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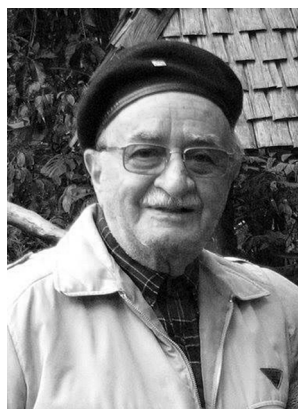

This issue of Lankesteriana is dedicated
to the memory of
MOISÉS BÉHAR (1922-2015),
pre-eminent Guatemalan orchidologist
and a dear friend to all

LANKESTERIANA

INTERNATIONAL JOURNAL ON ORCHIDOLOGY

Since the beginning of the century, LANKESTERIANA, the International Journal on Orchidology, has represented the most influential scientific forum entirely devoted to orchid science, and the preferred medium for hundreds of authors to have their work exposed to a large and selected public of scientists around the world. In fifteen years of activity, LANKESTERIANA established itself as a leading journal to publish cutting edge research on orchid systematics, ecology, evolution, anatomy, physiology, history, and other aspects of orchid science.

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IN MEMORIAM: MOISÉS BÉHAR (1922-2015)

CARLOS OSSENBACH

Orquideario 25 de mayo, Sabanilla de Montes de Oca
caossenb@racsa.co.cr

Moi, as he liked to be called by family and friends, passed away on February 14th in Jerusalem, where he had enjoyed the last years of his life in the loving care of his daughter Jacqueline. At the age of 92, he now rests in peace in the Mount of Olives Cemetery. After Otto Mittelstaedt (1919-2000) and Otto Tinschert (1915-2006), Guatemala's orchidology has now lost the third of its founding fathers.

Moisés Béhar Alcahé was born on August 28, 1922 in Huehuetenango, Guatemala, as the third of six children of Elías Béhar and his wife Eugenia, who had emigrated from Turkey in the aftermath of World War I, after the disintegration of the Ottoman Empire (Fig. 1A).

Elías Béhar set up business as a tailor and cloth importer in San Pedro Sacatepéquez, in the Department of San Marcos. A small village with a predominant indigenous population at an elevation of over 7,200 feet, San Pedro saw Moisés grow up and finish his primary education at the local school. He then went to high school in the neighboring city of Quetzaltenango. It was his childhood and adolescence in these pristine mountains of Guatemala's highlands that marked his life and character, for *Moi* developed a close and intimate relationship with nature.

After finishing high school, and wishing to study medicine, Moisés moved to Guatemala City against the will of this father, who wanted him to go into the family business. He graduated as Surgeon and Physician in 1949 at the University of San Carlos and in 1954 married Beatriz Aldana, daughter of a well-known Guatemalan physician and former Minister of Public Health (Fig. 1B). *Moi* and Beatriz had three children: Michelle (1955), a plastic artist who now lives in Curitiba, Brazil; Jacqueline (1957) a translator living in Jerusalem; and Henri (1958), an architect who serves as director of a prestigious school in Switzerland.

Moisés Béhar made a brilliant career in medicine. He specialized in Pediatrics and Hepatology at the University of Paris in 1951 and received a Master's Degree in Public Health from Harvard University in 1960. After working as Chief of the General Direction of Public Health from 1951 to 1953 he began his career as consultant in pediatrics for the Institute for Nutrition of Central America and Panama (INCAP), being named in 1957 as Assistant Director and in 1961 as Director, a position he held until 1974.

In 1975, Moisés Béhar moved to Geneva, Switzerland, to occupy the position of Chief of the Department of Nutrition of the World Health Organization.

During his professional life Moisés Béhar occupied important positions. He was President of the Guatemalan Pediatrics Society from 1956 to 1957, Vice-President of the American Society of Public Health from 1966 to 1967, received the Bronfman Prize from the American Society of Public Health in 1968, was installed as a full member of the Guatemalan Academy of Sciences in 1973, decorated by the Government of Guatemala with the order Rodolfo Robles in 1994 and again with the National Order of Pedro de San José de Bethancourt in 2007.

He published over 150 articles and chapters of books, mostly on infantile malnutrition, and gained international reputation for the development, conceptualization, testing and trials, together with a group of scientists, of *INCAPARINA*, a formula consisting of a mixture of predominantly vegetable protein made from entirely indigenous materials, designed to fight mal-nourishment amongst the low-income population of Central America. *INCAPARINA* derived its name from *INCAP*, the institute of which Moisés Béhar had been Director for so many years, and *HARINA,* the Spanish word for flour. In the words of Béhar, *"for many of our problems the solutions cannot be found in the textbooks, nor will they be sought for by other countries."*

FIGURE 1. A. Elías Béhar with his wife Eugenia Alcahé and six children. Moisés Béhar is the first sitting on the right (early 1950's). B. Moisés Béhar (1922-2015) (early 1950's).

His interest in orchids began early, and became almost a second profession as soon as he had established himself as a successful professional and had formed a family (Fig. 3). In 1960, and on the initiative of *Moi,* six friends devoted to orchids began to meet on a regular basis, and thirteen years later, the Guatemalan Society of Orchidology (*Asociación Guatemalteca de Orquideología* or AGO) was formally established by its eight founding members. Moisés Béhar became the Society's first President.

Moi dedicated himself to several areas of interest amongst orchids, but in two of them – intimately related– he became a noted international expert: the hybridization of orchids of the subtribe *Pleurothalidiinae* and the photography of miniature orchids long before the advent of digital photographic technology. His lectures on orchid photography where packed to the last seat (Fig. 4). The author was lucky to be able to attend two of them in Soroa, Cuba in 2000 and in San José, Costa Rica in 2001, and retains unforgettable memories of *Moi* and his generous and charming ways of sharing his enormous knowledge with the common mortals.

His daughter Jacqueline recalls how he fell in love with miniature orchids. When he moved to Switzerland in 1975, he left his large orchid collection in Guatemala. After a while, he could not resist the urge to grow orchids, and so he bought a small greenhouse which he attached to his house. One thing led to another, and so the small dimensions of the greenhouse led to the growing of miniatures. He had to confront many difficulties; the sun in summer scorched his plants, while in winter they froze to death. Again, *Moi* had great success and overcame all obstacles, ending as Vice-President of the Swiss Society of Orchidology (Groupe de Romandie), to which he inherited all his plants when he returned to Guatemala in 1986. Of *Moi's* dozens of hybrids, he dedicated two to his daughters: *Lepanthopsis* Michelle and *Pleurothallis* Jacqueline (Fig. 5).

FIGURE 3. *Moi* and wife Beatriz at their home in Guatemala with beautiful specimens of *Guarianthe skinneri*.

Figure 4. Examples of Moisés Béhar's achievements in macro photography. A. *Lepanthes* flower arrangements #1. B. *Lepanthes* flower arrangements #2 (for scale see wedding ring next to flowers).

An enthusiast of miniature orchids could not live long without crossing the path of the unchallenged world authority on *Pleurothalidiinae*, Dr. Carlyle Luer. When Luer first came to Guatemala and met *Moi* for the first time, a life-long friendship began. As doctor Luer remembers: *"Moi Behar was one of our best friends. We knew him for over 30 years. I guess it was Lepanthes that brought us together when he retired from Geneva. We visited him and his wife in Guatemala in their home and in the field. He had also visited with us in our home in Sarasota. Later, after he lost his wife, he moved to Curitiba where we also visited with him where he was living with his daughter Michelle. Our birthdays were five days apart; I was five days older. We corresponded frequently, so when I did not hear from him since last August, I knew he was not well."*

Moi and Luer's friendship yielded a large harvest. Together they contributed to Guatemala's orchidology

Figure 5. Moisé Béhar's miniature orchid hybrids. A. *Lepanthopsis* Michelle. B. *Pleurothallis* Jacqueline.

Table 1. Orchids described by Luer and Béhar.

Dresslerella archilae Luer & Béhar
Lepanthes almolongae Luer & Béhar
Lepanthes bífida Luer & Béhar
Lepanthes chapina Luer & Béhar
Lepanthes denticulata Luer & Béhar
Lepanthes empticia Luer & Béhar
Lepanthes fratercula Luer & Béhar [Fig. 08]
Lepanthes geniculata Luer & Béhar
Lepanthes herrerae Luer & Béhar
Lepanthes ibanezii Luer & Béhar
Lepanthes juanii Luer & Béhar
Lepanthes lenticularis Luer & Béhar
Lepanthes migueliana Luer & Béhar
Lepanthes mittelstaedtii Luer & Béhar
Lepanthes noelii Luer & Béhar
Lepanthes ordonezii Luer & Béhar
Lepanthes pabloi Luer & Béhar
Lepanthes pachyphylla Luer & Béhar
Lepanthes quetzalensis Luer & Béhar
Lepanthes stenosepala Luer & Béhar
Lepanthes tecpanica Luer & Béhar
Lepanthes velifera Luer & Béhar
Pleurothallis dixiorum Luer & Béhar

with the description of 23 orchids new to science, all from their beloved *Pleurothalidiinae*. In addition, Carlyle Luer described another new *Lepanthes* from Guatemala and named it in honor of his friend as *Lepanthes beharii* (Tab. 1).

Moi's grandson Asher, son of his daughter Jacqueline, became in his old days his pupil and companion, his fellow traveler and his 'second pair of eyes'. Asher went with *Moi* on field trips, climbed for him to the tree tops to bring down the beautiful miniatures, helped him with the determination of the plants, and traveled with him to various world orchid conferences. Today, and thanks to his years with his grandfather, Asher has become another orchid expert. In Asher's words, he not only lost his grandfather, but the only person in the world with whom he could talk on a similar intellectual level. Asher had a son 8 months ago and proudly named him Moshe, Moisés in Hebrew.

Moisés Béhar made another significant contribution to the orchidology of his country. Already in 1993 he had published a small book under the title *Orchids of Guatemala*, but his major work, in co-authorship with his close friend Otto Tinschert (1915-2006) was the publication in 1998 of *Guatemala y sus Orquídeas/*

Figure 6. *Guatemala and its Orchids* – Front cover.

Guatemala and its Orchids (Fig. 6), a beautiful masterpiece with descriptions and photographs of 260 species in 100 genera, with additional detailed information about the different life zones of the country. Most photographs were, as could be expected, taken by *Moi* himself.

Moisés Béhar and his friend Otto Tinschert tried to set in motion a large-scaled orchid conservation project in the northern department of Petén. Defying the internal wars between leftist groups and the Guatemalan Army, *Moi* and Otto travelled together, trying to convince the lumber industry to save the orchids from the large forest areas that were being cut down and to bring them to an Army base, so that they could be later re-planted in other areas. Unfortunately, the project met with no interest and soon failed.

Disappointed by the tragic situation of the deforestation in Guatemala, and with little hope of detaining it, *Moi* and Otto began, with a small group of interested friends, to promote the creation of a National Botanical Garden, which could fill in the voids in the areas of research, study, sustainable use and conservation of the country's flora. They worked arduously towards this ideal, convincing

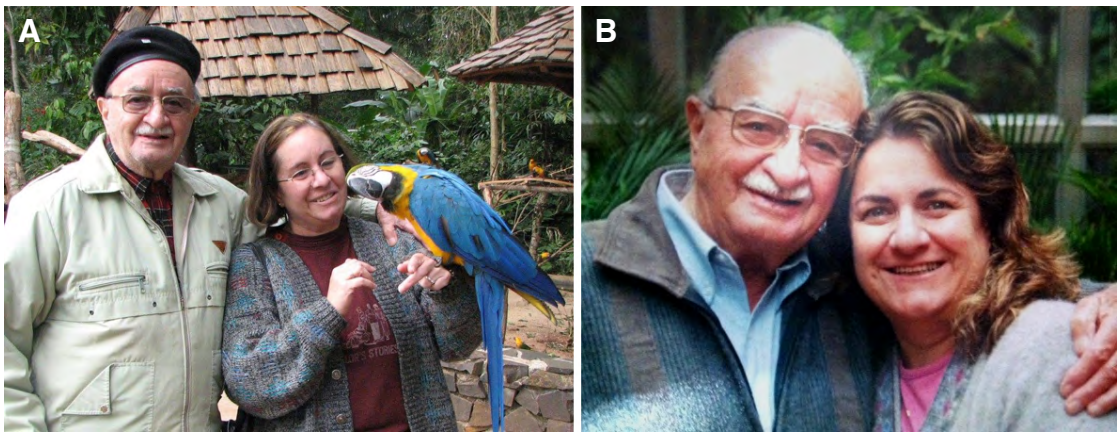

Figure 7. *Moi* with daughters Michelle (A) and Jacqueline (B) .

Figure 8. *Moi* and son Henri.

and motivating universities, foundations and other organizations. This idea has now little hope of it becoming reality.

After living for several years in Brazil with his daughter Michelle (Fig. 7A), in the last years of his life, *Moi* moved to Jerusalem with his daughter Jacqueline (Fig. 7B), while he still was able to travel a few times to Geneva, to visit with son Henri (Fig. 8). However, he never would see his beloved mountains of Guatemala again. Generous to his last day, he had donated his large collection of photographs to the Guatemalan Orchid Society, and shared his vast knowledge with anybody who came to him in need of answers, as the author can acknowledge from own experience.

Wonderful doctor, orchidologist, great-grandfather, grandfather, father and friend….

Farewell *Moi*! Rest in peace!

Acknowledgements. To Jacqueline Béhar, who has valuable insight into her father's life and provided all of the family photos; and to Julio Fonseca, President of the Guatemalan Orchid Society, who contributed with many of *Moi's* splendid orchid photographs.

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AN ANNOTATED CHECKLIST OF THE ORCHIDS OF WESTERN HIMALAYA, INDIA

JEEWAN SINGH JALAL & J. JAYANTHI

Botanical Survey of India, Western Regional Centre, Pune- 411 001, Maharashtra, India
Corresponding author: jeewan.orchid@gmail.com

ABSTRACT. A checklist of the Orchidaceae of Western Himalaya is presented based on recent orchid explorations and herbarium collections. This checklist comprised of 239 taxa of orchids belonging to 72 genera. Of these, 130 are terrestrial, 13 mycoheterotrophic and 96 epiphytic. Thirteen (13) species are endemic to Western Himalaya. The best represented genus is *Dendrobium*, with 16 species followed by *Habenaria* with 14 species and *Bulbophyllum* with 12 species. In this checklist habit, habitat, phenology, elevational range of distribution etc. are provided. .

KEY WORDS: Orchids, Western Himalaya, Checklist, Uttarakhand, Himachal Pradesh, Jammu & Kashmir

Introduction. The Western Himalaya of India lies between 28º 45'– 36^0 20' N latitude and 73^0 26'– 80^0 24' E longitude and occupies about 331,402 km² area, which is almost 10.08 % of India's total geographic area (Fig. 1). It spreads over three states viz., Jammu & Kashmir (J & K), Himachal Pradesh (HP) and Uttarakhand (UK) which has traditionally been categorized under one phytogeographic unit i.e., Western Himalaya (Hooker 1906; Rau 1975). Subsequently, a few authors described this region as North-west Himalaya (Deva & Naithani 1986). Rodgers & Panwar (1988) recognize four biotic provinces in this region viz., Trans-Himalayan Mountains in the Western Ladakh and North-western Himachal Pradesh (1A), Eastern plateau of Ladakh covering Changthang and Spiti (1B), North-west Himalaya west of Satluj (2A) and Western Himalaya between Satluj and Sharada in Uttarakhand (2B). The Western Himalaya represents a highly complex and diversified system both in terms of biological and physical attributes. Depending upon the physiographic conditions (size, structure, elevation), the western Himalaya is broadly divided into Shiwalik Hills, lesser Himalaya, greater Himalaya and trans Himalaya. The elevation of this region varies from 300 m to 8611 m. The climate ranges from the tropical plains to alpine and arctic conditions. The annual rainfall varies from 600 mm to 1800 mm. The amount of yearly rainfall increases from west to east along the front of the range. The region is characterized by a complex geologic structure, snow capped peaks, large valley glaciers, deep river gorges cut by the river system of Indus, Satluj and Ganga. Important peaks, Naga Prabat (8114 m), Karakoram (8611 m), Nanda Devi (7817 m), Kamet (7756 m) and Badrinath (7138 m) are amongst the highest in the world. There are a number of small, medium and large size glaciers in this part of the Himalayan ranges with typical landform features. Some of the famous and important ones are Siachen glacier, Baltoro glacier, Hispar glacier and Nubra glacier in J&K. Bara Shigri glacier, Chandra Glacier, Chandra Nahan Glacier and Bhadal Glacier are in HP. Gangotari glacier, Bunder Puunch, Pindari, Milam, Ralam, Sunderdhunga, Khatling and Kaphini are in UK.

The forest vegetation of Western Himalaya varies with climate, rainfall, altitude and soils. This may be largely attributed to the variation in topography and climatic conditions that prevail from tropical moist deciduous to dry alpine scrubs. Champion and Seth (1968) categories the vegetation of western Himalaya into six major groups viz., Moist Tropical Forests, Dry Tropical Forests, Montane Subtropical Forests, Montane Temperate Forests, Sub-Alpine Forests and Alpine Pastures (Fig. 2). It has been recognized as a major biodiversity hotspot by Conservation International due to its rich biodiversity.

History of Orchid studies in Western Himalaya. The earliest botanical exploration to North–Western Himalaya was started by Thomas Hardwicke, the

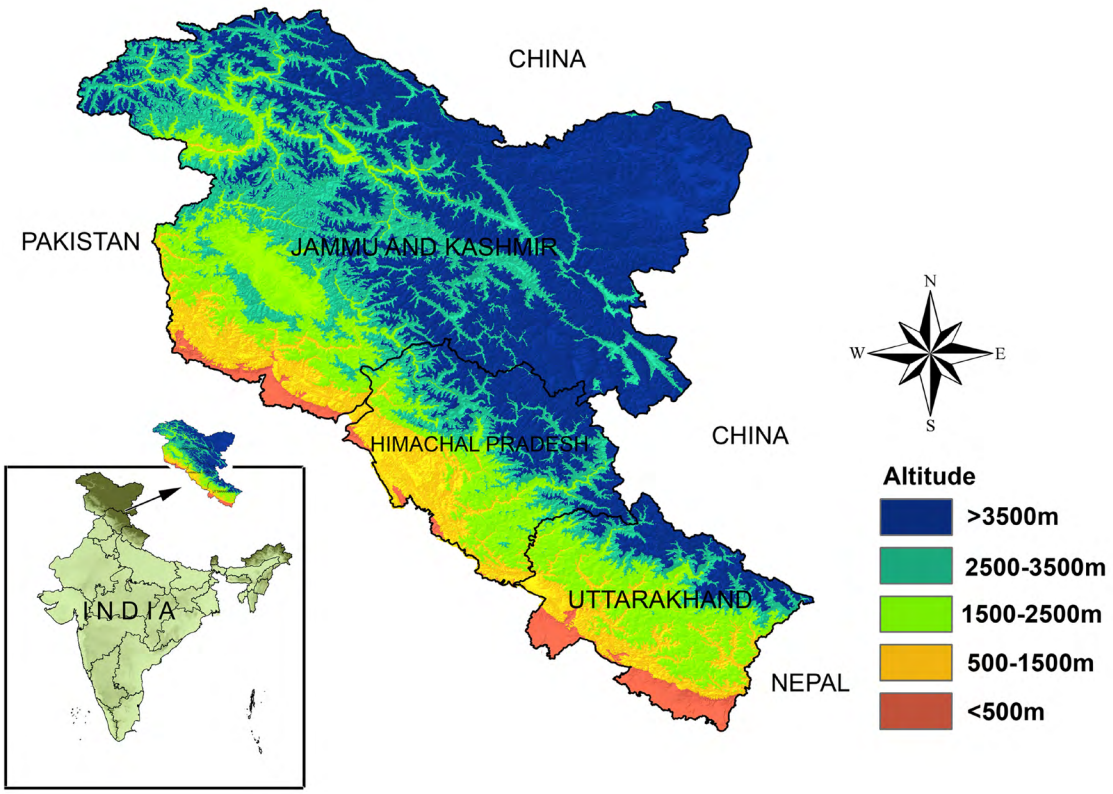

Figure 1. Location map of Western Himalaya

first European to collect plants during 1796. The next significant contribution was done by J.F. Royle in 1839, a pioneer phytogeographer of NW Himalaya who made extensive collections of plants from Kashmir to Garhwal and Himachal Pradesh. He also collected plants from Kumaun Himalaya, which are described in his Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains and of the Flora of Cashemere (1833 – 1839). Hugh Falconer who followed Royle at Saharanpur, collected along Indus in Kashmir form 1836 – 1838 and later in Garhwal with help of several plant collectors. William Griffith, Thomas Thomson, M.P. Edgeworth, Major Nathaniel Vicary, Lt. Col. E. Nadden, Werner Hoffmiester, Sir Richard Strachey, William Jameson, Sir. George King, John Lindsay Stewart, Dr. Dietrich Brandis, J.E.T. Aitchison, C.B. Clarke, Col. Sir. Henry Collett and Edward Winterbotton made extensive collection in North-Western Himalaya (Burkill, 1965). In Kumaun and Garhwal the most comprehensive collections were made by Richard Strachey and J.E. Winterbottom between the years 1846 – 1849. Their collections, consisting of about 2000 species, were distributed in the years 1852 – 1853 to the Hookerian Herbarium, the British Museum, the Linnanean Society and other important herbaria of the world. The original catalogue was published in 1882 in Atkinson's Gazetter of Himalayan Districts of North –West Provinces and Oudh. With the appointment of J.F. Duthie as successor to W. Jameson at Saharanpur Garden in 1876 and establishment of the Forest School at Dehradun by W. Schlich and D. Brandis in 1876 – 1881, gave a new impetus to the phytography of the sub Himalayan tracts in particular and northern India in general. Collett (1902) reported 38 orchid species under 18 genera from Shimla and adjacent hills. Duthie (1906) described 173 orchid species in 43 genera from the entire NW Himalaya and provided illustrations for 53 species. Blatter (1928) included 17 orchid species under 7 genera in his book flowers of Kashmir. Later, after independence with the establishment of Northern Circle of the Botanical Survey of India at Dehradun

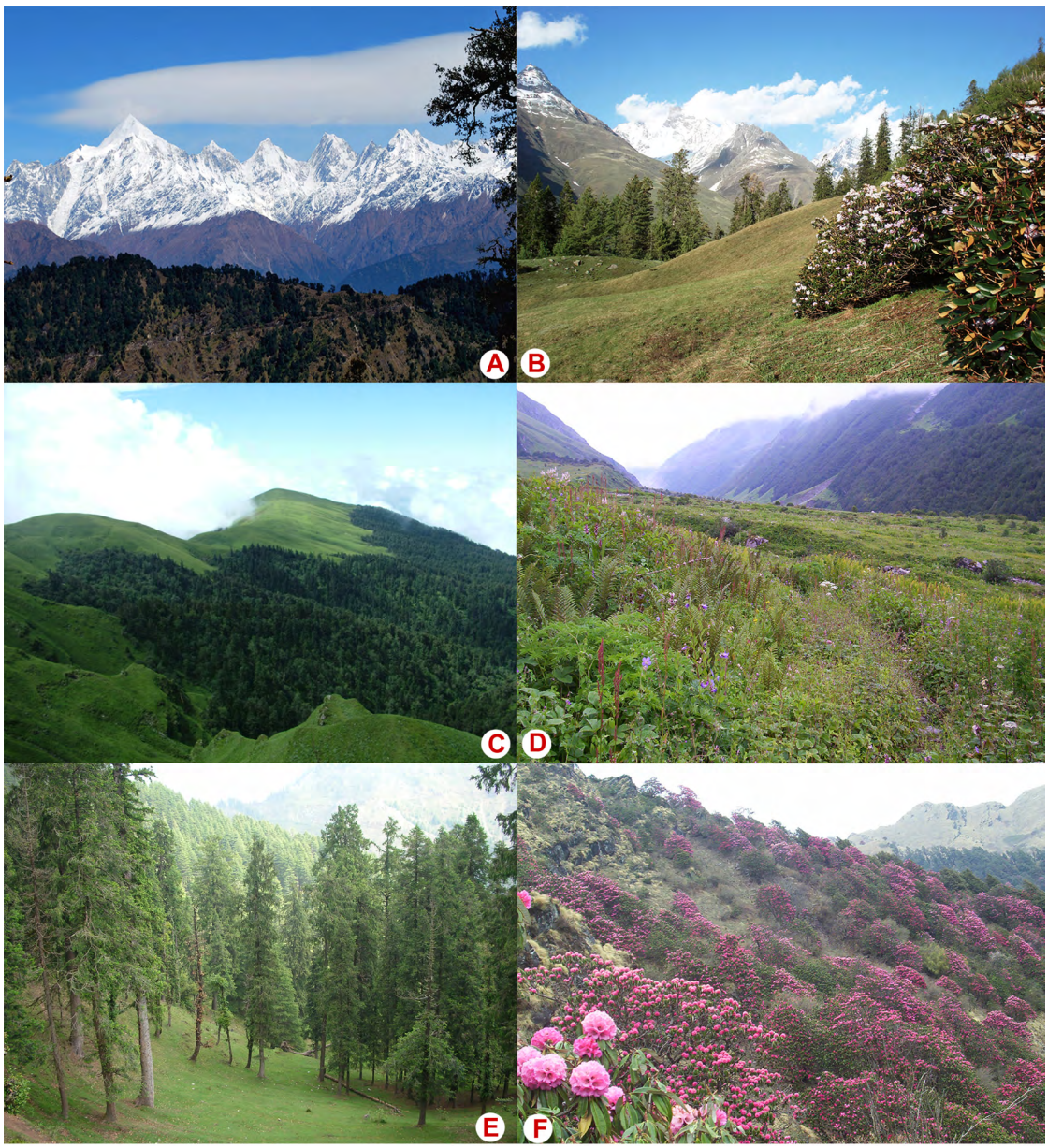

Figure 2. Landscape and different high altitude habitats of orchids in Western Himalaya: A. A view of Panchachuli from Munsiyari, B. Timber line forest (*Rhododendron campanulatum*), C. A view of Ali meadow, D. A view of Valley of Flowers, E. Mixed coniferous forest, F. *Rhododendron* forest

in 1956, extensive plant explorations and collections have been made in the north-western Himalaya and the upper Gangetic Plain. After which, Nair (1977) listed 43 orchid species in 19 genera from Bashahr Himalaya. Raizada *et al*. (1981) published orchids of Mussoorie and described 89 species in 35 genera. Seidenfaden & Arora (1982) enumerated the orchids of North–western Himalaya and gave an account of 250 species. Deva & Naithani (1986) revised and updated Duthie's Orchids of North-Western Himalaya based on recent collections and provided an illustrated account of 239 orchid species in 74 genera. Pangtey et al. (1991) provided a detailed account of orchids from Kumaun Himalaya and described a total of

Table 1. Endemic orchids of Western Himalaya.

Species	Habit	Elevation (m)
Aphyllorchis gollanii Duthie	Mh	3000
Dendrobium hesperis (Seidenf.) Schuit. & P.B.Adams	E	800 – 1500
Eria occidentalis Seidenf. & Arora	E	800 – 1500
Gastrochilus garhwalensis Tsi	E	1000
Herminium kumaunensis Deva & H.B.Naithani	T	3300 – 3600
Neottia inayatii (Duthie) Schltr.	Mh	3000
Neottia mackinnonii Deva & H.B.Naithani	Mh	800 – 1500
Neottia nandadeviensis (Hajra) Szlach.	T	3000 – 3500
Nervilia gleadowii A.N.Rao	T	1000
Nervilia pangteyana Jalal, Kumar & G.S.Rawat	T	800
Peristylus kumaonensis Renz	T	1800
Ponerorchis renzii Deva & H.B.Naithani	T	3300 – 4000

Abbreviations: Mh- Mycoheterotrophic, T- Terrestrial, E- Epiphytic.

61 genera belonging to 192 species. Uniyal *et al*. (2007) published a checklist of flowering plants of Uttarakhand which include 242 species of orchids in 72 genera. Jalal *et al*. (2008) enumerated a total 237 species belonging to 73 genera from Uttarakhand. Vij & Verma 2005; Vij & Verma 2007a, b; Lal *et al*. 2008; Verma *et al*. 2010; Lal *et al*. 2010a, b; Agrawala & Chowdhery 2009a, b; Jalal *et al*. 2009; Jalal *et al*. 2010 a, b; Jalal & Pangtey 2011a, b; Jalal *et al.*, 2012 a, b; Vikash *et al*. 2012; Bisht & Adhikari 2014, have reported several new records, rediscoveries and one new species from Western Himalaya. Recently Vij *et al*. (2013) published a book on Orchids of Himachal Pradesh and enumerated a total 85 species in 44 genera.

Many species are fast disappearing from wild due to habitat changes, forest fragmentation, road construction and clearance of virgin forests for making dams and other developmental activities. The present study is an attempt to provide a detailed documentation in relation to the up-to-date taxonomic information, nomenclatural changes and distributional records. Attempt was also made to solve any ambiguity found in the earlier works. We hope that this enumeration will give a summary of present situation which will be useful to students, researchers and conservationist.

Material and methods. The present study is based on extensive and intensive field surveys made during 2002 – 2010 in different seasons and various localities covering the altitudes from 300 m to 4800 m.a.s.l. of Western Himalaya. On encountering the orchids the location and habitat parameters were recorded and brief sketches of the plants were also made. For herbarium specimens one or two portions of the live plants were collected. For each species encountered, field notes were taken along with the voucher specimen following the standard technique (Jain & Rao 1977). Data was also collected from different herbaria viz., Botanical Survey of India, Northern Circle (BSD), Forest Research Institute (DD), Wildlife Institute of India (WII), Kumaun University Nainital (NTL), Punjab University Herbarium (PAN), Swiss Orchid Foundation at the Herbarium Jany Renz (SOF) http://orchid.unibas.ch. Author citations of books and journals have been used following Kew's website (www.rbgkew.org.uk) and www.ipni.org and also following Brummitt & Powell (1992).

Accepted taxon name in bold with author (s) followed by full citation. If there is a basionym, it is mentioned just after the correct name followed by most popular used heterotypic synonym(s) and respective authors provided. Information on flowering months, habit, habitat, forest types and altitudinal distribution is also provided. For doubtful species a detailed note is also provided. Herbarium consultation numbers collected from different herbaria WII, DD, BSD, PAN, NTL and SOF are given. In cases where herbarium specimens are lacking, the most reliable references (Duthie 1906; Deva & Naithani 1986) that are based on previous collections in Western Himalaya

TABLE 2. List of species which are reported from western Himalaya but not included in the world check list of selected families (KEW).

Species	Habit
Androcorys josephi (Rchb.f.) Agrawala & H.J.Chowdhery	T
Bulbophyllum hirtum (J.E.Sm.) Lindl.	E & L
Bulbophyllum muscicola Rchb.f.	E
Calanthe puberula Lindl.	T
Conchidium reticosum (Wight) Ormerod	E
Crepidium biauritum (Lindley) Szlachetko,	T
Cryptochilus luteus Lindl.	E
Cymbidium aloifolium (L.) Sw.	E
Dendrobium fugax Rchb.f.	E
Dendrobium longicornu Lindl.	E
Dienia ophrydis (J.Koenig) Seidenf.	T
Epipactis gigantea Dougl. ex Hook.	T
Eria coronaria (Lindl.) Rchb.f.	E
Eria globulifera Seidenf.	E
Eulophia epidendraea (J.Koenig ex Retz.) C.E.C.Fisch.	T
Eulophia mackinnonii Duthie	T
Eulophia obtusa (Lindl.) Hook.f.	T
Galearis roborovskyi (Maxim.) S.C.Chen, P.J.Cribb & S.W.Gale	T
Gastrochilus acutifolius (Lindl.) Kuntze	E
Geodorum densiflorum (Lam.) Schltr.	T
Goodyera vittata Benth ex Hook.	T
Habenaria diphylla Dalz.	T
Neottia acuminata Schltr.	S
Neottia chandrae Raskoti	T
Neottia longicaulis (King & Pantl.) Szlach.	T
Neottia tenuis (Lindl.) Szlach.	T
Nervilia infundibulifolia Blatt. & McCann.	T
Oberonia acaulis Griff	E & L
Oberonia caulescens Lindl.	E
Oberonia ensiformis (Sm.) Lindl.	E
Oberonia prainiana King & Pantl.	E
Oberonia pyrulifera Lindl.	E
Oreorchis patens (Lindl.) Lindl.	T
Phalaenopsis deliciosa Rchb.f.	E

TABLE 2 (continues).

Phreatia matthewsii Rchb.f.	E
Platanthera leptocaulon (Hook.) Soo.	T
Platanthera stenantha (Hook.f.) Soo.	T
Pleione grandiflora (Rolfe) Rolfe	E & L
Pleione hookeriana (Lindl.) J.Moore	E & L
Pleione humilis (Sm.) D.Don	E & L
Pteroceras teres (Blume) Holttum	E
Thelasis longifolia Hook.f.	E
Vandopsis undulata (Lindl.) J.J.Sm.	E
Zeuxine membranacea Lindl.	T

by different explorers are given to authenticate species present in Western Himalaya. In the checklist, all species including varieties have been dealt with either based on the fresh collections or on the authority of earlier published records only.

Results. There are 239 taxa of orchids belonging to 72 genera in Western Himalaya. Of these, 130 are terrestrial, 13 mycoheterotrophic and 96 epiphytic. They are distributed in variety of habitats between 300 – 4600 m.a.s.l. Thirteen (13) species are endemic to Western Himalaya (Table 1). The genus *Dendrobium* (16 spp.), *Habenaria* (14 spp.), *Bulbophyllum* (12 spp.), *Neottia* (11 spp.), *Liparis* (10 spp.), *Eulophia* & *Nervilia* (9 spp. each), *Calanthe*, *Oberonia* & *Peristylus* (8 spp.) are the most prolific genera. Twelve (12) species viz., *Anoectochilus roxburghii* (Wall.) Lindl., *Calanthe alismifolia* Lindl., *Calanthe brevicornu* Lindl., *Chiloschista usneoides* (D.Don) Lindl., *Dendrobium transparens* Wall. ex Lindl., *Eulophia mackinnonii* Duthie, *Eulophia obtusa* (Lindl.) Hook.f., *Gastrochilus garhwalensis* Tsi, *Geodorum densiflorum* (Lam.) Schltr., *Habenaria longifolia* Buch.-Ham. ex Lindl., *Liparis cordifolia* Hook.f and *Liparis nervosa* (Thunb.) Lindl. have not been recollected after a lapse of more than hundred years. This study also reveals that fortyfour (44) species (Table 2) have not been included in the Kew checklist for Western Himalaya (http://apps.kew.org/wcsp/home.do). Six (6) species namely *Brachycorythis galeandra* (Rchb.f.) Summerh., *Bulbophyllum guttulatum* (Hook.f.) N.P.Balakr., *Calanthe griffithii* Lindl., *Eulophia spectabilis* (Dennst.) Suresh, *Habenaria gibsonii* Hook.f., and *Habenaria gibsonii var. foetida* Blatt. & McCann are mentioned in the Kew checklist but there were no herbarium details collected from Western Himalaya. A statewise analysis reveals that Uttarakhand state shows maximum diversity of orchids (232 species) followed by Himachal Pradesh (84 species) and least in Jammu & Kashmir (44 species). Ten (10) species have been excluded from the list of Western Himalaya. Interestingly all earlier workers included such species on the strength of their first report. At present nothing is known about their occurrence in wild. The present annotated list includes collection data, habit and habitat, collection number in different herbaria and currently accepted name for each species.

Checklist

ACAMPE Lindl.

Acampe carinata (Griff.) Panigrahi, Taxon 34: 689. 1985. Fig. 3A.

Saccolabium carinatum Griff., Not. Pl. Asiat. 3: 354. 1851.

FLOWERING: October – November.

HABIT & HABITAT: Epiphytic & lithophytic, subtropical region, 500 – 1600 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: J.S. Jalal 13742 (WII), C.M.Arora 36458, 52435 & 70843 (BSD), Malhotra 19733 & 51521 (BSD), T.A.Rao 11615 & 2660 (BSD).

Acampe rigida (Buch.-Ham. ex J. E. Sm.) P. F. Hunt, Kew Bull. 24 (1): 98. 1970. Fig. 3B.

Aerides rigida Buch.-Ham. ex Sm. in A.Rees, Cycl. 39: 12. 1818.

Flowering: September – November.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: J.S. Jalal 13861 & 13897 (WII), P.K. Hajra 74471 (BSD).

Aerides Lour.

Aerides multiflora Roxb., Pl. Coromandel. 3: 68, t. 271. 1820. Fig. 3C.

Flowering: April – May.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 500 – 1200 m.

Distribution: Western Himalaya (Himachal Pradesh & Uttarakhand).

Specimens examined: J.S. Jalal 13879, 13966 & 13755 (WII), Inayat 25811 (DD), C.M. Arora 36453 (BSD), M.A. Rau 11383 (BSD), Uma & Singh 249 (PAN), G.C. Joshi 24145 (RKT), H.C. Pandey 14011 (RKT).

Aerides odorata Lour., Fl. Cochinch. 2: 525. 1790. Fig. 3D.

Flowering: May – July.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1200 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S. Jalal 13967 (WII), C.M. Arora 36455, 49522, 55818 & 52448 (BSD), P.K. Hajra 74438 (BSD), C.L. Malhotra 51588 (BSD), Balodi 75572 (BSD), U.C. Bhatacharyya 21169 & 21358 (BSD), H.C. Pandey 5796 (RKT).

Androcorys Schltr.

Androcorys josephi (Rchb.f.) Agrawala & H.J.Chowdhery, Kew Bull. 65(1): 106. 2010. Fig. 3E.

Herminium josephi Rchb.f., Flora 55: 276. 1872.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine region, 3000–4000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13932 & 13956 (WII).

Androcorys monophylla (D.Don) Agrawala & H.J.Chowdhery, Kew Bull. 65(1): 106. 2010. Fig. 3F.

Neottia monophylla D. Don, Prodr. Fl. Nepal. 27. 1825.

Herminium monophyllum (D.Don) P.F.Hunt & Summerh., Kew Bull. 20: 51. 1966.

Flowering: July – August.

Habit & Habitat: Terrestrial & lithophytic, subtropical to temperate regions, 800 – 2000 m.

Distribution: Western Himalaya (Himachal Pradesh & Uttarakhand).

Specimens examined: J.S.Jalal 13704 (WII), C.M. Arora 36469, 49619 & 70816 (BSD), U.C. Bhattacharyya 16026, 31197 & 31143 (BSD), P.K. Hajra 87622 (BSD), Jagdeep Verma 256 (PAN), Rani & Singh 12318 (PAN).

Androcorys pugioniformis (Lindl. ex Hook.f.) K.Y.Lang, Guihaia 16: 105. 1996. Fig. 3G.

Herminium pugioniforme Lindl ex Hook.f., Fl. Brit. India 6: 130. 1890.

Flowering: July – August.

Habit & Habitat: Terrestrial, alpine meadows, 3600 – 4000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh & Uttarakhand).

Specimen examined: J.S.Jalal 13942 (WII), U.C. Bhattacharyya 40492 (BSD), Jagdeep Verma 237 (PAN).

Anoectochilus Blume

Anoectochilus roxburghii (Wall.) Lindl. in J.F.Royle, Ill. Bot. Himal. Mts.: 368. 1839.

Chrysobaphus roxburghii Wall., Tent. Fl. Napal.: 37. t.27. 1826.

Flowering: July – August.

Habit: Terrestrial.

Distribution: Western Himalaya (Uttarakhand).

This species was reported by Royle from Kedarkanta in Tehri Garhwal (Uttarakhand) after that no collection was made by the subsequent workers till date. Therefore this species is being included solely on the authority of J. F. Duthie (1906).

Aphyllorchis Blume

Aphyllorchis gollanii Duthie, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 71: 42. 1902.

Flowering: August.

Habit: Mycoheterotrophic.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Ramsukh 23000 (DD).

This species is reported from Nagtibba (3000 m) in Tehri Garhwal (Uttarakhand) by Ramsukh collector of J.F.Duthie. It has not been recollected after its first report.

BRACHYCORYTHIS Lindl.

Brachycorythis obcordata (Lindl.) Summerh., Kew Bull. 10: 243. 1955. Fig. 3H

Planthera obcordata Lindl., Gen. & Sp. Orch.: 290. 1835.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, subtropical region, 1000 – 2000 m.

DISTRIBUTION: Western Himalaya (Himachal Pradesh & Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13711 (WII), Duthie 604 (DD), U.C. Bhattacharyya 29316 (BSD), C.M. Arora 38403 (BSD), U. Rani & S.G. Singh 2700 (PAN), Kailash Chandra 8698 (RKT), R.N. Tewari 11778 (RKT).

BULBOPHYLLUM Thouars

Bulbophyllum affine Wall. ex Lindl., Gen. & Sp. Orch.: 48. 1830. Fig. 3I.

FLOWERING: June – July.

HABIT & HABITAT: Epiphytic & lithophytic, subtropical region, 800 – 1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13872 & 13976 (WII), Inayat 24101 (DD), C.L. Malhotra 67686 (BSD).

Bulbophyllum careyanum (Hook.) Spreng, Syst. Veg. 3: 372. 1826. Fig. 4A.

Anisopetalon careyanum Hook., Exot. Fl. 2: t. 149. 1825.

FLOWERING: October – March.

HABIT & HABITAT: Epiphytic & lithophytic, subtropical region, 800 –1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: Balodi 79209 (BSD), U.C. Bhattacharyya 21254 (BSD).

Bulbophyllum cariniflorum Rchb.f. in Walp., Ann. Bot. Syst. 6: 253. 1861. Fig.4B.

FLOWERING: July – August.

HABIT & HABITAT: Epiphytic, subtropical region, 1000 – 1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13772 (WII), DD: Inayat 24085 (DD), C.M. Arora 38404, 41333, 36419, 37806 & 70812 (BSD), R.N. Tewari 19344 (RKT).

Bulbophyllum helenae (Kuntze) J. J. Sm., Bull. Buitenz. ser. 2, 8: 24. 1912.

Phyllorchis helenae Kuntze, Rev. Gen. Pl. 2: 676. 1991.

FLOWERING: August – September.

HABIT & HABITAT: Epiphytic, subtropical region, 1000 – 2000 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: C.M. Arora 37781, 37871 & 70824 (BSD).

Bulbophyllum hirtum (J.E.Sm.) Lindl., Gen. & Sp. Orchid. Pl. 51. 1830. Fig. 4C

Stelis hirta J.E. Sm. in Rees, Cycl. 34: Stelis, no. 11. 1819.

FLOWERING: October – December.

HABIT & HABITAT: Epiphytic & lithophytic, subtropical region, 900 – 1000 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMEN EXAMINED: J.S.Jalal 15072 (WII).

