

NEW OR LITTLE KNOWN EPIPHYLLOUS LIVERWORTS, XVI.

A SMALL COLLECTION FROM LAOS

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Epiphyllous liverworts from Laos
Laos, Indochina, *Cololejeunea*, *Leptolejeunea*

Abstract. *László Peregovits, lepidopterist, made a small collection of epiphyllous liverworts on the request of the author, when visited Laos in 2012. The sample was made in one hectar of the evergreen fagaceous forests of the Phou Samsoun Mountains in Xiang Khouang Province of northern Laos. The material contained 14 species, 13 of them new to the little known bryoflora of this country, this way the known number of liverworts is raised to 59.*

Introduction

Landlocked Laos is from hepaticological point of view the least known country in the Peninsula of Indochina. Only the publication of Hattori & Thaithong (1978) and those of Tixier (1970a, 1973, 1977, 1978, 1981, 1985) contain the 46 original liverwort records from the country, mostly from the collections made by Tixier himself. The moss flora is somewhat better known (Tixier 1970b), but the 145 moss species recorded from the area is also the lowest among Indochinese countries, compared with the 595 species known from Vietnam and the 563 species from Thailand (Tan & Iwatsuki 1993).

The locality of the epiphyllous collection made by Peregovits in Laos is in Xiang Khouang Province, ESE of Muang Moc, in the Phou Samsoun Mountains, at 2037m altitude, 19°8.169'N 103°47.122'E, at the side of a brook in a montane evergreen forest dominated by *Quercus spp.*. Date: Febr 16, 2012 (Fig. 1). The specimens were identified by the author and deposited in the Herbarium of Eszterházy College, Eger, Hungary (EGR).

Enumeration of the collected species

Species new to Laos are marked by *. The distributional data are based partly on Pócs (1965, 2011, 2012) and Tixier (1985), but mostly on Zhu & So (2001).

**Cololejeunea chenii* Tixier.

Distrib.: China (Guizhou, Xizang, Yunnan, Guangxi) and Vietnam. New Guinea

**Cololejeunea diaphana* A. Evans

Distrib.: Tropical America, Asia and Oceania.

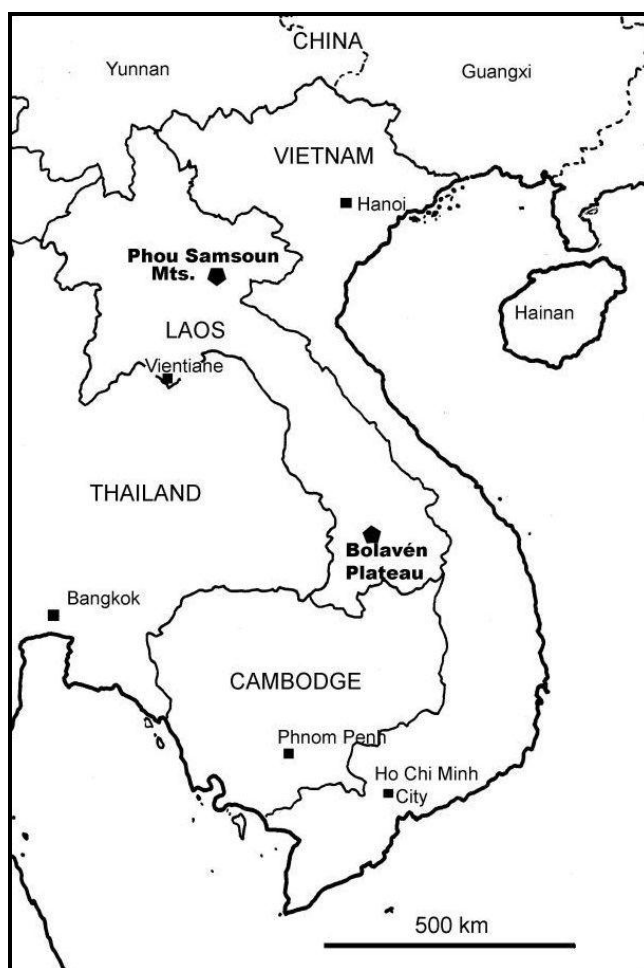


Fig. 1: The collecting sites of Peregovits and of Tixier in Laos.

****Cololejeunea inflata* Steph.**

Distrib.: Southeast Asia from Ceylon and China through S Japan to Malaysia and the Philippines, New Caledonia. In Indochina: Thailand, Cambodia and Vietnam.

****Cololejeunea latilobula* (Herzog) Tixier**

Distrib.: Widespread Palaeotropical species occurring from tropical Africa through Indomalesia and Southeast Asia to the Pacific (Fiji).

***Cololejeunea longifolia* (Mitt.) Mizut.**

Distrib.: Himalaya, India, Bangladesh, Sri Lanka, Andaman Thailand, Cambodia, Laos, Vietnam, Malaya, Borneo, Sulawesi, Philippines, China, Japan, Korea, New Guinea, Solomons, New Caledonia, Caroline Is and Fiji Islands.

***Cololejeunea pseudofloccosa* (Horik.) Benedix**

Distrib.: From Ceylon, Himalaya through China, Japan Indonesia, Malaysia to the Philippines, Queensland. In Indochina: Cambodia, Laos and Vietnam.

****Cololejeunea cordiflora* Steph.**

Syn.: *C. trichomanis* (Gottsche) ssp. *cordiflora* (Steph.) Pócs, *C. serrulata* Steph.

Distrib.: Indomalesia, Southeast Asia and Pacific from Ceylon to Society Islands, Japan.

****Cololejeunea verrucosa* Steph.**

Distrib.: Java, Cambodia, Vietnam, S Japan. Malaya, Sumatra, Borneo Sulawesi Moluccas ?Philippines, Solomon Islands, Hainan, Taiwan, ?Caroline Islands, ?Society Islands.

****Colura tenuicornis* (A. Evans) Steph.**

Widespread pantropical species.

****Drepanolejeunea yunnanensis* (P.C. Chen) Grolle & R.L. Zhu**

Distrib.: Vietnam S-China, Taiwan, S-Japan.

****Leptolejeunea apiculata* (Horik.) S. Hatt.**

Distrib.: Thailand, S-China, Taiwan, S Japan.

****Leptolejeunea elliptica* (Lehm. & Lindenb.) Schiffn.**

Distrib.: Pantropical species in Africa known only from the Comoro Islands.

****Ptychanthus striatus* (Lehm. et Lindenb.) Nees**

Distrib.: Widespread Indomalesian–Pacific species.

**Radula acuminata* Steph.

Distrib.: Widespread Indomalesian–Pacific species.

Discussion

As it can be seen, the list contain 3 species (*Cololejeunea chenii*, *Drepanolejeunea yunnanensis* and *Leptolejeunea apiculata*), which can be considered endemics in a broad sense, of the South China – Indochina and South Japan area. From the rest 7 species can be classified as widespread Indomalesian – Pacific and 4 as Pantropical or at least bicontinental disjunct. It is noticeable that the above species set has almost no overlapping with the epiphyllous community found by Tixier in southern Laos on the Boloven (Bolavén) Plateau. This fact can prove the very high diversity of Laotian epiphyllous flora which needs further investigation.

Acknowledgements

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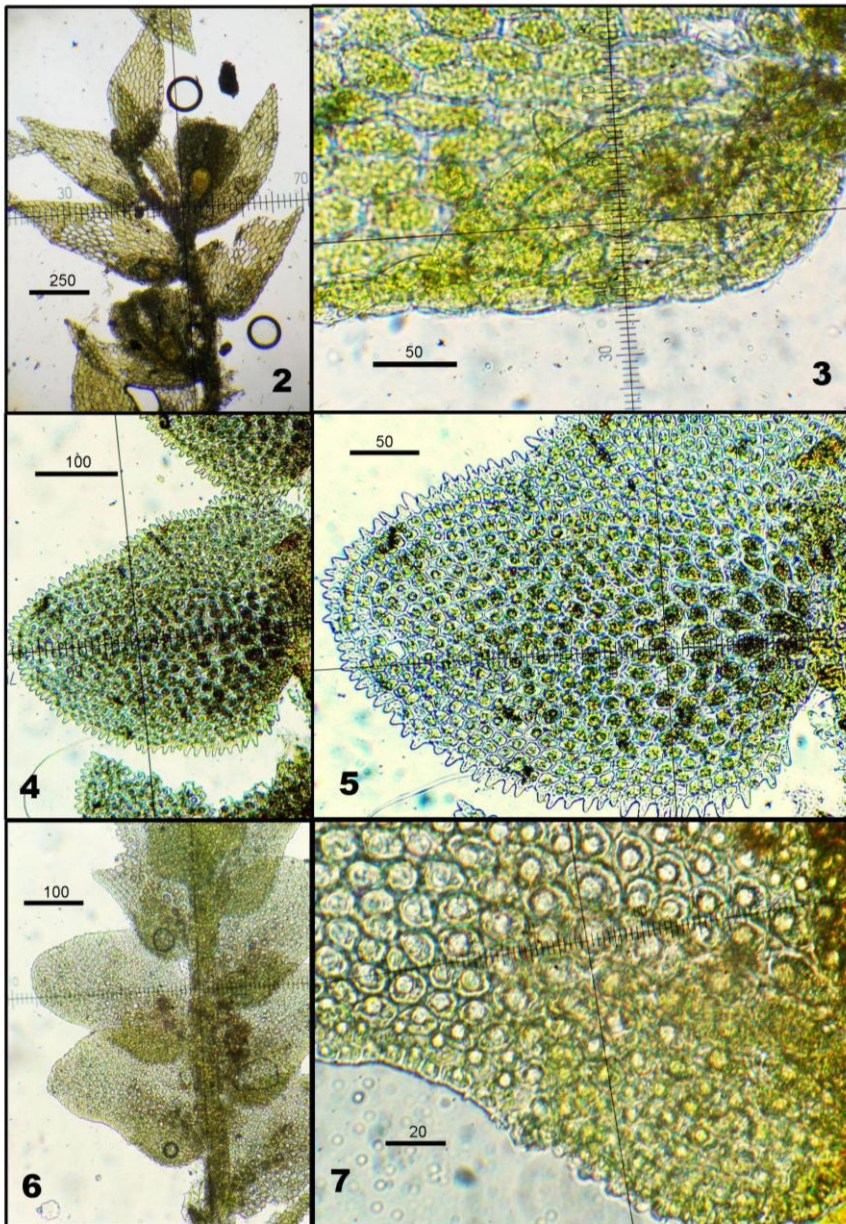


Fig. 2–3: *Cololejeunea longifolia* (Mitt.) Mizut. Fig. 4–5: *Cololejeunea chenii* Tixier.

Fig. 6–7: *Cololejeunea verrucosa* Steph. All from Peregovits, Laos, Phou Samsoun Mountains. Scale bars in µm.

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NEW OR LITTLE KNOWN EPIPHYLLOUS LIVERWORTS, XVII. RECORDS FROM THE CÁT TIÊN NATIONAL PARK, SOUTHERN VIETNAM

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Epiphyllous liverworts from Cát Tiên National Park, Vietnam

Cololejeunea, Colura, conservation, Indochina, Leptolejeunea, lowland
rainforest

Abstract. *The junior author collected 36 epiphyllous samples in the Cát Tiên National Park of South Vietnam and the senior author identified them. Although the lowland rainforest areas at this latitude usually have not a high diversity of epiphyllous liverworts, 21 species were observed, of which Colura ornata proved to be new for the bryoflora of Vietnam.*

Introduction

Trần Ninh collected epiphyllous liverworts in the Cát Tiên National Park of southern Vietnam, 120 km NE of Ho Chi Minh City (see fig. 1), established in 1992. The national park encounters 73,878 ha area between the latitudes of 11°21' and 11°48'N and longitudes 107°10' and 107°34'E. It consists of three sectors: Cat Loc (former Rhinoceros Sanctuary) in Lam Dong Province, on the foothills of Central highlands, and Tay Cat Tien and Nam Cat Tien sectors in Dong Nai Province, mostly on the lowland of the floodplain of Dong Nai River. The collection was carried out in the latter, in lowland rain forests dominated by

Dipterocarpaceae trees, at 100–150m m altitude, in the November of 2002. This dense, humid evergreen forest consists of *Dipterocarpus alatus*, *D. dyeri*, *Anisoptera costata*, *Shorea* and *Hopea* spp. (Trung 1988) with a mean annual rainfall of 2435 mm, with a wet season from May to October and a pronounced dry season between November and April. The mean annual temperature is 25.5°C (Scott 1989).

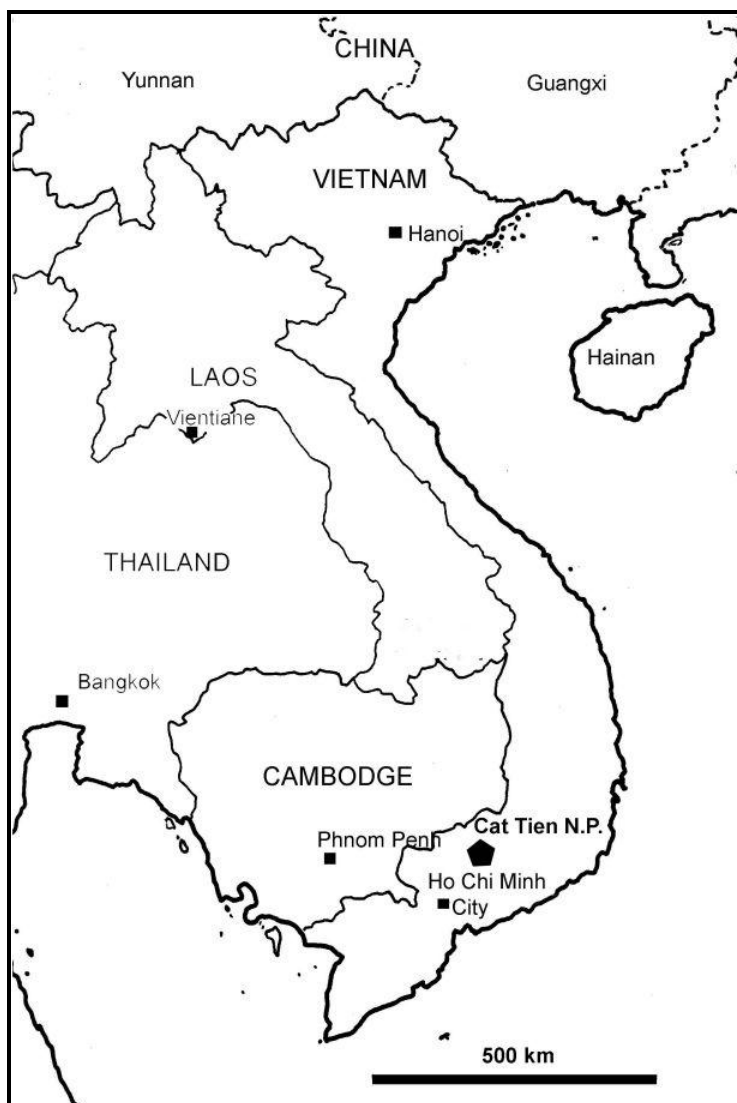


Fig. 1: The collecting site of Trần Ninh in southern Vietnam.

Enumeration of the collected species

Species new to Vietnam are marked by *. The distributional data are based on Asthana & Srivastava (2003), Pócs (1965, 2005, 2011, 2012a), Pócs & Piippo (2011), Tixier (1962, 1969, 1970, 1973, 1974, 1975, 1981, 1984, 1985), Zhu (1995) and on Zhu & So (1999, 2000, 2001). The number after the name of species reflects its frequency, showing in how many of the 36 samples it was found. The epiphyllous liverworts were identified by Tamás Pócs between 2003 and 2012.

Archilejeunea sp. 1 (sterile)

Caudalejeunea reniloba (Gottsche) Spruce 14

Syn.: *Caudalejeunea recurvistipula* (Gottsche) Steph.

Distrib.: Widely distributed Indomalaysian – Pacific species.

Cololejeunea ceatocarpa (Ångstr.) Steph. 1

Distrib.: Hitherto known only from Réunion, Bangladesh, Vietnam, New Caledonia, Fiji, Tonga, Samoa and the Hawaii Islands. It is close to *C. spathulifolia* (Steph.) Tix. from the Solomon Islands and to *C. polyantha* (Steph.) H.A. Mill. from the Pacific.

Cololejeunea cordiflora Steph. 3

Syn.: *Cololejeunea trichomanis* (Gottsche) Steph. subsp. *cordiflora* (Steph.) Pócs

Distrib.: A widespread Indomalaysian – Pacific species.

Cololejeunea floccosa (Lehm. & Lindenb.) Schiffn. cf. var. *aurita* Benedix 8

The specimens from Cát Tiên National Park have the vitta always consisting of only (3-)4 cells in a single row. This character matches *C. floccosa* var. *aurita* Benedix, but also *Cololejeunea subfloccosa* Mizut. As the collected material does not have female gamatoecia and paroicous shoots, which bear the main distinguishing characters, it was not possible to identify this taxon with certainty, although it occurred in eight samples. As *Cololejeunea subfloccosa* was described later (Mizutani 1984) than *C. floccosa* var. *aurita* (Benedix 1953), and also after the review of the *Cololejeunea floccosa* complex by Tixier (1981), it would be necessary to compare the types of the concerned taxa.

Distrib.: *Cololejeunea floccosa* is widespread Palaeotropical taxon while the known distribution of *Cololejeunea subfloccosa* is restricted to southern China and Japan.

Cololejeunea gottschei (Steph.) Mizut. 1

Syn.: *Cololejeunea yunnanensis* (P.C. Chen & P.C. Wu) Pócs

Tixier (1985) melted this species into the *C. longifolia* (Mitt.) Mizut. complex. The two species are closely related, characterized by the elongate lobe cells with several intermediate thickenings on the longitudinal walls, which results in the longitudinal shrivel of the leaves in dry state. But Zhu & So (2001) distinguishes the two species by several well usable characters, as the number of cells in the gemma, the perianth keels and the leaf shape.

Distrib.: Widespread Indomalesian species occurring from India and Sri Lanka through China (Hainan, Taiwan) and Vietnam to the Philippines and New Guinea.

Cololejeunea haskarliana (Lehm. & Lindenb.) Schiffn. 1

Distrib.: Widespread Indomalesian – Pacific species.

Cololejeunea lanciloba Steph. 4

Distrib.: A widespread Palaeotropical species distributed from West Africa to Polynesia. Also reported from Bolivia

Cololejeunea latilobula (Herzog) Tixier 10

Distrib.: Widespread Palaeotropical species occurring from tropical Africa through Indomalesia and Southeast Asia to the Pacific (Fiji).

Cololejeunea longifolia (Mitt.) Mizut. 4

As mentioned under *C. gottschei*, this species is treated here in the strict sense.

Distrib.: Himalaya, India, Bangladesh, Sri Lanka, Andaman Thailand, Cambodia, Laos, Vietnam, Malaya, Borneo, Sulawesi, Philippines, China, Japan, Korea, New Guinea, Solomons, New Caledonia, Caroline Is and Fiji Islands.

Cololejeunea planisssima (Mitt.) Abeyw. 3

Distrib.: Palaeotropical species known from East Africa to Micronesia.

Cololejeunea verrucosa Steph. 3

Distrib.: Java, Laos, Cambodia, Vietnam, S Japan (Ryukyu Is.). Malaya, Sumatra, Borneo, Sulawesi, Moluccas ?Philippines, Solomon Islands, Hainan, Taiwan, ?Caroline Islands, ?Society Islands.

Colura conica (Sande Lac.) K.I. Goebel 2

Distrib.: Widespread Indomalesian – Pacific species distributed from Sri Lanka through China to the Philippines, Australia and to Samoa.

****Colura ornata*** K.I. Goebel 2

Distrib.: Indomalesian species previously known from India, Sri Lanka, Java, Malaysia, Borneo, the Philippines, Moluccas and New Guinea, new to Indochina.

Drepanolejeunea angustifolia (Mitt.) Grolle 1

Distrib.: Widespread Indomalaysian species.

Drepanolejeunea pentadactyla (Mont.) Steph. 1

Distrib.: Widespread Indomalaysian – Pacific species.

Lejeunea anisophylla Mont. 1

Distrib.: Widespread Palaeotropical species..

Leptolejeunea balansae Steph. 1

Distrib.: India, Indochina, Malaysia, southern China, Indonesia.

Leptolejeunea elliptica (Lehm. & Lindenb.) Schiffn. 1

Distrib.: Pantropical species in Africa known only from the Comoro Islands.

Leptolejeunea epiphylla (Mitt.) Steph. 14

Distrib.: Palaeotropical species distributed from West Africa throughout tropical Asia to the Society Islands.

Leptolejeunea maculata (Mitt.) Schiffn. 24

Distrib.: Very widespread Pantropical species.

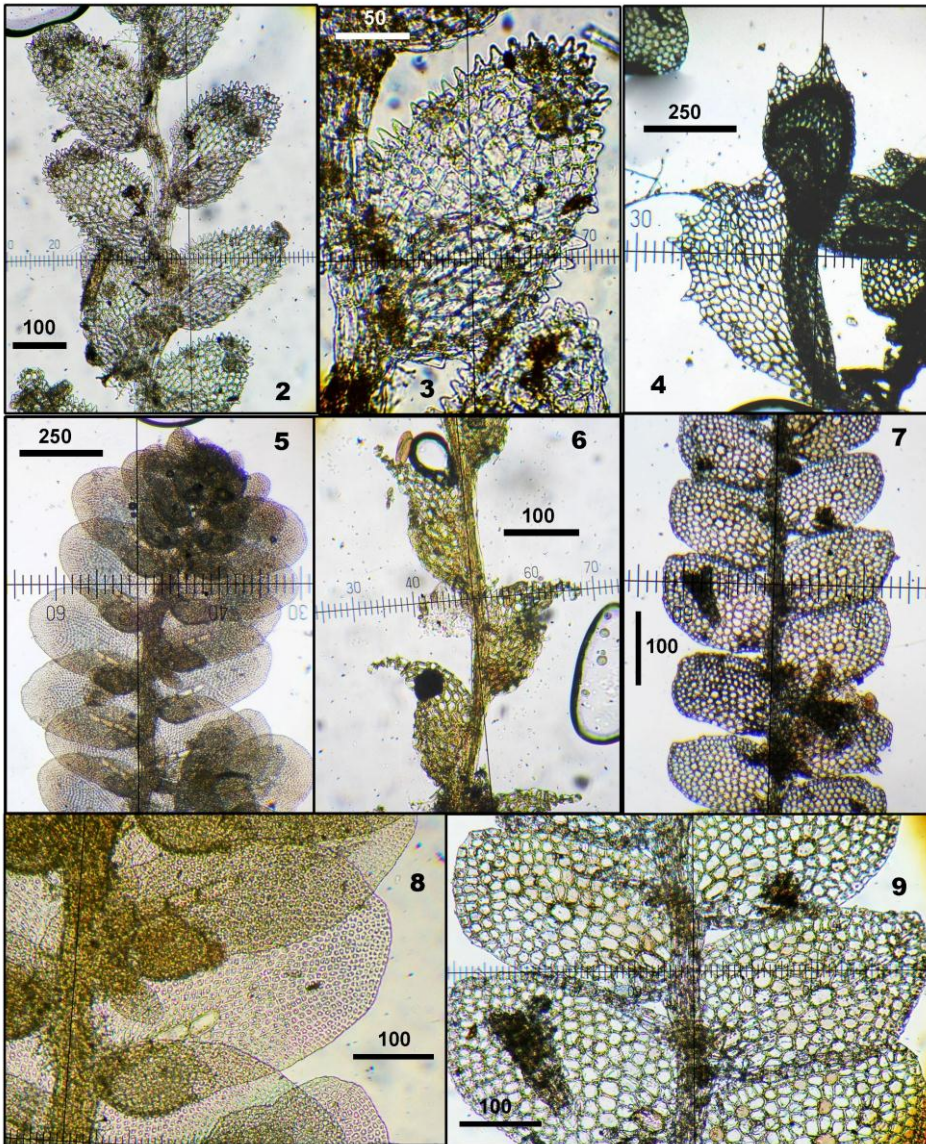


Fig. 2–3: *Cololejeunea haskarliana* (Lehm. & Lindenb.) Schiffn. Fig. 4: *Colura ornata* K.I. Goebel. Fig. 5, 8: *Cololejeunea floccosa* (Lehm. & Lindenb.) Schiffn. cf. var. *aurita* Benedix. Fig. 6: *Drepanolejeunea angustifolia* (Mitt.) Grolle. Fig. 7, 9: *Leptolejeunea epiphylla* (Mitt.) Steph. All from Trần Ninh, collected in Cát Tiên National Park. Scale bars in μm .

Discussion

The epiphyllous flora is typical for lowland rainforest habitat with the dominance of *Leptolejeunea* species. It is relatively rich with its 21 species compared to epiphyllous floras of similar latitude and altitude. For example the swamp and lowland rainforest remnants of Singapore (Piippo *et al.* 2002) had only 8 epiphyllous Lejeuneaceae species of which 2–3 have already disappeared.

As the distributional elements are concerned, there are no endemics in the area and the overwhelming majority, 12 species, belongs to the Indomalasian group and of which 5 species extends to the Pacific. Seven species are of Palaeotropic distribution while only 2 are Pantropical and 1 unknown. It is noticeable to compare the proportion of geoelements in this lowland rainforest area with that of the montane rainforests of Laos (Pócs 2012b), where 3 species out of 14 are subendemic to the South China – Indochina – South Japan realm.

The conservation value of this national park is high as it has relatively intact lowland rain forests, most of which were destroyed in southern Vietnam during the Vietnam War by the defoliating chemicals used. This forest area also harbours a rich flora of more than 1300 species of vascular plants, among which 34 species are listed in the Red Data Book of Vietnam (Sourcebook of Existing and Proposed Protected Areas of Vietnam), among others the endemic *Dipterocarpus bandii* and *Dracontomelon schmidii* (Trung 1986, 1988). The Cát Tiên National Park is also a nationally important site of primate conservation. Among the protected animals are the black gibbon, elephant, tiger, leopard, clouded leopard, gaur, banteng and the Indian muntjak and a very rich avifauna. (Sourcebook 2001). Sorry, probably the last specimen of the local variety of Javan rhinoceros was shot dead in the area (pers. comm. of Lars Söderström).

