (800 m.), *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725457, 2.7.1972, KATH], **Sankhuwasabha** [Chainpur, camp site just outside town, *c.* 4000 ft., *A.H. Norkett* 8525, 5.12.1961, BM], **Dhankuta** [*c.* 1½ to 4 km. N. of and below top of pass between Dharan and Dhankuta, S. of and above Shimshua village, Dhankuta District, *c.* 1200-1350 m., *C.R. Fraser-Jenkins* 20840 (FN 1088), 1.2.1994, E], **Panchtar** [Ektin, E. Nepal, *D.P. Joshi* 154, 2.10.1971, KATH], **Taplejung** [Khebang - Bharomdin and Bharomdin - Tharpu, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama s.n.*, 24.11.1963 and 25.11.1963, BM, both *sub* "*S. repanda*" in error]. E. Nepal [mostly Bhojpur and Sankhuwasabha], *sin. loc.*, *M.L. Banerji*

53, 65, 213, 547, CAL (localities will be preserved on the sheets at A, but were lost at CAL).

Peri-Himalayan distribution: Meghalaya; Manipur; Arunachal Pradesh; Bhutan; ?Sikkim; Nepal; Uttarakhand; Himachal Pradesh. N.E. India. Apparently absent from China.

(S, C). A common (in Nepal) lower-mid to upper-mid altitude species of shaded stream-banks in forests, or below sheltered damp rocks.

29. ***Selaginella pallidissima*** Spring

A medium sized species in the *S. helvetica* (L.) Spring group, which has delicate, wiry, often reddish, prostrate, creeping stems bearing thin rhizoids throughout their length, dying down and partly loosing their leaves in Winter with others persisting but dead and white, but regrowing from the apices in Spring; leaves thin, very pale yellow, sometimes almost white, lateral leaves symmetrical, distant on the main stem, denticulate, median leaves rather widely triangular, acuminate, denticulate; fertile spikes up to 3 cm. tall, erect, sporophylls dimorphic, slightly distant, megasporophylls ventral and microsporophylls dorsal (the opposite way round from all other Indo-Himalayan species apart from the much smaller and higher altitude *S. helvetica*), microspores orange-red.

Nepal:

W: **Darchula** [N.W.-facing rocks in forest below cliffs, *c.* 2 km. S. of Dorpatta village, (opposite Lamari and S. of Buddhi in India), *c.* 12 km. N. of Dumling, N. of Darchula, *c.* 1850 m., *C.R. Fraser-Jenkins*, with *A. Magar Thapa* & *B. Pariyar* 21622 (FN 289), 21.11.1994, E], **Jumla** [Ghurchi Lekh, near Chautha, 10,000 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3068, 22.8.1952, BM], **Dolpa** [Rohagaon, Suli Gad, banks in moist deciduous forest, 9500 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3364, 13.9.1952, BM; near Hurta, Bhalu Lekh, 9000 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3178, 5.9.1952, BM].

C: **Mustang** [steep, grassy bank beneath semi-open Pine forest, across bridge opposite and E. of (above) Tukuche, S. of Jomsom, *c.* 2900 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang* 30519, 28.6.2004, TAIF], **Gorkha** [Gapsya, Nubri Valley, Manaslu Conservation Area, N. Gorkha, 28° 55.8', 84° 77.6', damp, shady places, 2200 m., *S.*[*H*]. *Bhattarai* 973, 1.10.2012, KATH], **Rasuwa** [Ghopte, lower caves, by stream, *B.F.C. Sennitt* 81105, 23.10.1981, KATH].

Himalayan distribution: S.W. China; Nepal; Uttarakhand; Himachal Pradesh.

(S(W), Sc to very locally C). A rather rare, mostly W. Indo-Himalayan species occurring in very local masses on steep, open, rather dry banks among grasses *etc*. at upper-mid to higher altitudes.

Nepalese threatened status: **LC**.

30. ***Selaginella pennata*** (D.Don) Spring (syn.: *S. suberosa* Spring; misapplied name: "*S. kurzii*" *sensu* Iwatsuki (1975, 1988) *p.p.*).

Plants dying down completely in Winter, branching from the narrow base in a semi-erect, often radiate basket arrangement, either small and compact, like a 3-4 cm. miniature bush, or becoming very large (to 50 cm.) and lax, with the partly bare, glossy stem bases succulent, pinkish and bearing distant leaves, supported by stiff stilt-rhizoids; lateral leaves larger than in *S. subdiaphana*, slightly oblong, bearing a few scattered cilia anteriorly, median leaves rather long, aristate; spikes wide, sporophylls dimorphic, bearing long cilia, megasporophylls large, lax, ovate, acute, microsporophylls rather long, wide-based, microspores olive-brown.

Nepal:

C: **Gulmi** [Gundi khola, Kali Gandaki river, 5000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8922, 12.10.1954, BM *sub* "*S. bisulcata*" det. A.H.G. Alston (written by him on label) in error], **Syangja**, **Kaski** [Pokhara Boy's Boarding School, W. facing bank, *B.F.C. Sennitt* 71480, 12.12.1971, BM; limestone rocks and cliffs by path down from road south of Mahendra Gouffer, to Surjenagar village and on far (S.E.) side of river a little up the Kali Khola valley, *c.* 8 km N. of Pokhara, *C.R. Fraser-Jenkins* 30753, 17.9.2004, TAIF, small exposed plants; Annapurna region, *A. Hemp* 129, 2001-2, BM], **Tanahun**, **Gorkha** [path-side forest by stream above Komale khola, *c.* 1 km. below Deurali, *c.* 5 km. W.N.W. of Anbu Khaireni, 800 m., *C.R. Fraser-Jenkins* & *Nirmala Pariyar* 28378 (FN 4353), 16.10.1999, H, large plants], **Dhading** [Birjet, on mossy rock, 1620 m., *N.P. Manandhar* 12962, 4.11.1989, KATH], **Rasuwa** [Mani Gaon (on way to Ramche), 1230 m., *V.L. Gurung*, *T.K. Rajbhandari*, *N.P. Manandhar* & *A. Karki* 77/600, 29.9.1977, KATH], **Nuwakot**, **Kathmandu** [Nagarjong, *M.S. Bista* & *H. Kanai* 674444, 2.10.1967, KATH, *sub* "*S. biformis*" in error], **Lalitpur**, **Sindhupalchok** [Manichaur to Patibhanjyang, 7300-7010 ft., *V.L. Gurung* & *M. Gorkhali*, 78/604a, 21.10.1978, KATH], **Ramechap**. .

E: **Udayapur** [vers le col de Sukhchauri, boises exposés vers l'est, 1000 m., *A. Zimmermann* 2100, 7.11.1954, BM, G det. A.H.G. Alston as "*S. subdiaphana*" in error], **Solukhumbhu**, **Sankhuwasabha** [below Hedangna, terrestrial on deep shady slope, 2500 ft., *P.R. Shakya* & *M. Ohsawa* 850, 6.9.1971, KATH], **Dhankuta** [Gurjagaon, Dhankuta District, *c.* 6000 ft., *A.H. Norkett* 5504, 25.9.1961, BM], **Taplejung** [Sanghu, river terraces below camp, 5600 ft., *A.H. Norkett* 6753B, 28.10.1961, BM; Dumhan, Taplejung, *H. Kanai*, *M. Togashi* & *T. Tuyama s.n.*, 30.10.1963 and 31.10.1963, TI, BM, *sub* "*S. kurzii*" in error].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Sikkim; Darjeeling; Nepal. N.E. India; Thailand.

(S, C). A common (in Nepal) mid-altitude species of damp, semi-open or shaded banks by paths and roads, varying greatly in size depending on degree of exposure and moisture.

[***Selaginella picta*** A.Braun *ex* Baker was listed without locality as being present in Nepal by Ching & Wu (1983) in error, and thence noted by Iwatsuki (1988), but it is a further N.E. Indian species from China; Myanmar; Arunachal Pradesh; Assam; Manipur; Nagaland and mainland S.E. Asia, and is not known from Nepal. (M, Sc to R).]

31. ***Selaginella pulvinata*** (Hook. & Grev.) Maxim. (misapplied name: "*S. tamariscina*" from N. India, *sensu* Zhang, Nooteboom & Kato (2013) in the *Flora of China*, *non* (P.Beauv.) Spring).

A remarkable, rosette-forming species with a table of leaves above a usually short, thick basal stump of intertwined rhizoids, with many crowded, hard, flat, bright green branches arranged radially around the main growing point in the centre, branches with pale to yellowish undersides. The whole plant curls up into a dark-grey, tennis-ball-like dessicated survival stage during the Winter, and revives to open again during Spring rains and the monsoon in Summer. Leaves rather broadly triangular with a short pointed, aristate apex and pale, scarious, toothed margins; spikes borne at the edges of older branches, compact, quadrangular, with isomorphic sporophylls, microspores yellow.

Nepal:

W: **Darchula** [Makarighad to Khandeswori, on mossy stone, 2000 m., *P.R. Shakya*, *M.K. Adhikari* & *M.N. Subedi* 7897, 18.7.1984, KATH; Surmasarovar, 804295, rocky place, 4400 m., *D.P. Joshi* & *M.S. Bista* 597, 26.8.1972, KATH], **Bajhang** [Bauligad, on open rock, 1830 m., *P.R. Shakya*, *L.R. Sharma* & *K.R. Amatya* 6328, 6.7.1981, KATH]; **Rukum** [near Ranmagaon, 8000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 3316, 30.6.1954, BM], **Dolpa** [between Hurta and Narku, Bheri River, 7000 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3240, 6.9.1952, BM].

Himalayan distribution: China; Tibet; Myanmar; ["Assam" in a wide sense in K, was probably mislabelled by Hooker and may have come from China or elsewhere, though cited by Alston (1945)]; Nepal; Uttarakhand [but very locally common, Tawaghat, *B.S. Kholia*, BSD; *c.* 15 km. N. of Tintola, N. of Tawaghat on new road N. to Malpa, Pithoragarh, open, S.-facing dry rock-ridge and grassy slope, *c.* 1700 m., *C.R. Fraser-Jenkins* 21723 (FN 390), 23.11.1994, E, PAN]. E. Asia; Thailand; Vietnam. The closely related Chinese *S. tamariscina* was misreported from N. India in the *Flora of China*, by Zhang, Nooteboom & Kato (2013) in error for the present species.

(S(T), R). A very rare and restricted, but very locally common species of dry, open rocky and grassy slopes at upper mid altitudes, occurring nowhere else in the Indo-Himalaya apart from a very narrow belt between eastern Uttarakhand and western Nepal.

Indian threatened status: **EN**.

Nepalese threatened status: **EN**.

Fraser-Jenkins (2010) has shown strong distributional, symbolic and other grounds to suppose that this species, rather than the widely held and sold *S. bryopteris*, is more likely to have been the central species of the three mythological *Sanjeevani*, or life-restoring herbs, of the ancient Hindu epic, the *Ramayana* of Valmiki. This herb was brought from ancient Dronagiri (now the village of Dunagiri nearby to its occurrence in Pithoragarh) in the Himalaya to Lanka by the Monkey-God Hanuman. Not knowing precisely which herb to collect in the aeons prior to the advent of taxonomic pteridology or Carl Christensen, Hanuman brought along the whole mountain-top containing it and other medicinal herbs, in order to save the life of the arrow-struck Laxmana, brother of the deity, Lord Ram, in their battle against the Demon King Ravanna of Lanka who had stolen Lord Ram's wife Sita.

32. ***Selaginella remotifolia*** Spring (syn.: *S. japonica* Miq.).

A very long-creeping, largeish, lax-fronded species with thin rhizophores throughout its length, main-stem horizontal and close to the ground, occasionally abruptly altering direction by *c.* 25° at a joint in the stem, side-branches arising alternately at intervals, leaves rather large, each group of four (two subopposite laterals, two subopposite medians) well spaced out on the main stem, more crowded on the semi-erect side-branches, lateral leaves large, asymmetrical at their bases, rectangular-lanceolate, pointed, appearing entire though actually very minutely denticulate at least towards their apices, median leaves in close pairs, closely adpressed to the stem, denticulate towards their apices; strobili with largeish, aristate, almost entire to minutely denticulate, isomorphic sporophylls.

Nepal:

C: **Dolakha** [between Kenja and Sivalaya, Dolakha, *T. Nakaike* 3522, 23.10.1988, KATH]; **Ramechap** [between Sivalaya and Bhandar, 1800-2500 m., *T. Nakaike* 3137, 6.10.1988, KATH].

E: **Tehrathum** [Tinjure Phedi - Chauke, 872272, along path in forest, 2700 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725131, 7.6.1972, KATH, TI, sporophylls narrow, isomorphic, det. CRFJ, *sub* "*S. bisulcata*" det. K. Iwatsuki, redet. CRFJ, 1.11.2014].

Himalayan [*etc*.] distribution: China; Myanmar [N'Bapa, *F.G. Dickason* 5123, 25.4.1935, BM]; Bhutan; Manipur [very rare, along the ridge on the lee side, deep shade, Sirhoi, Manipur, 7500-8000 ft., *F. Kingdon-Ward* 17293, 15.4.1948, BM, det. A.H.G. Alston, 1949; Ukhrul, Manipur, 6000 ft., whole plant turns brown in Winter, *F. Kingdon-Ward* 17066, 10.3.1948, BM, det. A.H.G. Alston, 1949]; Nepal. Japan; Taiwan; Korea; Philippines and Indonesia.

(M, R). A very rare higher mid-altitude species of semi-open forest banks, previously overlooked in Nepal and first noticed by X.-C. Zhang for the *Flora of China* (2013), pers. comm. 2014. It was first identified from India (Manipur) by Alston, but because this was later than his monograph of Indian *Selaginella* (Alston 1945) it was omitted

by Dixit (1992) in his expanded reworking of Alston's paper. Its distribution pattern is not typical of a Malesian species, but also does not fit the Sino-Himalayan type well.

Nepalese threatened status: **EN**.

33. ***Selaginella repanda*** (Desv. *ex* Poir.) Spring (syn.: *S. tetragonostachyum* (Wall. *ex* Hook. & Grev.) Spring; *S. implexa* J.Scott).

Similar to a compressed *S. subdiaphana*, but with more erect and slightly stiffer plants, the leaves are more crowded and become more sloping and close together at the bases of the stems, lateral leaves auriculate, ciliate throughout their lower acroscopic basal half, not just with the fan of crowded cilia around the basal auricle characteristic of *S. subdiaphana*; spikes rounded, with isomorphic ciliate sporophylls, microspores red.

Nepal:

C: **Chitawan** [very locally common in the central *terai* lowlands and foothills; Steep banks of Buri Rapti Khola, by forest, shortly upstream from Elephant Breeding Nursery, S.W. of Sauraha, Chitwan National Park, *C.R. Fraser-Jenkins*, with *Nirmala Fraser-Jenkins* and *Jacob C.B. Fraser-Jenkins* 33030 (FN 143), 26 Dec. 2007, TAIF], **Makawanpur** [Suntari, W. of Hetauda, 200 m., *T. Nakaike* 3708, 8.11.1988, KATH], **Sindhuli** [N. facing, forested rocky stream-gully on N. side of second main ridge of hills up from the plains, *c.* 6 km S. of Sindhuli Madi, N. of Karkare, N. of Biman, *c.* 15 km N. of Bardibas, *C.R. Fraser-Jenkins*, with *K. Neupane* 26012 (FN 1990), 12.2.1998, H]. C. Nepal: [Nepal, *C. Maries s.n.*, 1.12.1882, CAL].

E: **Siraha** [entre Belsot et Sogaret, S.-exposition, 175 m., *A. Zimmermann* 2153a, 9.11.1954, BM, G], **Sunsari** [Dharan (400 m.) - Sanguri Bhanjyang (1300 m.), 872266, on rather dry bank of path in shade, *c.* 1000 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725032, 2.6.1972, BM].

Almost all the specimens reported by Iwatsuki (1988) are the similarly isomorphic sporophylled *S. pallida*, but the report by Nakaike & Gurung (1995) from Kathmandu valley, Nagarkot, 1899 m., *T. Nakaike* 1533, 16.9.1986 (TNS! KATH!), at too high an altitude for this species and outside its range, was found by CRFJ to refer to a specimen of *S. chrysocaulos* with nearly isomorphic sporophylls, as often happens in exposed plants of that species.

Peri-Himalayan distribution: China; Myanmar; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [very rare]. Uttar Pradesh; Assam; Nagaland; Meghalaya; C. and S. India; Thailand; S.E. Asia.

(M, C, but R in Himalayan region). A rare (in Nepal), low-altitude species of semi-open but sheltered river and road-banks, not reaching the altitudes reported by Iwatsuki (1988) and Nakaike & Gurung (1995) due to confusion with *S. chrysocaulos*. Nepalese threatened status: **VU**.

34. ***Selaginella reticulata*** (Hook. & Grev.) Spring (syn.: *S. rajasthanensis* Gena, Bhardwaja & A.K.Yadav, *S. jainii* R.D.Dixit; *S. panigrahii* R.D.Dixit; *S. nairii* R.D.Dixit; misapplied name: "*S. ciliaris*" *sensu* Fraser-Jenkins 1992, *non* (Retz.) Spring).

A small, usually pale yellow-green species (to *c.* 7 cm., occasionally to 15 cm. when very sheltered) belonging to the *S. chrysorrhizos* aggregate and very similar to it, with a few fronds, or a fan of erect fronds arising from a single stem-base, but plants and leaves smaller and median leaves rounded to acutely pointed apically, but not aristate; sporophylls dimorphic, microsporophylls dentate to ± cilate at their bases; microspores red. In drier regions in the further W. Himalaya and peninsular or W. India, or at high altitudes, plants often become minute, with most of their length (of *c.* 6 mm. to 1 cm.) being occupied by one or two strobili.

Nepal:

W: **Jumla** [path-side earth slopes below rocks, c. 3 km. above Chauriyachaur on S. side of Danphe Lagna pass, Jumla to Rara Tal, N. of Jumla, 3650 m., *C.R. Fraser-Jenkins* 35167, 27.9.2013, KATH, surprisingly high altitude for this species].

C: **Kaski** [Pokhara Boy's Boarding School, W. facing bank/N. facing cliff of river terrace, *B.F.C. Sennitt* 71478, 71482, 71482a 12.12.1971, BM; rocks below cliffs at N. entrance to Seti river gorge, below Mahendra Pul Power House, N. part of Pokhara, *C.R. Fraser-Jenkins*, with *G.* [*R.*] *Pariyar* & *L.B. Tamang* 25841 (FN 1819), 5.1.1998, BM, H], **Kathmandu** [banks of path from Sanagaon to Khatripakhar, above and north of Khulaltar village, S.W. of Sankhu, N.E. side of Kathmandu valley, Kathmandu District, *c.* 1500 m., *C.R. Fraser-Jenkins* & *Rajkumar K.C. Khatri* 21342 (FN 9), 20.9.1994, E], **Sindhuli**.

E: **Dhankuta** [Dhankuta District, Gurjagaon, 6000 ft., *A.H. Norkett* 5505A, 25.9.1961, BM; Dhankuta, East Nepal, on the wet and shady place by road side, 1100 m., *D.P. Joshi* 227, 11.10.1971, KATH], **Jhapa** [forest near Khudana bari, on shady bank, *N. Thapa* & *K. Bhattarai* J 33/97, 23.12.1997, KATH], **Ilam** [Ilam, on the partly shady and moist place, *D.P. Joshi* 60, 2.9.1971, KATH, *sub* "*S. kurzii*" det. N. Thapa 1988, in error], **Taplejung** [Sanghu, near lower D.S. area, 5900 ft., *A.H. Norkett* 6403A, 21.10.1961, BM].

Himalayan distribution: Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Jammu & Kashmir [Akhnoor, Poonch, *C.R. Fraser-Jenkins*]. N.E., C. and S. India; Bangladesh. Apparently absent from China.

(?H, Sc to C). A common low to upper-mid and occasionally higher altitude species of compacted, vertical path-banks, or growing on damp stones in semi-open places, dying down rapidly after the Summer monsoon, though completely dried, brown fronds may sometimes remain intact, hanging off vertical sheltered rocks.

35. ***Selaginella semicordata*** (Wall. *ex* Hook. & Grev.) Spring (syn.: *S. burghallii hort ex* R.Sim).

Main stem long-creeping among grasses, prostrate, with thin rhizoids throughout;

leaves and stems pale yellow-green; shortish, erect side branches arise alternately along the main stem; lateral leaves large, entire; spikes long, quadrangular, sporophylls isomorphic, acute, entire; microspores red.

Nepal:

C: **Chitawan** [Bharatpur, Chitwan, *A.K. Shrestha* 133, 29 Jan. 2006, TUCH, det. CRFJ].

E: **Morang** [1½ km. E. of Khanepokhari, 150 m., *C.R. Fraser-Jenkins* 29045 (FN 5380), 7.10.2001, H, KATH; small stream-gully in light mixed forest with sal trees and bushes, *c.* ½ km. east of Pathari, west of Urlabari, on south side of main East-West Highway, c. 30 km. E. of Itahari, *C.R. Fraser-Jenkins* & *Nirmala Fraser-Jenkins* 30111, 16.12.2003, TAIF], **Jhapa** [Range Danda, 100 m., *N. Thapa* 2016, 24.1.2003, KATH].

Himalayan distribution: Myanmar; Assam; Arunachal Pradesh; Bhutan; Darjeeling [Dhulkajhar, Naxal Bari, Darjeeling *terai*]; Nepal. N.E. India; Bangladesh; S.E. Asia.

(M, Sc). A very rare and restricted (in Nepal), low altitude species of wet, periodically flooded flat places at the edge of small stream-flows, growing among grasses. Nepalese threatened status: **EN**.

36. ***Selaginella subdiaphana*** (Wall. *ex* Hook. & Grev.) Spring (syn.: *S. glauca* Spring; *S. aggesta* Spring; *S. schlagintweitii* Hieron.; *S. namdaphaensis* Sarn.Singh & Panigrahi; misapplied names: "*S. repanda*" *sensu* Iwatsuki (1988) *p.p.*, Nakaike & Gurung (1995), *non* (Desv. *ex* Poir.) Spring; "*S. tenuifolia*" *sensu* Iwatsuki (1988) *p.p.*, *non* Spring; "*S. ornata*" *sensu* Dixit (1992) from N.E. India, *non* (Hook. & Grev.) Spring [from China and S.E. Asia]).

A very common and widespread species of lower-mid altitudes throughout the Indo-Himalaya, lateral leaves sloping, their acroscopic bases broadly auriculate and bearing a fan-like fringe of pale cilia around the auricles, denticulate above; lower leaves on the stems become more crowded, smaller, narrower and more sloping, almost peg-like, as also in *S. repanda*; sporophylls strongly dimorphic, microsporophylls ciliate, aristate, microspores abundant, orange-red (used to be used locally as coloured powder during the *Holi* festival in India). During the dry Winter season curious triangular compressed, stilt-rooted green branch-tips, *c.* 1 cm. long, survive among mosses etc. to rejuvenate in Spring, after the rest of the plant dies at the onset of Winter, though in more permanently damp places the Winter branches are often larger and not or hardly compressed.

Nepal:

W: **Kanchanpur** [spring in *Sal* [*Shorea robusta*] forest, *c.* ½ km. below Betkot, N. of Chaile and Daiji on path to Lipna, *c.* 15 km. N.E. of Mahendranagar, *C.R. Fraser-Jenkins* 24935 (FN 913), 30.10.1996, BM, H], **Dadeldhura**, **Darchula** [Darchula, 1171-1439 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yaho, N. Yamomoto*,

C.A. Pendry, A. Elliott, G.D. Bhatt ["*Bhatta*"] & *M.L. Pathak* 1216020, 9.7.2012, KATH], **Doti** [Doti - Kola, 804286, on wet areas, 1400 m., *M.S. Bista* & *D.P. Joshi* 70, 27.7.1972, KATH], **Baitadi** [Dorepani - Bagadi, 1540-1580 m., *M.M. Amatya* & *P.M. Regmi* W879/82, 17.9.1982, KATH], **Surkhet** [banks of river Kharekhola, from path *c*. ½ km. below and S.W. of Kharekhola village, down stream into Sal forest, *c*. 1 km. below and S. of Kharekhola village, *c*. 3 km. N.N.E. of Surkhet, *C.R. Fraser-Jenkins*, with *K. Neupane* & *K. Pongali* 25581 (FN1559), 27.9.1997, H], **Jumla**, **Dang** [between Kurpani and Ghorai, damp sheltered earth banks, 4000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 1331, 4.9.1952, BM], **Mugu** [Kama khola, 2225 m., *T.B. Shrestha* & *N.P. Manandhar* 334, 17.10.1975, KATH], **Rukum**.

C: **Myagdi** [nr. Jakumsibang, open slopes among rocks, 5000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4077, 30.8.1954, BM; Tatopani, S. of Dana, Kali Gandaki, on rocks beneath shrubs, 4000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7592, 30.8.1954, BM], **Parbat** [Kusma, on shady banks, 2500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7065, 5.9.1954, BM, CAL], **Manang** [Poundi doban to Phalia Sanghu, 841282, on damp shady place, 700-800 m., *D.P. Joshi* & *M.M. Amatya* 73/248, 5.7.1973, KATH], **Palpa**, **Syangja** [Andhi Khola, on shady banks, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8725, 2.10.1954, BM], **Kaski**, **Tanahun** [densely forested stream-gully in hills *c*. 1½ km. S.E. of Jamune village, *c*. 7 km. W. of and above Damauli, on road to Pokhara, W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins* 25521 (FN 1499), 19.8.1997, H, BM], **Makawanpur** [Balephi khola, Makwanpur, 27° 50', 85° 40', 1000 m., *J.F. Dobremez* 829, 22.8.1971, KATH], **Rasuwa** [Manigaon, on way to Ramche, 1230 m., *V.L. Gurung, T.K. Rajbhandari, N.P. Manandhar* & *A. Karki* 77/601, 29.9.1977, KATH], **Nuwakot**, **Kathmandu** [Chandagiri, 2000 m., *T. Nakaike* 3855, 19.11.1988, KATH], **Lalitpur** [Phulchowki Danda, *N. Thapa* L18, 22.12.2003, KATH, *sub* "*S. monospora*" in error], **Kabhrepalanchok**, **Sindhupalchok** [Bahrabise, *S. Matsumoto* SM09/01-12 and 01-25, 1.9.1988, KATH], **Dolakha**.

E: **Siraha**, **Bhojpur** [Saju Khola (1400 m.) - Dingla (1000 m.), 873273/873274, on bank along path in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725427, 1.7.1972, BM, KATH], **Sunsari** [Dharan to Chyurebas, 400 m., *P.R. Shakya* & *M. Ohsawa* 771, 27.8.1971, KATH], **Sankhuwasabha** [Telok, E. Nepal, *D.P. Joshi* 178, 3.10.1971, KATH], **Dhankuta** [near Dhankuta, *c.* 3000 ft., *A.H. Norkett* 9971, 23.2.1962, BM], **Ilam**, **Taplejung** [Khebang [1700 m.] - below Siling, Tzokupa [2100 m.], *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama*, 20.11.1963, TI, photo sent by Prof. K. Iwatsuki, 3.2015, also reported by Iwatsuki (1975, 1988) as "*S. tenuifolia*" in error].

Himalayan distribution: Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir (reported from Kathua, Jammu & Kashmir, by Dixit (1992) as "*S. pallidissima*" in error); Pakistan. Not present in S. India (misreported from Kerala by Dixit 1992) and apparently not known from

Myanmar or China, despite occurring commonly in N. and N.E. India.

(?H, C, an unusual distribution pattern whose affinities are not clear). A very common lower-mid to mid-altitude species of banks, roadsides and walls, often in masses on semi-open, overgrown slopes and damp cliffs.

37. ***Selaginella tenuifolia*** Spring (syn.: *S. aureola* Spring, Mém. Acad. Sci. Bruxelles **24**: 244 (1850), lectotype, here designated: "*S. aureola* Spring, Churra-Punjee, Khasya, [*W.*] *Griffith* (182), [in 1835], Herbarium Hookerianum 1867 (K)).

A taller (5 to 20 cm.), erect, delicate, less compact and later in the season, often pink-coloured member of the *S. chrysorrhizos* aggregate, stems fragile, slightly succulent, bearing rather spaced lax branches, lateral leaves usually rather short, well spaced out, denticulate at their acroscopic margins, median leaves aristate; strobili tapering towards their apices due to the more basal megasporophylls being longer; sporophylls dimorphic, not ciliate, microsporophylls acuminate, minutely denticulate, microspores red; rather closely similar to *S. miniatospora* (Dalzell) Baker of South India.

Nepal:

C: **Makawanpur** [S. slope of the first ridge of foothills, beyond (N. of) the Churiya Ghats, just N. of and above Liot village, Basmari, *c*. 5 km. W. of Hetauda, densely Sal forested and rocky stream gulley, *C.R. Fraser-Jenkins*, with *S.B. Sunchuri, J.B. Pariyar et al*. 25756 (FN 1734), 24.10.1997, BM, H]; **Sindhuli** [N.-facing rocky stream gully on N. side of second main ridge of hills up from the plains, *c.* 6 km. S. of Sindhuli Madi, N. of Karkare, Biman and Bardibas, *C.R. Fraser-Jenkins*, with *K. Neupane* 26010 (FN 1988), 12.2.1998, BM, H].

E: **Taplejung** [East Nepal, Bhandukay [1600 m.] - Yamphodin - Ghatte [2500 m.], *H. Kanai, G. Murata* & *M. Togashi s.n.*, 16.11.1963, TI, photo sent by Prof. K. Iwatsuki, 3.2015]. It was also reported by Iwatsuki (1975, 1988), followed by Thapa (2012), as collected by the Japanese third E. Himalayan expedition, from Taplejung on 20.11.1963. Professor Iwatsuki has kindly sent photos of the two collections and the 20.11 sheets are clearly *S. subdiaphana*, while the 16.11. sheet is *S. tenuifolia* as reported. Most Indian records of this species are also misidentifications in error for *S. subdiaphana etc.*

Himalayan distribution: Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Thailand. Dixit (1992) reported its synonym, *S. aureola*, from Kerala, S. India, in error for a small specimen of *S. tenera* (Hook. & Grev.) Spring. *S. tenuifolia* is apparently not known from China.

(?H, Sc, locally C). A scattered and rather uncommon low to mid altitude species preferring shaded, damp boulders beside stream-beds, or on banks of pathways in damp, shaded places; plants soon die and disintegrate after the end of the monsoon.

Nepalese threatened status: **NT**.

38. ***Selaginella vaginata*** Spring (syn.: *S. thomsonii* Hieron.; *S. bomiensis* Ching & S.K.Wu; misapplied names: "*S. exigua*" *sensu auct. Ind. p.p.*, *non* Spring [= *S. ciliaris*]; "*S. ciliaris*" *sensu* Iwatsuki (1988), Nakaike & Gurung (1995), *non* (Retz.) Spring; "*S. subdiaphana*" *sensu* Loyal & Kumar (1983), *non* (Wall. *ex* Hook. & Grev.) Spring).

Plant very small, far-creeping, prostrate and rooting throughout with fine rhizoids except in larger, more luxuriant and robust, semi-erect fertile shoots; branches narrow, leves small, lateral leaves long-ciliate at their wide bases, symmetrical, triangular, pointed and borne at 90° to the stem; sporophylls usually isomorphic, but can be rather weakly dimorphic as well, ciliate; forms carpets over steep banks and damp boulders, regrowing after the dry season from very small (*c*. 0.5 cm.), narrow, compressed branch-apices surviving close to the substrate while the rest of the mat of plants dies; microspores scarlet.

Nepal:

W: **Kanchanpur** [spring in *Sal* (*Shorea robusta*) forest, *c.* ½ km. below Betkot, N. of Chaile and Daiji on path to Lipna, *c.* 15 km. N.E. of Mahendranagar, *C.R. Fraser-Jenkins* 24934 (FN 912), 30.10.1996, H], **Surkhet** [Chinchhu, Surkhet, *N. Thapa* S5, 7.8.2001, KATH].

C: **Parbat** [Kusma, on shady banks, 2500 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 7064, 5.9.1954, BM, CAL], **Syangja**, **Kaski** [Pokhara Boy's Boarding School, W. facing banks, *B.F.C. Sennitt* 71481, 12.12.1971, BM], **Dhading**, **Rasuwa** [roadside banks, *c*. ½ to 1 km. N. of Kalikasthan, N. of Trisuli Bazaar on road up to Ramche, Dhunche (and Langtang), N. of Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins*, with *Rajkumar K.C.*, *R. Kharki* & *B. Pariyar* 21354 (FN 21), 27.9.1994, E], **Kathmandu** [Nagarjun, 1400 m., *T. Nakaike* 1139, 26.8.1986, KATH], **Kabhrepalanchok** [C. Nepal, Lamosangu to Bahrabise, *S. Matsumoto* SM08/31-23, 31.8.1988, KATH], **Sindhupalchok** [Melamchi khola, west side, bank, *B.F.C. Sennitt* 71244/71247, 21.10.1971, KATH/BM; W. side of Indrawati valley, on bare earth and rocks, *Brian F.C. Sennitt* 71247, 22.10.1971, BM, KATH; Lamosangu - Bahrabise, 750-840 m., *S. Matsumoto* SM08/31-23, 31.8.1988, KATH], **Dolakha** [entre la Tamba Khosi et Lamung [Laduk], 1000 m., *A. Zimmermann* 1198, 12.9.1954, BM; Busti, Dolakha, 1200 m., *K.R. Rajbhandari* & *B. Roy* 2341, 20.8.1977, KATH], **Ramechap**.

E: **Udayapur**, **Bhojpur** [Dingla (1000 m.) - Doban (800 m.), 873273, muddy rock along path in shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725644, 2.7.1972, KATH, BM *sub* "*S. ciliaris*" det. K. Iwatsuki in error, ditto 725456, BM], **Solukhumbhu** [Dudh Khosi, between Lukla and Namche, 2880 m., *G.* & *S. Miehe* 813, 30.8.1982, BM], **Sankhuwasabha** [Chainpur District, Tumlingtar, 27° 18', 87° 13', on cliffs beneath shrubs, 1800 ft., *A.H. Norkett* 8473, 8.12.1961, BM], **Dhankuta** [Dhankuta, E. Nepal, on the wet and shady soil and on the rock, *D.P. Joshi* 225, 11.10.1971, CAL], **Ilam** [Mai Majuwa - Mai Pokhari - Dhara Pani, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama*

s.n., 4.12.1963, BM], **Taplejung** [below Sanghu, 5250 ft., *A.H. Norkett* 7766, 19.11.1961, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. and C. India, mainland S.E. Asia.

(S, C). A very common species with a considerable altitude-range from lower-mid to upper-mid altitudes, preferring to spread over rather open, semi-dry boulders, road-banks and cliffs, drying up in Winter.

EQUISETACEAE

Equisetum (2 species two subspecies).

39. ***Equisetum arvense*** L. subsp. ***arvense*** (syn.: *E. campestre* C.F.Schultz; *E. boreale* Bong.; *E. arcticum* Rupr.).

A horsetail with stems diphyadic, i.e. sterile-fertile dimorphic, fertile stems appear first, brown without branches and with large, loose sheaths; sterile stems normally up to *c.* 50 cm., green, ridges taller and fewer than in *E. ramosissimum*, branches radiating in whorls just below each stem-sheath, sheaths small tightly clasping the stem and divided apically into a number of prominent, tapering teeth, sheath-ridges running up from the base of the sheath to the centre of each tooth, single, or sometimes becoming very shallowly grooved in their upper half; strobili with obtuse, narrowly rounded tips, but no pointed umbo.

Nepal:

W: **Jumla** [Sialgarhi, 11,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 2636, 5.1952, BM; Padmara, N.E. of Jumla, damp grass slope, 9000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 4051, 12.5.1952, BM], **Mugu** [Rara Tal, Mugu, *N.P. Manandhar* & *D.P. Joshi* 8101, 10.8.2001, KATH], **Dolpa** [Suli Gad, Dolpa, 29°02', 82° 55', bords de ruisseau humides, 2500 m., *J.F. Dobremez* 2793, 27.4.1971, (and *N.P. Manandhar* 74-422), KATH].

C: **Baglung** [*c.* 1 mile E. of Dhorpatan, island in the Uttar Ganga, near riverside, *c.* 9000 ft., *A.R. Vickery* 550, 3.4.1974, BM], **Mustang** [lower part of Phangde Darrah, above Ghato Khola, S.E. of and above Tini Gaon, S.E. of, opposite and above Jomsom, below and N.W. of Nilgiri North Peak, on North West side of Annapurna Himal range, Kali Gandaki valley (E. side), Mustang District, beneath rocks on dry slopes, and among stones of old wall, in fairly dense, natural conifer forest, *c.* 3000 m., *C.R. Fraser-Jenkins* 30499, 26.6.2004, TAIF], **Manang** [Manang, 13,500 ft., *K.N. Sharma* E 45, 22.7.1931, BM], **Kaski** [Annapurna region, *A. Hemp*, Univ. Bayreuth, 43, 2001-2, BM **Gorkha** [between Lho and Soma, swampland, forest clearing, 11,000 ft., *P.C. Gardner* 1125, 4.7.1953, BM; Shyalla, way to Lho, Nubri valley, Manaslu Conservation Area, N. Gorkha, 3400 m., *S.H. Bhattarai* 35/16, 9.6.2012, KATH].

E: **Sankhuwasabha** [Bharate Himal, Barun valley, Yangle pasture, rivulets, 3650 m., *T. Wraber* 430, 10.10.1972, BM].

Himalayan distribution: China; Tibet; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. W. and C. Asia; Europe; N. America. Zhang & Turland (2013) in the *Flora of China* reported it from W. Bhutan (based on a single specimen, Thimphu, *C.N. Parker* 4898, E, THIM) referring to one of the slightly intermediate plants of subsp. *diffusum* with the fertile stems initially brown and with loose sheaths, but with double ridges on the young green shoots.

(E and/or S [in China], Sc to R). This is a scattered and rather uncommon upper-mid and higher altitude to high Himalayan taxon occurring more in the inner Himalayan ranges than subsp. *diffusum* and is commoner in W. Nepal, very rare towards the east. It prefers sandy soil near streams, or in higher-altitude meadows, between rocks.

Nepalese threatened status: **LC**.

40. ***Equisetum arvense*** L. subsp. ***diffusum*** (D.Don) Fraser-Jenk., ***comb. nov***. (basionym: *Equisetum diffusum* D.Don, *Prodr. Flor. Nepalensis*: 19 (1824), lectotype (here designated): Nepal, "Equisetum scoparium, Wall. List no. 398. Napalia - *Dr. Wallich* (1819)", BM. The right-hand fertile specimen on the sheet, marked as no. 2. The "lectotype" designated by Hauke (1978), "Nepal, *Wallich* s.n., 1820" is one of Wallich's own later collections in Nepal, and is not part of the original material collected by the Hon. E. Gardner and assistants for Wallich and studied by Don, so is actually a neotype; syn.: *E. mekongense* C.N.Page; *E.* x *wallichianum* C.N.Page (sterile material), *E. diffusum* var. *paucidentatum* C.N.Page; misapplied name (if both treated at specific rank): "*E. arvense*" *sensu auct. Ind. plur.*).

Closely related to subsp. *arvense*, but not or hardly sterile-fertile dimorphic, though fertile stems may sometimes start without branches, with loose sheaths and hardly green, but later become branched and similar to sterile stems, sheath-ridges below each tooth deeply grooved so as to become double; but specimens with shallow grooves and normal diphyadic stems, but which are not sterile hybrids, sometimes occur, particularly at higher altitude and further east in Bhutan and far N.E. India, bridging the distinction between subsp. *diffusum* and subsp. *arvense*. Although some authors have considered subsp. *diffusum* to be related to *E. palustre*, this is not the case and it appears to constitute a vicariant adaptation of *E. arvense* to the climate of the Himalayan region, with intermediate specimens occurring fairly frequently, which are not sterile hybrids.

Nepal:

W: **Darchula** [W. facing forested rocks below cliffs by path, *c*. 2 km. N. of Dumling (opposite Jipti on the Indian side), on path south to Darchula, *C.R. Fraser-Jenkins* 21684, 22.11.1994, E], **Bajura** [Khaptad, Bajura, on stream bank, 3050 m., *N.K. Bhattarai* 90/993, 22.8.1990, KATH], **Dailekh** [Gairi, on moist rock crevices, 900

m., *N.P. Manandhar* 341-91, 25.2.1991, KATH], **Jumla** [Jumla, Chandhabise khola, *P.R. Shakya* & *B. Roy* 5768, 17.6.1980, KATH, intermediate, with brown, loose-sheathed fertile shoots, but double sheath-ridged sterile], **Salyan** [Sano Pipal, 28°37', 82°10', 700 m., *J.F. Dobremez* 2582 (and *N.P. Manandhar* 74-211), 17.4. 1974, KATH], **Jajarkot** [Barikot, Mulrang khola, on wet bank, 6500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5641, 13.10.1952, BM], **Rolpa** [Budhagaon, on shady and boggy place, 1330 m., *N.P. Manandhar and N.K. Bhattarai* 8813, 5.9.1982, KATH], **Dolpa** [Tibrikot, Dolpa Distr., 29° 03', 82° 50', rochers mixtante, endroits humides, 2100 m., *J.F. Dobremez* 2743 (and *N.P. Manadhar* 74-372), 25.4.1974, KATH].

C: **Gulmi**, **Baglung** [Ramdanda, 950 m., *Dr. D.K. Sharma* & *N. Thapa* 20+/96, 4.11.1996, KATH], **Myagdi** [near Malkabang, W. of Thulo Khola, damp, shady places, 6400 ft., *G.* & *S. Miehe* A M2, 16.1.1977, BM, *sub* "var. *paucidentatum* C.N. Page" det. C.N. Page 15.3.1979], **Mustang**, **Manang** [Marsyandi valley, between Thonje and Jagat, on sandy moisty places, *T. Wraber* 586, 1.11.1969, BM], **Parbat** [between Sikha and Chitre, common on shady slope, 1970 m., *H. Tabata, K.R. Rajbhandari, K. Tsuchiya* & *Y. Kono* 6579, 17.10.1976, KATH], **Kaski** [Pokhara Distr., Pathana (Dhampus) (2050 m.) - Tolka (1850 m.), 836282, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8330215, 8.7.1983, BM], **Gorkha**, **Makawanpur**, **Rasuwa** [Langtang village area, cornfield weed, 11,500 ft., *O. Polunin* 1551, 1.8.1949, and Langtang to Syarpagaon, 9500 ft. *O. Polunin* 1821, 23-31.8.1949, BM; roadside ditch between Dhunche and Syabrubensi, N. of Dhunche (and Trisuli Bazaar) on Langtang road, *C.R. Fraser-Jenkins* 15672, 10.11.1989, E], **Dhading [**Jharlang, on moist ground, 1550 m., *N.P. Manandhar* 13016, 5.11.1989, KATH], **Nuwakot** [Ramsay, 6000 ft., *Lieut. Lal Dhwoj* 87, comm. Major J. Manners Smith, 17.6.1914, K], **Kathmandu** [Shivapuri, 7000 ft., *T.B. Shrestha* & *A.V. Uphayaya* 626, 3.9.1962, KATH], **Lalitpur**, **Bhaktapur** [Sanga, *T. Nakaike* 2359, 4.10.1985, KATH], **Kabhrepalanchok**, **Sindhupalchok** [steep path through dense forest down below the "Bungy-Jumping" bridge across Bhote Khosi river, below Listikot, E. of Palang village, N.W. side of Bhote Khosi river, c. 3km S.W. of Chaku, N. of Bharabise on road to Tatopani and Tibet, Sindhupalchok District, *c.* 1050 m., *C.R. Fraser-Jenkins* 28957 (FN 4932), 5.6.2001, H], **Dolakha** [Those - Garjang, moist slope along the Khemiti river, 6500 ft., *Dr.*[*M.L.*] *Banerjee*, [*A.V.*] *Upadhyay* & [*T.B.*] *Shrestha* 3063, 24.9.1964, KATH], **Ramechap** [between Bhandar and Kenja, 2100-1700 m., *T. Nakaike* 3185, 7.10.1988, KATH].

E: **Solukhumbhu** [de Phuleli à Taksindhu, parmi cultures, 1800 m., *A. Zimmermann* 1943, 21.10.1954, BM, G, dark tooth-apices, double ridges], **Sankhuwasabha** [Arun valley, N. of Num, on wet gravel at rivers edge, 4500 ft., *J.D.A. Stainton* 1364, 18.8.1956, BM, KATH], **Sunsari**, **Dhankuta** [Sinduwa (2100 m.) - Bhalukop (2400 m.), 872271, on muddy rock along stream, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725076, 5.6.1972, BM, TI, KATH], **Tehrathum** [Chitre - Hile, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725507, 8.7.1972, BM], **Ilam**, **Taplejung** [Tamrang khola, bank near stream,

c. 5500 ft., *A.H. Norkett* 8803, 14.1.1962, BM; Mewa khola, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725354, 29.6.1972, BM].

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal, Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. India; Vietnam; Japan.

(S, C). A very common taxon throughout Nepal occurring in damp ruderal habitats from lower-mid to higher altitude, usually present among stones beside streams or on damp, overgrown road-banks, or the raised edges of terraced rice-fields *etc*.

[***Equisetum palustre*** L. was reported from [far W.] Nepal by Thapa (2002) in error, based on CRFJ's thinking of it as in the far-west Himalaya, in Pakistan and confusing that with far west Nepal, information for most genera and critical species being provided by him to Thapa for the book. It is known from China; Tibet; Jammu & Kashmir [rare]; Pakistan [rare]; and Afghanistan, but is not known further east in the Indo-Himalaya, or in in Nepal. (E and/or S, R).].

41. ***Equisetum ramosissimum*** Desf. (syn.: *E. campanulatum* Poir.; *E. ramosum* DC., *E. incanum* Vaucher; *E. pallidum* Bory; *E. ramosissimum* subsp. *debile* (Roxb. *ex* Vaucher) Hauke; the plant described as *E. debile*, said to be separated by its smoother stems and a slightly different stem-anatomy, and typically with a larger, wider main stem (though this feature is highly variable), merges completely in morphology into normal *E. ramosissimum* and some European and N.W. African material also has similarly low silica protruberances and thus smoother stems. In addition it cannot readily be separated geographically within the Indian subcontinent, or even S.E. Asia and some specimens from Europe are occasionally similarly smooth, though it is generally commoner in wetter regions of the subcontinent and Nepal, *i.e.* towards the S. and E., with the *ramosissimum* form more prevalent in the drier north and west, as well as at higher altitude, but they are often intermixed or not readily assignable to one or the other due to intermediacy. It is best recognised as a forma, ***E. ramosissimum*** f. ***debile*** (Roxb. *ex* Vaucher) Fraser-Jenk., ***comb. nov.***, basionym: *Equisetum debile* Roxb. *ex* Vaucher, *Mém. Soc. Phys. Genève* **1**: 387 (1822); misapplied name: "*E. hiemale*" *sensu auct. Ind.*, *non* L. [from boreal Europe *etc*.]).

This species is distinguishable from the above by its more crispaceous stem, larger stems with a very wide central space within, usually with fewer branches in less complete whorls, and with longer branchless bases and apices, the stems can become very tall, up to 1.5 m., or short and close to the ground in exposed plants; the ribs of the stem are much more numerous and are hardly raised; the stem-sheaths clasp the main stem more tightly than in *E. arvense* and have smaller, narrower, often fugaceous and deciduous teeth on the main stem, where the sheaths may have an almost unlobed rim at their apex; the apical strobilus or "cone" has a distinct darkened pointed umbo at its apex, very obvious in younger, more compact cones. The species is highly variable in main-stem width and in the presence, absence and number of

lateral branches at each whorl.

Nepal:

W: **Dadeldhura** (f. *debile*), **Bardiya** (f. *debile*), **Banke** (f. *debile*), **Surkhet** (f. *debile* [banks of river Kharekhola, from path *c*. ½ km. below and S.W. of Kharekhola village, down stream into Sal forest, *c*. 1 km. below and S. of Kharekhola village, *c*. 3 km. N.N.E. of Surkhet, *C.R. Fraser-Jenkins*, with *K. Neupane* & *K. Pongali* 25582 (FN 1560), 27.9.1997, H]), **Jajarkot** (f. *debile* [Jajarkot, among shrubs, 3500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5707, 16.10.1952, BM]), **Jumla** (f. *debile* [Garjiankot, Jumla, near rice field, 2400 m., *K.R. Rajbhandari* & *B. Roy* 4375, 8.8.1979, KATH]), **Dang** (f. *debile* [Qadhawa, Dang, 280 m., *N.P. Manandhar* & *P.M. Regmi* 334, 11.3.1976, KATH]).

C: **Baglung** (f. *debile*), **Myagdi** (f. *ramosissimum* and f. *debile* [Kabre, N. of Dana, in water meadow, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 631, 25.5.1954, BM]), **Mustang** (f. *ramosissimum* [Mustang Bhot, 834286, moist and open place, 3700 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/2202, 2.8.1974, KATH; Charang Khola, Mustang, on very wet watery slope, 3520 m., *M.N. Subedi* 205/ 2002, 24.8.2002, KATH] and f. *debile* [Lete - Marpha, dry rocky slope by the Gandaki river, 8500 ft., *Dr. S.B. Malla, T.B. Shrestha* & *S.B. Rajbhandari* 13854, 1.11.1971, KATH; Chhairogaon, N. of Tukucha, in marsh at edge of village, 9000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 807, 30.5.1954, BM]), **Rupandehi** (f. *debile* [Butwal, among shrubs, 1000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8782, 6.10.1954, BM]), **Kaski** (f. *debile* [Sisua near Pokhara, rice fields, 660 m., *T. Wraber* 36703, 15.9.1969, BM]), **Chitawan** (f. *debile* [banks in woods around Chitwan Jungle Lodge, Chitwan National Park, Sauraha, S.E. of Narayanghad, *C.R. Fraser-Jenkins* & *C.D. Fraser Jenkins* 15865, 25.11.1989, E; Chitwan National Park, S. bank of river Rapty, W. of Sauraha, 27° 33', 84° 27', 160 m., *C.A. Pendry, K.K. Shrestha et al.* DNEP2 A67, 22.11.2004, KATH, *sub* "*E. arvense*" det. M. Gibby 2006, in error]), **Makawanpur** (f. *debile* [Sunaturi, W. of Hetauda, Makawanpur, *c*.200 m., *T. Nakaike* 3707, 8.11.1988, KATH; Kamle, Makawanpur, moist and shady place, 1000 m., *N.P. Manadhar* & *L.P. Katel* 10,726, 22.6.1986, KATH]), **Rasuwa** (f. *ramosissimum* and f. *debile*), **Dhading** (f. *debile* [above Rosi village, Dhading, moist shady place along water stream 6000 ft., *Dr. M.L. Banerjee, T.B. Shrestha* & *A.V. Uphadyaya* 2989, 1.10.1964, KATH), **Kathmandu** (f. *debile* [Chobar, Kathmandu Distr., on shaded rocks at South end of gorge, 1371 m., *B.F.C. Sennitt* 71369, 13.11.197*, KATH]), **Lalitpur** (f. *debile* [Godavaree, 5000 ft., *K.N. Sharma* E 256, 28.4.1931, BM]), **Bhaktapur** (f. *debile*), **Sindhupalchok** (f. *debile*), **Sindhuli** (f. *ramosissimum* and f. *debile*), **Dolakha** (f. *debile*), **Ramechap** (f. *debile* [between Bhandar and Kenja, 2100 - 1700 m., *T. Nakakike et al.* 3177, 7.10.1988, TNS, KATH, *sub* "*E. hiemale*" in error]).

E: **Sankhuwasabha** (f. *ramosissimum* [Tumlingtar, Sabaya river, River Arun, sandy shore amongst rocks, 1800 ft., *A.H. Norkett* 8136, 17.12.1961, BM], f. *debile* [Arun

river, near confluence of Barun khola, 27° 41', 87° 22', degraded subtropical forest slopes, on damp, open bank, 1250 m., *D.G. Long*, *R.J.D. McBeath*, *D.R. McKean*, *D.A.H. Rae* & *N.K. Bhattarai* 792, 14.10.1991, E, KATH]), **Saptari** (f. *ramosissimum* [Kamalpur, Saptari, emergent, *P.R. Shakya*, *R.K. Manadhar* & *P. Shrestha* 216, 28.5.1993, KATH] and f. *debile* [Koshi Tappu Wildlife Reserve, Simana (65 m.) - Kanchanpur (65 m.), on sunny, wet grassland, 65 m., *M. Mikage*, *T. Kajita*, *N. Kondo*, *M. Suzuki* & *K. Yonekura* 9552959, 22.10.1995, BM, KATH), **Sunsari** (f. *debile* [Chulachuli, 1800 ft., *T.B. Shrestha* & *T.K. Bhattacharya* 72/102, 22.9.1972, KATH; Dharan (400 m.) - Sanguri Bhanjyang (1300 m.), 872266, on wet sandy ground along stream, *c.* 500 m., *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725031, 2.6.1972, KATH]), **Morang** (f. *ramosissimum* and f. *debile*), **Dhankuta** (f. *debile*), **Taplejung** (f. *debile* [Tamrang Khola, bank above stream, *c.* 5600 ft., *A.H. Norkett* 8805, 14.1.1962, BM]).

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. W., N.E., C. and S. India; Sri Lanka; Bangladesh; W., E. and S.E. Asia; Europe; Australasia.

(S, C). A very common ruderal species of open field-edges, banks of paths and roads, bases of walls, edges of ponds etc., with a large altitude-range from low to higher altitude.

PSILOTACEAE

Psilotum (1 species).

42. ***Psilotum nudum*** (L.) P.Beauv. (syn.: *P. triquetrum* Sw.; *P. nudum* var. *molesworthii* Iranzo, Prado & Salvo).

A reduced, whisk-like green plant up to *c.* 20 cm. tall, arising from a short, white, underground rhizome; consisting only of two upwardly directed halves separating half way up the stem and two or three times dichotomously branched beyond that, branches terete, but with long, raised ridges, bearing tiny scale-leaves at intervals; upper branches bearing occasional small, trilobed, bulbous sporangia with pale yellow spores.

Nepal:

C: **Kaski** [Ghandruk to Pokhara, epiphytic on tree-fern, *D.P. Joshi* 75/2739, 20.6.1975, KATH]; **Gorkha** [Tatopani, cited by Thapa (2002) without collector, and whereabouts of specimen or herbarium not known subsequently], **Kathmandu** [Napalia ["on decayed roots of trees at Sankoo" locality from Wallich (1821 *ined.*) *Filicologia Nepalensis*], *N. Wallich* Enum. List no. 46.2, in 1820, K-W].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh [rare]; Bhutan [rare]; Darjeeling [rare]; Nepal; Uttarakhand [rare]; Pakistan [rare]. N.E., C. and S. India; Sri Lanka; Bangladesh; E. and S.E. Asia; S.W. Europe [rare]; Africa;

Australasia; the Americas.

(M [and more widespead], R). A rather rare and very scattered species of mid-altitude light forests, usually epiphytic on Palm trunks, tree-ferns, or often semi-lithophytic on rocky banks.

Indian threatened status: **EN**.

Nepalese threatened status: **CR**.

OPHIOGLOSSACEAE

Botrychium (7 species).

The splinter genera of *Botrychium* recognised mainly in Japan are not deemed to be of sufficiently significant difference to be recognised here as genera, but are accepted as subgenera.

43. ***Botrychium daucifolium*** Wall. *ex* Hook. & Grev. (syn.: *Sceptridium daucifolium* (Wall. *ex* Hook. & Grev.) Lyon; *Botrychium subcarnosum* Wall. *ex* Bedd.; *Botrychium officinale* Ching).

Sahashi (1981, 1999) has recognised *B. formosanum* Tagawa as a distinct Chinese and Taiwanese species and also reported it from Darjeeling, recognisable by its fertile stalk arising further down the stem and in its pinnules having many short lobes including towards their apices. But the stalk position is entirely variable in *B. daucifolium* and individuals also vary in degree of lobing, so a dividing line is difficult to envisage. Plants similar to *B. formosanum* and also intermediates, occur in C. and E. Nepal and N.E. (Manipur, Meghalaya) and S. India in addition to normal *B. daucifolium*, but it is difficult to decide if they constitute a separate species, *B. formosanum*, or if they merely represent variation within the one species.

A large species in the genus, to *c*. 30 cm. tall, with deltate-pentagonal sterile fronds with wide, coarsely lobed pinnae and pinnules, to *c*. 2 cm. wide, pinnules varying from unlobed to pinnate and/or lobed, but usually with longish ± unlobed areas towards their apices, fertile fronds with a long petiole, pinnate, deltate, without lamina, bearing many crowded yellow, cylindrical sporangia; junction between the sterile and fertile frond beneath the sterile lamina, variable in position, but usually well down the main stem, often at ground level or shortly below.

Nepal:

C: **Kaski** [Panchase Lekh, in the mixed forest of Oak, on shady place, 2200 m., *D.P. Joshi* & *M.M. Amatya* 73/1189, 14.12.1973, KATH], **Dhading**, **Kathmandu** ["forest of temple of Pusputnanth (*i.e*. Pashupatinath) and Gokurrun (*i.e*. Gokarna)", localities from Wallich (1821 *ined.*) *Filicologia Nepalensis*, *N. Wallich* 49, in 1821, BM, K, K-W; Valley of Nepal, from *Dr.* [*H.*] *Login*, Feb. 1848, herb. Winterbottom, K; Gaucher, Kathmandu valley, 4300 ft., *R.L. Fleming* 1602, 1.1959, MICH; Doko Bhanjyang, Kathmandu, moist and shady place, 2300 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/654, 16.3.1975, KATH], **Lalitpur** [Chapagaon, Kathmandu valley,

4600 ft., *RL. Fleming* 1690, 9.1961, MICH; forest slopes beyond temple at Vajrabharahi forest, just E. of Chapagaon, *C.R. Fraser-Jenkins*, with *A. Monaf Ali* (Bishwanath, Sylhet and Oxford), *Dr. Vidya Laxmi Gurung* (National Herbarium, Godawari) & *Mr. Ram Kaji Gurung* 15465, 30.12.1988, E], **Bhaktapur**.

E: **Sankhuwasabha**, **Ilam** [Aulabari, Ilam, occasional, terrestrial in evergreen forest, 2100 m., *D.H. Nicolson* 3224, 12.4.1976, BM, KATH, ?*B. formosanum*; near Ilam, 1500-2000 m., *T. Nakaike* 3659, 5.11.1988, TNS, KATH, ?*B. formosanum*], **Taplejung**.

W. Nepal was also given by Thapa (2002), but we have seen no other reports and there is no W. Nepalese material in any of the herbaria we have seen; it is therefore excluded here as presumably having been reported without basis.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E., C. and S. India; Sri Lanka; S.E. Asia; Pacific Islands.

(M, Sc). A scattered and fairly uncommon species, though commoner in the east, occurring at mid altitude, usually in rather dense, moist forest in the outer ranges.

Nepalese threatened status: **LC**.

44. ***Botrychium lanuginosum*** Wall. *ex* Hook. & Grev. (sometimes as "var. *lanuginosum*" or "subsp. *lanuginosum*" but in error as other varieties and subspecies are not worthy of taxonomic recognition; syn.: *Osmundopteris lanuginosa* (Wall. *ex* Hook. & Grev.) Nishida; *Botrypus lanuginosus* (Wall. *ex* Hook. & Grev.) Holub; *Japanobotrychium lanuginosum* (Wall. *ex* Hook. & Grev.) M.Nishida *ex* Tagawa; *Botrypus tibeticus* Ching; *Botrychium lanuginosum* var. *nepalense* (M.Nishida) N.C.Nair & R.D.Dixit; *B. lanuginosum* subsp. *leptostachys* (Hayata) Holub; misapplied name: "*B. virginianum*" *sensu auct. Ind. plur. et* Zhang (2012) *p.p., non* (L.) Sw.).

A large species up to *c.* 50 cm. tall, with a finely dissect quadripinnate, deltate-pentagonal sterile lamina, bearing many scattered pale hairs, though sometimes nearly absent, lowest sterile pinnae widely deltate, widest at their bases, with the lowest basiscopic pinnule the longest; fertile blade borne on a stalk arising between the lowest and second pair of sterile pinnae, but sometimes at or just below the basal pair in small plants, bipinnate, deltate, compact, with yellow sporangia.

Nepal:

W: **Dadeldhura** [Dadeldhura Distr., Bajlekh, on moist and shady place, 2100 m., *D.P. Joshi* & *M.S. Bista* 139, 1.8.1972, KATH], **Darchula** [Kasoti [Kasauti], on open slope, 2430 m., *P.R. Shakya*, *M.K. Adhikari* & *M.N.* Subedi 7969, 20.7.1984, KATH], **Doti**, **Dailekh** [in remnant Quercus and Rhododendron forest, on rocky banks or epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c*. 40 km N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins* 25600 (FN 1578), 26.9.1997, H, BM], **Humla**, **Jumla** [Bumra, Riyan Lekh, on open dry grass slopes, 10,000 ft, *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3078, 28.8.52, BM; above spring beside path leading up to Danphe Lagna pass and over

Dori Lekh ridge to Rara Lake, above Chauriyachaur (Patama) meadow, *c.* 3 km. N. of Karnali Technical College, *c.* 6½ km. N. of Jumla, *c.* 3000 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.* & *K. Neupane* 22100 (FN 7), 7.6.1995, E], **Sallyan** [Riala, under low thickets on rather dry slopes, 5000 ft, *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 1298, 31.8.52, BM], **Jajarkot [**Dhimia, on grassy banks in partial shade, 5-6000 ft, *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 519, 20.8.52, BM; Samail, Jajarkot, epiphytic on tree trunk, 2100 m., *N.P. Manandhar* & *D.P. Joshi* 6422/81, 1.8.1981, KATH; Maina, grassy bank beside track, 6500 ft, *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5562, 12.10.52, BM], **Dolpa** [Suligad, Dolpa, shady place, 2600 m., *K.R. Rajbhandari* & *K.J. Malla* 6762, 26.9.1982, KATH].

C: **Baglung** [Bongakhani, grass bank, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3960, 22.8.1954, BM], **Myagdi**, **Mustang** [Lete, S. of Tukucha, Kali Gandaki, beneath trees in wood, 8000 ft., 8500 ft. and 9000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7713, 6.9.1954, 7892, 17.9.1954 and 1037, 9.6.1954, all in BM], **Manang** [Chame, 2680 m., *N.P. Manandhar* 9801, 12.8.1983, KATH], **Parbat**, **Kaski** [Mardi khola, on shady banks, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8446, 16.9.1954, BM], **Lamjung**, **Gorkha** [Gapsya, 28.5582°, 84.7760°, growing on forest floor, 2200 m., *S.H. Bhattarai* 58/1, 3.5.2012, KATH], **Makawanpur** [Simbhanjyang, Makwanpur, damp place, occasional, 8100 ft., *R.L. Fleming* 1421, 7.9.1957, KATH, MICH, KATH; Daman, on India - Nepal Motor-road, damp grassland in open woodland, 7600 ft., *A.D. Schilling* 660, 7.9.1965, K], **Rasuwa** [Syarpagaon, Langtang, shady ground, 9000 ft., *O. Polunin* 1846, 23-31.8.1949, BM; between Dhaibungket and Ramche, E. side of Trishuli River, Rasuwa, occasional along track in moist gully, 1650 m., *D.H. Nicolson* 2344, 15.9.1966, KATH; Manigaon - Thare, Langtang valley, *S. Sakamoto* 75-H10-6-25, 6.10.1975, TNS, *sub "B. strictum*" in error], **Dhading**, **Nuwakot**, **Kathmandu** [Thankot, 8 miles south-west of Kathmandu, 6000 ft., *Prof. K. de B. Codrington* [School of Oriental and African Studies, London] 2, in 1956, BM], **Lalitpur**, **Bhaktapur** [Mahadab Danda, Nagarkot, on shady and wetty rocky slope, 2000 m., *V.L. Gurung, M.M. Amatya* & *R. Kayastha* 170/76, 21.9.1976, KATH], **Kabhrepalanchok** [Sangasote, Bangatholi, shady places, 7600 ft., *S.B. Malla* & *S.B. Rajbhandari* 347, 8.10.1960, KATH], **Sindhupalchok** [meadows between Gulu-Bhanjyang and Khumsang, 27° 57', 85° 29', 2300 m., *J.H. de Haas* 2085-A, 7.8.1974, BM], **Dolakha**.

E: **Sankhuwasabha** [Arun valley, Wabak khola, E. of Num, beneath trees, 6000 ft., *J.D.A. Stainton* 1349, 13.8.1956, BM; Bungim - Sedua, Sankhuwasabha, terrestrial on semi exposed vertical slope, 6600 ft., *P.R. Shakya* & *M. Ohsawa* 890, 13.9.1971, KATH; Chantang (2250 m.) - a bridge (1750 m.) - Redak (2400 m.), *H. Ohashi, H. Kanai, H. Ohba* & *Y. Tateishi* 773589, 8.8.1977, BM, KATH], **Sunsari** [Phusre, Dharan, E. Nepal, *C.K. Prasad* & *B.N. Adhikari* NHMTU-2-6B-0152, -0153, TU Nat. Hist. Mus.], **Dhankuta** [Dhankuta, S. of Lam Pokhari, 27° 15', 87° 30', on dead mossy log and erect trees, *c.* 2730 m., *R.G. Troth* 95, 17.7.1971, MICH],

Tehrathum [Basantapur - Tsute - Chauke, Ghurmise, 2800 m., *Y. Omori, N. Acharya, K. Fujikawa, M. Munemasa, M. Okada, R.H. Ree, M. Tateno* & *N. Thapa* 9955019, 3.8.1999, KATH], **Ilam** [2 mi. N.W. of Shantipur, Ilam, 10,500 ft., *R.L. Fleming* 2689, 28.9.1978, MICH; Mai Pokhari, 27° 00' 30.2'', 87° 55' 38.1'', 2123 m., *S. Itoh, A. Takano, T. Nakane, D.R. Kandel* & *P.M. Yadav* 218, 17.8.2014, KATH], **Taplejung** [Gangdua, Wabak khola, on an exposed rocky bank, *c.* 5000 ft., *L.W. Beer*, Univ. Bangor Nepal Exped., 9513, 10.7.1971, BM; Shewaden - Mewa khola - Papung, 873274, on tree trunk in dense forest, *c.* 2200 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725327, 29.6.1972, BM, KATH; Kyapra to Pheri, Ghunsa khola, 27° 38', 87° 55', on rocks under Bamboo in mixed Rhododendron-Abies-Larix forest, 2660 m., *C. Grey-Wilson, S. Zmarzty, M. Sinnott, D.G. Long, R. McBeath, H.J. Noltie* & *M.N. Subedi* 345, 7.9.1989, K, E, KATH]. E. Nepal [Terra Bence, 9-10,000 ft., *Capt. Lall Dhwoj* 0435, *sin.* date [1930, rec. 1931], BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. N.E., C. and S. India; Sri Lanka; S.E. Asia; Australasia.

(S, C). A common mid to higher altitude species growing on rather open damp banks of paths *etc*., semi-vertical mossy rocks, or as a larger-branch epiphyte among deep moss.

45. ***Botrychium lunaria*** (L.) Sw. (syn.: *B. onondagense* Underw.; *B. lunaria* (L.) Sw. var. *onondagense* (Underw.) House).

A often overlooked small, high altitude species up to *c*. 10 cm. tall, with an oblong sterile, simply pinnate blade bearing 3-6 pairs of short-stalked crecent-shaped or lunate lateral pinnae and a similar apical one; fertile blade diverging from below the sterile one, triangular-lanceolate, pinnate to bipinnate, with many yellow sporangia.

Nepal:

W: **Bajhang** [Sumasarova, 29° 40', 81° 02', lande à Arundinaria, 2900 m., *J.F. Dobremez* 2131, 8.5.1973, BM], **Mugu** [between Mugu and Purana Mugu, Mugu khola, in shade at base of Birch, 12,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5336, 20.8.1952, BM; Rara Tal, *H. Tabata et al.*, KYO], **Jumla** [Chandhabise Khola, in peaty soil in mixed forest, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 966, 16.5.1952, BM; Burchula Lekh, near Jumla, open slopes, 12,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 4589, 12.7.1952, BM], **Dolpa** [Phoksundo Khola, Dolpa, shady place under trees among grasses, 12,000 ft., *T.B. Shrestha* 5366, 12.7.1966, KATH], **Rukum** [above Ranmagaon, among taller vegetation on grassy slopes, 11,000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3340, 2.7.1954, BM; Jangla Banyang [Dolpa-Rukum pass, 4523 m.], dry Alpine meadow *etc*., 3500 m., 3800 m. and 4000 m., *S. Einarsson, L. Skärby* & *B. Wetterhall* 215, 1040.637 and 2446, 27.5.1973, 26.6.1973 and 16.8.1973, all in BM].

C: **Baglung** [Dhorpatan, Baglung, under Cotoneaster sp., 3100 m., *H.K. Saiju* & *S.R.T.* 50/79, 24.6.1979, KATH], **Mustang** [Lete, Kali Gandaki valley, on open slopes, 12,000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 5587, 4.6.1954, and 11,500 ft., 1024, 7.6.1954, both in BM], **Gorkha** [Bimtakothi, on patches of bare earth on top of moraine, *c.* 13,000 ft., *D.G. Lowndes* L.1469, 27.8.1950, BM; below Larkya Bazar, mixed grass and low bushes, 13,200 ft., *P.C. Gardner* 1150, 6.7.1953, BM; near Birendra Tal, 28° 59.5', 84° 63.8', meadow, 3600 m., *S.* [*H*]. *Bhattarai* 15/13, 7.6.2012, KATH], ?**Makawanpur** [labelled as from Daman, Makawanpur, 2450 m., *V.L. Gurung* 82/1755, 24.9.1982, KATH, but origin of specimen dubious and requires confirmation from further collection], **Rasuwa** [Kyangjin Ghyang, close turf, 13,500 ft., *O. Polunin* 234, 9-10.6.1949, BM; Chilimagaon - Khola Kharka, grassy bank, 13,500 ft., *O. Polunin* 1130, 17-19.7.1949, BM], **Dhading**.

E: **Sankhuwasabha** [Barun Khola, Langmale, rocky places near river, 4550 m., *C. Grey-Wilson*, *R. Henderson*, *K.R. Rajbhandari* ["*Bhandary*"], *B. Rosedale* & *N. Taylor* 4269, 27.8.1981, K], **Taplejung [**Topke Gola (3600m.) - Shewaden (2600 m.), *c.* 3500 m., *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725281, 28.6.1972, TI].

Himalayan distribution: China; Tibet; Myanmar; Bhutan; Sikkim; Nepal; Uttarakhand; Himachal Pradesh [rare]; Jammu & Kashmir; Pakistan; Afghanistan. W. and E. Asia; Europe; N.W. Africa; Australasia; N. America.

(E and/or S [and more widespread], Sc). A scattered and uncommon higher altitude to high Himalayan species of open grassy slopes and meadows.

Nepalese threatened status: **NT**.

46. ***Botrychium multifidum*** (S.G.Gmel.) Rupr. subsp. ***robustum*** (Rupr. *ex* Milde) Clausen (syn.: *Sceptridium multifidum* (S.G.Gmell.) M.Nishida *ex* Tagawa; *B. robustum* (Rupr.) Underw.; *Sceptridium multifidum* var. *robustum* (Rupr.) M.Nishida *ex* Tagawa). Subsp. *multifidum* occurs in Europe, E. Asia and N. America.

A small species with obtuse and less dissect and almost untoothed, usually rather crowded or closely adjacent segments and lobes, glabrous, and the sterile and fertile blade-stems diverging well below the sterile lamina; sterile lamina compact, widely deltate, each lowest pinna ± deltate, but smaller than the rest of the frond; lowest pinnae not as relatively large as in *B. ternatum* and all lobes larger and more sessile and crowded. The Nepalese and all Himalayan plants belong to subsp. *robustum*, which is connected to the smaller, less lobed subsp. *multifidum* from Europe and N. America by frequent intermediate plants. It appears to be a slightly different vicariant geographical subspecies of *B. multifidum*.

Nepal:

W: **Darchula** [*c.* 2 km. S. of Dorpatta village (opposite Lamari and S. of Buddhi in India), *c.* 12 km. N. of Dumling, west side of Api Himal, N. of Darchula, E. side of

Kali river (border with India), Darchula District, N.W.-facing rocks in forest below cliffs, *c.* 1850 m., *C.R. Fraser-Jenkins* 21623 (FN 290), 21.11.1994, E], **Doti**, **Jumla** [Daphe lekh, Jumla, open rocky place, 2743.20 m., *T.B. Shrestha* & *N.P. Manandhar* 78, 11.10.1975, KATH].

C: **Myagdi**, **Nuwakot**, **Rasuwa** [on N.E. side of and below Khurpudara [Khurpudanda] ridge, above Army Headquarters, E. of Somdang, W. of Langtang, above and to the west of Syabrubense and Gatlang, N. of Dhunche, rocks in forest by stream, *c.* 13,000 ft., *C.R. Fraser-Jenkins* 15693, 10.11.1989, E, large specimen], **Kathmandu** [Kathmandu valley, 1371 m., *R.L. Fleming* 1589, 1-2.1959, KATH], **Kabhrepalanchok** [Sangasoti, Kabhrepalanchok, in shade, 7500 ft., *S.B. Malla* & *S.B. Rajbhandari* 347 *p.p.*, 8.10.1960, KATH], **Sindhupalchok**.

E: **Sankhuwasabha** [Thokpu - Sundanda, Sankhuwasabha, semi-shady floor of mixed broad leaved forest, 9000 ft., *P.R. Shakya* & *M. Ohsawa* 936, 26.9.1971, KATH], **Ilam**, **Taplejung** [upper Mewa gorge, occasional, open wet ground, 9500 ft., *R.L. Fleming* 2031, 9/17.12.1971, K, MICH, *sub* "*B. ternatum*" in error; Fungtaple, Taplejung Distr., E. Nepal, 8000 ft., *R.L. Fleming* 2396, 2.1978, MICH *sub* "*B. daucifolium* var. *parva*" in error].

Himalayan distribution: China; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]; Himachal Pradesh [rare]. N.E. India; E. Asia; Siberia; Aleutian Islands.

(S, Sc to R). An uncommon mid altitude to high Himalayan species usually growing in damp moss and grasses on sheltered banks or slopes below undisturbed light forest.

Nepalese threatened status: **VU**.

47. ***Botrychium simplex*** E.Hitchc. subsp. ***simplex*** (syn.: *B. tenebrosum* A.A.Eaton). *Subsp. kannenbergii* (Klinsm.) Fraser-Jenk. replaces it in Europe and western N. America.

Plant similar to a very small and weak *B. lunaria*, but the minute and simplified lamina is borne up near the top of the plant, crowded by the short and narrow fertile branch, stem often slightly curved backwards towards its apex; sterile lamina with one to two pairs of tiny lunate pinnae fusing into the apical segment, seldom more. Several specimens are desirable in a collection to be able to confirm that it is not just a minute plant of *B. lunaria*.

Nepal:

W: **Jumla** [Kagebada, moist and shady locality of Betula utilis, 3000 m., *N.K. Bhattarai* 84/35, 16.9.1984, KATH].

C: **Sindhupalchok** [Melamchi - Thadepati, Sindhupalchok, moist and shady places, 3100 m., *N.K. Bhattarai* 86/399, 19.6.1986, KATH].

Himalayan distribution: Tibet [vicinity of Jité, upper Taron Valley, 28° 30', 97° 50', scattered on mossy banks and rocks in the forest, 10-11,000 ft., *Capt. F. Kingdon-*

Ward 10070A, 10078, 13.9.1931, BM, det. CRFJ]; Bhutan [upper Pho Chu, Gasa, 28° 01', 89° 59', 3600 m., *G.* & *S. Miehe* 00-345-06, 1.9.2000, UC, det. CRFJ, 2014]; Sikkim [N. Sikkim, Thangu, *B.S. Kholia* 35481, BSHC, det. CRFJ, 2011]; Nepal. ?Japan; Eastern N. America. Identified and reported from the Indo-Himalaya by Fraser-Jenkins (2012).

(E and/or S, R). A rare and little known high Himalayan species, growing among low grasses and mosses, or among bushes on banks in high-Himalayan meadows.

Indian threatened status: **CR**. Nepalese threatened status: **CR**.

48. ***Botrychium ternatum*** (Thunb.) Sw. (syn.: *Sceptridium ternatum* (Thunb.) Lyon).

A medium sized species (up to *c.* 17-20 cm. tall), most similar to *B. multifidum*, but often taller when fully grown; the lamina is similarly or more widely deltate, often wider than long, but shows more of an obvious tripartite appearance as each one of the pair of lowest pinna is similar to the rest of the frond in size and deltate shape and is more symmetrical about its axis (acroscopic and basiscopic opposite pinnules of ± equal length); sterile frond more dissect and pinnule-lobes usually more distant and more obviously stalked, also usually smaller and more rounded; fertile fronds are similar in both species with their stalk arising similarly low down on the plant, usually at or below ground-level. The difference between this species and *B. multifidum* subsp. *robustum* has been very well illustrated in the fine drawings of them by Khullar (1994).

Nepal:

C: **Palpa** [Ribdikot, Palpa, 853276, mixed forest of oak and Rhododendron, on moist and shady slope, 1870 m., *D.P. Joshi* & *M.M. Amatya* 0223, 26.11.1973, KATH, very foliose specimen], **Gorkha** [Ganesh Himal, Shiar khola, Tumje, 9000 ft., *P.C. Gardner* 441, 16.4.1953, BM]; **Kathmandu** [E Monte Chandagiry, [part cut off label]tuli, *N. Wallich* 48 *p.p.* bottom left, 5.1821, K-W, BM (transposed in BM *sub* no. 49, the number for *B. subcarnosum*, in error); Sheopuri Lekh, shady banks among moss, 6500 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 6935 *p.p.*, 19.8.1954, BM], **Kabhrepalanchok** [Sangasoti, Kabhrepalanchok, in shade, "abnormal specimen", 7500 ft., *S.B. Malla* & *S.B. Rajbhandari* 347 *p.p.*, 8.10.1960, KATH], **Sindhupalchok** [Helambu, *N. Sahashi* 79016, TOHO; Manichaur hill, 7500 ft., *Giri Amatya* NHMTU-2-6B-0131, 25.7.1977, TU Nat. Hist. Mus.].

E: **Dhankuta**, **Tehrathum** [Tehrathum, 4000 ft., *L.H.J. Williams* & *J.D.A. Stainton* 8445, 11.9.1967, BM], **Ilam** [Mai river, Ilam, Alder terrace, 6700 ft., *R.L. Fleming* 2650, 24.9.1978, MICH; among bushes and small, grassy clearings in tall Cryptomeria forest, near top of ridge on its N. side, between Pashupatinagar and Tashigaon, beside Indian border, *c.* ½ km. N.E. of Pashupatinagar, N.E. of Ilam, *C.R. Fraser-Jenkins* 29675 (FN 5650), 24.10.2001, H], **Panchtar** [Chyangthaphu, *H. Kanai*, *G. Murata* & *M. Togashi*, 6305437, 25.10.1963, TI, *sub* "*B. multifidum*", as also reported by Iwatsuki (1988) in error].

Himalayan distribution: China; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]; Himachal Pradesh [rare]. E. Asia; Taiwan; Vietnam.

(S, Sc to R). A scattered to rare species, though becoming commoner in further E. Nepal, growing at mid to upper-mid altitude, on the shaded forest floor in forest. Nepalese threatened status: **EN**.

49. ***Botrychium virginianum*** (L.) Sw. (syn.: *Botrypus virginicus* (Houtt.) Michx.; *Japanobotrychium virginianum* (L.) M.Nishida; *Botrypus virginianus* (L.) Holub).

A large, widely deltate and finely dissect species with prominent acute teeth and a glabrous lamina, generally similar to *B. lanuginosum*, but easily distinguished from it by the lowest pinna which narrows towards its base and is widest above its mid point, instead of being widest at its base; the fertile spike arises at, or more usually slightly below the lowest sterile pinna and the fertile blade is triangular-lanceolate with pinnate lower pinnae, though it may sometimes become elongated rectangular with simple pinnae, thus approaching the Sino-Japanese *B. strictum* Underw. (*e.g.* India, Uttarakhand, Garhwal, Gangri, *U.C. Bhattacharyya* 39001, BSD), but has the more acute and lobed sterile pinnules of the present species, unlike in *B. strictum*.

Nepal:

C: **Mustang** [Lete, S. of Tukucha, Kali Gandaki, in forest, 9000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 1063, 9.6.1954, BM; Larjung, S. of Tukucha, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 750, 27.5.1954, BM]. The report by Thapa (2002) from Shikarkot to Daman, Makawanpur was based on a misidentifcation by CRFJ of a small *B. lanuginosum* (*C.R. Fraser-Jenkins* 26425 (FN 2403 [not 7403 as printed]), 11.8.1998) with the fertile frond arising at the junction of the lowest sterile pinnae, as often happens in small but fertile plants in that species. This species should be expected in W. Nepal.

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan [rare in all States]. Also Meghalaya. E. Asia; Europe; N. America.

(E and/or S(W), R). A very rare species of upper mid altitudes occurring in forests behind the main ranges in C. Nepal, and though not yet found there, presumably also in W. Nepal, but absent from the wetter eastern areas until reaching a second centre in Bhutan and the N.E. of India.

Indian threatened status: **EN**.

Nepalese threatened status: **CR**.

Helminthostachys (1 species).

50. ***Helminthostachys zeylanica*** (L.) Hook. (syn.: *Osmunda zeylanica* L.; *Helminthostachys laciniata* Voight).

Similar to *Botrychium daucifolium*, with the frond arising from the underground

rhizome, but with a nearly horizontal blade of up to 10 long, unlobed, and pinnately radiating pinnae, of which the lowest pair are usually forked near their bases; fertile spikes stick up vertically above the sterile lamina, borne in pairs, above a basal stalk, narrow with dense groups of sporangia borne on the main stem of the spike. Widely used as a vegetable, and locally medicinally, but now becoming rare and theatened as a result.

Nepal:

W: **Kanchanpur** [Suklaphanta, Kanchanpur, in Sal forest, 150 m., *K.R. Rajbhandari, P.M. Regmi* & *K.J. Malla* 5066, 4.8.1980, KATH], **Kailali** [3 miles E. Dhangarhi, locally abundant herb in dried up lowland in Shorea forest, 200 m., *D.H. Nicolson* 2827, 3.12.1966, KATH, MICH], **Banke**.

C: **Chitwan** [Ramnagar, Chitwan, moist place in Sal forest, 400 m., *K. Wesche* 5/65, 6.1994, BM], **Bara** [Nijgar - Patraia, Bara, 100 m., *H. Kanai* 676114, 15 Nov. 1970, KATH].

E: **Sunsari** [7 miles S. of Dharan, tarai forest, damp ground, scarce, 600 ft., *R.L. Fleming* 2245, *sin.* date, MICH; Salbani forest, Sunsari, terrestrial, only in restricted areas, sun loving at the base of shrubby plants, edible, delicious than *Ophioglossum* [*sic*], *c.* 100 m., *N. Thapa* & *K. Bhattarai* S 41/97, 25.12.1997, KATH], **Morang** [Kanepokhari - Sanischare, Morang, shady place in deciduous Sal forest, 260-400 m., *P. Pradhan, M. Amatya* & *R. Shrestha* 17/74, 3.6. 1974, KATH].

Peri-Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Assam State; Darjeeling *terai*; Nepal; Bihar; Uttarakhand *terai* [rare]. Nagaland, Manipur, Meghalaya, peninsular India, Sri Lanka; S.E. Asia.

(M, Sc). A rare (in Nepal) and decreasing low altitude species of flat, slightly wet ground beneath light forest, or in undisturbed Mango plantations. Over-exploited as a local medicinal herb and due to intensive draining and cultivation of waste ground and disappearing from former localities, where it was once common.

Indian threatened status: **VU**.

Nepalese threatened status: **EN**.

Ophioglossum (3 species).

51. ***Ophioglossum parvifolium*** Grev. & Hook. (syn.: *O. pumilum* (Racib.) Alderw.; *O. nudicaule* L.f. var. *macrorrhizum* (Kunze) Clausen; misapplied name: "*O. nudicaule*" *sensu auct. Ind. et Sin. plur. p.p., non* L.f. [endemic to S. Africa]).

The present species has long been included in *O. nudicaule* in India, along with the slightly larger C. Indian *O. eliminatum* Khand. & Goswami (which needs checking against names from other regions) and a recent addition to the group in India is *O. rubellum* Welw. *ex* A.Braun from Rajasthan (syn.: *O. indicum* Yadav & Goswami). But as concluded by Fraser-Jenkins (2008), *O. nudicaule* is a distinct species endemic to S. Africa and not known from Asia, though still so recorded by Liu & Sahashi

(2013) in the *Flora of China*; some other C. Indian material misnamed as *O. nudicaule* appears to be very similar to the African *O. convexum* J.E.Burrows.

The smallest "Adder's Tongue" fern in the Himalayan region, with a slender underground rhizome giving rise to thin, fleshy roots (which often bud adventitiously to form new plants) a very thin, short stem and one or two (-3) very small leaves (to *c.* 1 cm. long), borne close to the ground and either horizontal or slightly uplifted, in sterile plants only this minute presence can be seen after search among grases; leaves elliptical or ovate-elliptical, thin-succulent, veins not evident in the living state, fertile stalks very fine, erect, up to *c.* 4 cm. tall above the leaves, with a short (*c.* 1 cm.) thickened, apical fertile area, consisting of up to *c*. 15 compartmented sporangia, with a short, narrow, spike-like apex.

Nepal:

W: **Mugu** [Gamgadhi, Mugu, *N.P. Manandhar* & *D.P. Joshi* 6991, 10.8.1981, KATH].

C: **Kaski** [Sallyan, near Pokhara, in damp soil among short grass, 4500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.R. Williams* 7037, 5.9.1954, BM, spores attacked by mould], **Gorkha** [along path *c*. 100 m. N.E. of house [now ruined 2010] of Dal Bahadur Pariyar [father-in-law] at Komale stream, *c*. 1 km. S.W. of and below Deurali village, above and N.E. of Markichowk and Gopling, N. of Marsyangdi river, *c*. 5 km. W.N.W. of Anbu Khaireni, N. of main road between Mugling and Damauli, open, dry and sunny, compacted earth-banks between rocks, or at the tops of small, path-side banks, *c.* 800 m., *C.R. Fraser-Jenkins* & *Nirmala Fraser-Jenkins* 28551 (FN 4526), 26.5.2000, H, TAIF]; **Chitawan** [Lothar, Rapti valley, 27° 35', 84° 43', on bare bank, 1200 ft., *L.H.J. Williams* & *J.D.A. Stainton* 8296, 27.8.1967, BM], **Nuwakot** [Central Nepal, Dhaibungkot, Pine wood, 5500 ft., *O. Polunin* 035, 31.5.1949, BM], **Rasuwa** [Ganesh Himal, Trisuli river, sandy turf, 680 m., *M. Farille*, *D. Jordan* & *G. Lachard* 847019, 6.7.1984, BM, G], **Kathmandu** ["Sundarijal, *c.* 1700 m., *S.P. Rimal* & *S.C. Singh*, herb. Trichandra College, Ratna Park, Kathmandu", reported unidentified as a new species for Nepal, near *O. nudicaule* by Rimal & Singh (1970), specimen not seen by us, but illustration and description can only be *O. parvifolium*, though the very short fertile area otherwise suggests *O. lusitanicum* L.], **Bhaktapur** [Nagarkot, open fields, *P. Pradhan* & *R. Rana* 6394, 31.8.1966, KATH].

E: **Sankhuwasabha** [Sankhuwasabha District, Arun valley, ridge SW of Bhotebas, 27° 26', 87° 11', clearing in degraded Castanopsis forest, 1950 m., *D.G. Long*, *R.J.D. McBeath, D.R. McKean*, *D.A.Rae* & *N.P. Bhattarai* EMAK 47, 19.9.1991, E; Sankhuwasabha Distr., Kaptane (2000 m.) - Mude Danda (2000 m.) - Mude (2000 m.) - Ranidhunga (1870 m.) - Num (1540 m.), 27° 29' 33", 87° 15' 08" - 27° 33' 13", 87° 16' 58", in colonies in grassy place at holm, 1970 m., *S. Noshiro*, *N. Acharya*, *Y. Ibaragi*, *K. Kobayashi* & *T. Kurosawa* 9770171, 18.8.1997, E *sub* "*O. petiolatum*" in error; Gupha Pokhari, 2770 m., *D.K. Limbu s.n.*, 4.10.2012, KATH].

Himalayan distribution: China [Szechuan, Yunguing, *H. Handel-Mazetti* 7561, 9.8.1915, BM; Yunnan]; Myanmar [Zwa Ka Bin hill, Hpa'an, *CRFJ*]; Assam State; Nepal; Uttarakhand [rare]; Himachal Pradesh [rare]. N.E., C. and S. India, S.E. Asia; Australasia; the Americas (*sub* "*O. nudicaule*"). The "*O. nudicaule*" reported from Tibet by Liu & Sahashi (2013) in the *Flora of China* was in error for *O. polyphyllum* A.Braun *ex* Seub.

(M, Sc to R). A scattered and uncommon species, though doubtless much overlooked, of lower-mid to mid altitude, growing in short grassy turf beside paths and on path-banks or among rocks in pockets of compact earth where it is not overgrown.

Nepalese threatened status: **NT**.

52. ***Ophioglossum petiolatum*** Hook. (syn.: *O. cognatum* C.Presl (described from Nepal); misapplied name: "*O. vulgatum*" *sensu auct. Ind., non* L.; "*O. reticulatum*" *sensu* Wieffering (1964) *p.p.*). Although Fraser-Jenkins (2008) has found that Indian and Sri Lankan reports of the temperate European, N. American and N. Asian species, *O. vulgatum* refer to a mixture of *O. petiolatum* (N.W. India) and *O. reticulatum*, Liu & Sahashi (2013) have continued to report *O. vulgatum* from India and Sri Lanka in error.

Plant often smaller than *O. reticulatum*, usually bearing one or two to three semi-erect leaves; sterile blades simple and unlobed, usually from *c*. 4-7 cm. long, elliptical and gradually narrowed to both apex and base, with a long, erect fertile spike. Although some plants of *O. reticulatum* may have narrower, more acute sterile-frond bases and apices than usual when growing among undergrowth, the two species appear to be distinct from each other and *O. petiolatum* is not merely variation to be lumped within *O. reticulatum*, as thought by Weiffering (1964) and thence followed by several authors, including Fraser-Jenkins (1997). It is important to see a sample of numerous specimens on a sheet covering all their variation in order to identify them properly. Both this species and to a certain degree *O. reticulatum* as well have been misreported as the European *O. vulgatum*, but no true *O. vulgatum* is known from India or Nepal.

Nepal:

Although Thapa (2002) guessed reasonably that this species is probably also in W. and E. Nepal, no material of it has been collected from W. Nepal yet in herbaria studied by CRFJ.

C: **Mustang** [Thinigaon, N. of Tukucha, Kali Gandaki, in water meadow, 9000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 1211, 19.6.1954, BM, E], **Gorkha** [Ganesh Himal, Shiar khola, 10,500 ft., *P.C. Gardner* 518, 20.5.1953, BM]; **Rasuwa** [Khanjung [Kyangjing Gompa], moist meadow, 7-8000 ft., *O. Polunin* 131, 5.6.1949, BM, *sub* "*O. reticulatum*"], **Kathmandu** [adventive in cultivated pots in many roof-top gardens: in pots on roof of Student Guest House, Tridevi Marg, Thamel,

Kathmandu, *C.R. Fraser-Jenkins* 33045 (FN 158), 14.7.2008, TAIF], **Lalitpur** [Patan Hospital, Kathmandu, 4400 ft., *D.D. Bhatt* 197, 8.1958, UC; garden of Shanti Bhawan Hospital [now Patan Hospital], Patan, Kathmandu valley, in grass, 4300-4400 ft., *R.L. Fleming* 1888, 10.1967, MICH].

E: **Sankhuwasabha** [Jorpokhari - Lamopokhari, 3050 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955079, 5.8.1999, ?TI, this specimen was reported as an unidentified species by Thapa (2000, 2002), but has not been seen by us since Thapa showed it to the first author some 10 years ago, and is not now present in KATH where the rest of that collection is deposited, despite being reported as there. The whereabouts of the specimen remain unknown unless sent back to Tokyo, but from memory it appeared to belong to the present species], **Taplejung** [Milke Danda, rocky bank, 10,500 ft., *L.W. Beer* 10059, 3.10.1971, E].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; ?Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. India; E.and S.E. Asia; Australasia; the Americas.

(S, Sc). A scattered species but probably overlooked, usually occurring at upper-mid altitudes, but extends down to the plains in the western Himalayan region in India, growing in open grassy areas and like all *Ophioglossum* species, disappearing during the dry Winter season.

Nepalese threatened status: **LC**.

53. ***Ophioglossum reticulatum*** L. (syn.: *O. cordifolium* Roxb.; misapplied name: "*O. vulgatum*" *sensu auct. Ind., non* L.).

The largest species in Nepal and fairly widely gathered for cooking and eating as "tongue spinach" (*gibro sag*); sterile leaves variable in shape, thus requiring a good sample of plants on a sheet for study, blades simple and unlobed, usually from *c*. 4-10 cm. long, typically with a characteristically wide, but abruptly truncate to slightly cordate base and a bluntish to rounded apex, but it becomes narrower when growing among grasses *etc*., when the base may exceptionally become ± cuneate, veins with many anastomoses; fertile spike variable in length but usually relatively shorter than in *O. petiolatum*.

Nepal:

W: **Kanchanpur**, **Dadeldhura** [Salun, Dadeldhura, on forest floor, 500 m., *L.R. Kattel* 958, 30.8.1981, KATH], **Kailali** [forested bank of lake, on S.W. side of Godhagodhi Lake, Sukhar, *c*. 40 km. E. of Attariya and Dangadhi, *C.R. Fraser-Jenkins* 34701 (FN 203), 24.11.2010, TAIF], **Doti** [Doti - Bayal, 803285, in the Sal forest, 1000 m., *M.S. Bista* & *D.P. Joshi* 14, 25.7.1972, KATH], **Bardiya** [Belauli, Bardiya, *K.J. Malla* & party 1453, 3.1.1974, KATH], **Kalikot** [Dillikot, amongst undergrowth in Oak and Coniferous forest, 8000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3922, 20.4.1952, BM, *sub* "*O. petiolatum*" in error], **Salyan** [Riala, grassy earth slopes, 5000ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 1296,

31.8.1952, BM, *sub* "*O. petiolatum*" in error], **Dang** [Koilabas, Dang, under the shade of sal forest, 1000 ft., *K.J. Malla*, 9277, 7.1978, KATH].

C: **Mustang** [Lete, Kali Gandaki valley, among shrubs on damp hillside, 11,000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5566, 4.6.1954, BM], **Rupandehi** [Butwal, 832274, in mixed Sal forest, 1600 m., *D.P. Joshi, I. Bajracharya* & *R. Kayastha* 75/3636, 20.12.1975, KATH], **Kaski** [Ribhan, Kaski, 1800 m., *D.P. Joshi* & *M.M. Amatya* 74/1597, 19.5.1974, KATH], **Gorkha** [S.W. of small resting-place, *c.* ½ km. below and S.W. of Deurali village, below path to Chuli Hill, above and N.E. of Markichowk and Gopling, N. of Marsyangdi river, *c.* 5 km. W.N.W. of Anbu Khaireni, between Mugling and Damauli, banks of dry rice-fields, 800 m., *C.R. Fraser-Jenkins, with U.B. Adhikari* 28527 (FN 4502), 19.5.2000, H], **Chitwan** [Chitwan Distr., Chitwan National Park, lake on track to Bankadta from Sukibhar post, 27° 31' 37", 84° 15' 0", depression with alluvial soils collects water after rain, Sal forest, 150 m., *C.A. Pendry, K.K. Shrestha, S. Dahal, A. Giri, A.G. Miller, N. Pandey, M.R. Pullan, L.R. Shakya, S. Shrestha* & *M. Siwakoti* DNEP2 A96, 23.11.2004, E, KATH], **Makawanpur** [Brindaban [herbal] garden, Hetauda, 500 m., *N. Phuyal, S. Maharjan* & *K.K. Pokharel* 63, 15.6.2010, KATH], **Dhading**, **Rasuwa** [Gatlang, "Nuakot Distr." [error], grass, occasional, 8000 ft., *R.L. Fleming* 2206, *sin.* date, MICH]; **Kathmandu** [Thankot, 1524 m., *V.L. Gurung* 82/1757, 5.6.1982, KATH; Swambhu, 1405 m., *Anjali R. Shrestha* NHMTU-2-6B-00265, TU Nat. Hist. Mus.], **Bhaktapur** [Suryabinayak, 1731 m., *V.L. Gurung* 82/1760, 10.6.1982, KATH], **Sindhupalchok**.

E: **Sunsari** [Sunsari, *c.* 65 m., *K.R. Bhattarai* & *N. Acharya s.n.*, 3.5.2005, KATH], **Morang** [river-banks and marshy flats, 1¼ km. E. of Khanepokhari, E. of Itahari on Pathari, Birtamod and Kakkarbhitta road (East-West Highway), *C.R. Fraser-Jenkins* 29407 (FN 5381), 7.10.2001, H].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E., C. and S. India; Sri Lanka; S.E. and E. Asia; Taiwan; Africa; S. America. Its range as a widespread and common species in the Indian subcontient was entirely missed out by Liu & Sahashi (2013) in the *Flora of China*, probably due to confusing it with *O. petiolatum* and *O. vulgatum* and not being aware of the abundance of detailed Indian literature.

(M, C). This is the commonest species of the genus in Nepal, though even so rather seldom noticed. It occurs from low to mid altitude, but also sometimes at upper mid altitudes or above, when the fronds become smaller than usual. It usually inhabits damp grassland near streams or beside rice-fields.

[***Ophioglossum gramineum*** Willd. - Myanmar; E. Himalaya; C. India; not collected in Nepal; Uttarakhand [rare]; C. India. (H or M, R).]

[***Ophioglossum polyphyllum*** A.Braun *ex* Seub. (syn.: *O. aitchisonii* (C.B.Clarke)

d'Almeida) - C. India; Tibet; not collected in Nepal; Uttarakhand [Dehra Dun]; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. (S(W), Sc to R).]

MARATTIACEAE

Angiopteris (2 species).

As long known and commented on by many competent taxonomists since early last Century, a great number of synonymous supposed species of *Angiopteris* have been described by Presl, de Vriese and later workers which are of no taxonomic significance, along with certain others which are. Nevertheless accounts in India and elsewhere have sometimes listed many of this superfluity of names as if separate species by an indiscriminate process of compiling separately as many reported names as the authors could find, even attempting to describe and key them and give erroneous ranges (*e.g*. see Dixit 1984, Ghosh *et al.* 2004, and for other genera Chandra 2000). Fraser-Jenkins (2008) synonymised many of the conspecific and simultaneously published names concerning India and adjacent areas and this is further adjusted here to allow for the discovery of original material of the name *A. indica* Desv. This clarification work was entirely overlooked by He & Christenhusz (2013) in the *Flora of China*, who in failing to deal with some of the quintessentially important earlier Indian names that had already been clarified thereby reversed Chinese taxonomy into a state of further unstable confusion concerning them.

[***Angiopteris evecta*** (G.Forst.) Hoffm. (syn.: *Clementea palmiformis* Cav.; *Angiopteris palmiformis* (Cav.) C.Chr.; *A. indica* Desv., *non sensu* Fraser-Jenkins (2008) [= *A. helferiana*]; *A. angustifolia* C.Presl; *A. javanica* C.Presl; *A. durvilleana* C.Presl; *A. pinnata* Roxb.; *A. assamica* de Vriese). As explained by Holttum (1978) the name *A. evecta* has been very widely misapplied in mainland Asia, including Nepal and throughout India, and as shown by Fraser-Jenkins (2008), particularly to *A. indica* and *A. helferiana*. Holttum first pointed out that *A. evecta* differs among other ways in having long recurrent false veins originating at the margin and running back almost to the costa between the veins. But at that time it was only possible to state that it was a Pacific oceanic species (described from Tahiti). Having excluded it from India, Fraser-Jenkins then found on excursion to Arunachal Pradesh and in E. Bhutan, a third, much rarer species, confined to far N.E. India, which corresponded well with the plant known in the Philippines as *A. palmiformis*, which he had become familiar with in Mindanoa in 2007. This species was therefore reported by Fraser-Jenkins & Benniamin (2010) from India as *A. palmiformis*. But recently on studying much more and more complete and recent material of true *A. evecta* from various archipelagos in Oceania in UC herbarium, California, it has now become clear that *A. palmiformis* is entirely identical with *A. evecta sensu stricto* itself and is merely a synonym of it. Both have the exceptionally large (to 6 m.+) frond, long pinnae with many ± cordate-based pinnules, and long recurrent false veins. *A. evecta* is therefore again reported here from India, but in a revised sense and is only known

so far from Arunachal Pradesh, Assam State, and from Bhutan, as well as from Myanmar; Thailand; Malaya *etc.*; the Philippines; Taiwan; Australasia; the Pacific Islands; and quite possibly overlooked under other names in S. China, where many names were listed but not systematically reidentified by He & Christenhusz (2013). While not known from Nepal, it remains unknown how far west it might go beyond S.E. Bhutan, though it is not expected to go as far as Darjeeling, but all very large specimens of *Angiopteris* in low altitude subtropical forests of the central Indo-Himalaya (Nepal to Sikkim and Darjeeling) ought to be examined carefully with this species in mind.]

54. ***Angiopteris crassipes*** Wall. *ex* C.Presl, *Suppl. Tent. pterid.*: 23 (1845), lectotype of *A. crassipes*, here designated: "Angiopteris crassipes Wall. 187 A. evecta Hoffm proxima, sed differt caudice depresso orbiculato-placentiformi carnoso maximo, capsulis laevibus haud striatus. Legi in valle Napaliae ad loca umbrosa humida versus Mareko [now called Mudko on the Kathmandu-Dhading district boundary in Nagarjun forest], nec alibi. Jano. Febo." sheet 187.1 [label number attached by microfiche workers], K-W, from the same collection as material that was sent to Presl; isolectotype: K, BM, UC (syn.: *A. distans* C.Presl; *A. huegeliana* C.Presl; *A. latifolia* C.Presl; *A. hookeriana* de Vriese, *A. repandula* de Vriese (which is not in *A. helferiana* as written by Fraser-Jenkins, 2008) and several other names of de Vriese and others (see Fraser-Jenkins 2008: 25); misapplied names: "*A. evecta*" *sensu auct. Ind. p.p. maj.*, *non* (G.Forst.) Hoffm.; "*A. indica*" *sensu* Fraser-Jenkins (2008: 24-25), *non* Desv. [lectotype (Mazumdar 2015) = *A. evecta* Hoffm.]).

Although Wallich's sense of *A. crassipes* (*Num. List* no. 187) was a mixture of both of these common species in the area, Presl's sense was of the present species and it is so lectotypified here.

Fraser-Jenkins (2008) selected a neotype of *A. indica* from S. India in the sense of the present species, believing that as de Vriese & Harting (1853) convincingly stated, De Jussieu's son and Korthals had both found that the type of *A. indica* was missing in de Jussieu's herbarium in Paris, but now that a tiny, original fragment of the central part of a pinnule, presumably likely to have been from the missing type specimen, has been found in P by G. Rouhan and selected as lectotype by Mazumdar (2015), the neotype is superceded. However Mazumdar was not properly familiar with the species themselves, and misidentified the fragment as being *A. helferiana*, not realising that the soral line is too marginal and the lower surface too pale, slightly glaucous, for normal specimens of that species, and more importantly he also failed to observe that the specimen concerned has the diagnostic, very long recurrent false veins (visible on the left side in the photo), extending from the margin three quarters of the way to the segment midrib, so it cannot possibly be either *A. helferiana* or the present species. In fact the specimen belongs to *A. evecta* and the name *A. indica* is thus a synonym of *A. evecta* (epitype of *Angiopteris indica* Desv., *J. de Bot. Applic.* **1**: 267 (1813), here designated: "Angiopteris evecta, Tahiti, Faaa,

1135 ft., *M.L. Grant* 3512, 9.5.1930", UC (no 437848)). In addition this means that the lectotype of *A. indica* must probably have come from S.E. Asia and not S. India, Desvaux not having specified where. Although it is not known if the lectotype might have had cuneate segment-bases as described, it is not unusual that poor and exposed specimens of most *Angiopteris* species may have cuneate bases and marginal or near marginal sori as mentioned for *A. indica* by Desvaux.

He & Christenhusz (2013) surprisingly stated in the *Flora of China* that they did not see any material of *A. crassipes* (which is at K, K-W, BM, E *etc.*) and thus did not treat it, but this may be related to their not citing important taxonomic references concerning the genus due to a narrow molecular approach and lack of botanical experience. It is unclear from their account under what name they would treat this species in China as it appears to have been omitted in error, while their key mentioning long false veins over half way to the costa fits neither of the two main Indian subcontinental (and Chinese) species treated here that come under that heading.

A massive fern with thick, fleshy ground-level rhizomes, long, thick, smooth stipes (in the Indian subcontinent) and widely truncate-based bipinnate fronds; pinnae pinnate with short-stalked, simple, succulent pinnules and a similar terminal segment; the marginal or very slightly inframarginal soral lines consist of large (to 3 mm.) boat-shaped groups of *c.* 12-20 separate but closely adjacent sporangia in two contiguous lines. In comparison to *A. helferiana,* the present species, usually has smaller segments, which are more toothed throughout, the pinnule-base is variable in both species, but perhaps more often somewhat widely cuneate (as opposed to rounded-truncate) in *A. indica,* and the soral line is consistently marginal, or as close as makes no difference; both species have very short recurrent false-veins, darkened lines between the actual veins, which only reach from the margin to the soral line, or just within it, and are frequently almost invisible in the present species. Sterile or juvenile fronds of *Angiopteris* in the Indian region are unidentifiable.

Nepal:

C: **Makawanpur** [Makawanpur, in shady forest near water stream, 300 m., *M.S. Bista* 12122, 18.4.1969, KATH], **Kathmandu** ["N.W. corner of the Valley nr. the village of Marekoh [*i.e.* Mudkhu, N.W. of Balaju, at the foot of some hills beyond Nag-Arjuhn range", locality from Wallich (1821 *ined.*) *Filcologia Nepalensis*], *N. Wallich* 187, in 1821, K, K-W, BM]; **Bhaktapur** [forested rocky stream-gully, *c.* 1 km S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, *C.R. Fraser-Jenkins* 25223 (FN 1202), 15.2.1997, H, but specific identity not properly recorded].

E: **Jhapa** [E. Nepal, Chula Chuli, 26° 37', 87° 37', 750 ft., *L.H.J. Williams* & *J.D.A. Stainton* 8501, 15.9.1967, BM], **Ilam** [Mai khola, 26° 50', 87° 52', 1800 ft., *L.H.J.*

Williams 352, 2.6.1969, BM; right of Gorhwa road, Ilam, 800 ft., *R.L. Fleming* 2633 *p.p.* (longer pinna on right), 12.9.1978, KATH; and Chitregaon and Sudhung khola, Pashupatinagar, *C.R. Fraser-Jenkins* 29610 (FN 5585), 23.10.2001, H, and 29741 (FN 5716), 27.10.2001, H, but specific identity not properly recorded].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]. N.E., C. and S. India; Sri Lanka; Bangladesh *etc*.

(M, Sc). A rather uncommon species in Nepal, occurring at mid-altitude and confined to deep, dense, moist forest, usually on slopes above streams, and sensitive to exposure from tree-cutting, grazing or fire.

Nepalese threatened status: **NT**.

55. ***Angiopteris helferiana*** C.Presl (syn.: *A. wallichiana* C.Presl; *A. salicifolia* (C.Presl) de Vriese; *A. assamica* de Vriese; *A. repandula* de Vriese; *A. griffithiana* de Vriese, and many other names; misapplied names: "*A. crassipes*" *sensu* Singh & Panigrahi (2005) *p.p., non* Wall. *ex* C.Presl; "*A. evecta*" *sensu auct. Ind. p.p. max., non* (G.Forst.) Hoffm.; several synonyms of *A. helferiana* and *A. crassipes* were mistakenly thought by Huegel and de Vries to have come from Pakistani Punjab, partly due to confusing the wherabouts of "Pundooah", near Sylhet, Bangladesh, with Punjab ("Pendschab") and thinking it referred to Pakistan, but *Angiopteris* does not occur in Pakistan and only just reaches as far west as eastern Uttarakhand.

Gigantic, fleshy plants with massive terrestrial bases, branch-like, smooth stipes [in the area] and huge bipinnate leaves, with long, narrowly oblong pinnae bearing ultimate segments along their length and apically. *A. helferiana* differs from *A. crassipes* in its longer and larger segments, usually with less obvious teeth and characteristically a slightly or obviously inframarginal soral line, unless the leaf is very exposed when they can become nearly or mostly marginal and can then be confused with and difficult to separate from *A. crassipes*; very short recurrent false veins reaching only to the soral line or just beyond; segment-base variable, but usually rounded-truncate.

Fraser-Jenkins (2008) synonymised all the simultaneously published names that he found to belong to this and the above species, including *A. wallichiana*, and thereby fixed the name *A. helferiana* for the present species, which was entirely overlooked by He & Christenhusz (2013) in the *Flora of China*, who called it *A. wallichiana* in error, thus adding to the large amount of revision and correction that failed to be done at the time of publication in most critical genera in the *Flora*. They also lectotypified *A. wallichiana* on the basis of a specimen of Wallich 187.4 giving its locality as Nepal, *Wallich*, in 1821. However, as clearly written on the label, *Wallich* 187.4 was from the well known locality, "Pundooah m[isit]. *De Silva*" and was thus from Sylhet District, northern Bangladesh. The specimen annotated as "type" by Christenhusz in 2012, whose bar code K000784939 was cited in his confused

lectotypification, though labelled 187/4 has more recently had "Nepal" written on it by mistake in modern writing, and is labelled as having come to K from King's College only in November 1964. It was thus not in Hooker's herbarium and was not seen by Presl, nor was it collected from Nepal (which is 187.1), but Bangladesh. But despite Christenhusz's hasty confusion, it is doubtful if it could be said to be in serious conflict with the protologue, at least taxonomically, and it might perhaps therefore stand as lectotype. The specimen is an obvious collection of *A. helferiana*, with characteristic large pinnules and inframarginal sori, as CRFJ has seen occuring commonly around Sylhet, so it is fortunate that its random and uninformed selection did not cause any taxonomic or nomenclatural confusion. Presl's type of *A. helferiana* is a specimen with the sori further away from the margin, as often happens in this species, but is the same species. As the simultaneously published *A. wallichiana* was first synonymised within it by Fraser-Jenkins (2008), the species should continue to be called *A. helferiana*.

Nepal:

C: **Kaski** [Begnas Tal, *T. Nakaike* 3815, 11.11.1988, KATH, sterile], **Tanahun** [rocks and forested slope below waterfall, in next gorge, *c.* ½ km above Chowti Bara Temple gorge, *c.* 6 km S. of Damauli, E. of Pokhara, W. of Mugling and Anbu Khaireni, *C.R. Fraser-Jenkins* 25328 (FN 1307), 23.3.1997, H, and 25488 (FN 1466), 18.8.1997, H, but specific identity not properly recorded, as also Chabise, Khairenitar, *CRFJ* 25807 (FN 1785), H, and Jamune, Tanahun, *CRFJ* 28477 (FN 4452), H], **Makawanpur** [west aspect of Chillibas community forest, Aambhanjyang - 2, Makawanpur, 600 m., *N. Thapa* M 52, 10.9.2000, KATH]; **Sindhuli** [N. facing, forested rocky stream-gully on N. side of second main ridge of hills up from the plains, *c.* 6 km S. of Sindhuli Madi, N. of Karkare, N. of Biman, *c.* 15 km N. of Bardibas, E. of Hetauda off Janakpur road, *C.R. Fraser-Jenkins* 26013 (FN 1991), 12.2.1998, H, but specific identity not properly recorded].

E: **Sankhuwasabha**, **Morang** [Bisnetar - Kawaldhar, Morang, 1300 ft., *T.B. Shrestha* & *T.K. Bhattacharya* 72/226, 25.9.72, KATH], **Jhapa** [Jhapa Distr., forest by Ganjabari, 300 m., *D.H. Nicolson* 3071, 31.3.1967, MICH], **Ilam** [Ilam Dist., damp ravine, 1400 ft., *R.L. Fleming* 2080, 23.12.1971, K; right of Gorhwa Road, Ilam, 850 ft., *R.L. Fleming* 2685, 14.9.1978, KATH, and Gorhwa, *R.L. Fleming* 2633 *p.p.* (shorter pinna on left), 12.9.1978, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. S. India; Sri Lanka; Bangladesh; Thailand; S.E. Asia.

(M, Sc to C). A scattered but fairly common species of lower to mid altitude, occurring in dense, moist forest on slopes beside streams, but dying out rapidly whenever deforestation occurs.

Nepalese threatened status: **LC**.

OSMUNDACEAE

Osmunda (2 species).

56. ***Osmunda claytoniana*** L. subsp. ***vestita*** (Wall. *ex* Milde) Á.Löve & D.Löve (syn.: *Osmundastrum claytonianum* (L.) Tagawa; *Osmunda pilosa* Wall. *ex* Grev. & Hook.; *Osmundastrum claytonianum* subsp. *pilosum* (Wall. *ex* Grev. & Hook.) Tsvelev; *Osmunda claytoniana* subsp. *pilosa* (Wall. *ex* Grev. & Hook.) Fraser-Jenk.).

A large plant with a massive, branching and clumped rhizome covered in intertwined black roots; sterile fronds to 1.5 m. tall, erect, lanceolate, bipinnatifid, with large, untoothed. rounded pinna-lobes; fertile frond with sterile pinnae at both base and apex, though sometimes difficult to see at the apex when fronds not completely uncurled; wool-hairs red-brown. Both the sterile frond and the fertile one are somewhat different from *Osmunda cinnamomea* L. subsp. *asiatica* (Fernald) Fraser-Jenk. (syn.: *Osmundastrum cinnamomeum* (L.) C.Presl *p.p. Asiat.*; *Osmunda cinnamomea* var. *fokiensis* Copel.), which occurs from Bhutan eastwards as a considerable rarity and has fully fertile fertile fronds (Fraser-Jenkins & Benniamin 2010, Fraser-Jenkins 2012). *O. cinnamomea* has sometimes been misidentified from Nepal and the W. Indo-Himalaya in error for the present species with fertile fronds not fully unrolled.

Nepal: **W**: **Doti** [Khaptad National Park, Sukhedaha, on trail from Bichpani to Ghoda, Doti District, *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* [*"Bhatta"*] & *A.P. Bhattarai* 20915027, 2.7.2009, KATH], **Darchula** [Bramha lekh, Darchula, terrestrial on the grassy slope of oak forest under semi shade, 3100 m., *P.R. Shakya* & *D.P. Joshi* 524, 16.5.1971, KATH], **Bajhang** [Surmasarowa, Bajhang, 29° 40', 81° 02', lande un peu sèche, 2900 m., *J.F. Dobremez* 2125, 8.5.1973, KATH], **Jumla** [Napani, Jumla, under Picea forest in patches, *c.* 10,000 ft., *T.B. Shrestha* 5092, 6.6.1966, KATH], **Mugu** [Rara Daha, grass slopes in coniferus forest, 8500 ft. *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 4104, 17.5.1952, BM], **Humla** [Durpa, north of Margar Lagna, damp grassland in clearings in coniferous forest, 9500-10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 4174, 26.5.1952, BM], **Rukum** [C. Nepal, above Ranmagaon, clearings on ridge, 11,500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3384, 1.7.1954, BM].

C: **Parbat** [Parbat, Banthanti (2650 m.) - Gorepani Deorali (3170 m.), 835283, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8350261, 8310330, 12.7.1983, BM], **Baglung**, **Myagdi** [Dana, Myagdi, on shady moist place, 1400 m., *V.L. Gurung* 81/1292, 24.6.1981, KATH], **Lamjung** [Telbrung Danda, on ridge between Midam and Khudi river, N. of Ghanpokhara, in Telbrung Kharka, 234313, grazing opening in Abies spectabilis/Rhododendron barbatum forest, 3000 m., *Dorothy Allard* 1509, 14.8.1996, BM], **Gorkha** [Namjung, 28° 54' 12'', 84° 77' 66'', 2600 m., *S.H. Bhattarai* 29/10, 2.6.2012, KATH], **Dhading**, **Nuwakot** [near Ghonga Bhanjyanga, Nuwakot, 9000 ft., *P.R. Shakya* & *T.K. Bhattacharya* 2201, 19.5.1973, KATH],

Rasuwa [Thale (2000 m.) - Dhunche (2000 m.) - camp (1970 m.), *H. Kanai* 673197, 5.6.1969, KATH], **Dolakha** [Rolwaling khola, 3180 m., *N.P. Manandhar* & *M.K. Adhikari* 1584, 18.5.1977, KATH], **Ramechap**. A specimen labelled as from "Suryabinayak, Bhaktapur, *D.T. Yami* 4, 10.2.1996," KATH, where this species does not occur, was due to confusion with a sheet from "Hellok, Taplejung, *Liba Pejchar* 43, 8.5.1996," KATH.

E: **Okhaldhunga** [Maily, Okhaldhunga, on moist and shady place, sori brown, 2900 m., *N.P. Manandhar* & *M.K. Adhikari* 1828, 28.5.1979, KATH], **Solukhumbhu** [près de Namche Bazar sur l'Imja khola, 3100 m., *A. Zimmermann* 715, 9.6.1952, BM], **Sankhuwasabha** [Arun Valley, Kasuwa Khola, N. of Num, Sankhuwasabha, 10,500 ft., *J.D.A. Stainton* 592, 10.6.1956, BM, KATH], **Tehrathum** [near to Ghurmise, Basantapur - Chouki, 2800 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955027, 3.8.1999, KATH], **Taplejung** [Tamrang Khola, deep crevice beneath road, 6500 ft., *A.H. Norkett* 7273, 21.11.1961, BM; Siringdham, 27° 20', 87° 57', 9500 ft., *L.H.J. Williams* 609, 15.6.1969, BM; Taplejung Dt., Tamur, 3200 m., *K.R. Rajbhandari* 16452 (FN 9250452), 26.5.1992, KATH].

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

(S, C). A common species of upper-mid to higher altitude, growing in clumps among bushes on semi-open slopes, or in open, higher-altitude meadows

57. ***Osmunda japonica*** Thunb. (syn.: *O. speciosa* Wall. *ex* Hook. & Grev. [type with one abnormal semi-fertile frond with one pair of sterile basal pinnae, with fertile apices and the remaining pinnae fully fertile]; *O. regalis* L. subsp. *japonica* (Thunb.) Á.Löve & D.Löve; misapplied names: "*O. regalis*" *sensu auct. bor. Ind., non* L. [a mainly European species absent from the Indian subcontinent]; "*O. regalis* var. *spectabilis*" *sensu* M.L. Banerji (1972), *non* (Willd.) A.Gray [= *O. spectabilis* Willd., from N. America]).

A large plant with a massive rhizome surrounded by roots; sterile fronds to *c.* 80 cm. tall, though often smaller, bipinnate, deltate-lanceolate, widest at the base, bearing large oblong pinnules with rounded apices, rounded-truncate bases and insignificant or no teeth; fertile fronds smaller, normally fully fertile in all pinnae, with reduced lamina covered in sporangia, but fairly commonly abnormal, usually rather irregular semi-fertile fronds are produced, usually with one to three sterile basal pinnae and the upper ones fertile or semi-fertile, and have been confused with the European and W. Asian *O. regalis* or the American *O. spectabilis* (see Fraser-Jenkins 2008), as have sterile fronds. The irregular semi fertile fronds have been illustrated from Japan in a well illustrated study of these abnormalities (Hayashi 1937) and are usually dissimilar to the larger fertile fronds of *O. regalis*. Their existence does not mean that *O. japonica* in the Himalaya is conspecific with *O. regalis* as published by Kholia & Punetha (2008). The S. and C. Indian *O. huegeliana* C.Presl with semifertile fronds is closely vicariously allied to, or more probably

conspecific with *O. hilsenbergii* Grev. & Hook. (syn.: *O. capensis* C.Presl, *non* L.; *O. schelpei* A.E.Bobrov), from Africa and has also been confused with *O. regalis*. The only other species in the *O. regalis* group to have fully sterile-fertile dimorphic fronds is *O. abyssinica* (Kuhn) A.E.Bobrov from Ethiopia, which is otherwise closer to *O. huegeliana* and both in turn to the American *O. spectabilis* Willd. The report by Chandra *et al.* (2008) of *O. regalis* from Khasia was in error for *O. japonica.*

Nepal:

W: **Jumla** [Gothi Chaur, "E. Nepal" [error], on slope and rock crevices, 9500 ft., *S.B. Malla* 10963, 12.6.1968, KATH, with a semi-fertile and fully fertile frond].

C: **Rasuwa**, **Kathmandu** [ad Pusputnath [Pashupatinath], templum celeberr. et sanctiss. in valle Napaliae, [*N.*] *Wallich* List no. 50.1, in 1821, K-W, K]; **Lalitpur** [Phulchoki, Lalitpur, shady moist slope, 2438 m., *V.L. Gurung* 1525/82, 1.12.1982, KATH], **Ramechap** [between Bhandar & Kenja, 2100-1700 m., *T. Nakaike* 3176, 7.10.1988, KATH].

E: **Solukhumbhu** [Salleri, 2320 m., *A. Zimmermann* 844, 15.6.1952, G], **Sankhuwasabha** [Chepuwa, Sankhuwasabha, open sunny slope, 2060 m., *P.R. Shakya* 9720, 12.4.1991, KATH], **Taplejung** [Helok, Taplejung, 1500 m., *H. Hara*, *S. Kurosawa* & *T. Tuyama* 6304978, 8.11.1963, KATH]. E. Nepal [Terra Bence, 9-10,000 ft., *Capt. Lall Dhwoj* 0439, 21.2.1931, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. India; E. Asia; Thailand; Vietnam.

(S, C). A rather common upper-mid altitude to high Himalayan species, occurring on open path-sides, and banks, often among moss on wet rock surfaces (unlike the palustrine *O. regalis* and *O. huegeliana*).

PLAGIOGYRIACEAE

Plagiogyria (2 species).

58. ***Plagiogyria euphlebia*** (Kunze) Mett. (syn.: *P. elongata* R.D.Dixit & A.Das; *P. triquetra* Wall. *ex* Mett.; *P. chinensis* Ching; *P. christii* Copel., see Dixit & Das (1981), synonymised by Fraser-Jenkins (1997, 2008a) and Zhang & Nooteboom (1998)).

A medium-sized (fronds to *c.* 50 cm.), simply pinnate species with fronds arising from a thick erect rhizome; stipe rounded abaxially with a flat adaxial (upper) surface and a broadened, flattened base; fronds sterile-fertile dimorphic, sterile fronds spreading, pinnae to *c.* 1 cm. wide and 12 cm. long, somewhat distant, rounded-based, with narrowed, slightly toothed apices, frond-apex obviously imparipinnate (terminal pinna unlobed and similar to lateral ones); fertile fronds taller and erect, the lamina completely reduced so the costa is covered with the coenosorus. Many erroneous species of *Plagiogyria* have been named in China by Ching, mostly representing growth stages, and a further confusion of pointless names has been

perpetrated in India by Dixit & Das (1981), due to poor field investigation and a career requirement to report new records and invent new species. Fortunately these have now been properly synonymysed by Fraser-Jenkins (1997, 2008) and by Zhang & Nooteboom (1998), the latter being one of the more meaningfully synonymising monographic investigations from Leiden.

Nepal:

C: **Kathmandu** [Sheopuri Lekh, among shrubs, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6944, 19.8.1954, BM], **Lalitpur** [Chapagaon, 4900 ft., *R.L. Fleming* 1318B, 17.9.1956, DD; Bajrabarahi, *T. Nakaike* 1714, 19.9.1986, KATH; forest slopes beyond temple at Vajrabharahi Forest, just E. of Chapagaon, S.E. of Kathmandu, *C.R. Fraser-Jenkins*, with *A. Monaf Ali* and *Dr. V. L. Gurung* (National Herbarium, Godawari) & *Mr. R.K. Gurung* 15466, 30.12.1988, E], **Bhaktapur** [Suryabinayak, Bhaktapur, 4100 ft., *R.L. Fleming* 1459, 10.9.1957, KATH]; **Kabhrepalanchok** [forested stream-gully facing N.W., with footpath going up along it, across rice-fields, on W. side of ridge opposite Town Council office of Dhulikel town, *C.R. Fraser-Jenkins*, with *N. Fraser-Jenkins, C.K. Pariyar* & *Insp.* (*retd.*) *Indra Shrestha* 28764 (FN 4739), 10.2.2001, H].

Although likely to be present in E. Nepal, and so reported by Thapa (2002), probably by extrapolation, no material is present in KATH, K, BM, E, MICH, nor collected by the Japanese or the present first author, and it is therefore excluded until actually collected there.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Sikkim; ?Darjeeling; Nepal; Uttarakhand [Didihat, Pithoragarh, *H.C. Pande*, BSD, det. CRFJ]. N. India; E. and S.E. Asia.

(M, Sc). A scattered and rather uncommon species of mid altitude, growing in dark stream-gullies in dense forest.

Nepalese threatened status: **NT**.

59. ***Plagiogyria pycnophylla*** (Kunze) Mett. (syn.: *P. scandens* Mett.; *P. gigantea* Ching; *P. communis* Ching; *P. lanuginosa* Ching; *P. decrescens* Ching, *P. minguingensis* R.D.Dixit & A.Das, see Dixit & Das (1981), all synonymised by Fraser-Jenkins (1997, 2008a) and Zhang & Nooteboom (1998); misapplied name: "*P. glauca*" *sensu* Nair (1973), *non* (Blume) Mett.).

Rhizome thick, erect; stipe trilete to rounded with a broadened, flat base; sterile frond simply pinnate with many pairs of unlobed, rather crowded, acute-apexed, broadly cuneate-based pinnae with a rather prominent teeth at the narrowed apices, several pairs of spaced out reduced pneumatophores beneath the pinnae, and a decreasing, narrow, pinnately and ultimately shallowly lobed frond-apex; fertile fronds erect, with many very narrow or linear pinnae with totally reduced lamina and a continuous coenosorus beneath each.

Nepal:

E: **Solukhumbhu**, **Sankhuwasabha** [between Hatia and Barun Khola, under large tree, *c.* 8000 ft., *L.W. Beer* 12302, 25.11.1971, BM; Bungim - Sedua, Sankhuwasabha, 6000 ft., *P.R. Shakya* & *M. Ohsawa* 893, 13.9.1971, KATH; Sankhuwasabha Distr., Kuwa Pani (2890 m.) - Taklung Kharka (3110 m.) - Dogor Phuk (3755 m.), 27° 35' 57", 87° 10' 27" - 27° 38' 24", 87° 09' 31", in wet Rhododendron forest, 2900 m., *S. Noshiro, N. Acharya, Y. Ibaragi, K. Kobayashi* & *T. Kurosawa* 9770257, 23.8.1997, E *sub* "*P. communis*"], **Tehrathum**, **Ilam** [Mai Pokhari, Ilam, damp shade around lake, 7500 ft., *R.L. Fleming* 2501, 17.9.1978, KATH], **Taplejung** [Topke Gola (3600 m.) - Shewaden (2600 m.), 873374, on mountain slope along path in dense forest, 2800 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725309, 28.6.1972, KATH]. A specimen labelled "Thankot, Kathmandu, shady and wet places, rare, 1524 m., *V.L. Gurung* 82/1790, 27.6.1982, KATH", where this species does not occur, was a confused relabelling of *Shakya* & *Ohsawa* 893 from Sankhuwasabha, above.

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; S.E. Asia.

(S, Sc to C). A common species (from E. Nepal eastwards) at mid to upper-mid altitude, growing in damp, semi-open situations on slopes and by roadsides in light forest.

LYGODIACEAE

Lygodium (4 species).

60. ***Lygodium flexuosum*** (L.) Sw. (syn.: *L. scandens* (L.) Sw., though name often misapplied to *L. microphyllum* (Cav.) R.Br. in the past; misapplied name: "*L. longifolium*" *sensu* Singh & Panigrahi (1984) from Khasi Hills, *Jerdon* [as "*Jordan*" in error] *s.n.* in 1869, semi-juvenile, their specimen without data, cited as from Sri Lanka, where it is not known to occur, has not been seen for reidentification by CRFJ, *non* (Willd.) Sw.).

A climbing fern, with pseudo-dichotomous pinnae at intervals up the thin, twining main-stem; pinnae with a dormant apical bud at the dichotomy, bearing a pair of opposite pinnules, each with several alternate pinnulets (usually *c.* 6-12 cm. long, sometimes up to 15 cm.) and a similar apical segment, larger, more basal pinnulets becoming pinnate, each with longer basal lobes or segments, often a smaller lobe or segment above that an entire apical segment above, lobes to 2 cm. wide, bearing minute teeth around the margins and usually rounded-acute at their apices, the point of attachment to the petiole usually not, or hardly thickened, nor articulate; fertile segments and lobes bearing short, exserted soral spikes scattered around the margins, with plate-like stacks of small indusia. Occasionally the blades of the segments have swollen basal articulations, imitating *L. salicifolium* in that respect (but having much longer and more extensive lobing of the pinnulets), as in some specimens from Kaski in KATH. Large radiate juvenile leaves are sometimes mistaken for *L.*

circinnatum (Burm.f.) Sw. from S.E. Asia, Sri Lanka *etc*., while the next stage of maturity before developing adult leaves resembles *L. altum* (C.B.Clarke) Alderw., from further N.E. India, Myanmar and S.E. Asia, in having very long segments. *L. altum* was erroneously synonymised into the very different *L. flexuosum* by Zhang & Garrison Hanks (2013) in the *Flora of China*, but is close to the S.E. Asian and S. Indian *L. longifolium* (Willd.) Sw.

Nepal:

W: **Kailali** [Kailali, Malaketic, 14 miles N.W. of Dhangarhi, 200 m., *D.H. Nicolson* 2806, 30.11.1966, MICH, KATH], **Bardiya**, **Banke** [Nepalganj, 150 m., *N.P. Manandhar* 9874, 30.10.1972, KATH], **Surkhet** [banks of river Kharekhola, from path starting just below and S.W. of Kharekhola village, down stream into Sal forest, *c*. 1 km below and S. of Kharekhola village, *c.* 3 km N.N.E. of Surkhet, *C.R. Fraser-Jenkins*, with *K. Pongali* 25583, 27.9.1997, H], **Jajarkot** [Jajarkot, twining over shrubs, 4000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5712, 16.10.1952, BM], **Dang**.

C: **Rupandehi** [Charauga khola, Butwal, 300 m., in the Sal forest, *D.P. Joshi* & *M.M. Amatya* 74/1252, 26.2.1974, KATH], **Palpa**, **Tanahun**, **Gorkha** [third steam gulley down, *c*. 1-1½ km. below and S. of Komale khola, on path down from Deurali to Marsyangdi Dam at Gopling and Markichowk, W. of Anbu Khaireni, Gorkha Dist., wooded slope and edge of path, *c*. 600 m., *C.R. Fraser-Jenkins* 25098, 25099 (FN 1077, 1078), 30.12.1996, H, BM], **Bara**, **Chitawan** [Rapti Dun, 100 miles S.S.W. of Kathmandu valley, 500 ft., *R.L. Fleming* 1408, 6.9.1957, MICH, KATH], **Makawanpur** [Hetauda - Amlekhganj, 1500 ft., *P.R. Shakya* 9341, 21.8.1967, KATH], **Dhading**, **Rasuwa** [Betrawati to Ramche, 800-1800 m., *V.L. Gurung*, *T.K. Rajbhandari* & *D.P. Joshi* 812/79, 13.9.1979, KATH], **Kabhrepalanchok**, **Sindhuli** [Ratanpur, Sindhuli, open land, 1270 m., *N.P. Manandhar* 12517, 26.11.1988, KATH], **Dolakha**.

E: **Udayapur** [Aridunga à Belsot, avant la traversée du Terai, 320 m., *A. Zimmermann* 2118, 8.11.1954, BM, G], **Sunsari** [Dharan to Chyurebas, 400 m., *P.R. Shakya* & *M. Ohsawa* 775, 27.8.1971, KATH; S. of Dharan, 872265, dry ground in dry deciduous forest, 200 m., *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725025, 1.6.1972, TI, BM, KATH], **Morang**, **Dhankuta**, **Sankhuwasabha** [Tumlingtar, Arun river, 1300 ft., *R.L. Fleming* 2182, 13.11.1973, MICH], **Tehrathum**, **Jhapa** [forest near Khudunabari, shady bank, 200 m., *N. Thapa* J36/97, 23.12.1997, KATH], **Ilam** [Rangapani, 2400 m., *V.L. Gurung* 1294, 12.9.1980, KATH], **Taplejung** [Tamur valley, Mewa Khola, 2500 ft., *J.D.A. Stainton* 1271, 6.8.1956, BM, KATH; Sinwa, Taplejung, Alnus nepalensis forest along Tamur river, 1070 m., *Liba Pejchar* 5, 18.4.1996, KATH det. Diltara Yami Tuladhar as "*Pteris* sp." in error].

Himalayan distribution: Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh [rare].

(M, C). A very common low to mid-altitude climbing species of semi-open, dry habitats, path-banks, the edges of forests etc.

61. ***Lygodium japonicum*** (Thunb.) Sw. (syn.: *L. dissectum* Desv.; *L. chaerophyllum* Desv.; *L. microstachyum* Desv.; *L. pilosum* Desv., *L. finlaysonianum* Wall. *ex* C.Presl; *L. mearnsii* Copel, including *sensu* Panigrahi & Dixit (1970), Dixit (1984)).

Similar to *L. flexuosum*, but the "pinnules" and lobes smaller, narrower, more pointed and more toothed, the basal lobes usually more spreading and acute; fertile segments with a more-or-less narrowed lamina, often becoming reduced to a mass of fertile spikes.

Nepal:

W: **Darchula** [Lekam to Bitale, 740-874 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yano, N. Yamamoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216006, 7.7.2012, KATH]**, Baitadi [**Dhik Gad - Gokula, 620 m., *P.R. Shakya, M.K. Adhikari* & *M.N. Subedi* 7829, 12.7.1984, KATH], **Bajhang** [hillside west of Chainpur, Bajhang Distr., 1333 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915050, 5.7.2009, KATH], **Surkhet** [Chhinchu, common on paddy field's bank and in forest, 500 m., *N. Thapa* S7, 7.8.20001, KATH], **Salyan** [Marma Khola, in damp forest beside river, 3000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3778, 31.3.1952, BM], **Rolpa**, **Pyuthan** [Bhingri, on road side, 700 m., *D.R. Kandel, M.L. Pathak* & *G.D. Bhatt* ["*Bhatta*"] 126002, 9.6.2012, KATH].

C: **Arghakhanchi** [Matipur, moist places, 900 m., *N.P. Manandhar* & *P.M. Regmi* 121, 3.3.1976, KATH], **Myagdi** [Ranabang, 1000 m., *N.P. Manandhar* & *S.K. Acharya* 364-92, 27.5.1992, KATH], **Palpa**, **Syangja**, **Parbat [**Kushma, on shady place, 950 m., *Dr. D.K. Sharma* & *N. Thapa* 13/96, 3.11.1996, KATH], **Kaski [**Pokhara Valley, 700 m., *K.R. Bhattarai* 115, 8.8.1992, KATH], **Tanahun** [Mugling - Bhansar, on moist and shady place, 430-570 m., *D.P. Joshi & M.M. Amatya* 73/176, 2.7.1973, KATH], **Lamjung**, **Gorkha** [Pandrung Deurali, moist locality, 1100 m., *N.P. Manandhar* & *L.P. Katel* 11735, 12.5.1987, KATH], **Makawanpur** [near Hetauda, Makawanpur, *c.* 450 m., *T. Nakaike* 3608, 3.11.1988, KATH, TNS], **Dhading**, **Rasuwa** [Syarpagaon - Syabrubensi, 5500 ft., *O. Polunin* 1315, 30.7.1949, BM], **Kathmandu** [Narainhetty, Napaul, *Dr.* [*F.*] *Buchanan* [*Hamilton*] *s.n.*, 26.7.1802, BM; Katmandu, *F.M. Bailey's collectors s.n.*, 13.7.1935, BM; Thapathali, Maternity Hospital, along the S. wall, dry, shaded soil, 4200 ft., *P.M. Khwaunju* 1260, in 1973, K], **Lalitpur**, **Bhaktapur** [Nala, Amaldol, 1650 m., *D.P. Joshi & K.R. Rajbhandari* 75/404, 9.3.1975, KATH], **Sindhupalchok** [on the way of Helumbu, Bahunpati, *G. Amatya* 2-6B-0173, 29.8.1977, TU Nat. Hist. Mus.], **Sindhuli** [Khurkot, 1200 m., *N.P. Manandhar* 12366, 22.11.1988, KATH], **Dolakha** [Tamba Kosi, Pikhuti (950 m.) - Singati (950 m.) - Suri Dhoban (1000 m.) - Totlabari (100 m.), 861275-862275, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8351051, 28.8.1983, BM, ditto *K.R. Rajbhandari* 9417, 28.8.1993, KATH].

E: **Udayapur** [Udayapur Distr., Beltar (180 m.) - Kattike (440 m.) - Darula (600 m.) - Baplung (490 m.) - Simule (170 m.), *M. Mikage, T. Kajita, F. Kiuchi, N. Kondo, P. Lacoul, M. Suzuki* & *T. Yonekura* 9558029, 24.10.1995, KATH], **Khotang** [Thotne Khola, 27° 17', 86° 42'. 1600 m., *J.F. Dobremez* 272, 27.6.1970, BM, KATH], **Bhojpur** [Bir Gaon (1600 m.) - Saju Khola (1400 m.) - Dingla (1000 m.), 873274-873273, in thicket, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725428, 1.7.1972, BM, *sub* "*L. flexuosum*" in error], **Sankhuwasabha** [Ribouk, Barun khola, Arun River, 12,600 ft., *E.W. Cronin*, with *H.M. Emery, H.* & *A. Foster* & *K. Brooks* F 032, 26.7.1973, KATH], **Sunsari**, **Morang** [Biratnagar, 73 m., *N. Thapa* M31/97, 22.12.1997, KATH], **Dhankuta**, **Ilam** [Soktim, E. Nepal, 1500 m., *D.P. Joshi* 155, 2.10.1971, KATH], **Taplejung**.

Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. and S. India; E. and S.E. Asia.

(S, C). A very common low to mid-altitude climbing species of semi-open banks of paths, roads or streams, and in light forest.

62. ***Lygodium microphyllum*** (Cav.) R.Br. (syn.: *Ophioglossum filiforme* Roxb.; misapplied name: "*Lygodium scandens*" *sensu auct. plur.*, *non* (L.) Sw.).

Pinnae small, with ± short, thin segments on delicate basal stalks, segment bases cordate, articulated with a swollen basal joint, breaking off when old and leaving the often slightly zig-zag persistent axes behind, segments short (varying from *c*. 2.5 to 5 cm. long, occasionally longer), with rounded or narrowly rounded to acute apices, unlobed apart from slightly widened basal auricles; fertile segments shorter and more obtuse, bearing short fertile spikes around the edges.