Bulbophyllum leopardinum (Wall.) Lindl., Gen. & Sp. Orchid. Pl. 48. 1830.

Dendrobium leopardinum Wall., Tent. Fl. Nepal. 1: 39, t. 28. 1824.

FLOWERING: October – November.

HABIT & HABITAT: Epiphytic, subtropical region, 1000 – 1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMEN EXAMINED: P.K. Hajra 74473 (BSD).

Bulbophyllum muscicola Rchb.f., Flora 55: 275. 1872.

Cirrhopetalum hookeri Duthie, J. Asiat. Soc. Bengal 71 (2): 38. 1902.

Bulbophyllum hookeri (Duthie) J. J. Sm., Bull. Buitenz. ser. 2, 8: 25. 1912.

FLOWERING: September – October.

HABIT & HABITAT: Epiphytic, subtropical region, 1000 – 1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: C.M. Arora 52437 & 66188 (BSD).

Bulbophyllum polyrrhizum Lindl., Gen. & Sp. Orchid. Pl. 53. 1830.

FLOWERING: March – April.

HABIT & HABITAT: Epiphytic & lithophytic, subtropical region, 1000 – 1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13888 (WII), Bora

41390 (BSD), U.C. Bhattacharyya 20392 & 21253 (BSD), C.M. Arora 38849 (BSD).

Bulbophyllum reptans (Lindl.) Lindl., Gen. & Sp. Orchid. Pl. 51. 1830.

Stelis racemosa Sm. in.Rees, Cycl. 34: 10. 1816.

Bulbophyllum reptans var. *acuta* Malhotra & Balodi, Bull. Bot. Surv. India 26: 110. 1984 (publ. 1985).

Flowering: October – November.

Habit & Habitat: Epiphytic & lithophytic, subtropical to temperate regions, 1000 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13830 & 13867 (WII), M.A.Rau 35340 (BSD), C.M. Arora 45614 (BSD).

Bulbophyllum triste Rchb. f. in Walp., Ann. Bot. Syst. 6: 253. 1861.

Flowering: March – April.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 800 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13873 (WII), C.M.Arora 66109, 66103 & 36448 (BSD).

Bulbophyllum umbellatum Lindl., Gen. & Sp. Orchid. Pl. 56. 1830.

Bulbophyllum guttulatum sensu Seidenf. & Arora in Nord. J. Bot. 2: 10. 1982.

Flowering: April – May.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 1000 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13962 & 14020 (WII), T.A. Rao 6716 & 11599 (BSD), U.C. Bhattacharyya 21353, 21335 & 21393 (BSD), C.M.Arora 37821, 70852 & 36416 (BSD).

Bulbophyllum wallichii Rchb. f. in Walp., Ann. Bot. Syst. 6: 259. 1861.

Flowering: September – October.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 1200 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 45766 & 38824 (BSD).

Calanthe R.Br.

Calanthe alismifolia Lindl., Fol. Orchid. 6: 8. 1855.

Flowering: July – August.

Habit: Terrestrial.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Fairweather 24148 (DD).

This species was collected from Mussoorie nearly more than hundred years ago by Fairweather from 1500 – 2000 m elevation, but never recollected by the subsequent workers since then.

Calanthe alpina Hook.f. ex Lindl., Fol. Orch. Calanthe: 4. 1854.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate and subalpine regions, 1500 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: R.N.Tiwari 21262 (RKT).

Calanthe brevicornu Lindl., Gen. Sp. Orchid. Pl.: 251. 1833.

Flowering: May – June.

Habit: Terrestrial.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Mackinnon 24150a (DD), Harsukh 24150 (DD).

This species has been reported from Tehri (1500 – 2000 m). It has not been recollected since hundred years.

Calanthe davidii Franch., Nouv. Arch. Mus. Hist. Nat., II, 10: 85. 1888.

Calanthe pachystalix Rchb.f. ex Hook.f., Fl. Brit. India 5: 850. 1890.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate region, 1500–2500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Mackinnon 21742 (DD).

Calanthe mannii Hook. f., Fl. Brit. India 5: 850. 1890.

Flowering: May – June.

Habit & Habitat: Terrestrial, subtropical region, 1500–1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: P.K. Hajra 74476 (BSD), B.D. Naithani 47918 (BSD), Ramsukh 5996 (DD).

Calanthe plantaginea Lindl., Gen. & Sp. Orchid. Pl. 250. 1833. Fig. 4D

Flowering: March – April.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1500 – 2000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13836, 14030 & 14040 (WII), Mackinnon 22716 (DD), Osmaston 24149 (DD), M.A. Rau 14265, 35317 & 14420 (BSD),

B.P. Uniyal 90615 (BSD), P.C.Pant 31854 (BSD), P.K. Hajra 74469 & 73996 (BSD), C.M. Arora 36429 (BSD), G.C. Joshi 35956 (RKT).

Calanthe puberula Lindl., Gen. & Sp. Orchid. Pl. 252. 1833.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region, 1500 – 2000 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Osmaston 21787 (DD), Duthie 21076 (DD), M.A Rau 28589 (BSD), T.A. Rao 4330 (BSD).

Calanthe tricarinata Lindl., Gen. & Sp. Orchid. Pl. 252. 1833. Fig. 4E

Flowering: April – June.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2000 – 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13734, 14034 & 14039 (WII), Duthie 1265 (DD), Parkinson 7055 (DD), Gollen 2059 (DD), B.M. Wadhwa 53030 (BSD), H.J. Chowdhery & D.K. Agarwala 40189 (BSD), C.L. Malhotra 72593 (BSD), P.K. Hajra 73996 & 73725 (BSD), N.C. Nair 35742 & 36065 (BSD), K.S. Bawa 3037 (PAN), B.P. Singh 1259 (RKT), M.R. Uniyal 3967 & 3802 (RKT).

Cephalanthera Rich.

Cephalanthera longifolia (L.) Fritsch, Osterr. Bot. Zeit. 38: 81. 1888.

Serapias helleborine var. *longifolia* L., Sp. Pl.: 950. 1753.

Flowering: May – July.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1800 – 2500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: Inyat 25401 (DD), Duthie 11265 (DD), U.C. Bhattacharyya 20387 & 39010 (BSD), B.D. Naithani 44018 & 47973 (BSD), Neera Vaidya 6 (PAN), N. Shekhar 152 (PAN).

Cheirostylis Blume

Cheirostylis griffithii Lindl., J. Proc. Linn. Soc. Bot. 1: 188. 1857.

Flowering: March – April.

Habit & Habitat: Terrestrial, subtropical region ca.1500 m altitude.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Pangtey 4302 (NTL), Pangtey & Kalakoti 508 & 3328 (NTL).

Chiloschista Lindl.

Chiloschista usneoides (D.Don) Lindl., Edwards's Bot. Reg. 18: t. 1522. 1832.

Epidendrum usneoides D.Don, Prodr. Fl. Nepal.: 37. 1825.

Flowering: February – March.

Habit: Epiphytic.

Distribution: Western Himalaya (Uttarakhand).

This species is included here on the authority of J. F. Duthie (1906), who reported it from Tehri Garhwal more than hundred years ago.

Cleisostoma Blume

Cleisostoma aspersum (Rchb. f.) Garay, Bot. Mus. Leafl. Harv.: 23, 4: 169. 1971.

Sarcanthus aspersum Rchb. f., Hamb. Gart. 21: 297. 1865.

Flowering: July – August.

Habit & Habitat: Epiphytic, subtropical region between 600 – 800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Pant 35111 (BSD).

Coelogyne Lindl.

Coelogyne cristata Lindl., Collect. Bot.: t. 33. 1824. Fig. 4F

Flowering: February – March.

Habit & Habitat: Epiphytic & lithophytic, subtropical to temperate regions, 1200 – 2000 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13907 & 14022 (WII), C.M. Arora 66245, 38815 & 55801 (BSD), M.A. Rau 35304 (BSD), B.P. Uniyal 93501 (BSD), U.C. Bhattacharyya 20385 (BSD), B.D. Naithani 43982 & 41977 (BSD), H.C. Pandey 5406 (RKT), M.C. Joshi 4461 (RKT).

Coelogyne ovalis Lindl. in Edw. Bot. Reg. 24. 91. Misc. 171. 1838. Fig. 4G

Flowering: September – November.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 1000 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13898 & 13915 (WII), Gamble 23142 (DD), Duthie 25808 & 24099 (DD), C.M. Arora 36436 (BSD), U.C. Bhattacharyya 21385 (BSD), Balodi 75608 & 79207 (BSD), H.J. Chowdhery 76274 (BSD), C.L. Malhotra & Balodi 83215 (BSD), R.N. Tewari 22052 (RKT).

Coelogyne stricta (D. Don) Schltr. in Fedde Repert. 4: 184. 300. 1919. Fig. 4H

Cymbidium strictum D.Don, Prodr. Fl. Nepal.: 35. 1825.

Flowering: April – May.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 800 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S. Jalal 13862 & 14029 (WII), C.M. Arora 36489, 53817 & 35352 (BSD), T.A. Rao 6560 & 11596 (BSD), N.C. Nair 35556 (BSD), U.C. Bhattacharyya 21287 (BSD), R.N. Tewari 23165 & 19343 (RKT).

Conchidium Griff.

Conchidium muscicola (Lindl.) Rauschert, Feddes Repert. 94: 444. 1983.

Eria muscicola (Lindl.) Lindl., J. Proc. Linn. Soc., Bot. 3: 47 (1858).

Flowering: August – September.

Habit & Habitat: Epiphytic, subtropical region, c. 1400 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 70847 (BSD).

Conchidium reticosum (Wight) Ormerod, Taiwania 57: 119. 2012.

Eria reticosa Wight, Icon. Pl. Ind. Orient. 5(1): 4, t. 1637 (1851).

Flowering: August – September.

Habit & Habitat: Epiphytic, occurs in subtropical region c. 1300 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: C.M. Arora 70848 (BSD).

Corallorhiza Gagnebin

Corallorhiza trifida Châtel., Spec. Inaug. Corallorrhiza: 8. 1760.

Corallorhiza anandae Malhotra & Balodi, Bull. Bot. Surv. India 26: 108. 1984 publ. 1985.

Flowering: June – July.

Habit & Habitat: Mycoheterotrophic, subalpine to alpine regions, 3500 – 4000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: T.A.Rao 6851 (BSD), I.D.Rai & P.Kumar 11449 (WII).

Crepidium Blume

Crepidium acuminatum (D. Don) Szlachetko, Fragm. Florist. Geobot., Suppl. 3: 123. 1995. Fig. 4I.

Malaxis acuminata D. Don, Prodr. Fl. Nepal. 29. 1825.

Flowering: July – August.

Habit & Habitat: Terrestrial, tropical to subtropical regions between 1200 – 2000 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13770, 13817 & 13801 (WII), C.M. Arora 28590 (BSD), T.A.Rao 4780 (BSD), Uma & Singh 2245 (PAN).

Crepidium biauritum (Lindl.) Szlachetko, Fragm. Florist. Geobot., Suppl. 3: 124. 1995.

Microstylis biaurita Lindl., Gen. Sp. Orchid. Pl.: 20 (1830).

Malaxis biaurita (Lindl.) O. Ktze., Rev. Gen. Pl. 2: 673. 1891.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region, c. 800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Deva 8180 & 8029 (Herbarium Som Deva, 13, Balbir Avenue, Dehradun).

Crepidium mackinnonii (Duthie) Szlachetko, Fragm. Florist. Geobot., Suppl. 3: 128. 1995.

Microstylis mackinnonii Duthie, J. Asiat. Soc. Bengal 71 (2): 37. 1902.

Malaxis mackinnonii (Duthie) Ames, Orch. 6: 289. 1920.

Flowering: July – September.

Habit & Habitat: Terrestrial, subtropical region at altitude 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Mackinnon 25429 (DD), Deva 5855 (DD).

Crepidium purpureum (Lindl.) Szlachetko, Fragm. Florist. Geobot., Suppl. 3: 131. 1995.

Microstylis purpurea Lindl., Gen. & Sp. Orch. 20. 1830.

Malaxis purpurea (Lindl.) O. Ktze., Rev. Gen. Pl. 2: 673. 1891.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, subtropical region, 900 – 1400 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13908, 13712 & 13815 (BSD), Naithani 1042 (DD).

CRYPTOCHILUS Wall.

Cryptochilus luteus Lindl., J. Proc. Linn Soc., Bot. 3: 21. 1859.

FLOWERING: June – July.

HABIT & HABITAT: Epiphytic, subtropical region at altitude 1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMEN EXAMINED: C.M. Arora 38820 (BSD).

CYMBIDIUM Sw.

Cymbidium aloifolium (L.) Sw. in Nov. Act. Sci. Upsal. 6:73. 1799. Fig. 5A.

Epidendrum aloifolium L., Sp. Pl. 953. 1753.

FLOWERING: April – May.

HABIT & HABITAT: Epiphytic, subtropical region, 500 - 1500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: U.C. Bhattacharyya 21174 (BSD), P.C. Pant 31829 (BSD), C.M. Arora 66261 (BSD).

Cymbidium cyperifolium Lindl., Gen. & Sp. Orch. 163. 1833.

FLOWERING: November – April.

HABIT & HABITAT: Epiphytic, subtropical region at altitude 1000 – 1800 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: B.D. Naithani 44040 (BSD), M.A. Rau 35331 (BSD), T.A. Rao 9585 & 9588 (BSD).

Cymbidium iridioides D.Don, Prodr. Fl. Nepal. 36. 1825. Fig. 5B.

FLOWERING: October – November.

HABIT & HABITAT: Epiphytic, subtropical region, 800– 1800 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: N.C. Nair 35925 (BSD), M.A. Rau 35351, 6472 & 35349 (BSD), M.S. Pundir 97052 (BSD), B.D. Naithani 43915 (BSD), P.C. Pant 31845 (BSD), U.C. Bhatacharyya 21375 (BSD), C.M. Arora 36428 (BSD), A.C. Dey 2525 (RKT), G.C. Joshi 36439 (RKT).

Cymbidium macrorhizon Lindl., Gen. & Sp. Orch. 162. 1833. Fig. 5C

Cymbidiopsis macrorhiza (Lindl.) H.J.Chowdhery, Indian J. Forest. 32: 155. 2009.

FLOWERING: June – July.

HABIT & HABITAT: Mycoheterotrophic, subtropical region, 800 – 2000 m.

DISTRIBUTION: Western Himalaya (Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13767 (WII), M.A.Rau 15631 (BSD), R.S. Karki 82098 (BSD), B.D. Naithani 44223 (BSD), P.C. Pant 31896 (BSD), C.M. Arora 36473 (BSD), U.C. Bhatacharyya 33647 (BSD), M.R. Uniyal 3872 (RKT), H.C. Pandey 14015 (RKT), K.Chandra 10832 (RKT), R.N. Tewari 22962 (RKT).

CYPRIPEDIUM L.

Cypripedium cordigerum D. Don, Prodr. Fl. Nepal.: 37. 1824. Fig. 5D.

FLOWERING: May – June.

HABIT & HABITAT: Terrestrial, temperate region, 2000 – 3000 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13823 (WII), Fisher 1882 (DD), Gollan 2058 (DD), Harsukh 24153 (DD), A.K. Goel 64043 (BSD), T.A. Rao 9666 (BSD), B.D. Naithani 47985 (BSD), Bawa 3068 (PAN), Kuthiala 11566 (PAN), Shekhar 11454 (PAN), Singh 6810 (PAN), J.Verma 281 (PAN), G.S.Rawat 810 (NTL).

Cypripedium elegans Rchb. f., Flora 69: 561.1836. Fig. 5E.

FLOWERING: June – July.

HABIT & HABITAT: Terrestrial, subalpine meadows, 3000 – 3500 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13933 (WII), Naithani 1025 (DD), P.K. Hajra 73237 & 73789 (BSD),

U.C. Bhattacharyya 39009 (BSD), O.P. Misra 7627 (RKT), V.P. Tewari 11506 (RKT), G.S. Rawat 1608 (NTL).

Cypripedium himalaicum Rolfe ex Hemsl, J. Linn. Soc. Bot. 29: 319. 1893. Fig. 5F.

Flowering: July – August.

Habit & Habitat: Terrestrial, alpine and subalpine meadows, 3000 – 4500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13979 (WII), Duthie 192 (DD), A.K. Goel 72838 (BSD), Balodi 89640 (BSD), P.K.Hajra 73238a (BSD), A.C. Dey 3121 (RKT), G.S. Rawat 1256 (NTL).

Dactylorhiza Neck. ex Nevski

Dactylorhiza hatagirea (D. Don) Soo, Ann. Univ. Scient. Budapest. Sec. Biol. 3: 341. 1960. Fig. 5G.

Orchis hatagirea D.Don, Prodr. Fl. Nepal. 23. 1824.

Flowering: June – July.

Habit & Habitat: Terrestrial, subalpine to alpine region, 3000 – 4000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13938 & 13949 (WII), Sahni 24892 (DD), Naithani 53158 (DD), Duthie 519 (DD), A.K. Goel 72661 (BSD), P.K. Hajra 73790 & 74143 (BSD), U.C. Bhattacharyya 71292 (BSD), Jagdeep Verma 206 (PAN), Puri 7508 (PAN).

Dactylorhiza kafiriana Renz in Rech. f., Fl. Iran. 126:125, t.54. 1978.

Flowering: June – July.

Habit & Habitat: Terrestrial, alpine marshy meadows, 1700 – 4500 m.

Distribution: Western Himalaya (Jammu & Kashmir).

Specimen examined: Angmo, B.S.Adhikari & G.S.Rawat 21807 (WII).

Dactylorhiza viridis (L.) R.M.Bateman, Pridgeon & M.W.Chase, Lindleyana 12: 129. 1997.

Satyrium viride L., Sp. Pl.: 944. 1753.

Coeloglossum viride (L.) Hartmann, Hand. Skand. Fl. 329. 1820.

Flowering: July – August.

Habit & Habitat: Terrestrial, alpine region, 3000 – 4000 m.

Distribution: Western Himalaya (Jammu & Kashmir and Himachal Pradesh).

Specimens examined: Inayat 25387 (DD), Vij & Verma 290 (PAN).

Dendrobium Sw.

Dendrobium amoenum Wall. ex Lindl., Gen. & Sp. Orch. 78. 1830. Fig. 6A.

Flowering: May – June.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1600 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13870 & 13912 (WII), Mackinnon 21745 (DD), A.K. Goel 67747 & 73042 (BSD), P.C. Pant 31850 & 35107 (BSD), C.M. Arora 66242 & 66273 (BSD), N.K. Pandey 33569 (RKT), H.C. Pandey 5440 (RKT), M.R. Uniyal 2523 (RKT).

Dendrobium bicameratum Lindl. in Edward's, Bot. Reg. 25: 85. 1839. Fig. 6B.

Flowering: July – August.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1400 m.

Distribution: Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13833 (WII), Inayat 24092 (DD), Mackinnon 21744 (DD), C.M. Arora 55823 & 49996 (BSD).

Dendrobium chrysanthum Wall. ex Lindl. in Edward, Bot. Reg. 15: t. 1229. 1830.

Flowering: May – June.

Habit & Habitat: Epiphytic, subtropical region, 800 – 1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: H.J. Chowdhery 73183 (BSD), M.A. Rau 35343 (BSD), C.M. Arora 38809 & 45513 (BSD), R.N. Tewari 22057 (RKT).

Dendrobium chryseum Rolfe, Gard. Chron.1: 233. 1888.

Flowering: May – June.

Habit & Habitat: Epiphytic, subtropical region, 800 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 38432 (BSD).

Dendrobium crepidatum Lindl. in Paxton, Fl. Gard. 1:63. fig. 45. 1850.

Flowering: April – May.

Habit & Habitat: Epiphytic, subtropical region, 600 – 1400 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Awasthi 1546 (DD).

Dendrobium denudans D. Don, Prodr. Fl. Nepal. : 34. 1824. Fig. 6C

Flowering: September – October.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 1400 – 2000.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13865 & 13775 (WII), C.M. Arora 70844 (BSD), H.J. Chowdhery 73168 (BSD), R.N. Tewari 22010 (RKT).

Dendrobium fimbriatum Hook., Exot. Fl. 1: t. 71. 1823. Fig. 6D.

Dendrobium normale Falc., Ann. Nat. Hist. 3: 196. 1839.

Flowering: May – June.

Habit & Habitat: Epiphytic, subtropical region, 800 – 1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13769, 13735 & 13891 (WII), C.M. Arora 41389 (BSD).

Dendrobium fugax Rchb.f., Gard. Chron. 1871: 1257. 1871.

Flickingeria fugax (Rchb. f.) Seidenf., Dansk Bot. Arikv. 34 (1): 46. f. 17. 1890.

Flowering: May – June.

Habit & Habitat: Epiphytic, subtropical region, 800 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: C.M. Arora 70858 (BSD).

Dendrobium hesperis (Seidenf.) Schuit. & P.B.Adams, Muelleria 29(1): 67. 2011.

Flickingeria hesperis Seidenf. & Arora, Nord. J. Bot. 2:16. 1982.

Flowering: June – July.

Habit & Habitat: Epiphytic, subtropical region, 800 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 66130 (BSD), T.A.Rao 6598 (BSD), P.K. Hajra 74477 (BSD).

Dendrobium heterocarpum Wall. ex Lindl., Gen. & Sp. Orch. :78. 1830.

Flowering: May – June.

Habit & Habitat: Epiphytic, subtropical region, 600– 1600 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: U.C. Bhattacharyya 21382 (BSD).

Dendrobium longicornu Lindl., Edwards's Bot. Reg. 16: t. 1315. 1830.

Flowering: August – September.

Habit & Habitat: Epiphytic, subtropical region, 1200 - 3000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Soni Bisht 31 (WII).

Dendrobium macrostachyum Lindl., Gen. Sp. Orchid. Pl.: 78. 1830.

Flowering: June – August.

Habit & Habitat: Epiphytic, subtropical region, 600 – 800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Mackinnon 22983 (DD), C.M. Arora 38843 (BSD).

Dendrobium moniliforme (L.) Sw., Nova Acta Regiae Soc. Sci. Upsal. 6: 85. 1799.

Epidendrum moniliforme L., Sp. Pl.: 954 (1753).

Dendrobium candidum Wall. ex Lindl. in Edward, Bot. Reg.24. Misc.:36. 1838.

Flowering: April – May.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 1500 – 2500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Mackinnon 24155 (DD), C.M. Arora 66187 (BSD).

Dendrobium monticola Hunt. & Summerh., Taxon 10: 110. 1961. Fig. 6E.

Flowering: August – September.

Habit & Habitat: Epiphytic & lithophytic, temperate region, 1800 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: B.M. Wadhwa 57492 (BSD), C.M. Arora 70851 (BSD).

Dendrobium polyanthum Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 81. 1830.

Dendrobium primulinum Lindl., Gard. Chron. 1858: 223. 1858.

Flowering: March – April.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1400 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13892 (WII), P.C. Pant 31879 (BSD), U.C. Bhattacharyya 21140 (BSD), P.K. Hajra 74424 (BSD).

Dendrobium transparens Wall. ex Lindl., Gen. & Sp. Orch. 79. 1830.

FLOWERING: May – June.

HABIT: Epiphytic.

J.F. Duthie (1906) reported this species from Nainital (Kumaun). But it has never been recollected subsequently from this region.

DIENIA Lindl.

Dienia cylindrostachya Lindl., Gen. Sp. Orchid. Pl. 22. 1830.

Malaxis cylindrostachya (Lindl.) Kuntze, Revis. Gen. Pl. 2: 673. 1891.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, temperate to alpine regions, 2200 – 3500 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S. Jalal 13716 & 13787 (WII), Duthie 21777 (DD), Saxena 1256 (DD), C.M. Arora 49616 (BSD), U.C. Bhattacharyya 33724 (BSD), Jagdeep Verma 233 (PAN), Bawa 3029 & 3031 (PAN).

Dienia ophrydis (J.Koenig) Seidenf., Contr. Orchid Fl. Thailand 13: 18. 1997.

Epidendrum ophrydis J.Koenig in A.J.Retzius, Observ. Bot. 6: 46. 1791.

Malaxis latifolia Sm. in A.Rees, Cycl. 22: n.º 3. 1812.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, subtropical to temperate regions, 1000 – 2200 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMEN EXAMINED: H.C. Pandey 14033 (DD).

DIPLOMERIS D.Don

Diplomeris hirsuta (Lindl.) Lindl., Gen. & Sp. Orch. 330. 1835. Fig. 6F.

Diplochilus hirsuta Lindl. in Edw.Bot. Reg. sub t. 1499. 1832.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial & lithophytic, subtropical region at 1000 m elevation.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMEN EXAMINED: J.S.Jalal 15058 (WII), C.M. Arora 50016 (BSD), H.C. Pandey 6121 (RKT), R.N. Tewari 5890 (RKT).

DITHRIX (Hook.f.) Schltr. ex Brummitt

Dithrix griffithii (Hook.f.) Ormerod & Gandhi, Phytoneuron 2012-61: 3. 2012.

Habenaria griffithii Hook.f., Fl. Brit. India 6: 197. 1896.

Diphylax griffithii (Hook.f.) Kraenzl., Orchid. Gen. Sp. 1: 599. 1899.

FLOWERING: April – May.

HABIT & HABITAT: Terrestrial, temperate region between 2000-2500 m.

DISTRIBUTION: Western Himalaya (Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: Mackinnon 22733, 24170 (DD), B.P. Uniyal 93505 (BSD), U.C. Bhattacharyya 21314 (BSD), Kishan Lal 10429 (BSD).

EPIPACTIS Zinn

Epipactis gigantea Dougl. ex Hook., F1. Bor. Amer. 2: 202. 1839.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, temperate to alpine regions, 2500 – 4000 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir and Himachal Pradesh).

SPECIMENS EXAMINED: Duthie 6000 (DD), Harsukh 23336 (DD), Jagdeep Verma 216 (PAN), Bawa 3042 (PAN).

Epipactis helleborine (L.) Crantz, Strip. Austr., ed. 2: 467. 1769. Fig. 6G.

Serapias helleborine L., Sp. Pl.: 949. 1753.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, subtropical to alpine regions, 1000 – 4000 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13730 (WII), Champion 6114 (DD), Inayat 24090 (DD), B.D. Naithani 37528 (BSD), U.C. Bhattacharyya 48569 (BSD), R.N. Tewari 11758 (RKT), M.R. Uniyal 3390 (RKT).

Epipactis veratrifolia Boiss. & Hohen. in Boiss., Diagn. Pl. Or. Nov. Ser. 1, 13: 11. 1854. Fig. 6H.

FLOWERING: Februray – March.

HABIT & HABITAT: Terrestrial, subtropical region, 500 – 1000 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir

and Himachal Pradesh).

Specimens examined: J.S.Jalal 14019 (WII), Duthie 10783 (DD), Aswal 6271 (DD), Mackinnon 22720 (DD), N.C. Nair 22069 (BSD), B.P. Uniyal 79248 (BSD), Jagdeep Verma 137 (PAN), Kuthiala 11576 (PAN), M.C. Joshi 5220 (RKT).

Epipogium Borkh.

Epipogium aphyllum (F.W. Schmidt) Sw., Summa Veget. Scand.:32. 1814.

Satyrium epipogium L., Sp. Pl.: 945. 1753.

Flowering: August – September.

Habit & Habitat: Mycoheterotrophic, temperate to subalpine regions, 2400 – 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: M.A.Rau 12799 (BSD), U.C. Bhattacharyya 24123 (BSD).

Epipogium roseum (D.Don) Lindl., J. Proc. Linn. Soc., Bot. 1: 177. 1857.

Limodorum roseum D.Don, Prodr. Fl. Nepal.: 30. 1824.

Flowering: August – September.

Habit & Habitat: Mycoheterotrophic, subtropical to subalpine regions, 600 – 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S. Jalal 14001 (WII), M.A.Rau 31745 & 12799 (BSD).

Eria Lindl.

Eria coronaria (Lindl.) Rchb.f. in W.G.Walpers, Ann. Bot. Syst. 6: 271. 1861.

Coelogyne coronaria Lindl., Edwards's Bot. Reg. 27(Misc.): 83. 1841.

Flowering: October – November.

Habit & Habitat: Epiphytic, subtropical region at elevation 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: C.M. Arora 66208 (BSD).

Eria globulifera Seidenf., Opera Bot. 62: 125. 1982. Fig. 7A.

Flowering: July – August.

Habit & Habitat: Epiphytic, subtropical region, 800 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: H.J. Chowdhery & D. K. Agrawala 40133 (BSD).

Eria lasiopetala (Willd.) Ormerod, Opera Bot. 124: 22. 1995.

Aerides lasiopetala Willd., Sp. Pl. 4(1): 130. 1805.

Eria pubescens (Hook.) Lindl. ex Steud., Nomencl. Bot. 2 (1): 566. 1840. isonym.

Flowering: April – June.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13856 (WII), C.M. Arora 38851 (BSD), Balodi 75642 (BSD), U.C. Bhattacharya 21199 (BSD).

Eria occidentalis Seidenf. & Arora, Nord. J. Bot. 2: 15. f. 1. 1982.

Flowering: July – August.

Habit & Habitat: Epiphytic, subtropical region, 800 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 49508 (BSD), M.A. Rau 38785 (BSD).

Eulophia R.Br. ex Lindl.

Eulophia bicallosa (D.Don) P. F. Hunt & Summerh., Kew Bull. 20: 60. 1966.

Bletia bicallosa D.Don, Prodr. Fl. Nepal.: 30. 1825.

Flowering: March – April.

Habit & Habitat: Terrestrial, tropical to subtropical regions, 300 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Inayat 25803 (DD), Osmaston 1355 (DD).

Eulophia dabia (D.Don) Hochr., Bull. New York Bot. Gard. 6: 270. 1910.

Bletia dabia D.Don, Prodr. Fl. Nepal.: 30. 1825.

Eulophia hormusjii Duthie, Ann. Roy. Bot. Gard. Calcutta 9(2): 125. 1906.

Flowering: March – April.

Habit & Habitat: Terrestrial, tropical to subtropical regions, 300 – 2000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: U.C. Bhattacharyya 49457 (BSD), Mackinnon 22724 &22708 (DD), Jagdeep Verma 124 (PAN).

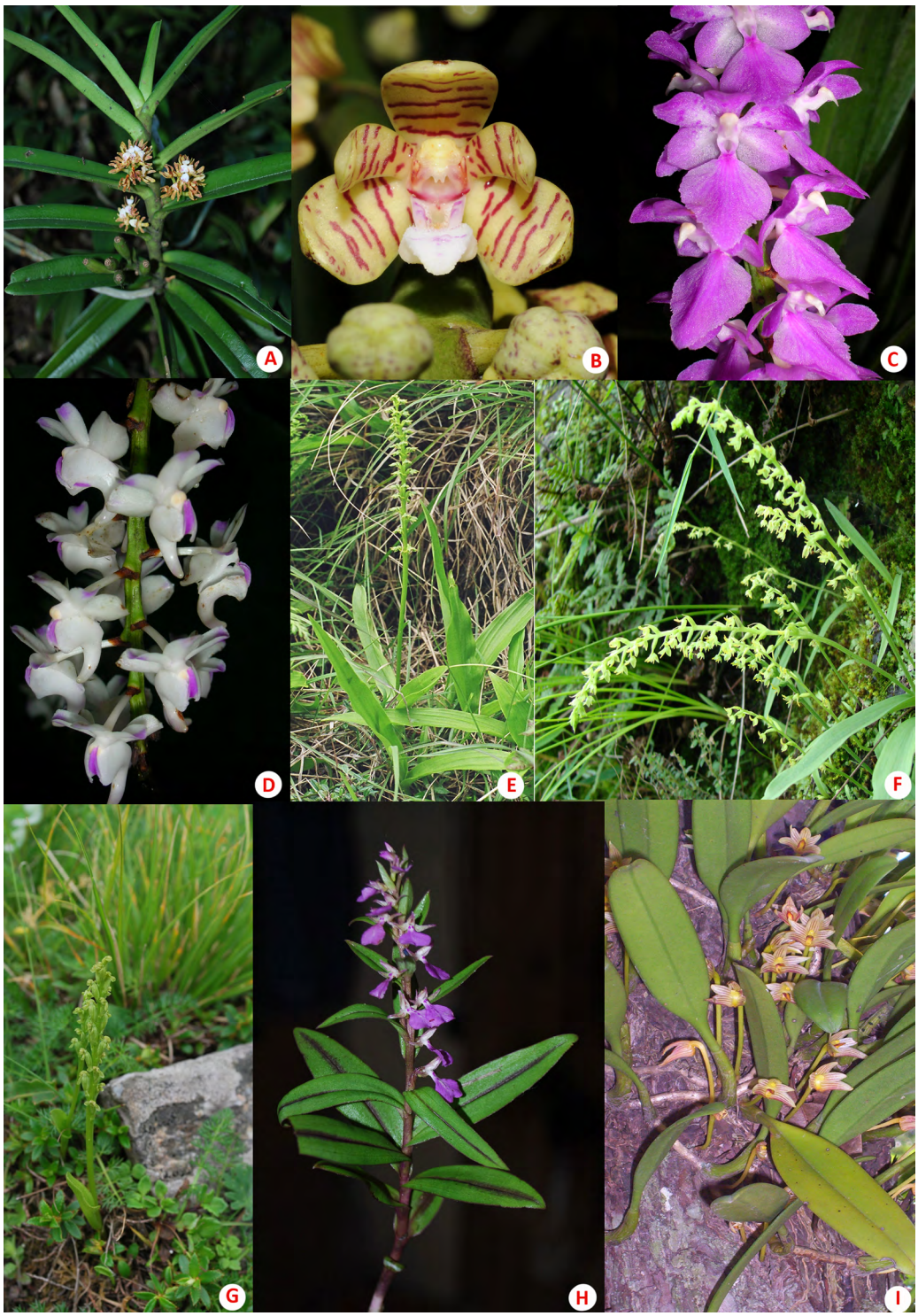

FIGURE 3. A. *Acampe carinata*, B. *Acampe rigida*, C. *Aerides multiflora*, D. *Aerides odorata*, E. *Androcorys josephi*, F. *Androcorys monophylla*, G. *Androcorys pugioniformis*, H. *Brachycorythis obcordata*, I. *Bulbophyllum affine*

FIGURE 4. A. *Bulbophyllum careyanum*, B. *Bulbophyllum cariniflorum*, C. *Bulbophyllum hirtum*, D. *Calanthe plantaginea*, E. *Calanthe tricarinata*, F. *Coelogyne cristata*, G. *Coelogyne ovalis*, H. *Coelogyne stricta*, I. *Crepidium acuminatum*

FIGURE 5. A. *Cymbidium aloifolium*, B. *Cymbidium iridoides*, C. *Cymbidium macrorhizon*, D. *Cypripedium cordigerum*, E. *Cypripedium elegans*, F. *Cypripedium himalaicum*, G. *Dactylorhiza hatagirea*

FIGURE 6. A. *Dendrobium amoenum*, B. *Dendrobium bicameratum*, C. *Dendrobium denudans*, D. *Dendrobium fimbriatum*, E. *Dendrobium monticola*, F. *Diplomeris hirsuta*, G. *Epipactis helleborine*, H. *Epipactis veratrifolia*

Eulophia epidendraea (J.Koenig ex Retz.) C.E.C.Fisch. in J.S.Gamble, Fl. Madras: 1434. 1928.

Serapias epidendraea J.Koenig ex Retz., Observ. Bot. 6: 65. 1791.

FLOWERING: May – June.

HABIT & HABITAT: Terrestrial, subtropical region c. 1600 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: H.J. Chowdhery & D.K. Agrawala 40199 (BSD).

Eulophia explanata Lindl., Gen. Sp. Orchid. Pl.: 180. 1833.

FLOWERING: May – June.

HABIT & HABITAT: Terrestrial, subtropical region, 500 – 1000 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: Mackinnon 22710 (DD).

Eulophia flava (Lindl.) Hook. f., Fl. Brit. India 6: 7. 1890. Fig. 7B.

Cyrtopera flava Lindl., Gen. Sp. Orchid. Pl.: 189. 1833.

FLOWERING: June – July.

HABIT & HABITAT: Terrestrial, subtropical region, 500 – 1000 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: K.M.M. Dakshni 8050 & 5535 (BSD); Mackinnon 22725 (DD).

Eulophia graminea Lindl., Gen. & Sp. Orch. 182. 1833.

FLOWERING: March – April.

HABIT & HABITAT: Terrestrial, subtropical region, 500 – 1200 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMEN EXAMINED: C.L. Malhotra 31544 (BSD).

Eulophia herbacea Lindl., Gen. & Sp. Orch. 182. 1833.

FLOWERING: June – July.

HABIT & HABITAT: Terrestrial, subtropical grasslands, 600 – 1500 m.

DISTRIBUTION: Western Himalaya (Himanchal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: N.C. Nair 30018 (BSD), Jagdeep Verma 227 (PAN).

Eulophia mackinnonii Duthie, J. Asiat. Soc. Bengal 71 (2): 40. 1902.

FLOWERING: July – August.

HABIT: Terrestrial.

SPECIMENS EXAMINED: Mackinnon 21748 & 22732 (DD), Inayat 25798 (DD).

This species has been included on the authority of J. F. Duthie (1906) who collected it from Mussoorie up to 1800 m. It was never recollected afterwards from the reported locality by the subsequent workers.

Eulophia obtusa (Lindl.) Hook. f., Fl. Brit. India 6: 3. 1890.

Cyrtopera obtusa Lindl., Gen. Sp. Orchid. Pl.: 190. 1833.

FLOWERING: July – August.

This species has been included here on the basis of J. F. Duthie (1906), who reported it from Mussoorie and Dehradun, but never recollected afterwards by the subsequent workers from there and thus appears very doubtful in Western Himalaya.

GALEARIS Raf.

Galearis roborovskyi (Maxim.) S.C.Chen, P.J.Cribb & S.W.Gale, Fl. China 25: 92. 2009.

Orchis roborovskyi Maxim., Bull. Acad. Imp. Sci. Saint-Pétersbourg, III, 31: 104. 1887.

Aorchis roborovskyi (Maxim.) Seidenf., Nordic J. Bot. 2: 9. 1982.

FLOWERING: June – July.

HABIT & HABITAT: Terrestrial, alpine region, 3300–4800 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: P.K. Hajra 73972 (BSD), T.A.Rao 4547 (BSD).

Galearis spathulata (Lindl.) P.F.Hunt, Kew Bull. 26: 172. 1971.

Gymnadenia spathulata Lindl., Gen. & Sp. Orch..: 280. 1835.

Aorchis spathulata (Lindl.) Vermeul., Nat. Ver. Wupper. 25: 33. 1972.

FLOWERING: July – August

HABIT & HABITAT: Terrestrial, alpine and sub-alpine regions, 3000 – 3500 m.

DISTRIBUTION: Western Himalaya (Himanchal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: N.C. Nair 36118 (BSD), A.K. Goel 72852 (BSD), Som Deva & Dwarika Prashad 75 (SOF), Vij & Verma 288 (PAN).

GALEOLA Lour.

Galeola falconeri Hook. f., Fl. Brit. India 6: 88. 1890.

FLOWERING: July – August.

Habit & Habitat: Mycoheterotrophic, subtropical to temperate regions, 1200 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Mackinnon 22726 (DD).

Galeola lindleyana (Hook. f. & Thomson) Rchb.f., Xenia Orchid. 2: 78. 1865.

Cyrtosia lindleyana Hook. f. & Thomson in Hook. f., Ill. Himal. Pl.t. 22. 1855.

Flowering: June – August.

Habit & Habitat: Mycoheterotrophic, temperate region, 1200 – 2400 m elevation.

Distribution: Western Himalaya (Himachal Pradesh).

Polunin & Stainton (1984) listed this species from Himachal Pradesh but without mentioning exact place of its occurrence, whereas Singh & Rawat (2000) reported it from Jiwa Nal Valley (Great Himalayan National Park, Kullu) in Himachal Pradesh. Vij et al. 2013 in orchids of Himachal Pradesh also quoted this based on above references.

Gastrochilus D. Don

Gastrochilus acutifolius (Lindl.) O. Ktze, Rev. Gen. Pl. 2: 661. 1891.

Saccolabium acutifolium Lindl., Gen. & Sp. Orch. 233. 1833.

Flowering: October – November.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 2000 – 2500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 70821 (BSD).

Gastrochilus calceolaris (Buch.-Ham. ex Sm.) D. Don, Prodr. Fl. Nepal. 32. 1825.

Aerides calceolaris Buch.-Ham. ex Sm. in A.Rees, Cycl. 39: 11. 1818.

Flowering: April – May.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 1500 – 2000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himanchal Pradesh and Uttarakhand).

Specimens examined: H.J. Chowdhery & D.K. Agrawala 40198 (BSD), N.C. Nair 35920 (BSD), Jagdeep Verma 178 (PAN), M.R. Uniyal 3704 (RKT).

Gastrochilus distichus (Lindl.) O. Ktze., Rev. Gen. Pl. 2: 661. 1891.

Saccolabium distchum Lindl., J. Proc. Linn. Soc. Bot. 3:36. 1859.

Flowering: March – April.

Habit & Habitat: Epiphytic, subtropical region, 600–1500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 1373 & 13838 (WII), B.P. Uniyal & Surendra Singh 90588 (BSD), R.N. Tewari 12784 (RKT), Kishan Lal 1614 (BSD).

Gastrochilus garhwalensis Tsi, Guihaia 16 (2) 16, t. 1. 1996.

This species is collected by Inayat (s.n.) in 15 Jun 1902 from Garhwal region in Uttarakhand. In 1996 Tsi undertook revisionary work on the genus Gastrochilus and published it as a new species in Guihaia (1996). The type specimen is only available in Oakes Ames Orchid Herbarium (AMES), Harvard. Not a single specimen is available in any Indian Herbaria. Included here following Tsi (1996) which was based on a more than 100 years old single specimen.

Gastrochilus inconspicuus (Hook. f.) O. Ktze., Rev. Gen. Pl. 2: 661. 1891.

Saccolabium inconspicuum Hook. f., Fl. Brit. India 6: 56. 1890.

Flowering: June – July.

Habit & Habitat: Epiphytic, subtropical region, 600–1200 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13857 (WII), A.K. Goel 65909 (BSD).

Gastrodia R. Br.

Gastrodia falconeri D.L.Jones & M.A.Clem., Orchadian 12: 350. 1998. Fig. 7C.

Gastrodia orobanchoides (Falc.) Benth. & Hook.f., Gen. Pl. 3: 617. 1883.

Flowering: July – August.

Habit & Habitat: Mycoheterotrophic, temperate to subalpine regions, 2300 – 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13902 (WII), A.K. Goel 64328 & 67793 (BSD), Jagdeep Verma 219 (PAN).

Geodorum Jacks.

Geodorum densiflorum (Lam.) Schlecht. in Fedde Repert. Beih. 4: 259. 1919.