Acknowledgements

The authors are grateful to Dr. Lars Söderström (TRH) for his additions to the distributional data and his other valuable nomenclatural comments.

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CONTRIBUTIONS TO THE BRYOFLORA OF AUSTRALIA, III. THE GENUS *NOWELLIA* MITT. (CEPHALOZIACEAE, JUNGERMANNIOPSIDA)

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Nowellia in Australia

Bellenden Ker, Laurasia, Indomalesia, Cardwell Range, conservation, Queensland

Abstract: The liverwort genus *Nowellia* Mitt. was previously unknown from the Australian continent. During a collecting trip by the authors in June of 2001 throughout northern Queensland, two species were found, the Laurasian *Nowellia curvifolia* (Dicks.) Mitt. from the cloud forest of Bellenden Kerr summit and the Malesian-Australasian *Nowellia langii* Pears. from the montane forests of Cardwell Range.

Introduction

The authors, within the framework of Flora of Australia project, visited the mountain ranges of northern Queensland, between 9 and 20 June 2001. The main object of the trip was to collect material for the revision of the Australian species of *Frullania*, but abundant collections were also made of other liverworts and some mosses. The collecting trip was sponsored by the Australian Biological Resources Study Participatory Program and supported by the Natio-

nal Herbarium of New South Wales, Royal Botanic Gardens Sydney (NSW), by the James Cook University, School of Marine and Tropical Biology, Townsville (JCU) and by the Cryptogam section of the Australian National Herbarium, Canberra (CANB).

Results

During the trip two species of *Nowellia* Mitt. were found in two different localities. As the genus is thoroughly revised by Grolle (1968), it was easy to identify them, as

Nowellia curvifolia (Dicks.) Mitt. (Subg. *Nowellia*) Figs 1, 3-4,6

Northern QUEENSLAND: Bellenden Ker Range and National Park. Along trail leading from the telecommunication tower to the main summit. 17°15'S, 145°51.4'E., 1580 m alt. Simple microphyll vine-fern thicket with *Dracophyllum sayeri*. On a decaying log. Coll. T. Pócs 01094/W, accompanied by E.A. Brown, A. Cairns & C. Cargill. (CANB, EGR, BRI, NSW).

Distribution: It is widespread in the more oceanic parts of the northern temperate belt of eastern Canada and USA, in Eurasia from the Azores and Britain to European Russia and the Caucasus Mts, in the milder climactic coastal parts of Siberia, and in Sakhalin, Korea, Japan, China including Taiwan. It is also found as far south as the higher tropical mountains in Mexico, Venezuela, Brazil, Sri Lanka, Indonesia, Malaysia and the Philippines (see maps in Grolle (1968), Gradstein & Váňa 1987, distributional data in Chuah-Petiot (2011), Gradstein & Costa (2003), Gradstein & Váňa (1994), León *et al.* (1998), Piippo (1990), Uribe & Gradstein (1998), Wang *et al.* (2011). *New to Australia.*

Illustrations: Müller & Herzog 1957-58: 1108, fig. 420; Schuster 1974: 818, fig. 465; 825, fig. 466; Inoue 1976: 39, plate 19; Paton 1999: 119, fig. 42.

Maps (after Piippo 1990): Grolle 1968: 45, map 1; Sweykowski 1969: map 213, Schuster 1983: 579, fig. 63:1; Gradstein & Váňa 1987: 406, fig. 21.

Nowellia langii Pears. (Subgen. *Metanowellia* Grolle) Figs 2, 5, 7

(Syn.: *N. caledonica* Steph.)

Northern QUEENSLAND: Cardwell Range. Kirrama State Forest, along Douglas (Curran) Creek, at the N side of Mt. Pershouse. 18°12.7'S, 145°48.5'E, 680-700 m alt. On a decaying log in relatively open rainforest (simple notophyll vine forest). Coll. E.A. Brown 01/155, accompanied by A. Cairns, C. Cargill and by S. & T. Pócs (CANB, EGR, BRI, NSW).

Distribution: Hitherto known only from Western Sumatra, Thailand, Malaysia (Perak, Sabah) and from New Caledonia (see map in Grolle 1968, distributional data in Chuah-Petiot 2011, Lai *et al.* 2008.). *New to Australia.*

Illustration: Grolle 1968: 42, fig. 8. Map: Grolle 1968: 46, map 2.

Discussion

Nowellia Mitt. is a peculiar genus within the family Cephaloziaceae Mig. distinguished by the ventral margin of the bilobed leaf modified into a water-sac. Grolle (1968) in his monograph enumerated 7 species; Robinson (1970) described one more (*N. reedii*). Out of the 8 species, *N. curvifolia* is Laurasian, with oceanic boreo-temperate distribution, but penetrating south on tropical mountains. Four of them are Neotropical and three Palaeotropical, with quite restricted Indo-Malesian distributions. None of them were previously known from Australia. It is easy to distinguish the two Australian species from each other, as is demonstrated in the key below (based on Grolle 1968):

1. Well-developed leaves at least 10–15 cells high from the leaf insertion to the sinus between the two acute segments of lobe; lobe margins entire. Water-sac large, 16–20 cells wide, inflated only in the lower half. Stem with 8–12 medullary cells. *Nowellia curvifolia*
2. Well-developed leaves only 4–6 cells high from the leaf insertion to the sinus between the two acute segments of lobe, lobe margins with long ciliae. Water-sac small, only 6–10 cells wide and fully inflated. Stem with 3–6 medullary cells. *Nowellia langii*

It is phytogeographically interesting that the distribution of the two species overlaps at the junction of Laurasia and Gondwana. Gradstein and Vána (1987) discussed the penetration of Laurasian elements into Gondwana, citing *Nowellia curvifolia* as a typical example. The new Australian locality is one of the southernmost occurrences in the world.

Acknowledgements

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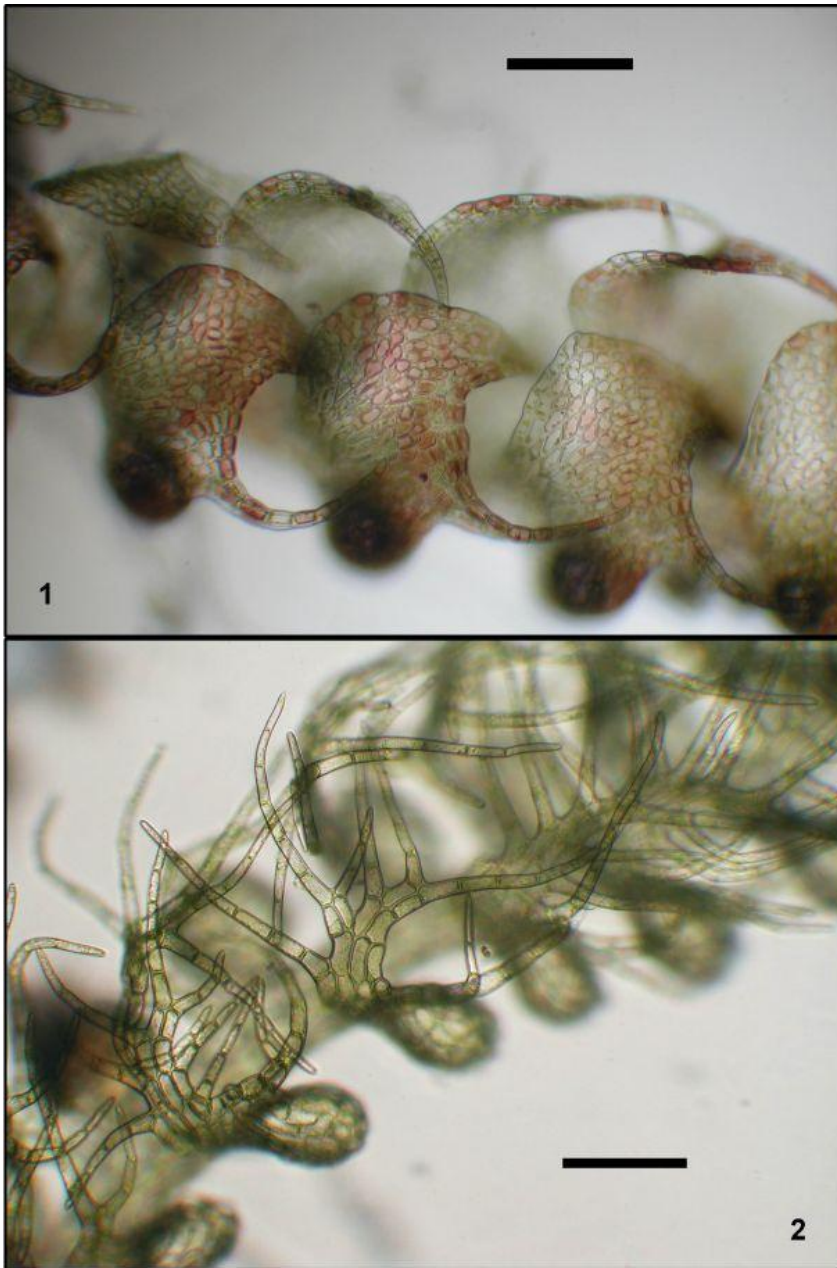


Plate I. Fig. 1: *Nowellia curvifolia* (Dicks.) Mitt. from Australia, Queensland, Bellenden Ker summit, 1580 m, T. Pócs 01094/W. Fig. 2: *Nowellia langii* Pears. From Australia, Queensland, Cardwell Range, Douglas Creek at the N side of Mt. Pershouse, 680 m, E.A. Brown 01/155. (Scale bars 200 μ m, microphotos made by A. Cairns).



Plate II. Fig. 3: Inside of the simple microphyll vine forest (cloud forest) of Bellenden Ker summit, at 1580 m. 4: *Dracophyllum sayeri* K. Muell. (Ericaceae), common in the microphyll vine forest. 6: The cloud forest of Bellenden Ker summit from outside. 5: Simple notophyll vine forest (montane rainforest) along Douglas Creek, Cardwell Range. 7: *Nowellia langii* at Douglas Creek. Figs.8–9: Participants of the collecting trip in Queensland. 8: Sarolta Pócs at Douglas Creek. 9: Christine Cargill, Elisabeth Brown and Andi Cairns on the Tucker Lookout, Cardwell Range. (Photos made by T. Pócs).

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CRITICAL ASSESSMENT OF THE FLORA OF THE VARGYAS GORGE (EASTERN CARPATHIANS)

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Vargyas Gorge, Eastern Carpathians, list of species, critical review:
Critical assessment of the flora of the Vargyas Gorge

Abstract: The Vargyas Gorge is situated in the northern part of the Persány Mountains (Eastern Carpathians in Romania), close to the village Homoródalmás (Merești) on the borders of two counties (Harghita and Covasna).

The gorge, which is cut by the Vargyas brook into a Jurassic and Cretacic limestone mass, is about 3,5 km long and over 200m high in certain places, between the altitudes of 930 metres above sea level, with an average temperature of 7,4°C with annual precipitation of 1460 mm.

Authors present an account of its flora based on literatures and on their collecting data. A detailed phytogeographical analysis will follow together with a vegetation description.

Introduction

Vargyas Gorge is formed in that limestone range which is part of the northern group of Persány-mountains (Mții Perșanii) – the northernmost forerunner of Rika-Mountain (Mții Perșanii de Nord) in Transylvania.

Limestone layers exceeding thickness of 500-600m become visible on the surface forming this spectacular gorge which is 4 km long. This gorge is considered to be a link between the limestone mountain of Nagyhagymás (Mții Hășmașul Mare) and the limestone cliffs located at the southern part of the Persány (Mții Perșani) and Királykő (Mții Piatra Craiului) mountains.

The gorge lies on the border of Hargita (jud. Harghita) and Kovászna (jud. Covasna) counties in Romania. The highest peaks are 930m (Mál-tető), 934m (Kőhát) and 945m (Tiva-tető) with 7,4°C yearly average temperature and 800-

1000 mm annual rainfall. The vegetational zone extends to the upper limit of beech forest.

First data on the vegetation of Vargyas gorge were published by Ádám Boros (1942-43) who was at the forefront of flora exploration in this period. Subsequently Szaniszló Priszter (1944) published further data from this area. However the most substantial exploration of the flora of this area was carried out by Sámuel PAP (1948), botanist from Székelykeresztúr (Cristuru Secuiesc), who reported his results in his doctoral thesis. His consultant was the late Prof. Erzsébet Kol. We were looking for the manuscript or its duplicate even at Babeş-Bolyai University (Kolozsvár, Cluj-Napoca), however, it had presumably got lost. Data in the literature and personal communication support this statement (Kovács 1983, Attila Kovács J. – pers. comm.).

As a result of further research, István Csűrös and Sámuel Pap (1958) published the occurrence of *Taraxacum hoppeanum*, based on their joint study. Almost 30 years later Sándor Kovács (1983), then Dan Munteanu and his colleagues (1987) summarized their results, based on literature data and on their own research as well.

The Authors visited the gorge in 1992 for the first time and returned several times in different vegetational periods in order to increase their knowledge on the flora and vegetation.

The first publication on the bryophyte flora of the valley was prepared by Andrea Gyarmati (1993), followed soon by her diploma work containing a detailed description on the vegetation (Gyarmati 1995).

Later, during several other vegetation and plant collecting exploratory trips, we studied the vegetation and the occurrence of rare and characteristic plants.

This year (2011) we visited the area together with BSc students of the Eszterházy College. Our recent data are also included in the present paper.

Our aim is to give a checklist with exact nomenclature and chronological references, which will provide a good starting point to compile a more complete flora and vegetation monograph of Vargyas Gorge.

New floristical data published in articles based on recent field exploration (Jakab *et al.* 2007) are also included in the present list, and we feedback to several of our previous collecting trips ("ined"). We indicate the collector's name in particular case with the year of collection.

Names of vascular plants follow the nomenclature of the actual manual flora of Ciocârlan (2009) and the recent critical summary of the vascular plants of Romania (Oprea 2005). The order of vascular families follows the synopsis of Soó (1966, 1968, 1970, 1973). The nomenclature of Frey *et al.* (2006) was applied for bryophytes and ferns.

The collected plants are deposited in the Herbarium of Eszterházy College (EGR), however in case of protected flowering plants mainly photo documentation was used.

Enumeratio

Abbreviations used in the enumeration:

BP = Hungarian Natural History Museum, Budapest

EGR = Herbarium of Eszterházy Károly College

Marchantiophyta

Apometzgeria pubescens (Schrank)
Kuw.
Gyarmati 1995, 2000, Jakab *et al.*
2007

Asterella saccata (Wahlenb.) Evans
Gyarmati 1993, 1995, 2000 (collected
by: K. Penksza), Jakab *et al.* 2007

Barbilophozia barbata (Schmid. ex
Schreb.) Loeske
Gyarmati 1995, 2000, Sass-Gyarmati
et Vojtkó 2011 (Herb. EGR)

Chiloscyphus polyanthus (L.) Corda
Gyarmati 1995, 2000

Cololejeunea rosettiana (Massal.)
Schiffn.
Boros 1943 (ap. Kovács 1983,
Munteanu *et al.* 1987), Gyarmati
1995, 2000, Jakab *et al.* 2007
Vargyas-szurdok. Boros Á. 1943 VI.
27. (BP)

Conocephalum conicum (L.) Lindb.
Gyarmati 2000, Jakab *et al.* 2007

Frullania dilatata (L.) Dum.
Gyarmati 1995, 2000, Jakab *et al.*

2007, Sass-Gyarmati *et Vojtkó* 2011
(Herb. EGR)

Lophocolea heterophylla (Schrad.)
Dum.
Gyarmati 2000

Mannia fragrans (Balbis) Frey *et*
Clark
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et Vojtkó* 2011
(Herb. EGR)

Marchantia polymorpha L.
Gyarmati 1995, 2000

Metzgeria conjugata Lindb.
Gyarmati 1995, 2000, Jakab *et al.*
2007

Metzgeria furcata (L.) Dum.
Jakab *et al.* 2007, Sass-Gyarmati *et*
Vojtkó 2011 (Herb. EGR)

Pedinophyllum interruptum (Nees.)
Lindb.
Boros 1943 (ap. Kovács 1983), Jakab
et al. 2007
Az Orbán Balázs barlang oldaljáratá-
nak nyílásánál, sziklán. Boros Á. 1942
VIII. 15; Patak medrében a baloldali
felmenő út alján. Boros Á. 1943 VI.
27. (BP)

Plagiochila asplenioides (L.) Dum.
Jakab *et al.* 2007

Plagiochila porelloides (Torrey *et*
Nees) Lindenb.
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et* Vojtkó 2011
(Herb. EGR)

Porella arboris vitae (With.) Grolle
Syn: *Porella arboris vitae* (With.)
Grolle var. *killarniensis* (Pears.)
Corley
Jakab *et al.* 2007

Porella platyphylla (L.) Pfeiff.
Gyarmati 1995, 2000, Jakab *et al.*
2007
Vargyas-szurdok. Boros Á. 1943 VI.
27. (BP), Sass-Gyarmati *et* Vojtkó
2011 (Herb. EGR)

Preissia quadrata (Scop.) Nees
Felső-Mál tetőn. Boros Á. 1942 VIII.
15. (BP)

Radula complanata (L.) Dum.
Gyarmati 1995, 2000

Bryophyta

Amblystegium serpens (Hedw.) B.S.G.
Gyarmati 1995, 2000, Jakab *et al.*
2007

Anomodon attenuatus (Hedw.) Hüben
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et* Vojtkó 2011
(Herb. EGR)

Anomodon longifolius (Brid.) Hartm.
Gyarmati 1995

Alsó-Mál sziklás oldalának aljában,
erdős sziklákon a patak medre felett.
Boros Á. 1943 VI. 27. (BP)

Anomodon rostratus (Hedw.) Schimp
Jakab *et al.* 2007

Anomodon rugelii (C. Müll) Keissler
Gyarmati 1995, 2000

Anomodon viticulosus (Hedw.) Hook
et Tayl.
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et* Vojtkó 2011
(Herb. EGR)

Atrichum haussknechtii Jur. & Milde
Gyarmati 1995, 2000

Atrichum undulatum (Hedw.) P.
Beauv.
Sass-Gyarmati *et* Vojtkó 2011 (Herb.
EGR)

Aulacomnium palustre (Hedw.)
Schwaegr.
Gyarmati 1995, 2000

Barbula fallax Hedw.
Gyarmati 1995, 2000

Brachythecium rutabulum (Hedw.)
B.S.G.
Gyarmati 1995, 2000, Jakab *et al.*
2007

Brachythecium salebrosum (Web. *et*
Mohr.) B.S. G.
Gyarmati 1995, 2000
Vízkelet árnyas sziklája. Boros Á.
1943 VI. 27. (BP)

Brachythecium velutinum (Hedw.)
B.S. G.

- Gyarmati 1995, 2000
4 számú barlang nyílásában. Boros Á.
1943 VI. 27. (BP)
- Bryorythrophyllum recurvirostrum*
(Hedw.) Chen
Gyarmati 1995, 2000, Jakab *et al.*
2007
Vargyas-szurdok. Boros Á. 1943 VI.
27. (BP)
- Bryum argenteum* Hedw.
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et Vojtkó* 2011
(Herb. EGR)
- Bryum capillare* Hedw.
Gyarmati 1995, 2000
- Bryum flaccidum* Brid.
Gyarmati 1995, 2000, Jakab *et al.*
2007
- Bryum pseudotriquetrum* (Hedw.)
Gaertn. *et al.*
Gyarmati 1995, 2000, Jakab *et al.*
2007
- Calliergonella cuspidata* (Hedw.)
Loeske
Gyarmati 1995, 2000, Sass-Gyarmati
et Vojtkó 2011 (Herb. EGR)
- Camptothecium philippeanum*
(Spruce) Kindbg.
Boros 1942 (ap. Kovács 1983)
- Campylium stellatum* (Hedw.) C. Jens
Gyarmati 1995, 2000
- Ceratodon purpureus* (Hedw.) Brid.
Gyarmati 1995, 2000
- Cirriphyllum crassinervium* (Taylor)
Loeske & M. Fleisch
Jakab *et al.* 2007
- Cirriphyllum vaucheri* (Schimp.)
Loeske *et Fleischer*
Boros 1943 (ap. Kovács 1983)
- Climacium dendroides* (Hedw.) F.
Weber & D. Mohr
Gyarmati 1995, 2000
- Cratoneuron commutatum* (Hedw.)
Roth.
Gyarmati 1995, 2000
- Cratoneuron filicinum* (Hedw.) Spruce
Gyarmati 1995, Gyarmati 2000
- Ctenidium molluscum* (Hedw.) Mitten
Boros 1942 (ap. Kovács 1983), Gyarmati
1995, 2000, Jakab *et al.* 2007,
Sass-Gyarmati *et Vojtkó* 2011 (Herb.
EGR)
- Cynodontium polycarpum* (Ehrh.)
Schimp.
Gyarmati 1995, 2000
- Dichodontium pellucidum* (Hedw.)
Schimp.
Jakab *et al.* 2007
- Dicranum fulvum* Hook.
Gyarmati 1995, 2000
- Dicranum scoparium* Hedw.
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et Vojtkó* 2011
(Herb. EGR)
- Ditrichum flexicaule* (Schwagr.)
Hampe
Gyarmati 1995, 2000

- Drepanocladus revolvens* (Sw.) Warnst.
Gyarmati 1995, 2000
- Encalypta streptocarpa* Hedw.
Jakab *et al.* 2007, Sass-Gyarmati *et Vojtkó* 2011 (Herb. EGR)
- Encalypta vulgaris* Hedw.
Gyarmati 1995, 2000
- Entodon cladorrhizans* (Hedw.) C. Müll.
Boros 1943 (ap. Kovács 1983, Munteanu *et al.* 1987, Gyarmati 1995) Sziklafelületen szép nagy gyp. Boros Á. 1943 VI. 27. (BP.)
- Entodon concinnus* (De Not.) Par. Jakab *et al.* 2007
- Eurhynchium pulchellum* (Hedw.) Jenn
Gyarmati 1995, 2000
- Eurhynchium striatum* subsp. *zetterstedtii* (Stoerm.) Podp.
Gyarmati 1995, 2000
- Fissidens bryoides* Hedw.
A 3. számú barlang nyílásában. Boros Á. 1943 VI. 27. (BP, Gyarmati 1995)
- Fissidens crassipes* Wils. ex. B.S. G. Jakab *et al.* 2007
- Fissidens cristatus* Wilson
Boros 1942 (ap. Kovács 1983, Munteanu *et al.* 1987), Gyarmati 1995, 2000, Jakab *et al.* 2007
Az Orbán Balázs barlangtól a patak medrében fölfelé haladva a baloldali felmenő út alján. Boros Á. 1943 VI. 27. (BP)
- Fissidens taxifolius* Hedw.
Jakab *et al.* 2007
- Fissidens viridulus* (Sw.) Wahlenb. var. *tenuifolius* (Boul.) A. J. E. Sm. Jakab *et al.* 2007
- Fontinalis antipyretica* Hedw.
Gyarmati 1995: 67 old., Jakab *et al.* 2007
- Grimmia pulvinata* (Hedw.) Sm.
Gyarmati 1995, 2000, Sass-Gyarmati *et Vojtkó* 2011 (Herb. EGR)
- Gymnostomum calcareum* Nees & Hornsch
Jakab *et al.* 2007
- Gymnostomum rupestre* Schleich.
Boros-Vajda 1967 (ap. Kovács 1983, Gyarmati 1995)
Az 1. számú barlang nyílásában. Boros Á. 1943 VI. 27; Az Orbán Balázs barlangtól a patak medrében fölfelé haladva, a baloldali felmenő út alján. Boros Á. 1943 VI. 27. (BP)
- Hedwigia ciliata* (Hedw.) Ehrh. ex P.Beauv
Gyarmati 2000

- Homalia trichomanoides* (Hedw.) B. S. G.
Gyarmati 1995, 2000
- Homalothecium philippeanum* (Spruce) BSG.
Gyarmati 1995, 2000, Jakab *et al.* 2007, Sass-Gyarmati *et Vojtkó* 2011 (Herb. EGR)
- Homalothecium sericeum* (Hedw.) B.S. G.
Gyarmati 1995, 2000
- Hypnum cupressiforme* Hedw.
Gyarmati 2000, Sass-Gyarmati *et Vojtkó* 2011 (Herb. EGR)
- Hypnum lindbergii* Mitten
Jakab *et al.* 2007
- Hypnum vaucheri* Lesq.
Gyarmati 1995, 2000
- Isothecium filescens* (Brid.) Moenkem.
Boros 1943 (ap. Kovács 1983, Munteanu *et al.* 1987, Gyarmati 1995)
Az Orbán Balázs barlangtól a patak medrében fölfelé haladva, a baloldali felmenő út alján. Boros Á. 1943 VI. 27. (BP, EGR)
- Leptobryum piriforme* (Hedw.) Wils
Vargyas szurdok. Boros Á. 1942 VIII. 15. (BP), Jakab *et al.* 2007
- Leucodon sciuroides* Schwaegr.
Gyarmati 1995, Sass-Gyarmati *et Vojtkó* 2011 (Herb. EGR)
- Mnium marginatum* Pal. de Beauv.
Jakab *et al.* 2007
- Mnium stellare* Hedw.
Gyarmati 1995, 2000
- Neckera complanata* (Hedw.) Hueb.
Gyarmati 1995, 2000, Jakab *et al.* 2007, Sass-Gyarmati *et Vojtkó* 2011 (Herb. EGR)
- Neckera crispa* Hedw.
Gyarmati 1995, 2000, Jakab *et al.* 2007
- Neckera webbiana* (Mont.) Düll
Jakab *et al.* 2007
- Orthotrichum anomalum* Hedw.
Gyarmati 1995, 2000
- Orthotrichum speciosum* Nees
Gyarmati 1995, Jakab *et al.* 2007
- Orthothecium intricatum* (Hartm.) B.E.
Boros-Vajda 1967 (ap. Kovács 1983, Gyarmati 1995)
Kis nyílású üreg az Orbán Balázs barlang mellett kb. 3 méternyire a völgy talpa felett. Boros Á. 1942 VIII. 15. (BP)
- Paraleucobryum longifolium* (Hedw.) Loeske
Gyarmati 1995
- Phascum cuspidatum* Hedw.
Gyarmati 1995, 2000
- Plagiomnium affine* (Funck.) Kop.
Sass-Gyarmati *et Vojtkó* 2011 (Herb. EGR)