Nepal:

E: **Morang** [Char-Kose Jhadi, near Belbari town, nearly damp place, *N. Thapa* M26/97, 20.12.1997, KATH, det. CRFJ; [same locality] swampy, open area at edge of Sal-tree forest, beside irrigation and drainage canal, behind stone-graves on E. side of small road-bridge, *c*. 1 km. E. of Belbari, *c*. 5 km. E. of Itahari, 7 km. W. of Khanepokhari, E. of Koshi dam, N. of Biratnagar, on East-West Highway from Hetauda to Kakkarbhitta (76 km. W. of Kakkarbhitta, Mechi Bridge), in terai, *c*. 100 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.* 26509, 12.8.1998, H]. Misreported from Phulchowki Darrah, Lalitpur by Misra & Misra (2008) in error for normal *L. japonicum* (specimen redetermined by CRFJ).

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Assam; Darjeeling *terai* [rare]; Nepal. N.E. and S. India; Sri Lanka; Bangladesh; S.E. Asia; Australasia; Pacific Islands; Africa; the Americas. This subtropical species does not occur in Pakistan, at Chitral, as an anomaly set up by Gatacre and given to Hope (see below under *Doryopteris ludens*).

(M, Sc). A very rare and restricted (in Nepal) low altitude species of marshy areas

where not being drained, growing among bushes.

Nepalese threatened status: **CR**.

63. ***Lygodium salicifolium*** C.Presl (syn.: *L. andamanicum* R.D.Dixit, Bhandari & Mukhopadhyay, type in Burdhaman (Burdwan) Univ., W. Bengal, redet. 2013 from photograph sent to CRFJ).

Generally similar to *L. flexuosum*, but most segments [actually pinnulets], except basal segments on each pinnule, unlobed, but with characteristic slightly auriculate-cordate bases; segments articulate with a swollen abscision-point, and falling off older fronds to leave a skeleton of basal stalks. This species varies from having all unlobed segments to having the lowest ones on each pinnule obviously lobed or pinnate, with longish lobes, somewhat towards *L. flexuosum*, in which state it has been determined by Garrison at BM, K, MICH, US *etc.* as *L. flexuosum*.

Nepal:

C: **Kaski** [steep, N.-facing slope and small cliff in Raniban forest, *c.* ½ km. W.N.W. of the dam outlet of Phewa Tal, on S. side of E. end of Phewa Tal lake, to the east of and above Fish-tail Lodge Hotel, opposite Baidam, Damside, Pokhara, *C.R. Fraser-Jenkins* 30728, 17.9.2004, TAIF]. Two further specimens from Pokhara, 841281 [S.E. of Pokhara], shady place, 900 m., *D.P. Joshi*, *I. Bajracharya* & *R. Kayastha* 75/3673, 23.12.1975, KATH, and Sundare Danda, 834282, Sal forest, on shady and dry place, 825 m., *D.P. Joshi* & *M.M. Amatya* 0530, 18.12.1973, KATH, are probably nearer to *L. flexuosum* showing some intermediacy towards *L. salicifolium* with unlobed mid and upper pinnulets, but though having slightly swollen points of laminar attachment, the lower pinnulets on each pinnule are perhaps too lobed for *L. salicifolium*, though both were so identified by N. Thapa.

E: **Jhapa** [Bhadrapur, open forests, 500 ft., *R.L. Fleming* 1872, 2.1965, KATH, *sub* "*L. scandens* (*L. microphyllum*)" in error; Mechi Campus, Bhadrapur, Jhapa, bank of river, 90 m., *N. Thapa* & *K.P. Bhattarai* J39/97, 23.12.1997, KATH, det. for Thapa by CRFJ, 1997 (published by Thapa (2001))], **Ilam** [Ghorwa - Sanichare, Ilam, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata* & *M. Togashi* 6304984, 10.12.1963, KATH, *sub* "*L. flexuosum*" det. H. Itô in error].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Darjeeling *terai*; Nepal. N.E., C. and S. India; Bangladesh; S.E. Asia.

(M, Sc). A rare (in Nepal), species of lowland forests growing on dry banks in semi-open forest.

Nepalese threatened status: **VU**.

MARSILEACEAE

Marsilea (1 species).

64. ***Marsilea minuta*** L. (syn.: *Zaluzianskya minuta* (L.) Kuntze; *M. dentata* Roxb.; *M. crenulata* Desv.; *M. quadrifolia* Jacquem., *non* L.; *M. diffusa* Lepr. *ex* A.Braun; *M. brachypus* A.Braun; *M. brachycarpa* A.Braun; *M. condensata* A.Braun; *M. minuta* subsp. *brachycarpa* (A.Braun) Bhardwaja; *M. gracilenta* A.Braun; *M. sinensis* Hand.-Mazz.; *M. major* (Haines) N.P.Chowdhury; *M. minuta* var. *indica* Gupta; *M. kedarmalii* Bhardwaja, Gena & D'Souza; *M. maheshwarii* Gopal; *M. poonensis* Kolhatkar; misapplied names: "*M. quadrifolia*" *sensu* D.Don *et auct. Ind., non* L. [from Europe, not present in the Indian subcontinent]; "*M.crenata*" *sensu auct. Ind., non* C.Presl).

A semi-aquatic plant with a thin main stem thin, creeping and rooted at intervals in the ground or mud at the bottom of ponds, with tufts of vertical stalks at intervals bearing apical flat leaves, floating leaves 4-partite, large with four contiguous radial leaflets (similar to a "4-leaved clover", *Trifolium*) each with a basal angle of 90° and entire, curved outer edges, sometimes becoming crenate distally; plants and leaves much smaller and becoming fertile when growing on land, when the leaves are more obviously crenate at the edges; one to several separate, short (to *c.* 3 mm.), fertile pedicels arise individually in the axil of the leaf-petiole with the main stem, but not borne on the leaf-pedicel itself as in *M. quadrifolia*; pedicel apex attached along the basal edge of each nut-like sorocarp; sorocarps ovoid, smooth, with two erect, acute horns near the point of attachment of the pedicel, and bearing a few adpressed hairs. Sterile specimens without sorocarps cannot be identified and collections should always include some of the smaller fertile plants growing on land in addition to the large sterile plants in water.

Nepal:

W: **Kailali** [Geti, 15 miles N.E. of Dhangarhi, margin of large watering pond, 200 m., *D.H. Nicolson* 2798, 28.11.1966, KATH; Atarawa, Dhangadi, 380 m., *A.R. Sakya* & *D.P. Joshi* 350, 26.4.1971, CAL, "to be returned to the Dept. of Medicinal Plants, Kathmandu"]], **Surkhet** [south bank of Bulbule Lake, *c.* 1 km. on W. side of Birendranagar/Surkhet, *C.R. Fraser-Jenkins* 35324, 30.5.2014, KATH], **Banke**, **Salyan** [Marma khola, shallow pool, in about 1-3 inches of water, 3000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 723, 1.4.1952, BM; Sallyan Distr., Dandagaon to Sankamul, 900 m., *K.R. Rajbhandari* & *B. Roy* 4815, 18.8.1979, KATH].

C: **Baglung** [Baglung (960 m.) - Ratnechour (820 m.) - Beni (840 m.), 83° 34 -36', 28° 15-20', 795 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takahashi* & *K. Yonekura* 9687030, 9681015, 1.9.1996, KATH], **Lamjung** [Marsyangdi khola, Shimalchaur (800 m.) - Bhackok (850 m.) - Ampchaur (800 m.) - Bhotioder (650 m.), 843282-843281, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331459, 8350988, 12.8.1983, BM *sub* "*M. crenata*"], **Tanahun**, **Chitawan**, **Parsa** [N. facing old wall of a wet field behind a building

just E. of the Hotel Everest, off Beyarak Road, east part of Birganj city, *C.R. Fraser-Jenkins*, with *S.K. Singh*, 25784 (FN 1762), 4.11.1997, H], **Bara**, **Nuwakot**, **Kathmandu** [Champi to Pharping, Kathmandu, *M.M. Amatya* & *T.K. Bhattacharya* 73/90, 17.3.1973, KATH], **Lalitpur** [Nakhu river, Lalitpur, shallow water, *B.F.C. Sennitt* 7296a, 21.10.1972, KATH], **Dhanusha** [Janakpur, Dhanusha, *Shova D. Shrestha* NMHTU—6A-0026, 1.1978, TU Nat. Hist. Mus.].

E: **Siraha** [Marahania, Siraha, *c.* 50 m., *T. Nakaike* 3612, 3.11.1988, KATH, TNS], **Bhojpur**, **Morang** [Biratnagar, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *M. Togashi* & *T. Tuyama* 6305410, 14.10.1963, BM, CAL; Rangeli Bazaar, Morang, 80 m., *N. Thapa* MT45/97, 27.12.1997, KATH], **Jhapa** [East Nepal, Sibganja - Gauriganja, *H. Hara*, *H. Kanai*, *S. Kurosawa* & *T. Tuyama* 6305410, 14.10.1963, CAL].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. N.E., C. and S. India; Sri Lanka; Bangladesh; E. and S.E. Asia.

(M, C). A common aquatic plant at low to mid altitude, or growing in marshes, on river-banks and pond-margins where seasonally flooded.

SALVINIACEAE

Azolla (2 species, one adventive).

*65. ***Azolla filiculoides*** Lam. subsp. ***filiculoides*** (syn.: *A. rubra* R.Br.; *A. caroliniana* Willd., *A. microphylla* Kaulf.). *A. filiculoides* subsp. *cristata* (Kaulf.) Fraser-Jenk. (2012: 178-179), originally of S. and C. American origin and differing slightly in microcharacters, mainly concerning the number of cells in the microscopic leaf-hairs (two) and in reproductive glochidia (multicellular), occurs in Jammu & Kashmir (Ahad *et al.* 2007), as a recent adventive taxon since 1991. Most localities in Nepal need rechecking whether it is the very closely similar subsp. *filiculoides* or subsp. *cristata*. CRFJ's collections from Kathmandu valley have kindly been identified by Prof. C. Van Hove, Louvain, Belgium, as *A. filiculoides sensu stricto*, referring to subsp. *filiculoides*.

An attractive, very small, free-floating water-fern, forming extensive colonies covering the water-surface, individual plants very small (*c.* 1-1.5 cm.), consisting of a flat to uptilted, pseudo-radiately branched "frond" with rather rounded branch-apices, bearing many tiny green or red (in Winter) pouch-like floating leaflets (the branching is pinnate, but because the lower "pinnules" on each branch are much the longest the plant body appears to be radiately organised), each leaflet has a few microscopic, short 1-celled gland-hairs on the top-surface (in subsp. *filiculoides*), leaflets white beneath, with occasional unbranched white rhizoids hanging down *c.* 2-3 cm. in the water; sporocarp a small, yellowish ball of paired microsporangia and megasporangia borne here and there underneath older parts of the "frond", megasporangia with 3 inflated float-chambers and 1-celled glochidial hairs (in subsp. *filiculoides*) on the microspore containers (massulae). In a few places both species

grow mixed together (as at Calcutta Botanic Garden; also at Bhangeri, N.W. of Sankhu, Kathmandu District, *CRFJ* 28759 (FN 4734) and 28760 (FN 4735), 28.12.2000, H; ditto *CRFJ* 29374 (FN 5349), 2.10.2001, H, rather intermediate).

Nepal:

W: **Dang** [Daha, Dang, 650 m., *Keshav Shrestha* NHMTU-6B-00412, 16.3.2043 (Nepali date), TU Nat. Hist. Mus., very small, inadequate specimen, identity not certain].

C: **Gorkha** [Samri khola, 2000 ft., *P.C. Gardner* 140, 7.4.1953, BM], **Chitawan** [Bharatpur, Chitawn Distr., terestrial on paddy field, 183 m., *V.L. Gurung* 82/1701, 22.6.1982, KATH *sub* "*A. imbricata*", poor material; light forest and stream-gullies, *c.* 2 miles S. of Sauraha, across river, Chitwan National Park, Chitawan District, *C.R. Fraser-Jenkins* 33043 (FN 156), 27.12.2007, TAIF], **Makawanpur**, **Dhading** [flooded fields between Galche and Baireni, *c.* ?50 km. W. of Kathmandu on road to Mugling and Pokhara, Dhading District, *C.R. Fraser-Jenkins*, with *Nirmala Fraser-Jenkins* & *Sagun Pariyar* 29818 (FN 5793), 27.1.2002, H], **Kathmandu** [wild in a fountain in old Rana palace garden, at the back of Nepal Indozuez Bank, Durbar Marg, Kathmandu city, *C.R. Fraser-Jenkins* & *C.D. Fraser Jenkins* (father), 15878, 6.12.1989, E, det. Prof. C. Evrard & Prof. C. van Hove, Univ. Cathol. Louvain; pond in open fields, *c.* 1 km N. of Pashupatinath temple complex, on back track to Bouddha, N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins*, with *Raghu Raj Onta* 25053 (FN 1032), 20.11.1996, H; Sankhu, *c.* 1400 m., *T. Nakaike* 1043, 24.8.1986, KATH; pond at Sanagaon hamlet, Khatripakhar village, N. of and above Kulaltar and Indrayani, S.W. of Sankhu, *C.R. Fraser-Jenkins* & *Rajkumar Khatri Chhetri* 25401 (FN 1379), 23.5. 1997, H; Khatripakha village, Sankhu, in ponds, *c.* 1400 m., *N. Thapa* & *C.R. Fraser-Jenkins* K7/98, 1.2.1998, KATH, same excursion as *CRFJ* 25979 (FN 1957)], **Lalitpur** [Bajrabarahi, *c.* 1400 m., *T. Nakaike* 1716, 19.8.1986, KATH], **Bhaktapur** [Bhaktapur District, Bode (or Bore), edge of Manohara river, just below village of Bode, floating aquatic collects in large quantities in quiet inlets at river's edge, 1325 m, *H. van T.* & *I.S. Cotter* & *H.B. Napit* N10, 27.4.1985, KATH, E *sub* "*A. imbricata*" in error; forested, rocky stream-gulley, *c.* 1 km. S. of Sankhu on the N. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli village, in heaps on damp soil, by damp stream-flush, *c.* 1500 m., *C.R. Fraser-Jenkins*, with *R.* ["*Ganesh*"] *Pariyar et al.* 25298 (FN 1277), 15.2.1997, BM, H, det. Prof. C. van Hove, Louvain], **Sindhuli** [floating along banks of Bagmati River on E. side, belov Joardi village, opposite Raigaon, *c.* 7 km. N. of Bagmati Bridge (on main E-W highway) E.N.E. of Chandranigarpur, S.E. of Hetaula, Sindhuli District, *C.R. Fraser-Jenkins*, with *K. Neupane*, *C.B. Tamang*, *G.B. Tamang* & *S.B. Sunchure* 26008 (FN 1986), 12.2.1998, H). Adventive since at least 1971 in Kathmandu.

E: **Sunsari** [Barampur, near Dharan, 26° 43', 87° 16', 750 ft., *L.H.J. Williams* 53, 19.5.1969, BM; in open, flooded waste-ground among rice-fields beside main East-

West highway (on S. side), ½ km. west of Inaruwa, W. of Itahari on road from Itahari W. to Lahan and Kathmandu, Sunsari District, *C.R. Fraser-Jenkins* 28955 (FN 4930), 26.3.2001, H], **Jhapa** [Deonia river, Rangedanda, Jhapa, floating on the river water, 100 m., *N. Thapa, G.D. Bhatt* ["*Bhatta*"] & *S. Khatri* 2036, 24.1.2003, KATH], **Taplejung** [Tamrang khola, "Glen Coe", on flooded rice terraces, *K.H. Hyatt* (for *A.H. Norkett*) 7087, 12.11.1961, BM; Dhoban, Taplejung District, on wet cliffs near Tamur river bridge, 3000 ft., A.H. Norkett 9741, 31.6.1961, BM].

Himalayan distribution (adventive): China; Arunachal Pradesh; Assam; Darjeeling, Nepal. N.E. India (adventive); Europe; Australasia; N. and S. America.

(A, Sc; European and more widespread). A scattered, rather uncommon species, spreading at lower-mid to mid altitude, on ponds, in rice-fields, slow-flowing streams, sometimes in side-inlets of rivers, and surviving on damp mud in the dry season, or regrowing from spores after dying in Winter.

66. ***Azolla pinnata*** R.Br. subsp. ***asiatica*** R.M.K.Saunders & K.Fowler (syn. *A. imbricata* (Roxb.) Nakai). A native species, long known in Asia as *A. pinnata* var. *imbricata* (Roxb.) Bonap., but that name was not used as a subspecies by Saunders & Fowler (1992) in their definitive study of the species, dividing it into Australasian, Asian and African subspecies.

Generally similar to *A. filiculoides* but the branching pattern is more obviously pinnate; the lower "pinnules" on the "pinnae" are shorter and the subapical ones are the longest, branch-shape more obviously deltate and apically pointed; megasporangia with 9 inflated float-chambers as there are 6 additional lower ones, and long flexible glochidial hairs on the microspore containers (massulae).

Nepal:

W: **Kailali** [forested bank of lake, on S.W. side of Godhagodhi Lake, Sukhar, *c*. 40 km. E. of Attariya and Dangadhi, Kailali District, *C.R. Fraser-Jenkins* 34718 (FN 218), 24.10.2010, TAIF], **Surkhet** [south bank of Bulbule Lake, *c*. 1 km. on W. side of Birendranagar/Surkhet, beyond the bus-park on the way to the airport, on S. side of road, Surkhet District, *C.R. Fraser-Jenkins* 35329, 30.5.2014, KATH], **Salyan** [Marma khola, near river bed in patch of shallow muddy water, 3000 ft., *O. Polunin, W.R.Sykes* & *L.H.J. Williams* 1822, 31.3.1952, BM], **Dang** [Anrai, South East of Bijauri, floating aquatic in shallow water, 2000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3649, 25.2.1952, BM].

C: **Myagdi** [Mayangdi khola, shallow pools beside main river, 3300 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2546, 23.4.1954, CAL, badly eaten specimen], **Kaski** [Phewa Lake, Pokhara, 834282, by the side of Phewa lake, as well as on the rice field, floating on water, 900 m., *D.P. Joshi* & *M.M. Amatya* 73/1205, 15.12.1973, KATH], **Tanahun** [banks beside road, *c*. 4 km. E. of Damauli, 32 miles E. of Pokhara on road to Mugling and Kathmandu, Tanahun District, 390 m., *C.R. Fraser-Jenkins* 18144, 24.1.1991, E], **Lamjung** [Tarkughat, Lamjung Distr.,

on the paddy field, floating, 600 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/2633, 23.8.1974, KATH], **Dhading** [Trisuli [river, not Bazaar] (500 m.) - Guwabari khola (500 m.) [- Dharam Pani - Mokwanpur Garhi], *H. Kanai* & *M.S. Bista* 12049, 21.4.1969, KATH, mislabelled by staff as "Nuwakot District", poor material], **Kathmandu** [Katmandu, floating on shallow water, 4200 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6952, 21.8.1954, BM], **Dolakha** [Kirantichhap, Dolakha District, rice field, floating on water, 1350 m., *K.R. Rajbhandari* & *B. Roy* 2368, 21.81997, KATH].

E: **Bhojpur** [Bhojpur Distr., Tokyo - Kathmandu - Deurali Danda (2280 m.) - Dipla (1760 m.) - Pikhuwa khola (1130 m.) - Dawa (1620 m.) - Shera khola (1270 m.) - Bokhim (1550 m.) - Deurali (1630 m.), 27° 10' 19" - 27° 12' 59", 86° 56' 00" - 87° 02' 34", in rice field, 1240 m., *M. Mikage*, *T. Kajita*, *F. Kiuchi*, *N. Kondo*, *P. Lacoul*, *M. Suzuki* & *K. Yonekura* 9558248, 31.10.1995, KATH], **Sankhuwasabha** [Arun valley, Pangma near Khandbari, floating in the rice fields, 1200 m., *T. Wraber* 94, 27.8.1972, BM], **Dhankuta** [Rajarani, Dhankuta, floating on water, 1600 m., *N. Thapa*, *K.P. Bhattarai* & *T.P. Gautam* 14001, 14.12.1994, KATH], **Sunsari** [Chulachuli region, between Kosi and Kankai Mai, floating on paddy field, 900 ft., *T.B. Shrestha* & *T.K. Bhattacharya* 72.251, 29.9.1972, KATH], **Morang**, **Taplejung** [Tamur valley, Mewa khola, in irrigated field, 3500 ft., *J.D.A. Stainton* 1276, 7.8.1956, BM, KATH; Dhoban, Taplejung, on wet cliffs near Tamur river bridge, 3000 ft., *A.H. Norkett* 9741, 31.1.1961, BM; E. Nepal, Bir Gaon (1600 m.) - Saju khola (1400 m.), 873274-873273, floating on paddy field, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725422, 1.7.1972, KATH].

Himalayan distribution: China; Assam; Darjeeling; Nepal; Uttarakhand; ??Himachal Pradesh; Jammu & Kashmir; Pakistan. Throughout most of India; Sri Lanka; Bangladesh; E. and S.E. Asia *etc*.

(H, C). A common species of low to mid-altitude, on ponds, lakes, quiet inlets of rivers, damp mud in seasonally flooded places *etc*.

Salvinia (2 species, one adventive).

*67. ***Salvinia molesta*** D.S.Mitch. (misapplied name: "*S. auriculata*" *sensu auct. Asiat.*, *non* Aubl.; "*S. natans*" *sensu* Iwatsuki (1988), *non* (L.) All.). Adventive. Chandra (2000) reported it as endemic to India, though named and described from Africa.

A rather small (plants to *c.* 8 cm., floating leaves to 4 cm.), free-floating aquatic fern, forming extensive, impressive or alarmingly profuse colonies covering the water-surface, plants with a main axis bearing opposite pairs of bright-green ovate floating leaves folded in two halves and somewhat uplifted from the water-surface (except when small juvenile plants), becoming larger and near vertical when crowded, leaf surface bearing many tallish, pale-green to whiteish papillae, and atop each papilla a group of 4 minute white hairs, diverging from each other below, but rejoining at their apices, thus forming a characteristic egg-whisk shape, but

much easier to see in living material than in pressed and dried herbarium specimens, where one may have to search several plants and younger leaves for them; submerged "leaves" appear like pairs of roots divided into many brown rootlets hanging down in the water beneath the plant-axis to *c.* 10 cm.; bearing sorocarps at their bases which hang down in the water to *c.* 6 mm., like a stalk of grapes after the grapes have been eaten, with tiny, stalked rounded and hairy brown sporangia, most of which are empty and produce no spores, in keeping with the allopolyploid hybrid-derived nature of this species. It becomes a pest of waterways, dams *etc*. with a very rapid growth-rate, but plants die in the Winter, to grow again from deposited mega and microspores the following spring. Its hybrid origin remains a most interesting conundrum, even now not yet fully clarified by the supposedly tell-all modern miracle of moleculology.

Nepal:

W. Reported by Thapa (2012), but we have not seen material of any *Salvinia* species from W. Nepal and do not know the origin of this record, though we do not exclude it here pending further investigation.

C. Thapa (2002), said "presumably also C. Nepal", but though possible we have not seen any material or reports from central Nepal.

[E: Itô's (1966) and Iwatsuki's (1988) report of *S. natans* from S.E. Nepal was initially mistakenly thought by both Fraser-Jenkins and Thapa (2002) to be more likely to be *S. molesta* and was the origin of Thapa's report of *S. molesta* from E. Nepal, in error].

Regional distribution (adventive): Taiwan; throughout N.E., C. and S. India (inc. W. Bengal, Assam, Uttarakhand, Himachal Pradesh, Punjab); Nepal. Sri Lanka; S.E. Asia; Africa *etc.*

(A, African and more widespread, R), Very rare (in Nepal) at lower altitude on lakes.

[Nepalese threatened status: **CR**. But as it is adventive and invasive, this status has little meaning].

68. ***Salvinia natans*** (L.) All. (syn.: *S. verticillata* Roxb.). Often reported in India error for *S. molesta*, especially referring to small, juvenile plants of the latter. Due to the bicentric range, previously from Jammu and Kashmir, and Bengal, but not between, Panigrahi at first sank it, but later suggested that the eastern plant is a separate species, *S. verticillata*, though no morphological differences were observed or given. But they are clearly conspecific and its presence in Uttar Pradesh partly bridges the distribution gap.

This native species remains a smaller plant (floating leaves to *c.* 1.2 cm.) when full-grown than the large, crowded leaves of mature *S. molesta*, leaves rather rounded-rectangular, slightly darkish grey-green, ± flat on the surface, or slightly spreading upwards, not becoming near-vertical when crowded, the papillae on the

upper surface very, short each with an apical cluster of 4 small, short, free-apexed pale hairs; sorocarps crowded in small bunches (or sometimes single), spherical and much larger than in *S. molesta*, with the pale-yellow sporangia clearly visible within them.

Nepal:

E: **Morang** [East Nepal, Kathgara - Rangali [east of Biratnagar], *H. Kanai, G. Murata* & *M. Togashi* 6305412, 14.12.1963, KATH, BM, TI, conf. CRFJ].

Regional distribution: China; Myanmar; W. Bengal; Assam; Nepal; Uttar Pradesh [restricted, Gorakpur, *Dr. Buch*[*anan*] *Hamilton*, 25.3.1814, K; Ramgarh Lake, *c.* 3 km. S. of Gorakhpur, *CRFJ, S. Dominic Rajkumar, S.K. Singh* (indicated locality), *R.P. Gautam* & *S.K. Srivastava* 35215 (FN 89), 31.10.2013, TAIF]; Jammu & Kashmir; Pakistan; E. Afghanistan [Logartal, Kabul, *H.F. Neubauer* 3114, 24.5.1963, E]. Iran; Iraq; Syria; S. Europe; Russia *etc.* Misreported by Kumari & Srivastava (2008) from Jharkhand (along with some other obvious misidentifications) in error for *S. molesta*.

(E and/or M, R). A very rare (in Nepal) and restricted low altitude pecies of lakes and ponds.

Nepalese threatened status: **CR**. Known only from a single collection.

GLEICHENIACEAE

Dicranopteris (4 species).

69. ***Dicranopteris lanigera*** (D.Don) Fraser-Jenk., described by Don from Srinagar, Garhwal, Uttarakhand, where *Diplopterygium giganteum* does not occur. (syn.: *D. linearis* (Burm.f.) Underw. var. *wattii* R.D.Dixit & Panigrahi, this is merely large plants of *D. lanigera*, not *D. curranii* Copel. as tentatively surmised by Fraser-Jenkins (2008); *D. linearis* var. *hirta* S.Kaur & Punetha; misapplied names: "*D. linearis* var. *linearis*" *sensu auct. plur.* and Fraser-Jenkins (1997), Singh & Panigrahi (2005), *non* (Burm.f.) Underw.; "*D. linearis* (Burm.f.) Underw. var. *subferruginea*" *sensu* Panigrahi & Dixit (1969), *non* (Hieron. *ex* Brause) Nakai [from New Guinea and Australasia]).

This is the common Indo-Himalayan plant, underground rhizome long, thin and straight, with spaced out erect, stiff, smooth stipes and bush-like fronds (up to c. 1.5 m. tall) above with dichotomous branching near the frond-apices, but often alternate longer and short branches further down, and longer, narrower segments, glaucous beneath and well furnished beneath with partly deciduous rusty-brown hairs, usually with very short or no bracts at the apical buds, though they can sometimes become longer; usually without basal accessory branches at the ultimate forks, or narrow and irregular if present; sori round, exindusiate in a single line on each side of the segment-midrib. Several taxa within the genus *Dicranopteris* can be difficult to identify due to the variability of individual characters and often need

to be recognised from a combination of characters. However the genus has recently been almost entirely confused and various clearly understood names left unidentified or misplaced by Jin, Ding & Iwatsuki (2013) in the *Flora of China*. In their inadequate and misleading account of the genus, with almost no idea of the distribution of the species even within China, they not only failed to understand the basic revision by Holttum but were also unaware of the definitive new treatment of species for the Indian region and thus China by Fraser-Jenkins (1997, 2008). Nor was it required to be rewritten and revised editorially as it should have been prior to publication, and has thus obscured the careful work done previously on the genus.

Nepal:

W: **Doti** [below Jhigarana, on way to Khaptad, Doti District, 2150 m., *M.L. Pathak, D.R. Luitel* & *K.R. Bhattarai* 201269, 21.4.2012, KATH], **Dailekh** [Dairi, Dailekh, shady side of hill slope, 900 m., *N.P. Manandhar* 345-91, 25.2.1991, KATH], **Jajarkot** [Dumjala, among shrubs on open slopes, 7500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5667, 15.10.1952, BM].

C: **Arghakanchi** [Wangla, 1100 m., *N.P. Manandhar* & *P.M. Regmi* 136, 4.3.1976, KATH], **Baglung**, **Manang** [Paudi ko doban - Manang basin, 700-900 m., *D.P. Joshi* & *M.M. Amatya* 73/271, 5.7.1973, KATH], **Palpa** [below Tansing/Tansen, W. Nepal, 3500 ft., *R.L. Fleming* 945, 2.11.1949, BM, DD, MICH], **Syangja**, **Parbat** [Naudanda to Birethanti, 1600-1180 m., *V.L. Gurung* 1385/81, 19.7.1981, KATH], **Kaski** [Argam, near Pokhara, among shrubs, 2500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7190, 12.9.1954, BM; Pokhara, in light forests, 900 m., *T. Wraber* 162, 10.9.1969, BM], **Tanahun**, **Gorkha** [*c.* 1-1½ km. below and S.W. of Komale khola, on path down to Markichowk and the Marsyangdi reservoir and Dam, W. of Anbu Khaireni, woody slope and edge of path, *C.R. Fraser-Jenkins* 25097 (FN 1076), 30.12.1996, BM, H], **Makawanpur**, **Rasuwa** [Manigaon, on way to Ramche, 1230 m., *V.L. Gurung* & *party* 77/593, 29.9.1977, KATH], **Dhading**, **Nuwakot** [Kakani, 5500 ft., *V.L. Gurung, R. Kayastha & P.M. Regmi* 75, 10.5.1976, KATH], **Kathmandu** [Sundarijal, 6200 ft., *R.L. Fleming* 1366, 21.8.1957, KATH; Sundarijal, *B.D. Pandey* 602, 18.5.1958, DD], **Lalitpur** [Godawari, S.E. of Katmandu, 5500 to 6500 ft., clearings, brow of steep slopes, *K. de B. Codrington* 94, 95, in 1956, BM], **Bhaktapur**, **Kabhrepalanchok** [Bokse Community Forest, Panchkhal Village Development Committee, exposed area, *S.R. Baral* & *P. Kurmi* 1085, 21.7.2001, KATH], **Sindhupalchok** [Manichur to Patibhanjyang, open dry place, 7300-7010 ft., *V.L. Gurung* & *M. Gorkhali* 78/601, 21.10.1978, KATH], **Dolakha** [Bhorle, Dolakha, 1170 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121111, 8.11.2012, KATH], **Ramechap** [between Bhandar and Kenja, 2100-1700 m., *T. Nakaike* 3172, 7.10.1988, KATH, TNS].

E: **Okhaldhunga** [Rumjatar, 1400 m., *N.P. Manandhar* & *M.K. Adhikari* 1932, 29.5.1979, KATH], **Khotang** [Khani Danda (1380 m.) - Shera Khaile (1660 m.) - Diktel (1620 m.) - Miya khola (1050 m.) - Dorpa Churi Danda (1460 m.), 27° 10'

44" - 13' 16", 86° 46' 23" - 49' 53", *M. Mikage, T. Kajita, F. Kinchi, N. Kondo, P. Lacoul, M. Suzuki & K. Yonekura* 9558157, 29.10.1995, KATH], **Solukhumbhu** [Pikekhop, 1600 m., *C.M. Joshi* J-1586810, 25.7.1995, KATH], **Sankhuwasabha** [Chandanpur, Sankhuwasabha, 1100 m., *N. Thapa* S 18/96, 24.4.1996, KATH].

Himalayan distribution: China; ?Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. N.E. India.

(?M or ?H, C). A very common species at lower-mid to mid altitudes, forming thickets beside paths in semi-open forests and on road-banks.

70. ***Dicranopteris linearis*** (Burm.f.) Underw. (syn.: *D. linearis* var. *brevis* Manickam & Irud.; *D. linearis* var. *tenuis* Manickam & Irud.).

Fronds up to *c.* 1.5 m. tall, blades usually dichotomously branching or nearly so throughout, though this is variable, sparsely to almost non-hairy beneath except in younger fronds, prominent, elongated, simple, ± unlobed bracts present at the main suppressed stem-buds; usually without basal accessory branches at the ultimate forks, or small if present; ultimate segments relatively slightly wider and seldom as long as in *D. lanigera*, usually emarginate at their apex, rather uncommonly so in *D. lanigera*; sori in a single line on each side of the segment midrib. The Sino-Japanese species, *D. pedata* (Houtt.) Nakaike (syn.: *D. dichotoma* (Thunb.) Bernh.), is close to *D. linearis*, but as explained by Fraser-Jenkins (2008), is not the same, and differs in its often longer, more glaucous and more crowded segments. But Ding *et al.* (2013) demonstrated a lack of nomenclatural as well as taxonomic competence by synonymising the almost universally used name, *D. linearis* (and its "range of variable forms" - *i.e.* including several well known distinct species), dating, as a *Polypodium*, from 1768, within *D. pedata*, dating, as a *Polypodium*, from 1783.

Nepal:

C: **Palpa** [just S. of Parvas, 8 km. S. of Tansen, *c*. 18 miles N. of Butwal, on road to Syangja and Pokhara, S. of Pokhara, Palpa District, wooded slope with Quercus *etc*., *c*. 900 m., *C.R. Fraser-Jenkins* 18037, 20.1.1991, E], **Gorkha** [among semi-open rocks with scattered Sal-trees and on steep, grassy slope below long cliff leading up to the summit of Chuli Darrah (hill), up Komale Khola (right fork), above and S.W. of Deurali, *c*. 5km W.N.W. of Anbu Khaireni, across and to N.E. of Marsyangdi river dam, N.E. of and above Gopling and Markichowk, S. of Gorkha, Gorkha District, *c.* 900 m., *C.R. Fraser-Jenkins* 28406, 28407 (FN 4381, 4382), 22.1.2000, H and ditto, *C.R. Fraser-Jenkins*, with *Nirmala Fraser-Jenkins* 28549 (FN 4524), 21.5.2000, H].

E: **Sankhuwasabha** [Arun valley, Khandbari, on clearings, 1200 m., *T. Wraber* 64, 27.8.1972, BM; Gari, *c.* 3800 ft., *H.M. Emery, E.W. Cronin, H. & A. Foster & K. Brooks* F 1279 [?1271], 19.7.1974, BM], **Jhapa** [near Range Danda, Jal-Thal forest, *N. Thapa, G.D. Bhatt* ["*Bhatta*"] & *S. Khatri* 2011, 24.1.2003, KATH].

Himalayan distribution: China; ?Tibet; Myanmar; Assam; Bhutan; ?Sikkim; Darjeeling; Nepal. C. and S. India, Sri Lanka, S.E. Asia.

(M, Sc). Uncommon and very scattered at mid altitude in the Indo-Himalaya and absent from the western part, occurring in open, rocky places on banks. Becomes common in lowland N.E. India, and entirely replaces *D. lanigera* in C. and S. India.

Nepalese threatened status: **NT**.

71. ***Dicranopteris splendida*** (Hand.-Mazz.) Tagawa (syn.: *D. ampla* Ching; *D. linearis* (Burm.f.) Underw. var. *latiloba* Holttum; misapplied names: "*D. linearis* (Burm. f.) Underw. var. *montana*" *sensu* Singh & Panigrahi (2005), *non* Holttum [= *D. taiwanensis*]).

The most robust species, fronds up to *c.* 2.5 m. tall, markedly larger than *D. linearis* in all its parts, with longer and wider segments than the other species, especially in sterile branches, and the small sori scattered in more than two rows on each side of the segment midrib, at least near the segment base, though it is not usually difficult to find some exposed plants which may not have more than one line each side; many sporangia, or whole sori often drop off during drying. As explained by Fraser-Jenkins (2008), having at first used the name *D. splendida*, Ching then redescribed the species as *D. ampla* because the type of *D. splendida* only has a single line of sori each side of the segment-midrib, but while no doubt further investigation is called for, including near the type locality, "Djiou-djiang" (Qiujiang) in W. Yunnan (the single Chinese locality given in the *Flora*), field study in N.E. India, where the species is common, appears to suggest that this might be just individual variation due to environmental factors. A specimen showing multiple sori in more basal pinnae and a single line of sori each side, above, is from the Philippines, Dumaguete (Cuernos Mts.), Negros Oriental, *A.D.E. Elmer* 10351, 6.1908, BM.

Nepal:

E: **Ilam** [Ilam, Godhak, *G. Ghose* 12, 18.7.1914, K; top of open, tall roadside bank on S. side of road, just W. of Sundergaon, W. of Pashupatinagar on Ilam road, *C.R. Fraser-Jenkins* 29495 (FN 5470), 9.10.2001, H].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Darjeeling; Nepal. Thailand, Vietnam, Philippines.

(M, Sc to R). A rare and restricted (in Nepal) lower-mid to mid altitude species of shaded and luxuriantly vegetated road-banks and steep slopes in semi-open forest.

Nepalese threatened status: **VU**.

72. ***Dicranopteris taiwanensis*** Ching & P.S.Chiu (syn.: *D. linearis* (Burm.f.) Underw. var. *altissima* Holttum and *sensu* Bir *et al*. (1989); *D. linearis* (Burm.f.) Underw. var. *montana* Holttum; *D. linearis* var. *demota* Holttum; *D. linearis* var. *sebastineana* ["*sebastiana*"] Panigrahi & R.D.Dixit; *D. tetraphylla* (Rosenst.) C.M.Kuo; misapplied names: "*D. linearis* (Burm.f.) Underw. var. *demota*" *sensu* Panigrahi &

Dixit (1969), *non* Holttum [from S.E. Asia]); "*D. warburgii*" *sensu* H. Itô (1966), *non* (Christ) Nakai [from Indonesia]).

D. taiwanensis was reinstated as a clearly distinct species, rather than a variety, by Fraser-Jenkins (1997, 2008), with its various characters elucidated, and vars. *tetraphylla*, *montana* and *altissima* properly synonymised within it following detailed study of variation within it. But this was not known to Jin *et al.* (2013), who erroneously included var. *tetraphylla* within the entirely different "*D. pedata*" (including *D. linearis*). *D. taiwanensis* varies in the height and robustness of plants, and in segment-width, laminar thickness, branching of the veins and in height of the point of insertion of accessory branches at the ultimate forks, and two extremes, a thinner, smaller one with smaller segments, and a very robust, large, thick and often very tall one with larger segments can be found. But though three forms have been described as separate varieties (and species) by Holttum (1959) and others, field-study shows that they merge imperceptibly into each other in every character and appear to offer no basis for separation.

Although Khullar's (1994) description and illustration of var. *demota* Holttum in the W. Indo-Himalaya, refer to the present species, the actual specimen in PAN herbarium cited as having been drawn is *D. lanigera*, whereas the specimen (but not his description and illustration) cited as being drawn for var. *subferruginea* is *D. taiwanensis.* Pangtey, Fraser-Jenkins & Khullar (2015, in press) cite the following localities for specimens seen of *D. taiwanensis* in Pithoragarh District, Uttarakhand: "Rare, but locally fairly common around Didihat, from 1600-1800 m altitude; Banlekh", and for Almorah District: "Mailgao".

Fronds up to *c.* 6 m. tall, branches and blades glabrous, bright light green, with short, slightly wider segments than the other species; axes and undersurface of the lamina glaucous green and without hairs; a pair of shortish, deflexed, elliptical accessory branches at each ultimate fork in a X-shaped arrangement; the young curled fronds are naked and bright green with a white glaucous bloom.

Nepal:

C: **Parbat** [Paiyukot, 834283, 1700 m., *D.P. Joshi* & *M.M. Amatya* 74/1511, 10.3.1974, KATH], **Kaski** [Modi khola, up from Birethanthi, 4800 m., *G.* & *S. Miehe* B 7, 7.7.1977, BM; between and above Chisapani and Kalche villages, S.E. of Chorepatan in Phusre khola valley, *c.* 15 km. S. of Pokhara off Syangja road, forested stream khola facing N., *C.R. Fraser-Jenkins* 25679 (FN 1657), 19.10.1997, BM, H], **Dhading**, **Nuwakot**, **Kathmandu** [S.W. side of Jamachok mountain, shortly in from Gate no. 2 entrance to Nagarjun forest, *c*. 4 km. N.W. of Balaju, on road from Kathmandu (via Thamel) N.W. to Kakani, Ranipowa and Trisuli Bazaar, forested stream-gulleys, *C.R. Fraser-Jenkins* 24178 (FN 156), 25.7.1996, BM, H, and ditto *C.R. Fraser-Jenkins* & *Sagun Pariyar* 34965 (FN 243), 4.12.2011, TAIF; forested stream-gully above and E.N.E. of Bhangeri, above and N.E. of Gagal Phedim, N. of Sanagaon, N.W. of Sankhu, N.E. of Kathmandu, *C.R. Fraser-Jenkins*

28721 (FN 4696), 28.12.2000, H], **Dolakha** [Kalinchok, 2400 m., *K.R. Rajbhandari* 14087, 18.6.1978, KATH].

E: **Sankhuwasabha** [Papung (2000 m.) - Bir Gaon (1600 m.), 873274, along path on open slope, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725391, 30.6.1972, BM, KATH, *sub* "*D. linearis*"], **Dhankuta**, **Jhapa**, **Ilam**, **Panchtar** [Irkhun valley, below Phedi villagae, E. Nepal, 3500 ft., *N.D. Bachkheti* 15, 30.1.1959, DD], **Taplejung** [Milke Danda forest, upper forest, *c.* 9000 ft., *A.H. Norkett* ("Lumbe Hardur" [= tall Sir]) 8763, 14.1.1962, BM; E. Nepal, Garhi Danra - Linkin - Tuwa, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi & T. Tuyama* 6304990, 4.11.1963, KATH].

Himalayan distribution: China (across S. and S.W. China); Myanmar; Arunanchal Pradesh; Assam; Bhutan; Sikkim; Darjeeling; Nepal, Uttarakhand [rare]. S. India, Sri Lanka, Thailand, Taiwan, Vietnam, Malaya, Sumatra, Borneo, Philippines, New Guinea, Australia.

(M, Sc to C). Slightly scattered in Nepal in higher rainfall areas at mid altitude, growing on steep, semi-shaded forest slopes at the edge of the trees or clearings.

Hybrid: ***Dicranopteris*** x ***nepalensis*** Fraser-Jenk. (*D. lanigera* x *D. taiwanensis*).

Kaski [Raniban, *c.* 400-500 m. beyond Fishtail Lodge Hotel on path to Nature's Home restaurant at Anadu, on S. side of Phewa Tal lake, S. of Pokhara, *C.R. Fraser-Jenkins* 25450, 25451 (FN 1428, FN 1429), 17.8.1997, BM (holotype), K, E, H, KATH, (isotypes), with both parents].

Diplopterygium (1 species).

Diplopterygium is not a synonym of *Dicranopteris*, which was inadvertently written by Fraser-Jenkins (2008), for which he actually had *Hicriopteris sensu* Christensen in mind, as previously shown by Holttum (1957). Alternatively to the present treatment, the genus *Diplopterygium* may be included within *Gleichenia*, if it is considered to be of too minor distinction. The case for either genus appears to be almost equally valid and a matter of choice.

73. ***Diplopterygium giganteum*** (Wall. *ex* Hook. & Bauer) Nakai (syn.: *Gleichenia gigantea* Wall. *ex* Hook.; many synonymous species were described from China effectively at random by Ching; misapplied names: "*Gleichenia longissima*" and "*G. glauca*" *sensu* Panigrahi & Dixit (1968) *et auct. Ind., non* Blume and Thunb. [from Java and Japan respectively]; *D. glaucum* continued to be misreported from India by Jin *et al*. (2013) in the *Flora of China*, though long since corrected in India; "*Diplopterygium volubile*" *sensu* H. Itô (1966), Ghosh *et al.* (2004), *non* (Jungh.) Nakai [from Java]).

Rhizome long, straight, underground, as thick as a finger, bearing tall, smooth, hard stipes, as thick as a little finger, at intervals and thus forming tall, often impenetrable thickets. Fronds very large (to *c.* 2 m. tall), bifurcated apically and

bearing one to several vertically seried pairs of long, opposite, bipinnatifid to bipinnate pinnae arising beside a large, curled terminal bud or frond-apex with large, dissected, triangular bracts and the bud bearing diagnostic dark-brown triangular-lanceolate scales with paler fimbriate-ciliate margins, main pinnae opposite, very long (to *c.* 1.5 m.), bearing many crowded, narrow, deeply pinnatifid or pinnate pinnules and gradually decreasing in width to an attenuated apex; pinnules bearing many small, elliptical-ovate, entire ultimate lobes or segments and bearing brown hairs on the midrib beneath, lamina slightly pale-glaucous beneath, dark green above; each lobe bearing a line of exindusiate round, yellow to brown sori on each side of the midrib. Very small, juvenile plants have deltate, pinnate fronds as the apical bud is not suppressed.

Nepal:

C: **Parbat** [Ghandruk (1950 m.) - Ghandruk Deorali (2530 m.), 835283, *H. Ohba*, *H. Kanai*, *M. Wakabayashi*, *M. Suzuki* & *S. Akiyama* 8350210, 10.7.1983, BM], **Kaski**, **Lamjung** [Bhiyung, near Ghanpokhara, in forest, 5000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 5115, 28.4.1954, BM], **Nuwakot**, **Kathmandu** [collected in three localities by Wallich (1821), where it remains today: Chandaghiry; Thankote to Chandaghiry and Nag-Arjuhn, [*N.*] *Wallich* 157, in 1821, BM, K], **Lalitpur** [Nagarkot, 7000 ft., *F.M. Bailey's collectors s.n.*, 5.7.1935, BM; steep slope in light forest above road zig-zags, on W. side of Phulchowki mountain, above and E. of Godawari, S.E. of Kathmandu, Lalitpur District, *c.* 2000m., *C.R. Fraser-Jenkins*, with *G.* [*R.*] *Pariyar* & *J.B. Pariyar* 24053 (FN 31), 30.6.1996, BM, H], **Sindhupalchok** [scrub, N. of Gulu Bhanjyang, 27° 55', 85° 30', secondary vegetation amidst pasture lands and forest remnants, 2300-2500 m., *J.H. de Haas* 2840-A, 20.9.1974, BM], **Dolakha**. Thapa (2002) stated that this species is abundant throughout W. to E. Nepal, but we have seen no other reports and no specimens from W. Nepal in any herbarium and this is presumed to be an error.

E: **Sankhuwasabha** [Bhotebas - Ahale, 1800 m., *P.R. Shakya* & *M. Ohsawa* 840, 4.9.1971, KATH; E. Nepal, Moray [Mure], *c.* 7000 ft., *L.W. Beer* 12353, 3.12.1971, BM], **Dhankuta** [forested N.W.-facing slope just below top of ridge (on Dhankuta District side, to W.) and narrow, rocky stream-gully at bottom of slope, c. 1km (by zig-zag road) W. of and above Basantapur [in Terathum District, to E. of ridge], N. of Hile and Dhankuta, on road to Terathum and Sankhuwasabha District, Dhankuta District, *c.* 1900 m., *C.R. Fraser-Jenkins* 28793 (FN 4768), 23.3.2001, H], **Tehrathum** [Bilbatay Bhanjyang, 2200 m., *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305008, 25.10.1963, BM], **Ilam**, **Panchtar** [near Chyangthaphu - Chyangthaphu - Birwa, *H. Kanai*, *G. Murata* & *M. Togashi* 6310032, 27.11.1963, BM], **Taplejung** [Tamrang Khola, open bank near large rock, 6500 ft., *A.H. Norkett* 7272, 21.11.1961, BM].

Himalayan distribution: China, Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India.

(S, C). This showy and unmissable species occurs at upper-mid altitudes and forms large stands and impenetrable thickets in semi-open damp, often coniferous forest conditions, lining road-banks or on steep hill-slopes.

DIPTERIDACEAE

Dipteris (1 species).

74. ***Dipteris wallichii*** (R.Br.) T.Moore (misapplied name: "*D. conjugata*" *sensu auct. Ind.*, *non* Reinw.).

Rhizome long-creeping, subterranean, stipes far apart, thick hard, smooth and very tall (up to 2 m.); frond up to 1 m. across, consisting of a pair of very large, half-joined, umbrella-like blades, each with several long narrow distal lobes, veins reticulate; sori round, exindusiate, yellow, scattered on the lower surface.

Nepal:

E: **Sankhuwasabha** [very rare, above Bhotibas, Arun Valley, *c*. 6000 ft., *H. Emery*, *E.W. Cronin, H. & A. Foster & K. Brooks* F1213, 20 June 1974, BM, det. CRFJ (reported by Fraser-Jenkins 2002, 2010)].

Himalayan distribution: Tibet; Arunachal Pradesh; Bhutan; Darjeeling ("Sikkim", *J.D. Hooker*, BM; British Bhutan [Kalimpong], *J.L. Lister*, BM) [rare]; Nepal. N.E. India; Bangladesh.

(M, R(A)). An extremely rare species (in Nepal), known only from one collection. In N.E. India it occurs at mid altitude, usually among secondary vegetation in disturbed habitats such as road-banks.

Nepalese threatened status: **CR**.

HYMENOPHYLLACEAE

Hymenophyllum (4 species).

The erstwhile minor splinter-genera of *Hymenophyllum* are now no longer being utilised at that rank internationally, and it is fortunately no longer necessary to explain briefly why they were neither used in Fraser-Jenkins' previous work, nor here.

75. ***Hymenophyllum badium*** Hook. & Grev. (syn.: *Mecodium badium* (Hook. & Grev.) Copel.; *H. crispatum* Wall. *ex* Hook. & Grev.; misapplied name: "*H. javanicum*" *sensu auct. Ind.*, inc. Hameed *et al.* (2003), *non* Spreng.; "*H. australe*" *auct., non* Willd. *H. badium* replaces the similar species, *H. javanicum*, in most of northern India despite many reports of the latter due to confusion with the more lobed and convoluted-winged "*crispatum*" form of *H. badium*. But more dissect (lobed) plants in the further N.E. in Meghalaya and Manipur, probably belong to *H. javanicum*, even though they mostly have large circular involucres more like *H. badium*. Both species also occur in Sri Lanka, South India and Myanmar, while only *H. badium* occurs in China, with both present in Taiwan).

A small to medium-sized filmy fern (to *c.* 20 cm. tall). Basal stem without hairs, stipe and rachis obviously winged, without hairs, wing varying with all stages from entire to highly lobed and contorted (the form "*H. crispatum*"); fronds deeply bipinnatifid to tripinnatifid, with narrowish, deeply pinnatifidly lobed pinna-lobes, the ultimate lobes being somewhat wide, rounded and the veinlet terminating shortly within the apical margin; the frond persistently curling downwards when drying; sori large, stalked with a winged stalk, markedly widely rounded to laterally oval, bivalved, with a pair of entire to undulate involucres. *H. javanicum* has a wider frond, very crisped, but narrower stipe and rachis wing, a quadripinnatifid lamina with more compound, wider, overlapping pinnae, with markedly narrower, more exserted lobes, and smaller, more elongated sori; the involucres are irregularly toothed at their narrower apices.

Nepal:

C: **Parbat** [above Ulleri, on wet rocks, 6000 ft., *Dr. R.L. Fleming* 907, 20.12.[1949], KATH, DD, *sub* "*H. radicans*" in error], **Kaski** [Banjan (2035 m.) - Mt. Panchase (2050 m.), 28° 13', 03" - 15' 12", 83° 49' 56" - 47' 54", hung in a rock, 2060 m., *M. Mikage, M. Yoshimitsu, A. Kaneda, C. Mouri, S. Tasukawa, Y. Yasada* & *M. Senoo* 9961208, 10.8.1999, KATH], **Makawanpur**, **Rasuwa** [between Bokajhunda and Dhunche, east side of Trisuli river, on rock in deep shade by rushing stream, 1900 m., *D.H. Nicolson* 2390, 16.9.1966, KATH], **Kathmandu** [Bagdwar, [Shivapuri Hill], on mossy tree trunk, 8500 ft., *T.B. Shrestha, P. Pradhan, V.L. Shrestha* [later *Gurung*] & *M. Bista* 11508, 20.3.1969, KATH], **Lalitpur**. Thapa (2002) listed this species as quite common from W. to E. Nepal, but we have not seen any other W. Nepalese reports, nor any specimens in herbaria (though, like Thapa, we could not so far include all of KYO in our study), so exclude W. Nepal here, though *H. badium* occurs in Uttarakhand as a rarity, reported under the name "*H. javanicum*" in error (see Khullar 1994).

E: **Solukhumbhu**, **Dhankuta**, **Ilam** [Khumbutar, Palamtar, on damp bank, 6500 ft., *R.L. Fleming* 2585, 1.10.1978, KATH, *sub* "*H. australe*" in error], **Taplejung** [forest above Lukuwa, [Milke Danda], beneath rock on edge of forest, 7750 ft., *A.H. Norkett* 7742, 28.11.1961, BM; Mewa Gorge, wet rocks, 6800-7800 ft., *R.L. Fleming* 2071, 9.12.1971, K, *sub* "*H. australe*" in error; Shewaden (2600 m.) - Mewa Khola (2100 m.), 873274, on moist, muddy cliff in deep shade, *c.* 2400 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725325, 29.6.1972, BM, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]. S. India; Taiwan; Thailand; Vietnam *etc*.

(S, C). This is a fairly common species of mid to higher altitude growing as a lithophyte or epiphyte, often in gullies in dense, dark and very moist forest.

[***Hymenophyllum barbatum*** (Bosch) Baker (syn.: *H. flaccidum* Bosch; *Meringium flaccidum* (Bosch) N.C.Nair; *H. khasianum* Baker; misapplied name: "*H. denticulatum*" *sensu* Beddome, Clarke (1880), *p.p., non* Sw.).

A small species, basal stem without hairs, the frond often becoming rather narrow and elongated, stipe and rachis winged and bearing long hairs beneath and short hairs at the margins; pinnae rather narrow, pinnatifidly lobed, lobes prominently toothed all round; involucres toothed.

It was listed in his Nepal paper by Iwatsuki (1988) and thence as if definite by Ghosh *et al.* (2004). But Iwatsuki mentioned it as not having been seen, but "highly probable that it occurs in Nepal", rather than recording it. It is excluded here as there are no specimens in any herbarium known to us and it appears never to have been collected there.

Himalayan distribution: China; Tibet; Myanmar, Arunachal Pradesh, Bhutan, Darjeeling. Meghalaya; Mizoram]. Indian threatened status: **EN**. Globally threatened.]

[***Hymenophyllum denticulatum*** Sw. (syn.: *Meringium denticulatum* (Sw.) Copel.; *H. neesii* (Blume) Hook.; misapplied name: "*H. tunbridgense*" *sensu auct. Ind.*, *non* (L.) Sm. [from Europe and Macaronesia]).

Basal stem without hairs, frond short, wide, rarely elongated ("var. *flaccidum* (Bosch) C.B.Clarke), upper stipe winged, some short hairs beneath rachis, lobes narrower than in *H. barbatum*, toothed with long, narrow, more erect teeth; involucres short-toothed, receptacle exserted.

This further E. Himalayan species, which has long been confused with *H. barbatum*, was reported from Pindari Glacier, Uttarakhand, 12,000 ft., *R. Strachey* & *J.E. Winterbottom*, CAL, by Kholia (2013), with a note by CRFJ not accepting it. Had it occurred there it would suggest that it should also occur in Nepal. But not only has it not been found in Nepal or anywhere near it, but also the high Himalayan altitude of the Pindari Glacier is obviously far too high for this species. There is no possibility for it to have come from there, and the tag-label being disconnected from the plant does not preclude its being one of the many old 19th Century transposed localities, either confused in Calcutta, or often in Kew before sending there, in this case, transposed onto the sheet for *Trichomanes latealatum*, see under that species.

Himalayan distribution: China; Myanmar; Arunachal Pradesh. Nagaland; Manipur; Meghalaya *etc.*. Sri Lanka; S. India; S.E. Asia]. A lower-mid to mid altitude species.]

[***Hymenophyllum edentulum*** (Bosch) C.Chr. (syn.: *Meringium edentulum* (Bosch) Copel.).

Bosch based this species on strongly toothed material from Sarawak, but erroneously included a collection by W. Griffith from "Assam" (Meghalaya), mentioning it as being more weakly toothed than the plant of his description. Griffith's collection at

Kew is a poor specimen of *H. denticulatum*, but this cannot be the lectotype of the species as it was mentioned as having atypical features. All reports of *H. edentulum* from the Indian subcontinent (Dixit 1984, copied by Chandra 2000 and Ghosh *et al.* 2004, the latter even listing it from the W. Himalaya) and determinations of it from Nepal are erroneous.]

76. ***Hymenophyllum exsertum*** Wall. *ex* Hook. (syn.: *Mecodium exsertum* (Wall. *ex* Hook.) Copel.; misapplied name: "*Mecodium tenellum* (D.Don) Sarn.Singh & Panigrahi" *sensu* Singh & Panigrahi (2005), *non* (D.Don) Parris [= *H. tenellum*]).

Basal stem without hairs; frond very long and linear when full grown, many characteristically long hairs on rachis and axes below, pinnae narrower than other species, slightly decurrent at their bases, with the short lobes rather deeply joined at their bases, margins untoothed apart from the acute apices of the pinna-lobes; sori bivalved, involucres toothed.

Nepal:

W: **Doti** [Tal Dugun - Dugun, Doti, 2200 m., *D.P. Joshi* & *T.B. Shrestha* 444, 15.8.1972, KATH].

C: **Parbat** [Ulleri, Kusma Distr., on wet rocks, 6000 ft., *R.L. Fleming* 907, 20.12.1949, BM], **Kaski** [Banjan (2035 m.) - Mt. Panchase (2500 m.), 28° 13' 03' '- 15° 12', 83° 49' 56'' - 47° 54', 2085 m., *M. Mikage, M. Yoshimitsu, A. Kaneda, C. Mouri, S. Tatsukawa, Y. Asada* & *M. Senoo* 9961207, 10.8.1999, KATH], **Makawanpur** [Simbhanjyang, 48 mi. S.W. of Kathmandu, Makawanpur, on shaded rock, 8100 ft. *Dr. R.L. Fleming* 1411, 7.9.1957, KATH], **Dhading**, **Rasuwa** [Gosainkund, Malemci, 28° 6', 35° 32', Tsuga forest, on rocks, *J.D.A. Stainton* 3791, 30.6.1962, BM], **Kathmandu** [Sheoporee Range, Nepal, [*J.E. Winterbottom*] *s.n.*, 2.1848, K; Bagdwar, Sheopuri, on rock in shady humid place, 2500 m., *H. Kanai* 670513, 30.12.1969, KATH], **Lalitpur**, **Sindhupalchok** [on way to Kalinchowk, 9000 ft., *S.B. Malla* & *S.B. Rajbhandari* 380, 11.10.1960 (26.6.2017), KATH; Helumbu, under large rock, 7500-12,000 ft., *R.L. Fleming* 1786, 18-23.7.1964, MICH], **Kabhrepalanchok** [Sangasoti [Sangswati] Danda, Chaubas onward, on moist rocks among mosses, 6000 ft., *Dr.* [*M.L.*] *Banerjee*, [*T.B.*] *Shrestha* & [*A.V.*] *Uphadyay* 2658, 11.9.1964, KATH], **Dolakha** [Jiri, Dolakha, *T. Nakaike* 3072, 4.10.1988, KATH], **Ramechap** [between Shivalaya and Bhandar, 1800-2500 m., *T. Nakaike* 3099, 6.10.1988, KATH].

E: **Solokhumbu** [Puiyan à Kharte, *A. Zimmermann* 1895a, 28.10.1954, BM], **Sankhuwasabha** [Bakung above Sekidim, Sankhuwasabha, mixed broad-leaved forest, very moist, 2800 m., *C. Grey-Wilson*, with *R. Henderson, K.R. Rajbhandari* ["*Bhandary*"], *B. Rosedale* & *N. Taylor* 4062, 17.8.1981, K], **Dhankuta**, **Tehrathum** [Dor - Tute, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725493, 7.7.1972, BM; Chitre (2400 m.) - Basantapur (Bilbatay Bhanjyang) (2300 m.), 872271 - 872272, on mossy tree trunk in dense forest, *H. Kanai, H. Ohashi, K.*

Iwatsuki, H. Ohba, Z. Iwatsuki & *P.R. Shakya* 725128, 6.6.1972, BM], **Ilam** [Mai Pokhari, Ilam, 2123 m., *S. Itoh, A. Takano, T. Nakane, D.R. Kandel* & *P.M. Yadav* 214, 17.8.2014, KATH], **Panchtar**, **Taplejung** [Sanghu, [27° 21, 87° 31], under rock on path to Secondary wood, *A.H. Norkett* 5977, 12.10.1961, BM; Mewa Gorge, on rocks, 6700 ft., *R.L. Fleming* 2067 *p.p.*, 6.12.1971, K, with *H. badium*; between Mamankhe and Kunjuri, 27° 25', 87° 52', on tree trunks in damp forests, 1700 m., *C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, S. Crawford, S. Zmartzty* & *M.N. Subedi* KEKE 1123, 1125, 30.9.1989, E, K, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. S. India, N.E. India, replaced in Sri Lanka by the closely related species, *H. gardneri* Bosch. N.E. India; S.E. Asia.

(S, C). A very common species of upper mid to higher altitude, hanging from mossy rocks, or in deep moss as a branch, or trunk epiphyte.

[***Hymenophyllum levingei*** C.B.Clarke (syn.: *Mecodium levingei* (C.B.Clarke) Copel.).

Basal stem or runner without hairs, fronds small (to *c.* 6 cm. long), stipe bearing small hairs,, unwinged, lamina narrowly lanceolate with a narrowly acute apex and narrow, crowded, pinnae, bearing crowded and toothed lobes and many longish hairs on the lamina and veins on both surfaces and narrow scales on the costae beneath; sori small, apical on the pinna or lobe, involucres rounded, subentire.

Nepal:

E: ??**Taplejung** [Nepal was reported by Ching & Wu (1983) but probably as a guess, and thence mentioned by Iwatsuki (1988), but without having seen any collections. Similarly reported as a rarity from E. Nepal by Thapa (2002) and also cited in the *Flora of China* from these sources]. We have not seen any specimens in any of the herbaria we have visited. But like *Dryopteris sikkimensis*, known from just over the E. Nepal border, it should probably be expected to find this species somewhere in at least Taplejung District.

Himalayan distribution: China (but not in Yunnan and Szechuan as surmised by Ghosh *et al.* (2004), nor at 1500 m., as they guessed); Tibet; Bhutan; Sikkim; ?Nepal.

(S(T), Sc to R). A very rare and restricted, high-altitude to high Himalayan species growing in rather open places on deeply mossy rocks or sometimes among moss on trees.

If present in Nepal it would presumably have the threatened status: **CR**. Globally threatened.]

[***Hymenophyllum oligosorum*** Makino was reported *sub Mecodium* in a *sens. lat.* by Nakaike in Nakaike & Gurung (1988) from Sankhu and Bajrayogini, Kathmandu Valley (specimens *TN* 1041, 2191, 2210 in TNS, KATH!), in error for smaller, shorter plants of *H. tenellum*. It was thence reported by Thapa (2002), with a comment

by CRFJ that it was doubtful, but was not corrected until now. *H. oligosorum* differs in having hairy axes, more deeply dissect pinnae and apical sorion stalks without lamina; it is a Sino-Japanese species occurring in E. China, Taiwan, Korea and Japan and does not occur in the Himalayan region.]

77. ***Hymenophyllum simonsianum*** Hook. (syn.: *Didymoglossum simonsianum* (Hook.) Bosch).

Basal stem without hairs; stipe unwinged, rachis not hairy, lamina ± narrowly lanceolate sometimes becoming very long and narrow (*c.* 6-20 cm.); pinnae short, lobes short, makedly wider and more joined together than other species and toothed throughout including at their rounded, sometimes emarginate apices; sori bivalved, involucres toothed.

Nepal:

E: **Sankhuwasabha** [Lamo Pokhari, 873272, on moist cliff in dense forest, 2900 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725171, 9.6.1972, BM, KATH; Bharate Himal, Barun valley, between Ne and Yangle pastures, wet shady rocks, 3700 m., *T. Wraber* 327, 1.10.1972, K; Maghang Kharka, Sankhuwasabha, on tree trunks and mossy rocks, 2600 m., *P.R. Shakya* 9342, 3.4.1989, KATH], **Panchtar** [Bhuspate Danra, 2600 m., *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 2.12.1963, KATH], **Taplejung** [Mewa khola, by path from Dongen to Dobhan, *c.* 4000 ft., *A.H. Norkett* 9137, 28.1.1962, BM; Mewa Gorge, wet rocks, 6300 ft., *R.L. Fleming* 2069, 7.12.1971, MICH; slopes, Dobala Danda, above Yamphudin, 27° 27', 87° 56', rock in wet shaded forest, 2350 m., *C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, S. Crawford, S. Zmartzty* & *M.N. Subedi* KEKE 1065, 28.9.1989, E, K, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. Manipur, N.E. India.

(S, R). A rather rare, higher altitude species growing in deep shade on mossy rocks by streams in the forest, or occasionally on tree-trunks.

Nepalese threatened status: **NT**.

78. ***Hymenophyllum tenellum*** D.Don (syn.: *Mecodium tenellum* Parris (in Parris & Latiff 1997), *nom. nov. inval.* (*sin.* basionym ref.) *et superfl.* since "*H. tenellum* (Jacq.) Bory *ex* Willd." does not exist (see Fraser-Jenkins & Benniamin 2010); *Mecodium tenellum* (D.Don) Panigrahi & Singh; *H. microsorum* Bosch; *H. sphaerocarpum* Bosch; *H. himalaianum* Bosch; *H. osmundoides* Bosch; misapplied name: "*H. polyanthos*" *sensu auct. Ind. et* Ebihara *et al.* (2006), *non* Sw. [from C. and S. America, with longer, narrower and straighter ultimate lobes]; "*H. blumeanum*" *sensu auct. Ind.*, *non* Spreng. [from S.E. Asia]. On studying the very small type specimen of *H. tenellum* (BM) in detail, Fraser-Jenkins (1997, 2008) has confirmed

Iwatsuki's (1985, 1988) placement of it as the present species and not *H. exsertum*, as thought by Morton (1973) and repeated by Singh & Panigrahi (2005), who thereby made an outdated and misapplied new combination in *Mecodium* intended misleadingly to replace *H. exsertum*. Fraser-Jenkins (2008) confirmed the separation of the Asian plant from the American *H. polyanthos*).

Basal stem without hairs, fronds widely ovate-lanceolate, but often becoming narrowly elongated, tripinnatifidly lobed; stipe unwinged, rachis either without hairs or sometimes bearing one or two very thin, distant hairs beneath (but not as in *H. exsertum*), lobes entire, much divided, convoluted and crowded, apices often emarginately notched; sori rounded, bivalved; involucres entire. The very elongated and less lobed material from Sri Lanka identified by Sledge (1968) and others as "*H. polyanthos*" may perhaps be a distinct taxon from elongated forms of Himalayan *H. tenellum* and probably corresponds with *H. blumeanum*, described from Java.

Nepal:

C: **Baglung** [Bhurungdi khola, moist forest, 7500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5361, 5361a, 21.5.1954, BM], **Myagdi** [Jalja La (3330 m.) - upper valley of Gujaghat khola (-3275 m.) - Jalja La (3330 m.) - Maraini (2520 m.), 83° 13'-15', 28° 30', on tree trunk, 2910 m., *M. Mikage*, *R. Hirano*, *A. Takahashi* & *K. Yonekura* 9682691, 16.9.1996, KATH], **Syangja**, **Parbat** [Banthanti - Ghorepani Lekh, epiphytic on mossy tree trunk, 2400-2830 m., *V.L.* Gurung 2226 b, 22.7.1981, KATH], **Kaski** [E. of Sikles, nr. headwaters of Gnach river, Easting 227918, Northing 3141535, on Rhododendron barbatum in mixed broadleaved evergreen-broad-leaved deciduous forest, 3100 m., *Dorothy Allard* 999, 19.7.1996, BM], **Dhading** [Ganesh Himal, Ankhu Khola, 28° 12', 85° 05', in Tsuga forest, 9000 ft., *J.D.A. Stainton* 3652, 1.5.1962, BM, KATH], **Bara**, **Makawanpur** [Simbhanjhyang near Daman on Hetauda to Kathmandu road, dense mat on vertical, moist, shady rock faces, frequent, 27° 35' 38'', 85° 5' 5'', 2420 m., *C.A. Pendry*, *K.K. Shrestha*, *S. Dahal*, *A. Giri*, *A.G. Miller*, *N. Pandey*, *M.R.Pullan*, *L.R. Shakya*, *S. Shrestha* & *M. Siwakoti* DNEP2 A239, 30.11.2004, KATH], **Nuwakot** [N.W. of Salme, Silangu valley, 28° 03', 85° 07', dark cliff, wet, 2000 m., *J.H. de Haas* 2552, 25.8.1974, BM], **Rasuwa** [Thare, 28° 04', 85° 15', 1800 m., *J.F. Dobremez* 1137, 13.9.1971, KATH], **Kathmandu**, **Lalitpur** [Bajrajogini, *T. Nakaike* 2191, 2210, 2.10.1986, KATH *sub* "*Mecodium oligosorum*" in error; forested stream-gully at Mahadev Khola, behind and above Sanagaon, below Khatripahar village, W. of Vajrayogini temple, N.W. of Sankhu, *C.R. Fraser-Jenkins*, with *K.L.M.* & *A.M. Davies* [sister] and *Rajkumar* & *Sundar K.C.* [of Khatripahar] 24952 (FN 930), 8.11.1996, H], **Bhaktapur** [forested rocky stream-gully, *c.* 1 km. S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, *c.* 1500 m., *C.R. Fraser-Jenkins* 25225, 25226 (FN 1204, 1205), 15.2.1997, H, BM], **Kabhrepalanchok**, **Sindhupalchok [**Helumbu gorge, Lakhung Gompa, on trees, *R.L. Fleming* 1769, 18-23 (20).7.1964, DD], **Dolakha**

[Beding to Demdem, Dolakha, undersurface of mossy rock in deep shade, 3500 m., *K.R. Rajbhandari* & *B. Roy* 1961, 28.7.1977, KATH], **Ramechap**. Thapa (2002) reported this species as common throughout W. to E. Nepal, presumably by extrapolation, but though to be expected, we have not come across any other reports or any specimens of it from W. Nepal in any herbaria, so have deleted W. Nepal until it turns up there.

E: **Okhaldhunga** [Khare khola, Phedi Kharka (2100 m.) - Koplang (2100 m.) - Khanigaon (1700 m.), 862275, *H. Ohba M. Wakabayashi*, *M. Suzuki* & *S. Akiyama* 8351506, 14.9.1983, BM], **Solukhumbhu** [Kenja to Goem, Solukhumbu, *T. Nakaike* 3227, 8.8.1988, KATH], **Sankhuwasabha** [forest above Seduwa, on rocks in shade, 7500 ft., *Dr. M.L. Banerjee, A.V. Uphadyaya* & *B.B. Baskola* 3361, 4.5.1965, KATH; above Bungim, 6000 ft., *P.R. Shakya* & *M. Ohsawa* 869, 11.9.1971, KATH], **Tehrathum** [Tinjure forest, 9000 ft., *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Upadhyaya* & [*B.B.*] *Baskola* 3545, 1.6.1965, KATH], **Jhapa**, **Ilam** [Chhintapu, 2800 m., *D.P. Joshi* 111, 29.9.1971, KATH], **Taplejung** [Nangki, E Nepal, 10,000 ft., *J.D. Hooker s.n.*, in 1848-9, K; Tamur valley, Mewa khola, Topke Gola, in forest, on rocks, 11,000 ft., *J.D.A. Stainton* 1697, 16.9.1956, BM; Ghunsa, Taplejung, moss covered rock, 3400 m., *Damant* 141, 29.9.1985, K].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. N.E., C. and S. India; Sri Lanka; S.E. Asia.

(S, C). An abundantly common and widespread upper-mid altitude to high Himalayan species, frquently as an epiphyte in moss on branches and tree-trunks, also abundant on mossy rocks, both in the open and in dense forest.

Trichomanes (8 species).

Morton's and Copeland's separation of microgenera belonging to *Trichomanes*, while those formerly belonging to *Hymenophyllum* should be accepted as one genus, is hardly logically consistent and is not dictated by either morphology or molecular cladonomic studies, but more by the history of work done on the genus by Iwatsuki and colleagues in Japan, retained by Ebihara *et al.* (2006), but overdue for revision. It is considered here to be a single genus, molecularly also constituting one of the two major clades within the family, the other being *Hymenophyllum*. It seems that the long-established existence of subordinate ranks such as subgenus or section and their appropriateness for the reshaped erstwhile microgenera within *Trichomanes* that are monophyletic is being overlooked.

79. ***Trichomanes auriculatum*** Blume (syn.: *Vandenboschia auriculata* (Blume) Copel.; *Crepidomanes auriculatum* (Blume) K.Iwats.; *Lacosteopsis auriculata* (Blume) Nakaike).

A medium-large, very attractive species species of filmy fern; rhizome densely hairy, up to *c.* 2 mm. thick, very long-creeping to *c.* 60 cm., adpressed to rocks or

sometimes tree-trunks; fronds markedly alternate at nearly 180° from each other on each side of the rhizome, usually ± flat against the rock, up to *c*. 25 or 30 cm. long, stipe and rachis winged, lamina narrowly lanceolate, with short pinnae often fused at their bases, pinnae variable in lobing from obtusely and shallowly lobed to more narrowly and deeply so, fertile pinnae usually with much narrower lobes; sori with a tube-shaped involucre and a long, exserted, hair-like receptacle.

Nepal:

C: **Kaski** [narrow, rocky gorge shortly above Poiyim village on track along slope from Burjung Khola to Kahaure and Tarakot village, N. of Pokhara, *C.R. Fraser-Jenkins*, with *George Yatskievych*, *Lisa A. Hooper*, *Jyoti Gajurel*, *Rita Thapa*, *Sagun Pariyar* & *Ganesh Tamang* 34244 (FN 47), 12 Sept. 2009, TAIF], **Kathmandu**.

E: **Sankhuwasabha** [densely forested stream-gullies on N. side of Tinjure ridge, *c*. 2 km. S.E. of Mude Sansuri, *c*. 8 km. N.N.W. of Basantapur [in Terathum District] and 3 km. N.N.W. of Deurali [in Terathum District], S. of and above Poluwa khola, S.E. part of Sankhuwasabha District, *C.R. Fraser-Jenkins* 28850 (FN 4825), 24.3.2001, H], **Dhankuta** [4 miles east of Raja Rani, dripping surface, shaded rock; scarce, 6400 ft., *R.L. Fleming* 2569, 29.9.1978, KATH], **Ilam** [Aulabari, Ilam, 2100 m., *D.H. Nicolson* 3242, 12.5.1967, KATH], **Taplejung** [Mew khola camp, 27° 32', 87° 37', 8250 ft., *A.H. Norkett* 9129, 26.1.1962, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling, Nepal. Assam State; Nagaland; Manipur; Meghalaya; Tripura *etc*.; S.E. Asia.

(M, Sc). A scattered and rather uncommon (in Nepal) mid to upper-mid altitude species attached to on rock surfaces in deep, dark stream gullies or on large boulders in dense forest, sometimes on tree trunks.

Nepalese threatened status: **LC**.

80. ***Trichomanes birmanicum*** (Bedd.) K.Iwats. (syn.: *Vandenboschia birmanica* (Bedd.) Ching; *Crepidomanes birmanicum* (Bedd.) K.Iwats.; *Lacosteopsis birmanica* (Bedd.) Nakaike & Gurung, repeated by Panigrahi & Singh (1990) and Shmakov (2009); *Trichomanes radicans* Sw. var. *anceps* C.B.Clarke, *non T. anceps* Hook.; *Vandenboschia anceps* (C.B.Clarke) S.Chandra & S.Kaur; *Trichomanes naseanum* Christ; *Trichomanes orientalis* C.Chr.; *Vandenboschia orientalis* (C.Chr.) Ching; *Lacosteopsis orientalis* (C.Chr.) Nakaike. This species was erroneously included as if a single species within "*Vandenboschia striata*" by Liu, Ebihara *et al.* in the *Flora of China*, despite the carefully reached conclusions of Ching, Fraser-Jenkins and others that the two are distinct species. This was partly due to uncritical and wide Japanese species-group concepts instead of being properly familiar with and able to recognise the two well known distinct species long known in India and China, but it may also have been due to misidentification of the type of *T. striatum*, in particular, and/or *T. birmanicum*. In addition, despite their further comment in

the *Flora* that the name *T. orientale* was misapplied to *T. birmanicum* there appears to be no difference between them. It is unfortunate that the group has now been misleadingly confused in this much disseminated Flora of errors when it had already been properly elucidated previously).

A medium-large species; rhizome hairy, up to *c.* 2 mm. thick, long-creeping; fronds from *c.* 12-25 cm. long; stipe broadly winged to just above the base, bearing many longish dark hairs when young; rachis similarly winged; pinnae rather short and varying from not very finely lobed to more copiosuly and narrowly lobed, bipinnatifid with shorter lobes on their basiscopic side; sori with a tube-shaped involucre and exserted, hair-like receptacles. *T. birmanicum* from Myanmar and further east often develops more narrowly acute lobes, especially in sterile fronds, but this also occurs fairly commonly in Himalayan *T. birmanicum* and does not suggest that they are different species. It is a smaller and less dissect species than the other larger-sized *Trichomanes* in the Indo-Himalaya, *T. striatum*, and is readily distinguishable by its prominent stipe-wing.

Nepal:

C: **Makawanpur** [1 km. S. of and below Mahaveer, N. of Lami Dara [Danda], 5 km. below and south of Aghor, on "Rajpath Road", N. of Hetauda, on road to Naubise and Kathmandu, among rocks in dark, wet stream-gulley, *c.* 4800 ft., *C.R. Fraser-Jenkins* 16134, 4.3.1990, E], **Rasuwa** [Langtang, near Shabru, *T. Nakaike* 1381, 6.9.1986, KATH], **Kathmandu** [Doko Bhanjyang, Kathmandu Valley, moist and shady place, 2400 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/642, 16.3.1972, KATH; Tare Bhir, [Sheopuri Hill], Kathmandu, *c.* 1800-2000 m., *T. Nakaike* 506, 24.11.1979, KATH, T.U. Nat. Hist. Mus.], **Bhaktapur** [*c.* 1 km S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, forested rocky stream-gully, *c.* 1500 m., *C.R. Fraser-Jenkins* 25227 - 25229 (FN 1206 - 1208), 15.2.1997, H, BM].

E: **Ilam** [remnant-forested banks of Ale khola (stream), just below and S. of Buddhadam, W. of Pashupatinagar on road to Ilam, *C.R. Fraser-Jenkins* 29479 (FN 5454), 8.10.2001, H], **Taplejung**.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [Pithoragarh, Deochula, *P.C. Pande* (Khullar 1994)]. N.E. India *etc.*

(S, Sc). A scattered and uncommon mid to upper-mid altitude species, occurring on very sheltered and damp slopes or on rocks by stream gorges in the forest.

Nepalese threatened status: **NT**.

81. ***Trichomanes campanulatum*** Roxb. (syn.: *Crepidomanes campanulatum* (Roxb.) Panigrahi & Sarn.Singh; *Trichomanes plicatum* (Bosch) Bedd.; *Crepidomanes plicatum* (Bosch) Ching; *T. racemulosum* Bosch; misapplied name: "*T. filicula*" *sensu auct. Ind.*, *non* (Bory *ex* Willd.) Bory).

Liu *et al.* (2013) in the *Flora of China* have erroneously placed *T. plicatum* within the synonymy of *Crepidomanes latealatum*, in contradiction to the conclusions of the more critically accurate work of Morton (1974), Sledge (1968, 1982), who explained that *T. campanulatum* had often been misidentified as *T. latealatum*, Fraser-Jenkins (2008), and many other authors. They also ignored the important name with priority, *T. campanulatum*, and were apparently unable to recognise and distinguish these two species, widely recognised in India and elsewhere, attributing them to variation in *T. latealatum* as a result of outdatedly coarse "species" group concepts, and thereby rendering Ebihara's determinations of "*T. latealatum*" at K, BM, TI *etc*. of little use. This continued imprecision evidently goes back to Iwatsuki's (1975, 1988) having recognised only "*Crepidomanes latealatum*" among the cited Japanese East-Nepalese material belonging to a mixture of both species, which is not being revised further. Ghosh *et al*. (2004) and Singh & Panigrahi (2005) mistakenly referred *T. campanulatum* to its synonym, *T. insigne*, and in the latter case treated the two as different taxa in error.

A small species (to *c.* 5 cm. tall); rhizome very narrow, creeping, well covered in small dark hairs; stipe winged to shortly above its base, stipe, stipe-wing and often rachis-wing with many, rather dense small black hairs on the margins; lamina wideish (to *c*. 3 cm. wide), often slightly stiff, usually paleish green, bi- to tripinnatifid, though sometimes very small and narrower, and then with a short stipe; many short, but rather prominent false veins in the lobes, but no unbroken inframarginal false veins; indusium two-lipped with shortish, rounded to somewhat widely deltate lips. The sori in the type collections from Chittagong at BM, K and BR appear to be tubular and bell-shaped at first sight (hence the specific epithet *campanulatum*) but mostly lie open and with reflexed margins and are actually bilabiate.

This species is often a little difficult to distinguish from *T. latealatum* particularly when the latter bears some hairs on the stipe and a few further up, or when the frond-shape is more elongated than usual in *T. campanulatum*, or wider than usual in *T. latealatum*. But the shorter bare part of the stipe with a longer winged part when full grown, denser stipe-wing hairs combined with the often wider frond and more joined lobes, narrower rachis-wing, more obvious and numerous false veins and usually shorter involucral lips of *T. campanulatum* readily distinguish them.

Nepal:

Reported from W. Nepal by Thapa (2002) under a combined concept within "*C. latealatum*", but though undoubtedly present, we have seen no collections of this species from there.

C: **Kaski** [Pathana (Dhampus) (2050 m.) - Tolka (1850 m.), 836282, *H. Ohba*, *H. Kanai*, *M. Wakabayashi*, *M. Suzuki* & *S. Akiyama* 8350174, 8.7.1983, BM], Rasuwa [Dumse (*i.e.* Dhunche) to Chandanbari, *V.L. Gurung* 942/79, 17.9.1979, KATH, *sub* "*Mecodium exsertum*" in error], **Kathmandu**, **Bhaktapur**, **Sindhupalchok** [N.W. of Malemchigaon, 28° 01', 85° 31', on vertical big boulder in Quercus

semecarpifolia forest, 2650 m., *J.H. de Haas* 2790, 18.9.1974, BM].

E: **Solukhumbhu**, **Dhankuta**, **Taplejung** [Bir Gaon (1600 m.) - Saju Khola (1400 m.), 873274 - 873273, on hanging cliff in shade, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725416, 1.7.1972, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. N.E., S. and S.W. India; Sri Lanka; S.E. Asia *etc*.

(M, C). A common mid to higher altitude species occurring on rocks by streams in dark gullies and often on tree trunks in dense, dark and moist forest.

[***Trichomanes diffusum*** Blume (syn.: *Gonocormus diffusus* (Blume) Bosch) was reported by Itô (1966) from Taplejung (Iladanda (1800 m.) - Helok (1500 m.), *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama s.n.*, 13.11.1963, TI), but the specimen was reidentified by Iwatsuki (1988) as the different species, *Crepidomanes minutum* (Blume) K.Iwats., *i.e. T. minutum* Blume (syn.: *T. proliferum* Blume), from S. India, Sri Lanka and S.E. Asia. It actually belongs to *T. saxifragoides* (below), which though lumped into *T. minutum* by Iwatsuki (1988) and thence Liu *et al*. (2013) in the *Flora of China*, has long been known to be a distinct species and not conspecific with *T. minutum* as still being confusingly stated by the Japanese hymenophyllologists.]

82. ***Trichomanes latealatum*** (Bosch) Copel. The holotype specimen Bosch labelled as "*Didymoglossum latealatum n. sp.* E. Ind. *Griffith*", K, is the present species, while attached to the sheet, originally from two separate blue coloured sheets, labelled "*Didymoglossum plicatum n. sp.* c. Malacca, *Griffith*", with "Malacca, *Griffith*" also written by Hooker, are *T. campanulatum*. (syn.: *Crepidomanes latealatum* (Bosch) Copel.; *T. insigne* (Bosch) Bedd.; *Crepidomanes insigne* (Bosch) S.H.Fu; *T. makinoi* C.Chr.; *T. euphlebium* (Bosch) Alston *ex* Panigrahi; *C. euphlebium* (Bosch) R.D.Dixit & S.Ghosh; misapplied names: "*T. bipunctatum*" *sensu* Clarke, Hope *et auct. Ind., p.p., non* Poir.; "*T. pyxidiferum*" *sensu* Hope (*nec al.*), *non* L. [from C. America]; "*Gonocormus prolifer*" *sensu* Khullar (1994), *non* (Blume) Prantl [= *T. minutum* Blume, from S. India, Sri Lanka and S.E. Asia]. Hameed *et al*. (2003) mistakenly referred what was actually *T. campanulatum*, a name they were apparently unaware of, to their misapplication of the name *C. insigne*, while commenting that this "*C. insigne*" was, consequently, different from *T. latealatum* and easy to distinguish by the presence of the dark marginal setae; they also called *T. latealatum T. plicatum* in error. It is the case, however, that use of the name "*T. insigne*" has been a mixed bag of the two species for many earlier authors, including Alston (at BM), and was also not resolved by Iwatsuki *et al.*).

A small species (to 7 cm. tall); rhizome very narrow, creeping, well covered in small dark hairs; stipes very variable in length, most of the lower and mid stipe usually without a wing, but stipe-wing above short, not or seldom, and then only

sparsely hairy, stipe either without hairs or often with a few small hairs at the base; fronds bipinnatifid, sometimes tripinnatifid, darkish green, usually rather long and narrowish above an often wider base, rachis-wing prominent and wider than in *T. campanulatum*, lobes with rather few, scattered short fragments of false veins; indusium two-lipped, lips rounded-triangular and longer than in *T. campanulatum*. Small plants of this species may appear rather different with narrow, hardly pinnate fronds with sloping lobes, decurrent bases and a very short stipe.

Nepal:

W: **Gulmi** [Lumpek, W. Nepal, on trees at bases, 7000 ft., *R.L. Fleming* 929, 9.11.1949, BM, DD].

C: **Baglung** [below Baglung, 2500 ft., *R.L. Fleming* 929, 14.11.1949, KATH, staff incorrectly wrote "E. Nepal, Sankhuwasabha", but Fleming did not visit E. Nepal until 1959 and was at Baglung in W.C. Nepal in Nov. 1949; Lumsum, S. side of Dar khola below Lumsum, wooded gully, covering moist shaded surfaces of boulders near stream, *c*. 6800 ft., *A.R. Vickery* 456, 24.3.1974, BM], **Myagdi** [Myagdi Distr., Dobang, 83° 23', 28° 37', on tree trunk, 2360 m., *M. Mikage* & *K. Yonekura* 9682369, 9.9.1996, KATH], **Parbat**, **Gorkha** [below Namjung, 28° 53' 55", 84° 78' 33", 2400 m., *S.H. Bhattarai* 23/11, 5.6.2012, KATH], **Rasuwa** [between Syabru and Lama Hotel, 2400-2600 m., *T. Nakaike* 1240, 30.8.1986, KATH], **Kathmandu** [sandy slopes in slightly open, degraded forest, S.E. part of Raniban forest-reserve, Gokarna, E. of Bouddha, N.E. of Kathmandu, *C.R. Fraser-Jenkins*, with *B. Bista*, Forest Officer 25207 (FN 1186), 23.1.1997, BM], **Lalitpur**, **Dolakha** [Khare Khola, Phedi Kharka (2100 m.) - Koplang (2100 m.) - Khanigaon (1700 m.), 862275, *H. Ohba*, *H. Kanai*, *M. Wakabayashi*, *M. Suzuki* & *S. Akiyama* 8332095, 14.9.1983, BM], **Ramechap**.

E: **Sankhuwasabha** [Mure (2100 m.) - Sinduwa (2100 m.), 872271, tree trunk in forest, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725073, 5.6.1972, KATH], **Dhankuta** [Podlabang Danda, ridge path to Sombu, on rock, *c*. 6500 ft., *A.H. Norkett* 5275, 23.9.1961, BM], **Tehrathum** [Dor (2600 m.) - Tute (2300 m.), 872272 - 872271, on muddy rock in deep shade, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725499, 7.7.1972, BM, KATH; Terhathum Distr., Chauki (2650 m.) - Tute (2480 m.) - Basantapur (2300 m.), 27° 12' 35", 87° 28' 01" - 27° 07' 00", 87° 26' 00", Tinjure, on deep shade of dense forest facing north, 2800 m., *M. Tateno*, *K. Fujikawa*, *R.H. Ree* & *N. Thapa* 9955143, 9955144, 17.8.1999, KATH], **Taplejung** [Shewaden, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725348, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand [including Pindari, Almora, *R. Strachey* & *J.E. Winterbottom*, BM; the specimen of Strachey & Winterbottom at CAL has been transposed with *H. denticulatum*, see above under that species], Himachal Pradesh. N.E., C. and S. India; S.E. Asia *etc.*

(M, C). A very common and widespread mid to upper-mid altitude species occurring on rocks and tree-trunks in semi-open or dense forest, often near streams.

[***Trichomanes makinoi*** C.Chr. was reported tentatively by Itô (1966) as *Crepidomanes* sp. *aff. C. makinoi* (C.Chr.) H.Itô, based on 3 specimens from Taplejung and two more from Sikkim. These were reidentified by Iwatsuki (1975) as *C. insigne* (Bosch) S.H.Fu, a synonym of *T. latealatum*. But at the same time he listed both *C. insigne* and *C. latealatum* as if separate species, while stating that he found it difficult to distinguish van den Bosch's Himalayan species. This continued difficulty was evidently why Iwatsuki (1988) later combined all these taxa into one super-species which he called *C. latealatum*, ignoring the name *T. campanulatum*, a policy still followed in Japan and now imposed on the *Flora of China* and reversing the previous understanding there. The specimens concerned (BM!, TI) are actually small specimens of *T. campanulatum*, redet. CRFJ, 2012.]

83. ***Trichomanes parvifolium*** (Baker) Copel. (syn.: *Hymenophyllum parvifolium* Baker; *Microgonium parvifolium* (Baker) Tagawa & K.Iwats.; *Crepidomanes parvifolium* (Baker) K.Iwats.).

A minute species, the smallest in the genus in the region (up to *c.* 6 mm. tall), rhizome very thin, short-creeping, bearing hairs; stipe very short, also hairy, lamina varying from simple to bifurcate or trilobate; all types of leaf bear bilabiate, open brown sori apically, with entire involucres. From a distance the small carpeting patches of this species look more like patches of a very dark coloured leafy-liverwort or moss.

Nepal:

C: **Gorkha** [on damp rock by the fall of the waterfall in a shallow cave, left fork of Komale Khola, above Komale hamlet (now abandoned), below and on N. side of Chuli and Mahalaxmi hills, 1 km. below and S.W. of Deurali village, above and N.E. of Gopling and Markichowk, *c.* 5 km. N.N.W. of Anbu Khaireni, 13 km. N.W. of Mugling, on N. side of Marsyangdi river and Kathmandu to Pokhara road, 800 m., *C.R. Fraser-Jenkins* & *Nirmala Fraser-Jenkins* (née Pariyar, of Komale) 28500 (FN 4475), 19.4.2000, H, BM, KATH].

Total Himalayan distribution: China; Myanmar [rare]; Arunachal Pradesh [Papum Pare, Ganga Lake, see Fraser-Jenkins & Benniamin (2010)]; Sikkim [rare]. Meghalaya (Jaintea Hills, *A. Benniamin*, in 2009, det CRFJ and conf. A. Ebihara); Thailand. It was previously thought to be endemic to Myanmar.

(M, R). A very rare lower-mid altitude species, growing on dark, periodically wet rocks beside waterfalls and small streams in dense shade.

Nepalese threatened status: **CR**. Known only from a single collection in Nepal. Indian threatened status: **EN**. Globally threatened.

84. ***Trichomanes saxifragoides*** C.Presl (syn.: *Gonocormus saxifragoides* (C.Presl) Bosch; *Trichomanes parvulum* Blume, *non* Poir. [from the Mascarenes]; *Trichomanes pusillum* Bedd.; *Gonocormus australis* Ching).

This species is distinct from and not a synonym of the southern *T. minutum* Blume [syn.: *T. proliferum* Blume, synonymised by Copeland (1958), which must be followed even though Sledge (1968) synonymised them the other way in his much more thoroughly researched treatment], as was often stated in the past, but including even by Liu *et al.* (2013) in the *Flora of China*, due mainly to the imprecise Japanese species-group concepts which follow without further revision Iwatsuki's (1988 *etc.*) treatments and comment that "species delimitation is difficult". Despite citing Sledge's (1968) masterly study, Ghosh *et al.* (2004) apparently did not understand the uncritical species-group concept of Iwatsuki (1985) and erroneously placed this species under *Gonocormus minutus* (Blume) Bosch.

A minutely attractive umbrella-like species (up to *c.* 8 mm. tall), with a very thin, creeping, hairy rhizome, a flat, radiately lobed, non-proliferating frond and the sori at the upper lobe-apices with a wide, trumpet-shaped, often dilated involucre, receptacle exserted. *T. minutum* (from S. India, Sri Lanka, and S.E. Asia, but not present in the Himalaya or N.E. India as listed by Chandra (2000)) has a less radial, more pinnate dissection of the often larger lamina and is proliferous here and there, though this can sometimes be difficult to find in a specimen.

Nepal:

C: **Kaski** [forested N. facing hill-side in Raniban forest, on S.E. side of Phewa Tal (lake), along and above path, *c.* 1-2 km. west of Fishtail Lodge Hotel, just south of Pokhara Baidam (Lakeside) township, Kaski District, *c.* 850 m., *C.R. Fraser-Jenkins* 18089, 23.1.1991, E; by the track ascending the W. side of Kahun Danda, just E. of Pokhara, with mosses on a tree, *c.* 1100 m., *C.C. Townsend* 92/267, 5.3.1992, K].

E: **Taplejung** [Iladanda (1800 m.) - Helok (1500 m.), *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 13.11.1963, TI (specimen reported by Itô (1966) *sub* "*Gonocormus diffusus*" in error, Iwatsuki (1988) *sub* "*T. minutum*" in error, but not seen by us)].

Himalayan distribution: China; Arunachal Pradesh; Myanmar; Assam State; Bhutan [rare]; Nepal. N.E. and S. India, Sri Lanka, S.E. Asia *etc*.

(M, R). A rare mid altitude species, epiphytic on mossy, often dying tree-trunks, or growing on mossy rock-surfaces in semi-open conditions in high rainfall areas.

Indian threatened status: **NT**. Nepalese threatened status: **EN**.

85. ***Trichomanes schmidianum*** Zenker *ex* Taschner (syn.: *T. latifrons* Bosch; *Crepidomanes latifrons* (Bosch) Ching; *Vandenboschia schmidiana* (Zenker *ex* Taschner) Copel.; *Vandenboschia titibumensis* H.Itô; *Trichomanes titibuensis* (H.Itô) C.V.Morton; *Lacosteopsis titibuensis* (H.Itô) Nakaike).

A small species similar to *T. latealatum*, with a thin, short-creeping rhizome covered in dense, short, brown hairs; fronds bipinnatifid, stipe narrowly winged towards the apex and slightly shortly hairy at the very base, but hairs not extending upwards or onto the wing; pinna-lobes without either marginal or scattered false veins; sori with a wide, trumpet-shaped involucre without labella, often becoming slightly inflated at the rim when fully mature, and the laminar wing on either side reaching up nearly to the rim, receptacle exserted, hair-like. Larger individuals of this species with more developed longer pinnae and longer lobes, were renamed as *T. latifrons*, which name was mistakenly treated as a distinct species by Ghosh *et al.* (2004). A specimen of *T. latealatum* from Bok, Garhwal, Uttarakhand, *J.F. Duthie*, BM, was misidentified by Alston as the present species, but has a few false veins near the lobe-junctions and has too wide an involucre, which is bilabiate above, not only tubular as first appears.

Nepal:

W: **Kalikot** [Dillikot, with moss on vertical rock face in Bamboo Zone, 9000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3926, 20.4.1952, BM].

C: Parbat [Banathanti to Ghorepani Lekh, on the mossy tree trunk of the dense forest, 2400-2830 m., *V.L. Gurung* 1424/81, 22.6.1981, KATH], **Kathmandu** [dense forest shortly below Bagdwar temple, on E.S.E. side of peak of Sheopuri (Shivapuri) mountain, above and N. of Buddhanilkantha, N. of Kathmandu, *c.* 2500 m., *C.R. Fraser-Jenkins* 15763, 16.11.1989, E].

E: **Sankhuwasabha** [Lamo Pokhari, 873272, on moist rock in dense forest, 2900 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725176, 9.6.1972, BM, KATH], **Tehrathum** [Dor (2600 m.) - Tinjure (2900 m.), 872272, on moist cliff in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725140, 7.6.1972, BM, KATH], **Taplejung** [Shewaden (2600 m.) - Mewa khola (2100 m.), on muddy cliff in deep shade, *c.* 2400 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725349, 29.6.1972, BM, KATH].

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. Meghalaya; N.E. India; S. India (*Revd. B. Schmid* and others); Japan.

(S, R). A rather rare, upper-mid to higher altitude species occurring on mossy boulders or in stream gulleys, rarely on tree-trunks, in dense moist forest.

Nepalese threatened status: **NT**.

86. ***Trichomanes striatum*** D.Don (syn.: *Crepidomanes striatum* (D.Don) Thapa; *Vandenboschia striata* (D.Don) Ebihara; *Trichomanes indicum* S.R.Ghosh, *non* (C.A.Hameed & Madhus.) C.A.Hameed [= *T. kurzii* (Bedd.) Tagawa & K.Iwats.]; misapplied names: "*T. radicans*" *sensu auct. Ind., non* Sw. [from C. America; *nec T. speciosum* Willd. from Europe *etc*.]; "*Trichomanes giganteum*" *sensu* Panigrahi,

from Arunachal Pradesh, and sensu Chandra (2000), *non* Bory [from the Mascarenes and Africa]; "*Lacosteopsis gigantea*" *sensu* Singh & Panigrahi (2005), from the Indo-Himalaya *etc*., *non* (Bory) Panigrahi & Sarn.Singh [from the Mascarenes]; "*Lacosteopsis maxima*" *sensu* Singh & Panigrahi (2005), *non* (Blume) Nakaike [= *T. maximum* Blume from S.E. Asia and just reaching further N.E. India]; "*T. orientalis*" *auct., p.p.*). Fraser-Jenkins (2008) confirmed Ching's (1985) separation of this species from the American *T. radicans* and his application to it of the name *T. striatum* (and see Kung 1988, Fraser-Jenkins 1997), having provided the type on loan to Ching from the BM, as well as confirming the well known separation of *T. striatum* from *T. birmanicum*. Unfortunately Liu *et al.* (2013) in the *Flora of China* very mistakenly included *T. birmanicum* within *T. striatum*, stating that "*T. striatum* is now confirmed as an earlier name for the plant formerly called *Vandenboschia birmanica*". This unwanted and misleading confusion was entirely erroneous and ignored all previous findings, if they were aware of them, as well as suggesting they may not have been able to identify the type of *T. striatum* properly at BM.

This is the largest species of filmy fern in the region, with narrowly triangular-lanceolate fronds up to *c.* 35 cm. when full grown; rhizome hairy, to *c.* 3 mm. wide, long-creeping to *c.* 40 cm. long, with well separated fronds; stipe long, largely unwinged, but a very narrow wing extending a little way downward from the lowest pinnae; rachis narrowly winged at least from mid-pinnae upwards, lamina tripinnate to quadripinnatifid; pinnae developed and lobed equally on both sides, lobes rather narrow; sori with a tube-shaped involucre and long, exserted, hair-like receptacles.

Nepal:

C: **Kaski** [narrow, rocky gorge shortly above Poiyim village on track along slope from Burjung Khola to Kahaure and Tarakot village, N. of Pokhara, *C.R. Fraser-Jenkins*, with *George Yatskievych, Lisa A. Hooper, Jyoti Gajurel, Rita Thapa, Sagun Pariyar* & *Ganesh Tamang* 34245, 34246 (FN 48, 49), 12 Sept. 2009, TAIF], **Makawanpur** [2,400m, stream-gully and hillocks in semi-open remnant forest-patches, between Shikarkot and Daman, S. of and above Naubise and Tistung, beside old "Rajpath" road from Kathmandu S. to Hetauda, stream-gully and hillocks in semi-open remnant forest patches, *c.* 2400 m., *C.R. Fraser-Jenkins* 26439 (FN 2416), 11.8.1998, H], **Dhading** [below Naubise, 16 mi. W. of Kathmandu, on wet rocks in ravine/dark stream nala, 3000 ft., *R.L. Fleming* 1443, 7.9.1957, KATH, MICH, *sub* "*T. latifrons*" in error], **Kathmandu** [forested gulley between Shivapuri Park entrance gate and below Nagi Gompa, S. side of and below Shivapuri Hill, N. of and above Bouddhanilkantha, N. of Kathmandu, *C.R. Fraser-Jenkins* 32011, 16.2.2006, TAIF]. Although Thapa (2002) reported it from W. Nepal, probably by extrapolation, we have not yet seen any material from there in herbaria, though it should probably be there as a rarity.

E: **Solukhumbu** [Karodo, near Kenja, Solukhumbu, *T. Nakaike* 3486, 22.10.1988, KATH], **Ilam** [above Mai Pokhari, Ilam, on mossy, vertical cliffs in gorge, 1900

m., *D.H. Nicolson* 3157, 6.4.1967, KATH], **Taplejung** [Taplejung District, Mewa khola, Dongen, cliff, *c.* 8000 ft., *A.H. Norkett* 9103, 21.1.1962, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [very rare]. N.E. and S. India; Sri Lanka; E. and S.E. Asia. "*T. radicans*" was misreported by Kumari & Srivastava (2008) from Jharkhand (along with some other obvious misidentifications), in error for *T. campanulatum.*

(S, Sc). A scattered and uncommon upper-mid altitude species of deep, dark stream-gorges, growing on the rock surface, or more rarely on bases of tree-trunks beside streams.

Nepalese threatened status: **NT**.

CYATHEACEAE

Cyathea (5 species).

Cyathea can be separated into about 5 different genera worldwide, of which 3 occur in the Indian subcontinent, two in Nepal, differing rather minutely in scale morphology and the presence or absence of an indusium, as advocated by Tryon (1970), followed by Smith *et al.* (2006, 2008). But the groups are very close morphologically and the distinguishing characters break down, so they are not discrete. The microgenera may therefore be considered too close and insignificant morphologically for that rank. Thus alternatively, while not contradicting molecular findings, they may be treated as subgenera and sections within a discrete and recognisable genus, *Cyathea*, as convincingly argued by Holttum (1963, 1964 a and b, 1965, 1981), Holttum & Tryon (1977) and Holttum & Edwards (1983) from his superior knowledge and experience of both Old World and New World species. His reasoning still stands today and though molecular results show that there are monophyletic subgroups, this has no bearing on the question of ranking and thus splitting or uniting the genus and we prefer the more obvious treatment as one, more significant genus *Cyathea* with subgenera within it.

87. ***Cyathea brunoniana*** (C.B.Clarke) C.B.Clarke & Baker, *non Alsophila* Wall., *nec Sphaeropteris* (Wall.) R.M.Tryon (syn.: *Hemitelia brunoniana* C.B.Clarke, *Trans. Linn. Soc.* (Lond.), ser. 2 Bot. **1**: 430 (1880), lectotype, here designated and so annotated by R.E. Holttum, July 1962: "Hemitelia brunoniana C.B. Clarke, Khasia, Regio temp., 4000 ped., Coal pits, June 22/50, fringed scale at base of sorus, *J.D. H*[*ooker*] & *T. T*[*homson*], Herbarium hookerianum 1867", K; *Alsophila costularis* Baker; *Hemitelia brunoniana* var. *scottii* C.B.Clarke; *Cyathea chinensis* Copel.; misapplied names: "*Alsophila etc. glauca*" *sensu* Wallich, Beddome, Clarke *et auct. Ind., non* (Blume) J.Sm. [= *Cyathea contaminans* (Wall. *ex* Hook.) Copel., syn.: *Sphaeropteris glauca* (Blume) R.M.Tryon, from N.C. India (Sikkim State, Rungbi valley, off Ratong Valley, presumed probably extinct), Myanmar and S.E. Asia], *nec Cyathea glauca* Bory; "*Cyathea latebrosa*" *sensu* Nair (1973), *non* (Wall. *ex*

Hook.) Copel. [from S.E. Asia]).

As a result of Clarke's creating a new species and name under the epithet *brunoniana* (see below under *C. sollyana*), though overridden by Holttum (1965), use of the name *Cyathea chinensis* Copel. for the present species is untenable as *Cyathea brunoniana* (C.B.Clarke) C.B.Clarke & Baker has priority and must replace the name *C. chinensis* (otherwise *Alsophila costularis* Baker, if that group is preferred as a genus). The present species was long known in India as *C. brunoniana* as can be seen from many herbarium specimens at K, BM, CAL *etc*. as well as in most of the literature up to the 1970s, when the name *C. chinensis* became more in use, but has hardly gained wide acceptance. *C. brunoniana* has now to be restored in that sense and its use in accordance with the *ICBN* is adopted here.

A tall tree-fern (trunk to *c.* 20 ft.); very similar to *C. spinulosa*, but usually at slightly higher altitude, axes pale- to mid-brown; but stipe and rachis, though spiny, less so than *C. spinulosa* and with slightly smaller spines, becoming warts further up the axes; diagnostically, as well as scattered scales, it has small, rather dense hairs clothing the undersurface of the costules or pinnule axes, unlike in *C. spinulosa*; sori with a small basal indusium at one side.

Nepal:

C: **Kaski** [very rare, Ghabung khola, Pokhara, in wood, 4000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 543, 13.5.1954, BM, costules hairy beneath; ? also *ditto*, shady ravine, 3500 ft., 2767, 18.5.1954, BM (identity of 2767 not properly checked by CRFJ)].

E: **Sankhuwasabha** [Sukapatel, Arun ridge, *R.L. Fleming* 2193, 2194, 11.11.1973, MICH, *sub C. brunoniana*; Bhutia khola, Pangma, Sankhuwasabha, along stream on shady place, 1200 m., *N. Thapa* S 16/96, 25.4.1996, KATH], **Jhapa** [banks and slopes at edge of forest, between Horkhoti and Kuttedara, N. of Charali and Bhudabare, on road to Ilam, N.E. of Birtamod and N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 26541, 26542 (FN 2519, 2520), 16.8.1998, H], **Ilam** [Mai valley, E. Nepal, [*J.D. Hooker*], 10.11.[1848], K; in a ravine, 7 mi. E. of Rabi Bazaar, Palamtar, 6600 ft., "only one", *R.L. Fleming* 2567, 29.9.1978, KATH, duplicate specimen label identical but says "7 mi. W. of", which would be in Panchtar, but this is an error as shown by 2567 and adjacent numbers all from "7 mi. E. of" in a list sent to CRFJ by Fleming, 20.5.1981; Cardamon-planted slopes and marshy area just below road on S. side, just E. of Sundergaon, W. of Pashupatinagar on Ilam road, Ilam District, *C.R. Fraser-Jenkins* 29491 (FN 5466), 9.10.2001, H], **Taplejung** [Milke Danda, N. of Ilam, [Taplejung side], *R.L. Fleming* 2078, 30.11.1971, MICH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Vietnam.

(S, R). A rare and restricted species (in Nepal, becoming rather common in N.E. India) of mid altitude forests, in semi-shaded conditions.

Nepalese threatened status: **EN**.

88. ***Cyathea gigantea*** (Wall. *ex* Hook.) Holttum (syn.: *Alsophila gigantea* Wall. *ex* Hook.; *Alsophila helferiana* C.Presl; *Cyathea balakrishnanii* R.D.Dixit & A.K.Tripathi; misapplied names: "*Alsophila glabra*" *sensu* Clarke, Beddome *et auct. Ind*., *non* (Blume) Hook.; "*A. podophylla*" *sensu* Bhandyopadhyay (2000), *non* Hook. [= *C. podophylla* (Hook.) Copel., from China, not present in India]). Zhang & Nishida (2013) in the *Flora of China* included *C. henryi* within *C. gigantea*, but though closely related it is not conspecific.

A common, low or semi-arboreal habit tree-fern; juvenile plants with lanceolate, bipinnatifid fronds are often mistaken for *Dryopteris* species *etc*.; adult plants usually with a shortish trunk up to *c*. 1.5 m., but becoming taller, up to *c*. 5 m. tall; stipe dark chestnut brown to nearly black, matt, without spines, bearing many narow, chestnut-brown glossy scales with paler, fimbriate edges; rachis similar but with few to no scales; fronds bipinnate, tripinnatifid; ultimate lobes (pinnule-lobes) usually rather shallow, or very shallow in smaller, more exposed plants; costulets without hairs and with few to almost no small scales beneath, 4-7 pairs of pinnate veinlets per ultimate lobe, the basal basiscopic veinlet may arise either from the pinnule costa (costule) or from the lobe-midrib, lobe-apex toothed with a few small, slightly broad teeth; fertile pinnules with markedly V-shaped rows of exindusiate sori, those at the base being nearly marginal on the lobe and much further apart from their opposite member than at the lobe-apex.

Nepal:

C: **Kaski** [forested gully on E. shore of Begnas Tal, *c.* 15 km. E. of Pokhara off road to Mugling and Kathmandu, Kaski District, *c.* 40 plants, with *C. spinulosa* [*CRFJ* 26041], *C.R. Fraser-Jenkins et al.* 26042 (FN 2020), 19.2.1998, H, one plant planted at Komale khola, Anbhu Khaireni, Gorkha in CRFJ's wild fern-garden just below waterfall and grown large, with offsets by 2015], **Tanahun** [rocks and forested slope below waterfall, in next gorge, *c*. ½ km. above Chowti Bara Temple gorge, *c*. 6 km. S. of Damauli, E. of Pokhara, W. of Mugling and Anbu Khaireni, Tanahun District, *C.R. Fraser-Jenkins* with *Ganesh* (*Ramchandre*) *Pariyar*, *Chandre Kumari Pariyar* & *Nirmala Pariyar* (later *Nirmala Fraser-Jenkins*) 25329 (FN 1308), 23.3.1997, H; small forested gully opposite and S. of Chabise village, *c*. 3 km. E. of Khairentar, E. of Pokhara on Damauli road, Tanahun District, *C.R. Fraser-Jenkins*, with *K. Pongali* 25809 (FN 1787), 27.12.1997, H], **Gorkha** [stream gulley of Chisopani Darrah Khola, on south-west side of ridge between Deurali village and Komale hamlet, *c.* ½ km. below Hattiya Deurali village, above and N.E. of Goplinghat village and Markichowk, west of Anbu Khaireni and Mugling, Gorkha District, in patch of natural mixed forest, *c.* 900 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.*& *G.* (*R.*) *Pariyar* 20879 (FN 1127), 16.2.1994, E; same loc. 25063 (FN 1042), 30.12.1996, H, BM], **Makawanpur** [Jaspal - Pass, in shady forest, 300 m., *M.S. Bista* 12120 (12097), 18.4.1969, KATH mislabelled by staff at KATH as

"Bara District" in error; Makawanpur, 300 m., *M.S. Bista* 12097, 20.4.1969, KATH; Aam Bhanjyang V[illage] D[evelopment] C[ommittee]-2, Chillibas community forest, Makawanpur, rare on moist bank of deep shade gulley, 600 m., *N. Thapa* M54, 10.9.2000, KATH]. Wallich *Num. List.*: 321.2 (1828) treated *Alsophila gigantea*, with "filix arborea altissima" on the specimen label, and gave the locality as "Napalia, 1821"; and Wallich (1821 *ined.*) listed an *Alsophila altissima* (*ined.*) with the description of *C. gigantea* and mentioned two localities, "Sylhet, *M.R. Smith*" and "Marekoh, behind Nag-Arjun, *Wallich*". But only *C. spinulosa* occurs at Mudkhu ("Marekoh"), on the border of Kathmandu and Dhading Districts, or anywhere else in the Kathmandu valley, and it appears that Wallich confused the species, and/or locality.

E: **Morang** [flat gravel-beds with water flowing over them, among bushes and grasses, by small Kershiya river running S.W. to cross main-road by a marshy lake (with small dam and ditches being built for drainage), on N. side of road, *c.* 1½ - 2 km. E. of Belbari, *c.* 30 km. E. of Itahari, on main East-West highway to Birtamod and Kakkarbhitta, Morang District, *C.R. Fraser-Jenkins* 28930 (FN 4905), 26.3.2001, H], **Ilam** [E. Nepal, Mechi khola, 26° 48', 88° 10', eveergreen gulley in Sal forest, 1000 ft., *J.D.A. Stainton* 6430, 5.3.1969, BM; Gorhwa, Ilam, scarce, rocky ravine, 800 ft., *R.L. Fleming* 2483, 14.9.1978, KATH; Ranga Pani - Chisa Pani - Loohya Mai - Ghorwa, 700-300 m., *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 9.12.1963, K, BM].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E., C. and S. India; Sri Lanka; S.E. Asia.

(M, R). A rare (becoming common and widespread in N.E. India), low to mid altitude species often occurring as smaller, immature plants, just becoming fertile, among low bushy vegetation where forest has been cut and where often overlooked or mistaken for other genera. Lower hill-slopes near streams or ditches, or at the edge of denser forest, where it reaches its full size. The only large, tall population seen by CRFJ in Nepal was of *c.* 40 plants up to 4 m. tall at Begnas Tal, Kaski (above), but all had been selectively cut down except 2 small plants by 2008.

Nepalese threatened status: **EN**.

[***Cyathea glauca*** Blume (syn.: *Sphaeropteris glauca* (Blume) R.M.Tryon), from S.E. Asia, was misreported from India by X.C. Zhang & Nishida (2013) in the *Flora of China*, who could not have been properly familiar with either Holttum's (1965) clear explanation that the name was misapplied to what is now *C. sollyana* in India, nor with the Indian literature and fern flora, as throughout much of the *Flora of China*.]

89. ***Cyathea henryi*** (Baker) Copel. (syn.: *Alsophila henryi* Baker; *Gymnosphaera henryi* (Baker) S.R.Ghosh; *Cyathea gammiei* R.D.Dixit [as "*gamblei*" in Fraser-Jenkins (2008) in error]; *C. sharmae* Bandhyopadhyay, T.Sen & U.Sen). Erroneously and

uncritically synonymised within *C. gigantea* by X.C. Zhang & Nishida (2013) in the *Flora of China*.

This species is closely related to *C. gigantea* and it is sometimes difficult to distinguish and draw a dividing line between them, but it is not the same species, as can readily be seen from field study and as treated more critically and accurately by Holttum (1965). *C. henryi* is like *C. gigantea* in its darkish brown to black stipe and rachis and stipe-base scales, but it has longer and larger pinnules, with more scales beneath their costules, more pairs of veinlets in the ultimate lobes, which are also longer, becoming slightly rectangular and the lower ones on larger pinnae are more deeply separated from each other; the sori, though well apart and forming weak V's, are in more parallel lines than in *C. gigantea*. It is intermediate in many respects between *C. gigantea* and *C. khasyana* and a possible hybrid origin might be tenable (several hybrids in *Cyathea* are fully fertile as so far known). One of the type collections from China has blacker axes than some of the specimens of Indian material, but others and other material is similar in both regions.

Nepal:

Jhapa [Ganja Bari, Jhapa, beside small streamlet, 1000 ft., *Dr. S.B. Malla* 7670, 31.3.1967, KATH, tentatively det. CRFJ, 11.2014]. This specimen is rather difficult to identify, but appears to be *C. henryi* as the pinnules are longer than in *C. gigantea* and tend to be slightly more rectangular, while there are many small, often dark-apexed scales beneath the pinnule-costules.

Total distribution: China; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. Thailand.

Nepalese threatened status: **CR**. Known only from a single collection.

90. ***Cyathea khasyana*** (T.Moore *ex* Kuhn) Domin (syn.: *Alsophila khasyana* T.Moore *ex* Kuhn); *Alsophila ornata* J.Scott *ex* Bedd.; *A. oldhamii* Bedd.; *Alsophila sikkimensis* C.B.Clarke & Baker; misapplied names: "*A. latebrosa*" *sensu auct. Ind., non* Wall. *ex* Hook.; "*A. comosa*" *sensu* J. Scott, *non* Wall. *ex* Hook. [from S.E. Asia]; "*Cyathea squamulata*" *sensu* S. Chandra (2000), *non* (Blume) Copel.).

A tall tree-fern (to *c.* 15 ft.); stipe and rachis non-spiny, minutely muricate below, dark-brown to purplish-brown, with a line of yellow stripes up the side, bearing many narrow mid-castaneous brown, glossy scales towards the stipe-base with paler, ciliate margins; pinnule-lobes or segments rather small, narrow and usually parallel-sided, with small apical and often upper marginal teeth and bearing many small, dark-tipped, bullate-based scales beneath the costules as well as small hairs; fertile segments usually markedly narrower than sterile ones, sori in separate, nearly parallel lines, not in V-shapes, basal basiscopic veinlet of each pinnule-lobe usually arises from the costulet (pinnule lobe midrib), not the costule; sori exindusiate.

Nepal:

E: **Ilam** [very rare, remnant-forested banks of Ale khola (stream), just below and S.

of Buddhadam, W. of Pashupatinagar on road to Ilam, one clump of three plants, *C.R. Fraser-Jenkins* 29477 (FN 5452), 8.10.2001, H].

Total distribution: China; Tibet; Arunachal Pradesh; Myanmar; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Bangladesh.

(S, R). A very rare (in Nepal, common in N.E. India) mid-altitude species, growing by streams at the edges of forests.

Nepalese threatened status: **CR**.

91. ***Cyathea sollyana*** (Griff.) Fraser-Jenk., ***comb. nov.*** (basionym: *Alsophila sollyana* Griff., *Notul. Plant. Asiat.* **2**: 624 (1849); syn.: *Alsophila brunoniana* Wall. (1829), *non Cyathea* (C.B.Clarke) C.B.Clarke & Baker; *Sphaeropteris brunoniana* (Wall.) R.M.Tryon [as ("Wall. *ex* Hook.") R.M.Tryon, as also given by Zhang & Nishida (2013), in error]; *Cyathea holttumiana* R.R.Rao & Jamir (type in NEHU! moved to LWG); misapplied names: "*Cyathea brunoniana*" *sensu* Holttum (1965), *non* (C.B.Clarke) C.B.Clarke & Baker [the combination "(Hook.) C.B.Clarke & Baker" does not exist]; "*Alsophila glauca*" *sensu* Wallich, Beddome, Clarke *et auct. Ind*., *non* (Blume) J.Sm. [= *Cyathea contaminans* (Wall. *ex* Hook.) Copel., syn.: *Sphaeropteris glauca* (Blume) R.M.Tryon, from ?N.C. India, ?extinct (a single specimen from Rungbee valley, off the Ratong valley in W. Sikkim, at K, unless with a transposed locality); Myanmar and S.E. Asia], *nec Cyathea glauca* Bory). Ghosh *et al.* (2004) erroneously misidentified and reported "*Sphaeropteris glauca*" (*i.e*. *Cyathea contaminans*) from six States of N.C. and N.E. India, in confusion for other species.

This species was called "*C. brunoniana*" following Holttum (1965), including by Fraser-Jenkins (2008) up to 11.2014, but initially Holttum himself applied that name (until *c.* 1963) to what he later called "*C. chinensis*" *nom. illeg*, *i.e*. the real *C. brunoniana*, above, at K and BM, as had nearly all botanists in India following Clarke. The confusion over the name was caused by Wallich's and Hooker's application of the name to the present species in the absence of Wallich's original material, while Clarke applied it to the above *C. brunoniana*. Holttum's (1965) choice to ignore Clarke's usage and misapply his *C. brunoniana* gradually led to nomenclatural confusion and the use of the name *C. brunoniana* instead of *C. sollyana* and *C. chinensis* instead of Clarke's *C. brunoniana*.

It appears that Wallich, perhaps unsurprisingly in this critical genus, had a mixed and uncritical sense of the name *A. brunoniana* and applied it first to one species, then to another. When subsequently organising the Wallich herbarium in Britain in 1849, he found that no original material of Wallich 7073 survived in his herbarium and he therefore replaced it from fronds he thought to be the same species, taken off a 45 ft. tree-fern trunk that had been collected in the Khasi Hills by one of his Calcutta collectors, William Gomez, then preserved at the BM and later exhibited there in three sections. The rather scrumpled specimens so labelled, "Montes ad

orient. Sylhet, Dr. Wallich (1831)" are at BM, with a note by the Keeper, J.J. Bennett, to that effect and others by Britton, the later Keeper). Hooker, who was in regular close contact with Wallich, thus took the name in the sense of these specimens, which are the present *C. sollyana*, long known to British-Indian botanists as "*Alsophila glauca*" in error.

However Clarke took the epithet *brunoniana* in the sense which he extrapolated from the various specimens at K, BM, CAL *etc*. was the original sense of Wallich's, and applied it to the species later known as *C. chinensis* by Holttum (1965). He had examined Wallich's replacement specimens under 7072 and correctly found them to be what he called "*A. glauca*", *i.e*. the present *C. sollyana*. He also stated that he had studied another tree-fern trunk from the staircase at Kew, referred to by Hooker (1844) and found it was definitely not the same as "*S. glauca*" [*C. sollyana*]. By deduction and knowing the ferns of the area Clarke identified the name *brunoniana* as referring to what Holttum later called *C. chinensis*, in which sense he then used it, excluding Hooker's concept, as did Beddome shortly after and as used here. This was not the same as Hooker's use of it, and Holttum (1965) therefore reasoned that since, as he thought, Hooker first validated the name, it must apply to the species Hooker intended it for, the same as what is now called *S. sollyana*, whatever sense Wallich first took it in. According to Holttum's conclusion, Clarke had actually created a new and independent species, *Hemitelia brunoniana* C.B.Clarke, the same species that later came to be called *C. chinensis*. On checking Wallich's *Numerical List* it turns out that, though overlooked by everyone, Wallich (1829) had himself validated *Alsophila brunoniana* from the Gomez specimen from the mountains above Sylhet (actually around Sohra (Cherrapunji) in Meghalaya) by providing a brief description of its height, and unequivocally referring to the trunk at the BM. Hooker, therefore, had not been the first to validate it and did not make an independent name. Wallich had written for his *Alsophila brunoniana* Wall., List no. 7078, "(Coest. spec. n. 180, 318, 320, 329.2, 336 et 385 [which are all various tree-ferns]), Mt. Sillet *W*[*illiam*].*G*[*omez*]. (Hujus filicis arboreo caudex ped. 45 altus ab ampliss. Procuratione Brit. Ind. Orient Museo Britanico anno 1831 donatus)". The name *A. brunoniana* Wall. must therefore refer to the old "*A. glauca*" of India, as Holttum concluded, despite Clarke's use of it in another sense.

But unfortunately the epithet *brunoniana* cannot be used in *Cyathea* in the same sense as Holttum did, because although Clarke (1880) cited "Wall.; Hook." as the name authority, he clearly excluded Wallich's and Hooker's plant of 7078 and thereby created an independent new species and name, *Hemitelia brunoniana* C.B.Clarke, and it was this name, not Wallich's or Hooker's, as Holttum thought, that he later transferred to *Cyathea* as *C. brunoniana* (C.B.Clarke) C.B.Clarke & Baker, thus obstructing the use of the name for Wallich's plant in the genus *Cyathea*. This therefore leaves Wallich's and Holttum's sense of "*Cyathea brunoniana*" without a name in *Cyathea*, which is supplied above as *Cyathea sollyana* (Griff.) Fraser-Jenk. Tryon (1970), albeit unaware of these unavoidable complications, combined

the epithet *brunoniana* in the genus *Sphaeropteris* by reference to *A. brunoniana* Hook., *i.e.* Wall., and should that minor genus be preferred it must be called *S. brunoniana* (Wall.) R.M.Tryon, an unfortunate situation arising from the two different epithets *brunoniana*.

Possible future alternatives (though not followed here) to the present treatment might be to reject either *A. brunoniana* Wall. and all combinations based upon it (in which case the two species would be *C. sollyana* (Griff.) Fraser-Jenk. or *S. sollyana* (Griff.) ——, the latter requiring a new combination, and *C. brunoniana* (C.B.Clarke) C.B.Clarke & Baker or *A. brunoniana* (C.B.Clarke) ——, the latter requiring a new combination); or otherwise to reject *H. brunoniana* C.B.Clarke and all combinations based upon it (in which case the two species would be *C. brunoniana* (Wall.) —— or *S. brunoniana* (Wall.) R.M.Tryon, the former requiring a new combination, and *C. chinensis* Copel. or *A. costularis* Baker). The latter option would preserve the current usage since 1970, even if utilising the epither *brunoniana* in a sense contrary to the way it has most often been used. None of the three treatments is entirely straightforward and as neither species is of wider importance (in cultivation, commerce *etc*.) and these critical species are not more widely known than most other ferns, there would hardly seem to be any need to invoke rejection or conservation of names here.

The tallest tree-fern in the Indo-Himalaya (to *c*. 50 ft.), usually with an unbranched trunk (see illustration by Diels (1899: 137), which must be this species); stipe and rachis pale- to mid-brown, smooth, but often slightly warty in the lower parts, glossy, without spines or thorns, stipe-base scales linear-lanceolate, pale brown with darker cilia at the margins; lamina pale-glaucous beneath, fresh blueish green above, segment-lobes rounded, hardly toothed, usually without scales apart from minute brown microscales beneath the costules, but deciduous lanceolate, white scales present beneath when leaf very young; fertile segments normally narrowed, completely covered in exindusiate sori, or when not so narrowed, sori close packed along the midrib.

Nepal:

E: **Sankhuwasabha** [E. Nepal, Arun valley, Sabhaya khola, 27° 28', 87° 20', mixed subtropical forest, 2600 ft., *J.D.A. Stainton* 5899, 29.4.1967, BM (reported by Fraser-Jenkins 2003)].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Bangladesh; Vietnam. Not present in the W. Indo-Himalaya as stated by Dixit (1986).

(M, R(A)). This is a very rare (in Nepal and Sikkim) lower-mid altitude species of shaded slopes in very damp, undisturbed subtropical forest. It was once common in Darjeeling ("Sikkim") and S. Sikkim, but is now very nearly extinct there,

Nepalese threatened status: **CR**. Only a single collection has been made from Nepal. It was formerly a common and majestically towering queen of the forests in

Sikkim and Darjeeling, but now been selectively cut down and has entirely disappeared from most places especially in N.C. India (Sikkim and Darjeeling), where it is effectively extinct. This is largely due to its illegal use for Orchid cultivation centred at Kalimpong (see Dixit 1986), and despite CITES protection tree-ferns are still being openly advocated for use in the attempted expansion of the Indian Orchid trade industry, without any trace of legal action for serious environmental criminal activity by the so-called Biodiversity Authority of India (see Ferny-Jokings 2013 for the tables turned). It would be preferrable that any Orchid growers wishing to use tree-fern trunks must first grow living tree-ferns from spores and only attach Orchids on tree-fern specimens they must maintain in living state in their gardens. Unfortunately these magnificent and seriously threatened species cannot have a higher I.U.C.N. threatened status in India because, like a considerable number of rarities elsewhere in India, they remain common, for now, in Arunachal Pradesh, which is nearly the only State where full-sized specimens of the present species can still be seen.

92. ***Cyathea spinulosa*** Wall. *ex* Hook. (syn.: *Alsophila spinulosa* (Wall. *ex* Hook.) R.M.Tryon; *Alsophila decipiens* J.Scott *ex* Bedd.; *Cyathea decipiens* (J.Scott *ex* Bedd.) C.B.Clarke & Baker; *Hemitelia beddomei* C.B.Clarke; *Alsophila fauriei* Christ; misapplied name: "*C. brunoniana*" *sensu* Nair (1973), *non* (C.B. Clarke) C.B.Clarke & Baker).

The commonest, tall tree-fern (trunk to *c*. 25-30 ft. tall); stipe and rachis pale-brown, prominently spiny, with smaller spines on the pinna-costae; stipe-bases bearing many narrowly lanceolate, bicolorous scales with darkish brown centres and thin, pale toothed margins; pinnule costules and lobe midribs paler beneath, bearing small, whiteish, lanceolate and deciduous scales beneath when young, becoming glabrous, but no hairs (below); young sori are surrounded by a thin white indusium, which shrivels and usually drops off on maturity.

Nepal:

?**W**. Thapa (2002) listed it as fairly common "throughout Nepal", but we have not seen any collections from W. Nepal, though it should be present there in sheltered valleys as it occurs in Uttarakhand further west.

C: **Manang** [Jagat - Dharapani, Manang, 841283, on shady and moist place, 1430-2000 m., *D.P. Joshi* & *M.M. Amatya* 73/351, 9.7.1973, KATH], **Palpa** [Ridikhola, shady and moist place, 4500 ft., *S.B. Malla* & *S.B. Rajbhandari* 769, 24.1.2019 [5. 1962], KATH], **Parbat**, **Kaski** [Kaski, near Pokhara, 4500 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 7106, 7.9.1954, BM; Modi khola, 4500 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 5308, 19.5.1954, BM; Birethanti, Kaski Distr., moist west face slope, 1440 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/1695, 19.7.1974, KATH; forested, deep, rocky stream-ravine above and just E. of "Nature Home" restaurant, *c*. 2 km. W. of "Fishtail Lodge" Hotel, in Raniban forest on S. side of E. end of Phewa Tal, across lake from and S. of Baidam ("Lakeside"),

Pokhara, *c.* 6 plants seen, *C.R. Fraser-Jenkins* 25124 (FN 1103), 1.1.1997, H], **Tanahun** [small forested gully opposite and S. of Chabise village, *c.* 3 km E. of Khairentar, E. of Pokhara on Damauli road, Tanahun District, *C.R. Fraser-Jenkins*, with *K. Pongali* 25808 (FN 1786), 27.12.1997, H], **Gorkha** [wooded slope and edge of path between Komale and the third stream-gully (khola) below Komale (not accessible from below), next to Balu Khola, 1 - 1½ km. below and S.W. of Komale, on path down to Markichowk (Marsyangdi) reservoir, W. of Anbu Khaireni, Gorkha District, *c.* 750 m., two plants seen, *C.R. Fraser-Jenkins* 25096 (FN 1075), 30.12.1996, H], **Dhading** [rocks and banks along stream in dense mixed forest of Raniban, below Nagarjun ridge, below Jamachok Mt. on N.E. side, *c.* 1 km. E. of Mudkhu (Wallich's "Mareko") check-post, below main Kathmandu to Trisuli Bazaar road, *c.* 3 km. N.W. of Balaju, *c.* 5 km. N.W. of N.W. of Kathmandu, just outside Kathmandu Valley, Dhading District, *C.R. Fraser-Jenkins* 31357, 9.9.2005, TAIF], **Kathmandu** [Sundarijal, Indian road, in a stream bed above lake, 6500 ft., *R.L. Fleming* 1643, 11.7.1961, K, KATH], **Bhaktapur** [forested rocky stream-gully, *c.* 1 km. S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, E.N.E. of Kathmandu, Bhaktapur District, *c.* 1500 m., *C.R. Fraser-Jenkins* 25224 (FN 1203), 15.2.1997, H], **Dolakha** [Totalabari, Tamba-Bhote Kosi valley, Dolakha, along ravine, 1150 m., common, *K.R. Rajbhandari* & *B. Roy* 1316 (d), 14.7.1977, KATH].

E: **Solukumbhu** [près de la Dudh Khosi, rive droite, 1580 m., *A. Zimmermann* 239, 10.4.1952, BM; Karodo, near Kenja, Solukumbu, *c.* 1750 m., *T. Nakaike* 3484, 22.10.1988, KATH], **Sankhuwasabha** [Arun valley, Num, beneath trees, 5500 ft., *J.D.A. Stainton* 769, 26.6.1956, ditto 5000 ft., 777, 29.6.1956, BM, KATH], **Bhojpur** [Dingla, Chirkhowa, dense forest, 1100 ft., *Dr. Banerjee* [*M.L. Banerji*], *A.V. Uphadyaya* & *B.B. Baskola* [*Basukala*] 3265, 23.4.1965, KATH; Saju Khola (1400 m.) - Dingla (1000 m.), 873274-873273, Taplejung Distr., in thicket along river, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725425, 1.7.1972, KATH], **Ilam** [Rangapani, S. of Ilam, *R.L. Fleming* 2293, 11.10.1976, MICH, *sub* "*C. brunoniana*" in error; near Ilam, Ilam, 1000 m., *T. Nakaike* 3613, 4.11.1988, KATH], **Taplejung** [Garhi Danra - Linkim - Tuwa, Taplejung, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 4.11.1963, BM, KATH; E. Nepal, Tamur valley, Mewa khola, 27° 25', 87° 35', *J.D.A. Stainton* 5886, 24.4.1967, BM; Sangu, north of Milke danda ridge, damp ravine, 4800-5000 ft., *R.L. Fleming* 2078, 30.11.1971, K; Tamur, Taplejung Distr., 730 m., *K.R. Rajbhandari* 16032 (FN 9250032), 11.5.1992, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [Debbichhina and Pamtori, Didihat, Pithoragarh, *B.D. Naithani*; *Y.P.S. Pangtey* & *N. Punetha*; Gopeshwar, Chamoli, *S. Singh*]. N.E., C. and S. India; Bangladesh; Sri Lanka; Thailand; Vietnam; Taiwan; S. Japan.

(S, Sc to C). A scattered, but not particularly uncommon lower-mid to mid-altitude species of clearings in semi-open, undisturbed forest on slopes, or otherwise in damp, forested gullies, but easily destroyed by forest disturbance, burning or selected cutting for horticultural use.

Nepalese threatened status: **LC**.

DICKSONIACEAE

Cibotium

[***Cibotium barometz*** (L.) J.Sm. (syn.: *C. assamicum* Hook., synonymised by Fraser-Jenkins (2008)). This species was listed without basis by Iwatsuki (1988) as being Himalayan, but with no collections from Nepal. It is not known from Nepal and is not expected there. While it might perhaps be expected to turn up in future as far west as further S.E. Bhutan, there are also no Bhutanese collections of it.

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh. Assam State and further N.E. India *etc*.]

DENNSTAEDTIACEAE

Dennstaedtia (2 species).

93. ***Dennstaedtia appendiculata*** (Wall. *ex* Hook.) J.Sm. (syn.: *Dicksonia appendiculata* Hook.; *Emodiopteris appendiculata* (Wall. *ex* Hook.) Ching & S.K.Wu, *comb. inval.*, no basionym ref.; *Patania appendiculata* (Wall. *ex* Hook.) Bedd.; *Dicksonia glutinosa* Wall. *ex* Hook.; *Dicksonia elwesii* Baker; *Dennstaedtia elwesii* (Baker) Bedd.; *Emodiopteris elwesii* (Baker) Ching & S.K.Wu, repeated as "(Bedd.) S.R.Ghosh"; *Emodiopteris appendiculata* var. *elwesii* (Baker) R.D.Dixit).

The very closely similar taxon, *Dennstaedtia elwesii* (Baker) Bedd., from Sikkim, Bhutan (Ritang to Ratsoo, *H. Hara et al.* 9214 and *s.n.*, 23.4.1967, BM, E, TI, KATH; Fraser-Jenkins, in prep.) and China, is perhaps of rather uncertain status. But it appears much more likely to be just variation in hairiness and glandulosity in *D. appendiculata*, as concluded by Fraser-Jenkins (2008), who synonymised it. It differs only in having very few and smaller hairs on the axes (though they are present) and almost no glands on the lamina; the pinnule lobes are also more deeply cut, narrower and more distant, but it does not differ in other respects and, importantly, intermediate plants can be found connecting the two extremes in all these individual respects. Yan, Qi & Serizawa (2013) in the *Flora of China* treated such plants as a distinct species, but erroneously stated that it differs diagnostically in not having a tapering frond-base and in having more distant pinnae, but those features are spurious and merely a matter of individual growth and development. All states can easily be observed in the field in normal, hairy *D. appendiculata*, from an abrupt, wider base to a strongly tapering one, as well as variation in the narrowness and closeness of the pinnule-lobes matching those of *elwesii*, while

fully tapering fronds and crowded pinnae are commonplace in the *elwesii* plants as well. Unfortunately very few living pteridologists have actually seen *elwesii* in the field and that also applies to CRFJ.

Rhizomes thick, semi-erect, forming clumps; stipes tufted, stramineous, matt, short (longer in sheltered specimens) variously hairy with jointed russett hairs, rachis similar with a variable amount of shortish, jointed russett hairs, all axes and veins usually well furnished with minute sticky glands beneath; fronds erect, narrowly lanceolate (but wider-based in large and sheltered specimens), lamina softly herbaceous, fresh green up to 1 m. tall, tripinnatifid, finely dissect, pinnules fairly closely adjacent, deeply lobed with variably narrow or linear, crowded to more distant lobes, pinnule-apices narrowly rounded long-toothed (lobed); sori terminal at the lobe-apices, small, rounded, cup-shaped, with an outward-opening indusium.

Nepal:

W: **Darchula** [N.W. facing rocks in forest below cliffs, *c*. 2 km. S. of Dorpatta village (opposite Lamari and S. of Buddhi in India), *c*. 12 km. N. of Dumling, west side of Api Himal, N. of Darchula, E. side of Kali river (border with India), Darchula District, *c.* 1850 m., *C.R. Fraser-Jenkins*, with *A.M. Thapa* & *B. Pariyar* 21631 (FN 298), 21.11.1994, E], **Doti** [Masintola, Doti Distr., *Bis Ram* 392, 11.5.1929, BM, DD], **Bajhang** [Dhalaun, Bajhang District, *H. Tabata*, *K.R. Rajbhandari* & *K. Tsuchiya* 1494, 23.7.1976, KATH], **Dailekh**, **Humla** [Poom to Kallas, 3000 m., *K.R. Rajbhandari* & *B. Roy* 4104, 28.7.1979, KATH], **Mugu** [Mugu, Karnali valley near Mangsi, wet place on open slope, 7000 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 5264, 16.8.1952, BM], **Jumla** [Poyora, in damp shady banks, 9500 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 357, 28.7.1952, BM; Chaurkot, S.E. of Jumla, on moist bank, 10,000 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 5432, 27.9.1952, BM; Jumla, *H. Tabata*, *D.P. Joshi*, *K. Tsuchiya* & *Y. Yasuda* 13602, in 1982, A], **Jajarkot** [Dhaulakot, shaded ravine in forest, 7500 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 494, 18.8.1952, BM].