Limodorum densiflorum Lam., Encycl. 3: 516. 1792.

Flowering: June – July.

Habit: Terrestrial.

This species is included here on the authority of J. F.

Duthie (1906), who reported it from Dehradun up to 1000 m. However, it has not been recollected from the area by any of the subsequent workers.

Goodyera R. Br.

Goodyera biflora (Lindl.) Hook. f., Fl. Brit. India 6: 114. 1890. Fig. 7D.

Georchis biflora Lindl., Gen. & Sp. Orch. 496. 1840.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1500 – 2500 m.

Distribution: Western Himalaya (Himanchal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 15062 (WII), C.M. Arora 37876 (BSD), Jagdeep Verma 258 (PAN), G.C. Joshi 32808 (RKT), Pangtey & Kalakoti 3805 (NTL).

Goodyera foliosa (Lindl.) Benth. ex C.B.Clarke, J. Linn. Soc. Bot. 25: 73.1889.

Georchis foliosa Lindl., Gen. & Sp. Orch. :496. 1840.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical to temperate regions between 1500 – 2500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: M.A.Rau 28588 (BSD), Osmaston 1512 (DD).

Goodyera fusca (Lindl.) Hook. f., Fl. Brit. India 6: 112. 1890. Fig. 7E.

Hetaeria fusca Lindl., Gen. & Sp. Orch.: 491. 1840.

Flowering: August – September.

Habit & Habitat: Terrestrial, alpine and subalpine regions, 3000 – 3700 m.

Distribution: Western Himalaya (Himanchal Pradesh and Uttarakhand).

Specimens examined: J.S. Jalal 15027 (WII), Inayat 24084 (DD), U.C. Bhattacharyya 24336 (BSD), G.C. Joshi 36089 (RKT), G.S. Rawat 598 (NTL).

Goodyera procera (Ker-Gawl.) Hook., Exot. Fl. 1. 3: t. 39. 1823. Fig. 7F.

Neottia procera Ker-Gawl. in Edgw., Bot. Reg. 8: t. 639. 1822.

Flowering: May – June.

Habit & Habitat: Terrestrial, subtropical region, 600-1000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13859 (WII), M.A.Rau 14608 & 35324 (BSD), G.C. Joshi 10931 (RKT).

Goodyera repens (L.) R. Br. in Aiton, Hort. Kew., ed. 2, 5: 198. 1813. Fig. 7G.

Satyrium repens L., Sp. Pl.: 945. 1753.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2000 – 3600 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13701 (WII), A.K. Goel 64333 (BSD), Jagdeep Verma 234 (PAN), G.C. Joshi 37010 (RKT), Pangtey & Kalakoti 2522 (NTL).

Goodyera viridiflora (Blume) Coll., Orch. Arch. Ind.:41, t. 9. 1854. Fig. 7H

Neottia viridiflora Blume, Bijdr.: 408. 1825.

Flowering: September – October.

Habit & Habitat: Terrestrial, temperate region, 1500–2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 15069 (WII), M.A.Rau 35307 (BSD).

Goodyera vittata (Lindl.) Benth. ex Hook., Fl. Brit. India 6: 113. 1890. Fig. 7I.

Georchis vittata Lindl., J. Linn. Soc. 1: 184. 1857.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate region, 2200–2500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 15049 (WII).

Gymnadenia R. Br.

Gymnadenia orchidis Lindl., Gen. & Sp. Orch. 278. 1835. Fig. 8A.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine to alpine regions, 3000 – 4500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 15025 (WII), Osmaston 24187 (DD), U.C. Bhattacharyya 24399 (BSD), Jagdeep Verma 292 (PAN).

Habenaria Willd.

Habenaria aitchisonii Rchb.f., Trans. Linn. Soc. London, Bot. 3: 113. 1886.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2000 – 4000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13981 (WII), Mackinnon 22991 (DD), P.K. Hajra 87062 (BSD), Jagdeep Verma 601 (PAN).

Habenaria arietina Hook. f., Fl. Brit. India 6: 138. 1890.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1800 – 2800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Inayat 24055 (DD).

Habenaria commelinifolia (Roxb.) Wall. ex Lindl., Gen. & Sp. Orch. 325. 1835.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical region, 1000–1200 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: Kanjilal 1077 (DD), Duthie 521 (DD), U.C. Bhattacharyya 37745 (BSD), M.A. Rau 12631 (BSD), Jagdeep Verma 305 (PAN).

Habenaria digitata Lindl., Gen. & Sp. Orch. 307. 1835.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region c. 1500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Duthie 24177 (DD), U.C. Bhattacharyya 37273 (BSD), Jagdeep Verma 501 (PAN).

Habenaria diphylla Dalz. in Hooker J. Bot. 2; 262. 1850.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region c. 600 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Mackinnon 25411 (DD).

Habenaria ensifolia Lindl., Gen. & Sp. Orch. 1835.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical to temperate region, 500 – 3000 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Naithani 1059 (DD), Jagdeep Verma 306 (PAN).

This species superficially resembles *Habenaria pectinata* and treated as a synonym of *H. pectinata* in World Checklist of Orchidaceae in Kew. However both species can be easily distinguinsed by floral characters for instance, *H. pectinata* has petals and lip white, midlobe of lip stout, longer than the side lobes. Spur stout, funnel shaped and curved outwards. In *H. ensifolia* flowers are greenish-yellow, midlobe shorter than side lobes. Spur slender and curved inwards. Moreover in *H. pectinata* the sidle lobes of the lip are uniformaly pectinate whereas in *H. ensifolia* side lobes of the lip are irregularly pectinate and somewhat like stag horn. Hence, we feel that *H. ensifolia* should be treated as a distinct species.

Habenaria furcifera Lindl., Gen. & Sp. Orch. 319. 1835.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region at an altitude 1500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: Duthie 2314 (DD), Mackinnon 21745 (DD), T.A.Rao 3418 (BSD).

Habenaria intermedia D. Don, Prodr. Fl. Nepal. 24. 1825. Fig. 8B.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2000 – 2700 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13702 (WII), Saxena 2045 (DD), Jagdeep Verma 249 (PAN).

Habenaria longifolia Buch.-Ham. ex Lindl., Gen. & Sp. Orch. 324. 1835.

Flowering: August.

Habit: Terrestrial.

Distribution: Western Himalaya (Uttarakhand).

This species is included on the authority of J. F. Duthie (1906), who recorded it from Kumaun and Garhwal occurring between 400 and 1500 m elevation. But not recollected from here by the subsequent workers since then.

Habenaria marginata Colebr. in Hook. Exot. Fl. 2: l7. t. 136. 1824. Fig. 8C.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical region, 500–1000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13726 (WII), Harsukh 24172 (DD), Jagdeep Verma 307 (PAN).

Habenaria pectinata (J.E. Sm.) D. Don, Prodr. Fl. Nepal. 24. 1825. Fig. 8D.

Orchis pectinata Sm., Exot. Bot. 2: 77. 1806. *nom. illeg.*

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1500 – 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13797 (WII), Duthie 21753 (DD), Naithani 1057 (DD), J. Verma 228 (PAN), R.N. Tewari 17368 (RKT).

Habenaria plantaginea Lindl., Gen. & Sp. Orch. 323. 1835.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical region, 500–1000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: Kanjilal 1078 (DD), J. Verma 308 (PAN), N.K. Pandy 25985 (RKT).

Habenaria pubescens Lindl. Gen. & Sp. Orch. 322. 1835. Fig. 8E.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region, 600–1200 m.

Distribution: Western Himalaya (Uttarakhand and Himachal Pradesh).

Specimen examined: J.S.Jalal 13907 (WII), Mackinnon 21765 (DD), Jagdeep Verma 602 (PAN).

Habenaria stenopetala Lindl., Gen. Sp. Orchid. Pl.: 319. 1835.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1000 – 2500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: Mackinnon 22980 (DD), U.C. Bhattacharyya 29342 (BSD), Vij & Verma 504 (PAN).

Hemipilia Lindl.

Hemipilia cordifolia Lindl., Gen. & Sp. Orch. 296. 1836. Fig. 8F.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region, 1500–2200 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13994 (WII), Mackinnon 21768 (DD), B.S. Karki 82224 (BSD), Balodi 77146 (BSD), Jagdeep Verma 294 (PAN).

Herminium L.

Herminium kumaunensis Deva & H.B.Naithani, Orchid Fl. North West Him. 159. 1986.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine region, 3300–3600 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Duthie 6003 (DD).

Herminium lanceum (Thunb. ex Sw.) Vuijk, Blumea 11 (1): 228. 1961.

Ophrys lancea Thunb. ex Sw., Kongl. Vetensk. Acad. Nya Handl. 21: 223. 1800.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 1200 – 2700 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13714 (WII), Mackinnon 21771 (DD), U.C. Bhattacharya 40404 (BSD), H.J. Chowdhery 73172 (BSD), J. Verma 229 (PAN).

Herminium mackinonii Duthie, J. Asiat. Soc. Bengal 71 (2): 44. 1902.

Flowering: August – September.

Habit: Epiphytic.

Habitat: Subtropical to temperate regions, 1500 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 15043 (WII), Arora 50068 (BSD).

Herminium monorchis (L.) R.Br. in Aiton. Hort. Kew 25: 191. 1813.

Ophrys monorchis L., Sp. Pl.: 947. 1753.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine to alpine regions, 3000 – 4000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: Duthie 3415 (DD), H.J. Chowdhery 76051 (BSD), Bawa 3052 & 3054 (PAN).

Liparis Rich.

Liparis caespitosa (Lam.) Lindl. in Edw. Bot. Reg. 11: sub. t. 882. 1825.

Epidendrum caespitosum Lam. in Encycl. 1(1): 187. 1783.

Flowering: July – August.

Habit & Habitat: Epiphytic, subtropical region, 1000 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13961 (WII), C.M. Arora 36437 (BSD).

Liparis cordifolia Hook. f., Ic. Pl. 19. t. 1811. 1889.

Flowering: September – October.

Habit: Terrestrial.

Distribution: Western Himalaya (Uttarakhand).

This species is included here on the authority of J. F. Duthie (1906), who recorded it from Garhwal (1800 m), but not been recollected by the subsequent workers till date.

Liparis deflexa Hook. f., Fl. Brit. India 5: 697. 1890. Fig. 9A.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region, 600 – 1000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Inayat 24113 (DD).

Liparis glossula Rchb. f., Linnaea 41: 44. 1876.

Flowering: August – September.

Habit & Habitat: Terrestrial, temperate region, 1800 – 2200 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13926 & 13794 (WII), Mackinnon 21772 & 22734 (DD), J. Verma 295 (PAN).

Liparis nervosa (Thumb.) Lindl., Gen. & Sp. Orch. 26. 1830.

Ophrys nervosa Thunb. in J.A.Murray, Syst. Veg. 14: 814. 1784.

Flowering: July – August.

Habit: Terrestrial.

Distribution: Western Himalaya (Uttarakhand).

This species has been included here on the authority of Duthie (1906), who reported it from Kumaun based on Blinkworth's collection from 1500 – 2300 m.

Liparis odorata (Willd.) Lindl., Gen. Sp. Orchid. Pl.: 26. 1830. Fig. 9B

Malaxis odorata Willd., Sp. Pl. 4: 91. 1805.

Liparis paradoxa (Lindl.) Rchb.f. in W.G.Walpers, Ann. Bot. Syst. 6: 218. 1861.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate region, 1800 – 2200 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Mackinnon 22995 & 21775 (DD), H.J. Chowdhery 78119 (BSD), C.M. Arora 70830 & 70831 (BSD).

Liparis platyrachis Hook. f., Ic. Pl. t. 1890. 1889.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical region, c. 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 49616, 66186 & 52436 (BSD).

Liparis resupinata Ridl. J. Linn. Soc. Bot. 22: 290. 1886.

Flowering: November – December.

Habit & Habitat: Terrestrial, temperate region, 1600-2200 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: C.M. Arora 38848 (BSD).

Liparis rostrata Rchb. f., Linnaea 41. 44. 1876.

Liparis diodon Rchb. f., Linnaea 41: 43. 1876.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1500 – 2500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13723 (WII), Mackinnon 21773 & 29971 (DD), B.D. Naithani 54077 (BSD), C.M. Arora 38422 & 36467 (BSD), J. Verma 259 (PAN).

Liparis viridiflora (Blume) Lindl., Gen. & Sp. Orchid. Pl. 31. 1830. Fig. 9C

Malaxis viridiflora Blume, Bijdr.: 392. 1825.

Flowering: September – October.

Habit & Habitat: Epiphytic, subtropical region, 1500 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Inayat 24112 (DD), P.K. Hajra 74456 & 74422 (BSD).

Luisia Gaudich.

Luisia brachystachys (Lindl.) Blume, Rumphia 4: 50. 1849.

Mesoclaster brachystachys Lindl., Gen. & Sp. Orchid. Pl. 43. 1830.

Flowering: March – April.

Habit: Epiphytic.

Distribution: Western Himalaya (Uttarakhand).

This species has not been collected for last 125 years in this region. Duthie (1906) menesioned two specimens one by by Falconer from Garhwal and other by J.L. Stewart from Kumaun. This species is superficially resembles with Luisia tristis.

Luisia trichorrhiza (Hook.) Blume, Mus. Bot. 1: 63. 1849.

Vanda trichorhiza Hook., Exot. Fl. 1: t. 72. 1823.

Flowering: March – April.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: T.A.Rao 4118 (BSD), C.M. Arora 36481 & 56481 (BSD).

Luisia tristis (G.Forst.) Hook.f., Fl. Brit. India 6: 25. 1890. Fig. 9D.

Epidendrum triste G.Forst., Fl. Ins. Austr.: 60. 1786.

Luisia zeylanica Lindl., Fol. Orchid. 4: 3. 1853.

Flowering: April – June.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1200 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13743 (WII), U.C. Bhattacharyya 21192 (BSD), C.M. Arora 66105 (BSD), J. Verma 201 (PAN).

Malaxis Sol. ex Sw.

Malaxis muscifera (Lindl.) Kuntze, Revis. Gen. Pl. 2: 673. 1891.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 1800 – 3500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Speciemens examined: Raizada 18224 (DD), C.M. Arora 53569 (BSD), M.A. Rau 38674 (BSD), J. Verma 209 (PAN).

Neottia Guett.

Neottia acuminata Schltr., Acta Horti Gothob. 1: 141. 1924.

Flowering: June – July.

Habit & Habitat: Mycoheterotrophic, temperate to subalpine regions, 3000 – 3600 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: A.K.Goel 72854 (BSD).

Neottia chandrae Raskoti, J.J.Wood & Ale, Nordic J. Bot. 30: 187. 2012.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine region, 3000–3200 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: K.R. Keshava Murthy 113101 (BSD).

Neottia inayatii (Duthie) Schltr., Bot. Jahrb. Syst. 45: 387. 1911.

Listera inayatii Duthie, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 71: 41. 1902.

Neottia kashmiriana (Duthie) Schltr., Bot. Jahrb. Syst. 45: 387. 1911.

Flowering: July.

Habit & Habitat: Mycoheterotrophic, moist temperate to subalpine regions c. 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir and Himachal Pradesh).

Specimens examined: Inayat 25389 (DD).

Neottia listeroides Lindl. in J.F.Royle Ill. Bot. Himal. Mts.1: 368. 1839.

Flowering: July – September.

Habit & Habitat: Mycoheterotrophic, moist temperate to subalpine regions, 2000 – 3500 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13728 (WII), Duthie 638 (DD), P.K. Hajra 73206 (BSD), J. Verma 236 (PAN).

Neottia longicaulis (King & Pantl.) Szlach., Fragm. Florist. Geobot., Suppl. 3: 117. 1995.

Listera longicaulis King & Pantl., J. Asiat. Soc. Bengal 65: 126. 1896.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine and alpine regions, 3000 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: M.A.Rau 31778 (BSD), U.C. Bhattacharyya 21285 & 29652 (BSD).

Neottia mackinnonii Deva & H.B. Naithani, Orchid Fl. North West Him.: 75, t. 30. 1986.

Flowering: August – September.

Habit & Habitat: Mycoheterotrophic, subtropical region, 800 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Mackinnon 2542a (DD).

Neottia microglottis (Duthie) Schltr. in Engler, Bot. Jahrb. 45: 387. 1911.

Listera microglottis Duthie, J. Asiat. Soc. Bengal 71 (2): 42. 1902.

Flowering: August – September.

Habit & Habitat: Mycoheterotrophic, moist temperate region, 2000 – 2400 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Mackinnon 25426 (DD), Stewart 14425 (DD).

Neottia nandadeviensis (Hajra) Szlach., Fragm. Florist. Geobot., Suppl. 3: 118. 1995. Listera nandadeviensis Hajra, Bull. Bot. Surv. India 25: 181. 1983 (pub. 1985.).

Flowering: August – September.

Habit & Habitat: Terrestrial, subalpine and alpine regions, 3000 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Hajra 73201 (BSD).

Neottia ovata (L.) Bluff & Fingerh., Comp. Fl. German., ed. 2, 2: 435. 1838.

Ophrys ovata L., Sp. Pl.: 946. 1753.

Listera ovata (L.) R.Br. in W.T.Aiton, Hortus Kew. 5: 201. 1813.

Flowering: June – July.

Habit & Habitat: Terrestrial, subalpine and alpine regions, 2100-3000 m.

Distribution: Western Himalaya (Jammu & Kashmir).

Specimens examined: Inayat 25389 (DD), Royle 2469 (DD).

Neottia pinetorum (Lindl.) Szlach., Fragm. Florist. Geobot., Suppl. 3: 118. 1995.

Listera pinetorum Lindl., J. Linn. Soc. Bot. 1: 175. 1857.

Flowering: June – July.

Habit & Habitat: Terrestrial, subalpine and alpine regions, 3000 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: M.A. Rau 31778 (BSD).

Neottia tenuis (Lindl.) Szlach., Fragm. Florist. Geobot., Suppl. 3: 119. 1995.

Listera tenuis Lindl., J. Linn. Soc. Bot. 1: 176 (1857).

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine and alpine regions, 3000 – 3500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13945 (WII), P.K. Hajra 73294 & 27221 (BSD).

Neottianthe (Rchb.) Schltr.

Neottianthe cucullata var. ***calcicola*** (W.W.Sm.) Soó, Ann. Hist.-Nat. Mus. Natl. Hung. 26: 353. 1929.

Gymnadenia calcicola W.W. Sm., Notes Roy. Bot. Gard. Edinb. 88: 188. 1924.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine to alpine regions, 3600 – 3800 m altitude.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Naithani 53973 (DD), G.S. Rawat 1935 & 1510 (NTL).

Neottianthe secundiflora (Hook. f.) Schltr. in Fedde, Repert. 16: 291. 1919.

Habenaria secundiflora Hook. f., Fl. Brit. India 6: 165. 1890.

Flowering: August – September.

Habit & Habitat: Terrestrial, subalpine to alpine regions, 3600 – 3800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: B.D. Naithani 53973 (BSD), B.P. Uniyal 94245 (BSD), P.K. Hajra 73239 (BSD).

Nervilia Comm. ex Gaudich.

Nervilia concolor (Blume) Schltr., Bot. Jahrb. Syst. 45: 404. 1911.

Cordyla concolor Blume, Bijdr.: 416. 1825.

Nervilia aragoana Gaud. in Freycinet, Voy. Bot. : 422, t. 35. 1829.

Flowering: June – July.

Habit & Habitat: Terrestrial, tropical to subtropical regions, 300 – 1500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: C.M. Arora 36484 (BSD), J. Verma 297 (PAN).

Nervilia crociformis (Zoll. & Moritzi) Seidenf., Dansk Bot. Ark. 32: 151. 1978. Fig. 9E

Bolborchis crociformis Zoll. & Moritzi, Syst. Verz.: 89. 1846.

Nervilia prainiana (King & Pantl.) Seidenf., Dansk Bot. Ark. 32(2): 149. 1978.

Flowering: May – June.

Habit & Habitat: Terrestrial, tropical to subtropical regions, 300 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: J.S.Jalal 13808 (WII), C.M. Arora 70808 (BSD).

Nervilia falcata (King & Pantl.) Schltr. in Engler, Bot. Jahrb. 45: 402. 1911.

Pogonia falcata King & Pantl., J. Asiat. Soc. Bengal 65 (2): 129. 1896.

Flowering: May – June.

Habit & Habitat: Terrestrial, subtropical region, 600 – 800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Deva 3845.

Nervilia gammieana (Hook. f.) Pfitzer, Nat. Pflanzenfam. 2 (6): 56. 1888. Fig. 9F

Pogonia gammieana Hook. f. in Curtis, Bot. Mag.:39. 1883.

Flowering: May – June.

Habit & Habitat: Terrestrial, subtropical region, 600 – 1600 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 15009 (WII), Naithani & Dayal 1712 (DD), B.P. Uniyal 86643 (BSD), P.K. Hajra 82361 (BSD), J.Verma 283 (PAN).

Nervilia gleadowii A.N.Rao, Indian Forester 118: 846. 1992.

Flowering: May.

Habit & Habitat: Terrestrial, subtropical region at 1000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: F.Gleadowii 23940 (DD).

Nervilia infundibulifolia Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 725. 1932.

Flowering: June – July.

Habit & Habitat: Terrestrial, subtropical region, 500–1000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: G.T. 2500 (DD).

Nervilia mackinnonii (Duthie) Schltr. in Engler, Bot. Jahrb. 45: 402. 1911. Fig. 9G.

Pogonia mackinnonii Duthie, J. Asiat. Soc. Bengal. 72 (2): 43. 1902.

Flowering: May – June.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 800-2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13900 (WII), Mackinnon 21781 (DD).

Nervilia pangteyana Jalal, Kumar & G.S.Rawat, Nordic J. Bot. 30: 407. 2012. Fig. 9H.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region at altitude 800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 15051 (WII).

Nervilia plicata (Andr.) Schltr. in Engler, Bot. Jahrb. 45: 403. 1911. Fig. 9I.

Arethusa plicata Andrews, Bot. Repos. 5: 321. 1803.

Pogonia plicata (Roxb.) Lindl., Gen. & Sp. Orchid. Pl. 415. 1840.

Flowering: May – June.

Habit & Habitat: Terrestrial, subtropical region, 600–1000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: Harsukh 24193 (DD), C.M. Arora 70813 (BSD).

Oberonia Lindl.

Oberonia acaulis Griff., Not. Pl. Asiat. 3: 275. 1851.

Flowering: September – October.

Habit & Habitat: Epiphytic, subtropical region, 1400 – 1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13863 (WII), M.A.Rau 6559 (BSD), C.M. Arora 36426 (BSD).

Oberonia caulescens Lindl., Gen. & Sp. Orchid. Pl. 15. 1830.

Flowering: May – July.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 1000 – 1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Pant & Naithani 39573 (BSD); C.M. Arora 38821 (BSD).

Oberonia ensiformis (Sm.) Lindl., Fol. Orch. 8: 4. 1859.

Malaxis ensiformis Sm. in A.Rees, Cycl. 22: 14. 1812.

Flowering: May – July.

Habit & Habitat: Epiphytic, subtropical region, 1000 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13880 (WII), P.K. Hajra 74421 (BSD), U.C. Bhattacharyya 21150 & 21377 (BSD).

Oberonia falconeri Hook. f., Ic. Pl. t. 1780. 1888.

Flowering: September – October.

Habit & Habitat: Epiphytic, subtropical region, 600 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13843 (WII), C.M. Arora 36474 (BSD).

Oberonia griffithiana Lindl., Sert. Orchid.: t. 8 B. 1838.

Flowering: March – June.

Habit & Habitat: Epiphytic, subtropical region, 1200 – 1600 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: C.M.Arora 55803 (BSD).

Oberonia pachyrachis Rchb. f. ex Hook. f. Fl. Brit. India 5: 681. 1890.

Flowering: July – August.

Habit & Habitat: Epiphytic, subtropical region, 1000 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13887 (WII), Mackinnon 24185 (DD), C.M. Arora 66101 (BSD).

Oberonia prainiana King & Pantl., J. Asiat. Soc. Bengal 64 (2): 331. 1895.

Flowering: April – June.

Habit & Habitat: Epiphytic, subtropical region, 600 – 1000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: J.S.Jalal 13977 (WII), C.L.Malhotra 55291 (BSD).

Oberonia pyrulifera Lindl., Fol. Orchid. 8: 3. 1859.

Flowering: September – October.

Habit & Habitat: Epiphytic, subtropical region, 600–2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 66143 (BSD).

Oreorchis Lindl.

Oreorchis foliosa (Lindl.) Lindl., J. Proc. Linn. Soc., Bot. 3: 27. 1858.

Corallorhiza foliosa Lindl., Gen. Sp. Orchid. Pl.: 535. 1840.

Flowering: June – July.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2500 – 3500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Osmaston 24188 (DD), M.A. Rau 10305 (BSD), J. Verma 238 (PAN).

Oreorchis foliosa var. ***indica*** (Lindl.) N.Pearce & P.J.Cribb, J. Orchid Soc. India 10: 5. 1996.

Oreorchis indica (Lindl.) Hook.f., Fl. Brit. India 5: 709. 1890.

Flowering: June – July.

Habit & Habitat: Terrestrial, moist temperate to subalpine regions, 2000 – 2700 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13931 (WII), Duthie 14592 (DD), M.A. Rau 31764 (BSD), J. Verma 285 (PAN).

Oreorchis micrantha Lindl., J. Proc. Linn. Soc., Bot. 3: 27. 1858. Fig. 9J.

Flowering: June – July.

Habit & Habitat: Terrestrial, moist temperate to subalpine regions, 1800 – 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 14038 (WII), B.D. Naithani 68132 (BSD), P.K. Hajra 73724 (BSD).

Oreorchis patens (Lindl.) Lindl., in J. Pro. Lin. Soc. Bot. 3: 27. 1858.

Flowering: June – July.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2200 – 2250 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: D.K. Agrawala 40119 (BSD).

Ornithochilus (Lindl.) Wall. ex Benth.

Ornithochilus difformis (Wall. ex Lindl.) Schlecht. in Fedde Repert. 4: 277. 1919.

Aerides difformis Wall. ex Lindl., Gen. & Sp. Orch. 242. 1833.

Flowering: June-July.

Habit & Habitat: Epiphytic, subtropical region, 1000 – 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13807 (WII), C.M. Arora 36446 (BSD).

Otochilus Lindl.

Otochilus lancilabius Seidenf., Opera Bot. 89: 94. 1986.

Flowering: October – January.

Habit & Habitat: Epiphytic, subtropical region, 1000-1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 37813 & 68256 (BSD).

Pachystoma Blume

Pachystoma pubescens Blume, Bijdr. Fl. Ned. Ind.: 376, t. 3, f. 29. 1825.

Flowering: March – April.

Habit & Habitat: Terrestrial, subtropical region, 1000 – 1800 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Mackinnon 24191 (DD); P.C. Pant 43736 (BSD); J. Verma 315 (PAN).

Pecteilis Raf.

Pecteilis gigantea (J. E. Sm.) Rafin., Fl. Tell. 2: 38. 1837.

Orchis gigantea J.E. Sm., Exot Bot 2: 79. 1805.

Flowering: September – October.

Habit & Habitat: Terrestrial, subtropical region, 900 – 1200 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 15061 (WII), Mackinnon 22981 (DD), C.M. Arora 36476 (BSD).

Pecteilis triflora (D.Don) Tang & F.T.Wang, Acta Phytotax. Sin. 1: 62. 1951.

Habenaria triflora D.Don, Prodr. Fl. Nepal.: 25. 1825.

Flowering: August – September.

Habit & Habitat: Terrestrial, subtropical region, 1200 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Osmaston 23102 (DD), C.M. Arora 41302 (BSD).

Pelatantheria Ridl.

Pelatantheria insectifera (Rchb. f.) Ridl., J. Linn. Soc. Bot. 32: 373. 1896.

Sarcanthus insectifera Reichb. f., Bot. Zeit. 15: 159. 1857.

Flowering: August – September.

Habit & Habitat: Epiphytic, subtropical region, 600–800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Inayat 25817 (DD).

Peristylus Blume

Peristylus affinis (D. Don) Seidenf., Dansk Bot. Arkiv. 31 (3): 48. 1977.

Habenaria affinis D.Don, Prodr. Fl. Nepal.: 25. 1825.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1200 – 2000 m.

Distribution: Western Himalaya (Himachal Pradesh & Uttarakhand).

Specimens examined: J.S.Jalal 13804 (WII), Vij & Verma 309 (PAN).

Peristylus constrictus (Lindl.) Lindl., Gen & Sp. Orch. 300. 1835.

Herminium constrictum Lindl., Edwards's Bot. Reg. 18: t. 1499. 1832.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical grassy slopes, 800 – 1200 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13806 (WII), P.K. Hajra 82310 (BSD), J. Verma 367 (PAN).

Peristylus duthiei (Hook. f.) Deva & H.B.Naithani, Orchid Fl. North West Him. 181. 1986.

Herminium duthie Hook. f., Fl. Brit. India 6: 130. 1890.

Flowering: July – August.

Habit & Habitat: Terrestrial, moist temperate to alpine regions, 2800 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13925 (WII), Duthie 4424 (DD), C.M. Arora 45690 (BSD).

Peristylus elisabethae (Duthie) Gupta, Fl. Nainital. 351. 1968.

Habenaria elisabethae Duthie, J. Asiat. Soc. Bengal 72 (2): 44. 1902.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2200 – 3500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13795 (WII), P.K. Hajra 87623 (BSD).

Peristylus fallax Lindl., Gen. & Sp. Orch. 298. 1835.

Peristylus fallax var. dwarikaii Deva & H.B.Naithani, Orchid Fl. North West Him. 187.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2200 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13954 (WII).

Peristylus goodyeroides (D. Don) Lindl., Gen. & Sp. Orch. 299. 1835.

Habenaria goodyeroides D.Don, Prodr. Fl. Nepal. 25. 1825.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 600 – 2500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Duthie 1878 (DD); C.M. Arora 36465 (BSD); J. Verma 310 (PAN).

Peristylus kumaonensis Renz, J. Orchid Soc. India 1: 23. 1987.

Flowering: July – August.

Habit & Habitat: Terrestrial & lithophytic, subtropical region at altitude around 1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: J.S.Jalal 13993 (WII); Renz, Y.P.S. Pangtey & Kalaokti 13587 (SOF).

Peristylus lawii Wight, Ic. Pl. Ind. Or. 5 (1): 12. t. 1695. 1851.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region, 600–1100 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Mackinnon 21767 (DD); K.M.M. Dakshini 5580 (BSD).

Phaius Lour.

Phaius tankervilleae (L′Herit.) Bl., Bot. Lugd. Bat. 2: 177. 1856.

Limodorun tancarvilleae Banks ex L. Herit., Sert. Angl. 28. 1789.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical region at altitude 600 m.

Distribution: Western Himalaya (Uttarakhand).

A very good population was seen in the Corbett National Park (on the way to Sultan), but could not collect the plant because of restriction in protected area.

Phalaenopsis Blume

Phalaenopsis deliciosa Rchb.f., Bonplandia (Hannover) 2: 93. 1854.

Kingidium deliciosum (Rchb.f.) H.R.Sweet, Amer. Orchid Soc. Bull. 39: 1095. 1970.

Flowering: July – August.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 1500 – 1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: C.M. Arora 70820 (BSD).

Phalaenopsis taenialis (Lindl.) Christenson & Pradhan, Indian Orchid J. 1: 154. 1985. Fig. 10A.

Aerides taenialis Lindl., Gen. Sp. Orchid. Pl.: 239. 1833.

Kingidium taeniale (Lindl.) P.F.Hunt, Kew Bull. 24: 98. 1970.

Flowering: April – June.

Habit & Habitat: Epiphytic, subtropical to temperate regions, 1500 – 2000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13864 (WII), P.C. Pant 31863 (BSD).

Pholidota Lindl.

Pholidota articulata Lindl., Gen. & Sp, Orch. 38. 1830.

Pholitoda griffithii Hook. f., Fl. Brit. India 5: 845. 1890.

Flowering: July – August.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 500 – 1800 m.

Distribution: Western Himalaya (Himachal Pradesh & Uttarakhand).

Specimens examined: J.S.Jalal 13706 (WII); C.M. Arora 37872 (BSD).

Pholidota imbricata Lindl. in Hooker Exot. Fl. t. 138. 1825.

Flowering: June – August.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 800 – 1800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13871 (WII), P.C. Pant 31832 (BSD), C.M. Arora 36438 (BSD).

Phreatia Lindl.

Phreatia matthewsii Rchb.f., Otia Bot. Hamburg.: 55. 1878.

Oberonia myosurus (G.Forst.) Lindl., Gen. Sp. Orchid. Pl.: 16. 1830.

Flowering: July – September.

Habit & Habitat: Epiphytic, subtropical region, 1000–1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S.Jalal 13884 (WII), C.M. Arora 41332 (BSD).

Pinalia Lindl.

Pinalia amica (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 679. 1891.

Eria amica Rchb. f., Xen. Orch. 2: 162. 1870.

Flowering: March – April.

Habit & Habitat: Epiphytic, subtropical region at altitude c. 1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: P.K.Hajra 74465 (BSD).

Pinalia bipunctata (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679. 1891.

Eria bipunctata Lindl., Edwards's Bot. Reg. 27(Misc.): 83. 1841.

Flowering: July – September.

Habit & Habitat: Epiphytic, subtropical region, 1000–1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: H.J. Chowdhery & D. K. Agrawala 40170 (BSD), P.C. Pant 35115 (BSD), C. M. Arora 36471 (BSD).

Pinalia leucantha Kuntze, Revis. Gen. Pl. 2: 679. 1891. Fig. 10B.

Eria alba Lindl., Gen & Sp. Orch. 67. 1830.

Eria graminifolia auct. non Lindl.: Seidenf. in Nord. J. Bot.2: 14. 1982.

Flowering: June – July.

Habit & Habitat: Epiphytic & lithophytic, subtropical to temperate regions, 1000 – 2000 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Mackinnon 22982 (DD), C.M. Arora 52459 (BSD).

Pinalia spicata (D.Don) S.C.Chen & J.J.Wood, in Fl. China 25: 354. 2009.

Octomeria spicata D.Don, Prodr. Fl. Nepal.: 31. 1825.

Eria spicata (D.Don) Hand.-Mazz., Symb. Sin. 7: 1353. 1936.

Flowering: August – September.

Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1500 m.

Distribution: Western Himalaya (Himachal Pradesh & Uttarakhand).

Specimens examined: C.M. Arora 38408 (BSD), U.C. Bhattacharyya 21343 (BSD).

Platanthera Rich.

Platanthera arcuata Lindl., Gen. & Sp. Orch. 289. 1835.

Flowering: June – July.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2500 – 3200 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: Thomas 20797 (DD).

Platanthera clavigera Lindl., Gen. Sp. Orchid. Pl.: 289. 1835.

Habenaria clavigera (Lindl.) Dandy, J. Bot. 68: 246. 1930.

Flowering: July – August.

Habit & Habitat: Terrestrial, temperate to alpine regions, 1800 – 3500 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 14014 (WII), Raizada 18279 (DD).

Platanthera edgeworthii (Hook.f. ex Collett) R.K.Gupta, Fl. Nainital.: 349. 1968.

*Habenaria_edgeworthii_*Hook.f. ex Collett, Fl. Siml.: 504. 1902.

Flowering: July – August.

Habitat: Temperate to subalpine region, 1500 – 3000 m.

Distribution: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13705 (WII), C.M. Arora 36463 (BSD).

Platanthera latilabris Lindl., Gen. Sp. Orchid. Pl.: 289. 1835.

Habenaria latilabris (Lindl.) Hook.f., Fl. Brit. India 6: 153. 1890.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1500 – 3000 m altitude.

Distribution: Western Himalaya (Jammu and Kashmir, Himachal Pradesh and Uttarakhand).

Specimens examined: C.M. Arora 36464 (BSD), U.C. Bhattacharyya 44747 (BSD).

Platanthera leptocaulon (Hook.f.) Soo, Ann. Hist. Nat. Mus. Nat. Hung. 26: 360. 1929.

Habenaria lepatocaulon Hook.f., Fl. Brit. India 6: 154. 1890.

Flowering: July – August.

Habit & Habitat: Terrestrial, subalpine to alpine regions, 2700 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: J.S.Jalal 15018 (WII).

Platanthera pachycaulon (Hook.f.) Soó, Ann. Hist.-Nat. Mus. Natl. Hung. 26: 364. 1929.

Habenaria pachycaulon Hook.f., Fl. Brit. India 6: 154. 1890.

Flowering: June – July.

Habit & Habitat: Terrestrial, alpine region, 3400 – 3700 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: *I.D.Rai* 11457 (WII).

Platanthera stenantha (Hook.f.) Soó, Ann. Hist.-Nat. Mus. Natl. Hung. 26: 363. 1929.

Habenaria stenantha Hook.f., Fl. Brit. India 6: 153. 1890.

Flowering: July – August.

Habit & Habitat: Terrestrial, subtropical to temperate regions, 1500 – 3000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: Duthie 3402 (DD).

Pleione D.Don

Pleione grandiflora (Rolfe) Rolfe, Orch. Rev. 11: 291. 1903.

Coelogyne grandiflora Rolfe, J. Linn. Soc. Bot. 36: 22. 1903.

Flowering: April – May.

Habit & Habitat: Terrestrial, temperate to subalpine regions, 2600 – 2700 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: N.C.Nair 35536 (BSD).

Pleione hookeriana (Lindl.) Rollisson, Nursery Cat. (Rollisson) 1875-1876: 39. 1875.

Coelogyne hookeriana Lindl., Fol. Orch. 14. 1854.

Flowering: May – June.

Habit & Habitat: Epiphytic & lithophytic, temperate to subalpine regions, 2200 – 3500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: H.J. Chowdhery 40136 (BSD), D.D. Bahali & M.S. Pundir 16 (BSD).

Pleione humilis (Sm.) D. Don, Prodr. Fl. Nepal. 37. 1825.

Epidendrum humile Sm., Exot. Bot. 2: 75. 1806.

Flowering: February - March.

Habit & Habitat: Epiphytic & lithophytic, temperate region, 2100 – 3000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: N.C.Nair 35519 (BSD).

Pleione praecox (Sm.) D. Don, Prodr. Fl. Nepal. 37. 1825.

Epidendrum praecox Sm., Exot. Bot. 2: 73. 1806.

Flowering: October-November.

Habit & Habitat: Epiphytic & lithophytic, temperate region, 2000-3000 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: C.M. Arora 45647 (BSD), R.N. Tewari 27159 (RKT).

Ponerorchis Rchb.f.

Ponerorchis chusua (D. Don) Soo, Acta Bot. Acad. Sci. Hung. 12: 352. 1966.

Orchis chusua D.Don, Prodr. Fl. Nepal.: 23. 1825.

Chusua pauciflora (Lindl.) P.F.Hunt, Kew Bull. 26: 175. 1971.

Ponerorchis nana (King & Pantl.) Soó, Acta Bot. Acad. Sci. Hung. 12: 353. 1966.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, subalpine to alpine regions, 3000 – 4000m.

DISTRIBUTION: Western Himalaya (Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 15017 (WII), G.S.Rawat & Gajendera 14781 (WII), M.S. Pundir 55740 (BSD), A.K. Goel 72653 (BSD).

Ponerorchis renzii Deva & H.B.Naithani, Orchid Fl. N.W. Himalaya: 199. 1986.

Chusua renzii (Deva & H.B.Naithani) S.Misra, Orchids India: 258. 2007.

FLOWERING: July-August

HABIT & HABITAT: Terrestrial, alpine meadows, 3300–4000 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: G.S.Rawat & B.S.Kalakoti 1225 (SOF).

PTEROCERAS Hasselt ex Hassk.

Pteroceras teres (Blume) Holttum, Kew Bull. 14: 271. 1960.

Dendrocolla teres Blume, Bijdr.: 289. 1825.

FLOWERING: Many times in a year.

HABIT & HABITAT: Epiphytic, subtropical region, 600–800 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: *J.S.Jalal* 13876 (WII), *C.M. Arora* 49524 (BSD), *Balodi* 75604 (BSD).

RHYNCHOSTYLIS Blume

Rhynchostylis retusa (L.) Blume, Bijdr. Fl. Ned. Ind.: 286. 1825. Fig. 10C

Epidendrum retusum L., Sp. Pl.: 953. 1753.

HABIT & HABITAT: Epiphytic & lithophytic, subtropical region, 500 – 1000 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13812 (WII), C.M. Arora 36454 (BSD), G.C. Joshi 28650 (RKT).

SATYRIUM Sw.

Satyrium nepalense var. ***ciliatum*** (Lindl.) Hook.f., Fl. Brit. India 6: 168. 1890.

Satyrium ciliatum Lindl., Gen. & Sp. Orch..: 341. 1838.

FLOWERING: July – August.

HABIT & HABITAT: Terrestrial, temperate to subalpine regions, 2000 – 3000 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMEN EXAMINED: G.S. Rawat 1929 (NTL).

Satyrium nepalense D. Don, Prodr. Fl. Nepal. : 26. 1825.

FLOWERING: August – October.

HABIT & HABITAT: Terrestrial, subtropical to temperate regions, 1500 – 3000 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13718 (WII), J.N. Vohra 54321 (BSD), N.C. Nair 23379 (BSD), J. Verma 101 (PAN).

SMITINANDIA Holttum

Smitinandia micrantha (Lindl.) Holttum, Gard. Bull. Singapore 25: 106. 1969. Fig. 10D

Saccolabium micranthum Lindl., Gen. & Sp. Orch. 220. 1833.

FLOWERING: June - August.

HABIT & HABITAT: Epiphytic & lithophytic, subtropical regions, 600 – 1400 m.

DISTRIBUTION: Western Himalaya (Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13813 (WII), T.A.Rao 6594 (BSD).

SPIRANTHES Rich.

Spiranthes sinensis (Pers.) Ames, Orchidaceae 2: 53. 1908.

Neottia sinensis Pers., Syn. 2: 511. 1807.

FLOWERING: May–June (flowers white), July–September (flowers pink).

HABIT & HABITAT: Terrestrial, subtropical to subalpine region, 1600 – 3500 m.

DISTRIBUTION: Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand).

SPECIMENS EXAMINED: J.S.Jalal 13727 (WII), U.C. Bhattacharyya 14935 (BSD), M.R. Uniyal 1311 (RKT).

Sunipia Lindl.

Sunipia bicolor Lindl., Gen. Sp. Orchid. Pl. 179. 1833.
Flowering: October – November.
Habit & Habitat: Epiphytic, subtropical to temperate regions, 1400 – 2200 m.
Distribution: Western Himalaya (Uttarakhand).
Specimens examined: C.M. Arora 52439 & 66169 (BSD).

Thelasis Blume

Thelasis longifolia Hook.f., Fl. Brit. India 6: 87. 1890.
Flowering: July – August.
Habit & Habitat: Epiphytic, subtropical region, 600-1500 m.
Distribution: Western Himalaya (Uttarakhand).
Specimen examined: J.S. Jalal 13896 (WII), C.M. Arora 70802 (BSD).