- Plagiomnium cuspidatum* (Hedw.)
Kop.
Boros 1943, Gyarmati 1995, 2000,
Jakab *et al.* 2007
Az Orbán Balázs barlangtól fölfelé
haladva, a baloldali felmenő út alján.
Boros Á. 1943 VI. 27. (BP), Sass-
Gyarmati *et* Vojtkó 2011 (Herb. EGR)
- Plagiomnium elatum* (B.S. G.) Kop.
Gyarmati 1995, 2000, Sass-Gyarmati
et Vojtkó 2011 (Herb. EGR)
- Plagiomnium ellipticum* (Brid.) Kop.
Gyarmati 1995, 2000, Sass-Gyarmati
et Vojtkó 2011 (Herb. EGR)
- Plagiomnium rostratum* (Schrad.) TJ
Kop.
Gyarmati 1995, 2000, Sass-Gyarmati
et Vojtkó 2011 (Herb. EGR)
- Plagiomnium undulatum* (Hedw.) TJ
Kop.
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et* Vojtkó 2011
(Herb. EGR)
- Plagiopus oederi* (Brid.) Limpr.
Syn: *Bartramia oederi* (Gum.) Sw.
Boros 1943 (ap. Kovács 1983,
Munteanu *et al.* 1987, Gyarmati 1995)
Az Orbán Balázs barlangtól a patak
medrében fölfelé haladva, a baloldali
felmenő út alján. Boros Á. 1943 VI.
27. (BP)
- Plagiothecium laetum* B.S. G.
Gyarmati 1995, 2000
- Platyhypnidium riparioides* (Hedw.)
Podp.
Gyarmati 1995 idézi Boros 1942,
1943
Vízkelet árnyas sziklája a vízkitörés
mellett és fölött. Boros Á. 1942. VIII.
15; 1943 VI. 27. TTM Növénytár (BP,
Gyarmati 1995)
- Pleuridium subulatum* (Hedw.)
Rabenh.
Gyarmati 1995, 2000
- Pohlia carnea* (Schimp.) Lindb.
Jakab *et al.* 2007
- Pohlia wahlenbergii* (Web. & Mohr)
Andr.
Jakab *et al.* 2007
- Polytrichum formosum* Hedw.
Sass-Gyarmati *et* Vojtkó, 2011 (Herb.
EGR)
- Polytrichum juniperinum* (Willd.)
Hedw.
Gyarmati 1995
- Pottia truncata* (Hedw.) Bruch *et*
Schimp
Gyarmati 1995, 2000
- Pseudocrossidium horschuchianum*
(Schultz) Zander
Syn: *Barbula horschuchiana* Schultz
Jakab *et al.* 2007
- Pseudoleskeella catenulata* (Brid.)
Kindb.
Gyarmati 1995, 2000

- Pseudoleskeella nervosa* (Brid.)
Loeske
Syn: *Leskeella nervosa* (Brid.) Loeske
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et Vojtkó* 2011
(Herb. EGR)
- Rhodobryum ontariense* (Kindb.)
Kindb.
Gyarmati 1995, 2000, Jakab *et al.*
2007
- Rhodobryum roseum* (Weis.) Limpr.
Boros 1942 (ap. Kovács 1983 és
Munteanu *et al.* 1987)
- Rhynchostegium megapolitanum*
(Bland.) BSG.
Gyarmati 1995, 2000
- Rhynchostegium murale* (Hedw.)
Schimp.
Vargyas-szurdok. Boros Á. 1942 VIII.
15. (BP), Jakab *et al.* 2007
- Rhynchostegium riparioides* (Hedw.)
Cardot
Jakab *et al.* 2007
- Rhynchostegiella tenella* (Dicks.)
Limpr.
Boros 1942 (ap. Kovács 1983), Gyarmati 1995
Vargyas-szurdok. Boros Á. 1942 VIII.
15. (BP)
- Rhytidiadelphus triquetrus* (Hedw.)
Warnst.
Gyarmati 1995, 2000, Jakab *et al.*
2007
- Rhytidium rugosum* (Ehrh.) Kindbg.
Boros 1942 (ap. Kovács 1983,
Munteanu *et al.* 1987), Gyarmati
1995, Jakab *et al.* 2007, Sass-
Gyarmati *et Vojtkó* 2011 (Herb. EGR)
- Schistidium apocarpum* Bruch & WP
Schimper in BSG
Gyarmati 1995, 2000, Sass-Gyarmati
et Vojtkó 2011 (Herb. EGR)
- Schistidium apocarpum* Bruch & WP
Schimper in BSG f. *epilosa*
Jakab *et al.* 2007, Sass-Gyarmati *et*
Vojtkó 2011 (Herb. EGR)
- Seligeria cf. pusilla* (Hedw.) Br. Eur.
Jakab *et al.* 2007
- Taxiphyllum depressum* (Bruch.)
Reimers.
Boros-Vajda 1967 (ap. Kovács 1983,
Gyarmati 1995)
Az 1. számú barlang nyílásában. Bo-
ros 1943 VI. 27. (BP)
- Thamnum alopecurum* (L.) B.E.
Boros 1943 (ap. Kovács 1983,
Munteanu *et al.* 1987)
- Thuidium abietinum* (Hedw.) Schimp.
Gyarmati 1995, 2000
- Thuidium philibertii* Limpr.
Jakab *et al.* 2007, Sass-Gyarmati *et*
Vojtkó 2011 (Herb. EGR)
- Timmia austriaca* Hedw.
Jakab *et al.* 2007

Timmia bavarica Hessel.
Gyarmati 1995, 2000, Jakab *et al.*
2007

Tortella fragilis (Drum.) Limpr.
Jakab *et al.* 2007, Sass-Gyarmati *et*
Vojtkó 2011 (Herb. EGR)

Tortella inclinata (Hedw.) Limpr.
Boros 1942 (ap. Kovács 1983), Gyarmati
1995, 2000, Jakab *et al.* 2007.
Alsó-Mál tető DK-i része K-i mészkő-
sziklás lejtőjén. Boros Á. 1943 VI. 27.
(BP)

Tortella tortuosa (Hedw.) Limpr.
Jakab *et al.* 2007, Sass-Gyarmati *et*
Vojtkó 2011 (Herb. EGR)

Tortula ruralis (Hedw.) Gaerten.
Gyarmati 1995, 2000, Jakab *et al.*
2007, Sass-Gyarmati *et* Vojtkó 2011
(Herb. EGR)

Tortula ruralis var. *calcicola* (J. J.
Amann) Barkman
Jakab *et al.* 2007

Tortula virescens (De Not.) De Not
Gyarmati 2000

Trichostomum crispulum Bruch.
Boros 1942 (ap. Gyarmati 1995)
Vargyas-szurdok. Boros Á. 1942 VIII.
15. (BP)

Trichostomum mutabile Bruch.
Syn: *Trichostomum brachydontium*
Bruch.
Boros 1942 (ap. Kovács 1983)

Pteridophyta

LYCOPODIOPSIDA

Selaginellaceae

Selaginella helvetica (L.) Spring
Kovács 1983

EQUISETOPSIDA

Equisetaceae

Equisetum arvense L.
Kovács 1983, Vojtkó *et al.* 2011

Equisetum hyemale L.
Priszter 1944, Kovács 1983, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)

Equisetum palustre L.
Vojtkó ined. 1995, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)

Equisetum telmateia Ehrh.
Vojtkó ined. 1995, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)

PTERIDOPSIDA

Ophioglossaceae

Botrychium lunaria (L.) Swartz
Syn: *Osmunda lunaria* L.
Kovács 1983

Ophioglossum vulgatum L.
Boros 1943, Kovács 1983

Hypolepidaceae

Pteridium aquilinum (L.) Kuhn
Kovács 1983, Vojtkó et al. 2011

Aspleniaceae

Asplenium adiantum-nigrum L.
Jakab et al. 2007

Asplenium lepidum C. Presl
Gyarmati 1995, Jakab et al. 2007

Asplenium ramosum L.
Syn: *Asplenium viride* Hudson
Boros 1942, Kovács 1983, Munteanu
et al. 1987

Asplenium ruta-muraria L.
Boros 1942, Csűrös-Pap 1958, Kovács
1983, Munteanu et al. 1987, Gyarmati
1995, Jakab et al. 2007

Asplenium scolopendrium L.
Syn: *Phyllitis scolopendrium* (L.)
Newm.
Boros 1943, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Jakab et
al. 2007, Vojtkó, Sass-Gyarmati et
Juhász 2011 (Herb. EGR)

Asplenium trichomanes L.
Boros 1942, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Jakab et
al. 2007

Athyrium filix-femina (L.) Roth
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)

Cystopteris fragilis (L.) Bernh.
Boros 1942, Kovács 1983, Gyarmati
1995

Dryopteris carthusiana (Vill.) H. P.
Fuchs.
Kovács 1983

Dryopteris expansa (C. B. Presl)
Fras.-Jenk.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Dryopteris filix-mas (L.) Schott
Priszter 1944, Kovács 1983,
Munteanu et al. 1987, Gyarmati 1995

Gymnocarpium dryopteris (L.)
Newman
Syn: *Dryopteris disjuncta* (Rupr.) CV.
Morton
Kovács 1983, Gyarmati 1995

Gymnocarpium robertianum (Hoffm.)
Newman
Syn: *Dryopteris robertiana* (Hoffm.)
Christ.
Kovács 1983

Thelypteris palustris Schott
Kovács 1983

Polypodiaceae

Polypodium interjectum Shivas
Ined. Vojtkó 1993, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Polypodium vulgare L.
Priszter 1944, Kovács 1983,
Munteanu et al. 1987, Gyarmati 1995,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Gymnospermatophyta

Taxaceae

Taxus baccata L.
Csűrös-Pap 1958, Kovács 1983,
Munteanu *et al.* 1987

Pinaceae

Picea abies (L.) Karsten
Syn: *Picea excelsa* Link
Boros 1943, Kovács 1983, Munteanu
et al. 1987, Jakab *et al.* 2007

Pinus sylvestris L.
Kovács 1983, ined. Vojtkó 1993,
Vojtkó *et al.* 2011

Cupressaceae

Juniperus communis L.
Csűrös-Pap 1958, Kovács 1983, Jakab
et al. 2007

Angiospermatophyta

DICOTYLEDONAE

Berberidaceae

Berberis vulgaris L.
Csűrös-Pap 1958, Kovács 1983,
Gyarmati 1995

Ranunculaceae

Aconitum anthora L.
Boros 1942, Kovács 1983, Gyarmati
1995, Jakab *et al.* 2007

Aconitum lycoctonum subsp. *vulparia*
(Reichb. ex Spreng. em Rchb.) Nyman
Gyarmati 1995

Aconitum moldavicum Hacq.
Boros 1942, Kovács 1983, Gyarmati
1995, Jakab *et al.* 2007, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)

Aconitum variegatum L.
incl. *Aconitum gracile* Rchb.
Boros 1943, Kovács 1983, Gyarmati
1995, Vojtkó, Sass-Gyarmati *et* Juhász
2011 (Herb. EGR)

Actaea spicata L.
Priszter 1944, Kovács 1983, Gyarmati
1995

Anemone nemorosa L.
Kovács 1983, Gyarmati 1995

Anemone ranunculoides L.
Kovács 1983, Gyarmati 1995

Aquilegia vulgaris L.
Gyarmati 1995

Caltha palustris L.
incl. *Caltha laeta* Schott; Nyman *et*
Kotschy
Kovács 1983, ined. Vojtkó 1992, Ja-
kab *et al.* 2007, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)

Clematis alpina (L.) Miller
Boros 1942-43, Priszter 1944, Kovács
1983, Gyarmati 1995, Jakab *et al.*
2007, Vojtkó, Sass-Gyarmati *et* Juhász
2011 (Herb. EGR)

Clematis integrifolia L.

Kovács 1983

Clematis recta L.

Kovács 1983, Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Clematis vitalba L.

Kovács 1983

Helleborus purpurascens Waldst. et Kit.

Boros 1942, Kovács 1983, Munteanu et al. 1987, Gyarmati 1995, Jakab et al. 2007

Hepatica transsilvanica Fuss

Syn: *Anemone transsilvanica* (Fuss) Heuff.

Boros 1942, Priszter 1944, Kovács 1983, Munteanu et al. 1987, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Isopyrum thalictroides L.

Priszter 1944, Kovács 1983, Gyarmati 1995

Pulsatilla pratensis (L.) Miller

Kovács 1983

Ranunculus auricomus L.

Kovács 1983

Ranunculus cassubicus L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Ranunculus ficaria Huds.

Syn: *Ficaria verna* Hudson
Vojtkó ined. 1995

Ranunculus flammula L.

Jakab et al. 2007

Ranunculus nemorosus DC.

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Ranunculus oreophilus Bieb.

Syn: *Ranunculus hornschurchii* Hoppe
Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Ranunculus polyanthemus L.

Vojtkó ined. 1995

Ranunculus repens L.

Kovács 1983, Jakab et al. 2007

Ranunculus sceleratus L.

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Thalictrum aquilegifolium L.

Priszter 1944, Kovács 1983, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Thalictrum foetidum L.

Gyarmati 1995

Thalictrum minus L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Trollius europaeus L.

Boros 1943, Priszter 1944, Kovács 1983, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Aristolochiaceae

Aristolochia clematitidis L.

Kovács 1983, Jakab *et al.* 2007

Asarum europaeum L.

Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Rosaceae

Agrimonia eupatoria L.

Kovács 1983, Jakab *et al.* 2007

Agrimonia pilosa Ledeb.

Jakab *et al.* 2007

Agrimonia procera Wallr.

Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Alchemilla xanthochlora Rothm.

Kovács 1983

Comarum palustre L.

Syn: *Potentilla palustris* (L.) Scop.

Kovács 1983, Gyarmati 1995

Cotoneaster integerrimus Medik.

Csűrös-Pap 1958, Kovács 1983, Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)

Crataegus laevigata (Poiret) DC

Syn: *Crataegus oxyacantha* L

Gyarmati 1995

Crataegus monogyna Jacq.

Kovács 1983, Munteanu *et al.* 1987,
Jakab *et al.* 2007

Filipendula ulmaria (L.) Maxim

Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Filipendula vulgaris Moench

Syn: *Filipendula hexapetala* Gilib.

Priszter 1944, Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Fragaria vesca L.

Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Fragaria viridis Weston

Kovács 1983, Jakab *et al.* 2007

Geum aleppicum Jacq.

Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Geum urbanum L.

Gyarmati 1995

Geum rivale L.

Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Malus sylvestris (L.) Miller

Kovács 1983

Padus avium Miller

Boros 1943, Priszter 1944, Kovács 1983, Gyarmati 1995

Potentilla alba L.

Kovács 1983, Vojtkó ined. 1995, Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)

Potentilla arenaria Borkh.

Syn: *Potentilla cinerea* Chaix

Kovács 1983, Gyarmati 1995

- Potentilla erecta* (L.) Rausch.
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)
- Potentilla heptaphylla* L.
Vojtkó ined. 1995, Vojtkó et al. 2011
- Potentilla patula* W. et K.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Potentilla thuringiaca* Bernh. ex Link
Boros 1942, Priszter 1944, Kovács
1983, Gyarmati 1995
- Prunus spinosa* L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007
- Pyrus pyraister* (L.) Burgsd.
Kovács 1983
- Rosa gallica* L.
Ined. Vojtkó 1993, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)
- Rosa pendulina* L.
Kovács 1983, ined. Vojtkó 1993, Ja-
kab et al. 2007, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)
- Rosa pimpinellifolia* L.
Csűrös-Pap 1958, Kovács 1983, ined.
Vojtkó 1993, Vojtkó et al. 2011
- Rubus caesius* L.
Kovács 1983, Munteanu et al. 1987
- Rubus hirtus* W. et K.
Vojtkó et al. 2011
- Rubus idaeus* L.
Gyarmati 1995
- Rubus saxatilis* L.
Gyarmati 1995, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)
- Sanguisorba minor* Scop.
Kovács 1983
- Sanguisorba officinalis* L.
Vojtkó ined. 1995, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)
- Spiraea chamaedrifolia* L.
Syn: *Spiraea ulmifolia* Scop.
Gyarmati 1995, Jakab et al. 2007,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Spiraea crenata* L.
Kovács 1983
- Sorbus aucuparia* L.
Kovács 1983, Gyarmati 1995
- Sorbus torminalis* (L.) Crantz
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)
- Waldsteinia geoides* Willd.
Boros 1942, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Jakab et
al. 2007
- Crassulaceae*
- Jovibarba globifera* (L.) J. Parnell
subsp. *hirta* (L.) J. Parnell
Syn: *Jovibarba hirta* (L.) Opiz
Ined. Vojtkó 1993

Jovibarba heuffelii (Schott) A. et D. Löve
Syn: *Sempervivum heuffelii* Schott
Kovács 1983, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Sedum acre L.
Kovács 1983, Vojtkó ined. 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Sedum album L.
Kovács 1983, Jakab et al. 2007

Sedum hispanicum Jusl.
Boros 1943, Csűrös-Pap 1958, Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Sedum maximum (L.) Hoffm.
Csűrös-Pap 1958, Kovács 1983, Jakab et al. 2007

Sedum sexangulare L.
Ined. Vojtkó 1993, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Sempervivum marmoreum Griseb.
Syn: *Sempervivum schlehani* Schott
Priszter 1944, Csűrös-Pap 1958, Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Saxifragaceae

Chrysosplenium alternifolium L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Parnassia palustris L.
Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Saxifraga paniculata Miller
Syn: *Saxifraga aizoon* Jacq.
Boros 1942, Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Grossulariaceae

Ribes alpinum L.
Kovács 1983, Gyarmati 1995

Ribes petraeum Wulfen in Jacq.
Gyarmati 1995, Jakab et al. 2007

Ribes uva-crispa L.
Syn: *Ribes grossularia* L.
Priszter 1944, Kovács 1983, Munteanu et al. 1987, Gyarmati 1995

Fabaceae

Anthyllis vulneraria L. subsp. *polyphylla* (DC.) Nyman
Kovács 1983, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Astragalus glycyphyllos L.
Kovács 1983, Vojtkó et al. 2011

Chamaecytisus albus (Hacq.) Rothm.
Boros 1943, Priszter 1944, Kovács 1983, Munteanu et al. 1987, Gyarmati 1995, Jakab et al. 2007

Chamaecytisus austriacus (L.) Link.
Kovács 1983, Jakab et al. 2007

Chamaecytisus ciliatus (Wahlenb.) Rothm. subsp. *ciliatus*
Syn: *Cytisus leucotrichus* L. subsp. *ciliatus*
Gyarmati 1995

Chamaecytisus hirsutus (L.) Link
subsp. leucotrichus (Schur) A et D.

Löve

Syn: *Cytissus leucotrichus* Schur
Boros 1943, Priszter 1944, Kovács
1983, Munteanu *et al.* 1987, Gyarmati
1995, Vojtkó, Sass-Gyarmati *et Juhász*
2011 (Herb. EGR)

Coronilla varia L.

Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Cytisus nigricans L.

Kovács 1983, Jakab *et al.* 2007

Cytisus procumbens (Waldst. et Kit.)
Sprengel

Kovács 1983, Vojtkó *et al.* 2011

Genista pilosa L.

Kovács 1983

Genista tinctoria L.

Kovács 1983, Jakab *et al.* 2007

Genistella sagittalis (L.) Gams

Syn: *Genista sagittalis* L.
Priszter 1944, Kovács 1983, Gyarmati
1995, Jakab *et al.* 2007

Lathyrus aphaca L.

Kovács 1983

Lathyrus hallersteinii Baumg.

Kovács 1983

Lathyrus niger (L.) Bernh.

Ined. Vojtkó 1993, Vojtkó, Sass-
Gyarmati *et Juhász* 2011 (Herb. EGR)

Lathyrus nissolia L.

Kovács 1983

Lathyrus sylvestris L.

Kovács 1983

Lathyrus laevigatus (Waldst. et Kit.)

Gren.

incl. *Lathyrus transsilvanicus*

(Sprengel) Fritsch

Priszter 1944, Kovács 1983, Gyarmati
1995, Jakab *et al.* 2007, Vojtkó, Sass-
Gyarmati *et Juhász* 2011 (Herb. EGR)

Lathyrus tuberosus L.

Kovács 1983, Jakab *et al.* 2007

Lathyrus vernus (L.) Bernh.

Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati *et Juhász* 2011 (Herb.
EGR)

Lotus corniculatus L.

Kovács 1983, Vojtkó ined. 1995, Ja-
kab *et al.* 2007, Vojtkó, Sass-
Gyarmati *et Juhász* 2011 (Herb. EGR)

Medicago falcata L.

Gyarmati 1995

Medicago lupulina L.

Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)

Medicago minima (L.) L.

Kovács 1983

Onobrychis arenaria (Kit.) DC.

Kovács 1983, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et Juhász* 2011
(Herb. EGR)

Trifolium alpestre L.

Gyarmati 1995

Trifolium campestre Schreber
Kovács 1983, Jakab *et al.* 2007

Trifolium hybridum L.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Trifolium medium L.
Kovács 1983

Trifolium montanum L.
Jakab *et al.* 2007

Trifolium ochroleucon Hudson
Jakab *et al.* 2007

Trifolium pannonicum Jacq
Kovács 1983, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Vicia cracca L.
Kovács 1983

Vicia pannonica Crantz
Kovács 1983

Vicia sylvatica L.
Ined. Vojtkó 1993

Vicia tenuifolia Roth.
Kovács 1983, Vojtkó *et al.* 2011

Thymelaeaceae

Daphne mezereum L.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995, Jakab *et al.* 2007

Lythraceae

Peplis portula L.
Jakab *et al.* 2007

Onagraceae

Epilobium montanum L.
Kovács 1983

Epilobium palustre L.
Jakab *et al.* 2007

Polygalaceae

Polygala amara L.
Kovács 1983, ined. Vojtkó 1993, Ja-
kab *et al.* 2007

Polygala comosa Schkuhr.
Kovács 1983, Vojtkó ined. 1995, Ja-
kab *et al.* 2007

Polygala major Jacq.
Priszter 1944, Kovács 1983, Gyarmati
1995

Aceraceae

Acer campestre L.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995, Jakab *et al.* 2007

Acer platanoides L.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995, Jakab *et al.* 2007

Acer pseudoplatanus L.
Kovács 1983, Gyarmati 1995

Balsaminaceae

Impatiens noli-tangere L.
Kovács 1983, Gyarmati 1995, Jakab *et*
al. 2007

Celastraceae

Euonymus europaeus L.
Kovács 1983, Gyarmati 1995

Euonymus verrucosus Scop.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Rhamnaceae

Frangula alnus Miller
Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Rhamnus cathartica L.
Kovács 1983, ined. Vojtkó 1993, Jakab et al. 2007

Rhamnus saxatilis Jacq. subsp. *tinctorius* (Waldst. et Kit.) Nyman.
Syn: *Rhamnus tinctoria* Waldst. et Kit.
Boros 1943, Csűrös-Pap 1958, Kovács 1983, Munteanu et al. 1987, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Araliaceae

Hedera helix L.
Kovács 1983, Jakab et al. 2007

Cornaceae

Cornus mas L.
Kovács 1983, Munteanu et al. 1987, Gyarmati 1995, Jakab et al. 2007

Cornus sanguinea L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Apiaceae (Umbelliferae)

Aegopodium podagraria L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Angelica sylvestris L.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Anthriscus nitida (Wahlenbg.) Garcke
Boros 1943, Kovács 1983, Munteanu et al. 1987, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Anthriscus sylvestris (L.) Hoffm.
Vojtkó ined. 1995

Astrantia major L.
Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Bupleurum falcatum L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Bupleurum junceum L.
Syn: *Bupleurum praealtum* Nath.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carum carvi L.
Kovács 1983, Vojtkó et al. 2011

Caucalis platycarpos L.
Kovács 1983

Chaerophyllum aromaticum L.
Gyarmati 1995

- Chaerophyllum aureum* L.
Syn: *Chaerophyllum maculatum*
Willd. ex DC.
Kovács 1983, Jakab *et al.* 2007
- Chaerophyllum hirsutum* L.
Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Chaerophyllum temulum* L.
Kovács 1983, Vojtkó *et al.* 2011
- Cnidium silaifolium* (Jacq.) Simonkai
Boros 1942, Priszter 1944, Kovács 1983, Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Daucus carota* L.
Kovács 1983, Jakab *et al.* 2007
- Eryngium planum* L.
Vojtkó ined. 1995, Vojtkó *et al.* 2011
- Ferulago sylvatica* (Besser) Reichenb.
Boros 1943, Priszter 1944, Kovács 1983, Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Heracleum sphondylium* L.
Kovács 1983, Gyarmati 1995
- Laser trilobum* (L.) Borkh.
Gyarmati 1995
- Laserpitium latifolium* L.
Kovács 1983, ined. Vojtkó 1993, Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Laserpitium prutenicum* L.
Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- palustre* (L.) Moench
Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Peucedanum oreoselinum* (L.)
Moench
Ined. Vojtkó 1993, Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Pimpinella major* (L.) Hudson
Kovács 1983, Jakab *et al.* 2007
- Pleurospermum austriacum* (L.)
Hoffm.
Priszter 1944, Kovács 1983, Gyarmati 1995, Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Sanicula europaea* L.
Kovács 1983, Jakab *et al.* 2007
- Selinum carvifolium* (L.) L.
Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et Juhász* 2011 (Herb. EGR)
- Seseli gracile* Waldst. *et* Kit.
Kovács 1983
- Seseli libanotis* (L.) Koch
Syn: *Libanotis montana* Crantz.,
Libanotis pyrenaica (L.) Bourg.
Boros 1942, Kovács 1983, Munteanu *et al.* 1987, Gyarmati 1995, Jakab *et al.* 2007
- Seseli rigidum* Waldst. *et* Kit.
Kovács 1983
- Torilis arvensis* (Hudson) Link.
Kovács 1983

Rubiaceae

Asperula cynanchica L.
Kovács 1983, Jakab et al. 2007,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Cruciata glabra (L.) Ehrend.
Kovács 1983, Vojtkó ined. 1995,
Vojtkó et al. 2011

Cruciata laevipes Opiz
Syn: *Galium cruciata* (L.) Scop.
Gyarmati 1995

Galium album Mill.
Syn: *Galium erectum* Huds.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Galium aparine L.
Gyarmati 1995

Galium mollugo L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Galium octonarium (Klokov) Pobed.
Syn: *Asperula campanulata* Klokov.
subsp. *octonaria* (Klokov)
Kovács 1983

Galium odoratum (L.) Scop.
Syn: *Asperula odorata* L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Galium purpureum L.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Galium rubioides L. subsp. *rubioides*
Čelak
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)

Galium schultesii Vest
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007, Vojtkó, Sass-Gyarmati et
Juhász 2011 (Herb. EGR)

Galium verum L.
Kovács 1983, Jakab et al. 2007

Caprifoliaceae

Lonicera xylosteum L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Sambucus ebulus L.
Kovács 1983, Jakab et al. 2007

Sambucus nigra L.
Kovács 1983, Munteanu et al. 1987,
Jakab et al. 2007

Sambucus racemosa L.
Priszter 1944, Kovács 1983, Gyarmati
1995, Jakab et al. 2007

Viburnum lantana L.
Kovács 1983, Jakab et al. 2007

Viburnum opulus L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Adoxaceae

Adoxa moschatellina L.
Priszter 1944, Kovács 1983, Gyarmati
1995

Valerianaceae

Valeriana dioica L.

Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Valeriana officinalis L.

Gyarmati 1995

Valeriana sambucifolia Mikan fil.

Gyarmati 1995

Valeriana tripteris L.

Boros 1942, Priszter 1944, Gyarmati
1995

Valeriana wallrothii Kreyer

Syn: *Valeriana officinalis* L. subsp.
collina (Wallr.) Nyman
Kovács 1983

Valerianella dentata (L.) Pollich

Kovács 1983

Dipsacaceae

Dipsacus laciniatus L.

Kovács 1983, Jakab et al. 2007

Knautia arvensis (L.) Coulter

Jakab et al. 2007

Scabiosa columbaria L. incl. subsp.

pseudobanatica (Schur) Jáv. et
Csapody

Boros 1942, Kovács 1983, Gyarmati
1995, Jakab et al. 2007, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Scabiosa ochroleuca L.

Kovács 1983, Jakab et al. 2007

Succisa pratensis Moench

Kovács 1983, Jakab et al. 2007

Tiliaceae

Tilia cordata Miller

Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Tilia platyphyllos Scop.

Gyarmati 1995

Tilia platyphyllos Scop. subsp.

caucasica (Rupr.) Soó

Syn: *Tilia caucasica* Rupr.

Boros 1943, Kovács 1983

Linaceae

Linum catharticum L.

Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Linum flavum L.

Kovács 1983, Jakab et al. 2007

Linum nervosum Waldst. et Kit.

Kovács 1983

Oxalidaceae

Oxalis acetosella L.

Kovács 1983, Gyarmati 1995

Geraniaceae

Erodium cicutarium (L.) L'Hérit.

Vojtkó ined. 1995

Geranium columbinum L.

Kovács 1983

Geranium lucidum L.

Kovács 1983

Geranium palustre L.

Kovács 1983, Vojtkó et al. 2011

Geranium phaeum L.

Priszter 1944, Kovács 1983,
Munteanu et al. 1987, ined. Vojtkó
1993, Vojtkó et al. 2011

Geranium pratense L.

Kovács 1983, Vojtkó ined. 1995,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Geranium robertianum L.

Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Geranium rotundifolium L.

Kovács 1983, Gyarmati 1995

Geranium sanguineum L.

Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Geranium sylvaticum L.

Kovács 1983, Jakab et al. 2007

Euphorbiaceae

Euphorbia amygdaloides L.

Kovács 1983, Gyarmati 1995

Euphorbia angulata Jacq.

Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Euphorbia carniolica Jacq.

Priszter 1944, Kovács 1983, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)

Euphorbia cyparissias L.

Csűrös-Pap 1958, Kovács 1983,
Gyarmati 1995

Euphorbia dulcis L.

Gyarmati 1995

Euphorbia epithymoides L.

Syn: *Euphorbia polychroma* A. Ker-
ner
Kovács 1983, Gyarmati 1995

Euphorbia villosa Waldst. et Kit. ex
Willd.

Kovács 1983

Mercurialis perennis L.

Kovács 1983, Gyarmati 1995

Callitrichaceae

Callitriche cophocarpa Sendtner

Jakab et al. 2007

Oleaceae

Fraxinus excelsior L.

Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Ligustrum vulgare L.

Kovács 1983, Jakab et al. 2007

Gentianaceae

Centaurium erythraea Rafin.

Jakab et al. 2007

Gentiana asclepiadea L.

Kovács 1983, Gyarmati 1995, Jakab et
al. 2007, Vojtkó, Sass-Gyarmati et
Juhász 2011 (Herb. EGR)

Gentiana cruciata L.
Kovács 1983, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Gentiana utriculosa L.
Kovács 1983

Asclepiadaceae

Vincetoxicum hirundinaria Medikus
Csűrös-Pap 1958, Kovács 1983,
Gyarmati 1995, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Convolvulaceae

Cuscuta europaea L.
Kovács 1983

Boraginaceae

Echium vulgare L.
Kovács 1983

Lithospermum arvense L.
Kovács 1983, Gyarmati 1995

Lithospermum officinale L.
Priszter 1944, Kovács 1983

Lithospermum purpureo-coeruleum L.
Kovács 1983

Myosotis arvensis Hill.
Kovács 1983

Myosotis scorpioides L.
Syn: *Myosotis palustris* (L.) Hill
Vojtkó ined. 1995, Jakab *et al.* 2007,
Vojtkó *et al.* 2011

Myosotis sparsiflora Mikan ex Pohl
Boros 1943, Kovács 1983

Myosotis sylvatica Ehrh. ex Hoffm.
Jakab *et al.* 2007

Pulmonaria mollis Wulfen ex
Hornem.
Kovács 1983

Pulmonaria officinalis L.
Kovács 1983, Vojtkó *et al.* 2011

Symphytum cordatum Waldst. *et* Kit.
Boros 1943, Priszter 1944, Kovács
1983, Munteanu *et al.* 1987, Gyarmati
1995, Jakab *et al.* 2007, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)

Symphytum tuberosum L.
Kovács 1983

Lamiaceae (Labiatae)

Acinos arvensis (Lam.) Dandy
Syn: *Calamintha acinos* (L.) Clairv.
Kovács 1983, Vojtkó ined. 1995,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Acinos alpinus (L.) Moench subsp.
majoranifolius (Miller) P.W. Ball
Syn: *Calamintha alpina* (L.) Lam.
subsp. *majoranifolia* (Mill.) Hay.,
Satureja hungarica (Simonkai) Hayek
Boros 1943, Kovács 1983, Gyarmati
1995, Vojtkó, Sass-Gyarmati *et* Juhász
2011 (Herb. EGR)

Ajuga genevensis L.
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)

Ajuga reptans L.

Kovács 1983, Vojtkó et al. 2011

Galeopsis ladanum L.

Kovács 1983

Glechoma hederacea L.

Kovács 1983

Glechoma hirsuta Waldst. et Kit.

Kovács 1983, Gyarmati 1995

Lamium album L.

Kovács 1983

Lamium galeobdolon (L.) L.

Syn: *Galeobdolon luteum* Hudson

Kovács 1983, Gyarmati 1995

Lamium maculatum L.

Kovács 1983, Gyarmati 1995

Lamium purpureum L.

Gyarmati 1995, Kovács 1983

Marrubium vulgare L.

Kovács 1983

Melittis melissophyllum L.

Kovács 1983, Jakab et al. 2007

Melittis melissophyllum subsp.

carpatica (Klokov) P.W. Ball

Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Mentha longifolia (L.) Hudson

Kovács 1983

Mentha verticillata L.

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Nepeta nuda L.

Syn: *Nepeta pannonica* L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Origanum vulgare L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Salvia glutinosa L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Salvia nemorosa L.

Kovács 1983

Salvia pratensis L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Salvia verticillata L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Stachys alpina L.

Munteanu et al. 1987, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Stachys germanica L.

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Stachys officinalis (L.) Trev.

Syn: *Betonica officinalis* L.

Vojtkó ined. 1995, Vojtkó et al. 2011

Stachys recta L.

Kovács 1983, Gyarmati 1995, Jakab et al. 2007

- Stachys sylvatica* L.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995, Jakab *et al.* 2007
- Prunella grandiflora* (L.) Scholler
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Prunella laciniata* (L.) Nath.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Teucrium chamaedrys* L.
Kovács 1983, Gyarmati 1995, Jakab *et*
al. 2007, Vojtkó, Sass-Gyarmati *et*
Juhász 2011 (Herb. EGR)
- Teucrium montanum* L.
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)
- Teucrium villosum* L.
Syn: *Teucrium divaricatum* Sieb.
subsp. *villosum* (Čelak.) Rech.
Boros 1942, Gyarmati 1995
- Thymus comosus* Heuffel ex Griseb.
Boros 1942, Kovács 1983, Gyarmati
1995, Jakab *et al.* 2007
- Thymus dacicus* Borb.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Thymus glabrescens* Willd.
Kovács 1983
- Thymus marginatus* Kern.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Thymus serpyllum* L.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Scrophulariaceae*
- Digitalis grandiflora* Miller
Kovács 1983, Jakab *et al.* 2007
- Euphrasia officinalis* Schübler *et* Mar-
tens
Syn: *Euphrasia rostkoviana* Hayne
Kovács 1983
- Euphrasia tatarica* Fisch.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Linaria angustissima* (Loisel.) Borbás
Kovács 1983
- Linaria genistifolia* (L.) Miller
Ined. Vojtkó 1993
- Melampyrum bihariense* A. Kerner
Kovács 1983, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Melampyrum sylvaticum* L.
Gyarmati 1995
- Pedicularis comosa* L. subsp.
campestris (Griseb) Jáv.
Syn: *Pedicularis campestris* L.
Boros 1943, Priszter 1944, Kovács
1983, Gyarmati 1995, Jakab *et al.*
2007
- Pedicularis palustris* L.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Rhinanthus angustifolius CC. Gmelin
Kovács 1983, Jakab et al. 2007,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Rhinanthus rumelicus Velen.
Kovács 1983, Gyarmati 1995

Scrophularia heterophylla Willd.
subsp. *laciniata* (Waldst. et Kit.)
Maire et Petitmengin
Syn: *Scrophularia lasiocaulis* Schur
Boros 1942, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Jakab et
al. 2007

Scrophularia nodosa L.
Jakab et al. 2007, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Scrophularia scopolii Hoppe
Kovács 1983

Verbascum x collinum Schrad.
(=*Verbascum nigrum* x *Verbascum*
thapsus)
Kovács 1983

Verbascum lychnitis L.
Gyarmati 1995, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Verbascum lychnitis L. subsp.
kanitzianum (Simk. et Walz.) Soó
Kovács 1983

Verbascum nigrum L.
Kovács 1983

Verbascum phlomoides L.
Kovács 1983, Jakab et al. 2007

Verbascum phoeniceum L.
Gyarmati 1995

Veronica beccabunga L.
Kovács 1983

Veronica chamaedrys L.
Kovács 1983, Gyarmati 1995

Veronica orchidea Crantz
Syn: *Veronica spicata* L. subsp. *orc-*
hidea (Cr.) Čelak
Kovács 1983, Jakab et al. 2007

Veronica spicata L.
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)

Veronica urticifolia Jacq.
Syn: *Veronica latifolia* L.
Boros 1943, Kovács 1983, Munteanu
et al. 1987, Jakab et al. 2007

Orobanchaceae

Orobanche alba Stephan ex Willd.
Kovács 1983, Jakab et al. 2007

Lentibulariaceae

Pinguicula vulgaris L.
Gyarmati 1995, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Plantaginaceae

Plantago lanceolata L.
Kovács 1983

Plantago media L.
Kovács 1983, Vojtkó ined. 1995,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Papaveraceae

Chelidonium majus L.
Kovács 1983, Gyarmati 1995

Fumariaceae

Corydalis capnoides (L.) Pers.
Syn: *Corydalis alba* (Mill.) Mansf.,
Corydalis gebleri Ledeb
Boros 1942, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Jakab *et al.* 2007

Corydalis cava (L.) Schweigg. *et*
Koerte
Syn: *Corydalis bulbosa* (L.) DC.
Kovács 1983, Gyarmati 1995

Corydalis solida (L.) Clairv.
Gyarmati 1995

Fumaria rostellata Knaf
Kovács 1983

Fumaria schleicheri Soy.-Willem.
Csürös-Pap 1958, Kovács 1983

Brassicaceae (Cruciferae)

Alliaria petiolata (Bieb.) Cavara *et*
Grande
Kovács 1983, Gyarmati 1995

Alyssum alyssoides (L.) L.
Kovács 1983

Alyssum repens Baumg. subsp.
transsilvanicum (Schur) Nyman
Kovács 1983

Alyssum saxatile L.
Boros 1942, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Jakab *et al.* 2007

Arabis alpina L.
Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Arabis auriculata Lam.
Syn: *Arabis recta* Vill.
Gyarmati 1995

Arabis hirsuta (L.) Scop.
Kovács 1983, Jakab *et al.* 2007

Arabis turrata L.
Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Biscutella laevigata L.
Kovács 1983, Jakab *et al.* 2007

Camelina sativa (L.) Cr.
Kovács 1983

Capsella bursa-pastoris (L.) Medik
Vojtkó ined. 1995

Cardamine amara L.
Gyarmati 1995, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)

Cardamine impatiens L.
Kovács 1983, ined. Vojtkó 1993, Ja-
kab *et al.* 2007

Cardaminopsis arenosa (L.) Hayek
Kovács 1983, Gyarmati 1995

Cardaminopsis halleri (L.) Hayek
subsp. *ovirensis* (Wulfen) Hegi et E.
Schmid
Kovács 1983

Dentaria bulbifera L.
Kovács 1983, Gyarmati 1995

Dentaria glandulosa Waldst. et Kit.
Syn: *Dentaria glanduligera* O.
Schwartz
Priszter 1944, Kovács 1983, Gyarmati
1995

Draba nemorosa L.
Gyarmati 1995

Erysimum cheiranthoides L.
Kovács 1983

Erysimum odoratum Ehrh.
Syn: *Erysimum pannonicum* Cr. var.
speciosum Nyár.
Csűrös-Pap 1958, Kovács 1983, Jakab
et al. 2007

Erysimum witmannii Zawadzki subsp.
transsilvanicum (Schur) P.W. Ball
Syn: *Erysimum baumgartenianum*
Schur
Priszter 1944, Kovács 1983, Gyarmati
1995, Jakab et al. 2007

Hesperis matronalis L.
Boros 1942-43, Kovács 1983, Gyarmati
1995, Jakab et al. 2007, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)

Kernera saxatilis (L.) Reichenb.
Kovács 1983

Lunaria rediviva L.
Boros 1942, Priszter 1944, Kovács
1983, Munteanu et al. 1987, Gyarmati
1995, Jakab et al. 2007

Rorippa pyrenaica (Lam.) Reichenb.
Syn: *Rorippa stylosa* (Pers.) Mansf. et
Rothm.

Boros 1943, Priszter 1944, Kovács
1983, ined. Vojtkó 1993

Sisymbrium strictissimum L.
Munteanu et al. 1987, Vojtkó et al.
2011

Cistaceae

Helianthemum nummularium (L.)
Miller
Kovács 1983, Jakab et al. 2007,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Helianthemum nummularium (L.)
Mill. subsp. *obscurum* (Čelak.) Holub
Kovács 1983

Violaceae

Viola arvensis Murray
Kovács 1983, Jakab et al. 2007,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Viola canina L. subsp. *montana* (L.)
Hartm.
Syn: *Viola montana* L.
Priszter 1944, Kovács 1983

Viola collina Besser
Kovács 1983

- Viola cyanea* Čelak.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Viola dacica* Borb.
Ined. Vojtkó 1993, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)
- Viola joói* Janka
Boros 1943, Kovács 1983, Munteanu
et al. 1987, Jakab et al. 2007
- Viola mirabilis* L.
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)
- Viola odorata* L.
Kovács 1983
- Viola reichenbachiana* Jordan ex
Boreau
Kovács 1983
- Viola riviniana* Reichenb.
Gyarmati 1995
- Viola tricolor* L. subsp. *subalpina*
Gaudin
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007
- Hypericaceae*
- Hypericum maculatum* Crantz
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007, Vojtkó, Sass-Gyarmati et
Juhász 2011 (Herb. EGR)
- Hypericum perforatum* L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007, Vojtkó, Sass-Gyarmati et
Juhász 2011 (Herb. EGR)
- Hypericum tetrapterum* Fries
Jakab et al. 2007
- Pyrolaceae*
- Chimaphila umbellata* (L.) Barton
Kovács 1983
- Orthilia secunda* (L.) House
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Monotropaceae*
- Monotropa hypopitys* L.
Jakab et al. 2007, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)
- Ericaceae*
- Vaccinium vitis-idaea* L.
Kovács 1983
- Campanulaceae*
- Adenophora liliifolia* (L.) Besser
Kovács 1983
- Campanula cervicaria* L.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Campanula glomerata* L.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Campanula latifolia L.
Gyarmati 1995, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Campanula patula L.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Campanula persicifolia L.
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)

Campanula rapunculoides L.
Kovács 1983, Gyarmati 1995, Jakab *et*
al. 2007

Campanula rotundifolia L.
Boros 1942, Kovács 1983, Gyarmati
1995

Campanula rotundifolia L. subsp.
kladniana (Schur) Tacik
Kovács 1983, Jakab *et al.* 2007

Campanula rotundifolia L. subsp.
polymorpha (Witašek) Tacik
Kovács 1983

Campanula sibirica L.
Boros 1942, Csűrös-Pap 1958, Kovács
1983, Gyarmati 1995, Jakab *et al.*
2007

Campanula trachelium L.
Kovács 1983, Jakab *et al.* 2007

Phyteuma orbiculare L.
Kovács 1983

Phyteuma spicatum L.
Jakab *et al.* 2007

Phyteuma tetramerum Schur
Boros 1943, Kovács 1983, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)

Asteraceae (Compositae)

Achillea asplenifolia Vent.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Achillea collina J. Becker
Kovács 1983, ined. Vojtkó 1993,
Vojtkó *et al.* 2011

Achillea distans Waldst. *et* Kit. ex
Willd.
Kovács 1983, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Achillea millefolium L.
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Achillea pannonica Scheele
Gyarmati 1995

Achillea ptarmica L.
Kovács 1983, Jakab *et al.* 2007

Achillea setacea Waldst. *et* Kit.
Kovács 1983

Anthemis tinctoria L.
Kovács 1983, Gyarmati 1995, Jakab *et*
al. 2007

- Arctium lappa* L.
Kovács 1983
- Arctium nemorosum* Lej.
Gyarmati 1995
- Artemisia alba* Turra
Syn: *Artemisia lobelii* All.
Kovács 1983
- Artemisia campestris* L.
Kovács 1983, ined. Vojtkó 1993,
Vojtkó *et al.* 2011
- Artemisia capillaris* Thunb.
Syn: *Artemisia scoparia* Waldst. *et*
Kit.
Kovács 1983
- Aster amellus* L.
Kovács 1983
- Carduus candicans* Waldst. *et* Kit.
Boros 1942, Kovács 1983, Munteanu
et al. 1987, Jakab *et al.* 2007, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)
- Carduus crispus* L.
Boros 1942, Kovács 1983, Jakab *et al.*
2007
- Carduus glaucinus* Holub.
Syn: *Carduus glaucus* Baumg. non
Cav.
Kovács 1983
- Carduus personatus* (L.) Jacq.
Boros 1943, Kovács 1983, Munteanu
et al. 1987, Jakab *et al.* 2007
- Carduus x umbrosus* Simonk.
Syn: *Carduus simonkaianus* Nyár.,
(=*Carduus candicans* x *Carduus*
crispus)
Boros 1942, Kovács 1983
- Carlina acaulis* L.
Jakab *et al.* 2007, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)
- Centaurea apiculata* Ledeb. subsp.
spinulosa (Rochel ex Spreng.) Dostál
Syn: *Centaurea scabiosa* L. subsp.
spinulosa (Rochel ex Spreng.) Arcang.
Kovács, 1983, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Centaurea biebersteinii* DC.
Syn: *Centaurea micranthos* SG.
Gmelin ex Hayek
Csűrös-Pap 1958, Kovács 1983
- Centaurea x erdneri* Wagn.
(=*Centaurea. phrygia* x *C. phrygia*
subsp. *pseudophrygia*)
Kovács 1983
- Centaurea jacea* L.
Vojtkó ined. 1995
- Centaurea melanocalathia* Borbás
Boros 1943, Kovács 1983
- Centaurea pinnatifida* Schur
Syn: *Centaurea triumfetii* All. subsp.
pinnatifida (Schur) Dostal
Kovács 1983
- Centaurea pseudophrygia* C. A. Mey.
Syn: *Centaurea phrygia* L. subsp.
pseudophrygia (C. A. Mey.) Gugl.

Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Centaurea scabiosa L.

Kovács 1983, Jakab et al. 2007,
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Centaurea stoebe L. subsp. *rhenana*

Hay
Kovács 1983

Centaurea triumfetii All.

Kovács 1983, Jakab et al. 2007

Centaurea triumfetii All. subsp.

aligera (Gugler) Dostál
Syn: *Centaurea axillaris* Willd.
Boros 1942, Priszter 1944, Csürös-Pap
1958, Kovács 1983, Gyarmati 1995

Cirsium arvense (L.) Scop.

Jakab et al. 2007

Cirsium canum (L.) All.

Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Cirsium erisithales (Jacq.) Scop.

Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Cirsium furiens Griseb. et Schenk

Jakab et al. 2007

Cirsium heterophyllum (L.) Hill

Kovács 1983

Cirsium oleraceum (L.) Scop.

Kovács 1983, ined. Vojtkó 1993, Ja-
kab et al. 2007

Cirsium pannonicum (L. fil.) Link.

Boros 1943, Priszter 1944, Kovács
1983

Cirsium rivulare (Jacq.) All.

Boros 1943, Priszter 1944, Kovács
1983, Vojtkó ined. 1995, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)

Crepis paludosa (L.) Moench.

Gyarmati 1995, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Doronicum austriacum Jacq.

Priszter 1944, Kovács 1983

Echinops exaltatus Schrader

Syn: *Echinops commutatus* Jur.
Boros 1943, Kovács 1983

Erigeron annuus (L.) Pers.

Jakab et al. 2007

Eupatorium cannabinum L.

Kovács 1983

Hieracium aurantiacum L.

Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)

Hieracium bauhini Besser

Kovács 1983

Hieracium bifidum Kit. ex Hornem.

Csürös-Pap 1958, Kovács 1983

Hieracium caespitosum Dumort.

Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

- Hieracium pilosella* L.
Kovács 1983, Vojtkó ined. 1995
- Hieracium villosum* Jacq.
Boros 1942, Kovács 1983
- Hypochaeris maculata* L.
Priszter 1944, Kovács 1983, Vojtkó
ined. 1995, Jakab *et al.* 2007
- Inula ensifolia* L.
Boros 1942, Gyarmati 1995, Jakab *et al.* 2007
- Inula helenium* L.
Kovács 1983
- Inula hirta* L.
Kovács 1983, Jakab *et al.* 2007
- Inula x rigida* Döll.
(=*Inula salicina* x *Inula hirta*)
Kovács 1983
- Jurinea mollis* (L.) Reichenb. subsp.
transylvanica (Sprengel) Hayek
Kovács 1983
- Leontodon crispus* Vill. subsp. *crispus*
Syn: *Leontodon asper* (Waldst. *et* Kit.)
Poiret, non Forskal
Boros 1943, Kovács 1983, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)
- Leucanthemum vulgare* Lam.
Syn: *Chrysanthemum leucanthemum*
L.
Kovács 1983, Vojtkó *et al.* 2011
- Mycelis muralis* (L.) Dumort.
Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007
- Petasites albus* (L.) P. Gaertner,
Ined. Vojtkó 1995
- Petasites hybridus* (L.) P. Gaertner, B.
Meyer *et* Scherb.
Kovács 1983, ined. Vojtkó 1993,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)
- Scorzonera hispanica* L.
Priszter 1944, Kovács 1983, ined.
Vojtkó 1995
- Scorzonera purpurea* L.
Priszter 1944, Kovács 1983
- Senecio germanicus* Wallr.
Syn: *Senecio nemorensis* L.
Gyarmati 1995, Jakab *et al.* 2007
- Senecio integrifolius* (L.) Clairv.
Priszter 1944, Kovács 1983, Gyarmati
1995
- Senecio ovatus* (P. Gaertner, B. Meyer
et Scherb.) Willd.
Syn: *Senecio fuchsii* C.C.Gmelin
Vojtkó ined. 1995
- Senecio papposus* (Reichenb.) Less.
Boros 1943, Kovács 1983, Munteanu
et al. 1987
- Senecio squalidus* L.
Syn: *Senecio rupestris* Waldst. *et* Kit.
Kovács 1983

- Serratula tinctoria* L.
Vojtkó ined. 1995, Vojtkó et al. 2011
- Solidago virgaurea* L.
Gyarmati 1995
- Tanacetum corymbosum* (L.) Schultz Bip.
Syn: *Chrysanthemum corymbosum* L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Taraxacum erythrospermum* Andrzej. ex Besser s.l.
Syn: *Taraxacum laevigatum* (Willd.) D. C.
Kovács 1983
- Taraxacum hoppeanum* Griseb.
Csűrös-Pap 1958, Kovács 1983
- Taraxacum officinale* Weber ex Wiggers
Kovács 1983, Gyarmati 1995
- Telekia speciosa* (Schreber) Baumg.
Boros 1942, Kovács 1983, Munteanu et al. 1987, Gyarmati 1995, Jakab et al. 2007
- Tragopogon pratensis* L. subsp. *orientalis* (L.) Čelak.
Syn: *Tragopogon orientalis* L.
Priszter 1944, Kovács 1983, Gyarmati 1995
- Santalaceae*
- Thesium bavarum* Schrank
Boros 1943, Kovács 1983
- Thesium linophyllum* L.
Priszter 1944, Kovács 1983, Gyarmati 1995, Jakab et al. 2007
- Caryophyllaceae*
- Arenaria serpyllifolia* L.
Kovács 1983, Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Dianthus carthusianorum* L.
Syn: *Dianthus puberulus* (Simk.) Kern.
Kovács 1983, Jakab et al. 2007
- Dianthus spiculifolius* Schur
Boros 1942, Csűrös-Pap 1958, Kovács 1983, Munteanu et al. 1987, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Dianthus superbus* L.
Jakab et al. 2007
- Dianthus tenuifolius* Schur
Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Holosteum umbellatum* L.
Ined. Vojtkó 1993
- Lychnis flos-cuculi* L.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Minuartia setacea* (Thuill.) Hayek
Kovács 1983, Jakab et al. 2007
- Moehringia muscosa* L.
Boros 1942, Csűrös-Pap 1958, Kovács 1983, Munteanu et al. 1987, Gyarmati

1995, Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)

Silene alba (Miller) E. H. L. Krause
Kovács 1983

Silene armeria L.
Kovács 1983, Jakab *et al.* 2007,
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Silene dioica (L.) Clairv.
Syn: *Melandrium diurnum* (Sibth. &
Sm.) Fr.
Priszter 1944, Kovács 1983

Silene heuffeli Soó
Kovács 1983

Silene italica (L.) Pers.
Kovács 1983

Silene nutans L. subsp. *dubia*
(Herbich) Zapal.
Syn: *Silene dubia* Herbich
Boros 1942, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Vojtkó,
Sass-Gyarmati *et* Juhász 2011 (Herb.
EGR)

Silene otites L. Wib.
Kovács 1983, ined. Vojtkó 1993, Ja-
kab *et al.* 2007

Silene vulgaris (Moench) Garcke
Kovács 1983, Vojtkó *et al.* 2011

Stellaria graminea
Vojtkó, Sass-Gyarmati *et* Juhász 2011
(Herb. EGR)

Stellaria holostea L.
Kovács 1983, Gyarmati 1995, Jakab *et*
al. 2007, Vojtkó, Sass-Gyarmati *et*
Juhász 2011 (Herb. EGR)

Stellaria media (L.) Vill.
Kovács 1983, Jakab *et al.* 2007
Stellaria uliginosa Murray
Syn: *Stellaria alsine* Grimm. nom.
inval.
Kovács 1983

Primulaceae

Primula elatior (L.) L.
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)

Primula veris L.
Kovács 1983, Gyarmati 1995, Jakab *et*
al. 2007

Lysimachia nummularia L.
Gyarmati 1995, Vojtkó, Sass-
Gyarmati *et* Juhász 2011 (Herb. EGR)

Lysimachia thyrsoiflora L.
ined Vojtkó 1995

Lysimachia vulgaris L.
Kovács 1983, ined. Vojtkó 1993, Ja-
kab *et al.* 2007

Polygonaceae

Polygonum bistorta L.
Kovács 1983, Gyarmati 1995, Jakab *et*
al. 2007, Vojtkó, Sass-Gyarmati *et*
Juhász 2011 (Herb. EGR)

Polygonum convolvulus L.
Syn: *Fagopyrum convolvulus* (L.) H.
Gross
Csűrös-Pap 1958, Kovács 1983,
Gyarmati 1995

Polygonum hydropiper L.
Kovács 1983

Polygonum mite Schrank
Kovács 1983

Rumex acetosella L.
Kovács 1983

Rumex aquaticus L.
Kovács 1983

Rumex obtusifolius L.
Kovács 1983

Cannabaceae

Humulus lupulus L.
Kovács 1983

Urticaceae

Parietaria officinalis L.
Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Urtica dioica L.
Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Ulmaceae

Ulmus glabra Hudson
Syn: *Ulmus scabra* Mill.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995

Betulaceae

Alnus glutinosa (L.) Gaertner
Kovács 1983, Munteanu *et al.* 1987,
Jakab *et al.* 2007

Alnus incana (L.) Moench.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995

Betula pendula Roth
Kovács 1983, Jakab *et al.* 2007

Corylaceae

Carpinus betulus L.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995, Jakab *et al.* 2007

Corylus avellana L.
Csűrös-Pap 1958, Kovács 1983,
Munteanu *et al.* 1987, Gyarmati 1995,
Jakab *et al.* 2007

Fagaceae

Fagus sylvatica L.
Kovács 1983, Munteanu *et al.* 1987,
Gyarmati 1995, Jakab *et al.* 2007

Quercus petraea (Mattuschka) Liebl.
Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007

Quercus robur L.
Kovács 1983, Jakab *et al.* 2007

Salicaceae

Salix alba L.
Kovács 1983

- Salix aurita* L.
Gyarmati 1995, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Salix caprea* L.
Kovács 1983
- Salix cinerea* L.
Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Salix pentandra* L.
Ined. Vojtkó 1993, Vojtkó et al. 2011
- Salix purpurea* L.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Populus tremula* L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007
- MONOCOTYLEDONAE
- Alismataceae*
- Alisma lanceolatum* With.
Kovács 1983
- Alisma plantago-aquatica* L.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Liliaceae*
- Anthericum ramosum* L.
Kovács 1983, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Colchicum autumnale* L.
Gyarmati 1995: 43.p., Jakab et al. 2007
- Convallaria majalis* L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007
- Erythronium dens-canis* L.
Kovács 1983, Gyarmati 1995
- Lilium martagon* L.
Kovács 1983, Gyarmati 1995, Jakab et al. 2007
- Maianthemum bifolium* (L.) F. W. Schmidt
Kovács 1983, Gyarmati 1995, Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Ornithogalum orthophyllum* Ten. subsp. *kochii* (Parl.) Zahar.
Syn: *Ornithogalum gussoneanum* (Parl.) A. et G., *Ornithogalum gussonei* T.
Csűrös-Pap 1958, Kovács 1983
- Ornithogalum umbellatum* L.
Gyarmati 1995
- Polygonatum multiflorum* (L.) All.
Csűrös-Pap 1958, Kovács 1983, Gyarmati 1995
- Polygonatum odoratum* (Miller) Druce
Syn: *Polygonatum officinale* All.
Priszter 1944, Kovács 1983, Gyarmati 1995, Jakab et al. 2007

Polygonatum verticillatum (L.) All.
Priszter 1944, Kovács 1983, Gyarmati
1995, Jakab et al. 2007, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Scilla bifolia L.
Kovács 1983

Veratrum album L.
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)

Veratrum nigrum L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Amaryllidaceae

Galanthus nivalis L.
Gyarmati 1995, Jakab et al. 2007

Trilliaceae

Paris quadrifolia L.
Priszter 1944, Kovács 1983, Gyarmati
1995, Jakab et al. 2007, Vojtkó, Sass-
Gyarmati et Juhász 2011 (Herb. EGR)

Alliaceae

Allium angulosum L.
Kovács 1983

Allium flavum L. subsp. *flavum* L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

Allium scorodoprasum L.
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)

Allium senescens L. subsp. *montanum*
(FW. Schmidt) Holub
Syn: *Allium montanum* F. W. Schmidt
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007, Vojtkó, Sass-Gyarmati et
Juhász 2011 (Herb. EGR)

Allium sphaerocephalon L.
Kovács 1983

Allium ursinum L.
Kovács 1983

Iridaceae

Crocus banaticus Gay
Jakab et al. 2007

Gladiolus imbricatus L.
Kovács 1983, Gyarmati 1995, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)

Iris aphylla L.
Syn: *Iris hungarica* Waldst. et Kit, *Iris*
furcata M. Bieb.
Csűrös-Pap 1958, Kovács 1983,
Gyarmati 1995, Jakab et al. 2007

Iris graminea L.
Vojtkó ined. 1995, Jakab et al. 2007

Iris graminea subsp. *pseudocyperus*
(Schur) Soó
Syn: *Iris pseudocyperus* Schur.
Kovács 1983

Iris ruthenica Ker-Gawl.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007

- Iris sibirica* L.
Kovács 1983, ined. Vojtkó 1993, Jakab *et al.* 2007
- Iris variegata* L.
Gyarmati 1995
- Juncaceae*
- Juncus alpinus* Vill.
Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)
- Juncus conglomeratus* L.
Kovács 1983
- Juncus effusus* L.
Vojtkó ined. 1995
- Juncus glaucus* Ehrh.
Syn: *Juncus inflexus* L.
Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)
- Luzula luzuloides* (Lam.) Dandy *et* Wilmott
Syn: *Luzula albida* (Hoffm.) DC.
Kovács 1983, Gyarmati 1995
- Orchidaceae*
- Cephalanthera damasonium* (Miller) Druce
Kovács 1983, Jakab *et al.* 2007
- Cephalanthera rubra* (L.) LCM. Richard
Kovács 1983, Jakab *et al.* 2007
- Cypripedium calceolus* L.
Kovács 1983, Kisgyörgy-Dénes 1980, Gyarmati 1995, Jakab *et al.* 2007
- Dactylorhiza x elatior* (Fr.) Soó
(*Dactylorhiza incarnata x maculata* subsp. *maculata*)
Kovács 1983
- Dactylorhiza incarnata* (L.) Soó
Kovács 1983, Gyarmati 1995, Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)
- Dactylorhiza maculata* (L.) Soó
Syn: *Orchis maculata* L.
Priszter 1944, Kovács 1983, Gyarmati 1995, Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)
- Epipactis atrorubens* (Hoffm.) Besser
Kovács 1983, Jakab *et al.* 2007
- Epipactis helleborine* (L.) Crantz
Kovács 1983, Jakab *et al.* 2007
- Epipactis palustris* (L.) Crantz
Gyarmati 1995, Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)
- Gymnadenia conopsea* (L.) R. Br.
Priszter 1944, Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007, Vojtkó, Sass-Gyarmati *et* Juhász 2011 (Herb. EGR)
- Gymnadenia odoratissima* (L.) LCM. Richard
Jakab *et al.* 2007
- Listera ovata* (L.) R. Br.
Priszter 1944, Kovács 1983, Gyarmati 1995, Jakab *et al.* 2007
- Neottia nidus-avis* (L.) LCM. Richard
Jakab *et al.* 2007

Orchis militaris L.

Priszter 1944, Kovács 1983, Gyarmati 1995

Orchis morio L.

Priszter 1944, Kovács 1983, Gyarmati 1995

Orchis ustulata L.

Kovács 1983, Vojtkó ined. 1995

Platanthera bifolia (L.) LCM. Richard

Priszter 1944, Kovács 1983, Gyarmati 1995

Traunsteineria globosa (L.) Reichenb.

Priszter 1944, Kovács 1983, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Cyperaceae

Blysmus compressus (L.) Panzer

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex brevicollis DC.

Kovács 1983, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex buxbaumii Wahlbg.

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex diandra Schrank

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex digitata L.

Kovács 1983, Gyarmati 1995

Carex distans L.

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex echinata Murray

Syn: *Carex stellulata* Good.
Kovács 1983, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex flava L.

Jakab et al. 2007, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex hartmanii Cajander

Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex humilis Leysser

Kovács 1983, Gyarmati 1995

Carex lasiocarpa Ehrh.

Kovács 1983

Carex leporina L.

Syn: *Carex ovalis* Good.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)

Carex michelii Host

Kovács 1983

Carex montana L.

Kovács 1983, Gyarmati 1995

Carex pairaei F. W. Schultz

Kovács 1983

Carex pilosa Scop.

Kovács 1983, Vojtkó et al. 2011

Carex guestphallica (Boenn. ex Rchb.) Boenn. ex O. Lang

- Syn.: *Carex polyphylla* Kar. et Kir.
Kovács 1983
- Carex sylvatica* Hudson
Gyarmati 1995
- Carex vesicaria* L.
Kovács 1983
- Eleocharis carniolica* Koch
Jakab et al. 2007
- Eriophorum angustifolium* Honck.
Syn: *Eriophorum polystachion* L.
Priszter 1944, Kovács 1983, Gyarmati 1995
- Eriophorum latifolium* Hoppe
Ined. Vojtkó 1993, Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Poaceae*
- Achnatherum calamagrostis* (L.) P.
Beauv.
Kovács 1983
- Agrostis canina* L.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Agrostis gigantea* Roth
Syn: *Agrostis alba* L.
Vojtkó ined. 1995
- Anthoxanthum odoratum* L.
Vojtkó ined. 1995, Vojtkó et al. 2011
- Brachypodium pinnatum* (L.) Beauv.
Kovács 1983, Jakab et al. 2007,
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Brachypodium sylvaticum* (Hudson)
Beauv.
Kovács 1983, Jakab et al. 2007
- Briza media* L.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Bromus commutatus* Schrad.
Syn: *Bromus commutatus* Schrad. var. *apricorum* Simk.
Kovács 1983
- Bromus erectus* Hudson
Kovács 1983
- Bromus ramosus* Huds.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Bromus secalinus* L.
Kovács 1983
- Calamagrostis arundinacea* (L.) Roth
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Cynosurus cristatus* L.
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Dactylis glomerata* L.
Kovács 1983, Vojtkó ined. 1995,
Vojtkó, Sass-Gyarmati et Juhász 2011 (Herb. EGR)
- Dactylis polygama* Horvátovszky
Syn: *Dactylis aschersoniana* Graebn.
Kovács 1983, Gyarmati 1995

- Danthonia alpina* Vest
Syn: *Danthonia calycina* (Vill.) Rchb,
Danthonia provincialis Lam. et DC.
Boros 1943, Priszter 1944, Kovács
1983
- Danthonia decumbens* (L.) DC.
Syn: *Sieglingia decumbens* (L.) Bernh.
Kovács 1983
- Deschampsia caespitosa* (L.) P.Beauv.
Boros 1943, Priszter 1944, Kovács
1983, Gyarmati 1995, Jakab *et al.*
2007
- Deschampsia flexuosa* (L.) Trin.
Gyarmati 1995
- Dicanthium ischaemum* (L.) Roberty
Syn: *Bothriochloa ischaemum* (L.)
Keng.
Kovács 1983
- Elymus hispidus* (Opiz) Melderis
Syn: *Agropyron intermedium* (Host.)
P. Beauv.
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)
- Festuca drymeja* Mert. et Koch
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)
- Festuca heterophylla* Lam.
Vojtkó, Sass-Gyarmati *et Juhász* 2011
(Herb. EGR)
- Festuca nigrescens* Lam.
Syn: *Festuca rubra* L. subsp.
commutata Gaud.
Kovács 1983
- Festuca pallens* Host
Syn: *Festuca glauca* Vill., *Festuca
cinerea* Vill. subsp. *pallens* (Host)
Stohr.
Boros 1943, Kovács 1983, Gyarmati
1995
- Festuca pratensis* Huds.
Vojtkó, Sass-Gyarmati *et Juhász* 2011
(Herb. EGR)
- Festuca rubra* L.
Jakab *et al.* 2007
- Festuca rupicola* Heuffel
Kovács 1983, Gyarmati 1995, Jakab *et
al.* 2007
- Festuca valesiaca* Schleicher ex
Gaudin
Kovács 1983, Gyarmati 1995, Jakab *et
al.* 2007
- Helictotrichon decorum* (Janka)
Henrard
Syn: *Avenastrum decorum* (Janka)
Degen
Boros 1943, Csűrös-Pap 1958, Kovács
1983, Munteanu *et al.* 1987, Gyarmati
1995, Jakab *et al.* 2007
- Helictotrichon pratense* (L.) Besser
Vojtkó, Sass-Gyarmati *et Juhász* 2011
(Herb. EGR)
- Holcus lanatus* L.
Jakab *et al.* 2007
- Hordelymus europaeus* (L.) Less ex
Harz.
Vojtkó, Sass-Gyarmati *et Juhász* 2011
(Herb. EGR)

- Koeleria macrantha* (Ledeb.) Schultes
Syn: *Koeleria gracilis* Pers. nom.
illegit.
Gyarmati 1995
- Koeleria majoriflora* Borb.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Koeleria macrantha* (Ledeb.) Schultes
subsp. *macrantha*
Kovács 1983
- Koeleria splendens* C. Persl.
Kovács 1983
- Melica ciliata* L.
Kovács 1983, Munteanu et al. 1987,
Jakab et al. 2007
- Melica transsylvanica* Schur
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Melica nutans* L.
Kovács 1983
- Melica picta* C. Koch
Gyarmati 1995
- Melica uniflora* Retz.
Ined. Vojtkó 1993, Vojtkó et al. 2011
- Molinia caerulea* (L.) Moench subsp.
arundinacea (Schrank) K. Richter
Syn: *Molinia arundinacea* Schrank.
Vojtkó ined. 1995, Vojtkó et al. 2011.
- Nardus stricta* L.
Vojtkó ined. 1995
- Phleum montanum* C. Koch
Boros 1943, Csűrös-Pap 1958, Kovács
1983, Munteanu et al. 1987, Jakab et
al. 2007
- Phleum phleoides* (L.) H. Karst.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Phleum pratense* L.
Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)
- Poa angustifolia* L.
Ined. Vojtkó 1993
- Poa bulbosa* L.
Vojtkó ined. 1995
- Poa molinerii* Balbis
Kovács 1983
- Poa nemoralis* L.
Kovács 1983, Gyarmati 1995, Jakab et
al. 2007
- Sesleria heuflerana* Schur
Boros 1943, Kovács 1983, Munteanu
et al. 1987, Gyarmati 1995, Vojtkó,
Sass-Gyarmati et Juhász 2011 (Herb.
EGR)
- Setaria pumila* (Poiret) Schultes
Jakab et al. 2007
- Trisetum flavescens* (L.) P.Beauv.
Kovács 1983, Vojtkó, Sass-Gyarmati
et Juhász 2011 (Herb. EGR)
- Araceae

Arum maculatum L.
Gyarmati 1995

Vojtkó, Sass-Gyarmati et Juhász 2011
(Herb. EGR)

Typha latifolia L.

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CONTRIBUTION TO THE BRYOFLORA OF CĂLIMANI MOUNTAINS IN THE EASTERN CARPATHIANS, ROMANIA, I.

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Bryoflora of Călimani Mts.

Liverworts, Mosses, Carpathians, Transylvania, Romania, conservation

Abstract. The authors visited the spruce, subalpine and alpine belts of Călimani Mts. in July 2011. From the collected 144 bryophyte taxa *Marsupella apiculata*, *Pohlia nutans* ssp. *schimperi* and maybe *Ditrichum lineare* are new to the Romanian bryoflora. Further 37 taxa are new to the Călimani Mountains, among them rare Arctic-Alpine species, like *Pleurocladula albescens*, *Arctoa fulvella*, *Dicranum brevifolium*, *Grimmia donniana* and *Racomitrium microcarpon*. An account on the environmental conditions of the mountains is given in the introduction.

Abstract: Autorii acestui studiu au vizitat zona boreală, subalpină și alpină a Munților Călimani în iulie anul 2011. Printre cele 144 specii de briofite colectate *Marsupella apiculata*, *Pohlia nutans* ssp. *schimperi* și probabil *Ditrichum lineare* sunt taxoni noi pentru brioflora României. 37 taxoni sunt semnalati pentru prima dată în flora Călimanului, printre acestea elemente arcto-alpine rare, cum sunt *Pleurocladula albescens*, *Arctoa fulvella*, *Dicranum brevifolium*, *Grimmia donniana* și *Racomitrium microcarpon*. În introducerea este redată și o sumarizare a condițiilor de mediu din zona Munților Călimani.

Introduction

As part of the Călimani-Ghiuguiu-Harghita volcanic chain the Călimani Mountains (Kelemen Havasok) is one of the highest and the youngest volcanic massif of the Eastern Carpathians. Its formation is a result of the repeated volcanic activity during the Pliocene. It is assumed that with its 10km diameter the Călimani volcanic crater is one of the largest among Europe's inactive volcanos. This famous geological structure preserved until the present, by the collapse of the inner part and by erosion formed a widely opened caldera facing towards the North. The highest peaks are the Pietrosul Călimani (2100 m), Negoitul Unguresc (2081m), the Răchițiș (2021m), Călimani Izvor (2032m).

Altogether the Călimani Mountains cover an area of about 2000 km², extending west to east for 60 km. This immense andesite barrier between Moldavia and Transylvania is bordered on the North by the Bărgăului Mountains and the Vatra Dornei Depression, and on the South by the Gurghiului Mountains from which it is separated by the strait Mures river defile. The Eastern border is lined out mainly by the intermontaneous depressions Bilbor and Borsec that delimit Călimani from the Bistrița and Giurgeului Mountains.

The dominant bedrocks are andesite, andesite with amphibole, or amphibole-pyroxenes, very rarely andesite with basaltic content. Dacites originate from the late volcanic activity.

The surface of the mountain can be divided into three main parts; the central part with the caldera (1600-2100m), the volcanic plateau (1300-1600m) that remained from the cooling lava flow, thirdly the rich interfluvial network (400-800m) that is incised deeply into the plateau and in the deposited volcanic material at the bottom of the mountain. Brook valleys are narrow, mostly with steep, abrupt slopes, oriented straight to the North and to the South. The northern part is characteristic for its large glacier cirques (Naum 1972).

Climate

The climate of the mountain is quite severe with long winters and strong snowfalls. Average annual temperature on the lower elevations is 4-6 °C, on the upper alpine subalpine region around 0 or -2°C. Summer temperatures are rising to 8-15° C in the upper regions and to 14-18 °C in the lower mountains sites. Dominant winds bring large amounts of precipitation from the west, watering strongly the western slopes, while eastern slopes are less humid. Summer air humidity in the deep valleys can exceed 88%. Annual average precipitation is 1000-1400 mm; these values are the highest in the whole region. The snow cover lasts 180-200 days beginning from early October. Not more than 40 days are sunny in one year. The continental character of the climate is strengthened by the fast coming cold weather fronts that produce rapid decrease in the daily temperature even in the summer period. Almost every month of the year, night

temperature can decrease below 0°C. Moreover the summer foehn activity can produce drought on the local scale.

Soils

According to the cool wet climatic conditions and the volcanic bedrock, the soil cover of the Călimani Mountains, on the whole, is predominantly acidic. The deep, medium deep soils have good water supply and are rich in humus. The most characteristic soil types are the so called andosols, podzols and skeletal leptosols.

Andosols and podzols are quite frequent at the height of 1000-1800m above sea level where they can cover the medium steep slopes and the plateaus built mainly of lava flows. Those andosols that are located in special microtopographic positions with stronger water percolation tend to evolve towards podzols. Compared to the andosols, podzolic soils have less clay minerals and their structure is more compact with a higher raw humus layer on the surface. At lower elevations, mostly where the volcanic material has accumulated in form of pyroclastites and breccias the predominant soil types are luvisols and cambisols. Grasslands and pastures maintained by human activity can be characterized by different soil types. In many places within the mountain area the pastures are overgrazed and therefore these soils become hard with less oxygen supply. On the steep slopes and along the brook sites skeletal soils are very common. Skeletal leptosols and rock cliffs cover large surfaces on high elevations, mainly on the northern part of the mountain. Microbiological activity of the soils is generally high in the summer period, while in the rest of the year it becomes insignificant.

Vegetation

The territory of the Călimani Mountains has luxuriant vegetation, as large forests belts were maintained despite of intensive forestry and mining in some parts of the mountain. Mixed broad leaf forests dominated by *Carpinus betulus* and *Fagus sylvatica* occur just around 600-700m, while the most widespread deciduous forests are Carpathian beech forests (*as. Symphyto-Fagetum*). Typical for the Eastern Carpathians, the herb layer of these forests is rich in Carpathian endemic species and dacic elements like *Dentaria glandulosa* and *Symphytum cordatum*. Beech woods are subsequently followed by fir mixed beech spruce forests (*as. Pulmonario rubrae –Abieti- Fagetum*) considered to be the most threatened forest communities, since the sensible population equilibrium of the three tree species cannot be maintained following intensive forestry works. Deciduous forests are limited on higher elevations by homogenous spruce forests. The latter, with a strong boreal character are the most widespread forests within the Călimani Mountains and are represented by several plant associations,

depending on the slope, substrate and exposition. Spruce forests cover more than 10000ha. Subalpine shrub communities are also well-represented. At about 1700-1900m above the sea level dwarf mountain pine is widely distributed with spots of green alder. The high mountain ecotone is also characterised by the distribution of the *Pinus cembra*, glacial relict species of Europe.

One of the most valorous aspects of the alpine vegetation is the wide distribution, covering around 1300 ha, of the alpine dwarf shrub heaths dominated by alpine rose, *Rhododendron myrtifolium*. Bordering rock cliffs and screes alpine heaths are rich in Arctic-Alpine floral elements and boreal mosses, being the most colourful stands in the high elevations of the Călimani Mountains. Large areas are covered also by alpine meadows and rock communities in some parts strongly modified, degraded by pasturing activity. Overgrazing favoured the spreading of *Nardus stricta*. Azonal vegetation along the wet habitats is represented mainly by grey alder woods and nitrophylous tall herb vegetation, that are limited in some flat sites, where the acid water tends to accumulate, by assemblages of mineral-poor fen communities. Peat bogs are mainly distributed in the upper boreal zone. One of the deepest peat substrate evolved around the lake Iezer at 1750m. The largest Romanian raised bog, Tinovul Mare at Poiana Stampei (Suceava County), is also situated at the northern foot of this mountain.