C: **Baglung**, **Myagdi** [nr. Beni, terrace banks on open hillsides, 4500 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 2797, 23.5.1954, BM; Gurjakhani, in forest ravines and on edges of clearings, 8500 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 3671, 28.7.1954, BM; Myagdi Distr., Dobang (2360 m.) - Lapche Kharka (2060 m.) - Lipshe (1840 m.) - Boghara (2010 m.), 83° 23', 28° 33-37', 1820-2360 m. *M. Mikage*, *R. Hirano*, *N. Kondo*, *C. Mohri*, *A. Takahashi* & *K. Yonekura* 9685316, 10.9.1996, KATH, pinnule lobes narrow and deeply dissect as in "*D. elwesii*", but axes well hairy and lamina glandular], **Mustang** [Ghasa to Kokhethanti, Mustang, 2150-2600 m., *V.L. Gurung* 1457/81, 25.6.1981, KATH; Kali Gandaki, near Lete, in rather dry open grassland between rocks and shrubs, 6800 ft., *G.* & *S. Miehe* B 48, 11.7.1977, BM], **Manang** [Marsyandi valley, between Timang pasture and Bagarchap, in forests, 2400 m., *T. Wraber* 540, 30.10.1969, BM], **Parbat**, **Kaski** [Siklis, north of Pokhara, wet ground, among boulders on open slopes, 7000 ft.,

J.D.A. Stainton, W.R. Sykes & *L.H.J. Williams* 5001, 22.4.1954, BM; Pokhara Distr., Pathana (Dhampus) (2050 m.) - Tolka (1850 m.), 836282, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8310157, 8330214, both 8.7.1983, BM], **Tanahun**, **Lamjung** [Lamjung Distr., Syange, 84° 30', 28° 20', western slope, *c.* 1140 m., *K. Ishida* 340, 1.8.1986, KATH], **Dhading** [Ganesh Himal, Ankhu khola, 28° 12', 85° 6', riverside beneath overhangimg rocks, 6000 ft., *J.D.A. Stainton* 3658, 2.5.1962, BM], **Makawanpur**, **Rasuwa** [Chilimagaon - Khola Karka, deciduous forest, damp ground, 6000-7000 ft., *O. Polunin* 991, 13.7.1949, BM; Thanglot, 1750 m. - Chilime, 1200 m. - Paracaon, 2300 m. - Kiloget, 2250 m., *H. Kanai* & *P.R. Shakya* 624, 28.6.1970, KATH], **Nuwakot**, **Kathmandu** [Thankot, near Kathmandu, 4000-6000 ft., *B.D. Pande* F.10, 1.6.1949, BM], **Lalitpur** [Godawari (1600 m.) - Phulchauki (2500 m.), Kathmandu, *H. Hara, H. Kanai, G. Murata, H. Ohashi, O. Tanaka* & *T. Yamazaki* 3079, 23.6.1967, BM, KATH], **Bhaktapur**, **Sindhupalchok** [Tharki Ghyang, Helumbu, at edge of cultivation, 8800 ft., *R.L. Fleming* 1832, 5.8.1964, KATH], **Dolakha** [Risingo - Manga - Deorali, 5000-7700 ft., on moist soil near waterfalls, *R.S. Rao, Indian Cho Oyu Expedition* 13569, 31.3.1958, KATH].

E: **Solukhumbhu**, **Sankhuwasabha** [Tute (2300 m.) - Sindua (2100 m.), *H. Ohashi, H. Kanai, H. Ohba* & *Y. Tateishi* 773086, 2.9.1977, BM; Chantang (2250 m.) - a bridge (1750 m.) - Redak (2400 m.), *H. Ohashi, H. Kanai, H. Ohba* & *Y. Tateishi* 772147, 8.8.1977, BM], **Morang** [Morang, *J.Y. Berger, B.M. Davis* & *Tribhuvan Univ.* TUCH 128, 6.2009, KATH, TUCH], **Dhankuta** [Hile (1900 m.) - Mure (2100 m.), 872271, on marshy ground in open place, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725097, 5.6.1972, BM, KATH], **Bhojpur** [Chyamtang, in full sun on dry stone walls and rough banks around the village, *c.* 8000 ft., *L.W. Beer* 12238, 17.11.1971, BM], **Tehrathum**, **Taplejung** [Tamrang khola ("Glen Coe"), *c.* 2 miles from Sangu, rocky bank of stream, 7000 ft., *A.H. Norkett* 7277, 21.11.1961, BM; Shewaden (2600 m.) - Mewa Khola (2100 m.), 873274, along path in shade, *c.* 2300 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725317, 29.6.1972, BM, KATH]. E. Nepal [Terra Bence, 9-10,000 ft., *Capt. Lall Dhwoj* 436, *c.* 21.2.1931, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. N.E. India.

(S, C). A very common and very attractively dissect, fresh green fronded upper-mid to higher altitude species of open places, usually among stones or stone walls, or in pathside ditches, or beside open streams wherever the ground is damp, often in huge numbers beside village paths *etc*.

94. ***Dennstaedtia zeylanica*** (Sw.) Zink *ex* Fraser-Jenk. & Kandel, ***comb. nov***. (basionym: *Dicksonia zeylanica* Sw., in Schrader, *J. Bot.* **1800**(2): 91 (1801); syn.: *Dicksonia scabra* Wall. *ex* Hook.; *Dennstaedtia scabra* (Wall. *ex* Hook.) T.Moore; *Dicksonia deltoidea* Hook., *Dennstaedtia deltoidea* (Hook.) T.Moore; *Dennstaedtia*

glabrescens Ching; *D. scabra* var. *glabrescens* (Ching) C.Chr., the latter not separable from the species). Zink (2006) pointed out that *Dicksonia zeylanica* Sw. might be the correct earliest basionym for this species, but did not follow this up further. Dr. Kanchi Gandhi of Harvard (pers. comm. 3.2015) has kindly pointed out to us that Salomon (1883) identified it as a *Dennstaedtia*; Christensen (1905) also did so, as the Pacific Island *D. flaccida* (G.Forst.) Bernh., a species similar to the present plant, but which does not occur in Sri Lanka. Being of no wider interest or usage and not causing confusion, the present simple name-change should not induce any proposals to conserve or reject names.

Rhizome thin, very long-creeping; stipes arising separately, long (as long as the lamina), thin, hard, often purplish red or blackish later in the season, bearing scattered pale hairs, rachis varying continuously from being nearly glabrous to considerably hairy; fronds up to *c.* 60 cm., lamina herbaceous, variously hairy (sometimes almost glabrous), widely deltate (more narrowly so when young) and often slightly attenuated apically, tripinnate below; lowest basiscopic pinnules the longest; pinnule-lobes narrow, with blunt, toothless apices; sori apical on the side lobes, small, rounded, with an outward-opening indusium.

Nepal:

C: **Kaski** [Pasgam, on damp shady bank, 5500 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 5930, 25.6.1954, BM; densely forested stream-gully on N. facing slope, shortly above Poiyim village, on S side of and above Burjung Khola (river), shortly below and on N.W. side of ridge, *c.* 4½ km. N. of Kahure (Kaure) village, *c.* 9½ km. N. of Puranchaur, N.W. of Lamachaur, off Upper Seti valley, *c.* 20 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *C.R. Fraser-Jenkins*, with *J. Bhdr. Pariyar* & *K. Pariyar* 26326 (FN 2304), 9.5.1998, H], **Makawanpur**, **Kathmandu** [Shivpuri/Sheopure, Kathmandu, 6800 ft., *R.L. Fleming* 260, in 1949, DD, ditto, 1672, 14.7.1962, KATH; forested stream gully of Mahadev Khola, and forest slopes above Sanagaon village, N. of Kulaltar, W. of Sankhu, N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* 33053 (FN 166), 29.9.2008, TAIF], **Sindhupalchok** [Manichur-Patibhanjyang, Sindhupalchok, 7300-7010 ft., *V.L. Gurung* & *M. Gorkhali* 78/623, 21.10.1978, KATH], **Ramechap**.

E: **Solukhumbhu**, **Sankhuwasabha** [Lamo Pokhari (2900 m.) - Chauke (2700 m.), 873272-872275, along path in open slope, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725459, 4.7.1972, BM], **Dhankuta** [forested N.W.-facing slope just below top of ridge (on Dhankuta District side, to W.) and narrow, rocky stream-gully at bottom of slope, *c.* 1 km. (by zig-zag road) W. of and above Basantapur [in Tehrathum District, to E. of ridge], N. of Hile and Dhankuta, on road to Tehrathum and Sankhuwasabha, Dhankuta District, *c.* 1900 m., *C.R. Fraser-Jenkins* 28796 (FN 4771), 23.3.2001, H], **Tehrathum** [Tute, 872272, humus rich slope in dense hill forest, 2300 m., *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725124, 6.6.1972, BM; Basantapur - Chauki, 2600 m.,

H. Ikeda, D.R. Kandel, R. Chhetri, H. Uchiyama, K. Akai, H. Taneda, O. Yano, N. Yamamoto, K. Miyata & *M. Nakaji* 1228013, 8.8.2012, KATH], **Ilam** [Mai Pokhari, Ilam, roadside, 7500 ft., *R.L. Fleming* 2558, 17.9.1978, KATH]; **Taplejung** [above Sanghu, secondary wood, on banks of path, 6200 ft., *A.H. Norkett* 7108, 15.11.1961, BM; Taplejung - Heydewa - Garhi Danra, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 3.11.1963, BM].

Himalayan distribution: Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir. N.E. India; Sri Lanka; E. and S.E. Asia.

(S, C). A common upper-mid altitude species (though less common further west), of semi-open places among bushes at the edge of forests, or in clearings, on slopes, or shaded roadsides.

Histiopteris

[***Histiopteris incisa*** (Thunb.) J.Sm. - China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; a common mid to upper-mid altitude species similar to *Pteridium*, but with a blueish-green, glabrous frond and much wider, more ovate segments. It was listed by Iwatsuki (1988), but from Sikkim eastwards, though it should probably be looked for in far east Nepal. However it is well known at present for being one of a handful of adjacent species which is not known from Nepal. It certainly does not occur in the W. Indo-Himalaya, as surprisingly stated by Ghosh *et al.* (2004). (S, C).]

Hypolepis (1 species).

95. ***Hypolepis polypodioides*** (Blume) Hook. (syn.: *H. robusta* W.M.Chu; *H. coerulescens* A.Biswas; *H. gamblei* A.Biswas; *H. indica* A.Biswas; *H. sikkimensis* A.Biswas; *H. viridula* A.Biswas; misapplied names: "*H. punctata*" *sensu auct. Ind*. (including Fraser-Jenkins 1997), *sensu* Brownsey (1987), *p.p. Ind*., *non* (Thunb.) Mett. *ex* Kuhn [from Japan, E. China *etc*.]; "*H. alpina*" *sensu* Panigrahi (1960), Baishya & Rao (1982) and Ganguly & Mukhopadhyay (2005), *non* (Blume) Hook. [from Indonesia]; "*H. rugulosa* [error for *rugosula*]" *sensu* S. Chandra (2000), *non* (Labill.) J.Sm. [from Australia]). This species was widely misnamed in the Indian subcontinent as *H. punctata* in error, but the widespread presence of *H. polypodioides* was pointed out by Brownsey (1987) and the absence of *H. punctata* was then shown by Fraser-Jenkins (2008), while also finding the correct name for the S. Indian glandular plant is *H. resistens* (Kunze) Hook. (syn.: *H. glandulifera* Brownsey & Chinnock; *H. longa* A.Biswas), which is not present in N. India as erroneously stated by Chandra (2000). A number of spurious random species were named from India, but synonymised by Fraser-Jenkins (1997, 2008), and have now also been so determined by Brownsey on the type-sheets, which were not initially made available to others for study.

A large, bracken-like fern of waste places, with a long-creeping rhizome; distant, long stipes and deltate-lanceolate, tripinnate fronds, with the lowest pinnae opposite, but segments smaller, shorter and more finely lobed than in *Pteridium* species and bearing small teeth at the apices; many small, pale, glistening, jointed hairs on axes and lamina, but not the stalked or spherical glands which are present very densely in *H. punctata*, though loose, immature spores are often mistaken for them; sori slightly elongated but short, marginal, indusiate.

Nepal:

W: **Darchula** [N.W. facing rocks in forest below cliffs, *c.* 2 km. S. of Dorpatta village (opposite Lamari and S. of Buddhi in India), *c.* 12 km. N. of Dumling, west side of Api Himal, N. of Darchula, E. side of Kali river (border with India), Darchula District, *c.* 1850 m., *C.R. Fraser-Jenkins*, with *A.M. Thapa* & *B. Pariyar* 21630 (FN 297), 21.11.1994, E], **Bajhang**, **Salyan** [Kumak Ridge, north of Sallyan, damp, stony bank, 6000 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3751, 30.3.1952, BM, E].

C: **Myagdi**, **Kaski** [Kaski, near Pokhara, among boulders, 4000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 7102, 7.9.1954, BM], **Gorkha** [stream gulley of Chisopani Darrah Khola, in patch of natural mixed forest on south-west side of ridge between Deurali village and Komale hamlet, *c.* ½ km. below Hattiya Deurali village, between the main Gorkha and Pokhara roads, above and N.E. of Goplinghat village and Markichowk, west of Anbu Khaireni and Mugling, Gorkha District, *c.* 900 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.* & *R.* [*G.*] *Pariyar* 20868 (FN 1116), 16.2.1994, E], **Dhading**, **Rasuwa** [Ramche to Dhunche, terrestrial, occurring on shady forest floor, 1800-2000 m., *V.L. Gurung*, *T.K. Rajbhandari* & *D.P. Joshi* 844/79, 15.9.1979, KATH], **Nuwakot**, **Kathmandu** [Nagarjun, Kathmandu, sparing damp spot, 4700 ft., *R.L. Fleming* 1348, 14.8.1957, KATH; Thankote, Kathmandu, *A.R. Sakya* 7, 6.5.1973, BM, published as tetraploid, $n = 104$ by Roy, Sinha & Sakya (1971); Swayembhu, Kathmandu, on dirty slope near stream, 4200 ft., *P.R. Shakya* 62, 4.11.1968 (2025.7.18), KATH; dense forest by path on N.E. side of Sheopuri [Shivapuri] mountain, near Bagdwar temple, above and to N.W, of Nagi Gompa nunnery, N. of Buddhanilkantha and Kathmandu, *c.* 7500 ft., *C.R. Fraser-Jenkins*, *A.C. Jermy* & *Rajkumar K.C.* 19498 (FN 383), 16.1.1993, E], **Bhaktapur**, **Lalitpur** [limestone rocks in woods, shortly below peaks on N.W. side of Phulchowki mountain, above and east of Godawari, E.S.E. of Kathmandu, *c.* 8000 ft., sporelings with juvenile morphology, *C.R. Fraser-Jenkins* & *C.D. Fraser Jenkins* [father] 15839, 20.11.1989, E], **Kabhrepalanchok** [densely forested stream-gully above temple, on N.-facing slope, *c.* ½ km. S. of and above road from Kathmandu to Dhulikel, above Mailtar village, above and S.W. of Jangal village, *c.* 1½ km. W. of western limit of Banepa, *C.R. Fraser-Jenkins* 28671 (FN 4646), 18.10.2000, H], **Sindhupalchok**, **Dolakha** [Tamba Kosi, Pikhuti (950 m.) - Singati (950 m.) - Suri Dhoban (1000 m.) - Totlabari (1100 m.), 861275 - 862275, *H. Ohba*, *M. Wakabayashi*, *M. Suzuki* & *S. Akiyama* 8331567, 28.8.1983, KATH; Dolakha, Suri

Dovan, Suri-8, 1100 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121128, 9.11.2012, KATH].

E: **Solukhumbhu** [Solukhumbu, Junbesi, *T. Nakaike* 3397, 18.10.1988, KATH], **Sankhuwasabha**, **Sunsari**, **Dhankuta** [Hilay, *H. Hara, H. Kanai, S. Kurosawa* & *G. Murata* 6305069, 23.10.1963, E; Sanguri Bhajyang (1300 m.) - Dhara pani (1000 m.), 872266, in light shade, *c.*1250 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725041, 2.6.1972, BM, KATH, mislabelled by KATH staff as "Sunsari Distr." in error], **Tehrathum** [Tute (2300 m.) - Basantapur (2300 m.), 872272 - 872271, along path in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725496, 7.7.1972, KATH; Basantapur - Chauki, Sankhuwa-sabha, on marginal places, 2600 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955047, 3.8.1999, KATH], **Jhapa**, **Ilam** [Mai Pokhari, Ilam, under vegetation, 7500 ft. *R.L. Fleming* 2500, 17.9.1978, KATH], **Taplejung** [Sanghu, 27° 21', 87° 33', bank of lower path/secondary wood, 6000 ft./6200 ft., *A.H. Norkett* 5606/7110, 4.10.1961/15.11.1961, BM; Sangu base camp, by stone wall, N.E. aspect, 6000 ft., aphids taken on underside of fronds, *R.L. Coe* 3, 29.11.1961, BM; Shewaden (2600 m.) - Mewa khola (2100 m.) - Papung (2000 m.), 873274, along path in open place, *c.* 2200 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725371, 29.6.1972, BM, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir. N.E. India; Bangladesh; Thailand, S.E. Asia; Pacific Islands.

(S, C). A very common mid to upper-mid altitude species of waste places, roadsides, edges of paths, ditches, old walls (where juvenile sporeling plants can often be found) and other damp, open places.

Microlepia (10 species).

The species of this genus have long been badly confused, not only with the separate species not being recognised due to variability in the degree and width of lobing, and attempting to base species-concepts only on the hairs, which are very variable in density, but especially also nomenclaturally, making it one of the most complex and misunderstood genera in South Asia (along with *Arachniodes* and *Cyrtomium*). Names have been, and continue to be widely misused in many different senses, and the same epithet has often been validated as an independent name more than once, along with many similar sounding epithets, creating a highly convoluted and difficult nomenclatural situation, with lengthy synonymies and many misapplications. In India authors generally place misapplications as if independent synonyms thus adding to the confusion. Many of the central problems of nomenclature for this genus lie in the Indian subcontinent, and Fraser-Jenkins (1997, 2008) unravelled and clarified most of the problems after becoming fully familiar with the relevant species and studying all the relevant types, though this revision continues to be overlooked in India as most workers in the area do not study and assimilate others'

publications. Some further minor adjustments and revision are made here, for which we have included more cited specimens than in some other genera.

[***Microlepia calvescens*** (Wall. *ex* Hook.) C.Presl (syn.: *Davallia calvescens* Wall. *ex* Hook.; *M. marginata* var. *calvescens* (Wall. *ex* Hook.) C.Chr., repeated by Nair (1971); *M. urophylla* T.Moore, *nom. superfl.* for *D. calvescens, non D. urophylla* Hook. [= *M. caudigera* T.Moore (syn.: *M. ashtonii* S.-J.Moore), a very large, tripinnatifid species with large glabrous pinnules, from Bhutan, Arunachal Pradesh, Myanmar (Kachin, *P.K. Khine, G.* & *S. Miehe* & *J. Kluge* 13-102-258, PHMR, det. CRFJ 2014) and Sarawak]; ?*M. ravenii* S.-J.Moore, differing only in pinna-costa nearly glabrous beneath, though more material is required to be studied; Moore & Wang (2011) did not mention *M. calvescens*).

This is a distinct species, not a "variety" of *M. marginata*, a rank of uncertain meaning as treated by Yan, Qi & Serizawa (2013) in the *Flora of China.* Though closely similar to *M. marginata* it does not merge into it and has a distinct range in the further eastern Indo-Himalaya.

Stipe long (as long as the lamina), softly hairy; lamina widely truncate at the base, attenuate at its apex, pinnae long, acute apexed, with a diagnostic, obvious petiole (*c.* 6 mm. long, or often more), simple, asymmetrical at their bases with the lamina and lobes longer at the acroscopic base and very narrow basiscopically, acroscopic base usually auriculate, pinnae falcate, with shallow lobes, pinna midrib, but not lamina very densely short-hairy beneath with brown hairs (not, or very exceptionally glabrous, as stated in the *Flora of China*), similar hairs often extend a little way up the veins; sori in inframarginal loops.

Himalayan distribution: China; Arunachal Pradesh; Bhutan; ?Nepal. Assam; Nagaland; Manipur; Meghalaya; Thailand; S.E. Asia. It is not present in the W. Indo-Himalaya, as stated by Ghosh *et al.* (2004), presumably repeated from the confusion made by Chandra (2000) and in turn from Wallich's muddled report from Kumaon (two specimens at Kew labelled by Hooker as "Kamoon, *Wallich*" in error), long since pointed out correctly by Clarke (1880: 447) who reorganised the Wallich herbarium. Iwatsuki (1988) reported it from Nepal, but without basis as he stated that no specimens had been examined and none of the references he gave were from Nepal. Thapa (2002) therefore also reported *M. calvescens* from E. Nepal, but the only specimen he attempted to identify as it himself at KATH, is *M. marginata*, which species is quite common in C. Nepal but was not reported by Iwatsuki, presumably as it was not collected by Japanese botanists. The present author has not seen any material of *M. calvescens* that is definitely from Nepal (apart from herb. Wallich's 1819 collection, below), which might therefore be another phantom species in the flora, unless it should be found later. But in view of its further N.-Eastern distribution in the Indo-Himalaya, it is perhaps not particularly to be expected.

However there are two specimens of *M. calvescens* at BM, labelled "Davallia villosa

Wall. Napalia. *Dr. Wallich* 222 Herb John Smith 1866" and "Napalia. Dr. Wallich (1819)", the latter with similar labelling to other early Wallichian herbarium collections. The first is not Wallich's List no. 222, which is an *Asplenium*. From the date, at least the second specimen was collected by the Hon. Edward Gardner supervising Wallich's collectors, Francis de Silva and Baghat Singh, at the British Residency, Kathmandu (see Fraser-Jenkins 2006), but both specimens probably originated from one gathering. If they were correctly labelled they should have been collected in the hills surrounding or on the way up to the Kathmandu Valley, but it is strange that no other definite Nepalese collections of *M. calvescens* have been made, including in the now very well known and well collected central part of Nepal and the Kathmandu valley. Unless it does turn up there at some stage, it would appear that the specimens might be the result of yet another of Wallich's many muddlings of specimens (alluded to by Clarke and many other botanists). For this reason the species is not (as yet) accepted as being present in Nepal. A pinna which is the lectotype specimen, here designated, of Don's *Davallia scabra*, *Prod. Flor. Nepal.*: 9 (1824), mounted on its own blue paper, was glued onto the corner of the Wallichian herbarium sheet of 1819, with Don's slit-cut label and writing "Davallia scabra. Nepal. D. Don Prod.", BM. But it was not taken off the same *M. calvescens* specimen as the rest of the sheet, despite their confusing superficial similarity, but is different as it has the longer, paler hairs of *D. marginata*. The pinna was also identified in pencil writing by Anthony Gepp (former Keeper of Botany at the BM) as "Don's type". Morton (1974) cited the whole sheet as type, but did not differentiate between the pinna and the frond. (M, R in India). Indian threatened status: **NT**.]

96. ***Microlepia firma*** Mett. *ex* Kuhn (sometimes as "var. *firma*" in error, there are no varieties within *M. firma*; syn.: *Davallia villosa* D.Don, *non* Wall. *ex* Hook. [= *M. marginata*]; *M. villosa* (D.Don) Ching, *non* C.Presl [= *M. marginata*]; *M. doniana* Copel., *nom. nov*. for *D. villosa* D.Don; *Davallia inaequalis* Kunze var. *intermedia* Hook.; *M. pilosissima* Ching; *M. firma* var. *subglabra* Sledge; *M. dubia* var. *subglabra* (Sledge) C.V.Morton; *M. medogensis* Ching & Y.-X.Lin; misapplied names: "*M. dubia*" *sensu* Morton *pp. Ind., Sledge* (1982), Zink (2006) *et auct. Ind*., *non* (Roxb.) C.V.Morton [from S.E. Asia]; "*M. hirta*" *sensu* Bedd. from S. India, *non* (Kaulf.) C.Presl; "*M. pilosissima*" *sensu* Thapa (2002), *non* Ching; "*M. speluncae*" *sensu* Matsumoto (2009: Figs. 8, 9), *non* (L.) T.Moore). This species has usually been overlooked and combined together with *M. setosa* under either name, but the two were separated by Fraser-Jenkins (2008); *D. villosa* D.Don, *nec al.*, was misidentified by Sledge (1957) as *M. speluncae* due to the difficulty at that time of identifying those of Don's types based on a Wallich collection, which were not then available, being stored in unincorporated boxes at the BM (see Fraser-Jenkins 2006).

A common large species up to 1.5 m. tall, often occurring in massive, dense colonies;

rhizome long-creeping, fronds deltate, tripinnate, arising well apart on a long creeping rhizome, with widely deltate lower pinnae and the lowest basiscopic pinnules the longest, lamina darkish grey-green, striate, with long strigose (stiff, patent) hairs (less so in some Sri Lankan island populations); differs from *M. setosa* as that has a shorter-creeping rhizome and less widely deltate fronds, with rather narrower, elongated-triangular pinnae and does not have such long, stiff hairs.

Nepal:

C: **Parbat** [Lamdwari to Tikhedunga, on the rocky slope, 1340-1680 m., *V.L. Gurung* 1400/81, 20.6.1981, KATH *sub* "*M. strigosa*" in error], **Kaski** [near Pokhara, rather open, mixed broad-leaved forest, 3500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2459, 14.4.1954, BM, *sub* "*M. pilosula*"; above Bakhri Kharka, moist forest, 7000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5080, 24.4.1954, BM, *sub* "*M. pilosula*"; path in semi-open forest on W. facing slope, *c*. 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c*. 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c*. 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *c*. 1800 m., *C.R. Fraser-Jenkins*, with *J.B. Pariyar* 26131, 26132 (FN 2109, 2110), 13.3.1998, BM, H], **Dhading** [forested rocks and slopes beside path, *c*. 1 km. in from 2nd gate, Nagarjun Forest behind and to N.W. of Jamachok mountain, *c*. 3 km. N.W. of Balaju, *c*. 6 km. N.W. of Kathmandu on road to Trisuli Bazaar, Dhading District, *C.R. Fraser-Jenkins* 30973, 13.12.2004, TAIF], **Kathmandu** [Gokarna Ban, *T. Nakaike* 3588, 29.10.1988, KATH, *sub* "*M. khasiyana*" in error], **Lalitpur** [valley to S.W. of and below Phulchowki mountain, shortly above and S.E. of quarry, above and S.E. of Godawari, S.E. of Kathmandu, *C.R. Fraser-Jenkins* 24043 (FN 21), 4.6.1996, BM, H].

E. Thapa (2002) mentioned it as common in C. and E. Nepal, but though it should be present, we have seen no material in any herbaria from E. Nepal.

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]. N.E. and S. India, Sri Lanka, Thailand.

(S, C). A rather locally common mid- to upper-mid altitude species growing on steep banks in semi-open forest, or at the edges of the forest beside paths.

97. ***Microlepia hallbergii*** (d'Almeida) C.Chr. (syn.: ?*M. taiwaniana* Tagawa; *M. fadenii* Pic.Serm.; *M. neofadenii* A.Biswas & T.Sen). This species has usually been included within *M. rhomboidea*, within which group it belongs. Fraser-Jenkins (2008) identified specimens of it from the Indo-Himalaya and reported them as *M. hallbergii*, showing that it was neither confined to W. Central India, nor endemic to India, as previously thought, but occurred throughout the Indo-Himalaya and across S. China to Taiwan and in Vietnam, also placing *M. taiwaniana* Tagawa as a synonym. Knapp (2011) placed *M. taiwaniana*, in *M. rhomboidea sens. lat.*, stating that study was

required in Taiwan concerning separation of *M. hallbergii*. However Yan, Qi & Serizawa (2013) in the *Flora of China*, while not separating *M. hallbergii* from *M. rhomboidea*, placed *M. taiwaniana* as a synonym of *M. obtusiloba* Hayata, stating that if *M. hallbergii* were included, *M. obtusiloba* (which has nomenclatural priority) would have a greater range. However the illustrations of *M. obtusiloba* by Knapp and the Japanese material collected by Tagawa at BM, are of a species in the *M. strigosa* group and not at all like either *M. hallbergii* or *M. rhomboidea*, while the illustrations given by Knapp of *M. rhomboidea* from Taiwan could otherwise be *M. hallbergii*. The present author has not looked again at authentic *M. taiwaniana* to reassess his previous opinion, nor had the opportunity to study *M. obtusiloba*, but confirms the presence in the Indo-Himalaya, China and Taiwan of *M. hallbergii*, whichever name it should be known by.

A little known large species, with fronds up to 1 m., close to *M. rhomboidea*, with lanceolate, bipinnate-tripinnatifid fronds; lower pinnae slightly shortened; pinnae deltate-lanceolate, wider towards their bases; but pinnules usually more densely strigose-hairy (less so in otherwise similar material from Sri Lanka and occasionally in the Himalaya), with glistening hairs on both surfaces, than in *M. rhomboidea* and lobes smaller, "neater" and more rounded with narrower bases, vein-endings usually prominently visible above.

Nepal:

C: **Lamjung** [Syange, Lamjung Distr., 84° 30', 28° 20', western slope, *c.* 1140 m., *K. Ishida* 339, 1.8.1986, KATH], **Kathmandu** [Tare Bhir, 1500-2100 m., *T. Nakaike* 2088, 30.9.1986, KATH, *sub* "*M. trapeziformis*" in error], **Lalitpur** [Chapagaon forest, 4600 ft., *R.L. Fleming* 1691, 9.1961, MICH *sub* "*M. speluncae*" in error; forested stream-khola, with trees in process of being cut by "forest-guard" and team, in the N. edge area (richest part) of the Bajrabarahi temple and reserve area, E. side of Chapagaon village, S. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *J.B. Pariyar* 26083 (FN 2061), 4.3.1998, BM, H], **Bhaktapur** [forested rocky stream-gully, *c.* 1 km. S.E. of Sankhu across river on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, *C.R. Fraser-Jenkins* 25249-25251 (FN 1228-1230), 15.2.1997, BM, H, and ditto 31319, 31320, 20.8.2005, TAIF].

Himalayan distribution: China (Fraser-Jenkins 2008); Myanmar (Moolmain [Moulmein, Mawlamyine], [*W.*] *Griffith s.n.*, K); Arunachal Pradesh; Bhutan; Darjeeling [rare]; Nepal; Uttarakhand [rare]. C. and S. India; Vietnam; Malaya; Java. (M, R). A rare and seldom recognised mid-altitude species of dense forest, usually occurring on banks above streams.

Indian threatened status: **NT**. Nepalese threatened status: **EN**.

[***Microlepia hookeriana*** (Wall. *ex* Hook.) C.Presl

A very distinctive species with lanceolate fronds with truncate bases and many

simple, ± unlobed pinnae, apart from an acute basal auricle, lamina with a simple apical segment; sori in a marginal line.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Meghalaya. N.E. India, S.E. Asia.

Despite the mistaken listing of Nepal from memory by Ching (1959), followed by Iwatsuki (1988), Thapa (2002) and Yan, Qi & Serizawa (2013), all without having seen any collection from Nepal, this species is not known to be present in or near Nepal, nor in the W. Indo-Himalaya as erroneously listed by Chandra (2000). (M, Sc).]

98. ***Microlepia marginata*** (Panz.) C.Chr. (sometimes cited as "var. *marginata*" in error; syn.: *Polypodium marginale* Thunb., *non* L.; *Microlepia marginalis* (Sw.) Bedd.; *Davallia scabra* D.Don; *Microlepia scabra* (D.Don) J.Sm., *non Dennstaedtia scabra* (Wall. *ex* Hook.) T.Moore; *Davallia villosa* Wall. *ex* Hook., *nom. superfl.* for *D. scabra* D.Don, *non D. villosa* D.Don [= *M. firma*]; *M. villosa* C.Presl, *non* (D.Don) Ching [= *M. firma*]; *M. marginata* var. *villosa* (C.Presl) Y.C.Wu; ?*M. glaberrima* A.Biswas & T.Sen (see below)).

"*M. marginata* var. *villosa*" (C.Presl) Y.C.Wu was mistreated as a separate variety by Yan, Qi & Serizawa (2013) in the *Flora of China* and reported from Nepal and N. India, but belongs to *M. marginata sensu stricto* as suggested to them by Gilbert, whose sound advice was unfortunately not accepted. No "varieties" of *M. marginata* exist as taxonomically and nomenclaturally separate entities within the species.

"*M. marginata* var. *bipinnata*" Makino (syn.: *M. glaberrima* A.Biswas & T.Sen; *M. kerrii* S.-J.Moore) was reported from N. India and Nepal by Yan, Qi & Serizawa (2013) in the *Flora of China*, but plants so identified in Nepal and N.E. India merely represent large, more deeply lobed fronds of *M. marginata*, with slightly obtuse-apexed lobes and good, non-abortive spores, as often occurs in this species and can be readily understood from field observation. The genuine Japanese, E. Chinese and Taiwanese plant, *bipinnata*, is more deeply lobed with some separate basal pinnules and denser hairs more like a deeply lobed *M. calvescens*, but with sessile pinnae. It may be a hybrid, which was suggested by Shimura (1979) and Yan *et al.* (2013), especially as some plants have been found to be triploid (see Takamiya 1996), or it might otherwise be at least partly an allopolyploid species. There seems not to be a very clear differentiation between it and *M. intramarginalis* in frond-morphology, as some plants with short brown hairs are identified in Japan as var. *bipinnata*.

A distinct species that has been confused with more deeply lobed, larger plants of *M. calvescens* is *M. intramarginalis* (Tagawa) Seriz. (syn.: *M. calvescens* var. *intramarginalis* (Tagawa) W.C. Shieh; *M. marginata* var. *intramarginalis* (Tagawa) Y.H.Yan; *M. macrosora* A. Biswas [not a synonym of *M. hallbergii*, as confused by Fraser-Jenkins (2008)]; *M. brevistrigosa* A.Biswas [not at all a synonym of *M.*

trichocarpa as thought by Fraser-Jenkins (2008)]; *M. thailandensis* S.-J.Moore), from Arunachal Pradesh, Manipur, Meghalaya (first reported by Dixit 1984, repeated by Chandra 2000), S. India (Anamallays, *R.H. Beddome*, specimen for plate 255, K), Thailand and Taiwan, and perhaps also overlooked in mainland China. The pinnae are obviously stalked, similarly to *M. calvescens*, and it has a rather densely short-hairy pinna-costa with brown hairs, and sparsely hairy veins and lamina, and also differs from *M. marginata* in being a larger plant with the pinnae lobed to within a short distance from the costa (though they fuse together from just over half the length of the pinna towards the apex), the distinctive, sloping lobes are bi-elliptic, coming to a narrowed or pointed apex and are not like the blunter, less regular lobes in a large *M. marginalis*; the spores in Indian plants are not abortive and from its intermediate type of morphology it suggests that it might perhaps be an allopolyploid species, involving *M. calvescens* and a more deeply lobed species as ancestral diploids, which possibility requires investigation. It has not been collected in Nepal, though large, more lobed fronds of *M. marginata* might be confused with it.

M. marginata is a simply pinnate species up to 50 cm. tall, slightly dimorphic, with taller fertile fronds which have the pinnae more lobed, to *c.* half their depth; fronds deltate-lanceolate, with a narrow attenuated, pinnatifid apex, pinnae very short-stalked to sessile, sterile ones shallowly crenately lobed, just becoming pinnate at the bases of the lower pinnae, variably densely hairy on both sides, especially on the costae and veins, hairs whiteish, glistening and rather long; the lower, sterile fronds are smaller, less deeply lobed and less erect; rhizome thin, short-creeping, bearing many knob-like old leaf-bases. Close to *M. calvescens* (Wall. *ex* Hook.) C.Presl, which is distinguishable by its longer-stalked pinnae and shorter, denser hairs, mostly distributed on the pinna-costa and a few on the veins.

Nepal:

C: **Dhading** [forested stream-gully at N. edge of Nagarjun forest, S. of and below Osho Dam Centre, just W. of Mudkhu Dhoka, N.W. of Balaju on Kakani road, N.W. of Kathmandu, Dhading Distr., 1400 m., *C.R. Fraser-Jenkins* 29775 (FN 5750), 29.11.2001, H], **Kathmandu** [Napalia, [*N.*] *Wallich* List no. 222, K-W, K, BM, another plant so labelled, ex herb. John Smith at BM is probably *M. calvescens* from its hairs, though frond-base missing, and if so may have been added into 222 "by eye" by Wallich from a N.E. Indian plant, whose proper locality was not kept; *Davallia villosa*, Napalia, [*N.*] *Wallich* List n. 244, in 1821, K, is also *M. calvescens*; Gaucher forest, Kathmandu valley, 4100 ft., *R.L. Fleming* 1458, 13.9.1957, MICH, ? or perhaps *M. calvescens*?; first forested damp stream-gully above road, 6 km. N. from Pharping Bazaar, N. of Bansbari, 1 km. S. of Chalankhel, N.E. side of Neupane Dara (hill), on W. side of Bagmati River, *c.* 10 km. S. of Kathmandu on road to Dakshin Kali temple, *c.* 1400 m., *C.R. Fraser-Jenkins*, with *J.B. Pariyar et al.* 24110-24112 (FN 88-FN 90), 20.7.1996, BM, H], **Lalitpur** [Chapagaon forest, Kathmandu valley, 4500 ft., *R.L. Fleming* 1332, 24.9.1956 and 2225, 27.7.1976,

both in MICH *sub* "*M. platyphylla*" and "*M. caudigera*" in error; Bajrabarahi, *T. Nakaike* 1656, 19.9.1986, KATH; forest slope above river on S.E. side of Bajrabarahi temple, E. side of Chapagaon, S. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins* 24990 (FN 969), 18.11.1996, BM, 24991 (FN 970), 18.11.1996, BM, H, (with an intermediate towards *M. setosa*, perhaps similar to *M. substrigosa* CRFJ 24989 (FN 968), BM)], **Bhaktapur** [forested rocky stream-gully, *c.* 1 km. S.E. of Sankhu, across river on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, *c.* 1500 m., *C.R. Fraser-Jenkins*, with *G.* [*R.*] *Pariyar* 25242 (FN 1221), 15.2.1997, BM, H. and *ditto* 31315, 31316, 20.8.2005, TAIF].

E. Thapa (2002) mentioned it from E. Nepal, but we have seen no reports or material from there in any herbaria, though it could well be present.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Sikkim; Darjeeling; Nepal. N.C. and N.E. India; Sri Lanka; E. and S.E. Asia. Not present in the W. Indo-Himalaya, as reported by Chandra (2000) and Ghosh *et al.* (2004).

(M, Sc to C). This is a rather scattered and local mid-altitude species of semi-open forest slopes, usually on steep earth-banks above streams.

99. ***Microlepia nepalensis*** (Spreng.) Fraser-Jenk., Kandel & Pariyar, ***comb. nov***. (basionym: *Davallia nepalensis* Spreng., *Linn. Syst. Veg.* ed. 4: 121 (1827), *nom. nov.* for *D. flaccida* D.Don, *non Microlepia flaccida* (R.Br.) J.Sm.; syn.: *Davallia flaccida* D.Don, *non* R.Br. [= *M. speluncae*]; *Davallia polypodioides* var. *hispida* Hook. *p.p.*; *Microlepia hancei* Prantl; *M. speluncae* var. *hancei* (Prantl) C.Chr. & Tardieu; *Davallia flaccida* var. *pubera* C.B.Clarke; *Microlepia speluncae* var. *pubera* (C.B.Clarke) Sledge; *Davallia polypodioides* var. *pilosula* C.B.Clarke [excluding Wallich's *Hypodematium crenatum* subsp. *mehrae* from Kumaon, *R*[*obert*] *B*[*linkworth*], in 1827, Wall. List no. 337 *p.p*, K, and probably excluding the supposed locality of "Kamoun" [*N.*] *Wallich*, in 1829, List no. 337, in K, type of var. *pilosula*]; *Microlepia pilosula* (C.B.Clarke) Lac., *non* Prantl [= *M. speluncae*]; *M. puberula* Lac., *non* Alderw.; *Microlepia puberula* forma *pilosior* Lac.; *Microlepia intermedia* Ching; *Microlepia modesta* Ching; *M. haflangensis* B.K.Nayar & S.Kaur; *M. manohara* B.K.Nayar & Madhus.; *M. speluncae* var. *pubera* (C.B.Clarke) Sledge; misapplied names: "*Davallia polypodioides*" *sensu* Bentham (1861), *non* D.Don, *nec* Hook.; "*M. todayensis*" *sensu* Panigrahi (1960), Itô (1966, 1971), Dixit (1984) *et auct. Ind., non* Christ [from the Philippines]; "*M. pilosiuscula*" *sensu* Fraser-Jenkins (1997), *non* (Sm.) C.V.Morton; "*M. proxima*" was tentatively suggested *sensu* Fraser-Jenkins (1997), *non* (Blume) C.Presl, as a possible candidate name for the then unidentified *M. nepalensis*, and was taken up in that sense by Thapa (2003) prior to further research, but it applies to a different S.E. Asian species. It had previously been misplaced by Thwaites (1864) as a name for the very distinctive S. Indian, Sri Lankan and Myanmar species, *M. majuscula* (Lowe) T.Moore). *M. nepalensis* has sometimes been mistakenly included unrecognised within *M.*

speluncae, being in the same group.

Fraser-Jenkins (2008) used the well known name *M. hancei* for this species, as used in China (and by Yan *et al.* (2013) in the *Flora of China*), which was previously unrecognised and without a name in India and Nepal, and was erroneously synonymised and overlooked within *M. speluncae* in Lindsay & Middleton's Thai website summary. However he had overlooked the earlier name *Davallia nepalensis*, which he had already studied and typified some 10 years ago, though still unpublished, during his detailed study of David Don's pteridophytes (Fraser-Jenkins 2006 and in prep.). *D. nepalensis* was a *nom. nov*. based on *D. flaccida* D.Don, which latter was independent of Brown's *D. flaccida* R.Br. [= *Microlepia speluncae*]. Don's description of winged rachides (pinna costae) and smooth segments, with a solitary sorus beneath the sinus between lobes does not apply to *M. speluncae*, but to the present species, while the wide, ovate-oblong, tripinnate, flaccid, 3 ft. fronds can perhaps apply to either species (though *M. speluncae* is more deltate), but not to others in the area. The lectotype CRFJ had selected of *D. flaccida* D.Don, *Prodr. Flor. Nepal*.: 10 (1824), and now so designated here, is the only eligible specimen, "49 Polypodium marginale Wall. [in herb.] Napalia. Napalia, *Wallich* (ex Herb. Rudge)", BM, and is the same species as *M. hancei*. Rudge obtained original early "Wallich" material from Lambert and Smith that Don had worked on and this specimen was collected in Nepal by the Hon. Edward Gardner and team from 1817-1819 rather than by Wallich himself (see Fraser-Jenkins 2006).

M. hancei, mentioned by Singh & Panigrahi (2005: 264) was misunderstood by them as being close to *M. rhomboidea*, a specimen of which latter they then separated from it as an erroneous "new species", "*M. singhii*". Lindsay & Middleton (2012) erroneously synonymised *M. hancei* into *M. speluncae*, with little taxonomic knowledge of the genus.

A large species related to *M. speluncae* with rather delicate fronds up to nearly 2 m. tall in sheltered conditions, with tripinnate to quadripinnate fronds, but fronds ovate to lanceolate, instead of deltate due to several pairs of lower pinnae usually being shorter than the mid pinnae, thus when full sized with very long, often narrower-based, fronds, though exposed plants have shorter, wider-based, more oblong fronds and can then be confused with *M. speluncae*; pinnae narrowly triangular-lanceolate in large fronds, costae winged, lower pinnules often more symmetrical at their bases than in *M. speluncae*, with the lowest acroscopic and basiscopic pinnulet similar; lower pinnulets simple to pinnate, often with small, fine, but rounded lobes, thin, largely glabrous, only sparsely hairy with thin, pale hairs, pinnules rapidly flopping downwards in the sun in exposed plants.

Nepal:

C: **Myagdi** [Dana, "W. Nepal", "11,500 ft.", *R.L. Fleming* 899, 21.11.1949, MICH, but 889 and 890 were at Tukuche, Manang, 11,500 ft., 1.12.1949, so altitude transposed and number possibly an error for ?879, but locality and date correct],

Syangja [Andhi khola, among shrubs, 2500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8692, 30.9.1954, BM *sub* "*M. pilosula*"; Andhi khola, 23 mi. N.E. of Tansing, along road among rocks, 2200 ft., *Robert L. Fleming* 863, 8.1.1950, DD], **Kaski** [slightly degraded forested gullies and steep slopes, *c.* ½ km. W. of "Fishtail Lodge" Hotel in Raniban forest, on S. side of E. end of Phewa Tal lake, S. of and across Lake from Baidam ("Lakeside"), Pohkara, *C.R. Fraser-Jenkins* 25185, 25186 (FN 1164, 1165), 1.1.1997, *ditto*, 25573-25575 (FN 1551-1553), 24.9.1997, BM, H], **Tanahun** [densely forested stream-gulley in hills, *c.* 1 ½ km. S.E. of Jamune village, *c.* 7 km. W. of and above Damauli, on road W. of Mugling to Pokhara, *C.R. Fraser-Jenkins*, with *G.* [*R.*] *Pariyar* 25525-25527 (FN 1503-1505), 19.8.1997, BM, H, KATH, *sub* "*M. todayensis sensu auct. Ind.*, *M. hancei*"], **Chitawan** [light forest and stream-gullies, *c.* 2 miles S. of Sauraha, across river, Chitwan National Park, *C.R. Fraser-Jenkins* 33033 (FN 147), 27.12.2007, TAIF].

E: **Morang** [rocky banks and damp edges of Dhans khola stream, running S. through tropical mixed forest, leading to a Maoist ammunition-hiding tunnel in sandy stream-bank, S. of main-road, 3 km. E. of Khanepokhari, E. of Itahari, on main East-West highway to Birtamod and Kakkarbhitta, Morang District, *C.R. Fraser-Jenkins* 28951 (FN 4926), 26.3.2001, H; Biratnagar, on "Sisoo" [tree] floor, 73 m., *N. Thapa* M18/97 *p.p.*, 18.12.1997, KATH, *sub* "*M. todayensis*" and "*M. proxima*", in error], **Jhapa** [Sanichare - Sibganja, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305082, 11.12.1963, BM *sub* "*M. speluncae*" in error; tea garden, Range Danda, shady places, 100 m., *N. Thapa, G.D. Bhatt* ["*Bhatta*"] & *S. Khatri* 2008, 2009, 24.1.2003, KATH, *sub* "*M. proxima*" in error; stream running through secondary Sal-tree woods, *c.* 1½ km. N.W. of Kakkarbhitta town, on way to tea-estate, E. of Birtamod, shortly W. of Mechi river (Indo-Nepalese border), in the terai, Jhapa District, *C.R. Fraser-Jenkins*, with *U. Pongali* 26519 (FN 2497), 14.8.1998, H].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; ?Uttarakhand ([*N.*] *Wallich* Num. List no. 339, K, but his locality of Kumaon for this number and species is probably rather suspect). C. and ?S. India; Taiwan; Thailand; Vietnam; Malaya; S.E. Asia; Sumatra *etc.*

(M, Sc). A scattered and locally common lower to lower-mid altitude species at the edges of open woodland, usually among bushes, or tea-bushes *etc*. by irrigation ditches, also survives in the open in damp places, but the fronds do not then reach full size.

100. ***Microlepia platyphylla*** (D.Don) J.Sm. (syn.: *Davallia platyphylla* D.Don; *Davallia lonchitidea* Wall. *ex* Hook.; misapplied name: "*Davallia solida*" *sensu* H. Itô (1966, 1971), *non* (G.Forst.) Sw. [Davalliaceae]).

A fairly common, very distinctive large species (fronds up to 2 m. tall), with triangular-lanceolate, bipinnate-tripinnatid fronds, and large, wide, coarsely lobed,

acute-pointed, rectangular pinnules, bearing a few scattered, longish hairs beneath by their midribs; sori submarginal.

Nepal:

W. Thapa (2002) listed it as common from W. Nepal eastwards, but we have seen no reports and no material from W. Nepal in any herbaria and its occurrence there is doubtful.

C: **Kaski** [path in semi-open forest on W. facing slope, *c*. 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c*. 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c*. 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *c.* 1800 m., *C.R. Fraser-Jenkins*, with *J.B. Pariyar* 26130 (FN 2108), 13.3.1998, H; banks of path N. of Birethanti on way to New Bridge Lodge, S. of Chomrong, on way to Annapurna Base Camp, Kaski District, *C.R. Fraser-Jenkins*, with *G.B. Tamang* 32362 (FN 9), 27.11.2006, TAIF], **Rasuwa** [Langtang, *T. Nakaike* 1217, 30.8.1986, KATH], **Kathmandu** [Chandragiri, *T. Nakaike* 2455, 9.10.1986, KATH], **Lalitpur** [west side of lower Phulchowki mountain, in main N.W. facing forested stream gully, above and E. of quarry, above and E. of Godawari School and Godawari, before road goes on and starts the zig-zag ascent towards the summit, E.S.E. of Kathmandu, *C.R. Fraser-Jenkins* 18337, 25.7.1991, E; Phulchoki, Lalitpur, 1800 m., *M. Pathak, H.R. Paudel, S.K. Rai* & *R. Basnet* 201101, 20.1.2011, KATH].

E. Thapa (2002) listed it as common including in E. Nepal, but although it also occurs further east, we have seen no reports and no E. Nepalese collection, and Iwatsuki (1988) cited only Wallich's collection, which came from the Kathmandu valley.

Himalayan distribution: Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. S. India. A somewhat similar, but more hairy and less acute-segmented species, *M. kurzii* (C.B.Clarke) Bedd. (syn.: *M. kurzii* var. *manipurensis* A.Biswas & T.Sen) occurs in Manipur (as correctly reported by Dixit 1984, incorrectly excluded by Chandra (2000), Ghosh *et al.* (2004) and Fraser-Jenkins (2008)), Myanmar. China; Thailand; mainland S.E. Asia; Philippines.

(S, Sc). A scattered and rather uncommon local species growing among dense vegetation on steep banks beneath the edges of forest, above streams *etc*.

Nepalese threatened status: **LC**.

101. ***Microlepia rhomboidea*** (Wall. *ex* Kunze) Prantl (syn.: *Davallia polypodioides* var. *hispida* Hook. *p.p. Zeilan.*; *M. macrorhomboidea* Sarn.Singh & Panigrahi; *M. singhii* Panigrahi; *M. sikkimensis* A.Biswas; *M. tamenlongensis* A.Biswas; *M. viridula* A.Biswas; *M. oblongifolia* A.Biswas [not "*M. hallbergii*" as misidentified by Fraser-Jenkins (2008) due to its rather deeply lobed pinnules]; misapplied names: "*M. speluncae*" *sensu* Bedd.; "*M. trapeziformis*" *sensu* Holttum (1954), Sledge (1957), Itô (1966, 1971), Iwatsuki (1975, 1988), Nakaike, Matsumoto & Gurung (1990),

Dixit (1984) *et auct. Ind. et Jap., non* (Roxb.) Kuhn [= *M. pilosiuscula* from S.E. Asia]; "*M. todayensis*" *p.p., sensu* Itô (1966), *non* Christ; "*M. pilosiuscula*" *sensu* Singh & Panigrahi (2005), *non* (Sm.) C.V.Morton, excl. photo 122 of Singh & Panigrahi (2005), which is *Monachosorum henryi*; "*M. subrhomboidea*" *sensu* A. Biswas, *non* Ching [from China, = ?*M. speluncae*]).

A large species (fronds up to 2 m. tall); fronds bipinnate to tripinnatifid, lanceolate; pinnae mostly symmetrical at their bases, apart from the lowest ones with longer acroscopic lobes, triangular-lanceolate; pinnules varying from rounded-rectangular, with shallower, obtuse lobes to more deeply lobed and the apex extended into a more acute apex, but at least the less-lobed pinnules of the lower few pinnae usually with the characteristic ± rounded-truncate apices; degree of lobing and size of the lobes and pinnules variable, sometimes finer, sometimes coarser and becoming very large; lamina-surfaces with scattered, longish hairs, rarely nearly glabrous; small juvenile sporeling plants with finely and narrowly lobed pinnae, distinct from adult plants.

Nepal:

C: **Kaski** [forested stream-khola facing N., Kalche Khola, between and above Chisapani and Kalche villages, S.E. of Chorepatan in Phusre Khola valley, *c*. 15 km. S. of Pokhara off Syangja road, Kaski District, *C.R. Fraser-Jenkins* 25693 (FN 1671), 19.10.1997, BM, H; N. facing, lightly wooded slope above Kali Khola on S. side, *c*. ½ km. up-steam from Surjenagar village, S.E. of Mahendra Goufer Cave, *c*. 5 km. N. of Mahendrapul, N. of Pokhara, *C.R. Fraser-Jenkins* 26065 (FN 2043), 24.2.1998, BM, H], **Tanahun** [small forested gully opposite and S. of Chabise village, *c*. 3 km. E. of Khairentar, E. of Pokhara on Damauli road, Tanahun District, *C.R. Fraser-Jenkins* 25811 (FN 1789), 27.12.1997, BM, H], **Gorkha** [deep, rocky forested stream-gorge of Chisopani Darrah Khola, *c.* ½ km. above and N.E. of Komale hamlet, *c.* 1 km. below and S.W. of Deurali, above and N.E. of Markichowk (Marsyangdi) reservoir and Gopling, N.W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 25066-25070 (FN 1045-1049), 30.12.1996, BM, H], **Makawanpur** [Chillibas Community Forest, Aambhanjyang Village Development Committee-2, Makawanpur, deep shade gulley, 600 m., *N. Thapa* M53, 10.9.2000, KATH], **Dhading** [Naubise, W. of Kathmandu, along stream in shade, 3000 ft., *R.L. Fleming* 1446, 7.9.1957, MICH *sub* "*M. trapeziformis*" in error], **Sindhuli** [N. facing, forested rocky stream-gully on N. side of second main ridge of hills up from the plains, *c*. 6 km. S. of Sindhuli Madi, N. of Karkare, N. of Biman, *c*. 15 km. N. of Bardibas, E. of Hetauda off Janakpur road, Sindhuli District, *C.R. Fraser-Jenkins*, with *K. Neupane* 26018 (FN 1996), 12.2.1998, BM, H].

E: **Sankhuwasabha** [Arun valley, Num, beneath trees, 4500 ft., *J.D.A. Stainton* 785, 29.6.1956, BM, KATH], **Jhapa** [bed of Mechi river, Jhapa Dt., 1100 ft., *R.L. Fleming* 2036, 23.12.1971, K, MICH *sub* "*M. speluncae*" in error; 3 miles N. of Sunaschare, in nalas, 700 ft., *R.L. Fleming* 2302, 2310, 9.10.1976, MICH; stream-

gully in forest, *c.* 3 km. N. of and above Sunmai, on road from Bhudabare N. to Kuttedara, N. of Charali on road to Phikal and Ilam, N.E. of Birtamod and N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 26635, 26636 (FN 2613, 2614), 16.8.1998, H], **Ilam** [East Nepal, Illam - Jog Mai - Ranga Pani, 100-700 m., *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305086, 8.12.1963, K, BM, KATH, TI, *sub* "*M. todayensis*" and "*M. trapeziformis*" in error; Rangapani, Ilam District, 1800 ft., *R.L. Fleming* 2291, 13.10.1976, MICH *sub* "*M. todayensis*" in error; above Mai khola, E. of Chisapani, edge of field/nala, 1600 ft., *R.L. Fleming* 2295, 11.10.1976, MICH].

Himalayan distribution: Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]. S. India; Sri Lanka; Taiwan; S.E. Asia.

(M, C). A common lower-mid to mid-altitude species among rocks in deep, dark stream-gorges in dense forest, often arching over the stream in tall clumps, or otherwise in moist and sheltered banks in the forest.

102. ***Microlepia setosa*** (Sm.) Alston (syn.: *Davallia hirta* Kaulf.; *M. hirta* (Kaulf.) C.Presl; *Microlepia speluncae* var. *hirta* (Kaulf.) Bedd.; *Davallia polypodioides var. hirta* (Kaulf.) C.B.Clarke; *Microlepia firma* var. *hirta* (Kaulf.) Sledge [neither Clarke nor Sledge excluded Kaulfuss, so despite the sense they took it in (of *M. firma*) it remains a combination of Kaulfuss' *D. hirta*]; *Dicksonia kaulfussiana* Gaudich.; misapplied names: "*M. firma*" *sensu auct. plur. p.p., non* Mett. *ex* Kuhn; "*M. todayensis*" *sensu* Itô (1971); "*M. strigosa*" *sensu* Palmer (2003); "*M. dubia*" *sensu* Morton (1974), Sledge (1982), Fraser-Jenkins (1997), Thapa (2002)). Despite Alston's (1933) explanation, this species has been quite misunderstood in Hawai'i and its name ignored following Wagner (1993), and thence Palmer (2003), who thought it a variety of the very different *M. strigosa*.

Generally similar to *M. firma*, with which it has often been lumped together due to its tripinnatifid triangular lamina, but it is clearly a distinct species; rhizome creeping, but not so extensively so as in *M. firma*, forming a small clump of slightly separate leaves; fronds up to *c*. 60 cm. tall, bipinnate to tripinnatifid, rather narrowly triangular-lanceolate, in contrast to the very widely deltate ones of *M. firma*; pinnae narrowly triangular-lanceolate, the lowest basiscopic pinnules the longest, but not very markedly longer than the lowest acroscopic ones as they are in *M. firma*, pinnules deeply lobed with crowded lobes, hardly striate, pale to bright green; just as on Hawai'i, it is variable in degree of hairiness in Nepal *etc*., but bears rather scattered, stiff, pale hairs on the veins beneath, not as long or as numerous as the very prominent ones of *M. firma*.

Nepal:

C: **Manang** [Marsyandi valley, between Thonje and Jagat, in stony, shady forests, 1500 m., *T. Wraber* 577, 31.10.1969, BM; Jagat - Dharapand, 841283, moist and shady slope, 1430-2000 m., *D.P. Joshi* & *M.M. Amatya* 73/372, 9.7.1973, KATH

sub "*M. firma*" in error], **Parbat**, **Kaski** [banks of path N. of Birethanti on way to New Bridge Lodge, S. of Chomrong, on way to Annapurna Base Camp, Kaski District, *C.R. Fraser-Jenkins*, with *G.B. Tamang* 32361 (FN 8), 27.11.2006, TAIF], **Gorkha** [nearby Philim, Gorkha, shady, flooded area, *c.* 1500 m., *S.H. Bhattarai* 966, 16.6.2012, KATH], **Makawanpur**, **Dhading** [back of Nagarjong Hill, 1500 m., *D.H. Nicolson* 3256, 2.5.1967, KATH, *sub M. hirta*; forested stream gullies on N.W. side of Jamachok Mountain, *c.* 4 km. N.W. of Balaju, on road from Kathmandu (via Thamel) N.W. to Ranipowa and Trisuli Bazaar, Dhading District, *C.R. Fraser-Jenkins et al.* 24190-24192 (FN 168-170), 25.7.1996, BM, H], **Kathmandu** [Swayambhu hill, Kathmandu, *A.R. Sakya* 11, 6.5.1963, BM (published as tetraploid, *2n* = 172, by Roy, Sinha & Sakya (1971); Nagarjun, 5000 ft., *H. Kanai* & *M.S. Bista* 6952, 2.10.1969, KATH, sub "var. *hirta*"; Nagarjun, *c.* 1400 m., *T. Nakaike* 1085, 26.8.1986, KATH, *sub* "*M. khasiyana*" in error; Gokarna forest, 1300 m., *D.H. Nicolson* 2291, 10.9.1966, KATH, 2937, 8.2.1967, MICH, both *sub M. hirta*; Gokarna, Kathmandu, *H. Kanai, G. Murata, O. Tanaka* & *T. Yamazaki* 6707349 (and 4349, 7349), 22.6.1967, BM, KATH, *sub* "*M. todayensis*" in error], **Lalitpur** [Badgaon forest, 5000 ft., *R.L. Fleming* 1318, 14.9.1956, MICH, DD, *sub* "*M. trapeziformis*" in error; Chapagaon forest, 4500 ft., *R.L. Fleming* 2228, 27.7.1976, MICH *sub* "*M. pilosula*" in error; Bajrabarahi, *c.* 1400 m., *T. Nakaike* 1663, 19.9.1986, KATH, *sub* "*M. khasiyana*" in error; Bajrajogini, *T. Nakaike* 2214, 210.1986, KATH, *sub* "*M. khasiyana*" in error; forest slope above river on S.E. side of Bajrabarahi temple, E. side of Chapagaon, S. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins et al.* 24984 (FN 963), 18.11.1996, BM, H], **Bhaktapur** [Nagarkotphedi, *T. Nakaike* 1519, 16.9.1986, KATH, *sub* "*M. khasiyana*" in error; forested stream gully just above and behind temple at Surjebinayak, S.E. side of Bhaktapur, E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins*, with *J.B. Pariyar et al.* 24076 (FN 54), 16.7.1996, BM, H].

E. Thapa (2002) mentioned it from E. Nepal, but we have seen no reports apart from confusions with *M. firma* and have not seen material in any herbaria visited.

Himalayan distribution: Across China; Myanmar; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh. Taiwan; Thailand; Hawai'i. Absent from S. India and probably also Sri Lanka, where replaced by *M. firma*. The species appears to have been overlooked by Yan, Qi & Serizawa (2013) in the *Flora of China* and was presumably included within their *M. firma*, for which they gave no synonyms.

(S, Sc to C). A locally common mid-altitude species of semi-open, often grazed forest slopes, clearings, bushy roadsides *etc*.

103. ***Microlepia speluncae*** (L.) T.Moore (sometimes cited as "var. *speluncae*" in error; syn.: *Polypodium nudum* G.Forst.; *Dicksonia polypodioides* Sw., *nom. nov. superfl.* for *Polypodium nudum* G.Forst.; *Davallia flaccida* R.Br.; *Microlepia flaccida* (R.Br.) J.Sm.; *Cystopteris orientalis* Desv.; *Davallia polypodioides* D.Don [*non sensu* Don's specimen, which is *M. setosa*], *nom. nov.* for *Dicksonia polypodioides* Sw. and

nom. nov. superfl. for *Polypodium nudum* G.Forst; *Davallia trichosticha* Hook.; *Davallia pilosa* Roxb.; *Davallia polypodioides* Hook.; *Davallia polypodioides* var. *pubescens* Hook.; *Microlepia speluncae* var. *pubescens* (Hook.) Sledge; *Polypodium asperulum* J.Sm. *ex* Hook.; *Microlepia stenoloba* Prantl; *Microlepia pilosula* Prantl, *non* (C.B.Clarke) Lac. [= *M. nepalensis*]; *Davallia polypodioides* var. *pyramidata* C.B.Clarke; *Microlepia pyramidata* (C.B.Clarke) Lac.; *M. speluncae* var. *villosissima* C.Chr.; *M. mollifolia* Tagawa; *M. speluncae* var. *pubescens* (Hook.) Sledge; misapplied name: "*M. speluncae* var. *pubera*" *sensu* Singh & Panigrahi (2005), *non* (Wall. *ex* C.B.Clarke) Sledge [= *M. nepalensis*]).

A large species with fronds up to 2 m. tall; rhizome thickish, horizontal; stipe long, erect, fronds tripinnate, widely deltate and widest at the base, but can be ovate-lanceolate in small juvenile specimens, which can then be confused with *M. nepalensis*; pinnae long, narrowly triangular-lanceolate to linear-lanceolate, pinnules crowded, acute-apexed, lax, variably densely short-hairy, sometimes very markedly so and on the costae *etc*., usually markedly asymmetrical at their bases, with the acroscopic basal pinnulet longer and larger and the basiscopic one smaller and more sloping; pinnulets bearing small apical teeth, variable in size and lobing, sometimes larger, obtuse, less densely hairy, and nearly unlobed except at the margins, and sometimes finely lobed with small lobes and more densely hairy (more like the type specimen), depending partly on growth conditions, but all connected by intermediate plants and forms, often even in the same population, and though several of these variants have been named as if separate taxa, this seems untenable, though further investigation would be welcome.

Nepal:

W: **Dailekh** [Dailekh, *N.P. Manadhar* 281-91 *p.p.*, in 1991, KATH, mixed collection with *Hypodematium crenatum* subsp. *loyalii*].

C: **Palpa** [stream-gulley above bridge at Dobhan, 3 miles N. of Butwal on road to Syangja and Pokhara, Palpa District, *c.* 350 m., *C.R. Fraser-Jenkins* 18013, 20.1.1991, E], **Parbat** [Kusma, in shade, 2000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H. J. Williams* 7052, 5.9.1954, BM], **Manang**, **Syangja** [steep, rocky, east-facing cliff-slope with a patch of dense forest on far (west) side of Andhi Khola river, *c*. 5 km. N. of Gallyang ["Golleng"], S. of Syangja, on road from Pokhara south to Butwal, Syangja District, *C.R. Fraser-Jenkins* 31041, 3.1.2005, TAIF], **Kaski** [slightly degraded forested gullies and steep slopes, *c*. ½ km. W. of "Fishtail Lodge" Hotel in Raniban forest, on S. side of E. end of Phewa Tal lake, S. of and across Lake from Baidam ("Lakeside"), Pohkara, *C.R. Fraser-Jenkins* 25187 (FN 1166), 1.1.1997, BM, H; among rocks and below cliffs on both sides of river at N. entrance to Seti river gorge, below Mahendra Pul Power-house, N. part of Pokhara, *C.R. Fraser-Jenkins*, with *L.B. Tamang* & *G.* [*R.*] *Pariyar* 25843 (FN 1821), 5.1.1998, BM, H], **Tanahun** [Satrasaye Phant, Muglin[g] to Pokhara, *T. Nakaike* 1934, 27.9.1986, KATH; forested stream among rice-fields, *c*. 2 km. above and S.W. of

Chowti Bara Mandir, *c*. 8 km. S. of Damauli, E. of Pokhara, W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins* 25489, 25490 (FN 1467, 1468), 18.8.1997, BM, H], **Gorkha** [lower part of Chisopane Darrah Khola, below path, above Komale, S.W. of and below Deurali, N.E. of Markichowk, N.W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 25301 (FN 1280), 21.3.1997, BM, H], **Chitawan** [Tiger Tops [Hotel], Rapti Dun, damp sandy soil, 900 ft., *R.L. Fleming* 1865, 16.11.1964, MICH *sub* "*Macrothelypteris torresiana*" in error], **Makawanpur** [densely sal-forested and rocky stream-gully on S. slope of first range of foothills beyond (N. of) the Churiya Ghats, above Liot village, Basmari, *c*. 5 km. W. of Hetauda, off Narayanghat road, Makawanpur District, *C.R. Fraser-Jenkins* 25767 (FN 1745), 24.10. 1997, BM, H; forested ridges and cliffs of the Churiya Ghats, N. of Bagmati Bridge (*c*. 13 km. E. of Chandranigarpur) on path to Bogaon ("Bogar"), on W. side of Bagmati river, E. of Hetauda, Makawanpur District, *C.R. Fraser-Jenkins*, with *J.B. Pariyar et al*. 25728 (FN 1706), 21.10.1997, H], **Dhading**, **Kathmandu** [Gokarna, Kathmandu valley, sandy soil, 4200 ft., *R.L. Fleming* 1515, 30.8.1958, KATH, MICH; walled forest-area inside ring-road at Gaushala (Bankali Forest), above and W. of Pashupatinath temples, E. part of Kathmandu City, Kathmandu District, *C.R. Fraser-Jenkins*, with *G.B. Tamang* 25782 (FN 1760), 29.10.1997, H]; **Sindhuli** [N. facing, forested rocky stream-gully on N. side of second main ridge of hills up from the plains, *c*. 6 km. S. of Sindhuli Madi, N. of Karkare, N. of Biman, *c*. 15 km. N. of Bardibas, E. of Hetauda off Janakpur road, Sindhuli District, *C.R. Fraser-Jenkins*, with *K. Neupane* 26017 (FN 1995), 12.2.1998, H].

E: **Udayapur** [Udayapur Distr., Simule (170 m.) - Dhaplang (170 m.) - Adheri khola (200 m.) - camp site *c*. 1 km. S. of Chamling (185 m.), 26° 52' 23" - 56' 00", 86° 45' 50" - 49' 05", on shady forest margin, 160 m., *M. Mikage*, *T. Kajita*, *F. Kiuchi*, *N. Kondo*, *P. Lacoul*, *M. Suzuki* & *K. Yonekura* 9558043, 22.10.1995, KATH, *sub* "*Hypolepis punctata*" in error], **Bhojpur** [Dingla, in dense forest, near stream, 1600 ft., *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Uphadyaya* & [*B.B.*] *Baskola* 3256, 23.4.1965, KATH, *sub* "*Athyrium macdonelli*" in error; Dingla (1000 m.) - Doban (800 m.), 873273, on rather dry slope in light shade, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 725458, 2.7.1972, BM, KATH], **Solokhumbu**, **Sankhuwasabha** [Tumlingtar plateau, Arun cliffs, 1800 ft., *A.H. Norkett* 8124, 25.12.1961, BM; Chandanpur, Sankhuwa-Sabha, 1100 m., *N. Thapa* S17/96, 24.4.1996, KATH], **Sunsari** [Dharan, "Ilam", in stream, 2000 ft., *R.L. Fleming* 2625, 2626, 6.10.1978, MICH *sub* "*Acystopteris* sp." in error], **Morang** [Biratnagar, on "Sisoo" [tree] floor, 73 m., *N. Thapa* M18/97 *p.p.*, 18.12.1997, KATH, *sub* "*M. todayensis*" and "*M. proxima*", in error], **Dhankuta**, **Jhapa** [Mechi river, 1100 ft., *R.L. Fleming* 2036, 23.12.1971, MICH *sub* "*M. pilosula*" in error; Sanischare - Garuma, on shady bush [*sic*], 250-290 m., *Mrs. Prabha* [*Pradhan*], [*Mr. M.M.*] *Amatya* & *Miss Rajani* [*Shrestha*] 207/74, 8.6.1974, KATH], **Ilam** [tea garden, Ilam District, along wet gully, 400 m., *D.H. Nicolson* 3118, 3.4.1967, KATH, MICH, *sub* "*M. stenoloba*"; Soktim, 873264, by the side of Mai khola on shady place,

1300 ft., *Mrs. Prabha* [*Pradhan*], [*M.M.*] *Amatya* & [*Miss*] *Rajani* [*Shrestha*] 223/74, 10.6.1974, KATH], **Taplejung** [Khebang - Bharomdin, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 524, 24.11.1963, BM [*s.n.*], KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand (*H.C. Pande*, det. CRFJ; *Y.P.S. Pangtey* sub "*M. hancei*" redet. CRFJ). C. and S. India; Sri Lanka; S.E. Asia; New Guinea; Hawai'i *etc.*, widespread.

(M, C). A very common (but rare in West Nepal), low to mid-altitude species of flat ground or small banks in clearings in light forest, or at the edges of woods, roadside-banks *etc*., often in quite dry Winter conditions, often surviving in the open beside old walls *etc*.

104. ***Microlepia strigosa*** (Thunb.) C.Presl (syn.: *Trichomanes strigosum* Thunb.; *Dicksonia strigosa* (Thunb.) Thunb., inc. *sensu* D.Don; *Davallia strigosa* (Thunb.) Kunze; *Davallia polypodioides* var. *strigosa* (Thunb.) C.B.Carke; *M. khasiyana* (Hook.) C.Presl, *non sensu* Nakaike & Gurung (1995) [= *M. setosa*]); *M. neostrigosa* Ching; *M. akhoiensis* ["*akhoensis*"] A.Biswas & T.Sen; misapplied name: "*M. pseudostrigosa*" *sensu* Singh & Panigrahi (2005), *non* Makino [from China and Japan]; "*N. sinostrigosa*" *sensu* Biswas (1991), *non* Ching [= *M. pseudostrigosa*]). Yan, Qi & Serizawa (2013) in the *Flora of China* maintained *M. khasiyana* as a separate species, but mistakenly grouping it under the tripinnate to quadripinnate species in their key, while correctly mentioning the bipinnate lamina in the description. This treatment was in contrast to authors outside of China, but anomalously they also accepted *M. strigosa* as well from the "Himalaya" - evidently referring to the Indo-Himalaya, but not mentioning the countries concerned - and Sri Lanka, where all is the one species. It therefore appears that they were confused about the identity of the name *M. khasiyana*. Their complete misplacement of the entirely different, tripinnate, deltate *M. medogensis* Ching & Y.X.Lin as if a synonym of "*M. khasiyana*" may be further evidence of this.

A number of specimens from C. Nepal collected by the author (and from Tripura, *W. Koelz* 27582, MICH *etc.*) are intermediate between *M. strigosa* and *M. setosa* and appear sufficiently different that they are probably not just variation in those species, but are like a more lobed and dissect *M. strigosa* with more pointed pinnule-apices, or a narrower pinna'd, less dissect *M. setosa*. They correspond rather well with the far-eastern *M. substrigosa* Tagawa as well as having longer hairs than in *M. strigosa*, though of variable density, but due to the possible existence of hybrids, lack of familiarity personally with *M. substrigosa* and its not being reported from mainland China in the *Flora of China*, they are retained here for now as an unidentified species under *M. strigosa*, although distinct, pending further study. They do, however, appear rather likely to belong to *M. substrigosa* as opposed to representing variation in *M. strigosa*. Such plants are indicated below as representing a possible extra species in the flora of Nepal and India.

Stipe rigid, long, scabrous and scattered-hairy; frond bipinnate (becoming tripinnate), elongated triangular lanceolate, widest in the lowest quarter or at the base; lamina grey-green, strongly striated with the veins obviously raised beneath, bearing a variable density of longish stiff hairs on the veins beneath, rarely nearly glabrous; pinnae narrow, linear, simply pinnate, or some of the pinnules becoming shallowly to deeply lobed or even pinnatisect, but still rather obviously not as long as pinnate pinnules in other, fully tripinnate species and the pinnae relatively narrower throughout their length; pinnules short, all ± of equal length, the lowest ones only gradually slightly longer, pinnule-apices obtuse; lobes shallow and close together, seldom becoming more separate in some slightly longer lower pinnules.

Nepal:

C: **Kaski** [Raniban Forest, between "Fishtail Lodge" Hotel and "Nature's Home" restaurant, on S. side of Phewa Tal, S. of and opposite Pokhara "Lake-side" area (Baidam), Pokhara, *C.R. Fraser-Jenkins* 25459 (FN 1437), 17.8.1997, BM, H], **Kathmandu** [Gaucher, Kathmandu valley, on open banks, 4200 ft., *R.L. Fleming* 1461, 13.9.1957, MICH, both normal, ± unlobed pinnae, and another between *M. strigosa* and *M. setosa*, perhaps *M. substrigosa*; old wall in forest, just above road-bank near gate no. 1 into S.E. side of Nagarjun forest, below Jamachok, *c*. 1-3 km. N.W. of Balaju, on Trisuli Bazaar road, N.W. part of Kathmandu City, *C.R. Fraser-Jenkins* 25548 (FN 1526), 5.9.1997, H, with pinnules longer and more dissect, similar to *M. substrigosa*; degraded forested slope on N. side of Swayembunath Temple hill, W. side of Kathmandu City, *C.R. Fraser-Jenkins* 26363, 26364 (FN 2341, 2342), 13.6.1998, BM, H, with longer and more pointed and lobed pinnules than usual, similar to *M. substrigosa*], **Lalitpur** [Bajrabarahi, 5150 ft., *D.D. Bhatt* 27, 31.5.1958, UC, lobed, longer lower pinnules similar to *M. substrigosa*; Bazabarhi [Vajrabarahi], Chapagaon, shady forest floor, 1371 m., *V.L. Gurung* 8776, 3.1973, KATH, *sub* "*M. speluncae*" in error; a specimen labelled "Phulchowki, 2438 m., *V.L. Gurung* 82/1798, 4.10.1982" was probably taken from a specimen cultivated at the Botanic Garden, perhaps corresponding with *D.H. Nicholson* 3037, 22.3.1967, KATH; Chapagaon forest, 4800 ft., *R.L. Fleming* 1330 (1318), 3.9.1956, MICH, pinnatisect and pointed pinnules, similar to *M. substrigosa*; Bajrabarahi, *c*. 1400 m., *T. Nakaike* 1702, 19.9.1986, KATH, *sub* "*M. pilosissima*" in error, pointed and lobed pinnules towards *M. substrigosa*; forest slope above river on S.E. side of Bajrabarahi temple, E. side of Chapagaon, S. of Kathmandu, *C.R. Fraser-Jenkins et al.* 24987 (FN 966), 18.11.1996, BM, H, with intermediates towards *M. setosa*, similar to *M. substrigosa* (*CRFJ* 24985 (FN 964) and 24986 (FN 965, excluding a transposed *M. trichocarpa* at BM, which is really CRFJ 24988 (FN 967)), BM, H)], **Bhaktapur** [Bhadgaon forest, 5000 ft., *Dr. R.L. Fleming* 1318, 14.9.1956, KATH, *sub* "*M. speluncae*" in error; *ditto* 1221a, 10.8.1956, K, MICH, more lobed etc., similar to *M. substrigosa*; forested stream gully just above and behind temple at Surjebinayak, S.E. side of Bhaktapur, E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins* 24077 (FN 55), 16.7.1996, BM, H; forested rocky stream-gully, *c.*

1 km. S.E. of Sankhu across river, on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, *c.* 1500 m., *C.R. Fraser-Jenkins* 25243 (FN 1222 [but note that "sheet 2 of 2" of this number at BM is *M. trichocarpa* transposed from FN 967, from Bajrabarahi, while "sheet 2 of 2" labelled as FN 967 is *M. strigosa* transposed from FN 55, from Surjebinayak]), 25244 (FN 1223) and 25245 (FN 1224), 15.2.1997, BM, H, along with two intermediates towards *M. setosa*, similar to *M. substrigosa*, *CRFJ* 25246, 25247 (FN 1225, 1226), H, and *ditto* 31317, 31318, 20.8.2005, TAIF], **Kabhrepalanchok** [densely forested stream-gully above temple, on N.-facing slope, *c.* ½ km. S. of and above road from Kathmandu to Dhulikel, above Mailtar village, above and S.W. of Jangal village, *c.* 1½ km. W. of western limit of Banepa, E.N.E. of Kathmandu, Kavrepalanchok District, *C.R. Fraser-Jenkins* 28670 (FN 4645), 18.10.2000, H].

Iwatsuki (1988) stated that he had seen no specimens from Nepal, though he had previously (Iwatsuki 1975) reported it from Kathmandu valley in a sense we have not yet been able to identify ("Pouwa, 1600 m., *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama s.n.* [but probably now with a number], 9.10.1963, TI"), but that specimen, which we have not seen, was neither pointed out as corrected in identity, nor clearly, if at all mentioned again by Iwatsuki (1988), who did not cite localities.

E: **Sunsari** [Phusre, Dharan, E. Nepal, *C.K. Prasad* & *B.N. Adhikari* 2-6B-0064, 10.1977, TU Nat. Hist. Mus.], **Ilam** [Nepal orient. subtrop., 2-4000 ped., *J.D.H*[*ooker*], K, longer, lobed and acute lower pinnae, similar to *M. substrigosa*].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. S. India; Sri Lanka; E. and S.E. Asia.

(M, Sc). A scattered and rather occasional species of mid altitude, growing among dense bushes, or on banks in forest.

105. ***Microlepia trichocarpa*** Hayata (syn.: *M. trichosora* Ching; *M. herbacea* Ching & C.Chr. var. *trichosora* (Ching) Seriz.; *M. yunnanensis* Ching [Yan, Qi & Serizawa (2013) placed this as a synonym of *M. pilosiuscula* (*sub M. trapeziformis* (Roxb.) Kuhn; its placement requires investigation]; the name "*M. longistrigosa* Ching" (Biswas in Fraser-Jenkins 2008) applied to this species appears not to have been published).

Very similar to *M. strigosa* with simply pinnate pinnae, but wider, more contiguous pinnule-lobes, and the upper stipe, rachis and pinna-costae are densely furnished with obviously longer, soft russett hairs.

Nepal:

C: **Lalitpur** [forest slope above river on S.E. side of Bajrabarahi temple, E. side of Chapagaon, S. of Kathmandu,, *C.R. Fraser-Jenkins*, *R. Lama* & *D. Lama* (*Damai*)

24988 (FN 967, but excluding "sheet 2 or 2" at BM, which has become transposed with *M. strigosa CRFJ* (FN 1222) from Changu Narayan, Bhaktapur), 18.11.1996, BM, H].

Himalayan distribution: China; Darjeeling [Rishi Road, S.W. of Kalimpong [not "Damsong" (further east of Kalimpong), as stated by Fraser-Jenkins 2008], *C.R. Fraser-Jenkins* 30428, 25.5.2004, TAIF]; Nepal. ?Nagaland [Nasum, *A. Meebold* 7456, 12.1907, K, identity not certain, ?*M. strigosa*]; Meghalaya [Nunklow, [*J.D. Hooker*], 10 July [1850], K; Khasia Hills, *Mr. Riddell* 2, pres. 11.9.1928, K]; Tripura [Siava, Lushai Hills, 4000 ft., *Mrs. N.E. Parry* 547, 1.1928, K], Taiwan.

(S, R). A very rare and little known mid-altitude species of sheltered slopes in undisturbed forest, confined to a few remnant forest localities.

Indian threatened status: **EN**. Nepalese threatened status: **CR**.

Monachosorum (1 species).

106. ***Monachosorum henryi*** Christ (syn.: *M. subdigitatum* var. *henryi* (Christ) Tagawa; misapplied names: "*M. subdigitatum*" *sensu auct. Ind., non* (Blume) Kuhn [from S.E. Asia]; "*M. davallioides*" *sensu* Ghosh *et al*. (2004), *non* Kunze [= *M. subdigitatum*]). Previously known as *M. subdigitatum* in the Indian subcontinent, which refers to the closely related but distinct Malesian species, *M. subdigitatum* with finer-dissect and smaller, narrower, more stalked segments and without proliferous bulbils. Ghosh *et al.*'s (2004) separation of two species in the Indo-Himalaya was erroneous. We see no such difficulty as mentioned by X.C. Zhang & Nooteboom (2013) in the *Flora of China*, who thought that it was "almost impossible to separate it from the S.E. Asian *M. subdigitatum*" when there are no gemmae, CRFJ having studied the latter in the field in Java and in herbaria from elsewhere.

A large, finely dissect, delicate fern (fronds up to 80 cm.); rhizome short, thick, horizontal to ascendent, the apical young fronds crowded and usually being partly unrolled and nearly horizontal at their stipe-bases, until fully uncurling; stipes thickened at the base, with yellow lateral stripes and few scales; rachis and often costae bearing one or two (-3) prominent, but deciduous, large, green proliferous bulbils consisting of partly uncurled short frond-bases (which have been confused with aphlebiae by D'Rozario, Bera & Mukhopadhyay (1999) publishing under the wrong genus, *Dennstaedtia*); lamina tripinnate to quadripinnatifid, with wide, overlapping pinnae and delicate, ± rhombic-rounded with angular short-toothed margins, delicately short-stalked segments; sori small, round, yellow, inframarginal, exindusiate.

Nepal:

C: **Gorkha** [Ripchet khola, 84° 51', 28° 14', forêt humide de Chêne, 2100 m., *J.F. Dobremez* 742, [12.1970], BM, KATH].

E: **Bhojpur** [Suntaley to Dingla, in shady deep forest, 7000 ft., *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Upadhyaya* & [*B.B.*] *Baskola* 3230, 20.4.1965, KATH], **Sankhuwasabha**

[Chhungneri, 2460 m., *P.R. Shakya* & *M. Ohsawa* 985, 17.10.1971, KATH], **Dhankuta** [forested N.W.-facing slope just below top of ridge (on Dhankuta District side, to W.) and narrow, rocky stream-gully at bottom of slope, *c*. 1 km. (by zig-zag road) W. of and above Basantapur [in Tehrathum District, to E. of ridge], N. of Hile and Dhankuta, on road to Tehrathum and Sankhuwasabha, Dhankuta District, *c*. 1900 m., *C.R. Fraser-Jenkins* 28804 (FN 4779), 23.3.2001, H], **Ilam, Panchtar** [Tharpu - near Chyangthapu, *H. Kanai*, *G. Murata* & *M. Togashi* 6310017, 26.11.1963, BM], **Taplejung** [Upper Mewa, 6700 ft., *R.L. Fleming* 2044, 4.12.1971, MICH; Taplejung, Yamphodin, *C. Grey-Wilson*, *D.G. Long*, *R. McBeath*, *H.J. Noltie*, *M. Sinnott*, *S. Crawford*, *S. Zmartzty* & *M.N. Subedi* 1066, 28.9.1989, KATH].

Himalayan distribution: China; Myanmar; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. Mainland S.E. Asia. Misreported from Uttarakhand (Khullar 2000 and others) in error for *Deparia boryana* subsp. *boryana*.

(S, C). A rather common (in E. Nepal) upper-mid to higher altitude species of dense, damp forests, usually on slopes above streams.

Pteridium (1 species).

Although *Pteridium* had for long been treated as a "special case" genus, with different standards of ranking and taxonomy from other pteridophytes, there is no justification for this, even keeping in view the molecular data concerning introgression between some of the species and the regional geographical distinctions whereby N. American populations of most species show considerable molecular differences from old world populations. There is a number of generally discrete and readily recognisable good species, which strict interpretation of molecular findings of somewhat unclear taxonomic significance has not allowed some molecular workers to recognise. Nevertheless several of these taxa are incontrovertibly genuine species that cannot be ignored, and while most molecular work can be seen to fit in with them, it is unfortunate that in a few cases (notably concerning old world *P. latiusculum* and *P. revolutum*) some papers have subsumed them as infraspecific taxa. The idea that some of the morphologically and geographically distinct and easily recognisable species should again be reduced to subspecies of *P. aquilinum* is not actually the result of the molecular findings as put forward, which can be interpreted logically in various ways, and goes entirely against the very clear morphological situation (apart from the intermediates between *P. aquilinum* and *P. latiusculum*, which are not such a clear situation). It is an outdated and arbitrarily chosen throw-back to the primitive taxonomy of Tryon (1941) when he first attempted to tackle the taxonomy of the genus, at that time known as one world-wide species. But unfortunately conclusions degrading several well established and distinct species have recently been presented by Zhou *et al.* (2014) as if an authoritative molecular scheme, and thereby inherently mandatory to follow, disguising the arbitrary nature of their taxonomic choices. The taxonomy of the species of *Pteridium* present in S. Asia and Europe has been discussed and clarified by Fraser-Jenkins (1992, 1997, 2008), while a very important, ground-breaking and informative molecular clado-taxonomy has been presented in a series of studies by Thomson (2000

etc.), but still requires certain areas of taxonomic modification.

[***Pteridium aquilinum*** (L.) Kuhn (syn.: *Polypodium austriacum* Jacq.; *Pteridium tauricum* C.Presl *ex* Grossh.; *P. herediae* (Clemente *ex* Colmeiro) Barnola; *P. aquilinum* subsp. *brevipes* (Tausch) Wulfen; *P. aquilinum* subsp. *atlanticum* C.N.Page; *P. aquilinum* subsp. *fulvum* C.N.Page & R.R.Mill; *P. aquilinum* var. *osmundaceum* Christ, described from a frond of luxuriant sterile morphology from Switzerland, but misplaced by Page & Mill and Liao, Ding, Wu, Wu & Prado (2013) in the *Flora of China*; *P. pinetorum* C.N.Page subsp. *osmundaceum* (Christ) C.N.Page & R.R.Mill) is a European, W. Asian and African species, which despite an abundance of misidentifications and misreports, including economic, medicinal and veterinary ones, does not occur in the Indian subcontinent or in Nepal, where it is replaced by *P. revolutum*). *P. aquilinum* has long been widely misreported from the Indian and Himalayan region, and occasionally continues to be reported today, but is in fact absent from the region. One other taxon, *P. brownseyi* Fraser-Jenk., occurs in the far-west Himalayan region from Jammu & Kashmir, but it is uncertain, pending molecular data from material sent by CRFJ to Prof. J.A. Thomson in Australia, whether it belongs to true *P. aquilinum*, or, as thought by Fraser-Jenkins (1992 *etc*., modified), to the fertile intermediates between *P. aquilinum* and the boreal *P. latiusculum* (Desv.) R.E.Fr., which are common in north-central Europe (but are mainly replaced by *P. latiusculum* in the further north in Scandinavia, E. Europe, Siberia *etc*.). The intermediates have been shown to be a fertile, hybrid-derived taxon between *P. aquilinum* and *P. latiusculum* and were named *P. pinetorum* C.N.Page & R.R.Mill, or *P. latiusculum* subsp. *pinetorum* (C.N.Page & R.R.Mill) Fraser-Jenk. (syn.: *P. aquilinum* subsp. *pinetorum* (C.N.Page & R.R.Mill) J.A.Thomson; *P. aquilinum nothosubsp.* [as "subsp."] x *subaquilinum* Harmaja (2000-2006), *nom. prov.*), whose morphology, though intermediate, is more similar to *P. latiusculum*, with which it is usually confused. *P. latiusculum* subsp. *pinetorum* is the origin of reports of the *P. aquilinum* genome in chloroplasts of some S. Finnish material and of corresponding isozymic results from Denmark.

Although Thomson (2004) separated the N. American *P. latiusculum* from the further N. European and boreal Asian equivalent on molecular grounds, it was also shown that some other, quite unrelated species in N. America showed unexpected molecular relationships on a geographical level - a phenomenon apparently not only confined to *Pteridium*. It appears that major geographical regions in some genera have developed their own molecular similarities as well as differences that may in some cases be more obvious to moleculologists than the important morphological similarities between representatives of a single species in the different areas. It is indisputable to anyone who knows the plants in both regions, that *P. latiusculum* is, as long thought, a single and discrete circumboreal species of both the New World and the Old World, readily recognisable and not due to convergent evolution or synapomorphy - any other conclusion is untenable, making no sense at all

taxonomically. Unfortunately much of the molecular work which led to the interpretation that Old World *P. latiusculum* is a part of *P. aquilinum* was flawed as the so-called *P. latiusculum* sampled was mainly the intermediate taxon between them, subsp. *pinetorum* and not the real Old World *P. latiusculum*.

Various taxonomic anomalies and errors have been enshrined in a veneer of molecular cant and jargon by Zhou *et al.* (2014), without identifying Ching's erroneous species, which might have been a more useful exercise. Agardh's (1839) grasp of bracken taxonomy was actually more successful in various respects. Anomalies are as follows:

(i) While the recognition of two subspecies concerning *P. latiusculum* is valid, they needed to be transfered to that species, which is clearly not a mere subspecies of *P. aquilinum*. The two subspecies are *P. latiusculum* subsp. *latiusculum* from N. America and *P. latiusculum* subsp. *japonicum* (Nakai) Fraser-Jenk., ***comb. nov***. (basionym: *Pteridium aquilinum* var. *japonicum* Nakai, *Bot. Mag. Tokyo* **39**: 106 (1925); syn.: *P. aquilinum* subsp. *japonicum* (Nakai) Á.Löve & D.Löve; *P. pinetorum* subsp. *sibiricum* Gureyeva & C.N. Page (2005), the latter being misunderstood as if a separate taxon from subsp. *japonicum* and also misplaced under the wrong species, which they had misinterpreted as representing the Old World *P. latiusculum*, while being entirely ignored by Zhou *et al.*; *P. pinetorum* subsp. *sajanense* Stepanov) from further N.W. to N.E. Europe and across northern Asia, including Siberia, N. China and Japan.

(ii) "Subsp. *latiusculum*" in their restricted N. American sense was misreported from an unspecified locality in India, in an entirely unlikely, indeed ridiculous disjunction, and without details or even State mentioned to enable it to be understood and properly identified. Dr. H. Schneider has kindly informed CRFJ (pers. comm. 2014) that the result was taken from Der *et al.* (2009), and was said to be from S. India, but there were some doubts as to the origin of the specimen, and we can only conclude that it would seem more likely to be due to a confused specimen as only *P. revolutum* occurs in S. India. Had it instead been from far N.W. India, it could perhaps have referred to *P. brownseyi* Fraser-Jenk., which may be related to *P. latiusculum*, but was not referred to at all (although known to them). However *P. brownseyi* very evidently does not belong to *P. latiusculum* and had it instead been that that they worked on, molecular similarities they found could not turn it into *P. latiusculum*, even though insufficient taxonomic experience and approach may not have allowed the authors to realise that, but might be explained by its intermediate nature. *Pteridium aquilinum* var. *lanuginosum* (Bory *ex* Willd.) Kuhn, described from Mauritius, belongs to the African species, *P. capense* (Thunb.) Krasser and not, as a subspecies without the authorities given, to *P. latiusculum* from Canada *etc*. as they stated.

(iii) Subsp. *pinetorum* has been shown to be a fertile hybrid-derived intermediate with *P. aquilinum*, as its morphology strongly indicates, and there was also no molecular basis presented for synonymising it within subsp. *japonicum* as they did

in error. As chloroplast DNA comes only from the female parent or ancestor it is obviously impossible to place allopolyploids (or allodiploids) only from such studies, yet this well known pitfall was ignored and a premature placement was made regardless, which is to be rejected.

(iv) *P. revolutum* is entirely distinct in both morphology and range from *P. aquilinum*, as concluded by Fraser-Jenkins (1997), and molecular findings by Thomson are not actually in disagreement with that. Reversion to its synonym, *P. aquilinum* subsp. *wightianum*, is a taxonomic blunder that could only arise through lack of taxonomic experience combined with deliberate avoidance of wider morpho-taxonomic considerations, as also confirmed by their professed expression of ignorance of its well known range. *P. revolutum* is as good a species as any of the common European ferns of many genera, and its regressive reduction, going against carefully worked out taxonomic advances of decades in S. Asia is entirely rejected here.

Agardh's var. *wightianum* referred to a rather smaller and neater lobed form of the species, with narrower and often more rolled segments, common in Tamil Nadu, Kerala and Karnataka, S. India, which differs slightly as a local race of *P. revolutum*. Although having nomenclatural priority at the varietal rank used by Tryon, it is unfortunate that it was subsequently given priority as a subspecies by Shieh, who failed to take up Blume's *P. revolutum* at that rank and like Tryon and subsequent workers, did not realise that it represents a slighty atypical local form.]

[*Pteridium esculentum* (G.Forst.) Cockayne is another well known and distinctive S.E. Asian, S. Chinese and Australasian species not present in the Indian subcontinent. Its report from Uttarakhand by Nair (1972), and thus potentially in Nepal, was in error due to a confused specimen from Singapore having been misplaced by Wallich into his *Num. List* no. 103, as explained by Fraser-Jenkins (2008). The specimen concerned superficially resembles *P. esculentum* but actually belongs to a further distinct species, *P. semihastatum* (Wall. *ex* J.Agardh) S.B.Andrews, which has narrow wings of lamina between the ultimate lobes and simple, entire pinna and pinnule apices, and occurs from Myanmar, Thailand and S. China to S.E. Asia and Australasia. Nevertheless "*P. esculentum*" continued to be misleadingly reported from India by Liao, Ding, Wu, Wu & Prado (2013) in the *Flora of China*, without mention of *P. semihastatum* and with Ching's various supposed species still requiring proper study to identify and relate them to accepted species. They were presumably also unaware of recent pteridological literature from India and elsewhere. Fraser-Jenkins has now identified a genuine specimen of *P. semihastatum* from Arunachal Pradesh, but unfortunately without precise locality, collected by *S.S. Bhattee*, Indian Forest Service (formerly at Miao) no. 54, ITAF. The late Forest Officer Bhattee failed to pass on his locality-list to Dr. K. Haridasan, who organised his herbarium, but is known to have collected around Bomdila and Chakoo, in Kameng and Tawang, as written on a few of his specimens, which all appear to be from northern Arunachal Pradesh.]

107. ***Pteridium revolutum*** (Blume) Nakai (syn.: *Pteris revoluta* Blume; *Pteridium aquilinum* subsp. *revolutum* (Blume) XiaoQ.Chen & C.C.Zhang; *Pteris recurvata* Wall. *ex* J.Agardh; *Pteris recurvata* var. *wightiana* J.Agardh; *Pteridium aquilinum* (L.) Kuhn var. *wightianum* (J.Agardh) R.M.Tryon; *Pteridium aquilinum* (L.) Kuhn subsp. *wightianum* (J.Agardh) W.C.Shieh, repeated by Löve & Löve; *Pteridium capense* var. *densum* Nakai; misapplied names: "*P. aquilinum*" *sensu auct. Ind. plur., non* (L.) Kuhn [from Europe, Africa and W. Asia, not present in India]; "*P. capense*" and "var. *densum*" [Tagawa] *sensu* Dixit (1984), *non* (Thunb.) Krasser [= *P. capense* (Thunb.) Krasser, from Africa]).

P. revolutum is the well known Indian Bracken fern, with a long creeping, tough, black, subterranean rhizome, tall, erect, stiff, and nearly glabrous stipe, erect, tripinnate frond, with a hard, rigid lamina, long, opposite, narrowly deltate pinnae, and the ultimate lobes rectangular with rounded apices and without teeth, bearing dense hairs beneath and fertile fronds, which occur commonly, with the segments having an external pseudoindusium and small, internal outward-facing indusium and usually soriferous. *P. revolutum* is generally similar to European *P. aquilinum*, but clearly constitutes a distinct species, readily and consistently distinguishable by its harder, stiffer frond and denser hairs beneath, as well as its pinnae vernating before the frond-apex and its more frequent fertility. Its previous cladonomic treatment as a subspecies of *P. aquilinum* by Thomson (2004) is not accepted here as being appropriately ranked in view of its discrete and distinctive morphology and range.

P. revolutum is similarly highly toxic and carcinogenic as in *P. aquilinum* due to the presence, especially in young fronds, of Cyanide, Thiaminase and the carcinogen, Ptaquiloside, which is even passed into milk by cattle eating bracken. *P. aquilinum* is well documented as being dangerous to humans and *P. revolutum* is similarly documented in India and Australia, so is presumably the same, but it was stated by Matsumoto (2009) to be edible, presumably in confusion with the Chinese *P. esculentum* (G.Forst.) Cockayne), or for *Diplazium* species. It is frequently fatal to cattle in the Himalayan region, where it causes a serious veterinary problem each Spring of bovine haematonuria due to tumours. Indeed it is normally avoided by them, unless in early Spring after the Winter's a shortage of green fodder (see Fraser-Jenkins 2008: 303-308).

Nepal:

W: **Dadeldhura** [Ghanteswor, Dadeldhura Distr., *K.R. Rajbhandari, P.M. Regmi* & *K.J. Malla* 5413, 16.8.1980, KATH], **Darchula**, **Doti** [Tele Lekh, Doti, open place, 2000 m., *D.P. Joshi* & *M.S. Bista* 117, 28.7.1972, KATH], **Humla**, **Mugu** [Rara, Mugu Distr., *H. Tabata et al.* 14811, KYO *sub* "*P. aquilinum* var. *latiusculum*" in error; Gam Garhi, Mugu Distr., on open land, 2850 m., *N.P. Manadhar* & *D.P. Joshi* 8134/81, 10.8.1981, KATH], **Surkhet**, **Dailekh** [Dailekh, *H. Tabata et al.* 30055, KYO], **Jajarkot** [Dhaulakot, earth banks amongst shrub thicket, 7000 ft.,

O. Polunin, W.R. Sykes & *L.H.J. Williams* 459, 17.8.1952, BM], **Jumla** [Maharigaon khola, in herbaceous mictium, *c.* 13,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* Eoso.d. 1640, 27.7.1952, BM; Dhitachaur, Jumla, 2500 m., *V. Manandhar, A. Karki, M. Kayastha* & *R. Niraula* 95014, 2052.2.30 (Nepali date), KATH], **Dolpa** [between Rohagaon and Lulo khola, Suli Gad, open place in mixed forest, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3406, 15.9.1953, BM].

C: **Baglung** [Okhaldhungagaon, S. of Dhorpatan, amongst grass and rocks, 12,000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 376, 1.5.1954, BM], **Myagdi** [Tarakhola, W. of Beni, shady banks near stream, 7000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 499, 8.5.1954, BM; near Malkabang, E. of Myangdi khola, in clearings, 7500 ft., *G.* & *S. Miehe* A 111, 15.1.1977, BM], **Mustang**, **Manang** [Marsyandi valley, between Thonje and Jagat, on stony grassy slopes, *T. Wraber* 572, 31.10.1969, BM; Bhratang - Chame, Manang, on open place, 2800 m., *K.R. Rajbhandari* 8894, 5.8.1983, KATH], **Palpa**, **Syangja**, **Parbat** [Damankot, Parbat Distr., on open and dry rocky slope, 1900 m., *D.P. Joshi* & *M.M. Amatya* 74/1539, 13.3.1974, KATH], **Kaski** [hills N. of Pokhara, dry open banks, 3500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4836, 4.1.1954, BM; nr. Jilhar, rocky wayside track and among shrubs, *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2780, 19.5.1954, BM], **Gorkha**, **Makawanpur** [roadside bank, *c.* 5 km. S. of and below Lami Dara [Danda], N. of Hetauda on "Rajpath Road" to Naubise and Kathmandu, Makawanpur District, *C.R. Fraser-Jenkins* 16133, 4.3.1990, H], **Nuwakot**, **Rasuwa** [Syarpagaon - Syabrubensi, dry grassy slope, 7500 ft., *O. Polunin* 1404, 30.7.1949, BM], **Kathmandu** [Sundarijal, sunny spots, 6200 ft., *R.L. Fleming* 1369, 2.8.1957, KATH], **Lalitpur** [Phulchowki, south of Kathmandu, 852274, on open slope, 2200-2700 m., *H. Hara, K. Iwatsuki, H. Ohba* & *Z. Iwatsuki* 725538, 15.7.1972, KATH], **Bhaktapur**, **Sindhupalchok** [just S.W. of Bhrati, top of East-facing slope of ridge, *B.F.C. Sennitt* 71216, 19.10.1971, KATH], **Dolakha** [Chisapani, Dolakha, open place, 2400 m., *K.R. Rajbhandary* & *B. Roy* 2059, 4.8.1977, KATH].

E: **Okhaldhunga** [bois au S.-O. de Okhaldunga, 1670 m., *A. Zimmermann* 2004, 3.11.1954, BM], **Bhojpur** [Dingla, 3500 ft., *Dr.* [*M.L.*] Banerjee, [*A.V.*] *Upadhyaya* & [*B.B.*] *Baskola* 3235, 2.4.1965, KATH], **Solukhumbhu** [near Junbesi, Solukhumbu, *c.* 2500 m., *T. Nakaike* 3394, 18.10.1988, KATH], **Sankhuwasabha** [Arun valley, Walung, amongst Artemisia dubia, 1070 m., *T. Wraber* 459, 3.11.1972, BM; Sankhuwasabha District, forested slopes below Tashigaon, 27° 36', 87° 15', open area in Daphniphyllum-dominated forest, 1970 m., *D.G. Long, R.J.D. McBeath, D.R. McKean, D.A.H. Rae* & *N.P. Bhattarai* EMAK 192, 23.9.1991, KATH], **Dhankuta** [Pharkushe (890 m.) - Phalate (1570 m.) - Lamche (1790 m.) - Pakhribas (1700 m.) - Hile (1950 m.), 27° 01' 36" - 27° 05' 10", 87° 13' 31"-87° 19' 02", on sunny grassland, 1660 m., *M. Mikage, T. Kajita, F. Kiuchi, N. Kondo, P. Lacoul, M. Suzuki* & *K. Yonekura* 9558331, 3.11.1995, KATH], **Tehrathum** [Basantapur (2300 m.) - Chitre (2400 m.), 872272-872271, on open filed [*sic*], *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725500, 7.7.1972, BM, KATH],

Ilam [Mai Majuwa - Mai Pokhari - Dhara Pani, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305119, 4.12.1963, BM, KATH], **Panchtar**, **Taplejung** [Gunsa, Taplejung Distr., subalpine Abies spectabilis forest, 3300 m., *L. Pejchar* 41, 24.4.1996, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E., C. and S. India; Sri Lanka; E. and S.E. Asia; Australia; New Guinea; Pacific Isles.

(S or M, C). A very common lower-mid to higher altitude species, growing in large colonies in full sunlight on stoney and grassy slopes or among bushes, becoming enormous and attenuated in forest, which habitat it does not prefer.

LINDSAEACEAE

Lindsaea (3 species).

A recently separated "genus", *Osmolindsaea*, represents a small group of species within the genus that are not significantly distinct and are best treated as a section, as by Kramer (1968, 1972 *etc*.). The species as a group have very minor and generically insignificant morphlogical differences from the rest of *Lindsaea* - mainly spores monolete versus trilete, which is a secondary feature in this family, as demonstrated within *Odontosoria*, and the spores are not entirely constant within the rest of *Lindsaea*. It was unnecessarily raised to generic rank by Lehtonen *et al.* (2010, 2013), but only on molecular grounds which do not actually oblige its separation as a genus, and ignoring its undeniable, overwhelming and natural similarity to the rest of the genus - a consideration that was rightly fundamental to the widely accepted and meaningful taxonomy of the late Prof. K.U. Kramer. It thus represents a cryptic clado-genus or microgenus of insufficient taxonomic significance and is synonymised again here as a section.

108. ***Lindsaea commixta*** Tagawa (syn.: *L. orbiculata* var. *commixta* (Tagawa) K.U.Kramer; *L. tenera* var. *commixta* (Tagawa) K.Iwats.; *L. hainanensis* Ching; misapplied names: "*L. orbiculata*" *sensu auct. Ind., non* (Lam.) Mett. *ex* Kuhn [from China to S.E. Asia]). Following Kramer's placement, Dong, Lin, Christenhusz & Barcelona (2013) in the *Flora of China* included this species within *L. orbiculata*, taken, as they said, in an aggregate sense including different morphologies and cytotypes in a complex. But as stated by Fraser-Jenkins (2008), the two are not conspecific and *L. commixta* does not represent variation within *L. orbiculata*, but has a distinct and discrete morphology which does not merge into the latter.

A small (to *c.* 16 cm. tall) bipinnate species (though in smaller fronds the lowest pinna is elongated and lobed, but not pinnate), stipe thin, glabrous, with a dark-brown base, but above that green and drying stramineous; lamina narrowly triangular, the mid to upper pinnae simple, elongated rhombic, shortening above to more rounded lobes fusing at the apex; the lowest 1-3+ pairs of pinnae becoming pinnate,

with cuneate-based, rounded-rhombic segments and usually an elongated rhombic apical segment, or sometimes decreasing to their apex in larger plants; sori elongated, lying around the distal margins, indusiate, with the elongated, occasonally interrupted indusium opening outwards. It can be confused with *L. javanensis* Blume, which differs in having narrower, more pointed apices to the segments.

Nepal:

C: **Syangja** [very rare, [?Phurtlikhet,] 18/23 mi. N.[E.]. of Tansen, "Palpa District", by the Andhi Khola, in damp ravine, a colony in shade of and under overhanging rock, only one seen, 2000 ft., *R.L. Fleming*, Sr. 864, 8.1.1950, UC (with village name, Phurtlikhet, which, however, is further north), MICH, BM, KATH, DD - sheet in KATH with a frond of *L. odorata* attached later in error on left; in BM only with Fleming's printed label from Woodstock School, Mussoorie and thus misreported as from Uttarakhand, India by Kramer (1972), copied by Dixit & Ghosh (1983); not "Andheri khola" as misreported by Thapa (2002)].

Himalayan distribution: China; Myanmar; Meghalaya [rare]; Nepal. S. India; Sri Lanka; Japan; Thailand; E. and S.E. Asia.

(M, R). A very rare mid-altitude species known only from a single locality in Nepal, occurring in a sheltered ravine.

Indian threatened status: **EN**. Nepalese threatened status: **CR** or perhaps **EX**.

109. ***Lindsaea ensifolia*** Sw. sometimes as subsp. *ensifolia*, but inappropriately since the Australian and Pacific subsp. *agatii* (Brack.) K.U.Kramer represents a different species analagous to *L. heterophylla* Dryand. (syn. of *L. ensifolia*: *Schizolegnia ensifolia* (Sw.) Alston; *Schizoloma ensifolia* (Sw.) J.Sm.; *L. griffithiana* Hook.; *L. rutlandia* R.D.Dixit & B.Ghosh, this taxon matches many of the S.E. Asian collections of *L. ensifolia*, though Fraser-Jenkins (1997, 2008) had thought it to be similar to *L. walkerae* Hook.; *L. ensifolia* var. *gigantea* B.K.Nayar & Geevargh.).

A medium-small (to *c.* 50 cm. tall) species, rhizome thin, creeping, subterranean, with separate erect stramineous to dark, glabrous stipes, square in cross-section and usually as long as or longer than the lamina; lamina rectangular-lanceolate to triangular-lanceolate, widest at the base, simply pinnate, pinnae *c.* 3-10 pairs, upswept to horizontal, unlobed, cuneate to rounded-truncate at their bases, linear with a narrowly acute apex; sori borne along all or part of the margin, indusiate, with an uninterrupted indusium opening outwards. Very small, juvenile sporeling plants have deeply lobed pinnae.

Nepal:

C: **Kaski** [N. facing slope near top of ridge in Raniban forest, above and S.W. of Phewa Dam on S.W. side of S.E. end of Phewa Tal, Pokhara, *C.R. Fraser-Jenkins*, with *L.B. Tamang, D. Lama* [*Damai*] *et al.* 25867 (FN 1845), 6.1.1998, BM, H], **Gorkha** [among semi-open rocks with scattered Sal-trees and on steep, grassy slope below long cliff leading up to the summit of Chuli Darrah (hill), up Komale Khola

(right fork), above and S.W. of Deurali, *c*. 5 km. W.N.W. of Anbu Khaireni, across and to N.E. of Marsyangdi river dam, N.E. of and above Gopling and Markichowk, S. of Gorkha, Gorkha District, *c*. 900 m., *C.R. Fraser-Jenkins* 28408 (FN 4383), 22.1.2000, H; N. facing slope near top of ridge in Raniban forest, above and S.W. of Phewa Dam on S.W. side of S.E. end of Phewa Tal, Pokhara, *C.R. Fraser-Jenkins et al.* 25867 (FN 1845), 6.1.1998, BM, H], ?**Makawanpur** ["Pteris angustata", Napalia, [*N.*] *Wallich* Num. List no. 93, in 1820, K, K-W, BM].

E. Thapa (2002) reported it as becoming common in E. Nepal, but there are no other such reports and we have not seen any collections from E. Nepal, though it should be there, being present on either side.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Sikkim; Darjeeling; Nepal. N.E., C. and S. India; Sri Lanka; Bangladesh; E. and S.E. Asia; Australasia; Pacific Islands; Mascarenes; Africa.

(M, R). A rare (in Nepal) lower-mid to mid-altitude species known only from a few localities, occurring on rather dry, steep, semi-open slopes among grasses or below light forest.

Nepalese threatened status: **EN**.

110. ***Lindsaea odorata*** Roxb. (sometimes given as "var. *odorata*" in error; syn.: *Osmolindsaea odorata* (Roxb.) Lehtonen & Christenhusz; ?*Lindsaea cultrata* var. *minor* Hook.; ?*Osmolindsaea minor* (Hook.) Lehtonen & Christenhusz (lectotype designated by Kramer (1971), prior to Lehtonen *et al.* (2012)); *L. cultrata* var. *attenuata* Hook.; *L. cultrata* var. *pallens* Hook.; *L. cultrata* var. *parvula* Holttum; *L. odorata* var. *darjeelingensis* T.Sen & U.Sen, a growth and size stage definitively synonymised by Fraser-Jenkins (1997) and repeated as if a new or more valid finding by Lehtonen *et al.* (2013: 888); misapplied name: "*L. cultrata*" *sensu auct. Ind*., *non* (Willd.) Sw.). This species was long known in India as *L. cultrata* in error until Kramer (1972) and Morton (1974) separated it. Kramer (1972), in part of his fine study of the genus, recognised that var. *minor*, described from the Philippines, represents small and slightly variant plants of *L. odorata*. But despite molecular findings on a Philippine plant in agreement that this is its proper relationship, the momentum of the heady wine of "New Species Syndrome" (remarkably combined in this case with both "New Genus Syndrome" and even for other ferns a clearly demonstrated outbreak of "New Family Syndrome") led to its premature separation as a species based on insufficient evidence, tentatively re-synonymised here. The so-called "var. *darjeelingensis*", which is merely a less developed individual that should not have been named, was reported from India as if a separate taxon by Sen & Sen (1971) and Dixit (1984), referring to normal small plants of *L. odorata*, but was properly synonymised by Fraser-Jenkins (1997, 2008).

A small, simply pinnate species; stipe stramineous, lower surface of lower rachis and upper stipe rounded, not quadrangular (as in the otherwise very similar *L. lucida*

Blume from N.E. India *etc.*), fronds always simply pinnate, and generally supeficially similar to a smaller, narrower pinna'd and more lobed *Adiantum philippense*, or *A. incisum*, but with sori opening outwards, varying considerably in size but usually fertile at all stages, pinnae symmetrically semi-lunate, with ± acute apices, usually quite deeply lobed around their distal margin with short sori, but also frequently nearly unlobed with longer sori.

Nepal:

C: **Kaski**, **Makawanpur** [rocky, forested stream-gullies and roadside banks, *c.* 1 - 3 km. S. of and below Mahaveer, N. of Lamidara ("Lamidanda"), S. of Aghor and Simbhanjyang, N. of Hetauda on Rajpath road N. to Daman, Naubise and Kathmandu, Makawanpur District, *c.* 1500 m., *C.R. Fraser-Jenkins* 29049 (FN 5024), 5.7.2001, H], **Rasuwa** [near Bhogte, on tree trunks, 12000 ft., *Dr.* [*M.L.*] *Banerjee*, [*T.B.*] *Shrestha* & [*A.V.*] *Upadhyaya* 3022, 26.9.1964, KATH, US], **Kathmandu** [Katmandu, Sheopuri Lekh, on mossy banks, 6500 ft. *J.D.A. Stainton, W.R. Sykes, L.H.J. Williams* 6941, 19.8.1954, BM, *sub* "*L. cultrata*"; Sundarijal, on damp banks along rocks, 6200 ft., *R.L. Fleming* 1381, 21.8.1957, KATH, *sub* "*Schizoloma lobata*", det. R.R. Stewart, in error, *ditto*, 5900 ft., 1523, 13.9.[1958], MICH]; Sundarijal - Mulkharka, Kathmandu, *c.* 1600 m., *T. Nakaike* 412, 4.11.1979, KATH], **Lalitpur**, **Bhaktapur** [forested stream gully just above and behind temple at Surjebinayak, S.E. side of Bhaktapur, E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins* 24080 (FN 58), 16.7.1996, H], **Sindhupalchok** [entre Chyaubas et la Monastère de Likanchou, 1600 m., *A. Zimmermann* 134, 1.4.1952, BM, *sub* "*L. cultrata*"], **Dolakha** [Bumro (1900 m.) - Nauli Deorali (2000 m.) - Risanku (1800 m.), *H. Kanai* 670698, 12.3.1970, KATH, *sub* "*L. cultrata*" in error], **Ramechap** [between Shivalaya and Bhandar, 1800-2500 m., *T. Nakaike*, 3105, 6.10.1988, KATH].

E: **Sankhuwasabha** [Sukhapatal, E. Nepal, wet bank by forest road, 7000 ft., *R.L. Fleming* 2190, 10.11.1973, MICH; near Chepua, on wet rocks, *c.* 7000 ft., *L.W. Beer* 12262, 19.11.1971, BM, *sub* "*L. orbicularis* [*sic*] [*orbiculata*]", det. J.M. Mullin 1.1978, in error; Danda gaon - Gimi Gaon, 5400 ft., *P.R. Shakya* & *M. Ohsawa* 1007, 5.11.1971, KATH], **Tehrathum** [Samdo, Koshi Anchal, forest, on banks, *B.F.C. Sennitt* 7328, 17.1.1973, KATH], **Ilam**, **Taplejung** [below Siling, Tzokupa - Khebang, *H. Hara, H. Kanai, S. Kurosawa* & *G. Murata* 6305079, 22.11.1963, KATH, *sub* "*L. cultrata*" in error; Tamur Valley, Phembu, N. of Taplejung, beneath trees, 4500 ft., *J.D.A. Stainton* 1244, 3.8.1956, BM, KATH; slopes of Dobala Danda, above Yamphudin, 27° 27', 87° 56', wet shaded cliff, 2350 m., *C. Grey-Wilson, S. Smarzty, M. Sinnott, D.G. Long, R. McBeath, H.J. Noltie* & *M. Subedi* KEKE 1058, 28.9.1989, KATH, K, E, *sub* "*Adiantum*", det. RBG, Kew, in error].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. N.E. and S. India; Taiwan; E. and S.E. Asia; Pacific Islands.

(M, C). A common (in E. Nepal) mid to upper-mid altitude species at the bases of perpetually damp cliffs, on rocks by water seepage, or on steep, moist banks of paths in semi-open conditions.

Odontosoria (1 species, 2 subspecies).

The genus *Sphenomeris*, which was widely used for *O. chinensis*, and an invalid clado-genus *Bierhorstia* are not properly morphologically distinguishable from *Odontosoria* and were synonymised by Fraser-Jenkins (2008). A more recent molecular revival of *Sphenomeris* as if an effectively indistinguishable monotypic C. American cryptogenus by Lehtonen *at al.* (2010) and Dong, Lin, Christenhusz & Barcelona (2013) is of very doubtful taxonomic value or purpose and is not accepted here.

111. ***Odontosoria chinensis*** (L.) J.Sm. subsp. ***chinensis*** (syn.: *Trichomanes chinensis* L.; *Stenoloma chinensis* (L.) Bedd.; *Sphenomeris chinensis* (L.) Maxon; *Bierhorstia chinensis* (L.) J.F.Barcel. & Hickey, *comb. ined.*; *Sphenomeris chusana* (L.) Copel.; *Stenoloma chusana* (L.) Ching; *Odontosoria chusana* (L.) Masam.; *Hymenophyllum ramosissimum* D.Don, *Prodr. Flor. Nepal.*: 12 (1824), neotype, here designated: "Davallia an tenuifolia Sw.? E Napalia. Januario 1818. [?local name:] Chickdenga - Monange. Napalia - Dr. Wallich (1819)" BM, the Hamilton collection from Nilkantha [now Bouddhanilkantha, N. of Kathmandu] cited by Don and as type by Kramer (1971), but not seen by him is apparently lost and is not present in the BM, K, K-W, E or CAL. But another collection from that locality which Hamilton visited is *Trichomanes striatum* D.Don but is very strongly in conflict with the protologue description and there is hardly any possibility of it being connected with *H. ramosissimum*; ?*Trichomanes malayanum* Roxb.; misapplied name: "*Sphenomeris chinensis* var. *divaricata*" *sensu* Kramer *p.p.* from Asia *et sensu auct. Ind., non* (Christ) K.U.Kramer [= *O. krameri* Fraser-Jenk. (2008), from Africa], this latter does not occur in Nepal, India or Asia as reported by Iwatsuki (1988) and Dixit (1984), copied by Chandra (2000), in error for subsp. *chinensis*).

A medium-sized fern (up to *c.* 60 or 70 cm. tall), similar to a larger and more compound, finely dissect *Lindsaea*, fronds superficially similar to *Onychium* species apart from in its sori; stipe thin, glabrous, up to a third of the length of the whole frond, green to stramineous, becoming partly reddish or blackish later in the season; lamina lanceolate, with a tapered, slightly truncate base, tripinnate to quadripinnatifid, with small, decurrent-cuneate based, often furcate segments with wider, ± truncate apices and subapical sori, indusia rounded pouch-shaped with a truncate apex, opening outwards, not reaching the laminar margin; ultimate segments more gradually widening from their basal stalk and narrower than in subsp. *tenuifolia*.

Nepal:

W. Thapa (2002) gave it as abundant throughout W., C. and E. Nepal, but we have seen no reports or collections from W. Nepal, though it should certainly be present there. However Tabata *et al*. 18550, KYO, was cited without locality by Iwatsuki

(1988) and could perhaps have been from W. Nepal; we have not seen this specimen.

C: **Baglung** [below Baglung, "W. Nepal", on open clay banks, 2500 ft., *R.L. Fleming* 915 *p.p. max.*, 14.11.1949, BM, KATH, DD; 13 mi. S.E. of Baglung, *R.L. Fleming* 905, 12.11.1949, BM, DD], **Manang**, **Syangja** [Raja Smaura, Syangja, 834281, on shady slope, 1600 m., *D.P. Joshi* & *M.M. Amatya* 74/1591, 16.3.1974, KATH], **Palpa** [14 [mi.] N. of Riri Bazaar, Palpa District, on exposed banks, 2200 ft., *R.L. Fleming* 893, 8.11.1949, BM, UC, DD; Sattewati, on shady banks, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8917, 12.10.1954, BM], **Parbat**, **Kaski** [Pokhara, *R.L. Fleming* 866, in 1949, DD; Lumle Agricultural Centre, in damp shady site under Castanopsis indica, W. aspect, 5000 ft., *Gaye Dawson* [later Wormald] 253, 23.11.1974, KATH, *ditto*, S. aspect, hanging over top of bank above stream in semi-shade, 1705 m., 543, 10.7.1976, BM], **Tanahun**, **Lamjung** [Nalma, Nidham khola, on dry bank, 5500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5189, 3.5.1954, BM; Lamjung Himal, Hanshapur, easterly of Pokhara, amongst shrubs, 900 m., *T. Wraber* 223, 15.9.1969, BM], **Gorkha** [deep, rocky forested stream-gorge of Chisopani Darrah Khola, *c.* ½ km. above and N.E. of Komale hamlet, *c.* 1 km. below and S.W. of Deurali, above and N.E. of Markichowk (Marsyangdi) reservoir and Gopling, N.W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 25074 (FN 1053), 30.12.1996, BM, H], **Makawanpur**, **Rasuwa**, **Dhading** [Hulkigaon (1240 m.) - Chaurangi Phedi (350 m.), on soil cliff, 870 m., *H. Kanai* 670567, 8.1.1970, KATH; Katunje (1360 m.) - Charangi Pauwa (1040 m.) - Lapang (580 m.), steep wet rocky place, drooping from the rock, 580 m., 27° 58' 29", 84° 56' 26" - 28° 00' 23", 84° 55' 18", *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro* & *K. Yoda* 9485044, 16.7.1994, KATH], **Nuwakot** [Samre Banjang, 27° 57', 85° 03', on rocky slope, 3500 ft., *J.D.A. Stainton* 3819, 9.6.1962, BM, KATH], **Kathmandu** [Sundarijal, 4500 ft., *D.D. Bhatt* 164, 17.5.1958, UC; Chandragiri ascent, on mud wall, 6000 ft., *D.D. Bhatt* 233, 12.7.1958, UC; Nagarjun, Kathmandu valley, 6500 ft., *R.L. Fleming* 2354, 7.4.1977, MICH], **Lalitpur**, **Bhaktapur** [Surjebinayak, 6000 ft., *Dr. R.L. Fleming* 1238, 16.8.1956, KATH], **Kabhrepalanchok** [Sangasoti, shady place, 6000 ft., *Dr.* [*M.L.*] *Banerji*, [*T.B.*] *Shrestha* & [*A.V.*] *Upadhyay* 2665, 11.9.1964, KATH], **Sindhupalchok** [colline au N.-O. de Banepa ["Paneja" err.], 1450 m., *A. Zimmermann* 102, 30.3.1952, BM], **Dolakha** [Okhalain, Shildhunga, Lamosangu - Jiri, mixed broadleaved forest, 1800 m., *Ruth Schaffner* M19, 2.7.1984, KATH].

E: ?**Bhojpur** [Phalate, 7500 ft., *T.B. Shrestha* 1987, 2021.4.2 [= 7.1964], KATH, but label must be transposed as it says, "a small tree, fruits green (young) poisonous to cow"], **Sankhuwasabha** [Papung (2000 m.) - Bir Gaon (1600 m.), 873274, along path in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725374, 30.6.1972, KATH], **Jhapa** [Sanischare [Jhapa] - Gruwa [Ilam], "873264" [*sic*, but incorrect coordinates], damp slopes, 250-290 m., *Mrs. Prabha* [*Pradhan*], *Mr.* [*M.M.*] *Amatya* & *Miss Rajani* [*Shrestha*] 199/74, 8.6.1974, KATH], **Ilam**, **Taplejung** [Sanghu, shady banks in 'T' gulley, 6000 ft., *A.H. Norkett* 5612,

4.10.1961, BM; between Dumhan and Taplejung, *H. Kanai, G. Murata, M. Togashi* & *T. Tuyama* 6305179, 1.11.1963, BM, KATH, UC].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. N.E. and C. India; Sri Lanka; Bangladesh; Taiwan; E. and S.E. Asia *etc.*

(M, C). A very common, low to upper-mid altitude species of open pathside clay banks, damp-cliffs and sunny banks.

112. ***Odontosoria chinensis*** (L.) J.Sm. subsp. ***tenuifolia*** (Lam.) Fraser-Jenk. & Kandel, ***comb. nov.*** (basionym: *Adiantum tenuifolium* Lam., *Encycl. Méth. Bot.*: 44 (1783), lectotype, here designated, from S. India: Indes Orientales, *Sonnerat*, P; syn.: *Davallia tenuifolia* (Lam.) Sw.; *Sphenomeris chinensis* var. *tenuifolia* (Lam.) C.Chr., repeated by N.C.Nair (1971); *Sphenomeris chusana* var. *tenuifolia* (Lam.) Holttum, *non sensu* Holttum; *Odontosoria tenuifolia* (Lam.) J.Sm.; ?*Stenoloma gracilis* Tagawa; ?*Odontosoria gracilis* (Tagawa) Knapp).

This semi-cryptic taxon in the *O. chinensis* complex was initially separated by Fraser-Jenkins (2008) as a species, on observing its slightly different morphology corresponding with a different cytotype, and was thought to be confined to S. and C. India; Sri Lanka and S.E. Asia. However its morphology is too close, with too much overlap, to subsp. *chinensis*, to which it is intimately related in a cytological complex, to justify the specific rank, and it has now turned up in N.E. India *etc.* as well as in the south. It is therefore combined as a subspecies here. The critical taxonomy of *O. chinensis* and the commencement of its cyto-taxonomic elucidation by Fraser-Jenkins (2008) was ignored by Dong, Christenhusz *et al.* (2013) in the *Flora of China*, although aware of this work. The morphologically based identifications by CRFJ of material from Nepal, reported here, should be understood as tentative until at least one or two chromosome counts confirm the presence of this subspecies in Nepal and that they are not merely the result of variation within subsp. *chinensis*.

Close to subsp. *chinensis*, but recognisable from its coarser, often wider and generally more abruptly widened fertile ultimate segments, with a shorter tapering segment-base; the plants are seldom as tall and are not finely dissect as in subsp. *chinensis*.

Nepal:

C: **Arghakhanchi** [Wangla, Arghakanchi Distr., moist and shady places, 1100 m., *N.P. Manandhar* & *P.M. Regmi* 138, 4.3.1976, KATH], **Syangja** [edge of woods in stream-gulley, ½ km. S.W. of Ambot, *c.* 2 miles S. of Bhakundi, *c.* 55 miles N. of Butwal on road to Pokhara, S. of Pokhara, Syangja District, 820 m., *C.R. Fraser-Jenkins* 18062, 20.1.1991, E; Syangja, Raja Suraura, on shady place, 1600 m., D.P. Joshi & M.M. Amatya 74/1591, 16.3.1974, KATH], **Bhaktapur** [Nagarkot, Mahadeb danda, shady and wetty [*sic*] slope along the stream side, 2000 m., *V.L. Gurung, M.M. Amatya* & *R. Kayestha* 158/76, 21.9.1976 KATH; Nala - Amaldol,

on west facing mixed forest, 1650 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/384, 9.3.1975, KATH].

E: **Bhojpur** [Bhojpur, in moist and shady place, 6000 ft., *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Upadhyay* & party 3173 *p.p.*, 18.4.1964, KATH; Mangdin to Tewari, 3000 ft., *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Uphadyay* & party 3161, 14.4.1965, KATH].

Himalayan distribution: China; Myanmar; Thailand; Arunachal Pradesh; Bhutan; ?Darjeeling; Nepal; Uttarakhand [Kumaun, Lohár Khet, 6500-7000 ft., *E.W. Trotter* 748, 6.9.1991, BM]. Assam; Meghalaya; N.E., C. and S. India; Sri Lanka; Thailand; Japan; S.E. Asia.

(M, Sc to R). A rather uncommon and scattered mid-altitude taxon growing in similar habitats to subsp. *chinensis*.

Nepalese threatened status: **LC**.

PTERIDACEAE

While Adiantaceae, Pteridaceae, Parkeriaceae, Hemionitidaceae and Cheilanthaceae *etc.* were treated in the past as separate families, they were appropriately united by Kramer & Green (1990), and Smith *et al.* (2006, 2008), and when all are together Pteridaceae becomes the correct name, despite the conservation of Adiantaceae versus Parkeriaceae. The separation by Christenhusz *et al.* (2011) of taxonomically insignificant minor "families", Cryptogrammaceae *etc*., is rejected as they cannot be recognised or circumscribed morphologically and it ignores both their intimate similarity to the rest of the family in addition to their obvious lack of equivalent significance to any accepted families. Their transference a short while later by Christenhusz & Chase (2014) to a lower rank, but supposedly equivalent to Pteridaceae is equally misguided and yet more unacceptable, indeed hardly a serious proposition, ignoring, as it does, all the modern decades of study and conclusions by competent and experienced taxonomists. Although Vittariaceae have been found to form a molecularly monophyletic super-group or order along with Pteridaceae, this does not mean that they must be combined as a single family, which originated from ignoring the important morphological distinctions. It continues to be accepted as a different family here below and the recent idea that cladonomically it belongs together with *Adiantum* makes no sense at all taxonomically, invalidating the meaning and value of families.

Actiniopteris (1 species).

[***Actiniopteris radiata*** (Sw.) Link (syn.: *Asplenium radiatum* Sw.; *Acrostichum dichotomum* Forssk., *non* L. [= *Schizaea dichotoma* (L.) Sm.]; *Actiniopteris dichotoma* (Forssk.) Kuhn).

A very small (*c.* 8-15 cm. tall) clumped fern, with delightfully miniature fan-palm shaped leaves atop a short, thin stipe with bicolorous scales with narrow pale edges at its very base, and with a complete circular fan of narrow, crowded, radiate segments to the lamina, the leaves closing up laterally, hanging down and going grey during

the dry season (Winter), but reviving during rains, fertile segment-apices with 2 equal pointed teeth and some smaller ones; sori elongated, along either side of the midrib, indusiate.

Nepal:

E: ?**Dhankuta** [Dhankuta, on the moist and shady place, 400 m., *D.P. Joshi* 234, 11.10.1971, KATH]. This unique collection from Nepal is possibly of uncertain identity as while 234 strongly appears to be very typical and definite *A. radiata*, 235 of the same collection locality is obviously *A. semiflabellata*.

Peri-Himalayan distribution: Myanmar [Ava, [*N.*] *Wallich*, BM, K; Upper Burma, *Abdul Haq*, in 1891, herb. F.G. Dickason, MICH; Kyaukse Hill, 700 ft., *J.H. Lace* 4872, 28.7.1909, K]; ?Bhutan [a single collection, requiring re-collection or confirmation, Bootan, [*W.*] *Griffith* no. 1874, E]; ?Nepal; Uttarakhand [rare]; Uttar Pradesh; C. and S. India; Pakistan [very local, Kurram valley, "Afghanistan", *J.E.T. Aitchison*, in 1879, K, CAL; Khairi Murat Hill, Attock Distr., *R.R. Stewart* & *E. Nasir* 27907, 13.4.1957, BM, MICH, UC; near Attock, *CRFJ*]. ?Iran [Pichi Sermolli (1962)]; S. Arabia; C. and S. India; Sri Lanka; Mascarenes; Madagascar; throughout Africa; Cape Verdes.

(H, of African affinity, Sc to R; C in C. and S. India). A very rare (known only from a single collection in Nepal, but requiring confirmation), low to lower-mid altitude species of hot dry areas, among sheltered rocks, often below boulders on dry road-banks, occasionally on old walls, apparently preferring a calcareous substrate.

Nepalese threatened status, if genuinely present: **CR**. The existence of only a single specimen, while all others, including the adjacent number from the same locality, are *A. semiflabellata* suggests that the present identification might be in error even though it appears to be a very typical and characteristic specimen perfectly matching *A. radiata* and not *A. semiflabellata*, or otherwise that there is some other problem with it.]

113. ***Actiniopteris semiflabellata*** Pic.Serm.

Similar to *A. radiata*, but obviously distinct in its narrower, cuneate lamina, often divided into two narrow halves and the radiate segments more obviously arising dichotomously at their bases, longer and narrower and with more narrowly acute fertile segment apices terminating in a single point (though sterile apices often have a few shorter acute teeth below the main point; the stipe-base scales are partly concolorous and pale, and partly with a dark stripe and slightly broader pale edges than in *A. radiata*; the fertile fronds are usually more obviously taller than the sterile ones than in *A. radiata*. Smaller sterile fronds are often similarly widely fan-shaped to those in *A. radiata*.

Nepal (all specimens we have seen are cited):

C: [**Chitawan** [Chitawn [*sic*], on shady moist slopes, 200 m., *V.L. Gurung* 82/1775, 5.5.1982, KATH, ecology stated is unlikely, probably not actually collected

there or by her, unless confirmed by re-collection]], **Kavrepalanchok** [[Kuwapani to Tinpipli, 27° 32', 85° 40', *c.* 1065 m.], *M.L. Banerji* 89, *sin.* date, CAL, was also cited by Banerji (1972) *sub* "*A. dichotoma*" in error], **Sindhupalchok** [[on way to] Chipling ([on way to] "Gosaikunda", crossed out), open moist place on the rock, "7410 ft.", *Dr. S.B. Malla* 16068, 21.8.1969, KATH, "Gosaikunda" subsequently crossed out and "Sindhupalchok Distr," written in by KATH staff, but altitude not corrected, confirmed by S.B. Malla, pers.comm. to CRFJ, 8.3.2015, as probably being below and on way to Chipling], **Sindhuli** [Dumja - Jhangajhuli, growing under rock crevices, 1000 m., *H.K. Saiju* & *B. Roy* 203/81(b), 8.1.1981, KATH].

E: **Bhojpur** [Bhojpur District, Deurali (1630 m.) - Bhojpur (1640 m.) - Taksar Bhojpur (1350 m.) - Akhuwa khola (630 m.) - Bastim (1620 m.), in gaps of stone wall, 800 m., *M. Mikage, T. Kajita, F. Kinchi, N. Kondo, P. Lacoul, M. Suzuki* & *K. Yonekura* 9558281, 1.11.1995, KATH], **Sankhuwasabha** [Tumlingtar, above Sabbaya khola, on dry rocks on cliffs, 1800 ft., *A.H. Norkett* 8128, 26-12-1961, KATH; Munga khola, *c.* 1000 ft., *H. Emery, E.W. Cronin, H.* & *A. Foster* & *K. Brooks* F 1022, 24.7.1974, BM; right hand bank of the Hinwa khola, sunny place in rock fissure, 1160 m., *M. Farille* & *G. Lachard*, Geneva Expedition to Jaljale Himal, 847355, 9.8.1884, BM], **Sunsari** [Sunsari District, road to Mulghay, approx. 12 km. N. of Dharan, 26° 50', 87° 18', moist rocky slope, rock crevices, approx. 360 m., *Rebecca Gay Troth* [Univ. Michigan] 66, 12.7.1971, MICH; Churibas - Mulghat, in moist rocky slope in rock crevices, 1100 ft., *T.B. Shrestha* & *D.P. Joshi* 17, 12.7.1971, KATH *sub* "*A. dichotoma*" det. V.L. Gurung], **Dhankuta** [outer Hills of E. Nepal, *Kinlay Bhutia*, collector for *J.S. Gamble*, 1.1880, K, *sub* "*A. levingei n.sp.*", "looks like a diff't species [from *A. radiata*]" C.W. Hope; River Tamur, near Suspension bridge, amongst rocks by path near river, 1000 ft., *A.H. Norkett* 5093, 18.9.1961, KATH; Dhara Pani - Tambur bridge - Dhankuta, [*c.* 300 m.], *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6304992, 17.10.1963, K, BM, CAL; Tamur valley, 26° 55', 87° 22', on dry rocks, *L.H.J. Williams* & *J.D.A. Stainton* 8367, 4.9.1967, BM; Dhankuta, in rock fissures, 3000 ft., *L.H.J. Williams* 1168, 6.7.1969, BM; Leuti khola, on big rock facing west under shade, 250 m., *P.R. Shakya* & *M. Ohsawa* 786, 28.8.1971, KATH; Dhankuta, on the moist and shady place, 400 m., *D.P. Joshi* 235, 11.10.1971, KATH; Mohambedi khola - Tamur Bridge, in crevices of dry cliff along path in open place, 400-300 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725049, 3.6.1972, BM, KATH; Teku Nala (800 m.) - Tamur Bridge (300 m.), 872266, on rather dry muddy rock along the path on open slope, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725512, 9.7.1972, BM, KATH; Dhankuta Dt., rock crevices, common, 1200 ft., *Gay Troth*, in herb. *R.L. Fleming* 2021, *sin.* date, K; Dhankuta, *J.F. Dobremez* 1379, 1380, 1465, G; Dhankuta Distr., above 2500 ft. *R.L. Fleming s.n.*, 8.1971, DD *sub* "*A. nepalensis* Pic. Ser. [*ined.*]; E. Nepal, Tamur River, limestone rocks, above khola, between rocks, 1900 ft., *R.L. Fleming* 2175, 27.10.1973, MICH; Phusre - Dhankuta, E. Nepal, on stone, steep slope, *M.K. Adhikari* & *P.R. Pradhan*

16, 2034.4.2 [= 7.1977], KATH], **Tehrathum** [Keurani to Tamur valley, on rock crevice, common, 800 m., *K.R. Rajbhandari, S. Bhattarai, I. Sharma* & *R. Joshi* 6153, 3.2.1982, KATH], **Ilam** [[Godak to Mai khola], *B.K. Basnet* 27, in 2003, KATH], **Panchtar** ["Phedim to Moktara, 27° 07', 87° 48', *c.* 1065 m., *M.L. Banerji* 735", *sub* "*A. dichotoma*" was cited by Banerji (1972) and is surely correct, though we have not seen the specimen, which is in A], **Taplejung** [Dhule - Dobhan, E. Nepal, on the crevices of the rock and open moist places, 800 m., *D.P. Joshi* 205, 8.10.1971, KATH].

Distribution: N.E. Africa; S. Arabia; Socotra [Hagghier Mts., *A.R. Smith* & *J.E. Lavranos*, with *C.R. Fraser-Jenkins* & *K.M. Guichard*, 4.1967, K]. Despite its remarkable and highly anomalously disjunct distribution, a good number of collections of this African species, not known anywhere else in Asia, were made by different collectors from various places in C. and E. Nepal at KATH.

(?H, African, Sc). A scattered but in S.E. Nepal, locally frequent low to mid-altitude species of similar habitats to *A. radiata*.

Nepalese threatened status: **LC**.

Adiantum (11 species, 5 subspecies).

[***Adiantum capillus-junonis*** Rupr. was listed and keyed by Iwatsuki (1988) stating that it had not been actually recorded from Nepal, but is probably there. However it is certainly not likely to be present and is a purely Chinese, Taiwanese, Korean and Japanese species which does not occur anywhere in the Indian subcontinent. Panigrahi (1960) had listed it from N.E. India among many other often seriously mistaken identifications, subsequently rechecked by CRFJ, in error for small proliferous fronds of *A. philippense* (sometimes called f. *subjunonicum* Christ, but merely a growth form). It was relisted for India, "Assam" [*sens. lat.*] without checking by Dixit (1984), reproduced by Chandra (2000). *A. capillus-junonis* has opposite pairs of ovate to half-rounded pinnae, unlike *A. philippense* with alternate pinnae.]

114. ***Adiantum capillus-veneris*** L. (syn.: *A. capillus-veneris* forma *fissum* (Christ) Ching; *A. capillus-veneris* forma *dissectum* Ching; *A. capillus-veneris* var. *dissectum* B.K.Nayar, these varieties merely refer to commonly occurring, more deeply incised populations, and are not of taxonomic or nomenclatural significance. There are many old European *etc.* synonyms).