Thunia Rchb.f.

Thunia alba (Lindl.) Rchb.f., Bot. Zeitung (Berlin) 10: 764. 1852.
Phaius albus Lindl. in N.Wallich, Pl. Asiat. Rar. 2: 85. 1831.
Flowering: July – August.
Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1800 m.
Distribution: Western Himalaya (Uttarakhand).
Specimens examined: J.S.Jalal 13707 (WII), A.K. Goel 67755 (BSD), C.M. Arora 37873 (BSD).

Thunia alba var. ***bracteata*** (Roxb.) N.Pearce & P.J.Cribb, Edinburgh J. Bot. 58: 116. 2001.
Limodorum bracteatum Roxb., Fl. Ind. ed. 1832, 3: 466. 1832.
Flowering: July – August.
Habit & Habitat: Epiphytic & lithophytic, subtropical region, 600 – 1500 m.
Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).
Specimen examined: Kishan Lal 1958 (BSD).

Tipularia Nutt.

Tipularia cunninghamii (King & Prain) S.C.Chen, S.W.Gale & P.J.Cribb, Fl. China 25: 251. 2009.
Didiciea cunninghamii King & Prain, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 65: 119. 1896.
Flowering: July – August.
Habit & Habitat: Terrestrial, temperate region, 2000–2500 m.
Distribution: Western Himalaya (Uttarakhand).
Specimens examined: U.C. Bhattacharyya 29389 (BSD), M.A.Rau 31727 (BSD).

Tropidia Lindl.

Tropidia pedunculata Blume, Coll. Orchid.: 122. 1859.
Flowering: May – June.
Habit & Habitat: Terrestrial, subtropical region, 300–1000 m.
Distribution: Western Himalaya (Uttarakhand).
Specimens examined: C.M. Arora 38869 (BSD).

Vanda W. Jones

Vanda alpina (Lindl.) Lindl., Fol. Orchid. 4: 10. 1853. Fig. 10E.
Flowering: June – July.
Habit & Habitat: Epiphytic, subtropical region, 800–1500 m.
Distribution: Western Himalaya (Uttarakhand).
Specimen examined: J.S. Jalal 15049 (WII).

Vanda ampullacea (Roxb.) L.M.Gardiner, Phytotaxa 61: 48. 2012.
Aerides ampullacea Roxb., Fl. Ind. ed. 1832, 3: 476. 1832.
Ascocentrum ampullaceum (Roxb.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 1: 975. 1913.
Flowering: April – May.
Habit & Habitat: Epiphytic, subtropical region, 600–900 m.
Distribution: Western Himalaya (Uttarakhand).
Specimens examined: U.C. Bhattacharyya 21185 (BSD).

Vanda cristata Lindl., Gen. & Sp. Orchid. Pl.: 216. 1833. Fig. 10F.
Flowering: May – July.
Habit & Habitat: Epiphytic, subtropical to temperate region, 1000 – 2000 m.
Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).
Specimens seen: J.S.Jalal 13708, 13724, 13869 (WII), C.M. Arora 66107 (BSD), J. Verma 350a (PAN).

Vanda pumila Hook.f., Fl. Brit. India 6: 53. 1890.
Trudelia pumila (Hook.f.) Senghas in

FIGURE 7. A. *Eria globulifera*, B. *Eulophia flava*, C. *Gastrodia falconeri*, D. *Goodyera biflora*, E. *Goodyera fusca*, F. *Goodyera procera*, G. *Goodyera repens*, H. *Goodyera viridiflora*, I. *Goodyera vittata*

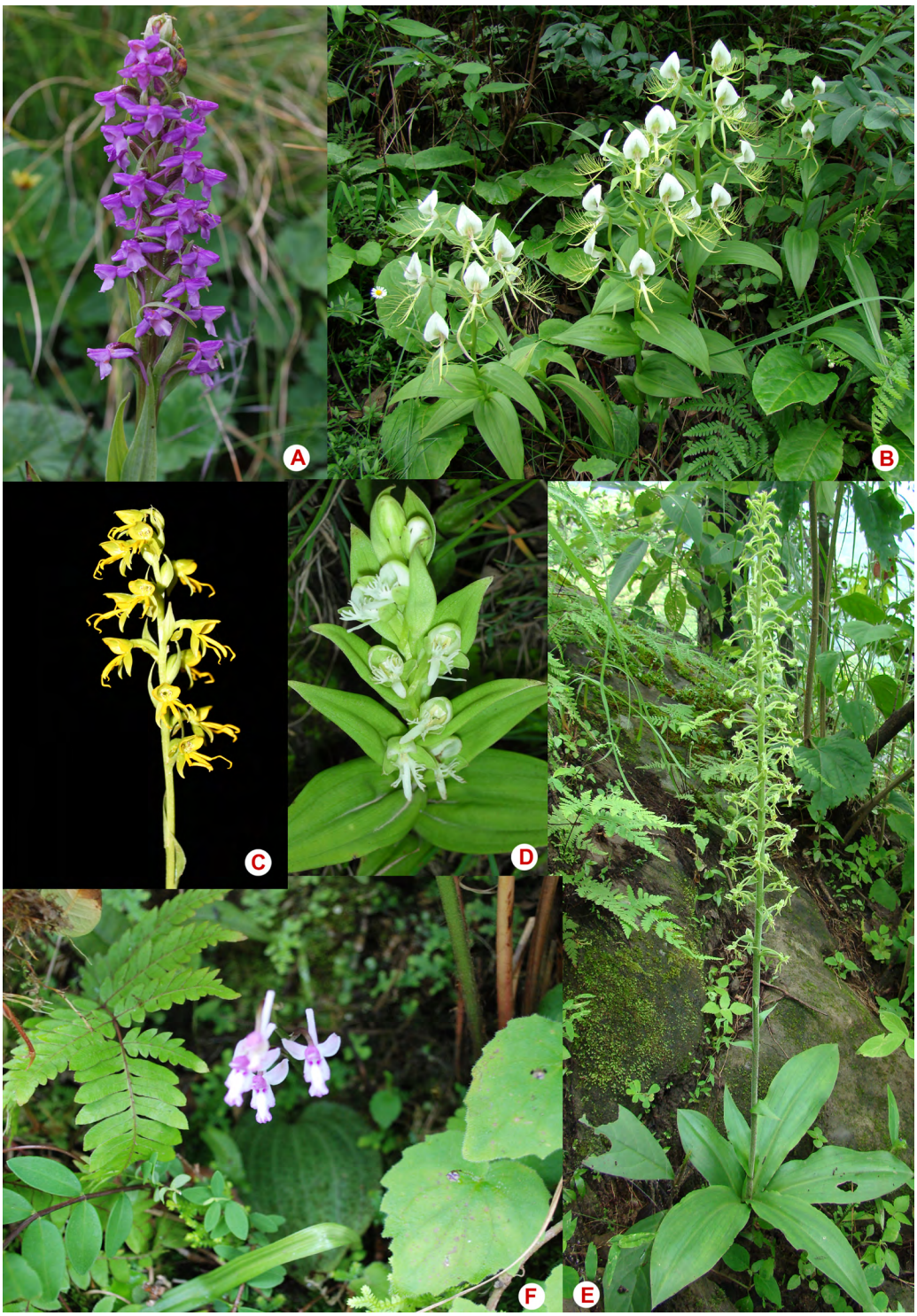

FIGURE 8. A. *Gymnadenia orchidis*, B. *Habenaria intermedia*, C. *Habenaria marginata*, D. *Habenaria pectinata*, E. *Habenaria pubescens*, F. *Hemipilia cordifolia*

FIGURE 9. A. *Liparis deflexa*, B. *Liparis odorata*, C. *Liparis viridiflora*, D. *Luisia tristis*, E. *Nervilia crociformis*, F. *Nervilia gammieana*, G. *Nervilia mackinnonii*, H. *Nervilia pangteyana*, I. *Nervilia plicata*, J. *Oreorchis micrantha*

FIGURE 10. A. *Phalaenopsis taenialis*, B. *Pinalia leucantha*, C. *Rhynchostylis retusa*, D. *Smithandia micrantha*, E. *Vanda alpina*, F. *Vanda cristata*, G. *Vanda tessellata*

F.R.R.Schlechter, Orchideen Beschreib. Kult. Zücht., ed. 3, 1(19-20): 1211. 1988.

Flowering: May – June.

Habit & Habitat: Epiphytic, subtropical region, 600–1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: U.C. Bhattacharyya 21238 (BSD).

Vanda tessellata (Roxb.) Hook. ex G. Don, J.C.Loudon, Hort. Brit. 372. 1830. Fig. 10G

Epidendrum tessellatum Roxb., Pl. Coromandel 1: 34. 1795.

Flowering: June – July.

Habit & Habitat: Epiphytic, subtropical region, 600–800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: M.A.Rau 5377 & 5417 (BSD), U.C. Bhattacharyya 18373 (BSD).

Vanda testacea (Lindl.) Rchb. f., Gard. Chron., n.s., 8:166. 1877.

Aerides testacea Lindl., Gen. Sp. Orchid. Pl.: 238. 1833.

Flowering: June – July.

Habit & Habitat: Epiphytic, subtropical region, 600-800 m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S.Jalal 13882 (WII), S.K. Malhotra 15371 (BSD), J. Verma 223 (PAN).

Vandopsis Pfitzer.

Vandopsis undulata (Lindl.) J. J. Sm., Naturk. Tijdschr. Ned.-Indie 72: 77. 1912.

Vanda undulata Lindl., J. Linn. Soc. Bot. 3: 42. 1859.

Flowering: April – May.

Habit & Habitat: Epiphytic, subtropical region, 600–800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: P.K. Hajra 74770 (BSD).

Zeuxine Lindl.

Zeuxine affinis (Lindl.) Benth. ex Hook.f., Fl. Brit. India 6: 108. 1890.

Monochilus affinis Lindl., Gen. Sp. Orchid. Pl.: 487. 1840.

Zeuxine seidenfadenii Deva & H.B.Naithani, Orchid Fl. North West Him.: 95. 1986.

Flowering: March-April

Habit & Habitat: Terrestrial, subtropical region at elevation 800 m.

Distribution: Western Himalaya (Uttarakhand).

Specimen examined: Deva 9712 (DD).

Zeuxine flava (Wall. ex Lindl.) Trimen, Syst. Cat. Fl. Pl. Ceylon: 90. 1885.

Monochilus flavum Wall. ex Lindl., Gen. & Sp. Orch.: 487. 1840.

Flowering: April – May.

Habit & Habitat: Terrestrial, subtropical region, 1000-1500 m.

Distribution: Western Himalaya (Uttarakhand).

Specimens examined: J.S. Jalal 14027 (WII), Balodi 75635 (BSD), Pangtey & Samant 2464 (NTL).

Zeuxine membranacea Lindl., Gen. Sp. Orchid. Pl. Pl. 486. 1840.

Flowering: January – March.

Habit & Habitat: Terrestrial, tropical region, 350 – 380 m.

Distribution: Western Himalaya (Himachal Pradesh).

Specimens examined: J.Verma 125 (PAN).

Zeuxine strateumatica (L.) Schltr. in Engler, Bot. Jahrb. 45: 394. 1911.

Orchis strateumatica L., Sp. Pl.: 943. 1753.

Flowering: Janurary – March.

Habit & Habitat: Terrestrial, tropical to subtropical regions, 300 – 1200m.

Distribution: Western Himalaya (Himachal Pradesh and Uttarakhand).

Specimens examined: J.S. Jalal 13740 (WII), C.L. Malhotra 26614 (BSD), M.A. Rau 8120 (BSD).

Excluded taxa

Arundina graminifolia (D.Don) Hochr., Bull. New York Bot. Gard. 6: 270. 1910.

There is a single report of this species from Almora by Gastiv probably based on cultivated specimen and never recollected before and after this work.

Coelogyne flaccida Lindl., Gen. & Sp. Orch. : 39. 1830.

This species was so far reported based on Das & Jain (1980) report which inturn is based on a single specimen collected by M.A. Rau 42954 from Eastern Kumaun in

vegetative condition. There is no such collection number in BSD herbarium; in fact this number was for a grass specimen. This species is known so far to occur from Nepal eastwards. This is probably a mistaken report and thus excluded from Western Himalaya.

Coelogyne nitida (Wall. ex D.Don) Lindl., Coll. Bot.: t. 33. 1824.

This species is also a doubtful occurence in western Himalaya. It is primarily an Eastern Himalayan species and its occurrence in western Himalaya needs further collection and verification. This species is included based on Duthie, 112. 1906. It was collected by Mackinnon (Duthie, loc. cit.) from Tehri, Roburts (Duthie, loc. cit.) from Pauri and Edgeworth Duthie, loc. cit.) from Kumaun.

Cymbidium eburneum Lindl. in Edw. Bot. Reg. 33: t, 67. 1847.

This species is generally seen cultivated in gardens of Didihat of eastern Kumaun region. During this survey we have not seen any such plants cultivated in gardens in this region. However, its occurrence in the wild state requires confirmation.

Cymbidium elegans Lindl., Gen. Sp. Orchid. Pl. 163. 1833.

This species is included here on authority of J. F. Duthie (1906), who reported it from Kumaun between 1200 and 2000 m. During our survey we could not locate any wild population of this species.

Cymbidium hookerianum Rchb.f., Gard. Chron. 1866: 7. 1866.

This species is generally seen cultivated in gardens of Didihat of eastern Kumaun region. During this survey we have not seen any such plants cultivated in gardens in this region. However, its occurrence in the wild state requires confirmation.

Dendrobium aphyllum (Roxb.) C.E.C.Fisch. in J.S.Gamble, Fl. Madras: 1416. 1928.

This species is included on the authority of J.F. Duthie (1906). He has included this based on Gamble & Mackinnon (Duthie, loc. cit.) from eastern part of Dehradun. It was also reported in garden as cultivated but its occrrrence in the wild is very doubtful.

Dendrobium moschatum (Buch.-Ham.) Sw. in Schrad. Neue Journ. 1: 94. 1806.

Duthie (1906) has included this based on Strachey & Winterbottom no. 09 from Kumaun region of the Western Himalaya.

Platanthera urceolata (Hook.f.) R.M.Bateman, Ann. Bot. (Oxford) 104: 439. 2009.

Duthie (1906) reported this species (Habenaria urceolata C.B.Clarke) from Byans valley in eastern Kumaun specimen number 6003 (DD), while revising orchid of north west Himalaya.

Spiranthes spiralis (L.) Chevall., Fl. Gén. Env. Paris 2: 330. 1827.

Duthie (1906) mentiond that this was reported by T. Thomson from Lohaghat. Deva & Naithani (1986) also wrote a note that it was collected only once from Himalaya about 150 years back by T. Thomson at Lohaghat in Kumaun. Its existence in an isolated spot far away from its natural range of distribution proves that it could have been only accidentally introduced by the early British settlers who developed tea gardens and fruit orchards in the vicinity of Lohaghat which was one of the earliest cantonments established after the conquest of Kumaun from Gurkhas or can this be only a case of just change of the labels by mistake.

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Literature cited

Agrawala, D.K. & Chowdhery, H.J. (2008). *Eulophia epidendraea* (J. Konig Ex Retz.) C.E.C. Fisch.- an addition to the orchid flora of Himalayan region. *Indian J. Forestry*, 31(4), 629-632.

Agrawala, D.K. & Chowdhery, H.J. (2009a). *Eria globuliflera* Seidenf. – Addition to the orchid flora of Sikkim and North-West Himalaya. *Indian J. Forestry,* 32(1), 103-106.

Agrawala, D.K. & Chowdhery, H.J. (2009b). On the occurrence of identity of *Eria apertiflora* Summerh. (Orchidaceae). *J. Non-Timber For. Prod*., 16(2), 163-166.

Agrawala, D.K., Chowdhery, H.J. & Kumar, V. (2013). Extended distribution of *Oreorchis patens* (Orchidaceae) and its Red List status in India. *Richardiana,* 13, 267-276.

Bisht, S. & Adhikari, B. (2014). *Dendrobium longicornu*: an addition to the orchid flora of Western Himalaya. *Richardiana,* 14, 157-168.

Blatter, E. (1928). Beautiful Flowers of Kashmir. Staples and Staples Ltd. Westminster.

Brummitt, R. K. and Powell, C.E. (1992). Authors of plant names: a list of authors of scientific names of plants, with

recommended standard forms of their names, including abbreviations. Royal Botanic Gardens, Kew.
Burkill, I.H. (1965). Chapters on the History of Botany in India. Calcutta: Manager of Publication, Govt of India, Calcutta.
Champion, H.G. & Seth, S.K. (1968). A revised survey of forest types of India. Manager of Publications, Government of India, Delhi. 404p.
Chowdhery, H.J. & Agrawala, D.K. (2008). *Pleione hookeriana* (Lindl.) B.S. Williams- An intresting orchid species from Garhwal Himalaya. *Indian J. Forestry*, 31(1), 147 – 149.
Collett, H. (1902). Flora Simlensis. Thacker, Spink and Co., Shimla, pl. 289-508.
Deva, S. & Naithani, H.B. (1986). The Orchid Flora of North-West Himalaya. Print & Media Associates, New Delhi.
Duthie, J.F. (1906). The Orchids of the North-Western Himalaya. *Ann. Royal Bot. Gard. Calcutta,* 9(2), 81-211.
Hooker, J.D. (1906). A Sketch of the Flora of British India. Londan. 55p.
Jain, S. K. and Rao, R.R. (1977). A Handbook of Field and Herbarium Method. Today and Tomorrow's Printers & Publishers, New Delhi. 157p.
Jalal, J. S., Kumar, P. & Pangtey, Y.P.S. (2009). *Habenaria pubescens* Lindley: an interesting orchid from Western Himalaya. *Richardiana*, 9(2), 76-84.
Jalal, J.S., Kumar, P., Kotia, A. & Rawat, G. S. (2012b). On the occurrence of *Pelatantheria insectifera* (Orchidaceae) in Jim Corbett National Park, India. *Richardiana*, 12(3), 108 – 115.
Jalal, J.S., Kumar, P. & Rawat, G.S. (2012a). *Nervilia pangteyana sp. nov*., a terrestrial orchid from western Himalaya, India. *Nord. J. Bot.*, 30, 407–411.
Jalal, J.S., Kumar, P., Rawat, G.S. & Pangtey, Y.P.S. (2008). Orchidaceae, Uttarakhand, Western Himalaya, India. *Checklist*, 4(3), 304-320.
Jalal, J.S. & Pangtey, Y.P.S. (2011a). Rediscovery of *Vanda alpina*, a rare epiphytic orchid in Western Himalaya, India. *Richardiana*, 9(4), 173-178.
Jalal, J.S. & Pangtey, Y.P.S. (2011b). *Gastrodia falconeri* recollected from Western Himalaya, India. *Richardiana*, 9(2), 53-60.
Jalal, J.S., Rai, I.D., Kumar, P., Rawat, G.S. & Pangtey, Y.P.S. (2010). *Platanthera leptocaulon* (Hooker f.) Soo: an addition to the orchid flora of western Himalayas, India. *Richardiana*, 10(2), 85-93.
Jalal, J.S., Rai, I.D., Kumar, P., Rawat, G.S. & Pangtey, Y.P.S. (2010). *Bulbophyllum hirtum* (Smith) Lindley (Orchidaceae) - New record from western Himalaya, India. *Indian J. Forestry*, 33(3), 447-448.
Jalal, J.S., Rai, I.D., Kumar, P., Rawat, G.S. & Pangtey, Y.P.S. (2010b). *Goodyera vittata* (Lindl.) Benth. ex Hook. f: A new record of Jewel Orchid for Western Himalaya. India. *J. Non-Timber For. Prod*., 17(3), 333-334.
Kumar, V., Chowdhery, H.J. & Keshava Murtyh, K.R. (2012). *Neottia chandrae* Raskoti *et al*. (Orchidaceae)- A new addition to the orchid flora of India. *Indian J. Forestry*, 35(3), 375-376.
Lal, K., Agrawala, D.K. & Chowdhery, H.J. (2008). Three new generic records of orchidaceae from Himachal Pradesh. J. Non-Timber For. Prod. 15(4): 293-296.
Lal, K., Agrawala, D.K. & Chowdhery, H.J. (2010a). New orchid records from Himachal Pradesh. *Indian J. Forestry*, 33(4), 619-622.
Lal, K., Agrawala, D.K., & Chowdhery, H.J. (2010b). Rediscovery of *Eria alba* Lindl. (Orchidaceae) from Himachal Pradesh after a gap of more than a century. *Indian J. Forestry*, 33(4), 647-650.
Nair, N.C. (1977). Flora of Bashahr Himalaya. International Bioscience Publishers, Hissar, Haryana.
Pangtey, Y.P.S., Samant, S.S. & Rawat, G.S. (1991). Orchids of Kumaon Himalaya. Bishan Singh Mahendra Pal Singh, Dehradun.
Polunin, O. & Stainton, A. (1984). Flowers of the Himalaya. Oxford Univ. Press, New Delhi.
Rai, I.D., Jalal, J.S., Singh, G. & Rawat, G.S. (2014). *Platanthera pachycaulon* (Orchidaceae): an addition to the orchid flora of Western himalaya, India. *Richardiana*, 14, 266-273.
Raizada, M.B., Naithani, H.B. & Saxena, H.O. (1981). Orchids of Mussoorie. Bishan Singh Mahendra Pal Singh, Dehradun.
Rau, M.A. (1975). High Altitude Flowering Plants of West Himalaya. Calcutta.
Rodgers, W.A. & Panwar, H.S. (1988). Planning a Wildlife Protected Area Network in India. Vol. 1 and 2. A report prepared for the Department of Environment, Forests and Wildlife, Government of India at the Wildlife Institute of India, Dehradun.
Seidenfaden, G & Arora, C.M. (1982). An enumeration of the Orchids of the north-western Himalaya. *Nord. J. Bot.*, 2, 7-27.
Singh, S.K. & Rawat, G.S. (2000). Flora of Great Himalayan National Park. Bishen Singh Mahendra Pal Singh, Dehradun.
Uniyal, B.P., Sharma, J.R., Choudhery, U. & Singh, D.K. (2007). Flowering Plants of Uttarakhand : A Checklist. Bishen Singh Mahendra Pal Singh, Dehradun.

Verma, J, Jaglan, P., Thakur, K., Sharma, K., Attri, L. K. & Vij, S.P. (2010). *Habenaria aitchisonii* Rchb. f. and *H.pubescens* Lindl. (Orchidaceae): New additions to flora of Himachal Pradesh. *J. Orch. Soc. India*, 24, 53-56.

Vij, S.P. & Verma, J. (2005). *Luisia zeylanica* Lindl. (Orchidaceae): A new record for Himachal Pradesh. *Rheedea*, 15(2),138-139.

Vij, S.P. & Verma, J. (2007a). *Peristylus constrictus* (Lindl.) Lindl.: A new orchid record for Himachal Pradesh, India. *J. Orch. Soc. India*, 21, 57-59.

Vij, S.P. & Verma, J. (2007b). *Gastrochilus calceolaris* D. Don (Orchidaceae): A new generic record for Himachal Pradesh. *J. Orch. Soc. India*, 21, 19-21.

Vij, S.P., Verma, J. & Kumar, C. S. (2013). Orchids of Himachal Pradesh. Bishen Singh Mahendra Pal Singh, Dehradun.

Vikas, K., Chowdhery, H.J. & Murthy, K.R.K. (2012). *Neottia chandrae* Raskoti et al. (Orchidaceae): a new addition to the orchid flora of India. *Indian Journal of Forestry*, 35, 375-376.

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AN ATTRACTIVE NEW BUT RARELY SEEN *ODONTOGLOSSUM* (ORCHIDACEAE: ONCIDIINAE) FROM ECUADOR

STIG DALSTRÖM

2304 Ringling Boulevard, unit 119, Sarasota FL 34237, USA
Lankester Botanical Garden, University of Costa Rica, Cartago, Costa Rica
National Biodiversity Centre, Serbithang, Bhutan
stigdalstrom@gmail.com

ABSTRACT. A new species of *Odontoglossum* from a limited area in western Ecuador is described, illustrated with a line drawing and color photographs, and compared with apparently closely related species, which are illustrated with color photographs. The new species differs from them all by a combination of features, such as the limited geographic distribution, frequently purple mottled pseudobulbs, a broadly pandurate lip lamina and widely spreading purple striped callus keels on the lip.

KEY WORDS: new species, Cymbidieae, Epidendroideae, Ecuador.

History and discussion. The *Odontoglossum* Kunth species described here belongs to a rather confusing complex of a taxonomically challenging genus that is difficult to survey. The taxonomic difficulties are caused mainly by the notorious variability in floral structures, which most *Odontoglossum* species display. The reason for this variability can probably be discussed forever, but natural hybridization appears to be a strong factor, which may actually benefit this probably deceit pollinated group of plants. *Odontoglossum* species in general do not seem to offer any particular rewards to the pollinator other than possibly perfume, and the variability in terms of flower size and coloration may contribute to lure various bees to repeat visiting the often rather strongly scented flowers (Dalström, 2003). Species of *Odontoglossum* have been transferred to *Oncidium* by Chase and others (Chase *et al*. 2008). A justification for rejecting this treatment is explained in more detail elsewhere (Dalström 2012, 2014).

Taxonomic treatment

Odontoglossum hirtzii Dalström, ***sp. nov.***

TYPE: Ecuador. Imbabura: Selva Alegre, alt. 2600 m, 29 Sept. 1984, *A. Hirtz 1923* (holotype: Rio Palenque Science Center [MO], left specimen on sheet 0000748). FIG. 1.

Diagnosis. *Odontoglossum hirtzii* (Figs. 1–3), differs from the similar and locally sympatric *O. armatum* Rchb.f. (Figs. 4, 5) by a slightly larger overall size, a larger and pandurate lip with distinctly cordate to hastate basal angles of the lamina, much more developed purple-striped callus keels, and with considerably larger column wings, versus a more slender habit, a cuneate lip lamina with a less developed, generally plain white callus and insignificant or no column wings for *O. armatum*. *Odontoglossum hirtzii* is also superficially similar to *O. cristatellum* Rchf.b. (Fig. 6), *O. cristatum* Lindl. (Fig. 7) and *O. furcatum* Dalström (Fig. 8) but is readily distinguished from them by the distinctly pandurate lip lamina and commonly purple mottled pseudobulbs, versus a more cordate lamina for the latter species, which all have plain green to yellowish or sometimes reddish pseudobulbs without any mottling.

Epiphytic *herb*. *Roots* typical for the genus and spreading. *Pseudobulbs* caespitose, on a compact bracteate rhizome, ovoid to pyriform, apically obtuse, ancipitous and slightly compressed, commonly mottled with purple, unifoliate (on type, but bifoliate on larger plants), *ca*. 3.0 × 1.5 cm, subtended basally by 6 to 7 distichous sheaths, the uppermost foliaceous. *Leaf* subpetiolate, conduplicate, narrowly ovate, acute, *ca.* 8.5 × 1.8 cm. *Inflorescence*, axillary from the base of the outermost sheath, erect and arching, to *ca*. 26 cm long, almost straight to loosely flexuous, *ca*. 8-flowered raceme; *bracts* appressed, scale-like, *ca*. 0.4 – 0.6 cm long. *Pedicel* and *ovary* ca. 2.5 – 3.0 cm

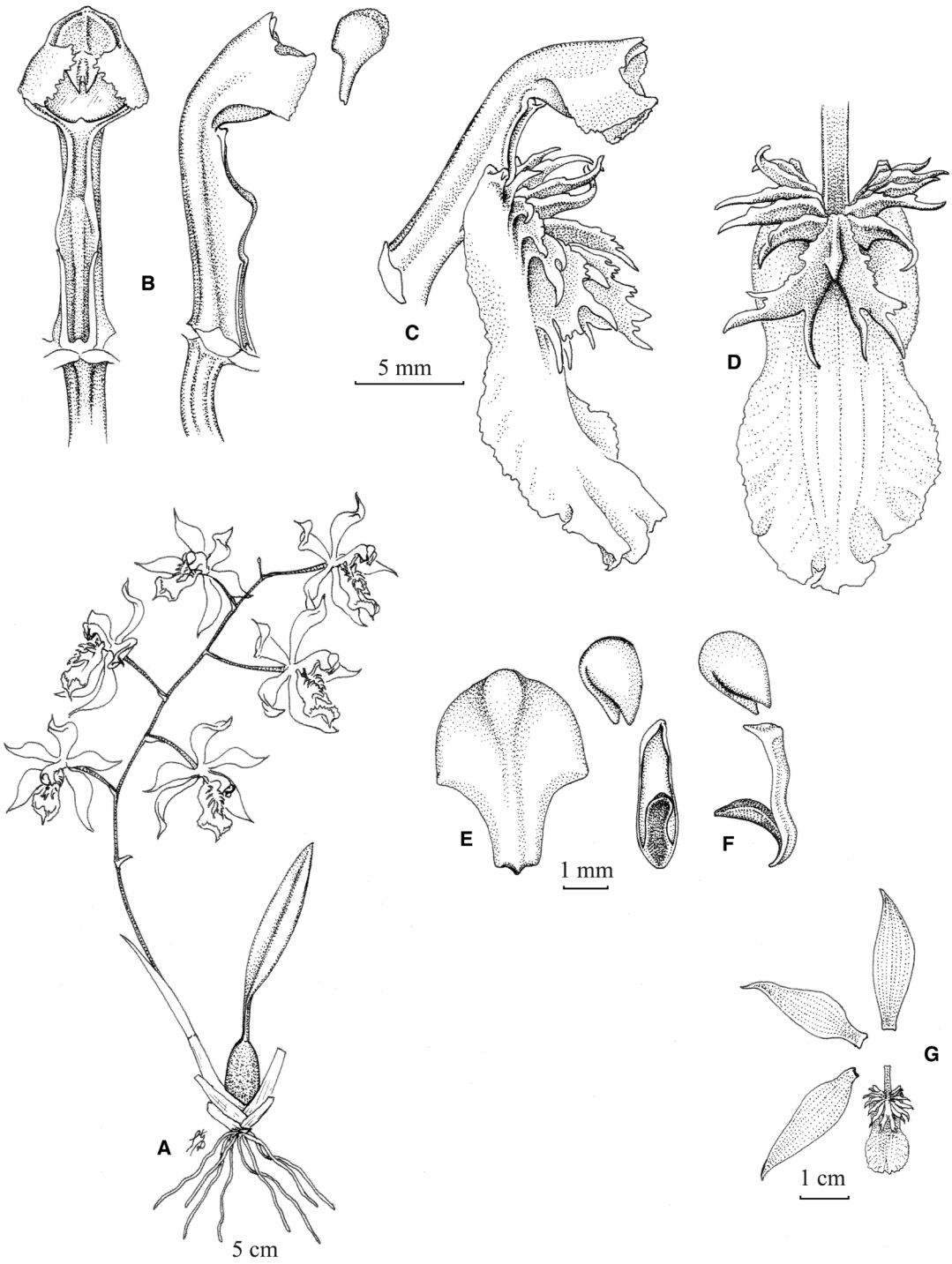

FIGURE 1. *Odontoglossum hirtzii*. A. Plant habit. B. Column, ventral and lateral views, with anther cap. C. Column and lip, lateral view. D. Lip, dorsal view. E. Anther cap, dorsal view. F. Pollinarium with one (of two) pollinia, ventral and lateral views. G. Flower dissected. Drawn from holotype by Stig Dalström.

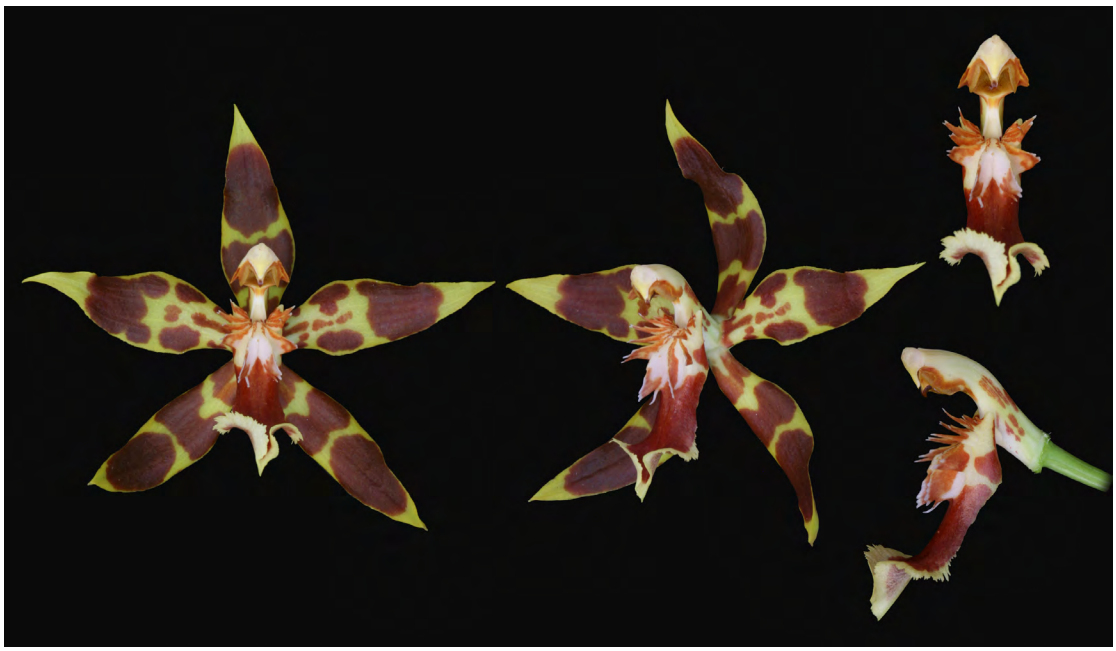

Figure 2. *Odontoglossum hirtzii*, *G. Deburghgraeve 039* (Dalström archives). Photo by G. Deburghgraeve.

Figure 3. *Odontoglossum hirtzii*, Mindo, *S. Dalström 3755* (color transparency; Dalström archives). Photo by S. Dalström.

long. *Flower* stellate, showy; *dorsal sepal* chocolate brown with yellow markings, weakly unguiculate, elliptic-ovate, narrowly acute to acuminate, *ca.* 3.0 × 0.9 cm; *lateral sepals* similar in size and color, and slightly oblique; *petals* similar to the sepals in color, unguiculate, ovate, acuminate, to *ca*. 3.0 × 1.0 cm; *lip* red-brown with a yellow margin, fused to the canaliculated ventral side of the column by a flat strap of tissue for *ca*. 4.0 mm, then free and developing into a cordate to hastate pandurate, slightly undulate and serrate lamina, to *ca*. 2.0 × 1.0 cm; *callus* white (*fide* Hirtz, but commonly spotted with purple) of well-developed radiating, gradually increasing in size, serrate to multifid and acute keels, emerging from the base of the canaliculated lamina; *column* color on type not described by Hirtz, but generally white with purple-brown spots, slender and erect, laterally weakly keeled, ventrally canaliculated with well-developed angles, and with a large rectangular and slightly serrate wing on each side of the stigmatic surface, ca. 1.5 cm long; *anther cap* color not described by Hirtz but commonly white to pale yellow, campanulate and angular rostrate, dorsally weakly lobulate; *pollinarium* of two cleft/folded pyriform pollinia on a narrowly elongate-ovate, *ca.* 3.0 mm long stipe, on a hooked, pulvinate viscidium.

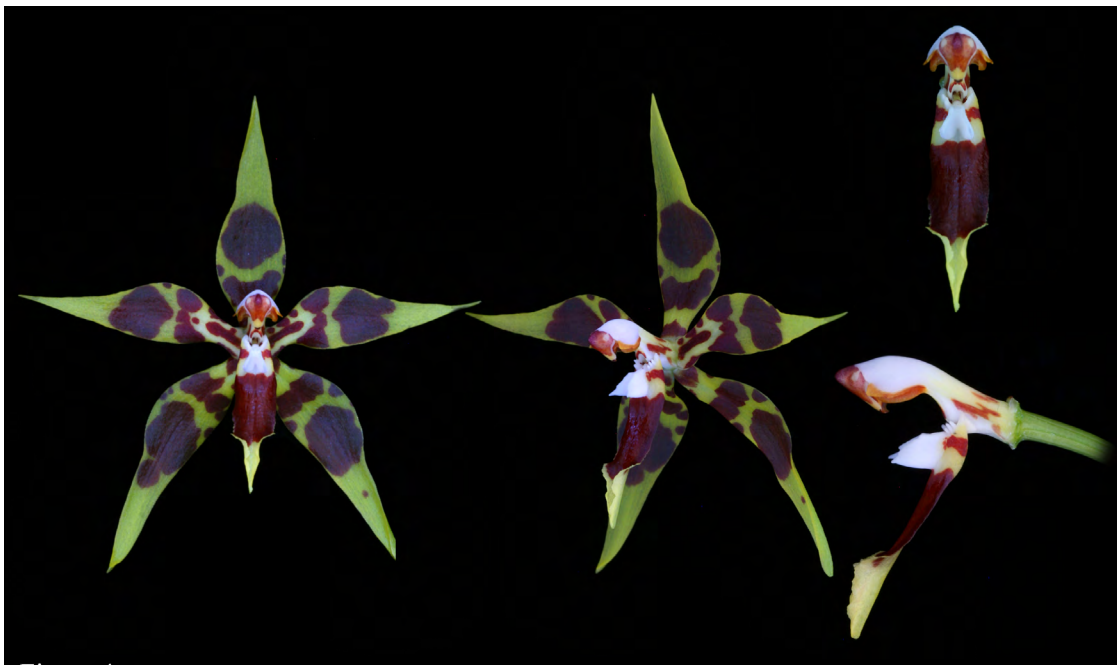

FIGURE 4. *Odontoglossum armatum* 'Rony'. Photo by G. Deburghgraeve.

FIGURE 5. *Odontoglossum armatum*, Maldonado, *S. Dalström 053* (flower in alcohol at SEL). Photo by S. Dalström.

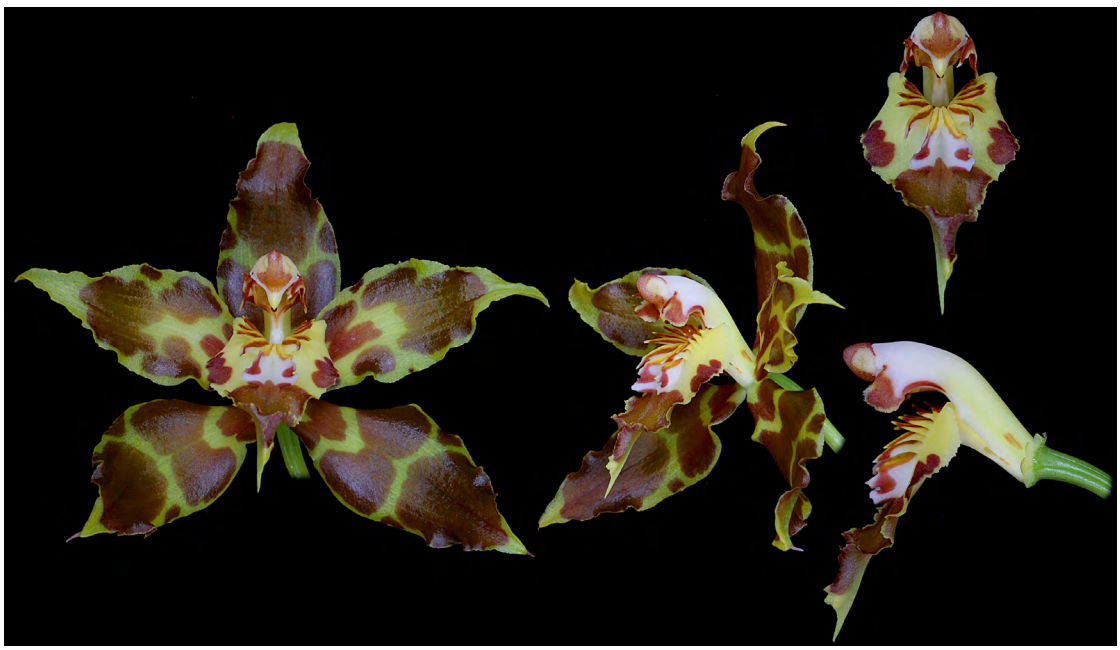

Figure 6. *Odontoglossum cristatellum*, plant cultivated and photographed by G. Deburghgraeve.