Since the 90th, the high mountain ecosystems of the Călimani Mountains were included within the administration of the Călimani National Parc, an area of 24.041 ha. However the landscape with the abandoned sulphur quarry and the nude peak of Negoitul Românesc in the vicinity of the protected area still provides an unusual aspect for the visitors.

Although detailed research was performed on the vascular flora and vegetation (Csürös 1951, Höhn 1996-1997), the moss flora of the Călimani Mts was not studied in details until the present. However, the bryophytes of certain localities have been investigated earlier, like the large peat bog "Tinovul Mare" of Poiana Stampei at the northern foothills (Pop 1960, Ștefureac 1965a, 1967) and the alpine vegetation of the main ridge (Mihai 1968, 1985, Ștefureac 1965b, 1986, Ștefanuț 2008). Our recent study focuses on the description of the bryophyte flora including zonal and edaphic communities of the boreal belt. We intend to continue this study at other sites in the future.

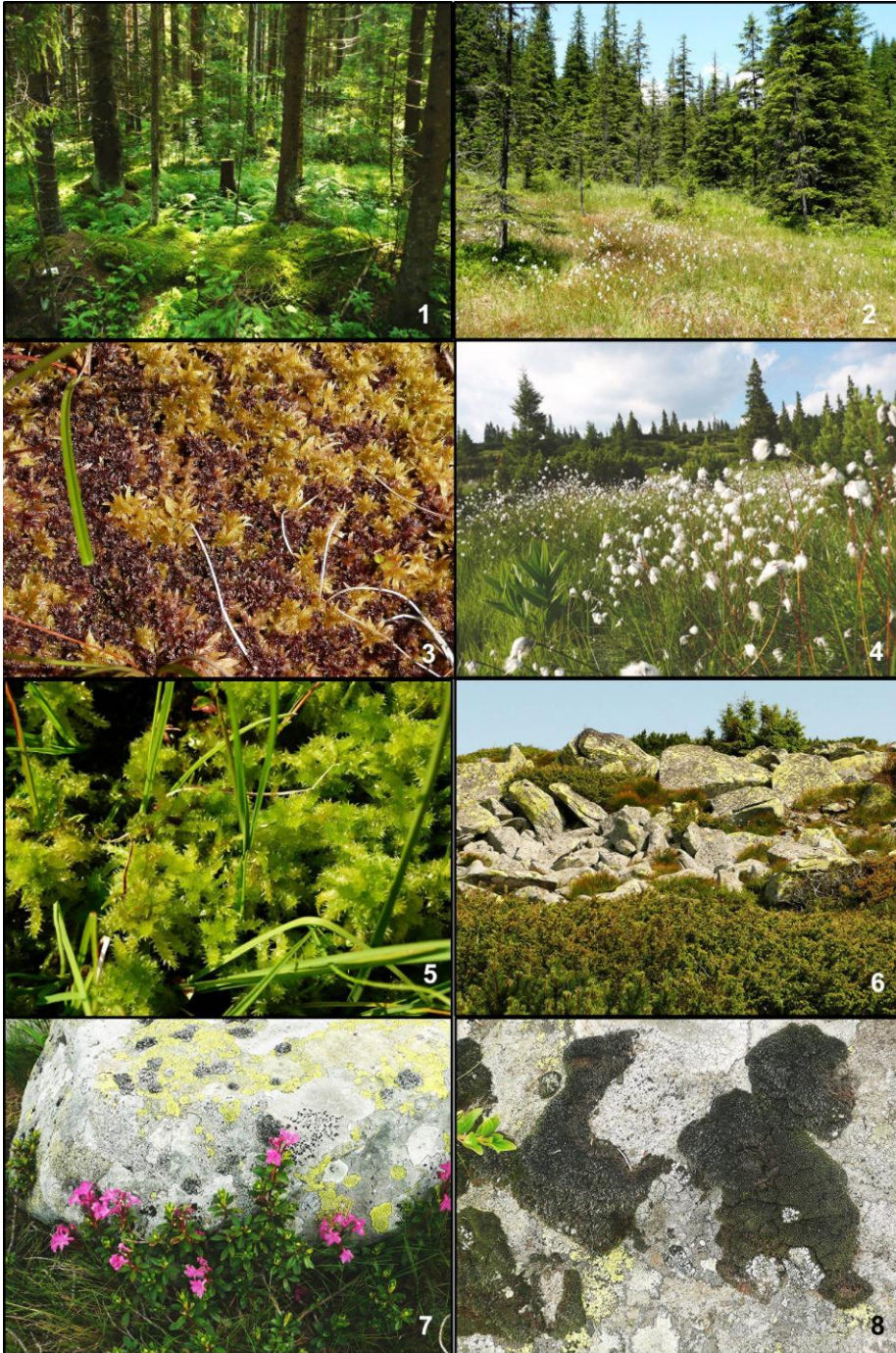


Plate I. Fig. 1: Mesophilous spruce forest in Toplița (Lomás) Valley, at 850 m alt. (Locality 4). Fig. 2: The „Puturosul” spring bog with *Eriophorum angustifolium*, at 1480 m alt. (Loc. 6). Fig. 3: *Sphagnum quinquefarium* and *Sph. acutifolium* ssp. *rubellum* on the „Puturosul” spring bog. Fig. 4: Peat bog complex with *Eriophorum vaginatum* near to the Mountain Rescue house, ENE from Iezer Lake, at 1725 m alt. (Loc. 8). Fig. 5: *Sphagnum squarrosum* in the transition bog at the margin of a raised bog in the above complex (Loc. 8). Fig. 6: Periglacial blocks on the main ridge, at 1880 m alt., surrounded by *Pinus mugo* and *Juniperus nana*, habitat of *Racomitrium microcarpon* and the three *Grimmia* species (Loc. 9). Fig. 7: Blocks with the lichen community *Rhizocarpetum alpicolae*, surrounded by *Rhododendron myrtifolium* bush on the S side of Răchițiș summit, at 1950 m alt. (Loc. 10). Fig. 8: *Grimmia sessitana* and *G. incurva* in the same community (Loc. 10). (Photos made by T. Pócs. In the on-line version each picture can be magnified up to 500%, which corresponds to desktop size).



Plate II. Fig. 9: Primaeval acidophilous spruce forest on the N slopes of the Neagra Șarului valley head, at 1610 m alt. (Loc. 16). Fig. 10: *Ptilium crista-castrensis* on the litter of acidophilous spruce forest of Puturosul valley, at 1100 m alt. (Loc. 5). Fig. 11: Typical habitat of *Schistostega pennata*, in the cavity under the root system of a spruce (Loc. 5). *Schistostega pennata* in the cavity.

Materials and Methods

The authors visited the Călimani Mountains between 12 and 16 July 2011, accompanied by

Péter Ábrán and József Sulyok, along the Toplița (Maroshéviz) – Vatra Dornei road and its surrounding area, crossing the main ridge between Răchițiș (Răchitișu, Rețișis) and Pietrosu summits. The collection was made in the spruce, subalpine and alpine belts. The specimens were collected by all authors and identified by P. Erzberger and by T. Pócs. The Romanian distribution of mosses was established from Mohan (1998) and Plămadă (1998), while that of the liverworts from Ștefănuț (2008). The collected specimens are deposited in the herbaria B, CL and EGR.

Nomenclature of liverworts follows Ștefănuț. (2008), except for *Marsupella apiculata*, where Váňa *et al.* (2010) is followed. The nomenclature of mosses follows Hill & al. (2006), except for *Grimmia sessitana* De Not., where Maier (2010) and for *Polytrichum perigoniale* Michx., where Meinunger & Schröder (2007) is followed.

List of collecting sites from the Călimani Mts. (Kelemen Havasok).

4. Harghita county (Județul Harghita), 7 km N from Toplița (Maroshéviz) town, along Toplița (Lomás) streamlet. Mesophilous spruce forest (*Leucanthemo waldsteinii-Piceetum*) N 47°01'04.7", E 25°21'57" at 850 m alt. 14.07.2011

5. Harghita county (Județul Harghita), ca. 12 km N from Toplița (Maroshéviz) town, SE slopes of the Călimani Mts, along a forest trail leading upwards, from near the Poiana Puturosul (Büdös Tisztás), shady andesite cliff, towards the base of the Piciorul Mocearului (Mocsárláb) ridge, in the Puturosul (Büdös) valley. Acidophilous spruce forest (*Hieracio rotundati-Piceetum*), between N 47°02'41.6", E 25°19'49.6" and N 47°03'55.7", E 25°17'52.7", at 950-1250m alt. 14.07.2011

6. Harghita county (Județul Harghita), „Puturosul” spring bog on the Piciorul Mocearului (Mocsárláb) ridge, N 47°04'41.9", E 25°16'48.2" at 1500 m alt. 14.07.2011

7. Harghita county (Județul Harghita), along the forest trail from the „Puturosul” spring bog to the Mountain Rescue (Salvamont) house, 500 m ENE from Jezer Lake above the forest line, between N 47°05'00.2", E 25°16'44.2" and N 47°05'50", E 25°16'13", at 1500-1700 m alt. 14.07.2011

8. Harghita county (Județul Harghita), SE ridge of the Călimani Mts. Peat bog complex of raised bog (*Eriophoro vaginati-Sphagnetum recurvi*) and transition bog (*Caricetum lasiocarpae*) near the Mountain Rescue (Salvamont) house, 500 m ENE from Jezer Lake, at the forest line, N 47°05'50", E 25°16'13", at 1725 m. alt. 14.07.2011

9. Harghita county (Județul Harghita), ridge of saddle between Vf. Ciunt (Csontheygy) and Vf. Răchițiș (Rekettyés csúcs). *Pinus mugo* stand (*Rhododendro myrtifolii-Pinetum mugi*) N 47°06'0", E 25°15'40" at 1880 m alt. 15.07.2011

10. Harghita county (Județul Harghita), ridge of Călimani Mts. In a small depression on the S slope of Răchițiș (Rekettyés) summit. *Rhododendro myrtifolii-Vaccinietum* N 47°05'45", E 25°15'15" at 1950 m alt. 15.07.2011

11. Maros county (Județul Mureș), NE slope of Vf. Negoiu, near waste piles of abandoned sulphur mine, surrounded by *Pinetum mugi*, N 47°06'30", E 25°13'35" at 1820 m alt. 15.07.2011

12. Harghita county (Județul Harghita), Negoii Saddle (Șaua Negoiiul, Negoii Nyereg), W slope of Vf. Pietricelul. *Pinus mugo* stand (*Rhododendro myrtifolii-Pinetum mugi*) with a few *Pinus cembra* N 47°06'25", E 25°14'03" at 1750-1780 m alt. 15.07.2011

13. Maros county (Județul Mureș), NW slope of Răchițiș (Rekettyés) summit. *Pinus mugo* stand (*Rhododendro myrtifolii-Pinetum mugi*) with many groups of *Pinus cembra* N 47°06'25", E 25°14'03" at 1780-1850 m alt. 15.07.2011

14. Harghita county (Județul Harghita), Vf. Răchițiș (Rekettyés). *Potentillo chrysocraspedae-Festucetum airoidis* on the flat summit with many *Juncus trifidus* tussocks and *Rhododendro myrtifolii-Vaccinietum* in the upper part of north facing glacial valley, N 47°05'53", E 25°14'48" at 2000-2020 m alt. 16.07.2011

15. Suceava county (Județul Suceava), N side of the ridge of Călimani Mts., NE slope of Vf. Negoiu, in a ditch with seeping water in the abandoned sulphur mine, surrounded by *Pinetum mugi*, N 47°07'08", E 25°13'41", at 1720 m alt. 16.07.2011

16. Suceava county (Județul Suceava), N side, head of Neagra Șarului (Fekete Sáros) valley. Acidophilous montane spruce forest (*Hieracio rotundati-Piceetum*) N 47°07'20", E 25°13'24" at 1610 m alt. 16.07.2011

17 N foot of Călimani Mts. (Kelemen Havasok), Suceava county (Județul Suceava), 2.4 km SW of Poiana Stampei, at Căsoi village. „Tinovul Mare”, 1.5 x 0.5 km large continental type raised bog (*Vaccinio- Pinetum sylvestris*), with *Sphagno-Piceetum* at the edges. N 47°17'54", E 25°06'57" at 920 m alt. 16.07.2011

Results and Discussion

39 Liverwort taxa and 105 mosses, altogether 144 bryophyte taxa were found. The liverwort records were checked against the „Hornwort and Liverwort Atlas of Romania“ (Ștefănuț. 2008). The moss records were checked against

Dihoru (1994), Mohan (1998) and Plămadă (1998). Taxa that represent new records to the Călimani Mts., are marked by an asterisk *, and taxa new to Romania are marked by a double asterisk **.

List of collected liverworts:

- Anthelia juratzkana* – 14: on soil over siliceous rock
Blepharostoma trichophyllum subsp. *trichophyllum* – 4, 7: on decaying wood
Calypogeia azurea – 5, 7: on soil
**Calypogeia muelleriana* – 17: on decaying wood
Cephalozia bicuspidata – 5, 6, 7: on soil
Cephalozia hampeana – 12: on soil
**Cephaloziella rubella* – 8, 14, 16: on soil
Chiloscyphus pallescens – 5: on soil
Conocephalum conicum – 5: on siliceous rock
Diplophyllum albicans – 13: on soil
Diplophyllum obtusifolium – 5, 12: on soil
Diplophyllum taxifolium – 14: on soil over siliceous rock
**Frullania fragilifolia* – 5: on bark of *Alnus*
**Jungermannia gracillima* – 7, 14: on soil over siliceous rock
**Lejeunea cavifolia* – 5: on siliceous rock
Lepidozia reptans – 4, 5, 17: on soil and on rotting wood
Lophocolea heterophylla – 4, 7: on (decaying) wood
**Lophozia ascendens* – 16: on rotting wood
Lophozia bicrenata – 9, 11, 12: on soil
Lophozia excisa – 5: on soil
Lophozia incisa – 7: on rotting wood
Lophozia sudetica – 14: on soil among siliceous rocks
Lophozia ventricosa – 5, 7, 11, 12: on soil
***Marsupella apiculata* Schiffn. (Syn.: *Gymnomitrium apiculatum* (Schiffn.) Müll. Frib.) – 14: on soil over siliceous rock
**Metzgeria conjugata* – 5: on siliceous rock
**Nardia geoscyphus* – 14: on soil over siliceous rock
Nardia scalaris – 14: on soil over siliceous rock
Pellia epiphylla – 4, 5: on soil and stones near running water
Plagiochila asplenioides – 4, 5: on soil
Plagiochila porelloides – 4, 5: on soil
**Pleurocladula albescens* – 14: on soil over siliceous rocks
Ptilidium pulcherrimum – 5, 16: on bark of spruce (*Picea abies*)
Radula complanata – 5: on the bark of *Alnus*
Riccardia palmata – 4: on decaying wood
**Scapania irrigua* – 5, 8, 16: on soil

- **Scapania scandica* – 11, 16: on soil
Scapania undulata – 5, 6, 8: on siliceous boulders near water and moist peat
Tritomaria exsecta – 4, 5, 7: on decaying wood
Tritomaria quinquedentata – 5: on soil

List of collected mosses:

- **Amphidium mougeotii* – 5: on siliceous rock
**Andreaea rupestris* var. *rupestris* – 8, 9, 13, 14: on siliceous rock
**Arctoa fulvella* – 14: on soil over siliceous rock.
Atrichum undulatum – 4, 11: on soil over siliceous rock
Aulacomnium palustre – 8, 17: on peat
Bartramia halleriana – 5: on siliceous rock
**Blindia acuta* – 11: on siliceous rock
**Brachythecium glareosum* – 5: on soil
Brachythecium rutabulum – 4: on soil
Brachythecium salebrosum – 4: on spruce (*Picea abies*) bark
Bryum caespiticium – 11: on soil
Bryum elegans – 4, 5: on soil
Bryum moravicum – 5: on the bark of *Alnus*
Calliergonella cuspidata – 4, 5: on soil
**Calliergonella lindbergii* – 5: on path with limestone gravel
Ceratodon purpureus – 4, 5, 8, 16: on soil
Climacium dendroides – 4: on soil
Cratoneuron filicinum – 4: on soil
Cynodontium polycarpon – 15: on siliceous rock
**Dichodontium pellucidum* – 5: on moist siliceous rock and on moist limestone
Dicranella heteromalla – 7, 16: on soil
**Dicranella humilis* – 5: on soil.
Dicranodontium denudatum – 8: on soil and on rotting wood
Dicranoweisia crispula – 5, 8, 9, 14: on siliceous rock
**Dicranum brevifolium* – 17: on peat (det. M. Sauer).
**Dicranum flexicaule* – 14: on soil (rev. M. Sauer); 17: on peat (det. M. Sauer)
Dicranum montanum – 4, 5, 7, 11, 12, 16: on bark and decaying wood
Dicranum scoparium – 4, 5, 7, 9, 11, 16: on soil; 17: on peat
Diphyscium foliosum – 14: on soil over siliceous rock
Ditrichum heteromallum – 5, 8, 14: on soil
**Ditrichum lineare* – 7, 12: on soil
**Eurhynchium angustirete* – 4: on soil
Funaria hygrometrica – 8: on soil
**Grimmia donniana* – 9: on siliceous rock (conf. E. Maier)

- Grimmia incurva* – 9, 10, 14: on siliceous rock, conf./rev. E. Maier
Grimmia sessitana – 9, 10: on siliceous rock, conf./rev. E. Maier
**Herzogiella seligeri* – 4: on decaying wood
Hylocomium splendens – 4, 5, 16, 17: on soil
Hypnum cupressiforme var. *cupressiforme* – 4: on soil
Leucodon sciuroides – 5: on tree bark
Mnium marginatum – 5: on soil
Mnium stellare – 5: on siliceous rock
Oligotrichum hercynicum – 8, 11, 12, 14: on soil among siliceous rock
Orthotrichum affine – 4: on spruce (*Picea abies*) bark
**Orthotrichum stramineum* – 4: on spruce bark
**Orthotrichum striatum* – 4: on spruce bark
Paraleucobryum enerve – 14: on soil over siliceous rock
Philonotis fontana – 7: on soil
Philonotis seriata – 5, 8: on soil
Plagiomnium affine – 4: on soil
Plagiomnium elatum – 4: on soil
Plagiomnium rostratum – 5: on siliceous soil
Plagiomnium undulatum – 4, 5: on soil
**Plagiothecium curvifolium* – 4, 16: on soil
Plagiothecium laetum – 5, 7: on soil
**Platygyrium repens* – 17: on bark of spruce
Pleurozium schreberi – 4, 5, 6, 9, 16, 17 on soil and decaying litter
Pogonatum aloides – 5, 7: on soil
**Pogonatum nanum* – 5: on soil
Pogonatum urnigerum – 5, 16: on soil
Pohlia annotina – 5: on soil
Pohlia cruda – 5, 11: on soil
**Pohlia elongata* – 5, 7, 11, 13: on soil
Pohlia nutans ssp. *nutans* – 4, 5, 7, 8, 11, 14, 15, 16: on soil
***Pohlia nutans* ssp. *schimperii* – 14: on soil over siliceous rock
**Pohlia prolifera* – 5, 11: on soil
Polytrichastrum alpinum – 7, 11, 14: on soil
Polytrichastrum formosum – 5, 16: on soil
**Polytrichastrum pallidisetum* – 9: on siliceous rock
Polytrichum commune – 5, 8: on soil; 6, 17: on peat
Polytrichum juniperinum – 7, 8, 11, 15, 16: on soil
Polytrichum longisetum – 8: on peat; 14: on soil over siliceous rock. In Călimani Mts. known only from Poiana Stampei (Plămadă 1998).
Polytrichum perigoniale – 8: on peat
Polytrichum piliferum – 7, 9, 11: on soil

- **Polytrichum strictum* – 8, 17: on peat ; 9, 11, 14: on soil among siliceous rocks
Pseudoleskea incurvata – 5: on siliceous rock
Ptilium crista-castrensis – 5: on spruce litter
**Racomitrium microcarpon* – 8, 9, 10, 11, 12, 14: on siliceous rock and boulders
Rhizomnium punctatum – 4: on soil
Rhodobryum roseum – 8: on soil
**Rhynchostegium megapolitanum* – 16: on soil
Rhytidiadelphus squarrosus – 4, 5, 8, 16: on soil and on peat
Rhytidiadelphus triquetrus – 4: on soil
Sanionia uncinata – 4, 5, 7, 16: on soil
Schistidium apocarpum – 5: on siliceous boulders
Schistidium papillosum – 5: on siliceous rock
Schistostega pennata – 7: on soil
**Sphagnum angustifolium* – 17: on peat
Sphagnum capillifolium – 5, 8, 9: on peat
Sphagnum fallax – 6, 8, 17: on peat. In Călimani Mts. known only from Poiana Stampei.
Sphagnum girgensohnii – 5, 6, 8, 11, 14: on soil and on peat
Sphagnum magellanicum – 6, 17: on peat
Sphagnum palustre – 5: on peat
Sphagnum quinquefarium – 5, 8: on soil and on peat
Sphagnum russowii – 6, 8, 11: on peat. In Călimani Mts. known only from Poiana Stampei.
Sphagnum rubellum – 9, 13, 17: on siliceous rock and on peat
Sphagnum squarrosus – 4, 5, 8: on soil and on peat
Sphagnum subsecundum – 8: on peat. In Călimani Mts. known only from Poiana Stampei.
Sphagnum warnstorffii – 8: on peat
Straminergon stramineum – 6, 8: on peat. In Călimani Mts. known only from Poiana Stampei.
Tetraphis pellucida – 4, 5, 7, 17: on decaying wood
Thuidium assimile – 4: on soil
Thuidium tamariscinum – 4: on soil
**Tortula schimperi* – 4: on soil
Warnstorfia exannulata – 8: on peat

There are 11 liverwort and 27 moss records which are new to the Călimani Mts.

One liverwort and four of the moss taxa recorded by us appear to be new to the bryoflora of Romania compared to Ștefănuț (2008), Sabovljević & al.

(2008), of which three were published already by Mohan (1998) under other combinations. The following species among them deserve special attention:

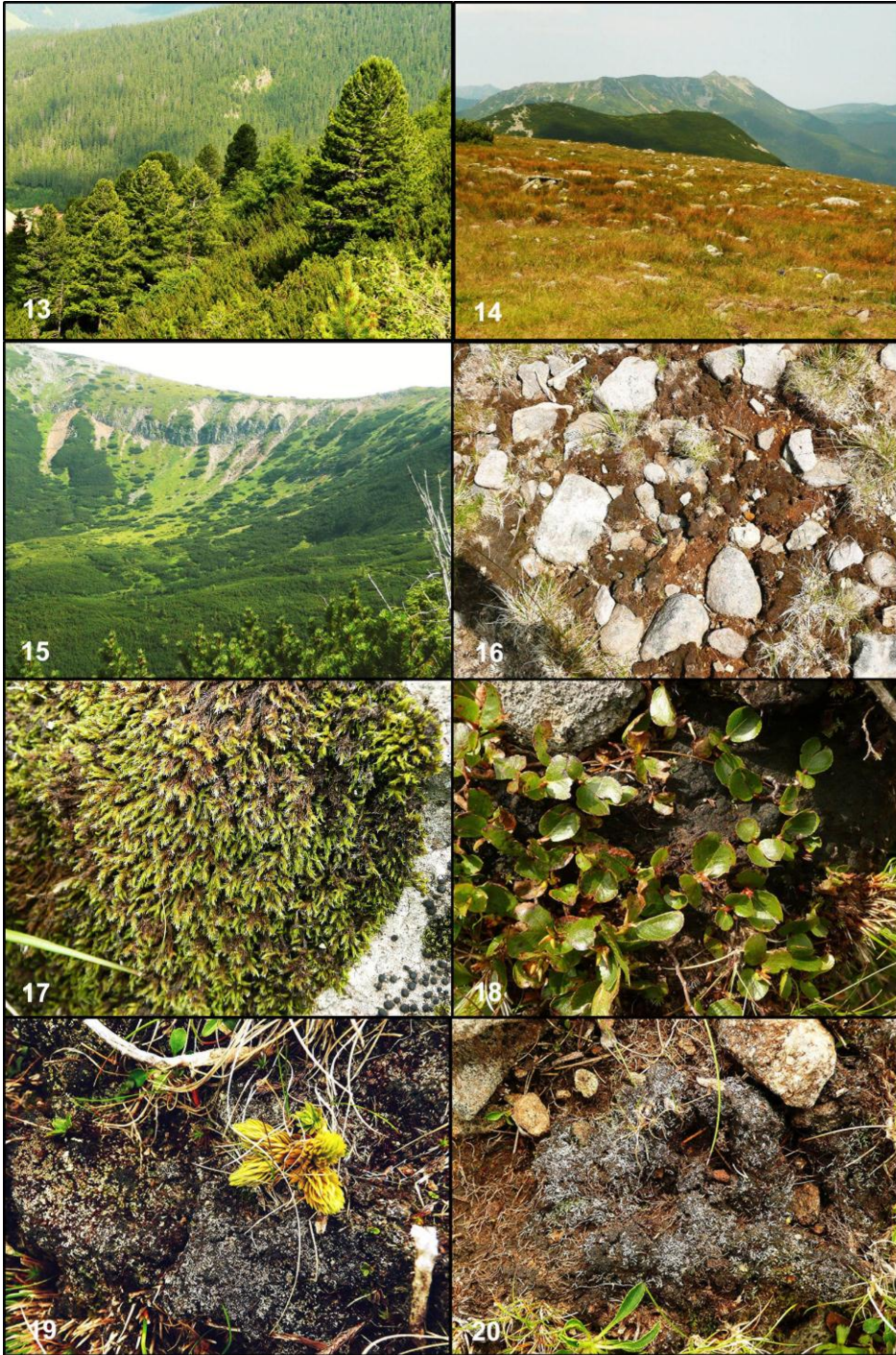
**Lophozia ascendens* (Warnst.) R.M. Schust.