The delicate, smallish to medium-sized (5-30 cm. long), well known "Maidenhair fern", forming extensive colonies; stipe glossy black, frond tripinnate, pinnae compound with rather small, rounded segments narrowing symmetrically to cuneate bases; the segment-stalk is black and the black colour extends a very short way, *c.* 0.5 mm., along both basal edges of the segment near the stalk, visible with a lens; apical margin of the segment usually deeply lobed into rounded-rectangular lobes, particularly in sterile fronds, which bear characteristic small, acute teeth, mainly

becoming visible in the lower, sterile segments; sori present in both small and large fronds, short, or occasionally elongated, marginal, often slightly bowed-in, indented at the distal margin, but not normally deeply indented as in *A. raddianum*.

Nepal:

W: **Baitadi**, **Darchula** [Lekam to Bitale, 740-874 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yaho, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216002, 7.7.2012, KATH], **Kailali**, **Bajhang** [trail from Tameli to Chainpur on south side of river, Bajhang District, 1160 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915047, 5.7.2009, KATH], **Surkhet** [Kuepani, Bheri River, [Siwalik Hills], crevices in conglomerate cliff in complete shade, 3000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 720, and 3789, 1.4.1952, BM], **Salyan** [Jugyana, 850 m., *N.P. Manandhar* & *P.M. Regmi* 411, 18.3.1976, KATH], **Kalikot** [base of roadside cliff, *c.* 5 km. N.E. of Kalikot town (Manma), on rough road to Jumla, overlooking Tila River valley, Kalikot District, *c.* 1000 m., *C.R. Fraser-Jenkins* & *Sagun Pariyar* 35155 (FN 29), 24.9.2013, TAIF], **Jumla**, **Banke** [Sivalik, à Nepalganj, 28° 20', 81° 47', sur les cailloux de la rivière, 500 m., *J.F. Dobremez* & *N.P. Manandhar* 2433 (*N.P.M.* no 74-62), 12.4.1974, KATH], **Rukum** [Rukum Distr., *sin.* loc., 800-1650 m., *D.P. Joshi* & *L.R. Sharma* 1181/80, 16.12.1980, KATH], **Pyuthan** [Khalanga, Pyuthan, 1420 m., *D.R. Kandel, M.L. Pathak* & *G.D. Bhatt* ["*Bhatta*"] 126013, 11.6.2012, KATH].

C: **Baglung**, **Myagdi** [Mayangdi khola, overhanging cliffs, moist with water seepage, 3500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2544, 23.4.1954, BM; Kabre, Kali Gandaki valley, on wet rock face, 6500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5485, 31.5.1954, BM; Myagdi Distr., Beni (840 m.) - Singa (910 m.) [*etc.*], 83° 27', 28° 20', 865 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takahashi* & *K. Yonekura* 9681033, 2.9.1996, KATH], **Mustang** [beneath dry boulders and rocks, with occasional scattered Juniperus trees, beside and just above road-track, *c.* 2 km. N. of Tukuche, on path S. from Marpha, *c.* 7 km S. of Jomsom, *c.* 2700 m., *C.R. Fraser-Jenkins* & *G.B. Tamang* 30511, 27.6.2004, TAIF], **Manang**, **Palpa** [Kaude Lekh, Palpa, 1500 m., *D.P. Joshi* & *M.M. Amatya* 74/1396, 3.3.1974, KATH], **Syangja**, **Parbat** [Ulleri, N. of Kusma, Kali Gandaki, on rock in wood, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8280, 1.11.1959, BM, *sub "A. wattii"* det. A.H.G. Alston, in error], **Kaski** [Pokhara, on shady rocks in wet forest, 4000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6722, 6.8.1954, BM], **Nawalparasi**, **Gorkha** [Gorkha Distr., Ekle Ghar (1620 m.) - Luktar (1600 m.) - Deng (1790 m.), 28° 26', 84° 52', damp, shady place, 1700 m., *M. Suzuki, N. Acharya, N. Fujii, T. Kajita, N. Kondo, M. Mikage, S. Noshiro* & *K. Yoda* 9485247, 2.8.1994, KATH], **Chitawan**, **Makawanpur** [Daman, 1500 m., *N.P. Manandhar* & *I.P. Katel* 1815A, 15.5.1987, KATH], **Rasuwa** [prope Gossain Than, *Barul* [*Bharat*] *Singh*, mei collectores, in *Wallich* Enum. List 73.6, in 1821, BM, K-W; Melung khola, 60 miles W.N.W. of Kathmandu valley, limestone

crevices, 3000 ft., *R.L. Fleming* 2434, 17.4.1978, MICH], **Dhading** [Ganesh Himal, Ankhu khola, 28° 12', 85° [as "86°" in error] 06', beneath waterfall, 6500 ft., *J.D.A. Stainton* 3729, 16.5.1962, BM], **Kathmandu**, **Lalitpur** [Godaveri, Kathmandu valley, 4800 ft., *R.L. Fleming* 1722, 2.9.1963, MICH; Godawari, Lalitpur, 1515 m., *D.T. Yami* 109, *sin.* date, KATH, *sub* "*A. venustum*" in error, and det. N. Thapa 2003 as *A. raddianum*, in error], **Kabhrepalanchok**, **Sindhupalchok**, **Dolakha** [Tamba Khosi, Totlabari (1100 m.) - Jagat (1100 m.) - Chhetchhet (1350 m.) - Simigaon (1950 m.), 862275 - 862276, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331613, 29.8.1983, BM].

E: **Udayapur** [entre le col de Balaute et Sukhchauri, 1150 m. *A. Zimmermann* 917, 23.6.1952, BM], **Sunsari** [Mulghat - Leuti, 400 m., *T.K. Bhattacharya* & *H.K. Sainju* 75/2795, 1.2.1975, KATH], **Dhankuta** [Mohamabedi khola (400 m.) - Tamur Bridge (300 m.), 872266, on wet cliff along river in shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725048, 3.6.1972, BM, KATH], **Tehrathum**, **Sankhuwasabha** [Khandbari to Chainpur, in river side under rock, 2500 ft., *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Upadhyay* & [*B.B.*] *Baskola* 3536, 1.6.1965, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghhanistan. Widespread throughout Asia; Pacific Isles; S and W. Europe; Africa; and the Americas. Perhaps originally a Sino-Himalayan species, but now very widespread and almost ubiquitous.

(?S and/or S, C). An abundantly common, low to upper-mid altitude species of rocky slopes wherever water seeps and usually wherever there is a calcareous substrate, on cliffs, old walls, boulders by streams and rivers, usually preferring open sun or only partial shade.

115. ***Adiantum caudatum*** L. (syn.: *A. lyratum* Blanco; *A. assamicum* (B.K.Nayar) B.K. Nayar, which is not *A. incisum* subsp. *indicum* as thought with a query by Fraser-Jenkins (1997) and is one of many Indian pseudoendemics (Fraser-Jenkins 2008a), Nayar separated it as at that time he had been misapplying the name *A. caudatum* to *A. incisum*; *A. caudatum* var. *assamicum* B.K.Nayar; *A. lomesam* B.K.Nayar & Geev., type lost by a later student at CALI; *A. flagelliferum* Wall., *Enum. List* 76, *nom. nud.*; misapplied name: "*A. proliferum*" *sensu* Nair & Ghosh (1976), Ghosh *et al.* (2004), not distinct from *A. caudatum* of S. India, *non* Roxb. [= *A. ciliatum* Blume (syn.: *A. malesianum* Ghatak), from Maluku (the Molucca islands), not from India, as thought by Ghosh and not distinct from *A. caudatum* in South India]). Earlier records of "*A. caudatum*" from Nepal and India did not distinguish between it and *A. incisum*, but true *A. caudatum* was reported from Nepal by Fraser-Jenkins (1997) and the Nepalese material cited under *A. caudatum* by (Itô 1966, 1977 and Iwatsuki 1975, 1988), with *A. incisum* in synonymy, has been separated here, as far as specimens have been seen.

A small (to *c.* 20+ cm. long), pinnate, narrow-fronded "walking fern" becoming extended and proliferous at the apices in many fronds; stipe and rachis black, well supplied with long hairs on both surfaces, lamina grey-green, pinnae ± semi-lunate, striated, more-or-less deeply, and diagnostically very narrowly incised with crowded, linear lobes (unlike the wider lobes in *A. incisum*) and short sori at their apices, hairs on lamina varying from curved to somewhat hook-shaped; frond-apex frequently narrowed to an extended flagellum, which roots at its apex to form new plants.

Nepal:

C: **Tanahun** [N. facing roadside bank below trees at W. end of lower Markichowk bazaar (near Marsyangdi dam), opposite resting-place near Shiva temple, E. side of Powa Khola, *c.* 5 km. W. of Anbu Khaireni, S. side of Marsyangdi river, off Mugling to Damauli road, Tanahun District, *c.* 450 m., *C.R. Fraser-Jenkins* 28461 (FN 4436), 17.3.2000, H, KATH; 6 km. S. of Damauli, rocky stream gorge at and just behind Chowti Bara Temple, *C.R. Fraser-Jenkins*, with *G.* [*R.*] *Pariyar*, *S.M. Pariyar* & *Nirmala Pariyar* 25322 (FN 1301), 23.3. 1997, BM, H; on forested, rocky slopes beside E. side of Ayeenapahar waterfall, *c.* 1½ km. E. of Anbu Khaireni on Mugling road, Kathmandu to Pokhara, *c.* 100 km. W. of Kathmandu, Tanahun District, *C.R. Fraser-Jenkins* & *Nirmala Fraser-Jenkins* 28595 (FN 4570), 1.8.2000, H], **Gorkha** [stream banks by footpath up to Deurali from Daphtar, above Golchina village, *c.* 3 km. N.W. of Khaireni bridge, W. of Anbu Khaireni and Mugling, N. side of Marsyangdi Khola river, Gorkha District, *c.* 500 m., *C.R. Fraser-Jenkins*, with *Rajkumar Khatri Chhetri*, *S. Adhikari* & *R.* ["*G.*"] *Pariyar* 20881 (FN 1129), 16.2.1994, H, KATH [labelled in KATH as "Chinatu" in error for Golchina]; deep stream-gulley adjacent to Galchina village, N.W. of Majuwa Khaireni on path up to Hattiya and Deurali at base of hill, N. of Marsyangdi river, Gorkha District, *c.* 450 m., *C.R. Fraser-Jenkins*, with *U. Pongali* & *Nirmala Pariyar* 25314 (FN 1293), 22.3.1997, H, *ditto* locality, 26258 (FN 2236), 25.3.1998, H; among rocks at second small waterfall, *c.* 1 km. N. of Rangdi, *c.* 5 km. N. of Anbu Khaireni, on road to Anbua and Gorkha, *C.R. Fraser-Jenkins* 28647 (FN 4622), 13.10.2000, KATH]. Mistakenly reported from W. Nepal, where it is not expected to occur, by Thapa (2002) in error for *A. incisum* subsp. *incisum*.

E: **Sunsari** [along the way from Dharan to Panchakanya, Sunsari Distr., 400 m., *N. Thapa* S2, 28.6.2001, KATH].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E., C. and S. India; Sri Lanka; Bangladesh; S.E. Asia. Not present throughout the Old World tropics as stated by Lin, Prado & Gilbert (2013) in the *Flora of China*, due to earlier confusion with other species in the literature. The distribution cannot be understood from literature since both *A. incisum* and *A. caudatum* were long included under the name *A. caudatum*, even though they are easily distinguished.

(M, Sc to R). A rare (in Nepal), low altitude species of shaded banks in forest, or below bushes, or at the bases of boulders by streams.

Nepalese threatened status: **VU**.

[***Adiantum diaphanum*** Blume was listed and keyed by Iwatsuki (1988) stating that it had not been actually recorded from Nepal, but is probably there. However it is certainly not likely to be present in Nepal and is a Sri Lankan, Chinese, Taiwanese, S.E. Asian, Australasian and Pacific species which does not occur in India or Nepal.]

116. ***Adiantum edgeworthii*** Hook. (syn.: *A. spencerianum* Copel.; misapplied name: "*A. caudatum* var. *rhizophorum*" *sensu* Clarke, *p.p., non* (Sw.) C.B.Clarke, *nec* "*A. rhizophorum*" *sensu* Wall., *p.p., non* Sw. [from the Mascarenes]. Its type locality was from Garhwal, Uttarakhand (M.P. Edgeworth *in litt.* to W.J. Hooker at K), not from the Adah River Valley, in the plains near Multan in the Punjab of Pakistan, in which country it does not occur at all, though misreported by Chandra (2000), and would obviously not have been present in the plains.

A small (to *c.* 15 cm. long), simply pinnate species with narrow fronds, which are pink when young, with crowded, ± rhombic pinnae, fronds and the glossy, black axes glabrous in contrast to *A. incisum* and *A.caudatum*, lamina smooth, not striate, fronds occasionally becoming extended and proliferous apically; distinguishable from a small *A. philippense* by its having more numerous and crowded, smaller pinnae with more obtuse corners, not semi-lunate.

Nepal:

W: **Darchula** [W. facing forested rocks below cliffs by path, *c.* 2 km. N. of Dumling (opposite Jipti on the Indian side), on path south to Darchula, E. side of Kali river, Darchula District, *c.* 1800 m., *C.R. Fraser-Jenkins*, with *A. Magar Thapa* & *B. Pariyar* 21691 (FN 358), 22.11.1994, H], **Mugu** [Gum Garhi, Mugu, 2440 m., *T.B. Shrestha* & *N.P. Manandhar* 253, 14.10.1975, KATH].

C: **Myagdi** [C. Nepal, Mayangdi khola, shadow place, not too damp, 7500 ft., *G.* & *S. Miehe* A 169, 27.1.1977, BM], **Kaski**, **Lamjung**, **Gorkha** [nearby Philim, Manaslu Wildlife Biodiversity Conservation Region, Gorkha, *c.* 1500 m., *S.H. Bhattarai* 969, 1.10.2012, KATH], **Rasuwa** [forest on S. side of valley to east of Trisuli Khola river, *c.* 3-4 km. above and E. of Dhunche, W. of and below Gossainkund, N. of Trisuli Bazaar off road to Langtang, Rasuwa District, *C.R. Fraser-Jenkins* 15648, 9.11.1989, E], **Dhading** [rocks in forested stream gulley above track around mountain on N.W. side of Jamachok mountain, in from Gate no. 2 at Mureko, Nagarjun Forest, beyond N.W. side of Kathmandu Valley, Dhading District, *c.* 6000 ft., *C.R. Fraser-Jenkins* 15592, 31.10.1989, E], **Nuwakot**, **Kathmandu** [Sundarijal, Kathmandu valley, in shade near stream, 6400 ft., *R.L. Fleming* 1377, 21.8.1957, MICH; Nagarjong, Kathmandu, on rock, 1500 m., *M.S. Bista* & *H. Kanai* 674443, 2.10.1969, KATH], **Lalitpur** [Chapagaon, clay banks, damp deep shade, 5000 ft., *Dr. R.L. Fleming* 1300, 3.9.1956, KATH, det. [K.M.

Vaid], F[orest] R[esearch] I[nstitute], Dehra Dun], **Bhaktapur** [hills S. of Bhadgaon, Kathmandu valley, 6000 ft., *R.L. Fleming* 1246, 16.8.1956, DD, MICH], **Sindhupalchok** [steep, mostly open, slightly bushy, mossy cliff-slopes opposite truck park and on either side of Liping Bridge, shortly S. of Tatopani, S. of Kodari and Tibet border, N. of Bungy-jumping bridge (at Listikot), N.E. of Banepa, Kavrepalanchok District, *c.* 1300 m., *C.R. Fraser-Jenkins* 34756 (FN 34), 12.7.2011, TAIF; cliffs and steep, partly open slopes, *c.* 1 - 3 km. S. of Miteri Bridge (to Tibet), Kodari, north of Tatopani, on W. side of Bhote Khosi river, N. of Barabise on road to Tibet border, N.E. of Kathmandu, Sindhupalchok District, *c.* 1800 m., *C.R. Fraser-Jenkins* 29009 (FN 4984), 5.6.2001, H], **Dolakha**.

E: **Taplejung** [Tambur river, E Nepal, *J.D. H*[*ooker*] 155 *p.p.*, Nov. 13th [1848], K, with *A. caudatum*, the latter presumably from Ilam or Jhapa; Khebang (1700 m.) - below Siling, Tzokupa (2100 m.), *H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6304997, 20.11.1963, TI; Iladanda (1800 m.) - Helok (1300 m.), *H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6304996, 13.11.1963, TI].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir (Kathua, *CRFJ*].

(S, Sc). A rather scattered but not rare, upper-mid altitude species of damp stony banks in light forest, or sometimes on damp ledges on forest cliffs.

[***Adiantum flabellulatum*** L. (syn.: *A. amoenum* Wall. *ex* Hook. & Grev.) is a pentangular, assymetrically branched, compound-fronded species with rather rounded and toothed segments, pink young fronds and tiny dense black hairs on the upper surface of the black axes.

It was listed for Nepal by Dixit (1984), Chandra (2000) and Ghosh *et al.* (2004) in error, presumably based on either Itô (1966), Iwatsuki (1988), or the collections, "Napalia, [*N.*] *Wallich* Enum. List no. 78.1, in 1821" at BM, K and K-W, but Wallich's record, supposedly from C. Nepal, can only be due to one of his many confused localisations, in this case transposed with Khasi material, and his locality of "Srinuggur" in Garhwal, coll. *Kamroop, Enum. List* 78.2 is certainly also confused; the sheet of specimens in K-W under Wallich, *Enum. List* no. 78, which look rather uniform, are labelled with the entry from Wallich's *Numerical List*, and also with a label "Adiantum amoenum, Wall. an A. flabellulatum? E Sylhet [in the Khasi Hills above Sylhet], ubi legit collector meus plantarum, De Silva, 1820".

This species was also reported by Itô (1966) and Iwatsuki (1988) from Taplejung [East Nepal, Thakma khola - Diorali Bhanjang - Bhandukay - Yamphodin, [3300-2100 m.], *H. Kanai, G. Murata* & *M. Togashi* 6304998, 17.11.1963, TI], and was thence treated by Thapa (2002), mentioning CRFJ's strong doubt, but the altitude reported is obviously far too high for the subtropical *A. flabellulatum*. A photograph

of the specimen has kindly been sent to CRFJ by Prof. K. Iwatsuki via Dr. A. Ebihara in March 2015 and is a merely a partly damaged specimen of *A. pedatum*, redet. CRFJ, with its typical symmetrically dichotomous and radiate branching and smooth, shiny axes, quite unlike in *A. flabellulatum*. Why it should ever have been thought to be *A. flabellulatum* is something of a mystery. Most of the other specimens of *A. pedatum* cited by Iwatsuki (1988) have been seen and listed here and are more complete specimens of *A. pedatum* and one collection of *A. myriosorum*. *A. flabellulatum* is confined to lower mid altitudes in further N.E. India in eastern Assam State, Meghalaya, Nagaland, Manipur, Tripura *etc*. and in China, Taiwan, Japan, Myanmar, Sri Lanka and S.E. Asia and would not be expected to occur in the central Indo-Himalaya in Nepal, from where it is now excluded.]

117. ***Adiantum incisum*** Forssk. subsp. ***incisum*** (syn.: *A. capillus-gorgonis* Webb; ?*A. recurvatum* (D.Don) Fraser-Jenk., it is difficult to be confident that the neotype of *A. recurvatum* in BM corresponds with subsp. *indicum* as thought by Jarrett and by Fraser-Jenkins (2008), in the absence of any chromosome counts of similar material from India or Nepal apart from of the type plant from Calcutta, but its less lobed and slightly smaller lower pinnae are probably more like subsp. *incisum*, despite Jarrett's determination of it as *A. indicum*, which it is evident from other material she so identified (K, BM, MICH) she applied to most Indian *A. incisum*; *A. radicans* Fée; *A. sinicum* Ching, similarly less lobed, compact and hairy specimens of *A. incisum* occur here and there throughout the Indo-Himalaya and in Arunchal Pradesh with every intermediate state towards normal *A. incisum*, although *A. sinicum* was listed as an endangered Chinese endemic in IUCN's (2012) *Red List*, and as globally threatened by Zhang in Ebihara *et al.* (2012), it had already been pointed out by Fraser-Jenkins (1997) as probably being a synonym of *A. incisum* subsp. *incisum* and as a dubious taxon and is so confirmed here, but was confused in China due to the rarity of *A. incisum*; misapplied name: "*A. caudatum*" *sensu* Itô (1966), Iwatsuki (1975, 1988) *et auct. Ind.* up to *c*. 1980). Long known in the Indian subcontinent as "*A. caudatum*" until the two were definitively distinguished by Pichi Sermolli (1957), followed by Verma & Khullar (1965).

A long (up to *c*. 50 cm. long), narrow-fronded, simply pinnate "walking fern" forming pendent colonies and usually proliferous at the extended, flagellate apices in most fronds and often again at the apices of the resulting connected secondary plants; stipe and rachis black, well supplied with brownish hairs all round; lamina striate and hairy on both sides with small, scattered hairs, the smaller hairs beneath the lamina unicellular; lower pinnae not usually larger than the rest and often somewhat reduced, pinnae basally dimidiate, rhombic, more-or-less deeply lobed with flabellate lobes, but sometimes very shallowly so, so as to be almost unlobed, rather widely incised compared to *A. caudatum*, but less so than subsp. indicum, with the lobes rounded at their apices and wider than in *A. caudatum*, varying from fairly crowded to fairly well apart and sori usually elongated, sometimes becoming continuous in

less lobed plants, indusia hairy; diploid sexual, in contrast to reported tetraploid sexual in subsp. *indicum* (Ghatak) Fraser-Jenk.

Nepal:

W: **Darchula** [Bitale (874 m.) - Paribagar (1171 m.), *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yaho, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216012, 8.7.2012, KATH], **Kailali**, **Bajhang** [between, Dhargaon and Dilbagar, Bajhang District, *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 1334, 17.7.1976, KATH; Bajhang District, hillside W. of Chainpur, 29° 33' 10", 81° 11' 34", steep SE facing slope, in scree, growing under shrubs, 1333 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915049, 5.7.2009, E *sub* "*A. caudatum*" det. D.J. Middleton in error], **Bajura** [between Bhundar and Boldig, Bajura District, *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 2737, 20.8.1976, KATH], **Surkhet** [Chhinchhu, Surkhet, 500 m., *N. Thapa* S12, 7.8.2001, KATH], **Kalikot** [base of roadside cliff, *c.* 5 km. N.E. of Kalikot town (Manma), on rough road to Jumla, overlooking Tila River valley, Kalikot District, *c.* 1000 m., *C.R. Fraser-Jenkins* & *Sagun Pariyar* 35154 (FN 28), 24.9.2013, TAIF], **Mugu** [between Hyanglu and Riga, Mugu Distr., W. facing slope, 1350 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 24677 *p.p. min.*, 6.9.1983, A]. **Jajarkot** [Jajarkot, among shrubs on dry slopes, 3500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5710, 16.10.1962, BM *sub* "*A. zollingeri*" det. A.H.G. Alston in error, the lobed pinnae are similar to subsp. *indicum*, but the lower pinnae are smaller], **Dang** [Tulsipur, Dang, 650 m., *Keshav Shrestha* NHMTU-6B-00415, 14.3.2043 (Nepali date), TU Nat. Hist. Mus.], **Salyan**, **Rolpa** [Jinawang - Nimri gaon, on vertical rock near pine forest, 1555-1079 m., *D.P. Joshi* & *M. M.M. Amatya* W290/82, 22.1.1982, KATH], **Dolpa** [below Lunh, Bheri river, between boulders on dry open slope, 6500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3259, 8.9.1952, BM *sub "A. zollingeri*" det. A.H.G. Alston in error].

C: **Baglung** [Baglung (960 m.) - Ratnechour (820 m.) *etc.*, 83° 34', 28° 15', 980 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takahashi* & *K. Yonekura* 9681002, 1.9.1996, KATH], **Myagdi** [Mayangdi khola, stone terrace walls, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4123, 31.8.1954, BM], **Mustang** [Lete, Mustang District, 834286, on moist rock crevices, 1250 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/1719, 24.7.1974, KATH], **Palpa** [stream-gulley above bridge at Dobhan, *c.* 3 miles N. of Butwal on road to Syangja and Pokhara, Palpa District, *c.* 350 m., *C.R. Fraser-Jenkins* 18014, 201.1.1991, E], **Syangja**, **Parbat** [Lamoduwali, on moist rock crevices, 1250 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/1719, 24.7.1974, KATH], **Kaski** [Pokhara, on vertical shady rock face, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6762a, 12.8.1954, BM; Bagar, Kaski District, on moist and shady place, 1000 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/1616, 18.7.1974, KATH; Pokhara (950 m.) - Suiket (1230 m), 836282, 83° 57', 28°

16', on stone bridge, 900 m., *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akuyama* 8310060, 6.7.1983, BM *sub* "*A. caudatum*" in error], **Tanahun** [among rocks by Khane Khola stream, near junction of its main southern and eastern tributaries, N.W. side of Chimkeshwori mountain, S. of and above Khane Khola village, *c*. 3 km. W. of Anbu Khaireni, S. of Marsyangdi river, between Mugling and Damauli, Tanahun District, *c*. 1000 m., *C.R. Fraser-Jenkins* 28539, 28540 (FN 4514, 4515), 20.5.2000, H], **Gorkha** [Kudi, 28° 19', 84° 19', sur murets, 750 m., *J.F. Dobremez* 656, 26.11.1970, BM], **Chitawan** [Ramnagar, Chitwan District, shady gullies in Sal Forest, 400 m., *K. Wesche* 2/117, 6. 1994, BM], **Makawanpur** [Sameri bridge, nr. Hetauda, Makawanpur, 530 m., *N. Thapa* M49, 9.9.2000, KATH], **Rasuwa**, **Kathmandu** [in front of the extension building, Tri-Chandra College, Ranipokhari, Kathmandu, on moist shaded ground, 4200 ft., *P.M. Khwaunju* 1256, in 1973, K; Kathmandu Airport, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6304994, 13.10.1963, KATH, *sub* "*A. caudatum*" in error], **Lalitpur** [Godaveri, Kathmandu valley, on walls, 4800 ft., *R.L. Fleming* 1721, 2.9.1963, MICH], **Kabhrepalanchok**, **Sindhupalchok** [Patibhanjyang to Talamarang, on moist sandy slope along the track, 7010-7800 ft., *V.L. Gurung* & *M. Gorkhali* 78/672, 22.10.1978, KATH], **Dolakha** [Suri Dovan, Suri-8, Dolakha, 1140 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121129, 9.11.2012, KATH].

E: **Udayapur** [de la Banahoura [as "Banäoura"] khola à Balaute, 400 m., *A. Zimmermann* 2076, 6.11.1954, BM], **Okhaldhunga** [près de Manbhanjyäng, 1700 m., *A. Zimmermann* 877, 20.6.1952, BM], **Bhojpur** [Saju khola (1400 m.) - Dingla (1000 m.), 873274-873273, in rather dry rock in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725415, 1.7.1972, KATH, *sub* "*A. caudatum*" in error], **Sunsari** [Tarhara, Sunsari Distr., beside a river, 300 m., *T.K. Bhattacharya* 7568, 2026.4.7 [= 21.7.1969], KATH; south of Dharan, on dry bank in deciduous forest, 200 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725019, 1.6.1972, BM, KATH, *sub* "*A. caudatum*" in error], **Morang**, **Dhankuta** [Dharapani, Dhankuta, 3800 ft., *R.L. Fleming* 2618, 4.10.1978, KATH; Dhankuta Distr., Hile (1835 m.) - Pakhribas (1670 m.) - Dhikure (1260 m.) - Gorikharka (950 m.) - Diyale (780 m.), 27° 02' 04", 87°18' 50" - 27° 05' 45", 87° 15'16", shady bank, 1460 m., *S. Noshiro, N. Acharya, Y. Ibaragi, K. Kobayashi* & *T. Kurosawa* 9770046, 12.8.1997, E *sub* "*A. caudatum*" in error], **Sankhuwasabha** [Arun valley, Tumlingtar, on the roots of shrubs, 480 m., *T. Wraber* 29, 24.8.1972, BM], **Taplejung**.

Himalayan distribution: China [rare]; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. W., N.E., C. and S. India; Sri Lanka; S.E. Asia; Arabia; Africa. Verdcourt (2006) in an uncritical account of the group placed Sri Lankan *A. incisum* under the name *A. indicum*, presumably thinking that Indian subcontinental plants ought to be that taxon and without consulation with others.

(?S or African, C). An abundantly common and widespread "Walking Fern" (*i.e.* proliferous at the frond-apices) from low to upper-mid altitude throughout the country and most of India, forming colonies on old walls and rocks, or on earth-banks in woods, tolerant of very dry conditions and of full sun or shade, but varying in degree of lobing and size with different conditions.

118. ***Adiantum incisum*** Forssk. subsp. ***indicum*** (Ghatak) Fraser-Jenk. (syn.: *A. indicum* Ghatak; ?*A. caudatum* var. *flabellatum* B.K.Nayar, *nom. nud.*, this latter is probably not likely to be a synonym of subsp. *incisum*, as thought with a query by Fraser-Jenkins (1997), following Morton (1974)).

Very similar to subsp. *incisum* and almost inextricably wound up with it, stipe and rachis similarly or perhaps slightly less densely hairy all round, but it appears to differ in having the lowest pinna usually slightly the largest, or at least hardly reduced, and semi-circular, slightly downward directed, rather fan-like; pinna-lobes lobes deep and well apart, smaller hairs beneath the lamina rather longer and multicellular, but this feature, if constant, is very difficult to differentiate in practice; cytotype tetraploid.

Its cytotype is known from several counts by both Ghatak (1963a) and Gibby (1982, *ined*.) vouchers, C[helsea] P[hysic] G[arden] 2483, 2515, from plants cult. by Ghatak in BM, but only from the type-population alone, from Belghoria, N. Kolkata (Calcutta) in W. Bengal, whereabouts it still occurs plentifully, but another specimen, CPG 2828, of subsp. *incisum* morphology, said to be from Belghoria, was diploid and CRFJ has not observed any subsp. *incisum* fron the vicinity, including at the adjacent Hooghly Ghat, Ariadoho (Ariadaha). Wide-scale cytological study is required in the region to detect possible tetraploids belonging to subsp. *indicum*, and after observing the morphology of plants counted from a few different localities, to identify other specimens critically, and to determine which subspecies *A. recurvatum* belongs to. At present the identifications of the specimens listed here below must be taken as tentative, and its possible distribution beyond Calcutta, or outside India is uncertain. But it is confirmed here that plants similar in morphology to the type occur widely at lower altitude in N.E. India, S. Nepal, the eastern part of the W. Indo-Himalaya, the Ganga Valley and in the south, but we do not have any proof that they are really subsp. *indicum*.

Nepal: Ghatak (1963b) listed N. and S. Nepal for this taxon, but all requiring cytological confirmation.

W: **Surkhet** [*c.* 1 km. below and S. of Kharekhola village, *c.* 3 km. N.N.E. of Surkhet, banks of Khare khola, from path *c.* ½ km. below and S.W. of Kharekhola village, down-stream into Sal forest, *C.R. Fraser-Jenkins*, with *K. Neupane* & *K. Pongali* 25588 (FN 1566), 27.9.1997, BM, H, a good match for the type].

C: **Palpa [**damp roadside wall just below and S. of Bartung on road up from Butwal, on way to Tansen and Syangja, Palpa District, *C.R., N.* & *Jacob C.B. Fraser-Jenkins*

33533 (FN 313), 4.12.2008, TAIF], **Tanahun** [on forested, rocky slopes beside E. side of Ayeenapahar waterfall, *c*. 1½ km. E. of Anbu Khaireni on Mugling road, Kathmandu to Pokhara, *c*. 100 km. W. of Kathmandu, Tanahun District, *C.R. Fraser-Jenkins* & *Nirmala Fraser-Jenkins* 28596 (FN 4571), 1.8.2000, H], **Chitawan** [damp, rocky sides of small stream-gully at Lambola Khola, *c*. ½ km. S. of Belbas (Satara Kilo) village, 18 km. S. of Mugling on road to Narayanghat, S.W. of Kathmandu, Chitawan District, 350 m., *C.R. Fraser-Jenkins* 28400 (FN 4375), 20.1.2000, H; light forest and stream-gullies, *c*. 2 miles S. of Sauraha, across river, Chitwan National Park, Chitawan District, *C.R. Fraser-Jenkins* 33038 (FN 151), 27.12.2007, TAIF].

E: **Morang** [river-banks and marshy flats, 1¼ km. E. of Khanepokhari, E. of Itahari on Pathari, Birtamod and Kakkarbhitta road (East-West Highway), Morang District, *C.R. Fraser-Jenkins* 29421 (FN 5395), 7.10.2001, H], **Dhankuta** [among rocks by waterfall and on steep slopes of small side-valley (Shimsua khola), just S.E. of Shimshua hamlet, where road from Dharan and Bhedetar comes down to main Leuti khola valley, N. of Dharan on Dhankuta road, Dhankuta District, *C.R. Fraser-Jenkins* 28917 (FN 4892), 25.3.2001, H], **Taplejung** [Bharomdin - Tharpu, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6304995, 25.11.1963, BM, KATH, *sub* "*A. caudatum*" in error, subspecific identity more uncertain].

Himalayan distribution: ?Bhutan; ?Myanmar; ?Sikkim; ?Darjeeling; W. Bengal; ?Nepal; ?Uttarakhand [Landour, Mussoorie, dry forest, 6-7000 ft., *R.R. Stewart* 14930, 17.8.1935, herb. C.E. DeVol, MICH]. Perhaps more prevalent in N.E. India; Uttar Pradesh [old British Residency, Lucknow, *CRFJ*]; ?Bihar [Garhwa, *W. Koelz* 18876, MICH]; ?Orissa; ?Madhya Pradesh [Pachmarhi, *J.F. Duthie* 10669, 19.2.1891, UC]; ?S. India [Coimbatore plains, *Beddome*, K; Yercaud, Shevaroy Hills, *K. Mohana Kurup* CU 52881, 24.2.2000, K]; ?Sri Lanka (Verdcourt in Shaffer-Fehre (2006), but probably confused, and like the present records, without firm evidence). The group probably requires further study in China. It appears not to occur in Pakistan, as surprisingly listed by Chandra (2000) and the localities later reported by Ghatak (1963), of Kashmir (Ladakh), Nepal, Bihar, Orissa and S. India were made without cytological information and thus require confirmation, particularly from the unlikely area of Ladakh. Its potential range outside India, in S.E. Asia *etc.*, is unknown, but some similar plants also occur there.

(probably M, ?C or Sc). A low-altitude plant of similar habitats to subsp. *incisum*, though apparently more likely to occur on earth-banks in low-altitude forests, than in higher dry rocky areas.

119. ***Adiantum myriosorum*** Baker (syn.: *A. pedatum* var. *myriosorum* (Baker) Christ; *A. pedatum* var. *glaucinum* Christ; misapplied name: "*A. pedatum*" *sensu auct. Ind.*, *p.p.*). In contrast to Fraser-Jenkins (2008), but not (2003), who was influenced by Ching's comments to him, *A. myriosorum* is not the only species of this alliance in the Indo-Himalaya. This was understood as a result of Prof. S.C. Verma's requesting

CRFJ to look again at his specimens that Verma had correctly differentiated as two taxa from N. Sikkim, some of which CRFJ has now reidentified as *A. myriosorum* and others as *A. pedatum*, followed by reexamining other specimens of the group from throughout the Himalaya. The correction is made here, *A. pedatum* reaching beyond the range of *A. myriosorum* as far west as the W. Indo-Himalaya.

A very attractive radiate "Maidenhair fern" (fronds up to *c.* 50 cm.), stipe tall, erect, stipe and axes glossy black, glabrous, lamina nearly horizontal, digitate-radiate, similar to *A. pedatum*; each of the *c.* 8-10 "fingers" with many rhombic, glabrous, short-stalked segments each side; differs from *A. pedatum* in its blacker, stiffer stipe, darker blue-green to grey-green and thicker, striate lamina-segments, ± glaucous beneath, which are more narrowly pointed apically with shallower, narrower and more acute tooth-lobes, not the more rounded, wider and deeper lobes of *A. pedatum*; and the sori are often shorter and reniform.

Nepal:

W: **Bajura** [Majpali to Patagaon, 2100 m., *K.R. Rajbhandari* 15073a, 15.8.1991, KATH], **Mugu** [Kawa, Khater Dara, in heavy forest, 8500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 847, 26.4.1952, BM, E].

C. Reported from C. Nepal by Thapa (2002), but without differentiating *A. pedatum* from it and we have seen no material, though it should presumably be present.

E: **Sankhuwasabha** [Kasuwa, Arun River, growing on cliff, 7200 ft., *E.W. Cronin*, with *H.M. Emery, H.* & *A. Foster* & *K. Brooks* F010, 15.6.1973, KATH].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Nepal. Taiwan. Commoner in the Himalaya from Bhutan eastwards and not known from the W. Indo-Himalaya. *A. myriosorum* was erroneously reported by Lin *et al.* (2013) in the *Flora of China* from a region the Flora called "Kashmir", which is also an unfortunate political policy, not applied to any other Indian subcontinental State, or any other country. It appears to imply that "area" is treated as if a separate country from either India or Pakistan, which no countries have treated it as, either in the past six decades, or today, and which also has no phytogeographical basis.

(S, R). A rare higher altitude to high Himalayan species, occurring on moist banks beneath cliffs, or on sheltered earth slopes, or in earth on well vegetated, larger cliff ledges.

Indian threatened status: **NT**. Nepalese threatened status: **EN**.

120. ***Adiantum pedatum*** L. subsp. ***pedatum*** (synonymy: Lin, Prado & Gilbert (2013) in the *Flora of China* synonymised a name, "*A. pedatum* var. *glaucinum* C.Chr." as if an independent name from Christs's var. *glaucinum*, which it is not, the name applying to *A. myriosorum* regardless of what sense Christensen partly took it in; misapplied name: "*A. myriosorum*" *sensu* Fraser-Jenkins (2008) *p.p.*, *non* Baker).

Another beautiful, radiate and yet more lovely "Maidenhair fern", closely related and generally similar to *A. myriosorum*, stipe tall, glossy black, thinnish, fronds

digitate-radiate, pale-green (Verma's (1961) "fresh green"), thin and smooth, segments usually more deeply lobed than *A. myriosorum* into rather more separate, rounded-rectangular lobes the segment-apex is rather wider, so the segment approaches more of a rounded-rectangular shape, than the cuneate shape of *A. myriosorum*, and the segment-apex is hardly, or not toothed. A few specimens are slightly intermediate and difficult to place, but they are usually easily distinguishable.

The precise identity of the Himalayan plants in relation to the subspecies of N. American *A. pedatum* has not yet been elucidated, but they appear to correspond better with the eastern N. American subsp. *pedatum* rather than the western subsp. *aleuticum* (Rupr.) Calder & RoyTaylor, though many specimens are somewhat intermediate. Many Japanese collections match subsp. *aleuticum*, while others do not. The two subspecies were treated as species by Paris & Windham (1988) and Paris (1991, 1993), mainly on the grounds that they occupy different geographical regions, yet both occur in the eastern USA, and their morphology is rather insignificantly different; they appear merely to represent minor geographical variation and are not worthy of the specific rank, but are subspecies at most. Lin *et al.* (2013) in the *Flora of China* synonymised *A. aleuticum* (Rupr.) C.A.Paris into *A. pedatum*. A highly cryptic N. American allotetraploid *A. viridimontanum* C.A.Paris, thought to be formed between the two, is treated here as *A. pedatum* subsp. *viridimontanum* (C.A.Paris) Fraser-Jenk., ***comb. nov.*** (basionym: *Adiantum viridimontanum* C.A.Paris, *Rhodora* **93**: 108 (1991)). The concept of recognising all "biological species" is an unneccesary, artificial restriction on the application of taxonomic ranks, ignoring their morphology and relationship and is not followed here.

Nepal:

W: **Darchula** [W. Nepal, opposite Budhi village, 11,000 ft., *J.F. Duthie* 6232, 18.7.1886, MICH], **Jajarkot** [Ranga Chautharka, on moist mossy banks in Quercus forest, *c.* 9000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 431, 14.8.1952, BM, E; between Panlotbas and Ranga Chautharka, south of Chakure Lekh, on bank in shade of Tsuga forest, 9000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5539, 11.10.1952, BM, E], **Dolpa** [Rohagaon, Suli Gad, in shade of moist deciduous forest, 9500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3361, 13.9.1952, BM].

C: **Myagdi** [S.W. of Gurjakhani, Betula, Rhododendron forest/forest earth banks in river gorge, 10.700 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 9096, 20.10.1954, BM, E, and S. of Gurjakhani, forest earth banks in river gorge, 10,500 ft., *ditto* 3899, 18.8.1954, BM, E], **Mustang** [Taglung, S. of Tukucha, Kali Gandaki, in thick forest, 11,500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 1759, 12.71954, BM, E; Kali Gandaki, Thulo Bugin, N.N.E. Ghasa, under mossy rocks in dense north-faced forest, steep slope, 10,800 ft., *G.* [& *S.*] *Miehe* B 799, 12.10.1977, BM], **Parbat** [Parbat Distr., Banthanti (2650 m.) - Gorepani Deorali (3170 m.), 835283, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama*

8330337, 8350284, 12.7.1983, BM], **Kaski** [northeast of Sikles, on north-facing slope above the Muckyun river, below Thodi Mai Kharka, Easting: 223529, Northing 3148333, in Abies spectabilis/Rhododendron barbatum forest, 3125 m., *Dorothy Allard* 217, 13.9.1995, BM; Sinkrish [*i.e*. Siklis], Pokhara, 2900 m., *D.T. Yami s.n.*, *sin.* date, KATH *sub* "*A. myriosorum*" det. N. Thapa 1998, in error]. .

E: **Solukhumbhu** [rive gauche de l'Imja khola, 3200 m., *A. Zimmermann* 1779, 20.10.1954, BM, E], **Panchtar** [Tambur river, E. Nepal, *J.D. H*[*ooker*] *s.n.*, Nov. 22nd [1848], K], **Taplejung** [Topke Gola (3600 m.) - Shewaden (2600 m.), 873274, along path in open place at edge of forest; *c.* 3000 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725280, 28.6.1972, BM, KATH; *ditto*, in between stems [*sic*] in the Abies forest, 3100 m., *P.R. Shakya* 1798, 28.6.1978, KATH]; ***sin. loc.*** [*sin*. coll. 14114, KATH, *sub* "*A. myriosorum*" det. N. Thapa 1998, in error].

Himalayan distribution: Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. India; E. Asia; N. America.

(S, with a wider range, Sc). A fairly common if scattered, higher altitude to high Himalayan species ocurring in similar habitats to *A. myriosorum*.

121. ***Adiantum philippense*** L. subsp. ***philippense*** (syn.: *A. lunulatum* Burm.f., inc. *sensu* D.Don). Although Verma (1962) and thence Sledge (1982) had treated *A. philippense* as a dubious name and preferred to use the synonym *A. lunulatum*, this was insufficiently researched at the time and cannot stand under more recent *ICBN* Articles. Fraser-Jenkins (2008) and Verma & Fraser-Jenkins (2008) carried out detailed investigation of the typification of *A. philippense*, which is unequivocally the correct name based on an easily recognisable drawing by Petiver, reliably known fom early sources to have been copied from Kamel, whose original, matching specimen is in BM-SL. The oft repeated idea that Petiver's drawing may not represent a fern or is quite unlike the present species is entirely false as the drawing is very accurate and unmistakably both the present species and subspecies and cannot possibly be anything else. *A. philippense* was also epitypified by the known triploid apomict from India. Lin *et al.* (2013) in the *Flora of China* incomprehensibly stated that Fraser-Jenkins merely "claimed" Petiver's drawing was copied from Kamel (as is similarly stated for unknown reasons in some other places in this frequently inaccurate Flora).

A. philippense consists of a number of partly sympatric different cytotypes occurring together in populations, those in at least the Himalayan region corresponding with partially distinctive morphology (Verma 1961, Verma & Fraser-Jenkins 2008). As yet the morphological distinction is not clear in South India due largely to supposed voucher-specimens seldom being from the actual plant counted. But it appears likely that further cyto-taxa, some apparently also larger plants, may exist in at least S. India and elsewhere that have not yet been fully understood. Although the

subspecies are based on the morphology of many plants of known cytotype originally investigated by Verma in the Darjeeling area, it should be understood that the advantage of using a name is that it reflects the morphology and not necessarily the cytotype, which is inevitably unknown for most specimens, as also here. The identifications here refer to plants of similar morphology to one of the known cytotypes and should thus be understood to be tentative, especially for subsp. *intermedium* and subsp. *teestae*, until more cytotaxonomic investigation has been carried out on a wider scale to enable better recognition of specimens. In addition the size and morphology of some individual plants in the *A. philippense* complex, specifically subsp. *philippense*, is considerably plastic due to both environmental differences and developmental stage. The close morphology and variability indicates why these taxa are best treated as a complex of closely related subspecies, rather than species.

Subsp. *philippense* is a beautiful, delicate pinnate plant (fronds larger, up to *c.* 35 cm.) of banks and old walls, dying down rapidly and dropping its pinnae, but not the black pinna-stalks, at the onset of the dry Winter; stipe thin, glossy black, glabrous, rachis with fine, alternate, black stalks, to *c.* 1 cm. long, bearing large (to *c.* 4 cm. long), markedly semilunate or semicircular pinnae and an apical segment; pinnae usually ± unlobed or only shallowly lobed, though the sterile lowest few may be more deeply lobed at the edge with somewhat close rounded-truncate lobes; sori elongated, around the distal edge of the pinnae, interrupted or continuous. Triploid apomict. Subsp. *philippense* is very variable in size, sometimes being as miniature as subsp. *teestae*, but then with larger basal angles to the lower pinnae than in that subspecies, but it is normally obviously larger than the other two known subspecies when full-grown; with a large basal angle of the pinna at the pinna-stalk, usually 180Ú-210Ú, at the base of the basal pinnae; the less frequent vegetative proliferous fronds with attenuate whip-like apices and rounder pinnae were misreported by Panigrahi (1960) as the Chinese species, "*A. capillus-junonis* Rupr." in error.

Nepal:

W: **Dadeldhura** [Betkot - Lipna, in Sal forest, 600 m., *K.R. Rajbhandari, P.M. Regmi* & *K.J. Malla* 5198, 11.8.1980, KATH], **Darchula** [Sipti - Seri, in crevices of stone in shady place, 1660-850 m., *M.M. Amatya* & *P.M. Regmi* W605/82, 31.8.1982, KATH], **Kailali** [forested bank of lake, on S.W. side of Godhagodhi Lake, Sukhar, *c.* 40 km. E. of Attariya and Dangadhi, Kailali District, *C.R. Fraser-Jenkins* 34707 (FN 209), 24.11.2010, TAIF], **Surkhet**, **Banke** [Zabdaha, 600 ft., *T.K. Bhattacharya* 3806, 2038.6.22, KATH, *sub* "*A. emarginatum*" in error], **Jajarkot** [Jajarkot, among shrubs on dry slopes, 3500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5711, 16.10.1952, BM], **Dang**.

C: **Kapilbastu**, **Rupandehi** [Namakot - Chaudithan, 800-900 m., *D.P. Joshi* & *M.M. Amatya* 73/932, 23.11.1973, KATH], **Baglung [**Baglung Distr., Baglung (960

m.) - Ratnechour (820 m.) *etc.*, 83° 34', 28° 15', 980 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takahashi & K. Yonekura* 9681003, 1.9.1996, KATH], **Myagdi** [Mayangdi khola, shady earth banks, 3000 ft., *J.D.A. Stainton, W.R. Sykes & L.H.J. Williams* 4142, 4.9.1954, BM], **Parbat** [Kusma, on shady banks, 2500 ft., *J.D.A. Stainton, W.R. Sykes & L.H.J. Williams* 7063, 5.9.1954, BM], **Palpa**, **Syangja** [Andhi khola, on shady bank, among shrubs, 3000 ft., *J.D.A. Stainton, W.R. Sykes & L.H.J. Williams* 8720, 2.10.1954, BM], **Kaski**, **Gorkha** [on raised mud-banks of terraced wet and dry rice-fields, *c.* 2 km. below and S.W. of Hattiya Deurali, 3 km. above and N.E. of Gopling Ghat, above Marsyangdi Dam, N. of Marsyangdi river, W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 30785, 18.9.2004, TAIF], **Lamjung** [Bahun dada, Lamjung District, 1330 m., *K.R. Rajbhandari* 9202, 9.8.1983, KATH], **Chitawan**, **Makawanpur** [Brindaban Garden, Hetauda, Makawanpur, on moist soil, 550 m., *N. Phuyal, S. Maharjan & K.K. Pokharel* 53, 15.6.2010, KATH sub "may be subsp. *intermedium*" det. CRFJ, 2014, in error], **Dhading**, **Nuwakot**, **Kathmandu** [Kathmandu, 4500 ft., *Lieut. Lal Dhoj* 95, comm. Major J. Manners Smith, 17.6.1924, K; Kalikasthan, Kathmandu valley, on wall, 4500 ft., *D.D. Bhatt* 16, 17.6.1958, UC; on the way to the reservoir, Balaju, on moist brick wall, 4450 ft., *P.M. Khwaunju* 1257, 1973, K], **Lalitpur** [Chapagaon, 5000 ft., *Dr. R.L. Fleming* 1327, 17.9.1956, KATH; St. Xavier's School, Jawalakhel, wall, 1371 m., *B.F.C. Sennitt* 71267, 27.10.1973, KATH], **Bhaktapur**, **Sindhupalchok** [near Dolalghat, shady place among grasses, 2500 ft., *Dr.* [*M.L.*] *Banerjee*, [*T.B.*] *Shrestha* & [*A.V.*] *Upadhyay* 2532, 9.9.1964, KATH], **Sindhuli** [S.E. of Duarde village, on path down to Bagmati Bridge, S.E. of Raigaon, on E. side of Bagmati River, banks on slopes of N. side of Churiya Ghats ridge, *C.R. Fraser-Jenkins*, with *L.B. Tamang, J.B. Pariyar, C.B. Sunchuri et al.* 25753 (FN 1731), 23.10.1997, BM, H], **Dolakha** [Suri Dovan, Suri-8, Dolakha, 1110 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel & R. Shrestha* 20121125, 9.11.2012, KATH], **Ramechap**.

E: **Sankhuwasabha** [Arun Valley, Hinwan khola, N. of Chainpur, beneath trees, 3000 ft., *J.D.A. Stainton* 1521, 4.9.1956, BM, KATH, and Sabhaya khola, N. of Chainpur, 1500 ft., *J.D.A. Stainton* 1574, 2.9.1956, BM, KATH; Tumlingtar, sides of shady ravines, 1800 ft., *A.H. Norkett* 8005, 7.12.1963, BM], **Sunsari** [Sunsari District, down from Dhara Oani, approximately 8 km., N. of Dharan, 26° 50', 87° 18', moist slope, 910 m., *R.G. Troth* 67, 12.7.1971, MICH; Sunsari Distr., N.E. of Dharan, Pantsakanya, 26° 49' 43", 87° 17' 45", under Sal forest, 530 m., *M. Mikage, T. Kajita, F. Kiuchi, N. Kondo, P. Lacoul, M. Suzuki & K. Yonekura* 9558352, 4.11.1995, KATH], **Morang** [Biratnagar, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi & T. Tuyama* 6305000, 14.10.1963, K, BM; Bahuni V[illage] D[evelopment] C[ommittee], Banwal, Morang, on canal's bank, 85 m., *N. Thapa* M10/97, 16.12.1997, KATH], **Dhankuta**, **Jhapa** [stream running through secondary Sal-tree woods, *c.* 1½ km. N.W. of Kakkarbhitta town, on way to tea-estate, E. of Birtamod, shortly W. of Mechi river (Indo-Nepalese border), in the terai, Jhapa

District, *C.R. Fraser-Jenkins*, with *U. Pongali* 26526 (FN 2503), 14.8.1998, H], **Ilam**.

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir. N.E., C. and S. India; Sri Lanka; Bangladesh; widespread in S.E. Asia; Australia; Pacific Islands; S. America; Africa; Arabia.

(M, C). A very common and widespread lower to mid altitude subspecies, occurring on semi-open, moist banks, old walls, path-sides *etc.* and dying down in the dry season (Winter).

122. ***Adiantum philippense*** L. subsp. ***intermedium*** S.C.Verma & Fraser-Jenk.

This subspecies consists of the virtually morphologically indistinguishable diploid apomict and tetraploid sexual cytotypes discovered by Verma, the type being the diploid apomict. Plants smaller than subsp. *philippense*, but larger and with slightly larger pinnae than subsp. *teestae*; fronds narrow, glabrous, with more-or-less semilunate to rounded segments; the pinnae are more rectangular than in subsp. *philippense* as the basal angle of lower and mid pinnae is nearer to 90º or 100º, rather than the c. 180º to 210º of subsp. *philippense*.

Nepal:

W: **Banke** [Zabdaha, 600 ft., *T.K. Bhattacharya* 3729, 2038.8.3, KATH, *sub "A. indicum*" in error], ?**Jajarkot** [near Phulgaon, on stone and earth walls, 5500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 583, 25.8.1952, BM].

C: **Syangja** [banks of rice-fields and rocky edge of path above east end of foot-bridge across Andhi Khola, below and across river from Udiyachaur village, N. of Gallyang ["Golleng"], N. of Butwal, S. of Syangja, Syangja District, *C.R. Fraser-Jenkins* 31036, 31037, 3.1.2005, TAIF], **Kaski** [Sundare danda, Kaski, Pokhara, 834282, in the Schima and Castanopsis forest on shady slope, 750 m., *D.P. Joshi* & *M.M. Amatya* 0483, 17.12. 1973, KATH; steep, N.-facing slope and small cliff in Raniban forest, *c.* ½ km. W.N.W. of the dam outlet of Phewa Tal, on S. side of E. end of Phewa tal, to the east of and above Fish-tail Lodge Hotel, opposite Baidam, Damside, Pokhara, *C.R. Fraser-Jenkins* 30737, 17.9.2004, TAIF], **Lamjung** [Lamjung Himal, between the Madi khola river and Simalshapur, shady moisty places on walls, *T. Wraber* 235, 16.9.1969, BM], **Kathmandu** [overgrown wall by big Bamboo clump, just above Kulaltar village, on path down from Sanagaon, S.W. of Sankhu, N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* 33083 (FN 196), 29.9.2008, TAIF], **Lalitpur**, **Bhaktapur**.

E: **Morang** [Tarhara forest, Morang Distr., shady and moist places, 300 m., *T.K. Bhattacharya* 7554, 7.1969, KATH].

Total distribution: China; Myanmar [*CRFJ*; near Kyaukpyu, Ramree Island, *E.L. Wallace* 159, 27.5.1945, BM]; Bhutan; Darjeeling; Nepal; Himachal Pradesh. Meghalaya; Orissa; S. India; Thailand; Vietnam; Celebes; Philippines; Marianas;

New Guinea; New Britain; Fiji.

(S, Sc). A scattered, less common, lower to lower-mid altitude subspecies occurring here and there in similar habitats to subsp. *philippense*.

Nepalese threatened status: **LC**.

123. ***Adiantum philippense*** L. subsp. ***teestae*** S.C.Verma & Fraser-Jenk.

Like subsp. *philippense*, but consistently much smaller plants at least in N.C. India and nearby), fertile fronds apparently not growing larger than *c*. 10 cm., though sterile ones may be larger; fertile fronds narrow, with very small rhombic-triangular pinnae, the lowest having a basal angle of *c*. 90Ú, and less for those above (but pinnae of sterile fronds larger and rounded). Diploid sexual. Many plants were chromosome-counted by Verma and all the diploid sexual plants, and only they, were consistently of this morphology. But until this subspecies is better known, cytological confirmation of several more specimens and from different areas is important to ascertain if they are diploid sexual as in the type of subsp. *teestae*. The specimens and distributions cited below should therefore be treated as tentative and representing plants of a similar morphology to subsp. *teestae* until more chromosome counts are available as confirmation.

The morphological features of the reported diploid sexual plants from south India are unclear as most voucher-specimens of other workers either do not exist, or vouchers were apparently not made from the actual plants counted, but from "suitable" or "nice" plants at the locality concerned (Ninan, Mathew, Kuriachan, pers. comm. to CRFJ). However the morphology of one of the presumably reliable voucher specimens of a south Indian diploid sexual cytotype, from a cytological voucher-specimen of Manickam & Irudayaraj's (1988, 1989), at RHT herbarium, is very similar to, if more lobed than subsp. *philippense* and very distinct from subsp. *teestae*. The south Indian plants thus require to be investigated further, with reliable voucher-specimens of the actual counted plants. Some other smaller, but less developed voucher specimens from S. India studied by Khullar (Mehra & Khullar 1977) are also quite different from subsp. *teestae*.

Nepal:

C: **Nawalparasi** [by stream-gulley with boulders in woods, near top of main-road pass, *c*. 1 km. E. of Dhaune village, S. of Dumkibas, E. of Butwal on Narayanghad road, Nawalparasi District, *C.R. Fraser-Jenkins* 31166, 4.2.2005, TAIF], **Syangja** [roadside rocks, cliffs and banks, shortly south of Chiuri village, south towards towards Gallyang ("Golleng"), on E. side of and above Andhi Khola river, N. of Butwal on main road S. from Syangja and Pokhara towards Waling, Syangja District, *C.R. Fraser-Jenkins* 31028, 3.1.2005, TAIF; banks of rice-fields and rocky edge of path above east end of foot-bridge across Andhi Khola, below and across river from Udiyachaur village, N. of Gallyang ["Golleng"], N. of Butwal, S. of Syangja, Syangja District, *C.R. Fraser-Jenkins* 31038, 3.1.2005, TAIF], **Kaski** [steep, N.-

facing slope and small cliff in Raniban forest, *c*. ½ km. W.N.W. of the dam outlet of Phewa Tal, on S. side of E. end of Phewa tal, to the east of and above Fish-tail Lodge Hotel, opposite Baidam, Damside, Pokhara, *C.R. Fraser-Jenkins* 30736, 17.9.2004, TAIF; limestone rocks and cliffs by path down from road south of Mahendra Gouffer, to Surjenagar village and on far (S.E.) side of river a little up the Kali Khola valley, *c*. 8 km. N. of Pokhara, *C.R. Fraser-Jenkins* 30771, 17.9.2004, TAIF; on old wall by track from New Bridge down south to Birethanti, on lower part of way down from Annapurna Base Camp, Modi Khola Valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32657 (FN 302), 3.12.2006, TAIF], **Gorkha** [Kudi, 28° 19', 84° 19', sur murets, 750 m., *J.F. Dobremez* 657, 26.11.1970, BM; on raised mud-banks of terraced wet and dry rice-fields, *c*. 2 km. below and S.W. of Hattiya Deurali, 3 km. above and N.E. of Gopling Ghat, above Marsyangdi Dam, N. of Marsyangdi river, W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 30787, 18.9.2004, TAIF; wall of path, just above and *c*. ½ km. below old house at Komale khola (stream), beside path down from Deurali to Goplinghat and Markichowk, above and N.E. of Marsyangdi Dam, N.W. of Anbu Khaireni, between Mugling and Dumre, S. Gorkha District, *C.R.*, *N.* & *J.C.B. Fraser-Jenkins*, *Sagun Pariyar* & *G.B. Tamang* 32688 (FN 333), 31.12.2006, TAIF], **Dhading** [small, deep stream-gorge at west end of village opposite main bridge across Trisuli Khola river, leading to Dhading, W. of Kathmandu on road to Mugling and Pokhara, Dhading District, *C.R.*, *N.* & *J.C.B. Fraser-Jenkins* 30713, 16.9.2004, TAIF], **Kathmandu** [wall of school at Sanagaon village, above Kulaltar, S.W. of Sankhu, N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* 33081 (FN 194), 29.9.2008, TAIF], **Sindhuli** [banks on slopes of N. side of Churiya Ghats ridge, S.E. of Duarde village, on path down to Bagmati Bridge, S.E. of Raigaon, on E. side of Bagmati river, Sindhuli District, *C.R. Fraser-Jenkins et al.* 25754 (FN 1732), 23.10.1997, H; N. facing, forested rocky stream-gully on N. side of second main ridge of hills up from the plains, *c*. 6 km. S. of Sindhuli Madi, N. of Karkare, N. of Biman, c. 15 km. N. of Bardibas, E. of Hetauda off Janakpur road, Sindhuli District, *C.R. Fraser-Jenkins*, with *K. Neupane* 26022 (FN 2000), 12.2.1998, H].

E: ? **Dhankuta** [Dhankuta, E. Nepal, on the wet and shady slope, runner, 400 m., *D.P. Joshi* 231, 11.10.1971, KATH, immature creeping frond, identity very doubtful], **Jhapa** [N. of Sunischare, E. Nepal, on banks, 700 ft., *R.L. Fleming* 2305, 9.10.1976, MICH; among bushes and at wet edges of fields by west bank of Mechi river, N. of Kakkarbhitta, by road to Nakalbanda, Jhapa District, *C.R. Fraser-Jenkins* 30097, 14 Dec. 2003, TAIF; roadside verges *c*. 2 km. N. of Kakkarbhitta, near Nakhalbandi, E. of Dhulabari, not far from West Bank of Mechi Khola (river), Jhapa District, *C.R. Fraser-Jenkins* 33227 (FN 7), 9.11.2008, TAIF], **Ilam** [3 mi. S. of Gorhwa, on a wet forest bank, 700 ft., *R.L. Fleming* 2473, 13.9.1978, MICH, KATH].

Full distribution: China [Hainan]; Myanmar [Zwa Ka Bin, Kayin, *CRFJ* 32115, 19.6.2006, TAIF]; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. Nagaland; Manipur; Orissa; [Bundelkhand]; Karnataka; Kerala; Andamans; Bangladesh (*CRFJ*;

Rinkheong valley, Chittagong, *J.S. Gamble* 6741A, B, 26.2.1879, K].

(M, Sc). A rather scattered subspecies of lower to lower-mid altitude, occurring in similar habitats to subsp. *intermedium*, preferring rocks and old walls.

Nepalese threatened status: **LC**.

*124. ***Adiantum raddianum*** C.Presl, *nom. nov.* for *A. cuneatum* (syn.: *A. cuneatum* Langsd. & Fisch., *non* G.Forst.; *A. mexicanum* C.Presl; *A. cuneipinnulum* N.C.Nair & S.R.Ghosh; and other New World synonyms). Adventive species in Asia.

Generally similar to *A. capillus-veneris*, but lamina more ovate and more delicate, segments usually noticeably smaller and more numerous (though segment-size varies considerably and some plants have larger segments similar in size to *A. capillus-veneris*), with less obvious teeth; sori round and deeply indented from the lamina-margin, indusium curved right round almost in a circle, except at the top. In at least S. India there is a cytological complex and some specimens belong to some of the many horticultural cultivars with attractively minute segments (cv. 'Fancy Ruffles' *etc*.) developed in Europe and especially Japan, where they have been photographically catalogued, while some others approach slightly towards the morphology of another widespread adventive species from C. America, *A. concinnum* Humb. & Bonpl. *ex* Willd., and might perhaps have originated locally in India if allopolyploid.

Nepal:

E: **Taplejung** [Taplejung, Sinwa - Chhiruwa, along the main trekking path to Kanchunjungha Base Camp, *c.* 15 min. walk N. of Sinwa, on the foot of a big stone, 850 m., *N. Thapa* T4, 27.7.2001, KATH].

Himalayan distribution (adventive): Sikkim; Darjeeling; Nepal. S. India; Sri Lanka; China *etc*.; native to C. and S. America. A very widely adventive species in Asia and Africa, escaped from cultivation and spreading widely in the C. and E. Indo-Himalaya, N.E. India, and S. India *etc*.

(A, Sc; C. & S. America). A scattered to fairly common mid to upper-mid altitude species occurring along shaded roadside banks usually near towns or villages.

[***Adiantum soboliferum*** Wall. *ex* Hook. (syn.: *A. mettenii* Kuhn) was listed and keyed out by Iwatsuki (1988) stating that it had not been actually recorded from Nepal, but is probably there. However it has not been collected from Nepal and is not expected to be present there. It is a very rare N.E. and S. Indian species from Assam State, Nagaland and S. India, also in China, Myanmar, Taiwan, S.E. Asia and Africa. It was also misreported from Nepal by Lin *et al*. (2013) in the *Flora of China*, presumably repeated from Iwatsuki.]

[***Adiantum tenerum*** Sw., erroneously as Willd. by Verdcourt in Shaffer-Fehre (2006) (syn.: *A. trapezoides* Fée).

A. tenerum is like a large and robust *A. capillus-veneris*, but the ultimate segments are larger and somewhat rectangular, or rounded-rectangular and have a small, slightly swollen articulation point, visible by naked eye, or more easily visible with a hand lens, where the base of the lamina meets the black stalklet, and where the segments drop off in older fronds. Unlike in *A. capillus-veneris*, the dark color is confined to the stalklet and does not extend a very short way along the basal margins, as revealed under a hand-lens.

Nepal:

C: ?**Kathmandu** [Central Nepal: Pouwa, Kathmandu, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305006, 9.10.1963, TI *sub* "*A. venustum*" det. H. Itô, in error, photograph redet. CRFJ]. This specimen was cited by Itô (1966) and thence Iwatsuki (1988) under *A. venustum*, which differs markedly in its smaller, differently-shaped segments and prominent small teeth, as well as thicker texture and striated lamina. The specimen must have been collected from a garden-grown plant, but quite naughtily failed to say so.

Distribution: *A. tenerum* was described from Jamaica and occurs naturally from Florida to the West Indies, Mexico, throughout C. America and in Venezuela in S. America. It is commonly cultivated world-wide, being a large, elegant and easily grown, reasonably forgiving (of neglect) "Maidenhair Fern", unlike a lot of the other, more particular species that can suffer badly from either over- or under-watering. It has occasionally escaped and become adventive in secondary habitats near towns and settlements in S. India (see Fraser-Jenkins (2008: 363) for references) and quite commonly in Sri Lanka, though not so treated or keyed out by Verdcourt in *A Revised Handbook to the Flora of Ceylon*. It has not escaped in the Indo-Himalaya or Nepal and is excluded here as part of the Nepalese flora.]

125. ***Adiantum tibeticum*** Ching & Y.X.Lin (syn.: *A. venustum* D.Don subsp. *tibeticum* (Ching & Y.-X.Lin) Khullar; *A. breviserratum* Ching & Y.X.Lin; misapplied name: "*A. venustum*" *sensu* Fraser-Jenkins (1992, 1997, but not 2008), *sensu* Khullar (1994 *etc*.).

Close to *A. venustum* within which it had long been included in India, but is a rather well distinguished species, with smaller, mostly evergreen fronds (to *c*. 20 cm. long), and fewer, more symmetrical, broader, striated, stiffer segments, with wider, more deltate-based teeth, approaching towards the Chinese and Tibetan endemic species, *A. davidii* Franch., but less extreme in morphology and without the aristate tooth-apices of the latter; sori often a little elongated, hardly indented, usually 1-2 per segment. Octaploid sexual, perhaps derived partly by allopolyploid derivation from *A. davidii*. Confused in gardens in N. America, Britain and Europe with the rare and beautiful Chinese endemic *A. davidii* Franch. (syn.: *A. prattii* Baker; *A. latedeltoideum* (Christ) C.Chr.), with very black axes, strongly aristate, but triangular-based teeth and often rather longer sori, which is cytologically unknown, but was recently reported by Lin *et al.* (2013) as being octaploid without any details,

provenance or voucher-specimen given, but perhaps more probably due to misidentification of *A. tibeticum*.

Nepal:

W: **Darchula** [Thumti - Patha, Darchula Distr., on moist slopes in Oak forest, 2060-2460 m., *M.M. Amatya* & *P.M. Regmi* W699/82, 4.9.1982, KATH], **Jumla** [Jumla, shady places by mountain streams, 8500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 1888, 14.4.1952, BM; Bahara Gaon, Jumla Distr., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 13667, KYO, det. CRFJ 1991 as "*A. davidii*" in error; forested stream, N.W. side of Dhitachaur hill, *c.* 2 km. E. of Jumla, on S. side of river, *C.R. Fraser-Jenkins* 35333, 1.6.2014, KATH], **Mugu** [Mugu Distr., Toli - Rara, 2400 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 24935, 8.9.1983, KYO, det. CRFJ 1991 as "*A. davidii*" in error], **Rukum** [Sehragaon, on south-west side of the Uttar Ganga, among grasses on rock ledges just east of the village, *c.* 7000 ft., *A.R. Vickery* 803, 8.4.1974, BM], **Dolpa** [Rohagaon, Suli Gad, in shade of moist, deciduous forest, 9500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3360, 13.9.1952, BM; Tarakot, on stones in cultivated ground, 2700 m., *S. Einarsson, L. Skärby* & *B. Wettterhall* 1457, 2.7.1973, BM]. Nepal [Gulire, *Roshani Manandhar* 2-6B-0211A, 4.12.1982, TU Nat. Hist. Mus.].

C: **Mustang** [dense mixed, mainly coniferous forest, on way up to and behind first ridge of Marte Darrah, opposite and above Tukuche, *c.* 15 km. S. of Jomsom, below and W. of Nilgiri main Peak, North West side of Annapurna Himal range, Kali Gandaki valley (E. side), Mustang District, *c.* 2800-3500 m., *C.R. Fraser-Jenkins* & *G.B. Tamang* 30534, 28.6.2004, TAIF], **Manang** [Tilje, 28° 38', 84° 31', rochers ombragés, 2500 m., *J.F. Dobremez* 696, 1.12.1970, BM, KATH; Dharapani - Thanchok, C. Nepal, on shady place, specially in the rock crevices, 2000-2750 m, *D.P. Joshi* & *M.M. Amatya* 73/470, 10.7.1973, KATH; Marsyangdi khola, Chame (2630 m,) - Qupar (2530 m.) - Thangjo (2580 m.) - Dhanagyang (2200 m.), 84° 18', 28° 31', 2200 m., *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8311093, 6.8.1983, BM], **Gorkha** [Gorkha Distr., Dumje/Thumje (2310 m.) - Ripche (2390 m.) - Sardu khola (1800 m.), 28° 28' 16", 85° 00' 27" - 28° 26' 49", 84° 55' 56", shady mossy place along the railroad track, 2100 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro* & *K. Yoda* 9485220, 31.7.1994, KATH], **Rasuwa** [Trail from Gatlang to Thangjet, 28° 10', 85° 17', wet gap, 2000 m., *J.H. de Haas* 2421, 19.8.1974, BM].

Total distribution: China; Tibet; Bhutan; Sikkim; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. More common in the N.W. Indo-Himalaya, becoming rare in the wetter parts of the Central Himalaya (Nepal, Darjeeling and Sikkim) and we have not seen any collections from E. Nepal.

(S(T), Sc). A rather scattered but locally common (in Nepal) species of higher and high Himalayan altitude, preferring the drier, more westerly areas, growing among rocks and low bushes in open areas.

126. ***Adiantum venustum*** D.Don (syn.: *A. microphyllum* Roxb., *non* Sw., *nec al.*; *A. argutum* C.Presl *ex* Ettingsh., *non* Splitg.; *A. fimbriatum* Christ; *A. bonatianum* Brause; *A. smithianum* (C.Chr.) Ching). Fraser-Jenkins (1992, 1997) followed prevailing Indian concepts from Verma & Khullar (1965) and before them from Ching (1957) as to the identity of *A. venustum*, in the absence of any original type-material of it, and thus took the name to mean what is now called *A. tibeticum*. He recognised the two different Indo-Himalayan species within what was formerly thought to be a single species, *A. venustum*, from a combination of their different cytotypes and associated distinctive morphology (without which they should not be separated), but as a result of the above misapplication referred to the present species by its synonym, *A. fimbriatum*. Fraser-Jenkins (2008) later corrected the transposed nomenclature after studying *A. venustum* in its type locality (below Gossainthan, Rasuwa), and neotypified the species. Lin *et al.* (2013) in the *Flora of China* have continued to treat *A. fimbriatum* and *A. bonatianum* as if further separate species, though their descriptions of them also apply to *A. venustum*, while their description of *A. tibeticum* appears to be mixed, and does not bring out the difference in segment-shape and teeth clearly. Khullar (2000, onwards) has also transposed part of the distinctive morphology of *A. venustum* and *A. tibeticum* in error (details of the teeth) and was thus unable to separate them, leading to his conclusion of making them subspecies.

This species has larger fronds than *A. tibeticum* (to *c.* 50 cm. long), dying down in Winter, with many more, usually smaller and narrowish, usually more narrowly cuneate-based, often slightly asymmetrical, slightly softer, striated segments; teeth long, narrow and fan-like, though occasionally becoming less developed and small and then difficult to recognise unless present in better developed condition in other fronds; sori often shorter and more indented, usually 2-3 per segment. Tetraploid sexual (Fraser-Jenkins (2008) inadvertently transposed their cytotype by *lapsus mentis*, but had previously (Fraser-Jenkins 1997) cited it for the correct species, if under the transposed names of that time. Numbers are not his strong-point, despite doing all the typing of them when typing this book!).

Nepal:

W: **Darchula** [W. facing forested rocks below cliffs by path, *c.* 2 km. N. of Dumling (opposite Jipti on the Indian side), on path south to Darchula, E. side of Kali river, Darchula District, *c.* 1800 m., *C.R. Fraser-Jenkins*, with *A. Magar Thapa* & *B. Pariyar* 21690 (FN 357), 22.11.1994, H], **Dadeldhura**, **Doti** [Salimgada, 811292, on moist and shady place, *D.P. Joshi* 160, 1.8.1972, KATH], **Bajhang**, **Bajura** [Majpali - Pategaon, Bajura Distr., on moist slope, Terrestrial, 2100 m., *K.R. Rajbhandari* 15073 B, 15.8.1991, KATH], **Humla** [above Simikot, Humla District, 29° 59' 04", 81° 48' 50", south facing slope, very coarse boulder scree in damp depression, 3650 m., *C.A. Pendry*, *S.R. Baral*, *S. Noshiro*, *S. Rajbhandary*, *P.P. Kumi*, *B. Dell* & *B. Adhikari* JRS A194, 19.6.2008, KATH, *sub* "*A. capillis*[*sic*]-*veneris*" det. S. Lindsay in error], **Surkhet**, **Jumla** [Maharigaon, on earth banks in

Betula forest, 10,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 193, 15.7.1952, BM, US; Dori Lekh - Sipty, Jumla Distr., *K.R. Rajbhandari* & *B. Roy* 3412, 18.7.1979, KATH], **Rukum**, **Pyuthan** [Khalanga, Pyuthan, 1430 m., *D.R. Kandel*, *M.L. Pathak* & *G.D. Bhatt* ["*Bhatta*"] 126014, 11.6.2012, KATH].

C: **Baglung** [damp forest near Raptor, "W. Nepal", 6600 ft., *R.L. Fleming* 1749, 12.1963, MICH; 3 miles above Dana, Baglung District, on northern wooded slopes, 7300 ft., *Robert L. Fleming* 1756, 12.1963/1964, MICH, KATH], **Myagdi** [S.W. of Gurjakhani, upon boulders in Betula forest, 10,750 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 9102, 20.10.1954, BM, GH], **Mustang** [Lete, S. of Tukucha, Kali Gandaki, on open rocky slopes, 12,500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 1017, 7.6.1954, BM, *ditto*, 7797, GH], **Manang** [Thange - Tal, *P.R. Shakya*, *S.R. Adhikari* & *K.R. Amatya* 5307, 7.8.1979, KATH], **Parbat** [Parbat Distr., Banthanti (2650 m.) - Gorepani Deorali (3170 m.), 835283, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akuyama* 8350285, 12.7.1983, BM], **Kaski**, **Lamjung**, **Gorkha** [Ganesh Himal, Shiar khola, below Thumje, 8000 ft., *P.C. Gardner*, New Zealand Himalayan Expedition 428, 15.4.1953, BM; Ripche, 2100 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi* & *M.M. Amatya* 73/932, 23.11.1973, KATH], **Rasuwa** [Ghoda Tabela - Thulosyapru, Langtang, on dry open rock crevice along the wayside of the forest, 2120 m., *Mrs. V.L. Gurung, Mrs. T.K. Rajbhandari, Mr. N.P. Manandhar* & *Mrs. A. Karki* 77/749, 7.10.1977, KATH].

E. Reported by Iwatsuki (1988), without differentiation of *A. tibeticum*, with many specimens cited but not mentioned whether they are from E. Nepal, nor mentioned in the previous accounts of the Japanese expeditions. Thapa (2002) guessed that it was common in E. Nepal, *sub A. fimbriatum* (the name then being used by Fraser-Jenkins on first differentiating the two species, and informed to Thapa while working through, correcting and adding to the first typescript of his book), but we have seen no specimens from E. Nepal, though at least *A. venustum* is likely to be there.

One of the specimens cited by Iwatsuki (Central Nepal: Pouwa, Kathmandu, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305006, 9.10.1963, TI) was from Kathmandu valley where neither *A. venustum* nor *A. tibeticum* occur, nor in its near vicinity, but a photograph kindly sent to CRFJ in March 2015 by Professor K. Iwatsuki via Dr. A. Ebihara shows that the collection is a large and typical specimen of the cultivated C. American species *A. tenerum* Willd., redet. CRFJ, which is occasionally cultivated in pots in gardens in Nepal, but has not escaped and become adventive in Nepal, unlike in S. India and Sri Lanka. It must have been collected from a garden-cultivated plant but failing to state it.

Himalayan distribution: China; Tibet; Bhutan; ?Arunachal Pradesh; Sikkim; ?Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Its presence in Arunachal Pradesh is based on the report by Chandra (1980) from Broxer, Tawang, *P. Chandra* 100535, 8-9.1976, but this specimen has since been

discarded at LWG, though after much search, CRFJ and Dr. S. Behera together managed to save and photograph a number of Chandra's unincorporated but important numbered and published specimens from among a pile of old newspapers in 2011; the other specimen cited by Chandra from Pankinshow, Tawang, *P. Chandra* 80455, has been saved by us and is *A. wattii*.

(S, C). A fairly common (in W. and C. Nepal) upper-mid to high Himalayan species, including in the wetter Himalayan areas, usually occurring on shaded slopes in rather light forest, often among Bamboos.

127. ***Adiantum wattii*** Baker (syn.: *A. levingei* Baker; *A. refractum* Christ; *A. delavayi* Christ; *A. edentulum* Christ, not at all a possible synonym of *A. poiretii* Wikstr. as mentioned with a query by Fraser-Jenkins (1997), but corrected (2008a); *A. muticum* Ching). Lin *et al.* (2013) in the *Flora of China* suggested that *A. refractum*, which name they used for the present species, is very similar to *A. wattii* and "perhaps should be included in that species", but it had already been correctly placed as a synonym of *A. wattii* by Fraser-Jenkins (2008), with earlier explanation by Fraser-Jenkins (1997), as they were aware.

This species is very similar to *A. capillus-veneris* but is quite distinct, differing in having tall fertile fronds, above smaller, basal sterile fronds; the ultimate segments are narrower-based and often slightly falcate near their stalk and even when sterile, are without teeth or crenate, not with some acute teeth as in *A. capillus-veneris*; many of the indusia are often elongated, sometimes extending along the whole distal margin of the segment, with a raised rounded horn of lamina each side. Not to be confused with occasional leaves of *A. capillus-veneris* that may rarely have similarly elongated indusia, but can be distinguished from it by the acute teeth of the sterile segments in *A. capillus-veneris*.

Nepal:

W: **Jumla** [Sialgarhi, Chandhabise khola, under trees in shade, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 2030, 15.5.1952, BM].

C: **Mustang** [Taglung, E. of Tukucha, Kali Gandaki, in wood, 10,000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7981, 22.9.1954, BM, E; Thorungse Phedi, Mustang, 4050 m., *K.R. Rajbhandari* 8293, 24.7.1983, KATH], **Kaski** [Kaski District, northeast of Sikles village on north-facing slope on banks of Muckyun River, Easting 223611, Northing 3148969, on forest floor in forest dominated by Abies spectabilis and Rhododendron barbatum, 2950 m., *Dorothy Allard* 304, 21.9.1995, BM; Annapurna region, *Andreas Hemp*, Univ. Bayreuth 34, in 2002, BM; among mossy rocks and scrub-patches, Deurali Lodge to Machapuchare Base Camp, N. of Chomrong and Birethanthi, N. of Pokhara off Baglung road, en route to Annapurna Base Camp, Kaski District, 3200-3700 m., *C.R. Fraser-Jenkins, Sagun Pariyar* & *Jacob C.B. Fraser-Jenkins* 35020 (FN 297), 3.6.2012, TAIF].

E: **Sankhuwasabha** [Rihatay [?Rimatay], 8000 ft., *H. Emery, E.W. Cronin, H.* &

A. Foster & *K. Brooks* F 1366, 20.7.1974, BM].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Sikkim; Nepal; Uttarakhand; Himachal Pradesh. It obviously does not occur in Bangladesh, as surprisingly listed by Dixit (1984) and thus Chandra (2000), nor in Kashmir and South India as added by Chandra (2000), perhaps in error for the S. American *A. poiretii*, adventive in S. India, but not present in Sikkim or Assam, as also erroneously stated by Chandra.

(S(T), Sc to R). An uncommon and seldom collected, higher altitude and high Himalayan species of semi-open steep, rocky banks among low shrubs, or on grassy scree-slopes among rocks, often also in humus on well vegetated ledges of cliffs. *A. wattii* does not occur as low as 1000-2000 m., as mentioned under its synonym, *A. levingei*, by Ghosh *et al.* (2004), presumably with little knowledge of how to distinguish it from the common *A. capillus-veneris*, but is only found above 2500 m., and more usually around 3000 m.

Indian threatened status: **VU**. Nepalese threatened status: **EN**.

Aleuritopteris (15 species).

128. ***Aleuritopteris albomarginata*** (C.B.Clarke) Ching (syn.: *Cheilanthes albomarginata* C.B.Clarke; *C. farinosa* var. *albomarginata* (C.B.Clarke) Bedd.; *Cheilanthes dalhousieae* ["*dalhousiae*"] Hook., *nom. rejic., non sensu auct. Ind. et Sin.* [= *A. leptolepis*]; *Aleuritopteris dalhousieae* ["*dalhousiae*"] (Hook.) Ching; *Leptolepidium dalhousieae* ["*dalhousiae*"] (Hook.) K.H.Shing & S.K.Wu; misapplied name: "*Cheilanthes farinosa*" *sensu* Itô (1966), *non* (Forssk.) Kaulf. [= *Aleuritopteris farinosa* (Forssk.) Fée, from S. Arabia and Africa]). Often mistakenly reported from lower altitudes in error for *A. bicolor etc.*, on the basis of the name referring to whiteness, but the name referred to the pale margins of the bicolorous scales, and this species does not extend down to mid altitude. Hooker mistakenly described and illustrated his *C. dalhousieae* based on efarinose Summer fronds of the present species collected at Simla by the Vicereine of India, Lady C.B. Dalhousie, an error noticed later in confirmation by Baker. Thus Fraser-Jenkins (1997) was obliged to apply the name to the present species as did Thapa (2002), but then submitted an informal proposal for this confused name to be rejected, in response to a proposal submitted by Zhang (2002) to conserve it with a different type in a different sense, and the Committee then rejected the name.

Species of *Aleuritopteris* have been so confused to this day, with many wide misidentifications as a result of failing to examine the distribution and colour of the diagnostic scales, that almost no reports concerning Indian species can be relied on. Panigrahi's (1960) confusion of *A. grisea* persists even today; Saiki (1984) was almost totally confused and introduced many misapplications of names from other regions, along with many spurious and erroneous new species, and misidentified the majority of specimens in his and other herbaria; while Ghosh *et al.* (2004) had

little idea of the application of any of the names they extracted from the literature, misapplied several different names to the common *A. bicolor* and misidentified most of their specimens in CAL, all due to not looking at the scales properly. Most of the names listed by Iwatsuki (1988) applied to a mixed bag of any other species. In China, too, no less than 6 illustrations and one name were incorrect in *Aleuritopteris* in the photo book by X.-C. Zhang (2012). Yet most of the nomenclature (excluding the *A. argentea* group) was already elucidated by Khullar (1994) (but unfortunately with partly transposed, or part-mixed illustrations) and by Fraser-Jenkins (1997, 2008), indeed basicly also by Blanford (1886) himself, and on examining the scales and their distribution on the stipe and leaf, the species are mostly easy to identify accurately as outlined there.

This species (along with *A. dubia* and *A. rufa*) has seasonally dimorphic fronds with the compact and persistent basal Winter (dry season) fronds having an obvious white farina beneath and many small costal scales along the pinna-costa, but the tall and large Summer (monsoon) fronds having wider segments, fewer, sometimes very few laminar scales and very weak or often no farina, soon dying and turning brown, though remaining in place for some time, at the onset of the first frosts. Stipe slightly mauve-black, bearing rather narrow, bicolorous scales throughout and along the whole rhachis, diagnostically extending onto the costae and costules, stipe-scales more scattered than in the other two species and without narrow fibrils intermixed; lamina varying from small and deltate to sometimes very long, triangular-lanceolate in favourable sheltered conditions, always having small scales on the pinna-costae beneath, many in farinose Winter fronds, few in efarinose Summer fronds; lowest two pairs of pinnae the longest and the lowest basicopic pinnule the longest in the frond. Pseudoindusia (incurved and modified from the laminar margin) interrupted, strongly fimbriate apically (see the accurate illustration of them by Hooker in the protologue). Diploid sexual (reports of tetraploids are erroneous).

Both the farina in all species, and some of the laminar scales are washed off in herbarium-specimens treated with alcohol with insecticide, particularly in India where some important herbaria gradually turn into Insect menageries due to staff and management failure to renew paradichlorobenzene regularly; excessive glue on the stipe also sticks all the important and diagnostic scales to the stipe in a brown mass, so as to be unavailable for examination; heat drying also removes the farina and makes the species look rather different and not so easily recognisable.

This species was found by Wollenweber (Wollenweber & Fraser-Jenkins *ined.*) to be one of a group of three with identical flavinoids in the white farina beneath the frond, along with *A. dubia* and *A. rufa*. This may have some bearing on the existence of a few occasional intermediate plants, but with normal spores, between the three. All other Indian and Chinese species have species-distinctive flavinoids.

Nepal:

W: **Darchula** [N.W. facing rocks in forest below cliffs, *c.* 2 km. S. of Dorpatta

village (opposite Lamari and S. of Buddhi in India), *c.* 12 km. N. of Dumling, west side of Api Himal, N. of Darchula, E. side of Kali river (border with India), Darchula District, *c.* 1850 m., *C.R. Fraser-Jenkins*, with *A.M. Thapa* & *B. Pariyar* 21633 (FN 300), 21.11.1994, E], **Doti**, **Bajura** [Talkot - Aagar, Bajura Distr., 2000 m., *K.R. Rajbhandari* 15356, 18.8.1991, KATH], **Surkhet** [among semi-calcareous metamorphic roadside rocks on slopes in semi-open Pine forest, just below Cheda hamlet, *c.* 20 km. N. of Surkhet (Birendranagar) town, on road north to Dailekh, Surkhet District, *c.* 1300 m., *C.R. Fraser-Jenkins* 35143 (FN 17), 22.9.2013, TAIF], **Dailekh**, **Kalikot** [base of roadside cliff, *c.* 5 km. N.E. of Kalikot town (Manma), on rough road to Jumla, overlooking Tila River valley, Kalikot District, *c.* 1000 m., *C.R. Fraser-Jenkins* & *S. Pariyar* 35152 (FN 26), 24.9.2013, TAIF], **Mugu** [between Rara and Gumgadi, Mugu District, 2430 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 16857, 22.7.1983, KYO *sub* "*C. anceps*" in error], **Jumla** [Bumra, Riyan Lekh, on vertical banks by trail, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3079, 28.8.1952, BM, E; en route from Jumla to Padmara, Jumla Distr., 2900 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 12514, 10.5.1983, KYO, A; small stream gully above cave-spring, above and off the path leading up to Danphe Lagna pass and over Dori Lekh ridge to Rara Lake, above Chauriyachaur (Patama) meadow, *c.* 3 km. N. of Karnali Technical College, *c.* 6½ km. N. of Jumla, Jumla District, *c.* 3300 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.* & *K. Neupane* 22102 (FN 9), 7.6.1995, E], **Sallyan** [Riala, on earth banks in thickets, 5000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 1299, 31.8.1952, BM, E].

C: **Baglung** [Bongakhani, shady terrace banks, 6500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3946, 22.8.1954, BM, E, G, GH], **Myagdi** [northwest of Gurjakhani, earth pockets in boulders, 10,000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4494, 19.9.1954, BM, E], **Palpa** [4 mi. W. of Tansing, "W. Nepal", on rocks, 3000 ft., *R.L. Fleming* 1638, 6.11.1949, KATH], **Mustang** [Lete, S. of Tukucha, Kali Gandaki, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7707, 6.9.1954, E; Kali Gandaki, Lete, in forests and open grassland between rocks, sometimes rather dry, 7200 ft., *G.* & *S. Miehe* A 13, 11.11.1976, BM], **Kaski** [Khare, E. of Lumle, W. of Pokhara, "*c.* 600" m. [anomalous], *C. Grey-Wilson* & *B. Phillips* 916, 10.9.1973, K, Darmstadt (E.T.H. Univ.), and cult (345-73-04635) K *sub* "*C. anceps*", "a mixed living coll.", P.J. Edwards], **Gorkha**, **Makawanpur** [forested stream below road, between Daman and Simbhanjyang, on S. side of pass, S. of Naubise on Hetauda road, S. of Kathmandu, Makawanpur District, *c.* 2100 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C., S.B. Sinchuri et al.* 26475 (FN 2453), 11.8.1998, H], **Dhading** [Ganesh Himal, Ankhu khola, 28° 12', 85° 06', damp riverside forest, on rocks, 6500 ft., *J.D.A. Stainton* 3700, 12.5.1962, BM], **Rasuwa** [Syarpagaon, 28° 10', 85° 24', 2700 m., *J.F. Dobremez* 981, 6.9.1971, G], **Kathmandu** [Ropeway, Chandragiri, 5500-7200 ft., *R.L. Fleming* 1285 *p.p.*,

28.8.1956, MICH, DD; Gaucher, Kathmandu airport, forest, Kathmandu valley, 4200/4300 ft., *R.L. Fleming* 2221, 10.9.1975, MICH], **Lalitpur** [Hills beyond Bhagaon, 5000-6500 ft., *R.L. Fleming* 1244, 16.8.1956, DD; Godaveri, Kathmandu valley, walls of garden, *c.* 5000 ft., *R.L. Fleming* 1941, 1942, 1943, 1944, 1945, 15.8.1969 ["1959"], MICH, F (nos. 1942, 1944); Tinpani Bhanjyang, 10 mi. S. of Kathmandu valley, *R.L. Fleming* 1549, 10.9.1958, MICH; Chapagaon, Kathmandu valley, rocks, *R.L. Fleming* 1926, 11.9.1968, MICH; Phulchowki, Kathmandu valley, 8100 ft., *R.L. Fleming* 1926, 14.9.1968, MICH; Godawari Botanic Garden, [naturally occurring], 1500 m., *D.H. Nicolson* 3001, 22.3.1967, US], **Bhaktapur**, **Kabhrepalanchok**, **Sindhupalchok** [cliffs and steep, partly open slopes, *c.* 1 - 3 km. S. of Miteri Bridge (to Tibet), Kodari, north of Tatopani, on W. side of Bhote Khosi river, N. of Barabise on road to Tibet border, N.E. of Kathmandu, Sindhupalchok District, *c.* 1800 m., *C.R. Fraser-Jenkins* 29007 (FN 4982), 5.6.2001, H], **Dolakha**.

E: **Solokhumbu** [rochers au dessus de Ghat, rochers sud-ouest, 2650 m., *A. Zimmermann* 761, 11.6.1952, BM, G], **Dhankuta** [Sangure ridge above Dharan, Dhankuta, in open field, 4100 ft., *R.L. Fleming* 1926, 2286, 2624, 12.7.1971/1978, KATH, MICH *sub* "*C. farinosa*"], **Ilam** [Mai river, Ilam, banks, 7000 ft., *R.L. Fleming* 2652, 24.9.1978, MICH; 10 mi. E. of Rabi Bazaar, roadside banks, occasional, 7400 ft., *R.L. Fleming* 2568, 29.9.1978, MICH, KATH], **Panchtar**, **Taplejung** [Helok to Iladanda, *H. Kanai*, *G. Murata* & *M. Togashi* 6305019, 8.11.1963, K, BM, E, KYO, A, *sub* "new sp." det. in K by G. Panigrahi, 8.12.1975, in error; Ghunsa khola, S.W. of Amjilassa, 27° 33', 87° 51', on rocks, steep-sided grassy hillside, 2500 m., *S. Crawford*, *C. Grey-Wilson*, *D.G. Long*, *R. McBeath*, *H.J. Noltie*, *M. Sinnott*, *M.N. Subedi* & *S. Zmarzty* KEKE 263, 5.9.1989, K].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Orissa; Maharashtra [Mahabaleshwar, *V.D. Vartak* 9, 8.1955, BSA]; Thailand; Vietnam. Not present in Bangladesh, whence reported by Ghosh *et al.* (2004), not realising that it is a higher-altitude species (see Fraser-Jenkins 2013), nor in southern West Bengal State as recently reported.

(S, C). A very common species occurring at mid to, more normally upper-mid, to higher altitude, but sometimes extending down as low as 1300 m. in the Himalayan region (*c.* [1300-] 1500 - 3600 m.), in moist, rather open places, favouring shaded, N.-facing old walls, bases of damp rocks, crevices in cliffs, steep banks *etc*.

129. ***Aleuritopteris anceps*** (Blanf.) Panigrahi (syn.: *Cheilanthes anceps* Blanf.; *Cheilanthes farinosa* var. *anceps* (Blanf.) Blanf.; *Aleuritopteris pseudofarinosa* Ching & S.K.Wu; *Cheilanthes pseudofarinosa* (Ching & S.K.Wu) K.Iwats.; *Aleuritopteris javanensis* Saiki, *non Cheilanthes javanensis* (Willd.) T.Moore). The name *A. anceps* was persistently misapplied by Ching and by S.K. Wu in China to *A. formosana*, despite discussion after 1980 with CRFJ. Several authors followed

Ching in this misapplication of the name. The present species, being uncommon in China, was hardly known there until redescribed as *A. pseudofarinosa*, which was synonymised by Fraser-Jenkins (1997, 2008). Iwatsuki's (1975) mention of a sparsely scaly undersurface of the rachis and costae in "*C. anceps*" can only have applied to *A. albomarginata*, which might partly also be what he meant later (Iwatsuki 1988), though his naming of most *Aleuritopteris* species was too confused to be unravelled entirely.

A. anceps is related to the African and S. Arabian *A. farinosa*, but differs in its clearly bicolorous, pale-margined stipe-scales as opposed to wider, reddish or yellowish brown, vaguely bicolorous scales, and the pinnae are less strongly sessile, whereas the basal pinnules in *A. farinosa* are very close to, often overlapping the rachis. Stipe slightly thicker than in *A. bicolor*, jet black, bearing prominent, slightly wide, bicolorous scales, with a narrow dark central stripe and quite wide pale margins longer and larger than in *A. formosana* or *A. bicolor*, pale at their edges with a prominent brown central stripe, scales dense at the stipe-base, but more scattered above, and not or hardly extending above the stipe, costae and most of the rachis entirely without scales beneath; fronds triangular lanceolate, lamina not very wrinkled above, bearing a thick, smooth, bright-white farina beneath; lowest pinna the longest and its lowest basiscopic pinnule the longest in the frond; pinnules well lobed with small lobes. Tetraploid sexual, reports of diploids (also mistakenly listed by G.M. Zhang, Yatskievych & Hooper (2013) in what is clearly one of the better generic accounts in the *Flora of China*, despite wide misidentifications of a number of Indian specimens by Zhang at K), refer to *A. formosana.*

Nepal:

W: **Darchula** [Maikholi - Sipti, in crevices of stone on road side, 1810-1660 m., *M.M. Amatya* & *P.M. Regmi* W585/82(a), KATH], **Dailekh**, **Kalikot** [base of roadside cliff, *c.* 5 km. N.E. of Kalikot town (Manma), on rough road to Jumla, overlooking Tila River valley, Kalikot District, *c.* 1000 m., *C.R. Fraser-Jenkins* & *S. Pariyar* 35151 (FN 25), 24.9.2013, TAIF], **Mugu** [Kharka Jamiro - Poiku, 1540 m., Mugu Distr., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 24781, 24783, 7.9.1983, KYO; Poiku - Toli, Mugu Distr., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 24818, 7.9.1983, KYO], **Rolpa**, **Pyuthan** [Khalanga, 1450 m., *D.R. Kandel, M.L. Pathak* & *G.D. Bhatt* ["*Bhatta*"] 126020, 11.6.2012, KATH].

C: **Gulmi** [Gulmi District, Kali Gandaki, 150 m. above the conflux of Andhi khola, west bank 80° 36', 27° 55', on steep bank, 505 m., *K.A. Lye* 17522, 4.10.1991, E *sub* "*C. farinosa*"], **Palpa**, **Syangja**, **Kaski** [densely forested path N. of Sinuwa on way to Bamboo Lodge, N. of Chomrong, on way to Annapurna Base Camp, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32411 (FN 58), 29.11.2006, TAIF], **Makawanpur** [Zentral Nepal, Kulikhani valley, nordhang, *c.* 1500 m., *sin.* coll. 18, 2.5.1952, G], **Dhading** [rocks in forested stream gulley above track around

mountain on N.W. side of Jamachok mountain, in from Gate no. 2 at Mureko, Nagarjun Forest, beyond N.W. side of Kathmandu Valley, off road to Kakani and Trisuli Bazaar, Dhading District, *c.* 6000 ft., *C.R. Fraser-Jenkins* 15598, 31.10.1989, E], **Kathmandu**, **Lalitpur** [wall of Royal Botanic Garden, by road, opposite and below Godawari School, Godawari, E.S.E. of Kathmandu, Lalitpur District, *c.* 1650 m., *C.R. Fraser-Jenkins* 15837, 20.11.1989, E].

?E. Thapa (2002) said probably also E. Nepal, but we have seen no specimens in any herbaria and the material from E. Nepal cited by Iwatsuki (1988) was *A. formosana*.

Himalayan distribution: China; Tibet; Myanmar; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. W. (Rajasthan; Maharashtra); W., C. and S. India; Bangladesh; Sri Lanka; Thailand; Indonesia (Java, Timor); New Guinea.

(?H or M, Sc). A rather scattered (in Nepal, but common in the W. Indo-Himalaya), but not uncommon, low to mid altitude species occurring on steep, compact, earthen and conglomerate river-cliffs, or old calcareous walls (as commonly in Kathmandu valley). Ghosh *et al*'s. erroneous report from 3000 m. could only have been due to their confusion of most of the species.

130. ***Aleuritopteris argentea*** (S.G.Gmel.) Fée (syn.: *Pteris argentea* S.G.Gmel.; *Cheilanthes argentea* (S.G.Gmel.) Kunze; *Aleuritopteris subargentea* Ching & S.K.Wu, G.M. Zhang *et al.* (2013) in the *Flora of China*, synonymised this name, and of course, var. *flava*, into *A. argentea*, which is surely appropriate and although Fraser-Jenkins (2008) reported the former from Nepal under the name *A. subargentea*, he could not actually tell the two apart, it merely being a question of developmental degree of dissection and lobing, with every intermediate stage occurring; *A. argentea* var. *flava* Ching & S.K. Wu; *A. flava* (Ching & S.K.Wu) S.R.Ghosh (reported from only one specimen in CAL, and as if Lhasa was situated in the plains of Assam State!); *A. nuda* Ching; *A. shensiensis* Ching; *A. argentea* var. *obscura* (Christ) Ching).

This species belongs to the same group as *A. tamburii*, but has smaller and more numerous lobes. Stipe thin, erect, reddish purple to dark brown-black, with a tuft of narrow concolorous, dark-reddish scales at its very base, stipe as long as or longer than the lamina; lamina small (*c.* 5 x 7 cm.), horizontal, strongly deltate, pentagonal, pinnate with the lowest pair of pinnae fully separate, but the rest only pinnatifid, pinnae triangular, with several pinnule-like lobes, the lowest basiscopic one being the longest and divided into further deep lobed, usually with a small, flat-triangular diamond-shaped wing of lamina between the lowest pinna and the next main lobe (similar to that in the S. Indian *Doryopteris concolor* (Langsd. & Fisch.) Kuhn, several *Doryopteris* species having a similar frond shape), lamina with at least the lower parts of costae and costules blackish, glabrous, but with a usually rather weak or thin white farina beneath, which can sometimes be a slightly creamy

yellowish white, some fronds can usually be found without farina, but in China some populations ("forma *obscura*") can be entirely without farina and thus confusable with *A. ducouxii* (Christ) Ching, known also from Arunachal Pradesh, but that has narrower pinna-lobes with simple regions between them and jet black costae and costules. Pseudoindusia continuous around the margins of lobes, entire.

Nepal:

C: **Mustang** [very rare, beneath dry boulders and rocks, with occasional scattered Juniperus trees, beside and just above main track, *c.* 2 km. N. of Tukuche, on path S. from Marpha, *c.* 7 km. S. of Jomsom, North West side of Annapurna Himal range, Kali Gandaki valley (W. side), Mustang District, *c.* 2700 m., *C.R. Fraser-Jenkins* & *G.B. Tamang* 30509, 27.6.2004, TAIF *sub* "*A. subargentea*"].

Himalayan distribution: China; Tibet; Bhutan [among stones under light Pinus forest, Taba, *c.* 5 km. N. of Thimphu, Thimphu District, W. Bhutan, *c.* 2500 m., *C.R. Fraser-Jenkins* 31500, 8.10.2005, THIM, TAIF; in crevices of roadside rocks, *c.* 2 km. above and S.W. of Bondey, on way to Chele La Pass and Ha, *c.* 3 km. S.E. of Paro, Paro Chhu Valley, S.W. of Thimphu, Paro District, *c.* 2700 m., *C.R. Fraser-Jenkins*, with *Rebecca Pradhan*, *T. Wangdi* & *L. Desmarches* 31597, 12.10.2005, THIM, TAIF]; Sikkim; Nepal. E. Asia; Siberia. Previous reports from the Indo-Himalaya all referred to *A. tamburii*; it does not occur in Meghlaya, one of Sir Joseph Hooker's specimens so labelled at Kew presumably being from N. Sikkim and other reports referring to Gustav Mann's collection of *A. tamburii*.

(S(T), R). A very rare and little known (in India, Nepal and Bhutan), higher-altitude species growing among stones on the ground, in crevices of rocks, or at the bases of boulders in dry inner-Himalayan areas beyond the forest, or among scattered trees.

Indian threatened status: **CR**. Nepalese threatened status: **CR**.

131. ***Aleuritopteris bicolor*** (Roxb.) Fraser-Jenk. (syn.: *Cheilanthes bicolor* (Roxb.) Griff. *ex* Fraser-Jenk.; *C. farinosa* var. *tenera* C.B.Clarke & Baker, this is not a synonym of *A. grisea* as placed by G.M. Zhang *et al*. (2013), which does not occur in or near the Khasi Nills; *A. kathmanduensis* Ching & S.K.Wu [although poorly drawn to look partly like *A. anceps*, this name belongs to *A. bicolor*, though the type is missing in KYO]; misapplied names: "*C. farinosa*" *sensu* Blanford *et auct. Asiat.*; "*A. grisea*" *sensu* Panigrahi (1960) *p.p.*, Panigrahi & Dixit (1966), *non* (Blanf.) Panigrahi; "*Cheilanthes hancockii*" *sensu* Itô (1966), *non* Baker; "*A. pulveracea*" *sensu* Saiki (1984), Chandra (2000) *et auct. Ind*., *non* (C.Presl) Fée [a synonym of *A. argyrophylla* Fée from Africa]; "*A. doniana*" *sensu* Ghosh *et al.* (2004), *non* S.K.Wu, *nom. superfl.* [= *A. dealbata*]; "*A. platychlamys*" *sensu* Ghosh *et al.* (2004), *non* Ching [= *A. grisea* (Blanf.) Panigrahi]).

As long since discovered (Manton & Sledge 1954, Manton, Roy & Jarrett 1966 and Verma & Loyal 1960), the Afro-Arabian, tetraploid sexual species, *A. farinosa* (as also the triploid apomictic *A. argyrophylla*, both chromosome-counted from Africa

by Manton (vouchers in BM, and in herb Panigrahi, ASSAM, CAL), are not present in the Indian subcontinent, despite many continuing uncritical reports of it (*e.g.* Dixit 1984, Chandra 2000 and many local papers) in error for several Indian species of the genus, but chief among them, in the sense of Blanford, being *A. bicolor*, whereas *A. farinosa* itself is more similar and presumably related to *A. anceps*.

A. bicolor is the main "Silver Fern", or "Rani Sinkha" in Nepali, the smooth stipe used to plug ear-piercing holes without infection and the whole lamina swallowed to settle stomach upsets in villages. Stipe long, thin, dark purplish brown, with very narrow, bicolorous scales confined to near the stipe-base and none on the upper stipe, rachis, costae *etc*.; lamina markedly deltate-pentagonal, the lowest pinnae the longest, with markedly long basal basiscopic pinnules, rather finely dissect or lobed, pale, often yellowish green, white-farinose beneath, though not as densely and smoothly so as in *A. anceps*. Though the frond-shape is similar to *A. subdimorpha*, it is a much more delicate species with a thinner and browner stipe, more finely lobed pinnules, and narrower, all bicolorous scales with pale margins. Diploid sexual.

Nepal:

W: **Dadeldhura** [Bachela gad, in Acacia forest, 250 m., *K.R. Rajbhandari, P.M. Regmi* & *K.J. Malla* 5151, 9.8.1990, KATH], **Darchula** [locality data and date missing in KATH, presumably given in TI, *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yaho, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1214069, KATH], **Kailali** [forested bank of lake, on S.W. side of Godhagodhi Lake, Sukhar, *c*. 40 km. E. of Attariya and Dangadhi, Kailali District, *C.R. Fraser-Jenkins* 34706 (FN 208), 24.11.2010, TAIF], **Doti** [above Doti Bazar, way to Khaptad, Doti District, 1800 m., *M.L. Pathak, D.R. Luitel* & *K.R. Bhattarai* 201275, 21.4.2012, KATH, det. CRFJ], **Bajhang** [Bajhang District, hillside west of Chainpur, 29° 33' 10", 81° 11' 34", steep SE facing slope, in scree growing under shrubs, 1333 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915048, 5.7.2009, E, KATH], **Bajura** [Ukhadigaon, in Pinus roxburghii forest, 1696 m., Bajura Distr., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 2521 *p.p.*, 16.8.1976, KATH, KYO], **Bardiya** [Neupani, Bardiya Distr., 570 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 30321, 19.12.1983, KYO and *ditto*, 30477, 26.12.1983, KYO, A], **Surkhet** [banks of river Kharekhola, from path *c*. ½ km below and S.W. of Kharekhola village, down stream into Sal forest, *c*. 1 km below and S. of Kharekhola village, *c*. 3 km N.N.E. of Surkhet, Surkhet [Birendranagar] District, *C.R. Fraser-Jenkins at al.* 25578 (FN 1565), 27.9.1997, H], **Dailekh** [between Dhungeswar and Talpokhari, Dailekh Distr., 780 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, Y. Yasuda* & *A. Ujihara* 14436, 13.11.1982, KYO, A; Latopani, Dailekh, *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 30102, 8.12.1983, KYO], **Jajarkot**

[Jajarkot, on dry stony banks, 3500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5797, 17.10.1952, BM, E, KYO], **Jumla** [Bumra, on shady and moist rocky hill slope, 2700 m., *T.B. Shrestha* & *N.P. Manandhar* 128, 12.10.1975, KATH], **Banke**, **Salyan**, **Dang** [Chyalapani, Dang, *Keshab Shrestha* NMHTU-6B-00416, 4.3.2043 (Nepali date) TU Nat. Hist. Mus.; Dang, Koilabas, on rocky and shady place, 182 m., *Jeet Bahadur*, 14551, *sin.* date, KATH], **Rukum**, **Pyuthan** [Khalanga, Pyuthan, 1450 m., *D.R. Kandel, M.L. Pathak* & *G.D. Bhatt* ["*Bhatta*"] 126018, 11.6.2012, KATH].

C: **Gulmi** [Gulmi District, Kali Gandaki, 150 m. above the conflux of Andhi khola, west bank, 83° 36', 27° 55', on steep bank, 505 m., *K.A. Lye* 17522, 4.10.1991, E *sub* "*C. farinosa*" in error], **Rupandehi**, **Baglung** [Jimire, Baglung, on moist rock crevices, 1600 m., *N.P. Manandhar* 915-91, 7.9.1971, KATH], **Myagdi**, **Mustang** [Tatopani to Ghasa, Mustang, 1350-2150 m., *V.L. Gurung* 1451/81, 24.6.1981, KATH**]**, **Manang** [Lete Phant - Lam Pata, 842283, on open rocky slope, 920-1270 m., *D.P. Joshi* & *M.M. Amatya* 73/293, 7.7.1973, KATH], **Palpa**, **Parbat** [between Khaniyaghat and Benari, near Kusma, Parbat Distr., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 3997, 27.9.1976, KYO; Naudanda to Birethanti, Parbat, 1600-1180 m., *V.L. Gurung* 1383/81, 19.6.1981, KATH], **Syangja** [Hyenda - Naudanda, 1100-1300 m., *Y. Suehiro* 145 (ii-1), 21.9.1976, KYO *sub* "*C. farinosa*"], **Kaski** [Pokhara, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6762, 12.8.1954, E, GH *sub* "*C. dealbata*" in error; Pokhara, on walls, 900 m., *T. Wraber* 127, 9.9.1969, BM; Pokhara, 2000 m., *K. Hondo* 758519, 5.8.1975, KYO], **Lamjung** [Pheligsanku, 28° 13', 84° 24', 650 m., *J.F. Dobremez* 647, 25.11.1970, BM], **Gorkha**, **Chitwan** [Ramnagar, Chitwan District, shady gullies in Sal forest, 400 m., *K. Wesche* 170, 6.1994, BM], **Makawanpur**, **Parsa** [Parsa Distr., Parsa Wildlife Reserve, along Bhalu khola, 27° 13' 55" - 27° 14' 17", 84° 57' 07" - 84° 57' 24", on shady steep slope by stream, 220 m., *M. Mikage, T. Kajita, N. Kondo, P.R. Shakya, T. Shimizu, P. Shrestha, Y. Tsuda* & *K. Yonekura* 9552862, 11.10.1995, BM, KATH], **Bara**, **Dhading** [forested slopes above track leading into Nagarjun forest from Gate no. 2 at Mudko (Mareko), N.W. side of Jamachok Hill, N.W. of Balaju off Kakani road, N.W. of Kathmandu, Dhading District, *C.R. Fraser-Jenkins* & *Sagun Pariyar* 34983 (FN 261), 4.12.2011, TAIF diploid, 2*n* = 60, from root-apex, det. S. Matsumoto, 2013], **Nuwakot**, **Rasuwa** [Bainse (600 m.) - Betrawati (700 m.) - Sim Ghotala (900 m.), 851276 - 851281 [*sic*], *H. Kanai, H. Hara* & *H. Ohba* 725873, 19.8.1972, BM, TI], **Kathmandu** [the cut, Bagmati gorge, 5000 ft., *R.L. Fleming* 1265, 22.8.1956, DD; Kathmandu, près de l'aerodrome, ravins sud-ouest, 2650 m., *A. Zimmermann* 1007, 3.9.1954, G; Gaucher Forest [now Kathmandu Airport], Kathmandu, sandy overhanging banks, 4300 ft., *R.L. Fleming* 1932, 9.8.1969, MICH, *ditto* 1952, 10.9.1969, KYO, *ditto* 2222, 10.9.1975, MICH; Kathmandu Airport, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305022, 13.10.1963, K, US, TI, KYO, A *sub* "*C. hancockii*" in error; Nagarjun, wall, 2500 ft., *Miss V.L. Shrestha* [*Gurung*], *Miss R. Thapa* & *Mr. P. Pradhan* 7236, 9.5.1969,

US; Sundarijal, 27° 45', 85° 15', on rocks and walls, 1400 m., *J.F. Dobremez* 865, 29.8.1971, G, KATH], **Lalitpur** [Got Dada, Phulchowki, 4000 ft., *R.K. Manandhar* 1058, 2024.3.8 [= 22.6.1967], US; Chapagaon forest, 4700 ft., *R.L. Fleming* 2233, 22.7.1976, MICH, *sub* "*A. pulveracea*" det. Y. Saiki, 4.12.1985, in error; Godawari, S. of Kathmandu, between rocks on the side of a wall, north-aspect, shady, 5300 ft., *A.D. Schilling* 1088, 4.10.1966, K], **Bhaktapur**, **Sindhupalchok** [Barhabise - Thala (Khalincok), 800 m., *H. Kanai, C. Chuma* & *T. Nagano s.n.*, 9.9.1970, KATH], **Kabhrepalanchok** [Hukse to Dolaghat, *c.* 3000 ft., *M.L. Banerji* 1178, 7.10.1960, A; 15 miles E. of Kathmandu valley, open ditches, 3800 ft., *R.L. Fleming* 2369, 26.7.1977, MICH, KYO *sub* "*C. hancockii*" in error], **Sindhuli**, **Dolakha** [Lamosangu to Jiri road, Thumpakhar, 1450 m., *Ruth Schaffner* 494, 1124, 20.9.1983/27.10.1983, ZT; Bhorle, Dolakha, 1110 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121113, 8.11.2012, KATH].

E: **Udayapur** [Udayapur Distr., Beltar (180 m.) - Kattike (440 m.) - Darula (600 m.) - Baplung (490 m.) - Simule (170 m.), 26° 48' 54" - 26° 52' 23", 86° 49' 05" - 86° 53' 05", on shady steep slope at pathside, 190 m., *M. Mikage, T. Kajita, F. Kiuchi, N. Kondo, P. Lacoul, M. Suzuki* & *K. Yonekura* 9558003, 24.10.1995, KATH], **Bhojpur** [Saju khola (1400 m.) - Dingla (1000 m.), 873274-873273, on rather dry rock in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725413, 1.7.1972, BM], **Sankhuwasabha** [Tumlingtar, Sabbaya khola, 27° 18', 87° 13', walls of ravines and shady cliffs, 1800 ft., *A.H. Norkett* 8002, 7.12.1961, BM; E. Nepal, Waleng to Walung, *c.* 3500 ft., *M.L. Banerji* 1590, 29.4.1965, A; Upper Arun valley, Choyung, *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Upadhyaya* & [*B.B.*] *Baskola* 3392 *p.p.*, 29.4.1965, US *sub* "*C. anceps*" det. D.B. Lellinger 1972, in error], **Sunsari** [above Dharan, overhanging banks, 1800 ft., *Robert L. Fleming* 2629, 6.10.1978, KATH *sub* "*C. hancockii*" in error], **Morang**, **Dhankuta** [E. Nepal, Phushri - Sanguri Bhajyang - Dhara Pani, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305023, 16.10.1963, TI, KYO *sub* "*C. hancockii*" in error], **Jhapa**, **Ilam** [Ranga Pani - Chiso Pani, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama s.n.*, 9.12.1963, TI, and 6305027A, 9.12.1965, TI; Mechi River, limestone wall crevice, 1500 ft., *R.L. Fleming* 2041, 20.12.1971, K *sub* "*C. grisea*" in error, and det. *G.M. Zhang* 2012 as "*C. subdimorpha*" in error], **Panchtar** [Irkhun valley, below Phedi, E. Nepal, 3500 ft., *N.D. Bachkheti* 21, 30.1.1959, DD], **Taplejung** [Dumhan, Taplejung, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305024, 30.10.1963, TI and *ditto, s.n.*, 1.11.1963, KYO *sub* "*C. hancockii*" in error; Arun valley, Khandbari, on tree roots, 1200 m., *T. Wraber* 63, 27.8.1972, BM *sub* "*C. anceps*" in error; above Mewa River, 3000 ft., *R.L. Fleming* 2040, 1.12.1971, K; near Dhoban, Taplejung Distr., *R.L. Fleming* 2398, 2.1978, MICH].

Total distribution: Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Haryana; Jammu & Kashmir; Pakistan. Rajasthan;

Bihar; Maharashtra; Orissa; W., N.E., C. and S. India; Meghalaya; Mizoram; Tripura; Bangladesh; ?Thailand (towards *A. subdimorpha*); Laos; W. Africa (French Guinea). Material from Sumatra and New Guinea belongs to *A. subdimorpha*, or very near. Apparently absent from China.

(?H or M, C). An abundantly common species of banks *etc*. with a wide altitude range from low to upper-mid altitude, though commonest at lower mid altitude, preferring banks, semi-open slopes, roadsides, walls *etc.*

[***Aleuritopteris bullosa*** (Kunze) Ching was listed by Chandra (2000) as present in Nepal, Bhutan, China, Thailand and Australia in his confection of names from Indian literature, but it is endemic to S. India and Sri Lanka.]

132. ***Aleuritopteris chrysophylla*** (Hook.) Ching (syn.: *C. chrysophylla* Hook.; *C. argentea* var. *chrysophylla* (Hook.) Hook.; *C. farinosa* var. *chrysophylla* (Hook.) C.B.Clarke; *Aleuritopteris farinosa* var. *chrysophylla* (Hook.) Panigrahi; *C. argentea* var. *sulphurea* C.B.Clarke; *A. flavopygmaea* S.R.Ghosh; *A. humatifolia* X.C.Zhang & L.Shi).

Plants usually small, *c.* 2-10 cm, tall, with long, thin, reddish-purple stipes bearing a few bicolorous scales in their lower half, but not on the rachis or beneath the costae, lamina pinnate-bipinnatifid, with compact and less lobed pinnules; farina beneath lamina bright yellow, unlike all other species in the region.

Nepal:

C: **Rasuwa** [rocks beside road, by first cliff north of Ramche, *c.* ¾ km. N. of Ramche on road to Dhunche, Syabru Bensi (and Langtang), N. of Trisuli Bazaar and Kalikasthan, N. of Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins* 21362 (FN 29), 28.9.1994, E].

E: **Sankhuwasabha** [6 miles E. of Chainpur, E. Nepal, 9000 ft., *R.L. Fleming* 2208, 1.12.1974, MICH], **Tehrathum** [Dor - Tinjure - Tinjure Phedi - Chauke, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725151, 7.6.1972, TI; Gupha Pokhari - Kopinkharka, 3021 m., *H. Ikeda, D.R. Kandel, R. Chhetri, H. Uchiyama, K. Akai, H. Taneda, O. Yano, N. Yamamoto, K. Miyata & M. Nakaji* 1228026, 10.8.2012, KATH], **Ilam** [Bilbatay Bhanjyang - Tinjuray - Hati Sar, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi & T. Tuyama* 6305016, 27.10.1963, TI, KYO; Minchin Dhap - Mai Pokhari, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi & T. Tuyama* 6305018, 29.10.1963, TI, KYO].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; W. Bengal; Nepal; Himachal Pradesh [rare]. Meghalaya; Thailand.

(S, R). An uncommon and very occasional higher-altitude species, usually growing among deep moss and grasses on steep slopes or cliffs, or on rocks and banks in sheltered and very damp, semi-open places.

Nepalese threatened status: **VU**.

133. ***Aleuritopteris dealbata*** (C.Presl) Fée (syn.: *Cheilanthes dealbata* D.Don, *non* Pursh; *Allosorus dealbatus* C.Presl; *Aleuritopteris doniana* S.K.Wu, *nom. nov. superfl.*; *Cheilanthes doniana* Fraser-Jenk. & Khullar, *nom. nov.* [as "*comb. nov.*" in error] (the correct name in *Cheilanthes*); *Aleuritopteris gymnocarpa* Ching, *nom. nud.*; *Aleuritopteris interrupta* Saiki, Fraser-Jenkins (2008) placed this name as a synonym of *A. anceps*, though while studying type material at KYO, Z and MO he came to differing conclusions as to whether it is material of *A. anceps* or *A. dealbata*, but G.M. Zhang *et al.* (2013) have reidentified it as *A. dealbata*, which is accepted here; *Aleuritopteris sikkimensis* S.R.Ghosh; misapplied names: "*A. albomarginata*" *sensu* Itô (1966), Iwatsuki (1975, 1988) *p.p. max.*, *non* (C.B.Clarke) Ching; "*C. mexicana*" *sensu* Punetha *p.p*, *non* (Fée) Punetha & Kholia, *nom. illeg.*, *non* Davenp. [= *A. mexicana* Fée, from C. & S. America]).

A spectacularly long-fronded, pendent species (to *c.* 80 cm.); stipes thick, glossy-black, their basal halves bearing scattered and readily deciduous, wide yellowish-brown scales, with concolorous bases and a central dark stripe towards their gradually darker brown apices, scales not extending onto the rachis *etc*., lamina very long and narrow, narrowly triangular lanceolate, usually rather darkish green, pinnae with wide segments, the mid and upper ones almost unlobed, unlike in *A. anceps*, usually with obtuse, rounded apices, lower pinnuleson lower pinnae lobed, but not as long or as deeply lobed as in *A. anceps*, markedly compactly, bright-white farinose beneath; sori usually becoming separated into small lobes, which sometimes have only a very narrow indusium, occasionally none, but which becomes continuous in more fully fertile and compact fronds. Diploid (*2n* = 58, from root-apex, det. S. Matsumoto, 19.4.2013, on *C.R. Fraser-Jenkins* & *S. Pariyar* 34982 (FN 260), 4.12.2011, from wall by Gate no. 2, Mureko, Nagarjun, Kathmandu, Nepal). A living plant from this same locality was illustrated on the front cover of Fraser-Jenkins (1997), held by Deepak Lama (the title was inadvertently omitted).

Nepal:

W: **Baitadi** [Dorepani - Bagadi, on vertical rock under shade, 1540-580 m., *M.M. Amatya* & *P.M. Regmi* W881/82, 17.9.1982, KATH], **Darchula** [west-facing, mossy cliff-slopes overlooking and on east side of the village of Darchula, immediately E. of the Kali river (border with India), Darchula District, 860 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang*, *A.M. Thapa* & *B. Pariyar* 21483 (FN 150), 16.11.1994, E], **Bajhang** [Chainpur - Jimkot, Bajhang Distr., on open slope, 1200 m., *K.R. Rajbhandari* 15575, 25.8.1991, KATH], **Bajura**, **Dailekh** [roadside boulders, between Kidikada khola and Khusma, Tulo Dhungeswar and Padukasthan north to Manma (Kalikot), on rough road from Surkhet to Jumla, Dailekh District, *c.* 800 m., *C.R. Fraser-Jenkins* & *S. Pariyar* 35149 (FN 23), 23.9.2013, TAIF], **Rolpa**.

C: **Baglung**, **Myagdi** [Ranipauwa, N. of Beni, Kali Gandaki, 3500 m., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 7644, 3.9.1954, E; Tara khola, W. of Beni, on rocky bank, 6000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 489, 8.5.1954,

E, GH], **Kaski** [C. Nepal, Pokhara - Hyenda, 1000-1100 m., *Y. Suehiro* 77, 20.9.1976, KYO; path through woods on S. side of bend of Madi Khola, below and N. of Kalikasthan, on way to Madibesi and Chitre, N. of Begnas Tal, E. of Pokhara on path to Sikles, S.E. side of Annapurna range, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 26280 (FN 2258), 13.4.1998, BM, H], **Palpa** [4 mi. W. of Tansing, "W. Nepal", on rocks, 3000 ft., *R.L. Fleming* 956, 6.11.1949, KATH *sub* "*C. farinosa*", and 5 mi. N. of Riri Bazaar, "W. Nepal", 2200 ft., *R.L. Fleming* 935, 7.11.1949, DD, UC, *sub* "*C. farinosa*" det. K.M. Vaid], **Makawanpur** [roadside cliff with bushes, 1 mile N. of Tirkande Swar Mahadev Shiva temple, on "Rajpath Road", *c.* 5 miles N. of Hetauda, Hetauda to Daman and Kathmandu, Makawanpur District, *c.* 3000 ft., *C.R. Fraser-Jenkins* 15573, 19.10.1989, E], **Nuwakot**, **Dhading** [back of Nagarjong hill, on cliff, 1500 m., *D.H. Nicolson* 3257, 2.5.1967, KATH, MICH; between Dhamechour and Narkunde, S. of and above Naubise on "Rajpath highway" to Tistung and Hetauda, rocky banks beside road, *C.R. Fraser-Jenkins* 26416 (FN 2394), 11.8.1998, H; forested slopes above track leading into Nagarjun forest from Gate no. 2 at Mudko (Mareko), N.W. side of Jamachok Hill, N.W. of Balaju off Kakani road, N.W. of Kathmandu, Dhading District, *C.R. Fraser-Jenkins* & *Sagun Pariyar* 34982 (FN 260), 4.12.2011, TAIF, diploid det. S. Matsumoto, 19.4.2013]; **Kathmandu** [Ropeway, Chandragiri, under dry rock, 5500-7200ft./ 6500 ft., *Dr. R.L. Fleming* 1287, 28.8.1956, DD, KATH *sub* "*C. farinosa*" det. K.M. Vaid, Forest Research Inst., Dehra Dun; back of Nagarjun Hill, 1500 m., *D.H. Nicolson* 3257, 2.5.1967, US; Kathmandu valley, Nagarjun (1350-1600 m.), *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8330025, 29.6.1983, BM *sub* "*C. albomarginata*" in error; old wall in forest, just above road-bank near gate no. 1 into S.E. side of Nagarjun forest, below Jamachok, *c.* 1-3 km. N.W. of Balaju, on Trisuli Bazaar road, N.W. part of Kathmandu City, Kathmandu District, *C.R. Fraser-Jenkins* 25552, 25553 (FN 1530, 1531), 5.9.1997, BM, H], **Lalitpur** [Godawari (1600 m.) - Phulchauki (2500 m.), Kathmandu, *H. Kanai, G. Murata, H. Ohashi* & *T. Yamazaki* 12745, 23.6.1967, BM, KYO *sub* "*C. farinosa*"], **Kabhrepalanchok**, **Sindhupalchok** [steep path through dense forest down below the "Bungy-Jumping" bridge across Bhote Khosi river, below Listikot, E. of Palang village, N.W. side of Bhote Khosi river, *c.* 3 km. S.W. of Chaku, N. of Bharabise on road to Tatopani and Tibet, N.E. of Kathmandu, Sindhupalchok District, *c.* 1050 m., *C.R. Fraser-Jenkins* 28977 (FN 4952), H], **Dolakha** [Tamba Kosi, Totlabari (1100 m.) - Jagat (1100 m.) - Chhetchhet (1350 m.) - Simigaon (1950 m.), 862275 - 862276, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331608, 29.8.1983, BM *sub* "*C. albomarginata*" in error].

E. Thapa (2002) said presumably also in E. Nepal, but we have seen no specimens from there, though it is certainly likely to be present.

Total distribution: China; Myanmar; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [rare]; Thailand.

(S, Sc). A fairly common species scattered through Nepal at mid altitude, growing on steep banks, rocky roadside cuttings and in crevices in cliffs, preferring rock of a calcareous nature.

134. ***Aleuritopteris dubia*** (C.Hope) Ching (syn.: *C. dubia* C.Hope; *Cheilanthes leveillei* Christ; *C. subrufa* Baker; *A. subrufa* (Baker) Ching; *A. humatoides* Saiki, type removed from KGU and taken to KUN; *C. wusukungii* Miyam. & H.Ohba).

Intermediate between *A. albomarginata* and *A. rufa*, with the many dense, linear, hair-like fibrils and scales of *A. rufa*, but a deltate lamina as in *A. albomarginata*, not narrowly lanceolate and slightly narrower at the base as in *A. rufa*. The spores are not abortive, nor larger than other related species. Occasional intermediates between *A. rufa* and *A. albomarginata* are not difficult to find, but in a study in 1991 and 2005 by CRFJ of plants (*CRFJ* 18606-18620, E; *CRFJ* 31113-31116, TAIF), including intermediates, in the type locality between Dehra Dun and Mussoorie, Uttarakhand, all these plants had good spores of a similar size, unlike hybrids involving other species in the genus. However the majority of plants rather clearly fall into one of the three species, even though the group seems to be intimately intraconnected and a few plants are rather intermediate in morphology. It is perhaps still in a stage of differentiation ecologically, which would also fit with Prof. E. Wollenweber's analysis at E.T.H. University, Darmstadt, of the farina of the material of the three species and intermediates CRFJ collected, which unlike all other species of the genus, all showed identical flavinoids.

Nepal:

W: **Darchula** [west-facing, mossy cliff-slopes overlooking and on east side of the village of Darchula, immediately E. of the Kali river (border with India), Darchula District, 860 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang, A.M. Thapa* & *B. Pariyar* 21484 (FN 151), 16.11.1994, E], **Surkhet** [among semi-calcareous metamorphic roadside rocks on slopes in semi-open Pine forest, just below Cheda hamlet, *c*. 20 km. N. of Surkhet (Birendranagar) town, on road north to Dailekh, Surkhet District, *c.* 1300 m., *C.R. Fraser-Jenkins* 35144, 35145 (FN 17, 18), 22.9.2013, TAIF].

C: **Kaski** [path in semi-open forest on W. facing slope, *c.* 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c*. 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c*. 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *c.* 1800 m., *C.R. Fraser-Jenkins* 26161-26163 (FN 2139-2141), 13.3.1998, H], **Dhading** [rocks in forested stream gulley above track around mountain on N.W. side of Jamachok mountain, in from Gate no. 2 at Mureko, Nagarjun Forest, beyond N.W. side of Kathmandu Valley, off road to Kakani and Trisuli Bazaar, Dhading District, *c.* 6000 ft., *C.R. Fraser-Jenkins* 15594, 15595, 31.10.1989, E], **Kathmandu** [Ropeway, Chandragiri, 5500-7200 ft., *R.L. Fleming* 1285 *p.p.*, 28.8.1956, MICH, DD; Baghyaban, Kathmandu valley, 5000 ft., *R.L. Fleming* 1580, 27.9.1958, MICH; Sankhu, Kathmandu, *T. Nakaike* 1054, 24.8.1986, KGU], **Lalitpur** [Godawari, "N." [S.E.] of Katmandu, on clearings,

K. de B. Codrington 112, in 1956, BM; Godaveri, Kathmandu valley, 4800 ft., *R.L. Fleming* 1945, 15.8.1969, MICH *sub* "*C. rufa*" in error], **Kabhrepalanchok**, **Sindhupalchok** [steep path through dense forest down below the "Bungy-Jumping" bridge across Bhote Khosi river, below Listikot, E. of Palang village, N.W. side of Bhote Khosi river, *c.* 3 km. S.W. of Chaku, N. of Bharabise on road to Tatopani and Tibet, N.E. of Kathmandu, Sindhupalchok District, *c.* 1050 m., *C.R. Fraser-Jenkins* 28974 (FN 4949), 5.6.2001, H].

E. Listed by Thapa (2002) from E. Nepal, but we have seen no other reports and no material from there in any herbaria, though there is no reason to suppose it would not be there.

Total distribution: China; Tibet; Myanmar, Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir. Maharashtra [Mahabaleshwar, *V.D. Vartak* 20, 10.1975, BSA]; Thailand; Vietnam; Taiwan; Philippines.

(S, Sc). A fairly common, but scattered species, often less numerous in populations than *A. dalhousieae* and *A. rufa*, occurring at mid to upper-mid altitudes, on old walls, roadside banks, cliffs, preferring calcareous substrates.

135. ***Aleuritopteris duthiei*** (C.Hope) Ching & S.K.Wu (syn.: *Cheilanthes duthei* C.Hope; *Leptolepidium duthiei* (Baker) X.C.Zhang & G.M.Zhang).

Plants vary from *c.* 4 cm. tall (and precociously fertile) to *c.* 20 cm. tall when fully grown (not particularly small, as mentioned by Zhang *et al.* (2013), though the type and thus Hope's description of it is a stunted small plant, only *c.* 5 cm. tall); stipe dark brown, often longer than the lamina bearing scattered ovate to ovate-lanceolate, pale brown scales towards the base; lamina delicate-herbaceous, pale-green, densely sticky-glandular, without farina, costae prominently grooved above, lamina triangular-lanceolate when small, ovate-pentagonal when full-grown, becoming tripinnate at its base, pinnae triangular-lanceolate, lowest basiscopic pinnules obviously the longest, pinnulets ovate with toothed edges; sori separated into short lobes around the margins, pseudoindusia interrupted into short lobes, edges toothed to fimbriate. Distinguishable from *A. leptolepis* by its wider and more dissect fronds, more separate segments and toothed edges, with more separate lobes of indusia.

Nepal:

W: **Rukum** [east of Chalike Pahar, earth banks, among dwarf shrubs, 13,000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4594, 25.9.1954, BM, E, GH *sub* "*C. dalhousiae*", det. A.H.G. Alston, in error].

C: **Gorkha** [Bimtakothi, in shade of dwarf bushes on steep rocky hillside, *c.* 12,500 ft., *D.G. Lowndes* L.1464, 26.8.1950, BM], **Rasuwa** [slightly mislabelled: "Dumse [Dhunche] to Chandanbari, 3000-3200 m.", *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 1002/79, 17.9.1979, KATH *sub* "*C. subvillosa*" in error, but the specimen must have been from above Chandanbari; another specimen of the same collection

and number is correctly labelled: Chandanbari to Gosainkund, on shady slope along the trekk [*sic*], 3200-4250 m.], **Dolakha** [Beding, on the bank of Rolwaling river, 12,000 ft., *P.R. Shakya*, *K.R. Rajbhandari* & *H.K. Saiju* 2999, 19.7.1975, KATH].

E: **Sankhwasabha** [Thudam, E. Nepal, 873275, on clayey slope along river in open place, 3400 m., *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725236, 22.6.1972, BM, KATH, TI *sub* "C. duthiei" in error], **Solukhumbu** [Namchee to Thyangbochee, in rock crevices, *c.* 12,500 ft., *M.L. Banerji* 1891, 28.7.1966, A, cited by Banerji (1972) as "*C. dalhousiae*" in error; Panboche - Fereche, on shady crevices of stones, *c.* 14,000 ft., *Dr.* [*M.L.*] *Banerjee* & *P.R. Shakya* 5705, 2023.4.15 [= 8.1966], KATH *sub* "*Cheilanthes dalhousiae*" in error].

Total distribution: China; Tibet; Bhutan; Sikkim; Nepal; Uttarakhand [type locality, Gangotri, Chamoli].

(S(T), R). A rare high-Himalayan species, occurring in crevices in acid rock cliff-faces.

Indian threatened status: **CR**. Nepalese threatened status: **EN**. Globally threatened.

136. ***Aleuritopteris formosana*** (Hayata) Tagawa (syn.: *Cheilanthes formosana* Hayata; *C. brevifrons* (Khullar) Khullar; misapplied names: "*A. anceps*" *sensu* Ching *et auct. plur. Sin., Jap. et Ind., non* (Blanf.) Panigrahi; "*A. grisea*" *sensu* Panigrahi (1961) *p.p.*, Panigrahi & Dixit (1966), *non* (Blanf.) Panigrahi; "*A. albomarginata*" *sensu* Singh & Panigrahi (2005) *p.p. max., non* (C.B.Clarke) Ching, but excl. photo 198 [= *Cheilanthes nitidula*] and plate 204 [= *A. albomarginata*, but presumably not from the area]). *A. formosana* was found by Fraser-Jenkins (1992, 1997 *etc.*) to be the correct name for this species then being called *C. brevifrons* in India, and as if endemic to the W. Indo-Himalaya.

A. formosana is a small, loose-rosette forming plant, with leaves *c.* 10 cm. long, though becoming larger (to *c.* 20 cm.) when sheltered, stipe rather thin, black, bearing many small, bicolorous, pale-edged scales, smaller and narrower than in *A. anceps* (but wider than in *A. bicolor*), scales extending up most of the rachis, but not present on the pinna-costae, apart from an occasional one or two rarely being present, ocasional white farinaceous glands scattered up the stipe and rachis in living plants, but easily lost on pressing; lamina bipinnate, slightly narrowly lanceolate, narrowed slightly to its base, so that the basal pair of pinnae are not usually the longest, strongly bullulate-wrinkled above; pseudoindusia prominent, brown, divided into crowded lobes around the edge of the segments, fimbriate-dentate apically; farina bright white and smooth beneath, but not appearing as bright white as in *A. anceps*, as the brown, matured sori are often rather wide and may cover half of the lamina. Diploid sexual.

Nepal:

W: **Dadeldhura**, **Darchula** [W. facing forested rocks below cliffs by path, *c.* 2 km.

N. of Dumling (opposite Jipti on the Indian side), on path south to Darchula, E. side of Kali river, Darchula District, *c.* 1800 m., *C.R. Fraser-Jenkins* 21692 (FN 359), 22.11.1994, E], **Bajhang** [Talkot-Aagar, terrestrial, 2100 m., *K.R. Rajbhandari* 15339, 18.8.1991, KATH], **Bajura** [Ukhadigaon, in Pinus roxburghii forest, 1696 m., Bajura Distr., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 2521 *p.p.*, 16.8.1976, KATH, KYO], **Surkhet**, **Dailekh** [in remnant Quercus and Rhododendron forest, on rocky banks or on epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c*. 40 km N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins et al.* 25621 (FN 1599), 26.9.1997, H.], **Jumla** [Kudari - Nagma, Jumla Distr., *H. Tabata, D.P. Joshi, K. Tsuchiya, Y. Yasuda* & *A. Ujihara* 14162, 6.11.1982, KYO], **Mugu** [Lumsa - Chhaila, Mugu Distr., W. facing slope, 1920 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 16964, 23.7.1983, KYO, A; Lumsa - Gumgadi, Mugu Distr., 2430 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 21307, 5.11.1983, KYO], **Dang** [Balle, 5300 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 614, 27.3.1952, E], **Pyuthan**.

C: **Palpa** [4 mi. N.W. of Tansing, "W. Nepal", on rocks, 3000 ft., *R.L. Fleming* 1244, 6.11.1949, KATH *sub* "*C. farinosa*"], **Baglung** [Lumsum, S. side of Dar khola below Lumsum, wooded gully, in sheltered crevices amongst boulders near river, *c.* 6000 ft., *A.R. Vickery* 457, 25.3.1974, BM], **Myagdi** [Tarakhola, W. of Beni, steep rocky bank, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 493, 8.5.1954, BM], **Parbat**, **Kaski** [Sallyan, near Pokhara, 5000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7079, 6.9.1954, E; on path from Landrung to Gandrung, on rather dry undersides of rocks, 5500 ft., *Sir Colville Barclay* (Pitshill, Petworth) & *Patrick M. Synge* (R.H.S., Wisley) 2244, 24.5.1971, K; Deurali - Landrung via Gandrung, Kaski Distr., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 19133, 2.8.1983, KYO], **Gorkha** [Buri Gandaki, Philim, under boulders on open hillsides, 5200 ft., *P.C. Gardner* 351, 13.4.1953, BM], **Makawanpur**, **Dhading** [Ganesh Himal, Ankhu khola, 28° 12', 85° 05', riverside beneath overhaging rocks, 6000 ft., *J.D.A. Stainton* 3657, 2.5.1962, BM; Kalinchok - Barabisa (850 m.) - Thula (2050 m.), *H. Kanai, C. Chuma* & *T. Nagano s.n.*, 9.9.1970, TI], **Rasuwa** [forest above road, *c*. half way between Ramche and Dhunche, N. of Trisuli Bazaar and Kalikasthan, on road to Langtang Valley, N. of Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins* 15631, 15632, 9.11.1989, E], **Nuwakot**, **Kathmandu** [Sankhu, 10 miles N.E. of Kathmandu, *K. de B. Codrington* 34, 8-11.7.1956, BM], **Lalitpur** [Godawari, boundary wall of the fields, 4500 ft., *B.D. Pande* 254, 18.8.1956, DD], **Bhaktapur**, **Rasuwa** [3 miles from Langtang village, "10,000" ft. [anomalous altitude], *R.L. Fleming* 1982B, 20.10.1969, K *sub* "*C. anceps*"], **Sindhupalchok** [steep path through dense forest down below the "Bungy-Jumping" bridge across Bhote Khosi river, below Listikot, E. of Palang village, N.W. side of Bhote Khosi river, *c*. 3 km. S.W. of Chaku, N. of Bharabise on road to Tatopani and Tibet, N.E. of Kathmandu, Sindhupalchok District, *c.* 1050

m., *C.R. Fraser-Jenkins* 28976 (FN 4951), 5.6.2001, H], **Dolakha**, **Ramechap** [between Shivalaya and Bhandar, 1800-2500 m., *T. Nakaike* 3134, 6.10.1988, KATH].