Odontoglossum hirtzii is an attractive and colorful little species that has been hiding in herbaria under different names or simply unidentified. It is also a very floriferous species that often produce two and sometimes even three inflorescences per growth. The purple mottling on the pseudobulb of *O. hirtzii* is a feature shared by the sympatric *O. armatum*, which speculatively may suggest that *O. hirtzii* has a hybrid origin, or evolved away from *O. armatum* at some time due to some genetic alterations. *Odontoglossum cristatellum* is not found near the area where *O. hirtzii* occurs and differs in having a more robust flower with a thicker column, while *O. cristatum*, which is not sympatric, and *O. furcatum* generally occur at lower elevations than *O. hirtzii*. *Odontoglossum furcatum* may possibly be sympatric with *O. hirtzii* where their distribution elevations meet but has larger flowers with a longer column (*ca*. 20 mm versus 15 mm long for *O. hirtzii*) and different looking bi-furcated wings. *Odontoglossum hallii* Lindl. (Fig. 9) may superficially resemble *O. hirtzii* as well but is much larger in overall size (for example: sepals 5.0 – 6.0 cm long versus *ca.* 3.0 cm long for *O. hirtzii*) and the pseudobulbs lack the purple mottling, which is typical for *O. hirtzii*. Plants of *Odontoglossum hirtzii* have also been misidentified as *Odontoglossum* "*denticulatum*" [*nomen nudum*] by me in the past. This particular epithet was coined by Friedrich Lehmann, based on some of his collections from Nanegal, Ecuador (which, coincidently, corresponds with the known area for *O. hirtzii*), but was never officially described and therefore should not be used at all. After some lengthy analysis and comparisons between Lehmann's "*denticulatum*" and the type, and other collections, of *O. armatum*, the conclusion is that they represent the same species, and differ from the locally sympatric and rather similar *O. hirtzii*. The most distinct difference between the two can be seen in the size and shape of the column, and particularly the cordate to hastate base of the pandurate lip lamina, as well as the more developed and purple-spotted lip callus of *O. hirtzii*. The impressive variability of the flower shape and size among plants of *O. armatum*, however, suggest that natural hybridization may be rather common, which, of course, blurs the species distinctions. Plants have been found by me and others that suggest several possible 'hybrid partners', such as a small-flowered form of *O. mirandum* Rchb.f. (*O. reversum* Bockem.), *O. cristatellum* Rchb.f., and possibly also *O. aspidorhinum* Lehm., which all occur sympatrically in northern Ecuador on the western

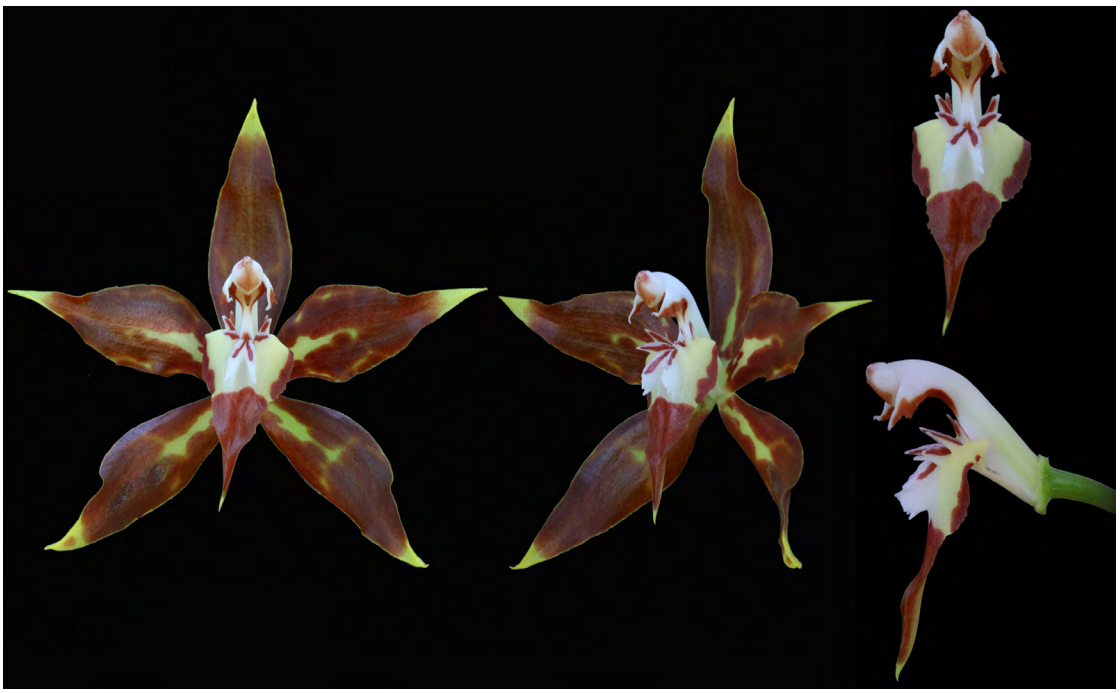

FIGURE 7. *Odontoglossum cristatum*, plant cultivated and photographed by G. Deburghgraeve.

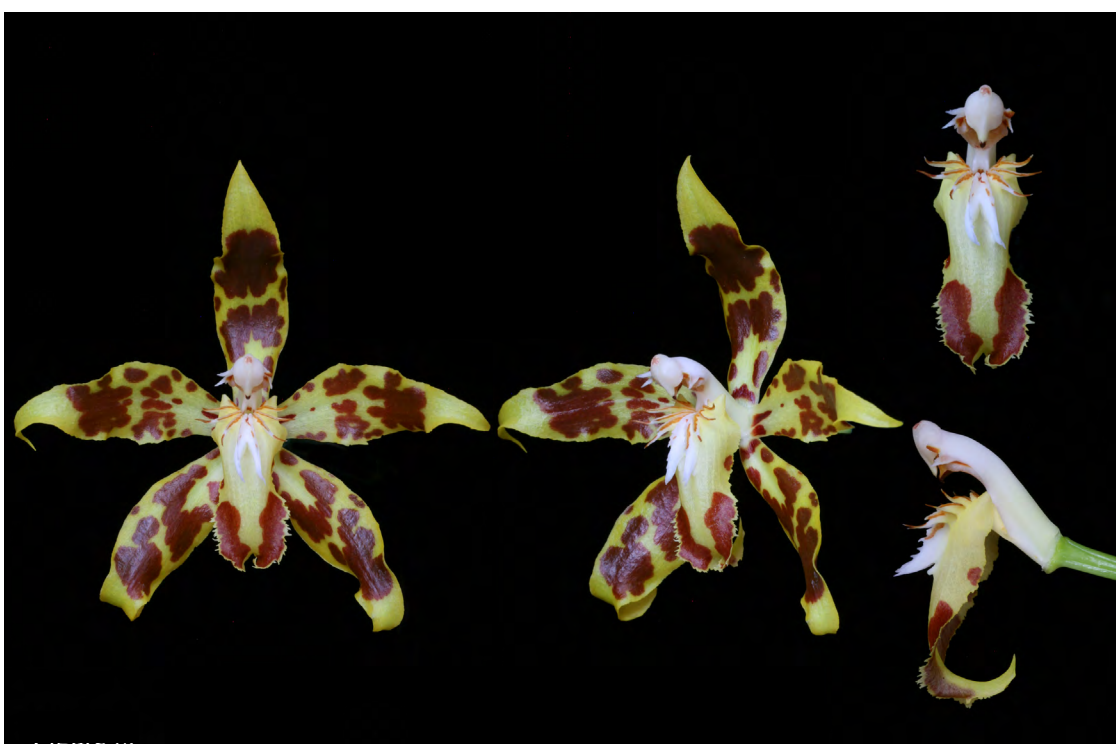

FIGURE 8. *Odontoglossum furcatum*, plant cultivated and photographed by G. Deburghgraeve.

Figure 9. *Odontoglossum hallii*, plant cultivated and photographed by G. Deburghgraeve.

slopes of the Andes near the Colombian border. Only by repeating these suspected crosses in a controlled environment can these identity problems possibly be solved. No plants of *Odontoglossum hirtzii* have been seen by me or reported from this area though, and a sufficient number of plants with a sufficiently consistent morphology have been seen (in addition to the specimens cited below), to justify treating it as a valid species, honoring one of the world's greatest orchid discoverer.

Additional material seen: Ecuador. Imbabura, "Otavalo", 2200 – 2500 m, collected and flowered in cultivation by Ecuagenera, May 2004, *S. Dalström 2490* (Dalström archives). Pichincha, Mindo, alt. 2000 – 2400 m, date unknown, *A. Hirtz 031* (SEL). Same province, Canton Quito, Bosque Protector Maquipucuna, montane rain forest, crest and upper slopes of Cerro Monte Cristo, *ca*. 9 km airline SE of Nanegalito, 2700 – 2795 m, 00° 03' N, 78° 36' W, 8–9 Sept. 1993, *G. L. Webster et al. 30556* (DAV). Same province, Mindo, ca. 2200 – 2400 m, Jan. 1979, *S. Dalström et al. 574* (color transparency-Dalström archives). Same area, Feb. 1992, flowered in cultivation later same year, *S. Dalström et. al. 3755* (color transparency–Dalström archives). Fig. 3. Same province, Tandayapa, along road Nono – Nanegal, alt. 2000 m, collected and cultivated in Paute by A. Andreetta, 25 Feb. 1982, *C. H. Dodson 12858* (SEL). Same area, 1800 [?] – 2200 m, Feb. 1982, *A. Andreetta 0216* (SEL).

Distribution: *Odontoglossum hirtzii* is only known from, and probably endemic to the seasonally extremely wet cloud forests of the western slopes of the Andes in north-central Ecuador at elevations of *ca*. 2000 – 2800 m.

Eponymy: Named in honor of Alejandro "Alex" Hirtz, a mining engineer and prominent nature explorer of Quito, Ecuador, who has contributed more than anyone else to the discovery of new plants, and particularly orchids in his country.

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Literature cited

Chase, M. W., Williams, N. H., Neubig, K. M. & Whitten, W. M. (2008). Taxonomic transfers in Oncidiinae to accord with *Genera orchidacearum*. *Lindleyana*, 5, 20–31.

Dalström, S. (2003). Orchids smarter than scientists – an approach to Oncidiinae (Orchidaceae) taxonomy. *Lankesteriana*, 7, 33–36.

Dalström, S. (2012). New combinations in *Odontoglossum* (Orchidaceae: Oncidiinae) and a solution to a taxonomic conundrum. *Lankesteriana*, 12(1), 53–60.

Dalström, S. (2014). A new and striking *Odontoglossum* (Orchidaceae: Oncidiinae) from Peru. *Lankesteriana*, 13(3), 401–405.

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TWO NEW SIMILAR SPECIES OF *MASDEVALLIA* (ORCHIDACEAE: PLEUROTHALLIDINAE) FROM PASCO, PERU

STIG DALSTRÖM[1,3] & SAUL RUÍZ PÉREZ[2]

[1] 2304 Ringling Boulevard, unit 119, Sarasota FL 34237, U.S.A.
Lankester Botanical Garden, University of Costa Rica, Cartago, Costa Rica
National Biodiversity Centre, Serbithang, Bhutan

[2] Allamanda 142, Surco, Lima 33, Peru

[3] Corresponding author: stigdalstrom@gmail.com

ABSTRACT. Two new species of *Masdevallia*, subgenus *Pygmaeia*, section *Amaluzae* are described, illustrated with line drawings and color photographs, and compared with similar taxa. The two new species are sympatric and share many morphological characteristics, but differ from each other through features such as pubescent sepals versus glabrous sepals, size and coloration. Both new species differ from all other members of the same subgenus and section by much larger plant habits.

KEY WORDS: New *Masdevallia*, Pleurothallidinae, Epidendreae, Epidendroideae, Pasco, Peru, taxonomy

In 2006 the genus *Masdevallia* Ruíz & Pav., had become massive with over 500 species, classed into numerous subdivisions (Luer, 2000a, 2000b, 2001, 2002, 2003). This vast number of species, in combination with molecular investigations (Abele et. al, 2005; Pridgeon & Chase, 2001), encouraged Luer to split the genus into 16 new genera, in addition to the remaining *Masdevallia* (Luer, 2006). The taxonomic advantages of this division of *Masdevallia*, or improvements of the pre-existing classification by Luer are not recognized by us, however, because of difficulties in separating the various new genera from each other in consistent ways, and in recognizing user-friendly and practical features to readily identify in which genus many species belong. We therefore favor the previous and more conservative taxonomic treatment of the genus as circumscribed by Luer (2000a, 2000b, 2001, 2002, 2003), for scientific, user-friendly and practical reasons. Various authors (*e.g.* Collantes *et al*., 2007; Zelenko & Bermudez, 2009; Zelenko, 2014) also maintain the name *Masdevallia* as defined by Luer prior to 2006.

TAXONOMIC TREATMENT

Masdevallia fenestralis Dalström & Ruíz-Pérez, ***sp. nov.***

TYPE: Peru. Huanuco, Choto, along trail Monopampa–Pozuzo, in dense and seasonally exceedingly wet cloud forest, at *ca*. 3000 m elevation, 09°48.249'S, 075°44.722'W, 24 Nov. 2013, *S. Dalström et al. 3664* (holotype: USM). FIGS. 1–3.

Diagnosis. *Masdevallia fenestralis* appears most closely related to *Masdevallia carmenensis* Luer & Malo (Figs.4, 5), in addition to the next described species, which all share a deeply tubular flower. But *M. fenestralis* differs in the overall much larger size, and with a flower twice as large as *M. carmenensis* (*ca.* 10 cm versus *ca*. 5 cm long). *Masdevallia fenestralis* differs from the following new species by the white and purple, internally pubescent flower, versus an overall smaller sized plant, with a smaller white and glabrous flower.

Epiphytic or terrestrial *herb*. *Plant* tall for the subgenus, caespitose. *Ramicauls* erect, slender, to *ca*. 6.5 cm long, enclosed basally by 3 to 4 tubular sheaths. *Leaf* erect, coriaceous, petiolate, blade basally conduplicate and cuneate, elliptic, obtuse, to *ca*. 17.0 × 3.5 cm, including the to *ca*. 7 cm long petiole. *Inflorescence* erect, terete, successive-flowered with at least two flowers, with a to *ca*. 12–13 cm long peduncle and a *ca.* 2 cm long rachis; *peduncular bracts* 2, tubular, below the middle of the peduncle, *ca*. 0.5 cm long; *floral bracts* appressed, tubular, *ca*. 1.0–1.5 cm long; *pedicel* to *ca*. 1.5 cm long; *ovary* sulcate,

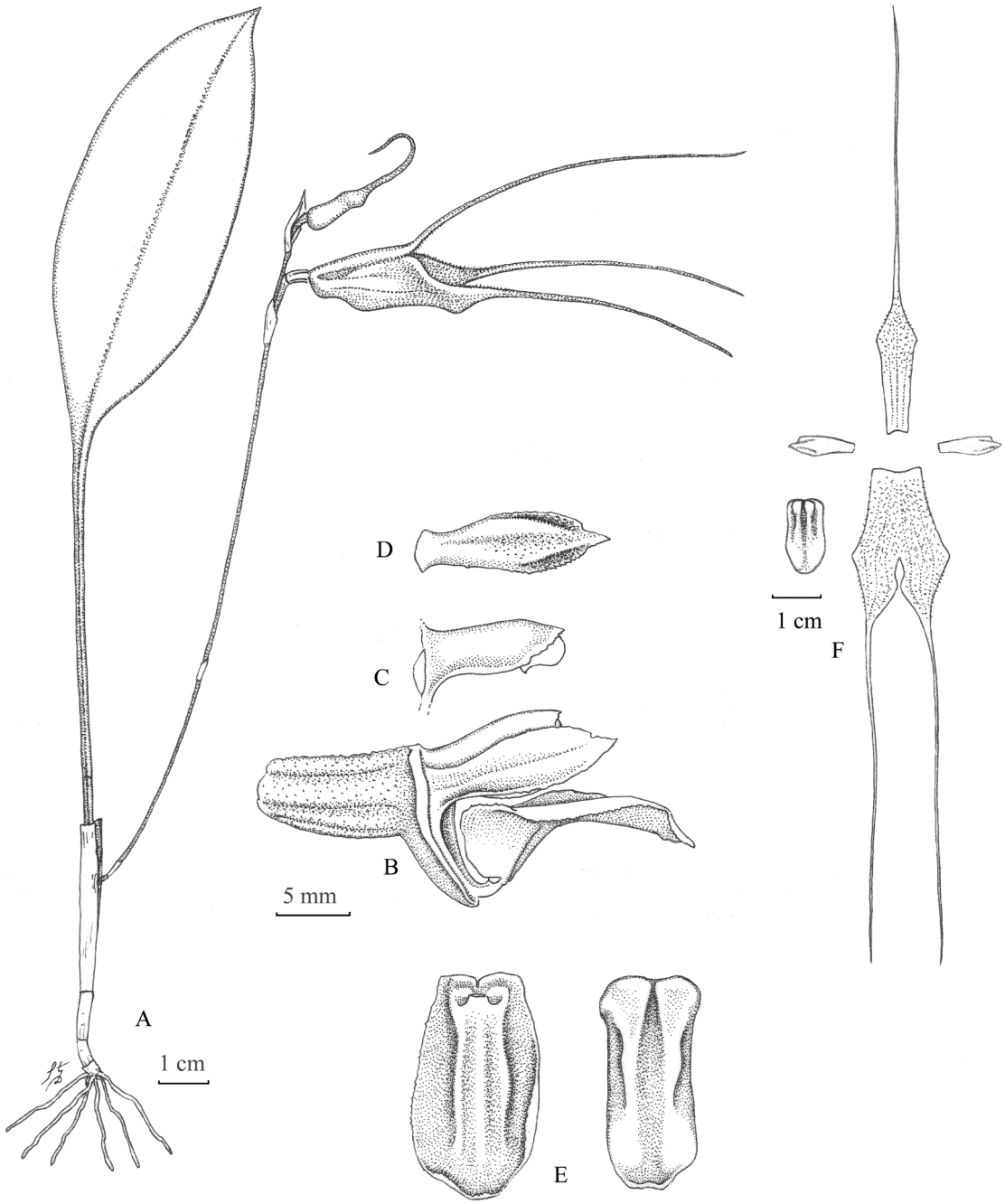

FIGURE 1. *Masdevallia fenestralis.* A. Plant habit. B. Ovary, petal, column and lip, lateral view. C. Column, lateral view. D. Petal, internal lateral view. E. Lip, ventral (slightly flattened) and dorsal views. F. Dissected flower. Drawn from holotype by Stig Dalström.

Figure 2. *Masdevallia fenestralis* in situ. Photo by S. Dalström.

Figure 3. *Masdevallia fenestralis* flower. Photo by S. Dalström.

smooth to weakly rugose, *ca*. 0.5–1.0 cm long. *Flower* tubular, forming a *ca.* 20 mm long sepaline tube with a *ca*. 8–9 mm long and *ca.* 1.5–2.0 mm broad obliquely ovate, transparent section (a 'window') near the base and along the seam between the sepals; *dorsal sepal* white with deep purple spots, mottling and longitudinal stripes along the 3 veins, microscopically pubescent and carinate externally, densely pubescent internally, cuneate to linear, angulate-obovate and

Figure 4. *Masdevallia carmenensis* in situ, Chiguinda road, Ecuador. Photo by S. Dalström.

Figure 5. *Masdevallia carmenensis* flower. Photo by S. Dalström.

connate to the lateral sepals for *ca*. 20 mm, acuminate into a thin more or less erect to arching purple tail, *ca*. 90 × 10 mm, including the *ca*. 60 mm long tail; *lateral sepals* similar in texture and coloration, microscopically pubescent and carinate externally, and densely pubescent internally, connate for *ca*. 20 mm, obliquely and angulate-ovate, acuminate with apical whitish tails, *ca*. 105 × 22 mm combined, including the *ca*. 75 mm long tails; *petals* white with a purple stripe, cartilaginous, oblong, obtuse with an elongate acute apex and slightly serrate, with a longitudinal fleshy ridge, extending from the slightly unguiculate base, continuing along the midline and ending with the narrowly acute apex, *ca*. 13.5 × 4.3 mm; *lip* basally white and with a pink lamina, hinged on the column foot, with a basal, dorsally furrowed truncate swelling, and weakly erect lateral lobes that turn slightly downwards near and above the middle, basally truncate, then slightly obovate when flattened, with a weakly revolute apex, *ca.*16 × 10 mm when flattened; *column* white with purple lateral stripes, straight, *ca*. 10 mm long, with an equally long, curved foot ; *anther cap* white and campanulate; *pollinia* not seen.

Additional material seen: Peru. Only a small population of plants was discovered in the same location as the holotype. No other collections known.

Distribution: *Masdevallia fenestralis* has only been found in a single location, along the trail between Monopampa and Pozuzo, at ca. 3000 m.

Etymology: This species is named in reference to the window-like patch of translucent tissue near the base on each side of the sepaline tube (*fenestralis*; Latin for windowed).

Masdevallia fenestrellata Dalström & Ruíz-Pérez, ***sp. nov.***

TYPE: Peru. Huanuco, Choto, along trail Monopampa–Pozuzo, in dense and seasonally exceedingly wet cloud forest, at *ca*. 3000 m elevation, 09°48.249'S, 075°44.722'W, 24 Nov. 2013, *S. Dalström et al. 3663* (holotype: USM). Figs. 6-8.

Diagnosis. *Masdevallia fenestrellata* is morphologically similar and appears closely related to the much larger *Masdevallia fenestralis* but differs in an overall smaller size and a white, internally glabrous flower. It also appears closely related to *Masdevallia carmenensis*, but differs in a larger vegetative size and having a white flower, versus white with purple stripes for the latter species.

Epiphytic or terrestrial *herb*. *Plant* medium sized for the genus, caespitose. *Ramicauls* erect, slender, to *ca*. 4 cm long, enclosed basally by 3 to 4 tubular sheaths. *Leaf* erect, coriaceous, petiolate, blade basally conduplicate and cuneate, elliptic, obtuse, to *ca*. 10.0 × 2.5 cm, including the *ca*. 3 cm long petiole. *Inflorescence* erect, terete, successive-flowered with at least two flowers, with a to *ca*. 8 cm long peduncle and a *ca.* 2 cm long rachis; *peduncular bracts* 2, tubular, below the middle of the peduncle, *ca*. 0.5–0.7 cm long; *floral bracts* appressed, tubular, *ca*. 1.0–1.2 cm long; *pedicel* to *ca*. 1cm long; *ovary* sulcate, weakly rugose, *ca*. 0.6–0.7 cm long. *Flower* tubular, forming a *ca.* 18 mm long sepaline tube, with a *ca*. 5 mm long and *ca.* 1 mm broad obliquely ovate, transparent section (a 'window') near the base and along the seam between the sepals; *dorsal sepal* dull white, glabrous and carinate externally, glabrous internally, cuneate to linear, angulate-obovate and connate to the lateral sepals for *ca*. 18 mm, acuminate into a thin suberect to arching whitish to pale yellow tail, *ca*. 70.0 × 0.8 mm, including the *ca*. 45 mm long tail; *lateral sepals* similar in texture and coloration but with some pale yellow basally, glabrous and carinate externally, and glabrous internally, connate for *ca*. 20 mm, obliquely and angulate-ovate, acuminate with apical pale yellowish tails, *ca*. 70 × 17 mm combined, including the *ca*. 45 mm long tails; *petals* white, cartilaginous and slightly oblique, weakly unguiculate, oblong, obtuse with a shortly acuminate, narrowly acute apex and slightly verrucose and serrate on the dorsal half side, with a longitudinal fleshy ridge, extending from the base, continuing along the midline and ending with the narrowly acute apex, *ca*. 8 × 2 mm; *lip* white, hinged on the column foot, with a basal, dorsally shallow furrowed truncate swelling, and strongly revolute edges of the lamina, forming a slightly bilobed apex, which is obtuse to rounded when the lip is flattened, *ca.* 9–10 × 6 mm when flattened; *column* white, straight, *ca*. 6 mm long, with an equally long, curved foot ; *anther cap* white and campanulate; *pollinia* not seen.

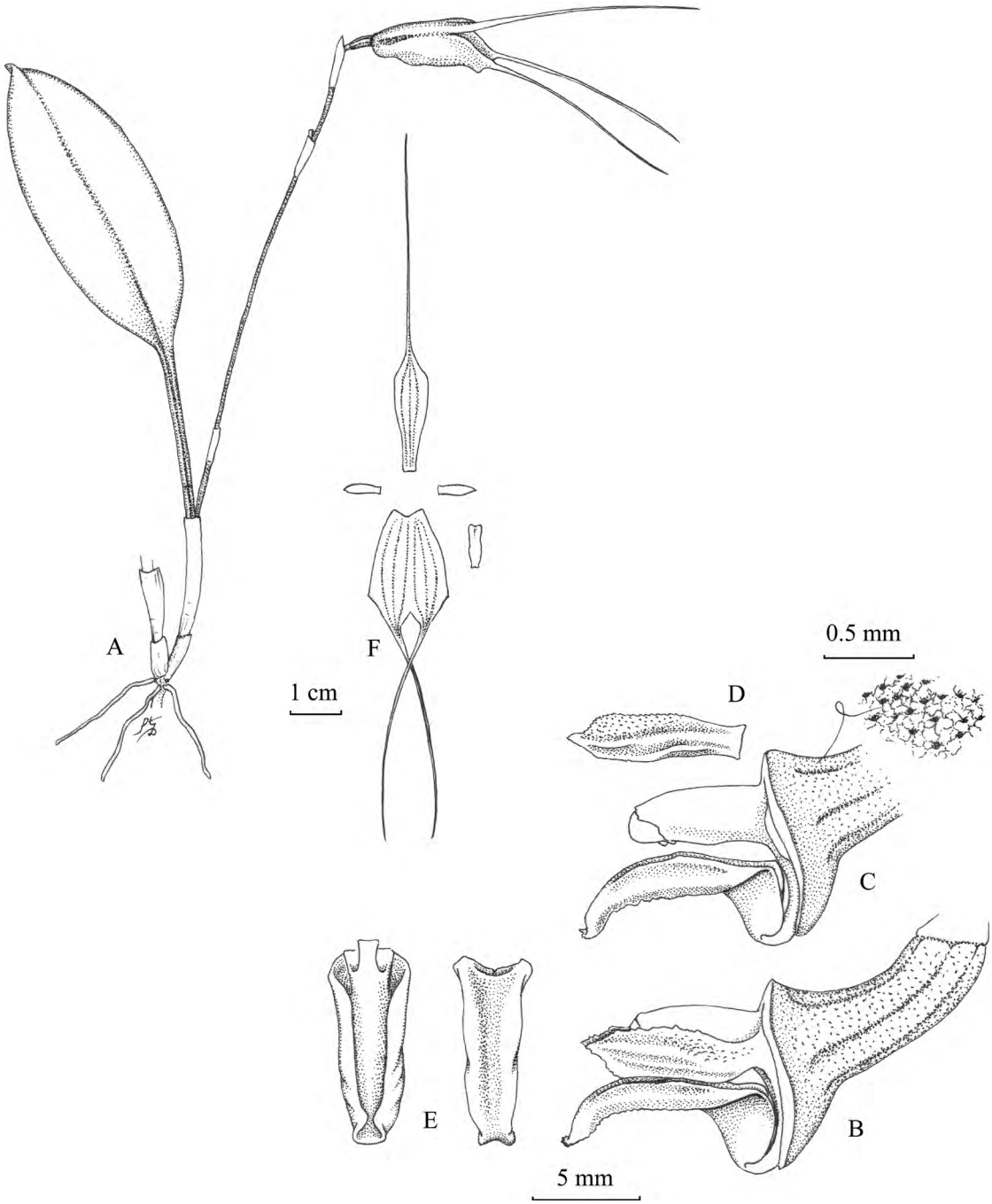

Figure 6. *Masdevallia fenestrellata*. A. Plant habit. B. Ovary, petal, column and lip, lateral view. C. Column and lip, lateral view. D. Petal, internal lateral view. E. Lip, ventral and dorsal views. F. Dissected flower. Drawn from holotype by Stig Dalström.

FIGURE 7. *Masdevallia fenestrellata* in situ. Photo by S. Dalström.

FIGURE 8. *Masdevallia fenestrellata* flower. Photo by S. Ruíz Pérez.

FIGURE 9. *Masdevallia* habitat along the Monopampa-Pozuzu trail. Photo by S. Dalström.

FIGURE 10. The Monopampa-Pozuzu trail. Photo by S. Dalström.

ADDITIONAL MATERIAL SEEN: Peru. Only a small population of plants was discovered in the same location as the holotype. No other collections known.

DISTRIBUTION: *Masdevallia fenestrellata* has only been found in a single location, along the trail between Monopampa and Pozuzo, at ca. 3000 m where it grows sympatrically with the larger *Masdevallia fenestralis*.

ETYMOLOGY: This species is named in reference to the small 'window-like' patch of translucent tissue near the base on each side of the sepaline tube (*fenestrellata*; Latin for "with a small window").

Masdevallia fenestrellata and the much showier *Masdevallia fenestralis* were originally discovered several years ago by Saúl Ruíz Pérez in some extremely wet and dense cloud forest along the trail between Monopampa in Huanuco, and Pozuzu in Pasco (Figs. 9, 10). Both species grow intermingled with each other and flower simultaneously but no intermediate forms have been observed. The only known collection site is an almost constantly rainy, thick and impenetrable cloud forest at rather high altitude in central Peru. Uncountable wanderers have used the ancient trail that crosses the summit of Abra de Vacas, but hardly any orchid explorers, which promises to reveal more interesting taxa over time. The collection site was re-visited by the two authors in 2013 after a strenuous hike which included several high-risk passages of variously entertaining sorts.

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Literature cited

Abele, C., Rudolph, B., Thiede, J. & Rohwer, J. G. (2005). Phylogeny of the genus *Masdevallia* Ruíz & Pav., based on morphological an molecular data. Proceedings of the 18th World Orchid Conference, Dijon, France, 111-115.

Collantes M. B., Soto, C. & Koechlin, J. (2007). *Orchids in Inkaterra at Machu Picchu pueblo hotel*. Inkaterra Asociación. Andalucia 174, Miraflores, Lima 18, Peru.

Luer, C. A. (1986). Icones Pleurothallidinarum 2, Systematics of *Masdevallia* (Orchidaceae). *Monogr. Syst. Bot. Missouri Bot. Gard.*, 16.

Luer, C. A. (2000a). Icones Pleurothallidinarum 19. Systematics of *Masdevallia* part one. *Monogr. Syst. Bot. Missouri Bot. Gard.*, 77, 1-264.

Luer, C. A. (2000b). Icones Pleurothallidinarum 21. Systematics of *Masdevallia* part two. *Monogr. Syst. Bot. Missouri Bot. Gard.*, 82, 265-518.

Luer, C. A. (2001). Icones Pleurothallidinarum 22. Systematics of *Masdevallia* part three. *Monogr. Syst. Bot. Missouri Bot. Gard.*, 86, 510-780.

Luer, C. A. (2002). Icones Pleurothallidinarum 23. Systematics of *Masdevallia* part four. *Monogr. Syst. Bot. Missouri Bot. Gard.*, 87, 781-1047.

Luer, C. A. (2003). Icones Pleurothallidinarum 25. Systematics of *Masdevallia* part five. *Monogr. Syst. Bot. Missouri Bot. Gard.*, 91, 1049-1293.

Luer, C. A. (2006). Icones Pleurothallidinarum 28. A reconsideration of *Masdevallia*, Systematics of *Specklinia* and vegetatively similar taxa (Orchidaceae). *Monogr. Syst. Bot. Missouri Bot. Gard.*, 105.

Pridgeon, A. M. & Chase, M. W. (2001). A phylogenetic reclassification of Pleurothallidinae. *Lindleyana*, 16(4), 235-271.

Zelenko, H. (2014). Orchids, *Masdevallia* with its segregates including *Dracula*. ZAI Publications, Quito, Ecuador

Zelenko, H. & Bermudez, P. (2009). *Orchids, species of Peru.* ZAI Publications, Quito, Ecuador.

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A NOVEL SEED BAITING TECHNIQUE FOR THE EPIPHYTIC ORCHID *RHYNCHOSTELE CERVANTESII*, A MEANS TO ACQUIRE MYCORRHIZAL FUNGI FROM PROTOCORMS

Jesús Bernardo Cruz-Higareda[1,2], Bárbara Susana Luna-Rosales[1] & Amadeo Barba- Álvarez[1]

[1] Unidad de Investigación en Biología Vegetal (L-301), Facultad de Estudios Superiores Zaragoza Campo II, Universidad Nacional Autónoma de México, AP 0920, México, D.F., CP 09230, México
[2] Author for coorespondece: bdocruzh@gmail.com

Abstract. We developed a new and novel seed baiting technique sowing mature seeds of the epiphyitic orchid *Rhynchostele cervantesii* under natural conditions, We introduced a sponge in each package that may serve as a reservoir for water retention to benefit germination; In three of 22 packets we found protocorms in an early stage of development, six of wich were of sufficient size to warrant fungal isolations; Nine strains were isolated in pure culture and were inoculated on seeds and protocorms under *in vitro* conditions.

Key words: Orchid, Epiphytic, Seed, Baiting, Mycorrhiza, *Rhynchostele*

Introduction. In nature, orchids utilize mycorrhizal fungi as a carbon source (mycotrophy) to facilitate seed germination and seedling development, and many are thought to remain intimately tied to fungi into maturity. Although most (73%) the world's 17,000-35,000 orchid species exist as tropical epiphytes (Atwood 1986; Cribb *et al.* 2003), surprisingly few taxa have been studied with respect to their mycorrhizal associations compared to their temperate terrestrial counterparts. During the last decade, however, a growing number of studies have been published that document mycorrhizal fungi from tropical orchids worldwide including Brazil (*e.g*., Pereira *et al*. 2003, 2005), China (*e.g*., Chen *et al.* 2012), Ecuador (Suárez *et al*. 2006), Puerto Rico (Otero *et al*. 2007), and Thailand (*e.g*., Nontachaiyapoom *et al*. 2010) among other places. This information comes at a critical time for specialists seeking knowledge of mycorrhizal fungi for conservation purposes (*e.g*., symbiotic seed germination), but a great deal still must be learned about this aspect of orchid biology before effective protocols can be developed.

The difficulty faced by most researchers who aspire to study mycorrhizal associations of orchids *in situ* lies in the extremely small dust-like size of the orchid seed itself which is nearly impossible to observe on natural substrates with the unaided eye. For epiphytic orchids, researchers are faced with an additional burden of having to ascend into the tree canopy for long periods of time. The seed baiting technique initially developed by Rasmussen and Whigham (1993) has helped considerably with the former, resulting in more than a hundred studies carried out *in situ* during the past 20 years, mostly involving terrestrial orchids (Rasmussen, 2002). For epiphytic orchids, a modified seed baiting technique has since been developed that emphasizes affixing seed packets to arboreal substrates (Zettler *et al*. 2011; Zi *et al.* 2014) which may have potentials for use in a wide range of taxa. Nevertheless, seeds in packets that are attached to aerial substrates are highly vulnerable to desiccation, even in packets placed in direct contact with (moist) moss in continuous shade. Zettler *et al.* (2011) reported that only one of 60 seed packets affixed to trees harbored protocorms of *Epidendrum amphistomum* in south Florida, for example, and they proposed that moisture-rich substrates were needed for fungal growth and proliferation to trigger epiphytic orchid seed germination. If true, it is conceivable that placing a water absorbing/retaining material within the seed packet itself may raise moisture to levels conducive to germination. This possibility was the focus of our study.

In this paper, we propose a novel technique for enhancing epiphytic orchid seed germination *in situ* using seed packets containing mature seeds of a threatened species endemic to Mexico, *Rhynchostele cervantesii* (Fig. 1).

FIGURE 1. Photography of *Rhynchostele cervantesii* taken on study site.

Material and Methods. *Development of the Seed Baiting Technique* –. Seeds of *Rhynchostele cervantesii* (La Llave & Lex.) were obtained from mature capsules in the act of dehiscing during February of 2011 and March of 2012, from three individual plants within a natural population in "El Tepozteco" National Park (vicinity of Tepoztlán, in the state of Morelos). The seeds of each capsule were added to sealed, sterile glass vials containing desiccant (CaSO4, Baker ® Chemical Co.) and stored at 4°C in darkness. Seed viability was assessed using a 1% solution of triphenyltetrazolium chloride (TTC). The TTC solution was prepared by dissolving 1g of 2,3,5-triphenyltetrazolium chloride in 100 ml of sterile deionised (DI) water. Seeds were then pre-treated in small flasks (vials) containing 20 ml of a 5% NaOCl + 1% solution for 5 min. Following pre-treatment, seeds were rinsed then allowed to soak in10 ml DI water, and were then transferred to 1% TTC solution (10 ml) for 72 hrs at 30˚C in darkness. Seeds were examined under a stereomicroscope and scored as viable (pink or red embryo) or unviable (unstained embryo) as described by Van Waes and Debergh (1986).

Packets were constructed from 10 × 5 cm rectangles of plankton netting mesh with pore size of 65 µm purchased from (Medios Industriales Filtrantes S.A de C.V. San Andres Atoto St. No 75, Nauclapan de Juárez) (Fig. 2). The netting was folded in half and sealed on two of the three sides using a hot glue gun purchased from a local hobby store (Surtek ® model PS611). The glue used consisted of stick hot melt glue (25 cm in length and 7 mm in diameter, Surtek® Perillar AV. N° 99 Méx.) that is considered non-toxic, and the above process resulted in 5 × 5 cm packets (Fig. 3). Using a scalpel, 3.5 × 2.5 × 0.5 cm rectangles of a synthetic sponge (Polyurethane foam, Fischermex® Avila Camacho Blvd. N° 3130 Tlalnepantla Mex.) were constructed (Fig. 4), and both packets and sponge pieces were then rinsed in tap water to strip any chemical residue that may be present. The packets and sponges were then disinfested in a solution of NaOCl (0.5% v/v) for 10 min., subsequently rinsed with sterile DI water, and were allowed to dry at ambient temperature. Once dry, ca. 7,000-7,500 seeds (100 mg) were homogeneously dispersed over the sponge (Fig. 5) after it was placed into a nylon mesh packet (Fig. 6). The third edge of the packet was then sealed shut assisted by the hot glue gun (Fig. 7). A total of 22 packets were constructed in this manner.

Seed Packet Installation and Retrieval –. A total of 22 host trees (phorophytes) were selected for seed packet placement. Each tree harbored at least one seemingly-healthy specimen of *R. cervantesii*, and these phorophytes were identified as: *Quercus rugosa* Neé (1801). Each packet was placed at a height of 1-30 m from the ground on a branch that harbored young orchid specimens (ca. 1.5 cm in height, with pseudobulbs and leaves). All packets were placed in close proximity (ca. 5 cm) of a young orchid (Fig. 8), and affixed to the branch by means of an elastic nylon thread. Each packet was then lightly covered with lichen and/or moss colonies from the same tree branch to mimic natural environmental conditions. Half (11) of the packets were placed *in situ* 1-3 months after seeds were collected (March-May on 2011), and other 11 packets were outplanted one year later (2012) (seed used were always of the same year they were col-

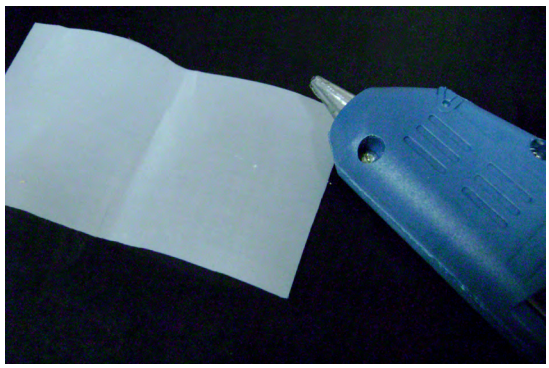

FIGURE 2. Rectangles of plankton netting mesh.

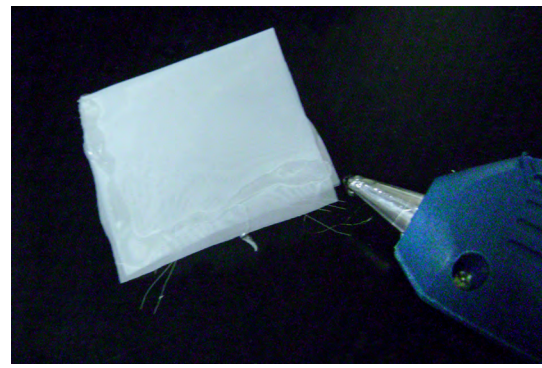

FIGURE 3. Plankton netting mesh was folded and sealed to create a single packet.

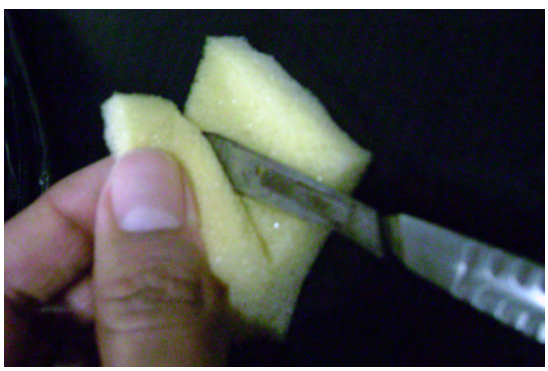

FIGURE 4. Construction of synthetic sponge rectangles.

FIGURE 5. Seeds was dispersed on the surface of the sponge.

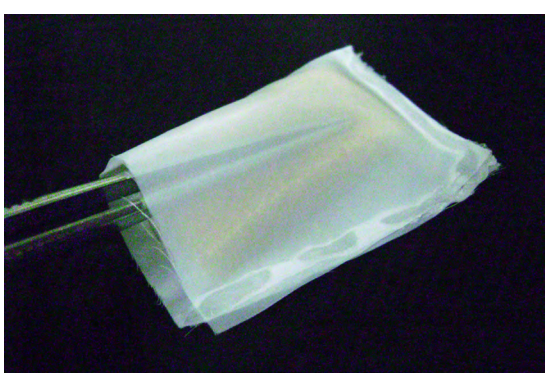

FIGURE 6. The sponge whit seeds was placed into a nylon mesh packet.

FIGURE 7. The packet was finally sealed.

lected, this is because the stored seeds lose their viability after six months)- Each packet was assigned a reference number and the following parameters were recorded: UTM coordinates with a GPS to georeference each phorophyte, orientation (north, south, east, west), height above the ground, location on the phorophyte (trunk, branch or fork), associated organisms (lichens, mosses, ferns, bromeliads, etc.). All packets remained in the field 3-5 months, after which time the packets were collected. Care was taken to detach packets along with associated substrate (bark, moss, lichens) which were added to separate sterile containers that were sealed to retain moisture. Containers were placed into an insulated ice cooler (lacking ice) for

FIGURE 8. One of the 22 baits installed *in situ.*

transport to the laboratory 24-48 hrs later. Packets and sponges were initially inspected in the laboratory using a dissection microscope, and those that appeared to contain seeds in the act of germinating were placed on microscope slides for additional observations using a compound microscope fitted with a camera.