A circumboreal element in the forested „Tinovul Mare” bog near Poiana Stampei, at 920 m alt. on rotting log. According to the European Red Data Book of Bryophytes (ECCB) this species is considered rare. It grows on well decayed logs in constantly humid sites and is therefore considered an indicator of old forest stands (Goia & Schumacker 2000). In Romania it is known from nine mountain regions and four counties (Ștefanuț 2008), but not from the Călimani Mts.

** *Marsupella apiculata* Schiffn. (Syn.: *Gymnomitrium apiculatum* (Schiffn.) Müll. Frib.)

It is a rare circumboreal Arctic-Alpine species known from Alaska, Greenland, Novaya Zemlya, northern Siberia, Mt. Ontake in Japan, only Scotland in Britain, Fennoscandia, Spitzbergen, NW Russia and in the Alps (Schuster 1974). Hitherto known in the Carpathians only from the Polish and Slovakian side of Tatra Mountains at 1700–2380 m (Sweykowski & Koźlicka 1977), on the Muran Plateau in Slovakia at 1384 m (Peciar 1984) and in the Ukrainian Carpathians near Tatul, at 1700 m altitudes (Zerov 1964), always on siliciferous substrate. It is new for Romania. We collected nice fertile wefts of this small liverwort on the volcanic rocks covered by a thin humus layer, in *Rhododendro myrtifolii-Vaccinietum*, at the upper part of north facing glacial valley of Vf. Răchițiș (Reketyés csúcs), at 2000–2020 m alt. 16.07.2011. The species resembles *Gymnomitrium concinnatum* with its julaceous habit, living in the same habitat with long laying snow cover, but differs by its acuminate leaf lobes with hyaline margin and smooth, epapillose cuticle.

Plate III. Fig. 13: *Pinus cembra* group in the *Pinus mugo* stand on the NW slope of Răchițiș summit, at 1780–1850 m alt. (Loc. 13). Fig. 14: Alpine grassland on the Răchițiș summit at 220 m alt., dominated by *Juncus trifidus* and *Festuca airoides* (Loc. 14). Fig. 15: The glacial valley at the NW slope of Răchițiș summit (1700–1980 m), as seen from locality 13. Fig. 16: Open grassland of Negoii saddle, with the occurrence of *Oligotrichum herynicum*, *Cephaloziella hampeana* and of *Ditrichum lineare* (Loc. 12). Fig. 17: *Racomitrium microcarpon* on the open rocks of Răchițiș summit (Loc. 14). Fig. 18: *Salicetum herbaceae* on the N facing cliffs of Răchițiș summit, at 2000 m alt. (Loc. 14). Fig. 19. *Anthelia juratzkana* on the soil of the same habitat, with *Huperzia selago* var. *alpina*. Fig. 20: *Pleurocladula albescens* in the same community (Loc. 14).



**Pleurocladula albescens* (Hook.) Grolle var. *albescens*

It is also a typical circumboreal Arctic-Alpine element of snow valleys, growing often together with *Anthelia* species. Worldwide it is known from the northern part of North America and Asia, in Iceland, Scotland, northern Fennoscandia, Spitzbergen, in the Alps, Tatra Mountains and in the Apennines (Schuster 1974), Pyrenees, Krkonose and Balkan Mts. In central Europe its localities lie between 2000 and 2900 m in areas of long lasting snow cover (Frey *et al.* 2006). In Romania it is known only from the Rodna, Făgăraş and Retezat Mts. (Ştefănuţ 2008).

**Scapania scandica* (S.W. Arnell & H. Buch) Macvicar

A circumboreal-montane species with oceanic character, rare in central Europe. In Romania known only from the higher mountain ranges, as Rodna, Piatra Mare, Bucegi, Piatra Craiului, Făgăraş and Bihor Mts. New to Călimani Mts.: On soil in the N facing Neagra Şarului valley, at the edge of montane spruce forest, 1610 m alt. and on the NE slope of Vf. Negoiu, near the waste piles of abandoned sulphur mine, surrounded by *Pinetum mugii*, at 1820 m alt.

**Arctoa fulvella* (Dicks) Bruch & Schimp.

A circumboreal Arctic-Alpine species distributed from the northernmost parts of North America, Europe and Asia. In Central Europe it occurs in the mountain ranges of the Alps, Sudety and the Carpathians. We collected it in the upper part of north facing glacial valley of Răchiţiş summit, on soil covered andesite rocks with *Rhododendro myrtifolii-Vaccinietum*, at 2000-2020 m alt. 16.07.2011. In Romania it was known only from Rodna and Retezat Mountains before (Mohan 1998), and does not occur further Southeast in Europe (Sabovljević *et al.* 2008).

**Blindia acuta* (Hedw.) Bruch & Schimp.

A circumboreal-montane species, occurring in all major mountain ranges of the Romanian Carpathians, but unknown from Călimani Mts., where we have found it on volcanic rocks of the NE slope of Vf. Negoiu, near the waste piles of abandoned sulphur mine, surrounded by *Pinetum mugii*, at 1820 m alt.

**Ditrichum lineare* (Sw.) Lindb.

It is a circumboreal-montane species, occurring northwards in Europe rarely also on lowland but in the Carpathians only above or near the treeline. Our collections from the Călimani Mts. are from the forest trail from the „Puturosul” spring bog to the Mountain Rescue (Salvamont) house, near the forest line, at 1500–1600 m alt. and from Negoii Saddle (Şaua Negoii, Negoii Nyereg), W slope of Vf. Pietricelul. On bare soil in *Pinus mugii* stand (*Rhododendro myrtifolii-Pinetum mugii*) with a few *Pinus cembra* at 1750-1780 m alt. It is a

tiny species growing scattered on open soil surface and is easy to overlook, but its narrow and abruptly pointed leaf apex is quite characteristic.

The only Romanian record of this rare species is from the 300-350 m high, forested Repedea hills (Masivul Bârnova-Repedea) S of Iași town, 47°05'N, 27°38'E (Papp & Eftimie 1967), which might be an error from such habitat.

**Dicranella humilis* R. Ruthe

An Eurasian species occurring scattered throughout from Central Europe to East Asia. This species is listed as “rare” in the European Red List (ECCB 1995) and occurs only scattered in SE Europe. We collected it on soil along a forest trail leading upwards in Puturosul valley between 950 and 1250 m. In Romania it is known only from two localities in Neamț County.

**Dicranum brevifolium* (Lindb.) Lindb. is a circumboreal Arctic-Alpine species occurring in North America, Northern Asia, Fennoscandia and in the high mountains of Central Europe. According to Sabovljević *et al.* (2008) in Southeast Europe it occurs in the alpine habitats of Bulgaria, Bosnia-Herzegovina, Romania and Slovenia. According to Mohan (1998), under the name of *D. muehlenbeckii* var. *brevifolium* Limpr., it is known in Romania only from the Ceahlău Mts. Its occurrence on the peat bog of Tinovul Mare bog near Poiana Stampei, at 920 m altitude seems to be an interesting relic occurrence.

**Dicranum flexicaule* Brid. A circumboreal montane species scattered all over the northern part of North America and Asia. In Europe it is widespread in the northern parts of Fennoscandia and Britain and occurs sporadically in all higher central and SE European mountains. We collected it on soil with many *Juncus trifidus* tussocks of the flat summit of Răchițiș at 2020 m and on peat of Tinovul Mare bog, at 920 m alt. In Romania known from the Giumalău Mts. in the Bucovina part of Suceava County (Ștefureac & Pascal 1981, under the name of *D. fuscescens* var. *flexicaule*) and in several parts of Transylvania (Mohan 1998, under the name of *D. congestum* Brid.).

**Grimmia donniana* Smith.

A circumboreal montane species according to Greven (1995), occurring also in the Antarctic, but according to Ochyra *et al.* (2008) all the Antarctic records proved to be *G. sessitana*. *Grimmia donniana* was collected on andesite boulders surrounded by *Pinus mugo* stand at the ridge between Ciunt and Răchițiș summits. In Romania it was known from practically all mountain ranges reaching the alpine belt, except for the Călimani Mts.

***Pohlia nutans* (Hedw.) Lindb. ssp. *schimperi* (Müll.Hal.) Nyholm

This taxon was long neglected and thought to be in Europe confined to Fennoscandia, but recent finds in the Alps, Sudetes and Carpathians (Köckinger & al., 2005) brought it to the attention of bryologists. It has subsequently been found also in the Stara Planina Mts. in Serbia (Erzberger, 2007), and even in predominantly montane areas of Germany (Meinunger & Schröder, 2007) and Hungary (Papp, 2009). Its occurrence in the Romanian Carpathians therefore was to be expected. We found this taxon in the Călimani Mts. (loc. 14), on the top of Vf. Răchițiș (Reketyés), on thin layers of soil in fissures of siliceous rock in N exposition, growing in close association with *Pleurcladula albescens* and *Nardia scalaris*. Köckinger & al. (2005) consider the Central European occurrences to be glacial relicts resulting from migratory events in the pleistocene. The new location fits well into this concept.

One reason for the apparent neglect of the taxon is the fact that some authors (e.g. Corley & al., 1981, Koperski & al., 2000) placed it in synonymy of *Pohlia nutans*. However, ssp. *schimperi* (treated at species rank by Limpricht, 1895, Mönkemeyer, 1927 and Nyholm, 1993) is distinguished from the typical subspecies by the purple coloration of the leaves and sometimes a different sexual condition (Köckinger & al., 2005). It is missing from Dihoru (1994), Mohan (1998) and from Sabovljević & al. (2008) and therefore believed to be a new record for the bryoflora of Romania.

* *Pohlia prolifera* (Kindb.) Lindb. ex Broth.

A circumboreal montane species known in Romania only from Rodna, Bucegi and Sibin Mts. and from Mera near Cluj-Napoca (Mohan 1998). Our collection was made from soil along the forest trail leading upwards in Puturosul valley between 950 and 1250 m and on the NE slope of Vf. Negoiu, near waste piles of abandoned sulphur mine, surrounded by *Pinetum mugii*, at 1820 m.

**Polytrichastrum pallidisetum*

Distributed in the eastern part of North America and in eastern Europe, does not occur in western and in southern Europe. Known from several places in the Romanian Western and East Carpathians, under the name of *Polytrichum pallidisetum* Funck (Mohan 1998, Plămadă 1998), but new to Călimani Mts.: saddle between Ciunt and Răchițiș summits, on volcanic rocks surrounded by *Pinus mugo* stand at 1880 m alt.

**Racomitrium microcarpon* (Hedw.) Brid. = *Bucklandiella microcarpa* (Hedw.) Bedn.-Ochyra & Ochyra in Ochyra, Żarnowiec & Bedn.-Ochyra

A circumboreal-montane species new to Călimani Mts. Known from the Northern Carpathians from 600–2550 m altitude, in the Eastern and Southern

Carpathians only above 1900 m, from the Czarnahora, Rodnei, Făgăraș and Retezat Mountains (Rehmann 1878, Boros & Vajda 1969, Bednarek-Ochyra 1995, Mohan 1998). We collected it at several localities on volcanic rocks and boulders, between 1700 and 2000 m altitude.

**Rhynchostegium megapolitanum* (Blandow ex F. Weber & D. Mohr) Schimp.

An Atlantic-Submediterranean species, more widespread in the drier, southern parts of Europe, like in Hungary and in Balkan Peninsula (Sabovljević et al. 2008), relatively rare in Romania and new to Călimani Mts.: On soil in the N facing Neagra Șarului valley. At the edge of montane spruce forest, at 1610 m alt.

**Tortula schimperi* M.J.Cano, O. Werner & J. Guerra (syn. *T. subulata* var. *angustata* (Schimp.) Limpr.)

We found this taxon in the Călimani Mts. (loc. 4), 7 km N from Toplița (Maroshéviz) town, along Toplița (Lomás) streamlet, growing on soil in mesophilous spruce forest (*Leucanthemo waldsteinii-Piceetum*) N 47°01'05", E 25°21'57" at 850 m a.s.l., 14 July 2011, leg. P. Erzberger, T. Pócs & M. Höhn, det. P. Erzberger (B Erzberger 14778).

According to Sabovljević & al. (2008), *T. schimperi* has been recorded in SE Europe in Greece, Montenegro and Serbia, but not in Romania, but Mohan (1998) records it from Romania based on the publications of several authors, under the name of *Tortula subulata* Hedw. var. *angustata* (Wils.) Schimp. It has perhaps been overlooked many times up to now, which might also result from the fact that it has been treated for a long time at infraspecific level within the common *T. subulata*, and only recently been elevated to species rank.

Other interesting record

Polytrichum perigoniale Michx. (syn. *P. commune* var. *perigoniale* (Michx.) Hampe)

This taxon was found on the SE ridge of the Călimani Mts. (loc. 8), in a peat bog complex of raised bog (*Eriophoro vaginati-Sphagnetum recurvi*) and transition bog (*Caricetum lasiocarpae*) near the Mountain Rescue (Salvamont) house, 500 m ENE from Jezer Lake, at the forest line, growing on peat together with *P. strictum*, *Oligotrichum hercynicum*, *Sphagnum girgensohnii*, and *Scapania irrigua*.

Some authors place this species as a variety in *P. commune*, or fail to recognize it as specifically distinct from the latter (e.g. Hill & al., 2006, Sabovljević & al., 2008), with the result that it is a neglected taxon, and it is much more difficult to obtain information on its occurrences. It is published by

several authors from a number of places in the Eastern and Southern Carpathians, incl. the Tinovul Mare of Poiana Stampei at the N foot of Călimani Mts., under the name of var. *perigoniale* (Mohan 1998, Plămadă 1998), but missing from Sabovljević & al. (2008).

P. perigoniale is easily identified when leaf cross-sections are studied. The uppermost cells of costal lamellae are variable in shape within the same leaf, some are furrowed (especially in median part of costa), and some are rounded (especially in marginal part of costa). In *P. commune* s.str. all end cells are uniformly furrowed, and in *P. pallidisetum* they are usually uniformly truncate or with a very flat furrow (see fig.50c in Plămadă 1998: 151). The latter species is also characterized by a cylindrical capsule without constriction at the hypophysis, whereas the capsule in *P. perigoniale* is shortly cylindrical and strongly constricted at the neck (Schoepe 2000).

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DISTRIBUTION OF *SPHAGNUM* *QUINQUEFARIUM* IN HUNGARY

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We have found several *Sphagnum* colonies of different size on the 10 October 2010 near Parádfürdő village, at the entrance of Ilona valley. The species was determined as *Sphagnum quinquefarium* which was not known in the area of Mátra Mountains till now (Misik–Misik-Bartók 2010). This species became known only from a few point of our country in the last decades. It was first published from Hungary by Pócs (1958) from the Vend country near Szakonyfalu. In the 60ties of last century it was recorded beside only along the Kemence brooklet in North-Hungary and from the Vas ridge from Farkas-forest of Petőmihályfa (Boros 1968). On the basis of research in the last years we could find a small *Sphagnum* patch only near Kishuta village of Zemplén Mountains in East-Hungary. This species is not common in western Hungary either, but is generally known from the area of Őrség, Vend country, Vas ridge and Kőszeg Mountains (Szurdoki 2005). The herbarium data from Hungary are as follows:

Zemplén Mountains: Kishuta, Kemence-brooklet (Boros 1953 BP), Kishuta, Lackó-mountain (Szurdoki 1997 BP).

Mátra: Parád, Ilona-valley, above a mine-shaft, which was created by searching copper boring (Misik 2010 EGR).

Keszthely Mountains: Zala, Lesenceistvánd (Gáyer 1922 BP, Boros 1923 BP). It is extinct at this locality.

Vend country: Apátistvánfalva, Rókalyuk forest, on the brink of blueberry's in the table-land (Barbalics 1980 EGR). Rábatótfalu (Pócs 1956 EGR), Szakonyfalu, in a transition peat bog (Boros 1960 EGR). **Őrség:** Farkasfa, Ördög-lake (Vajda 1972 BP). **Vas ridge:** Farkas-forest, Bertók-lake (Barbalics 1967 BP), Farkas-forest, Petőmihályfa, Köcse-lake (Barbalics 1967 BP, 1968 BP), Nagymákfa, Füzes-lake (Barbalics 1969 BP), Vasvár, Nyíres-lake (Barbalics 1971 BP).

This species is much more frequent outside the Pannonian Basin, being a characteristic *Vaccinio-Piceetalia* element of spruce forests in the Carpathians; therefore in Mátra Mountains its occurrence is unusual. But near to its locality other *Vaccinio-Piceetalia* elements, like *Bazzania trilobata* and *Lepidozia reptans*, also occur in the acidophilous oak forest (Boros 1968).

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Fig. 1. The Sphagnum quinquefarium in the Ilona Valley of the Mátra Mountains in Northeast-Hungary

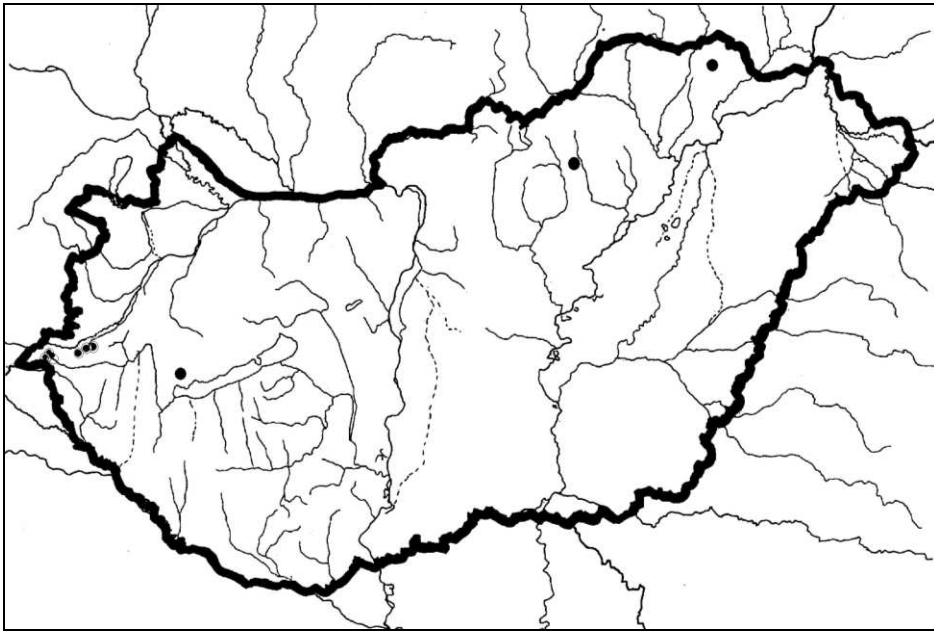


Fig. 2. Distribution of *Sphagnum quinquefarium* in Hungary

NOTES ON THE REPRESENTATIVES OF GENUS *KURZIA* G. MARTENS (LEPIDOZIACEAE, JUNGERMANNIOPSIDA) IN THE COLOMBIAN ANDES

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Andes, Colombia, endemics, páramo, Neotropics, new subspecies, South America

Abstract: *Kurzia brasiliensis* is new to Colombia compared to the two taxa hitherto known from here (*Kurzia capillaris* and *Kurzia flagellifera*). *Kurzia capillaris* ssp. *paramicola* is described, as new to science. The latter is distinct in having erect leaves adherent to the stem with leaf segments composed mostly of two rows of cells. All four taxa are known from the peaty soil in the páramos in Colombia, at an altitude of 3230–3750 m. A key with illustrations of all Colombian taxa is provided here.

Introduction

In 1978, Professor S. R. Gradstein kindly sent to the author a number of Andean Lepidoziaceae, collected by A. M. Cleef in the high Andes of Colombia, for identification. Most of the *Lepidozia* collections were identified long ago but a group of *Kurzia* specimens, supposed to represent a new taxon, remained unrevised until now. A new subspecies is described and illustrated in detail below and, compared to the related taxa. A key is also given for all Colombian *Kurzia* taxa.

Description of the new subspecies

***Kurzia capillaris* (Sw.) Grolle ssp. *paramicola* Pócs, subsp. nov. (Figs. 1–15)**

Differt a Kurzia capillaris (Sw.) Grolle ssp. *capillaris* foliis erectis sicco ad caulem adherentibus segmentibus longis parallelis maxime parte cellulis biseriatis compositis.

Typus : ‘COLOMBIA, Departamento Cundinamarca, Páramo de Palacio, approx. 500 m NW de la mina de Cal, vertiente húmedo con *Swallenochloa*, *Sphagnum*, *Breutelia* y *Riccardia*, alt. 3530 m, 13-V-1972. Coll. A.M. Cleef 3781, (Holotype U, Isotypes COL 379349, EGR only on microslide).

A blackish-brown plant, forming cushions up to 10 mm in height or wefts, growing on the peaty soil in wet páramo vegetation. Shoots 4–10 mm long and up to 190 μm wide, stem remotely, pinnately branched with both *Frullania* and *Microlepidozia* type branches. Main stems are up to 120 μm , stems of primary branches up to 80 μm , secondary ones up to 50 μm thick. The main stems have 12–14 cortical cells with about 16 medullary cells. The cortical cells are thickened and have brownish pigment. The leaves are transversely inserted, deeply 4-segmented, 180–200 x 140–170 μm in size, with fragile, often with broken, segment tips.

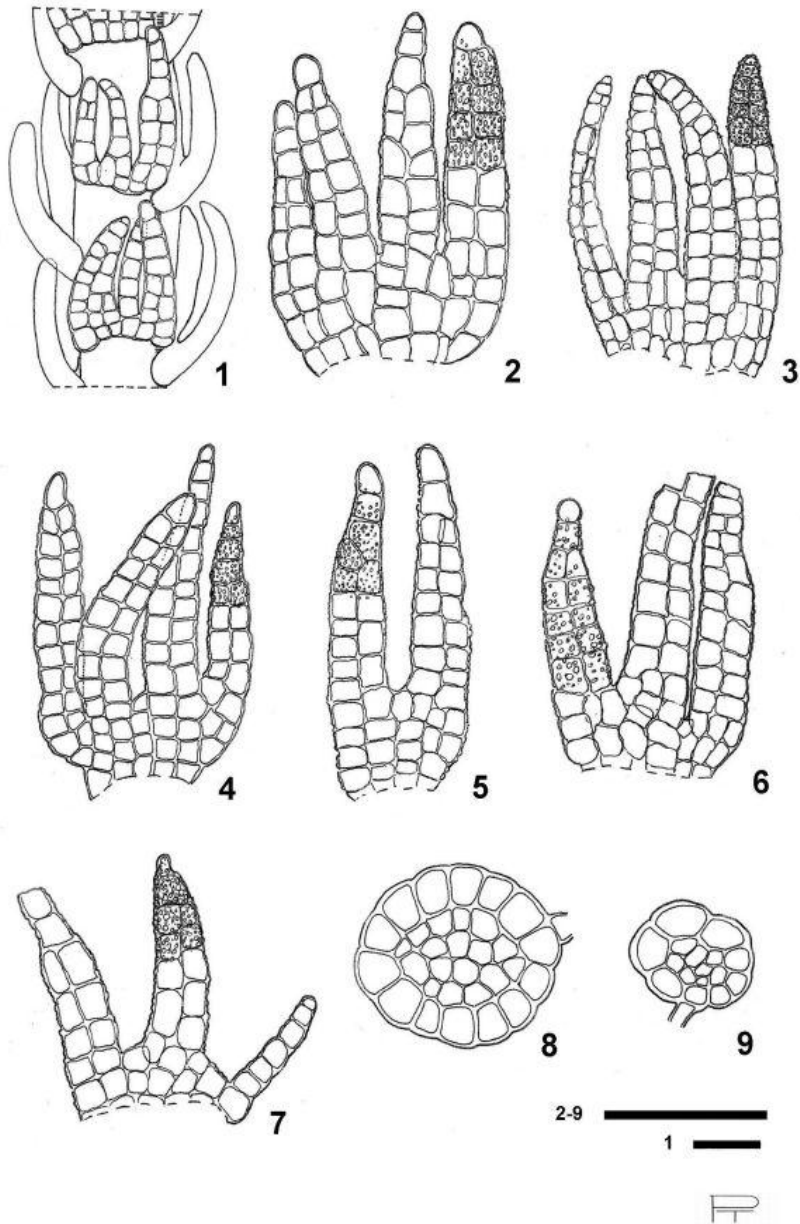


Plate I. *Kurzia capillaris* ssp. *paramicola* Pócs, ssp. nov. Fig. 1: Habit with underleaves. Fig. 2-4: Leaves. Fig. 5-7: Underleaves. Fig. 8 : Stem section. Fig. 9: branch section. Scale bars: 100 μ m. (All drawn from the type).