E: **Okhaldhunga** [Torkhe à Okhaldunga, rochers en plein soleil, exp. E. et S.E., 1950 m., *A. Zimmermann* 1989, 2.11.1954, BM, E, G, KYO, *sub* "*C. albomarginata*"], **Sunsari** [Dharan (400 m.), 872266, on dry bank along path in open place, *c.* 450 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725036, 2.6.1972, BM *sub* "*C. albomarginata*" in error], **Sankhuwsabha** [Papung (2000 m.) - Bir Gaon (1600 m.), 873274, in muddy crevices of cliff along path in open place, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725384, 30.6.1972, BM, TI], **Dhankuta** [Sanguri, Dhankuta, in open field, 4100 ft., *R.L. Fleming* 1942, 12.7.1971, KATH and *ditto*, 4500 ft., *R.L.Fleming* 2252, 16.8.1976, MICH; Mure [Mude] (2100 m.) - Sinduwa (2100 m.), 872271, along path in half shaded place, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725067, 5.6.1972, BM *sub* "*C. albomarginata*" in error], **Jhapa**, **Ilam** [3 mi. W. of Raja Rani, Ilam, 5900 ft., *R.L. Fleming* 2597, 3.10.1978, MICH; 3 mi. W. of Chisapani, Ilam, overhanging banks, 6300 ft., *R.L. Fleming* 2602, 1.10.1978, MICH *sub* "*A. grisea*" in error; above Pua khola, Ilam Distr., 5400 ft., *R.L. Fleming* 2039, 20.12.1971, K *sub* "*C. anceps*"; Ilam, 26°54', 87° 57', 1200 m., *J.F. Dobremez* 1176, 27.9.1971, G], **Taplejung** [Taplethok - Helok, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305014, 6.11.1963, US *sub* "*C. albomarginata*" in error; Mewa gorge, 7800 ft., *R.L. Fleming* 2038, 3.12.1971, MICH *sub* "*C. albomarginata*" in error; Tamur, 2300 ft., *R.L. Fleming* 2176, 27.10.1973, MICH; confluence of Ghunsa khola and Tamur River, 27° 32', 87° 49', on shady moss-covered rocks, 1700 m., *C. Grey-Wilson, D.G. Long, R.J.D. McBeath, H.J. Noltie, M. Sinnott, S. Crawford, S. Zmartzty* & *M.N. Subedi* KEKE 232, 4.9.1989, K *sub* "*C. anceps*" det. P.J. Edwards, 6.12.1989]. E. Nepal [E. Nepal, between Sakyatom and Amjiresa, 1850 m., *K. Nishioka* 925, 22.9.1962, KYO].

Full distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Rajasthan; Uttar Pradesh; Jharkand; Maharashtra [Wada, S. Concan, 3000 ft., *G.M. Woodrow*, 10.1890, DD]; Orissa; Nagaland; Manipur; Meghalaya; Mizoram; Thailand; Taiwan; Philippines; W. Africa (Guinea, Dalaba, *Gentse Explor.* G 86-235, 20.7.1986, GENT, det. CRFJ, see Fraser-Jenkins & Dulawat (2009), after its identification, this specimen was confirmed in a joint programme (Wollenweber & Fraser-Jenkins *ined*.) with E. Wollenweber to have a similar flavinoid chemistry to the present species, but with one compound missing, as often occurs in India as well).

A further specimen identified by Fraser-Jenkins, as the present species, does not belong here as the lower pinnae are much the longest and scales extend onto the costae. It is a previously undescribed species, *Aleuritopteris rouxii* Fraser-Jenk. &

E. Wollenw. ***sp. nov.***, *frondes similis ad A. formosanam sed pinnae basalae longiorae*, *costae pinnarum paleis parvis vestitae*. Holotypus: Bauchi Plateau, Jos, Nigeria, *R.W.J.* & *J.M. Keay* 20082, 21.8.1946, BM. Named after our late lamented colleague (see Widén, Fraser-Jenkins & Roux 2015), Dr. J.P. (Koos) Roux, of the South African National Botanic Garden, the outstanding "Christensen" of African pteridology. Unfortunately *Aleuritopteris* had been more poorly treated in Africa than in Asia, with almost random splitting by Saiki (1984), outdated and uncritical lumping by Verdcourt (2002), and sadly the remarkable Dr. Roux (2009) in his magnificent and unequalled major work did not have time to tackle at least the two main critical but distinct species (see Fraser-Jenkins 1997) in the genus before the great loss of his untimely demise in a road accident.

(S, C and more widespread). A common and widespread mid- to upper-mid altitude dweller of earth-banks and rocks, often forming very attractive adornments to old walls

137. ***Aleuritopteris grisea*** (Blanf.) Panigrahi [persistently misspelt as "*gresia*" by Chinese and Indian botanists until very recently] (syn.: *A. platychlamys* Ching, misreported from Meghalaya and at far too low altitude by Ghosh *et al.* (2004); *Cheilanthes platychlamys* (Ching) Fraser-Jenk., *non sensu* Fraser-Jenkins *p.p. max.* (1997) [= *A. stenochlamys*]; misapplied name: "*Cheilanthes farinosa*" *sensu* Itô (1966) *p.p. max.*). A supposed synonym, "*C. farinosa* forma *minor*" listed by G.M. Zhang *et al.* (2013) in the *Flora of China* and attributed to C.B. Clarke and Baker was not a name at all, not being in italics, but Clarke merely misidentified *C. grisea* as being a small form of *C. farinosa*, the paper being written in Latin. Despite validating the combination *Aleuritopteris grisea* as he did not exclude Blanford's plant, Panigrahi's own concept of the name was entirely erroneous, applying mainly to *A. formosana* and secondly to *A. bicolor.* Subsequently widely misreported by Panigrahi (1961), Panigrahi & Dixit (1966, 1984), Chandra (2000) and others, from low-altitude, peninsular India and Bangladesh in error mainly for *A. formosana* and *A. anceps*.

Plants varying from *c.* 6 - 30 cm. tall; stipe long, ± thin, dark reddish-brown, bearing small, ovate-acute, easily dislodged, diagnostically concolorous dark-red scales near the stipe-base (as pointed out by Blanford), but not extending to the top of the stipe or rachis *etc.*, lamina elongated triangular lanceolate, bipinnate, pinnules with small, fine segments or lobes, with a strongly bullulate-wrinkled upper surface to the lamina, farina beneath bright white, often scattered as a prominent sprinkling on the stipes and upper surface of the lamina in full-sized but younger fronds; sori with crowded, subentire lobes of pseudoindusium, spore perispore papillose, not spiny.

Nepal:

W: **Mugu** [Rara, Mugu Distr., 3050 m., *H. Tabata*, *D.P. Joshi*, *K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 20365, 1.9.1983 and *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 13116, 14.6.1983, both in KYO *sub* "*C. albomarginata*" in

error; Mugu, 3400 m., *P.R. Shakya* & *B. Roy* 5537, 7.6.1980, KATH], **Jumla**, **Dolpa** [Rohgaon, Dolpo Distr., 9000 ft., *R.L. Fleming* 2008, 6.6.1971, K, det. G. Panigrahi as "*C. subdimorpha*" in error and thence listed by Stewart (1976, *ined*.); Tarakot, in moss at a stone in dry needle-forest, 2800 m., *S. Einarsson, L. Skärby* & *B. Wettterhall* 386, 30.5.1973, BM].

C: **Mustang** [rocks by road, upper half of Phulchowki Darrah (hill) on N.W. side, above and east of Godawari village, *c*. 15 km. S.E. of Kathmandu, Lalitpur District, *c.* 9000-11,000 ft., *C.R. Fraser-Jenkins* 30631, 18.7.2004, TAIF], **Kaski** [among mossy rocks, N. of Himalaya Lodge on way up to Deurali Lodge, N. of Chomrong, on way up to Himalaya Lodge, N. of Chomrong, on way to Annapurna Base Camp, upper Modi Khola valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32555 (FN 201), 30.11.2006, TAIF] **Gorkha** [Tallo Rupal, Manaslu Conservation Area, Gorkha Distr., *S.H. Bhattarai* 105/18, 10.6.2012, KATH], **Rasuwa** [Langtang, 10,000 ft. and above, *R.L. Fleming* 1987, 18.10.1969, DD; Langtang, on cliffs in moss, 12,000 ft., *R.L. Fleming* 2358, 7.1977, MICH], **Lalitpur** [Godawari (1600 m.) - Phulchowki (2500 m.), *H. Kanai, G. Murata, H. Ohashi, O. Tanaka* & *T. Yamazaki* 12745, TI; limestone rocks in woods, shortly below peaks on N.W. side of Phulchowki mountain, above and east of Godawari, E.S.E. of Kathmandu, Lalitpur District, *c.* 8000 ft., *C.R. Fraser-Jenkins* & *C.D. Fraser Jenkins* (father) 15841, 20.11.1989, E, cult. by C.A. Brotherton, Dudley, UK].

E: **Solokhumbu** [Dale to Namchebazar, dry soil covered rocky slopes, 13,300 ft.. *R.S. Rao*, Indian Cho Oyu Expedition, 13942, 16.5.1958, KATH *sub* "*Aleuritopteris albomarginata*" in error; Gokyo, Everest region, on Mani walls, 12,600 ft., *R.L. Fleming* 2377, 25.10.1977, MICH].

Total distribution: China; Tibet; Bhutan; Sikkim; ?Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Thailand. Not present in peninsular India or Bangladesh (see Fraser-Jenkins 2013).

(S(T), Sc). A higher altitude and mainly high Himalayan species not occurring below *c.* 2500 m. and usually higher, misreported from lower altitude by Ghosh *et al.* (2004); occurs in moss between open rocks, in screes or at bases of boulders, or damp crevices in cliffs.

138. ***Aleuritopteris leptolepis*** (Fraser-Jenk.) Fraser-Jenk. (syn.: *Cheilanthes leptolepis* Fraser-Jenk.; misapplied name: "*A. dalhousieae*" ["*dalhousiae*"] *auct., non* (Hook.) Ching, *nom. rejic.*, Hooker's description, illustration and Lady Dalhousie's type-collection of *C. dalhousieae* from Simla in various herbaria (including K, BM, E, G, CAL) are the efarinose Winter fronds of *A. albomarginata*).

A high-altitude, always efarinose species, stipe black, brittle, thick, bearing scattered broad, pale to mid-brown scales in its lower half, but not above, which are easily dislodged; lamina brittle, elongated triangular-lanceolate, but the lowest pinnae and their basal basiscopic pinnules not as abruptly long as in *A. bicolor*, upper surface of lamina with many surface wrinkles, totally efarinose below and above,

segments or lobes rounded-pointed, not toothed; pseudoindusia extending round the lobes, interrupted here and there.

Nepal:

W: **Darchula** [Birch forest opposite Buddhi village, in Nepal, 11,000 ft., *J.F. Duthie* 6262, 6263, 18.7.1886, DD, RAW, MICH; N.W. facing rocks in forest below cliffs, *c.* 2 km. S. of Dorpatta village (opposite Lamari and S. of Buddhi in India), *c.* 12 km. N. of Dumling, west side of Api Himal, N. of Darchula, E. side of Kali river (border with India), Darchula District, *c.* 1850 m., *C.R. Fraser-Jenkins*, with *A.M. Thapa* & *B. Pariyar* 21634 (FN 301), 21.11.1994, E], **Jumla**, **Mugu** [Mugu District, Rara, *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 15412, 13.7.1983, KYO, *ditto,* 20568, 23.9.1983, KYO, both *sub* "*C. subvillosa*" in error].

C: **Parbat**, **Mustang** [dense mixed mainly coniferous forest, on way up to and behind first ridge of Marte Darrah, opposite and above Tukuche, *c.* 15 km. S. of Jomsom, below and W. of Nilgiri main Peak, North West side of Annapurna Himal range, Kali Gandaki valley (E. side), Mustang District, *c.* 2800-3500 m., *C.R. Fraser-Jenkins* & *G.B. Moktan Tamang* 30531, 186.2004, TAIF], **Manang**, **Kaski** [semi-open forested, bushy and rocky path-banks, N. of Dobhan Lodge on way to Himalaya Lodge, N. of Chomrong, on way to Annapurna Base Camp, upper Modi Khola valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32480 (FN 126), 30.11.2006, TAIF], **Gorkha**, **Rasuwa** [forest, bushes and cliffs on path to Gosainkund, between Deorali river-bridge and Chandanbari hamlet (near top of ridge), *c.* 2 - 10 km. N.E. of and above Dhunche, next valley south of Langtang valley, N. of Trisuli Bazaar and Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins et al.* 21224 (FN 1472), 13.6.1994, E], **Lalitpur** [Phulchowk[i], on large rocks and between them above road, upper section, 8500 ft., *Dr. R.L. Fleming* 1463, 1468, 18.9.1957, KATH, MICH, *sub* "*C. dalhousiae*"; rocks by road, upper half of Phulchowki Darrah (hill) on N.W. side, above and east of Godawari village, *c.* 15 km. S.E. of Kathmandu, Lalitpur District, *c.* 9000-11,000 ft., *C.R. Fraser-Jenkins* 30636, 18.7.2004, TAIF], **Sindhupalchok** [Dupuk, Helumbu, 11,500 ft., *R.L. Fleming* 1824, 3.8.1964, MICH; S.E.-facing slope, Bamboo belt, near a stream, loamy rocky soil, *c.* 3030 m., *R.G. Troth* 105, 9.11.1971, MICH].

E: **Sankhuwasabha** [Thodung - Thudam, between rocks, 10,000 ft., *Dr. R.L. Fleming* 1630, 1636, 9.9.1959, KATH, MICH *sub* "*C. subvillosa*" in error], **Taplejung** [E. Nepal, Baroya Khimty - Thakma khola, *H. Kanai, G. Murata* & *Y. Togashi* 6305028, 16.11.1963, TI *sub* "*C. kuhnii*" in error].

Total distribution: China; Tibet; Myanmar; Bhutan; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Not present in the Philippines as reported by G.M. Zhang, Yatskievych & Hooper (2013). Not present in Orissa, whence reported by Dixit (1966) due to confusion with *A. bicolor* with the farina washed off by alcohol.

(S, C). A common, if scattered, higher altitude and high Himalayan species, occurring in damp places between rocks and in crevices of cliffs, often on N. facing slopes, in semi-shade.

139. ***Aleuritopteris rufa*** (D.Don) Ching (syn.: *Cheilanthes rufa* D.Don).

A very distinctive species, confusable only with a small *A. dubia*; dead, brown Summer fronds with wider segments often persist sticking up above the smaller basal Winter fronds; stipe, rachis and costae densely clothed with rusty brown woolly, hair-like fibrils, the lowest ones with dark centres, mixed with some narrow scales on the stipe; stipe short (but can be long in very luxuriant plants); frond narrowly lanceolate, widest just above its base, bipinnatifid, with short, pinnatifid pinnae, widest at their bases, lamina densely fibrillose above, with a somewhat obscured whiteish or cream-coloured farina beneath; pseudoindusia of close interrupted lobes around the margin of the pinnule, fimbriate apically. Diploid sexual.

Nepal:

W: **Kanchanpur** [by spring in Sal forest, *c.* ½ km. below Betkot, N. of Chaile and Daiji on path to Lipna over Churria Ghats, *c.* 15 km. N.E. of Mahendranagar on S. side of Ghats, Kanchanpur District, *C.R. Fraser-Jenkins* 24938 (FN 916), 30.10.1996, E], **Darchula** [Paribagar - Makarigad, *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yaho, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1214103, 9.7.2012, KATH], **Bajhang** [environs de Chainpur, 29° 35', 81° 12', 1200 m., *J.F.Dobremez* 1992, 27.4.1973, G], **Surkhet**, **Dailekh [**Baluwatar, 4000 ft., *U.R. Paudyal* & *R.N. Shukla* 4120, 19.8.1982, KATH], **Kalikot** [base of roadside cliff, *c.* 5 km. N.E. of Kalikot town (Manma), on rough road to Jumla, overlooking Tila River valley, Kalikot District, *c.* 1000 m., *C.R. Fraser-Jenkins* & *S. Pariyar* 35153 (FN 27), 24.9.2013, TAIF], **Salyan** [Tulsipur - Phalwang, 730-1841 m., *D.P. Joshi & M.M. Amatya* W185/82, 17.1.1982, KATH], **Dang**, **Dolpa** [Phulchangi, Thuli Bheri river, under shelter of boulder, 8000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3330, 11.9.1952, BM].

C: **Gulmi** [Lumpek, on shady and moist rocky place, 1540 m., *D.P. Joshi* & *M.M. Amatya* 73/1070, 30.11.1973, KATH], **Baglung** [below Baglung, "West Nepal", on rocks, 2200 ft./2500 ft., *R.L. Fleming* 885, 13.12/11.1949, A, DD], **Myagdi** [Myagdi Distr., Beni (840 m.) - Singa (910 m.) - Tatopani (920 m.) - Bholamza (950 m.) - Shimarchaur (950 m.) - Babichor (960 m.), 83° 27' -33', 28° 20' - 23', 955 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takahashi* & *K. Yonekura* 9681047, 2.9.1996, KATH], **Mustang**, **Manang** [Marsyangdi valley, on rocks in a gorge, 1700 m., *E. Brentnall* 213 11.1983, *ex hort* Kew (056-84-00296), 30.7.1986, K]; **Palpa** [8 mi. N. of Butwal, "W. Nepal", 2500 ft., *R.L. Fleming* 954, 2.11.1949, DD, UC], **Parbat**, **Kaski** [Pokhara - Hyenda, 1000-1100 m., *Y. Suehiro* 81, 20.9.1976, KYO; among rocks and below cliffs on both sides of river at N. entrance to Seti river gorge, below Mahendra Pul Power-house, N. part of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *L.B. Tamang* & *G.* [*R.*] *B. Pariyar* 25850

(FN 1828), H], **Makawanpur**, **Rasuwa**, **Dhading** [wall just beyond check post by Gate no. 2 at Mureko [Mudko], and by path around N. side of Jamachok mountain, Nagarjun Forest, N.W. of Balaju, N.W. of Kathmandu on road to Kakani and Trisuli Bazaar, Dhading District, *c.* 1600 m., *C.R. Fraser-Jenkins* & *A.C. Jermy* 19483 (FN 368), 15.1.1993, E], **Kathmandu** [overhanging rocks, Ropeway, S.W. Kathmandu valley, 5500 ft., *R.L. Fleming* 1282, 28.10.1956, F; Sankhu, 10 miles north east of Katmandu, on grazing grounds, *K. de B. Codrington* 81, in 1956, BM], **Lalitpur** [Godawari, foot of boundary walls, 4500 ft., *B.D. Pande* 253, 18.8.1956, DD; Godaveri, on overhanging rocks, 5000 ft., *Dr. R.L. Fleming* 1615, 15.8.1959, KATH, *ditto*, 1724, 2.9.1963, MICH; 10 miles S.E. of Kathmandu, Godawari, on S. facing stone wall, 1500 m., *D.H. Nicolson* 2195, 1.9.1966, KATH, US], **Sindhupalchok**, **Dolakha** [bois vers le col, en descendant sur Tandi, 1440 m., *A. Zimmermann* 1129, 9.9.1954, G, KYO], **Ramechap**.

E: **Taplejung** [Ghatte [1600 m.] - Khebang [1700 m.], *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305029, 19.11.1963, TI, photo sent by Prof. K. Iwatsuki, 3.2015].

Total distribution: China; Myanmar; Arunachal Pradesh; Sikkim; Darjeeling; Uttarakhand; Himachal Pradesh; Jammu & Kashmir. Maharashtra; Thailand. Reported from the Philippines by G.M. Zhang *et al.* (2013) in error for *A. dubia.*

(S, C). A common lower-mid to mid-altitude rock-dwelling species of calcareous rocks and walls, often growing under overhangs on large rocks.

140. ***Aleuritopteris stenochlamys*** Ching (misapplied name: "*A. platychlamys*" *sensu* Fraser-Jenkins 1997, *non* Ching, *A. platychlamys* is a synonym of *C. grisea*, rather than being the present species).

Very close to *C. grisea* and sometimes very difficult to tell apart, but with a thicker stipe bearing longer, more yellowish-red concolorous scales and the frond usually larger and not as finely dissect or lobed; farina similarly powdered over the top surface as well as beneath; spore perispore papillose-spiny. Despite the difficulty to distinguish between this species and larger specimens of *A. grisea*, it appears to be a distinct species, which is also confirmed by its distinctive flavinoid content, substantially qualitatively different from *A. grisea* from the same locality (analysed by Prof. E. Wollenweber at E.T.H. Univ., Darmstadt, on the specimen cited here below). Zhang *et al*'s. (2013) synonymising it in the *Flora of China* while admitting doubt and uncertainty due to the complex nature of the *A. grisea* group should not have happened, being a new disposition, unless they confidently thought it to be so.

Nepal:

W.; **E**. Thapa (2002) mentioned that it was presumably also present in W. and E. Nepal (under Fraser-Jenkins' misapplied name, *C. platychlamys*), but we have seen no material from either.

C: **Mustang** [dense, mixed, mainly coniferous forest, on way up to and behind first

ridge of Marte Darrah, opposite and above Tukuche, *c*. 15 km. S. of Jomsom, below and W. of Nilgiri main Peak, North West side of Annapurna Himal range, Kali Gandaki valley (E. side), Mustang District, *c.* 2800-3500 m., *C.R. Fraser-Jenkins* & *G.B. Moktan Tamang* 30532, 28.6.2004, TAIF], **Kaski** [light forest between Deurali Lodge and Himalaya Lodge, below "MBC" Machapuchare Base Camp, above and N. of Ghundruk, above Naya Pul, East of Baglung on way to "ABC" Annapurna Base Camp, Kaski District, *Ganesh* (*Gopal Bahadur Moktan*) *Tamang* and *Edwin Johan Santana Gaarder* (of 26 North Hill, Highgate, London, Lincoln College, Oxford, and Oslo, volunteer teacher from i-to-i), in *C.R. Fraser-Jenkins* 32210, 5.8.2006, TAIF].

Lalitpur [Godawari - Phulchauki, 2650 m., *H. Kanai, G. Murata, H. Ohashi* & *T. Yamazaki* 12745, 23.6.1967, TI; limestone rocks in woods, shortly below peaks on N.W. side of Phulchowki mountain, above and east of Godawari, E.S.E. of Kathmandu, Lalitpur District, *c.* 8000 ft., *C.R. Fraser-Jenkins* & *C.D. Fraser Jenkins* (father) 15841, 20.11.1989, E, cult. by C.A. Brotherton, Dudley, UK; locality *ditto*, *C.R. Fraser-Jenkins, A.C. Jermy* & *V.L. Gurung*, with driver, field assistant, factotum, paeons *et al.* 19460 (FN 345), 12.1.1993, E].

Total distribution: Tibet; Bhutan; Sikkim; Nepal; Uttarakhand [Gini, Pithoragarh, *C.R. Fraser-Jenkins* 34658-34660 (FN 159-162), 19.11.2010, TAIF, Michigan State Univ.]. Manipur; Thailand [Doi Chang Dao, 1900-2175 m., *T. Shimizu, H. Koyama* & *A. Nalampoon* T 10094, 14.9.1967, K]. Misreported from various localities and lower altitude by Ghosh *et al.* (2004).

(S(T), R). A rare, higher altitude to high Himalayan species growing between rocks on sheltered slopes in light forest, or on ledges on semi-open cliffs.

Indian threatened status: **EN**. Nepalese threatened status: **EN**.

141. ***Aleuritopteris subdimorpha*** (C.B.Clarke & Baker) Fraser-Jenk. (syn.: *Cheilanthes farinosa* var. *subdimorpha* C.B.Clarke & Baker; *Cheilanthes subdimorpha* (C.B.Clarke & Baker) Hieron.; *Aleuritopteris pseudoargentea* S.K.Wu; *A. longipes* Ching & S.K.Wu, *nom. inval.* [this is not *A. bicolor* as initially thought more likely by Fraser-Jenkins (1997) in the absence of the type, lost from KYO by loan ?to KUN?]; *Cheilanthes longipes* (Ching & S.K.Wu) R.D.Dixit & Bal Krishna *A. pentagona* Saiki; misapplied names: "*A. stenochlamys*" *sensu* Ghosh *et al*. (2004), *non* Ching & S.K.Wu; "*A. pseudofarinosa*" *sensu* Ghosh *et al*. (2004), *non* Ching & S.K.Wu [= *A. anceps*], Ghosh *et al*. were unaware of *A. subdimorpha*). *A. gongshanensis* G.M.Zhang, from Yunnan, requires comparison with *A. subdimorpha* and was unfortunately not illustrated photographically, nor compared with the related species.

Similar to *A. bicolor*, but stipe relatively longer, usually noticeably thicker, and blacker, scales at the stipe-base more attenuated-lanceolate, dark, becoming dark reddish brown above the rhizome, then more pale reddish brown at the top of their

distribution *c*. ¼ the way up the stipe, usually concolorous without a darker central streak except lower scales in a few plants which may have a vaguely darker central streak; lamina elongated-deltate, often shorter than the stipe, markedly less finely dissect than in *A. bicolor* and thicker, lowest basiscopic pinnules usually strongly curved outwards; farina beneath a denser bright white.

Nepal:

C: **Kaski** [forest and below cliffs in main stream-gullies, Jhinu to New Bridge to Kyumi, on way back from Annapurna Base camp, N. of Pokhara off Baglung road, route to Annapurna Base Camp, Kaski District, *c.* 1600 m., *C.R. Fraser-Jenkins*, *Jacob C.B. Fraser-Jenkins* & *S. Pariyar* 35073 (FN 350), 6.6.2012, TAIF], **Kathmandu** [north rim of Kathmandu valley, under heavy vegetation, 6500-7000 ft., *Robert L. Fleming* 2242, 3-5.8.1976, MICH, KGU *sub* "*C. farinosa*"; second khola from the W. side of valley, at edge of low forest, *c*. 150 m. above and ¼ km. S.E. of Bhangeri, above Gagal Phedim, N.W. of Sankhu, N.E. of Kathmandu, Kathmandu Distr., *C.R. Fraser-Jenkins* & *G.B.* (*Moktan*) *Tamang* 29358 (FN 5333), 2.10.2001, H].

E: **Sankhuwasabha** [Chichila, Sankhuwasabha, *D. Karkee* 27, 18.9.1999, KATH *sub* "*C. doniana*" det. N. Thapa, 2.10.1999, in error], **Ilam** [between cardamon-plantations in forested, rocky stream-gully of Sudhung khola, leading south below road, from Sundergaon to Sudhung, W. of Pashupatinagar on Ilam road, Ilam District, *C.R. Fraser-Jenkins* 29499 (FN 5474) 9.10.2001, H].

Total distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Uttarakhand [rare]. Very common in Meghalaya. Manipur; Bangladesh; Thailand; Vietnam; Sumatra [Dolok Si Patsa-patsa, Habinsaran, *H.H. Bartlett* 7831, 15.5.1927, BM, MICH, det. CRFJ, 25.9.1992 as "*C. bicolor*" in error, rather delicate specimens]. Not present in the W. Himalaya as thought by Chandra (2000). Overlooked by G.M. Zhang *et al.* (2013) though correctly reported from S. China by Fraser-Jenkins & Dulwat (2009).

(M, R). A very scattered and rare (in Nepal), upper-mid altitude species of open grassy slopes, banks and between rocks, among bushes.

142. ***Aleuritopteris tamburii*** (Hook.) Ching (syn.: *Pellaea tamburii* Hook.; *Aleuritopteris punethae* Kholia, Bhakuni & Richa, the latter continued to be published as if a new species even after having it definitively identified for them by CRFJ some time previously, but now agreed to be a synonym; misapplied name: "*Doryopteris concolor*" *sensu* Itô (1966), Gurung (1991), *non* (Langsd. & Fisch.) Kuhn [from S. India, S.E. Asia, Africa *etc.*]).

A very distinctive and spectacular species (fronds up to *c.* 25 cm. long), the largest of the *A. argentea* alliance, with an erect black stipe bearing a tuft of narrow, bicolorous, brown scales with dark centres at its very base, rachis and costae glabrous, dark; fronds deltate-pentagonal, pinnate (for the lowest pinna only), but tripinnatifid

with long pinna-lobes, each with side-lobes, and with wide wings of lamina connected the upper pinna-like lobes; farina bright, smooth white beneath; sori with a continuous, entire pseudoindusium running right round the lamina-margin as in *Doryopteris* species. Differs markedly from *A. argentea* in its size, the wider lobes and brighter white farina beneath the lamina. Often detectable only when brown and white dead fronds fall down from above onto the path.

Nepal:

C: **Myagdi** [Dharapani (1550 m.) - Takum (1650 m.) - Sibang (1750 m.) - Dhara Khola (1640 m.) - Muri (1820 m.), 83° 19' - 22', 28° 27' - 30', 1800 m., *M. Mikage*, *R. Hirano*, *N. Kondo*, *R. Lacoul*, *C. Mohri*, *A. Takahashi* & *K. Yonekura* 9681133, 4.9.1996, KATH *sub* "*Doryopteris concolor*" in error], **Manang** [Tal to Jagat, 841285["3"], C. Nepal, 1766-1466 m., *D.P. Joshi* & *M.M. Amatya* 73/811, 25.7.1973, KATH], **Rasuwa** [Langtang, Ghoda Tabela - Thulo Syapru, by path in forest, 2120 m., *V.L. Gurung* & party 77/752, 7.10.1977, KATH; rocks beside road, by first cliff north of Ramche, *c.* ¾ km. N. of Ramche on road to Dhunche, Syabru Bensi (and Langtang), N. of Trisuli Bazaar and Kalikasthan, N. of Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins* 21361 (FN 28), 28.9.1994, E; steep slope below dry, grassy, S.W. facing cliff above stream, where footbridge crosses it at Deurali, *c.* 1½ km. E.S.E of Dhunche on path to Chandanbari and Gossainkund, Rasuwa District, 1900 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.*, *R. Kharki* & *B. Pariyar* 21400 (FN 67), 29.9.1994, E], **Khabrepalanchok** [camp de Chyaubas, rochers sud-est, 1950 m., *A. Zimmermann* 1086A, BM, G, KYO].

E: **Taplejung** [upper Tamur valley, *J.D. Hooker*, K, US; Helok to Iladanda, *H. Kanai*, *G. Murata* & *M. Togashi* 6305066, 8.11.1963, US, A *sub* "*Doryopteris concolor*" in error].

Total distribution: China; ?Tibet; Myanmar; Arunachal Pradesh; Meghalaya [above Terriaghat, Khasi Hills, 1500 ft., *G. Mann s.n.*,10.1885/9.1889, DD, K, BM, MICH *sub* "*C. argentea*"]; Sikkim [rare]; Nepal; Uttarakhand [*Bhakuni*, Govt. Postgraduate College, Pithoragarh]. Meghalaya. Although long known from Sikkim and Meghalaya since Sir J.D. Hooker's and Gustav Mann's collections, Ghosh *et al.* (2004) predicted that it might become available in India.

(S, R). A rare and restricted upper-mid to higher altitude species (but as low as 1500 ft. in Meghalaya), growing in crevices on often inaccessible, shaded, acid-rock cliffs, or between rocks on steep, sheltered slopes.

Indian threatened status: **EN**. Nepalese threatened status: **EN**.

Hybrids: Sterile F1 hybrids are common in this genus and have recognisably intermediate frond morphology (but to recognise which one must first be fully familiar with the species themselves) and most, but not all have very weak or no farina (actually present in very low quantities) beneath the lamina, they also show an additive pattern of the flavinoids between the presumptive parental species. A mature spore-sample shows that the spores are abortive, irregular in size and shape, black, with many

small dark fragments (not to be confused with dust) and diads of conjoined spores are often present. Care must be taken to distinguish between semi-immature spores and genuinely abortive spores; spores are best viewed dry on a slide without coverslip and a compound stage microscope is necessary, not a binocular dissecting microscope. The following hybrids have been found in Nepal, more may be expected:

Aleuritopteris x ***confundans*** Fraser-Jenk., ***hybr. nov.*** (*A. anceps* x *A. formosana*). *Morphologia plantae intermedia inter eas parentium praesumptivi*; *paleae ad stipitem et rhachidem vestitae*, *frons latiora quam in A. formosana*; *farina alba valde manifesta*; *sporae abortivae*. Holotype: **Dhading** [rocks in forested stream gulley above track around mountain on N.W. side of Jamachok mountain, in from Gate no. 2 at Mureko, Nagarjun Forest, beyond N.W. side of Kathmandu Valley, off road to Kakani and Trisuli Bazaar, Dhading District, *c.* 6000 ft., *C.R. Fraser-Jenkins* 15599, 31.10.1989, E, TAIF]. Normal white farina, but fully abortive spores. The frond morphology similar to *A. anceps* in width; stipe-scales wide-based with long, narrow, bicolorous apices, a few small scales up lower rachis; farina-glands present on stipe, rachis and costae; fronds white beneath, lamina-base rather narrow, or some wide; spores abortive as in a hybrid, irregular, dark, with dark, irregular, fragmenting edges, oval-shaped and a number of smaller, irregularly surfaced, triangular ones, including among those still sitting in sporangia, which contain much sporangial debris of spore-coat material. This hybrid perhaps represents a backcross hybrid between the tetraploid *A. anceps* and diploid *A. formosana*, in which case the genetic similarity, with full genomes in common may be connected with its otherwise anomalous ability to produce a normal farina.

Aleuritopteris x ***fraser-jenkinsii*** (N.Thapa) Fraser-Jenk. & Khullar (*A. dealbata* x *A. formosana*) (syn.: *Cheilanthes* x *fraser-jenkinsii* N. Thapa). Almost no visible farina, spores fully abortive. Perhaps represents the forerunner hybrid between two diploid species, from which *A. anceps* may have arisen. Some errors in Thapa's Latin diagnosis are corrected here to: *donianam*, *aliquantum*, *stipitem*, *sporae*, *totaliter*. **Kaski** [semi open light forest from New Bridge down south to Birethanti, on lower part of way down from Annapurna Base Camp, Modi Khola Valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32656, (FN 301), 3.12.2006, TAIF], **Dhading** [between Dhamechour and Narkunde, S. of and above Naubise on "Rajpath highway" to Tistung and Hetauda, rocky banks beside road, *C.R. Fraser-Jenkins* 26417 (FN 2395), 11.8.1998, H, E, the author's herbarium at NMW, where this holotype specimen was originally cited from, was transferred to E in *c.* 2009].

Aleuritopteris x ***gardneri*** Fraser-Jenk. & Pariyar, ***hybr. nov.*** (*A. dealbata* x *A. rufa*). *Morphologia plantae intermedia inter eas parentium praesumptivi*; *segmenta laminae lata*, *paleae aliquantum latae ad stipitem*, *rhachidem et costas vestitae*, *farina absenta*. Holotype: **Kathmandu** [old brick wall around Nagarjun Forest, on N. side of Jamachok Mountain, *c.* 1 - 2 km. N.W. of Balaju, N.W. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* 31920, 28.11.2005, TAIF]. A single plant, growing between adjacent parents, with *C. anceps*, *C. formosana*, *C. bicolor*, *C.* x

wallichiana, *C.* x *unicolor* and *C.* x *pangteyi* also present. Narrowish fronds with broad segments; weak powder present; slightly broadish scales up stipe, rachis and costae. Named after the Hon Edward Gardner, first British Ambassador to Nepal and second botanist to collect there (see Fraser-Jenkins 2006).

Aleuritopteris x ***hamiltonii*** Fraser-Jenk. & Khullar, ***hybr. nov.*** (*A. dubia* x *A. formosana*). *Morphologia plantae intermedia inter eas parentium praesumptivi*; *frons angusta similaris ad A. formosanam sed valde paleata ad axes, farina absenta, sporae abortivae*. Holotype: forested path below main road, leading to footbridge crossing Myang Chhu (river), W. of Toong on road to Manul and Mangan, N. of Gangtok on "North Sikkim Highway," N. Sikkim District, Sikkim, *C.R. Fraser-Jenkins* 27358 (FN 3335), 10.10.1998, H]; other material seen: **Kaski** [path in semi-open forest on W. facing slope, *c*. 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c*. 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c*. 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *C.R. Fraser-Jenkins* & *Jeet B. Pariyar* 26160 (FN 2138), 13.3.1998, H; forest from Bamboo Lodge down south to Sinuwa, and some from further down, via Chomrong to New Bridge, on way down from Annapurna Base Camp, Modi Khola Valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32603 (FN 248), 2-3.12.2006]. The report from Nagarjun, Kathmandu District, by Fraser-Jenkins (2008) was in error for *A.* x *gardneri*. Very faint white farina, spores fully abortive, very large, spherical, but many small, dark outer-spore fragments with pale perispore, some diads, tetrads and giant spores also present.

Aleuritopteris x ***nepalensis*** Fraser-Jenk. (*A. formosana* x *A. rufa*). Very faint white farina hardly visible, spores fully abortive. **Kaski** [Puranchaur, 18 km. N.W. of Pokhara, *C.R. Fraser-Jenkins*, with *J.B.* & *K. Pariyar* 26302-26305 (FN 2280-2283), 9.5.1998, H; E. of Surjenagar village, *c.* 8 km. N. of Pokhara, *C.R. Fraser-Jenkins* 30769, 17.9.2004, TAIF]

Aleuritopteris x ***pangteyi*** Fraser-Jenk. & E.Wollenw. (*A. bicolor* x *A. formosana*). White farina hadly visible, spores fully abortive. Chemical analysis of the flavinoids in the traces of farina in the holotype by Prof. E. Wollenweber at E.T.H. University, Darmstadt, has shown the above parentage. **Kathmandu** [Nagarjun forest, wall by Gate no. 1, 1-2 km N.W. of Balaju, *C.R. Fraser-Jenkins* 31919, 28.11.2005, TAIF].

Aleuritopteris x ***unicolor*** Fraser-Jenk. & Khullar (*A. bicolor* x *A. rufa*). No visible white farina, spores fully abortive. **Kathmandu** [old wall, Bouddha to Chabahil, Kathmandu, *C.R. Fraser-Jenkins* 31199, 12.6.2005, TAIF, holotype; old brick wall around Nagarjun Forest, on N. side of Jamachok Mountain, *c.* 1 - 2 km. N.W. of Balaju, N.W. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* 31924, 28.11.2005, TAIF], **Lalitpur** [quarry wall, Phulchowki darrah, Godawari, *C.R. Fraser-Jenkins* 31906, 28.11.2005, TAIF], **Sindhupalchok** [steep path through dense forest down below the "Bungy-Jumping" bridge across Bhote Khosi river, below Listikot, E. of Palang village, N.W. side of Bhote Khosi river, *c.* 3 km. S.W.

of Chaku, N. of Bharabise on road to Tatopani and Tibet, N.E. of Kathmandu, Sindhupalchok District, *C.R. Fraser-Jenkins* 28975 (FN 4950), 5.6.2001, H].

[***Aleuritopteris*** x ***vermae*** (Fraser-Jenk. & Viane) Fraser-Jenk. & Khullar (*A. albomarginata* x *A. bicolor*). White farina hardly visible, spores fully abortive. Viane played no part in the discovery and recognition of this hybrid, which was already identified by CRFJ, and the holotype from Vaishnodevi, Jammu & Kashmir, India (*CRFJ* 17357, sheet no. 436, 28.11.1990, 1 frond of which = *T. Reichstein* 7816) which is supposed to be returned to the BM, as published, has been retained by him at GENT, despite requests to return it, having been been sent to him only on loan for spore study by the author's late colleague Prof. T. Reichstein (in litt.). The record from Jamachok/Nagarjun, Balaju, Kathmandu District (Fraser-Jenkins 2008) was in error for *A.* x *pangteyi* (*CRFJ* 31919).]

Aleuritopteris x ***wallichiana*** Fraser-Jenk. (*A. bicolor* x *A. dealbata*). A thin but visible farina, spores fully abortive. **Kaski** [by path through calcareous cliffs above and N. of Surjenagar, *c.* 8 km. N. of Pokhara, *C.R. Fraser-Jenkins* 30765. 17.9.2004, TAIF, holotype; N. entrance to Seti river gorge, Mahendrapul power-house, Pokhara, *C.R. Fraser-Jenkins*, with *G.*[*R.*] *B. Pariyar* & *L.B. Tamang* 25847 (FN 1825), 5.1.1998, H], **Kathmandu** [wall around Nagarjun/Jamachok, 1-2 km. N.W. of Balaju, *C.R. Fraser-Jenkins* 31923, 28.11.2005, TAIF].

Anogramma (1 species).

[***Anogramma leptophylla*** (L.) Link was listed for Nepal by Stewart (1976 *ined*.), Dixit (1984), Chandra (2000), Khullar (1994) and Gurung (1985), but Fraser-Jenkins (1992, 1997) separated the plants from the W. Indo-Himalaya and Nepal as the morphologically and cytologically distinct species, *A. reichsteinii*, which was overlooked by Chandra. *A. leptophylla* in the Indian subcontinent occurs in the far west in Afghanistan and Pakistan, and in peninsular C. and S. India (Maharashtra, Karnataka, Kerala and Tamil Nadu) and when full grown is a larger plant than *A. reichsteinii* with more dissect fronds. It has not yet been investigated cytologically from India, but is diploid sexual in Europe and other continents.]

143. ***Anogramma reichsteinii*** Fraser-Jenk.

An annual species, fronds turning straw-coloured and dying with the whole plant during the dry Winter (but *A. leptophylla* dying during the Summer), regrowing from spores in Spring and early Summer. Plants very small (to *c.* 2 cm. tall) and delicate, stipes thin and delicate, whiteish green, lower fronds 0.5-1 cm. tall with the thin lamina simple to bipartite with a widely ovate-cuneate blade and apical crenations, the tallest fronds suberect, pinnate, with up to *c.* 2-3 pairs of small, pinnate or lobed and usually rather closely held pinnae, with a few distal, crenate to dentate teeth on the segments or lobes; sori exindusiate, several lines of black sporangia running up the veins from shortly above the base of the blade or segment to shortly below the distal margin, becoming confluent, turning brown after

dehiscence, but persistent on old dead fronds.

Nepal:

W: **Mugu** [Tum, Mugu, on deep shade along trail, moist, mossy soil, 2320 m., *T.B. Shrestha* & *N.P. Manandhar* 261, 15.10.1975, KATH].

C: **Bhaktapur** [Chapagaon Town, wall of town/in village, 4900 ft. *R.L. Fleming* 1328, 17.9.1956, KATH, DD, det. F.R.I., Dehra Dun; Chapagaon town, Katmandu valley, *R.L. Fleming* 2231, 23.7.1976, MICH]. Fraser-Jenkins (2012) thought this specimen, at that time the only Nepalese collection known to him, might have originated from near Woodstock School, Mussoorie, with a transposed label, as in one or two such instances in Fleming's labelling, but Stewart (1976 *ined.*) who collaborated in detail with Fleming, also gave the same locality which helps to prove it is correct. A second specimen, labelled "Chapagaon, on shady moist forest [anomalous habitat], 1371 m., *V.L. Gurung* 82/1780, 14.8.1982", KATH, was due to a transposed label from Fleming's collection, Gurung also wrote "Chapagaon Forest", but Fleming himself crossed out "Forest" and wrote the correction in pencil to "Town", which also substantiates the locality, confirmed by Fleming's subsequent collection from the same population, seen later by CRFJ.

E: **Solukhumbu** [rive gauche de la Dudh Kosi, [between Namche Bazar and Monjo, 27° 49', 86° 43' - 27° 47', 86° 44'], 2800 m., *A. Zimmermann* 1754, 17.10.1954, BM, G].

Full distribution: ?Tibet; Nepal; Uttarakhand; Himachal Pradesh. Apparently endemic to the Indo-Himalaya, unless also present in Tibet. X.C. Zhang's (2012) illustration of it from Taiwan was obviously erroneous and arose through his lack of communication, being typical *A. leptophylla*. It has not yet been investigated whether *A. reichsteinii* might occur in China (the genus is known from Yunnan), but material seen so far by CRFJ from Taiwan is *A. leptophylla*. It has also been collected in mid-west Tibet, which should therefore refer to the present species, but needs to be investigated. *A. reichsteinii* and Zhang's report of it were not mentioned by G.M. Zhang & Ranker (2013) in the *Flora of China*.

(E, R). An extremely rare species (in Nepal), scattered at mid to higher altitudes, growing on steep, open banks, at the bases of stones, or sometimes on mossy walls, in slightly dry conditions.

Nepalese threatened status: **CR**.

Ceratopteris (1 species, two subspecies).

The distribution and separation of *Ceratopteris* species in India has been widely misunderstood, with reports being made under any of the commonly used names, and *C. thalictroides* subsp. *gaudichaudii* in India, Nepal *etc*. had previously been overlooked here until discovered by Masuyama, who has kindly identified some collections for CRFJ. Despite most recent authors in the region, including Fraser-Jenkins (2008), accepting only *C. thalictroides* as being present, it is now clear that four taxa, *C. thalictroides*

subsp. *thalictroides*, *C. thalictroides* subsp. *gaudichaudii*, *C. pteridoides* and a further rarer species, *C. cornuta* (Pal.Beauv.) Lepr., with much less dissect sterile fronds, are all distinct taxa (as outlined in detail by Lloyd 1974) and all occur in India (the latter in Rajasthan, det. S. Masuyama; Assam State; Bangladesh *etc*.), but previous records of these names in Indian literature (*e.g*. Dixit 1984, Ghosh *et al.* 2004) are widely misidentified and spurious, as are many of the cytological records from India in terms of their taxonomy and nomenclature.

144. ***Ceratopteris thalictroides*** (L.) Brongn. subsp. ***thalictroides*** (syn.: *Acrostichum thalictroides* L., described from Sri Lanka, *Pteris thalictroides* (L.) Sw., *non* Muhl.; *Acrostichum siliquosum* L.; *Ceratopteris siliquosa* (L.) Copel.; *Pteris succulenta* Roxb.; *C. succulenta* (Roxb.) Fraser-Jenk., although Roxburgh's drawing for this name, illustrated by Fraser-Jenkins (2008), rather clearly appears to belong to what is now recognised here as subsp. *gaudichaudii*, as also mentioned by Masuyama & Watano (2010: 78), they subsequently found that by contrast, Morton's (1974) lectotype of *Pteris succulenta* Roxb. belongs to what is here called subsp. *thalictroides*. Fraser-Jenkins (2008) thus misapplied the name *C. succulenta* in the sense of Roxburgh's drawing, but not its lectotype, to *C. thalictroides* subsp. *gaudichaudii*).

Masuyama & Watano (2002, 2010 and in other papers) separated among other taxa what are here called subsp. *thalictroides* and subsp. *gaudichaudii*, although they recognised most taxa simply at specific rank, which we deem less appropriate for relatively minor and intricately related taxa. They found that subsp. *thalictroides* is an aneuploid based on $n = 77$, while the latter is based on $n = 78$. The two have correspondingly slightly, but consistently different frond morphology, which, though variable, is usually recognisable by eye, while allowing for the overlying confusing phenotypic/environmental variability of species of *Ceratopteris*. In addition to these two, Indian diploid plants from west, central and south India, also extending up to the W. Bengal plains around Calcutta, belong to another, partly sympatric species, *C. pteridoides* (Hook.) Hieron., which is closely related to the American *C. richardii* Brongn. (an earlier name). *C. pteridoides* is more fully aquatic than *C. thalictroides* and usually becomes a very large, floating plant with considerably less lobed or dissect sterile leaves, but much more dissect fertile ones, usually with a markedly thick to rather ballooning-based, spongy, inflated and more ribbed stipe.

A smallish, but very variable fern in size (to *c*. 20-30 cm. tall, often considerably smaller, less commonly larger) and degree of dissection from place to place, rhizome short, erect, the whole plant fragile, succulent herbaceous, stipe green, spongy, not thickened, usually as long or longer than the lamina, lamina bipinnate-tripinnatifid, sometimes more, softly succulent herbaceous, glabrous throughout, lower, sterile fronds less dissect, with wide-based lobes with acute apices, sometimes bearing proliferous bulbils, fertile leaves more divided, with very narrow, rolled segments; sori enclosed by the pseudoindusium from each margin of the segment,

pseudoindusium as long as the segment. As found by many authors, but under a range of different unidentified names, *C. thalictroides* is a tetraploid species.

Nepal:

C: **Tanahun** [Satrasaye Phant, between Muglin and Pokhara, *c.* 450 m., *T. Nakaike* 1938, 27.9.1986, KATH, TNS], **Nuwakot**/**Rasuwa** [Betrawati to Ramche, growing along the water canal on the open area by the way side, 1800 m., *V.L. Gurung*, [*T.*]*K. Rajbhandari* & *D.P. Joshi* 808/79, 13.9.1979, KATH, note: the locality was probably slightly mistakenly written and the altitude is also too high - it presumably refers to the large irrigation canal at the bottom of the valley above Trisuli Bazaar, on the way to Betrawati in Nuwakot District]. A specimen labelled "Lalitpur, Godawari, *D.T. Yami* 137, 1.10.2053", KATH, "locality doubtful", det. N. Thapa, 1999, is incorrectly localised probably confused with one of Liba Pejchar's collections from Jhapa, given to Yami for KATH.

Indian subcontinental distribution: Himachal Pradesh [Saharanpur]; Uttarakhand; Nepal; Uttar Pradesh; Bihar; W. Bengal; Orissa; Assam; Manipur; C. and S. India; Sri Lanka. S. China; Taiwan; Myanmar; Thailand; S. Japan; S.E. Asia; Australia; Pacific Islands. Also recorded from Africa and the Americas, in which latter (at least) sterile hybrids with the other species are also known.

(M (but more widespread), R). A very rare (in Nepal) and scattered, low to lower-mid altitude species of subaquatic habitats, edges of ponds, seasonally flooded hollows, damp rice-field banks etc., not usually floating or in deeper water, but usually rooted on the ground.

Nepalese threatened status: **VU**.

145. ***Ceratopteris thalictroides*** (L.) Brogn. subsp. ***gaudichaudii*** (Brongn.) Fraser-Jenk. & Pariyar, ***comb. nov.***, basionym: *Ceratopteris gaudichaudii* Brongn., *Bull. Sci. Soc. Philom. Paris*, sér. 3, **8**: 35 (1821); syn.: *Ceratopteris gaudichaudii* var. *vulgaris* Masuy. & Watano; misapplied name: "*Ceratopteris succulenta*" *sensu* Fraser-Jenkins (2008) *p.p.*, *non* (Roxb.) Fraser-Jenk.).

Following Masuyama *et al*'s. (2002) & Masuyama & Watano's (2010) study of different taxa within *C. thalictroides*, and discussion with Masuyama as to the identity and name of Roxburgh's drawing, Fraser-Jenkins (2008) used the name *C. succulenta* for the present subspecies. But Masuyama & Watano (2010) subsequently found that the lectotype specimen of *C. succulenta* unfortunately does not match Roxburgh's illustration and belongs to subsp. *thalictroides*. They investigated the present taxon's genetic relationships and named it as *C. gaudichaudii* Brongn. var. *vulgaris*, at a rank of rather unclear status, which is molecularly closely related to what they called *C. gaudichaudii* subsp. *gaudichaudii* and has a generally similar morphology. The morphological difference, mostly in size of some individuals and the type, between "var. *gaudichaudii*" and "var. *vulgaris*" is hardly significant and is not recognised here. The subspecific rank chosen here reflects both the biological

distinction and the very close relationship between the two subspecies as well as their close and semi-cryptic morphology, and we would also recommend a similar treatment as a subspecies within *C. thalictroides* for *C. oblongiloba* Masuy. & Watano.

Plants rather small (usually to *c.* 18 cm. tall, commonly only *c.* 10 cm.), very similar to subsp. *thalictroides*, but the stipes relatively shorter, approximately only half the length of the lamina, though some taller central fertile fronds in larger specimens may have the stipe approaching the same length as the lamina, lamina usually less dissect than in subsp. *thalictroides*, with fewer and more crowded pinnae and pinnules, but fertile segments usually noticeably longer and straighter so the frond is more ovate, sterile fronds not as dissect as in subsp. *thalictroides*, their segment-apices usually narrower than in subsp. *thalictroides*. This taxon was found to be tetraploid, based on $n = 78$.

Nepal:

W: **Kailali** [forested bank of lake, on S.W. side of Godhagodhi Lake, Sukhar, *c.* 40 km. E. of Attariya and Dangadhi, Kailali District, *C.R. Fraser-Jenkins* 34705 (FN 207), 24.11.2010, TAIF], **Banke** [Fultekra, Nepalganj, in paddy field, growing on moist soil, *Chandrabali* 17114, 4.11.1973, KATH]; **Surkhet** [by wet path to village, towards river Kharekhola, from path *c.* ½ km. below and S.W. of Kharekhola village, down stream into Sal forest, *c.* 1 km. below and S. of Kharekhola village, *c.* 3 km. N.N.E. of Surkhet, Surkhet District, *C.R. Fraser-Jenkins*, with *K. Neupane* & *K.* [*U.*] *Pongali* 25586 (FN 1564), 27.9.1997, BM, H, morphology somewhat towards subsp. *thalictroides*].

C: **Kaski** [Begnas Lake, near Pokhara, *c.* 650 m., *T. Nakaike* 1967, 28.9.1986, KATH, TNS, det. CRFJ, 2014, as "subsp. *thalictroides*" in error, corrected here], **Lamjung** [Marsyangdi khola, Shimalchaur (800 m.) - Bhachok (850 m.) - Ampchaur (800m.) - Bhotioder (650 m.), *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331464, 12.8.1983, KATH, but sterile fronds only], **Gorkha** [edges of wet rice-fields, *c.* ½ km. N.E. of Gopling, by path up to Deurali, N. of Marsyangdi dam, *c.* 5 km. W.N.W. of Anbu Khaireni, N. side of Marsyangdi river, between Mugling and Damauli, Gorkha District, *C.R. Fraser-Jenkins* 28604 (FN 4579), 20.8.2000, H], **Chitawan** [Chitwan Distr., 5 mi. W. of Tiger Tops, Rapti Dun, in wet ditches, edge of ricefields, 450 ft./900 ft./1000 ft., *R.L. Fleming* 1863, 10.11.1964, KATH, *ditto*, 1863, 16.11.1964, MICH; Kasara, Royal Chitwan, 843274, shady and moist place of Sal forest, 200 m., *D.P. Joshi, I. Bajracharya* & *R. Kayastha* 75/3448, 18.12.1975, KATH; Tigori (= Tikauli), near Bharatpur, *c.* 180 m., *T. Nakaike* 1909, 26.9.1986, KATH, TNS, det. CRFJ, 2014, as "subsp. *thalictroides*" in error, corrected here; Chitwan National Park, lake on track to Bankadta from Sukibhar Post, 27° 31' 37", 84° 15' 0", 150 m., *C.A. Pendry et al.* DNEP2 A90, 23.11.2004, KATH]; **Bara** [Chandranigharpur, *c.* 100 m., *T. Nakaike* 3694, 7.11.1988, KATH, TNS], ?**Makawanpur** [Napalia, [*N.*] *Wallich*, Enum. List. no. 83, 1821, K], **Nuwakot**

[Trisuli, on the bank of the Trisuli river, [*T.B.*] *Shrestha* & [*A.V.*] *Upadhyay s.n.*, 10.1962, KATH]; **Kathmandu** [Swoyambhunath, 5000 ft., *R.L. Fleming* 1694, 10.1962, KATH], **Sindhupalchok** [Talang Marang to Norbu Timure, Sindhupalchok Distr., open place along the track, 7800 ft. [altitude highly anomalous, incorrect], *V.L. Gurung* 78/772, 23.10.1978, KATH]. C. Nepal, locality data not written at the Nat. Hist. Mus., given in TNS, [*T. Nakaike*] 185, T.U Nat. Hist. Mus.].

E: **Sankhuwasabha** [Chandanpur, Sankhuwasabha, aquatic, rooted, 1000 m., *N. Thapa* S7/96, 21.4.1996, KATH], **Jhapa** [stream running through secondary Sal-tree woods, *c.* 1½ km, N.W. of Kakkarbhitta town, on way to tea-estate, E. of Birtamod, shortly W. of Mechi river (Indo-Nepalese border), in the terai, Jhapa District, *C.R. Fraser-Jenkins*, with K. ["*U.*"] *Pongali* 26522 (FN 2500), 14.8.1998, H]; **Taplejung** (Dumhan (700 m.), *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305181, 30.10.1963; Khebang - Baromdin, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama*, 6305182, 24.11.1963, K, KATH, TI [KYO also cited by Masuyama & Watano (2010)]).

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Assam; Bhutan; W. Bengal; Sikkim; Darjeeling; W., C. and E. Nepal; Uttarakhand; Himachal Pradesh. Manipur; Bihar; S. India; Taiwan; Japan; Korea; Pacific Islands; the Americas.

(?S (but more widespread), Sc). A scattered but often overlooked, low to mid-altitude semi-aquatic species, of similar habitats to subsp. *thalictroides*.

Cerosora (1 species).

146. ***Cerosora microphylla*** (Baker) Domin (syn.: *Gymnogramma microphylla* Hook.; *Grammitis microphylla* (Hook.) Bedd.; *Anogramma microphylla* (Hook.) Diels; *Idiogramma microphylla* (Hook.) S.R.Ghosh). This species and genus are very distinct from *Anogramma*, in which genus G.M. Zhang & Ranker (2013) in the *Flora of China* have continued to treat it.

A small (fronds *c.* 6-18 cm. long), finely dissect species, stipes very thin, smooth, wiry, reddish-purple, often longer than the lamina; lamina small, deltate, bipinnate-tripinnate, finely dissect, with many finely stalked, very small, ovate segments, toothless or terminating in 1 to 2 small teeth; sori exindusiate, acrostichoid, spreading throughout much of the centre of the segment.

Nepal:

E: **Sankhuwasabha** [E. Nepal, Lamo Pokhari, 873272, on wet muddy rock in deep shade in forest by lake, 2900 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725158, 8.6.1972, BM, KATH].

Full distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling. Meghalaya.

(S, Sc). An extremely rare (in Nepal), higher altitude species of mossy banks *etc.*; or at the bases of tree-trunks or rocks in very moist conditions.

Nepalese threatened status: **CR**, known only from one collection in Nepal.

Cheilanthes (4 species).

Very recent use (by Christenhusz 2012, and thence Rumsey 2014) of the genus *Allosorus* Bernh. to refer to an entirely cryptic molecular clado-genus, including the European and some of the Indian subcontinental species referred by Ching to *Cheilosoria*, segregated from *Cheilanthes*, is both erroneous and unnecessary. *Allosorus* was first typified by Röhling (1813), followed by Woynar (1911), with the type species being what is now widely called *Cryptogramma crispa* (L.) R.Br. *ex* Hook. and his selection, being perfectly proper, is to be followed. The lectotype of *Allosorus* Bernh., in Schrader, *Neues J. Bot*. **1**(2): 5, 36 (1805), here designated, is *Allosorus crispus* (L.) Bernh. [= *Cryptogramma crispa* (L.) R.Br. *ex* Hook.]. Obviously it is important that *Allosorus* be recommended for rejection, and though a previous proposal by Panigrahi (1987) to this effect failed, that was because he also wished to lectotypify *Cheilanthes* in a different sense in his proposal and did not present sufficient clear reasoning. The very highly confused and meaningless genus *Allosorus* should rapidly be rejected as a *nom. utriqe rejic.* so that it does not interfere with *Cryptogramma* or any other genus. The separation of a microgenus "*Allosorus*" from *Cheilanthes* to include European and some Himalayan *Cheilanthes* is anyway untenable because there is no morphological distinction between them and such a genus cannot be circumscribed, a basic principle which must not be ignored by moleculologists, especially given that the cheilanthoid infrageneric subgroups are all closely related.

Christenhusz (2012) claimed that the name *Allosorus* had never been used "in its original sense" but gave no explanation as to what that sense should be, or why it was supposed by him to apply to European *Cheilanthes*, citing Pichi Sermolli (1953), where, however, the name was not lectotypified as it could not legitimately be changed in sense from applying to *Cryptogramma*. He also claimed on molecular grounds only that *Aleuritopteris* was a synonym of *Allosorus*, which is morphologically unacceptable unless all are subsumed into *Cheilanthes* and only serves to emphasise the taxonomic bancruptcy and lack of common sense of attempted classifications based only on molecular cladonomy, which is all he was prepared to consider. The very minor group concerned is therefore best treated merely as a subgenus or section *Cheilosoria* within *Cheilanthes* regardless of its moleculo-cladistic difference. All the new combinations made by both Christenhusz and Rumsey are therefore to be synonymised into *Cheilanthes*, or, if some really felt it necessary regardless of its inappropriateness, into a genus *Cheilosoria*. It is certainly not mandatory to separate it generically as some molecular workers feel they must automatically do without paying heed to proper morpho-taxonomic considerations that they are less than familiar or competent with.

147. ***Cheilanthes belangeri*** (Bory) C.Chr. (syn.: *Pteris belangeri* Bory; *Cheilosora belangeri* (Bory) Ching & K.H.Shing; *Cheilanthes varians* Wall. *ex* Hook.; *Pellaea cambodiensis* Baker).

A small species (fronds *c.* 15-20 cm.) with a tuft of erect, narrow fronds; stipe scaly with narrow brown scales at its base, erect, black and glossy, considerably shorter than the lamina; lamina bipinnate, very narrow, with many strongly upswept pinnae tapering to the narrow frond-apex; pinnae triangular, pinnate at their bases, tapering to longish entire apices, pinnules narrowly triangular-lanceolate, usually bearing a few small, elongated, pale bulbils on the surface when alive; sori marginal, with an occasionally interrupted marginal pseudoindusium around the quite wide central area of lamina in each segment or lobe.

Nepal:

E: **Sunsari** [Panchakanya V.D.C, Patrangbari village Community Forest, E. of Ghairi village, slope above paddy field, 500 m., *N. Thapa*, *K.R. Bhattarai* & *D. Poudel* S1, 28.6.2001, KATH], **Jhapa** [stream running through secondary Sal-tree woods, *c.* 1 ½ km. N.W. of Kakkarbhitta town, on way to tea-estate, E. of Birtamod, shortly W. of Mechi river (Indo-Nepalese border), in the terai, Jhapa District, *C.R. Fraser-Jenkins*, with *K.* [*U.*] *Pongali* 26524 (FN 2502), 14.8.1998, H; among Sal-trees in Kutte Dange wood, *c.* 1 km N. of Dhulabari, N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 29397 (FN 5372), 6.10.2001, H].

Peri-Himalayan distribution: S. China; Myanmar; Darjeeling *terai*; Nepal. W. Bengal; Assam State; Meghalaya; Tripura; Mizoram; Bangladesh; Thailand; S.E. Asia.

(M, Sc to R). A very rare (in Nepal), low-altitude species of small open clearings in forest, or earth banks in semi-open forest.

Nepalese threatened status: **EN**.

148. ***Cheilanthes nitidula*** Wall. *ex* Hook. (syn.: *Pellaea nitidula* (Wall. *ex* Hook.) Baker; *Mildella nitidula* (Hook.) C.C.Hall & Lellinger; *Mildella henryi* (Christ) C.C.Hall & Lellinger; *Cheilanthes nitidula* subsp. *henryi* (Christ) Fraser-Jenk; misapplied name: "*Aleuritopteris albomarginata*" *sensu* Singh & Panigrahi (2005) *p.p.*) The E. Indo-Himalayan and Chinese populations were distinguished as *M. henryi* by Hall & Lellinger (1967), following Christ, which was said to differ from *C. nitidula* in having shorter basal pinnules and the short, black hairs on the rachis often extending further around the rachis, but though extreme plants appear a little "neater" in habit (smaller segments), it varies considerably and the two merge together entirely throughout the Indo-Himalaya with overlapping ranges, so are combined here, as also by G.M. Zhang & Yatskievych (2013) in the *Flora of China* (2013), though it could be recognised as a forma if preferred.

A small plant (*c.* 12-18 cm. tall); stipe black or grey-black, not as long as the lamina, stipe and rachis furnished with very scattered, linear-aristate scales throughout much of its length, rachis black, but grey in very young fronds, bearing many dense, minute black hairs on the upper surface, sometimes spreading slightly around the sides; lamina stiff, narrow, bipinnate, elongated oblong-lanceolate, the lowest pinna only slightly longer than the next above, often striate beneath; pinnules stalked,

rather narrow, entire and simple apart from at the pinnatifid to pinnate bases of lower pinnules, their apices pointed; pseudoindusia starting pale green, becoming brown on soral ripening, continuous, as long as the length of the lobe, margin dentate, edges of lamina extend minutely beyond the indusia.

Nepal:

W: **Jumla** [Jumla, on vertical cliffs, 7500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 921, 6.5.1952, BM; Gum, Jumla Distr, 6500 ft., *R.L. Fleming Jr.* [son of Dr. "Bob" Fleming Sr.] 2004, 1-2.1971, K; between Kudari and Nagma, Jumla District, 2050 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, Y. Yasuda* & *A. Ujihara* 14161, 6.11.1982, KYO; Dhunge dhara - Phalke odar, Jumla District, 2100 m./2300 m., *P.R. Shakya* & *B. Roy* 5490, 5512, 5.6.1980, KATH], **Mugu** [Gumgadi - Dhauleya, Mugu District, *H. Tabata*, *D.P. Joshi, K. Tsuchiya*, *N. Fujita, E. Suzuki*, *Y. Shimizu*, *F. Koike, K. Matsui* & *T. Yumoto* 16886, 22.7.1983, KYO], **Dolpa** [Rohagaon, Suli Gad, growing among rocks on open slopes, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3432 *p.p.* (among *Notholaena delavayi*, plant on top left of sheet), 15.9.1952, BM]. Seven more Tabata specimens are in KYO, cited by Iwatsuki (1988).

Himalayan distribution: China; Tibet; Arunachal Pradesh; Bhutan; N. Sikkim; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Taiwan; Japan.

(S, R to Sc). A rather rare and restricted (in Nepal) upper-mid to more usually higher altitude to high Himalayan species growing in shaded rock crevices or at the bases of boulders in drier areas.

Nepalese threatened status: **NT**.

149. ***Cheilanthes subvillosa*** Hook. (syn.: *Aleuritopteris subvillosa* (Hook.) Ching; *Leptolepidium subvillosum* (Hook.) K.H.Shing & S.K.Wu; although Fraser-Jenkins (2008) had placed *Leptolepidium tenellum* Ching & S.K.Wu as a synonym of the present species, G.M. Zhang *et al.* (2013) reidentified it as being the Chinese species *C. kuhnii* Milde, which is presumably correct). This species and its ally, *C. kuhnii*, from China and Japan *etc*., were included by Ching, Saiki *et al*. within *Aleuritopteris* and are still treated as that genus by G.M. Zhang *et al.* (2013) in the *Flora of China*. They were partly separated into a mixed genus, *Leptolepidium*, by Wu (1979), but as that was mistakenly typified by "*A. dalhousieae*" in the sense of *A. leptolepis*, both being *Aleuritopteris* species, it cannot stand.

Stipe as long as the lamina, very brittle, glossy black, bearing very scattered, thin, broad-ovate pale scales, with darker, abruptly pointed apices, throughout much of its length; lamina delicate, pale-green, narrowly lanceolate, usually narrowed slightly to the basal pair of pinnae, always efarinose, bearing hairs beneath near the pinna-costae; pinnae short, deltate; pinnules or lobes obtuse, lower pinnules pinnatifid, rest lobed, untoothed; pseudoindusia elongated around the margin, but separated into lobes.

Nepal:

W: **Jumla** [above spring, on walls of and beside a small overhang, half-cave beside path leading up to Danphe Lagna pass and over Dori Lekh ridge to Rara Lake, above Chauriyachaur (Patama) meadow, *c*. 3 km. N. of Karnali Technical College, *c*. 6½ km. N. of Jumla, Jumla District, *c*. 3300 m., *C.R. Fraser-Jenkins*, with *Rajkumar K.C.* & *K. Neupane* 22099 (FN 6), 7.6.1995, E], **Dolpa** [Tarakot, on and among stones on cultivated ground, 2700 m., *S. Einarsson, L. Skärby* & *B. Wetterhall* 1484, 2.7.1973, BM; Dunai, Dolpa Distr., 2818 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 3366, 9.9.1976, KYO].

C: **Rasuwa** [Langtang village area, stone walls, 11,500 ft., *O. Polunin* 1579, 1.8.1949, BM; Langtang, around the village, common on rocks 11,300 ft., *R.L. Fleming* 1980, 20.10.1969, K, DD, MICH; Syarpagaon, N. side of Langtang river, 2500 m., *D.H. Nicolson* 2450, 19.9.1966, US; Kyanchin Gomba, 28° 13', 85° 34', 3600 m., *J.F. Dobremez* 1035, 8.9.1971, G *sub* "*C. dalhousiae*" in error], **Gorkha** [Tsumje, 3300 m., *S. Nakao s.n.*, 23.7.1953, TI, KYO].

E: **Solukhumbhu** [Tesinga, 3300 m., *A. Zimmermann* 1823, 23.10.1954, BM, G].

Total distribution: China; Tibet; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

(S, Sc). A rather uncommon or scattered and local, though fairly widespread higher altitude to high Himalayan species usually preferring drier regions, rock crevices, often at bases of or among old stone walls in half shade.

Nepalese threatened status: **LC**.

150. ***Cheilanthes tenuifolia*** (Burm.f.) Sw. (syn.: *Trichomanes tenuifolium* Burm.f.; *Cheilosora tenuifolia* (Burm.f.) Trevis.; *Acrostichum tenue* Retz.; misapplied name: *C. contigua sensu* Quirk & Chambers (1983), *pro parte Ind.*, non Baker [from Australasia]).

A small (fronds to *c.* 30 cm. tall, often less) tufted species, rhizome short, ascendent, bearing much divided roots with many small, lateral tips; stipes erect, thin, black, glossy, bearing some small scales at the base, as long as or longer than the lamina; lamina markedly deltate-pentagonal, delicate, finely quadripinnate, the lowest pinna and its lowest basiscopic pinnule being the longest, axes black, pinna-costae and costules bearing some scattered minute glandular hairs, variablr in density; ultimate segments very small, ovate-lanceolate, with small teeth in sterile segments, without teeth in fertile ones; pseudoindusia continuous around the margin of lobes or segments, entire.

Nepal:

W: **Surkhet** [Chhinchu, Surkhet Distr., on semi open to open grasslands or slopes, 500 m., *N. Thapa* S11, 7.8.2001, KATH].

C: **Syangja** [roadside rocks, cliffs & banks, shortly south of Chiuri village, south

towards towards Gallyang ("Golleng"), on E. side of and above Andhi Khola river, N. of Butwal on main road S. from Syangja and Pokhara towards Waling, Syangja District, *C.R. Fraser-Jenkins* 31021, 3.1.2005, TAIF], **Parbat** [Ghodepani, *D. Bhajracharya* NHMTU-2-6B-00373, 9.10.1984, TU Nat. Hist. Mus.], **Kaski** [Pokhara, among shrubs, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6772, 12.8.1954, BM, E], **Manang**, **Tanahun** [forested stream among rice-fields, *c.* 2 km. above and S.W. of Chowti Bara Mandir, *c.* 8 km S. of Damauli, E. of Pokhara, W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins* 25493 (FN 1471), H, BM], **Gorkha** [forested rocky slope facing south, leading up to small temple of Buddhikothi Mandir, on rocks at the top of the mountain north of Deurali, overlooking Marsyangdi valley to the south and a large valley towards Gorkha to the north, between the main Gorkha and Pokhara roads, N.W. of Anbu Khaireni, W. of Mugling, Gorkha District, *c.* 1500 m., *C.R. Fraser-Jenkins* & Rajkumar Khatri Chhetri 20890 (FN 1138), 17.2.1994, E], **Chitawan** [Ramnagar, Chitwan District, shady gullies in Sal forest, 400 m., *K. Wesche* 5/244, 6.1994, BM], **Makawanpur** [stream in forest on N. side of Churiya Ghats ridge, N. of Bogaon ("Bogar") on path to Raigaon, N. of Bagmati Pul (bridge), on W. side of Bagmati river, N.E. of Chandranigarpur, E. of Hetauda, Makawanpur District, *C.R. Fraser-Jenkins et al.* 25736 (FN 1714), 22.10.1997, H], **Rasuwa**, **Dhading** [forested stream-gully at N. edge of Nagarjun forest, S. of and below Osho Dam Centre, just W. of Mudkhu Dhoka, N.W. of Balaju on Kakani road, N.W. of Kathmandu, Dhading Distr., *c.* 1400 m., *C.R. Fraser-Jenkins* 29783 (FN 5758), 29.11.2001, H], **Kathmandu** [Sundarijal, Kathmandu valley, 5800 ft., *R.L. Fleming* 1530, 13.9.1958, MICH; Nagarjung, *R.L. Fleming* 1670, in 1961-1962, DD, *ditto*, 1562, 9.1958, MICH], **Bhaktapur** [Bhadgaon forest, Kathmandu valley, open grassy places, 5500 ft., *R.L. Fleming* 1949, 25.8.1969, MICH], **Kabhrepalanchok**, **Sindhuli** [banks on slopes of N. side of Churiya Ghats ridge, S.E. of Duarde village, on path down to Bagmati Bridge, S.E. of Raigaon, on E. side of Bagmati river, Sindhuli District, *C.R. Fraser-Jenkins et al.* 25752 (FN 1730), 23.10.1997, H].

E: **Khotang** [Indkhu khola, 27°29', 86°44', 1400 m., *J.F. Dobremez* 290, 2.7.1970, KATH], **Sankhuwasabha** [Tumlingtar, *c.* 1500 ft., *H. Emery, E.W. Cronin, H.* & *A. Foster* & *K. Brooks* F 1324, 21.7.1974, BM], **Solukhumbu** [Indkhu khola, 27° 29', 86° 44', clarière dans Schima, 1400 m., *J.F. Dobremez* 290, 2.7.1970, BM], **Bhojpur** [Bhojpur District, Agati, *c.* 40 km. N. of Dharan, on monsoon trail to Bhojpur, above Leguwaghay, near Agati village, up from Arun River, open dry rock-slope in sun, E.-facing, *c.* 600 m., *c.* 27° 10', 87° 15', *R.G. Troth* 98, 28.7.1971, MICH, det. R.R. Stewart], **Dhankuta** [Distr. Dhankuta, road to Dhankuta, *c.* 17 km. N. of Dharan, *c.* 26° 55', 87° 22', in open rock crevices, *c.* 695 m., *R.G. Troth* 74, 13.7.1971, MICH; Tamur Bridge (300 m.) - Mohamabedi khola (400 m.), 872266, on muddy crevices of cliff in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725510, 9.7.1972, BM], **Sankhuwasaba** [Tumlingtar, Sabhaya river, on cliffs, 1800 ft., *A.H. Norkett* 8006, 7.12.1961, BM], **Jhapa** [stream

running through secondary Sal-tree woods, *c.* 1½ km. N.W. of Kakkarbhitta town, on way to tea-estate, E. of Birtamod, shortly W. of Mechi river (Indo-Nepalese border), in the terai, Jhapa District, *C.R. Fraser-Jenkins* 26523 (FN 2501), 14.8.1998, H], **Ilam** [Ilam, *J.F. Dobremez* 1174, G; Ilam, E. Nepal, in the sal forest floor, 800 m., *D.P. Joshi* 28, 26.9.1971, KATH].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Sikkim; Darjeeling; W. Bengal; Nepal; ?Uttarakhand [Pithoragarh, *B.S.Kholia*, Pithoragarh Post Graduate College (!) (Kholia & Punetha 1975), probably originating from further east in the Himalaya]. N.E., C. and S. India; S.E. Asia; Australasia, Pacific Isles. A specimen from Azad Kashmir State, Pakistan, thought to be this species (Bangas, Muzaffarabad, *J.F. Duthie* 20786, 21.7.1887, K) is *Cystopteris montana*.

(M, C). A common low to mid altitude species of open steep, compact earth banks beside paths, among rocks *etc.*

Coniogramme (6 species).

151. ***Coniogramme affinis*** Hieron. (syn.: *Gymnogramma affinis* C.Presl., *nom. nud.*; ?*Conigramme rosthornii* Hieron.). *C. affinis* was synonymised into the entirely different species, *C. fraxinea*, by Iwatsuki (1988) in error. Apart from various random misidentifications, this species has sometimes been reported under the name *C. rosthornii* Hieron., including by Ching and also tentatively Fraser-Jenkins (1992), and thence by Chandra (2000). *C. rosthornii* from China, from where many excess new species were described, is very similar to a small *C. affinis* and might even be synonymous, though maintained by G.M. Zhang & Ranker (2013) in the *Flora of China*.

Typical of species of *Coniogramme*, with a long-creeping, somewhat thick underground rhizome, fronds up to *c.* 70 cm. tall, usually less), stipe fairly robust, pale green or stramineous when dry, glabrous, up to the same length as the lamina, lamina thinly herbaceous, turning brown and dying down rapidly in Winter, pale green, glabrous, or slightly hairy beneath in fertile parts, bipinnate to tripinnate below; pinnae pinnate or the lowest bipinnate, diagnostically bearing many (*c.* 3-5 alternate pairs) long, shortly stalked simple segments (to *c.* 15 x 2 cm.), more than in other species except *C. procera*, and with a similar or slightly longer terminal segment, segments with broadly cuneate bases and tapering gradually at the apex to a narrow extended tip, up to *c.* 1 cm. long, margins prominently toothed with many diagnostically long, very narrow, linear-apexed teeth, with the vein-tips running up into the teeth, usually to their tips, or at least well into the tooth. Sori running along the veins in crowded, parallel lines from near the midrib to about 2/3 the length to the margin on each side, exindusiate.

Nepal:

W: **Darchula** [Simar - Dhaula odar, Darchula, 2848-3448 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yaho, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt*

["*Bhatta*"] & *M.L. Pathak* 1216060, 13.7.2012, KATH], **Bajhang** [between Nayaodyar and near Dhuli, Bajhang District, 2878 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 2135, 3.8.1976, KATH *sub* "*Pteris cretica*" in error], **Humla** [Chankheli, Humla, on north facing forest, 3000 m., *K.R. Rajbhandari* & *B. Roy* 4305, 3.8.1979, KATH], **Mugu**, **Jumla** [Ghurchi Lekh, near Chautha, in partial shade of deciduous forest, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3075, 28.8.1952, BM], **Jajarkot** [Dhotbas, south of Chakure Lekh, shady bank in Tsuga Forest, 8500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5563, 12.10.1952, BM].

C: **Kaski**, **Manang** [Marsyangdi khola, Chame (2630 m.) - Qupar (2530 m.) - Thangjo (2580 m.) - Dhanagyang (2200 m.), 842284, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8350880, 6.8.1983, BM *sub* "*C. intermedia*" in error], **Gorkha** [below Namrung, Manaslu Conservation Area, Gorkha, 2400 m., *S.H. Bhattarai* 1310, 6.10.2012, KATH], **Rasuwa** [rocks in forest by stream, on N.E. side of and below Khurpudara [Khurpudanda] ridge, above Army Headquarters, E. of Somdang, W. of Langtang, above and to the west of Syabrubense and Gatlang, N. of Dhunche, Trisuli Bazaar and Kathmandu, Rasuwa District, *c.* 13,000 ft., *C.R. Fraser-Jenkins* 15697, 10.11.1989, E].

E: **Solukhumbhu** [rive gauche de la Dudh Kosi, [between Namche Bazaar and Monjo, at the foot of rocks, half shade], 2850 m, *A. Zimmermann* 1749, 17.10.1954, BM, *sub* "*C. caudata*" in error and "*C. intermedia*?"; rive droite de l'Imja khola, 2885 m., *A. Zimmermann* 725, 9.6.1952, BM *sub* "*Angiopteris evecta*" in error, difficult to distinguish from *C. intermedia* as very young].

Total distribution: China; Tibet; ?Myanmar (listed by G.M. Zhang & Ranker (2013), but we have seen no material); Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

(S, C). A quite common, if often overlooked, higher altitude to high Himalayan species, occurring at a higher elevation than other species apart from *C. procera*, and growing among bushes and at the edges of the forest along paths or on steep well vegetationed slopes in semi-open conditions, often forming large colonies of considerable beauty when all the young fronds are coming up at the same time in early Summer.

152. ***Coniogramme fraxinea*** (D.Don) Fée *ex* Diels (syn.: *Diplazium fraxineum* D.Don; *Diplazium falcatum* D.Don; *Syngramma fraxinea* (D.Don) Bedd.; *Coniogramme falcata* (D.Don) Salomon; *Gymnogramma javanica* Blume; *Coniogramme javanica* (Blume) Fée; *C. macrophylla* (Blume) Fée; *C. petelotii* Tardieu; *C. merrillii* Ching; *C. subcordata* Ching, *nec al.*; *C. fraxinea* var. *tirapensis* Sarn.Singh. *C. petelotii* (misspelt as "*pitelotii*" by Dixit & Das (1979, Ghosh et al. (2004)) and *C. merrillii* are confirmed here as being poorly developed plants of *C. fraxinea*, though they were still maintained as species by G.M. Zhang & Ranker (2013) in the *Flora of China*, but tellingly with the latter being reported from Nepal and N.E. India, where

only the single relevant species, *C. fraxinea*, occurs). Dixit & Das (1979) in a paper marked for the inclusion of many erroneous "new species" entirely confused the variation within this species which is easily observable in the field, by assuming that plants with simple lowest pinnae constituted a different species from those with pinnate lowest pinnae. This error dated back to Don (1824) and indeed to Hamilton (1805, *ined.*) before him, but had already been corrected in the interim. Don described *D. falcatum* from a specimen with simple lowest pinnae and *D. fraxineum* from one with compound lowest pinnae, the previously lost lectotype of *D. fraxineum* D.Don, *Prodr. Flor. Nepalensis*: 12-13 (1824), here designated, is "*Hemionitis ramosa* B[uchanan], Suembu, [*F. Buchanan* later *Hamilton*], 28 April 1802", CAL, and was discovered in Kolkata (Calcutta) after much search by CRFJ in 2012, where it could only have been taken on loan, presumably by Panigrahi for his student, Dixit's paper, and not returned to BM. It still grows in the rather damaged woods on Swayembhunath Hill today (*e.g. CRFJ* 26371 (FN 2349), 13.6.1998, H, in a survey of extant Swayembhunath pteridophytes).

A large species (up to *c.* 1.5 m. or more), distinguished by its long, often very wide segments (to *c.* 25 x 3-4 cm.) with long simple mid and upper areas, and diagnostically entire, if sometimes slightly undulate margins, including at the apex, with the broadened vein-endings terminating just within the margin, segment-apices usually abruptly caudate, or sometimes gradually tapering pinna-apices; the pinnae and pinnules vary from having a cuneate base to a broadly rounded or somtimes slightly cordate one and usually bear a few pinnules towards their base when full-sized, either basiscopic ones only or on both sides, otherwise all simple, the lamina is usually dark green and smooth. Very young plants may have cordate bases and wide, simple pinnae. Plants of this species and *C. serrulata* sometimes develop a most attractive pattern of pale yellow streaks and crescents when growing in good conditions, which is sometimes maintained on transplanting, sometimes not.

Nepal:

W: **Jajarkot** [Jhapra, under tree shade, 1500 m., *N.P. Manandhar* 639-91 A, 3.3.1991, KATH].

C: **Palpa**, **Syangja**, **Kaski** [deep steam-gorge in forest just beyond N.W. end of Rupa Tal, on N. side of lake-valley, N. of Begnas, *c.* 15 km E. of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *G.B. Tamang* & *K.* [*U.*] *Pongali* ["*Chhetri*"] 25947, 25948 (FN 1925, 1926), 13.1.1998, BM], **Lamjung** [Jagat, Lamjung, 1500 m., *N.P. Manandhar* 3364, 24.12.1979, KATH], **Gorkha** [among moss etc. in small, N. facing waterfall below and N. of Buddhi Kotti temple, between Piyor and Bhanjyang, N. of Deurali, above Batobesi, N.W. of Majua Khaireni, S. of Gorkha, Gorkha District, *c.* 900 m., *C.R. Fraser-Jenkins* 28513 (FN 4488), 12.5.2000, H], **Rasuwa** [Grang, 28°03', 85°13', wet places, 1800 m., *J.F. Dobremez* 912, 3.9.1971, KATH], **Dhading**, **Kathmandu** [Narainhetty, Napaul, *Dr.* [*F.*] *Buchanan* [later *Hamilton*], 1 March 1803, BM *sub* "Hemionitis falcata B[uchanan]"; Napalia, [*N.*]

Wallich Num. List. no. 4, in 1821, K-W, BM, US; forested gulley on N.E. side of Jamachok mountain, Nagarjun Forest, by road near Gate no. 1, N.W. from Balaju, *c*. 3 km. N.W. from Balaju on Kakani and Trisuli Bazaar road, N.W. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* 16179, 14.3.1990, E], **Lalitpur [**Chapagaon forest, Kathmandu valley, 5000 ft., *R.L. Fleming* 1308, 3.9.1956, K; Godawari, S.E. of Katmandu, *K. de B. Codrington* 107, in 1956, BM], **Bhaktapur** [hills *c*. 4 miles south of Bhadgaon, 5700 ft., *R.L. Fleming* 1245, 16.8.1956, KATH, sub "*C. affinis*" in error], **Dolakha** [Suri Dovan, Suri-8, Dolakha, 1120 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121126, 9.11.2012, KATH].

E: **Dhankuta**, **Panchtar** [Panchtar District, Hima khola, on rocky, shady cliffs, 1200 m., *D.H. Nicolson* 3209, 10.4.1967, BM, KATH; Tharpu - near Chyangthaphu, *H. Kanai, G. Murata* & *M. Togashi* 6305042, 26.11.1963, BM, K], **Jhapa**, **Ilam** [densely forested, rocky stream-gully of Sudhung khola, shortly below Sudhung, leading south below road, below Sundergaon, W. of Pashupatinagar on Ilam road, Ilam District, *C.R. Fraser-Jenkins* 25535 (FN 55010), 9.10.2001, H. **Taplejung** [above Mewa river, damp hillside, 3500 ft., *R.L. Fleming* 2097, 1.12.1971, K].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. N.E. India; Taiwan; Thailand; S.E. Asia.

(M, C). A rather common if slightly scattered lower-mid to mid-altitude species, usually growing in luxuriant, deep-shaded places on well vegetated slopes in forest, often near stream-gullies.

153. ***Coniogramme intermedia*** Hieron., lectotype (Fraser-Jenkins 2008) from Jammu & Kashmir State, India (syn.: *C. intermedia* var. *villosa* Ching; *C. intermedia* var. *glabra* Ching; *C. glabra* (Ching) S.R.Ghosh - some confusion was made by Fraser-Jenkins (2008) in giving var. *glabra* under both *C. serrulata* and *C. intermedia*; misapplied name: tentative "*C.* ?*rosthornii*" *sensu* Fraser-Jenkins (1992), *non* Hieron. [= ?*C. affinis* or a separate species?]). From the description and illustrations, G.M. Zhang & Ranker (2013) in the *Flora of China* did not distinguish properly between the abruptly caudate segment-apices of *C. serrulata* and the gradually tapering ones of *C. intermedia*, explained by Fraser-Jenkins (1997, 2008), and included much of the latter in the former.

Similar to *C. affinis* and *C. serrulata*, but with a paler green and more dissect, thinner lamina than the latter, and the segments tapering gradually to their apices, while the pinnae do not have as many segments as in *C. affinis* and the marginal teeth are not as long and narrow and always have the vein endings terminating in the lower part of the tooth unlike in *C. affinis* and not shortly below the tooth as in *C. serrulata*. The acroscopic bases of the lowest pinnule-lobes or segments are usually asymmetrical and obviously dimidiate acroscopically at the fork. The species varies continuously in hairiness beneath, but is more commonly glabrous, apart

from some hairs being present in fertile regions; sori extend from the segment midrib to 2/3 the way to the margin and often remain characteristically yellow for longer than in *C. serrulata*, where they turn brown sooner. The species is not separable into two varieties as was done by Ching and Ching & Shing (1937), followed by G.M. Zhang & Ranker (2013). Illustrated in the *Flora of China* illustrations volume, Fig. 232 and Fig. 233 under the name "*C. intermedia* var. *glabra*".

Nepal:

W: **Jumla** [Kawa khola, Jumla, on moist and shady rock crevices, 2225 m., *T.B. Shrestha* & *N.P. Manandhar* 322, 18.10.1975, KATH].

C: **Parbat** [dense forest by stream at Nagethanthi, between Banthanthi and Nangethanthi, above Ulleri on way up to Ghorepani, N. of Birethanthi, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c.* 2200-2700 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang*, *K. "Nepali" Pariyar* & *P. McCormack*, Dublin, i-to-i volunteer) 34517 (FN 22), 13.6.2010, TAIF], **Gorkha**, **Bhaktapur** [forested rocky stream-gully, *c.* 1 km. S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, E.N.E. of Kathmandu, Bhaktapur District, *c.* 1500 m., *C.R. Fraser-Jenkins*, with *R.* ["*G.*"] *Pariyar et al.* 25261 (FN 1240), 15.2.1997, H], **Lalitpur** [forested W. facing stream valley on W. side of lower Phulchowki mountain, above and S.E, of Godawari, E.S.E. of Kathmandu, Lalitpur district, *c.* 1700 m., *C.R. Fraser-Jenkins*, with *A.C. Jermy*, *V.L. Gurung*, driver, field-assistant, factotum, paeons *etc*. 19464 (FN 349), 12.1.1993, E].

E: **Solokhumbu**, **Sankhuwasabha** [densely forested stream-gullies on N. side of Tinjure ridge, *c*. 2 km. S.E. of Mude Sansuri, *c*. 8 km. N.N.W. of Basantapur [in Terathum District] and 3 km. N.N.W. of Deurali [in Terathum District], S. of and above Poluwa khola, S.E. part of Sankhuwasabha District, *C.R. Fraser-Jenkins* 28854 (FN 4829), 24.3.2001, H], **Sunsari** [above Sangure Ridge, in open glades, 6000 ft., *R.L. Fleming* 2620, 4.10.1978, KATH], **Ilam** [Kutidanda, Haspokhri, 2700 m., *V.L. Gurung* 1170, 2.9.1980, KATH].

Himalayan distribution: China; Tibet; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Taiwan; Japan; Siberia.

(S, Sc). A somewhat less common and scattered, though locally common species (in Nepal, commoner in the W. Indo-Himalaya), though widely misidentified and over-reported in error for *C. serrulata* and confused in India and China; occurs at upper-mid to higher altitude at the edges of forest, or beside semi-shaded paths, on slopes above streams *etc*.

154. ***Coniogramme procera*** Fée (syn.: *C. parvipinnula* Hayata; misapplied name: "*C. subcordata*" *sensu* Dixit & Das (1979), Ghosh *et al.* (2004), *non* Copel. [= *C. serrulata*]).

A very large and distinctive species (to *c.* 2.5 m. or more tall), with a robust stipe, deltate, dark-green frond, widest at the base, and many (often 10-15 pairs), ± short, alternate pinnules on each pinna, with the pinna-apex terminating in a somewhat longer pinna-like segments which become pinnately lobed towards their bases, then simply and in lower pinnae, more compoundly pinnate; pinnules with rounded-truncate to characteristic slightly cordate bases, the lamina has a strong smell of *Sambucus edulis* on crushing when living, margins bearing many small deltate teeth, especially towards the often slightly caudate-attenuate segment-apices; sori exindusiate, forming rather short lines along the veins.

Nepal:

C: **Baglung** [nr. Lumsum, rocks in forested ravine, 7000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 9140, 24.10.1954, BM; Dana, Baglung Distr., 8000 ft., *R.L. Fleming* 1757, 1.8.1959, K], **Myagdi** [Myagdi Distr., Maraini (2520 m.) - Dhara khola (2160 m.) - Lumsung (2160 m.) - Lulang (2430 m.) - Khaban Gurase (2870 m.), 83° 15'-17', 28° 30'-32', on shady slope at streamside, 2870 m., *M. Mikage, R. Hirano, A. Takahashi* & *K. Yonekura* 9682772, 17.9.1996, KATH], **Parbat** [Ulleri to Birethanthi, *T.B. Shrestha* & *M.S. Bista* 1471, 7.1964, US], **Kaski** [dense natural mixed mossy forest, Dovan Lodge to Bamboo Lodge to Sinuwa, N. of Birethanti and Chomrong on way back from Annapurna Base camp, N. of Pokhara off Baglung road, route to Annapurna Base Camp, Kaski District, *c.* 2200-2500 m., *C.R. Fraser-Jenkins, J.C.B. Fraser-Jenkins* & *Sagun Pariyar* 35037 (FN 314), 4-5.6.2012, TAIF], **Manang**, **Gorkha** [Ripchet khola, 28° 14', 84° 51', 2200 m., *J.F. Dobremez*, G], **Dhading**, **Nuwakot** [Satsae khola, 28° 00', 85° 10', forêt de Quercus lamellosa, 2400 m., *J.F. Dobremez* 606, 12.5.1970, BM; Salme, Nuwakot, 1850 m., *N.P. Manandhar* 3277, 19.11.1979, KATH], **Sindhupalchok**, **Ramechap** [between Sivalaya and Bhandar, 1800-2500 m., *T. Nakaike* 3115, 6.10.1988, KATH].

E: **Solukhumbhu** [Puiyan à Kharte, 2700 m., *A. Zimmermann* 1893, 28.10.1954, BM, G], **Sankhuwasaba** [above Norbu gaon, 7300 ft., *P.R. Shakya* & *M. Ohsawa* 998, 23.10.1971, KATH; Milke Danda ridge, wet hillside, 10,000 ft., *R.L. Fleming* 2100, 27.11.1971, K; Sankhuwasabha District, Bakung above Sekidim, mixed broad-leaved deciduous forest, moist, 2600 m., *C. Grey-Wilson, R. Henderson, K.R. Rajbhandari* ["*Bhandary*"], *B. Rosedale* & *N. Taylor* 4026, 15.8.1981, K], **Dhankuta**, **Tehrathum** [Terhathum Distr., Basantapur (2300 m.) - Tsute (2480 m.) - Chauki (2650 m.), Panchpokhari - Phedi, North and N.W. facing places in dense forest, 2800 m., *Y. Omori, N. Acharya, K. Fujikawa, M. Munemasa, M. Okada, R.H. Ree, M. Tateno* & *N. Thapa* 9955006, 3.8.1999, KATH], **Ilam**, **Taplejung** [Nipal orient, *J.D. H*[*ooker*], [in 1848], K; Tamur valley, Thapabu khola, N. of Taplejung, in forest, 10,000 ft., *J.D.A. Stainton* 1172, 1.8.1956, BM; Baroya Khimty - Thakma Khola [- Yamphodin], *H. Kanai, G. Murata* & *M. Togashi* 6305064, 16.11.1963, BM, K; Mewa gorge, damp hillside, 8500 ft., *R.L. Fleming* 2099, 3.12.1971, K; slopes, Dobala Danda, above Yamphudin, 27° 27', 87° 56', wet shaded

forest, 2350 m., *C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, S. Crawford, S. Zmartzty* & *M.N. Subedi* KEKE 1069, 1074, 28.9.1989, K], **Ilam** [below Kala Pokhari, Ilam, Roadside under tree, occasional, 9000 ft., *R.L. Fleming* 2543, 23.9.1978, KATH], **Taplejung** [Gupha Pokhari - Kopinkharka, 3008 m., *H. Ikeda, D.R. Kandel, R. Chhetri, H. Uchiyama, K. Akai, H. Taneda, O. Yano, N. Yamamoto, K. Miyata* & *M. Nakaji* 1228022, 10.8.2012, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Taiwan; Thailand; Vietnam.

(S, C). A rather common (towards the east) higher-altitude to high Himalayan species of very damp places beside streams or muddy water-flows in semi-open places among bushes at the edge of forests, beside paths *etc.*

155. ***Coniogramme pubescens*** Hieron. (syn.: *C. spinulosa* (Christ) Hieron.; *C. caudata* var. *nepalia* [*sic*] R.D.Dixit & A.Das; misapplied names: "*C. caudata*" *sensu auct. Ind., non* (C.Presl *ex* Ettingsh.) Ching [= *C. serrulata*]; "*C. caudiformis*" *sensu* Fraser-Jenkins (1992), *non* Ching & K.H.Shing [from China]). This species was widely known in India and China as "*C. caudata*" in error due to its name sounding like the segment-apices of the present species, but the identity and typification of that name was elucidated by Fraser-Jenkins (1992, 1997, 2008), based on Ettingshausen's nature-print, and found to belong to another caudate species, *C. serrulata*. Despite this clear and easily verifiable finding, the name *C. caudata* was misplaced as a synonym of the entire-segmented *C. fraxinea* by G.M. Zhang & Ranker (2013) in the *Flora of China* and was listed without its basionym authority as if a new species of Ching's.

A very distinctive and handsome species, fronds up to *c.* 40-50 cm. tall; frond pinnate to bi-pinnate basally, lamina rather coriaceous and thick, usually dark-green, somewhat glossy above, often strongly stiff-hairy beneath in fertile areas, but can often be glabrous, pinna- and segment-bases characteristically narrowly cuneate, generally tending to be widest shortly below their apices or in the middle, segment-apices abruptly caudate, teeth fine, narrowly triangular, with the vein-endings entering the bases of the teeth; sori exindusiate, extending along the veins from the segment-midrib to just within the margin.

Nepal:

W: **Doti** [Balma village [Kaptad National Park], Doti District, *Bis Ram*, Forest Research Institute, Dehra Dun 433, 20.5.1929, BM *sub* "*Gymnogramma javanica*" in error], **Kalikot** [Kalikot Dt., Chaukebada - Badarigaon, 1600 m., *K.R. Rajbhandari* 14601 (FN 301), 5.8.1991, KATH], **Jajarkot** [Maina, between Jajarkot and Jumla, steep wooded slopes in ravine, very common, 6500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3861, 6.4.1952, BM].

C: **Baglung** [Lumsum, south side of Dar Khola below Lumsum, wooded gully, in relatively dry areas in mossy woodland, *c.* 6500 ft., *A.R. Vickery* 514, 26.3.1974,

BM], **Parbat**, **Kaski** [Panchase Lekh, in mixed forest of Quercus semecarpifolia and Rhododendron arboreum, on shady slope, *D.P. Joshi* & *M.M. Amatya* 0436, 13.12.1973, KATH], **Makawanpur**, **Dhading** [Ganesh Himal, Ankhu Khola, 28° 12', 85° 05', in broadleaved forest, 8000 ft., *J.D.A. Stainton* 3677, 8.5.1962, BM], **Rasuwa** [Dhunche - Singum Gompa, "Nawakot" [err.], *c.* 2200-3000 m., *T. Nakaike* 252, 18.10.1979, KATH; cliffs and forested slopes on path leading up from Dhunche to Chandanbari and Gossainkund, *c.* 3 km. above and E. of Dhunche, N. of Trisuli Bazaar, Rasuwa District, *C.R. Fraser-Jenkins et al.* 30939, 2.12.2004, TAIF], **Kathmandu** [Central Nepal, *J. Scully Esq.*, 9.1880, K *sub* "*Gymnogramma javanica*" in error; dense forest shortly below Bagdwar temple, on E.S.E. side of peak of Sheopuri (Shivapuri) mountain, above and N. of Buddhanilkantha, N. of Kathmandu, Kathmandu district, *c.* 2500 m., *C.R. Fraser-Jenkins* 15766, 16.11.1989, E], **Lalitpur** [Godawari, Lalitpur, on moist and shady forest, *M.L. Pathak* 201114, 29.1.2011, KATH *sub* "*C. serrulata*" in error], **Bhaktapur** [Suryabinayak, Bhaktapur, 4500 ft., *Shova D. Shrestha* 2-6B-0143, 14.7.1977, TU Nat. Hist. Mus.], **Sindhupalchok** [Norbu Timur to Tarke Ghyang, on shady moist forest floor, 11,600 ft., *V.L. Gurung* & *M. Gorkhali* 78/788, 23.10.1978, KATH], **Ramechap** [between Bhandar and Kenja, 2100-1700 m., *T. Nakaike* 3173, 7.10.1988, KATH].

E: **Solukhumbhu** [rive gauche de la Chaunrikharka khola, Ghat, 2630 m., *A. Zimmermann* 454, 9.5.1952, BM *sub* "*C. fraxinea*" in error], **Sankhuwasabha** [Honeyguide grotto, Kasuwa, Arun river, 7200 ft., *E.W. Cronin*, with *H.M. Emery*, *H.* & *A. Foster* & *K. Brooks* F001, 10.6.1973, KATH], **Dhankuta** [Murhay, Dhankuta Distr., 2000 m., *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305032, 23.10.1963, BM *sub* "*C. caudata*" in error], **Tehrathum** [Chitre (2400 m.) - Basantapur (Bilbatay Bhanjyang) (2300 m.), 872271, on grassy bank of path in dense forest, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725110, 6.6.1972, BM, KATH *sub* "*C. caudata*" in error], **Ilam** [Nepal, Ilam, Kanopokhri, *G. Ghose* 11, 5-6.1914, Herb. Prince Roland Bonaparte, Paris, K *sub* "*C. fraxinea* var. *serrulata*" in error; Ilam, Aulabari, *D.H. Nicolson* 3233, US], **Taplejung** [Zongi - Iladanda, *H. Kanai, G. Murata* & *M. Togashi* 6305038, 6305039, 12.11.1963, BM, K, KATH *sub* "*C. caudata*" in error; Iladanda - Selap, *H. Kanai, G. Murata* & *M. Togashi* 6305036, 9.11.1963, K].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

(S, C to Sc). A common if somewhat local, upper-mid to higher altitude species of semi-open forest slopes and path-sides.

156. ***Coniogramme serrulata*** (Blume) Fée (syn.: *C. indica* Fée; *C. serra* Fée; *Gymnogramma caudata* C.Presl *ex* Ettingsh., *Die Farnkr. der Jetzwelt etc.*: 57, t. 37, *f.* 7, *t.* 38, *f.* 13 (1865), lectotype, here designated: the nature-printed illustration, *loc. cit. t.* 37, *f.* 7 showing analysis of segment-shape, venation and teeth, cited as from a specimen of Wallich's; *C. caudata* (C.Presl *ex* Ettingsh.) Ching, *non sensu*

Wallich 198 [= *C. fraxinea*], *nec sensu auct. Ind. et Sin.* [= *C. pubescens*]; *C. maxima* Ching & K.H.Shing; *C. purpurea* R.D.Dixit & A.Das; ?*C. denticulatoserrata* (Hieron.) R.D.Dixit & A.Das, a weakly toothed, less robust plant from Meghalaya and W. Myanmar, which is common in the Khasi Hills and might perhaps be distinct) Ching; misapplied name: "*C. procera*" *sensu* Singh & Panigrahi (2005), *non* Fée). Widely confused in India and China with *C. intermedia* and G.M. Zhang & Ranker's (2013) concept of *C. intermedia* in the *Flora of China* is largely *C. serrulata*.

Stipe variable in colour from green (when alive) to stramineous (when dried) to dark-brown or even blackish (later in the season) as in most *Coniogramme* species. Lamina slightly succulent-herbaceous, thus soft, but slightly thicker than in *C. intermedia*; pinna-bases widely rounded-truncate (very exceptionally more cuneate and then confusable with *C. pubescens*, but normally quite different); pinna- and segment-apices diagnostically more-or-less abruptly caudate which distinguishes it from the gradually tapering apices of *C. intermedia*, though not uncommonly only weakly caudate in some specimens, which are then confused with *C. intermedia* apart from their mid and upper pinnae having longer entire parts with less lobes except those at the pinna-base, margins toothed strongly or more weakly towards the segment-apex; pinnae usually with relatively few pinnules and long, entire mid- and apical parts, unlike in *C. intermedia*, vein-endings usually terminating just below the marginal teeth, though somewhat variable and a few confusing specimens (??hybrids) have veins running up the teeth but are obviously not *C. affinis*; lamina variably hairy or glabrous beneath as in most of the toothed *Coniogramme* species; sori exindusiate, extending from the midrib to about 2/3 the way to the margin, rapidly turning from white to brown on maturing. Illustrated photographically by Wangdi in Fraser-Jenkins, Matsumoto & Wangdi (2009) under the name *C. pubescens*, in error and drawn in the *Flora of China* illustrations volume, Figs. 231-234 and 236 under the name "*C. intermedia* var. *intermedia*" in error and also in Figs. 234 and 235 under "*C. intermedia* var. *glabra*", demonstrating their confusion over this species.

Nepal:

W: **Dadeldhura** [Sahukharka, 29°13.530', 80°37.170', 2035 m., *D.R. Kandel, T.R. Pandey* & *M.S. Thapa Magar* 14205, 21.5.2014, KATH], **Darchula** [W. facing forested rocks below cliffs by path, *c*. 2 km. N. of Dumling (opposite Jipti on the Indian side), on path south to Darchula, E. side of Kali river, Darchula District, *c*. 1800 m., *C.R. Fraser-Jenkins*, with *A.M. Thapa* & *B. Pariyar* 21694, 22.11.1994, E], **Bajhang** [north slope of Mt. Rosia range, Bajhang District, undergrowth of Abies, Aesculus indica dominated forest, 2570 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 1537, 24.7.1976, KATH, sub "*C. intermedia*" det. CRFJ 2014, in error; Dhaulan - Rasa, on open slope, terrestrial, 2600 m., *K.R. Rajbhandari* 15476, 20.8.1991, KATH].

C: **Baglung** [near/above Lumsum, ravine forest, 9500 ft., *J.D.A. Stainton, W.R.*

Sykes & *L.H.J. Williams* 3509 and 4333, 14.7.1954 and 10.9.1954, BM *sub* "*C. procera*" det. A.H.G. Alston in error, and det. CRFJ, 21.8.2003 as "*C. intermedia*" in error], **Parbat** [Parbat Distr., Gorepani Deorali (3170 m.) - Chitre (2400 m.) - Shikha (2100 m.), 835283, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8350139, 14.7.1983, BM *sub* "*C. procera*" in error and det. CRFJ, 21.5.2003 as "*C. intermedia*" in error], **Kaski** [Mardi khola, in shade of forest, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8424, 16.9.1954, BM, *sub* "*C. affinis*" det. A.H.G. Alston due to the veins going well up in the teeth in this specimen; Lumle Agricultural Centre, steep slope, 5600 ft./1705 m., *G. Dawson* 488, 20.12.1975, BM, KATH; path in semi-open forest on W. facing slope, *c.* 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c.* 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c.* 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *c.* 1800 m., *C.R. Fraser-Jenkins*, with *J.B. Pariyar* 26136-26139 (FN 2114 - 2117), 13.3.1998, BM, H; Kaski District, northeast of Sikles village on north-facing slope above Muckyun river, Easting 223554, Northing 3148856, on forest floor in forest dominated by Abies spectabilis and Rhododendron barbatum, 2950 m, *Dorothy Allard* 328, 21.9.1995, BM], **Makawanpur** [among rocks in dark, wet stream-gulley, 1 km. S. of and below Mahaveer, N. of Lami Dara [Danda], 5 km. below and south of Aghor, on "Rajpath Road", N. of Hetauda, on road to Naubise and Kathmandu, Makawanpur District, *c.* 4800 ft., *C.R. Fraser-Jenkins* 16137-16139, 4.3.1990, E], **Rasuwa**, **Kathmandu** [Gokarna, near Kamandu, 4000-6000 ft, *B.D. Pande* F.7, 29.5.1949 *sub* "*C. caudata*"; first forested damp stream-gully above road, 6 km N. from Pharping Bazaar, N. of Bansbari, 1 km. S. of Chalankhel, N.E. side of Neupane Dara (hill), on W. side of Bagmati River, *c.* 10 km. S. of Kathmandu on road to Dakshin Kali temple, Kathmandu District, *c.* 1400 m., *C.R. Fraser-Jenkins et al.* 24116 (FN 94), 20.7.1996, BM, H], **Lalitpur** [Godawari, in front of the swimming pool, on sloping soil in between Bamboo bushes, 4300 ft., *P.M. Khwaunju* 1250, in 1973, K frond apex only, *sub* "*C. fraxinea*" in error; Godawari, Fulchoki, Lalitpur, moist and shady places in north facing forest, 1800 m., *M.L. Pathak* 201103, 20.1.2011, KATH *sub* "*C. fraxinea*" in error]; **Kabhrepalanchok**.

E: **Solokhumbu** [near Junbesi, Solukhumbu, *c.* 2900 m., *T. Nakaike* 3447, 3450, 3452, 20.10.1988, KATH], **Sankhuwasabha** [densely forested stream-gullies on N. side of Tinjure ridge, *c.* 2 km. S.E. of Mude Sansuri, *c.* 8 km. N.N.W. of Basantapur [in Terathum District] and 3 km. N.N.W. of Deurali [in Terathum District], S. of and above Poluwa khola, S.E. part of Sankhuwasabha District, *C.R. Fraser-Jenkins* 28853 (FN 4828), 24.3.2001, H], **Dhankuta**, **Jhapa** [forest below roadside temple, shortly above Kuttedara on road to Horkhoti, N. of Charali and Bhudabare, on road to Phikal and Ilam, N.E. of Birtamod and N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 26576 (FN 2554), 16.8.1998, H], **Ilam**, **Taplejung** [Ghatte - Khebang, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305052, 19.11.1963, BM, K *sub* "*C. intermedia* var. *glabra*" in error; Khebang -

below Siling Tzokupa, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305045, 20.11.1963, K, *sub* "*C. intermedia* var. *villosa*" in error; Baroya Khimty - Thakma khola, *H. Kanai, G. Murata* & *M. Togashi* 6305051, 16.11.1963, BM, K *sub* "*C. intermedia* var. *glabra*" in error; Topke Gola (3600 m.) - Shewaden (2600 m.), 873274, along path in forest, *c.* 2800 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725306, 28.6.1972, BM, KATH, *sub* "*C. intermedia*" in error; Garhi Danra - Linkim - Tuwa, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305047, 4.11.1963, KATH *sub* "*C. intermedia* var. *glabra*" in error; Sanghu [27° 21, 87° 31], "Dhankuta Province", shady spot by drinking spout, 6000 ft., *A.H. Norkett* 6056, 15.10.1961, BM]. East Nepal: [Rimoo, on ground, 9-10,000 ft., *Capt. Lall Dhwoj* [*Sunawar*] 0445, [coll. 1930] rec. 21.2.1931, BM].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. India; Sri Lanka, but not S. India; Taiwan; S.E. Asia.

(M, C). The commonest and most widespread species, occurring at upper-mid to higher altitude in semi-open places at the edges of forests, path-sides *etc*.

Hybrids: hybridisation with failure of chromosome-pairing and the formation of abortive spores is known to occur in *Coniogramme* in India (Verma in Mehra 1961, under erroneous identifications and names with misplaced x-signs, as "x var. *denticulatoserrata*" and "x *indica*") and may be commoner than so far detected, but it is not quite easy to recognise spore abortion in this genus as its trilete spores are often somewhat irregular and are white in colour when young. The following possible Nepalese hybrid of intermediate frond-morphology, occurring with both putative parental species are not yet confirmed from spores:

?***C. fraxinea*** x ***C. serrulata*** - A robust plant most similar to *C. fraxinea* with margins entire, but several rather insignificant small acute teeth around the segment-apex just before it narrows to the apical tail. **Rasuwa** [forested slopes just above Domen Inn, in lower part of Gupte khola, below and N. of Thulo Syabru, on S. side of lower Langtang valley, E. of Syabrubensi, N.E. of Dhunche, Rasuwa District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 29843 (FN 5818), 6.1.2002, H], **Ilam** [densely forested, rocky stream-gully of Sudhung khola, shortly below Sudhung, leading south below road, below Sundergaon, W. of Pashupatinagar on Ilam road, Ilam District, *C.R. Fraser-Jenkins* 25534 (FN 5509), 9.10.2001, *ditto*, 29750 (FN 5725), 27.10.2001, H]. Another possible specimen is: **Bhojpur** [Danda Dalu - Deurali, 1630 m., *M. Mikage, T. Kajita, F. Kinchi, N. Kondo, P. Lacoul, M. Suzuki* & *K. Yonekura* 9558250, 11.1995, KATH].

?***C. pubescens*** x ***C. serrulata*** - **Lalitpur** [forested stream-valley (now being foraged by goats) on S.W. side of Phulchowki mountain, straight beyond and into the forest where the road up turns to the left and then upwards, *c.* ½ mile above quarry, above

and S.E. of Godawari, E.S.E. of Kathmandu, Lalitpur District, *c.* 1700 m., *C.R. Fraser-Jenkins* 19701 (FN 586), 5.3.1993, E]. Segment bases narrowed, apices tapering.

Cryptogramma (2 species, two subspecies).

157. ***Cryptogramma brunoniana*** Wall. *ex* Hook. & Grev. subsp. ***brunoniana*** (syn.: *C. crispa* forma *indica* Hook.; misapplied name: "*C. crispa*" *sensu auct. Brit.-Ind. antiq.*, *non* (L.) R.Br. *ex* Hook. [from Europe and W. Asia]. *C. brunoniana* has long been known to be obviously distinct from the larger (and in all its parts), laxer and less dimorphic *C. crispa* of the wider European flora, under which name it often appeared in the 19th Century.

A very attractive, miniature and rather compact clump-forming species (to *c.* 18 cm. tall), rhizome thick, ascendent; fronds strongly sterile-fertile dimorphic; sterile fronds patent, crowded at the base, to *c.* 8 cm. long, often smaller, ovate, variably dissect, *c.* tripinnate, with small, broadly and more narrowly ovate, entire to slightly crenate ultimate segments their form depending on the transition of the frond towards fertile fronds; fertile fronds central, erect, borne on a long thin, but stiff, stramineous to brownish, glabrous stipe, to *c.* twice or more the length of the lamina, lamina ovate, tripinnate with oval to rounded, shortly stalked segments; sori marginal, protected by the turned down marginal pseudoindusium which is continuous around the margin. Diploid sexual, erroneously reported as well under the additional names, *C. acrostichoides* and *C. crispa*, see Bir & Verma (2010).

Nepal:

W: **Darchula** [Chheti - Mechchra, Darchula Distr., in Birch forest, 3250 m., *P.R. Shakya, M.K. Adhikari* & *M.N. Subedi* 8012 *p.p.*, 22.7.1984, KATH; around Base camp or Joge Tal, 3829-4000 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yano, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1213197, 17.7.2012, KATH], **Bajhang** [Surma Sarovar, 804295, on the alpine grassland, 4250 m., *D.P. Joshi* & *M.S. Bista* 595, 26.8.1972, KATH], **Humla** [above Juma Kharka, Humla, 3770 m., *P.R. Shakya, M.N. Subedi* & *R. Uprety* 8723, 18.8.1985, KATH; Humla District, above Simikot, 29° 59' 4", 81° 48' 50", S. facing slope, very coarse boulder scree in damp depression, 3650 m., *C.A. Pendry, S. Baral, S. Noshiro, S. Rajbhandary, P.P. Kumi, B. Dell* & *B. Adhikari* JRS A192, 19.6.2008, KATH, det. CRFJ], **Jajarkot** [Thakurji Lekh, growing from shady rock crevices, 14,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5492, 1.10.1952, BM], **Jumla** [Maharigaon, 4 miles N.E., sheltered rocky slopes, *c.* 14,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 317, 25.7.1952, BM]. Nepal [Nepal, Partse, 3800 m., *S. Nakao* TNS 279573, 14.3.1953, TNS].

C: **Kaski** [Annapurna Himal, Seti khola, among boulders, 12,500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6606, 3.8.1954, BM], **Gorkha** [Bimtakothi, on steep scree among big stones, *c.* 12,500 ft., *D.G. Lowndes* L.1453, 26.7.1950, BM],

Lamjung [Rambrong, Lamjung Himal, growing from rock crevices, 12,000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6032, 29.6.1954, BM], **Rasuwa** [Dhudkhund, 5 mi. E. of Timure, screes, 15,500 ft., *O. Polunin* 817, 5.7.1949, BM; Chilime Kharka, birch wood, 13,000 ft., *O. Polunin* 1195, 7.1949, BM; [Langtang], South of Gompa, 16,000 ft., *R.L. Fleming* 1966, 12.10.1969, K; Langtang, *R.L. Fleming* 197*, 12.10.1969, DD; Singum Gompa (3200 m.) - Gosainkund (4200 m.), 852281, *H. Kanai, H. Hara* & *H. Ohba* 725910, 23.8.1972, BM, KATH; "Nawakot", Gosainkund - Thare Pati, *c.* 4000 - 3300 m., *T. Nakaike* 299, 23.10.1979, TNS; Langtang, Ganja La, N. flank, *c.* 28° 10', 85° 25', E.-facing Rhododendron dwarf scrub on boulderfield *etc.*, 3900/4000/4860 m., *G.* & *S. Miehe* Iter Himalayicus V, no. 5581, 5596/5888/5992, 16/19/20.7.1986, TNS; near Brambring, upper Langtang, N-facing moraine, Salix-Rhododendron successions, 4180 m., *G.* & *S. Miehe*, Iter Himalayicus V, nos. 13748, 13818, 13825, 9.10.1986 (and many other numbers from adjacent localities in the valley), TNS], **Dhading** [below Singla, Dhading Distr., under rock in Abies forest, 3400 m. [not 1036 m. as "converted" again in error by staff at KATH], *P.R. Shakya* & *T.K. Bhattacharya* 2256, 21.5.1973, KATH, specimen slightly towards subsp. *raddeana*], **Sindhupalchok** [Dupuk, Helumbu, E. No. 1, between rocks in open sunny places on path, 13,000 ft., *R.L. Fleming* 1799, 24-31.7.1964, KATH, DD; Sindhu Palchok District, south of Ganja La, 3900 m., *D.H. Nicolson* 2639, 26.9.1966, KATH], **Dolakha** [eboulis du Gaurisankar, 4400 m., *A. Zimmermann* 1562, 2.10.1954, BM; Rolwaling khola, Na (4050 m.) - Rinaldung (4300 m.) - Na (4050 m.), 863276, *H. Ohba, M. Wakabayashi* & *S. Akiyama* 8331839, 5.9.1983, BM].

E: **Solokhumbu** [Chhule, 27° 56' 28", 86° 36' 10", N.E. facing rocky steep slope in Rhododendron lepidotum, Juniperis recurvata shrubland, 4632 m., *M.F. Watson, K.R. Rajbhandari, K.K. Shrestha, D. Knott, C.A. Pendry, S.K. Acharya, U. Koirala, L.N. Mandar, N. McCheyne, R.C. Poudel, S. Rajbhandary* & *S. Vaidya* DNEP3 BY121, 20.9.2005, KATH, det. CRFJ], **Sankhuwasabha** [Khumbakarna Himal, on the ridge between the Upper and Lower Barun valley, among boulders, 4900 m., *T. Wraber* 256, 21.9.1972, BM], **Tehrathum**, **Taplejung** [Arun - Tamur watershed, S. of Topke Gola, on rocky slopes, 13,000 ft., *J.D.A. Stainton* 1723, 14.9.1956, BM, KATH ("duplicates in TNS, TAIF"), [det. A.H.G. Alston in his writing]; Arun - Tamur valley, Iswa khola, 13,200 ft., *L.W. Beer*, Bangor University Expedition 25458, 13.9.1975, BM, KATH; Saju Pokhari (4000 m.) - pass (4300 m.) - Topke Gola (3600 m.), 873274, among rocks along path on open slope, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725198, 16.6.1972, BM, KATH and *ditto*, on mossy rock, 4260 m., *P.R. Shakya* 1550, 16.6.1972, KATH; between Ghunsa and Tamo La, 27° 38', 87° 57', in wet Abies/Rhododendron forest on mossy rocks in deep shade, 3650 m., *C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, S. Crawford, S. Zmartzty* & *M.N. Subedi* KEKE 681, 15.9.1989, E; Taplejung Distr., Jaljale Pokhari (4080 m.) - Tin Pokhari (4130 m.), Duleghairi, Henwakhola, 27° 28' 23", 87° 27' 00' - 27° 30' 21", 87° 28' 31", N.W.

aspect, stony slope, 4000 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955110, 9.8.1999, KATH].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. Taiwan.

(S, Sc). A fairly common, but scattered, high Himalayan taxon, rather seldom collected because of its altitude, occurring on open steep, stony slopes at the bases of rocks, in screes, or on banks between low bushes, sometimes on small cliffs.

158. ***Cryptogramma brunoniana*** Wall. *ex* Hook. & Grev. subsp. ***raddeana*** (Fomin) Fraser-Jenk. (syn.: *Cryptogramma raddeana* Fomin; *C. crispa* var. *sinensis* Christ; *C. brunoniana* var. *sinensis* (Christ) G.M.Zhang; a name listed by G.M. Zhang, Alverson & Metzgar (2013) in the *Flora of China*, "*C. brunoniana* var. *raddeana* (Fomin) Fraser-Jenk." was not combined by Fraser-Jenkins and does not exist; this taxon has long been known not to represent mere local variation in *C. brunoniana*).

Metzgar's *et al*'s. comment in the *Flora* that because *C. raddeana* and *C. brunoniana* are genetically different, which is obviously to be expected, they are shown to be different species, does not follow as a consequence of that. It was presumably based on the taxonomically inadequate and unnecessarily misleading concept of "biological species", not realising that subspecies, whose meaning they may have restricted artificially in their molecular confines, should also be genetically distinct, while monophyly of the two does not provide an answer to this question. Their explanation supports not unexpected doubts, based on morphological aspects of taxonomy, concerning their ranking of other similar "interspecific" divergences in the genus. In particular, subspecific rank is more appropriate for *Cryptogramma acrostichoides* R.Br. subsp. *cascadensis* (E.R.Alverson) Fraser-Jenk., ***comb. nov.*** (basionym: *Cryptogramma cascadensis* E.R.Alverson, *Amer. Fern J.* **79**: 95 (1989)), which hardly differs morphologically from *C. acrostichoides* subsp. *acrostichoides*, the different N. American cytotype vicariant of *C. crispa*, within which former it was long included. Concerning subsp. *raddeana*, we agree with them on its close relationship and only slight, if consistent morphological difference (concerning basal sterile leaves, not intermediate leaves, which are of no use for identification) from subsp. *brunoniana*. These factors support the appropriateness of their treatment as subspecies, which, by the inherent nature of such data cannot be decided by molecular-cladistic considerations alone.

Subsp. *raddeana* is very close to subsp. *brunoniana* but smaller and more delicate, neater in all its parts, sterile fronds diagnostically different in having the lobes joined and noticeably narrow, though upper sterile fronds become slightly more towards subsp. *brunoniana*; fertile fronds similar to subsp. *brunoniana*, but smaller and thinner and the segments often more elliptically rounded, not so rounded ovate.

Nepal:

Fraser-Jenkins (2008, 2012) mentioned some material from N.W. Nepal as possibly being this taxon, but this was referring to the specimen below from C. Nepal.

C: **Dolakha** [Dudh Kunda, Dolakha District, in open place, 4550 m., *K.R. Rajbhandari* 9977, 5.9.1983, KATH, *det.* CRFJ, 6.2014].

Full distribution: China; Tibet; Myanmar [Nam Tamai valley, Ka Karpo Razi, 13,000-14,000 ft., *F. Kingdon Ward* 13377, 5.11.1937, BM, det. CRFJ 5.3.2013]; Arunachal Pradesh; Nepal; E. Siberia (Khabarovsk). The "Caucasus" listed by Fraser-Jenkins (2008) was a *lapsus mentis* for Siberia!

(S, R). A very rare, high Himalayan taxon, previously overlooked in the Indo-Himalaya and Myanmar, reported by Fraser-Jenkins (2008), occurring in similar situations to subsp. *brunoniana*, but with a slight preference for crevices in cliffs.

Indian threatened status: **CR**. Nepalese threatened status: **CR**.

159. ***Cryptogramma stelleri*** (S.G.Gmel.) Prantl (syn.: *Pteris stelleri* S.G.Gmel.; *Allosorus stelleri* (S.G.Gmel) Rupr.; *Pellaea stelleri* (S.G.Gmel.) Baker; *Pteris gracilis* Michx.; *Allosorus gracilis* (Michx.) C.Presl; *Pellaea gracilis* (Michx.) Hook.; *Cryptogramma gracilis* (Michx.) Clute).

A very distinct, small, thin and delicate species (usually *c.* 4-12 cm. tall) considerably different from the closely related species-group of the rest of the genus; rhizome very short, thin, pale, creeping and subterranean, bearing a few weak roots; stipe weak, as long as, or up to twice as long as the lamina, fronds often single to only 2 or 3 per plant, glabrous, somewhat gradually sterile-fertile dimorphic, sterile fronds borne below the fertile ones and more spreading, pinnate to bipinnate, with oval, entire, slightly crenate segments, fertile fronds taller and more erect, with somewhat longer stipes, segments elongated, slightly wider shortly above their bases; apical segment of the pinnae and of the frond usually obviously longer, unlike in *C. brunoniana*; sori marginal, protected by a continuous, slightly loose, pale pseudoindusium.

Nepal:

W: **Darchula** [Chheti - Mechchra, Darchula Distr., in Birch forest, 3250 m., *P.R. Shakya, M.K. Adhikari* & *M.N. Subedi* 8012 *p.p.*, 22.7.1984, KATH], **Jumla**, **Mugu** [above Wangri, on mossy edges of rocks and sheltered under rocks in Birch forest, 3300 m., *P.R. Shakya* & *B. Roy* 5675. 14.6.1980, KATH, *sub* "*C. crispa*", det. V.L. Gurung 13.2.1985, in error], **Dolpa** [Lulo khola, growing from rock crevices, 15,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3507, 19.9.1952, BM; N.W. Nepal, Thingchyu, Dolpo Distr., 13,500 ft., *R.L. Fleming* 2020, 19.6.1971, K].

C: **Mustang** [Thorungse Phedi, on rock crevice, in shady and moist place, 4050 m., *K.R. Rajbhandari* 8268, 24.7.1983, KATH], **Manang** [Jargang khola, in moist earthy scree, *c.* 14,500 ft., *D.G. Lowndes* L.1337, 5.8.1950, BM], **Kaski**.

E: **Solukhumbhu**, **Taplejung** [Topke Gola (3600 m.) - Jalang Chhyongo (4300 m.), 873274, on rather dry slope along path, *c.* 4000 m., *H. Kanai, H. Ohashi, K.*

Iwatsuki, H. Ohba, Z. Iwatsuki & *P.R. Shakya* 725225, 20.6.1972, BM, KATH; Arun - Tamur valley, Iswa khola, 13,200 ft., *L.W. Beer*, Bangor University Expedition 25443, 10.9.1975, BM].

Himalayan distribution: China; Tibet; Bhutan; Sikkim; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. Circumboreal.

(S(T), plus N.E. Asia and N. America, Sc). A widespread and fairly common, but scattered high Himalayan species, growing on steep grassy and mossy earth-slopes at the bases of or above rocks or among short bushes in steep, sheltered, moist half-sunlit places.

Doryopteris (1 species).

160. ***Doryopteris ludens*** (Wall. *ex* Hook.) J.Sm. (syn.: *Pteris ludens* Wall. *ex* Hook.; *Litobrochia ludens* (Wall. *ex* Hook.) Bedd.; *Calciphilopteris ludens* (Wall. *ex* Hook.) Yesilyurt & H.Schneid.). A new entirely cryptic molecular microgenus, *Calciphilopteris*, with minor, non-exclusive and non-generic characters, cannot be distinguished in any way (apart from as species) from *Doryopteris* and cannot be considered relevant or of any value to taxonomic classification and nomenclature. The character given of a long-creeping rhizome with more spread out fronds breaks down even within the present species. It is subsumed here as an infrageneric category which we do not recognise.

A medium sized species (to *c.* 50 cm., often smaller), usually with a fairly short-creeping rhizome and fronds borne towards the apex and slightly further back, stipes tall, erect or suberect, stiff and glossy black, the lower sterile leaves are shorter, simpler, more spreading and have wider areas of lamina, with more obtuse lobes, than the tall erect fertile leaves, with more acute, narrower lobes; the simple lamina is borne horizontally to the stipe and is ovate-acute when small, to markedly pentagonally lobed in larger fronds, the midrib and lower parts of the costae are black underneath the lamina, in strong contrast to the wide, glabrous areas of fresh-green lamina; sori very long, continuous, marginal, protected by the inflexed marginal pseudoindusium.

Nepal:

E: **Sunsari** [Sunsari District, Chatara, near a stream in semi-deciduous subtropical forest, 170 m., *K. Shrestha*, *P.K. Shrestha* & *B. Khanal s.n.*, 1.2000, herb. Nat. Hist. Mus., Swayembhunath, Kathmandu (seen and confirmed by CRFJ in 2000, but not refound in 2015)].

Himalayan distribution: China; Myanmar; Nepal. Assam State; Manipur; Nagaland; Tripura; Bangladesh; Orissa; Thailand; S.E. Asia; Australia. Not present in N.W. India as written by Shrestha (2001). Although Iwatsuki (1988) stated that Hope recorded this species, he did not record it from Nepal, but in error from Pakistan. The specimen concerned, labelled as from Chitral, far N.W. Pakistan, was collected by Gen. Sir William Gatacre (incorrectly said by him to be common in many places

in the area) and is at DD (photographed by CRFJ). It is correct *D. ludens* but is without the slightest shadow of a doubt nothing but a fake perpetrated by the General to bemuse the Botanical boffins. It was collected by him in Myanmar were he was stationed a year or two previously. Having studied the area in Chitral in detail, CRFJ confirms that there is not the slightest chance of that species ever having occurred there among all the expected high-altitude Sino-Himalayan and European elements in the frigid valley just north of the Lowarai Pass, nor anywhere else in the N.W. Himalaya. In the circumstances one imagines it would hardly have been the done thing for Hope to have called out Sir William's bluff! The same applies to Gatacre's equally impossible *Lygodium microphyllum* from the same locality, the specimen again correctly identified and at DD.

(M, R). An extremely rare (in Nepal), low altitude species growing on shaded slopes in light subtropical forest, preferring calcareous substrates.

Nepalese threatened status: **CR**. Only known from a single collection in Nepal.

Notholaena (5 species).

Notholaena was long understood for nearly two centuries in three continents to be typified by *N. marantae*, as explained in detail by the late Professor R.E.G. Pichi Sermolli (1983, 1989), whose encyclopaedic knowledge and careful application of the literature in the typification of fern genera was unrivalled. However Tryon & Tryon (1980) had unsuccessfully submitted a proposal to conserve *Notholaena* with an American type that he preferred as he had used the name in his previous work on N. American species. Yet subsequently he ignored and never again mentioned the rejection of their proposal to legitimise their idiosyncratic misapplication of the genus, and instead altered its typification illegally to the American species, *N. trichomanoides* (L.) R.Br. This was based on the assumption that an apparent typification by Smith (1875), who misleadingly used the word "type" was the equivalent of modern lectotypification, regardless of the instability and disruption caused in the rest of the world. After the American representatives were, perhaps not surprisingly, found to be molecularly separate, from the old world species, Yatskievych & Smith (2003) followed Tryon's view, based mainly on force of numbers of species, while downplaying the overwhelmingly extensive old world application of the genus. They concluded that the old world species belonged to a different genus, which had been renamed, somewhat by chance, as *Paragymnopteris* K.H.Shing. It is thus only recently since their paper that the genus is being altered in application in some works in Europe and Asia. However it should be understood that despite using a word "type" throughout his book, by which he meant merely a typical species, Smith did not in any way do the equivalent of lectotypification of today, which could be accepted as valid under the modern ICBN. In a number of instances he cited more than one species as "type" of a genus, in others he cited species that were not mentioned in the protologue of genera - it was just a random selection of species he himself thought typical of each genus and none of them can be interpreted as lectotypification. The disruption to the long held application of the genus *Notholaena* in order to support a mere decade or so of erroneous

nomenclature used by Tryon and students in N. America, should never have happened, and it is clear that the proper course of action is to conserve *Notholaena* with the type *N. marantae* in the sense it has always been used in the rest of the world.

We also need to look further into how qualitatively different N. American *Notholaena* species really are from the old world species, both morphologically and molecularly, and what the taxonomic significance and meaning of that difference is, given that all cheilanthoid ferns form a great convoluted intertwined evolutionary trunk of similar and overlapping groups. Morphological circumscription of a separate genus for the N. American species appears to be impossible, and the value of such a cryptic "genus" has to be questioned. Even in the old world, *Notholaena* itself is not morphologically consistent and the group of *N. himalaica*, with its narrowly fibrillose indument and imparipinnate frond is considerably different from the group of the type species, *N. marantae*, let alone other traditionally accepted *Notholaena* species from S.E. Asia and Africa. *Notholaena* thus continues to be beset with morphological, molecular and typification problems, which certainly suggests that we should not be too hasty to sanction Tryon's local N. American misadventure, revived by Yatskievych & Smith. *Notholaena* is therefore taken here in its continued traditional sense.

161. ***Notholaena borealisinensis*** (Kitag.) Fraser-Jenk. (syn.: *Gymnogramma borealisinensis* Kitag.; misapplied name: "*N. dipinnata*" *sensu* Fraser-Jenkins (2008) *quoad spec. Arunachal.*, "Lohit, *B. Krishna* 48966, 13.1.1970", ASSAM, but "Lohit, *F. Kingdon Ward* 19149 *p.p.*, 1948-1950", BM, is correct *N. dipinnata*). Fraser-Jenkins (2008) found that this species, present in Bhutan and N.E. India, is apparently not conspecific as a "variety" or developmental form of the strictly Chinese Tibetan and far N.E. Indian *N. dipinnata* Fraser-Jenk., all of which was ignored by G.M. Zhang & Ranker (2013) in the *Flora of China*. Although, as may be expected, *N. dipinnata* may have simply pinnate fronds when small, *N. borealisinensis* does not develop bipinnate parts of the frond in good conditions and their general habit is distinct. Simply pinnate fronds of *N. dipinnata* do not really match fronds of *N. borealisinensis*.

A critical species similar to *N. himalaica* but differs in being a smaller, neater plant with slightly smaller pinnae, not developing such large, long pinnae, and the lower and mid pinnae have longer petiole-stalks; pinnae markedly more cordate-based to rather narrow apexed, rounded-hastate and usually slightly more yellowish-, or golden-grey hairy beneath. Smaller plants of *N. himalaica* can appear confusingly similar especially as some pinnae can have rather cordate bases, but they are usually more sessile and the pinna-apex is usually more widely rounded, at least in some of the fronds on a plant.

Nepal:

C: **Manang** [Chame, retaining walls etc., 8500 ft., *D.G. Lowndes* l.1402, 16.8.1950, BM; Chame to Thanchok, Manang Distr., on moist and shady rock, 2600 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/2503 *p.p.*, 18.8.1974, KATH].

Total distribution: China; Tibet; Arunachal Pradesh; Bhutan; Nepal.

(S (T), R). An extremely rare (in Nepal) and little known higher-altitude species of drier areas, occurring in crevices in sheltered, dry cliffs. Known only from one small area in Nepal.

Indian threatened status: **CR**. Nepalese threatened status: **CR**.

162. ***Notholaena delavayi*** (Baker) C.Chr. (syn.: *Gymnogramma delavayi* Baker; *Paraceterach delavayi* (Baker) R.M.Tryon; *Paragymnopteris delavayi* (Baker) K.H.Shing; *Gymnopteris marantae* var. *intermedia* Ching; *Paragymnopteris delavayi* var. *intermedia* (Ching) X.C.Zhang). "Forma *intermedia*" (*comb. ined.*) was reinterpreted by Fraser-Jenkins (1997) as a full growth developmental stage of *N. delavayi*, rather than belonging to *N. marantae*, and was thence transferred to the present species by X.-C. Zhang, but as such is not worthy of nomenclatural recognition, though its origin still requires investigation.

A small species (to *c.* 18 cm. tall) with a short-creeping rhizome covered in narrow golden-brown scales, stipes fairly crowded, arising laterally stiff, erect, black, as long as the lamina, covered in small brown scales; lamina narrowly lanceolate, but with a narrowly truncate base, imparipinnate, usually simply pinnate, but becoming bipinnatifid in "f. *intermedia*", densely covered in small brown lanceolate scales beneath, very scattered above where the dark-green laminar surface is visible; pinnae simple and unlobed, narrow, with narrowly rounded apices, and a similar segment at the frond apex, some plants develop rounded-apexed, basal lobes to the lower and mid pinnae, or the lower to mid pinnae may become mostly lobed apart from a longish entire apex, but upper pinnae are unlobed; sori exindusiate, spreading along the veins beneath the dense scaly covering on the undersurface of the pinnae.

Nepal:

W: **Dolpa** [Rohagaon, Suli Gad, growing among rocks on open slopes, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3432 *p.p.*, 15.9.1952, BM, KYO; above Rohgaon, Dolpo Distr., 10,000 ft., *R.L. Fleming*, 2014, 6.6.1971, MICH, F; Suli Gad, 29° 07', 82° 54', sur rochers moussus, forêt de Cupressus-Picea-Pinus, 2900 m., *J.F. Dobremez* 2831 & *N.P. Manandhar* 74/460, 28.4.1974, KATH, not "Doti Distr." as written in on the label by staff at KATH]; **Jumla** [Kabre - Choutha, Jumla District, 2900 m., *H. Tabata, D.P. Joshi, K. Tsuchiya, N. Fujita, E. Suzuki, Y. Shimizu, F. Koike, K. Matsui* & *T. Yumoto* 14715, 24.6.1983, KYO, becoming "forma *intermedia*"; Bamara, Jumla District, on moist and shady place, *N.P. Manandhar* 6886, 8.8.1981, KATH *sub* "*Cheilanthes rufa*" in error], **Mugu** [Pina to Ghurchi, Mugu Distr., on stony open slope, 2830 m., *P.R. Skakya, M.N. Subedi* & *R. Uprety* 8786, 23.8.1985, KATH].

C: **Manang** [Marsyangdi khola, Humde (3320 m.) - Pisang (3130 m.) - Deorali Danda (3050 m.) - Bardang (2850 m.), 841284-842284, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331165, 4.8.1983, TI, BM *sub* "*N. marantae*", partly

"forma *intermedia*"], **Gorkha** [Gapunja, 2200 m., *S.H. Bhattarai* 940, 3.6.2012, KATH].

E: **Solukumbhu** [Pangboche, 3900 m., *A. Zimmermann* 629 *p.p.* (top right specimen), 3.6.1952, BM].

Total distribution: China; Tibet; Bhutan; Nepal; Uttarakhand [Garbyang, Pithoragarh, *CRFJ*].

(S(T), R). A very rare and seldom collected high Himalayan species, usually growing in moss on boulders or on steep stony slopes among low bushes, between stones.

Indian threatened status: **CR**. Nepalese threatened status: **EN**.