Fungal isolation and symbiotic seed germination –. Protocorms (3 to 5 mm in diameter) were carefully removed from the sponge whit sterile forceps measured and placed in individual sterile glass vials containing sterile distilled water and vigorously shaken to remove debris and surface contaminants (rinse five times according to (Bonnardeaux *et al.,* 2007). Protocorms were then removed from the distilled water using a sterile pipette and surface sterilized 1 mm in another glass vial containing 5 ml of absolute ethanol (EtOH) for three minutes; 25% NaOCl (Clorox bleach) and 900 ml of distilled water for 10 minutes. Protocorms were removed from the solution and rinsed twice for 1mm each in sterile DI water in a third vial each protocorm was then placed in its own sterile plastic Petri plate. Each protocorm was dissected with a sterile scalpel and each segment plated onto nutrient agar culture media used for fungal isolations (FIM, Angle *et al*., 1991). Hyphal tips originating from pelotons that were clearly visible under a dissection microscope were excised using a sterile scalpel. Pure cultures were obtained by removing a single hyphal tip from FIM to FIM or Potato dextrose agar (Bioxon Becton Dickinson®). Colony growth was observed during a three week period, and cultural characteristics (hyphal growth rate, width, cell appereance) similar to protocol outlined by Currah *et al*., (1990). Seeds were removed from cold storage (4 °C) surface disinfected as reported previously for protocorms, between 100-600 seeds were placed over the surface of a filter paper strip (Whatman No. 40) on the surface of oat medium agar (OMA) (3.5 g rolled oats, 0.1g yeast extract, 6.0 g agar, 1L DI water) whitin a Petri plate. A 0.5 cm3 block of fungal inoculums was added to one side of the paper strip, and each plate was immediately wrapped in Parafilm to retain mois-

ture and minimize contamination. Plates were then wrapped tightly in aluminum foil to exclude light, and incubated at 22° C for 13 weeks (three replicate plates were prepared per fungus). We sown seeds on Murashige and Skoog medium (MS) with [50%] of basal salts, supplemented with sucrose and agar (Sigma ® Aldrich Co.). After three months, spherical protocorms (5-7 mm of diameter) with apical shoots were developed, 15 of these protocorms were placed on Petri dish with OMA by adding a bucket with fungal hyphae agar for inoculation *in vitro* (three replicate plates were prepared per fungus and protocorms were incubated at 22°C in a photoperiod of 16 hours light and 8 hours dark, with a light intensity of 322.9 lux, for 15 weeks)

Results and Discussion. The seed baiting method presented here improved on previous techniques in the following: flexibility for closer contact with natural substrates and increased water retention using pieces of sponge. These modifications showed distinct advantages. First, replacing the rigid frame by a flexible frame made with hot glue made the placement of the baits on the trunks, forks or branches easier and allowed for better mimicking of the natural conditions. It is often difficult to place the rigid frames of previously used techniques to close contact with the surface of phorophyte and, therefore, seeds often lose their viability or do not become infected by the fungal symbionts. In our improved seed baiting technique, the sponge mimics the water retention capacity of the mosses so the seeds do not lose moisture as quickly, raising the possibility of priming the mycorrhizal fungus. Yoder *et al*. (2000) establishes that the seeds of the epiphytes are able to absorb water from the air, this capacity suggests that these seeds are able to acquire the rainwater in a very porous substrate (the sponge provides an aerated substrate). Three of the 22 seed packets harbored developing protocorms of *R. cervantesii* after 124 days of incubation *in situ* on tree trunks, especially those with 80-90% moss coverage. In one particular packet (RC08), four protocorms were observed, and in the other two packets (RC06, RC07), seeds appeared to be in the process of germinating (Fig. 9). In two of the protocorms (Fig. 9 E and F), dark spherical inclusions were apparent that resembled fungal pelotons in epiphytic orchid protocorms published previously (*e.g*,. Zettler *et al*. 1999). The fact is that these packages were collected during the months in which the fog and the rainfall was evident in the study area. According to some authors seasonal patterns in orchid fungal symbionts are closely related to host phenology and climate variations; and the overall picture shows that the diversity of fungi associated with orchids and the frequency and intensity of colonization in the roots increase in the wet months, while many of these fungi remain dormant as spores during dry seasons (Lugo & Cabello, 2002; Dumbrell *et al*., 2010). During the sampling seasons, packets were colonized by lichens and mosses present on the phorophyte, and formed a dense rug of about 5 cm thick on the surface, with an accumulating layer of decomposing organic matter. Many lichens and mosses can fix atmospheric nitrogen via their symbiotic cyanobacteria of the genus (e.g. the genus *Nostoc*) mosses can absorb leached-out nutrients from runoff water (Rai *et al.,* 2000; DeLuca *et al*., 2002). It is likely that the sponge contained in the packets can absorb runoff in a similar matter, facilitating germination and fungal colonization. So it is not surprising that some authors suggest that mosses retain much of the nitrogen after death and during decomposition (Turetsky, 2003; Clarck *et al.,* 1998; 2005). The fact is that lichens and particularly mosses are authentic recalcitrant stores of carbon and nitrogen whose concentrations are higher in epiphytic than in terrestrial bryophytes and that when they die, they produce humus whit nutrients that are highly soluble in water, being a dominant mass of carbon and nitrogen which is involved in the cycle of nutrients to flow through the canopy to the ground via runoff (Chia-Chun *et al*., 2002; Turetsky, 2003; Clarck *et al*., 2005, Cornelissen *et al*., 2007) For future works, we recommend install the packets (or plantlets generated *in vitro* for purposes of reintroduction) on moss substrate on the surface of the phorophyte; Also we observed that the phorophytes (*Quercus rugosa*) had developed a layer of bark (about 3-5 cm thick) underneath the moss colonies. Rasmussen & Wigham (1988 a) reported that the debris of certain species of trees can stimulate germination of orchid seeds, and is also suitable substrate for inducing subsequent mycorrhizal seedling development, suggesting that indeed the fungi involved are saprophytic.

Nine strains with different morphology were successfully isolated from six protocorms and inoculated on seeds and protocorms generated under

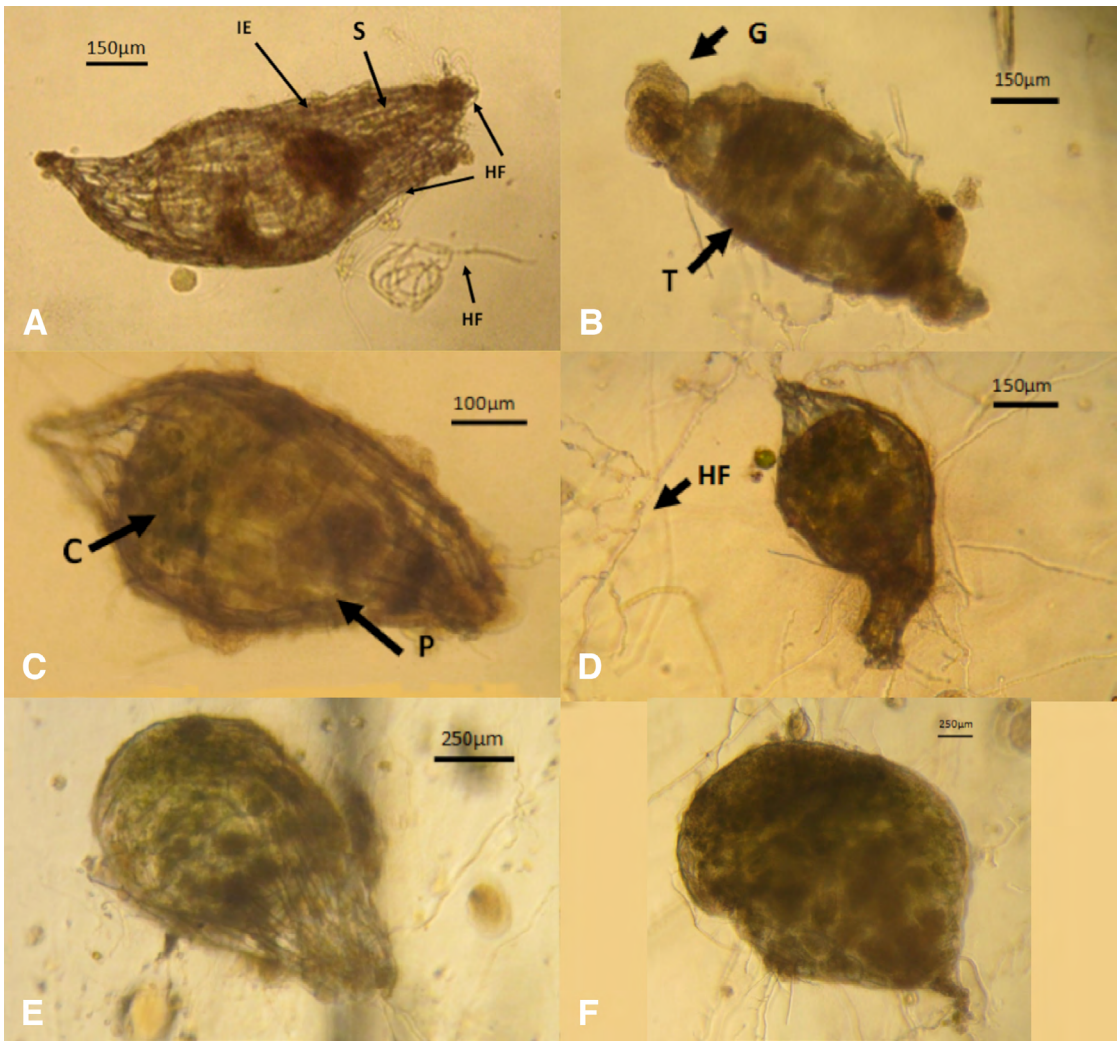

FIGURE 9. Photography of inoculated seeds at different stages in the baitings. A – Can appreciate the hyphae of the endophyte (HF) colonizing the seed through suspensor (S) and inoculating the basal region of the embryo (IE). B – On the surface of the testa (T), can be appreciated a segregated brown substance by the endophyte (G) .C – Embryo cells in the chalazal pole (C) are smaller than the pole near the suspensor where we will see the formation of coils (P). D – The external secretions on the surface of the testa have decreased dramatically. E – Rupture of the testa. F – Protocorm.

in vitro conditions. The strain RC062.4EFIM (Fig. 10) generally colonizes the surface of the testa in 10 days and fungal structures appear near the embryo (Fig.11). After 28 days in culture, 98% of the embryos break the testa, generate protocorms of dark color, have protuberances on their surfaces, showing that the strain had some epiparasitic activity, and after 60 days of culturing the protocorms become necrotic (Fig. 12). This strain cannot colonize the protocorms intracellularly and after 8 days protocorms die. On the other hand, the strain RCRPTC6.3FIM (Fig.13) is unable to infect the seeds, but in 12 days is capable of colonizing the protocorms intracellularly (Fig. 14). However, after 17 days of culture, the protocorms become necrotic. Seeds and protocorms placed in OMA without adding strain (control) survive for 47 days (seeds are only able to break the testa). We agree with many authors that the orchid fungus relationship is not the same under *in situ* conditions than *in vitro* (Masuhara *et al*., 1993; 1994; Taylor & Bruns, 1999;

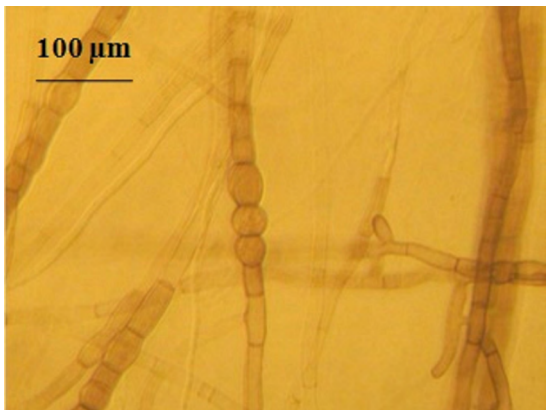

FIGURE 10. The strain RC062.4EFIM.

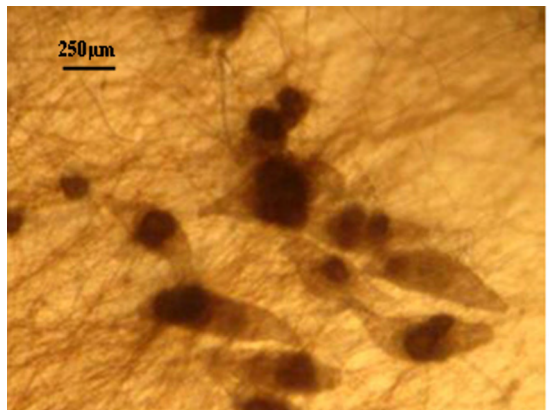

FIGURE 11. Fungal structures of the strain RC062.4EFIM colonized the seeds under in vitro conditions.

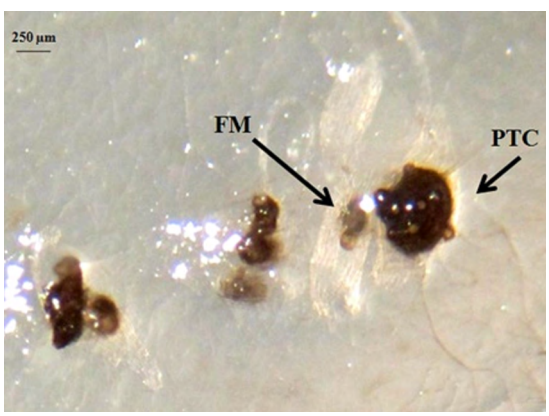

FIGURE 12. Protocorm (PTC) hatched after 60 days with protuberances on its surface,in the image can observer fungal masses (FM) inside of the testa by some embryo that broke.

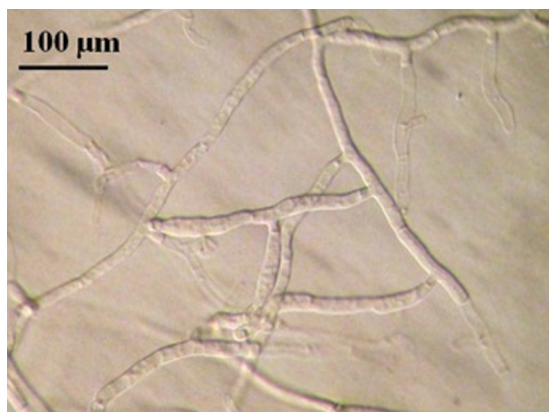

FIGURE 13. The strain RCRPTC6.3FIM.

Taylor *et al.,* 2003; Bidartondo & Bruns, 2005). The photosynthetic orchids tend to be specific to a single dominant fungus. For epiphytic orchids, these symbionts generally are members of the Tulasnellaceae and Ceratobasidiaceae, while micoheterotrophics orchids associate with wide range of mycobionts (Ma *et al*., 2002; Otero *et al*., 2002; McCormick *et al*., 2004, 2006; Shefferson, 2005; Jolou *et al*., 2005; Suarez *et al*., 2006; Dearnaley, 2006). High specificity goes hand in hand with the rarity (or endemic) orchid; however, the dependence on the fungi varies according to gender, species, growth habits, reproductive strategies, physiology and morphology (Brundrett *et al*., 2003; Stewart & Kane, 2006; Bonnardeaux *et al*., 2007), as well as specific microhabitats that allow the establishment (Phillip *et al*., 2011). Some strains in pure culture are capable of secreting substances via hyphal tip; perhaps under natural conditions hyphal tip works like a "drinking straw" that establishes a biotrophic system during the early stages of seed inoculation, the fungus is able to transform the leachate present in the microhabitat in organic compounds to nourish the seed. To better illustrate this point, according to Stewart and Zettler (2002), the symbiotic germination *in vitro*, the oat medium is low in nutrients and Rasmussen and Whigham (1998b) observed no seeds germination of *Liparis lilifolia* in asymbiotic culture, while the seeds germinated when a mycorrhizal fungus was added to these media, showing some fungus need an external source of nutrients. Perhaps the oat meal agar is not the best option to evaluate whether fungal exudates can stimulate germination;

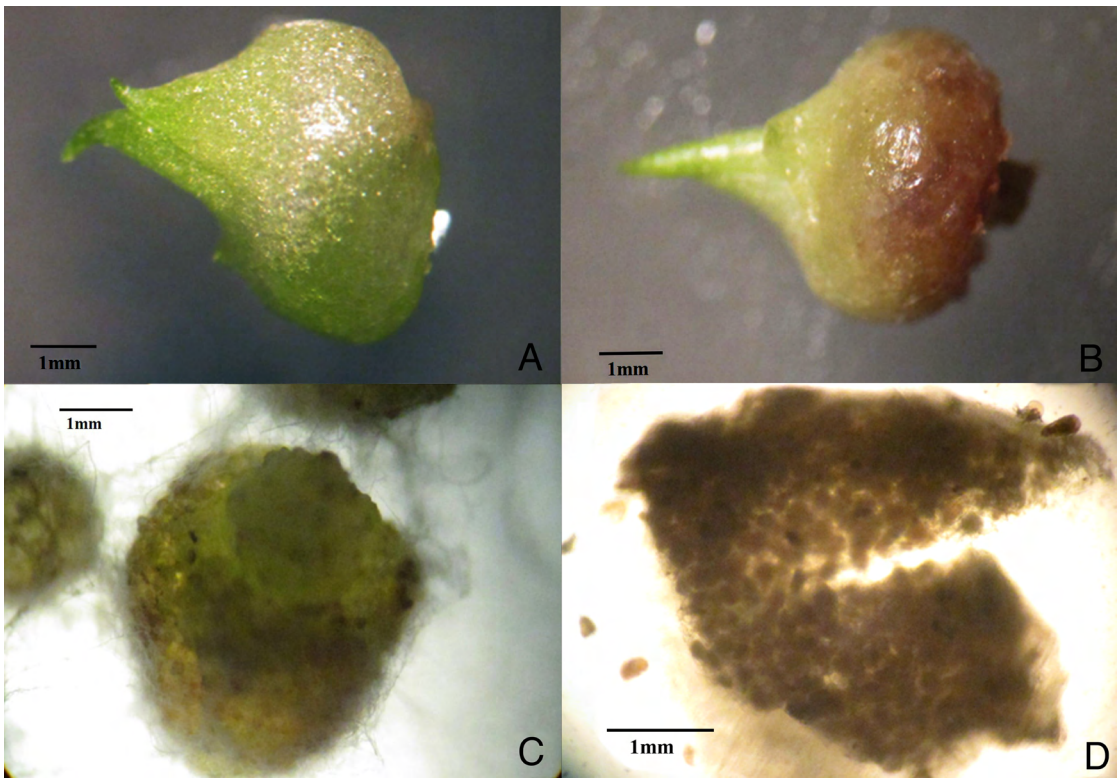

FIGURE 14. Photography of in vitro inoculated Protocorms. A. Control whit apical shoot. B. Protocorm inoculated basally after 12 day of incubation. C. Protocorm in which can observe fungal hyphae and intracellular coils in the base. D.Tissue section of the basal part of one of the protocorms inoculated, in wich can be observed hyphal coils.

the best option would be to test an alternative culture medium made from bark, or leachate water agar, trying to simulate the natural substrate and saprophytic habitat where germination occurs. We hope that in the future this novel seed baiting technique allows to know the fungal partners and the processes involved during germination and establishment of other species of epiphytic orchids.

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LITERATURE CITED

Angle J. S., McGrath S. P., & Chaney R. L. (1991). New culture medium containing ionic concentrations of nutrients similar to concentrations found in the soil solution. *Appl. Environ. Microbiol.*, 57, 3674 –3676.

Atwood J. T. (1986). The size of the Orchidaceae and the systematic distribution of epiphytic orchids. *Selbyana*, 9(1), 171-186.

Bidartondo, M. I. & Bruns, T. D. (2005).On the origins of extreme mycorrhizal specificity in the Monotropoideae (Ericaceae): performance trade-offs during seed germination and seedling development. *Mol. Ecol.*, 14, 1549–1560.

Bonnardeaux, Y., Brundrett, M., Batty, A., Dixon, K., Koch, J. & Sivasithamparam, K. (2007). Diversity of mycorrhizal fungi in terrestrial orchids: compatability webs, brief encounters, lasting relationships and alien invasions. *Mycol Res.*, 111, 51-61.

Brundrett, M. C., Scade, A., Batty, L. A., Dixon, W. & Sivasithamparam, K. (2003). Development of *in situ* and

ex situ seed baiting techniques to detect mycorrhizal fungi from terrestrial orchids habitats. *Mycol Res.*, 107, 1210-1220.

Chen, J. Wang, H., & Guo, S-X. (2012). Isolation and identification of endophytic and mycorrhizal fungi from seeds and roots of Dendrobium (Orchidaceae). *Myco.*, 22, 297-307.

Chia-Chun, H., Fu- Wen, H. & Chen-Meng, K. (2002). Epiphyte biomass and nutrient capital of a moist subtropical forest in north-eastern Taiwan. *J. T. Ecol.*, 18, 659-670.

Clark, D. L., Nadkarni, N. M. & Ghozl, H. L. (1988). Growth, net production, litter decomposition, and net nitrogen accumulation by epiphytic bryophytes in a tropical montane forest. *Biotrop.*, 30, 12-23.

Clark, D. L., Nadkarni, N. M. & Ghozl, H. L. (2005). Retention of inorganic nitrogen by epiphytic bryophytes in a tropical montane forest. *Biotrop.*, 30, 12-23.

Cornelissen, J. H. C., Lang, I. S., Soudzilovskaia, N. A., & During, H. J. (2007). Comparative cryptogam ecology: A review of Bryophyte and lichen traits that drive biogeochemistry. *Ann. Bot.,* 99, 987-1001.

Cribb, P. J., Kell, R. L., Dixon, W. K. & Barrett, R. L. (2003). *Orchid Conservation: A global perpective*. Natural History Publications, Kota Kinabalu, Sabah. pp. 1–24.

DeLuca, T. H., Zackrisson, O. & Sells-Tedt, A. (2002). Quantifying nitrogen-fixation in feather moss carpets of boreal forest. *Nat.*, 419, 917-920.

Dumbrell, A. J., Ashton, P. D., Aziz, N., Feng, G., Nelson, M., Dytham, C., Fitter, A.H., & Helgason, T. (2010). Distinct seasonal assembleges of arbuscular mycorrhizal fungi revealed by massively parallel pyrosequencing. *New Phytol.*, 190, 794-804.

Jolou, T., Burghardt, B., Gebauer, G., Berveiller, D., Damesin, C. & Selosse, M.-A. (2005). Mixotrophy in orchids: insights from a comparative study of green individuals and nonphotosynthetic individuals of Cephalanthera damasonium. *New Phytol.*, 166, 639-653.

Lugo, A. M. & Cabello, M. N. (2002). Native arbuscular mycorrhizal fungi (AMF) from mountain grassland (Córdoba, Argentina) I. Seasonal variation of fungal spore diversity. *Mycol.*, 94, 579-586.

Ma, M., Tan, T. K. & Wong, S. M. (2002). Identification and molecular phylogeny of Epulorhiza isolates from tropical orchids. *Mycol Res.*, 107, 1041-1049.

Masuhara, G., Katsuya, K. & Yamagucki, K. (1993). Potential for symbiosis of *Rhizoctonia solani* and binucleate Rhizoctonia with seeds of *Spiranthes amoena* var. amoena *in vitro*. *Mycol Res.*, 97, 746–752.

Masuhara, G. & Katsuya, K. (1994). In situ and *in vitro* specificity between Rhizoctonia spp. and *Spiranthes sinensis* (Persoon) Ames. var. amoena (M. Biebertsien) Hara (Orchidaceae). *New Phytol.*, 127, 711-718.

McCormick, M. K., Whigham, D. F. & O'Neill, J. (2004). Mycorrhizal diversity in photosynthetic terrestrial orchids. *New Phytol.*, 163, 425-438

McCormick, M. K., Whigham, D. F., Sloan, D. O'Malley, K., & Hodkinson, B. (2006). Orchid–fungus fidelity: a marriage meant to last? *Ecol.*, 87, 903–911.

Nontachaiyapoom, S., Sasirat, S., & Manoch, L. (2010). Symbiotic seed germination of *Grammatophyllum speciosum* Blume and Dendrobium draconis Rchb. f., native orchids of Thailand. *Sci. Hort.*, 130, 303–308.

Otero, J. T., Ackerman, J. D. & Bayman, P. (2002). Diversity and host specificity of endophytic Rhizotonia-like fungi from tropical orchids. *Am. J. Bot.*, 89, 1852-1858.

Otero, J. T., Flanagan, S. N., Allen Herre, E., Ackerman, D. J. & Bayman, P. (2007). Widespread mycorrhizal specificity correlates to mycorrhyzal function in the neotropical, epiphytic orchid Ionopsis utricularioides (Orchidaceae). *Am. J. Bot.*, 94(12), 1944-50.

Pereira, O. L., Rollemberg, C. L., Borges, A. C., Matsuokae, K. & Kasuya, M. C. M. (2003). *Epulorhiza epiphytica* sp. nov. isolatated from mycorrhizal roots of epiphytic orchids in Brazil. *Mycos*, 44, 153-155.

Pereira, O. L., Kasuya, M. C. M., Rollemberg, C. L. & Borges, A. C. (2005). *In vitro* seed Germination of *Oncidium flexosum* (Orchidaceae) by Rhizoctonia-like Mycorrhizal fungi. *R. Bras. Ci. Solo*, 29, 199-206.

Phillips, R. D., Barret, D., Dixon, W. K. & Hopper, D. S. (2011). Do mycorrhizal symbioses cause rarity in orchids?. *J. Ecol.*, 99, 858-869.

Rai, A. N. Soderback, E. & Bergman, B. (2000). Cyanobacterium-plant symbioses. *New Phytol*, 147, 449-481.

Rasmussen, H. N. & Whigham, D. F. (1993). Seed ecology of dust seeds *in situ*: a new study technique and its application in terrestrial orchids. *Am. J. Bot.*, 80, 1374–1378.

Rasmussen, H. N. & Whigham, D. F. (1998a). Importance of woody debris in seed germination of *Tipularia discolor* (Orchidaceae). *Am. J. Bot.*, 85, 829–834.

Rasmussen, H. N. & Whigham, D. F. (1998b). The underground phase: a special challenge in studies of terrestrial orchids populations. *Bot. J. Linnean Soc.*, 126, 49-64.

Rasmussen H. N. (2002). Recent developments in the study of orchid mycorrhiza. *Plant and soil*., 244, 149-163.

Shefferson, R. P., Weiß, M., Kull, T. & Taylor, D. L. (2005). High specificity generally characterises mycorrhizal association in rare lady's slipper orchids, genus Cypripedium. *Mol. Ecol.*, 14, 613-626.

Stewart, S. L. & Zettler, L. W. (2002). Symbiotic germination of three semi-aquatic rein orchids (*Habenaria repens, H. quinqueseta, H. macroceratitis*) from Florida. *Aquat. Bot.*, 72, 25–35.

Stewart, S. L. & Kane, M. E. (2006). Symbiotic seed germination of *Habenaria macroceratitis* (Orchidaceae), a rare Florida terrestrial orchid. *Pl. Cell Tissue Organ Cult.*, 86, 159–167.

Suarez, J. P., Weibßb, M., Abeleb, A., Garnica, S., Oberwinkler, F. & Kottke, I. (2006). Diverse tulasnelloid fungi form mycorrhizas with epiphytic orchids in an Andean cloud forest. *Mycol Res.*, 110, 1257–1270.

Taylor, D. L. & Bruns, T. D. (1999). Population, habitat and genetic correlates of mycorrhizal specialization in the 'cheating' orchids *Corallorhiza maculata* and *C. mertensiana*. *Mol. Ecol.*, 8, 1719–1732.

Taylor, D. L., Bruns, T. D., Szaro, T. M. & Hodges, S. A. (2003). Divergence in mycorrhizal specialization within *Hexalectris spicata* (Orchidaceae), a nonphotosynthetic desert orchid. *Am. J. Bot.*, 90, 1168-1179.

Turetsky, M. R. (2003). The role of Bryophytes in Carbon and Nitrogen Cycling. *The Bryol.*, 106, 395-409.

Van Waes, J. M. & Debergh, P. C. (1986). Adaptation of the tetrazolium method for testing the seed viability, and scanning electron microscopy study of some Western European orchids. *Phys. Plant.*, 66, 435-442.

Yoder, J. A., Zettler, L. W. & Stewart, S. L. (2000). Water requirements of terrestrial and epiphytic orchid seeds and seedlings, and evidence for water uptake by means of mycotrophy. *Pl. Science*, 156, 145–150.

Zettler, L. W, Burkhead, J. C. & Marshall, J. A. (1999). Use of a mycorrhizal fungus from *Epidendrum conopseum* to propagate *Encyclia tampensis* from seed *in vitro*. *Lindleyana*, 14, 102-105.

Zettler, L. W., Corey, L. L., Richardson, L. W., Ross, A. Y. & Moller-Jacobs, L. (2011). Protocorms of an epiphytic orchid, (*Epidendrum amphistomum* A. Richard) recovered *in situ*, and subsequent identification of associated mycorrhizal fungi using molecular markers. *E. J. Enviro. Sc.*, 1, 108-114.

Zi, X-M., Sheng, C-L., Goodale, U. M. Shao, S-Ch., & Gao, J-Y. (2014). *In situ* seed baiting to isolate germination-enhancing fungi for an epiphytic orchid, *Dendrobium aphyllum* (Orchidaceae). *Myc.*, 10, 565-572.

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NEW SPECIES AND NOMENCLATURAL NOTES IN *ACIANTHERA* FROM BRAZIL

A. L. V. Toscano de Brito[1,3] & Carlyle A. Luer[2]

[1] Marie Selby Botanical Gardens, 811 South Palm Avenue, Sarasota, FL 34236-7726 U.S.A.

[2] Missouri Botanical Garden, 2345 Tower Grove Avenue, St. Louis, Missouri 63110, U.S.A.
Corresponding address: 3222 Old Oak Drive, Sarasota, FL 34239-5019 U.S.A.

[3] Corresponding author: atoscano@selby.org

Abstract. Two new Brazilian species of the orchid genus *Acianthera*, *Acianthera calopedilon* and *Acianthera cephalopodiglossa*, are described and illustrated. The identities of *Acianthera bidentula*, *Acianthera saundersiana*, and *Acianthera serpentula* are discussed. *Acianthera velteniana*, recently described for Espírito Santo, is placed in the synonymy of *Acianthera bidentula*. An epitype is selected for *Pleurothallis saundersiana* and a lectotype for *Pleurothallis serpentula*. Updated synonymy lists are provided for the taxa treated in the article.

Key words: *Acianthera bidentula, Acianthera calopedilon, Acianthera cephalopodiglossa, Acianthera saundersiana*, *Acianthera serpentula, Acianthera velteniana*, Pleurothallidinae

Introduction. The genus *Acianthera* Scheidw. comprises over two hundred Neotropical species. The World Checklist of Selected Plant Families (WCSP, accessed 17 Sept. 2014) published online by the Royal Botanical Gardens, Kew, lists 286 valid names of which 121 names have been recently reported from Brazil (Chiron & van den Berg 2012; Barros *et al.* 2014). As neither of these accounts on Brazilian species presents a taxonomic revision of the genus and because there still are several obscure and problematic taxa, including a number of yet undescribed species (Toscano de Brito & Luer, in prep.), this latter number is obviously provisional and will certainly change in the future.

While preparing a taxonomic revision of the Brazilian *Acianthera*, the authors discovered two new species that belong to a complex of long-repent, similar taxa, henceforth referred to as *Acianthera saundersiana* complex. Chiron & van den Berg (2012) assigned some species of this complex to *Acianthera* sect. *Sicariae* subsect. *Auritae* Chiron & van den Berg. Species in this group are uncommon in Peru and Bolivia but frequent and variable in southern Brazil where it has accumulated a long list of epithets from several authors. Of about 30 binomials published in this complex, the most familiar is undoubtedly *Acianthera saundersiana* (Rchb.f.) Pridgeon & M.W.Chase.

After studying all protologues and available type specimens in this species complex, it has become clear that several names have been consistently misidentified and confused in herbaria and literature. A number of published illustrations have been wrongly named (e.g. Cogniaux 1896; Pabst & Dungs 1975; Chiron & Bolsanello 2010), and several specimen citations in floristic treatments are in fact a mixture of different taxa (e.g. Cogniaux 1896). Therefore, the taxonomy of this species group is highly confused. It is, however, beyond the scope of this work to discuss or review in detail all published names in this complex. This will be part of a forthcoming taxonomic revision of the genus, which is currently in preparation by the authors.

In this article we describe two new species, *Acianthera calopedilon* Toscano & Luer and *A. cephalopodiglossa* Toscano & Luer. We briefly discuss the identity of *Pleurothallis bidentula* Barb. Rodr. [= *A. bidentula* (Barb.Rodr.) Pridgeon & M.W.Chase], *Pleurothallis saundersiana* Rchb.f. (= *A. saundersiana*) and *Pleurothallis serpentula* Barb.Rodr. [= *A. serpentula* (Barb.Rodr.) F.Barros], and the name *A. velteniana* Chiron & Xim.Bols. is placed in the synonym of *A. bidentula*. An epitype is selected for *P. saundersiana* and a lectotype for *P. serpentula*.

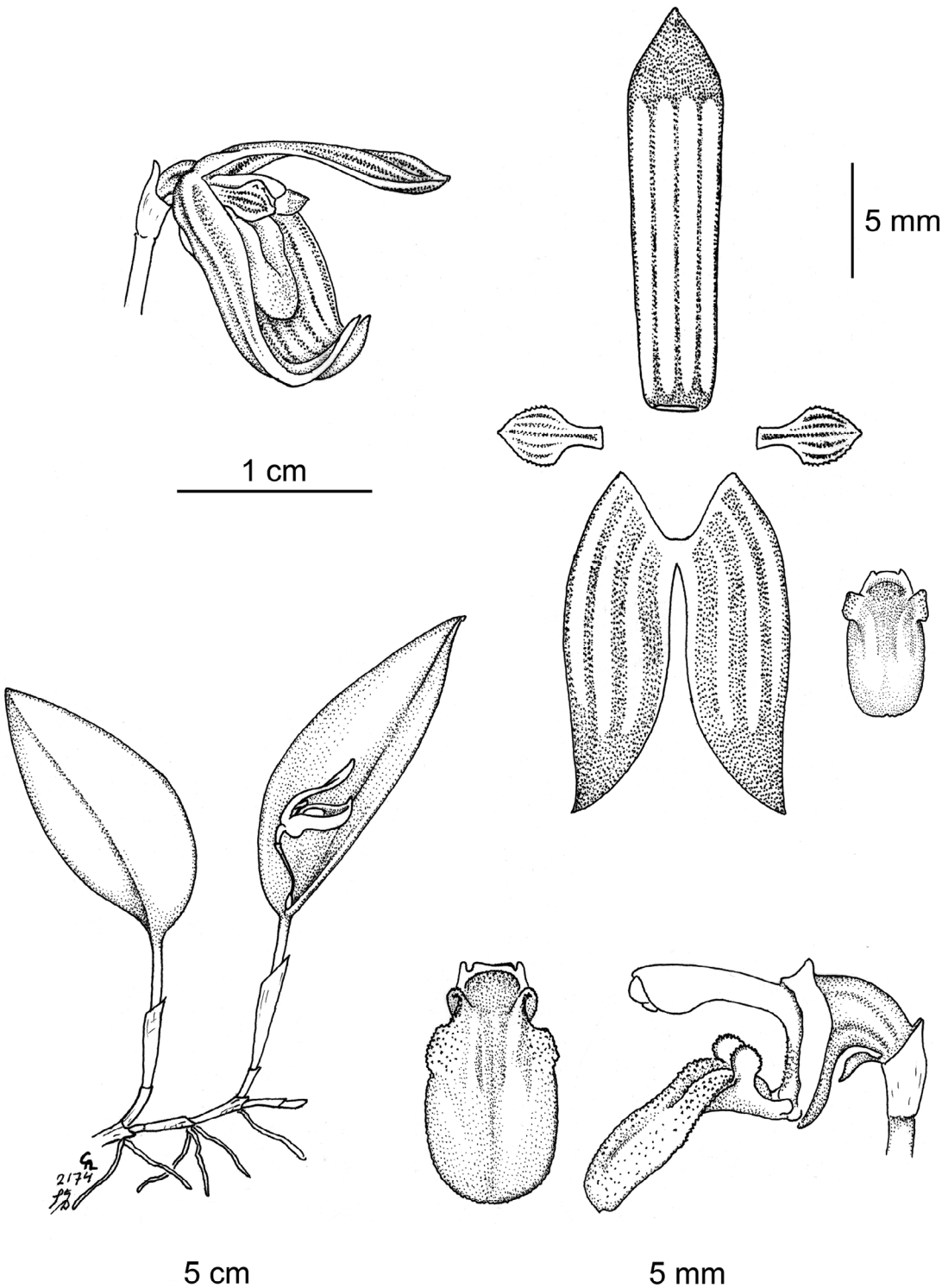

Figure 1. *Acianthera calopedilon* Toscano & Luer. Drawn by C.A. Luer based on *C.A. Luer 2174* (SEL).

New Species

Acianthera calopedilon Toscano & Luer, ***sp.nov.***

TYPE: Brazil. Paraná: road Alexandra to Matinhos, collected and cultivated by M. Klingelfus s.n., flowered in cultivation, 7 Oct. 2011, *A. Toscano de Brito 2911* (Holotype: UPCB). Fig. 1–2.

Plant medium in size, epiphytic, long-repent, the rhizome 0.5–2.5 cm long between ramicauls; roots slender. *Ramicauls* ascending, suberect, 2–5 cm long, enclosed by 2 loose, tubular sheaths toward the base. *Leaf* suberect, coriaceous, elliptical, acute, 4.5–7.5 cm long, 2.3–3.0 cm wide, the base shortly cuneate, sessile. *Inflorescence* a single flower or a fascile of 2 successively flowers, from the apex of the ramicaul at the base of the leaf, with a spathe 3 mm long; peduncles 6.0–8.5 mm long; floral bract tubular, 2.2–3.0 mm long; pedicels 2.0–2.5 mm long; ovary 2--3 mm long; *sepals* ivory to slightly greenish, densely striped with deep purple, the apical portion and the margins purple, the dorsal sepal oblong-obovate or oblong-lanceolate, acute, 13.5–17.0 mm long, 4.5–5.0 mm wide, 3-veined, free from the lateral sepals, the lateral sepals connate (easily separating) into an elliptical, concave, usually incurved, acute, shortly bifid lamina, 13–15 mm long, 4.5–7.0 mm wide unexpanded, 6-veined; *petals* translucent-ivory, with three purple veins, occasionally with two outer, obscurely verrucose purple stripes, spathulate, unguiculate, serrate-fimbriate above the lower third, acute or subacute, 4.5–5.5 mm long, 2.0–2.5 mm wide; *lip* deep purple, thick, rigid, fleshy, verrucose, trilobed, convex toward the apex, 6.0–6.5 mm long, 3.5–4.0 mm wide, with the margins deflexed and minutely denticulate, the apex broadly rounded, the marginal lobes, on the lower quarter, small, erect, subobovate-auriculate, the disc shallowly sulcate between a low pair of verrucose calli on the middle third, anterior to the marginal lobes, the base truncate, minutely lobed at the angles, hinged to the column-foot; *column* greenish-white, semiterete, slightly winged above the middle, minutely denticulate at the apex, 4–5 mm long, the foot thick, 3 mm long, the anther, rostellum and stigma ventral.

Distribution: This species occurs from Espírito Santo (L.F. Varella, pers. com. 2014), in southeast Brazil, to Paraná and Rio Grande do Sul, in the south. It reaches Argentina in its southernmost distribution.

Figure 2. *Acianthera calopedilon* Toscano & Luer. A – Flower in front view. B – Flower in side view. Photographs by Wade Collier based on *A. Toscano de Brito 3272* (UPCB).

Etymology: The specific epithet derives from the Greek *kalopedilon*, "a wooden shoe," and refers to the shape of the synsepal, which resembles the Dutch all-wooden shoes or clogs.

Acianthera calopedilon is common in private collections and usually confused with *A. saundersiana*, from which it is distinguished by the distinct convex, broadly obtuse lip. It is similar to *A. cephalopodiglossa*, also described herein, with which it has been also confused, but differs mainly in the shape of lateral sepals and lip (see discussion under *A. cephalopodiglossa*). Photographs of specimens of *A. calopedilon* have been labelled "Acianthera andreana" in a few websites (e.g. http://www.aorquidea.com.br/forum/viewtopic.php?t=22299&sid=3f84b872ebc1fd5ea4c215db21ac51e7) but this name has never been validly and effectively published.

Additional Material Examined: BRAZIL: São Paulo, collected by Bauman s.n. from trees along the roadside between São Paulo and Santos, 170 m, May 1976, flowered in cultivation in Easton, Connecticut, 12 Nov. 1977, *C.A. Luer 2174* (SEL). Paraná: without precise locality, collected and cultivated by M. Klingelfus s.n., flowered in cultivation 7 Oct. 2011, *A. Toscano de Brito 2910* (UPCB). Rio Grande do Sul: Santa Vitória do Palmar, Taim, 20 m, collected by Sérgio Englert, flowered in cultivation L.F. Varella s.n., 19 July 2014, *A. Toscano de Brito 3272* (UPCB). ARGENTINA: without precise locality, obtained from Rita Franke in Argentina, flowered in cultivation, 14 Nov. 2003, *B. Rinke s.n.* (SEL-OIC 15729).

Acianthera cephalopodiglossa Toscano & Luer, ***sp. nov***.

TYPE: Brazil. São Paulo: Registro, near sea level, flowered in cultivation, 24 March 2007, *J.L.M. André s.n.* (Holotype: MBM), C.A. Luer illustr. 21182. Fig. 3.

Plant medium in size, epiphytic, long-repent, the rhizome 1.5–3.0 cm between ramicauls; roots slender. *Ramicauls* ascending, erect, slightly compressed and sulcate, 4–7 cm long, with 2 tubular sheaths, one below the middle and another sheath at the base. *Leaf* suberect, coriaceous, broadly elliptical, 5.5–6.5 cm long, 2.0–2.5 cm wide, obscurely notched, acute to subobtuse, the base sessile, obtuse to broadly cuneate. *Inflorescence* a fascicle of successive, single flowers, from the apex of the ramicaul at the base of the leaf, with a spathe 5 mm long; peduncles 10–12 mm long; floral bracts 2 mm long; pedicel 3 mm long; ovary 2 mm long; *sepals* gray with dark purple veins, glabrous, the dorsal sepal oblong-lanceolate, acute, concave below the middle, convex and slightly recurved on the apical third, free from the laterals, 17 mm long, 5 mm wide, 3-veined, slightly carinate on the midvein; lateral sepals connate to the apex into a concave, acute, broadly elliptical-obovate synsepal, 16 mm long, 8 mm wide expanded, 6-veined, obscurely bicarinate; *petals* same color as sepals, lanceolate-spathulate, acute, margins minutely denticulate on the apical half, 5.5 mm long, 1 mm wide, 3-veined; *lip* dark purple, obovate-oblong, trilobed, rigid, coarsely verrucose on the upper surface, 8 mm long, 4 mm wide, 3-veined, the lateral lobes below the middle, erect, rounded, the disc shallowly channeled between a pair of parallel, crested calli on the middle third, the margins erose-denticulate, incurved at the convex apical third, the lateral margins of the apical third folded and auriculate, the base callose, truncate, minutely biauriculate, hinged to the column-foot; *column* semiterete, winged above the middle, minutely denticulate at the apex, 5 mm long, the foot 2.5 mm long, the anther, rostellum and stigma ventral.

Distribution: So far, this species is only known for the municipality of Registro, State of São Paulo, southeastern Brazil.

Etymology: From the Greek *kephalópoda* (= Cephalopoda), a class of mollusks in which octopuses are included, and the Greek element *glossa* (= tongue), in reference to the lip, which resembles the head and mantle of an octopus.

In habit and size of flowers, *Acianthera cephalopodiglossa* is similar to large forms in the *A. saundersiana* complex and to *A. calopedilon*. It is readily distinguished from these and all other *Acianthera* species by the peculiar shape of its verrucose, rigid lip: the apical half is convex and folded on the lateral margins, each fold forming two auricles, the whole lip resembling the head and mantle of an octopus.

Nomenclatural note on *Acianthera saundersiana*

Acianthera saundersiana (Rchb.f.) Pridgeon & M.W.Chase, Lindleyana 16: 246. 2001. Fig. 4–6.

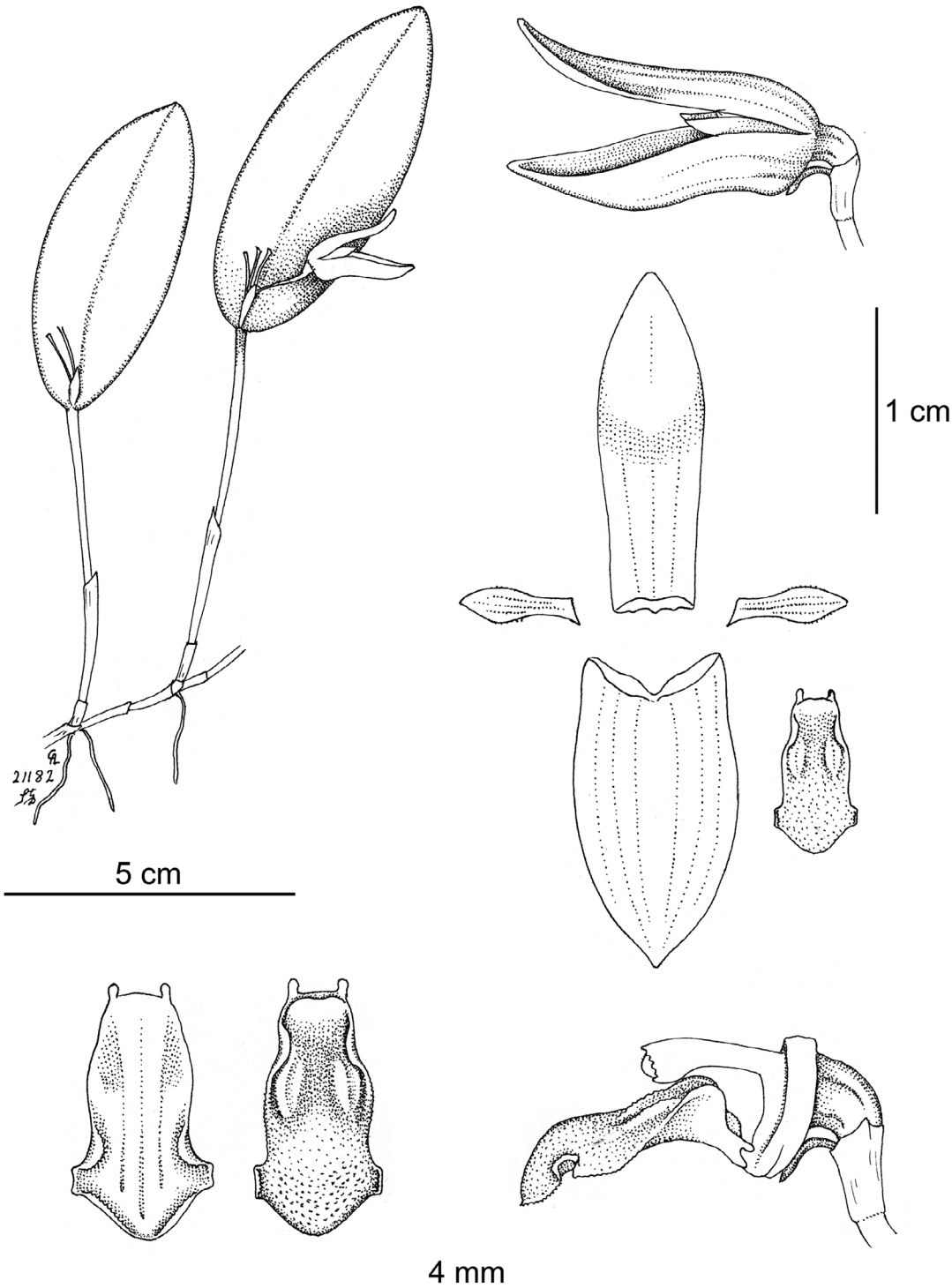

Figure 3. *Acianthera cephalopodiglossa* Toscano & Luer. Drawn by C.A. Luer based on the holotype, *J.L.M. André s.n.* (MBM).

Basionym: *Pleurothallis saundersiana* Rchb.f., Gard. Chron. 74. 1866. TYPE: [BRAZIL?]: without collection data, imported by Messieurs Linden of Brussels, cultivated at Reigate, England, by *W.W. Saunders s.n.* (Holotype: W; Epitype selected here: original plate prepared by W.H. Fitch now kept in the illustration collection in the orchid herbarium at K, reproduced in Saunders's Refug. Bot. 2, tab. 120. 1872).

Synonyms: *Pleurothallis felislingua* Barb.Rodr., Gen. Sp. Orchid. 2: 18. 1881. TYPE: BRAZIL. Rio de Janeiro, Rodeio, *J. Barbosa Rodrigues s.n.* (Holotype: Lost; Lectotype selected by Chiron & Bolsanello in Richardiana 10(4): 203. 2010, here clarified: tab. 158, fig. A, vol. 3 in Iconogr. Orchid. Brésil at the Library of Rio de Janeiro Botanical Garden, cited as tab. 543 (then unpublished) in Barb.Rodr. loc.cit; copied and reproduced in black and white in Cogn., Fl. Bras. (Martius) 3(4), tab. 97, fig. 1. 1896; reproduced in color in Sprunger *et al.*, 1996, vol. 1: 216, fig. A, as "*Pleurothallis saundersiana*").

Pleurothallis josephensis Barb.Rodr., Vellosia, ed. 2, 1: 116. 1891. TYPE: BRAZIL. Minas Gerais, Serra de São José Del Rei, *J. Barbosa Rodrigues s.n.* (Holotype: Lost; Lectotype selected by Chiron & Bolsanello in Richardiana 10(4): 203. 2010, here clarified: tab. 160, fig. E, vol. 3 in Iconogr. Orchid. Brésil at the Library of Rio de Janeiro Botanical Garden, cited as tab. 825 (then unpublished) in Barb.Rodr. loc.cit; copied and reproduced in black and white in Cogn., Fl. Bras. (Martius) 3(4), tab. 93, fig. 5; reproduced in color in Sprunger *et al.*, 1996, vol. 1: 218, fig. E, as "*Pleurothallis saundersiana*").

Pleurothallis repens Rolfe, Bull. Misc. Inform. Kew 1912: 131. 1912, *nom. illeg.*, non Ames 1908. TYPE: Brazil. Without precise locality, imported and found amongst a clump of *Laelia purpurata*, flowered in cultivation 6 Jan. 1904 (not mentioned in the protologue), *F. Wigan s.n.* (Holotype: K).

Pleurothallis juergensii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 35: 54. 1925. TYPE: Brazil. Rio Grande do Sul, Rio Pardo, Fazenda Boa Esperança, 70 m, March 1921, *C. Jürgens 20* (Holotype: B, destroyed).

Pleurothallis insularis Hoehne & Schltr., Arch. Bot. São Paulo 1(3): 217. 1926. TYPE: Brazil. São Paulo, Ilha da Queimada, 6 April 1921, *A. Gehrt s.n.* (Holotype: B, destroyed; Lectotype: SP, designated by Barros in Orchid Memories: 17. 2004).

Pleurothallis josephensis var. *integripetala* Hoehne, Arch. Inst. Biol. (São Paulo) 2: 22. 1929. TYPE: Brazil. São Paulo, fl. cult. 20 May 1897, *G. Edwall ex Comissão Geográfica e Geológica de São Paulo nr. 3705* (Holotype: SP).

Pleurothallis josephensis var. *papillifera* Hoehne, Arch. Inst. Biol. (São Paulo) 2: 22. 1929. TYPES: Brazil. São Paulo, Piassaguera, 14 March 1923, *A. Gehrt s.n*. (Syntype: SP 8236); São Paulo, Ilha da Queimada, 6 April 1921, *A. Gehrt s.n.* (Syntype: SP 5452, also the lectotype of *P. insularis* Hoehne & Schltr.). São Paulo, Serra Negra, 1 June 1927, *F.C. Hoehne s.n.* (Syntype: SP 20633, not located).

Pleurothallis josephensis var. *subcrenulata* Hoehne, Arch. Inst. Biol. (São Paulo) 2: 22. 1929. TYPE: Brazil. Minas Gerais, Pouso Alegre, 1 May 1927, *F. Hoehne s.n.* (Holotype: SP).

Pleurothallis ascendens Garay, Arch. Jard. Bot. Rio de Janeiro 12: 171.1953, replacement name for *Pleurothallis repens* Rolfe.

Specklinia saundersiana (Rchb.f.) F.Barros, Hoehnea 10: 110.1983 [publ. 1984].

Acianthera insularis (Hoehne & Schltr.) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 112: 118. 2007.

Reichenbach described this species in 1866 as *Pleurothallis saundersiana*, based on a specimen obtained by William Wilson Saunders of Hillfield House at Reigate, Surrey, England and whose epithet it honors. No published illustration of this species was known until 1872, when a detailed, partially colored plate was published in Saunders's *Refugium Botanicum*, tab. 120. Reichenbach stated in the protologue that this species was believed to have been imported from Brazil by Hugh Low, from Clapton Nursery, London. However, a note by Saunders in *Refugium Botanicum* (1872) says that he received it from Messieurs Linden of Brussels.

According to Reichenbach (1872), Saunders suggested that the plant might have come from Popayan, Colombia. Although the correct provenance of the specimen cannot be ascertained, it seems that it

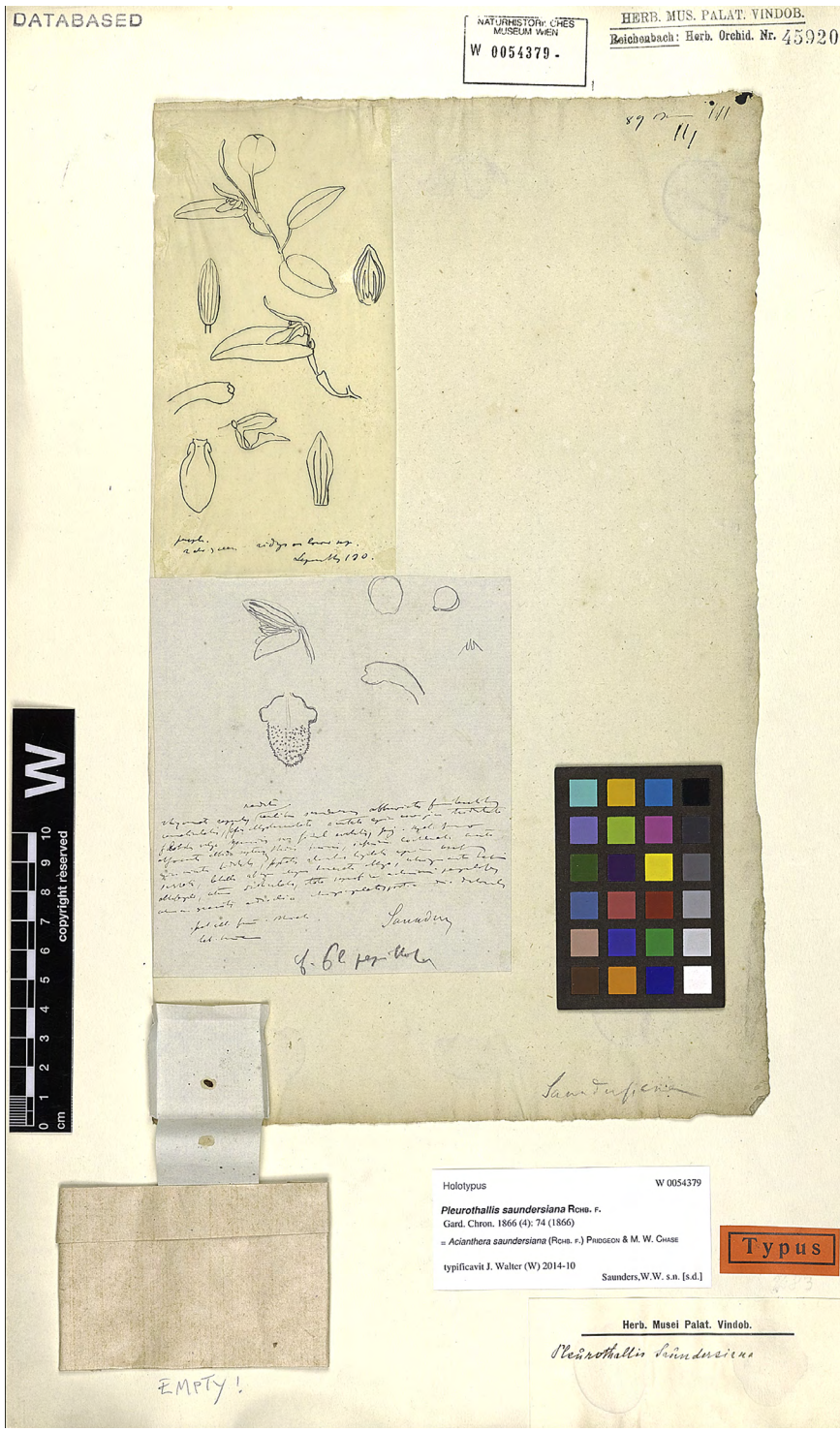

FIGURE 4. Holotype of *Pleurothallis saundersiana* Rchb.f. at W. By permission of the Keeper, Herbarium Natural History Museum in Vienna.

FIGURE 5. Epitype of *Pleurothallis saundersiana* Rchb.f., proposed here. Original plate prepared by Walter Fitch and reproduced in *Refugium Botanicum* plate 120. Reproduced with the permission of the Board of Trustees of the Royal Botanic Gardens, Kew.

was in fact Brazilian in origin as stated by Luer (1977), as this species is common and widespread in Brazil. Still writing in *Refugium Botanicum*, Reichenbach (1872) listed the materials that he had seen of this species, namely: Saunders's specimen and sketches, and his own sketches and description. The type sheet at W (Fig. 4) contains the two cited sketches but the actual specimen seems to have been lost. With the exception of an almost disintegrated lip in one of two envelopes glued on the sheet, nothing else exists. This lip is about 4 mm long and 2 mm wide and agrees well with the drawings on the type sheet and those shown on plate nr. 120 of *Refugium Botanicum*. It is possible that this plate has been based on a clone of Saunders's collection sent to Reichenbach, or probably on a specimen from the same gathering, which might have flowered later in cultivation at Reigate. Reichenbach (1872) stated that he did not see the plant depicted on the *Refugium* plate 120 and that he could not understand the "three flowering stems at once and one of them also two-flowered at once." Nonetheless, this is a common feature, not only in this species but also in other taxa of this complex. As the type of *Pleurothallis saundersiana* contains drawings and only a fragmented lip, we have selected as epitype the original plate (Fig. 5) prepared by the Scottish botanical artist, Walter Hood Fitch (1817–1892), and reproduced in *Refugium Botanicum* plate 120. Fitch's drawings are now kept in the illustration collection in the orchid herbarium at K.

The drawings and fragmented lip on the type sheet and the selected epitype agree well with the illustrations presented by Luer (1977, 2004) and with a collection from Rio de Janeiro that flowered in cultivation at Rio de Janeiro Botanical Garden in 1989 (Fig. 6). They also agree with the types of the taxa placed herein in synonymy and with collections from Peru and Bolivia that we have studied.

Acianthera saundersiana is a variable species and quite common in the Atlantic forests of southeastern Brazil. An assortment of names has been assigned to its synonymy (e.g. Barros *et al.* 2014; Luer 1977, 2004; Chiron & Bolsanello 2010). However, some of these names represent valid species, others are synonyms of distinct species, while a few possess no extant types or usable flowers and could refer to other similar taxa in this complex. We have updated the synonymy of *A. saundersiana* based on the examination and study of types and protologues of various taxa. The synonymy list represents the current knowledge by the authors and might slightly change to include additional binomials in the future. With exception of *A. bidentula*, which is also discussed herein, the excluded binomials will be treated in forthcoming articles.

Plants of *Acianthera saundersiana* are epiphytes and possess a long-repent rhizome that gives rise to a series of suberect to erect ramicauls, 2–5 cm long, each with a sessile, broadly or narrowly elliptical leaf about equally long. From the base of the leaf, a relatively large, short pedunculate, bilabiate flower is produced singly or in a successively two-flowered raceme. The sepals are fleshy and mottled, suffused or striped with purple or brown, the dorsal is slightly longer than the lateral ones, 11–12 mm long, 3–4 mm wide, the laterals 8–10 mm long, 5.0–6.5 mm wide. The petals are small, narrowly obovate, acute, denticulate or erose, 2.5–4.0 mm long, 1.0–1.5 mm wide. The lip 3.5–5.0 mm long, 2–3 mm wide, usually very dark purple, sometimes almost black, thick and oblong with small, marginal, erect, denticulate lobes below the middle, a pair of verrucose calli on the middle third, and a minute lobule at each corner of the base. The column 2.5–3.5 mm long and foot 1.5–2.0 mm long.

As said above, the taxonomy of *Acianthera saundersiana* and other species in this complex has been problematic and confusing since the time of its publication in 1861. Chiron & Bolsanello (2010) attempted to review this species complex in Espírito Santo, southeast Brazil. Unfortunately, most illustrations presented in Chiron & Bolsanello (2010) are crude, lack detail and are therefore misleading. Several of them can fit any of the many species in this complex.

Additional Material Examined: BRAZIL: Without locality, flowered in cultivation in the Jardim Botânico do Rio de Janeiro, 28 Nov. 1989, *C.A. Luer 14487* (SEL). PERU: Amazonas: near Chachapoyas, cultivated in Tacoma, WA, 1993, *K. Tokach 17* (MO), C.A. Luer illustr. 17028. BOLIVIA: La Paz: North of Yungas, wet forest near Rio Coroico, 1100 m, collected in Jan. 1980, flowered in cultivation at SEL 80-235, 30 March 1981, *C.A. Luer et al. 5603* (SEL); Santa Cruz: collected by Janet Kuhn with Fred Fuchs, probably in 1973, cultivated at J & L Orchids, Easton, CT., 29 Oct. 1975, *C.A. Luer 592* (SEL).

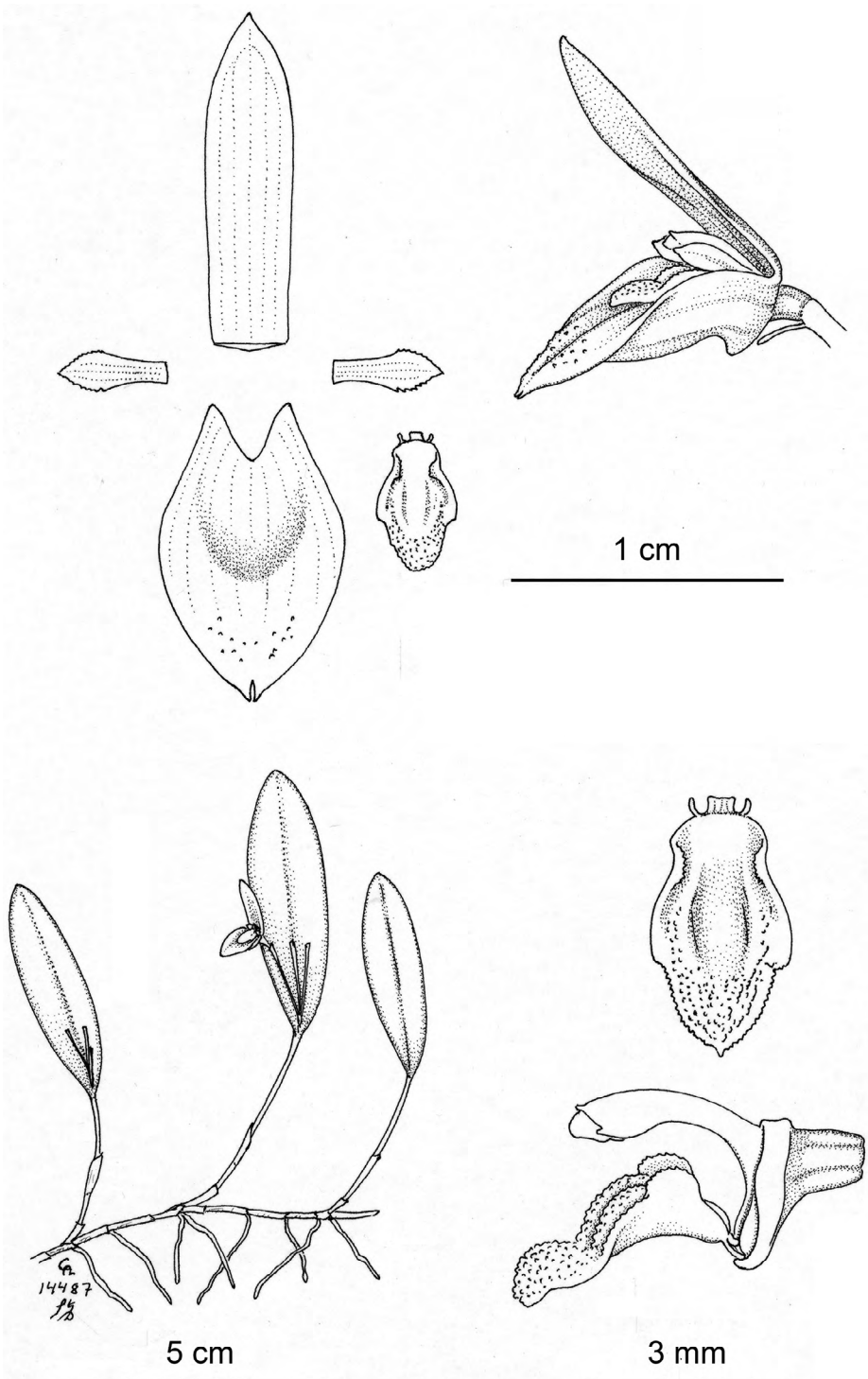

FIGURE 6. *Acianthera saundersiana* (Rchb.f.) Pridgeon & M.W.Chase. Drawn by C.A. Luer based on *C.A. Luer 14487* (SEL).

Nomenclatural note on *Acianthera bidentula*

Acianthera bidentula (Barb.Rodr.) Pridgeon & M.W.Chase, Lindleyana 16: 242. 2001. Fig. 7–8.

Basionym: *Pleurothallis bidentula* Barb.Rodr., Revista Engen. 3(7): 109. 1881. TYPE: BRAZIL. Rio de Janeiro, Palmeiras, *J. Barbosa Rodrigues s.n.* (Holotype: Lost; Lectotype selected by Chiron & Bolsanello in Richardiana 10(4): 201. 2010, here clarified: tab. 158, fig. B, vol. 3, in Iconogr. Orchid. Brésil at the Library of Rio de Janeiro Botanical Garden, cited as tab. 728 (then unpublished) in Barbosa Rodrigues (1881, 1882); copied and reproduced in black and white in Cogn., Fl. Bras. (Martius) 3(4), tab. 93, fig. 4. 1896; reproduced in color in Sprunger *et al.* (1996, vol. 1: 216, fig. B).

Synonyms: *Pleurothallis vinosa* Hoehne & Schltr., Arch. Bot. São Paulo 1: 227. 1926. TYPE: Brazil. São Paulo: Prata, 29 March 1920, *F.C. Hoehne s.n.* (Syntype: B, destroyed; Lectotype: SP [photo seen], designated by Barros in Orchid Memories: 18. 2004. Minas Gerais: Poços de Caldas, 24 March 1920, *F.C. Hoehne s.n*. (Syntype: B, destroyed; Isosyntype: S, photo seen).

Acianthera velteniana Chiron & Xim.Bols., Richardiana 13: 278. 2013. TYPE: Brazil. Espírito Santo, Domingos Martins, 780 m., *L. Velten s.n. ex Chiron 13321* (Holotype: MBML, not located), ***syn. nov.***

Barbosa Rodrigues first described *Acianthera bidentula* in the genus *Pleurothallis* R.Br. based on a specimen from Palmeiras, in Rio de Janeiro. A description first appeared in Revista de Engenharia in 1881 and was later reproduced in Genera et Species Orchidearum Novarum in 1882. Pridgeon and Chase (2001) proposed the new combination *A. bidentula* with a full and direct reference to "*Pleurothallis bidentula* Barb.Rodr., Gen. Spec. Orch. 2: 20. 1882." This, however, is not the place of valid publication of *P. bidentula*. According to article 41.6 of the ICN, Pridgeon's and Chase's error does not affect the valid publication of their new combination.

According to Barbosa Rodrigues (1881, 1882), *Pleurothallis bidentula* was apparently a common species in the type locality for it was found covering tree trunks in the virgin forests of Palmeiras. As far as we could ascertain, Palmeiras is a locality in the municipality of Paulo de Frontin, formerly Rodeio, in the State of Rio de Janeiro. Barbosa Rodrigues collected extensively in Rodeio and described several new species from this area (see Duveen & Toscano de Brito, 1991).

The type specimen of *P. bidentula* is lost and the only extant original material is the illustration that appeared in Barbosa Rodrigues's *Iconographie des orchidées du Brésil*, which is now deposited in the library of Rio de Janeiro Botanical Garden. This illustration, of which a copy is reproduced here (Fig. 7), was selected as lectotype by Chiron & Bolsanello (2010). It was copied and reproduced in black and white in Cogniaux (1896) and reproduced in color in Sprunger *et al.* (1996). Despite the fact that Barbosa Rodrigues neither included measurements in his original description nor in his original illustration, plant and floral sizes of this species can be traced back through consultation of Barbosa Rodrigues's original illustration and Cogniaux's orchid illustration in Martius's *Flora Brasiliensis* (1896). Barbosa Rodrigues's original drawings show a small, repent plant whose ramicauls are c. 1 cm apart, the ramicauls are only c. 1 cm long, leaves are 2.0–2.5 cm long, 1.3–1.5 cm wide, the inflorescence is single-flowered, the dorsal sepal 8.5–9.0 mm long, 2.5 mm wide, and c. 1 mm fused with the synsepal at base, synsepal is c. 8 mm long, 6.5 mm wide, petals c. 3 mm long, 1.25 mm wide, and the lip c. 3.25 mm long, 2.25 mm wide across the lateral lobules. The column is enlarged and is shown in side view, but no enlargement ratio is provided. Based on other collections we studied, we believe the column was about 2.5 mm long. As far as flower color is concerned, the sepals are described as white, the dorsal sepal as having 3 lines, the synsepal suffused with purple, the lip and column-foot purple. Cogniaux (1896) expanded significantly Barbosa Rodrigues's original description of *Acianthera bidentula* (as *Pleurothallis bidentula*) by adding measurements and information on the morphology of this species. Although his description mostly agrees with Barbosa Rodrigues's illustration, it was based not only on Rodrigues's illustration and description but also on examination of an additional Brazilian collection by L. Riedel, a specimen without precise provenance. We have been unable to locate Riedel's collection and confirm Cogniaux's determination.

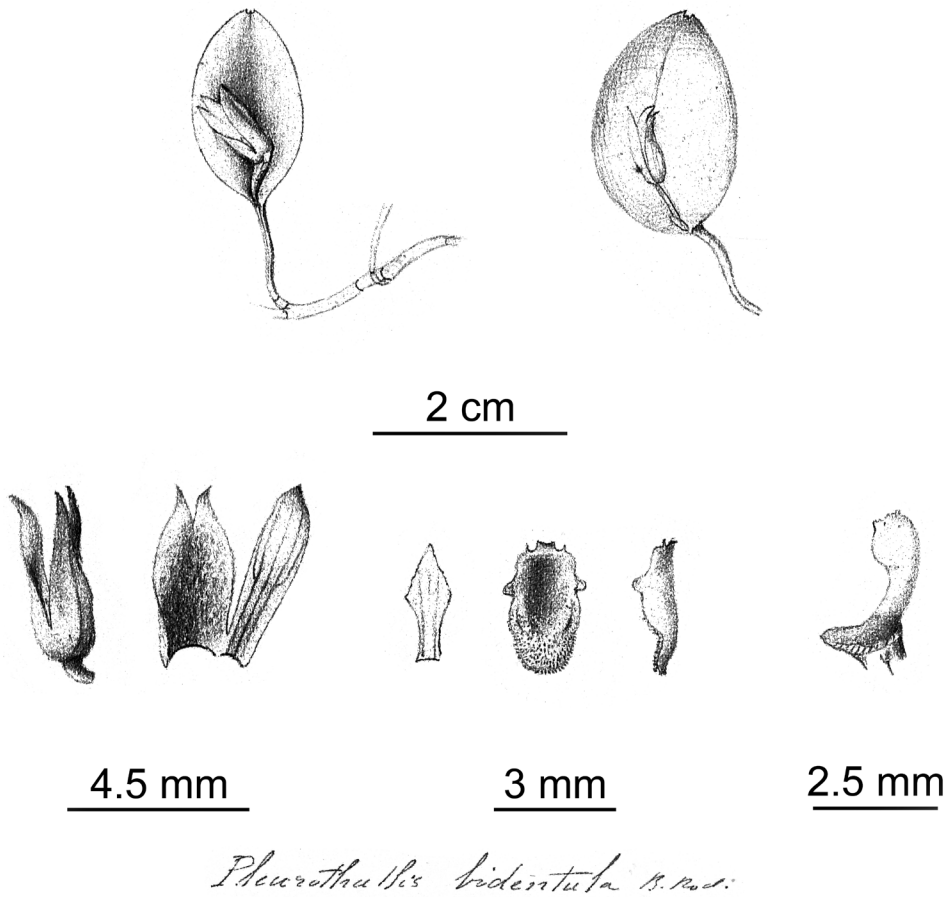

FIGURE 7. *Acianthera bidentula* (Barb.Rodr.) Pridgeon & M.W.Chase. Barbosa Rodrigues's original illustration reproduced in Sprunger *et al.* (1996: vol. 1: 216, fig. B, as *Pleurothallis bidentula* Barb.Rodr.) and here modified to show this species with estimated scales. Reproduced with permission of the Reinhardt Verlag, Basel.

In the absence of an actual specimen, it is impossible to be sure of the true identity of *Pleurothallis bidentula* and any conclusion relies on interpretation of the only extant materials, namely, Barbosa Rodrigues's original illustration and description. Nevertheless, as illustrated in Barbosa Rodrigues's *Iconographie*, this species is shown to be distinct from all other species in the *Acianthera saundersiana* complex. The closest taxon, and certainly only a variant with slightly larger leaves, is *P. vinosa* Hoehne & Schltr., which Pabst & Dungs already reduced to synonymy in 1975. The collections we have so far examined agree well with Barbosa Rodrigues's original illustration. With the exception of the dorsal sepal, which is narrower in Barbosa Rodrigues's drawings, overall floral size and morphology fit: dorsal sepal 10–12 mm long, 4–5 mm wide; synsepal 8–12 mm long, 6–8 mm wide; petals 2.5 mm long, 1–2 mm wide; lip 3.3–4.0 mm long, 2 mm wide, column c. 2.5 mm long. The dorsal sepal of *P. bidentula* is illustrated and described as fused to the synsepal at base. In the specimens examined, dorsal sepal is obscurely fused to the synsepal. One would feel tempted to use this feature to separate this species from others in this complex. However, fusion of dorsal sepal and synsepal can be observed in a certain degree in other species of this complex (e.g. *A. glanduligera* (Lindl.) Luer, *A. rostellata* (Barb. Rodr.) Luer, and *A. serpentula*) and cannot be used to distinguish this species.

Acianthera bidentula is apparently a common species in southeast Brazil. It has been found in Rio de Janeiro, São Paulo and Minas Gerais, and has been recently redescribed as *A. velteniana* Chiron & Xms.

Figure 8. *Acianthera bidentula* (Barb.Rodr.) Pridgeon & M.W.Chase. A – Habit. B – Flower in side view. A: Photographed by A. Toscano de Brito based on *A. Toscano de Brito 2890* (UPCB); B: Photographed by Wade Collier based on *A. Toscano de Brito 3289* (UPCB).

Bols. based on a collection from Domingos Martins, in Espírito Santo. *A. velteniana* is only distinguished from the lectotype of *Pleurothallis bidentula* by the slightly shorter, more elliptical, subdeltoid petals. However, petals of *A. bidentula* seems to vary even in the same individual and cannot be used to distinguish these two species. Figures 8A–8B are based on cultivated specimens from Rio de Janeiro. Figure 9 illustrates a collection from Domingos Martins, Espírito Santo, Brazil, the type locality of *A. velteniana*. We have been unable to locate the holotype of *A. velteniana* at MBML and apparently it has never been deposited there (L. Kolmman 2014, pers. com.). Barros *et al.* (2014) recorded *A. bidentula* for Rio Grande Sul, Santa Catarina, and Paraná. We have been unable to study any collection of *A. bidentula* from these Brazilian states. We believe that these records are based on misidentifications.

Additional Material Examined: BRAZIL: without collection data, purchased from Seidel in 2004, 15 March 2007, *D.H. Baptista 071* (SEL), C.A. Luer illustr. 21115; without collection data, flowered in cultivation in Piracicaba, São Paulo, 15 March 2007, *D.H. Baptista* 058 (SEL), C.A. Luer illustr. 21128. Espírito Santo: Domingos Martins, flowered in cultivation by R.A. Kautsky 807, 3 Feb. 1991, *A. Toscano de Brito 912* (SEL), C.A. Luer illustr. 20558. Rio de Janeiro: without precise locality, obtained from Orquidário Exdra in Rio de Janeiro, flowered in cultivation by M. Klingelfus s.n., 31 July 2014, *A. Toscano de Brito 3289* (UPCB); without precise locality, flowered in cultivation by M. Klingelfus s.n., 24 July 2011, *A. Toscano de Brito 2890* (UPCB).

Nomenclatural Note on *Acianthera serpentula*

Acianthera serpentula (Barb.Rodr.) F. Barros, Hoehnea 30: 187. 2003.

Basionym: *Pleurothallis serpentula* Barb.Rodr., Gen. Sp. Orchid. 2: 20.1882, replacement name for *Pleurothallis punctata* Barb.Rodr. 1877, *non* Ker Gawl. 1823, *nec* Lindl. 1835, *nec* Schltr. 1919. TYPE: BRAZIL. Minas Gerais, Caldas, *J. Barbosa Rodrigues s.n.* (Holotype: Lost;

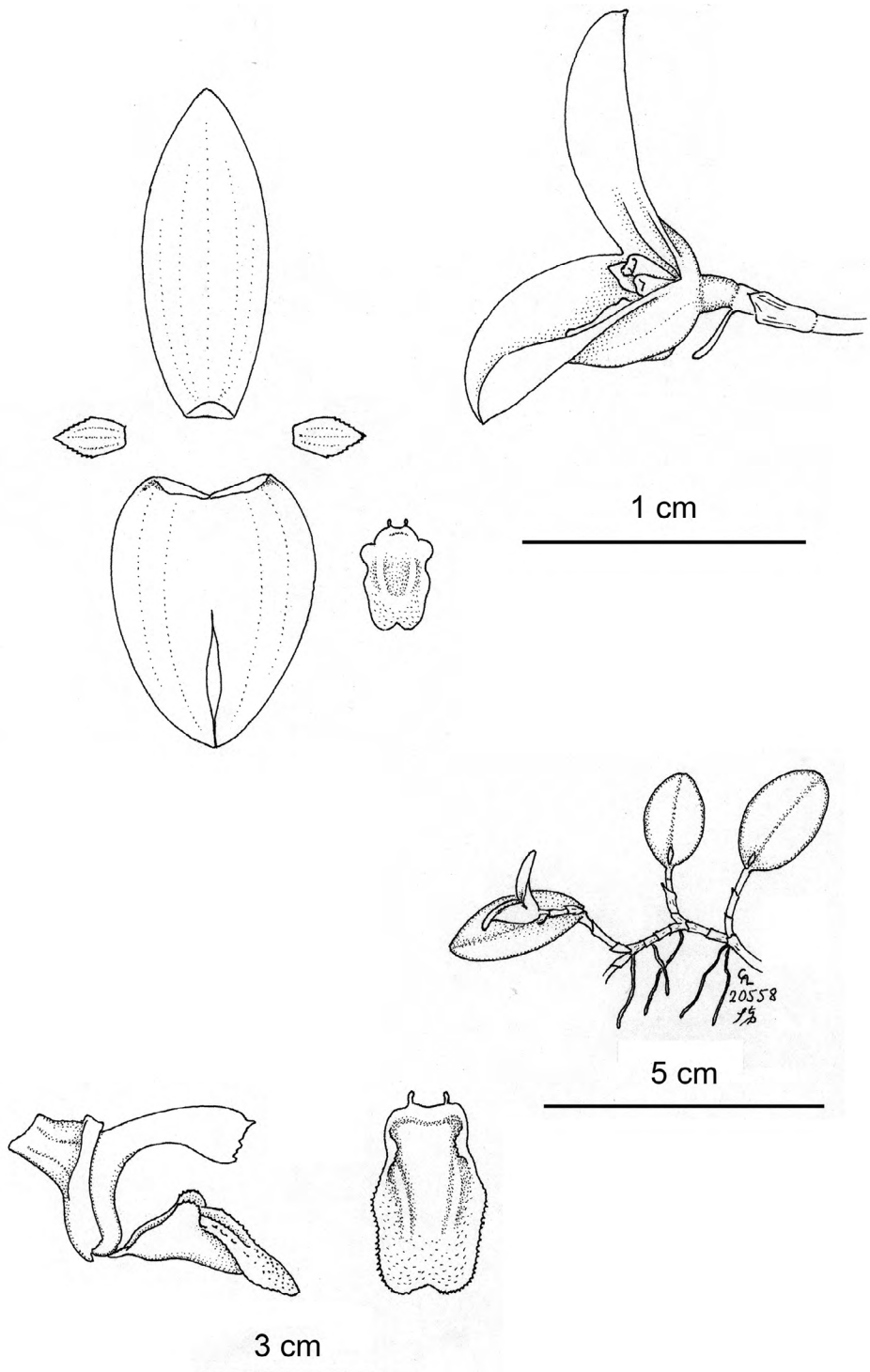

Figure 9. *Acianthera bidentula* (Barb.Rodr.) Pridgeon & M.W.Chase. Drawn by C.A. Luer based on *A. Toscano de Brito 912* (SEL).

Lectotype designated by Barros in Hoehnea 30(3): 187. 2003: *A. Regnell III-1649* (SP), here rejected. New lectotype designated here: tab. 167, fig. A, vol. 3 in Iconogr. Orchid. Brésil at the Library of Rio de Janeiro Botanical Garden, cited as tab. 407 A (then unpublished) in Barbosa Rodrigues (1877, as *Pleurothallis punctata*); copied and reproduced in black and white in Cogn., Fl. Bras. (Martius) 3(4), tab. 97, fig. 5.1896; reproduced in color in Sprunger *et al.* (1996, vol. 1: 225, fig. A).

Barbosa Rodrigues proposed the name *Pleurothallis serpentula* in 1882 to replace the illegitimate name *P. punctata* Barb.Rodr., which he published in 1877. As already stated elsewhere (e.g. Cribb & Toscano de Brito 1966; Buzatto *et al.* 2013, Toscano de Brito 2013), Barbosa Rodrigues did not explicitly cite type specimens in his publications. Following standard rules of his time, he only cited provenance and flowering time of his collections. Most of Barbosa Rodrigues's illustrations were based on living material and are usually dated. The original plate of *P. serpentula*, which is reproduced in Sprunger *et al.* (1996, vol. 1: 225, fig. A), shows the following information: "Caldas 19 December 1876." When Barros (2003) transferred this species to the genus *Acianthera*, he claimed to have seen an isotype at SP, a collection made by A. Regnell, nr. III-1649, dated 26 December 1876. We have seen a photograph of this collection at SP and images of duplicates at P and BR. There seems to exist a confusion with the collection dates of these specimens. Differently from the collection at SP, the specimen deposited at P is dated 28 June 1878, while a duplicate at BR is dated January ("Janv.") 1877. Even though it is difficult at present to ascertain a correct collection date for Regnell's materials, this is actually not relevant for the purpose of typification of this species. Regardless the collection date, Regnell's collection nr. III-1649 is not the type of *P. serpentula*.

When Barbosa Rodrigues (1882) proposed the new name *Pleurothallis serpentula*, he made a direct reference to the protologue of his *P. punctata*, the replaced synonym. He also cited Regnell's collection nr. III-1849 (most probably an error for "III-1649"). In Barbosa Rodrigues's *Iconographie*, Regnell's collection number III-1649 is found next to the floral analysis of *P. serpentula* and was later annotated there by his son, João Barbosa Rodrigues Jr. Regnell's collection is not cited anywhere in the original description of *P. punctata* and, therefore, it is not part of the protologue of this species. Barbosa Rodrigues based his illustration of *P. punctata* on a specimen he collected in Caldas, most certainly around the same date he made his illustration, i.e., on 19 December 1876. This collection should be considered the type of the name *P. punctata* and therefore the type of *P. serpentula*, the replacement name. Unfortunately, Barbosa Rodrigues's actual specimen has been lost. For this reason, we have selected as lectotype the original illustration in Barbosa Rodrigues's unpublished *Iconographie*, the only extant original material.

Acianthera serpentula is apparently related to *A. saundersiana* and to several other similar taxa in this complex. The floral color in Barbosa Rodrigues's original illustration, mainly the dorsal sepal, resembles that of *A. calopedilon*. However, *A. serpentula* is readily distinguished not only from these two species, but also from all others in this complex, by the shape of its oblong, slightly pandurate lip. It is apparently a rare species, whose actual specimens, living or preserved, we have so far not been able to study.

Acknowledgments. The present paper is part of the project "The Pleurothallid Orchids of Brazil: Contributions to an inventory and an understanding of evolution, ecology and conservation," currently sponsored by the Marie Selby Botanical Gardens. We thank Wade Collier for providing photographs used in this article; the curator of SP, Maria Candida Mamede, for making available several images of types deposited at SP; Luiz Fillipe Varella, Jacques Klein, and Bryon Rinke, for providing specimens and additional information on *Acianthera calopedilon*; Maria Rita Cabral for providing useful information on *A. velteniana*; Kanchi Gandhi of AMES for his assistance in resolving some nomenclatural issues; Rudolf Jenny for help in obtaining literature; Nancy Karam and Wade Collier for help in assembling the illustrations; Stig Dasltröm for inking the illustrations, and the Pleurothallidinae Alliance for making it possible.

Literature Cited

Barros, F. de, Vinhos, F., Rodrigues, V.T., Barberena, F.F.V.A., Fraga, C.N., Pessoa, E.M., Forster, W. & Menini Neto, L. (2014). Orchidaceae in Lista de espécies da flora do Brasil. Jardim Botânico do Rio de Janeiro. Published on the Internet: http://reflora.jbrj.gov.br/jabot/floradobrasil/

FB11051Accessed on: 17 Sept. 2014.

Barbosa Rodrigues, J. (1881). Orchideae rodeienses et alterae ineditae. *Revista Engen.,* 3(7), 109–110.

Barbosa Rodrigues, J. (1882). *Genera et species orchidearum novarum*. Vol. 2. Typographia Nacional, Rio de Janeiro.

Chiron, G.R. & Bolsanello, R.X. (2010). Quatre taxons nouveaus pour l'Éspírito Santo (Brésil) dans le morphogroupe *Acianthera saundersiana* (Orchidaceae). *Richardiana,* 10(4), 198–220.