163. ***Notholaena dipinnata*** Fraser-Jenk. (syn.: *Gymnopteris bipinnata* Christ, *non Notholaena bipinnata* Liebm. [= *N. aschenborniana* Klotzsch, from Mexico]; *Hemionitis bipinnata* (Christ) Mickel; *Paraceterach bipinnata* (Christ) R.M.Tryon; *Paragymnopteris bipinnata* (Christ) K.H.Shing; *Gymnogramma vestita* var. *auriculata* Franch.; *Gymnopteris vestita* var. *auriculata* (Franch.) C.Chr.; *Gymnopteris bipinnata* var. *auriculata* (Franch.) Ching; *Paragymnopteris bipinnata* var. *auriculata* (Franch.) K.H.Shing).

A largeish species for the genus (fronds to *c.* 40 cm. long), very similar to *N. himalaica* in less developed fronds, but with longer and more triangular, often slightly acroscopically auriculate pinnae, but more developed fronds have a single basiscopic or acroscopic pinnule on each pinna, and when fully developed the pinnae are bipinnate with one or two or more largeish, pinnules on each side, segments larger and longer than in *N. borealisinensis*.

Nepal:

W: **Bajhang** [Bajhang District, trail from Pasela to Banjh, 29° 33' 23", 80° 58' 44", cliff by stream, ravine in W facing slope, open grassy Quercus forest, 2452 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 209151139, 16.7.2009, E *sub* "*Hemionitis vestita*" det. D.J. Middleton, 2012, in error].

Total distribution: China; Tibet; Arunachal Pradesh [Lohit, *F. Kingdon Ward* 19149 *p.p.*, 1948-1950, BM]; Nepal.

(S, R). A very rare species (in India and Nepal), of higher altitude, occurring in dry regions, beneath shaded large rocks, or in cliffs in light forest.

Indian threatened status: **CR**. Nepalese threatened status: **CR**. Only known from one collection each in India and Nepal.

164. ***Notholaena himalaica*** Fraser-Jenk. (syn.: *Gymnogramma vestita* Hook., *non Notholaena vestita* (Spreng.) Desv.; *Hemionitis vestita* (Hook.) J.Sm.; *Gymnopteris vestita* (Hook.) Underw.; *Paraceterach vestita* (Hook.) R.M.Tryon; *Paragymnopteris vestita* (Hook.) K.H.Shing).

A very attractive small species (to *c.* 25 cm. tall) with a short-creeping rhizome and fairly crowded fronds arising laterally; stipes thin, wiry, black, bearing many small grey fibrils; lamina imparipinnate, simply pinnate with many fairly spaced soft pinnae and a similar apical segment; pinnae stipitate, ovate to rounded-rectangular, slightly wider at their bases, with widely rounded apices, occasionally slightly hastate-cordate, densely covered in long, straight, silky, silvery-coloured fibrils on both surfaces, giving the appearance and presumed feel (not an experience I know) of a soft "mouse ear", from which it gets its popular name among local muscine afficionados of "mouse-ear fern"; sori exindusiate, scattered over the lower surface along the veins beneath the dense fibrils, which have to be removed to see them. While younger fronds close up their pinnae during the dry Winter, older fronds loose their pinnae and die.

Nepal:

W: **Humla** [between Toli and Padi, under the shrubbery in the grassland, 2606 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 2886, 23.8.1976, KATH], **Bajhang** [Ganai Gad, Bajhang District, on moist and shade place in Quercus forest, on the moist soil, 1630 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 1479, 23.7.1976, KATH; Bajhang District, trail from Pasela to Banjh, 29° 33' 23", 80° 58' 442, cliff by ravine in W. facing slope, open grassy Quercus forest, 2452 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915139, 16.7.2009, E], **Jumla** [Jumla, shady and somewhat dry rock crevices, 7500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 4029, 8.5.1952, BM, E; along the way from Jumla Bazaar - Dhitachaur, Jumla, common on sunny slopes, sometimes semi-open, 2250 m., *N. Thapa* J12, 6.7.2001, KATH, rather towards *N. borealisinensis*; Jumla district, above Bumra, towards Chautha, 29° 24' 542, 82° 7' 25", growing on base of Pine tree, Pinus wallichiana forest *etc.*, 2820 m., *C.A. Pendry, S. Baral, S. Noshiro, S. Rajbhandary, P.P. Kumi, B. Dell* & *B. Adhikari* JRS A67, 6.6.2008, KATH *sub* "*Hemionitis vestita*" det. S. Lindsay, 2009], **Mugu** [Pina - Ghurchi, Mugu Distr., overhanging from vertical slope in open area in Picea-Pine forest, 2650 m., *P.R.* Shakya, *M.N. Subedi* & *R. Uprety* 8780, 23.8.1985, KATH; Rara, Mugu District, 3000 m., *R.B. Basnet, H.R. Paudel* & *S. Khatri* 031R, 24.4.2011, KATH], **Dolpa** [between Lunh and Lan, rock crevices on dry slopes, 9000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3292, 9.9.1952, BM; Rohagaon, Suli Gad, among rocks on open slopes, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3435, 15.9.1952, BM].

C: **Myagdi** [near Gurjakhani, earth bank along river, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4466, 17.9.1954, BM], **Mustang** [Lete, S. of Tukucha, Kali Gandaki, on rock, 8000 ft., *J.D.A.* Stainton, *W.R. Sykes* & *L.H.J. Williams* 7714, 6.9.1954, BM; Kali Gandaki, Thulo Bugin, S.-facing slope, mostly grass, growing in abri-like places, 9000 ft., *G.* & *S. Miehe* B 742, 10.10.1977, BM], **Manang** [Chame to Thanchok, Manang Distr., on moist and shady rock, 2600 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/2503 *p.p.*, 18.8.1974, KATH], **Gorkha** [Ganesh

Himal, Shiar khola, above Tumji, 9000 ft., *P.C. Gardner* 543, 24.5.1953, BM], **Rasuwa** [Ganesh Himal, Gatlang, 28° 12', 85° 16', beneath rocks, 8600 ft., *J.D.A. Stainton* 3748, 21.5.1962, BM, KATH, det. CRFJ], **Lalitpur** [near Botanical Garden, Godawari, growing on dry soil, 5400 ft., *P.M. Khwaunju* 1230, in 1973, K [perhaps only from cultivation?]], **Sindhupalchok** [Helambu, Sindhupalchok, on mossy rock of shady moist place, 3300 m, *V.L. Gurung* 78/1198, 5.10.1978, KATH, specimen requires authentication].

E. Although Thapa (2002) mentions this species as common, including in E. Nepal, neither Alston & Bonner (1956), nor Iwatsuki (1988) report any collections from E. Nepal and we have seen no collections from there in any herbaria.

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Nepal; Uttarakhand; Himachal Pradesh; Pakistan. Manipur; Thailand; Taiwan.

(S, Sc). A fairly common if scattered species, but commoner in W. Nepal, occurring at higher altitude in drier areas, usually at the bases of large rocks or boulders, where the rhizome is protected from wet, or otherwise in crevices in low cliffs, or steep, dryish banks among bushes.

165. ***Notholaena marantae*** (L.) R.Br. (syn.: *Paragymnopteris marantae* (L.) K.H.Shing; *Paraceterach marantae* (L.) R.Tryon; *Notholaena marantae* (L.) R.Br. subsp. *subcordata* (Cav.) Benl & Poelt).

A smallish plant (fronds to *c.* 40 cm. tall); rhizome short-creeping, densely rufous-brown scaly, stipes fairly crowded, arising laterally, stiff, black, densely small-scaly; all except the upper surface of the lamina densely clothed with narrowly lanceolate mid-brown scales; lamina rather narrowly lanceolate, with a narrowly truncate base, bipinnate, tripinnatifid, decreasing pinnately to its small apical segment; pinnae pinnate, lower ones becoming bipinnatifid at their basiscopic bases, pinnules lobed with entire, rounded, wide-based, lobes, lobed to simple, with rather narowly rounded apices and lobe apices; sori exindusiate, spreading along the veins beneath the dense scaly covering the undersurface of the pinnae. The pinnae and pinnules curl up during the dry season, but many recover during rain; fronds persistent in curled state during the Winter.

Nepal:

W: **Humla**, **Jumla** [Maharigaon, mossy rocks in mixed forest, 11,500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 202, 16.7.1952, BM; between Gargiankot and Munigaon, overhanging earth banks, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3132, 3.9.1952, BM, US; Dhinta Chour, Jumla, on forest floor, 2650 m., *N. Thapa* & *A. Lama* 7406, 22.11.1995, KATH], **Mugu** [Phal ko odar - Pipling, on stone crevices, open place, 2500 m., *P.R. Shakya* & *B. Roy* 5513, 6.6.1980 KATH, some upper pinnae less lobed; Mugu - Pipling, amongst big boulders, 3100 m., *P.R. Shakya* & *B. Roy* 5581, 9.6.1980, KATH], **Dolpa** [Rohagaon, Suli Gad, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3432 *p.p.*, 15.9.1952, BM, KYO; Tarakot,

needle-forest, by a stone, 2800 m., *S. Einarsson, L. Skärby* & *B. Wetterhall* 382, and *ditto*, 3500 m, 2570, 30.5.1973 and 19.7.1973, KATH].

C: **Baglung** [near Dogadi khola, among rocks on open slopes, 12,500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3820, 11.8.1954, BM; near Dhorpatan, dry banks in riverside forest, 10,500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 9078, 18.10.1954, BM], **Gorkha** [Ganesh Himal, Shiar khola, above Tumji, 10,000 ft., *P.C. Gardner* 522, 20.5.1953, BM], **Rasuwa** [Langtang village area, 11,500 ft., *O. Polunin* 1578, 1.8.1949, BM; Langtang Ghompa, 12,600/12,000/10,000 ft., *R.L. Fleming* 1982, 1973, 1979, 1982, [20].10.1969, MICH; Kyanchin Gomba, 28° 13', 85° 24', on prayer wall, 3600 m., *J.F. Dobremez* 1034, 5.9.1971, KATH *sub* "*Cheilanthes rufa*?" in error; Chandanbari to Gossainkund, 3200-4250 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi*, 998/77, 17.9.1979, KATH], **Dolakha** [Dudh Khosi valley, 3962 m., Dolakha Distr., *David Bathgate* 59, 23.10.1972, KATH; Rolwaling khola, Kyalche (2700 m.) - Dongang (2650 m.) - Thandingma (3200 m.), 862276, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331733, 1.9.1983, BM].

E: **Solukhumbhu** [entre Tesinga et Namche Bazar, 3450 m., *A. Zimmermann* 1713, 15.10.1954, BM, G (and in neaby localities *A. Zimmermann* 265, 629, 1650, G); near Khumjung, Khumbu region, 27° 49', 86° 43', between boulders, 3800 m., *J.H. de Haas* 2965, 4.10.1974, BM; Solu Khumbu, Bhote Koshi valley, Phurte to Syangboche, trail from Thamo to Khumjung, 27° 48' 38", 86° 41' 55", S.W. facing slope, dry banks covered in Abies litter, 3550 m., *M.F. Watson, K.R. Rajbhandari, D. Knott, A.G. Miller, B. Adhikari, K. Maden, V. Manandhar* & *R. Uprety* DNEP1 83, 11.5.2004, KATH], **Taplejung** [Walungchung Gola - Zongi, *H. Kanai, G. Murata* & *M. Togshi* 6305093, 11.11.1963, BM; Ghunsa to Kambachen, 27° 42', 87° 58', on open slopes amongst boulders, 3700 m., *C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, S. Crawford, S. Zmartzty* & *M.N. Subedi* KEKE 455, 9.9.1989, K, E; Gyabla - Phale, Taplejung, deep shade, forest, 2750 m., *N. Thapa* T20, 1.8.2001, KATH].

Himalayan distribution: China; Tibet; Bhutan; Sikkim; ?Darjeeling (listed by Khullar 1994); Nepal; Uttarakhand; Himachal Pradesh. Mediterranean Europe; W. Asia; Macaronesia; N. Africa. Not present in Jammu & Kashmir as listed by Chandra (2000).

(?E or S(T), C). A common (in Nepal), if slightly scattered, higher-altitude to high Himalayan species, occurring in drier regions on steep path-banks, semi-open slopes between bushes and among rocks.

Onychium (6 species, 2 subspecies).

Onychium consists of three main species groups in the area, and two of them, the *O. japonicum* and *O. cryptogrammoides* groups, contain a number of critical species or cryptic cytotypes and subspecies, respectively. The *O. japonicum* group has recently turned

out to be more complex than previously thought, and some new taxa in the group are described here along with considerable revision, resulting from recent cytotaxonomic study by Fraser-Jenkins & Matsumoto (in press). We have cited more specimens for this genus in order to show the concepts involved. In this genus it is essential to be able to study fully fertile and mature frond morphology as the much more divided fronds of sterile or semi-sterile or semi-juvenile morphology are effectively indistinguishable and all the species are more plastic than in most other genera.

166. ***Onychium cryptogrammoides*** Christ subsp. ***cryptogrammoides*** (syn.: *O. japonicum* (Thunb.) Kunze var. *multisecta* C.B.Clarke; *O. multisecta* (C.B.Clarke) F.Hend. *ex* Panigrahi & Sarn.Singh, although Clarke included *Leptostegia lucida* D.Don within his var. *multisecta* the latter was not a superfluous name at the rank of variety, nor when Singh & Panigrahi (2005) combined it as a species, as they did not include *O. lucidum* (D.Don) Kunze within it; misapplied names: "*O. contiguum*" *sensu auct. Ind.*, *non* C.Hope [*nom. superfl.* for *O. lucidum* (D.Don) Spreng.]). This species was known to Hope (1899) and Ching (1934) and others following Ching as "*O. contiguum*", but as noticed by Dr. Sarnam Singh (in Fraser-Jenkins 1997, 2008, Singh & Panigrahi 2005) that was a superfluous name for *O. lucidum*, included in it, which Ching overlooked. A recent Chinese proposal (Zhang & Yang 2014) has been made to conserve the name *O. contiguum* with a different type, without specifying the infraspecific taxonomy and cytotypes of suggested types, but there is no real or particular reason to do so for a critical and complex species of no commercial or wider importance and a simple name change should not be any problem.

Like nearly all *Onychium* species this large species (fronds to *c.* 60 cm. tall) has a creeping subterranean rhizome, bearing fronds at intervals and forming large stands of fronds; stipe erect, as long as or longer than the lamina, dark fuscous brown to blackish in the basal *c.* 2-4 cm., green, becoming stramineous and straw-like in appearance above, not hard (unlike *O. lucidum*); lamina ovate and often bunched to become ovoid when the lower pinnae are directed forward out of the plane of the lamina, sometimes more deltate, widest at or shortly above the base, quadripinnate and very finely dissect, very herbaceous, pale green, rapidly dying and Winter-deciduous (resulting in masses of pale whiteish brown dead leaves), with wide, overlapping pinnae, and narrow, crowded segments; fertile segments narrow, variable in length, ripe sori with an opposite pair of whiteish, closed, elongated, entire pseudoindusia until they shrivel up on dehiscence; commonly diploid sexual. Verma (1963) found that though the diploid sexual cytotype is predominant, this species contains a very close-knit, highly cryptic cytological complex in Darjeeling and Sikkim in the C. Indo-Himalaya, including the widespread diploid sexual cytotype and a diploid and a triploid apomict (the latter sometimes with rather longer fertile segments), but they were not investigated or further separated taxonomically due to their closeness. A triploid has also been reported from Yunnan, China, but cytological

work there has not been taxonomically targeted and has so far been very limited in this genus (see Cheng & Zhang 2010). We have not found it possible to separate any different morphologies in Nepal in the absence of further cytotaxonomic investigation in the Himalayan region. Verma & Khullar (2014) have recently reviewed the cytological results from the Panjab University school, but also did not tackle any further morpho-taxonomic entities nomenclaturally.

Nepal:

W: **Darchula** [N.W. facing rocks in forest below cliffs, *c.* 2 km. S. of Dorpatta village (opposite Lamari and S. of Buddhi in India), *c.* 12 km. N. of Dumling, west side of Api Himal, N. of Darchula, E. side of Kali river (border with India), Darchula District, *c.* 1850 m., *C.R. Fraser-Jenkins* with *A.M. Thapa* & *B. Pariyar* 21636 (FN 303), 21.11.1994, E], **Doti** [Baj Lekh, 840292 [as "804292"], on open place, 2100 m., *D.P. Joshi* & *M.S. Bista* 147, 1.8.1972, KATH], **Bajhang**, **Humla** [Rimi, Humla Distr, in forest, 2500 m., *K.R. Rajbhandari* & *B. Roy* 3930, 26.7.1979, KATH], **Jumla** [Maharigaon, on steep grassy banks and among rock outcrops, 12,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 310, 26.7.1952, BM; Rini, S.E. of Jumla, moist, shady bank, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5434, 27.9.1952, BM; Jumla valley, 2316 m., *T.B. Shrestha* & *N.P. Manandhar* 6, 10.10.1975, KATH; Jumla ["Lumla"], NW Nepal, 8000 ft., *R.L. Fleming* 2410, 13.11.1977, MICH], **Mugu** [Padi, near Rara Lake, in Aesculus forest along the stream, 2575 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 2936, 24.8.1976, KATH]; **Dolpa** [Kaigaon, in broad-leaved forest, 2600 m., *S. Einarsson, L. Skärby* & *B. Wetterhall* 3754-5, 25.8.1973, BM].

C: **Baglung** [Dhorpatan, among rocks on open slope, 9300 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3987, 23.8.1954, BM], **Myagdi** [Myagdi District, Khabari, Khaban Gurase (2870 m.) - Deorali (3180 m.) - Baishi Kharka (3090 m.) - Ritu Kharka (2910 m.) - Tham Kharka (3160 m.), 83° 14-17', 28° 32-33', on semi-shaded forest margin, 2920 m., *M. Mikage, R. Hirano* & *K. Yonekura* 9682778, 18.9.1996, KATH], **Mustang** [Ghasa, S. of Tukucha, Kali Gandaki, beneath trees, 7500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7708, 5.9.1954, BM; Kali Gandaki, near Lete, between rocks in open grassland with shrubs, 7500 ft., *G.* & *S. Miehe* A 17, 12.11.1976, BM; Ghasa to Kokethanthi, forest slope, 2150-2600 m., *V.L. Gurung* 1456/81, 25.6.1981, KATH], **Manang** [Bhratang - Chame, on moist and shady place, 3000 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/2459, 14.8.1974, KATH], **Parbat** [Ghodapani - Phalate, on shady wet place, 9000 ft., *T.B. Shrestha* & *M.S. Bista* 1788, 2021.4.2 [*c.* 17.7.1964], KATH; Parbat District, Gorepani Deorali (3170 m.) - Chitre (2400 m.) - Shikha (2100 m.), 835283, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8350403, 14.7.1983, BM], **Kaski** [Dumpus Thakkola, "W. Nepal", 8000 ft., *R.L. Fleming* 2271, 29.7.1973, MICH *sub "O. lucidum*" in error], **Gorkha** [Gorkha Distr., Ekle Ghar (1620 m.) - Sharyung (2000 m.) - Anga (2140 m.) - Lokpa (1900 m.) - Sardu Khola (1800 m.), 28° 24' 35", 84°

53' 40" - 28° 26' 49", 84° 55' 56", shady places, 2000 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro* & *K. Yoda* 9485150, 25.7.1994, KATH], **Makawanpur** [Simbhanjyang, on shady place, 2450 m., *N. Phuyal, S. Maharjan* & *K.K. Pokharel* 5, 12.6.2010, KATH], **Rasuwa** [Langtang village area, stony scree, covered in bush, shady, 11,500 ft., *O. Polunin* 1536, 1.8.1949, BM; Sherpagaon - Langtang, on dry open rock, *c.* 2000-3000 m., *P.R. Shakya* EF3, 21.7.1971, KATH; Langtang, 9000 ft., *R.L. Fleming* 2351, 26.7.1976, MICH *sub* "*O. lucidum*" in error], **Sindhupalchok** [Tingoang (3100 m.) - Lhosori Khabre (1500 m.), Kalingchok, *H. Kanai, C. Chuma* & *T. Nagaono* 670029, 12.9.1970, KATH; Helambu, open wash with tree windfalls, 9500 ft., "*Miss* [*R.*] *Gay* [*Troth*]" A 5, 9.11.1971, KATH; Sindhu Palchowk District, Melemchi Gaon, 52 km N.E. from Kathmandu, 28° 00', 85° 30', open wash with tree windfalls, SE-facing slope toward waterfall, 2875 m., *R.G. Troth* 103, 9.11.1971, MICH *sub* "*O. japonicum*" det. R.R. Stewart, in error], **Dolakha** [Lamosangu to Jiri road, Hanumante, 2800 m., *Ruth Schaffner* 351, 26.8.1983, ZT], **Ramechap** [between Sivalaya and Bhandar, Janakpur, 1800-2500 m., *T. Nakaike* 3122, 6.10.1988, KATH, small plant, det. CRFJ, 20.4.2014 as "check spore-size this might be subsp. *fragile*", in error].

E: **Dhankuta** [Hile, open field, on banks, *T.B. Shrestha* & *D.P. Joshi* 56, 15.7.1971, KATH small fertile specimen], **Solukhumbhu** [pâturage de Satama, 3400 m., *A. Zimmermann* 1658, 14.10.1954, BM; Dudh Kosi valley, Khumbu region, in meadows and forest edges near Lukla, 27° 41', 86° 45', 2830 m., *J.H. de Haas* 2882, 30.9.1974, BM; between Goem and Junbesi, Solukhumbu, 3200-2650 m., *T. Nakaike* 3238, 9.10.1988, KATH], **Sankhuwasabha** [Arun valley, Maghang khola, E. of Num, in forest, on rocks, 5000 ft., *J.D.A. Stainton* 1602, 7.9.1956, BM, KATH, TAIF], **Tehrathum** [Terhathum Distr., Basantapur (2300 m.) - Tsute (2480 m) - Chauki (2650 m.), 27° 07' 00", 87° 26' 00" - 27° 12' 35", 87° 28' 01", on recently exposed grey, non-haemic soil of sunny slope, 2800 m., *Y. Omori, N. Acharya, K. Fujikawa, M. Munemasa, M. Okada, R.H. Ree, M. Tateno* & *N. Thapa* 9955022, 3.8.1999, KATH], **Ilam** [Iladanda - Selap, *H. Kanai, G. Murata* & *M. Togashi* 6305098, 9.11.1963, K, BM, US, some plants small; Chhinthapu, E. Nepal, on the partly moist and shady place, 3000 m., *D.P. Joshi* 129, 30.9.1971, KATH; Minchin Dhap - Mul Pokhari, 2900-2500 m., *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305097, 29.10.1963, KATH], **Panchtar**, **Taplejung** [Shewaden (2600 m.) - Mewa Khola (2100 m.) - Papung (2000 M.), 873274, along path in open place, 2200 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725333, 29.6.1972, BM]. ?E. Nepal [Terra Bence, on ground, 9-10,000 ft., *Capt. Lall Dhwoj* 434, received 21.2.1931, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Thailand; mainland S.E. Asia; Taiwan.

(S, Sc). A widespread and abundantly common, upper-mid altitude to high Himalayan

species, occurring on semi-open and open slopes and meadows, or banks at the edges of forests, or among bushes and rocks at higher altitude.

167. ***Onychium cryptogrammoides*** Christ subsp. ***fragile*** (S.C.Verma & Khullar) Fraser-Jenk. & S.Matsumoto, ***comb. nov.***, basionym: *Onychium fragile* S.C.Verma & Khullar, *Nova Hedwigia* **9**: 85 (1965); misapplied name: "*O. tenuifrons*" *sensu* Fraser-Jenkins (2008), *non* Ching). We agree fully with Khullar & Verma's (2012) finding that Fraser-Jenkins' (1997, 2008, 2012) initial, partly tentative identification of "*O. fragile*" as being *O. tenuifrons* Ching was erroneous and the two are definitely very distinct species (true *O. tenuifrons* with a clumped rhizome and narrow pinnae occurring in China; Myanmar [Chin Hills, Minkin, 11th mile from Falam, 5400 ft., *F.E.W. Venning* CH.36, 29.7.1910, K, det. CRFJ]; Arunachal Pradesh and Bhutan [Serbithang, Thimphu, *CRFJ* 35256, TAIF, THIM] and being related to *O. divaricatum* (Poir.) Alston from N.E. Africa, Arabia and Iran). This taxon was initially thought by Khullar & Verma to be intermediate between *O. cryptogrammoides* and *O. japonicum*, but shows no intermediate features at all, matching subsp. *cryptogrammoides* in stipe colouration, thinness of the lamina and in its fine dissection. It is now evident that "*O. fragile*" certainly belongs within *O. cryptogrammoides* as one of its several cryptic infraspecific cytotypes and on the basis of its apparently small frond-size and different altitude requirements is appropriately recognisable as a subspecies.

This taxon is very close to subsp. *cryptogrammoides*, and is only distinguishable by having (as known so far) smaller fronds (*c.* 12-18 cm.) with thin stipes, very similar to those in small subsp. *cryptogrammoides*; lamina spreading to slightly pendent, elongated triangular, flat, thin and finely dissect, but not as congested as in large subsp. *cryptogrammoides*; pinnae triangular, segments with small lobes, fertile segments narrowly acute, shorter and narrower than in large subsp. *cryptogrammoides*, pseudoindusia straight to very slightly wavy, not strongly erose or fimbriate in the original and other material (although drawn as such by Verma & Khullar 1965a), slightly overlapping, opening when spores ripen. There is almost no difference detectable between this subspecies and small plants of subsp. *cryptogrammoides*, which can also be fertile when small and then match it in nearly all characters except for the larger spore-size resulting from its triploid apomictic cytotype (but also present in Verma's triploid apomict large cytotype of "*O. contiguum*"); the fronds are not usually as erect as in larger subsp. *cryptogrammoides*, but small plants of the latter are often more spreading However populations studied so far in Uttarakhand and Nepal suggest that the present taxon may perhaps not be able to become larger in size, as well being able to occur at somewhat lower altitude in some places, though overlapping.

Nepal:

W: **Surkhet** [among semi-calcareous metamorphic roadside rocks on slopes in semi-open Pine forest, just 50 m. below Cheda hamlet on main road, *c.* 15 km. N.

of Surkhet (Birendranagar) town, on road north to Dailekh, Surkhet District, *c.* 1300 m., *C.R. Fraser-Jenkins* 35140 (FN 14), 22.9.2013, TAIF only 1 clump found on road bank], **Dailekh** [in remnant Quercus and Rhododendron forest, on rocky banks or on epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c.* 40 km N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins*, with *K. Neupane* & *K.* ["*U.*"] *Pongali* ["*Chhetri*"] 25614-25616 (FN 1592 - 1594), 26.9.1997, BM, H, spores good, very large, with some abortive spores].

C: **Kaski** [narrow, rocky gorge and luxuriant, leech-ridden forested slope, shortly above Poiyim village on track along slope from Burjung Khola to Kahaure and Tarakot village, N. of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *George Yatskievych*, *Lisa Hooper*, *Jyoti Gajurel*, *Rita Thapa*, *Sagun Pariyar* and *Ganesh Bahadur Tamang* 34247 (FN 50), 12.9.2009, TAIF, MO; semi-open forest and rocks (from Chomrong onwards), Sinuwa to Chomrong to Jhinu, on way back from Annapurna Base camp, N. of Pokhara off Baglung road, route to Annapurna Base Camp, Kaski District, 1800-2350 m., *C.R. Fraser-Jenkins*, *J.C.B. Fraser-Jenkins* & *S. Pariyar* 35058 (FN 335), 5.6.2012, TAIF], **Lalitpur** [Godawari, cluster on top of stone wall, rare, 4500 ft., *Dr. R.L. Fleming* 1344, 25.6.1957, KATH, det. N. Thapa, 2004, as "*O. tenuifrons*", "probably subsp. *fragile* but spore-size needs checking" det. CRFJ, 2014], **Sindhupalchok** [cliffs and steep, partly open slopes, *c.* 1 - 3 km. S. of Miteri Bridge (to Tibet), Kodari, north of Tatopani, on W. side of Bhote Khosi river, N. of Barabise on road to Tibet border, N.E. of Kathmandu, Sindhupalchok District, c. 1800 m., C.R. *Fraser-Jenkins* 29005 (FN 4980), 5.6.2001, H; steep grassy and rocky roadside banks on S. side of Liping Bridge, shortly S. of Tatopani, on E. side of main river, S. of Kodari and Tibet border, N.E. of Banepa, Sindhupalchok District, *G.B. Tamang*, for *C.R. Fraser-Jenkins* 35087 (FN 364), 10.2012, E (1 frond to Heleen Plaisier)], **Dolakha** [Jiri, Dolakha, Janakpur, 2000-2500 m., *T. Nakaike* 3038, 3.10.1988, KATH].

E: **Taplejung** [Gyabla - Gonging, Taplejung, semi open mossy and stony banks, 2300 m., *N. Thapa* T29 *p.p.*, 4.8.2001, KATH *sub* "*O. tenuifrons*" det. N. Thapa 2001, "spore-size needs checking, not as convincing [as the other one of the 2 duplicate sheets]", det. CRFJ 2014].

Total distribution: China [Yunnan, *E. Maire* 2775 *p.p. min.*, BM, E]; Arunachal Pradesh [Kameng, *A.S. Rao* 49477; Lohit], Bhutan, Sikkim; Nepal; Uttarakhand [inc. "O. multisectum, small form, Mussoorie, Camel's Back, 6950 ft., *C.W. Hope*, 8.1887, K, BM]; Himachal Pradesh.

(S, Sc). A scattered and rather uncommon mid- to upper-mid altitude taxon of steep semi-open, damp slopes, often slightly pendent from banks among grasses and mosses.

168. ***Onychium kholianum*** Fraser-Jenk. & S.Matsumoto, ***sp. nov.*** *Morphologia plantae intermedia inter O. cryptogrammoidem* Christ *et O. vermae*, *sed O. vermae similia*.

Rhizoma longiore repens. Frondes aliquantum rigescentes, quam in O. vermae breviores valde deltatae et subtilitius dissectae, segmenta lobique minores breviores quam in O. vermae. Sori brevi ovati, saepe flavi ubi non perfecte maturi, lobi indusiorum seorsi. *Sporae bene factae. Cytotypus triploideus. Holotypus*: "N.W. India, Uttarakhand, Pithoragarh, on slope above road near to where *Chamaerops* palms grow, *c.* ½ km. E. of main stream/waterfall, *c.* 1 km west of Gini main road-bend, above upper stretch of road, N. of Pithoragarh and Thal on road up to ridge south of Munsiyari, damp or marshy, grassy areas on calcareous stony substrate, between mixed smallish trees, *c.* 2600 m., *C.R. Fraser-Jenkins* 34655 (FN [*i.e.* Field number] 156), 19.11.2010 (TAIF), paratype: ditto, 34567 (FN 157) (TAIF). This species is named after Dr. B.S. Kholia of the Botanical Survey of India, in recognition of his dedicated work and services to Indian pteridology.

Cytotype: Mitosis in 34655 showed 2*n* = 87, triploid (from the base number 29), det. S. Matsumoto, 2011 (Fraser-Jenkins & Matsumoto in press), from its good, non-abortive spores combined with a triploid cytotype it may be safely assumed that it is triploid apomict, though a meiotic count is still required in order to prove it.

This species in the *O. japonicum* group is nearest to *O. vermae* while slightly towards a small *O. cryptogrammoides* in morphology. It is a rather small species (fronds to *c.* 25 cm. long), with a thin, very long-creeping subterranean rhizome and well separated fronds; stipes thin, dark fuscous at the base, green, stramineous, or becoming dark later in the season, usually longer than the lamina; lamina rather short, tripinnate, slightly elongated deltate to somewhat ovate, obviously wider at the base, slightly crispaceous but delicate and thinner than in *O. vermae* or *O. lucidum*, but not softly herbaceous as in *O. cryptogrammoides*, finely dissect with small, short segments and lobes, usually joined quite widely at their bases; fertile lobes short, crowded, the sori short and ovate-elliptical, remaining yellow for quite some time until turning pale brown on sporangial dehiscence, pseudoindusia lying widely open except when very young. Spores not abortive, large. Cytotype triploid, presumed apomict.

Nepal:

W: **Jumla** [Kawakhola, Jumla Distr., on moist and shady places, *T.B. Shrestha* & *N.P. Manandhar* 330 *p.p.*, 18.10.1975, KATH, with one frond of *O. cryptogrammoides* subsp. *cryptogrammoides*], **Jajarkot** [Jhapra, Jajarkot, under the tree shade, 1500 m., *N.P. Manandhar* 638-01, 3/3/1991, KATH].

C: **Rasuwa** [Gosainkunda, Rasuwa, *Rahunar* 9535034, 21.7.1995, KATH].

Total distribution: China [Yunnan, Tong-tchouan, 2550 m., *E. Maire* 141, herb. C. Christensen, BM]; Arunachal Pradesh; Bhutan [*CRFJ*, Fraser-Jenkins, Bhutan, in prep.]; Sikkim; Nepal; Uttarakhand; Himachal Pradesh [*e.g.* Saraj-Kulu, grassy bank above Jibi rest house, Jibi nullah, 6100 ft., *D.C. Sayers* 3676, 24.4.1981, BM]; Jammu & Kashmir.

(S, R). A rather rare (in Nepal, commoner in the west Indo-Himalaya and Bhutan), but often locally common, upper-mid to higher altitude species, preferring drier regions, growing in light forest in clumps on steep slopes, often between rocks on banks.

Nepalese threatened status: **VU**.

169. ***Onychium lucidum*** (D.Don) Spreng. (syn.: *Leptostegia lucida* D.Don; *O. japonicum* var. *lucidum* (D.Don) Christ; *O. contiguum* C.Hope, *nom. superfl.*; *O. dulongjiangense* W.M.Chu; *O. tibeticum* Ching & S.K.Wu; misapplied name: "*O. japonicum*" *sensu auct. Ind.*, inc. Fraser-Jenkins, *p.p.*, *non* (Thunb.) Kunze, *nom. cons.*, *nec* Blume [from W., C., S. and mainly E. China, Taiwan, Japan, Korea and the Philippines, syn.: *O. capense* Kaulf., *loc. falsa*; *O. chinense* (Desv.) Fée]). Although often called *O. lucidum*, it has equally frequently also been called "*O. japonicum*" in the Indian subcontinent (including in many of the determinations by CRFJ in BM *etc.* from 2002 to 2013) and combined taxonomically with what is now *O. vermae*.

A large (fronds to *c.* 60 cm. tall) and usually robust member of the *O. japonicum* group; rhizome subterranean, rather long-creeping, fronds arising separately; stipe hard, erect to spreading, the basal 4 cm. or more dark fuscous brown, green to stramineous above, but much of the stipe, at least the lower half, becoming dark later in the season, as long as or longer than the lamina; fronds arching to semi-erect, lamina 3-4 pinnate, sterile fronds very finely dissect and toothed (as in most *Onychium* species and thus, along with semi-sterile fronds, of little use for identification), the taller and more erect fertile fronds have well dissect pinnules, the lobes of the pinnulets are diagnostically separate to their bases, narrow and usually quite well apart, varying in length, but often rather long, longer and further apart than in *O. vermae* and much more so than in *O. japonicum*; pseudoindusia long, entire, not usually very widely open on ripening, usually extending to the apex of the fertile segment. Cytotype hexaploid sexual (Matsumoto & Nakaike 1990, Fraser-Jenkins & Matsumoto in press). Close to *O. vermae*, but fully fertile fronds more dissect, with more distant and deeply cut, more separate, narrower ultimate fertile lobes or segments. Sterile and semi-fertile fronds are indistinguishable between species.

Nepal:

C: **Palpa** [Sathemati, Mondanda, Palpa Distr., 833275, on shady slope/place, 1330 m./1600 m., *D.P. Joshi* & *M.M. Amatya* 74/1365 *p.p. min.*, 74/1416 *p.p. min.*, 4.3.1974, KATH], **Kaski** [path in forest on W.- facing slope on E. side of Seti Khola, *c*. 2 km. above and N. of Kahure village, on upper path to Burjung Khola valley and Poiyim village, *c*. 6 km. N. of Puranchaur and Boonpure, N.W. of Lamachaur, upper Seti valley, *c*. 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *c*. 1800 m., *C.R. Fraser-Jenkins*, with *J.B. Pariyar* & *K. Pariyar* 26300 (FN 2278), 9.5.1998, BM, H], **Rasuwa** [Dumse [Dunche] to Chandanbari, 3000-

3200 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 926/79, 17.9.1979, KATH; forest and rocks beside road, *c.* 2 - 6 km. N. of Ramche on road to Dhunche, Trisuli Bazaar (and Langtang), N. of Trisuli Bazaar and Kalikasthan, N. of Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins* 21385 (FN 52), 28.9.1994, E], **Nuwakot** [Ranipauwa, Distr. Nuwakot, on dry rocky slope, 5500 ft., *V.L. Gurung, R. Kayastha* [later *Joshi*] & *P.M. Regmi* 14, 10.5.1976, KATH, fertile frond very young; Kakani, on the wetty and shady area, *V.L. Gurung, R. Kayastha* [later *Joshi*] & *P.M. Regmi* 85, 12.5.1976, KATH], **Dhading** [forested slopes above track leading into Nagarjun forest from Gate no. 2 at Mudko (Mareko), N.W. side of Jamachok Hill, N.W. of Balaju off Kakani road, N.W. of Kathmandu, Dhading District, *C.R. Fraser-Jenkins* & *S. Pariyar* 34969 (FN 247), 4.12.2011, TAIF, hexaploid, det. from root-apex mitosis by Dr. S. Matsumoto, 2013 (see Fraser-Jenkins & Matsumoto in press)], **Kathmandu** [Napaul, Narainhetty, *Dr. Buchanan* [*Hamilton*] *s.n.*, 22 Feby. 1803, BM, lectotype (Morton 1973); Gokarna, near Kathmandu, 4000-6000 ft., *B.D. Pande* F.4, 29.5.1949, BM; Thankot, semi-shade, *c.* 5000 ft., *P.R. Shakya* 73, 2025.8.1 [= 11.1968], KATH; Sundarijal, on the shady moist place, *Miss V.L. Shrestha* [later *Gurung*] & *Miss R. Thapa* [later *Rana*] 6025, 2026.2.26 [= *c.* 10.6.1969], KATH, a small specimen; Chandragiri Lekh, on north facing slope, 2100 m., *D.P. Joshi, K.R. Rajbhandari* & *M.K. Ghimire* 75/307, 12.1.1975, KATH; Kathmandu valley, Nagarjun (1350-1600 m.), *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8350002, 29.6.1983, BM; semi-shaded roadside-bank, above Karma Samtenling Monastery by bend in road up to Terku Oseling Monastery, on hill west of Swayembhunath Hill, east of Ichangu Hill, W. edge of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* & *J.C.B. Fraser-Jenkins* 34742 (FN 21), 8.7.2011, TAIF, hexaploid, det. from root-apex mitosis by Dr. S. Matsumoto, 2013 (see Fraser-Jenkins & Matsumoto in press)], **Lalitpur** [Phulchoki, on shady and moist place, 7500 ft., *Dr.* [*M.L.*] *Banerji* & *Mr. P.R. Shakya* 10225A, 10225B, 2023.1.30 [= 16.5.1966], KATH; Phulchowki, Rato Kakaro, on the shade of Magnolia, 7500 ft., *R.K. Manadhar's collectors* 8833, 17.2.1971, KATH; Godawari, Sangure khola, on shady place, 6000 ft., *Miss Manandhar and party* 10507, 5.5.1968, KATH; Lele - Tika Bhairab, on rocky slope, 5200 ft., *M.M. Amatya* & *T.K. Bhattacharya* 73-77, 16.3.1973, KATH; Godawari, mid-Phulchowki forest, Lalitpur District, north facing forest, moist and shady, 1800 m., *M.L. Pathak* 201104, 20.1.2011, KATH *sub* "*O. cryptogrammoides*" in error, small, semi-sterile morphology], **Bhaktapur** [Nala Amaldol, Bhaktapur, north and west facing slopes, 1650 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/372, 9.3.1975, KATH], **Sindhupalchok** [Tanguni (1840 m.) - Chipling (2160 m.), 2000 m., *H. Kanai* & *S.B. Malla* 673563, 21.8.1969, KATH; Norbu Timure to Tarke Ghyang, on moist slope of the forest, 7800-11,600 ft., *V.L. Gurung* & *M. Gorkhali* 78/800, 23.10.1978, KATH].

E: **Sankhuwasabha** [E. Nepal, Papung (2000 m.) - Bir Gaon (1600 m.), 873274, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725376, 30.6.1972, KATH], **Taplejung** [Khebang - below Siling Tzokupa, *H. Hara, H.*

Kanai, S. Kurosawa, G. Murata & M. Togashi 6305102, 20.11.1963, K; Amjilesa - Sekathum, Taplejung, open - semi-open place, 1800 m., *N. Thapa* T33, 5.8.2001, KATH].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [*e.g.* Mussoorie, spur S.W. of Castle Hill, *C.W. Hope*, 24.10.1881, BM]; Himachal Pradesh [*e.g.* Chumba - Kajiar, *E.W. Trotter*, 2.6.1887, Herb. C.W. Hope, BM]; ?Jammu & Kashmir [semi open slope below bushes, facing north, 11 miles N. of Bhund, 35 miles N. of Basohli, on road to Bani (towards Bhaderwah), E. Kathua District, *c.* 1500 m., *C.R. Fraser-Jenkins* 17800, 16.12.1990, E, to recheck versus *O. vermae*]. N.E. India; Vietnam; ?Indonesia; ?Japan [rare or erroneous, a few collections similar to the morphology of *O. lucidum* have been seen by CRFJ, but so far no targeted chromosome counts have been made and only the much commoner *O. japonicum* has been confirmed cytologically from there; the distributions given by G.M. Zhang & Yatskievych (2013), at the inappropriate rank of "varieties" in the *Flora of China* are not differentiated between at least *O. lucidum* and *O. vermae*, though probably mostly so for *O. japonicum*].

(S, C). A rather common (but less so in the W. Indo-Himalaya) mid-altitude species, of forest slopes and the edges of paths in shaded conditions.

170. ***Onychium moupinense*** Ching (syn.: *O. japonicum* subsp. *moupinense* (Ching) Fraser-Jenk., a mistaken combination made due to confusion with *O. lucidum*, some smaller specimens of which were included in it by Fraser-Jenkins (2008) leading to their being treated as conspecific which is revised here). *O. ipii* Ching (syn.: *O. angustifrons* K.H. Shing; *O. moupinese* var. *ipii* (Ching) K.H.Shing) from China (but not known in India or Nepal) is closely related to *O. moupinense*, but has wider pinnule-bases and narrower pinnae with a very narrow, attenuated frond apex. Although tentatively treated by G.M. Zhang & Yatskievych (2013) in the *Flora of China*, as a "variety" of *O. moupinense* its morphology appears to be rather distinct and it requires cytological and molecular investigation before its status should be altered, either to a species (or subspecies) if genuinely distinct, or a synonym if merely inconstant variation within *O. moupinense*. A specimen of *O. ipii* was nicely illustrated by Zhang (2012: 206) *sub* "*O. japonicum*".

O. moupinense is a smaller member of the *O. japonicum* group (fronds to *c.* 40 cm. tall), similar to a narrower and obviously much more compact *O. lucidum*, to which it is evidently closely related, but it usually has ± narrow-attenuated pinna and frond-apices, the pinnules are shorter, with more crowded lobes (but more separate in their lower parts than in *O. ipii*), the short fertile segments have the pseudoindusia extending the length of the lobe as in *O. lucidum*, but are usually more widely joined at their bases than in that species. The differences are rather subtle, with some specimens tht are difficult to decide. Cytotype hexaploid sexual (Verma (1957), *sub* "*O. ipii*" from Sikkim).

Nepal:

E: **Khotang** [Thotne Khola, 27° 17', 86° 42', lande, 1600 m., *J.F. Dobremez* 271 *p.p.*, 27.6.1970, BM, KATH, specimen in KATH semi-fertile], **Dhankuta** [on the way from Danda bazar to Raja-rani, Dhankuta, on soil, 1700 m., *N. Thapa* 14020 (FN 50), 15.12.1994, KATH, slightly intermediate towards *O. lucidum*], **Taplejung** [above Mewa river, occ. by roadside, 7500 ft., *R.L. Fleming* 2060, 4.12.1971, K].

Total distribution: China; Sikkim [N. Sikkim, *S.C. Verma* (1957), *sub* "*O. ipii*" in error, redet. CRFJ]; Bhutan [Wamrong, E. Bhutan, *CRFJ* & *T. Wangdi* 34058 (FN 144), 23.5.2009, THIM, TAIF]; Nepal and Mizoram.

(S, R). A very rare upper-mid to higher altitude species growing at the bases of rocks, or on steep banks, in moist, well-shaded places, among bushes *etc*.

Nepalese threatened status: **CR**.

[***Onychium plumosum*** Ching - a large, finely dissect species with a clumped rhizome and fronds arising closely together, with a thin, bright-green, herbaceous lamina and segments with crowded, very acute, partly fused lobes, the narrow fertile lobes slightly exserted from the segment, and the sori remaining yellow for a long time before ripening. It was listed from Nepal by G.M. Zhang & Yatskievych (2013) in the *Flora of China*, but we have seen no specimens from there despite intensive study of the genus in many herbaria, and the basis of this perhaps unlikely report is not now known. They also recorded it from Bhutan, India and Thailand, though we have not seen any such specimens and G.M. Zhang has no record of the specimens (pers. comm. to CRFJ 2015). It occurs in China, but a similarly dissect plant from Banikhet, Dalhousie, *F.E.W. Venning* 579, 14.9.1930, K, is just finely dissect *O. vermae* and not *O. plumosum* as det. in error by CRFJ in 2013.

A similar, but more narrowly dissect plant from Thailand, which is presumably the Thai plant referred to by Zhang & Yatskievych (2013) under "*O. plumosum*" and which CRFJ had also determined as *O. plumosum* in error, is a hithertoo undescribed species, *Onychium siamense* Fraser-Jenk. & Kandel, ***sp. nov.*** *Planta similis ad O. plumosum sed segmenta minora angustiora distantiora*; *lamina herbacea pallide viridis, pinnae infimae longissimae*. *Holotypus*: "Siam, Chiengrai, on rocks in shaded situations in evergreen jungle, 1100 m., *Winit* 1100, 6.8.1923", K. There are several specimens at BM and K, including a small but fertile one, "Doi Nang Ka, Chiengmai, *Put* for *A.F.G. Kerr* 3318, 2.11.1980", BM, K].

171. ***Onychium siliculosum*** (Desv.) C.Chr. (syn.: *Pteris siliculosa* Desv.; *Lomaria decomposita* D.Don; *Onychium auratum* Kaulf.; *Pteris daucifolia* Roxb.; *O. viviparum* (Cav.) Kümmerle; *O. chrysocarpum* (Hook. & Grev.) C.Chr.; *O. tenue* Christ; *O. aureum* Kümmerle).

A very distinctive large species (fronds to *c.* 70 cm. tall, but often precociously fertile even when *c.* 5 cm. tall) of its own group, with a somewhat thicker and shorter, ascendent rhizome, bearing much-branched roots with many side-lobes,

and ± persistent, more crowded leaves than the other species; stipe long, stiff, partly green to often all dark blackish brown; fronds strongly sterile-fertile dimorphic or part-dimorphic, sterile fronds very finely dissect, to quadripinnate, with very narrow, shorter and crowded segments, apart from at fertile tips, fertile fronds usually tripinnate, pinnatifid, with rather well separated, long segments, the pseudoindusia rapidly opening to expose the mass of thick sporangia coloured a characteristic and diagnostic bright sulphur-yellow colour by a thick indument of farinaceous glands, though the farina may be much removed by heat-drying or brushing with alcohol and insecticide. Unfortunately this beautiful, if weedy species seems to be impossible to transplant and grow in cultivation and can only be propagated by spores in places it chooses to grow in.

Nepal:

W: **Surkhet**, **Jajarkot** [Jajarkot, on dry, earth bank, 4000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5722, 16.10.1952, BM; Jajarkot, 28° 42', 82° 12', eboulis de quartzite dans un torrent à sec, 1100 m., *J.F. Dobremez* 2607 & *N.P. Manandhar* 74-236, 18.4.1974, KATH].

C: **Baglung** [Baglung, "W. Nepal", along road in sun, 2500 ft., *Robert L. Fleming* 917, 14.11.1949, BM, DD], **Myagdi** [Mayangdi khola, among boulders on hot dry slope, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4104, 30.8.1954, BM; Beni, Kali Gandaki River, among boulders, 2500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7012, 4.9.1954, BM; Myagdi Distr., Beni (840 m.) - Singa (910 m.) - Tatopani (920 m.) - Bholamza (950 m.) - Shimarchaur (950 m.) - Babichor (960 m.), 83° 27' - 33', 28° 20' - 23', 840-970 m., 830 m./865 m./850 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takashi* & *K. Yonekura* 9687047/ 9681035/9685059, 2.9.1996, KATH], **Palpa** [Dobhan, 6000 ft., *K.N. Sharma* E 193, 3.11.1931, BM], **Manang**, **Parbat** [Kali Gandak, between Kusma and Baglung, on dry stream bed, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 572, 20.5.1954, BM], **Syangja**, **Kaski** [near Pokhara, beneath shrubs in rather dry place, 4500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2463, 14.4.1954, BM], **Lamjung** [Midam khola, Walma [?Nalma], on dry slopes, 3500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5174, 3.5.1954, BM; Lamjung Himal, Hanshapur easterly of Pokhara, among shrubs, 1000 m., *T. Wraber* 222, 15.9.1969, BM, *ditto*, 228, 16.9.1969, BM; Pheligsanku, 28° 13', 84° 24', murets de pierres, 650 m., *J.F. Dobremez* 648, 25.11.1970, KATH], **Tanahun** [roadside banks on the way between Damauli and Chowti Bara Mandir, *c.* 3-4 km S. of Damauli, E. of Pokhara, W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins* 25480 (FN 1458), 18.8.1997, H], **Nawalparasi**, **Gorkha** [Marsyangdi valley, Jagat, on rocks, *T. Wraber* 598, 1.11.1969, BM; near by Philim, Gorkha, *S.H. Bhattarai* 958, 5.6.2012, KATH], **Chitawan**, **Bara** [near Badahikim bridge, on road from Hetauda to Birgunj, banks of Chure khola river, 27° 21' 17", 84° 59' 36", densely vegetated gully and banks of river, riverine forest, 610 m., *C.A. Pendry, K.K. Shrestha, S. Dahal, A. Giri, A.G.*

Miller, *N. Pandey*, *M.R. Pullan*, *L.R. Shakya*, *S. Shrestha* & *M. Siwakoti* DNEP2 A165, 27.11.2004, KATH], **Makawanpur**, **Dhading**, **Nuwakot** [Trisuli Bazar, 20 miles WNW of Kathmandu, 600 m., *D.H. Nicolson* 2304, 13.9.1966, KATH; Nuwakot Distr., Trisuli Bazar (630 m.) - Ragsinge Bazar (610 m.) - Horagaru (880 m.) - Chilaune Bas (1030 m.) - Samre Bhanjyang (1280 m.), 27° 55' 47", 85° 08' 43" - 27° 56' 53", 85° 02' 50", on newly made road side, 610 m., *M. Suzuki*, *N. Acharya*, *N. Fuji*, *L. Joshi*, *T. Kajita*, *N. Kondo*, *M. Mikage*, *S. Noshiro* & *K. Yoda* 9450002, 14.7.1994, KATH], **Rasuwa** [Bainse (600 m.) - Betrawati (700 m.) - Sim Ghotala (900 m.), 851276 - 851281, *H. Kanai*, *H. Hara* & *H. Ohba* 725866, 19.8.1972, KATH], **Kathmandu [**Narainhetty, *Dr. Buchanan* [*Hamilton*] *s.n.* 13.12.1802, BM, ditto, 21.2.1803, BM; lecta in regno Napalense prope Katmandu, [*The Hon. E. Gardner* for *N. Wallich*], Febr. 1818, BM; on way to Deurali, Thankot, moist shady rock, 5500 ft., *P.M. Khwaunju* 1272, 1973, K], **Bhaktapur**, **Sindhupalchok** [Helambu, on the rock face, in slope, 4000 ft., *Miss* [*R.*] *Gay* [*Troth*] A 1, 4.11.1971, KATH; Sindhu Palchowk District, Pharsica on way to Melamchi Gaon, 28° 00', 85° 30', rock face with earth, NE-facing, 45°, *c.* 1210 m., *R.G. Troth* 99, 4.11.1971, MICH], **Sindhuli** [banks on slopes of N. side of Churiya Ghats ridge, S.E. of Duarde village, on path down to Bagmati Bridge, S.E. of Raigaon, on E. side of Bagmati river, Sindhuli District, *C.R. Fraser-Jenkins et al.* 25751 (FN 1729), 23.10.1997, H], **Ramechap**, **Dolakha** [Tamba Kosi, Malephu (900 m.) - Kosikhet (1000 m.) - Pikhuti (950 m.), 861275, *H. Ohba*, *M. Wakbayashi*, *M. Suzuki* & *S. Akiyama* 8331547, 8351016, 27.8.1983, BM].

E: **Udayapur** [du col de Sukhchausi au camp de Aridinga, 850 m., *A. Zimmermann* 2108, 7.11.1954, BM], **Okhaldhunga**, **Bhojpur** [below Chhoyang, Bhojpur Distr., on exposed sandy place on river side, 1680 ft., *P.R. Shakya* & *M. Ohsawa* 1016, 6.11.1971, KATH; Dingla (1000 m.) - Doban (800 m.), 873273, on dry slope in open place, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725449, 2.7.1972, BM], **Sunsari** [Dharan Bazar, Biratnagar, amongst shrubs on stony ground, 1250 ft., *J.D.A. Stainton* 32, 16.4.1956, BM, KATH, det. CRFJ], **Sankhuwasabha** [Arun valley, Subhaya khola, N. of Chainpur, beneath trees, 2500 ft., *J.D.A. Stainton* 1546, 5.9.1956, BM, KATH], **Morang**, **Dhankuta** [among rocks by waterfall and on steep slopes of small side-valley (Shimsua khola), just S.E. of Shimshua hamlet, where road from Dharan and Bhedetar comes down to main Leuti khola valley, N. of Dharan on Dhankuta road, Dhankuta District, *C.R. Fraser-Jenkins* 228913, 28914 (FN 4888, 4889), 25.3.2001, H], **Tehrathum**, **Jhapa**, **Ilam** [Illam - Jog Mai - Ranga Pani, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305108, 8.12.1963, KATH; N. of Sunischari, Ilam Distr., 700 ft., *R.L. Fleming* 2306, 9.10.1976, MICH], **Panchtar**, **Taplejung** [Bharomdin - Tharpu [- Khebang], *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305106, 25.11.1963, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh [[below] Simla, *W.*

Griffith, BM]. N.E., C. & S. India; Bangladesh; Thailand; S.E. Asia; Taiwan; Pacific Islands.

(M, C). A very common to abundant weedy species of low to mid-altitude, often growing in full sunshine in hot, seasonally dry valley bottoms in well drained stony places and on slopes beside roads, or on cliffs, and most fronds capable of surviving the dry season.

[***Onychium tenuifrons*** Ching - reported by Thapa (2002) based on Fraser-Jenkins' misidentification of *O. cryptogrammoides* subsp. *fragile* as being this species. Fraser-Jenkins had informed Thapa that their possible conspecificity required investigation. *O. tenuifrons* is not known from Nepal, but occurs in Bhutan [Serbithang, Thimphu, *CRFJ*, Fraser-Jenkins, Bhutan, in prep.], Arunachal Pradesh and China.]

172. ***Onychium vermae*** Fraser-Jenk. & Khullar, ***sp. nov.*** *Species similaris ad O. japonicum et O. lucidum, morphologia frondium aliquantum intermedium inter ea dua. Frondes minores dissectae quam in O. lucido et pinnulae minores. Segmenta ultima fertilia breviora quam in O. lucido sed longiora et maiora quam in O. japonico. Cytotypus tetraploideus sexualis.*

Holotypus: India, West Bengal, "Onychium lucidum, Lebong, Darjeeling, fairly common near Lebong race course on forest margin, 1650 m., *S.C. Verma* Serial no. 3 (Onychium japonicum var.? akin to O. tenuifrons Ching), Sept. [19]57. Tetraploid, *n* = 58, PAN no. 3761", PAN. This voucher-specimen was published as tetraploid sexual by Verma in Mehra (1961) and Verma (1963). (misapplied name: "*O. japonicum*" *sensu auct. Asiat. et* Fraser-Jenkins, *p.p., non* (Thunb.) Kunze; "*O. lucidum*" *sensu auct. Asiat., p.p., non* (D.Don) Kunze).

This species has for much of the present and last Century been thought to be the only representative of the *O. japonicum* group present in the Indo-Himalaya, either under the name *O. japonicum*, or under *O. lucidum*. Most usage and references to "*O. lucidum*", especially in the west Indo-Himalaya and including determinations by CRFJ in the BM in 2013, refer to *O. vermae*. Apart from a little true *O. lucidum* in the present revised sense, which appears to be occurring there uncommonly (but could do with at least one confirmation count cytologically), it is nearly the only representative of that group in the west Indo-Himalaya and a number of tetraploid counts have been made of it from there by Khullar.

True *O. japonicum*, *nom cons., non* Blume, from C. and E. China; Korea, Japan; ?Thailand; Philippines; ?Indonesia; Azores (adventive) *etc*. (lectotype: Reveal *et al*. (2010): Japan, [*C.P. von*] *Thunberg*, L!) is a more delicate species similar to *O. lucidum* with the pseudoindusia reaching the tip of the fertile segments, but smaller, "neater" (smaller in all its parts) and the fertile segments shorter and more crowded. But the situation is more complex further east and there are also a number of very much more dissect collections from Jammu & Kashmir, Himachal Pradesh and Uttarakhand [*e.g.* British Garhwal, *Col.* and *Mrs. Fischer*, *ex* J.S. Gamble in 1899,

Herb. C.W. Hope, BM], some similar plants of which from Manali were found to be tetraploid by Khullar. Some of these approach the Chinese species, *O. plumosum* Ching, and some in herb. CRFJ and in BSD in Feb. 2005 were so misidentified by CRFJ, so that *O. plumosum* was reported in error by Fraser-Jenkins (2008), but the west Indo-Himalayan plants are too stiff-fronded with more acute ultimate lobes and are clearly not *O. plumosum*, but almost certainly represent the maximum extreme of dissection in *O. vermae*. The illustration of Biswas & Ghosh's (1983) and Ghosh *et al*'s. (2004) reported *O. plumosum* from Sikkim (*G.A. Gammie*, 29.7.1892, CAL) represents a fragmentary specimen of *O. cryptogrammoides*. G.M. Zhang & Yatskievych's (2013) listing of *O. plumosum* from Nepal is anomalous and it is not known on what basis or misidentification it was made. G.M. Zhang pers. comm. to CRFJ, 2.2015, thinks it may have come from unchecked reports from literature.

A medium-large species (fronds to *c.* 50 cm. tall); rhizome subterranean, creeping with fronds arising separately; stipes erect or suberect, hard, long (usually rather longer than the lamina), mostly dark brown later in the year; fronds tripinnate to quadripinnate, triangular-lanceolate, stiffly coriceous and somewhat crispaceous, dark green; pinnules bearing rather closer fertile lobes than in *O. lucidum*, usually wider and somewhat more fused towards their bases, more narrowly acutely pointed at their apices and not as long as in well developed *O. lucidum*; sori slightly divergent towards their bases, pseudoindusia entire, often not opening very widely on soral ripening, usually terminating beneath the acute-acuminate sterile apex of the fertile segment. Tetraploid sexual (Khullar & Mehra 1972 *etc.*; Verma 1963; Matsumoto & Nakaike 1990).

Nepal:

W: **Darchula** [W. facing forested rocks below cliffs by path, *c*. 2 km. N. of Dumling (opposite Jipti on the Indian side), on path south to Darchula, E. side of Kali river, Darchula District, *c.* 1800 m., *C.R. Fraser-Jenkins*, with *A.M. Thapa* & *B. Pariyar* 21693 (FN 360), 22.11.1994, E, specimen to be rechecked versus *O. lucidum*], **Dhoti** [Buglekh, way to Khaptad, Doti District, *M.L. Pathak*, *D.R. Luitel* & *K.R. Bhattarai* 201266, 21.4.2012, KATH sterile material, precise identity uncertain], **Bajhang** [Talkot - Aagar, Bajhang District, terrestrial, 2000 m., *K.R. Rajbhandari* 15298, 18.8.1991, KATH], **Pyuthan** [Swargadwari, Pyuthan, 2100 m., *D.R. Kandel*, *M.L. Pathak* & *G.D. Bhatt* 1216012, 9.6.2012, KATH sterile material, precise identity uncertain].

C: **Palpa** [Mondanda, Palpa Distr., 833275, on shady place, 1600 m., *D.P. Joshi* & *M.M. Amatya* 79/1416 *p.p. max.*, 4.3.1974, KATH, well dissect, and *ditto*, 1330 m., 74/1365, 2.3.1974, KATH, well dissect], **Lamjung** [Jagat, Lamjung, on moist and shady side of hill slope, 1500 m., *N.P. Manandhar* 3365, 24.12.1979, KATH, det CRFJ, 10.4.2014, as "probably *O. kholianum*, but not sure" in error], **Kathmandu** [Gokarna, on moist wall by the road side, 4500 ft., *Miss V.L. Shrestha* [later *Gurung*]

8459, 30.8.1969, KATH; Gokarna, in the shade of the forest, 1363 m., *Ramola* [*Rana*] *and party* 9920, 6.7.1971, KATH], **Lalitpur** [Phulchowki, on shady place, 7000 ft., *Miss R.K. M*[*anandhar*] 5835, 27.7.1971, KATH, US], **Bhaktapur** [forest 2 mi. beyond Bhadgaon, in damp place, 5000 ft., *R.L. Fleming* 1239, 16.8.1956, KATH, MICH, DD].

Total distribution: China; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan.

(S, C). A common and widespread mid- to higher altitude species, growing in semi-open places among bushes on slopes, or on grassy banks, or beside paths.

Hybrid: ***Onychium*** x ***matsumotoi*** Fraser-Jenk. & Kandel (*O. lucidum* x *O. vermae*), ***hybr. nov.*** *Planta hybrida, morphologia frondis intermedia inter O. lucidum et O. vermae segmenta ultima approxima breviora quam in O. lucido, sori aliquantum subroseo-brunnei, sporae abortivae. Cytotypus pentaploideus*. Holotypus: C. Nepal, Dhading District: "above track leading into Nagarjun forest from Gate no. 2 at Mudko (Mareko), N.W. side of Jamachok Hill, N.W. of Balaju off Kakani road, N.W. of Kathmandu, forested slopes, *c.* 1600 m., *C.R. Fraser-Jenkins* & *S. Pariyar* 34968 (FN 246), 4.12.2011", TAIF. Specimen annotated by CRFJ as "*O. japonicum* lamina fairly dissect, but not as finely as in FN 247, long, open sori". Mitosis showed 2*n* = *c.* 145, pentaploid (from the base number 29), spores abortive, det. S. Matsumoto 2011 (Fraser-Jenkins & Matsumoto in press).

Nepal: **C**: **Dhading**, **Dolakha** [Matsumoto & Nakaike 1990].

This sterile hybrid with abortive spores was first reported as pentaploid by Matsumoto & Nakaike (1990) from Kenja, between Jiri and Junbesi, Dolakha District, E.C. Nepal. Their plant is the same hybrid as the present refinding. The morphology of the hybrid is very cryptic and close to the revised *O. lucidum*, but it has somewhat less distant, and shorter fertile lobes and is slightly less dissect. It was growing with both presumptive parents (and no *O. kholianum* is known or expected from Kathmandu valley or near to it) and was first detected by Dr. Sadamu Matsumoto at Tsukuba, after whom it is named, from its cytology.

Pellaea (1 species).

173. ***Pellaea calomelanos*** (Sw.) Link (syn.: *Pteris calomelanos* Sw.; *Allosorus calomelanos* (Sw.) C.Presl; *Pteris hastata* Thunb., *non* Sw.; *Pellaea hastata* (Thunb.) Prantl, *non* (L.f.) Link).

A small, tufted fern (fronds to *c.* 20 cm. tall); stipes crowded, stiff, black, brittle, bearing narrow brown, hair-like scales towards the lower half, glabrous and glossy above, *c.* 1/3 the lenght of the lamina; frond pinnate to bipinnate (sometimes tripinnate below), lanceolate, pinnae with black costae and segment-stalks, bearing up to *c.* 4 or 5 alternate pairs of stalked pinnules and a similar segment at the pinna-apex and at the imparipinnate frond apex; pinnules ovate-auriculate to shallowly

hastate, with cordate bases, as wide as long, glabrous, dull pale green; sori marginal, with the pseudoindusium continuous around the margin, curling back and shrinking to reveal the thick line of brown sporangia around nearly the whole margin of the segment.

Nepal:

W: **Mugu** [Mugu, *c.* 2400 m., *D.P. Joshi s.n.*, a photograph only, no herbarium specimen collected, unidentified photograph det. CRFJ, 1997, for N. Thapa], **Dolpa** [between Phulchangi and Chong, near Tibrikot, growing from rock crevices on dry open slopes, 8000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3322, 11.9.1952, BM, E].

Himalayan distribution: China; Nepal; Uttarakhand [rare]; Himachal Pradesh [rare]; Pakistan [Besham, Swat, *T. Nakaike*]. Africa; Mascarenes and Madagascar; Macaronesia (?introduced), S.W. Europe.

(African, R). An extremely rare and little known higher altitude species (in Nepal) of the drier parts of the Indo-Himalaya, growing in crevices in slightly shaded, seasonally dry cliffs or large rocks.

Indian threatened status: **EN**. Nepalese threatened status: **CR**.

Pityrogramma (1 adventive species).

*174. ***Pityrogramma calomelanos*** (L.) Link., adventive in Asia. (syn.: *Acrostichum calomelanos* L.).

This medium-large fern (fronds to *c.* 70 cm.) has a clumped rhizome with many crowded fronds, stipes as long as the lamina, brittle, black, glossy, with some narrow, hair-like brown scales at the base, rhachis and lower parts of pinna-costae black and glossy; lamina bipinnate or just becoming tripinnatifid below, elongated triangular lanceolate, widest at its base gradually decreasing to the attenuated apex, pinnae numerous, narrowly elongated triangular with acute apices and bearing many decreasing, slightly distant except when sterile, triangular-acute pinnules, pinnules shallowly lobed at the sides, with small teeth; the whole underside of the lamina (the whole frond when young and uncurling) and parts of the axes more-or-less covered with a weak white farina beneath, often partly absent on some pinnules; fertile pinnules usually rather narrower, bearing acrostichoid, exindusiate sori along the veins, covering the surface beneath at maturity. Difficult to transplant, but in cultivation it grows rapidly and readily from spores wherever it wants to.

Nepal:

W: **Surkhet** [temple on small hill, just S. of Birendranagar Surkhet town, *C.R. Fraser-Jenkins s.n.*, 30.5.2014, seen but not collected]. Thapa (2002) reported this species as common in W. Nepal as well as further east. While that must indeed be so, we have not seen any actual herbarium specimens from W. Nepal.

C: **Baglung** [Baglung, "W. Nepal", on dry hillsides, 2500 ft., *R.L. Fleming* 916,

14.11.1949, BM], **Myagdi** [Mayangdi khola, among boulders on hot dry slope, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4105, 30.8.1954, BM; Myagdi Distr., Beni (840 m.) - Singa (910 m.) - Tatopani (920 m.) - Bholamza (950 m.) - Shimarchaur (950 M.) - Babichor (960 m.), 83° 27' -33', 28° 20' - 23', 875 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takahashi* & *K. Yonekura* 9681040, 2.9.1996, KATH], **Manang**, **Parbat** [Kushma, open landslide place, 950 m., *Dr. D.K. Sharma & N. Thapa* 10/96, 3.11.1996, KATH], **Syangja** [Dhandhunge, on open and rocky land, *N.P. Manandhar* 741-91, 3.9.1991, KATH], **Kaski** [Madi khola, Karalung, among boulders, 2000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5882, 23.6.1954, BM], **Tanahun** [banks beside road, *c*. 4 km. E. of Damauli, 32 miles E. of Pokhara on road east to Mugling and Kathmandu, Tanahun District, 390 m., *C.R. Fraser-Jenkins* 18146, 24.1.1991, E], **Lamjung** [Lamjung Himal, Hanshapur, in rocks fissures, 1000 m., *T. Wraber* 227, 16.9.1969, BM], **Chitawan** [Ramnagar, Chitwan District, shady gullies in Sal forest, 200 m., *K. Wesche* 2.61, 6.1994, BM], **Dhading**, **Nuwakot** [Samre Bajang, 27° 57', 85° 03', on rocky slope, 3500 ft., *J.D.A. Stainton* 3820, 9.6.1962, BM; Trisuli Bazar, 20 miles NNW of Kathmandu, growing under a rock [*sic*], 600 m., *D.H. Nicolson* 2322, 14.9.1966, KATH],Trisuli Bazar, on gravels, 600 m., *J.F. Dobremez* 985, 2.9.1971, KATH], **Makawanpur**, **Bara** [Pasahn, Bara, *c*. 150 m., *T. Nakaike* 3697, 7.11.1988, KATH], **Rasuwa** [Gosainkund, Sim Chautara (970 m.) - Ramche (1800 m.), 1300 m, *H. Hara, H. Kanai, S. Kurosawa* & *H. Ohba s.n.*, 2.6.1969, BM], **Kathmandu** [on way to reservoir, Balaju, on moist wall, 4450 ft., *P.M. Khwaunju* 1274, in 1973, K], **Lalitpur** [Tinpani, just above Tika Bhairab/10 miles S. Kathmandu valley, on roadsides, sunny, 4400 ft., *R.L. Fleming* 1552, 10.9.1958, KATH, MICH], **Sindhupalchok**, **Dolakha** [Tamba Kosi, Pikhuti (950 m.) - Singati (950 m.) - Suri Dhoban (1000 m.) - Totlabari (100 m.), 861275-862275, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8351036, 28.8.1983, BM], **Ramechap**.

E: **Sankhuwasabha** [Choyang, 1600 ft., *Dr.* [*M.L.*] *Banerjee*, [*A.V.*] *Upadhyaya* & [*B.B.*] *Baskola* 3392 *p.p.*, 29.4.1995, US; Arun valley, Marmidara between Sedua and Iswa khola, stony places, 1450 m., *T. Wraber* 451, 2.11.1972, BM], **Sunsari** [District Sunsari, road to Sangure, 5 km. from Dharan, 26° 50', 87° 18', open slope, *c*. 600 m., *Rebecca Gay Troth* 64, 11.7.1971, MICH; Chyure bas, 450 m., *P.R. Shakya* & *M. Ohsawa* 1168, 27.8.1971, KATH; Dharan (400 m.) - Sanguri Bhanjyang (1300 m.), 872266, on rather dry slope in open place, *c*. 500 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725500, 2.6.1972, BM, KATH], **Sunsari** [Phusre, Dharan, *C.K. Prasad* & *B.N. Adhikari* NHMTU-2-6B-0154, 10.1976, TU Nat. Hist. Mus.], **Morang** [Tare Morang, under cliffs in sand along river bank, 3200 ft., *R.L. Fleming* 1851 (E. no. 1), 6.8.1964, KATH], **Dhankuta** [among rocks by waterfall and on steep slopes of small side-valley (Shimsua khola), just S.E. of Shimshua hamlet, where road from Dharan and Bhedetar comes down to main Leuti khola valley, N. of Dharan on Dhankuta road, Dhankuta District, *C.R. Fraser-Jenkins* 28915 (FN 4890), 25.3.2001, H], **Jhapa**, **Ilam** [Illam - Jog

Mai - Ranga Pani, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305112, 8.12.1963, K; near Ilam, Ilam, 1500-2000 m., *T. Nakaike* 3648, 5.11.1988, KATH], **Taplejung** [Tamur valley, Taplejung, 3000 ft., *J.D.A. Stainton* 1255, 4.8.1956, BM, KATH].

Himalayan distribution (all adventive): China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling, Nepal; Uttarakhand; Himachal Pradesh. Omitted by Khullar (1994, 2000). Throughout India; Sri Lanka; Bangladesh; S.E. Asia; Taiwan *etc*. Native of C. and S. America, but widely adventive in Asia, Africa, Australasia, Pacific Islands *etc.*, even in the most remote places, though not so in the early 19th Century. Probably spreads locally by spores carried in clothes while walking along paths *etc*. In S. India and Sri Lanka another common C. and S. American adventive and distinct species occurs in addition, *P. austroamericana* Domin (syn.: *P. calomelanos* var. *aureoflava* (Hook.) Weath. *ex* Bailey), which is smaller, less dissect and has bright golden yellow farina beneath (when not washed off with alcohol treatment), but it apparently cannot stand the long dry Winters in the Himalayan region and has not so far spread to northern India or Nepal.

(A, C; C. and S. America). An abundant and widespread weedy species of low to upper mid or higher altitude, often forming large stands, growing in full sunshine in dry rocky gullies beside streams, or on river-banks, banks along paths, roadsides, cliffs, sometimes on old walls, on drier rice-field terrace banks *etc.* and penetrating even to remote inner Himalayan villages, trails and rivers.

Pteris (27 species, 7 subspecies).

This large and complex genus contains many apomictic and presumed allopolyploid species, but the species are usually rather constant in morphology and not too difficult to recognise when the characters to look for are known, though stipe-base scale-characters are not very diagnostic. A few species contain partly overlapping and semi-cryptic subspecies, but again these can normally be recognised with experience, though some specimens, especially incomplete or juvenile ones may not be identifiable. Whereas Iwatsuki (1988) recognised only 16 species in Nepal, more recent elucidation and separation of species within the large assemblage of compound *Pteris* species (particularly in the detailed account by Fraser-Jenkins, 2008) has now resulted in 27 species being recognised from Nepal. We have cited more specimens than usual for the widely misunderstood critical taxa in order to assist with forming a concept of the often rather critical species or subspecies.

The genus has in the past been classified to recognise a section *Campteria* with anastomosing veins, but this is entirely artificial and of no use as species obviously very closely related to *P. biaurita* (in *Campteria*), but with fee veins, fall into a section *Quadriauricula*, while the rest of Sect. *Campteria* is not related to *P. biaurita*. All the supposed differences between Sect. *Quadriauricula* and Sect. *Pteris* also break down. In fact in S. Asia there are no sections or subgenera within the genus and though one can

refer to certain groups of species, separating them infragenerically is a rather meaningless exercise.

In the descriptions below we have used the non-classificatory descriptive terms "compound *Pteris*" to refer to all the *P. aspericaulis* - *P. biaurita* assemblage with nearly or quite bipinnate pinnae and nearly pinnate developed lowest pinnules, and have included in this *P. terminalis*, *P. longipinnula* and *P. wallichiana*, and "dactylate *Pteris*" to refer to all the *P. cretica* - *P. ensiformis* and *P. stenophylla* assemblage, with long, unlobed pinnae or segments. The pinnation of *P. vittata* and *P. alata* does not fit either of these terms, but they are both quite normal *Pteris* species, despite occasional suggestions in past literature that *P. vittata*, the type of the genus, is not a typical member according to the rest of the genus.

175. ***Pteris alata*** Lam. (syn.: *P. dimidiata* Willd.; *P. dimidiata* Roxb.; misapplied name: "*P. semipinnata*" *sensu auct. Ind. et Sin.*, *non* L. [syn.: *P. dispar* Kunze, from China and Japan]). Fraser-Jenkins (2008: 104) discussed the Chinese type of *P. semipinnata* and though in 6.2003, he had identified the left hand specimen as *P. dispar* (note in BM), he pointed out that it was possible that the right hand frond (lectotype) might be what is here called *P. alata*, but might also be *P. dispar*, pending Japanese pteridologists' opinion, but that if both were *P. dispar* then the present species must be called *P. alata*. Dr. A. Ebihara has now informed CRFJ (pers. comm. 2014) that both specimens on the type-sheet of *P. semipinnata* are the same as *P. dispar* (see Ebihara *et al.* 2015). We therefore conclude that it is urgently needed to submit a proposal to reject the name *P. semipinnata* in order to avoid the confusion of calling *P. dispar* by the name *P. semipinnata*. In any event, the present species should now be called *P. alata* and as it does not have any wider commercial or horticultural interest it should not be necessary to conserve the name *P. semipinnata* with a different type.

A small to medium large (fronds to *c.* 60 cm. long, and often longer in S.E. Asia) species intermediate between dactylate and compound *Pteris* species, stipe as long as the lamina, dark brownish purple to blackish and glossy, as also the rachis; lamina narrowly elongated triangular lanceolate, widest at or just above the base, pinnate, with rather short, well spaced pinnae, each pinna "semipinnate", *i.e.* with a simple main branch and some 4-6 elongated basiscopic simple lobes directed downwards, and entire acroscopically, or occasionally one (rarely 2 or more) basal acroscopic lobe, larger specimens may also have the lowermost pinna-lobe lobed again, all parts with a wing of unlobed entire lamina, *c.* ½ cm. wide, pinna-apex and frond-apex with a longer simple terminal lobe, apices of pinnae and pinna-lobes acute, with a few short teeth, extending downwards for some way in sterile fronds; sori marginal and as in all *Pteris*, with a long, uninterrupted marginal pseudoindusium. Cytotype tetraploid sexual (from China (Hong Kong),, Malaya and Taiwan) It is possible to confuse small juvenile plants of the higher altitude *P. terminalis* with *P. semipinnata* as baby plants (up to some 30 cm. or more) go through a stage where

the pinnae are similarly semipinnate; the specimen that was the basis for Thapa's (2001) report of *P. semipinnata* from Godawari, C. Nepal, was reidentified for him by CRFJ as a juvenile *P. terminalis* (at that time as "*P. excelsa*"), this confusion then being explained by Thapa (2002).

Nepal:

C: **Kaski** [forest along East shore of Begnas Tal, N. of Begnas, E. of Pokhara, Kaski District, *C.R. Fraser-Jenkins* & *Ranil Rajapaksha* (National Botanic Garden, Peradeniya, Sri Lanka) 34227 (FN 30), 13.7.2009, TAIF], **Tanahun** [patch of forest by stream-gully, *c.* ½ km S.E. of Jamune village, *c.* 7 km. W. of and above Damauli, on road to Pokhara, E. of Pokhara, W. of Mugling, Tanahun District, *c.* 500 m., *C.R. Fraser-Jenkins* with *Ganesh* [*Ramchandre*] *Pariyar* (brother-in-law) 25508 (FN 1486), 19.8.1997, H, KATH (specimen given to N. Thapa for KATH); Jamune village, Tanahun, 27.979°, 84.21°, moist and shady gully, 350 m., *R.D. Thapa, S. Chhetri* & *R.P. Marahatta* TJ-1, 28.1.2012, KATH; small forested gully opposite and S. of Chabise village, *c.* 3 km E. of Khairentar, E. of Pokhara on Damauli road, Tanahun District, *C.R. Fraser-Jenkins* with *K.* ["*U.*"] *Pongali* 25815 (FN 1793), 27.12.1997, H].

E: **Morang** [small stream-gully in light mixed forest with Sal trees and bushes, *c.* ½ km. east of Pathari, west of Urlabari, on south side of main East-West Highway, *c.* 30 km. E. of Itahari, Morang District, *C.R. Fraser-Jenkins* & *Nirmala Fraser-Jenkins* 30113, 16.12.2003, TAIF], **Jhapa** [among Sal-trees in Kutte Dange wood, *c.* 1 km. N. of Dhulabari, N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 29387 (FN 5362), 6.10.2001, H; roadside verges *c.* 2 km. N. of Kakkarbhitta, near Nakhalbandi, E. of Dhulabari, not far from West Bank of Mechi Khola (river), Jhapa District, *C.R. Fraser-Jenkins* 33224 (FN 4), 9.11.2008, TAIF].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. to S. India; Sri Lanka; Bangladesh; S.E. Asia; S. Japan.

(M, R). A rare (in Nepal) low to lower-mid altitude, subtropical species, growing on moist earth beside small streams in forest.

Nepalese threatened status: **VU**.

176. ***Pteris arisanensis*** Tagawa (syn.: *P. linearis* var. *manipurensis* S.R.Ghosh; *P. pseudoconfusa* Sarn.Singh & Panigrahi; *P. vijaynagarensis* Sarn.Singh & Panigrahi (a smaller, coarse plant with more subapiculate and coarser segments as sometimes happens in this species); misapplied names: "*P. linearis*" *sensu auct. Ind. p.p. maj.*, *non* Poir. [syn.: *P. nemoralis* Willd. (lectotype Fraser-Jenkins (2008) with tall areolae, some free), *P. rottleriana* Link, *nom. nov. superfl.*, from the Mascarenes and Africa]; "*P. confusa*" *sensu* Singh & Panigrahi (2005), *non* T.G.Walker [from Sri Lanka and S. India]). This species is evidently very close to the diploid apomictic species, *P. confusa* from South India and Sri Lanka (misreported from Arunachal Pradesh by Singh & Panigrahi, 2005) but the range of variation of *P. confusa* includes large,

deltate fronds with long pinna-lobes, which does not occur in large plants of *P. arisanensis* and the two are probably not conspecific.

This is a typical compound *Pteris*, stipe as long as the lamina, hard, stramineous, smooth; frond imparipinnate apically, pinnate-pinnatifid, with the lowest pinna bipinnate-pinnatifid with a developed basiascopic basal pinnule; all pinnae pinnatifid with many pinna-lobes; it is closely related and similar to *P. biaurita* in its wide/deep connection (joined up to *c.* 3 mm. deep) between the pinna-lobe bases and non-apiculate (mucronate) lobe-apices, but the lamina is of a slightly stiffer texture, with more prominent short spines above the distal part of the pinna-costae, a tendency for some of the segments to become slightly subapiculate, and the veinlets beneath the sinus between pinna-lobes all free and curving evenly up to just above the base of the sinus. Diploid apomict, erroneously reported by Chao *et al.* (2013) as being triploid apomict, misquoting Fraser-Jenkins (2008); reported by Tsai & Shieh (1984) as tetraploid sexual (voucher-specimen ?lost), probably in error for diploid apomict, awaiting a definitive chromosome count from the type locality in Taiwan. Liao *et al.* (2013) in the *Flora of China* entirely misunderstood that *P. arisanensis* has free veins as can be seen from the type and as clearly stated in the study of it made by Fraser-Jenkins (2008: 116-118), whom they cited, describing instead the largely anastomosing venation of *P. biaurita* subsp. *walkeriana* and misleadingly attributing it to *P. arisanensis*, thereby initiating unwanted long-lasting confusion for Asian pteridologists.

Nepal (all Nepalese specimens known to us cited):

C: **Kaski** [forested N. facing hill-side in Raniban forest, on S.E. side of Phewa Tal (lake), along and above path, *c.* 1-2 km. west of Fishtail Lodge Hotel, just south of Pokhara Baidam (Lakeside) township, Kaski District, *C.R. Fraser-Jenkins* 18105, 23.1.1991, E, *ditto* (Anadu), 25142 (FN 1121), 1.1.1997, H, *ditto, C.R. Fraser-Jenkins* & *Sagun Pariyar* 33095 (FN 208), 3.10.2008, TAIF; waterfall and forested khola in upper Chiso Khola, S. of Yamdi Khola, S.W. of Yamdi village, on N.E. side of Sarangkot Hill, *c.* 4 km. N.W. of Bogar, shortly N.W. of Pokhara, Kaski District, *C.R. Fraser-Jenkins,* with *Rajendra Boruwal* 25886 (FN 1864), 8.1.1998, H; deep steam-gorge in forest just beyond N.W. end of Rupa Tal, on N. side of lake-valley, N. of Begnas, c. 15 km E. of Pokhara, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang*, with *K.* ["*U.*"] *Pongali* 25946 (FN 1924), 13.1.1998, H; N. facing, lightly wooded slope above Kali Khola on S. side, *c.* ½ km. upstream from Surjenagar village, S.E. of Mahendra Goufer Cave, *c.* 5 km. N. of Mahendrapul, N. of Pokhara, Kaski District, *C.R. Fraser-Jenkins* 26070 (FN 2048), 24.2.1998, H; path in semi-open forest on W. facing slope, *c.* 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c.* 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c.* 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District,, *C.R. Fraser-Jenkins*, with *J.B. Pariyar* 26153 (FN 2131), 13.3.1998, H, *ditto, C.R. Fraser-Jenkins* with *G. Yatskievych* (Missouri Bot. Garden), *E.A. Hooper* (Duke Univ.), *J.P. Gajurel* (Tribhuvan Univ.), *Rita Thapa* (Tribhuvan

Univ.), *Sagun Pariyar* (sister-in-law) & *G.B. Tamang* (Bardibas and Kathmandu) 34256, 34257 (FN 59, 60), 12.9.2009, TAIF], **Tanahun** [forested stream among rice-fields, *c.* 2 km. above and S.W. of Chowti Bara Mandir, *c.* 8 km. S. of Damauli, E. of Pokhara, W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins* 25491 (FN 1469), 18.8.1997, H; densely forested stream-gully in hills *c.* 1½ km. S.E. of Jamune village, *c.* 7 km. W. of and above Damauli, on road to Pokhara, W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins* 25530 (FN 1508), 19.8.1997, BM, H], **Dhading** [forested stream gulley and adjacent rocks along lower path around back (N.W. side) of Jamachok mountain, Nagarjun Forest, in from Gate no. 2 by Mureko [Mudko], N.W. of Balaju, N.W. of Kathmandu, Dhading District, *c.* 1400 m., *C.R. Fraser-Jenkins* & *A.C. Jermy* 19478 (FN 363), 15.1.1993, E (and *ACJ* no. in BM), *ditto, C.R. Fraser-Jenkins et al.*, 24193, 24194 (FN 171, 172), 25.7.1996, BM, H; *ditto, C.R. Fraser-Jenkins* 26251 (FN 2229), 24.3.1998, H, *ditto*, 29781, 29782 (FN 5756, 5757), 29.11.2001, H, *ditto*, 30978, 30979, 13.12.2004, TAIF, *ditto*, 31362, 9.9.2005, TAIF, *ditto*, 31873-31875, 25.10.2005, TAIF, *ditto*, 31916, 31917, 28.11.2005, TAIF; *ditto, C.R. Fraser-Jenkins* & *Sagun Pariyar* 34774, 34775 (FN 52, 53), 1.9.2011, TAIF; *ditto, C.R. Fraser-Jenkins* & *Sagun Pariyar* 34976-34978 (FN 254-256), 4.12.2011, diploid at mitosis, 2*n* = 58, det. S. Matsumoto, 2013, TAIF], **Kathmandu** [Nagarjun, 5000 ft., *P. Pradhan, R. Thapa* & *M.S. Bista* 8522, 30.8.1968, KATH; Gokarna Ban, Kathmandu, [*T. Nakaike*] 359, in 1979, T.U. Nat. Hist. Mus.; first forested damp stream-gully above road, 6 km. N. from Pharping Bazaar, N. of Bansbari, 1 km. S. of Chalankhel, N.E. side of Neupane Dara (hill), on W. side of Bagmati River, *c.* 10 km. S. of Kathmandu on road to Dakshin Kali temple, Kathmandu District, *c.* 1400 m, *C.R. Fraser-Jenkins*, with *Bikram Pariyar*, *Jeet Bhdr. Pariyar et al.* 24127, 24128 (FN 105, 106), 20.7.1996, BM, H; sandy slopes in slightly open, degraded forest, S.E. part of Raniban forest-reserve, Gokarna, E. of Bouddha, N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins*, with *B. Bista* (Forest Officer) 25212 (FN 1191), 23.1.1997, BM, H, *ditto, C.R. Fraser-Jenkins* with *P. Kuikel* (Forest Lodge guide) 34206 (FN 9), 5.7.2009, BM, TAIF; forest on E. side of and below Pashupatinath temple, on E. side of Bagmati river, E. Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins et al.* 25416 (FN 1394), 21.7.1997, BM, H; Raniban [Nagarjun], Kathmandu, 1420 m., *R.D. Thapa, S. Chhetri* & *R.P. Marahatta* R5-10, 27.6.2010, KATH], **Lalitpur** [Bajrabarahi, in the mixed forest, moist and shady slope, 1400 m., *D.P. Joshi* & *R. Joshi* 1098, 16.5.1976, KATH *sub* "*P. quadriaurita*" det. V.L. Gurung, 25.6.1977, in error, redet. CRFJ 14.2.1997, for N. Thapa], **Bhaktapur** [forested rocky stream-gulley, *c.* 1 km. S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, E.N.E. of Kathmandu, Bhaktapur District, *c.* 1500 m., *C.R. Fraser-Jenkins* with *R.* ["*G.*"] *Pariyar et al.* 25256 (FN 1235), 15.2.1997, BM, H, *ditto, C.R. Fraser-Jenkins* 31321, 20.8.2005, TAIF].

E: **Ilam** [densely forested, rocky stream-gully of Sudhung khola, shortly below

Sudhung, leading south below road, below Sundergaon, W. of Pashupatinagar on Ilam road, Ilam District, *C.R. Fraser-Jenkins* 25333 (FN 5508), 9.10.2001, H], **Taplejung** [Sanghu, 5900 ft., *A.H. Norkett* 8601, 8.1.1962, BM]. A specimen from Kalimpong, Darjeeling, *C.B. Clarke* 9186, K, is heavily infected with *Taphrina laurencia* galls and was marked by Clarke as "(*prolifera*)". Another specimen at Kew from Meghalaya, Nunklow Hills, Assam, [*C.J.*] *Simons* 259, [in *c.* 1852], herb. W. Griffith (misdetermined by CRFJ as "*P. dixitii*" in error due to its subapiculate segment-apices), must be one of the earliest collections of a heavy *Taphrina laurencia* gall infestation, and was anotated by J.G. Baker as "caused by a fungus *Taphrina laurencia*, See Tubeuf & Smith *Diseases of Plants* p. 149" (Tubeuf (1895), where *Taphrina* species on ferns are listed).

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [Ghansi, Tehri, *B.P. Uniyal* 81769, BSD; *c.* 6 km. N. of and above Kathgodam on Nainital road, *C.R. Fraser-Jenkins* 31140, 4.2.2005, TAIF]. N.E. to S. India; Sri Lanka; Thailand; Vietnam; Taiwan; Philippines.

(S, Sc to C). A fairly common mid to upper mid altitude species of slopes in dense forest.

177. ***Pteris aspericaulis*** Wall. *ex* J.Agardh (syn.: *P. pseudoquadriaurita* Khullar; *P. bomiensis* Ching & S.K.Wu, despite having apiculate ultimate segments, Liao *et al.* (2013) stated that *P. bomiensis* fell within the range of the entirely different, non-apiculate *P. fauriei* Hieron., i.e. *P. khasiana* (C.B.Clarke) Hieron.; misapplied names: "*P. quadriaurita*" *sensu auct. plur., non* Retz. [endemic to Sri Lanka], see *Kew Bull*. 1932: 76 and Walker (1960); "*P. rosio-lilacina* [*sic*]" *sensu* Ghosh *et al.* (2004), *non P. roseolilacina* Hieron.; "*P. scabristipes*" *sensu* Ghosh *et al.* (2004), *non* Tagawa).

The account of species under the name *P. aspericaulis* by Liao, Ding, Wu, Wu, Prado & Gilbert (2013) in a *Flora of Errors* is confused and incorrect in almost every possible way and though not putting forward different research-conclusions, failed to assimilate the taxonomic elucidation researched and published from the Indo-Himalaya, nor did they realise the diagnostic importance of setae above the ultimate segments (as opposed to the pinna-costae), or even of the very well documented and quintessential, frequently specifically diagnostic cytology. They also included within *P. aspericaulis* at the erroneous status of "varieties", or unrecognised as if synonyms, several entirely and obviously different species, including some long known to be distinct. These were *P. subindivisa*, *P. tricolor* Linden (misreported by them from Bhutan and Sikkim in error for white-variegated *P. subquinata*, already specifically corrected by Fraser-Jenkins (2008: 112)) and *P. roseolilacina*, and entirely omitted *P. normalis*, despite it being correctly reported from China by Fraser-Jenkins (2008), which work they cited widely elsewhere. In addition they misplaced the quite different species *P. tibetica* Ching (see below) and four of Singh & Panigrahi's synonyms of *P. subindivisa*, already definitively

reidentified from careful study of their types and field study in the *loci classici* by Fraser-Jenkins (2008), and mistakenly placed them all under what they erroneously called *P. aspericaulis* "var. *aspericaulis*", while failing to identify and give proper status to Ching's "var. *cuspigera*" and some other Chinese names. It is incomprehensible how all this could have come about, given the well marked distinction of the species concerned and their elucidation in the Indo-Himalaya. Publication of such a disastrously erroneous account and the lack of study and knowledge it entailed can only result in seriously misleading Asian pteridologists who might think this Flora should be reliable, and it will obstruct future research by regression to the state of confusion which had already been correctly and carefully clarified. It appears that none of the names they used can be relied upon as far as their identity is concerned and those parts of the genus *Pteris* must remain confused in China until proper investigative research is entered into there instead of hasty Flora projects more connected with national pride and taxonomically inexperienced N. American intrusion.

P. aspericaulis is a typical medium-large (fronds *c.* 50-80 cm.) compound *Pteris*; stipe and rachis very variable in colour, often pink-mauve, or otherwise green-stramineous, dull and slightly asperous; lamina long (with 12-17 pairs of pinnae), lower one to three pairs of pinnae with a single, or sometimes two developed accessory, basal basiscopic pinnules, the intersegmental sinus reaches the pinna-costa, segments smallish and "neat", rather abruptly apiculate (mucronate) at their apices, either without setae above them, or more usually with one or two setae above midpoint; cytotype diploid sexual (including from the type locality overlooking Kathmandu Valley, det. T.G. Walker, cytological voucher-specimen: Sheopuri Hill, Kathmandu District, *CRFJ* 19496 (FN 381), 16.1.1993, TAIF). Also several counts from the W. Indo-Himalaya *sub* "*P. pseudoquadriaurita*" by Khullar. Walker (1962) grew progeny from spores of specimens we have seen at BM and reported the related species, *P. dixitii* under the name "*P. aspericaulis*", from Meghalaya (*H. Scott* 155, BM), as being triploid apomict, but reported true *P. aspericaulis* under the name "*P. roseolilacina*", from Nepal (*Polunin*/*Stainton, Sykes* & *Williams* 5688, 4304 - presumably an error for 4303 as no 4304 could be found, 9038), as being diploid sexual. In his joint later work with CRFJ he had corrected these misapplications of names. The identity of this species is very precisely known, both taxonomically and cytologically, and is properly based on its correctly selected lectotype at Kew (Morton 1973). It can easily be distinguished from *P. normalis* by its longer, relatively narrower frond with more pairs of pinnae, a rather less strongly asperous stipe, more herbaceous lamina, smaller ultimate segments with more abrupt apices and the usual presence of setae above the upper part of the ultimate segment midrib (though these are variable and partly deciduous). It is also similar to *P. roseolilacina* and *P. dixitii* (see under those species).

Nepal:

W: **Darchula** [Maikhola - Sipti, Darchula Distr., *M.M. Amatya* & *P.M. Regmi* W.601/82, 30.8.1982, KATH; [Api] Base camp - Khayakot, 3829-2021 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yano, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216127, 19.7.2012, KATH], **Bajhang** [Talkot - Aagar, Bajhang, 2000 m., *K.R. Rajbhandari* 15332, 18.8.1991, KATH], **Dailekh** [Bhama Saini, moist and shady place, 2600 m., *T.B. Shrestha* & *N.P. Manandhar* 442, 25.10.1975, KATH; in remnant Quercus and Rhododendron forest, on rocky banks or on epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c*. 40 km N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins*, with *K. Neupane* & *U.* [*K*] *Pongali* 25622-25628 (FN 1600-1606), 26.9.1997, BM, H, US, G], **Jajarkot** [Samela, shaded ravine in dense forest, 7000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 513, 19.8.1952, BM *sub P. aspericaulis* det. A.H.G. Alston, and *ditto*, 5688, 15.10.1952, BM, diploid sexual, det. T.G. Walker (Walker 1962)], **Rukum**.

C: **Baglung** [below Baglung, "W. Nepal", on open clay banks, 2500 ft., *R.L. Fleming* 915 *p.p. min.*, 14.11.1949, BM; nr. Lumsum, shady banks in ravine forest, 7500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4303, 9.9.1954, BM, diploid sexual, det. T.G. Walker (Walker 1962 *sub* "4304" presumably in error); Bhuji khola, shady banks in ravine forest, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 9038, 15.10.1954, BM, 14 pairs of pinnae, det. CRFJ 2013 as "*P. normalis*" in error, redet. from photos 2015, diploid sexual, det. T.G. Walker (Walker 1962); above Sikha, Banglung Distr., on ground, 8000 ft., *R.L. Fleming* 1747, 12.1963, MICH, DD], **Myagdi** [Myagdi Distr., Dobang (2360 m.) - Lapche Kharka (2060 m.) - Lipshe (1840 m.) - Boghara (2010 m.), 83° 23', 28° 33'-37', 2250 m., *M. Mikage, R. Hirano, N. Kondo, C. Mohri, A. Takashi* & *Y. Yonekura* 9681330, 10.9.1996, KATH], **Parbat** [dense forest by streams and stream gorge, between Banthanthi and Nangethanthi, above Ulleri on way up to Ghorepani, N. of Birethanthi, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c*. 2200-2700 m., *C.R. Fraser-Jenkins*, with *Ganesh Bhdr. Tamang, Keshab Nepali* & *Philip McCormack* (Ireland, i-to-i volunteer), 34514 (FN 19), 13.6.2010, TAIF], **Gorkha** [Gorkha Distr., Ekle Ghar (1620 m.) - Sharyung (2000 m.) - Anga (2140 m.) - Lokpa (1900 m.) - Sardu khola (1800 m.), 28° 24' 35", 84° 53' 40" - 28° 26' 49", 84° 55' 56", open grassy place, somtime shady place, 2050 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro* & *K. Yoda* 9485138, 25.7.1994, KATH *sub* "*P. subquinata*" in error], **Makawanpur** [Simbhanjyang, 50 miles W.S.W Kathmandu, 8100 ft., *R.L. Fleming* 1416, 7.9.1957, MICH], **Rasuwa** [Dhunche to Dumse [Dhunche] Guard [checkpost], 2000 - 3000 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 885/79, 16.9.1979, KATH; Langtang National Park, Rasuwa, [along path from Dhunche N.E. to Deorali], 2385 m., *Rita D. Thapa*, with *C.R. Fraser-Jenkins* (no. 34301, TAIF), *G. Yatskievych, E.A. Hooper, J.P. Gajurel, G.B. Tamang* & *Sagun Pariyar* 09-089, "15.9.2009", 19.9.2009, KATH), *Ganesh B. Tamang* & *Sagun Pariyar* 34301-34303 (FN 104-106), 18.9.2009, TAIF],

Dhading [Raniban forest, by second stream along path from Gate no. 2, at back (N. side) of Jamachok mountain, N.W. of Balaju, N.W. side of Kathmandu, Dhading District, *C.R. Fraser-Jenkins*, with *Jeet Bhdr. Pariyar* (brother-in-law) 26248 (FN 2226), 24.3.1998, BM, H, also *ditto* 24195 (FN 173, 25.7.1996, BM, H], **Nuwakot** [Kakani, Nuwakot, *V.L. Gurung at al.* 132a, 12.5.1976, KATH *sub* "*P. quadriaurita*" in error], **Kathmandu** [Sundarijal, Kathmandu valley, 6200 ft., *R.L. Fleming* 1374, 21.8.1957, MICH; Bagdwar (2500 m.) [- Budhnilkantha (1500 m.)], *H. Kanai* 670530, 31.12.1969, KATH; forested ridge on E. side of top of Shivapuri mountain, near Bagdwar, in stream-gully, N. of and above Buddhanilkantha and Naranthan, N. of Kathmandu City, Kathmandu District, *C.R. Fraser-Jenkins*, with *Raju* & *Ganesh* [*Ramchandre*] *Pariyar* 25372-25380 (FN 1351-1359), 19.4.1997, BM, H, US], **Lalitpur** [Godawari, S.E. of Katmandu, clearings between Laurel, *Kenneth de B. Codrington* 102, in 1956, BM; Chapagaon forest, 4800 ft., *Dr. R.L. Fleming* 1320 [*p.p.* b], 17.9.1956, MICH, DD det. R.R. Stewart as "*P. quadriaurita*" in error; Godawari (1600 m.) - Phulchowki (2500 m.), Kathmandu, *H. Hara, H. Kanai, G. Murata, H. Ohashi, O. Tanaka* & *T. Yamazaki* 25453, 23.6.1967, BM *sub* "*P. quadriaurita*" det. H. Itô in error; Phulchowki, south of Kathmandu, 852274, along road in light shade, *c.* 1500 m., *H. Hara, K. Iwatsuki, H. Ohba* & *Z. Iwatsuki* 725543, 15.7.1972, KATH; valley to S.W. of and below Phulchowki mountain, shortly above and S.E. of quarry, above and S.E. of Godawari, S.E. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *Deepak Lama, Lok Bhdr. Tamang* & *Ganesh* [*Ramchandre*] *Pariyar* 24101 (FN 19) 4.6.1996, BM, H, and *ditto* loc. 24970 (FN 949), 15.11.1996, BM, segments slightly towards *P. normalis*; forest slope above river on S.E. side of Bajrabarahi temple, E. side of Chapagaon, S. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *Deepak Lama* & *Raju Lama* 24993, 24995, 24997 (FN 972, 974, 976), 18.11.1996, BM, H, some fronds rather wide-based], **Bhaktapur** [Bhadgaon, Bhaktapur, 5000 ft., *Dr. R.L. Fleming* 1320 [*p.p.* a], 14.9.1956, KATH det. R.R. Stewart as "*P. quadriaurita*" in error], **Sindhupalchok** [Tarke Ghyang, Helumbu, 7500 ft., *Robert L. Fleming* 1850, 8.1964, MICH], **Dolakha** [C. Nepal, Tamba Kosi, Totlabari (1100 m.) - Jagat (1100 m.) - Chhetchhet (1350 m.) - Simigaon (1950 m.), 862275 - 862276, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331600, 29.8.1983, BM; near Jiri, Dolakha, Janakpur Zone, *c.* 1800 m., *T. Nakaike* 3017/3542, 3/25.10.1988, KATH], **Ramechap** [between Sivalaya and Bhandar, Janakpur Zone, 1800-2500 m., *T. Nakaike* 3124, 6.10.1988, KATH].

E: **Sankhuwasabha** [Sedua, Sankhuasabha, 1740 m., *P.R. Shakya* & *M. Ohsawa* 1172, 15.9.1971, KATH; E. Nepal, Papung (2000 m.) - Bir Gaon (1600 m.), 873274, along path in open place, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725383, 30.6.1972, BM], **Dhankuta** [forested N.W.-facing slope just below top of ridge (on Dhankuta District side, to W.) and narrow, rocky stream-gully at bottom of slope, c. 1km (by zig-zag road) W. of and above Basantapur [in Tehrathum District, to E. of ridge], N. of Hile and Dhankuta, on road to Tehrathum

and Sankhuwasabha, Dhankuta District, *c*. 1900 m., *C.R. Fraser-Jenkins* 28799, 28800 (FN 4774, 4775), 23.3.2001, BM, H], **Tehrathum** [E. Nepal, Dor (2600 m.) - Tute (2300 m.) [- Basantapur (2300 m.) - Chitre (2400 m.)], 872372 - 872271, along path in dense forest, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725479, 7.7.1972, BM, KATH], **Ilam** [3 mi. W. of Chisapani, Ilam, clusters in open glades, common, 6600 ft., *R.L. Fleming* 2603, 1.10.1978, MICH det. K.U. Kramer 1990 as "*P. scabripes*" [err. for *P. scabristipes*] in error], **Panchtar [**7 miles west of Bhandukybhanjyang, "Ilam", along road side [on Panchtar side], fairly common, 7500 ft., *R.L. Fleming* 2548, 2554, 28.9.1978, KATH], **Taplejung** [East Nepal, Zongi - Iladanda, *H. Kanai*, *G. Murata* & *M. Togashi* 6305160, 12.11.1963, K; East Nepal, Yamphodin - Ghatte, *H. Kanai, G. Murata* & *M. Togashi* 6305162, 18.11.1963, KATH *sub* "*P. quadriaurita*" in error; E. Nepal, Shewaden (2600 m.) - Mewa khola (2100 m.), 873274, along path in light shade, *c*. 2300 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki & P.R. Shakya* 725337 *p.p.*, 29.6.1972, KATH, the specimen of this number in BM is *P. puberula*].

Total distribution: China [*e.g.* Yunnan, Dali, *M. Kato et al*. 421, BM]; Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. N.E. India; ?Taiwan. Absent from S. India, from where it has been widely reported in error mainly for *P. blumeana* J.Agardh.

(S, C). A common to abundant upper-mid to higher altitude species, growing in a variety of different habitats, from banks in dense forest, to fairly open, moist slopes, edges of paths, at the bases of rocks *etc*.

178. ***Pteris assamica*** Fraser-Jenk. & T.G.Walker.

A compound species similar to and in the group of *P. biaurita* with its pinna-lobes joined rather deeply at their bases, the sinuses not reaching the costa and its herbaceous texture, pale yellow-green colour and general habit like *P. biaurita*, but also in some respects approaching *P. longipinnula*, especially when it hardly has any developed lowest basiscopic pinnules. Differs from *P. biaurita* in having the veins beneath the sinuses all free and the lowest basiscopic developed pinnule on the lowest pinna varies from absent to simple but slightly more elongated, to longer and pinnatifidly lobed, but usually shorter than in *P. biaurita*, the basal developed pinnules often differ in length and degree of lobing from each other on the left and right side of the frond. It is not similar to *P. arisanensis* in general aspect, being much more herbaceous and the pinna-lobes are more rounded apically and less crowded, the costae are without spines on the upper surface. Cytotype diploid apomict, 2*n* = 58, prothalli apogamous, det. T.G. Walker, 1997, from voucher-specimen, just west of Bhor Bhil Forest Gate, *c*. 5 km. S. of Digboi, Assam State, *C.R. Fraser-Jenkins* 23943, 27.12.1995, TAIF, spores mainly good, not abortive.

Nepal:

E: **Jhapa** [stream running through secondary Sal-tree woods, *c*. 1½ km. N.W. of

Kakkarbhitta town, on way to tea-estate, E. of Birtamod, shortly W. of Mechi river (Indo-Nepalese border), in the terai, Jhapa District, *C.R. Fraser-Jenkins* with *K.* ["*U.*"] *Pongali* 26521 (FN 2499), 14.8.1998, H; among Sal-trees in Kutte Dange wood, *c*. 1km N. of Dhulabari, N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 29388-29355 (FN 5363-5370), 6.10.2001, H; steep slope in dense Bamboo stands above water-"tanks", on E. bank of Mechi Khola, *c.* ½ km. S. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32008, 5.1.2006, TAIF; roadside verges *c*. 2 km N. of Kakkarbhitta, near Nakhalbandi, E. of Dhulabari, not far from West Bank of Mechi Khola (river), Jhapa District, *C.R. Fraser-Jenkins* 33225 (FN 5), 9.11.2008, TAIF].

Total distribution: ?China; Myanmar; Arunachal Pradesh; Assam; Bhutan; Darjeeling [rare]; Nepal. N.E. India; Bangladesh; Thailand; Malaya.

(M, R). A very rare (in Nepal, very common in Assam *etc.*), low-altitude, subtropical species, growing in high rainfall areas in ruderal places such as moist patches below the banks of paths and roads, or on small stream-banks in semi-shade conditions, often on the flat forest floor in small remnant patches of light forest, further eastwards often grows on damp, shaded old walls among trees.

179. ***Pteris biaurita*** L. subsp. ***fornicata*** Fraser-Jenk. (syn.: *Campteria biaurita* (L.) Hook.; *Litobrochia biaurita* (L.) Bedd.; *P. pectinata* D.Don, lectotype (Morton 1973) in BM (!) annotated by Don, *non* Cav., *nec* Desv.; *P. flavicaulis* Hayata). *P. biaurita* subsp. *biaurita* was described from C. America, and closely resembles subsp. *fornicata*, but has even narrower, linear costal areoles formed by the two basal opposite veinlets anastomosing below the sinus more closely to the pinna-costa. Many plants of apparent subsp. *fornicata* from further N.E. India east to further S.E. Asia have very long and narrow costal areoles, similar to subsp. *biaurita* from C. and S. America. But the C. American plant is diploid apomict, unlike subsp. *fornicata* and like the morphologically different subsp. *walkeriana*. Liao *et al*'s. (2013) sense of *P. biaurita* was mainly subsp. *fornicata* while the obvious connection with subsp. *walkeriana* was lost among a mixture of subsp. *walkeriana* and *P. arisanensis* under the latter name.

P. biaurita subsp. *fornicata* is a large and robust compound *Pteris* species (fronds up to *c.* 1 m. tall), stipe green, becoming stramineous on drying, occasionally becoming fairly extensively dark brown to black later in the season; lamina wide (to *c.* 25 cm.), herbaceous pale green, pinna-costae with at most only short stumps of spines towards the pinna-apex above; pinna-lobes in *P. biaurita* are diagnostically not cut-down so deeply towards the costa as in most other compound *Pteris* species, leaving an obvious wing of up to *c.* 2 or 3 mm. between the base of the sinus and the costa, and commonly with a wide U-shaped gap between adjacent pinna-lobes, pinna-lobe apices rounded, basal opposite veinlets in the lobes in subsp. *fornicata* anastomose to form a long, usually shallow (sometimes very shallow in S.E. Asia in particular), narrowly segmentally curved, semi-elliptical areole beneath the sinus,

the fused veinlets often running from just above the base of one lobe midrib on one side to the basal junction of the next lobe-midrib on the other, but this should be observed in lower-mid pinnae, rather than upper ones, and in fully fertile fronds of fully adult plants, excluding semi-juvenile and foliose, semi-sterile morphology; cytotype triploid apomict (from the W. Indo-Himalaya, Nepal, Darjeeling, Assam State (Nambor Forest, *CRFJ* 23665, 9.12.1995, TAIF, det. T.G. Walker), Meghalaya, S. India, Sri Lanka, Myanmar, Sumatra, Java and the Philippines). Note that Fraser-Jenkins (2008) erroneously said Verma's chromosome-counts were only of the diploid apomict (subsp. *walkeriana*), but meant to say that they were only of the triploid apomict (subsp. *fornicata*), as reported.

Nepal:

W: **Kanchanpur** [Kanchanpur District, 5 miles NW of Mahendranagar, closed Sal forest, growing near opening, 250 m., *D.H. Nicolson* 2861, 8.12.1966, KATH], **Surkhet** [Kalyan, Surhkhet District, on moist hill slope, 870 m., *N.P. Manandhar* 167-91, 23.2.1991, KATH], **Jajarkot** [Jajarkot, on shady banks among shrubs, 4000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5717, 16.10.1952, BM triploid apomict, det. T.G. Walker (Walker 1962); *ditto*, plants 5717(2) and 5717 grown from spores and cult. at new Tropical Fern House, Leeds Univ. Botanic Garden, coll. *A.H.G. Alston* 17605, 14.11.1956, BM and 17480, 23.10.1965, BM].

C: **Baglung** [Burungdi khola, on dry bank, 5000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5338, 20.5.1954, BM, det. CRFJ 2013 as "?fornicata - a bit difficult, not confident of this one", confirmed from photo 2015, triploid apomict, det. T.G. Walker (Walker 1962 *sub* "5538", presumably in error for 5338 as no 5538 found)], **Myagdi** [Mayangdi khola, exposed boulders in valley, 2000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4106, 30.8.1954, BM; Myagdi Distr., Beni (840 m.) - Singa (910 m.) - Tatopani (920 m.) - Bholamza (950 m.) - Shimarchaur (950 m.) - Babichor (960 m.), 83° 27' - 33', 28° 20' - 23', 870 m., *M. Mikage, R. Hirano, N. Kondo, R. Lacoul, C. Mohri, A. Takahasi* & *K. Yonekura* 9681036, 2.9.1996, KATH; Hagalegaunda, Myagdi, *N.P. Manandhar* 1072-91 *p.p.*, in 1991, KATH], **Palpa** [Sisneri khola, Palpa, on shady place, 900 m., *D.P. Joshi* & *M.M. Amatya* 73/968, 24.11.1973, KATH; Hathikot, Palpa District, on shady place, 1000 m, *D.P. Joshi* & *M.M. Amatya* 74/1284, 27.2.1974, KATH], **Syangja**, **Parbat** [valley below Ulleri, 3000 ft., *V. Puri* [with *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams*] 554, 20.5.1954, CAL; Tikhedhunga to Banathanti, on forest floor, 1680-2400 m., *V.L. Gurung* 1402/81, 21.6.1981, KATH], **Kaski** [nr. Pokhara, abundant in Castanopsis forest, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2432 *p.p.* (left-hand plant), 13.4.1954, BM, triploid apomict, det. T.G. Walker (Walker 1962); nr. Pokhara, by terrace stone walls in village, 3300 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2769, 18.5.1954, BM; Pokhara, stony, grassy places, 900 m., *T. Wraber* 142, 10.9.1969, BM; C. Nepal, Pokhara (950 m.) - Suiket (1230 m.), 836282, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8350067, 6.7.1983, BM; Lumle Agricultural Centre, in crevice of stone wall, S. aspect, 1705 m., *G. Dawson*

[*Wormald*] 505a, 15.3.1976, BM; Begnas Lake, Kaski, Gandaki Zone, *c.* 600 m., *T. Nakaike* 3805, 11.11.1988, KATH; Raniban, Kaski, 700 m., *K.R. Bhattarai* 117, 9.8.1992, KATH], **Lamjung** [C. Nepal, Marsyandi khola, Jagat (1300 m.) - Shangy (1070 m.) - Kani Gaon (1150 m.) - Bahundanda (1300 m.), 843283, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8331388, 9.10.1983, BM], **Gorkha** [deep, rocky forested stream-gorge of Chisopani Darrah Khola, *c.* ½ km. above and N.E. of Komale hamlet, *c.* 1 km. below and S.W. of Deurali, above and N.E. of Markichowk (Marsyangdi) reservoir and Gopling, N.W. of Anbu Khaireni, Gorkha District, 900 m., *C.R. Fraser-Jenkins* 25072 (FN 1051), 30.12.1996, BM, H], **Chitawan** [between Saurha and Kasara, in Bombax malabaricum dominant forest, 190 m., *H. Tabata, K.R. Rajbhandari, K. Tsuchiya* & *Y. Konno* 7563, 13.12.1976, KATH; banks in woods around Chitwan Jungle Lodge, Chitwan National park, Sauraha, S.E. of Narayanghad, Chitawan District, *c.* 150 m., *C.R. Fraser-Jenkins* & *C.D. Fraser Jenkins* [father] 15870, 25.11.1989, E], **Makawanpur** [Pisulin [*i.e.* Fishling], near Muglin, "Gorkha", Gandaki Zone, *c.* 300 m., *T. Nakaike* 3836, 12.11.1988, KATH; rocky and grassy, steep sides of deep stream-gully, beneath Raigaon village-school, to S. of Raigaon, leading down into Bagmati River, on W. side of Bagmati River, *c.* 7 km. N. of Bagmati Bridge (on main E-W highway), E.N.E. of Chandranigarpur, S.E. of Hetauda, Makawanpur District, *C.R. Fraser-Jenkins, G.B. Tamang et al.* 25989 (FN 1967), 12.2.1998, BM, H; Makwanpur, Hetauda, east of town, on slopes below Manohamona [*sic*] temple, 27° 25' 51", 85° 02' 52", degraded hill Shorea robusta with Terminalia chebula forest on slope, 550 m., *C.A. Pendry, K.K. Shrestha, S. Dahal, A. Giri, A.G. Miller, N. Pandey, M.R. Pullan, L.R. Shakya, S. Shrestha, M. Siwakoti, U.T. Cobley et al.* DNEP2 B187, 28.11.2004, KATH], **Rasuwa** [Betrawati, growing profusely on the dry open ground, 715 m., *Mrs. V.L. Gurung, Mrs. T.K. Rajbhandari, Mr. N.P. Manandhar* & *Mrs. A. Karki* 77/580, 28.9.1977, KATH det. CRFJ 16.6.2014 as "I think *walkeriana*, but rather intermediate", difficult specimen, redet. from photos 2015; Dumse Guard from Dhunche, 2000-3000 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 875/79, 16.9.1979, KATH], **Bara**, **Nuwakot**, **Kathmandu** [gorge, Sankhu, 10 miles north east of Katmandu, *Kenneth de B. Codrington* 31, 8-11.7.1956, BM; Chobhar, under trees, 5000 ft., *Dr. R.L. Fleming* 1264, 22.8.1956, MICH, very typical, but with "*walkeriana*" written by mistake intending "*fornicata*" by CRFJ in 2014, KATH det. [K.M. Vaid,] F.R.I., Dehra Dun; Thankot, on semishade, *c.* 5500 ft., *P.R. Shakya s.n.*, 2025.8.1 (Nepali date) = 11.1968, KATH; Sundarijal, on the side of the rock on open place, *Miss V.L. Shresth* & *Miss Thapa* 6052, 2026.2.26 (Nepali date), CAL; waterfall, Sundarijal, 27° 46', 85° 24', E. exposition, morning sun, 1525 m., *J.H. de Haas* 2866-c, 21.9.1974, BM; sandy slopes in slightly open, degraded forest, S.E. part of Raniban forest-reserve, Gokarna, E. of Bouddha, N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins*, with *B. Bista*, Forest Officer 25210 (FN 1189), 23.1.1997, BM, H], **Lalitpur**, **Kabhrepalanchok** [Dhulikhel, *D.T. Yami* [*Tuladhar*] 168, KATH], **Sindhupalchok** [Talangmarang to Norbu Timur,

Sindhupalchok, *V.L. Gurung* & *M. Gorkhali* 78/695, 78/698, 23.10.1978, KATH], **Dolakha** [Kapre to Namdu, Dolakha, *K.R. Rajbhandari* & *B. Roy* 2333, 20.8.1977, KATH; Bhorle, 1120 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121117, 8.11.2012, KATH], **Ramechap** [between Bhandar & Kenja, Janakpur Zone, *T. Nakaike* 3179, 7.10.1988, KATH].

E: **Udayapur** [Beltar (180 m.) - Kattike (440 m.) - Darula (600 m.) - Baplung (490 m.) - Simule (170 m.), 26° 48' 54" - 52' 23", 86° 49' 05" - 53' 05", on semi-shaded steep slope at pathside, 220 m., *M. Mikage, T. Kajita, F. Kiuchi, N. Kondo, P. Lacoul, M. Suzuki* & *K. Yonekura* 9558007, 24.10.1995, KATH], **Solukhumbhu**, **Sankhuwasabha** [Arun valley, Marmidara between Sedua and Iswa khola, stony places, 1450 m., *T. Wraber* 452, 2.11.1972, BM], **Morang** [Sombare, Bahuni V[illage] D[evelopment] C[ommittee], Resalia stream bank, on "Sisoo" [forest] floor, *N. Thapa* M3/97, 15.12.1997, KATH], **Dhankuta** [East Nepal, Phusri - Sanguri Bhanjang - Dhara Pani, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305121, 16.10.1963, CAL; East Nepal, Dhankuta, 1200 m., *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305122, 20.10.1963, KATH; Rajarani, on stone wall, 1600 m., *N. Thapa, K.P. Bhattarai* & *T.P. Gautam* 14036, 16.12.1994, KATH], **Ilam**, **Taplejung** [Tambur river, E. Nepal, [*J.D. Hooker*], ?Novr. 13, CAL].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. N.E., C. and S. India; Bangladesh; Sri Lanka; Thailand; Vietnam; S.E. Asia; Taiwan. W. tropical Africa [São Tomé "St. Thomas", *G. Don*, BM]; Comoro Islands. Subsp. *fornicata* is generally commoner in the west and west-central Indo-Himalaya at lower altitudes, and subsp. *walkeriana* becomes more common than it from C. Nepal eastwards and at mid- to upper-mid altitude, though both are widespread.

(M, C). Subsp. *fornicata* is a common, usually low to mid altitude taxon growing on banks in woods and sheltered moist places, and by roadsides and on stream-banks, but also able to tolerate a fair degree of exposure.

180. ***Pteris biaurita*** L. subsp. ***walkeriana*** Fraser-Jenk. & Dominic Rajkumar (misapplied names: "*P. linearis*" *sensu auct. Sin., p.p. maj. et Ind. p.p. min.*, inc. *sensu* Singh & Panigrahi (2005: descr. and plate 213 for "*P. linearis*", though no specimens cited), *sensu* Ghosh *et al.* (2004) *p.p. max.*, ?*non* Poir. [from the Mascarenes and ?E. Africa]; "*P. nemoralis*" *sensu auct. Ind. p.p.* and *sensu* Alston & Bonner (1956), the two specimens they cited, Zimmermann 243, 1173, were not seen at the BM by CRFJ, *non* Willd. [= *P. linearis*]). This subspecies was partly included in *P. biaurita* by Liao *et al*. (2013) and also largely lost sight of within their mixed sense of *P. arisanensis*. Its relationship to the similarly veined *P. linearis* of Africa and the Mascarenes (lectotype with anastomosing veinlets and tall, triangular areoles) is not known, nor is the cytotype of true *P. linearis*. The very close similarity and relationship of all these taxa, normally treated as being under *P. biaurita*, makes the

subspecific rank more appropriate except for the more distinct, free-veined *P. arisanensis* with its stiffer laminar texture. The venation of subsp. *walkeriana* was well illustrated by Zhang (2012: 219) under the name *P. linearis*, while that of subsp. *fornicata* was illustrated by Kumari *et al.* (2014).

This subspecies is very similar to and slightly overlaps subsp. *fornicata* in general morphology though the majority of plants are readily distinguishable, as the basal-opposite veinlets anastomose to form a taller, rounded or more often pointed arch, often with one side of the anastomosing basal veinlet arising between a quarter and a third the way along the costa and the other reaching the next lobe midrib, while quite commonly some of the basal veinlets in a frond do not actually anastomose beneath some of the sinuses in the same frond, but turn abruptly upwards to run vertically to the sinus shortly before they would have met, occasionally the majority are free but nearly anastomosing, which can cause confusion with *P. arisanensis* (vein-characters needs to be checked in lower-mid to mid pinnae and in fully mature plants, in fertile leaves not showing juvenile or foliose morphology), the laminar texture is usually slightly more chartaceous (though very close to the herbaceous frond of subsp. *fornicata*), the pinna-lobes are often, but not always closer together, *i.e.* more commonly with a narrower U- to V-shaped sinus, and the apical parts of the pinna-costae often bear rather more visible short spines above; cytotype diploid apomict (from Uttarakhand, Nepal, Darjeeling (Badamtan, *CRFJ* 23460A (FN 1367A), 27.11.1995, TAIF det. T.G. Walker), Bihar, Assam State, W. India, S. India, Sri Lanka, Myanmar, Sumatra, Java and the Philippines). Although this species is not very often infected, a specimen from Sri Lanka (*Thwaites*, C[at.] P[eradeniya] 1048, BM) has a large gall of the fungus, *Taphrina laurencia* Giesenh.

Nepal:

W: **Surkhet** [Chhinchu, Surkhet Distr., shade to semi-shade banks, 500 m., *N. Thapa* S16, 7.8.2001, KATH], **Jumla** [exposed roadside rocks facing south, between Urthu and Jumla, *c.* 5 km. E. of Jumla, Jumla Distr., *c.* 2600 m., *C.R. Fraser-Jenkins*, with *Man Bhdr. Nepali* (porter, Jumla) 35411, 5.6.2014, KATH], **Jajarkot** [Jajarkot, on shady place, 800-1300 m., *D.P. Joshi & L.R. Sharma* 1158/80, 16.12.1980, KATH].

C: **Myagdi** [Beni, Kali Gandaki river, among shrubs, 2500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7017, 4.9.1954, BM; Hagalegaunda, Myagdi, *N.P. Manandhar* 1072-91 *p.p.*, in 1991, KATH], **Palpa** [5 mi. N. of Riri Bazaar, "W. Nepal", along road, 2200 ft., *Robert L. Fleming* 934, 7.11.1949, BM; below Tansing, "W. Nepal", in sunny place, 3500 ft., *Robert L. Fleming* 944, 2.11.1949, DD, BM det. CRFJ 2013 as "subsp. *fornicata*" in error, redet. from photo 2015; N. facing slope by road in Dobhan village, 3 miles N. of Butwal on road to Syangja and Pokhara, S. of Pokhara, Palpa District, *C.R. Fraser-Jenkins* 18018, 18019, 20.1.1991, E], **Palpa**/**Syangja** [Angahora, between Butwal and Pokhara, *T. Nakaike* 3725, 9.11.1988, KATH], **Parbat** [Tribeni Panchayat, on shady rocky place, 1000 m., *D.P. Joshi* & *M.M. Amatya* 74/1496, 9.3.1974, KATH], **Kaski** ["W. Nepal", Pokhara,

in ground along walls, 2000 ft., *Robert L. Fleming* 865, 6.1.1950, BM, DD; nr. Pokhara, abundant in Castanopsis forest, 3000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 2432 *p.p.* (right-hand plant), 13.4.1954, BM; Karanha, near Pokhara, *c.* 900 m., *T. Nakaike* 3741, 9.11.1988, KATH; Dhampus, Pokhara, Gandaki Zone, 1000-1500 m., *T. Nakaike* 3775, 10.11.1988, KATH; forested, deep, rocky stream-ravine above and just E. of "Nature Home" restaurant, *c.* 2 km. W. of "Fishtail Lodge" Hotel, in Raniban forest on S. side of E. end of Phewa Tal, across lake from and S. of Baidam ("Lakeside"), Pokhara, Kaski District, *C.R. Fraser-Jenkins* 25141 (FN 1120), 1.1.1997, BM, H; Kaski Distr., vicinity of Tamage (1730 m.), 28° 17' 22", 83° 49' 28", 1650 m., *M. Mikage*, *M. Yoshimitsu*, *A. Kaneda*, *C. Mouri*, *S. Tatsukawa*, *Y. Asada* & *M. Senoo* 9962875, 11.8.1999, KATH; Ghale Kharka, Kaski, open grassland, *R.D. Thapa* & *D.K. Gurung* G1-10, 6.10.2010, KATH], **Tanahun** [rocks and forested slope below waterfall, in next gorge, *c.* ½ km. above Chowti Bara Temple gorge, *c.* 6 km. S. of Damauli, E. of Pokhara, W. of Mugling and Anbu Khaireni, Tanahun District, *C.R. Fraser-Jenkins* 25336 (FN 1315), 23.3.1997, BM, H], **Lamjung** [Pheligsanku, 28° 13', 84° 24', talus à l'ombre, 650 m., *J.F. Dobremez* 649, 25.11.1970, BM rather difficult specimen], **Gorkha** [Thanti Pokhari, on rock crevices, 950 m., *N.P. Manandhar* & *L.P. Katel* 11490, 8.5.1987, KATH], **Chitawan** [Ramnagar, Chitwan District, shady gullies in Sal forest, 400 m., *K. Wesche* 1/62, 6.1994, BM], **Makawanpur** [near Hetauda, Makawanpur, Narayani Zone, *c.* 450 m., *T. Nakaike* 3611, 3.11.1988, KATH; Makwanpur, west of Hetauda, Saraswati forest above Laxminarayan temple, 27° 27' 29", 85° 00' 06", hill Shorea robusta forest on steep (30°) S-facing slopes with Terminalia, Semecarpus *etc.*, 700 m., *C.A. Pendry*, *K.K. Shrestha*, *S. Dahal*, *A. Giri*, *A.G. Miller*, *N. Pandey*, *M.R. Pullan*, *L.R. Shakya*, *S. Shrestha* & *M. Siwakoti* DNEP2 B149, 27.11.2004, KATH], **Rasuwa**, **Dhading** [Thambu, Dhading, *N.P. Manandhar* 12908, 4.11.1989, KATH], **Nuwakot**, **Kathmandu** [Central Nepal, Kathmandu Air Port, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305120, K; Sundarijal, on the side of the rock on open place, *Miss V.L. Shresth* & *Miss Thapa* 6055, 2026.2.26 (Nepali date), CAL Gokarna, 4500 ft., *Ramola Rana* & party 9919, 6.7.1971, KATH; Swayambhu hill, Kathmandu, 4600 ft., *S. Pande* 2, 7.1961, CAL species det. S.K. Mukerjee], **Sindhuli** [N. facing, forested rocky stream-gully on N. side of second main ridge of hills up from the plains, *c.* 6 km. S. of Sindhuli Madi, N. of Karkare, N. of Biman, *c.* 15 km. N. of Bardibas, E. of Hetauda off Janakpur road, Sindhuli District, *C.R. Fraser-Jenkins*, with *K. Neupane* 26021 (FN 1999), 12.2.1998, H, BM, misidentified by CRFJ 2013 as "difficult, probably subsp. fornicata", reidentified from photos 2015], **Dolakha** [probably the plant reported by Alston & Bonner (1962) under the name, "*P. nemoralis*", but specimen not found by CRFJ in BM, nor noted in G, "beyond Sunkhani, 1550 m., *A. Zimmermann* 1173, 11.9.1954"], **Ramechap** [between Bhandar and Kenja, Janakpur Zone, 2100-1700 m., *T. Nakaike* 3179, 7.10.1988, KATH].

E: **Bhojpur** [E. Nepal, Saju khola (1400 m.) - Dingla (1000 m.), 873274-873273,

on rather dry slope in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725412, 1.7.1972, BM, KATH, rather difficult specimen], ?**Solukhumbhu** [probably the plant reported by Alston & Bonner (1962) under the name, "*P. nemoralis*", but specimen not found by CRFJ in BM, nor noted in G, "Taksindu - left bank of the Dudh Kosi, 1550 m., *A. Zimmermann* 243, 10.4.1952"], **Sankhuwasabha** [Tumlingtar, fairly common throughout area, beneath rock on shore of Sabbaya river/cliffs above Sabbaya khola, 1800 ft., *A.H. Norkett* 8024/8104, 9/24.12.1961, BM; Tumlingtar, in gulley, 1500 ft., *R.L. Fleming* 2120, 22.3.1971, K juvenile], **Dhankuta** [Karang, Dhankuta Distr., 4200 ft., *R.L. Fleming* 2119, 25.11.1971, K; Chuliban, Dhankuta-8, 1150 m., *Milan Dahal* 12, 1.1999, KATH], **Taplejung** [East Nepal, Garhi Danra - Linkin - Tuwa, *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305123, 4.11.1963, BM; East Nepal, Khebang - below Siling Tzokupa, *H. Hara, H. Kanai, S. Kurosawa, G. Murata* & *M. Togashi* 6305125, 20.11.1963, CAL].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling, Nepal; Uttarakhand. N.E., C. and S. India; Sri Lanka; Bangladesh; Thailand; S.E. Asia; ?Africa; ?Socotra [*Prof. Bayley Balfour* 450, 2-3.1880, BM, or *P. linearis*?].

(M, C). A very common low to higher altitude taxon, growing in similar places to subsp. *fornicata*, and often also in damp places below or on cliffs *etc.*

181. ***Pteris cretica*** L. subsp. ***cretica*** (syn.: *P. nervosa* Thunb.; *P. cretica* var. *nervosa* (Thunb.) Ching & S.H.Wu; *P. semiserrata* Forssk., *non* Roxb.; *P. serraria* Sw.; ?*P. mysorensis* Fée; *P. confertinervia* Ching; *P. pseudodactylina* Ching; *P. cretica* forma *sikkimensis* S.C.Verma, *nom. nud.*). A number of other presumed synonyms have not yet been critically identified as to which subspecies they belong to.

P. cretica is a typical dactylate *Pteris* with a tuft of long, thin stramineous stipes that are similar in both subspecies, often becoming partly dark later in the season in either subspecies, and sterile-fertile dimorphic fronds, the shorter, more spreading sterile ones, which are essential for identification, with wider segments and bearing teeth along the margins, and the taller, erect fertile ones with longer, narrower segments with small teeth only at the sterile apices and most of the rest of the segment with a long, marginal pseudoindusium, thus entire, occasionally abnormal semi fertile fronds may occur with wider sterile parts of the segment and partly narrower fertile parts in the same frond (as in the type, but not fully in the isotype of the mistakenly separated "*P. prainii*" S.R.Ghosh [= subsp. *laeta*]). The lamina consists of 2-5 pairs of opposite pinnae, each having a single long, simple and unlobed main axis and, at least in lower and mid pinnae (unless in small plants), with 1-3 long, similarly unlobed, usually basiscopic basal pinnules; the frond-apex is imparipinnate with a similar long, unlobed terminal segment, the uppermost pinnae vary from very shortly stalked to decurrent on the rachis, often in smaller plants, especially of subsp. *cretica*, being fused to the base of the terminal segment and

decurrent (but not thereby a different species). The margins of sterile pinnae are diagnostic for the subspecies as fertile fronds only have a few small teeth at the very apices, often hardly visible, thus collections without sterile fronds are usually subspecifically unidentifiable.

Subsp. *cretica* has somewhat more herbaceous fronds than in subsp. *laeta*, and small plants of it can approach towards the morphology of *P. dactylina* when growing among rocks at high altitude, though becoming full-sized and typical of *P. cretica* in cultivation; the sterile fronds have narrower segments than in most subsp. *laeta*, with flatter margins and diagnostically slightly shorter, more regularly angled erect marginal teeth, and the stipe-base has been said to have more glandular-margined scales. Further cytological confirmation is needed on both subspecies to enable them to be distinguished with more confidence in order to specify their ranges definitively; but judging from Pakistani, Indian, Nepalese and Sri Lankan cytological voucher-collections made by CRFJ and others (in Indian herbaria) of known cytotype, counted by S.C. Verma, the late T.G. Walker and others, they appear to be fairly easily recognisable from sterile fronds, though much more difficult or impossible from fertile ones. Cytotype of subsp. *cretica* diploid apomict (from W. Himalaya, Taiwan, Japan and Italy). Small. high-altitude plants with more radiate fronds and raised pale lateral veinlets were tentatively named "forma *sikkimensis*" S.C. Verma (in Mehra 1961) *ined.*, but become normal sized and with normal long laminar axes on cultivation at lower altitude; Verma found that they are also diploid apomict.

Nepal:

W: **Doti** [Baj Lekh, 804292, on shady place, 2100 m., *D.P. Joshi* & *M.S. Bista* 148, 1.8.1972, KATH fertile frond only, no teeth visible as apices immature, effectively unidentifiable subspecifically, det. R.D. Thapa, 7.7.2011, as "*P. pellucida*" in error], **Bajhang** [along the Ghat Chola near Kanda, Bajhang District, in Betula, Aesculus, Alnus, Poplus mixed forest, along the stream, 2050 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 1564, 24.7.1976, KATH fertile frond only], **Bajura** [Majpali - Pategaon, 2100 m., *K.R. Rajbhandari* 15072, 15.8.1991, KATH], **Jajarkot** [Maina, among shrubs, 6500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5586, 12.10.1952, BM, difficult, fertile fronds only, diploid apomict, det T.G. Walker (Walker 1962)], **Jumla** [Jumla, 8000 ft., *R.L. Fleming* 2402, 11.12.1977, KATH; Kawa khola, Jumla Distr., on moist and shady places, 7300 ft., *T.B. Shrestha* & *N.P. Manandhar* 328, 341, 18.10.1975, KATH, fertile fronds only], **Mugu** [Rara National Park, Mugu, in Pinus forest, 3100 m., *P.P. Kurmi* & *N. Thapa* 7472, 26.11.1995, KATH]; **Pyuthan** [Bhingri - Swargadwari, 2100 m., *D.R. Kandel, M.L. Pathak* & *G.D. Bhatt* 1216004, 9.6.2012, KATH].

C: **Baglung** [Lumsum, south side of Dar khola below Lumsum, wooded gully, on dry, shaded bank, *c*. 6000 ft., *A.R. Vickery* 439, 23.3.1974, BM], **Myagdi** [Gurjakhani, beneath shrubs on earth banks, 8500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3627, 26.7.1954, BM, typical sterile and fertile fronds; Gurjakhani,

shady place in gully, 8500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4372, 12.9.1954, CAL (fertile fronds only), BM, *sub* "*P. actiniopteroides*" det. A.H.G. Alston, in error, redet. K.U. Kramer 1992 as *P. cretica*, fertile fronds only, but small regular teeth at sterile apices; Myagdi Distr., Ritu Kharka (2910 m.) - Lulang (2430 m.) - Lumsung (2160 m.) - below Lumsung (2140 m.), 83° 14' - 17', 28° 31' - 32', under evergreen forest, 2380 m., *M. Mikage, R. Hirano, A. Takahashi* & *K. Yonekura* 9682976, 21.9.1996, KATH], **Mustang** [Lete, S. of Tukucha, Kali Gandaki, shady slope amongst trees, 9000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7920, 18.9.1954, BM (sterile and fertile), E (fertile only), *sub* "*P. actiniopteroides*" det. A.H.G. Alston in error, redet. K.U. Kramer 1992 as *P. cretica*; Dana - Lete, Muktinath, under shady and moist place under Pinus wallichii forest, 7800 ft., *Drs. S.B. Malla, T.B. Shrestha* & *S.B. Rajbhandari* 13835, 31.10.1971, KATH], **Manang** [Marsyandi valley, between Timang pasture and Bagarchap, 2400 m., *T. Wraber* 539, 30.10.1969, BM; Thanchok - Dhanagyung, Manang District, on open slope, 2400 m., *K.R. Rajbhandari* 8936, 6.8.1983, KATH fertile frond only with immature toothless sterile tips, effectively unidentifiable subspecifically, det. R.D. Thapa, 7.7.2011, as "*P. pellucida*" in error; Marsyangdi khola, Chame (2630 m.) - Qupar (2530 m.) - Thangjo (2580 m.) - Dhanagyang (2200 m.), 842284, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8350867, 6.8.1983, BM; Manang Distr., Bagarchap (2030 m.) - Danake (2120 m.) - Timang Besi (2220 m.) - Latamanang (2320 m.) - Koto (2510 m.) - Chame (2600 m.), 28° 31' 59", 84° 20' 24" - 28° 32' 59", 84° 14' 41", in Quercus forest, shady place, 2230 m., *M. Mikage, N. Fujii, T. Kajita, N. Kondo, S. Noshiro* & *K. Yoda* 9470412, 14.8.1994, KATH fertile frond only, identity uncertain], **Parbat** [Tikedhunga to Banathanti, met with on the forest slope, 1680-2400 m., *V.L. Gurung* 1412/81, 21.6.1981, KATH; Parbat Distr., Gorepani Deorali (3170 m.) - Chitre (2400 m.) - Shikha (2100 m.), 835283, *H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8330401 and 8350313, 14.7.1983, BM, with one separate lower left frond of 8330401 that is probably subsp. *laeta*], **Kaski** [Odane Lekh, Kaski, 834282, on shady place, 2300 m., *D.P. Joshi* & *M.M. Amatya* 74/106, 19.3.1974, KATH, difficult rather intermediate specimen, undulate edges, but regular teeth, identity uncertain], **Gorkha** [Lukuwa, 28° 30', 84° 48', versant N.-N.W., 2200 m., *J.F. Dobremez* 722, 18.12.1970, BM], **Makawanpur**, **Rasuwa** [Tibet [N. from Rasuwa Garhi], Lende khola, in forest by water, shady earth banks, 7500 ft., *O. Polunin* 949, 949A, 9-11.7.1949, BM, 949A det. CRFJ as "subsp. *laeta*" in error, redet. from photos 2015; on the way from Ghoda Tabela - Thulosyapru, Langtang, Distr. Rasuwa, on shady moist slope of the dense forest, 2120 m., *Mrs. V.L. Gurung* & party 77/733, 7.10.1977, KATH; on the way from Bokejhundo to Dunche, Langtang, growing on wetty [*sic*] and shady part of the forest floor, 1900-1980 m., *Mrs. V.L. Gurung* & party 77/647, 31st.9.1977 [*sic*], KATH *sub* "*P. stenophylla*" in error; Dumse to Chandanbari, 3000-3200 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 920/79, 17.9.1979, KATH, det. by F. Miyamoto 1991 as "not *P. cretica*, similar to *Pteris* x *sefuricera* Kurata (hybrid of *P. cretica* x *P.*

multiflora)" [*i.e. P.* x *sefuricola* Sa.Kurata *ined.*, now *P.* x *pseudosefuricola* Ebihara, Nakato & S.Matsumoto (2015)], in error, redet. by CRFJ, 2012 "I totally disagree, 100% definitely subsp. *cretica*"]; **Lalitpur** [Chapagaon forest, Kathmandu valley, 5000 ft., *R.L. Fleming* 1919, 11.9.1968, MICH teeth regular, though margins rather undulate; Phulchoki, Lalitpur Distr., on exposed slope, 1828-2743 m., *V.L. Gurung* 1507, 15.9.1982, KATH; c. 9000-11000ft., rocks by road, and forest, upper half of Phulchowki Darrah (hill) on N.W. side, above and east of Godawari village, *c*. 20 km. S.E. of Kathmandu, Lalitpur District, *c*. 9000-11,000 ft., *C.R. Fraser-Jenkins* 30625, 18.7.2004, H, Verma's "forma *sikkimensis*" cult. in pot in Kathmandu and became normal full-sized subsp. *cretica*; Phulchoki, 1800 m., *M.L. Pathak* 201105, 20.1.2011, KATH], **Sindhupalchok** [Gosainkund, Malemci, 28° 02', 85° 32', beneath rocks, 8000 ft., *J.D.A. Stainton* 3771, 29.5.1962, BM].