Chiron, G.R. & van den Berg, C. (2012). Révision taxinomique du genre *Acianthera* (Orchidaceae, Pleurothallidinae). *Richardiana,* 12(2), 59–77.

Cogniaux, A. 1896. Orchidaceae, Fl. Bras. (Mart.) 3(4): 317–672.

Duveen, D. & Toscano de Brito, A.L.V. (1991). Barbosa Rodrigues (1842--1909) and his round-up of orchids at Rodeio. *Orchid Digest*, 55(4), 149–154.

Luer, C.A. (1977). Icones Pleurothallidinarum (Orchidaceae). Miscellaneous Species in the Pleurothallidinae. *Selbyana*, 3(3–4), 382.

Luer, C.A. (2004). Icones Pleurothallidinarum XXVI. Systematics of *Pleurothallis* subgenus *Acianthera* (Orchidaceae). *Monogr. Syst. Bot. Missouri Bot. Gard.*, 95, 64--65

Pabst, G.F.J. & Dungs, F. (1975). *Orchidaceae Brasilienses*, Vol. 1. Brücke-Verlag Kurt Schmersow, Hildesheim.

Pridgeon, A.M. & Chase, M.W. (2001). A phylogentic reclassification of the Pleurothallidinae (Orchidaceae). *Lindleyana,* 16(4), 235–271.

Saunders, W.W. (ed.) (1872). *Refugium Botanicum or figures and descriptions from living specimens of little known or new plants of botanical interest*, Vol. 2. John van Voorst, London.

Sprunger, S., Cribb, P. J. & Toscano de Brito, A. L. V. (eds.). (1996). *João Barbosa Rodrigues - Iconographie des orchidées du Brésil, Vol. 1: The illustrations*. Friedrich Reinhardt Verlag, Basel.

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A NEW SPECIES AND A NEW RECORD IN *TRICHOSALPINX* (ORCHIDACEAE: PLEUROTHALLIDINAE) FROM PERU

LISA THOERLE[1,3] & CARMEN SOTO[2]

[1] 23 John Dyer Rd, Little Compton, Rhode Island, U.S.A.
[2] Inka Terra Association - ITA, Machu Picchu, Cusco, Peru
[3] Corresponding author: lthoerle@cox.net

ABSTRACT. A new species in *Trichosalpinx* is described, illustrated, and compared with similar species, and a new record for Peru is described and illustrated. A brief history of the genus is provided. *Trichosalpinx reticulata* is most similar to *T. carmeniae*, but differs with a reticulated, gray-green leaf; a longer inflorescence; and a lip with a pair of low, rounded basal lobes and an obtuse apex. *Trichosalpinx acremona* is recorded from Peruvian collections.

KEY WORDS: *Trichosalpinx*, Pleurothallidinae, Peru, taxonomy

In 1983, Luer proposed the genus *Trichosalpinx* to unite 85 species mostly scattered between various sections and subsections of the genus *Pleurothallis* R. Br., but the first species destined for this genus was discovered 181 years earlier. During their epic collecting expedition in the Americas around the dawn of the nineteenth century, Humboldt and Bonpland collected a plant in 1802 that Kunth later described as *Dendrobium pusillum* (Humboldt *et al.* 1816), now *Trichosalpinx pusilla* (Kunth) Luer. In the notes accompanying the original description in 1816, Kunth wondered if it might not better be described in the genus *Masdevallia* Ruiz & Pav., but allowed the difficulty of examining such a small flower, coupled with the small number of specimens, to dissuade him. Before the century was out, Lindley transferred this taxon first to *Specklinia* Lindl. (1835) and then to *Pleurothallis* (1842). The confusion was not limited to this species: Lindley described the species currently known as *T. ciliaris* (Lindl.) Luer and *T. orbicularis* (Lindl.) Luer in the genus *Specklinia* in 1838, and the present day *T. arbuscula* (Lindl.) Luer and *T. intricata* (Lindl.) Luer in the genus *Pleurothallis* several years later (Lindley 1842, 1846). Subsequent species described and transferred by many others were attributed to *Pleurothallis*, *Lepanthes* Sw., *Physosiphon* Lindl., and *Humboltia* Ruiz & Pav.

Not all of Luer's original 85 species remained in the genus *Trichosalpinx*, some having been transferred yet again to other genera, but new discoveries had boosted the number of species to 97 when Luer revised the genus and sorted the species between four subgenera in 1997. Luer differentiated species of *Trichosalpinx* from the three other genera in the Pleurothallidinae characterized by ramicauls with lepanthiform sheaths (*Lepanthes* Sw., *Lepanthopsis* Ames, and *Draconanthes* Luer) by the column, with four variations accepted in *Trichosalpinx*. Subgenus *Tubella* Luer, which includes the proposed species *T. reticulata* Thoerle & C. Soto and the newly reported *T. acremona* (Luer) Luer, is characterized by a slender column with a column-foot and an unhooded but more or less winged apex, as well as slender ramicauls, often proliferating; racemes usually longer than the leaf; and flowers with lateral sepals nearly free from one another, entire petals, and an eciliate lip lacking basal lobules. Current investigations at the Jardín Botánico Lankester show that *Trichosalpinx sensu* Luer and subsequent rearrangements (Archila 2000) are not monophyletic, and generic-level changes are expected (Fernández 2013; Fernández & Bogarín 2013; Fernández & Karremans pers. comm. 2014).

Since 1997, the discovery of new species has resulted in a total of about 112 species accepted in *Trichosalpinx* (Luer 1998, 2002, 2006, 2007, 2009; Fernández-Concha & Ramírez 1998; Archila 2000; Christenson 2001; Fernández & Bogarín 2011, 2013). Approximately 15 species in subgenus *Tubella* have been identified in Peru. About an equal number of described species in the subgenus are known from very close to the borders of Peru and may be expected to occur there.

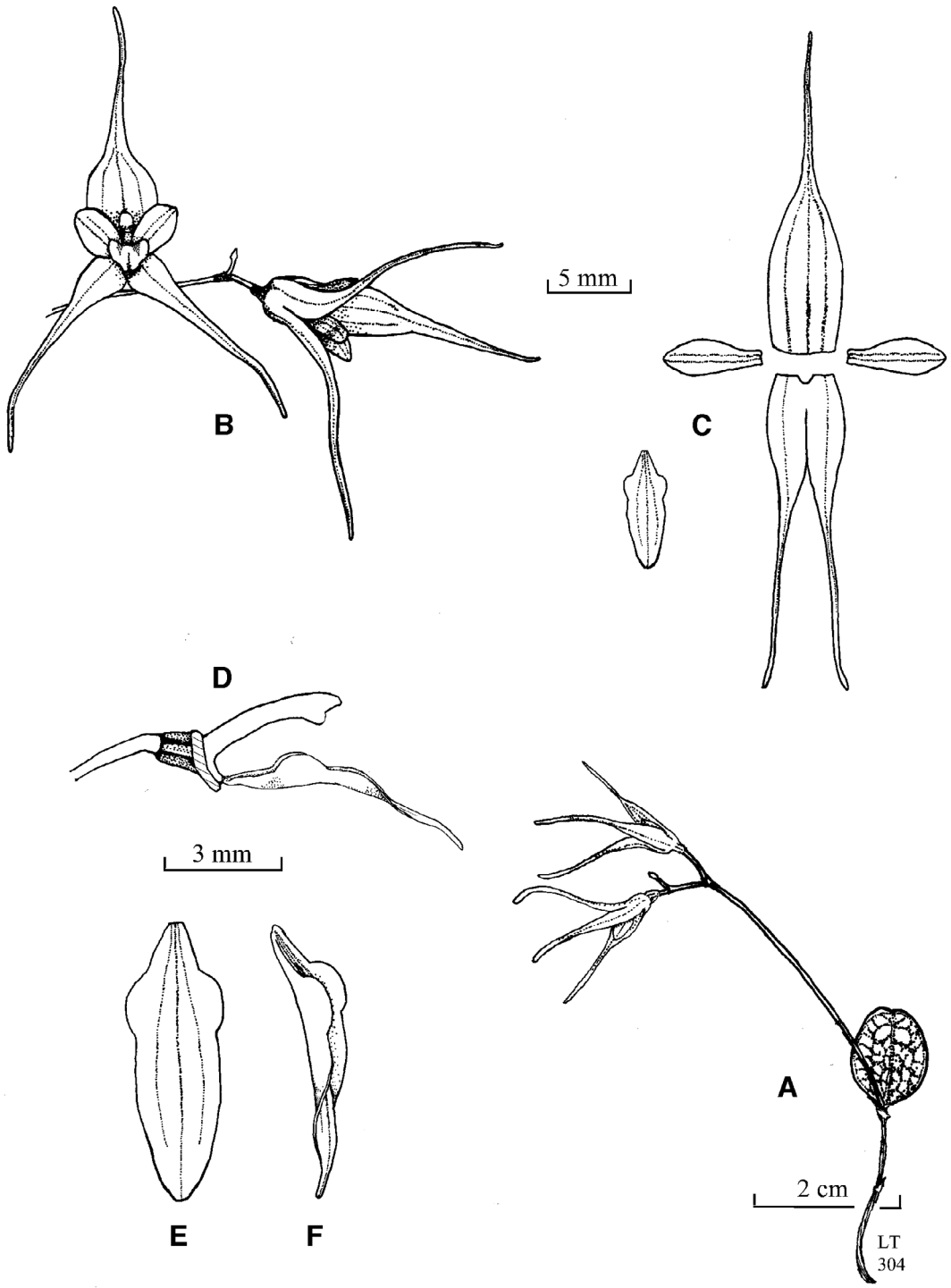

FIGURE 1. *Trichosalpinx reticulata* Thoerle & C.Soto. A. Habit. B. Detail of the inflorescence. C. Dissected perianth, expanded. D. Ovary, lip, and column, lateral view. E. Lip, expanded. F. Lip, oblique view. Drawn by L. Thoerle from *C. Soto Trichosalpinx #3* (isotype: MO).

Trichosalpinx reticulata Thoerle & C.Soto, ***sp. nov.***

TYPE: Peru. Cusco, on the side of a mountain within the Historic Sanctuary of Machu Picchu, 2200 m, 24 April 2012, collected by Daniel Auccayllo *et al.,* flowered in cultivation at the Inkaterra Machu Picchu Pueblo Hotel April 2013, *C. Soto Trichosalpinx #3* (holotype: USM!; isotype: MO!). Figs. 1, 2.

Diagnosis: This species is similar to *Trichosalpinx carmeniae* Luer, but differs in having gray-green, reticulated leaves, and a much longer inflorescence bearing flowers with a lip with a pair of low, rounded basal lobes and an obtuse apex.

Plant small, epiphytic, caespitose. *Roots* slender. *Ramicauls* erect to suberect, slender, 2-3 cm long, enclosed by 2-3 tight, ribbed, microscopically scabrous lepanthiform sheaths with dilated, acuminate ostia. *Leaf* coriaceous, gray-green with purple reticulation, broadly elliptical to subcircular, apex rounded and minutely retuse with a small, deflexed apiculum, 11-12 mm long, 9-10 mm wide, the broadly cuneate base abruptly contracted into a petiole 3 mm long. *Inflorescence* from the apex of the ramicaul, a loose, simultaneously few-flowered raceme of 2-4 flowers with the dorsal sepal closest to the rachis, displaying the exterior of the lateral sepals in the natural arrangement, at least 6-7 cm long including the erect to suberect peduncle 4-5 cm long. *Floral bracts* microscopically verrucose, acuminate, 1.5 mm long. *Pedicels* 6 mm long. *Ovary* 1 mm long, sulcate. *Flowers* light tan-yellow with veins marked with red. *Sepals* glabrous, membranous. *Dorsal sepal* oblong, concave at the base, 20 mm long with a blade 11 mm long, 5 mm wide, 3-veined, acute, acuminate into a slender tail 9 mm long, connate to the lateral sepals for 1 mm. *Lateral sepal*s narrowly oblong, 20 mm long with a blade 9 mm long, 2.5 mm wide, 1-veined, connate 2 mm, the apices acute, acuminate into slender tails 11 mm long. *Petals* glabrous, obovate, apex obtuse, 5.5-6 mm long, 2 mm wide, 2-veined. *Lip* glabrous, elliptical, apex obtuse, 7 mm long, 3 mm wide expanded, 3-veined, the margins erect below the middle with low, rounded side lobes, the broadly cuneate base hinged to the tip of the column-foot. *Column* slender, with small, obtuse, rounded apical wings, 3-3.5 mm long, column-foot 0.5 mm long. *Anther* and *stigma* ventral. *Pollinia* not observed.

Figure 2. *Trichosalpinx reticulata* Thoerle & C.Soto. The plant from which the type specimens were harvested. Photograph by C. Soto.

Distribution: Known only from the Historic Sanctuary of Machu Picchu, Peru.

Etymology: From the Latin *reticulatus*, "netted," for the netlike pattern on the leaves.

Habitat in Peru: It grows epiphytically on small trees of Lauraceae, nestled in moss and lichens, approximately two meters above the ground, in wet cloud forest at an elevation of 2200 m.

Phenology: Cultivated along Inkaterra's orchid trail, this species flowers in January, February, and April.

Trichosalpinx reticulata is most similar to the recently described *T. carmeniae* Luer (fig. 3, 4). The leaves of *T. reticulata* are smaller, proportionally wider (index *ca*. 1.2), and gray-green in color, reticulated with purple; those of *T. carmeniae* are longer, proportionally more slender, 15-16 mm long and about 8 mm wide (index *ca*. 1.9), and green without the attractive reticulation. The inflorescence of *T. reticulata* is about

FIGURE 3. *Trichosalpinx carmeniae*. A flower of the plant from which the type specimens were harvested. Photograph by C. Soto.

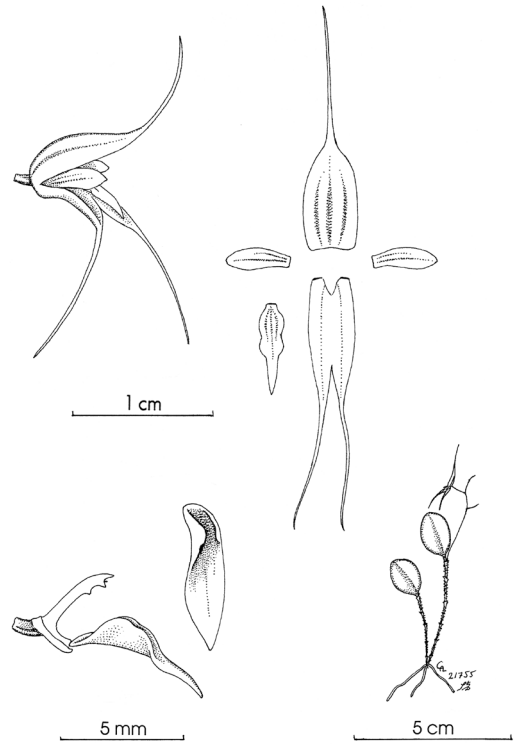

FIGURE 4. *Trichosalpinx carmeniae*. A. Habit. B. Flower. C. Dissected perianth, expanded. D. Ovary, lip, and column, lateral view. E. Lip, oblique view. Drawing by C. A. Luer from *C. Soto Trichosalpinx #1* (MO). Reproduced with the permission of C. A. Luer and the Orchid Herbarium of Oakes Ames, Harvard University Herbaria..

thrice as long as that of *T. carmeniae.* The long-tailed, acuminate sepals and the relatively large, two-veined petals are similar in size and shape. The petals and lip of *T. carmeniae* are solid rose in color, while those of *T. reticulata* are tan-yellow with red veins. The pair of low, well-defined, rounded lobes on the erect margins of the basal third of the lip of *T. reticulata* differs from the obscurely 4-lobed basal half of the lip in *T. carmeniae*. The apex of the lip of *T. carmeniae* is acute, rather than obtuse.

The Inka Terra Association Team discovered this lovely species on the mist-swept side of a mountain within the Historic Sanctuary of Machu Picchu. It grows on thin branches of a small tree in the Lauraceae, nestled in moss and lichens, approximately two meters above the ground. In cultivation along Inkaterra's orchid trail, *Trichosalpinx reticulata* flowers in January, February, and April.

Trichosalpinx acremona (Luer) Luer, Phytologia 54: 394. 1983.

TYPE: Ecuador. Collected by Janet Kuhn, without locality, flowered in cultivation by J & L Orchids, Easton, Connecticut, USA, November 1975, *C. Luer 596* (holotype: SEL). Fig. 5.

DISTRIBUTION: Colombia, Ecuador, Peru, Bolivia.

ETYMOLOGY: From the Greek *acremon*, "a branch," referring to the branching habit of the plant.

HABITAT IN PERU: Epiphytic in wet cloud forest in the Historic Sanctuary of Machu Picchu between 2200 and 2600 m elevation.

PHENOLOGY: In cultivation along Inkaterra's orchid trail, this species flowers in March and April.

PERUVIAN MATERIAL STUDIED: Cusco: Montaña Poques,

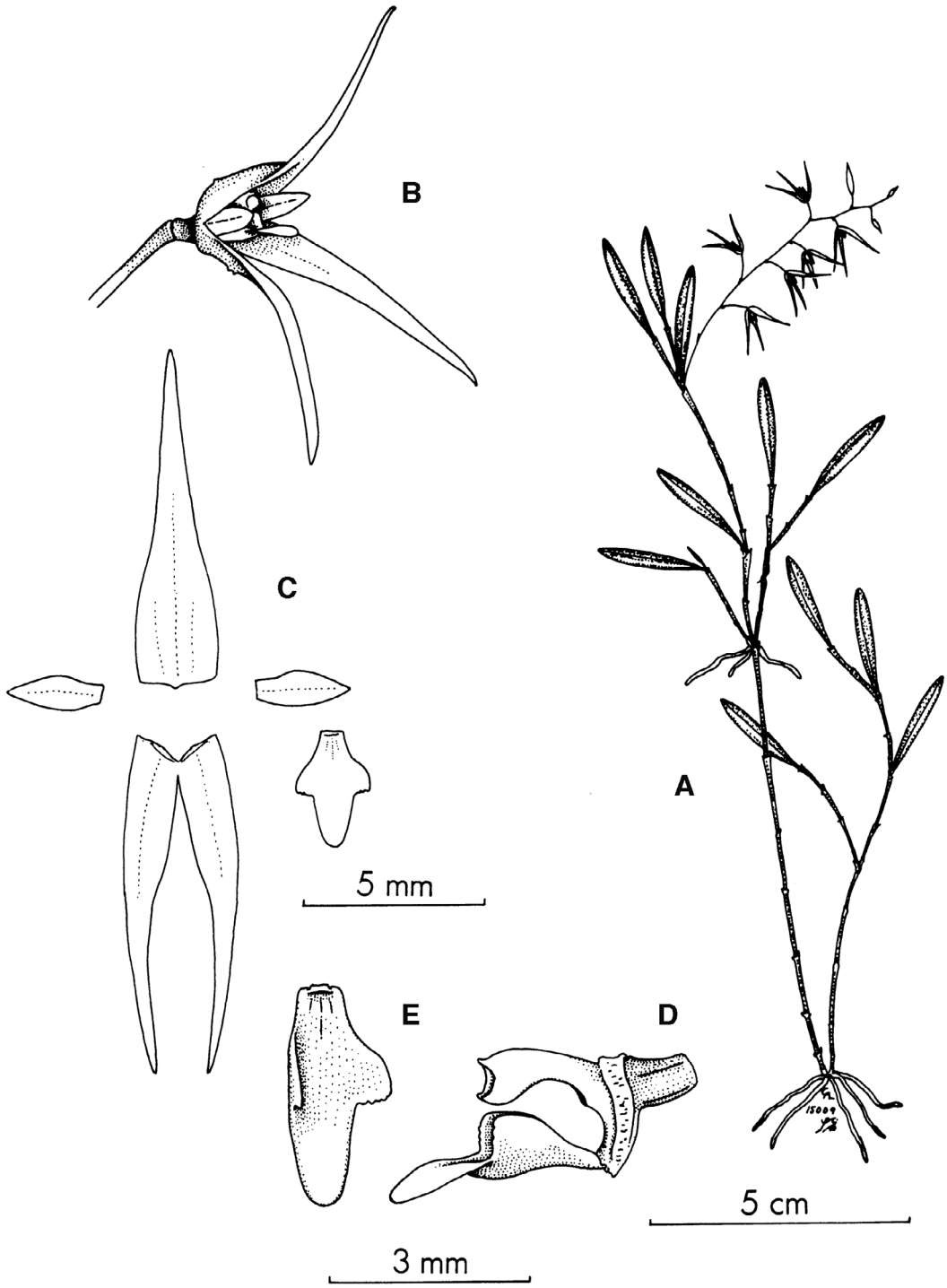

Figure 5. *Trichosalpinx acremona.* A. Habit. B. Flower. C. Dissected perianth, expanded. D. Ovary, lip, and column, lateral view. E. Lip, right side expanded. Drawing by C. A. Luer from *C. Luer et al. 15009* (MO). Reproduced with the permission of C. A. Luer and the Missouri Botanical Garden Press.

Figure 6. *Trichosalpinx acremona.* The plant from which the type specimen was harvested (*C. Soto Trichosalpinx #7*, MO). Photograph by C. Soto

within the Historic Sanctuary of Machu Picchu, 2200 m elevation, 24 April 2012, collected by Daniel Auccayllo *et al*., flowered in cultivation at the Inkaterra Machu Picchu Pueblo Hotel April 2013, *C. Soto Trichosalpinx #4* (USM!, MO!). Same area, 2600 m elevation, 24 April 2012, collected by Daniel Auccayllo *et al.*, flowered in cultivation at the Inkaterra Machu Picchu Pueblo Hotel April 2013, *C. Soto Trichosalpinx #7* (MO!). Fig. 6.

Trichosalpinx acremona has long been suspected to occur in Peru, because existing collections are known from the eastern slopes of the Andes in the surrounding countries of Colombia and Ecuador to the north, and Bolivia to the south (Luer 1997). The two specimens cited here were collected within the Historic Sanctuary of Machu Picchu by the Inka Terra Association team.

Trichosalpinx acremona (figure 5) shares a prolific growth habit, with subsequent ramicauls arising from the apex of older ramicauls, and flowers with long, slender, acuminate sepals with a number of species in the subgenus *Tubella*. From these similar species, *T. acremona* is most easily distinguished by the lip. The well-developed, erect lateral lobes on the basal half of the lip are distinctively antrorse with an anterior margin ranging from irregular to minutely erose. The rounded apical portion is thickened and cellular-glandular to minutely verrucose above a smooth, featureless disc.

Acknowledgments. The authors thank the National Service of Natural Protected Areas (SERNANP) for the permits under which these specimens were collected and the duplicates sent to the United States; Carlyle A. Luer for permission to use his drawings, and so much more; José Koechlin of Inkaterra and José Purisaca of the Inka Terra Association-ITA for their support of research and conservation, including this project; the Orchid Herbarium of Oakes Ames, Harvard University Herbaria, for allowing us to reprint Luer's drawing of *Trichosalpinx carmeniae*, and the Missouri Botanical Garden Press for permission to reprint his drawing of *T. acremona*; the librarians at the Harvard Botany Library for sharing essential references; Melania Fernández and Adam Karremans for discussions of their current research on the genus *Trichosalpinx*; and two anonymous reviewers.

Literature Cited

Archila, F. (2000). Estudio taxonómico - morfológico y delimitación de tres géneros de la subtribu Pleurothallidinae (Orchidaceae). *Revista Guatemal.,* 3, 33–88.

Bennett, D. E. & Christenson, E. A. (2001). *Icones Orchidacearum Peruviarum: plates 601–800*. A. Pastorelli de Bennett, Lima, t. 792–793.

Fernández, M. (2013). *Tubella* - die etwas anderen *Trichosalpinx*. *Die Orchidee,* 64(4), 310–317.

Fernández, M. & Bogarín, D. (2011). A new *Trichosalpinx* (Orchidaceae: Pleurothallidinae) from the northern Pacific lowlands of Costa Rica. *Phytotaxa,* 38, 41–48.

Fernández, M. & Bogarín, D. (2013). A new species of *Trichosalpinx* (Orchidaceae: Pleurothallidinae) from Costa Rica. *Brittonia*, 65(1), 96–101.

Fernández-Concha, G. C. & Ramírez, I. (1998). Notes on the orchid flora of the Cruz Carrillo National Park (Guaramacal), Venezuela. *Harvard Pap. Bot.,* 3(2), 239–252.

Humboldt, A., Bonpland, A. & Kunth, C. S. (1816.) *Nova Genera et Species Plantarum (quarto ed.)* 1, 357. Paris. Hurka, H. and B. Neuffer.

Lindley, J. (1835). *Pleurothallis grobyi*. *Edwards's Bot. Reg.* 21, sub t. 1797.

Lindley, J. (1838). *Specklinia ciliaris. Edwards's Bot. Reg.* 24, Misc. 31.

Lindley, J. (1842). *Pleurothallis. Edwards's Bot. Reg.* 28, Misc. 72, 82–83.

Lindley, J. (1846). *Orchidaceae Lindenianae* 1, 1-38. Bradbury and Evans, London.

Luer, C. A. (1983). *Trichosalpinx*, a new genus in the Pleurothallidinae. *Phytologia,* 54(5), 393–398.

Luer, C. A. (1997). Systematics of *Trichosalpinx. Monogr. Syst. Bot. Missouri Bot. Gard.* 64, 1–118.

Luer, C. A. (1998). Corrigenda to Icones Pleurothallidinarum –15. *Monogr. Syst. Bot. Missouri Bot. Gard*. 65, 82.

Luer, C. A. (2002). Addenda to *Barbosella, Dracula, Dresslerella, Lepanthopsis, Platystele, Pleurothallis, Restrepia, Scaphosepalum, Teagueia* and *Trichosalpinx*. *Monogr. Syst. Bot. Missouri Bot. Gard.* 88, 97–122.

Luer, C. A. (2006). Miscellaneous new taxa in the Pleurothallidinae. *Monogr. Syst. Bot. Missouri Bot. Gard.* 105, 245–259.

Luer, C. A. (2007). Miscellaneous new genera, new species and new combinations. *Monogr. Syst. Bot. Missouri Bot. Gard.* 112, 106–114.

Luer, C. A. (2009). Miscellaneous new species in the Pleurothallidinae. *Selbyana* 30, 1–71.

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A NEW AND PREVIOUSLY MISIDENTIFIED *CYRTOCHILUM* (ORCHIDACEAE: ONCIDIINAE) FROM THE HIGH PLAINS OF CENTRAL ECUADOR

STIG DALSTRÖM

2304 Ringling Boulevard, unit 119, Sarasota FL 34237, USA
Lankester Botanical Garden, University of Costa Rica, Cartago, Costa Rica
National Biodiversity Centre, Serbithang, Bhutan
stigdalstrom@gmail.com

ABSTRACT. A new and previously misidentified, small-flowered *Cyrtochilum* (Orchidaceae: Oncidiinae) from central Ecuador is described, illustrated with a line drawing and photographs, and compared with the species that it has previously been taxonomically mixed-up with by the author. The new species is readily distinguished by the dark yellow, gibbous and carnose lip callus, versus more elongate, longitudinally furrowed and bilobed calli for similar species.

KEY WORDS: *Cyrtochilum*, Orchidaceae, Oncidiinae, new species, Ecuador, Azuay

Introduction. The *Cyrtochilum* species described here has previously been misidentified by the author as "*Cyrtochilum viminale* (Rchb.f.) Dalström" (2001, 2010). However, that name refers to a different species with a different floral morphology. Our new, but well-known species represents an enigmatic paradox. It is very common along roads in the south-central highlands of Ecuador, particularly around the old city of Cuenca. Plants can sometimes be found growing on the road itself, clinging tenaciously to the dirt while the relentless traffic constitutes a permanent threat to crush the plants. Anybody that passes by and has an interest in orchids will sooner or later notice the flowers and stop to investigate, and often make herbarium specimens. The peculiar thing, however, is that our new *Cyrtochilum* is most rarely encountered in herbaria from older collections. The reason for this may have an interesting explanation. It seems plausible that before modern transportation entered the stage (and the Ecuadorian wilderness) this species occurred only as terrestrials in remote, scrub and grass vegetation, not seen by anybody except occasional natives passing by. Professional collectors probably avoided this seemingly 'empty' land that did not seem to host any commercial rewards. As roads began to crisscross these relatively flat and engineering friendly areas, however, the disturbed road cuts offered suitable habitats for the orchid. In addition, passing vehicles loaded with livestock, plants and miscellaneous equipment may have helped dispersing the seeds, with new populations establishing along the roads as a consequence.

TAXONOMIC TREATMENT

Cyrtochilum soennemarkii Dalström *sp.nov*.

TYPE: Ecuador. Azuay, km 52 from Cuenca towards Loja, in full sun along roadside, at 3250 m, 13 Dec. 1982, *S. Dalström 354* (holotype: SEL). Figs. 1, 2.

Diagnosis. *Cyrtochilum soennemarkii* (Figs. 1–4) is distinguished by the tall and erect loosely flowered inflorescences, carrying dull brownish to clear yellow flowers commonly with a purplish column and a bright yellow to orange, basally gibbous, carnose and somewhat tuberous callus. *Cyrtochilum soennemarkii* differs from the similar but previously misapplied *Cyrtochilum viminale* Rchb.f.) Dalström (Fig. 5) by the gibbous and convex lip with a carnose and bright yellow to orange callus, versus a basally straight, slightly elongated, smooth, dorsally furrowed and bifurcated callus of the same ivory white color as the lip lamina for *C. viminale*. *Cyrtochilum soennemarki* is distinguished from all other yellow-flowered and superficially similar species by the gibbous lip with a carnose and slightly tuberous callus.

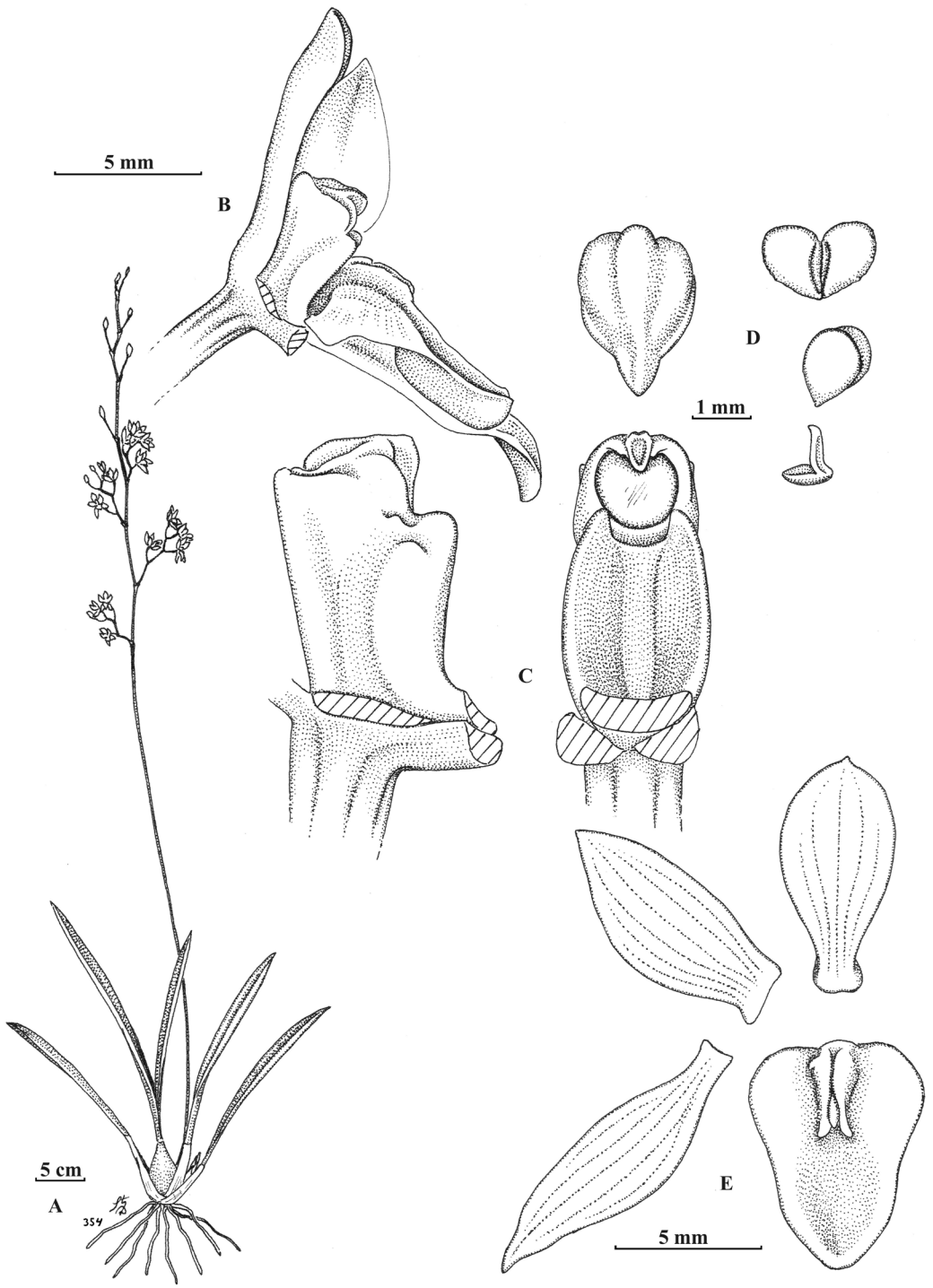

FIGURE 1. *Cyrtochilum soennemarkii*. A. Plant habit. B. Column and lip lateral view. C. Column lateral and ventral views. D. Anther cap dorsal view and pollinia frontal, and lateral view with stipe. E. Flower dissected. Drawn from holotype by Stig Dalström.

Figure 2. *Cyrtochilum soennemarkii*. Plant cultivated and photographed by G. Deburghgraeve.

Figure 3. *Cyrtochilum soennemarkii*, plant habit, Azogues, Ecuador. Photo by S. Dalström.

Terrestrial *herb*. *Pseudobulbs* caespitose, ovoid, unifoliate or bifoliate, *ca*. 5 × 3 cm, subtended basally by 5 to 6 distichous sheaths, the uppermost foliaceous. *Leaves* subpetiolate, conduplicate, linear elliptic to obovate, acute to obtuse, sometimes apiculate, 22–34 × 1.5–1.7 cm. *Inflorescences* axillary and arising from the uppermost sheaths, erect to slightly arching, to *ca*. 80 cm long almost straight panicle, with widely spaced, to *ca*. 5 cm long and to 5-flowered side-branches; *bracts* appressed, scale-like, 0.2–1.2 cm long; *pedicel* with *ovary* 0.5–1.5 cm long. *Flowers* campanulate to stellate; *dorsal sepal* dull olive brown on type, but generally yellow and sometimes with purple stains near the base, unguiculate, broadly elliptic to obovate, obtuse, apiculate, *ca*. 8 × 4 mm; *lateral sepals* similar in color, slightly oblique, narrowly unguiculate to slightly spathulate, ovate, acute, *ca*. 10–11 × 3.0–3.5 mm; *petals* similar in color, broadly unguiculate, obliquely ovate, acute, *ca*. 8.5 × 4.0 mm; *lip* similar in color, rigidly fused to the base of the column, then gibbose and recurved away from the column, apically concave, truncate, broadly ovate to indistinctly 3-lobed, lateral lobes rotund, front lobe bluntly obtuse, *ca*. 7.5 × 6 mm; *callus* bright yellow, of a fleshy

FIGURE 4. *Cyrtochilum soennemarkii*, flowers of the type specimen. Photo by S. Dalström.

and broad, gibbose, central, longitudinally grooved, fleshy keel, extending from the base up to *ca*. 1/2 of the length of the lamina, ending in a pair of rounded, somewhat diverging angles, with an intermediate apical knob; *column* variably purplish, stocky, dorsally straight, ventrally concave, with concave lateral flanks, ending in a rounded lobe on each side of the stigmatic surface, *ca*. 4 mm long; *anther cap* purplish to yellow, campanulate, rostrate, dorsally lobulate; *pollinarium* of two obovoid, cleft, or folded, pollinia with an ovate, *ca*. 1 mm long stipe on a pulvinate viscidium.

ADDITIONAL MATERIAL SEEN: Ecuador. Cañar, uplands of "Huairacaja", 10–20 km NE Azogues, 3600 m, 2 Feb. 1945, *W. H. Camp E-1788* (NY). Cañar, near San Marcos, NE Azogues, "1000" m [most certainly 3000 m; author's note], 13 Apr. 1945, *W. E. Camp E-2602* (AMES). Cañar, Azoguez to Taday, 3300 m, 9 Mar. 1992, *S. Dalström 1630* (SEL). Cañar, Azogues—Taday, km 16, 3300 m, 2 Feb. 1988, *U. Molau et al. 2849* (QCA). Azuay, Cuenca—Loja, km 78, 3000 m, 20 Sep. 1980, *C. A. Luer et al. 5507* (SEL). Azuay,

FIGURE 5. *Cyrtochilum viminale*. Plant cultivated and photographed by G. Deburghgraeve.

Cuenca—Loja, km 52, 3250 m, 13 Dec. 1982, *S. Dalström 343* (SEL). Azuay, Cuenca—Loja, km 42, 2900 m, 30 Nov. 1984, *C. H. Dodson* & *B. Malo 15490* (MO, QCNE, RPSC). Azuay, Cuenca—Loja, km 67, 3380 m, 30 Jul. 1959, *H. G. Barclay & P. Juajibioy 8573* (AMES, MO). Azuay, Sigsig, 2800 m, 6 May 1981, *J. Kuhn 44* (SEL); Cuenca—Loja, km 30, 3360 m, 29 Dec. 80, *M. Madison et al. 7407* (SEL). Azuay, Sigsig—Ludo, km 5, 3100 – 3300 m, 78° 50'W, 3° 05'S, 17 Nov. 1983, *B. Eriksen* & *B. B. Larsen 45727* (AAU). Azuay, W Andes of Cuenca, 2400 – 2800 m, *F. C. Lehmann 8069* (AMES). Azuay, Cuenca—Loja, km 80, 3000 m, 17 Jul. 1977, *C. A. Luer et al. 1723* (SEL). Azuay, Cuenca—Loja, Paramo de Tinajillos, Sta Rosa, 3000 m, 2 Nov. 1988, *G. Harling* & *L. Andersson 25580* (AMES). Azuay, Cuenca—Loja, 65 km S of Cumbe, 2900, 3 Nov. 1988, *G. Harling* & *L. Andersson 25622* (AMES). Azuay, Cuenca—Loja, Paramo de Tinajillos, Sta Rosa, 3200, 4 Nov. 1988, *G. Harling* & *L. Andersson 25636* (AMES). Azuay, Oña—Rio Yacuambi, 2600 m, 10 Sep. 1945, *F. Prieto P-206* (AMES). Azuay, Sigsig—Gualaquiza, Río Altarurucu, 2800 m, 13 Apr. 1968, *G. Harling et al. 8285* (AMES, GB). Azuay, Sigsig, 10 km S, 3200 m, 3 Aug. 1975, *C. A. Luer et al. 406, 421* & *416* (SEL). Azuay, Km 40 S Cuenca, ca. 3600 m, 20 Sept. 1944, *I. L. Wiggins 10767, 10823* (AMES). Azuay, Cuenca—Loja, km 65 – 70, 3400 m, 3 Jan. 1981, *H. Balslev 1423* (AMES). Loja, Loja—Cuenca, km 65, at pass above Saraguro, 3100 m, 20 Sep. 1980, *C. H. Dodson et al. 10500* (SEL, MO). Loja, Loja—Cuenca, 12 km N Saraguro, 3000 m, 3 Jan. 1981, *H. Balslev 1405* (NY). Loja, Cuenca—Loja, near Saraguro 3000 m, 5 Mar. 1977, *C. A. Luer et al. 1524* (SEL). Loja, Loja—Cuenca, vicinity of Saraguro, 27 Sep. 1918, *J. N. Rose et al. 23141* (US). Loja, Saraguro—Tenta, 2700 m, 16 Sep. 1980, *J. Jaramillo 3828* (AAU, QCA, QCNE). Loja, San Lucas to Oña, 2600, 7 Sep. 1923, *Hitchcock 21574* (US). Loja, Cuenca—Loja, km 80, 3000 m, 19 Dec. 1957, *C. H. Dodson* & *G. P. Frymire 257* (SEL). Loja, Saraguro to Loja, 3100 m, 6 Feb. 1993, *S. Dalström 1854* (SEL). Loja, Cuenca—Loja, km 140, 2800 m, 10 Feb. 1978, *C. A. Luer et al. 2504* (SEL). Loja, Km 78 S Cuenca, *ca*. 3000 m, *C. A. Luer et al. 5510* (SEL). Morona-Santiago, Sigsig—Chiguinda, 3000 m, 11 Aug. 1990, *A. Hirtz et al. 5047* (QCNE). Morona Santiago, Gualaceo—Chiquinda, near Chiquinda, 3200 m, Jan. 1989, *A. Hirtz et al. 4015* (MO).

Distribution and habitat: *Cyrtochilum soennemarkii* is reported from the high altitude, grassy and shrubby plains of the Ecuadorean provinces of Azuay, Cañar and Loja, at the altitude of 2400 – 3600 m.

Eponymy: Named in honor of Jan Sönnemark of Halmstad, Sweden, who contributed substantially to the understanding of the true identity of this species.

Acknowledgments. I thank Jan Sönnemark for many years of great companionship in the field.

Literature cited

Dalström, S. (2001). A synopsis of the genus *Cyrtochilum* (Orchidaceae; Oncidiinae): Taxonomic reevaluation and new combinations. *Lindleyana*, 16(2), 56–80.

Dalström, S. (2010). *Cyrtochilum*. In Harling, G. & Persson, C. (Eds.), *Flora of Ecuador No. 87* (pp. 18-198). Sweden: Göteborg University.

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  4. Book chapter: Nobody, A. B. (1991). The effect of light on growth. In: C. D. Somebody (Ed.), *Light and growth* (pp. 209-291). London: Light Press. – or - Nobody, A. B. (1991). The effect of light on growth. In: C. D. Somebody & E. F. Someother (Eds.), *Light and growth* (pp. 209-291). London: Light Press.
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- Prof. Franco Pupulin
  Editor-in-Chief, LANKESTERIANA
  Universidad de Costa Rica
  Jardín Botánico Lankester
  P.O. Box 302-7050 Cartago
  Costa Rica
  E-mail: franco.pupulin@ucr.ac.cr
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  Managing editor, LANKESTERIANA
  Universidad de Costa Rica
  Jardín Botánico Lankester
  P.O. Box 302-7050 Cartago
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  E-mail: adam.karremans@ucr.ac.cr
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  Editorial assistant, LANKESTERIANA
  Universidad de Costa Rica
  Jardín Botánico Lankester
  P.O. Box 302-7050 Cartago
  Costa Rica
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