E: **Solukhumbhu** [Namche Bazar and surroundings, inside a cave, 11,850 ft. - 12,000 ft., *Rolla S. Rao*, Indian Cho Oyu Expedition 13968, 26.5.1958, KATH; Dorange, Junbesi, Solukhumbu, *c*. 2500 m., *T. Nakaike* 3463 *p.p.* (larger plant and frond), 20.10.1988, KATH], **Sankhuwasabha** [Kasuwa, Arun river, East Nepal, inside rock shelter, 8400 ft., *E.W. Cronin*, with *H.M. Emery*, *H.* & *A. Foster* & *K. Brooks* F019, 13.7.1973, KATH, det. V.L. Gurung as "*Coniogramme intermedia*" in error], **Tehrathum** [Chitre (2400 m.) - Basantapur (Bilbatay Bhanjyang) (2300 m.), 872271 - 872272, in dense forest along path, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725114, 6.6.1972, BM, KATH]. E. Nepal ["Terra Bence", on rocks, 9-10,000 ft., *Capt. Lall Dhwoj* 438, [received] 21.2.1931, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. S. India; Sri Lanka; Taiwan; Japan; Arabia; Turkey; Africa; Europe. The ranges of the subspecies worldwide have not yet been critically identified and most of the distribution given under "var. *cretica*", an inappropriate rank as the subspecies do not merely represent insignificant variability, by Liao *et al.* (2013) is that of the whole species misplaced as if under that "variety".

(S and more widespread, C). A common to abundant taxon of lower mid to high Himalayan altitude, though tending to be commoner at higher altitudes and further into the Indo-Himalaya in slightly less high rainfall areas in the west and east of the Himalayan ranges, occurring in masses on open bushy slopes or at the edge of or in light forest, or on banks along paths, above streams *etc.* This subspecies grows on any substrate, not just in calcareous areas as thought by Liao *et al.* (2013), whose concepts are doubtful and descriptions partly missed the diagnostic characters given by Fraser-Jenkins (2008), while adding further variable ones of no significance.

182. ***Pteris cretica*** L. subsp. ***laeta*** (Wall. *ex* Ettingsh.) Fraser-Jenk. (syn.: *P. laeta* Wall. *ex* Ettingsh., *Farnkr. Jetzwelt*: 96, *t.* 57, *f.* 8-11, *t.* 58, *f.* 4, 12 (1865); lectotype, here designated: the nature-printed illustration of a pinna of "*Pteris laeta* Wall." showing

analysis of the veins and teeth given by Ettingshausen, *Farnkräuter der Jetzwelt*: *t.* 58, *f.* 12 (1865), *non* Kaulf *ex* C.Presl, *nom. nud.*; *P. cretica* var. *latifolia* J.Agardh; *P. cretica* L. var. *cartilagidens* Christ; *P. prainii* S.R.Ghosh; misapplied name: "*Pteris cretica*" *sensu* D.Don *p.p., non* L.). *P. laeta* "Wall. *ex* S.R.Ghosh, *stat.* & *comb. nov.*", which would have been a superfluous name, was attempted to be repeated by S.R.Ghosh in Ghosh *et al.* (2004), but without indicating the valid basionym. The Taiwanese *P. pellucidifolia* Hayata was synonymised here by Fraser-Jenkins (2008), but Knapp (2011, 2013), whose remarkably critical, accurate and experienced knowledge of Taiwanese pteridophytes is of the highest standard and competence, has found it to be a different species (though CRFJ disagrees with the idea that it is not closely related to *P. cretica*) and it is not therefore listed as a synonym here. However some of the plants from S. India (*e.g. c.* 5 km. E. of Perar, on Kotagiri road, Nilgiri Hills, *C.R. Fraser-Jenkins* 3442 (FN 93), 6.2.2010, TAIF, along with subspp. *laeta* and *cretica*) with almost untoothed lower halves to the sterile pinnae seem to be very similar to it.

It needs to be assimilated that as pointed out by Fraser-Jenkins (2008) a different triploid apomict related to this aggregate, *P. parkeri* J.J. Parker (a nurseryman, of Rose Nursery, Whetstone, UK), was described in 1912 (syn.: *P. cretica* var. [cv.] *albolineata* T.Moore) and is the correct name for what Liao *et al.* (2013) in the *Flora of China* continued to call by its synonym, *P. nipponica* W.C.Shieh, even while citing Fraser-Jenkins (2008). A specimen *A.H.G. Alston* 17238 at BM assumed by Alston to be *P. parkeri*, *ex hort.* Kew, is not that but *P. esquirolii* Christ, from China.

This subspecies is similar to subsp. *cretica*, and is not taller and stronger as thought by Liao *et al.* (2013), which depends on altitude and habitat; the sterile fronds are rather more rustling dry-hard and slightly rigid-crispaceous in contrast to subsp. *cretica*, and usually have somewhat wider segments; the diagnostically longer, irregularly sized teeth are more variously directed at the more undulate margins. Cytotype triploid apomict (from Turkey and Japan). Liao *et al*'s. (2013) description of the pinna-base being decurrent (as opposed to "decurrent or not" in "var. *cretica*") was incorrect as it is equally variable in subsp. *laeta*, while stipe colour is also seasonal and variable in both subspecies. Although mature and well collected specimens are normally easily identifiable, smaller and more weakly developed collections may not be, and mistakes can occur; in particular attempting to identify the subspecies from either juvenile collections, or fertile specimens with only short sterile, toothed areas at the segment-apices can easily become something of an illusion and is better avoided where possible.

Nepal:

W: **Dadeldhura** [Banda, near Daha barrack, 29° 16.682', 80° 37.162', 1786 m., *D.R. Kandel, T.R. Pandey* & *M.S. Thapa Magar* 14202, 21.5.2014, KATH], **Jajarkot** [Samela, growing in shady ravine in dense forest, 7000 ft., *O. Polunin, W.R. Sykes*

& *L.H.J. Williams* 515, 19.8.1952, BM].

C: **Baglung** [nr. Lumsum, among rocks in gorge, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 9146, 25.10.1954, BM, teeth rather poorly developed but irregularly directed, margin undulate], **Myagdi** [Nepal Central, Thulo khola, Dhaulagiri I south face, in quite shady places, 8800 ft., *G.* [& *S.*] *Miehe* A 60, 4.1.1977, BM typical sterile frond, and *ditto*, A 70, BM, fertile frond, possibly subsp. *cretica*, but not enough teeth to identify it; Myagdi Distr., Gorepani (2890 m.) - Chitre (2310 m.) - Sikha (1950 m.) - Ghara (1550 m.) - Tatopani 1290 m.), 28° 24' 07" - 20' 31", 83° 42' 04" - 35' 46", roadside, betw. Gorepani and Tatopani, 2525 m., *M. Mikage, M. Yoshimitsu, A. Kaneda, C. Mouri, S. Tatsukawa, Y. Asada* & *M. Senoo* 9961232, 14.8.1999, KATH, undulate margins, but teeth rather small], **Manang** [Thanchok - Dhanagyung, on open slope, 2300 m., *K.R. Rajbhandari* 8947, 6.8.1983, KATH; Bagarchap - Chame, Manang, in Quercus forest, shady place, 2230 m., *M. Mikage, N. Fujii, T. Kajita, N. Kondo, S. Noshiro* & *K. Yoda* 9070412, 14.8.1994, KATH], **Palpa**, **Kaski**, **Gorkha** [Lukuwa, 28° 30', 84° 48', versant N-NW,2200 m., *J.F. Dobremez* 722, 18.12.1970, KATH, inadequate fertile frond only, subspecific identity uncertain; Gorkha Distr., Ekle Ghar (1620 m.) - Sharyung (2000 m.) - Anga (2140 m.) - Lokpa (1900 m.) - Sardu khola (1800 m.), 28° 24' 35", 84° 53' 40" - 28° 26' 49", 84° 55' 56", forest floor, shady place, 2140 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro, K. Yoda* & *O.B. Wonkonobe* 9485144, 25.7.1994, KATH, fertile frond, identity tenuous and a sterile frond with undulate margins and large, irregular teeth], **Makawanpur** [Chitlang Phedi, south west facing slope, 2300 m., *D.P. Joshi, K.R. Rajbhandai* & *M.K. Ghimire* 75/233, 10.1.1975, KATH fertile fronds only, identification tenuous], **Rasuwa** [Lama Lodge - Ghoda Tabela, rocky moist slope of the dense forest, 2700-3100 m., *Mrs. V.L. Gurung, Mrs. T.K. Rajbhandari, Mr. N.P. Manandhar* & *Mrs. A. Karki* 77/713 *p.p.*, 3.10.1977, KATH; Dumse to Chandanbari, 3000-3200 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 992/79, 17.9.1979, KATH; forest on S. side of valley to east of Trisuli Khola river, *c.* 3-4 km. above and E. of Dhunche, W. of and below Gossainkund, N. of Trisuli Bazaar off road to Langtang, N. of Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins* 15654, 9.11.1989, E], **Kathmandu** [Napaul, Suembu, *Dr.* [*F*] *Buchanan* [*Hamilton*] *s.n.*, 30th. April 1802, BM; Gokarna, near Katmandu, 4000-6000 ft., *B.D. Pande* F.2, 29.5.1949, BM, fertile frond only; Nagarjong, Kathmandu, 1524 m., *H. Kanai* 67/627, 24.4.1970, KATH; Borlang Bhanjyang, on shady place, 2550 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/679, 17.3.1975, KATH], **Lalitpur** [Chapagaon, 4900 ft., *Dr. R.L. Fleming* 1326, 17.9.1956, KATH, species det. [K.M. Vaid], F.R.I., Dehra Dun; valley to S.W. of and below Phulchowki mountain, shortly above and S.E. of quarry, above and S.E. of Godawari, E.S.E. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *Ganesh Bhdr. Tamang et al.* 24029 (FN 7), 20.5.1996, BM, H], **Bhaktapur** [forested rocky stream-gulley, *c.* 1 km. S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli

and Salamutar villages, N.N.E. of Bhaktapur, E.N.E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins*, with *R.* ["*G.*"] *Pariyar* (brother-in-law) *et al.* 25253 (FN 1232), 15.2.1997, BM, H, US, G, FR], **Sindhupalchok** [Sindhu Palchowk District, melemchi Gaon, 52 km. NE from Kathmandu, N.W. of village, 28° 00', 85° 30', open rock-strewn wash, S-facing slope, fairly dry, *c.* 2575-2730 m., *Rebecca Gay Troth* 111, 11.11.1971, MICH; N.W. of Malemchigaon, 28° 01', 85° 31', under overhanging rock in forest of Quercus semecarpifolia, 2650 m., *J.H. de Haas* 2785, 18.9.1974, BM; Norbu Timure to Tarke Ghyang, on shady moist forest floor, 7800-11,600 ft., *V.L. Gurung* & *M. Gorkhali* 78/299, 23.10.1978, KATH], **Dolakha** [Lamabagar to Hum, on shady place, moist mossy ground, 2050 m., *K.R. Rajbhandari* & *B. Roy* 1481, 16.7.1977, KATH].

E: **Solukhumbhu** [entre Monjo et Benkar, 2700 m., *A. Zimmermann* 1847, 20.10.1954, BM; East Nepal, Paiya to Ghat, on shady soil, 8050 ft. - 9825 ft., *Rolla S. Rao*, Indian Cho Oyu Expedition 13715, 10.4.1958, KATH; near Junbesi, Solukhumbu, *c.* 2500 m., *T. Nakaike* 3403, 18.10.1988, KATH], **Sankhuwasabha** [Papung (2000 m.) - Bir Gaon (1600 m.), 873274, along path in light shade, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725382, 30.6.1972, BM, KATH; Hatia Gola (1600 m.) - Digedanra (2300 m.) - Taram Bhajyang (2700 m.) - Honkon (2400 m.), *H. Ohashi*, *H. Kanai*, *H. Ohba* & *Y. Tateishi* 771985, 5.8.1977, BM, poorly developed teeth, but undulate edge, det. CRFJ 2012 as "difficult, I think ? subsp. *cretica*" in error, redet. from photos 2015], **Ilam** [below Itabare, Ilam Distr., damp roadside bank, 4000 ft., *R.L. Fleming* 2117, 18.12.1971, K], **Taplejung** [East Nepal, Iladanda - Selap, *H. Kanai*, *G. Murata* & *M. Togashi* 6305138, 9.11.1963, K, BM, teeth smaller than some, but irregularly directed and margins undulate; E. Nepal, Papung (2000 m.) - Bir Gaon (1600 m.), 873274, along path in light shade, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725382, 30.6.1972, KATH, sterile frond is subsp. *laeta*, fertile frond inadequate, but possibly otherwise subsp. *cretica*; Hellok, Taplejung, in dense N-facing subtropical forest, 1550 m., *Liba Pejchar*, U.S.A. 11, 19.4.1996, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan. N.E., C. and S. India; Sri Lanka; Iran; Turkey; Taiwan; Japan; Thailand; S.E. Asia; Ethiopia, Tanzania.

(S and more widespread in Asia, C). A very common, often abundant, low to higher altitude taxon, growing in similar places to subsp. *cretica* and sometimes mixed together with it, but tends to be commoner than it at lower altitudes and seems to be predominant in the higher rainfall areas of the Central Indo-Himalaya (Nepal, Sikkim, Darjeeling). It often grows in small clumps scattered throughout steep, fairly lightly forested slopes at mid to upper-mid altitude. It is not confined to acid soils in valleys as thought by Liao *et al.* (2013).

183. ***Pteris dactylina*** Hook.

An attractive small to miniature (fronds *c.* 8-15 cm. tall), dactylate *Pteris* species with radiate fronds varying in size from plant to plant and habitat to habitat, stipes delicate, thin and stramineous, borne in a dense tuft at the apices of the branched clump of short-creeping rhizomes; lamina borne ± horizontally at the tips of the stipes, bearing 3-4 crowded pairs of pinnate, pseudo-radiate or dactylate pinnae, the lowest pair tripartite, the next ones forked, and a similar simple apical segment; segments pale green, thin, narrow, *c.* 3 mm. wide and *c.* 4-8 cm long, simple, unlobed, sterile fronds with serrated segment-margins, fertile fronds with long marginal pseudoindusia, thus entire, apart from their prominently serrate apices. Cytotype triploid apomict (Walker 1962, *sub* "*P. actiniopteroides*" in error and *P. dactylina* from W.C. and W. Nepal).

Nepal:

W: **Jumla** [Jumla, under overhanging banks, 7600 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 758, 13.4.1952, BM; Chandhabise khola. Jumla, on rock crevices in shady floor in Oak forest, 3200 m., *P.R. Shakya* & *B. Roy* 5820, 18.6.1980, KATH; overhanging dry calcareous cliff, or semi-cave walls and steep grassy slope, shortly above Urthu, on track down from Patmara and Kali pass, N.E. of Jumla, Jumla District, *c.* 2700 m., *C.R. Fraser-Jenkins*, with *Man Bhdr. Nepali* 35397, 5.6.2014, KATH; Choutha, shady forest ground, 2700 m., *P.P. Kurmi & N. Thapa* 7457, 25.11.1995, KATH], **Dolpa** [Garpung khola, on banks and in rock crevices in shade of mixed forest, 10,000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5411, 25.9.1952, BM, triploid apomict, det. by T.G. Walker (Walker 1962)].

C: **Myagdi** [south of Gurjakhani, beneath rocks in river gorge, 9500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3038, 7.6.1954, CAL, BM, det. A.H.G. Alston as "*P. actiniopteroides*" in error, triploid apomict, det. T.G. Walker (Walker 1962) *sub* "*P. actiniopteroides*" in error], **Mustang** [5 mi. above above Tukcha, "W. Nepal", under/between rocks, 11,500 ft., *R.L. Fleming* 891, 7.11/1.12.1949, KATH, BM, MICH, DD species det. by Kew; Larjung, S. of Tukucha, Kali Gandaki, under/on rocks beneath trees, 9000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8159, 16.10.1954, BM], **Kaski** [Kaski District, 6 km. E. of Ghorpani, 8900 ft., *R.L. Fleming s.n.*, 28.10.1981, MICH; Annapurna region, *Andreas Hemp*, Univ. Bayreuth 59, 2001-2, BM]; **Gorkha [**Gapsya, Gorkha, 2200 m., *S.H. Bhattarai* 21/21, 12.6.2012, KATH], **Lalitpur** [Godawari (1600 m.) - Phulchowki (2500 m.), *H. Hara, H. Kanai, G. Murata, H. Ohashi, O. Tanaka* & *T. Yamazaki* 4012, 26.6.1967, BM; Godawari - Phulchoki, Kathmandu, *H. Kanai* 11349, 11.4.1969, KATH; limestone rocks in woods, shortly below peaks on N.W. side of Phulchowki mountain, above and east of Godawari, E.S.E. of Kathmandu, Lalitpur District, *c.* 8000 ft., *C.R. Fraser-Jenkins* & *C.D. Fraser Jenkins* [father] 15844, 20.11.1989, E; Phulchoki, Lalitpur, rocky crevices of road trail, *Rita D. Thapa* L2-09, KATH], **Sindhupalchok** [Gosainkund, Malemci, 28° 02', 85° 32', beneath rocks, 8000 ft.,

J.D.A. Stainton 3778, 29.5.1962, BM; on way to Roll-khani from Kalinchok, on shady places, abundant, 10,300 ft., *S.B. Malla* & *S.B. Rajbhandari* 417, 13.10.1960, 2017.6.28 (Nepali date), KATH, CAL, species det. by B[otanical] S[urvey] of I[ndia]].

E: **Solukhumbhu** [Namche Bazar, en direction de la Dudh Kosi (Monjo), 2780 m., *A. Zimmermann* 1737, 17.8.1954, BM; Dorange, Junbesi, Solukhumbu, *c.* 2500 m., *T. Nakaike* 3463 *p.p.* (small plant), 20.10.1988, KATH], **Taplejung** [Nepal orient, *J.D. H*[*ooker*], K; East Nepal, Selap - Zongi - Walunchung Gola, *H. Kanai*, *G. Murata* & *M. Togashi* 6305140, 10.11.1963, BM, K; East Nepal, Baroya Khimty - Thakma khola, *H. Kanai*, *G. Murata* & *M. Togashi* 6305141, 16.11.1963, KATH].

Total distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; ?Darjeeling (Khullar 1994); Nepal; Uttarakhand; Himachal Pradesh. The collections by Griffith, Clarke 42793 and Mann from Lohit; Khasia (Meghalaya); and Meghalaya, Cherrapunji Coal Hill, all in K, are not *P. dactylina*, but *P. actiniopteroides* Christ, hitherto overlooked in India, including by the present author.

(S(T), Sc). A scattered but not uncommon higher altitude to high Himalayan species, growing in crevices of rocks, often on small cliffs, or at the bases of boulders.

[***Pteris dixitii*** Fraser-Jenk. & Pariyar, ***sp. nov.*** *Species similis ad P. aspericaulem sed stipes rachisque rubri non nisi parum asperi, lamina breviora paria opposita pinnarum pauciora quinque ad septem jugi, segmenta ultima maiora apices segmentorum mucronati*; *ab P. normale apicibus segmentorum obtusioribus et duo vel tria setas roseo-purpureas apices versus praeditas distinguitur*.

Holotypus: India, Meghalaya, "mixed primary-forested stream-gorge below and behind (N.E. side of) the old site of the ruined "Peak Lodge Hotel", above football ground, on W. side of top of Shillong Peak, above and South of Shillong, in crevices of small cliffs above the stream, *c.* 7000 ft., *C.R. Fraser-Jenkins* 33242 (FN 22), 11.11.2008", TAIF, isotype: TAIF.

This medium-sized (fronds spreading, to *c.* 60 cm. tall) compound *Pteris* species is a very critical member of the *P. aspericaulis* group with reddish axes, the stipe slightly asperous and apiculate segments, but the stipe is relatively longer and less asperous than in *P. aspericaulis*, the lamina is shorter and wider with 4 to 9 pairs of pinnae, and the ultimate segments are larger; it differs very slightly but significantly from its closest ally, *P. normalis*, in its much less strongly asperous stipe and more obtuse, though similarly large and apiculate segment apices, with 2 or 3 pinkish-purple setae above at around half their length; the members of the uppermost pair of setae are not displaced to one side as in *P. roseolilacina* Hieron. (which is a smaller plant, with fewer, shorter pinnae, smaller segments and a longer imparipinnate lamina-apex). In some respects *P. dixitii* is rather intermediate between *P. normalis* and *P. aspericaulis*, or another distinct species, *P. tricolor* (from Yunnan, China; Myanmar; and furthest N.E. India [*e.g.* Mizoram, Aijal, Lushai Hills, 3500

ft., *W.N. Koelz* 27785, 30.3.1951, MICH]), which may be green or variegated in colour, but it does not belong to either of them. Cytotype triploid apomict, 2*n* = 87, prothalli apogamous, det. T.G. Walker, voucher-specimen road banks below Pinewood Hotel, Shillong town, Meghalaya, *C.R. Fraser-Jenkins* 19652 (FN 537), 7.2.1993, TAIF; also from the above type locality, Shillong Peak, *C.R. Fraser-Jenkins* 20956, 20957, 20958, 20959 (FN 1204, 1205, 1206, 1207), 18.4.1994, TAIF and Elephant Fall, Meghalaya, *C.R. Fraser-Jenkins* 19591 (FN 475), 6.2.1993, TAIF; also Walker (1962) from Meghalaya, *H. Scott* 155, BM.

Full distribution: China [Yunnan, Yangbi, Shi Lung, *K. Iwatsuki et al.* 168, 25.8.1984, BM]; Myanmar [Kachin, *P.K. Khine* & *G.* & *S. Miehe* 13-092-001, PHMR and ?Hpalalangdam, valley of the Nam Tamai, 3500 ft., *F. Kingdon Ward* 13087, 1.9.1937, BM identity uncertain]; Arunachal Pradesh [Papum Pare; Siang, *A. Benniamin* 22318 *p.p.* a (see Fraser-Jenkins & Benniamin, 2010: 8, where mentioned as an unidentified species under *P. mawsmaiensis*); Lohit, Debang valley]; Nagaland [Kohima, *W.N. Koelz* 25505, 19.7.1950, MICH]; Manipur; Meghalaya [Khasi Hills, where it is common around Shillong *etc*.; Tripura].

It was also reported as an unnamed species (mentioned below *P. mawsmaiensis* Fraser-Jenk. & Benniamin) from a single collection (*CRFJ* 32365) from below Annapurna Base Camp, Kaski, Nepal by Fraser-Jenkins & Benniamin (2010: 8), but that collection (see below sub Hybrids) remains of uncertain identity as the stipe is more glossy and the setae above the ultimate segments are too numerous, longer and pale coloured, while the apiculate segments also have small crenulate lobes on either side of the apical mucro; it is more likely be a hybrid, perhaps with *P. spinescens*, but none of the 20 or so rather distantly connected plants of the single ancient clump were fertile to enable study of the spores.

(M or S, R). An uncommon to rather rare species (in India) of upper-mid to higher altitude, preferring rocky substrates and growing on very sheltered, steep rocky stream-banks in deep gorges, or often in crevices under overhangs in small sheltered cliffs.

Indian threatened status: **VU**.]

184. ***Pteris ensiformis*** Burm.f. (syn.: *P. crenata* Sw.; *P. stricta* Poir.; *P. gracilis* Roxb.; *P. prionitis* Fée).

A dactylate *Pteris* with rather weakly herbaceous, erect to arching fronds to *c.* 50 cm long but usually less, stipe longer than the frond, glabrous, green to stramineous; fronds markedly sterile-fertile dimorphic, sterile fronds short, often ± ovate, with shorter segments and lobes and fertile ones often much taller, narrowly lanceolate, with long segments and lobes; lamina imparipinnate with a long attenuated, unlobed apical segment, with a longish decurrent base, joined through the uppermost pair, or sometimes two pairs of pinnae, pinnae rather few (to *c.* 5 pairs), distant, with a few short (sterile) or long (fertile), obtuse to obovate, or acute-apexed, basiscopic

and acroscopic pinnules or lobes towards their bases, the lowest ones often a little lobed again, sterile lobes acutely toothed around the distal margin, lobe or segment width *c.* 7 mm., pinnae having a long unlobed upper part, margins entire, apart from teeth present around sterile apices of fertile segments, or extending some way along sterile segments; sterile fronds smaller with shorter, more obtuse pinnae and pinna-lobes, fertile fronds with several long subsidiary segments to the pinnae, margins with long pseudoindusia, but absent from the bases and apices of segments. Cytotype tetraploid sexual (from Assam State, Sri Lanka, S. India, Java, Taiwan and New Caledonia).

Of various "varieties" treated by Liao *et al.* (2013) two are just abnormal states of the species of no taxonomic significance and the third (var. *merrillii* C.Chr. *ex* Ching, from S.E. China) is either a synonym of *P. ensiformis*, as the others are, or a species. Thus a "var. *ensiformis*" as treated does not exist. However they omitted Nepal from the range they gave for the latter, and included India, Myanmar and Sri Lanka in the range of "var. *victoriae*" Baker (properly called *P. ensiformis* cv. 'Victoriae'), which originated as a wild white-variegated 'sport' or abnormality in Java and is only cultivated in the countries mentioned, as indeed in many countries world-wide.

Nepal:

C: **Tanahun** [open banks of fields and among limestone rocks in light woods, on path up to Siddha Gouffer (cave), *c*. ½ km. above and S. of Bimalnagar village, *c*. 2 km. E. of Dumre, E. of Damauli and Pokhara on Mugling and Kathmandu road, W. of Anbu Khaireni, Tanahun District, 500 m., *C.R. Fraser-Jenkins et al*. 28368 (FN 4343), 28.2.1999, H; N. facing roadside bank below trees at W. end of lower Markichowk Bazaar (near Marsyangdi dam), opposite resting-place near Shiva temple, E. side of Powa Khola, *c.* 5 km. W. of Anbu Khaireni, S. side of Marsyangdi river, off Mugling to Damauli road, Tanahun District, 450 m., *C.R. Fraser-Jenkins* 28460 (FN 4435), 17.3.2000, H], **Gorkha** [pathside bank shortly to N.E. of and below Deurali village up above on the hill-crest, on track up from Anbua and Anbu Khaireni, *c*. 700 m., *C.R. Fraser-Jenkins*, with *Nirmala Fraser-Jenkins* (*Pariyar*) and *Jacob Charles Bhdr. Fraser-Jenkins* no. yet to be assigned, 30.1.2015, KATH (and previously collected at Komale, between Deurali and Markichowk by CRFJ); ?**Kathmandu** ["Pouwa, Kathmandu, 1600 m., *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305142, 9.10.1963, TI" cited by Itô (1966) and Iwatsuki (1988), though not seen by us, and it would seem surprising from the Kathmandu valley unless escaped].

E: **Sankhuwasabha** [E. Nepal, Tumlingtar, "Dhankuta Distr.", 1500 ft., *R.L. Fleming* 2121, 22.11.1971, K].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. to S. India; Sri Lanka; Bangladesh; S.E. Asia; Australasia *etc.*

(M, Sc to R). A very rare (in Nepal) lower-mid to mid altitude species occurring in damp places usually near a supply of water, among vegetation beside paths or on stream-banks in semi-open conditions.

Nepalese threatened status: **EN**.

[***Pteris grevilleana*** Wall. *ex* J.Agardh, as "var. *grevilleana*", was listed for Nepal by Liao, Ding, Wu, Wu, Prado & Gilbert (2013) in the *Flora of China* in an unexplained error. It is a small dactylate species with black axes, and many lobes to the pinnae, and occurs from Arunachal Pradesh and Assam state north-eastwards at low altitudes.]

185. ***Pteris inaequalis*** Baker (syn.: *P. excelsa* var. *inaequalis* (Baker) S.H.Wu; *P. inaequalis* var. *simplicor* Tagawa; *P. sinensis* Ching, *nom. nov. superfl.*; misapplied name: "*P. excelsa*" *p.p. min. sensu auct. Ind.*, *non* Gaudich. [= *P. terminalis*]).

Not categorisable as either the compound or dactylate species of *Pteris*; it is nearest to the dissection of *P. alata*, but can be very irregularly lobed with simple, unlobed areas among pinnatifidly lobed areas. Intermediate in size (to *c.* 80 cm. tall) and morphology between *P. alata* and *P. terminalis*, stipe long, stramineous, often becoming darkened later in the season; fronds bipinnatifid, rather narrowly triangular-lanceolate; pinnae generally ± "semipinnate" with most pinna-lobes directed basiscopically downwards from the pinna-costa, but several basal ones of pinnae, and those of lower pinnae are acroscopically directed, it also has some longer, narrow, entire and unlobed pinnae, or parts of pinnae, usually on the acroscopic side of the pinna-costa on the upper-mid to upper pinnae, some upper-mid pinnae may be all simple and unlobed, yet lie opposite to a compound one, and several pinna-lobes may be abruptly longer or shorter than those on either side of them, upper pinnae entire and simple, as is the lamina-apex; lower pinnae usually bear long pinnules on both sides; rarely extreme fronds may have nearly all simple, very shallowly lobed pinnae, with only a few longer lobes in the whole frond; sori marginal in any part of the mid and upper frond. Cytotype triploid apomict. The "mixed morphology" of this species suggests an allopolyploid origin between compound and dactylate species. It is possible to confuse *P. inaequalis* with juvenile morphology in small plants of *P. terminalis*, which can appear similar, as the upper pinnae in juvenile *P. terminalis* are also "semipinnate", but such plants are not fertile and have wider lower parts of the fronds and intermediate fronds in stands of plants show their development into large adult *P. terminalis*.

Nepal:

E: **Taplejung** [Helok - Iladanda, *H. Kanai, G. Murata* & *M. Togashi* 6305143, 8.11.1963, TI, photograph kindly sent by Dr. A. Ebihara, det. CRFJ 11.2014].

Himalayan distribution: China; Arunachal Pradesh (Fraser-Jenkins & Benniamin 2010, Fraser-Jenkins 2012); Manipur (Ghosh *et al.* 2004, verified); Nepal. Japan.

(S or Sino-Japanese, R). A very rare species in the Indo-Himalaya occurring at upper-mid altitudes at the edges of light forest, on semi-open path-banks, or beside streams.

Indian threatened status: **CR**. Nepalese threatened status: **CR**. Only known from one collection from Nepal, a photograph of which was sent to CRFJ under the name *P. terminalis* as a triploid cytotype.

186. ***Pteris kathmanduensis*** Fraser-Jenk. & T.G. Walker (misapplied name: "*P. aspericaulis*" *auct., non* Wall. *ex* J.Agardh).

This is a large (fronds 60 - 1.5 m.) compound *Pteris* of the *P. aspericaulis* group with all free veins, but with larger segments less obviously mucronate. It was formerly unrecognised within the complex, but is easily distinguished by its very long, glossy stramineous to slightly brownish stipe (not normally slightly pinkish), longer than the lamina, lamina long, with up to *c.* 10 pairs of pinnae, and the sinus between segments usually reaching down to a little above the costa or some lower ones to the costa, ultimate segments longer and wider than in *P. aspericaulis* and well spaced out towards the base of the lowest pinnae; the segment-apices are more rounded, subapiculate to almost non-apiculate, but have a small apical mucro on closer examination; there are usually two to three lowest developed compound basiscopic pinnules on each lowest pinna (only one in small plants) and two well spaced out small acroscopic segments between their points of origin but on the acroscopic side of the costa; very occasionally well developed compound lower pinnules may also develop abnormally on the acroscopic base of the lowest pinna, the second pair of pinnae also have one or two pairs each of basal basiscopic develeoped compound pinnules (longer than the small ones that may occur in some *P. aspericaulis*); a few of the segments may have one or sometimes two small, pale setae above their midribs approximately half way down the segment, but most are without setae; spores large, with many abortive ones. Cytotype unknown, but prothalli apomictic, det. T.G. Walker from just N. of Sukhidang, Champawat, Uttarakhand, *CRFJ* 21884 (FN 551 A, B, C, D), 28.12.1994, TAIF. The spores are large and contain some small abortive ones as well. A possible count of triploid cited tentatively by Fraser-Jenkins (2008), but awaiting finding the voucher-specimen from below Jamachok, Nagarjun forest, *A.C. Jermy* & *C.R. Fraser-Jenkins ACJ* 20312, 15.1.1993, BM, very probably referred to either *P. roseolilacina* (the same plant as the triploid *C.R. Fraser-Jenkins* & *A.C. Jermy* 19476 (FN 361), 15.1.1993, E), or *P. normalis* (the same plant as *CRFJ* & *ACJ* 19477 (FN 362), 15.1.1993, E), the voucher-specimen should be in Jermy's herbarium in the unincorporated cupboards at BM, but was not readily findable in 2012-13. Unfortunately Dr. Walker was unable to obtain a chromosome count from CRFJ's material before his death.

Nepal:

C: **Kaski** [banks of path N. of Birethanti on way to New Bridge Lodge, S. of Chomrong, on way to Annapurna Base Camp, Kaski District, *C.R. Fraser-Jenkins*

& *G.B. Tamang* 32368, 32369 (FN 15, 16), 27.11.2006, TAIF; densely forested path N. of Sinuwa on way to Bamboo Lodge, N. of Chomrong, on way to Annapurna Base Camp, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32387, 32388 (FN 34, 35), 29.11.2006, TAIF], **Dhading** [forested rocks and slopes beside path, *c*. 1 km. in from 2nd gate, Nagarjun Forest behind and to N.W. of Jamachok mountain, *c*. 3 km. N.W. of Balaju, *c*. 6 km. N.W. of Kathmandu on road to Trisuli Bazaar, Dhading District, *C.R. Fraser-Jenkins* 30980, 13.12.2004, TAIF; *ditto*, 31365, 9.9.2005, TAIF; *ditto*, 31876-31878, 25.10.2005, TAIF; *ditto*, 31909 (holotype), BM, 31910, 28.11.2005, BM, TAIF; *ditto, C.R. Fraser-Jenkins* & *Sagun Pariyar* 34769, 34770 (FN 47, 48), 1.9.2011, TAIF;, 34979], **Rasuwa** [Dumse [Dhunche] to Chandanbari, 3000 - 3200 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 911/79, 17.9.1979, KATH], **Kathmandu** [first forested damp stream-gully above road, 6 km. N. from Pharping Bazaar, N. of Bansbari, 1 km. S. of Chalankhel, N.E. side of Neupane Dara (hill), on W. side of Bagmati River, *c*. 10 km. S. of Kathmandu on road to Dakshin Kali temple, Kathmandu District, *C.R. Fraser-Jenkins et al.* 24121 (FN 99), 20.7.1996, BM, H; forested stream-gulley S.E. side of lower Jamachok Hill, N.W. from and above Halchowk village and ridge, north from the hill W. of Swayembhunath, W. Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* & *S. Pariyar* 34781, 34782 (FN 59, 60), 6.10.2011, TAIF], **Lalitpur** [forest slope above river on S.E. side of Bajrabarahi temple, E. side of Chapagaon, S. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *Raju Lama* & *Deepak Lama* 24994 (FN 973), 18.11.1996, BM, H; sheltered and well vegetated banks of small khola (stream) just below and west of Godawari village, to west of and below main road, S.E. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *G.B. Tamang* & *Radhe Panta* (Panta & sons Nursery, Godawari) 30307, 24.2.2004, TAIF], **Kabhrepalanchok** [Dhulikhel, Kabray District, on the forest area, 1800 m., *Dil Tara Yami* [*Tuladhar*] 169, 20.1.1996, KATH *sub* "*P. quadriaurita*" in error, redet. CRFJ].

Himalayan distribution: China; Arunachal Pradesh; ?Sikkim [*B.S. Kholia*, BSHC, identity uncertain]; Darjeeling; Nepal; Uttarakhand [*c*. 3 km. below and N. of Sukhidang, S. of Chalthi, Champawat, *C.R. Fraser-Jenkins* 34571 (FN 74), 2.11.2010, TAIF, plant to IHBT garden, Palampur, Himachal Pradesh]. The report from Yunnan, China by Fraser-Jenkins (2008) was omitted by Liao *et al*. (2013).

(S, Sc). A scattered and local mid to upper-mid altitude species, growing in the forest on moist and well shaded banks of streams or of paths.

Nepalese threatened status: **LC**.

187. ***Pteris longipinnula*** Wall. *ex* J.Agardh (syn.: *P. amoena* Blume var. *longipinnula* (Wall. *ex* J.Agardh) C.V.Morton; ?*P. pectinata* Roxb., *non* D.Don [= *P. biaurita* subsp. *fornicata*], *nec. al.*). Liao *et al.* (2013) in the *Flora of China* recognised a "var. *longipinnula*" which does not exist, and only listed it for China, though some of the localities they cited under the main species heading (N.E. India and Nepal)

obviously belong to this "variety". However they omitted Malaya, from where *P. longipinnula* was described, and having cited Bhutan under the species, from where only *P. hirtula* (C.Chr.) C.V.Morton (syn.: *P. subhirtula* Sarn.Singh & Panigrahi) has been collected (by CRFJ), they omitted it from what they misnamed with early 20th Century taxonomy as *P. longipinnula* var. *hirtula* C.Chr. As Morton (1974) had realised, *P. hirtula*, which occurs in China, Myanmar, Arunachal Pradesh and Bhutan, is an entirely different species from *P. longipinnula*, confirmed again by Fraser-Jenkins (2008) and Fraser-Jenkins & Benniamin (2010), and full sized plants have a large basal compound pinnule on the lowest one or two pinnae. Regression to its placement as a meaningless variety is unacceptable by any standards of taxonomy. Some other S.E. Asian species from Java *etc.* with compound basal pinnules, labelled in herbaria as *P. longipinnula* and cited as "*sens. lat*." by Walker (1962) are incorrectly identified and Holttum's plant of "*P. longipinnula*" with basal pinnules is *P. assamica*.

A very distinctive medium large (fronds to *c.* 80 cm. tall), compound *Pteris* with no developed compound basal basiscopic pinnules to the lowest (or other) pinnae; stipe stiff, erect, from 1½ to twice as long as the lamina, smooth, stipe, rachis and costae bright blueish green, often drying an unusual olive-blue colour, as if stained with blue ink, and partly stramineous; fronds erect or suberect, lamina bright green, oblong lanceolate, widest at the base, pinnate-pinnatifid, imparipinnate apically, pinnae rather few and distant with a narrow unlobed apex, like the terminal segment, elongated ovate, narrowed abruptly at their bases with the lowest opposite pair of pinna-lobes smaller and cuneately decurrent on the costa, pinnatifid into rather long, rounded-pointed pinna-lobes, pinna-lobes unlobed, close, the narrow sinus not quite reaching the pinna-costa, pinna-lobe midribs bearing a number of rather inconspicuous small, pale setae scattered throughout most of their length above, lobe-apices narrowly rounded to pointed, subapiculate to rather inconspicuously apiculate; sori not reaching the apices of the pinna-lobes. Cytotype diploid $2n = 58$, at mitosis, det. T.G. Walker, 1997 (fixing no. 95/80/3), voucher specimen: luxuriant, dark, overgrown, partly rocky, narrow stream-gully in dense mixed tropical forest, walking up stream *c.* 1-2 km. S. from shortly behind Forest Inspection Bungalow at Kamalpur, south of Margherita and eastern Arunachal Pradesh road, heading across-country towards Joypur road (which goes south from Digboi), *c.* 2 km. S.S.E. of Digboi, northern Assam, *c.* ?250 m., *C.R. Fraser-Jenkins* 23889 (Pt. 80), 24.12.1995, E. The diploid sexual counts from Java listed by Walker (1962) under "*P. longipinnula sens. lat.*" and reported again by Singh & Panigrahi (2005) under *P. longipinnula* do not apply to this species, but to as yet unidentified material near *P. blumeana* that CRFJ has also collected there (Pelabuhonratu, *CRFJ* 21918 (FN 585), 2.2.1995, E) with small narrow pinnules and a compound basal pinna with developed lowest basiscopic pinnules.

Nepal (all specimens known to us from Nepal cited):

C: **Tanahun** [patch of forest by stream-gully, *c.* ½ km. S.E. of Jamune village, *c.* 7 km. W. of and above Damauli, on road to Pokhara, E. of Pokhara, W. of Mugling, Tanahun District, *c.* 500 m., *C.R. Fraser-Jenkins* with *Ganesh* [*Ramchandre*] *Pariyar* 25509 (FN 1487), 19.8.1997, BM, H, KATH; small forested gully opposite and S. of Chabise village, *c.* 3 km. E. of Khairentar, E. of Pokhara on Damauli road, Tanahun District, *C.R. Fraser-Jenkins* 25816 (FN 1794), 27.12.1997, H; small stream-valley among bamboo and other forest, *c.* ½ km. W. of Dugadi, E. of Jamune, *c.* 5 km. W. of and above Damauli, W. of Mugling on road from Kathmandu to Pokhara, Tanahun District, 700 m., *C.R. Fraser-Jenkins* 28481, 28482 (FN 4456, 4457), 16.4.2000, H].

E: East Nepal was given by Thapa (2002), but we have seen no reports or specimens in any herbaria from there.

Full distribution: China; Myanmar; Arunachal Pradesh; ?"Sikkim" (*J.D. Hooker*, K); Darjeeling; Nepal. Assam State; Nagaland; Manipur; Meghalaya; Mizoram; S. India; Thailand; Malaya; Indonesia; Philippines.

(M, R). A very rare (in Nepal) low to lower-mid altitude species, growing in damp marshy depressions in light, semi-open forest, amomg bushes.

Nepalese threatened status: **EN**.

188. ***Pteris medogensis*** Ching & S.K.Wu (syn.: *P. himalayensis* S.C.Verma, *nom. nud.*; *P. himalayensis* S.R.Ghosh). Liao *et al.* (2013) erroneously thought that this species appeared "to fall within the range of variation [they] accepted" for *P. fauriei*, *i.e*. *P. khasiana*, as they did not recognise the relationship of the species to *P. spinescens*, and did not take account of the setae above the ultimate segment midribs, which are much more important taxonomically than the spines above pinna-costae.

A tall, compound *Pteris* (fronds to *c.* 80 cm.) very closely similar and evidently closely related to *P. spinescens*, stipe rigid, nearly as long as the lamina, smooth, glossy, stramineous, becoming brown later in the season; frond rather narrow and long with many (to *c.* 14) pairs of pinnae, with rounded-apexed, non-apiculate, deeply cut segments (the narrow sinus reaching the pinna-costa), bearing many opposite pairs of usually longish, white setae adaxially along their midribs. It differs from *P. spinescens* only in having a single developed basal basiscopic pinnule on the lowest pinna instead of two or more, in nearly always having green-stramineous, usually not pink axes, in having a slightly less smooth lamina, and importantly in being diploid apomictic, not triploid apomict. Cytotype diploid apomict, det. S.C. Verma (*sub* "*P. blumeana*" and "*Pteris himalayensis* forma á" S.C.Verma, *nom. nud.*, no. 73, PAN, K) from voucher-specimens, Lloyd Bot, Garden, Darjeeling, *S.C. Verma s.n.*, PAN 425; Lebong, Darjeeling, *S.C. Verma s.n.*, 8.1956, PAN 3847; and Lebong, Darjeeling, *S.C. Verma* 73, 703, 8.1957, PAN 3853, 3855, 3856; and det. T.G. Walker, from voucher specimen, Myang Chhu, N. Sikkim, *CRFJ* 23278 (FN 1185), 17.11.1995, TAIF; but also a triploid apomict count, det, T.G. Walker, from voucher-specimen, Shillong Peak, Meghalaya, *CRFJ* 22454 (FN 361),

8.10.1995, TAIF. The vouchers cited all have a single basal basiscopic developed pinnule on each lowest pinna and match *P. medogensis*. Had a cytological difference not been found (by Verma in Mehra 1961) this species would surely be thought to be merely part of the range of variation within *P. spinescens*, differing only in the normally rather variable feature of the number of lowest pinnules. Even though the two seem readily distinguishable when plants are full sized; smaller and less developed specimens of either species are very difficult to distinguish.

At present it is impossible to make sense of the cytological results as there are anomalous results for both this species and *P. spinescens*, if indeed they are genuinely different species, and it is obvious that further cytotaxonomic investigation is needed on a larger scale to investigate if there is really a morphological difference between them that corresponds with a consistent cytological difference. The most likely explanation might be that the triploid apomictic result for *P. medogensis* could perhaps have been a contaminant sporeling plant, but this remains uncertain.

Just as in Nepal, plants in Taiwan collected at Mai Feng, Nantou (*CRFJ* 22126, 22127, 22170, 22171 (FN 33, 34, 77, 78), 16.7.1995, *CRFJ* 22290 (FN 197), 17.7.1985), also show either multiple basal basiscopic developed pinnules or single ones, respectively, but the late Dr. T.G. Walker did not manage to investigate these plants cytologically before his death.

Nepal:

C: **Kaski** [narrow, rocky gorge and luxuriant, leech-ridden forested slope, shortly above Poiyim village on track along slope from Burjung Khola to Kahaure and Tarakot village, N. of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *George Yatskievych*, *Lisa Hooper* (*E.A. Hooper*), *Jyoti Gajurel*, *Rita Thapa*, *Sagun Pariyar* and *Ganesh Tamang* 34251 (FN 54), 12.9.2009, TAIF].

E: **Taplejung** [Sanghu, Dhankuta Province, shady side of gulley below camp, 6000 ft., *A.H. Norkett* 8558 = 8559? [*sic*], 7.1.1962, BM juvenile sterile specimen, could also be *P. spinescens*; *ditto*, 8559 *p.p.* top right specimen, 7.1.1962, BM]. Presumably much overlooked in E. Nepal, having few features that stand out and bring it to attention. It is abundantly common in Darjeeling and Sikkim, whence CRFJ compared his material with the type while searching for a name for this species when last in Bejing (PE) in 2005.

Full distribution: Tibet; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal (also listed by Ghosh *et al.* 2004).

(S, R). Apparently very rare in Nepal, an upper-mid to higher altitude species of dense forests, usually growing by small streams, or on moist, shaded banks near stream-gullies.

[* ***Pteris multifida*** Poir. (name misapplied by Singh & Panigrahi (2005) to *P. cadieri* Christ), an adventive semi-lithophytic species similar to a small *P. cretica* with very decurrent bases to the upper and mid pinnae and longer narrower apical

segments. It has escaped widely on old walls and ditches around the town from an original planting in the Forest Research Institute, Dehra Dun, Uttarakhand, and is adventive in several other States of N.E. and S. India. Its natural range is in the far-east, in Japan; China; and Korea; adventive in Bangladesh; W. Bengal (common on old masonry in Calcutta); Uttarakhand; Pakistan. Not as yet known from Nepal. (A, Sc; Sino-Japanese).]

189. ***Pteris normalis*** D.Don (syn.: ?*P. scabristipes* Tagawa, CRFJ is not absolutely confident that this very close and difficult taxon is really identical with *P. normalis* (Fraser-Jenkins 2008) as though very close to it indeed, it tends to have up to 10 pairs of pinnae (just within the range of *P. normalis*) and some collections have some small setae above the ultimate segments; but typical *P. normalis* does occur in Taiwan and "*P. scabristipes* Tagawa, Takao, between Chirifu and Yoshida, Kizan-gun, *M. Tagawa* 1489, 15.12.1938", also "*Pteris scabristipes* Tagawa, Takao, between Kuwarusu and Mt. Daibu, Chôshû-gun, *M. Tagawa* 2062, 25.1.1938", MICH, for example, are *P. normalis*, with narrowly acute, apiculate and seta-less segments. But given the polyploid complexity of the group it is essential at least to know its cytotype from the type locality first, as its slightly different morphology might possibly correspond with a different cytotaxon which should in that case be recognised taxonomically. Presumably Liao *et al.* (2013), who keyed it out as having non-muricate segments, might not have meant the same taxon, as though some segments in *P. scabristipes* are weakly apiculate, they are normally obviously apiculate; misapplied names: "*P. aspericaulis*" *sensu* Verma in Mehra (1961), Singh & Panigrahi (2005), *et al.*, *non* Wall. *ex* J.Agardh; "*P. asperula*" *sensu* Ghosh *et al.* (2004), *non* J.Sm. *ex* Christ [= *P. oppositipinnata* Fée, syn.: *P. luzonensis* Hieron., endemic to the Philippines]; "*P. oppositipinnata*" *sensu* Thapa (2004)). *P. normalis* is not at all a synonym of, or even related to "*P. linearis*" as stated by Chandra (2000).

Unlike several other compound species in further N.E. (and S.) India, this species is only rather seldom infected by the gall-forming ascomycete fungus, *Taphrina laurencia* Giesenh., but one such specimen is from Nongram, Khasia, Meghalaya, *C.B. Clarke* 16707, 5.11.1871, BM and another is also from Khasiya, [*W.*] *Griffith, herb. J. Smith*, BM; we now report *T. laurencia*, below, from Kaski, Nepal, though it is very uncommon and perhaps previously unknown in Nepal.

A medium-large and wide-fronded (fronds up to *c.* 60 x 30 cm., including the stipe) compound *Pteris* in the *P. aspericaulis* agg., but easily distinguished from that by its much rougher, very asperous, stipe and axes, which are nearly always brick-pink to puplish-brown, a shorter, wider frond, with 4-9 (-10) pairs of pinnae of a hard crispaceous texture, and the obviously larger segments, tapering more gradually to their strongly apiculate apex, and entirely without setae above the segment-midrib, apart from one or two minute, insignificant teeth sometimes visible on the segment-midrib, unlike the occasional scattered and definite setae present in the very similar,

but less asperous-axised *P. dixitii*. Cytotype triploid apomict (counts by T.G. Walker and S. Matsumoto on CRFJ collections). The report by Verma in Mehra (1961) of "*P. aspericaulis*" being diploid apomict from Birch Hill, Darjeeling, led to the redescription of *P. aspericaulis* as if a new species *P. pseudoquadriaurita* Khullar, being a diploid sexual taxon, but Verma's voucher-specimens (PAN, and no. 62, K) have been reidentified by CRFJ as typical *P. normalis*, despite the reported difference in cytotype (diploid versus triploid). By contrast, three triploid counts with corresponding apomictic prothalli, were obtained from spore-progeny by T.G. Walker from CRFJ's collections of typical *P. normalis*, exactly matching Verma's material. One was from the probable type-locality in C. Nepal (Nagarjun Forest, Kathmandu, *CRFJ* & *A.C. Jermy* 19477 (FN 362), 15.1.1993, TAIF), and two from N. Sikkim (Chungthang, N. Sikkim, *CRFJ* 23280, 23281 (FN 1187, 1188), 17.11.1995, TAIF); and a further triploid mitotic count from Nagarjun Forest was obtained by Matsumoto (Fraser-Jenkins & Matsumoto in press) from the corresponding living plant of *CRFJ* & *S. Pariyar* 34980 (FN 258), 4.12.2011, TAIF, with good spores. Confirmation of the cytotype of material from Birch Hill would therefore be desirable as it appears to be anomalous.

Nepal:

Thapa (2002) mentioned this species, *sub* "*P. oppositipinnata*" as also being scattered in W. Nepal, but we have not seen any collections from there in any herbaria. Its possible presence there is not established.

C: **Syangja** [Rani Swara, Syangja, 1700 m., *N.P. Manandhar* 805-91, 4.9.1991, KATH], **Kaski** [path in semi-open forest on W. facing slope, *c*. 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c*. 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c*. 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *c*. 1800 m., *C.R. Fraser-Jenkins* & *J.B. Pariyar* 26141-26152 (FN 2119-2130), 13.3.1998, BM, H, US, no. 26152 (FN 2130) infected with a gall of *Taphrina laurencia*; **Dhading** [Raniban forest, by second stream along path from Gate no. 2, at back (N. side) of Jamachok mountain, N.W. of Balaju, N.W. side of Kathmandu, Dhading District, *C.R. Fraser-Jenkins*, with *Jeet Bhdr. Pariyar* 26250 (FN 2228), 24.3.1998, BM], **Kathmandu** [Nagarjung, 27° 45', 85° 19', wet places, 1500 m., *J.F. Dobrememez* 889, 30.8.1971, KATH; Sundarijal, on shady place by the side of Nagmati river, 1700 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/694, 18.3.1975, KATH *sub* "*P. geminata*" det. R. Shrestha in error; Kageswari Danda, Sundarijal - Manichaur, on rocky slope, in the shrubby forest, 1500 m., *M.M. Amatya, I. Sharma* & *R. Shrestha* 164-76 MS, 19.5.1976, KATH; wooded path above and to N.E. of Sundarijal village up stream-valley and shortly beyond waterfall, *c*. 15 km. N.E. of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins*, with *Rajkumar K.C., Sanobhai K.C., Ganesh B. Tamang, Arjun Chhetri, Shyam Thapa Magar, Krishna Kharki* & *Rajkumar Chhetri Kharka* 18759, 4.1.1992, E; Raniban, Kathmandu, 1400 m., *Rita D. Thapa, S. Chhetri* & *R.P. Marahatta* R

10-10, 4.10.2010, KATH], **Lalitpur** [Chapagaon/Bajrabarhi, Lalitpur, 1371 m., *V.L. Shresth* [later *Gurung*] & *R. Thapa* [later *Rana*] 8789, 3.1973, KATH det. V.L. Gurung as "*P. geminata*" in error, redet. CRFJ for N. Thapa as "*P. oppositipinna*" in error, *i.e. sensu CRFJ = P. normalis*; Hattiban forest, Lalitpur, in the shaded forest, 1400 m., *N. Thapa* 405, 19.5.2001, KATH det. as "*P. oppositipinnata*", tentative name, by CRFJ for N. Thapa], **Bhaktapur** [forested rocky stream-gulley, *c.* 1 km. S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, E.N.E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins*, with *Ramchandre* ["*Ganesh*"] *Pariyar*, *Raju Pariyar et al.* 25254, 25255 (FN 1233, 1234), 15.2.1997, BM, H], **Dolakha** [Susma Chhemawati, Dolakha, 1420 m., *D.R. Kandel*, *S. Maharjan*, *J. Shrestha*, *S. Paudel* & *R. Shrestha* 20121130, 10.11.2012, KATH], **Ramechap** [between Bhandar and Kenja, Janakpur Zone, 2100-1700 m., *T. Nakaike* 3206, 7.10.1988, KATH].

E: **Sankhuwasabha** [15 miles E. of Tumlingtar, E. Nepal, by roadside, 6000 ft., *Robert L. Fleming* 2179, 6.11.1973, MICH], **Dhankuta** [E. Nepal, Dhankuta (1300 m.) - Nigale (1600 m.), 872266-872271, terrestrial in open slope, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725062, 4.6.1972, KATH; *c.* 1½ to 4 km N. of and below top of pass between Dharan and Dhankuta, S. of and above Shimshua village, Dhankuta District, *c.* 1200-1350 m., *C.R. Fraser-Jenkins* 20852 (FN 1100), 1.2.1994, E; Dhankuta Distr., Pharkushe (890 m.) - Phalate (1570 m.) - Lamche (1790 m.) - Pakhribas (1700 m.) - Hile (1950 m.), 27° 01' 36" - 05' 10", 87° 13' 31" - 19' 02", in sunny steep slope at pathside, 1620 m., *M. Mikage*, *T. Kajita*, *F. Kiuchi*, *N. Kondo*, *P. Lacoul*, *M. Suzuki* & *K. Yonekura* 9558326, 3.11.1995, KATH]; **Taplejung** [on Tamur, on way to Wallungchong, *K.H. Hyatt* (for *A.H. Norkett*) *s.n.*, *sin.* date [1.1962], BM; Mewa Khola, by path, 6500 ft., *R.L. Fleming* 2118, 8.12.1971, K]. East Nepal, Taplethok - Helok, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305156, 6.11.1963, BM, CAL *sub* "*P. quadriaurita*" in error].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Taiwan [Mt. Niitakayama (Morrison), *H.H. Bartlett* 6291, 8.10.1926, MICH]. Omitted by Liao *et al.* (2013).

(S, C). A common upper-mid to higher altitude species, growing on slopes in dense forest, often above streams or paths.

[***Pteris oppositipinnata*** Fée (syn.: *P. asperula* J.Sm. *ex* Christ). Although Thapa (2002) used the name *P. oppositipinnata* for what is now called *P. normalis* and Ghosh *et al.* (2004) used its synonym, *P. asperula*, in the sense of *P. normalis*, *P. oppositipinnata* is actually endemic to the Philippines and differs considerably from *P. normalis*, having smaller, narrower segments with many setae above their midribs, and a quite different aspect. While Ghosh's misuse of the name goes back to Dixit (1984) and before that to Beddome's wide Victorian concepts, Thapa's usage stems

from the earlier days of Fraser-Jenkins' search for names for the, at that time, unnoticed and unreported distinct species that were all being referred to under the general name "*P. aspericaulis*" *sens. lat.* At one time it looked as if *P. oppositipinnata*, clarified by Price (1972), being a very asperous and slightly similar species, might be the correct name for *P. normalis*, though research was still ongoing. But a name was needed for Thapa's book and it thus came into use in error, corrected by Fraser-Jenkins (2008).]

190. ***Pteris pellucens*** J.Agardh (syn.: *P. zollingeri* Mett.; *P. radicans* Christ; misapplied name: "*P. longipes*" *sensu auct. Asiat., non* D.Don [= *P. wallichiana*]). Don's protologue of *P. longipes* described a ternate frond with ternate pinnae, *i.e.* 7 main divisions, and this and other described features were correctly interpreted by Agardh (1839), who described the frond as having 7 divisions and placed *P. longipes* in the group with anastomosing veinlets, along with his *P. wallichiana* (he separated the latter as the specimen he saw had no secondary anastomoses), in a quite different group from his *P. pellucens*. Clarke (1880) also stated "from Don's description and the history of the plant, I should have thought *P. longipes*, Don, to have been *P. wallichiana*; but as I do not possess the authentic example of Don for comparison I follow Mr. Baker" and "but Mr. Edgeworth (in Herb.) takes *P. wallichiana*, Agardh, to be the true *P. longipes*, Don, and, to me it seems, with much probability". The name *P. longipes* Don appears to have been another casualty of the unscientific dismemberment and sale of the Lambert herbarium that Don had worked on (see Fraser-Jenkins 2006); this was combined with Don's incompetent failure to write his nomenclature on the sheets; Hooker's disdain for Don's new species and names replacing those of his friend Wallich, materialised in Hooker & Baker (1865-1868); and the frequent hasty misapplication of Don's names by Hooker when obliged to consider them. Hooker clearly would not have wished to replace the name *P. wallichiana*, and initially (Hooker 1857: 225-227) took the name *P. longipes* as a synonym of *P. tripartita* Sw., which is not present in the area at all, but is superficially exactly like *P. wallichiana* in general aspect. Hooker & Baker was uncritically followed by Christensen (1906) and the name *P. longipes* thus came into misuse for the present species. It is clear now, however, that the name was misapplied to *P. pellucens* and belongs to the same species as *P. wallichiana*, which it would have been very surprising if Don had not noticed it in the collections available to him.

Pteris longipes D.Don, *Prodr. Flor. Nepalensis*: 15-16 (1824) is therefore lectotypified in accordance with the protologue, lectotype here designated, "Pteris Napalia - *Dr. Wallich* (1819)" BM, with a determination label by Alston, "Type specimen of Pteris pellucens Ag. *etc*." and an annotaion by CRFJ, 10.6.2003, "It is missing its original label ... This would seem to be the type collection for Pteris longipes Don *etc*."; the specimen was collected by the Hon. Edward Gardner, British Resident or Ambassador at the residency at Narayanhatti, Kathmandu, along with Bharat Singh and Francis de Silva (from Calcutta Botanic Garden) prior to Wallich's

own visit to Nepal, and was part of the pre-Wallich collection Don worked on, purchased later by the BM from the remnants of the Lambert sale (of which only the Hamilton collections were ticked in the BM copy of the *Prodromus*). There is no doubt that in order to avoid the confusion of having to call the widely and very well known, highly distinctive, horticulturally outstanding and popular *P. wallichiana*, probably the most characteristic and emblematic of all Himalayan ferns, by the name *P. longipes*, the confused name *P. longipes* D.Don needs to be proposed for rejection. As the present species already has another quite well known name, *P. pellucens*, used here (and there), this should not create any particular problem.

P. pellucens is a very large (fronds to *c.* 1.3 m. tall), robust compound *Pteris* with all free veins; the strong, glossy, pale- to mid-brown stipe is erect and usually longer than the lamina, pinnately tripartite the apical division of the frond imparipinnate (as are the main basal pinnae), bearing many short, deeply pinnatifidly lobed pinnae, the opposite pair of basal pinnae much larger, as long as the apical division, and bipinnatifid, bearing many pinnules, of which the basal basiscopic ones are twice as long or more than the acroscopic ones, but subapical ones are similar acrosopically and basiscopically, the pinnules themselves bearing many deeply cut lobes; costae and costules bearing small spines above, sometimes more and more prominent, sometimes less; ultimate lobes or segment rounded-rectangular, with insignificant small, blunt teeth or crenations, slightly varying in size from plant to plant; sori and pseudoindusia rather short, confined to the sides of the lobes. Cytotype diploid sexual (Verma in Mehra 1961), with a slightly different and distinct, less robust African-element species, *P. pteridioides* (Hook.) F.Ballard (syn.: *P. brevisora* Baker), which is tetraploid sexual (Irudayaraj & Manickam 1987), replacing it in S. India and Sri Lanka, though overlooked in the Indian subcontinent until now.

Nepal:

?**W**: Thapa (2002) reported this species *sub* "*P. longipes*" as scattered in W. Nepal, but we have seen no reports and no specimens in any herbaria from there, nor is it known from Uttarakhand *etc.*, so it is probably to be excluded.

C: **Kaski** [waterfall and forested khola in upper Chiso Khola, S. of Yamdi Khola, S.W. of Yamdi village, on N.E. side of Sarangkot Hill, *c.* 4 km. N.W. of Bogar, shortly N.W. of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *Rajendra Boruwal* (of Katunje) 25878-25881 (FN 1856-1859) 8.1.1998, BM, H; path in semi-open forest on W. facing slope, *c.* 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, *c.* 6 km. N. of Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c.* 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *c.* 1800 m., *C.R. Fraser-Jenkins*, with *J.B. Pariyar* 26157 (FN 2135), 13.3.1998, BM, H], **Tanahun** [among boulders by stream in forest on W. side of Khane khola valley, between Dumrekharkha village and W. part of Chimkeshwori Darrah (mountain), S. of Khanekhola village, *c.* 3 km. W. of Anbu

Khaireni, W. of Mugling on Damauli and Pokhara road, Tanahun District, *C.R. Fraser-Jenkins* 28638 (FN 4613), 7.10.2000, BM, H], **Dhading** [rocks in forested stream gulley above track around mountain on N.W. side of Jamachok mountain, in from Gate no. 2 at Mureko, Nagarjun Forest, beyond N.W. side of Kathmandu Valley, off road to Kakani and Trisuli Bazaar, Dhading District, *c.* 6000 ft., *C.R. Fraser-Jenkins* 15600, 31.10.1989, E], **Kathmandu** [10 miles S. Kathmandu valley, 5200 ft., *R.L. Fleming* 1708, 28.8.1963, MICH], **Bhaktapur** [forested rocky stream-gulley, *c.* 1 km. S.E. of Sankhu on the N.W. slope of the ridge between Changu Narayan temple and Nagarkot, just W. of Gausuli and Salamutar villages, N.N.E. of Bhaktapur, E.N.E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins*, with *Ramchandre* ["*Ganesh*"] *Pariyar et al.* 25257 (FN 1236), 15.2.1997, H].

E: **Sunsari** [Churibas - Sanguri - Dharapani - Leuti, on open place, 1200-400 m., *T.K. Bhattacharya* & *H.K. Sainju* 75/2751, 30.1.1975, KATH], **Taplejung** ["Khebang (1700 m.) - below Siling Tzokupa (2100 m.), *H. Hara, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305144, 20.11.1963, TI", reported by Iwatsuki (1988), but not seen by us].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; ?Uttarakhand. N.E. India; Thailand; S.E. Asia; Taiwan; Philippines.

(M, Sc). A scattered, local, and rather uncommon, low to mid altitude species, occurring on banks and lightly forested slopes in semi-open areas.

Nepalese threatened status: **LC**.

191. ***Pteris puberula*** Ching (syn.: *P. nepalensis* H.Itô).

A medium-sized (fronds *c.* 30-50 cm. tall) compound *Pteris* species, plant growing in clumps in semi-open places, with entirely Winter-deciduous fronds, unusual in the genus; stipes smooth, green-stramineous, to dark-brown, or black later in the season, the rachis is not zig-zag, as stated by Ghosh *et al.* (2004), lamina thin herbaceous and fragile, usually pale yellowish green, short, usually equally wide as long, with 2 - 4+ pairs of pinnae, the lowest bearing a long developed accessory basal basicopic pinnule, ultimate segments cut almost to the costa, entire to almost slightly subapiculate at their apices, their midribs without setae, lateral veinlets usually forked, bearing small glands beneath; sori with the paseudoindusia not quite reaching the segment-apex. Cytotype diploid sexual (Verma in Mehra 1961) and in Bir & Verma (2010), though this result, obtained from several collections, is hidden there as for a number of other species, as Bir did not add the necessary taxonomic clarifying note that "*P. laxa*" S.C.Verma, *nom. nud.*, and "*P. tongluensis*" S.C.Verma, *nom. nud.*, refer to *P. puberula* (as does his "*P. excelsa"* no. 218, K), long before redetermined by CRFJ at PAN, K. A count of triploid apomict by T.G. Walker on a typical plant, *CRFJ* 23429 (FN 1334), 26.11.1995, from Sukhia Pokhari to Ghoom, Darjeeling, must have been made on a contaminant sporeling among the progeny.

Nepal:

W: **Jajarkot** [between Paulotbas/Patlibas and Ranga Chauthaka, south of Chakure Lekh, 9500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5543, 11.10.1952, BM, E].

C: **Parbat** [Ulleri, Kusma Distr., "W. Nepal", damp banks, 6000 ft., *Robert L. Fleming* 911, 20.12.1949, BM. MICH *sub* "*P. subquinata*" and "*P. longipinnula*" in error; Ulleri, Nayathanti, 2500 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/1817, 21.7.1974, KATH; Tikhedunga - Banathanti, Parbar Distr., *V.L. Gurung*, 14.10.1981, KATH], **Kaski** [Mardi khola, among shrubs, forming clumps, 9500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8475, 17.9.1954, BM, E; on calcareous cliff, forest from Bamboo Lodge down south to Sinuwa, and some from further down, via Chomrong to New Bridge, on way down from Annapurna Base Camp, Modi Khola Valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32596 (FN 241), 2-3.12.2006, TAIF], **Makawanpur** [Simbhanjyang, 48 mi. S.W. of Kathmandu, 8100 ft., *Dr. R.L. Fleming* 1413, 1417, 1732, 7.9.1957, 28.9.1963, KATH. MICH *sub* "*P. biaurita*", and "*P. quadriaurita*" in error], **Rasuwa** [Dumse to Chandanbari, Rasuwa Distr., forest edge along the track, 3000-3200 m., *V.L. Gurung*, *T.K. Rajbhandari* & *D.P. Joshi* 991/79, 17.9.1979, KATH], **Nuwakot** [Salme, Nuwakot, 1850 m., *N.P. Manandhar* 3254, 19.11.1979, KATH], **Kathmandu** [Sheopuri, Kathmandu valley, open sunny places, *c.* 7200 ft., *R.L. Fleming* 1584, 11.10.1958/28.11.1971, MICH *sub* "*P. quadriaurita*" in error; Bagdwar, Sheopuri, Kathmandu, 2570 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/782, 21.3.1975, KATH det. R. Shrestha 1976 as "*P. geminata*" in error], **Sindhupalchok** [C. Nepal, Kalingchok, Tingoang (3100 m.) - Khosori Khabre (1500 m.), *H. Kanai, Ch. Chuma* & *T. Nagano* 670031, 12.9.1970, KATH; Melamchi Gaon, 52 km. NE from Kathmandu, NW of village, 28° 00', 85° 30', S-facing slope, moist earth in woods, 2575-2730 m., *Rebecca Gay Troth* 110, 11.11.1971, MICH; Helambu [area], in woods, not dense undergrowth, moist, 8500-9000 ft., *Miss* [*R.*] *Gay* [*Troth*] [FN] A 12, 11.11.1971, KATH; C. Nepal, Mangen (3100 m.) - Khodang Danda (2500 m.), 852276, *H. Kanai, H. Hara* & *H. Ohba* 725932, 28.8.1972, BM, KATH; heavily grazed pasture N. of village Khumsang, 27° 58', 85° 30', 2900 m., *J.H. de Haas* 2098-A, 8.8.1974, BM; trailsides and open forest N.E. of Tarke Ghyang, 28° 00', 85° 33', very common on manmade pastureland, 3000-2600 m., around Take Ghyang, 2750 m., *J.H. de Haas* 2766-B, 16.9.1974, BM; Norbu Timur to Tarke Gyang, growing on the forest floor by the wayside, 11,600 ft., *V.L. Gurung* & *M. Gorkhali* 78/792, 78/794a, 23.10.1978, KATH], **Dolakha** [Thodung, Jiri, "E. Nepal", 10,000 ft., *R.L. Fleming* 1626, 1.9.1959, MICH; C. Nepal, Khare khola, Patale Pokhari (4000 m.) - a pass (4200 m.) - Phedi Kharka (2100 m.)/Koplang (2100 m.) - Khanigaon (1700 m.), 862276-862275, *H. Ohba, M. Wakabayashi, M. Suzuki* & *S. Akiyama* 8332028, 8351478, 8332097, 13/14.9.1983, BM; Patle Pokhari - Phedi Kharka, Dolakha District, on shady places, 3400 m., *K.R. Rajbhandari* 10217, 13.9.1983, KATH det. D.P. Joshi 11.7.2007 as "*P. aspericaulis*" in error; Jiri,

Dolakha, 2000-2500 m., *T. Nakaike* 3019, 3.10.1988, KATH], **Ramechap** [between Sivalaya and Bhandar, 1800-2500 m., *T. Nakaike* 3141, 3143, 6.10.1988, KATH].

E: **Solukhumbhu** [Tesinga à Namche Bazar, 3400 m., *A. Zimmermann* 1826, 23.10.1954, BM; steep roadside 500 m. N. of Jorsale, Khumbu region, 27° 47', 86° 43', half shade, 2800 m., *J.H. de Haas* 2945, 4.10.1974, BM; between Goen and Junbesi, Solukhumbu, 3200-2650 m., *T. Nakaike* 3234, 9.10.1988, KATH; near Junbesi, Solukhumbu, *c.* 2600 m., *T. Nakaike* 3384, 17.10.1988, KATH], **Sankhuwasabha** [Lamo Pokhari (2900 m.) - Chauke (2700 m.), 873272-872275, along path in open slope, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725460, 4.7.1972, BM, KATH; Upper Arun valley, in the shade of large boulders in a mixed woodland, *c.* 11,000 ft., *L.W. Beer* 10701, 10.11.1971, E, BM, det. J. Mike Mullin 1.1978 as "*P. biaurita*" in error; Basantapur - Chowki, Sankhuwasabha, very common clumping fern on open places or the edges of forest, 2500 m./2540 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955046/9955052, 3/13.8.1999, KATH; densely forested stream-gullies on N. side of Tinjure ridge, *c.* 2 km. S.E. of Mude Sansuri, *c.* 8 km. N.N.W. of Basantapur [in Terathum District] and 3 km. N.N.W. of Deurali [in Terathum District], S. of and above Poluwa khola, S.E. part of Sankhuwasabha District, *C.R. Fraser-Jenkins* 28856 (FN 4831), 24.3.2001, BM, H], **Dhankuta** [E. Nepal], **Tehrathum** [E. Nepal, Chauke (2700 m.) - Tinjure Phedi (2700 m.), 872272, along path on open slope, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725464, 6.7.1972, BM, KATH; Tute Deorali, Terhathum, [coordinates given for Jaljale Pokhari, Taplejung: 27° 28' 23", 87° 27' 82" [*sic*] - 27° 25' 00", 87° 27' 00" in error], a very common clumping fern on open places or the edges of forest, 2440 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955011, 13.8.1999, KATH; Tutedeorali Panchpokhari, [coordinates given for Jaljale Pokhari, Taplejung: 27° 28' 23", 87° 27' 82" [*sic*] - 27° 25' 00", 87° 27' 00"], a very common clumping fern on open places or edges of forest, 2600 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955043, 13.8.1999, KATH], **Ilam** [Hati Sar (2700 m.) - Minchin Dap (2800 m.), *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305145, 28.10.1963, TI, holotype of *P. nepalensis*, KYO, 6305147, A], **Panchtar** [East Nepal, Thakma Khola - Diorali Bhanjang - Bhandukay - Yamphodin, *H. Kanai, G. Murata* & *M. Togashi* 6305147, 17.11.1963, BM, K, KATH], **Taplejung** [E. Nepal, N. of Milkedanda/Milkedanda ridge, under Rhododendron trees, 8000/10,400 ft., *R.L. Fleming* 2122, 2124, 28/27.11.1971, MICH/K *sub* "*P. quadriaurita*" in error; Taplejung Distr., *sin. loc.*, *R.L. Fleming* 1626, 2397, *sin.* date, KATH; E. Nepal, Topke Gola (3600 m) - Shewaden (2600 m.), 873274, on rather dry slope along path, *c.* 3200 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725305, 28.6.1972, KATH; E. Nepal, Shewaden (2600 m.) - Mewa khola (2100 m.), 873274, along path in light shade, *c.* 2300 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725337 *p.p.*, 29.6.1972, BM the specimen of this number in KATH is a young frond of *P. aspericaulis*; N.E. Nepal, Ghunsa khola, Amjilassa

to Kyapra, 27° 37', 87° 53', shady rocky banks, 2650 m., *S. Crawford, C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, M.N. Subedi* & *S. Zmarzty* KEKE 293, 6.9.1989, K; Simbua khola, between Tseram & Tarangdi, 27° 31', 87° 56', mixed Abies-Tsuga forest, 2960 m., *S. Crawford, C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, M.N. Subedi* & *S. Zmarzty* KEKE 812, 21.9.1989, K det. P.J. Edwards 5.12.1989 as "*P. subquinata*" in error, redet. CRFJ 5.1996 as *P. nepalensis*; Surke Danda, above Suketar, 27° 22', 87° 44', open woodland, 2400 m., *S. Crawford, C. Grey-Wilson, D.G. Long, R. McBeath, H.J. Noltie, M. Sinnott, M.N. Subedi* & *S. Zmarzty* KEKE 1159, 2.10.1989, K det. P.J. Edwards 5.12.1989 as "*P. subquinata*" in error; Taplejung, Koping, Milke Danda, 3050 m., *D.G. Long, R.J.D. McBeath, D.R. McKean, D.A.H. Rae* & *N.K. Bhattarai* 994, 23.10.1991, E; Kopinkharka - Gupha Pokhari, 3123 m., *H. Ikeda, D.R. Kandel, R. Chhetri, H. Uchiyama, K. Akai, H. Taneda, O. Yano, N. Yamamoto, K. Miyata* & *M. Nakaji* 1228051, 30.8.2012, KATH]. E. Nepal [Rimoo [?= Ringmo, Solukhumbhu], on ground, 9-10,000 ft., *Capt. Lall Dhwoj* 443, rec. 21.2.1931, BM].

Himalayan distribution: China; Tibet; Myanmar [Kachin, *P.K. Khine* & *G.* & *S. Miehe* 13-077-096, det. CRFJ]; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [Dwali, *Y.P.S. Pangtey* & *S.S. Samant*, Nainital Univ.; the reports by Punetha (1985) and Kholia & Punetha (1995) were in error for *P. subquinata* (redet. CRFJ 10.1996, at Govt. P.G. College, Pithoragarh)]. Thailand.

(S, C). A common upper-mid to higher altitude species in sunny places at the edges of forests, beside paths, often on damp slopes in open areas.

192. ***Pteris roseolilacina*** Hieron. This name is not a synonym of *P. aspericaulis* as stated by Liao *et al.* (2013) in the *Flora of China*, who ignored its detailed differentiation by Fraser-Jenkins & Walker in Fraser-Jenkins (2008). Its report from NC and NE India by Ghosh *et al.* (2004), mistakenly based on having a pink *versus* red stipe, was in error for *P. aspericaulis*, as shown by their specimens so misidentified in CAL and their illustration.

A small species (fronds up to *c.* 40 cm. tall, rarely becoming large (- 60 cm.) and then more coarsely lobed), of compound *Pteris* related to *P. aspericaulis*; stipe as long as the lamina, only slightly asperous, pink-mauve, or less commonly green, to stramineous (on drying), rachis and costae markedly pink (unless in occasional green-fronded individuals), lamina slightly crispaceous, with 3-6 (-8+) pairs of horizontal pinnae, not decreasing very much in length towards the abrupt, truncate-based pinna-like apex, which is often longer than the pinnae; the lowest pinna, or sometimes two pinnae with ± short developed compound basal basiscopic pinnules, pinna-apex with a short entire and unlobed terminal segment; ultimate segments small, rather abruptly rounded, apiculate-apexed but less prominently so than in *P. aspericaulis*, or subapiculate, the upper part of many of the segment-midribs bearing a group of three or four or more pairs of prominent, stiff, slightly thick, rich reddish-

purple, strongly erect setae, of which the uppermost pair has the setae displaced laterally on each side and arising from the middle of a lateral veinlet; sori with the pseudoindusia at the sides and not extending upwards to the rounded segment-apex. Cytotype triploid apomict, 2*n* = 87, prothalli apogamous, det. *T.G. Walker* from *CRFJ* 19476 (FN 361), 15.1.1993, from Nagarjun Forest, below and behind Jamachok, Dhading District, and also *ditto, A.C. Jermy* 20308; also from Sukhidank, Champawat, Uttarakhand, *CRFJ* 21884 E, F, K, L (FN 551 E, F, K, L), 28.12.1994, TAIF. It differs from *P. aspericaulis* in having fewer pinnae, and in its thick, reddish-purple, curiously laterally displaced upper setae, as well as in cytotype. The reports from Nepal by Walker (1962) of sexual diploids were misidentifications for *P. aspericaulis* and its report from Teesta Valley by Verma (in Mehra 1961) as sexual diploid was in error for *P. blumeana* J.Agardh (reidentified by Fraser-Jenkins 2008).

Nepal:

C: **Gorkha** [wooded slope and edge of path between Komale and the third stream-gully (khola) below Komale (not accessible from below), next to Balu Khola, 1 - 1½ km. below and S.W. of Komale, on path down to Markichowk (Marsyangdi) reservoir, W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 25107 (FN 1086), 30.12.1996, BM, H], **Dhading** [on small cliff, near forested stream gulley and adjacent rocks along lower path around back (N.W. side) of Jamachok mountain, Nagarjun Forest, in from Gate no. 2 by Mureko [Mudko], N.W. of Balaju, N.W. of Kathmandu, Dhading District, *c.* 1400 m., *C.R. Fraser-Jenkins* & *A.C. Jermy* 19476 (FN 361), 15.1.1993, TAIF; forested stream gullies on N.W. side of Jamachok Mountain, behind Mudko, *c.* 4 km. N.W. of Balaju, on road from Kathmandu (via Thamel) N.W. to Kakani and Trisuli Bazaar, Dhading District, *C.R. Fraser-Jenkins et al.* 24197 (FN 175), 25.7.1996, BM, H], **Kathmandu** [Raniban [Nagarjun], Kathmandu, 1420 m., *R.D. Thapa, S. Chhetri* & *R.P. Narahatta* R9-10, 4.10.2010, KATH, det. CRFJ].

Himalayan distribution: China; ?Sikkim; Myanmar; Darjeeling; Nepal; Uttarakhand [Kukrouli, Thal to Didihat, Pithoragarh, *Y.P.S. Pangtey*, sent to CRFJ 8.4.2002, det. CRFJ 5.2005; Sukhidank, Tanakpur, *CRFJ* 21884 E-L (FN 551 E-L), 28.12.1994, prothalli apogamous, det. T.G. Walker)]. Meghalaya [below Beadon Fall on N.W. side of polluted Wah Umkrah river, west side of Shillong town, Meghalaya, *CRFJ* & *Rajkumar K.C.* 27593 (FN 3570), 22.11.1998, BM, H). Its report from S. India by Dixit (1984) was erroneous and it was probably also reported from an incorrect basis from the E. Indo-Himalaya.

(S, R). A rare and local mid-altitude species, growing on sheltered steep banks of streams and paths in rather dense forest conditions.

Nepalese threatened status: **EN**.

193. ***Pteris scabririgens*** Fraser-Jenk., S.C.Verma & T.G.Walker (syn.: *P. rigida* S.C.Verma, *nom. nud.*, *non* Sw., *nec* Sodiro [from Ecuador]; misapplied names: "*P. scabristipes*"

sensu Ghosh *et al.* (2004), *non* Tagawa [from Taiwan and China]; misidentified from Darjeeling by Bir in Mehra & Bir (1964) as being *P. rigida* Sodiro, a quite unrelated S. American species (as found by Fraser-Jenkins (2008) rather than Lellinger, as stated by Thapa (2002)), and thence repeated by Dixit (1984) and Chandra (2000) without further study).

This medium-sized (fronds to *c.* 60 cm. tall) compound *Pteris* species is near to *P. aspericaulis*, with a narrow frond, a long apical "pinna" and apiculate ultimate segments, but the stipe is dark purple, often becoming blackish later, hard and very scabrous-asperous, with a tuft of linear, dark brown scales at the base, and the lamina is hard-coriaceous crispaceous, the lowest pinna with a developed basiscopic, compound pinnule, pinna-apices acute, ultimate segments slightly longer and narrower than in *P. normalis*, very acute-apexed and strongly apiculate and without setae on their midribs, unlike in *P. aspericaulis*; fronds bright pink when young, turning green.

Nepal:

E: **Sunsari** [Itahari, E. Nepal, 5500 ft., *R.L. Fleming* 2116, 18.12.1971, MICH *sub* "*P. subindivisa*" in error], **Jhapa** [banks and slopes at edge of forest, between Horkhoti and Kuttedara, N. of Charali and Bhudabare, on road to Ilam, N.E. of Birtamod and N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 26550 (FN 2528), 16.8.1998, H, KATH], **Ilam** [E. Nepal, Itabari/15 miles W. of Mechi, E. Nepal, damp banks, 4700-5000-5600 ft., *R.L. Fleming* 2115, 2116, 20.12.1971, K, MICH det. K.U. Kramer 1990 as "*P. scabripes*" [err. for *P. scabristipes*] in error].

Himalayan distribution: Tibet [Mönyül, Shakti, Nyam Jang Chu, 27° 38', 91° 46', on steep banks in dense shrub forest, 5500 ft., *F. Ludlow*, *G. Sherriff* & *G. Taylor* 6697, 14.11.1938, BM]; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India.

(S, C). A common (from E. Nepal eastwards) upper-mid altitude species of sheltered forested banks, slopes in semi-dense forest and semi-shaded path banks *etc*.

194. ***Pteris spinescens*** C.Presl (syn.: *P. setulosocostulata* Hayata [*teste* Holttum 1969], type of *P. spinescens* from the Philippines in PRC photographs kindly sent by L.B. Zhang and confirmed as representing the present species in 2014 by CRFJ]; misapplied name: "*P. khasiana*" *sensu* Ghosh *et al.* (2004), *non* (C.B.Clarke) Hieron.; "*P. setuloso-costulata*" *sensu* Ghosh *et al.* (2004); the name "*P. spinescens*" *sensu* Singh & Panigrahi (2005) referred to *P. khasiana*). Some of the Taiwanese and Philippine plants, including the type, may have slightly narrower and less crowded ultimate segments than the Himalayan and most of the Chinese plants, though otherwise and in most cases, exactly matching, but no doubt their cytology needs further investigation, currently hampered by the confusingly anomalous cytological findings concerning this *P. spinescens* and *P. medogensis*.

A large (fronds to *c.* 1 m. tall) and distinctive compound *Pteris*; stipe long, smooth,

axes often reddish, including the pinna-costa, but can also be green-stramineous; lamina usually erect, long, with many pairs of pinnae (*c.* 14 or more), the lowest pair of pinnae the longest, sometimes markedly so, and usually bearing at least two basiscopic developed pinnate pinnules, often 3 and in some specimens 4, exceptionally also on the acroscopic side, ultimate segments slightly narrow and longish, rounded at the apex and non-apiculate, bearing many opposite pairs of rather long, semi-erect, stiff, red or (in green-axised fronds) white setae above their midribs, from shortly above the base to shortly below the apex of the segment, or sometimes only subapically, with short stumps below that; sori with pseudoindusia at the sides, not reaching the segment apex. Cytotype diploid apomict, det T.G. Walker from voucher-specimen, Vajra Hall, Gangtok, Sikkim, *CRFJ* 20314 (FN 563), 19.12.1993, TAIF; also triploid apomict, det. S.C. Verma (*sub* "*Pteris sikkimensis*" and "*Pteris himalayensis* forma â" S.C.Verma, *nom. nud.*) from voucher-specimens, Ging, Darjeeling, *S.C. Verma* 708, 23.7.1957, PAN 1468, 3857, 72, K; Gangtok - Dikchu, Sikkim, *S.C. Verma s.n.*, 7.1958, PAN 2899, 2900, and Lebong, Darjeeling, *S.C. Verma* 703, PAN 3861, 3862; and triploid apomict, det. Mitui (1966) from Yakushima, S. Japan).

All the above cytological vouchers, seen by CRFJ, have three or more pairs of developed basal basiscopic pinnules on each lowest pinna, either side of the stipe/rachis, yet two different cytotypes have been reported and it is tempting to believe that Walker's anomalous counts might have been due to contaminant plants in the cultivated sporelings, though that might be too simplistic an explanation. It would be of great value to chromosome count more Indo-Himalayan plants of this group and check further, studying mitosis in root-apices.

Nepal:

C: **Kaski** [Mardi khola, in shade of forest, 6500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8434, 16.9.1954, BM det. A.H.G. Alston as "*P. aspericaulis*" in error; Dhampus, Pokhara, 1000-1500 m., *T. Nakaike* 3784, 10.11.1988, KATH; forest from just S. of and above Chomrong on path to New Bridge, on way down from Annapurna Base Camp, Modi Khola Valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32597 (FN 242), 2-3.12.2006, TAIF], **Kathmandu** [*c.* 7500 ft., dense forest by path on N.E. side of Sheopuri [Shivapuri] mountain, near Bagdwar temple, above and to N.W, of Nagi Gompa nunnery, N. of Buddhanilkantha and Kathmandu, Kathmandu District, *c.* 7500 ft, *C.R. Fraser-Jenkins* & *A. Clive Jermy* (British Museum (Natural History), London), with *Rajkumar K.C.* [*Khatri*] (Khatripakhar, Sanagaon) 19493 (FN 378), 16.1.1993, E], **Lalitpur** [stream ravine facing N.W. on south side of lower Phulchowki Dara [Danda, mountain], *c.* 1½ km. above and E. of Godawari, E.S.E. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins* 16171,13.3.1990, E, and *ditto*, 19694 (FN 579), 5.3.1993, E].

E: **Sankhuwasabha** [E. Nepal, above Shinbun (2100 m.) - Hatia Gola (1600 m.), *H. Ohashi, H. Kanai, H. Ohba* & *Y. Tateishi* 771976, 3.8.1977, BM *sub P. setuloso-*

costulata; Sukipatl forest, E. Nepal, 7000 ft., *H.M. Emery, E.W. Cronin, H.* & *A. Foster* & *K. Brooks* F016, 9.11.1973, KATH], **Ilam** [Ilam, Hanketam, in open glades, 8000 ft., *R.L. Fleming* 2520, 21.9.1978, KATH], **Taplejung** [Sanghu, Dhankuta Province, shady side of gulley below camp, 6000 ft., *A.H. Norkett* 8559 *p.p.* bottom and left specimens, 7.1.1962, BM].

Full distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. India; Taiwan; S. Japan; Philippines.

(S, C). A common upper-mid to higher altitude species, occurring on damp slopes in rather open forest or at the edge of forests beside paths *etc*.

195. ***Pteris stenophylla*** Wall. *ex* Hook. & Grev. (syn.: *P. cretica* var. *stenophylla* (Wall. *ex* Hook. & Grev.) Baker; *P. pellucida* var. *stenophylla* (Wall. *ex* Hook. & Grev.) C.B.Clarke; *P. digitata* Wall. *ex* C.Hope; *P. gracillima* Ching & S.K.Wu).

A medium-small (fronds to *c.* 50 cm. long) dactylate *Pteris* species, with few pinnae or segments; stipes crowded, stramineous, thin; lamina digitate with 3-5 segments, *c.* 0.5 to 0.8 cm. wide, *c.* 20 cm. long, margins entire in both sterile and fertile fronds, narrowed to an entire, acuminate point apically, never toothed as stated by Thapa (2003); fertile fronds usually taller and with narrower blades, the pseudoindusium long and uninterrupted, but not reaching the apex. Cytotype diploid sexual, Verma in Mehra (1961) from the W. Indo-Himalaya, sexual prothalli also confirmed by T.G. Walker in Nepalese and Uttarakhand collections of CRFJ (inc. Dhading, Nagarjun, *CRFJ* 19475, below, and Gini, Pithoragarh, *CRFJ* 21782 (FN 449), 27.11.1994, TAIF); a report by Punetha & Sen (1989) of an apomictic diploid was in error due to misidentification of *P. cretica* subsp. *cretica*.

Nepal:

C: **Myagdi** [Nepal Central, Mayangdi khola, damp forest, shady, 5000 ft., *G.* [& *S.*] *Miehe* A 122, 17.11977, BM], **Palpa** [Sisneri khola, "W. Nepal", on shady places, 900 m., *D.P. Joshi* & *M.M. Amatya* 73/970, 24.11.1973, KATH *sub* "*P. longifolia*" in error; Kaude Lekh, on open and rocky slope, 1500 m., *D.P. Joshi* & *M.M. Amatya* 74/1395, 3.3.1974, KATH, det. A.C. Jermy as "*P. cretica*" in error], **Parbat** [Gadi, [Paiyukot], Parbat Distr., 833283, on open slope, 1750 m., *D.P. Joshi* & *M.M. Amatya* 74/1528, 10.3.1974, KATH *sub* "*P. cretica*" in error, redet. V.L. Gurung 10.3.1975 as "*P. dactylina*" in error], **Tanahun** [steep path through dense forest down below the "Bungy-Jumping" bridge across Bhote Khosi river, below Listikot, E. of Palang village, N.W. side of Bhote Khosi river, *c.* 3 km. S.W. of Chaku, N. of Bharabise on road to Tatopani and Tibet, N.E. of Kathmandu, Sindhupalchok District, *c.* 1050 m., *C.R. Fraser-Jenkins* 28970 (FN 4945), 5.6.2001, H **Dhading** [forested stream gulley and adjacent rocks along lower path around back (N.W. side) of Jamachok mountain, Nagarjun Forest, in from Gate no. 2 by Mureko [Mudko], N.W. of Balaju, N.W. of Kathmandu, Dhading District, *c.* 1400 m., *C.R. Fraser-Jenkins* & *A.C. Jermy* 19475 (FN 360), 15.1.1993, E], **Kathmandu** [Balaji, Kathmandu valley,

4500 ft., *F.M. Bailey's collectors s.n*., 12.7.1935, BM; Chandragiri/Ropeway, 6000 ft. *R.L. Fleming* 1284, 28.8.1956, DD/MICH; Nagarjun, 5500 ft., *M.S. Bista* 8551, 2024.2.13 (Nepali date = 5.1967), KATH, det. C.V. Morton; Nagarjun, 5000 ft., *P.R. Shakya* 10, 2024.12.9 (Nepali date = 3.1968), KATH *sub* "*P. cretica*" in error, redet. V.L. Shrestha [= Gurung] 16.3.1968; Raniban [Nagarjun], Kathmandu, 1400 m., *Rita D. Thapa* R3-10, 27.06.2010, KATH], **Lalitpur** [above Godawari, at base of large rock on north-facing slope in Carpinus forest, 1550 m., *D.H. Nicolson* 3006, 22.3.1967, KATH; on far side of stream between quarry and the first sharp left-hand bend in the road, lower Phulchowki Darah, above and E. of Godawari, S.E. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *Prof. X.C. Zhang*, Academy of China Botanic Garden, Xiang Shan, Beijing, & *Rita D. Thapa*, Botany Dept., Tribhuvan Univ., Kathmandu, 34719, 11-12.2010, TAIF, PE, KATH], **Sindhupalchok**.

E. Thapa (2002) listed it from E. Nepal, though no collections were reported by Iwatsuki (1988) and we have not seen any specimens from there.

Himalayan distribution: Tibet; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. Reported from Bhutan by Liao *et al.* (2013) in error, and from Jammu & Kashmir by Khullar (1994) and thence Chandra (2000) in error for *P. cretica*. A similar plant from N.E. India to Laos differs in having small teeth at the segment apices and belongs to the distinct species, *P. pseudopellucida* Ching.

(S, Sc). A scattered and rather uncommon (in Nepal) mid- to upper-mid altitude species, growing in rock crevices in small cliffs, or at the bases of boulders in shaded conditions.

Nepalese threatened status: **NT**.

196. ***Pteris subindivisa*** C.B.Clarke (syn.: *P. quadriaurita* Retz. var. *subindivisa* (C.B.Clarke) Bedd.; *P. aspericaulis* var. *subindivisa* (C.B.Clarke) Ching *ex* S.H.Wu; *P. beddomei* Sarn.Singh & Panigrahi; *P. panigrahiana* Sarn.Singh (excluding drawing); *P. submiaoensis* Sarn.Singh & Panigrahi; *P. tirapensis* Panigrahi & Sarn.Singh). This species is well known in Indian literature (including Fraser-Jenkins 1997, 2008) to be a separate species and is not at all a variety of *P. aspericaulis* as regressively treated by Liao *et al*. (2013) in the *Flora of China*.

A small to small-medium sized (fronds to *c*. 30 cm. tall.) compound *Pteris* species related to the *P. aspericaulis* group with mucronate ultimate segments; stipe asperous, pinkish red, rarely stramineous, as long as the lamina; lamina somewhat crispaceous, pinnate to bipinnate, with a long imparipinnate apex, which sometimes constitutes most, or even all of the lamina; pinnae rarely absent, more usually varying from 1 short pair (*c*. 1-2 cm. long) to two or three pairs, sometimes four pairs of short to long (1 cm to 10 cm. long) pinnae; lowest pinnae usually without a basal basiscopic developed pinnule, but present in larger fronds that are over 20 cm. tall, usually short (to *c*. 4 or 5 cm. long) and curved towards the pinna-apex, but longer and straight in large fronds; ultimate segments often bearing one or two rather

insignificant stiff setae on their midribs, rather abruptly rounded at their apices, markedly apiculate. Cytotype triploid and presumed apomictic from the good, non-abortive spores (2*n* = *c.* 87, at mitosis in root-apices), det. S. Matsumoto, 2012 (Fraser-Jenkins & Matsumoto 2015, in press), from a voucher specimen from S.E. Bhutan, *c.* 7 km. N. of Samdrup Jongkhar, *CRFJ* 34180 (FN 266), 26.5.2009, THIM, TAIF).

Nepal:

E: **Jhapa** [Chulachuli region, [Ratuwa Mai khola, T.B. Shrestha pers. comm. 3.2015], deeply shaded place on vertical slope of gorge, growing on sandy soil, 1500 ft., *T.B. Shrestha* & *T.K. Bhattacharya* 72/73, 72/91, 22.9.1972, KATH, det. CRFJ 2014]. Thapa's (2002) report of it from Nepal was referring to *P. tibetica* discovered around Pokhara and Kathmandu by CRFJ.

Full distribution: China; Myanmar [Stilwell Road, *H. Young s.n.*, rains 1942, MICH; *S. Toppin* 4476, CAL]; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. Misreported from Uttarakhand by Pande (1992), Pande & Bir (1995) and thence Chandra (2000), in error for juvenile *P. terminalis* (redetermined by CRFJ at Kumaon Univ., Almora). Misreported from E. Nepal by Chandra (2000) in error for other species.

(S, R). A very rare (in Nepal) lower to lower-mid altitude species, growing among bushes on steep dry banks, or on small earth-cliffs, path banks *etc.* in open conditions.

197. ***Pteris subquinata*** Wall. *ex* J.Agardh (syn.: *P. quadriaurita* var. *subquinata* (Wall. *ex* J.Agardh) Bedd.; *P. monghaiensis* Ching *ex* K.H.Shing & S.H.Wu).

A small to small-medium (fronds to *c.* 30 cm. tall) compound *Pteris* species, with a thin, stramineous stipe, and short, somewhat rigid pale-green to bright-green fronds, lamina short, as wide as long, usually with one or two, sometimes three pairs of markedly opposite pinnae and with a similar imparipinnate frond-apex; the ultimate segments are rather narrow and long, cut down very nearly to the costa and are rounded at their apices, non-apiculate to subapiculate, and without setae; sori with long marginal pseudoindusia not extending to the apex. Cytotype diploid sexual from Sikkim, det. S.C. Verma in Mehra (1961), voucher-specimen checked in PAN. An attractive variegated form, cv. 'White Hooker' Fraser-Jenk. (diploid sexual, det. T.G. Walker, voucher-specimen from cliff 1 km. N.E. of Chungthang, N. Sikkim, *CRFJ* 23242 (FN 1149), 16.11.1995, TAIF), first collected by Hooker & Thomson at Chungtang, Sikkim, with a marked central white band to the pinnae, occurs fairly commonly mixed in the populations from Sikkim eastwards, and has sometimes been misreported as *P. tricolor* Linden in error. Unfortunately this species is extremely difficult to transplant and cultivate, even if removing a good piece of substrate with the plant *in situ*. Liao *et al*'s. (2013) frond-size of 90 cm. and forest dwelling habitat are not possible for this species.

Nepal:

W: **Darchula** [west-facing, mossy cliff-slopes overlooking and on east side of the village of Darchula, immediately E. of the Kali river (border with India), Darchula District, 860 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang, A. Magar Thapa* & *B. Pariyar* 21485 (FN 152), 16.11.1994, BM, H].

C: **Baglung** [Baglung, *R.L. Fleming* 900, in 1949, DD; Tityang V.D.C., on shady place, rock bank, 900 m., *Dr. D.K. Sharma* & *N. Thapa* 17/96, 4.11.1996, KATH], **Myagdi** [below Tatopani, Kali Gandaki valley, 83° 37', 28° 30', growing from dry conglomerate cliff, 4000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 5463, 29.5.1954, BM; Dana, Kali Gandaki, in wood, 5500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8266, 30.10.1954, BM; Mayangdi khola, Dhaulagiri S., 4700 m., *G.* & *S. Miehe* A 172, 29.1.1972, BM], **Mustang** [Lete, S. of Tukucha, Kali Gandaki, on rock, 7500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7705, 6.9.1954, BM], **Palpa** [Riri Bazaar, *R.L. Fleming* 934, 7.11.1949, DD], **Syangja** [steep, rocky, east-facing cliff-slope with a patch of dense forest on far (west) side of Andhi Khola river, *c.* 5 km. N. of Gallyang ["Golleng"], S. of Syangja, on road from Pokhara south to Butwal, Syangja District, *C.R. Fraser-Jenkins* 31043, 3.1.2005, H], **Parbat** [Ulleri, *R.L. Fleming* 911, DD], **Kaski** [Birethanti - Lamdwari, Kaski, 1180-1340 m., *V.L. Gurung* 1390/81, 20.6.1981, KATH; among rocks and below cliffs on both sides of river at N. entrance to Seti river gorge, below Mahendra Pul Power-house, N. part of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *L.B. Tamang* & *G.* [*R.*] *Pariyar* 25844, 25845 (FN 1822, 1823), 5.1.1998, BM, H], **Tanahun** [among rocks by Khane Khola stream, near junction of its main southern and eastern tributaries, N.W. side of Chimkeshwori Darrah mountain, S. of and above Khane Khola village, *c.* 3 km. W. of Anbu Khaireni, S. of Marsyangdi river, between Mugling and Damauli, Tanahun District, *c.* 1000 m., *C.R. Fraser-Jenkins* 28538 (FN 4513), 20.5.2000, H], **Lamjung** [Marsyangdi valley, between Thonje and Jagat, on stony shady places, *T. Wraber* 569, 31.10.1969, K, BM det. K.U. Kramer 1991 as "*P. nepalensis*" in error], **Gorkha** [near by Philim, Gorkha, *c.* 1500 m., *S.H. Bhattarai* 955, 15.6.2012, KATH], **Chitawan** [damp, rocky sides of small stream-gully at Lambola Khola, *c.* ½ km. S. of Belbas (Satara Kilo) village, 18 km. S. of Mugling on road to Narayanghat, S.W. of Kathmandu, Chitawan District, 350 m., *C.R. Fraser-Jenkins* 28398 (FN 4373), 20.1.2000, H], **Dhading** [Ganesh Himal, Ankhu khola, 28° 12', 85° 05', beneath rocks, 6500 ft., *J.D.A. Stainton* 3730, 16.5.1962, BM; forested rocks and slopes beside path, *c.* 1 km. in from 2nd gate, Nagarjun Forest behind and to N.W. of Jamachok mountain, *c.* 3 km. N.W. of Balaju, *c.* 6 km. N.W. of Kathmandu on road to Trisuli Bazaar, Dhading District, *C.R. Fraser-Jenkins* 30976, 13.12.2004, TAIF], **Kathmandu** [the cut, Chobar, Bagmati Gorge, 4800 ft., *R.L. Fleming* 1261, 22.8.1956, KATH, DD; Chobar, in cracks around rocks in sunny exposed site by footbridge, 1371 m., *Ropindra Pradhan* & *B.F.C. Sennitt* 71316, 31.10.1971, KATH; Chobar, on shaded rocks in gorge at South end, 1371 m., *B.F.C. Sennitt* 71372a, 13.11.1971, KATH], **Sindhupalchok** [steep path through dense forest down below the "Bungy-Jumping"

bridge across Bhote Khosi river, below Listikot, E. of Palang village, N.W. side of Bhote Khosi river, *c.* 3 km. S.W. of Chaku, N. of Bharabise on road to Tatopani and Tibet, N.E. of Kathmandu, Sindhupalchok District, *c.* 1050 m., *C.R. Fraser-Jenkins* 28972 (FN 4947), 5.6.2001, H], **Dolakha** [Totalabari, Dolakha, *N.P. Manandhar* & *M.K. Adhikari* 1456, 16.5.1979, KATH; Suri Dovan, Suri-8, 1140 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121123, 9.11.2012, KATH; between Jiri and Sivalaya, Janakpur Zone, 2000-1800 m., *T. Nakaike* 3087, 5.10.1988, KATH].

E: **Taplejung** [East Nepal, Khebang - below Siling Tzokupa, *H. Hara, H. Kanai, S. Kurosawa, G. Murata* & *M. Togashi* 6305163, 20.11.1963, BM, K, KATH, CAL; Gyepla Raniban, 2775 m., *Liba Pejchar* 38, 22.4.1996, KATH *sub* "*P. quadricurita* [*sic*]" det. D. Yami Tuladhar, and "*P. aspericaulis*" det. N. Thapa, in error; Gonging - Tawa, Taplejung, on rainfed rocks, 1750 m., *Naresh Thapa* T54, *sin.* date, KATH].

Full distribution: China; Myanmar; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. Thailand.

(S, Sc). A rather scattered lithophytic species confined to crevices in calcareous cliffs, or at the bases of calcareous boulders or rarely path-banks, usually in rather dry, semi-shaded areas.

198. ***Pteris terminalis*** Wall. *ex* J.Agardh (syn.: *P. excelsa* Gaudich. (1829), *non* Blume (1828) [= *Pteridium revolutum* Blume], the date of Gaudichaud-Beaupré's publication of *P. excelsa* was given incorrectly as 1827 in the main text of Christensen's *Index Filicum*; *P. inaequalis* Baker var. *aequata* (Miq.) Tagawa; *P. torricelliana* Christ; *P. excelsissima* Hayata; *Pteris excelsa* var. *rotunda* ["*rotundus*"] P.C.Pande & H.C.Pande, a semi juvenile, small, sterile specimen from an individual with correspondingly laxer and less acute pinnules). Previously known as *P. excelsa*, the name *P. terminalis* was found to be the correct name by Fraser-Jenkins (2008) after W. Greuter (pers. comm. 2005) kindly pointed out to him the date error concerning publication of *P. excelsa* Gaudich.

A very large (fronds to *c.* 1.5 m. tall and 50 cm. wide) compound *Pteris* species; rhizomes forming clumps or stands of many fronds; stipe robust, purplish-brown, glabrous and glossy, as long as the lamina; lamina elongated triangular-lanceolate, imparipinnate with a large apical "pinna" wider than the other pinnae and the smaller uppermost lateral pinna often "semipinnate" (*i.e.* only bearing basiscopic pinnules, the acroscopic side an unlobed wing), mid- to yellow-green (when exposed); pinnae and frond-apex terminating in a shortish, narrow apical segment, lowest pinna with a large basal basiscopic developed and pinnate accessory pinnule, ultimate segments borne on both sides of the pinna, the interpinnular sinus reaching the pinna-costa, veins free, pinnule-bases slightly decurrent so as to become contiguous, rest of the pinnule distant from the adjacent one except in sterile fronds, long (to *c.* 5 cm.) markedly acute, toothed towards their apices; sori marginal with a long

pseudoindusium running up from the pinna-costa and ending below the toothed segment-apex. Cytotype diploid sexual (Verma in Mehra (1961) *etc.*), reports of triploids by Liao *et al.* (2013) refer to *P. inaequalis*. Small juvenile plants of *P. terminalis* may have "semipinnate" mid to upper pinnae and have been confused with *P. semipinnata* (e.g. by Thapa 2002).

Nepal:

W: **Darchula** [W. facing forested rocks below cliffs by path, *c*. 2 km. N. of Dumling (opposite Jipti on the Indian side), on path south to Darchula, E. side of Kali river, Darchula District, *c*. 1800 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang*, *A. Magar Thapa* & *B. Pariyar* 21695 (FN 362), 22.11.1994, E; Darchula, Dhanbora to Khayakot, Ghunsa V.D.C., 1735-2066 m., *H. Ikeda*, *S. Noshiro*, *K. Yonekura*, *K. Akai*, *O. Yano*, *N. Yamamoto*, *C.A. Pendry*, *A. Elliott*, *G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216039, 11.7.2012, KATH]; **Doti** [above Jhigrarana, way to Khaptad, Doti District, 2100 m., *M.L. Pathak*, *D.R. Luitel* & *K.R. Bhattarai* 2012135, 31.3.2012, KATH].

C: **Baglung** [nr. Lumsum, moist place beneath ravine boulder, 7000 ft., *J.D.A. Stainton*, *W.R. Sykes* & *L.H.J. Williams* 4279, 7.9.1954, BM, det. A.H.G. Alston as *P. terminalis*], **Myagdi** [Thulo khola, Dhaulagiri I, S. face, 8000 ft., *G.* & *S. Miehe* A 74, 5.1.1977, BM], **Parbat** [dense forest by streams and stream gorge, between Banthanthi and Nangethanthi, above Ulleri on way up to Ghorepani, N. of Birethanthi, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c*. 2200-2700 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang*, *Keshab Pariyar* ["*Nepali*"] & *Philip McCormack* 34516 (FN 21), 13.6.2010, TAIF], **Kaski** [densely forested path N. of Sinuwa on way to Bamboo Lodge, N. of Chomrong, on way to Annapurna Base Camp, Kaski District, *C.R. Fraser-Jenkins*, with *G.B. Tamang* 32386 (FN 33), 29.11.2006, TAIF], **Gorkha** [Lukuwa, 28° 30', 84° 48', versant N-NW, 2200 m., *J.F. Dobremez* 720, 18.12.1970, BM, KATH], **Makawanpur** [Simbhanjyang, 8100 ft., *Dr. R.L. Fleming* 1417, 7.9.1957, KATH, sterile, juvenile specimen], **Rasuwa** [C. Nepal, Dunche (2000 m.) - Trisuli khola (1900 m.), 852281, *H. Kanai*, *H. Hara* & *H. Ohba* 725906, 22.8. 1972, BM, KATH; forest on S. side of valley to east of Trisuli Khola river, *c*. 3-4 km. above and E. of Dhunche, W. of and below Gossainkund, N. of Trisuli Bazaar off road to Langtang, N. of Kathmandu, Rasuwa District, *C.R. Fraser-Jenkins* 15656, 9.11.1989, E, and *ditto*, 21218 (FN 1466), 13.6.1994, E; way to Dhunche to Chandanbari, moist & shady place, 2200 m., *K.R. Bhattarai* 76, 25.7.1992, KATH], **Lalitpur** [Godaveri valley, Kathmandu valley, along stream, 4800 ft., *R.L. Fleming* 1497, 15.8.1958, MICH; on the bank of road, south of Coronation pond, Royal Botanic Garden, Lalitpur, Godawari, 1550 m., *N. Thapa* 158, 2.3.1999, KATH, published by Thapa (2001) as "*P. semipinnata*" in error, redet. CRFJ as semijuvenile "*P. excelsa*", *i.e. P. terminalis*, fully grown plants and intermediate sizes also present at the locality], **Bhaktapur** [Surjabinayak, near stream, 5200 ft., *Dr. R.L. Fleming* 1466, 10.9.1957, KATH].

E: **Taplejung** [E. Nepal, Shewaden (2600 m.) - Mewa khola (2100 m.), 873274, along path in forest, *c.* 2500 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725339, 29.6.1972, BM, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan. Taiwan; S.E. Asia; Pacific Islands.

(S, C). A fairly common upper-mid to higher altitude species growing in forest on moist, sheltered and well-shaded slopes, usually near small streams.

199. ***Pteris tibetica*** Ching (misapplied name: "*P. subindivisa*" *sensu* Thapa (2002), *non* C.B.Clarke). Misplaced by Liao *et al.* (2013) in the *Flora of China* as if a synonym of *P. subindivisa* ignoring the study and illustrations of it by Fraser-Jenkins (2008) and Fraser-Jenkins & Benniamin (2010), now also confirmed cytologically as distinct from *P. subindivisa*.

A small (fronds to *c.* 40 cm. tall) compound *Pteris* species similar to *P. subindivisa* and usually without basal basiscopic developed pinnules, or only with small ones in larger fronds; stipe green to stramineous, not pink, slightly asperous, as long as or longer than the lamina; lamina herbaceous, mid- to pale green, bipinnatifid with 2-5 pairs of pinnae, imparipinnate with the terminal "pinna" longer and slightly wider than the lateral pinnae; pinnae usually without basal developed pinnules, but a short basal basiscopic developed pinnatifid pinules present on each basal pinna of a pair in larger fronds, pinnae deeply pinnatifidly lobed with the sinus between pinna-lobes not quite reaching the costa, pinna-apex narrowly attenuated, lobes crowded, gradually tapering to longish, usually narrowly rounded-pointed, subapiculate to weakly apiculate apices, occasionally with one or two pale setae above the segment-midribs; sori marginal with the pseudoindusium almost reaching the segment-apex; spores good, mostly non-abortive, large. Cytotype diploid (from mitosis in root-apices), det. S. Matsumoto, 2013, from a voucher-specimen from Nagarjun forest, behind Jamachok, Dhading District, C. Nepal, *CRFJ* & *S. Pariyar* 34981 (FN 259), 4.11.2011 (Fraser-Jenkins & Matsumoto 2015, in press). This species is near to *P. subindivisa*, but with a smoother, pale stipe and rachis and less stiff fronds, with less deeply cut pinnae and the pinna-lobes with narrower, less abruptly rounded and only weakly apiculate (mucronate) segment-apices.

Nepal:

C: **Kaski** [waterfall and forested khola in upper Chiso Khola, S. of Yamdi Khola, S.W. of Yamdi village, on N.E. side of Sarangkot Hill, *c.* 4 km. N.W. of Bogar, shortly N.W. of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *Rajendra Boruwal* 25882-25885 (FN 1860-1863), 8.1.1998, BM, H; N. facing, lightly wooded slope above Kali Khola on S. side, *c.* ½ km. up-steam from Surjenagar village, S.E. of Mahendra Goufer Cave, *c.* 5 km. N. of Mahendrapul, N. of Pokhara, Kaski District, *C.R. Fraser-Jenkins* 26071-26073 (FN 2049-2051), 24.2.1998, BM, H;

path through woods on S. side of bend of Madi Khola, below and N. of Kalikasthan, on way to Madibesi and Chitre, N. of Begnas Tal, E. of Pokhara on path to Sikles, S.E. side of Annapurna range, Kaski District, *C.R. Fraser-Jenkins* & *Ganesh B. Tamang* 26278, 26279 (FN 2256, 2257), 13.4.1998, BM, H], **Dhading** [Raniban forest, by second stream along path from Gate no. 2, at back (N. side) of Jamachok mountain, N.W. of Balaju, N.W. side of Kathmandu, Dhading District, *C.R. Fraser-Jenkins*, with *Jeet Bhdr. Pariyar* 26246, 26247 (FN 2224, 2225), 24.3.1998, BM, H], **Kathmandu** [sandy, steep slopes in primary mixed forest between Gokarna Forest Lodge Hotel and Ban Devi Mandir temple, E. side of Gokarna Forest Lodge, Gokarna Forest, *c.* 4-5 km. N.E. of Jorpati, N.E. of Kathmandu off road to Sankhu, Kathmandu District, *C.R. Fraser-Jenkins*, with *Pirushottam Kuikel* (Lodge guide) 34207 (FN 10), 5.7.2009, TAIF], **Bhaktapur** [forested stream gully just above and behind temple at Surjebinayak, S.E. side of Bhaktapur, E. of Kathmandu, Bhaktapur District, *C.R. Fraser-Jenkins et al.* 24079, (FN 57), 16.7.1996, BM, H].

E: Reported by Fraser-Jenkins (2008) without specifying where, but we have seen no specimens during the present study and it is presumed here more likely to have been an error of memory.

Full distribution: Tibet; ?Sikkim; Nepal.

(S, R). A restricted and very local mid-altitude species, growing on steep banks beside paths among bushes in semi-forested, semi-open conditions.

Nepalese threatened status: **EN**. Only known from a few localities.

200. ***Pteris venusta*** Kunze subsp. ***matsudae*** (Masam.) Fraser-Jenk. & Kandel, ***comb. nov.*** (basionym: *Pteris matsudae* ["*matsudai*"] Masam., *Trans. Nat. Hist. Soc. Formosa* **25**(136-139): 12-13 (1935); syn.: *P. pseudoesquirolii* S.R.Ghosh; misapplied name: "*P. pellucida*" *sensu auct. plur. et* Fraser-Jenkins (2008), *non* C.Presl).

This taxon has usually been known as *P. pellucida*, but that name has sometimes been misinterpreted in India (notably by Holttum 1955, Ghosh *et al.* 2004 and Singh & Panigrahi (2005)) as being a plant having only simple pinnae and distal-marginal toothing, whereas the type specimen of *P. pellucida* actually has forked lowest pinnae on the sterile frond, simple on the fertile, and has absolutely entire, but rather strongly undulate distal margins. Because the characters of *P. pellucida* were mistaken, the name *P. venusta*, described from South India, has sometimes been used instead, but for the wrong reason. Fraser-Jenkins (2008) synonymised *P. venusta* within *P. pellucida* after studying both types, but pointed out that it is likely to represent a further critical complex.

Consequent further study by CRFJ of Philippine plants (at K, BM, MICH and UC) and discussion in 2014 with Dr. Michael Price in Michigan has brought out some other differences between *P. pellucida* and *P. venusta*, which though they are indeed closely related, show that they are not really conspecific. These are that Philippine

P. pellucida usually has darkened castaneous lower to mid stipes, and, as mentioned by Fraser-Jenkins (2008), the fertile fronds have a much reduced number of segments, often only three (as in the type), though there may be many more in some larger plants. *P. pellucida* is also strongly sterile-fertile dimorphic, with more spreading sterile fronds, usually having rather narrow segments, and has obviously taller fertile ones on long stipes, the fertile segments being considerably reduced in width and held more closely, nearly parallel. The Indian subcontinental plant, however, whether with all simple or forked pinnae, which is a variable feature, is hardly at all dimorphic apart from the later fertile fronds being larger and thus generally rather taller, and the segments are not, or hardly reduced in width, nor is the number of pinnae smaller, the pinnae remaining vertically separated from each other and spread out as in sterile fronds.

The Indian and Chinese plant is therefore now referred to *P. venusta* and not *P. pellucida*, but, as pointed out by Fraser-Jenkins (2008), it is very close, but not exactly the same as the commoner South Indian (and Javan) tetraploid cytotype, first discovered by Walker (1962) and again, with details, by Kuriachan (1967) whose Ph.D. photographs CRFJ has seen, but voucher-specimens lost at Trivandrum, which has rather wider, thicker and darker-green sterile-frond pinnae with more prominent lateral veins, as in the type material of *P. venusta*. The North Indian plant is diploid sexual, with generally narrower, paler-green sterile-frond pinnae and less raised veins. This similarly distinct diploid plant also occurs in S. India, but from morphology is the only plant occurring in the north, and appears to be the same as the Chinese and Taiwanese plant. The difference is subtle and rather minor, but is usually more-or-less recognisable, though the two are obviously very closely related. They are therefore treated here as subspecies. Subsp. *venusta* occurs in S. India and further S.E. Asia (at least Indonesia).

This is a larger (fronds to *c.* 60 cm. tall) dactylate *Pteris*; the general form is similar to the *P. cretica* assemblage, with stramineous axes, more spreading, often slightly wider-segmented sterile fronds and gradually taller, larger fertile fronds with longer segments, but the segments with totally entire margins, which may become slightly undulate near the apices, but never toothed; lamina pale to mid-green; lowest pinna simple (in which case all pinnae simple) or forked (as in Presl's type in PRC!), sometimes tripartite or more, and sometimes pinnae further up may bear one or two accessory pinnules at their bases; cytotype diploid sexual (from Darjeeling and S. India).

Nepal:

W: **Kailali** [Dhangari, far western Nepal, dry ravine, 800 ft., *R.L. Fleming* 1590, 12.1952, MICH], **Surkhet** [lowland mixed Sal (Shorea robusta) forest, on steep roadside slope above Kasputa and Army barracks, *c.* 5 km. above and north of Surkhet (Birendranagar) town, on Dailekh road, Surkhet District, *c.* 750 m., *C.R. Fraser-Jenkins* 35132 (FN 6), 22.9.2013, TAIF].

C: **Palpa** [stream-gulley above bridge at Dobhan, *c.* 3 miles N. of Butwal on road to Syangja and Pokhara, Palpa District, *c.* 350 m., *C.R. Fraser-Jenkins* 18015, 20.1.1991, E], **Tanahun** [forested stream among rice-fields, *c.* 2 km. above and S.W. of Chowti Bara Mandir, *c.* 8 km S. of Damauli, E. of Pokhara, W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins* 25492 (FN 1470), 18.8.1997, BM, H], **Lamjung** [Bhansar - Chambass, "842276" [apparently in error for 844283?], on moist and shady slope, 63-600 m., *D.P. Joshi* & *M.M. Amatya*, "collection of Manang" 73/179, 3.7.1973, KATH det. R. Shrestha as "*P. cretica*" in error], **Gorkha** [Wooded slope and edge of path between Komale and the third stream-gully (khola) below Komale (not accessible from below), next to Balu Khola, 1 - 1½ km. below and S.W. of Komale, on path down to Markichowk (Marsyangdi) reservoir, W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins* 25106 (FN 1085), 30.12.1996, H], **Chitawan** [Rapti Dun, 80 miles SW Kathmandu valley, 500 ft., *R.L. Fleming* 1739, 22.1.1966, MICH; Tiger Tops, Chitwan, 5-900 ft., *R.L. Fleming* 2338, 27.10.1976, MICH; N.E. face of Narayanghat, 700 ft., *V.L. Gurung, B. Roy* & *M. Basukala* 502/77, 3.1.1977, KATH; banks in woods around Chitwan Jungle Lodge, Chitwan National park, Sauraha, S.E. of Narayanghad, Chitawan District, Ramnagar, Chitwan District, *c.* 150 m., *C.D. Fraser Jenkins* & *C.R. Fraser-Jenkins* 15869, 25.11.1989, E; shady gullies in Sal forest, 400 m., *K. Wesche* 5/261, 6.1994, BM], **Makawanpur** [inter Het[auda] & B[him]pedy, *N. Wallich* List no. 96, 15.12.1820, K; Hetauda, Makawanpur Distr., *N. Thapa* M19, M26, 7/8.9.2000, KATH; densely sal-forested and rocky stream-gully on S. slope of first range of foothills beyond (N. of) the Churiya Ghats, above Liot village, Basmari, *c.* 5 km. W. of Hetauda, off Narayanghat road, Makawanpur District, *C.R. Fraser-Jenkins*, with *S.B. Sunchure, J.B. Pariyar et al.* 25768 (FN 1746), 24.10.1997, BM; rocky and grassy, steep sides of deep stream-gully, beneath Raigaon village-school, to S. of Raigaon, leading down into Bagmati River, on W. side of Bagmati River, *c.* 7 km. N. of Bagmati Bridge (on main E-W highway), E.N.E. of Chandranigarpur, S.E. of Hetauda, Makawanpur District, *C.R. Fraser-Jenkins, G.B. Tamang et al.* 25988 (FN 1966), 12.2.1998, BM, H], "**Lalitpur**" [Kathmandu valley, 4200 ft., *Dr. R.L. Fleming* 1590, 1-2.1954, KATH, a confused number and locality], **Sindhuli** [N. facing, forested rocky stream-gully on N. side of second main ridge of hills up from the plains, *c.* 6 km. S. of Sindhuli Madi, N. of Karkare, N. of Biman, *c.* 15 km. N. of Bardibas, E. of Hetauda off Janakpur road, Sindhuli District, *C.R. Fraser-Jenkins*, with *K. Neupane* 26020 (FN 1998), 12.2.1998, H]. The above specimen labelled "Kathmandu Valley, *R.L. Fleming* 1590, 1-2.1954", KATH, is undoubtedly incorrectly localised (label transposed), the adjacent numbers were all from 8000 ft. on Phulchowki Darrah, Lalitpur, 1.1954, which is far too high an altitude for this species in Nepal and only E. Himalayan specimens were listed by Stewart (1976 *ined.*), who included Fleming's collections.

E: **Udayapur** [Udayapur Distr., Simule (170 m.) Dhaplang (170 m.) - Adheri khola (200 m.) - Camp site *c.* 1 km. S. of Chamling, (185 m.), 26° 52' 23" - 56' 00", 86°

45' 50" - 49' 05", on shady pathside, 190 m., *M. Mikage, T. Kajita, F. Kiuchi, N. Kondo, P. Lacoul, M. Suzuki* & *K. Yonekura* 9558053, 25.10.1995, KATH], **Sunsari** [E. Nepal, south of Dharan (200m.), 872265, on dry bank in deciduous forest, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shrestha* 725023, 1.6.1972, BM, KATH; "Dharan, *I.M. Bhagat* & *S. Shrestha* 21, 8-10.2001, Post Graduate Campus, Tribhuvan Univ., Biratnagar, *sub* "*P. pellucida*" det. N. Thapa", cited by Bhagat & Shrestha (2010), not seen by us], **Jhapa** [steep slope in dense Bamboo stands above water-"tanks", on E. bank of Mechi Khola, *c*. ½ km. S. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32005, 32006, 5.1.2006, TAIF], **Ilam** [East Nepal, Ranga Pani - Chisa Pani - Loohya Mai - Ghorwa, *H. Hara, H. Kanai, S. Kurosawa, G. Murata* & *M. Togashi* 6305164, 9.12.1963, BM, KATH, CAL; N. Sunischari, Ilam, 750 ft., *R.L. Fleming* 2322, 9.10.1976, MICH; 3 mi. S. Gorhwa, forest floor near stream, 700 ft., *R.L. Fleming* 2471, 13.9.1978, KATH].

Himalayan distribution: China; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [below Nainital, *H.G. Champion*, DD; Chalthi to Sukhidang, *P.C. Pande* 521, 20.9.1989, Kumaon Univ., Almora; *ditto, H.C. Pande*, BSD, all conf. CRFJ]. N.E. India; Bangladesh; S. India; Thailand; Laos; S.E. Asia; Taiwan.

(M, Sc). A scattered, but not entirely uncommon low to mid-altitude subtropical species, growing on rather dry slopes in light forest areas, or among vegetation on or at the base path-banks, where it can often be surprisingly difficult to notice and has undoubtedly been much overlooked.

201. ***Pteris vittata*** L. subsp. ***vittata*** (syn.: *Polypodium trapezoides* Burm.f., *non* Sw.; *Pteris ensifolia* Poir.; *Pteris indica* Poir.; *P. diversifolia* Sw., *nom. superfl.*; *P. costata* Bory *ex* Willd.; *P. acuminatissima* Blume; *P. amplexicaulis* Roxb.; *P. linearis* Roxb., *non* Poir.; *Pteris longifolia* L. var. *vittata* (L.) C.Chr.; *P. vittata* L. subsp. *bengalensis* Fraser-Jenk., named before finding that the type in LINN is this subspecies; misapplied name: "*P. longifolia*" *sensu auct. Asiat., non* L. [from C. and S. America]). The very distinct subspecies of *P. vittata*, which are thought probably to have had different genomic origins, were partly discovered in India by Verma (in Mehra 1961) and in China by Wang (1989) and were then named and discussed in detail by Fraser-Jenkins (1997, 2008) with illustrations and cytological evidence from hybrids, but were entirely overlooked in the uncritical account of the species by Liao *et al.* (2013) in the *Flora of China*, who erroneously thought that *P. vittata* merely varies according to habitat. An interesting extreme, narrow plant of exaggerated subsp. *vittata*-like morphology occurs in New Guinea (*e.g.* Kaisenik, Morobe, *J.S. Womersley* & *A. Millar* 7865, 30.12.1955, BM), along with another, miniature, narrow related species, *P. zippelii* (Miq.) M.Kato & K.U.Kramer, but they have never been investigated cytologically.

The frond-dissection of this variably sized (fertile fronds from 10 cm., when

precociously fertile, to *c.* 1.7 m.) species along with several other similar secies from the Old and New World, does not fit the descriptions of dactylate or compound *Pteris*, though nearer the dactylate species in its unlobed segments. Fronds in this subspecies erect to arching, stipe short, with many rather dense, narrow pale scales; lamina simply pinnate with many alternate pinnae (up to *c.* 30 pairs), the pinnae variable in width (from *c.* 3 mm. to 1 cm.), well apart and upper ones drooping, decreasing gradually below to short rounded segments at the base; frond apex imparipinnate, suddenly reduced to an abrupt, usually longer, drooping terminal segment; some plants (in Uttarakhand; Nepal; Bhutan; N.E. India *etc.*) may have very narrow and long, distant pinnae, but are apparently not otherwise distinct. Cytotype tetraploid sexual. Very occasionally beautiful 'cristate' abnormalities have been found with tasselled pinna-apices, as in Assam (*S. Devi* in LWG) and Tripura (*Revd. W.J.L. Wenger* 336, K). Had these been preserved and propagated in cultivation they should be named as cultivars.

Nepal:

W: **Kanchanpur** [Kanchapur District, 4 miles NW of Mahendranagar, on steep bank of stream, 250 m., *D.H. Nicolson* 2858, 8.12.1966, KATH], **Darchula** [Lekam to Bitale, 740-874 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yano, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216007, 7.7.2012, KATH], **Kailali** [above Godawari [Mandir], Dhangadhi, W. Nepal, 700 m., *P.R. Sakya* & *D.P. Joshi* 359, 27.4.1971, KATH], **Surkhet** [Humre, Surkhet, on rocky hill slope, 780 m., *N.P. Manandhar* 103-91, 22.2.1991, KATH; Kalyan, Surket, on moist and shady place, 870 m., *N.P. Manadhar* 321-91, 24.2.1991, KATH; Chhinchu, Surkhet, semi-shade to open banks, 500 m., *Naresh Thapa* S9, 7.8.2001, KATH], **Banke** [Dewarali to Babar, Banke, on moist and shady slope, 750-340 m., *D.P. Joshi* & *L.R. Sharma* 1007/80, 3.12.1980, KATH, difficult specimen, wide, crowded pinnae], **Salyan** [Marma khola, in rock crevices beside river, 3000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 3775, 31.3.1952, BM], **Pyuthan** [Joghi, Tari, Puythan, on moist rock crevices, 650 m., *N.P. Manandhar* & *P.M. Regmi* 175, 5.3.1976, KATH].

C: **Myagdi** [Tatopani, S. of Dana, Kali Gandaki, amongst grass, 4500 ft., *J.D.A, Stainton, W.R. Sykes* & *L.H.J. Williams* 7666, 4.9.1954, BM], **Mustang** [Nepal Central, Kali Gandaki, near Gasa, S. facing slopes, 6300 ft., *G.* [& *S.*] *Miehe* 350, 11.7.1977, BM], **Palpa** [Dawonne danda, 834274, on moist & shady place, 400 m., *D.P. Joshi, I. Bajracharya* & *R. Kayastha* 75/3067 [?3667], 18.12.1975, KATH], **Palpa**/**Syangja** [Angahora, between Butwal and Pokhara, *c.* 650 m., *T. Nakaike* 3727, 9.11.1988, KATH], **Parbat** [Tribeni panchayat, Parbat District, open rocky place by the side of stream, 1000 ["9000"] m., *D.P. Joshi* & *M.M. Amatya* 74/1506, 9.3.1974, KATH, frond young, det. CRFJ 25.7.2014 as "?subsp. *emodi* - inadequate material", probably in error], **Kaski** [nr. Pokhara, by stone terrace walls, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2436, 13.4.1954, BM; Turanti khola,

in shade of forest, 2000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 6835, 9.8.1954, BM; near Lumli, W. of Pokhra, 4500 ft., *V. Puri* [with *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams*] 505, 19.5.1954, CAL; Pokhara to Suinkhet, C. Nepal, on rocky slope along the wayside, 1200 m., *V.L. Gurung* 1353/81, 18.6.1981, KATH], **Gorkha** [rocks by stream, near path shortly above and N.E. of Markichowk (Marsyangdi) reservoir-dam, on path up to Komale, below Deurali, W. of Anbu Khaireni, Gorkha District, *C.R. Fraser-Jenkins et al.* 25057 (FN 1036), 29.12.1996, H], **Chitawan** [north east face of Narayan Ghat, Distr. Chittaun, growing on shady & stony slope, 213.36 m., *Mrs. V.L. Gurung*, *B. Roy* & *Mrs. M. Basukala* 503, 3.1.1977, KATH; Rampur, Chitaun, on shady place, *N. Joshi* & *I. Shrestha* 333, 8.8.1992, KATH; Ramnagar, Chitwan District, shady gullies in Sal forest, 200 m., *K. Wesche* 2/62, 6.1994, BM], **Makawanpur** [west and south side of Brindaban Herbal Farm, Hetauda, profusely growing on the stony and shady cliff of Rapati river bank, 1800 ft., *Mrs. V.L. Gurung, Mr. B. Roy* & *Mrs. M. Basukala* 296/76, 24.12.1976, KATH; near Hetauda, Makawanpur, *c.* 450 m., *T. Nakaike* 3609, 3.11.1988, KATH; Choughada village, Hetauda-6, Makawanpur, on stony banks, 520 m., *Naresh Thapa s.n.*, 8.9.2000, KATH; stream in forest on N. side of Churiya Ghats ridge, N. of Bogaon ("Bogar") on path to Raigaon, N. of Bagmati Pul (bridge), on W. side of Bagmati river, N.E. of Chandranigarpur, E. of Hetauda, Makawanpur District,, *C.R. Fraser-Jenkins*, with *J.B. Pariyar, R. Boruwal, K.* [*U.*] *Pongali* ["*Chhetri*"] & *S.B. Sunchuri* [of Liot, Hetauda] 25735 (FN 1713), 22.10.1997, BM, and stream gully beneath Raigaon village school, *C.R. Fraser-Jenkins*, with *L.B. Tamang* (Raigaon) *et al*. 25986 (FN 1964), 12.2.1998, BM *sub* "subsp. *bengalensis*" redet. CRFJ 2012; Brindaban garden, Hetauda, Makwanpur, growing from rock crevices, 550 m., *N. Phuyal, S. Maharjan* & *K.K. Pokharel* 54, 15.6.2010, KATH; on the way to Manakamana temple, Hetauda, Makwanpur District, 650 m., *N. Phuyal, S. Maharjan* & *K.K. Pokharel* 70, 15.6.2010, KATH], **Parsa** [N. facing old wall of a wet field behind a building just E. of the Hotel Everest, off Beyarak Road, east part of Birganj city, Parsa District, *C.R. Fraser-Jenkins*, with *Satish Kumar Singh*, Varuna Travels, Thamel, 25784 (FN 1762), 4.11.1997, BM, H, KATH very narrow, well spaced pinnae], **Bara** [Pasahn, Bara, *c.* 150 m., *T. Nakaike* 3695, 7.11.1988, KATH; Bara Distr., north of Tinnambarpur, along Dudhaura khora [*i.e.* khola], 27° 19' 12", 85° 00' 21", on sunny rocky slope at riverside, 470-490 m., *M. Mikage, T. Kajita* & *K. Yonekura* 9552866, 11.10.1995, BM], **Rasuwa** [Betrabati, Rasuwa-Langtang, profusely met with on exposed and sunny places along the wayside, 715 m., *Mrs. V.L. Gurung* & party 77/583, 28.9.1977, KATH; Dhunche to Dumse Guard, 2000-3000 m., *V.L. Gurung* 881/79, 16.9.1979, KATH], **Dhading** [Mathilo Obang, Dhading Distr., shady place, 870 m., *N.P. Manandhar* 14178, 19.11.1989, KATH], **Kathmandu** [Thankot, 8 miles west of Katmandu, roadside, 6000 ft., *K. de B. Codrington* 197, in 1956, BM; Nagarjun, on open slope, 5500 ft., *Miss V.L. Shresth* [later Gurung], *Miss R. Thapa* & *Mrs. Prabha* 7227, 9.5.1969, KATH; on the bank of Shali river, on moist slope, 1360 m., *V.L. Shrestha s.n.*,

2028.1 (Nepali date = 4-5.1971), KATH; old brick-wall of house, *c*. ¼ km. S. of Maephi temple-hill, on footpath towards Naya Bazaar, N.W. side of Kathmandu City, Kathmandu District, *C.R. Fraser-Jenkins* 31896, 28.11.2005, TAIF; Chalnakhel, Kathmandu, moist and shady forest floor, *Rita D. Thapa* L5-09, 13.10.2009], **Sindhupalchok** [Tatopani, on the bank of the river, 3000 ft., *V.L. Shresth* [later *Gurung*] 8451, 21.2.1969, KATH long, narrow pinnae; Patibhanjyang to Talangmarang, growing on rocky slope, 7010-7800 ft., *V.L. Gurung* & *M. Gorkhali* 78/661, 22.10.1978, KATH], **Dolakha** [du monastère de Likanchou à Manga Deorali, 1500 m., *A. Zimmermann* 148, 2.4.1952, BM; Rekhuti, Dolkha, on moist and shady places, 970 m., *N.P. Manandhar* & *M.K. Adhikari* 1400, 15.5.1979, KATH].

E: **Udayapur** [de Balaute à Sukhchauri, 600 m., *A. Zimmermann* 2083, 6.11.1954, BM], **Khotang** [Udayapur & Khotang Distr., Camp site (185 m.) - Chamling (180 m.) - Ghumne (270 m.) - Rasuwa (220 m.) - Dihigaon (240 m.), 26° 56' 00" - 27° 00' 40", 86° 45' 04" - 54", on sunny steep slope by strea, 185 m., *M. Mikage, T. Kajita, F. Kiuchi, N. Kondo, P. Lacoul, M. Suzuki* & *K. Yonekura* 9558084, 26.10.1995, KATH], **Sankhuwasabha** [Tumlingtar, Sabbaya river, in hollow beneath sandy overhang on shore, 1800 ft., *A.H. Norkett* 8061, 14.12.1961, BM], **Sunsari** [Dharan Bazaar, Biratnagar, amongst scattered shrubs on dry hillside, 1250 ft., *J.D.A. Stainton* 23, 16.4.1956, BM; Kusha, Sunsari, in grassland, *P.R. Shakya, R. Manandhar* & *P. Shrestha* 11, 25.5.1993, KATH], **Morang** [Biratnagar, Morang, on Sisoo [forest] floor, 73 m., *N. Thapa* M15/97, 18.12.1997, KATH], **Dhankuta** [Dhankuta, E. Nepal, on the wet & shady place by the roadside, 400 m., *D.P. Joshi* 229, 11.10.1971, KATH], **Jhapa** [among Sal-trees in Kutte Dange wood, *c*. 1km. N. of Dhulabari, N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 29386 (FN 5361), 6.10.2001, BM, H det. CRFJ as "subsp. *emodi*" in error, redet. 2013], **Ilam** [Soktim, Ilam, *Mrs. Prabha Pradhan, Mrs. Rajani Shrestha* & *Mr. M.M. Amatya* 244/74, 10.6.1974, KATH].

Himalayan distribution of subsp. *vittata*: S.W. and S. China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh (less common); Jammu & Kashmir (rare); Pakistan (rare). W., N.E., C. and S. India; Bangladesh; Sri Lanka; Thailand; throughout S.E. Asia; Taiwan; Korea; S. Japan; N. Australia; New Guinea; Pacific Islands; Africa; Socotra; Arabia; S. Europe; Macaronesia; naturalised in the S.W. U.S.A.

(M, C). This subspecies is common at lower altitude, usually from low to mid altitude, in N., C. and S. India and in the subtropics of S.E. and E. Asia. It is semi-lithophytic, preferring old brick walls, roadside culverts *etc*., though also common on earth banks and roadsides, preferring open conditions in well drained places It has increased and spread considerably on dilapidated brick walls in Kathmandu city over the last three decades, due to increasing areas of urbanisation from migration into the city providing more habitats, though many plants die in the increasingly drier and colder Winters of recent years, but are soon replaced by volunteer sporelings

during the monsoon.

The very closely related indigenous C. and S. American plant is *P. vittata* subsp. *longifolia* (L.) Fraser-Jenk. & Pariyar, ***comb. nov.***, basionym: *Pteris longifolia* L., *Sp. Plant.* **2**: 1074 (1753) (syn.: *P. bahamensis* (J.Agardh) Fée, mistakenly reported to have been diploid and thus separated in error). In CRFJ's experience in the W. Indies, and also having cultivated it side-by-side, the articulated pinna-bases are not as obvious and distinct as they are usually said to be in Floras.

202. ***Pteris vittata*** L. subsp. ***emodi*** Fraser-Jenk. (misapplied names: "*P. longifolia*" *sensu* D.Don, *non* L. [from C. America]; "*P. vittata* subsp. *vittata*" *sensu* Fraser-Jenkins (1997), *non* (2008)). As this was the subspecies most familiar to Fraser-Jenkins (1997) it was thought to represent subsp. *vittata* until the wider distribution of real subsp. *vittata* and the identity of its type in London became known to him.

A widespread, large Himalayan taxon close to subsp. *vittata*, but with crowded, rather wide (usually *c.* 1 cm. wide) pinnae (up to *c.* 40 pairs) more gradually decreasing to a short or shortish (occasionally longer, mainly in sterile fronds) apical segment; mature and sterile fronds becoming more widely spreading to horizontal, or pendent on slopes; tetraploid sexual.

Nepal:

W: **Dadeldhura** [Jogbura - Mauri, Dadeldhura, on open place, 400 m., *K.R. Rajbhandari, P.M. Regmi* & *K.J. Malla* 5337, 14.8.1980, KATH frond apices folded under and hidden], **Darchula** [Paribagar (1171 m.) - Makarigad (1439 m.), *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yano, N. Yamomoto C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216021, 9.7.2012, KATH], **Bajhang** [Oathi - Chiltha/Tolimando, Bajang District, on vertical slope among shrubs, 1690-2120 m., *M.M. Amatya* & *P.M. Regmi* W 840/82, 12.9.1982, KATH; trail from Tameli to Chainpur on south side of River, Bajhang, 1130 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915042, 5.7.2009, KATH], **Bajura** [Majpali - Pategaon, Bajura, on shady slope, 2000 m., *K.R. Rajbhandari* 15061, 15.8.1991, KATH], **Surkhet**, **Jajarkot** [Dhaulakot, in open grass slope, 6000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5613, 13.10.1952, BM, tetraploid sexual, det. T.G. Walker (Walker (1962))], **Dang** [Purandhara, Dang, 650 m., *Keshav Shrestha* NHMTU-6B-00417, 11.3.2043 (Nepali date), TU Nat. Hist. Mus.].

C: **Baglung**, **Myagdi** [Ranipauwa, N. of Beni, on rocky bank, 3500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 603, 23.5.1954, BM; above Mayangdi khola, dry steep rocky slopes, 5500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4003, 26.8.1954, BM], **Palpa** [Sisneri khola, West Nepal, on shady & moist place, 900 m., *D.P. Joshi* & *M.M. Amatya* 73/971, 24.11.1973, KATH; Ribdikot, Palpa District, 1870 m., *D.P. Joshi* & *M.M. Amatya s.n.*, 26.11.1973, KATH], **Kaski** [Mardi khola, among shrubs, 4000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7199,

13.9.1954, BM; Tolkha (1850 m.) - Modi khola (1370 m.) - Ghandruk (1950 m.), 836283 - 835283, *H. Ohba*, *H. Kanai*, *M. Wakabayashi*, *M. Suzuki* & *S. Akiyama* 835089, 9.7.1983, BM, upper pinnae rather narrow], **Manang** [Lampata - Shyange, Manang, 841282, on open & moist place, 1220 m., *D.P. Joshi* & *M.M. Amatya* 73/325, 8.7.1973, KATH], **Parbat** [Sikha, Parbat District, on open slope, 1700 m., *D.P. Joshi* & *T.K. Bhattacharya* 74/1903, 23.71974, KATH poor stunted material], **Gorkha** [Gorkha Distr., Macha khola (850 m.) [- Kholabesi (890 m.) - Tatopani (930 m.) - Dovan (990 m) - Syaule Bhatti (1070 m.)], 28° 13' 51", 84° 52' 23" - 28° 18' 39", 84° 54' 10", along the river margin, grassy slope, 800 m., *M. Suzuki*, *N. Acharya*, *N. Fujii*, *L. Joshi*, *T. Kajita*, *N. Kondo*, *M. Mikage*, *S. Noshiro* & *K. Yoda* 9485098, 22.7.1994, KATH], **Rasuwa**, **Dhading** [steep road-bank *c*. 2 km. E. of Majhimtar, W. side of Krishna Bhir landslide, Dhading District, 385 m., type population, *Rita D. Thapa*, with *C.R. Fraser-Jenkins*, *G. Yatskievych*, *E.A. Hooper*, *J.P. Gajurel* & *G.B. Tamang* 09-68, 9.9.2009, KATH], **Kathmandu** [Swyambhu, on dry place, 4200 ft., *P.R. Shakya* 66, 2025.7.18 (Nepali date = 11.1968), KATH poor material, no base or apex; Nagarjun, on open place, 5000 ft., *Miss Ramola Thapa* [later *Rana*] & *Mrs. P. Pradhan* 7274, 2026.3.9 (Nepali date = 6.1969), KATH; Balaju garden, beside canal, 4500 ft., *Mr. T.B. Shrestha* & *Mr. M.S. Bista* 11006, 31.8.1969, CAL; Rajni Kunja, Gokarna, open place by the wayside, 4500 ft., *Ramola Rana* & *Vidya Laxmi Gurung* 12250, 15.8.1971, KATH; Nagarjung, 27° 45', 55° 19', wet places, 1500 m., *J.F. Dobremez* 888, 30.8.1971, KATH highly inadequate ecologists' material, no base or apex, identity uncertain], **Lalitpur** [along the stream, N.W. of ICIMOD, Godawari, Lalitpur, 1550 m., *N. Thapa*, *B.K. Basnet* & *H.R. Poudel* 145, 2.3.1999, KATH], **Dolakha** [Torikhet, Dolakha District, in shady place of subtropical forest along track, 950 m., *K.R. Rajbhandari* & *B. Roy* 1215, 12.7.1977, KATH difficult specimen with crowded wide pinnae but rather abrupt frond-apex with terminal segment broken, but longish, det. CRFJ 23.7.2014 as subsp. *vittata*, probably in error].

E: **Dhankuta** [Mohamabedi khola (400 m.) [- Tamur Bridge (300 m.)], 872266, along stream in open place, *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725047, 3.6.1972, BM det. CRFJ 2002 in BM as "subsp. *vittata*" from bottom half only, probably in error, KATH pinnae lax, det. CRFJ 25.7.2014 in KATH as "subsp. *vittata*" probably in error; Mulghat - Lenti, on dry rock in riverine forest, 400 m., *T.K. Bhattacharya* & *H.K. Sainju* 75/2812, 1.2.1975, KATH det. CRFJ 25.7.2014 as "a big subsp. *vittata*" in error].

Full distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir; Pakistan; Afghanistan.

(S, C). This is the commoner W. Indo-Himalayan taxon (initially more familiar to CRFJ than subsp. *vittata*), and throughout the Indo-Himalaya to S.W. China and N. Myanmar, with a wider altitude range (from low to upper-mid altitude), growing on moist open slopes, often hanging down from small ciffs near water-seepage, though

also occurring in drier conditions. It appears to be confined to the Himalayan region.

203. ***Pteris vittata*** L. subsp. ***vermae*** Fraser-Jenk. (syn.: *P. vittata* forma *brevipinna* S.C.Verma, *nom. nud.*).

This subspecies is closer in morphology to subsp. *emodi*, but differs from both the other subspecies by its rather smaller (to *c.* 60+ cm.), narrow, erect fronds, with obviously narrower, shortish, crowded pinnae, decreasing to a short apical segment, due to the narrower pinnae, the sori appear to be relatively wider when fully expanded and ripe; the spores were found by Verma (1964, *ined.*) to have only one central band in his material from Uttarakhand, instead of two in the other two subspecies. Cytotype diploid sexual (from Bujia Ghat, below Nainital, Verma in Mehra 1961; and several provinces of central China, Wang 1989). The Chinese and Indian plant are similar in morphology.

I appear to be seeing this subspecies scattered here and there and not so uncommonly throughout much of the Indo-Himalaya, including Nepal and several places in Uttarakhand. But without just one or two more chromosome squash-counts to confirm its identity for a first few specimens, it is not possible to be confident of its identity at this stage, as those populations might only rpresent subsp. *emodi* with narrow, crowded pinnae.

A number of population-collections deliberately made by CRFJ from Uttarakhand (Pithoragarh), quite commonly throughout Nepal (also by chance herbarium collections by others), and in Bhutan and Arunachal Pradesh match the type well, and after much study of the species throughout the Indo-Himalaya *etc*., these plants probably do not seem to be connected as variants to subsp. *emodi* and not normally to subsp. *vittata*. We have tentatively included them here below as being potential candidates for subsp. *vermae*. However it essential that at least two or three such plants showing the correct morphology are chromosome-counted and found to be diploid before they and others can be positively identified and excluded from merely being variant populations of subsp. *emodi*, or sometimes subsp. *vittata*, with narrower fronds and more and narrower pinnae than normal. So far no counts have been made or programme to do so and due to a preference for quick easy indicators from molecular work doubtfully applied, no more such essential work is being carried out in the region or in China. The situation therefore remains glaringly unresolved over the last 50 years, with most unlikely and unsupported hypotheses being put forward (Khare & Kaur 1983, Khare 1995) re possible extinction of diploids *etc.* whereas it is plainly evident that it is more the extinction of cytologists and taxonomists that is likely to be responsible for the embarrassing dearth of targetted research results in this group, as in so many other complex and critical fern genera.

Nepal:

W: **Bajhang** [between Dhargaon and Dilbagar, Bajhang District, in open thicket along the trail of cultivated zone, 1575 m., *Hideo Tabata*, *Keshab R. Rajbhandari*

& *Kazumi Tsuchiya* 1335, 17.7.1976, KATH], **Kalikot** [base of roadside cliff, *c*. 5 km. N.E. of Kalikot town (Manma), on rough road to Jumla, overlooking Tila River valley, Kalikot District, *C.R. Fraser-Jenkins* & *Sagun Pariyar* 35150, 24.9.2013, TAIF], **Dolpa** [Ila, Bheri river, on bank of irrigation channel, 6000 ft., *O. Polunin*, *W.R. Sykes* & *L.H.J. Williams* 3274, 8.9.1952, BM].

C: **Myagdi** [Myagdi Distr., Jugepani (Naura, 1470 m.) - Dhola khola (1420 m.) - Muri (1820 m.) - below Dhar (1800 m.), 83° 19' - 22', 28° 30' - 32', in sunny grassland, 1740 m., *M. Mikage*, *R. Hirano*, *A. Takahashi* & *K. Yonekura* 9682478, 13.9.1996, KATH], **Parbat**, **Kaski** [semi open light forest from New Bridge down south to Birethanti, on lower part of way down from Annapurna Base Camp, Modi Khola Valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32649 (FN 294), 3.12.2006, TAIF; open roadside bank between stones, just north of Birethanti, N. of Naya Pul, at start of route to Annapurna Base Camp, N. of Pokhara off Baglung road, Kaski District, *C.R. Fraser-Jenkins*, *Sagun Pariyar* & *Jacob Charles Bahadur Fraser-Jenkins* 35080 (FN 357), 6.6.2012, TAIF], **Tanahun** [rocky roadside bank, *c*. 1 km. E. of Anbu Khaireni, before waterfall above road, 5 km. W. of Mugling, Tanahun District, *C.R. Fraser-Jenkins*, with *G.B. Tamang, J.B. Pariyar et al*. 25970 (FN 1948), 23.1.1998, H; *ditto*, *CRFJ* & *Nirmala F-J*. 28587 (FN 4562), 1.8.2000, H], **Gorkha** [edges of wet rice-fields, *c*. ½ km. N.E. of Gopling, by path up to Deurali, N. of Marsyangdi dam, *c*. 5 km. W.N.W. of Anbu Khaireni, N. side of Marsyangdi river, between Mugling and Damauli, Gorkha District, *C.R. Fraser-Jenkins* 28610 (FN 4585), 20.8.2000, H], **Kathmandu** [Nagarjun, on dry place, 5000 ft., *P. Pradhan* & *S. Gurung* 8689, 2025,2.17 (Nepali date = 2. 1968), KATH; roadside bank behind Shanti Tole sports field and club, on N.W. side of base of hill, *c*. 1 km. N. of Sheshmati Pul bridge, Nepaltar, N.W. side of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* & *J.C.B. Fraser-Jenkins* no. to be assigned, 17.4.2015, KATH], **Lalitpur** [Godawari, S.E. of Katmandu, *K. de B. Codrington* 114, in 1956, BM, if not a long, narrow fronded and pinna'd subsp. *vittata*; Phulchoki, Gothe Hill, on sunny place, 6000 ft., *Miss Manandhar* 7362, 24.8.1969, KATH, if not subsp *emodi*], **Kabhrepalanchok** [growing on a wall a few km. S. of Tatopani, S. of Kodari and Tibet border, N. of Bungy-jumping bridge, N.E. of Banepa, Kavrepalanchok District, *c*. 1300 m., *C.R. Fraser-Jenkins* 34749 (FN 27), 12.7.2011, TAIF].

E: **Sankhuwasabha** [Tumlingtar, on shore of Sabhaye river, 1800 ft., *A.H. Norkett* 8056, 14.12.1961, BM], **Taplejung** [E. Nepal, Yamphodin - Ghatte, *H. Kanai*, *G. Murata* & *M. Togashi* 6305169, 18.11.1963, BM (inadequate semi-juvenile material), KATH (potential *vermae*), CAL (young frond, probably emodi), K (potential vermae)].

Full distribution: China; Tibet (Trulung, Pome, *Ludlow, Sherriff* & *Elliot* 12096, BM); Arunachal Pradesh; Bhutan; ?Sikkim; Nepal; Uttarakhand; ?Himachal Pradesh; Jammu & Kashmir (Kathua, between Sibdi Mandir and Kardor, N.E. of Bhund, *CRFJ* 18402, 23.8.1991, E).

(S, ?Sc to C). A less common, but not rare taxon (if correctly identified) occurring in populations at mid altitude, on open roadside banks, or open stony slopes among boulders *etc*.

204. ***Pteris wallichiana*** J.Agardh (syn.: *Campteria wallichiana* (J.Agardh) T.Moore; *Litobrochia wallichiana* (J.Agardh) Fée; *P. longipes* D.Don, [intended to be a *nom. rejic. prop.*]; lectotype: "Napalia - *Dr. Wallich* (1819)", BM, see above *sub P. pellucens*; *P. yunnanensis* Christ; *P. wallichiana* var. *yunnanensis* (Christ) Ching & S.H.Wu; *P. wallichiana* var. *magna* (Christ) Tagawa; *P. tomentella* Hand.-Mazz.; *P. morrisonicola* Hayata; *P. austrosinica* (Ching) Ching; *P. taiwanensis* Ching (*non sensu* Fraser-Jenkins & Benniamin (2010) [= *P. occidentalisinica* Ching]; *P. raghavendrae* ["*raghavendreii*"] H.J.Choudhery & Sur.Singh; *P.* x *khullarii* Pangtey, Samant & S.Verma, abnormal frond, not a hybrid as postulated, as spores good, partly immature, in a slightly more mature isotype part of the same frond at Nainital University herbarium; *P. rufopilosa* Ching & X.Y.Lin). The identity of "var. *obtusa*" S.H.Wu, listed by Laio *et al.* (2013) is unclear and it is not known if it is a distinct species or subspecies, or more likely part of the normal variation of the species. No "var. *wallichiana*" is recognised here.

A very large (fronds to *c.* 1.5 m. tall), highly distinctive and spectacular, robust compound, horizontally radiate fronded, umbrella-like *Pteris* species; stipe thick (to *c.* 2 cm.), erect, longer than the lamina, stramineous, becoming chestnut-brown later in the season, often bearing many small brown scales towards the base, most of the stipe at first glabrous or with few tiny (to *c.* 2 mm.) multicellular, stiff, rusty brown, crispaceous bristles, later some plants, especially those with the stipe turning brown, becoming densely clothed with bristles especially at the base, but they may extend up to the rachis and even rarely on veinlets beneath the lamina; lamina horizontal, arranged like an umbrella into 7 or more parts, from three main tripartite radiating pinnae and the nearly equally sized and dissected pinnules, each part bipinnatifidly dissect; ultimate lobes varying from adjacent to joined rather distantly at their bases, toothed with small, slightly blunt teeth around their rounded to narrowly rounded apices and with a single very shallow costal areole at their bases, formed by the basal opposite veinlets from each ultimate lobe anastomosing close to the costa; sori rather short, the pseudoindusium not reaching the lobe-apex. Cytotype diploid sexual (from Himachal Pradesh, Uttarakhand, Darjeeling, Nepal and Japan). The extraordinary crispaceous bristles that grow on the stipe later in the year in some specimens from Himachal Pradesh [Manali, Kulu Distr., 6500 ft., *E.*[*A.C.L.E.*] *Schelpe* 3646, 31.7.1952, BM], many from Uttarakhand [Gini, on road to Munsiyari, Pithorgarh, *c.* 2600 m., *C.R. Fraser-Jenkins* 34652 (FN 154), 19.11.2010, TAIF, intermediate] and very many from W. Nepal eastwards, while others lack such bristles or have very few of them, do not appear to indicate a different taxon despite their distinctive appearance, as all grades from absent to dense bristles occur without any other differentiating characters or range difference.

The undersurface of the lamina is also variable from glabrous to hairy. Liao *et al.* (2013) recognised the hairy-stiped plants as a var. *yunnanensis*, but it is more probably an inconstant form to be considered part of the normal morphology of the species, being fully connected by intermediates and developing in older fronds, and thus not to be recognised nomenclaturally. A spectacular and beautiful plumose-fronded abnormal plant of *P. wallichiana* was collected at Sonada, below Darjeeling by *C.B. Clarke* 9109, K, which is yet more extreme and dissect than the type of *P.* x *khullarii*.

Nepal:

W: **Darchula** [[Api] base camp to Khayakot, 3829-2021 m., *H. Ikeda, S. Noshiro, K. Yonekura, K. Akai, O. Yano, N. Yamomoto, C.A. Pendry, A. Elliott, G.D. Bhatt* ["*Bhatta*"] & *M.L. Pathak* 1216126, 19.7.2012, KATH], **Doti** [between Galsera and Napanpi, Doti District, south-west flank of Mahabharat Lekh, on moist shady place near the small stream, 1730 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 734, 28.6.1976, KATH; between Doti and Rhikula, Doti District, in and around the Aesculus indica mixed forest along the small stream, 2120 m., *H. Tabata, K.R. Rajbhandari* & *K. Tsuchiya* 996, 7.7.1976, KATH; Ghigrana, Doti entrance to Khaptad National Park, Doti District, 2268 m., H. Ikeda, *S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915012, 30.7.2009, KATH], **Bajhang** [Bajhang Distr., trail from Thalara to Budhori, Lekgaun V.D.C., 29° 34' 06", 81° 3' 7", S. facing hillside, at base of terrace, 2480 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915083, 11.7.2009, E], **Surkhet** [Kalyan, Surkhet, in moist ground in rocky land, 870 m., *N.P. Manandhar* 314-91 B, 24.2.1991, KATH], **Dailekh** [Bhama Saini, Dailekh,on moist and shady places, 2600 m., *T.B. Shrestha* & *N.P. Manandhar* 440, 25.10.1975, KATH], **Jajarkot** [Dhaulakot, in shady places on edge of forest and grassy glades, 7500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 502, 18.8.1952, BM, fairly hairy stipe-base, diploid sexual, det. T.G. Walker (Walker 1962); Ranga Chauthaka, south of Chakure Lekh, among boulders in the open, 8000 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5527, 11.10.1952, BM; Dhaulakot, ("Dolpa Distr" written in error by staff at KATH), on shady place, 2100 m., *K.R. Rajbhandari* & *B. Roy* 4622, 13.8.1979, KATH hairy stipe; Daluko, Jajarkot, on moist and shady place, 1200 m., *N.P. Manandhar* & *D.P. Joshi* 6333/81, 10.7.1981 smooth stipe].

C: **Myagdi** [nr. Gurjakhani, among tall herbs by stream in forest, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3666, 28.7.1954, BM; Thulo khola, Dhaulagiri I, south face, quite shady forests, even in clearings, 7900 ft., *G.* [& *S.*] *Miehe* A 73, 5.1.1977, BM; Myagdi Distr., [Chhau Khatka (3680 m.) - a peak (3860 m.) - Chhau Kharka (3680 m.) - a pass (3360 m.) - Tham Kharka (3160 m.) -] Ritu Kharka (2910 m.), 83° 13'-15', 28° 32', on semi-shaded forest margin, 2910 m., *M. Mikage, R. Hirano, A. Takahashi* & *K. Yonekura* 9682940, 20.9.1996, KATH stipe hairy], **Gulmi** [Lumpek, "W. Nepal", 7000 ft., *R.L. Fleming* 926, 9.11.1949, BM,

DD], **Palpa [**Ribdikot, on partly shady & moist place, 1850 m., *D.P. Joshi* & *M.M. Amatya* 73/1013, 26.11.1973, KATH stipe hairy], **Parbat**, **Kaski** [Mardi khola, among shrubs, 6000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8440, 16.9.1954, CAL, BM, diploid sexual, det. T.G. Walker (Walker 1962); Dhampus, Pokhara, 1000-1500 m., *T. Nakaike* 3770, 10.11.1988, KATH stipe hairy], **Lamjung** [Bahun Danda, Lamjung, on open place, 1330 m., *K.R. Rajbhandari* 9204, 9.8.1983, KATH], **Gorkha** [Gorkha Distr., Ekle Ghar (1620 m.) [-Sharyung (2000 m.) - Anga (2410 m.) - Lokpa (1900 m.) - Sardu khola (1800 m.), 28° 24' 35", 84° 53' 40" - 28° 26' 49", 84° 55' 56", open grassy place, 1600 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro* & *K. Yoda* 9485128, 25.7.1994, KATH], **Makawanpur** [Simbhanjyang, Makwanpur District, 2500 m., *N. Phuyal, S. Maharjan* & *K.K. Pokharel* 20, 12.6.2010, KATH], **Rasuwa** [Dunche, 28° 07', 85° 17', wet place, 2000 m., *J.F. Dobremez* 940, 4.9.1971, KATH; Bokejhunda to Dhunche, Distr. Rasuwa, on open rocky part of forest edge along the water canal, 1900-2000 m., *Mrs. V.L. Gurung* & party [*M. Gorkhali*] 77/641, 31.9.1977, KATH; Dumse to Chandanbari, Rasuwa, forest edges along the track, 3000-3200 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 935/79, 17.9.1979, KATH stipe smooth, brown; along path from Dhunche to Deorali, 2005 m., *Rita D. Thapa*, with *C.R. Fraser-Jenkins, G. Yatskievych, E.A. Hooper, J.P. Gajurel, G.B. Tamang* & *Sagun Pariyar* 09-93, 18.9.2009 [as "16.9.2009" in error], KATH], **Dhading**, **Nuwakot** [Kakani, 8 miles north west of Katmandu, 6000-7000 ft., *K. de B. Codrington* 290, in 1956, BM; Samre Bhanjyang, 27° 57', 85° 03', beneath trees, 4000 ft., *J.D.A. Stainton* 3817, 9.6.1962, BM, ultimate lobes rather distant, stipe-bases scaly; Satsae khola, 28° 00', 85° 10', forêt de Quercus lamellosa, 2400 m., *J.F. Dobremez* 605, 12.8.1970, BM, KATH], **Kathmandu** [Thankot, on semi-shade, 5500 ft., *P.R. Shakya* 75, 2025.8.1 (Nepali date - 11.1968), KATH; Nagarjong, north west, Kathmandu, *H. Kanai* 9886, 7.4.1969, KATH, and *ditto*, *H. Kanai* & *P.R. Sakya* 671674, 29.4.1970, KATH; Bagdwar (2500 m.) - pass (2400 m.) [- Phedigaon - Budhnilkantha], *H. Kanai* 670536, 31.12.1969, KATH], **Lalitpur** [Phulchowk, along path in shade, 6000 ft., *Dr. R.L. Fleming* 1385, 28.8.1957, KATH stipe smooth; C. Nepal, Phulchoki, south of Kathmandu, 852274, along path in open place, 2200-2700 m., *H. Hara, K. Iwatsuki, H. Ohba* & *Z. Iwatsuki* 725541, 15.7.1972, KATH], **Bhaktapur** [Bhangeri darbar, Nagarkot, on stone crevice along the wayside, 1900-2000 m., *V.L. Gurung, M.M. Amatya* & *R. Kayastha* 221/76, 22.9.1976 (Nepali date 2033.6.6), KATH; Mahadab danda, Nagarkot, on shady ground by the way side, 1900 m., *V.L. Gurung, M.M. Amatya* & *R. Kayastha* 262/76, 23.9.1976 (Nepali date 2033.6.7), KATH], **Sindhupalchok** [on way to Roll-khani/from Kalinchowk to Roll-khani, on shady places, 9800 ft., *S.B. Malla* & *S.B. Rajbhandari* 420, 13.10.1960 (Nepali date: 2017, 6.28), CAL, KATH det. B.S.I., Calcutta as "*P. excelsa*" in error; just S.W. of Bhrati, in stream gully with bushes, just below crest of mountains and facing west, *B.F.C. Sennitt* 71235, 19.10.1971, KATH stipe hairy; Helambu, forest edge in clear area, 8500 ft., *John* & *Naomi Bishop* BB7, 22.12.1971,

KATH], **Dolakha** [Suspa community forest, 3000 m., *D.R. Kandel, S. Maharjan, J. Shrestha, S. Paudel* & *R. Shrestha* 20121108, 7.11.2012, KATH smooth stipe], **Ramechap** [Tambe, danda, Ramechap District, on open place in disturbed Khasru forest, 2700 m., *K.R. Rajbhandari* & *B. Roy* 2276, 15.8.1977, KATH stipe slightly hairy at base; between Sivalaya and Bhandar, Janakpur Zone, 1800-2500 m., *T. Nakaike* 3126, 6.10.1988, KATH stipe hairy].

E: **Solukhumbhu** [près de Gumila, 2600 m., *A. Zimmermann* 1854, 26.10.1954, BM; entre Ghat et Phuyan, 2600 m., *A. Zimmermann* 1873, 27.10.1954, BM], **Sankhuwasabha** [Arun valley, Maghang khola, E. of Num, in forest, 5000 ft., *J.D.A. Stainton* 1599, 7.9.1956, BM; above Bungim, 6000 ft., *P.R. Shakya* & *M. Ohsawa* 1094, 12.9.1971, KATH; Suki Patl, E. Nepal, 7000 ft., *H.* & *A. Foster*, with *E.W. Cronin*, *H.M. Emery* & *K. Brooks*, Arun Valley Wildlife Project, F018, 19.11.1973, KATH det. V.L. Shrestha as "*P. aspericaulis*" in error; around Tashigaon, Sankhuwasabha, 2120 m., *M.N. Subedi* 395, 13.7.1988, KATH], **Dhankuta** [E. Nepal, Hile (1900 m.) - Mure (2100 m.), 872271, along path in open place, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725099, 5.6.1972, BM, KATH; Dandabazar - Rajarani, Dhankuta, 1650 m., *N. Thapa, K.P. Bhattarai* & *T.P. Gautam* 14007, 14.2.1994, KATH stipe smooth, brown], **Tehrathum** [Chitre, open field along road side, 7700 ft., *T.B. Shrestha* & *D.P. Joshi* 71, 16.7.1971, KATH; Basantapur (2300 m.) - Chitre (2400 m.), 872271, along path on open slope, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725487, 7.7.1972, BM, KATH; Terhathum Distr., Chauke (2650 m.) - Tute (2480 m.) - Basantapur (2300 m.), 27° 12' 35", 87° 28' 01" - 27° 07' 00", 87° 26' 00", Phedi, on open places, 2670 m., *M. Tateno, K. Fujikawa, R.H. Ree* & *N. Thapa* 9955148, 17.8.1999, KATH juvenile frond, and Tute, 2340 m., *ditto* 9955050, 3.8.1999, KATH], **Ilam** [Mai Pokhari, open glades, 7500 ft., *Robert L. Fleming* 2507, 18.9.1978, KATH *sub "P. longipes"* in error; 4 mi. S.E. of Itabari, Ilam Distr., wet ravine, 3800 ft., *R.L. Fleming* 2114, 19.12.1971, K; near Ilam, Ilam, Mechi Zone, 1500-2000 m., *T. Nakaike* 3622, 5.11.1988, KATH with stipe of *Diplazium*], **Panchtar** [East Nepal, Yektin - Akasay [-Batasay], *H. Hara, H. Kanai, S. Kurosawa, G. Murata, M. Togashi* & *T. Tuyama* 6305177, 30.11.1963, K; **Taplejung** [Sanghu Downs, 6750 ft., *A.H. Norkett* 7384, 23.11.1961, BM; East Nepal, Thakma khola - Diorali Bhanjang - Bhandukay - Yamphodin, 2500-2000-2400 m., *H. Kanai, G. Murata* & *M. Togashi s.n.*, 17.11.1963, KATH, CAL; slopes of Dobala Danda, above Yamphudin, 27° 27', 87° 56', wet shaded forest, clump forming fern to 2 m., 2350 m., *C. Grey-Wilson, Sue Zmartzty, Mike Sinnott, David Long, Ron McBeath, Henry Noltie* & *Mahendra Subedi* KEKE 1063, 28.9.1989, K, KATH stipe hairy, labelled as det. RBG, Kew as "*Cyclogramma himalayensis*" due to some confusion of sheets]. E. Nepal [Rimoo, on ground, 9-10,000 ft., *Capt. Lall Dhwoj* 442, rec. 21.2.1931, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh; Jammu & Kashmir.

Absent from S. India (from where it has been mistakenly reported in error for *P. tripartita* Sw.); present in Thailand; Taiwan and S.E. Asia, but often confused in the Malesian region with *P. tripartita* Sw.

(S, C). A very common upper-mid to higher altitude species, of slightly open forest, growing on moist slopes at the edges of paths and above streams.

Hybrids: Although hybridisation must have occurred on a large scale in the formation of allopolypolyploid and apomictic *Pteris* species, extant sterile F1 hybrids have seldom been detected in the genus in the Indo-Himalaya or Nepal. This is probably largely due to difficulty in recognising spore-abortion due to hybridity in this genus with trilete spores, where probable abortive spores may just be white, similar to the appearance of young spores. Preparing material and squashing it on a slide as if for a chromosome squash-count may give more easily recognisable results based on the irregular size and shape of the young spores in each single sporangium. Occasional single individual plants of unrecognisable and intermediate morphology tends to suggest that some hybrids might have been collected, but it requires detailed and accurate knowledge of all the critical species before such plants can be noticed and such knowledge hardly exists in the region. It must also be borne in mind that two apomictic species cannot hybridise together, at least one parent must be sexually reporoducing. A handful of potential hybrid plants of unidentifiable intermediate morphology have been collected by CRFJ in Nepal and the Indo-Himalaya, but are too doubtful to catalogue here.

P. aspericaulis ?x ***P. spinescens***. **C**: **Kaski** [Kaski District, Birethanti to New Bridge, S. of Chomrong, way to Annapurna Base Camp, only one extensive clump seen, *CRFJ* 32365 (FN 12), 27.11.2006, TAIF all plants sterile, without sporing leaves]. The description of this plant from CRFJ's Herbarium Index is "rhizome horizontal, short, much branched and clump-forming; stipe completely smooth and glossy, axes pink; fronds not very large, 4-7 pairs of pinnae; only a single basal developed pinnule; pinnules rather large, apiculate, with crenulate apical regions; bearing many pale, longish setae through most of their length; sterile".

Pteris vittata nothosubsp. x ***nayariana*** Fraser-Jenk., S.C.Verma & Khullar, ***hybr. nov.*** (*P. vittata* subsp. *emodi* x *P. vittata* subsp. *vittata*). *Morphologia plantae intermedia inter* subsp. *emodi et subsp. vittatam et valde similaris ad subsp. vermae sed pinnae minores adjacentes vel angustae*; *longitudinis apicis frondis aliquantum variabilis sed brevioris quam in subsp. vittata intermedius inter subsp. vittatam et subsp. emodi*; *sporae plerumque abortivae*. *Cytotypus pentaploideus dictus sed confirmationis ut videtur.* Holotypus: India: Meghalaya, roadside just south of the junction of the southern road-exit from Sohra Circuit House onto the Mawsmai road from Shillong and Sohra town, *c.* 3 km. south of Sohra ("Cherrapunji"), plant coll. Prof. B.K. Nayar in *c.* 1955 (B.K. Nayar pers. comm. to CRFJ in Calicut, 1.2009), and cultivated for 6 decades in a large clump in the front garden bed next to the low wall immediately outside the Director's office at the National Botanical

Research Institute, Rana Pratap Marg, Lucknow, Uttar Pradesh, India. Fronds coll. *C.R. Fraser-Jenkins*, with *S. Behera et al.* 34996 (FN 273), 17.12.2011, TAIF. Mature spores partially appearing good, if rather pale, with occasional very large spherical ones and with many small abortive and irregular chips (det. CRFJ, 19.6.2012). Its hybrid nature and abortive spores were discovered by Dr. Shanti Devi (Devi 1977), and further cytological work on the plant was then reported by Khare & Kaur (1983), who reported it as pentaploid with various bivalents and multivalents at meiosis, though study of the photograph does not show a clear count. A slide prepared by Khare's student, Arun Kushwant, and shown to CRFJ for interpretation on 15.12.2011 showed a metaphase plate with many obviously lagging univalents, confirming the hybrid nature suspected from its abortive spores and intermediate frond-morphology, but as yet no precise confirmation of its actual cytotype as an anomalous pentaploid, as opposed to an expected tetraploid has been obtained (preferably from root-apex mitosis). Reports of pentaploid, tetraploid and triploid progeny from spores of various cytotypes by Khare are unclear and not properly substantiated and he later agreed (pers. comm. 2007) at least the pentaploid plants were from vegetative propagation and the others might have arisen from the pentaploid (from spores?). Plants at the original wild locality in Meghalaya revisited by CRFJ with A. Benniamin in 2009, from Prof. Nayar's clearly recounted memory of it (not reported by Khare) consisted of a rather narrow pinna'd subsp. *emodi*, along with some possible intermediates (*CRFJ* 33816-33821 (FN 50-55), 28.2.2009) and subsp. *vittata* occurred some 10 km. further down the road towards the Bangladesh border.

VITTARIACEAE

Antrophyum (2 species).

205. ***Antrophyum obovatum*** Baker (syn.: *A. latifolium* Blume var. *obovatum* (Baker) C.Chr.; *A. cuneifolium* Rosenst.; misapplied name: "*A. latifolium*" *sensu auct. Ind.*, *non* Blume [from S.E. Asia, not present in mainland India]).

Fronds lanceolate (in small plants) to ± broadly ovate-lanceolate (*c.* 10-20 cm. long), usually rather abruptly narrowing to obvious, sometimes long stipes, lamina usually widest just below the apical narrowing, flat to somewhat striated if pressed when partly dried, terminating in one or two acute apices or teeth, midrib indistinct to absent; sori reticulate above the veins, exindusiate, soral paraphyses stalked, often more than one branch per stalk, clavate-capitate at the apex.

Nepal:

C: **Kaski** [narrow, rocky gorge and luxuriant, leech-ridden forested slope, shortly above Poiyim village on track along slope from Burjung Khola to Kahaure and Tarakot village, N. of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *G. Yatskievch, E.A. Hooper, J.P. Gajurel, Rita Magar Thapa, Sagun Pariyar* & *Ganesh B. Tamang* 34262 (FN 65), 12.9.2009, TAIF]; **Lalitpur** [Godaveri, Kathmandu

valley, south of school, 4900 ft., *R.L. Fleming* 1876, 8.1965, MICH *sub* "*A. plantagineum*" in error; lower Phulchowki Darrah, above Godawari, *C.R. Fraser-Jenkins* 16173, 13.3.1990, E, and *C.R. Fraser-Jenkins, A.C. Jermy* & *V.L. Gurung* 19465 (FN 350), 12.1.1993, H].

E: **Taplejung** [Tawa, Taplejung, on open mossy banks, rare, 1000 m., *N. Thapa* T44, 7.8.2001, KATH very small plant, *sub* "*A. coriaceum*" in error]; Iwatsuki (1988) reported it from the Japanese E. Nepalese collections without locality, no. 771955, TI.

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. Taiwan; Japan; Thailand; Vietnam.

(S, R). A rare species of mid- to upper mid-altitude dense forests, growing as a trunk-epiphyte among mosses.

Nepalese threatened status: **EN**.

206. ***Antrophyum reticulatum*** (G.Forst.) Kaulf. (syn.: *Hemionitis coriacea* D.Don; *Antrophyum coriaceum* (D.Don) Wall. *ex* T.Moore; *non* (Kaulf.) Blume [= *Loxogramme lanceolata* (Sw.) C.Presl, from the Mascarenes]; *Antrophyum wallichianum* M.G.Gilbert & X.C.Zhang (*nom. nov.*); *Antrophyum plicatum* Fée). In contrast to Zhang & Gilbert's (2013) statement in the *Flora of China*, the combination *Antrophyum coriaceum* was not validated by Wallich (Dec. 1828, not "1829" as mentioned, and thus the same year as Blume's name) as he did not mention under his "*A. coriaceum* Wall." any basionym specific epithet. He merely cited "*Hemionitis* D.Don" without mention of "*coriacea*", nor any line after the generic name, *Hemionitis*, that could be taken as indicating the specific name. Other such cases in Wallich's *Numerical List* either mention the species, or intend just the genus, or have an unclear intention, but in this case, without the species name written for a supposed basionym there can be no validation of it.

Lectotype of *Hemionitis coriacea* D.Don, Prodr. Flor. Nepal.: 13 (1824), here designated, "Hemionitis sessilifolia? Hab. parasit. supra arboribus in Napalia - Nomen Mauro Loah [in Newari]. Recepi Januario 1818. *Dr. Wallich*", BM (the two right-hand plants); isolectotype in K. It was collected for Wallich by the Hon. Edward Gardner, Bharat Singh and Francis de Silva before his own visit to Nepal, and came from the material studied by Don, dispersed after the break-up of the Lambert herbarium. Alston wrote on the sheet, "paraphyses ribbon shaped, twisted, spores trigonous." The fronds are shortly stipitate with a narrowly winged base, rather narrowly lanceolate above, partly straight, others slightly curved, widest about the middle, tapering to narrow, acute apices and a partly striated, veiny lamina.

The date of validation of *A. coriacea* would not affect Zhang & Gilbert's *nom. nov.* for *H. coriacea*, surprisingly not named after David Don as normally done in such cases, but *A. wallichianum* is in any case predated by the name *A. plicatum*, which they overlooked. In addition the taxonomy they used was perhaps confused. They

tentatively thought that *A. callifolium* Blume from S.E. Asia and Australasia (misreported from N.E. India by Singh & Panigrahi (2005), and repeated by Zhang (1999a) and Zhang & Gilbert (2013), both in error for *A. reticulatum* (see Fraser-Jenkins 2008)) might be the same as *A. reticulatum*, as also tentatively suggested by Holttum (1955), although the two have since been carefully separated and *A. reticulatum* excluded in the *Flora of Australia.* But it is not *A. callifolium* but *A. reticulatum* that has always been suspected to be the same as *A. coriaceum* by Beddome, Clarke, Dixit & Nair (1974), Iwatsuki (1988) and others, and in the material from the Indian subcontinent and S.E. Asia at K, BM, and in some recent works in the Indian subcontinent, and this is confirmed here, albeit tentatively (as CRFJ has not seen the type of *A. reticulatum*). *A. coriaceum* in Nepal and N. India varies from flat-fronded to striate (when dried up), as does *A. reticulatum*, has a similarly very short stipe usually with a longer "pseudo-stipe" with narrow laminar wings, and a similar laminar shape, size, texture and similarly reticulate sori with narrow, hair-like paraphyses. It can often have long, straight fronds when full grown, as in *A. reticulatum*. Singh & Panigrahi's (2005) concept of *A. reticulatum* was based on a Morton photograph of a later specimen, the type of Blume's "var. D", from Java, which was obviously not "authentic" for Forster's species and probably belongs to *A. callifolium*, but is mixed.

Rhizome short, erect, bearing a cluster of simple, unlobed, lanceolate fronds (*c.* 10-30 cm.), varying from narrow to somewhat broad (*c.* 1-6 cm. broad); stipe short or almost absent, but rather ill-defined due to a narrow decurrent wing of laminar tissue; lamina varying from straight to slightly falcate-curved, narrowly decurrent below, widest about or just above the middle, tapering to slightly abruptly narrowed above to an acute apex, slightly thick, smooth when growing in mid monsoon and pressed firmly, to striated, with prominent raised veins if pressed when partly drying, midrib indistinct to absent; sori in the upper half of the lamina, in a reticulate pattern of lines, following the veinlets, exindusiate, bearing sporangia among a mass of narrow, brown, ribbon-shaped paraphyses.

Nepal:

C: **Kaski** [waterfall and forested khola in upper Chiso Khola, S. of Yamdi Khola, S.W. of Yamdi village, on N.E. side of Sarangkot Hill, *c*. 4 km. N.W. of Bogar, shortly N.W. of Pokhara, Kaski District, *C.R. Fraser-Jenkins*, with *Rajendra Boruwal* (of Katunje) 25888 (FN 1866), 8.1.1998, H], **Gorkha** [Buri Gandaki river, 17 miles above Arughat Bazar, 4000 ft., *P.C. Gardner*, New Zealand Himalayan Expedition 293, 12.4.1953, BM; Gorkha Distr., Macha khola (850 m.) - Kholabesi (890 m.) - Tatopani (930 m.) - Dovan (990 m.) - Syaule Bhatti (1070 m.), 28° 13' 51", 84° 52' 23" - 28° 18' 39", 84° 54' 10", on overhung wall, 929 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro, K. Yoda* & *R. van Winkle* 9460055, 22.7.1994, KATH], **Makawanpur** [Kulekhani, in north facing slope, mossy place, 4800 ft., *K.R. Rajbhandari, M.M. Amatya* & *Bhusal* 75/

906, 8.10.1975, KATH; Khulekhani, epiphytic on mossy tree trunks, 1460 m., *V.L. Gurung* 82/1691, 24.7.1982, KATH], **Kathmandu** [Nepal, *C. Maries*, 12.1882, CAL; Gokarna, Kathmandu valley, trees, 4400 ft., *R.L. Fleming* 1512, 8.1958, MICH; Gokarna (1400 m.), *H. Kanai*, *G. Murata*, *O. Tanaka* & *T. Yamazaki* 25057, 22.6.1967, BM, KATH; Pashupati, epihytic on tree, 4400 ft., *D.P. Joshi* 42, 28.10.1968, KATH; Nagarjun, *c.* 1500 m., *H. Kanai* 9725, 7.4.1969, KATH; on trees and on wooded slope between Balaju Baisdhara water park and swimming pool and start of north-east slope of Jamachok mountain, Balaju, N.W. side of Kathmandu, Kathmandu District, *C.R. Fraser-Jenkins* & *Rajkumar Khatri Chhetri* 18159, 15.3.1991, E], **Lalitpur** [Chapagaon, in clusters at bases of trees, 5000 ft., *R.L. Fleming* 1307, 3.9.1956, KATH, DD, narrow fronds, det. [K.M. Vaid], F.R.I., Dehra Dun, also cited by Dixit & Nair (1974) *sub A. reticulatum*, as opposed to *A. coriaceum*, ditto *RLF* 1857, 10.1964, MICH; forest slope above river on S.E. side of Bajrabarahi temple, E. side of Chapagaon, S. of Kathmandu, Lalitpur District, *C.R. Fraser-Jenkins*, with *R. Lama* and *D. Damai* ("*Lama*") 25006 (FN 985), 18.11.1996, BM, H], **Bhaktapur** [Bhaktapur District, Gokarna Forest, 7 miles E.N.E. of Kathmandu, epiphytic on mossy trees, 1350 m., *D.H. Nicolson* 2292, 10.9.1966, KATH].

E: **Ilam** [densely forested, rocky stream-gully of Sudhung khola, below Sudhung on path down to Melbote, to S. of main-road below Sundergaon, W. of Pashupatinagar on Ilam road, Ilam District, *C.R. Fraser-Jenkins* 29752 (FN 5727), 27.10.2001, H], **Taplejung** [Tawa, Taplejung, on open mossy banks, rare locally, 1000 m., *N. Thapa* T44, 7.8.2001, KATH; Tuwa [1800 m.] - Kiwa - Taplethok [1300 m.], *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305389, 5.11.1963, TI, photo sent by Prof. K. Iwatsuki, 3.2015; Ghatte [1600 m.] - Khebang [1700 m.], *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305390, 19.11.1963, TI, photo sent by Prof. K. Iwatsuki, 3.2015].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal. N.E. and S. India; Sri Lanka; Thailand; S.E. Asia.

(M, Sc). A scattered and uncommon lower-mid to mid-altitude species, epiphytic among moss on shaded tree-trunks in mature forest, or sometimes on main branches, rarely also lithophytic.

Nepalese threatened status: **VU**.

Vittaria (5 species).

This genus is maintained here instead of *Haplopteris*, recognised generically by Crane (1998) and Smith *et al.* (2006, 2008) on molecular grounds, and thence followed by default by Zhang (2003), Zhang & Gilbert (2013) and others believing it compulsory to translate molecular cladonomy directly into taxonomic classification. The different subgenera of *Vittaria* had a common origin before their geographical diversion and it is clear that they have not diversified morphologically in any way that would be sufficient

to merit generic recognition. The microcharacters given for each group (mainly obconical versus clavate paraphyses and monolete versus trilete spores) are not mutually exclusive and include exceptions across the groups emphasising their generic insignificance, the only remaining difference being a partial geographical one, which is not the proper usage of the rank of Genus. Their great morphological similarity however, is overwhelming and must be balanced against the minute and inconstant differences. We do not propose to recognise "cryptic genera", which amounts to serious taxonomic tautology, and is a practice that should not be approved of as Botanists must continue to look beyond and above molecular considerations alone and genera, especially, need to be more major entities that are readily recognisable.

Distinguishing *Vittaria* species has two difficult pitfalls, firstly that when fronds are rolled up in the dry season, the shape of the midrib alters to become wider, the margin tightens around the sorus and the sori appear to fill the space between the margin and midrib, but may be visible only from a narrow slit allowing a partial view of each side of the midrib. The appearance of such fronds on a herbarium-sheet may be so different from unrolled fronds from the wet season that it may be almost impossible to recognise the species, and realise that the two avatars may be one and the same species. Useless, rolled up herbarium-specimens constitute the ubiquitous "*Vittaria rolypolyana*" Fraser-Jenk., *ined*., of most herbaria, a nick-name for specimens of *Vittaria* species pressed in that state during the dry season. Secondly, since the fronds curl up laterally in all species during dry conditions, rendering specimens unidentifiable (unless from scales alone), they should in that case be soaked out for a good 24 hours in a bucket of water so the soral position becomes visible before pressing, unkind though that may seem. The same applies to many *Lepisorus* and some *Pyrrosia* species, which can appear to be little more than green or woolly half-coiled watch-springs if pressed without bothering to soak them out first, though at least the rhizome-scales of *Lepisorus* are more distinct, making them easier than *Vittaria* to identify when information from the fronds is unavailable due to being rolled up.

[***Vittaria doniana*** Mett. *ex* Hieron. (syn.: *Haplopteris doniana* (Mett. *ex* Hieron.) E.H.Crane; *Vittaria forrestiana* Ching; *V. wattii* R.D.Dixit & N.C.Nair). This robust upper-mid to higher altitude species has brown rhizome-scales, more crowded, thicker, often flattened, pale stipe-bases and markedly thicker fronds than the slightly similar *V. taeniophylla* which is often mistaken for it, with the lamina descending narrowly down nearly to the rhizome, but leaving a very short, thick, pale stipe, or almost no stipe at all; the sori are superficial and obviously intramarginal. It was reported in error by Banerji (1972) from Bhusinga to Jhaprebas, [Solukhumbhu], *c.* 6500 ft., *M.L. Banerji* 1505, 3.10.1964 (A), but the specimen (kindly photographed and sent to CRFJ by Dr. K. Gandhi, of Harvard) consists of three small plants of *V. taeniophylla*, with narrowish fronds and typical long, glossy grey scales and superficial inframarginal sori. We have seen no collections or further reports of *V. doniana* from Nepal, and it is excluded here].

[***Vittaria elongata*** Sw. (syn.: *Haplopteris elongata* (Hayata) E.H.Crane; *Pteris graminifolia* Roxb.; *V. elongata* var. *angustifolia* Holttum; *V. elongata* var. *latifolia* Holttum; *Vittaria pauciareolata* Ching; *V. formosana* Nakai; misapplied names: "*V. merrillii*" *sensu* Dixit (1981) [species omitted from Dixit (1984)], Singh & Panigrahi (2005), *non* Christ [= *V. zosterifolia*, described from the Philippines]; "*V. zosterifolia*" *sensu auct. Asiat.*, Dixit (1981), Ching & Wu (1983), Singh & Panigrahi (2005), *p.p.*, ?*non* Willd. [from the Mascarenes, Africa, India and S.E. Asia]).

V. elongata is very variable in the length and width of the fronds, stipe, and visibility of the midrib, giving rise to its treatment under different names in the region. As yet it is not clear if *V. zosterifolia* (syn.: *V. merrillii*; *V. copelandii* Christ) is really distinct or merely represents variation within *V. elongata* and is thus a synonym. At least much of what is reported as *V. zosterifolia* from India seems to differ only in having a longer stipe, a variably wide frond, both of which merge into larger plants of *V. elongata*, and a more distinct midrib. We await more authoritative information as to their distinction. One specimen (and duplicate) of *V. zosterifolia*, *i.e.* a long-stiped *V. elongata* with midrib and outward-edge sori is labelled, "Tehri Garhwál, Kulni Valley, 6000 ft., *J.F. Duthie* 23942, 21.5.1900", CAL, but it remains is uncertain whether the label is correct or transposed as the locality is highly anomalous, even though the specimen appears to be this eastern species, though the sori are a bit young. No such specimen is at BM or K. It is probably one of the three W. Himalayan specimens reported by Dixit (1981) for this species, though given as no 23944 (from DD); however the other two specimens (*C.M. Arora* 38142 and *U.C. Bhattacharyya* 15029) at BSD (!) are normal *V. flexuosa*.

Like all *Vittaria* species, this has a bunch of long, grass-like, hanging fronds with marginal to inframarginal, elongated, exindusiate sori; rhizome often rather long-creeping, with fronds varying from being crowded to being quite well spaced out, covered in long, very dark brown or blackish, narrow scales with attenuated apices; fronds (up to *c.* 60 cm. long), but fertile even when much smaller, with a short to longish stipe, lamina usually narrow (*c.* 5 mm. wide), but becoming up to 1.5 cm. wide; lamina partly with a visible midrib below, but mostly without a midrib; sori strictly marginal, diagnostically facing outwards from the outer edge or sometimes the edge turned slightly downwards, the sporangia borne in a two-lipped marginal groove.

"Nepal":

"Nepalia *Dr. Wallich* (*ex* herb. Rudge)", BM. This specimen of a small, rather wide-fronded *V. zosterifolia* form of *V. elongata* was almost certainly confused in origin and locality by Wallich, as often happened, and most probably came from either Myanmar or Malaya. Rudge obtained a set of early "Wallich" Gardner collections from Nepal, among which no *V. elongata* is known from other sources, and also obtained later Wallich collections from Nepal, Myanmar, Malaya *etc*. Wallich himself is known to have sorted mixtures of specimens from the folders at

Calcutta (CAL) into sets "by eye" (*teste* C.B. Clarke, see Fraser-Jenkins (2006)) and did not distinguish clearly between the species of *Vittaria*, while further confusion often occurred in various herbaria following receipt of Wallichian sets of specimens. If *V. elongata* does turn up in Nepal, it would be most likely down in the furthest S. Eastern *terai*, where Wallich did not collect and his local and Calcutta Botanical Garden collectors did not venture. Iwatsuki (1988) listed the species but stated that he had seen no Nepalese specimens (in Japanese and other herbaria). Banerji (1972) misreported it from Nagarjun, Kathmandu (*c.* 1675 m., *M.L. Banerji* 1690), in error for *V. flexuosa* and Thapa (2004) erroneously stated that it is common in W., C. and E. Nepal, but his determinations on sheets at KATH, where there is no genuine material of this species in the herbarium, show that this was in error due to misidentification for *V. flexuosa*. We have seen no Nepalese collections in the main herbaria with Nepalese holdings, nor ourselves collected it, and therefore exclude it from Nepal.

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Darjeeling. N.E., C. and S. India; Bangladesh; Sri Lanka; Thailand; S.E. Asia; E. Africa; Australasia *etc.*

(M, Sc). A rather scattered, though much over-reported, low altitude subtropical forest species of the outer foothills and *terai* in the eastern Himalayan region; epiphytic, usually rooted among *Leucobryum* moss, hanging from tree-branches].

207. ***Vittaria flexuosa*** Fée (syn.: *Haplopteris flexuosa* (Fée) E.H.Crane; *V. revoluta* D.Don (Dec. 1824), *non* Willd. *ex* Kaulf. (May 1824), lectotype of *V. revoluta* D.Don, *Prodr. Flor. Nepal*.: 15 (1824), in BM!, here designated, "Vittaria revoluta, Nepal, D.Don Prod. Fl. Nep." [written by D. Don] the far right specimen on the sheet which also has in the middle two specimens of *V. taeniophylla* labelled "Pteris lineata L. ? Narainhetty 2nd Feby. 1803 [written by Hamilton]. Nepal. *Dr. Buchanan*," the lectotype specimen exactly matches and was presumably taken off the rather rolled up leaved plant on another sheet labelled "supra arboribus parasitica, Napalia Dr. Wallich lecta Januario 1818, nomen Bhooemurga [in Newari]", BM, which is here designated isolectotype (and another at K). The two middle plants are excluded, being *V. taeniophylla*; *V. revoluta* was erroneously cited by Fraser-Jenkins (2008) as a synonym of *V. taeniophylla*, referring to the central plants on the sheet with flat fronds, thinking they were all one collection; further synonyms: *V. ophiopogonoides* Ching; *V. caricina* Christ, both also synonymised by Zhang (1999b) in the *Flora Reipublicae Popularis Sinicae* and by Zhang & Gilbert (2013) in the *Flora of China*; further synonyms: *Vittaria filipes* Christ; *V. modesta* Hand.-Mazz.; *V. ophiopogonoides* Ching; *V. arunachalensis* R.D.Dixit, a defunct name described as having "densely tufted, needle-like leaves", but only because they are totally curled up).

Dixit (1981), Chandra (2000) and Ghosh *et al.* (2004) all took up the defunct Chingian name, *V. ophiopogonoides* and followed his failure to recognise Christ's

V. caricina as *V. flexuosa* in order to add both names to the number of Indian species they could report. Singh & Panigrahi's (2005: *t.* 270, 271) photographs of both *V. ophiopogonoides* and what they called *V. merrillii*, the latter photograph being upside down, are actually *V. zosterifolia*, *i.e.* perhaps just a form of *V. elongata*. Their description and drawing of the sori of *V. ophiopogonoides*, however, were muddled as the two specimens they cited are normal *V. flexuosa*, reidentified by CRFJ, albeit partly curled up.

Rhizome-scales shortish, a dark greyish brown (not the misleading "yellow-brown" of the *Flora of China*); fronds to *c.* 50 cm. long, varying from narrow to rather wideish (*c.* 2-7 cm.), with the midrib raised beneath and an obvious gap between it and the sori; sori facing downwards, with a diagnostically raised inner lip-ridge running along the inner edge (sometimes partly hidden in poor quality herbarium-specimens) and the margin of the frond revolute, which does not at any time flatten out beyond the sorus, forming the outer protection of the soral line. The inner lip to the sorus should not be confused with the receptacular line running along lying directly beneath the sorus, which is visible on scraping away and area of sporangia with a needle or pen-top.

Nepal:

W: **Dailekh** [in remnant Quercus and Rhododendron forest, on rocky banks or on epiphyte-laden tree-trunks, between Rattanangla and Ranimatta, *c*. 40 km. N. of and above Surkhet on road to Dailekh, Dailekh District, *C.R. Fraser-Jenkins*, with *K. Neupane* & *Kodananda Pongali* ["*U. Chhetri*"] 25629 (FN 1607), 25.9.1997, H, specimen identity requires confirmation], **Kalikot** [Chaukebada - Badarigaon, Kalikot, 1600 m., *K.R. Rajbhandari* 14588, 5.8.1991, KATH], **Jajarkot** [Jhapra, Jajarkot, epiphytic on trunk of Quercus, 1500 m., *N.P. Manandhar* 628-91, 3.3.1991, KATH *sub* "*V. elongata*" in error].

C: **Myagdi** [Jakumsibang, epiphyte upon isolated Myrica nagi, 6500 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 4233, 6.9.1954, BM], **Parbat** [Kokethanthi - Tatopani, "Mustang", *V.L. Gurung* 1466, 3.7.1981, KATH; subtropical forest between Hile and Sudame, N. of Birethanthi on way to Ghorepani and Poon Hill, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c.* 1300 m., *C.R. Fraser-Jenkins*, with *Keshab Nepali* 34556 (FN 60), 15.6.2010, TAIF], **Kaski** [near Pokhara, epiphyte in Castanopsis forest, 3000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 2427, 13.4. 1954, BM, CAL; near Pokhara, on mossy tree trunks, 4000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 7099, 7.9.1954, CAL; Lumle Agricultural Centre, S.E. aspect, on trunk of Schima, by path, 1990 m., *G. Dawson* 370, 4.6.1975, BM *sub* "*V. elongata*" in error; Pokhara Distr., Suiket (1230 m.) - Pathana (Dhampus) (2050 m.), 836282, *H. Ohba*, *H. Kanai*, *M. Wakabayashi*, *M. Suzuki* & *S. Akiyama* 8310106, 7.7.1983, BM *sub* "*V. taeniophylla*" in error; path in semi-open forest on W. facing slope, *c.* 2 km. above and N. of Kaure (Kahure) village, on upper path to Burjung Khola and Poiyim village, c. 6 km. N. of

Puranchaur, N.W. of Lamachaur, in upper Seti river valley, *c.* 18 km. N.W. of Pokhara (Mahendra Pul), Kaski District, *C.R. Fraser-Jenkins*, with *Jeet Bdr. Pariyar* 26166 (FN 2144), 13.3.1998, BM, H], **Gorkha** [Gorkha Distr., Sardu Khola (1800 m.) - Ripche (2390 m.), 28° 26' 49", 84° 55' 56" - 28° 27' 57", 84° 57' 46", shady place, forest floor, drooping from the rock, 2030 m., *M. Suzuki, N. Acharya, N. Fujii, L. Joshi, T. Kajita, N. Kondo, M. Mikage, S. Noshiro* & *K. Yoda* 9485175, 27.7.1994, KATH], **Makawanpur**, **Rasuwa** [Dumche, Rasuwa Distr., 28° 07', 85° 17', epiphytic, 2000 m., *J.F. Dobremez* 948, 4.9.1971, KATH; C. Nepal, Gram (1900 m.) - Thale (1900 m.) - Dhunche (2000 m.), 851281-852281, *H. Kanai, H. Hara* & *H. Ohba* 725900, 21.8.1972, KATH; Ramche to Dhunche, 1800-2000 m., *V.L. Gurung, T.K. Rajbhandari* & *D.P. Joshi* 826/79, 15.9.1979, KATH *sub* "*V. elongata*" in error], **Nuwakot**, **Dhading** [forested stream gullies on N.W. side of Jamachok Mountain, behind Mudko, *c*. 4 km. N.W. of Balaju, on road from Kathmandu (via Thamel) N.W. to Kakani and Trisuli Bazaar, Dhading District, *C.R. Fraser-Jenkins et al.* 24207 (FN 185), 25.7.1996, B, H], **Kathmandu** [Narainhetty, [*F. Buchanan* (*Hamilton*)], 28 Jany. 1803, Thomas Moore's Fern Herbarium, CAL, mostly rolled specimen, *sub* "Pteris lineata L.?" in error, det. R.D. Dixit 25.9.1975 as "*V. ophiopogonoides*, an abnormal specimen", but not abnormal; Napalia, supra arboribus parasitica, [the Hon. *E. Gardner* for] *Dr. Wallich*, Januario 1818, nomen: Bhooemurga [in Newari language], BM; Chapagaon, Kathmandu valley, on tree trunks, 4700 ft., *R.L. Fleming* 1274, 27.8.1956, MICH *sub* "*V. lineata*" in error; Nagakot, Kathmandu, 2000 m., *H. Kanai, G. Murata, H. Ohashi, O. Tanaka* & *T. Yamazaki* 25210, 24.6.1967, BM; Nagarjun, epiphytic on Schima tree, 6000 ft., *M.S. Bista* 6962, 2.10.1969, KATH], **Lalitpur** [Lalitpur District, Godawari, 10 miles southeast of Kathmandu, epiphytic on tree trunk, 1500 m., *D.H. Nicolson* 2201, 2.9.1966, KATH; Godawari (1600 m.) - Phulchauki (2500 m.), *H. Kanai, G. Murata, H. Ohashi* & *T. Yamazaki* 1062, 26.6.1967, BM *sub* "*V. himalayensis*" in error; Bajrabarahi, Lalitpur, epiphytic on tree, 4500 ft., *D.P. Joshi* 59, 6.11.1968, KATH], **Dolakha** [near Dolakha, epiphytic, 5000 ft., *Dr.* [*M.L.*] *Banerjee*, [*T.B.*] *Shrestha* & [*A.V.*] *Uphadhyay* 2848, 19.9.1964, KATH *sub* "*V. himalayensis*" in error; Gongar to Chhetchhet, epiphytic on mossy branch as well as mossy surface, 1350 m., *K.R. Rajbhandari* & *B. Roy* 1358, 14.7.1977, KATH], **Ramechap** [Nunthala, 1800 m., *C.M. Joshi* J-1585816, 27.7.1995, KATH; between Bhandar and Kenja, Janakpur Zone, *T. Nakaike* 3205, 7.10.1988, KATH det M.L. Pathak as "*V. elongata*" in error].

E: **Bhojpur** [Bhojpur to Sunteley, epiphytic, 7000 ft., *Dr.* [*M.L.*] *Banerjee*, [*T.B.*] *Shrestha* & [*A.V.*] *Uphadyay* 3182, 19.4.1965, KATH], **Solukhumbhu** [Cho Oyu Expedition, *Rolla S. Rao* 13795, in 1958, CAL *sub* "*V. lineata*" in error], **Sankhuwasabha** [Arun Valley, Hatiar, N. of Num, on rocks, 6000 ft., *J.D.A. Stainton* 1387, 20.8.1956, BM, KATH; E. Nepal, Papung (2000 m.) - Bir Gaon (1600 m.), 873274, on tree trunk along path in open place, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725385, 30.6.1972, BM, KATH; E. Nepal,

above Shinbun (2100 m.) - Hatia Gola (1600 m.), *H. Ohashi*, *H. Kanai*, *H. Ohba* & *Y. Tateishi* 771977, 3.8.1977, BM; below Tashigaon, Sankhuwasabha, 2000 m., *M.L. Pathak* & *L.R. Tharu* 20110566, 29.5.2011, KATH *sub* "*V. elongata*" in error], **Sunsari** [Bisnetar - Kawal Dhar, 1300 ft., *T.B. Shrestha* & *T.K. Bhattacharya* 72/239, 25.9.1972, KATH det. N. Thapa 2004 as "*V. elongata*" in error], **Jhapa** [forest below roadside temple, shortly above Kuttedara on road to Horkhoti, N. of Charali and Bhudabare, on road to Phikal and Ilam, N.E. of Birtamod and N.W. of Kakkarbhitta, Jhapa District, *C.R. Fraser-Jenkins* 26577 (FN 2555), 16.8.1998, H, identity requires confirmation from Helsinki Botanical Museum website], **Ilam** [Mai valley, E. Nepal, *J.D. Hooker s.n.*, 7.11.[1848], K, rolled up, scales short, dark], **Panchtar**, **Taplejung** [East Nepal, Taplethok - Helok, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305386, 6.11.1963, BM, CAL; Taplejung, *ditto*, 6305384, 2.11.1963, KATH; East Nepal, Ghatte - Khebang, *H. Hara*, *H. Kanai*, *S. Kurosawa*, *G. Murata*, *M. Togashi* & *T. Tuyama* 6305392, 19.11.1963, BM, K *sub* "*V. himalayensis*" in error; around Yamphudin, 27° 27', 87° 55', on trunk of lopped tree, 1720 m., *S. Crawford*, *C. Grey-Wilson*, *D.G. Long*, *R. McBeath*, *H.J. Noltie*, *M. Sinnott*, *M.N. Subedi* & *S. Zmarzty* KEKE 1020, 27.9.1989, K, E].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand; Himachal Pradesh. N.E. and S. India; mainland S.E. Asia; Japan; South Korea.

(S, C). A common mid to higher altitude epiphytic or rarely lithophytic species, growing on tree-branches in fairly light forest or even on remnant scattered trees, the commonest *Vittaria* in the region.

[***Vittaria forrestiana*** Ching, a synonym of *V. doniana*, was listed by Iwatsuki (1988) while saying no Nepalese specimens had been examined, and reporting it from Sikkim. This must presumably have referred to *V. doniana*, if correctly identified, which is known to reach as far west as Sikkim in the central Indo-Himalaya, but is mainly distributed in the east Indo-Himalaya and beyond]

208. ***Vittaria linearifolia*** Ching (syn.: *Haplopteris linearifolia* (Ching) X.C.Zhang; ?*Vittaria doniana* var. *angustata* Hieron., the type of var. *angustata* from Bhutan, "Ascent to Woolooka, on trees, 8500 ft., *W. Griffith* E.I.", in B, is entirely curled up, hence its narrowness, and a leaf needs to be soaked out to confirm the identification made here; misapplied names: "*Vittaria mediosora*" *sensu* H. Itô (1966), ?*non* Hayata). "*Drymotaenium miyoshianum*" *sensu* Dixit & Nair (1975) from Arunachal Pradesh, *non* Makino [= *Lepisorus miyoshianus* (Makino) Fraser-Jenk. & S.Chandra, from China and Japan] appears to be mostly *V. fudzinoi* Makino (syn.: *V. suberosa* Christ). It is possible that *V. mediosora* Hayata, with the sori slightly further apart, as sometimes occurs in this species, may be conspecific and therefore the correct name for this species, replacing the randomly applied Chingian name, but we have

not yet investigated it thoroughly and tentatively continue to use the name *V. linearifolia* here. Some specimens at K, BM, determined by Ching in 1931 as *V. caricina* Christ, belong to *V. linearifolia*, but the type of that name is a narrow *V. flexuosa*.

Zhang & Gilbert (2013) confusingly described the scales as light brown, whereas they are distinctly dark brown both in the type material in K and BM and in other Nepalese and Indian material and were described by Ching in the protologue as black. The otherwise very similar species, *V. mediosora* from Taiwan *etc.* was also said to have light brown scales by Zhang & Gilbert (2013), but their description of scale colour in at least the dark-scaled *V. linearifolia* was inaccurate.

Rhizome with very dark brown, short, narrow scales with linear apices; fronds crowded, very narrow (*c.* 3-4 mm.), often not very long (*c.* 20-50 cm.), pendent, midrib raised beneath and often rather flattened when the lamina is rolled up during the dry season; sori superficial, with mixed brown and many yellow sporangia usually filling most or all of the space between the margin and the midrib, though not so in some more foliose and fully unrolled, flat fronds.

Nepal:

W: **Doti** [Silgiri - Doti, W. Nepal, on trees, 7000 ft., *R.L. Fleming* 1755, 11.1959, MICH, difficult specimen, perhaps a narrow *V. taeniophylla*?], **Jajarkot** [Ranga Chauthaka, south of Chakure Lekh, on moss covered tree trunk in Tsuga forest, 8500 ft., *O. Polunin, W.R. Sykes* & *L.H.J. Williams* 5554, 12.10.1952, BM *sub* "*Vittaria sp. nov.* aff. *caricina*", det. A.H.G. Alston].

C: **Myagdi** [near Gurjakhani, epiphytic upon trees in moist ravine, 800 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 3665, 28.7.1954, BM], **Kaski** [semi-open forested, bushy and rocky path-banks, N. of Dobhan Lodge on way to Himalaya Lodge, N. of Chomrong, on way to Annapurna Base Camp, upper Modi Khola valley, Kaski District, *c.* 2700 m., *C.R. Fraser-Jenkins* & *G.B. Tamang* 32487 (FN 133), 30.11.2006, TAIF], **Rasuwa** [Langtang, between Lama Hotel and Sharpugaon, 2600-2800 m., *T. Nakaike* 1324, 3.9.1986, KATH; Lama Lodge, Rasuwa district, 2700 m., *K.R. Bhattarai* & *K.J. Malla* 78, 22.7.1992, KATH], ?**Kathmandu** [Nagarjun, Kathmandu valley, on trees, occasional, 4500 ft./4600 ft. [altitude anomalous, ?locality perhaps doubtful], *R.L. Fleming* 1653, in 1959/7.1961, MICH *sub* "*V. elongata*" in error].

E: **Sankhuwasabha** [Sankhuwasabha Distr., Kuwa Pani (2890 m.) - Taklung Kharka (3110 m.) - Dogor Phuk (3755 m.), 27° 35' 57", 87° 10' 27" - 27° 38' 24", 87° 09' 31", hang down from mossy trunk, deciduous forest, 2930 m., *S. Noshiro, N. Acharya, Y. Ibaragi, K. Kobayashi* & *T. Kurosawa* 9770267, 23.8.1997, E *sub* "*V. flexuosa*" in error, and redet. by K. Yonekura, 2.1998 as "*V. taeniophylla* in error], **Tehrathum** [Terhathum - Taplejung Distr., Chauki (2650 m.) - Mangar Bhare (2900 m.) - Gupha Pokhari (2860 m.), 27° 12' 35", 87° 28' 01" - 27° 17' 14", 87° 30' 40", epiphyte, 2670 m., *Y. Omori, N. Acharya, K. Fujikawa, M. Munemasa, M. Okada,*

R.H. Ree, *M. Tateno* & *N. Thapa* 9955056, 4.8.1999, KATH *sub* "*V. taeniophylla*" det. N. Thapa 10.1999, in error], **Ilam**, **Panchtar** [Bhandukybhanjyang, on a tree trunk, scarce, 9000 ft., *R.L. Fleming* 2677, 26.9.1978, KATH; East Nepal, Thakma khola - Diorali Bhanjang - Bhandukay - Yamphodin, *H. Kanai*, *G. Murata* & *M. Togashi* 6305405, 17.11.1963, BM, E, KATH *sub* "*V. taeniophylla*" in error], **Taplejung** [E. Nepal, Topke Gola (3600 m.) - Shewaden (2600 m.), 873274, on tree trunk in dense forest, *c.* 3000 m., *H. Kanai*, *H. Ohashi*, *K. Iwatsuki*, *H. Ohba*, *Z. Iwatsuki* & *P.R. Shakya* 725308A, 28.6.1972, BM *sub* "*V. taeniophylla*" in error; Simbua khola, between Tseram and Tarangdi, 27° 31', 87° 56', on rocks in mixed Abies-Tsuga forest, 2960 m., *S. Crawford*, *C. Grey-Wilson*, *D.G. Long*, *R. McBeath*, *H.J. Noltie*, *M. Sinnott*, *M.N. Subedi* & *S. Zmarzty* KEKE 810, 21.9.1989, K, some fronds rather wider with more inframarginal and separate lines of sori, but probably not *V. taeniophylla*, *sub* "*L. loriformis*" in error and det. P.J. Edwards 5.12.1989 as "*V.* ?*forrestiana*" in error; Chhiruwa - Tapethok, on mossy stone, Taplejung Distr., 1250 m., *N. Thapa* T 43, 29.7.2001, KATH].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Nepal; Uttarakhand [in BM, BSD].

(S, Sc). A rather scattered but locally common higher-altitude species of dense and luxuriant moss-forests, hanging from tree-branches, or on shaded mossy rocks.

209. ***Vittaria sikkimensis*** Kuhn (syn.: *Haplopteris sikkimensis* (Kuhn) E.H.Crane; *V. minor* Bedd., *non* Fée; misapplied name "*V. modesta*" *sensu* Itô (1966), *non* Hand.-Mazz. [= *V. flexuosa*]).

A tussock of very distinctive, small, narrow, stiff fronds, 1-3 inches long, with a wider, flat, raised mid-area between the two lines of sunken sori; rhizome scales dark brown. Not to be confused with small, immature plants of other species, which may sometimes become precociously fertile.

Nepal:

C: **Kaski** [Raniban Forest, between "Fishtail Lodge" Hotel and "Nature's Home" restaurant, on S. side of Phewa Tal, S. of and opposite Pokhara "Lake-side" area (Baidam), Pokhara, Kaski District, *C.R. Fraser-Jenkins* 25462 (FN 1440), 17.8.1997 BM, H; steep earth slopes in forest of Rani Ban, alongside of Phewa Tal south-east shore, going from the path up to Peace Pagoda, east to Fishtail Lodge Hotel near the Dam, Pokhara, Kaski District, *C.R. Fraser-Jenkins* & *Sagun Pariyar* 33097 (FN 210), 3.10.2008, TAIF; path through woods on S. side of bend of Madi Khola, below and N. of Kalikasthan, on way to Madibesi and Chitre, N. of Begnas Tal, E. of Pokhara on path to Sikles, S.E. side of Annapurna range, Kaski District, *C.. Fraser-Jenkins* & *Ganesh Bhdr. Tamang* 26282 (FN 2260), 13.4.1998, BM, H; forested stream-khola facing N., Kalche Khola, between and above Chisapani and Kalche villages, S.E. of Chorepatan in Phusre Khola valley, *c.* 15 km. S. of Pokhara off Syangja road, Kaski District, *C.R. Fraser-Jenkins* 25701 (FN 1679), 19.10.1997,

H; forest from Bamboo Lodge down south to Sinuwa, and some from further down, via Chomrong to New Bridge, on way down from Annapurna Base Camp, Modi Khola Valley, Kaski District, *C.R. Fraser-Jenkins* & *G.B. Tamang* 32607 (FN 252), 2-3.12.2006, TAIF]; **Gorkha** [pathside forest by stream, Komale Khola, *c*. 1 km. below and S.E. of Deurali village, *c*. 5 km. W.N.W. of Anbu Khaireni, across and to N.E. of Marsyangdi river dam, N.E. of and above Gopling and Markichowk, off Mugling to Damauli road, S. of Gorkha, Gorkha District, naturally occurring on one tree-trunk only, 800 m., *C.R. Fraser-Jenkins* & *Nirmala Pariyar* (later Mrs. Fraser-Jenkins) 28387 (FN 4362), 16.10.1999, H]; **Dhading** [lower footpath shortly above main stream and up first side-stream in dense mixed forest, Raniban, Nagarjun Forest, behind Jamachok mountain, beyond and below Mudku ("Mareko" of Wallich) check-point on main road from Kathmandu to Trisuli Bazaar, N.W. of Balaju, N.W. of Kathmandu, Dhading District, *C.R. Fraser-Jenkins* 31880, 25.10.2005, TAIF]; **Kathmandu** [sandy, steep slopes in primary mixed forest between Gokarna Forest Lodge Hotel and Ban Devi Mandir temple, E. side of Gokarna Forest Lodge, Gokarna Forest, *c*. 4-5 km. N.E. of Jorpati, N.E. of Kathmandu off road to Sankhu, Kathmandu District, *C.R. Fraser-Jenkins*, with *P. Kuikel* (Lodge guide) 34211 (FN 14), 5.7.2009, TAIF].

E. Thapa (2002) listed E. Nepal without details, but we have seen no specimens from there in any herbarium, and no other reports from Nepal prior to its finding by CRFJ (Fraser-Jenkins 1997), which was the basis of Thapa's report from Nepal. Iwatsuki (1988) listed it but stated that he had not actually examined any Nepalese specimens. Itô (1966) had listed it from Sikkim under the mistaken identification of *V. modesta*.

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand [Kanak to Chauri, *S. Singh* 81074 *p.p. max*., BSD]. N.E. India.

(S, Sc to R). An uncommon mid-altitude species, epiphytic on tree-trunks, rarely on mossy rocks, nearly always grows in association with *Leucobryum* "white moss" species.

Nepalese threatened status: **NT**.

210. ***Vittaria taeniophylla*** Copel. (syn.: *Haplopteris taeniophylla* (Copel.) E.H.Crane; *V. arisanensis* Hayata; *V. doniana* var. *intermedia* Hieron.; *V. himalayensis* Ching (1931), type from Kumaon (K!); *Haplopteris himalayensis* (Ching) E.H.Crane; *V. himalayensis* var. *elongata* Ching; ?*Vittaria tibetica* Ching & S.K.Wu, placed by Zhang & Gilbert (2013) in "*Haplopteris*" *mediosora*, which seems doubtful; *V. garhwalensis* R.D.Dixit, the holotype in BSD is a 4-inch sterile baby plant of no scientific value apart from having been used as the basis and type of this valueless name by Dixit (at first synonymised by Fraser-Jenkins (1997) with "*V. himalayensis*", but then erroneously (Fraser-Jenkins 2008) with *V. flexuosa*), two identically small isotypes in CAL are sterile, but one on the same sheet marked as type in CAL,

though similarly small, has some short superficial sori and typical long, grey *V. taeniophylla* scales; misapplied name: "*V. mediosora*" *sensu* H. Itô (1966) [corrected, along with *V. taeniophylla*, in the later report by Iwatsuki (1975) to *V. himalayensis* and both names corrected by Iwatsuki (1988) to *V. taeniophylla*], *non* Hayata [from Taiwan]; "*V. mediosora*" *sensu* Zhang (2003) *p.p*. from Sikkim, *non* Hayata, but not in Zhang & Gilbert (2013) following communication with CRFJ to Zhang that the type and other Philippine material of *V. taeniophylla* is probably the same as *V. himalayensis* and is not *V. mediosora*). Isotypes of *V. taeniophylla* seen by CRFJ in B, US and PNH are the correct plant, but the same numbered plant at K has the sori in deep, bilipped, lateral trenches in direct contrast with the protologue and is not the correct material.

V. taeniophylla, both in the Philippines and as so identified in India, appears to represent shorter, slightly stiffer specimens of the same species as *V. himalayensis*, which varies in frond-length and width in both areas without any cut-off point between them, according to growing conditions, longer ones usually being identified as *V. himalayensis*, as explained and synonymised by Fraser-Jenkins (2008) and previously by Iwatsuki (1975) and Kuo (1985). Zhang & Gilbert maintained *V. taeniophylla* and *V. himalayensis* as distinct, mentioning a greater lamina-width and a larger gap from the sori to the margin for *V. taeniophylla*, both of which features have a similar range of variation for both names. Their descriptions of the scales were also inaccurate, *V. taeniophylla* was said to have pale brown scales and *V. himalayensis* dark brown ones. Both actually have characteristic long, pale grey, glistening scales and match identically in all respects. If they were really distinct it would be near impossible to describe and separate them accurately.

Rhizome scales larger, paler and noticeably longer than in *V. flexuosa*, a characteristic glistening pale grey to a pale, slightly brownish-grey, darker towards their bases; fronds slightly succulent-herbaceous (as described also by Copeland) to slightly stiffer, becoming laxer when long in sheltered conditions (*c.* 25-70 cm.), and varying from *c*. 3-12 mm. (commonly *c.* 8 mm.) broad, midrib raised beneath, thin, with an obvious gap between it and the sori, sori intramarginal by 1-2 mm., superficial, in a shallow groove with no inner raised ridge, lamina extends flat beyond the sorus, but lifts up loosely around the outer edge of the sorus after the monsoon, varying from yellow to reddish-brown to mid-brown on maturing.

Nepal:

W: **Bajhang** [Bajhang District, trail from Thalara to Budkhori, Lekgaun V[illage] D[evelopment] C[ommittee], 29° 33' 57", 81° 03' 07", damp gulley in S. facing slope, Qurecus-Rhododendron forest, 2443 m., *H. Ikeda, S. Noshiro, M. Amano, T. Tanaka, N. Yamamoto, C.A. Pendry, B. Dell, Y. Wang, G.D. Bhatt* ["*Bhatta*"] & *A.P. Bhattarai* 20915084, 11.7.2009, E, det. CRFJ, 2013].

C: **Gulmi** [Lumpek, "Baglung Distr.", "W. Nepal", hanging on trees, 7000 ft., *R.L. Fleming* 928, 9.11.1949, BM; exact duplicate: Baglung, C. Nepal, on rocks, 2580

ft., *R.L. Fleming* 928, 14.8.1949, KATH]; **Baglung** [Lumsum, south side of Dar khola below Lumsum, wooded gully, on mossy tree boles in moist forest, *c.* 6000 ft., *A.R. Vickery* 511, 26.3.1974, BM], **Myagdi** [Myagdi Distr., Boghara (2010 m.) - Lipshe (1840 m.) - Lapche Kharka (2060 m.) - Dobang (2360 m.), 83° 23', 28° 33'-37', *c.* 2200 m., *M. Mikage, R. Hirano, N. Kondo, C. Mohri, A. Takahashi* & *K. Yonekura* 9681249, 7.9.1996, E *sub* "*V. flexuosa*" in error, and *ditto*, 1950 m., 9687192, 7.9.1996, KATH; Myagdi Distr., Maraini (2520 m.) - Jalja La (3330 m.), 83° 14-15', 28° 30', on tree trunk, 2820 m., *M. Mikage, R. Hirano, A. Takahashi* & *K. Yonekura* 9682573, 15.9.1996, KATH *sub* "*V. flexuosa*" in error; Dobang (2360 m.), 83° 23', 28° 37', on tree trunk, *M. Mikage* & *K. Yonekura* 9682375, 9.9.1996, KATH], **Mustang** [Lete, S. of Tukucha, Kali Gandaki, on tree in wood, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 9882, 16.9.1954, BM], **Parbat** [Gurjang, on trees, 8-9000 ft., *Capt. Lall Dhwoj* 566, rec. 21.2.1931, BM *sub* "*V. himalayensis* var. *elongata* Ching *n. var*, det. R.C. Ching 1931" holotype; above Ulleri, epiphytic fern with rolled leaves, 7800 ft., *V. Puri* 587, 21.5.1954, CAL *sub* "*V. lineata*" in error; Ghore Pani, near Sika, 8000 ft., *V. Puri* 612, 22.5.1954, CAL; dense forest by streams and stream gorge, between Banthanthi and Nangethanthi, above Ulleri on way up to Ghorepani, N. of Birethanthi, S.W. side of Annapurna Himal, N. of Pokhara, Parbat District, *c.* 2200-2700 m., *C.R. Fraser-Jenkins*, with *G.B. Tamang*, *Keshab Nepali* & Philip McCormack (i-to-i volunteer, Ireland) 34518 (FN 23), 13.6.2010, TAIF], **Kaski** [Tangting, epiphytic in Rhododendron forests, 8000 ft., *J.D.A. Stainton, W.R. Sykes* & *L.H.J. Williams* 8982, 21.10.1954, BM, CAL *sub* "*V. doniana*" det. A.H.G. Alston, in error; Naudanda, on mossy tree trunk of the forest, 1600 m., *V.L. Gurung* 1370/81, 18.6.1981, KATH; N.W. of Summer huts above Siklis, 28° 07', 84° 06', moist, dark Rhododendron arboreum forest, *c.* 2700 m., *Rebecca G. Troth* 953, 28.8.1976, BM; Kaski District, east of Sickles, near headwaters of Gnach river, Easting: 227863, Northing: 3140036, on Rhododendron barbartum in mixed vergreen broad-leaved deciduous forest, 3100 m., *Dorothy Allard* 886, 16.7.1996, BM; path through woods on S. side of bend of Madi Khola, below and N. of Kalikasthan, on way to Madibesi and Chitre, N. of Begnas Tal, E. of Pokhara on path to Sikles, S.E. side of Annapurna range, Kaski District, *C.R. Fraser-Jenkins* & *Ganesh Bdr. Tamang* 26283 (FN 2261), 13.4.1998, BM, H, *sub* "*V.* ?*flexuosa*" in error], **Lamjung** [Lamjung District, Telbrung Danda, on ridge between Midam and Khudi river, north of Ghanpokhara, Easting: 233697, Northing: 3139503, east facing slope, rpihyte in Abies spectabilis/Rhododendron barbatum forest, with Abies heavily cut for shingle production, 3150 m., *Dorothy Allard* 1355, 6.8.1996, BM, det. CRFJ 2013 as "*V. linearifolia*" ?in error, tentatively redet. CRFJ 2015], **Makawanpur**, **Rasuwa** [Langtang - Syarpagaon, Oak forest, epiphyte, *c.* 9500 ft., *O. Polunin* 1861, 23-31.8.1949, BM; among mixed Pine and broad-leaved forest, along path from Dhunche N.E. to Deorali, Dhunche to Chandanbari and Gossainkund, N. of Trisuli Bazaar, Rasuwa District, *C.R. Fraser-Jenkins*, with *George Yatskievych* (Missouri Bot. Garden), *Lisa* (*E.A.*) *Hooper*

(Michigan State Univ.), *Jyoti P. Gajurel* (Trubhuvan University), *Rita Thapa* (T.U.), *Ganesh* (*Gopal*) *Bhdr. Tamang* (Bardibas and Thamel) & *Sagun Pariyar* (Deurali, Gorkha and Kathmandu) 34305 (FN 108), 18.9.2009, TAIF], **Dhading** [Ganesh Himal, Ankhu Khola, 28° 12', 85° 05', deep inside forest, 6500 ft., *J.D.A. Stainton* 3699, 12.5.1962, BM], **Nuwakot** [on ridge near hamlet Chaseragari [Sundarijal - Pati Bhanjyang], 27° 48', 85° 26', cloud forest remnants with Quercus, epiphyte, 2400 m., *J.H. de Haas* 2071-f, 6.8.1974, BM], **Kathmandu** [Sheopuri Lekh, on Oak forest, hanging from mossy tree trunk, 2600 m., *D.P. Joshi* & *K.R. Rajbhandari* 75/809, 22.3.1975, KATH "*rolypolyana*", determined by CRFJ 2014 from scales only, *sub* "*V. flexuosa*" in error; forested ridge on E. side of top of Shivapuri mountain, near Bagdwar, in stream-gully, N. of and above Buddhanilkantha and Naranthan, N. of Kathmandu City, Kathmandu District, *C.R. Fraser-Jenkins* 25384 (FN 1363), 19.4.1997, BM, H *sub* "*V.* ?*flexuosa*" in error], **Lalitpur** [Chapagaon, Kathmandu valley, 4800 ft., *R.L. Fleming* 1274, 8.1956, MICH *sub* "*V. elongata*" in error; Phulchowki, Kathmandu valley, 7000 ft., *R.L. Fleming* 1487, 8.1957, MICH, *ditto*, *R.L. Fleming* 1389, 28.8.1957, KATH, *sub* "*V. flexuosa*" in error; Mt. Phulcoki, 1800-2600 m., *T. Nakaike* 1581, 17.9.1986, KATH], **Sindhupalchok** [Helumbu gorge, (Lakhung Gompa), N.C. Nepal, on trees, 10,000 ft., *R.L. Fleming* 1777, 18-23 (20).7.1964, K, MICH, DD (moved to CAL!) cited for *V. taeniophylla* by Dixit (1981) with the mistakenly written locality of "Helmu, Lakhung Loampa"; Sindhupalchok District, Malemchi Gaon, N. of village, 28° 00', 85° 30', S.-facing, epiphyte on trunk of broad-leaved tree, 2666-2730 m., *R.G. Troth* 109, 11.11.1971, MICH; C. Nepal, Mangen (3100 m.) - Khodang Danda (2500 m.), 852276, *H. Kanai, H. Hara* & *H. Ohba* 725928, 28.8.1972, BM], **Dolakha** [Jiri, Dolakha, *T. Nakaike* 3035, 3.10.1988, KATH], **Ramechap** [Khare - Dovan, *P.R. Shakya, P. Pradhan, H.K. Saiju* & *N. Shrestha* 4850, 25.7.1978, KATH].

E: **Solukhumbhu** [Bhusinga to Jhaprebas, *c.* 6500 ft., *M.L. Banerji* 1505, 3.10.1964 (A) identified from photograph, published by Banerji (1972) as "*V. doniana*" in error; near Junbesi, Sagarmatha, *c.* 2500 m., *T. Nakaike* 3406, 18.10.1988, KATH], **Sankhuwasabha** [rive gauche de la Dudh Kosi, 2850 m., *A. Zimmermann* 1748, 17.10.1954, BM *sub* "*V. elongata*" det. C.E.B. Bonner in error, "*V. himalayensis*" det. A.H.G. Alston, 8.1955; E. Nepal, Chauke (2700 m.) - Tinjure Phedi (2700 m.), 872272, on mossy tree trunk in forest, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725471, 6.7.1972, BM; Kasuwa khola, Arun river, arboreal, 7000 ft., *E.W. Cronin*, with *H.M. Emery, H.* & *A. Foster* & *K. Brooks* F052, 10.6.1973, KATH; below Deurali, Makalu Barun National Park, 2400 m., *M.L. Pathak* & *L.R. Tharu* 20110536, 27.5.2011, KATH], **Dhankuta** [Dhankuta District, Chitre, 27° 10', 87° 25', epiphyte on mossy tree trunk, *c.* 2270 m., *Rebecca Gay Troth* 87, 16.7.1971, MICH, and Lam Pokhari, *ditto* 96, 17.7.1971, MICH det. CRFJ 21.9.2004 as "*V. linearifolia*" in error; East Nepal, Sinduwa, Dhankuta Distr., 1100 m., *H. Hara, H. Kanai, S. Kurosawa* & *G.Murata* 6305394, 24.10.1963, BM, KATH, CAL; E. Nepal, Sinduwa (2100 m.) - Bhalukhop (2400 m.), 872271, on

tree trunk in light shade, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725081, 5.6.1972, BM, KATH], **Tehrathum** [E. Nepal, Chauke (2700 m.) - Tinjure Phedi (2700 m). 872272, on mossy tree trunk in forest, *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725471, 6.7.1972, KATH; Terhathum Distr., Basantapur (2300 m.) - Tute (2480 m.) - Chauke (2650 m.), 29° 07' 00", 87° 26' 00" - 27° 12' 35", 87° 28' 01", epiphyte in dense forest, 2800 m., *Y. Omori, N. Acharya, K. Fujikawa, M. Munemasa, M. Okada, R.H. Ree, M. Tateno* & *N. Thapa* 9955002, 3.8.1999, KATH; Terhathum Distr., Basantapur (2300 m.) - T[s]ute (2480 m.) - Chauki (2650 m.), Tutedeorali - Dundpani, 27° 07' 00", 87° 26' 00" - 27° 12' 35", 87° 28' 01", epiphyte, 2500 m., *Y. Omori, N. Acharya, K. Fujikawa, M. Munemasa, M. Okada, R.H. Ree, M. Tateno* & *N. Thapa* 9955054, 3.8.1999, KATH *sub* "*V. linearifolia*" det. CRFJ 2014, in error; Basantapur - Chauki, 2305 m, *H. Ikeda, D.R. Kandel, R. Chhetri, H. Uchiyama, K. Akai, H. Taneda, O. Yano, N. Yamamoto, K. Miyato* & *M. Nakaji* 1228008, 8.8.2012, KATH], **Ilam** [Dhobhata, Ilam, 8800 ft., *R.L. Fleming* 2664, 23.9.1978, MICH], **Taplejung** [Milke Danra forest, hanging from rock, 9000 ft., *A.H. Norkett* 7118, 16.1.1961, BM; Mewa, E. Nepal, on wet trees, 6100 ft./8000 ft., *R.L. Fleming* 2075 (rolled up)/2076/2077, 3.12.1971, K/MICH, K/K *sub* "*V. elongata*" in error; E. Nepal, Topke Gola (3600 m.) - Shewaden (2600 m.), 873274, on tree trunk in dense forest, *c.* 3000 m., *H. Kanai, H. Ohashi, K. Iwatsuki, H. Ohba, Z. Iwatsuki* & *P.R. Shakya* 725308B, 28.6.1972, BM].

Himalayan distribution: China; Tibet; Myanmar; Arunachal Pradesh; Bhutan; Sikkim; Darjeeling; Nepal; Uttarakhand. N.E. India. Taiwan; Philippines.

(S, C). A common upper-mid to higher altitude forest epiphyte, hanging or arching down from branches in dense luxuriant forest.

LIST OF PLATES

Photographs by CRFJ, unless stated otherwise; further photographs of pteridophytes and the Annapurna Base Camp route by CRFJ, with S. Pariyar and J.C.B. Fraser-Jenkins from 1-7.6.2012 are available for viewing on www.photobucket.com/albums/r616/chrisopteris (see Fraser-Jenkins, C.R. 2014 ["2013"]. Ferns and allies on the Annapurna Base-Camp trek, C. Nepal, *Indian Fern J.* **30**(1-2): 25-39, pre-printed 2013. *The Hardy Fern Foundation Quarterly* (USA) **23**(2): 46-47, 50-60 *et tt.*).

1. *Huperzia phlegmaria*, Rani Ban, Phewa Tal, Pokhara, Kaski, *CRFJ* & *SP* 33085 (FN 198), 3.10.2008 (TAIF).
2. *Huperzia phlegmaria*, Rani Ban, Phewa Tal, Pokhara, Kaski, *CRFJ* & *SP* 33085 (FN 198), 3.10.2008 (TAIF).
3. *Huperzia hamiltonii* and *pulcherrima*, Chomrong, Annapurna, *CRFJ*, *SP* & *Jacob C.B. Fraser-Jenkins* (not collected), 5.6.2012.
4. *Huperzia pulcherrima*, Sinuwa, below Annapurna Base Camp, Kaski, *CRFJ*, *SP* & *Jacob C.B.Fraser-Jenkins* (not collected), 5.6.2012.
5. *Huperzia serrata*, Mahadev khola, Sanagaon, Sankhu, Kathmandu, *CRFJ* (not collected), 29.9.2008.
6. *Huperzia squarrosa*, Rani Ban, Phewa Tal, Pokhara, Kaski, *CRFJ* 30723, 17.9.2004 (TAIF).
7. *Lycopodium japonicum*, Khaling, Tashigang, E. Bhutan, *CRFJ* & *T. Wangdi* (not collected), 22.5.2009 (THIM, TAIF).
8. *Selaginella bisulcata*, Shillong Peak, Meghalaya, India, *CRFJ* 33269 (FN 49), 11.11.2008 (TAIF).
9. *Selaginella bisulcata*, Shillong Peak, Meghalaya, India, *CRFJ* 33269 (FN 49), 11.11.2008 (TAIF).
10. *Selaginella bryopteris*, from Mugling, Chitawan, *CRFJ* 35085 (FN 362), 7.6.2012 (TAIF).
11. *Selaginella bryopteris*, from Mugling, Chitawan, *CRFJ* 35085 (FN 362), 7.6.2012 (TAIF).
12. *Selaginella chrysocaulos*, Taplejung, Chauki - Gupha Pokhar, *Y. Omori et al.* 9955057 (KATH).
13. *Selaginella emodi*, Dhunche to Chandanbari, Gossainthan, Rasuwa, *CRFJ* (not collected), 18.9.2009.
14. *Selaginella fulcrata*, Mugling, Chitawan, *CRFJ*, *G.B.* & *U. Tamang et al.* 25793 (FN 1771), 13.12.1997 (H).
15. *Selaginella helvetica*, Danphe Lagna pass, Kali, above Jumla, *CRFJ* 35375, 5.6.2014 (KATH).
16. *Selaginella pallida*, Deurali, Anbu Khaireni, S. Gorkha, *CRFJ*, *N.* & *J.C.B. Fraser-Jenkins* (not collected), 30.1.2015.

17. *Selaginella pallidissima*, above Tukche, Mustang, *CRFJ* & *G.B. Tamang* 30519, 28.6.2004 (TAIF).
18. *Selaginella reticulata*, below Mawmluh, Sohra, Meghalaya, India, *CRFJ* 33370 (FN 150), 21.11.2008 (TAIF).
19. *Selaginella subdiaphana*, Raniban, above Anadu, Pokhara, Kaski, *CRFJ* & *SP* (not collected), 3.10.2008.
20. *Selaginella vaginata*, Raniban, above Anadu, Pokhara, Kaski, *CRFJ* & *SP* (not collected), 3.10.2008.
21. *Equisetum arvense* subsp. *arvense*, Muktinath, Mustang, *CRFJ*, *SP* & *J.C.B. Fraser-Jenkins* 34723 (FN 2), 1.6.2011 (TAIF).
22. *Botrychium lanuginosum*, Basantapur, Tehrathum, *H. Ikeda, D.R. Kandel et al.* 1228063, 2.9.2012 (KATH), photo by DRK.
23. *Botrychium multifidum* subsp. *robustum*, above Thimphu Zoo towards Phajudin, Thimphu, Bhutan, *CRFJ* & *SP* 35291 (FN 165), 15.12.2013 (THIM, TAIF).
24. *Botrychium simplex* subsp. *simplex*, N. Sikkim, India, *B.S. Kholia* (BSHC), photo by B.S. Kholia.
25. *Ophioglossum parvifolium*, Komale, Deurali, Anbu Khaireni, Gorkha, *CRFJ* 30780, 18.9.2004 (TAIF).
26. *Ophioglossum parvifolium*, Komale, Deurali, Anbu Khaireni, Gorkha, *CRFJ* 30780, 18.9.2008 (TAIF).
27. *Angiopteris helferiana*. Lohapul, Teesta Bazaar, Darjeeling, India, *CRFJ, N. Fraser-Jenkins*, *SP* & *C.K. Pariyar* 30488, 26.5.2004 (TAIF).
28. *Angiopteris helferiana*. Lohapul, Teesta Bazaar, Darjeeling, India, *CRFJ, N. Fraser-Jenkins*, *SP* & *C.K. Pariyar* 30488, 26.5.2004 (TAIF).
29. *Osmunda japonica*, Tashigang, Bhutan, *CRFJ* & *T. Wangdi* , 5.2009 (THIM, TAIF).
30. *Plagiogyria pycnophylla*, Wak Kabah Fall, Sohra, Meghalaya, India, *CRFJ* (not collected), 21.11.2008.
31. *Marsilea minuta*, Panitanki, Naxal Bari, W. Bengal, India, *CRFJ* 35223 (FN 97), 25.11.2013 (TAIF).
32. *Azolla filiculoides* subsp. *filiculoides* (sori beneath), Brahmaputra Bridge, Tezpur, Assam, India, *CRFJ* 33764 (FN 227), 19.2.2009 (TAIF).
33. *Dicranopteris splendida*, Shillong Peak, Meghalaya, India, *CRFJ* 33271 (FN 51), 11.2008 (TAIF).
34. *Dicranopteris taiwanensis*, Raniban, above Anadu, Pokhara, Kaski, *CRFJ* & *SP* 33086 (FN 199), 3.10.2008 (TAIF).
35. *Diplopterygium giganteum*, Wamrong, Bhutan, *CRFJ* & *T. Wangdi* (not collected), 22.5.2009.
36. *Hymenophyllum tenellum*, Sinuwa, route to Annapurna, Kaski, *CRFJ*, *SP* & *J.C.B. Fraser-Jenkins* (not collected), 4-5.6.2012.
37. *Trichomanes auriculatum*, Shillong Peak, Meghalaya, India, *CRFJ* (not collected), 11.11.2008.

38. *Trichomanes campanulatum*, [Chittagong, Bangladesh, *F. Buchanan* (*Hamilton*)] Ind. or., *Roxburgh s.n.* (BM).
39. *Trichomanes parvifolium*, Komale, Deurali, Anbu Khaireni, Gorkha, *CRFJ*, *N.* & *J.C.B. Fraser-Jenkins* (not collected), 31.1.2015.
40. *Trichomanes saxifragoides*, Raniban, Baidam, Pokhara, Kaski, *CRFJ* 30733, 17.9.2004 (TAIF).
41. *Cyathea gigantea*, Begnas Tal, Leknath, E. of Pokhara, Kaski, *CRFJ*, with *G.B.*, *U.* & *A. Tamang* 26042 (FN 2020), 19.2.1998 (H).
42. *Cyathea khasyana*, Ladmawphlong, Sohra, Meghalaya, India, *CRFJ* 33313 (FN 93), 21.11.2008 (TAIF).
43. *Cyathea sollyana*, Deothang, Samdup Jongkhar, E. Bhutan, *CRFJ* & *T. Wangdi* 33953 (FN 39), 20.5.2009 (THIM, TAIF).
44. *Dennstaedtia appendiculata*, Patmara to Urthu, N.E. of Jumla, *CRFJ* (not collected), 5.6.2014.
45. *Dennstaedtia appendiculata*, Phulchowki Danrah, Godawari, Lalitpur, *CRFJ* 30622, 18.7.2004 (TAIF).
46. *Microlepia hallbergii*, Samtengang - Choojom, Bhutan, *G. Murata et al.* 10076, 26.4.1967 (KATH).
47. *Microlepia marginata*, Nagarjun, Kathmandu, ex Godawari Bot. Garden, *D.H. Nicolson* 3037, 22.3.1967 (KATH).
48. *Microlepia nepalensis*, Raniban, Baidam, Pokhara, Kaski, *CRFJ* 30734, 17.9.2004 (TAIF).
49. *Microlepia nepalensis*, Raniban, above Anadu, Pokhara, Kaski, *CRFJ* & *SP* 33092 (FN 205), 3.10.2008 (TAIF).
50. *Microlepia rhomboidea*, Chisopani khola, Deurali, Anbu Khaireni, Gorkha, *CRFJ*, *N.* & *J.C.B. Fraser-Jenkins* (not collected), 31.1.2015.
51. *Microlepia setosa*, Birethanti to New Bridge, Annapurna, Kaski, *CRFJ*, *SP* & *J.C.B. Fraser-Jenkins* (not collected), 31.5.2012.
52. *Microlepia speluncae*, Deurali, Anbu Khaireni, Gorkha, *CRFJ*, *N.* & *J.C.B. Fraser-Jenkins* (not collected), 31.1.2015.
53. *Microlepia strigosa*, Bajrabarahi, Chapagaon, Lalitpur, *V.L. Gurung* 8776, 3.1973 (KATH).
54. *Lindsaea ensifolia*, Raniban, Baidam, Pokhara, Kaski, *CRFJ* 30739, 17.9.2004 (TAIF).
55. *Odontosoria chinensis*, Chisopani khola, Deurali, Anbu Khaireni, Gorkha, *CRFJ*, *N.* & *J.C.B. Fraser-Jenkins* (not collected), 31.1.2015.
56. *Actiniopteris semiflabellata*, Leuti khola, Dhankuta, *P.R. Shakya* & *M. Ohsawa* 786, 28.8.1971 (KATH).
57. *Adiantum edgeworthii*, Nagarjun, Mudko, Balaju, Dhading, *CRFJ* & *SP* (not collected), 1.9.2011.
58. *Adiantum myriosorum*, Majpali - Patagaon, Bajura, *K.R. Rajbhandari* 15073A, 15.8.1991 (KATH).

59. *Adiantum pedatum* subsp. *pedatum*, Machapuchare Base Camp, Annapurna, Kaski, *CRFJ, SP* & *J.C.B. Fraser-Jenkins* 35021 (FN 298), 6.2012 (TAIF).
60. *Adiantum tibeticum*, Dhitachaur, Dhansagu, Jumla, *CRFJ* 35333, 1.6.2014 (KATH).
61. *Adiantum tibeticum*, Dhitachaur, Dhansagu, Jumla, *CRFJ* 35333, 1.6.2014 (KATH).
62. *Adiantum venustum*, Gini, Pithoragarh, Uttarakhand, India, *CRFJ* 34664 (FN 166), 19.11.2010 (TAIF).
63. *Adiantum venustum*, Gini, Pithoragarh, Uttarakhand, India, *CRFJ* 34664 (FN 166), 19.11.2010 (TAIF).
64. *Adiantum wattii*, Machapuchare Base Camp, Annapurna, Kaski, *CRFJ, SP* & *J.C.B. Fraser-Jenkins* 35020 (FN 297), 3.6.2012 (TAIF).
65. *Aleuritopteris albomarginata*, Tatopani, Sindhupalchok, *CRFJ* 34754 (FN 32), 12.7.2011 (TAIF).
66. *Aleuritopteris albomarginata*, Tatopani, Sindhupalchok, *CRFJ* 34754 (FN 32), 12.7.2011 (TAIF).
67. *Aleuritopteris anceps*, Boga Lake, Ruma, Chittagong, Bangladesh, *CRFJ* 30256, 1.1.2004 (TAIF).
68. *Aleuritopteris argentea*, 2 km. N. of Tukuche, Jomsom, Mustang, *CRFJ* & *G.B. Tamang* 30509, 27.6.2004 (TAIF).
69. *Aleuritopteris argentea*, 2 km. N. of Tukuche, Jomsom, Mustang, *CRFJ* & *G.B. Tamang* 30509, 27.6.2004 (TAIF).
70. *Aleuritopteris chrysophylla*, Mirror cliff, Samdrup Jongkhar, E. Bhutan, *CRFJ* & *T. Wangdi* 34116 (FN 202), 24.5.2009 (THIM, TAIF).
71. *Aleuritopteris dealbata*, Nagarjun, below Jamachok, Balaju, Kathmandu, *CRFJ* 31922 , 28.11.2005 (TAIF).
72. *Aleuritopteris dubia*, Jhinu, Chomrong, Annapurna route, Kaski, *CRFJ, SP* & *J.C.B. Fraser-Jenkins* (not collected), 1.6.2012.
73. *Aleuritopteris dubia*, Jhinu, Chomrong, Annapurna route, Kaski, *CRFJ, SP* & *J.C.B. Fraser-Jenkins* (not collected), 1.6.2012.
74. *Aleuritopteris duthiei*, Chele La pass, Ha, Bhutan, *CRFJ, T. Wangdi* & *Rebecca Pradhan* 31626, 12.10.2005 (THIM, TAIF).
75. *Aleuritopteris formosana*, Jhinu, Chomrong, Annapurna route, Kaski, *CRFJ, SP* & *J.C.B. Fraser-Jenkins* (not collected), 1.6.2012.
76. *Aleuritopteris grisea*, top of Phulchowki Danrah, Godawari, Lalitpur, *CRFJ* 30631, 18.7.2004 (TAIF).
77. *Aleuritopteris grisea*, top of Phulchowki Danrah, Godawari, Lalitpur, *CRFJ* 30631, 18.7.2004 (TAIF).
78. *Aleuritopteris leptolepis*, Kali to Patmara, N.E. of Jumla, *CRFJ* 35377, 5.6.2014 KATH).
79. *Aleuritopteris rufa*, Listikot, Tatopani, Sindhupalchok, *CRFJ* 28973 (FN 4948), 5.6.2011 (H).
80. *Aleuritopteris tamburii*, Dhunche to Chandanbari, Gossainthan, Rasuwa, *CRFJ, SP et al*. (not collected), 18.9.2009.

81. *Ceratopteris thalictroides*, E. side of Banbasa, on Nepal border, Tanakpur, Uttarakhand, India, *CRFJ* 34562 (FN 65), 31.10.2010 (TAIF).
82. *Cheilanthes belangeri*, Panitanki, Naxal Bari, Siliguri, W. Bengal, India, *CRFJ* (not collected), 25.11.2013
83. *Cheilanthes nitidula*, Tongsa - Tashiling, Bhutan, *H. Kanai et al.* 7153, 19.4.1967 (KATH).
84. *Cheilanthes subvillosa*, Lama Hotel - Langtang, Rasuwa, *T. Nakaike* 1280, 31.8.1986 (KATH).
85. *Cheilanthes tenuifolia*, Begnas Tal, Leknath, Kaski, *CRFJ* & *Ranil Rajapaksha* (not collected),13.7.2009.
86. *Coniogramme affinis*, Patmara to Urthu, N,E. of Jumla, *CRFJ* 35402, 5.6.2014 (KATH).
87. *Coniogramme affinis*, Patmara to Urthu, N,E. of Jumla, *CRFJ* 35402, 5.6.2014 (KATH).
88. *Coniogramme pubescens*, Sinuwa, Annapurna, Kaski, *CRFJ*, *SP* & *J.C.B. Fraser-Jenkins* (not collected), 5.6.2012.
89. *Coniogramme procera*, Sinuwa, Annapurna, Kaski, *CRFJ*, *SP* & *J.C.B. Fraser-Jenkins* (not collected), 5.6.2012.
90. *Coniogramme serrulata*, Phulchowki Danrah, Lalitpur, *CRFJ* 30637, 18.7.2004 (TAIF).
91. *Coniogramme serrulata*, Phulchowki Danrah, Lalitpur, *CRFJ* 30637, 18.7.2004 (TAIF).
92. *Cryptogramma brunoniana* subsp. *brunoniana*, Surma Sarovar, Bajhang, *D.P. Joshi* & *M.S. Bista* 595, 26.8.1972 (KATH).
93. *Cryptogramma stelleri*, Danphe Lagna pass, N. of Jumla, *CRFJ* 35378, 5.6.2014 (KATH).
94. *Doryopteris ludens*, Boga Lake, Ruma, Chittagong, Bangladesh, *CRFJ* 30255, 1.1.2004 (TAIF).
95. *Notholaena delavayi*, Chele La pass, Ha, Bhutan, *CRFJ*, *T.Wangdi* & *Rebecca Pradhan* 31629, 12.10.2005 (THIM, TAIF).
96. *Notholaena himalaica*, N. of Jumla on way to Karnali Technical College, *CRFJ* & *SP* 35161, 27.9.2013 (TAIF).
97. *Notholaena marantae*, Chele La pass, Ha, Bhutan, *CRFJ*, *T. Wangdi* & *Rebecca Pradhan* 31631, 12.10.2005 (THIM, TAIF).
98. *Onychium cryptogrammoides* subsp. *cryptogrammoides*, Ghuguti, above Jumla, *CRFJ* (not collected), 27.9.2013.
99. *Onychium cryptogrammoides* subsp. *cryptogrammoides*, Ghuguti, above Jumla, *CRFJ* (not collected), 27.9.2013.
100. *Onychium cryptogrammoides* subsp. *fragile*, Liping Bridge, Tatopani, Sindhupalchok, *CRFJ* 34751 (FN 29), 12.7.2011 (TAIF).
101. *Onychium cryptogrammoides* subsp. *fragile*, Liping Bridge, Tatopani, Sindhupalchok, *CRFJ* 34751 (FN 29), 12.7.2011 (TAIF).

102. *Onychium kholianum*, Gini, Pithoragarh, Uttarakhand, India, *CRFJ* 34587 (FN 90), 3.11.2010 (TAIF).
103. *Onychium lucidum*, Jhinu to New Bridge, Annapurna, Kaski, *CRFJ, SP* & *J.C.B. Fraser-Jenkins* 35071 (FN 348), 6.6.2012 (TAIF).
104. *Onychium lucidum*, holotype, Narainhetty, Kathmandu, *Dr. Buchanan s.n.*, 22.2.1803 (BM).
105. *Onychium lucidum*, holotype, Narainhetty, Kathmandu, *Dr. Buchanan s.n.*, 22.2.1803 (BM).
106. *Onychium vermae*, holotype, Lebong, Darjeeling, W. Bengal, India, *S.C. Verma* 3, 9.1957 (PAN 3761).
107. *Onychium vermae*, holotype, Lebong, Darjeeling, W. Bengal, India, *S.C. Verma* 3, 9.1957 (PAN 3761).
108. *Onychium siliculosum*, Anbua to Deurali, S. Gorkha, *CRFJ*, *Nirmala* & *J.C.B. Fraser-Jenkins* (not collected), 30.1.2015.
109. *Pteris arisanensis*, Nagarjun forest, Mudko, Dhading, *CRFJ* & *SP* 34775, 1.9.2011 (TAIF).
110. *Pteris arisanensis*, Nagarjun forest, Mudko, Dhading, *CRFJ* & *SP* 34775, 1.9.2011 (TAIF).
111. *Pteris aspericaulis*, Gini, Munsiyari,Pithoragarh, Uttarkhand, India, *CRFJ* 34584 (FN 87), 3.11.2010 (TAIF).
112. *Pteris aspericaulis*, Phulchowki Danrah, Godawari, Lalitpur, *CRFJ* & *G. Yatskievych* (not collected), 5.9.2009.
113. *Pteris biaurita* subsp. *fornicata*, Panitanki, Naxalbari, Siliguri, W. Bengal, India, *CRFJ* (not collected), 25.11.2013.
114. *Pteris biaurita* subsp. *walkeriana*, roadside in Baidam, Pokhara, Kaski, *CRFJ* (not collected), 29.5.2012.
115. *Pteris cretica* subsp. *cretica*, Gini, Pithoragarh, Uttarakhand, India, *CRFJ* 34583 (FN 86), 3.11.2010 (TAIF).
116. *Pteris cretica* subsp. *laeta*, Swala, below Pithoragarh, on Chalthi road, Pithoragarh, Uttarakhand, India, *CRFJ* (not collected), 2.11.2010.
117. *Pteris dactylina*, Patmara to Urthu, N.E. of Jumla, *CRFJ* 85397, 5.6.2014 (KATH).
118. *Pteris kathmanduensis*, Nagarjun forest, Mudko, Dhading, *CRFJ* & *SP* 34769, 1.9.2011 (TAIF).
119. *Pteris kathmanduensis*, N. of Sukhidang, Tanakpur, Champawat, Uttarakhand, India, *CRFJ* 34750 (FN 73), 2.11.2010 (TAIF).
120. *Pteris normalis*, Nagarjun forest, Mudko, Dhading, *CRFJ* & *SP* 34767, 1.9.2011 (TAIF).
121. *Pteris puberula*, Gandhi Road, Darjeeling to Ghoom, W. Bengal, India, *CRFJ* 30892, 22.10.2004 (TAIF).
122. *Pteris puberula*, Gandhi Road, Darjeeling to Ghoom, W. Bengal, India, *CRFJ* 30892, 22.10.2004 (TAIF).
123. *Pteris roseolilacina*, Nagarjun forest, Mudko, Dhading, *CRFJ* & *SP* 34765, 1.9.2011 (TAIF).

124. *Pteris roseolilacina*, Nagarjun forest, Mudko, Dhading, *CRFJ* & *SP* 34765, 1.9.2011 (TAIF).
125. *Pteris subquinata* cv. 'White Hooker', Morong, Samdrup Jongkhar, E. Bhutan, *CRFJ* & *T. Wangdi* 34149 (FN 235), 24.5.2009 (THIM, TAIF).
126. *Pteris vittata* potential subsp. *vermae*, N. of Listikot, Tatopani, Sindhupalchok, *CRFJ* 34749 (FN 27), 12.7.2011 (TAIF).
127. *Pteris wallichiana*, Ghorepani to Ulleri, Parbat, *CRFJ* & *Keshab Nepali* (not collected), 14.6.2010.
128. *Pteris wallichiana*, Ghorepani to Ulleri, Parbat, *CRFJ* & *Keshab Nepali* (not collected), 14.6.2010.
129. *Antrophyum reticulatum*, Gokarna Forest resort, Bhaktapur, *CRFJ*, *N.* & *J.C.B. Fraser-Jenkins* 34209 (FN 12), 5.7.2009 (TAIF).
130. Vittaria flexuosa, Sudame, Banthani, Parbat, *CRFJ* & *Keshab Nepali* 34556 (FN 60), 15.6.2010 (TAIF).
131. *Vittaria linearifolia*, Dobhan Lodge, Annapurna, Kaski, *CRFJ* & *G.B. Tamang* 32487 (FN 133), 29.11.2006 (TAIF).
132. *Vittaria linearifolia*, Dobhan Lodge, Annapurna, Kaski, *CRFJ* & *G.B. Tamang* 32487 (FN 133), 29.11.2006 (TAIF).
133. *Vittaria sikkimensis*, Raniban above Anadu, Pokhara, Kaski, *CRFJ* & *SP* 33097 (FN 210), 3.10.2008 (TAIF).
134. *Vittaria sikkimensis*, Gokarna Forest resort, Bhaktapur, *CRFJ* 34210 (FN 14), 5.7.2009 (TAIF).
135. *Vittaria sikkimensis*, Gokarna Forest resort, Bhaktapur, *CRFJ* 34210 (FN 14), 5.7.2009 (TAIF).
136. *Vittaria taeniophylla*, Sinuwa to Bamboo Lodge, Annapurna, Kaski, *CRFJ* & *G.B. Tamang* 32417 (FN 64), 29.11.2006 (TAIF).
137. *Vittaria taeniophylla*, Sinuwa to Bamboo Lodge, Annapurna, Kaski, *CRFJ* & *G.B. Tamang* 32417 (FN 64), 29.11.2006 (TAIF).
138. *Vittaria taeniophylla*, Banthanti, Ghorepani, Parbat, *CRFJ* & *K. Nepali* 34518 (FN 23), 13.6.2010 (TAIF).

Cover photo: *Cyathea spinulosa* in the monsoon, Burjung Khola, North of Pokhara, Kaski, 12.9.2009

1. *Huperzia phlegmaria*

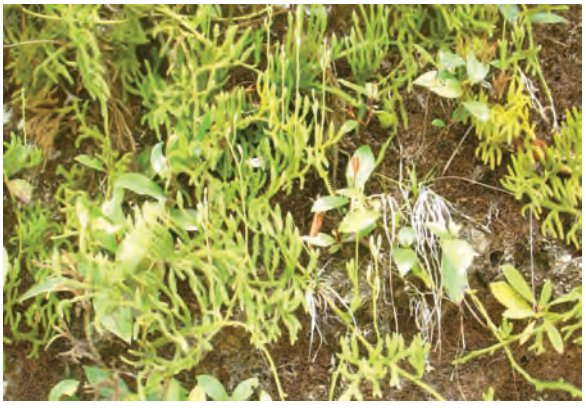
2. *Huperzia phlegmaria*

3. *Huperzia hamiltonii and pulcherrima*

4. *Huperzia pulcherrima*

5. *Huperzia serrata*

6. *Huperzia squarrosa*



7. *Lycopodium japonicum*

8. *Selaginella bisulcata*

9. *Selaginella bisulcata*

10. *Selaginella bryopteris*

11. *Selaginella bryopteris*

12. *Selaginella chrysocaulos*

13. *Selaginella emodi*

14. *Selaginella fulcrata*

15. *Selaginella helvetica*

16. *Selaginella pallida*

17. *Selaginella pallida*

18. *Selaginella reticulata*

19. *Selaginella subdiaphana*

20. *Selaginella vaginata*

21. *Equisetum arvense subsp. arvense*

22 *Botrychium lanuginosum*

23. *Botrychium multifidum*

24. *Botrych simplex*

25. *Ophioglossum parvifolium*

26. *Ophioglossum parvifolium*

27. *Angiopteris helferiana*

28. *Angiopteris helferiana*

29. *Osmunda japonica*

30. *Plagiogyria pycnophylla*

31. *Marsilea minuta*

32. *Azolla filiculoides subsp. filiculoides*

33. *Dicranopteris splendida*

34. *Dicranopteris taiwanensis*

35. *Diplopterygium giganteum*

36. *Hymenophyllum tenellum*

37. *Trichomanes auriculatum*

38. *Trichomanes campanulatum*

39. *Trichomanes parvifolium*

40. *Trichomanes saxifragoides*

41. *Cyathea gigantea*

42. *Cyathea khasyana*

43. *Cyathea sollyana*

44. *Dennstaedtia appendiculata*

45. *Dennstaedtia appendiculata*

46. *Microlepia hallbergii*

47. *Microlepia marginata*

48. *Microlepia nepalensis*

49. *Microlepia nepalensis*

50. *Microlepia rhomboidea*

51. *Microlepia setosa*

52. *Microlepia speluncae*

53. *Microlepia strigosa*

54. *Lindsaea ensifolia*

55. *Odontosoria chinensis subsp. chinensis*

56. *Actiniopteris semiflabellata*

57. *Adiantum edgeworthii*

58. *Adiantum myriosorum*

59. *Adiantum pedatum*

60. *Adiantum tibeticum*

61. *Adiantum tibeticum*

62. *Adiantum venustum*

63. *Adiantum venustum*

64. *Adiantum wattii*

65. *Aleuritopteris albomarginata*

66. *Aleuritopteris albomarginata*

67. *Aleuritopteris anceps*

68. *Aleuritopteris argentea*

69. *Aleuritopteris argentea*

70. *Aleuritopteris chrysophylla*

71. *Aleuritopteris dealbata*

72. *Aleuritopteris dubia*

73. *Aleuritopteris dubia*

74. *Aleuritopteris duthiei*

75. *Aleuritopteris formosana*

76. *Aleuritopteris grisea*

77. *Aleuritopteris grisea*

78. *Aleuritopteris leptolepis*

79. *Aleuritopteris rufa*

80. *Aleuritopteris tamburii*

81. *Ceratopteris thalictroides subsp. gaudichaudii*

82. *Cheilanthes belangeri*

83. *Cheilanthes nitidula*

84. *Cheilanthes subvillosa*

85. *Cheilanthes tenuifolia*

86. *Coniogramme affinis*

87. *Coniogramme affinis*

88. *Coniogramme pubescens*

89. *Coniogramme procera*

90. *Coniogramme serrulata*

91. *Coniogramme serrulata*

92. *Cryptogramma brunoniana subsp. brunoniana*

93. *Cryptogramma stelleri*

94. *Doryopteris ludens*

95. *Notholaena delavayi*

96. *Notholaena himalaica*

97. *Notholaena marantae*

98. *Onychium cryptogrammoides subsp. cryptogrammoides*

99. *Onychium cryptogrammoides subsp. cryptogrammoides*

100. *Onychium cryptogrammoides subsp. fragile*

101. *Onychium cryptgrammoides subsp. fragile*

102. *Onychium kholianum*

103. *Onychium lucidum*

104. *Onychium lucidum*

105. *Onychium lucidum*

106. *Onychium vermae*

107. *Onychium vermae*

108. *Onychium siliculosum*

109. *Pteris arisanensis*

110. *Pteris arisanensis*

111. *Pteris aspericaulis*

112. *Pteris aspericaulis*

113. *Pteris biaurita subsp. fornicata*

114. *Pteris biaurita subsp. walkeriana*

115. *Pteris cretica subsp. cretica*

116. *Pteris cretica subsp. laeta*

117. *Pteris dactylina*

118. *Pteris kathmanduensis*

119. *Pteris kathmanduensis*

120. *Pteris normalis*

121. *Pteris puberula*

122. *Pteris puberula*

123. *Pteris roseolilacina*

124. *Pteris roseolilacina*

125. *Pteris subquinata cv. 'White Hooker'*

126. *Pteris vittata subsp. vermae*

127. *Pteris wallichiana*

128. *Pteris wallichiana*

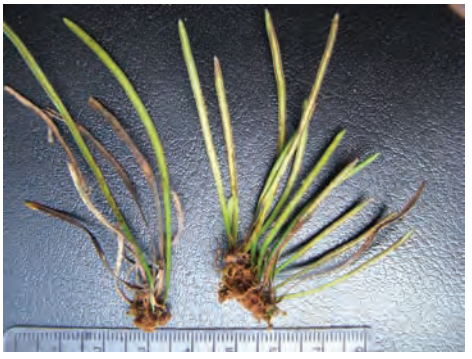
129. *Antrophyum reticulatum*

130. *Vittaria flexuosa*

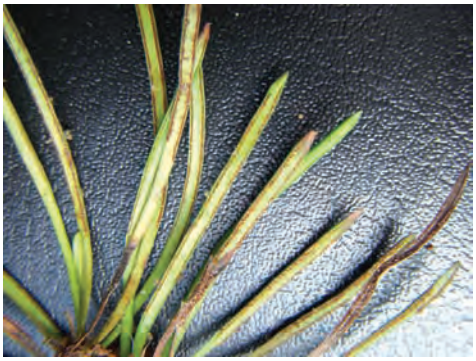
131. *Vittaria linearifolia*

132. *Vittaria linearifolia*

133. *Vittaria sikkimensis*



134. *Vittaria sikkimensis*



135. *Vittaria sikkimensis*

136. *Vittaria taeniophylla*

137. *Vittaria taeniophylla*

138. *Vittaria taeniophylla*

APPENDIX

THE CONFUSED NAME, *ATHYRIUM SETIFERUM*

The following account, related to the above list, is extracted and modified to bring it up to date from Fraser-Jenkins' (1995, *ined.*) monograph, *Himalayan athyrioid ferns*, as the names *A. setiferum* and *A. nigripes* have been badly confused in the *Flora of China* and the present information had remained generally unavailable:

Athyrium setiferum C.Chr., *Ind. Fil.* **1**: 146 (1905), *basionym*, *nom. nov.* for *Asplenium tenellum* (Wall. *apud* T.Moore *ex* R.Sim) C.Hope; *synonyms*: *Asplenium gracile* D.Don., *Prodr. Flor. Nepal.*: 8 (1824) (*lectotype*: "*Asplenium gracile* D. Don, Prod. Fl. Nep., Hab. in summis alpibus reg. Himalayae dicto Nepaliae [written by Don]. Nepaliae. *Dr. Wallich*, ex herb. Rudge.", BM), *non* Fée (1857) *nec al., nec Athyrium gracile* Fourn. (1872); *Allantodia tenella* Wall., *Num. List*: *sub* no. 206 (1828), *pro parte, nom. nud.*; *Athyrium tenuifrons* var. *tenellum* Wall. *apud* T.Moore *ex* R.Sim, *Priced Cat. Ferns* **6**: 22 (1859); *Asplenium tenellum* (Wall. *apud* T.Moore *ex* R.Sim) Hope, *J. Bombay Nat. Hist. Soc.* **12**: 529-531 (1899), *non* Roxb. (1816), *nec* Fée (1852); ?*Asplenium tozanense* Hayata, *Mater. Flor. Formos.*: 440 (1911); ?*Athyrium tozanense* (Hayata) Hayata, *Icon. Plant. Formos.* **4**: 235 (1914); *Athyrium supraspinescens* C.Chr., *Contrib. U.S. Nat. Herb.* **26**(6): 297, *t.* 19 (1926); *Athyrium yui* Ching, *Bull. Fan Meml. Inst. Biol., Bot.*, **10**: 6 (1940); *Athyrium medogense* X.C.Zhang, *Bull. Bot. Res.* **11**(3): 11-13 (1991).

Although Sledge (1956) stated that *Asplenium stramineum* J.Sm. *ex* Hook. & Baker (1867), *nom. nud., non Athyrium* Copel., referred to *A. nigripes* (*i.e. A. setiferum*) Smith's specimens of *A. stramineum* at BM (!) and K (!) are actually *A. devolii* Ching, which occurs from E. Nepal eastwards through N.E. India to Tibet, China and Myanmar.

Rhizome upright, thick. *Stipe* thin, very long, bearing a tuft of lanceolate, pale- to mid-brown scales at its base; stipe & rachis pale-green or stramineous, occasionally ± pink. *Fronds* delicate, the fertile fronds usually taller and more erect than the surrounding sterile ones; *lamina* lanceolate, widest just below the middle, lowest one or two pairs of pinnae shorter than the next, but frond-base somewhat truncate, thinly herbaceous; *pinnae* short, well separated, narrowly triangular-lanceolate, pinnate, auriculate, the basal acroscopic pinnule being longer than the rest and the basal basiscopic one often slightly shortened; *pinnules* rhombic-ovate, with narrow, cuneate, ± adnate bases, the lowest ones becoming stalked, asymmetrical about their axes, their acroscopic basal lobes being longer than the more sloping and decurrent basiscopic ones, somewhat curved so that they often approach a slight S-shape; pinnule-apices ± narrowly obtusely rounded, pinnules ± shallowly lobed with rounded lobes, bearing a few minute, insignificant teeth, or ± toothless (sometimes more deeply lobed and more prominently toothed); *costules* (pinnule-midribs) bearing prominent, pale setae above. Frond never bearing proliferous buds, unlike in *A. strigillosum*. *Sori* very short, ovate, close to the costule, straight, indusiate; *indusia* small, very thin and insignificant. *Spores* very small, smooth, non-perisporiate (*c.* 30µm long), similar to those of *A. distans*, *A. fangii* and *A. strigillosum*. *Cytotype* diploid, sexual, *n* =

40 (Bir 1967 and 1974 *sub A. nigripes* and "*Athyrium* new species"). The true *A. setiferum* can easily be recognised by its nearly toothless and narrower pinna-lobes or pinnules, with more rounded apices and lobes, as well as by its more delicate texture and stipe, compared to the very toothy *A. strigillosum*; furthermore it is never proliferous, which *A. strigillosum* nearly always is in older fronds, and the lamina is narrower than in *A. strigillosum*. The small spore-size and spore-morphology of the present form of *A. setiferum* (*c.* 30µm long, ± without a perispore) is similar to that in *A. distans* and normal *A. setiferum*.

Scattered and rather uncommon in the west Himalaya from Kulu eastwards; Kulu; Kangra; Simla; Mussoorie; Chamoli; Nainital; Almora; Pithoragarh; common throughout the length of Nepal and in Darjeeling; Sikkim; Bhutan; Arunachal Pradesh (Kameng. *A.K. Baishya* 90979, ASSAM (!), det. CRFJ); Meghalaya; Manipur; Myanmar; also present in S. India (Nilgiri and Palni Hills); Sri Lanka; Tibet; S.W. China (Yunnan); ?Taiwan; Thailand; Vietnam; Sumatra and S. Japan. Occurs at mid-altitudes in the outer and main ranges of the Himalaya, from *c.* 2000-2800m, on slopes usually in very damp places beside small streams in clearings in luxuriant forests.

This species had long been known to workers on Indian-subcontinental ferns (including to Fraser-Jenkins 1984) as *A. nigripes* (Blume) T.Moore. The type of that species, from Java, "Baera Burangrang, in paludis inter montes Burangrang et Tankuvan Prahu. *Dr. Blume*," L (!), does indeed look similar to some forms of *A. setiferum*, with more toothed, wider and more lobed pinnules and slightly longer lower pinnae. But, as can be seen from BO, SING, L and K herbaria, there is apparently no *A. setiferum* in Java. During the present author's visit to Java in 1995 it became clear to him that the types of *A. nigripes* are merely small, higher-altitude specimens of a species he collected there (*CRFJ* 22019 (FN 686), 7.2.1995, E) on Gunung Gede in various growth-stages (and also studied in the herbaria at L, SING and BO), which has a much larger frond and develops a much wider frond-base with more lobed pinnules when reaching its full growth-potential, which is the true *A. nigripes*. It may be fertile even when quite small (as in the types), but though again a setose-pinnuled species, this is quite distinct from *A. setiferum*. *A. setiferum*, by contrast, has a considerably narrower frond and smaller, less lobed pinnules. Khullar (2000) erroneously stated that Fraser-Jenkins "is of the opinion that these are quite similar species," which was the opposite to what was concluded. Nor do the types of *A. nigripes* "resemble *A. setiferum* in their wide frond-base," as *A. setiferum* has a narrower frond, while under "excluded species" he stated that "*A. setiferum* in its true sense is confined to S.E. Asia," meaning to refer to *A. nigripes*.

Beddome, Clarke and earlier authors included a number of quite distinct species under the name *A. nigripes*, notably what are now known as *A. setiferum*, *A. strigillosum*, *A. distans*, *A. clarkei*, *A. mackinnoniorum* and *A. silvicola*. But Hope (1899-1904) managed to clear up much of the confusion and separated most of the species. He was not completely clear about the present species, however, as his sense of *A. tenellum* was a mixed entity and included both small, foliose plants of *A. strigillosum* (as, for example, the frond he illustrated, which was Macleod's collection from the Gori valley, BM (!), cited below) and *A. setiferum* (as, for example, "*A. tenella Wallich* no. 206," part, K-W (!), which was

the main cited specimen representing Hope's concept, along with Ralam valley, *J.F. Duthie* 3624, K (!) and others) and even some small *A. distans* (Sowarna Nala, Mussoorie, *P.W. Mackinnon*, K (!)). Morton (1973) was incorrect in designating a specimen of *A. strigillosum* from Gori Valley, Kumaon, above Bugdiar, 9000ft., *R.W. Macleod s.n.*, Aug.-Sept. 1893, BM (!) as lectotype of *A. tenellum* C.Hope, as if of an independent name, as Hope's account was not the protologue and basionym of the species. Hope cited Wallich, Moore and Hooker & Baker and included Wallich's material undifferentiated in his concept, citing the same *Wallich* specimen as that cited by Moore which was the basis of Sim's var. *tenellum* as well, as Sim gave Moore for the authority. It is likely that this error arose mainly due to Morton, like Hope, not being familiar with Sim's rather little known work (which was produced some 34 years before the collection-date of the Macleod specimen he cited as type) and thinking that it was Hope who first validated the name, overlooking that Hope was merely making a new combination of it. But in any case "*A. tenellum*, *Wallich* 206" at K-W, would obviously have been the main candidate-specimen representing Hope's concept.

A further specimen of the present sense of *A. setiferum* that Hope included centrally in his concept of *A. tenellum*, despite Morton's incorrectly saying that he separated it varietally, is labelled (erroneously, as to number) *Wallich* no. 131, BM (!), a duplicate specimen of which is labelled, "*Athyrium tenuifrons tenellum* Moore. Ind. Fil. 188! Allantodia? tenella Wall. 131. H. & T. 214. coll. *Wallich.* Herb. Thomas Moore," in K (!). Hope annotated the Kew specimen, "this is my *A. intermedia* [*ined.*], which being a good species must now be called *Asplenium tenellum* [*i.e.* following Wallich, whose names were treated at that time as if valid] if Roxburgh's *A. tenellum* does not hold good," on 28 Oct. 1896. This latter specimen in K was the basis of Moore's citation and is here designated as lectotype of *A. tenuifrons* var. *tenellum* Wall. *apud* T.Moore *ex* R.Sim, *Priced Cat. Ferns* **6**: 22 (1859), representing the type-part of Hope's concept of *A. tenellum*, and is thus also designated here as lectotype of *A. setiferum* C.Chr., *Index Fil.* **1**: 146 (1905), as well.

Hope treated smaller *A. setiferum* from the E. Himalaya and Khasi Hills under the name *A. nigripes*, which he excluded from the W. Indo-Himalaya, presumably thinking it to be distinct, as did Christensen, later, when he named similar plants from China as *A. supraspinescens*.

Sledge (1956 and 1962) clarified the identity and characteristics of this species, *sub A. nigripes*, from Sri Lanka and south India but Himalayan workers have generally remained confused. Bir (1974), for example, treated the species as if two different ones (his "*A. nigripes*" and *Athyrium* "new species") and mistakenly applied the name *A. setiferum* to a mixture of two others, namely *A. strigillosum* and *A. distans* (see under those species, above). Bir & Shukla's (1967) sense of *A. setiferum* was found by CRFJ to be *A. strigillosum* with some *A. distans* included and their anomalous tetraploid count, if correct, is of uncertain application. Dhir (1980) misidentified *A. setiferum* (voucher-specimens, near Bhutti, Kullu, 1800m. *K.K. Dhir* 3039, 21 Oct. 1964, PAN 6153, 6154 (!), redet. CRFJ) as *A. solenopteris* var. *pusillum.* But *A. solenopteris* does not occur in the west or even west-central Himalaya and the species intended by use of that name, *A. devolii*, also

does not occur west of east-central Nepal. Ching (1983) rather overstated the case by saying that all species from Java are entirely different from those in the Himalaya, but was accidentally correct in saying that *A. nigripes* does not occur in the Himalaya, because he mistakenly thought that what was meant by "*A. nigripes*" there was mainly *A. tenuifrons* (*i.e. A. strigillosum*) or *A. clarkei* instead.

Jamir & Rao's (1988) records of "*Athyrium nigripes*" from Nagaland actually refer to *A. drepanopterum* (specimens, *N.S. Jamir* 6475, 6476, 7085 and 7910, redetermined by the present author in NEHU (!)). Despite having received an earlier version of the present work, Chandra (2000) quite confusedly listed both *A. nigripes* and *A. setiferum* from India, apparently not understanding that if a species' name is excluded from India, where it was confused for another species, only one, not both, species occurs there! He also listed *A. nigripes* as occurring in Kashmir, which must presumably have been in error for *A. mackinnoniorum*, a confusion already long since clarified by Hope (1899-1904), as well as in other places in India, and in Java *etc.*. He also listed *A. solenopteris pro parte* as if a synonym of *A. nigripes*, giving the authority as "(Kze.) Moore in Bedd., *non* T. Moore in Bedd.," but there has no such authority for it as T.Moore in Bedd. He additionally listed *A. nigripes* var. *stramineum* T. Moore [*ex* Bedd.] as a distinct and endemic taxon from Sikkim and Meghalaya, when it is actually a synonym of *A. devolii*.

A small, higher-altitude form of this species with narrow fronds and merely pinnatifidly lobed pinnae, common in Sikkim and also present in Nepal and the W. Himalaya, has been described as a species, *A. supraspinescens* C.Chr. (syn.: *A. yui* Ching), from China, but it is widely connected by intermediates to normal *A. setiferum* and seems to be only an ecotype, if that, which appears not to be fully stable or constant. Hope (1902: 119) mentioned it as his "high-level plants," with a manuscript name, "var. *alpina*" C.B.Clarke, but it does not appear to be separable as a species or subspecies and is best understood as only a part of the variation within the species, which does not warrant nomenclatural recognition.

In several places in the central and east Himalaya, in addition to rather less lobed forms of *A. distans*, there is another taxon that appears at first sight to be a transitional form between *A. setiferum* and *A. distans*. These plants are larger, with longer stipes, fronds and pinnae and the pinnules are slightly more lobed pinnules than in most *A. setiferum*, but not as deeply or acutely lobed as in *A. distans* and are more similar to the more rounded-lobed ones of *A. setiferum*. It does not have abortive spores like a hybrid and indeed forms populations, varying to include less lobed plants approaching *A. setiferum* but with longer fronds, unlike. These plants belong to *A. fangii* Ching. Nakaike in Nakaike & Gurung (1995) listed it (TNS! KATH!) from C. Nepal, as "*Athyrium* aff. *tozanense*," but the types and other material of *A. tozanense* are less lobed and closer to normal *A. setiferum*, differing only in having more glandular axes, which is often a variable character in several *Athyrium* species. Liu, Chiou & Liu (2009) separated *A. tozanense* as a species due to its glandularity, but this might perhaps require further consideration, as it is identical in all other respects and glandularity is often an unreliable distinction between species.

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The Hariyo Ban Program is named after the famous Nepali saying *'Hariyo Ban Nepal ko Dhan'* (Healthy green forests are the wealth of Nepal). It is a USAID funded initiative that aims to reduce the adverse impacts of climate change and threats to biodiversity in Nepal. This will be accomplished by working with the government, communities, civil society and private sector. In particular, the Hariyo Ban Program works to empower Nepal's local communities in safeguarding the country's living heritage and adapting to climate change through sound conservation and livelihood approaches. Thus the Program emphasizes the links between people and forests and is designed to benefit nature and people in Nepal. At the heart of Hariyo Ban lie three interwoven components – biodiversity conservation, payments for ecosystem services including REDD+ and climate change adaptation. These are supported by livelihoods, governance, and gender and social inclusion as cross-cutting themes. A consortium of four non-governmental organizations is implementing the Hariyo Ban Program with WWF Nepal leading the consortium alongside CARE Nepal, FECOFUN and NTNC.

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