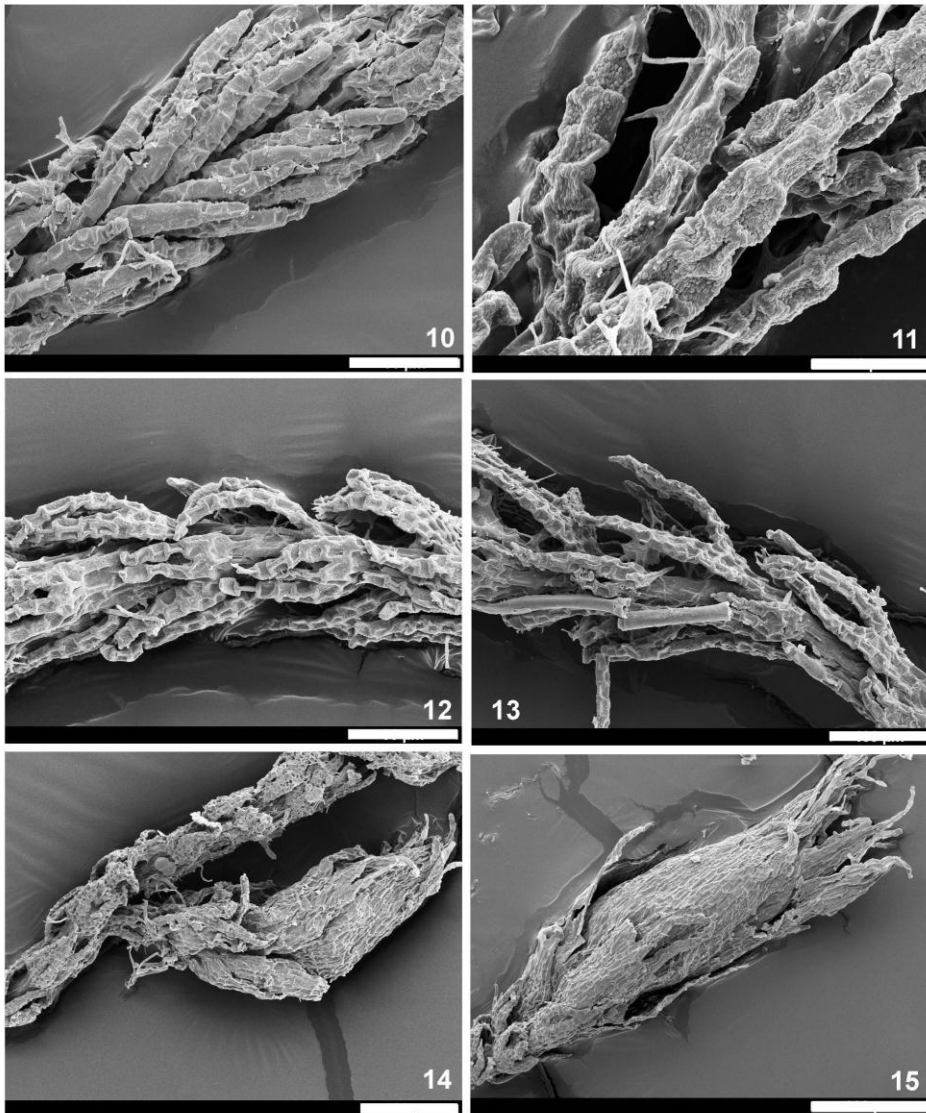


Plate II. *Kurzia capillaris* ssp. *paramicola* Pócs, ssp. nov. Fig. 9: Main stem, habit, dorsal view (scale bar 90 μ m). Fig. 10: Leaves on the main stem (scale bar 40 μ m). Fig. 12: Primary branch, ventral view (scale bar 90 μ m). Fig. 13: Secondary branch, ventral view (scale bar 100 μ m). Fig. 14: Female branch with young gynoecium, ventral view (scale bar 200 μ m). Fig. 15: Gynoecium with pericaetial leaves (scale bar 300 μ m). (SEM pictures made from the type of ssp. by A. Sass-Gyarmati).

Discs are 2-4 cells high. Leaf segments are almost parallel-sided, each consisting of two rows of cells up to the 6–9th cells, then ending in a uniseriate apex of 1–3(–5) cells long and tipped by an obtuse rounded cell. Most of the leaf cells are square or near so, 10–15 µm wide, with moderately and evenly thickened walls. Their cuticle is densely verruculose except for the apical cells. The leaves, in a dry state, are adherent to the main stem, but on branches they are more patent. The underleaves are smaller and consist of (1–)2–3 segments, the smaller segments sometimes consisting only of one row of cells. The gynoecea, which growing on short secondary side branches, consists of 3–4 rows of bracts and bracteoles, irregular serrate with long teeth and acute tips, ending in an uniseriate row of 4–8 cells. Perianthium, sporophyte and androecium were not present.

Etymology: It is named after its exclusive habitat, the páramo vegetation.

Other specimens seen: COLOMBIA. Boyaca: Páramo de la Rusia, NW of Duitama, "fondo pantanoso del valle 1 km al SE de la Laguna Negra, frailejónal denso de *Espeletia incana* con *Sphagnum* ssp.", 3745 m, 15-XII-1972, A.M. Cleef 7273 (COL, U 379380). "Cundinamarca, Páramo de Palacio, Lagunas de Buitrago y alrededores. Pantano con *Swallenochloa*, *Werneria humilis* var. *angustifolia* y *Sphagnum* ssp.", alt. 3580 m., 25-V-1972, A.M. Cleef 4101a (COL, U 379509, EGR). Cundinamarca: Páramo between Cogua y San Cayetano, Laguna Verde, "vegetación húmeda con *Xyris acutifolia* y *Aragoa abietina* predominantes, asociadas con *Sphagnum* a lo largo de vallecito pantanoso 800 m WNW de la laguna", 3675 m, 13-XI-1972, A.M. Cleef 6329 (COL, U).

Discussion

The American populations recently known, as *Kurzia capillaris* (Sw.) Grolle were distinguished first under the names of *K. capillaris* and *Kurzia verrucosa* (Steph.) Grolle, while the mainland African populations were known, as *Kurzia tabularis* (Steph.) Grolle (Grolle 1964) and the East African islands populations as *Kurzia stephanii* (Renauld) Grolle. Pócs (1984) united them within the frame of *Kurzia capillaris*, giving subspecies rank to *K. stephanii*, which differs because the leaf lobules with a higher ratio of the uniseriate part than in ssp. *capillaris*. However, it occurs also in certain parts of East Africa where it intergrades with rare intermediate forms into ssp. *capillaris*. Specimens with different level of cuticle verrucosity occur everywhere within ssp. *capillaris*, therefore they merit only variety rank (Pócs 1984).

Since long time is used in the classification of different Lepidoziaceae genera the length and width of basal, median and apical part of leaf and underleaf segments, measured by the number of cells. Practically: the number of cells are counted in each of the of uni-, bi- and more-seriate parts in the segment. This

ratio defines the shape of leaf or underleaf segments. Two kinds of diagrams are given to show these cell arrangement patterns. Fig.16 compares how many cells long are the 1-, 2-, 3- and 4-cell wide parts of leaf segments in the four Colombian taxa of *Kurzia* while in fig. 27 *Kurzia capillaris* ssp.*paramicola* is compared with American and African representatives of *Kurzia capillaris* ssp. *capillaris*. For each population the average of 10 random measurements were used. It is clear that ssp.*paramicola* is well separated by its 7-8 cells long biserial and 1.5–2.5 cells long uniseriate part from ssp. *capillaris* which has 2-5 cells long biserial and 2–3 cells long uniseriate part of leaf segments. There is however a Brazilian population in between these two types. The latter is classified to ssp.*capillaris* because its leaf position (see fig.20). There is a difference between the American and African populations too in the ratio of uniseriate and biserial parts (figs. 21–22 versus figs 23–25, as there is a further, similar difference between *Kurzia capillaris* ssp. *capillaris* and ssp. *stephania*). Therefore it seemed to be wise to distinguish the new taxon known from the Andean páramos only at the subspecies level, while leaving the rest of American and most African populations together within ssp. *capillaris*. Molecular investigations could perhaps better elucidate these taxonomic interrelationships within this group of taxa.

Distribution: *Kurzia capillaris* ssp. *paramicola* is a typical, small, compact cushion forming plantlet growing on the wet, peaty páramo soils at 3500–3800 m altitude and seems to be endemic for the Colombian high Andes.

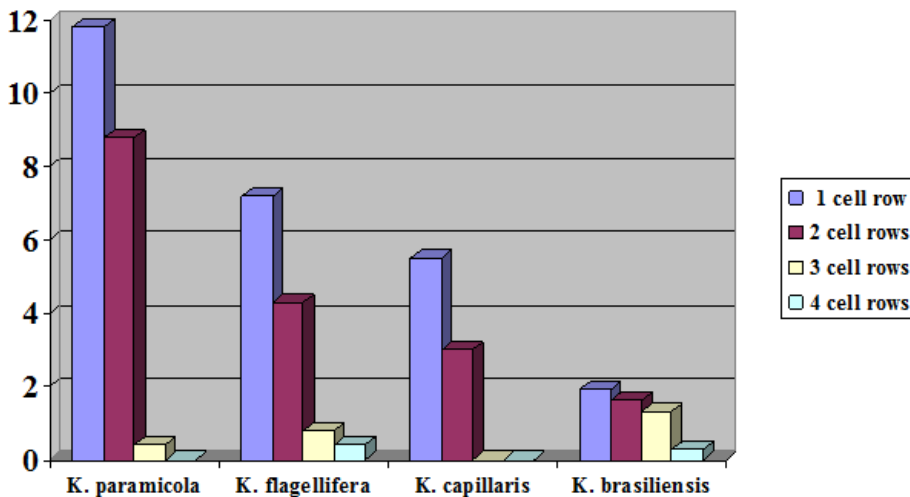


Fig. 16: The cell composition of the leaf segments in the three Colombian *Kurzia* species.

The columns represent, how many cells long are the parts with different number of cell rows in the leaf segments, in the average of 4-4 leaves of 3-3 different plant specimens of each species.

Selection of other taxa investigated (identified by the author unless otherwise stated)

***Kurzia capillaris* (Sw.) Grolle**

Var. *verrucosa* (Steph.) Pócs. COLOMBIA: Cundinamarca, “Páramo de Cruz Verde, Alto de la Viga, flanco N, vertiente seco con Rastrojo de *Arcytophyllum nitidum* y *Aragoa cupressina*, asociado con *Calamagrostis effusa*. Límite superior del subpáramo. Hepáticas terrestres.” Alt. 3460 m, 12-IV-1972. Coll.: A.F. Cleef, 2813 (COL, U. EGR). VENEZUELA:

Mérida, “Parque Nacional Sierra Nevada, teleférico de Mérida, Estación la Montana, Bosque Montano Andino, sobre farallón. Coll.: S. & T. Pócs, R. Rico 9712/L (MERC, EGR).

Var. *capillaris*: PERU: Amazonas, prov. Chachapoyas, “Straße Chachapoyas-Cajamarca km 418, lianenreicher Sekundärwald mit dünnstämmigen Baumen, teilweise beweidet” Alt. 3000 m, 7.9.1982. Coll.: J.-P. Frahm et al., *Bryotrop 1194* (EGR). BRAZIL: “São Paulo, Litoral Norte, Ilha São Sebastião, Mata Atlântica am Südabhang. Schlucht des Riberão da Laje, au großem Felsblock”, 150 m. 10-II-1990. Coll. A. Schäfer-Verwimp 12476 (Hb. Schäfer-Verwimp, EGR). TANZANIA, Morogoro Reg., Nguru Mts., elfin forest and ericaceous heath on the E side ridge between Chazi and Dikurura Valleys, WNW of Mhonda Mission, 1900 m, thin mat on shady granite cliff below the summit. 5-II-1989. Coll.: T. Pócs & E. Knox 89056/R (EGR, Bryophyta Africana Selecta No. 49). SOUTH AFRICA, Western Cape Prov., Silvermine Nature Reserve, above Silvermine river reservoir, on wet ditch side in fynbos, 500 m, 15-X-1996. Coll.: Th. Arts RSA 102/25 (Hb. Arts, RSA, EGR). MADAGASCAR: Antsiranana (Diego-Suarez), “Réserve speciale de Manongarivo, Andranomalaza source, sommet, point côté 1869 m, sur tronc de 1 à 3 m diamètre”, 20-III-1999. L. Gautier & N. Messmer 19899 (CJB-G, EGR). RÉUNION, Cirque de Cilaos. Dwarf subalpine bush (*Philippia*, *Helichrysum*) near Gîte de Caverne Dufour, on soil, 2478 m, 11-VII-1996. E. Kónya 9641/F (EGR). SEYCHELLES, Mahé Island, Morne Seychellois Nat. Park, mossy elfin forest dominated by *Northea* (Sapotaceae) and *Phoenicophorum* (Arecaceae) on the summit ridge of Congo Rouge, 690-730 m, 24-VIII-1993. T. Pócs 9345/A (EGR).

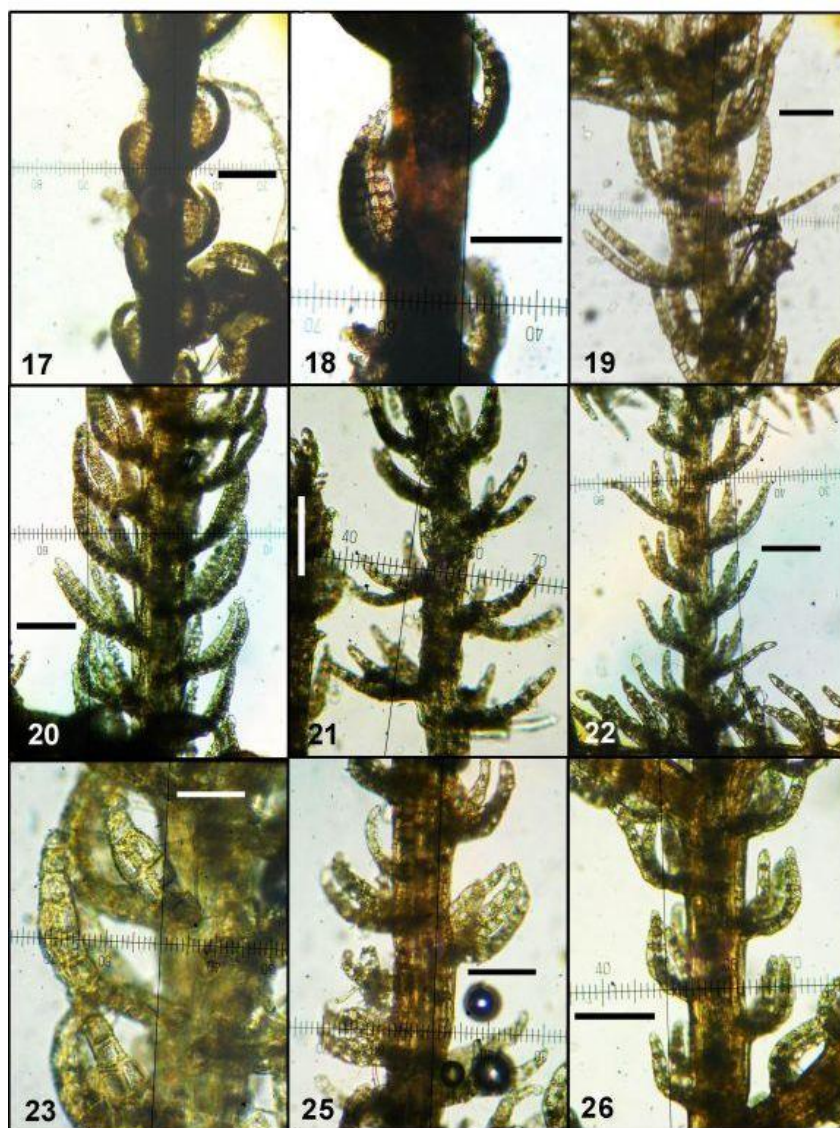


Plate III: *Kurzia capillaris* ssp. *paramicola* Pócs. Fig. 17–18. Main stem, from the type. Fig. 19: primary branch with leaves, from *Cleef* 7273. *Kurzia capillaris* ssp. *capillaris*, 20–26, all from the main stems. Fig. 19: from Brazil, *Schäfer-Verwimp* 12476. Fig. 21: From Colombia, *Cleef* 2813. Fig. 22: from Tanzania, *Pócs & Knox* 89056. Fig. 23: From Réunion, *Kónya* 9641/F. Fig. 25: From South Africa, *Arts RSA* 102.25. Fig. 26: From the Seychelles, *Pócs* 9345/A. (Scale bars in each case 100 μ m, except for fig. 23, where it is 50 μ m).

Distribution of *Kurzia capillaris*: Mountainous areas of tropical America and Africa, in the southernmost and also in island areas at lower altitudes (see map in Gradstein *et al.* 1984: 142, fig.15).

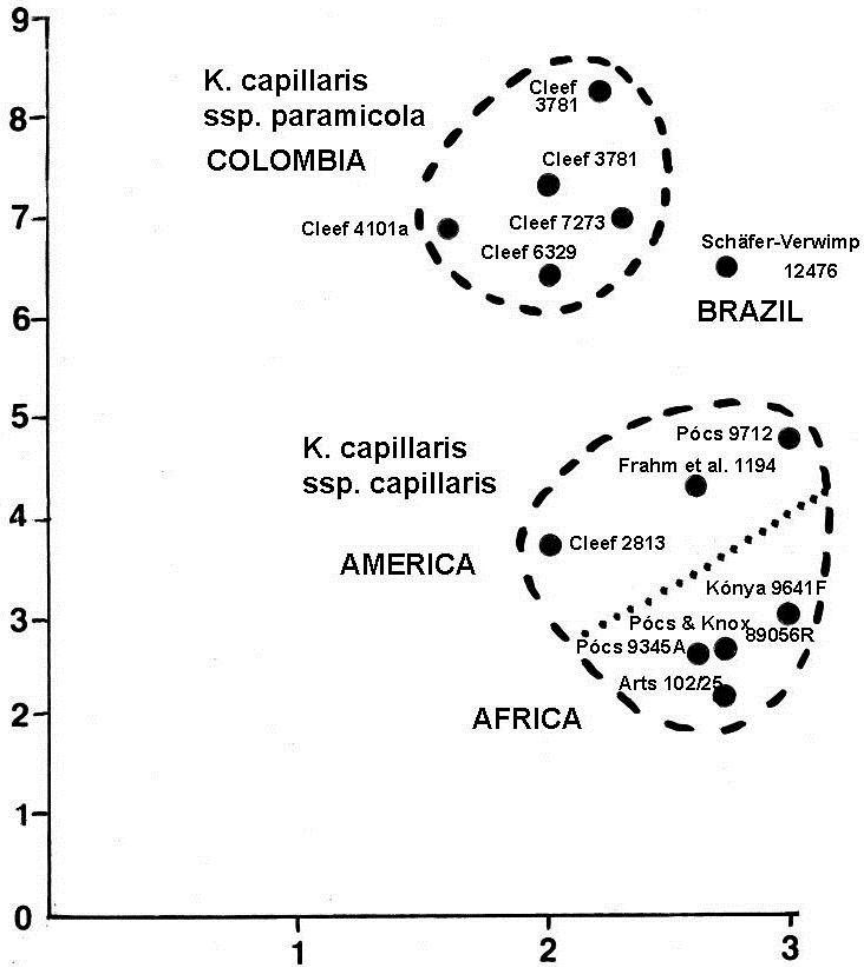


Fig. 27. The ratio of the two and one cell wide parts of leaf segments. The ordinate represents the length of the 2 cells wide part, while the abscissa represents the length of the uniseriate part, counted in terms of cells.

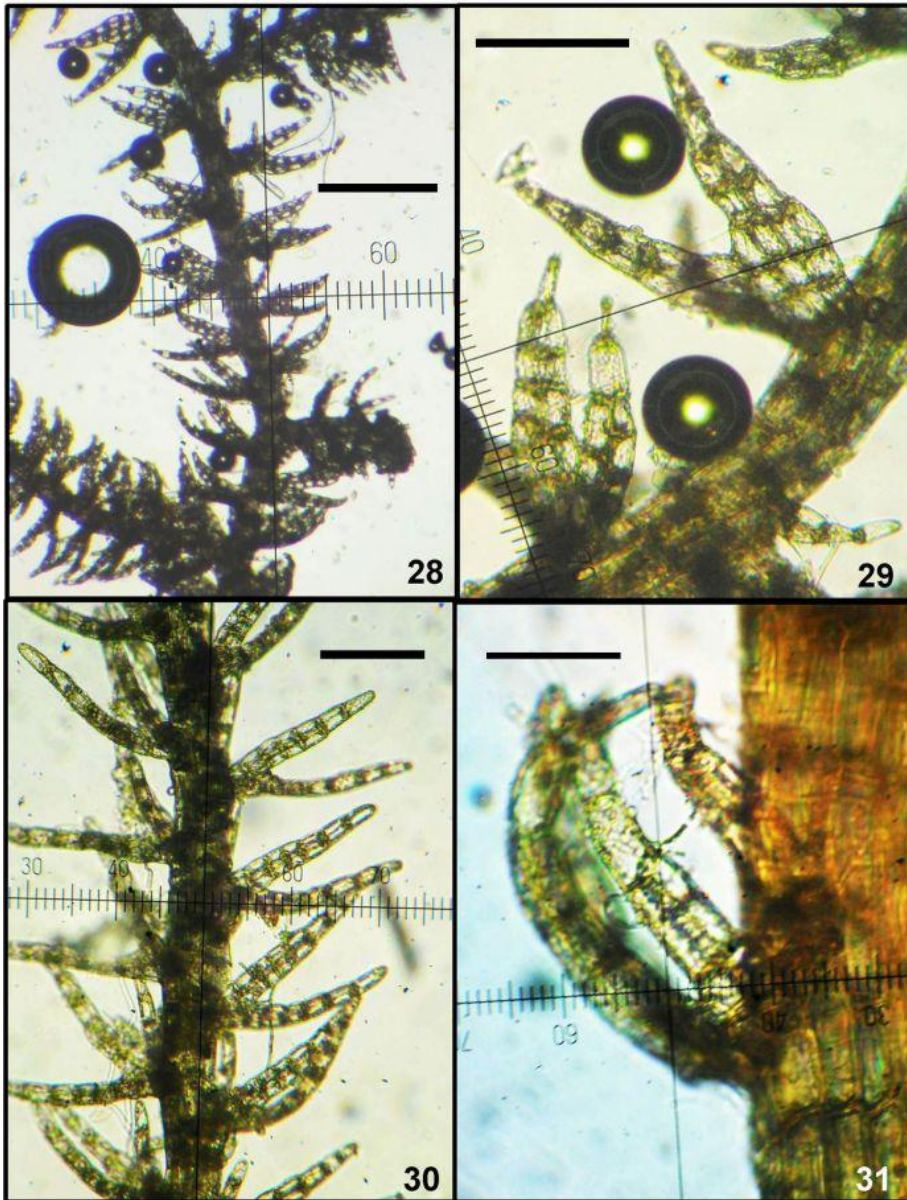


Plate IV: *Kurzia brasiliensis* (Steph.) Grolle. Fig. 28: Habit, ventral view (scale bar 250 μ m). Both from Colombia, *Cleef 36848*. Fig. 29: Stem leaves (scale bar 100 μ m). *Kurzia flagellifera* (Steph.) Grolle. Fig. 30: Habit, dorsal view (scale bar 100 μ m), from Costa-Rica, *Holtz 00-132*. Fig. 31: Stem leaf (scale bar 50 μ m), from Colombia, *Cleef 6897a*.

***Kurzia brasiliensis* (Steph.) Grolle**

COLOMBIA, Cundinamarca, “Páramo de Palacio, flanco W, km 8 de la carretera, subpáramo: vertiente pendiente seco con *Calamagrostis effusa*, *Espeletia corymbosa* y *Arcytophyllum nitidum*, asociados con matorral de *Befaria*. Hepáticas terrícolas escionófilas”, 3250 m, 12-V-1972. Coll.: A.M. Cleef 3685b, det. S.R. Gradstein (COL, U). Record new to Colombia (compared to Gradstein & Hekking 1979, Uribe & Gradstein 1998).

Distribution: Hitherto known only from Brazil (Fulford 1966, Gradstein & da Costa 2003).

***Kurzia flagellifera* (Steph.) Grolle**

COLOMBIA, Cundinamarca, “Páramo de Palacio, Lagunas de Buitrago y alrededores, 2 km al SE de la Mina de Cal. Vertiente pantanoso con *Swallenochloa* predominante asociada con *sdpeletia grandiflora* (fma. con tallo 150 cm), *Calamagrostis effusa*, *Breutelia* y *Sphagnum*”, 3750 m, 29-XI-1972. Coll.: A.M. Cleef & L. Uribe 6697a, det. S.R. Gradstein COL, U, EGR). COLOMBIA, Cundinamarca, “Páramo de Cruz Verde, vertiente pantanoso cerca de la orilla NW de la Laguna El Verjón con *Chusquea*, *Senecio flos-fragens*, *Sphagnum* y *Péeurozium schreberi*. Hepática terrestre”, 3500 m, 27-IV-1972. Coll.: A.M. Cleef 3251 (COL, U, EGR). COSTA RICA, Cartago, Cordillera de Talamanca, small *Blechnum* bog at Panamerican Highway (km 70), Entrada ‘Mirador de Quetzales’, S of road, on rotten log, 2650 m, 19-I-2000. Coll.: I. Holtz CR 00-132, det. J. Váña (GOET, EGR).

Distribution: A species occurring in the mountainous areas from Costa Rica through Guatemala, Venezuela and Colombia to Brazil (Dauphin 2005, Fulford 1966, Gradstein & da Costa 2003).

Key to the Colombian species of *Kurzia* G. Martens

1. Leaf segments triangular, 3–4 cells wide at the base, leaf lamina (disc) 3–4 cells high ***K. brasiliensis***
1. Leaf segments lanceolate, with more or less parallel sides, 2 and 1 cell wide for most of their length, lamina (disc) only 1–2 cells high. 2
2. Leaf cells elongate rectangular, 1.5–3 times longer than wide. Remotely branched, branches often elongated, with remote leaves. ***K. flagellifera***
2. Leaf cells quadrate, approximately as long as wide. Quite regularly pinnately branched, leaves also on the branches densely attached. ***K. capillaris***
3. Stem and branch leaves with the shape of a palm with inside curved fingers. The two cell rows wide part of segments are 2–5 cells long. The uniseriate

- end of segments at least half as long as the part composed of two cell rows.
..... 4
3. Stem leaves in dry state adherent to the stem, the two median segments composed mostly of two cell rows for the height of 6–9 cells, the uniseriate part is much shorter than the part of two cell rows. Branch leaves patent
..... ***K. capillaris* ssp. *paramicola***
4. Leaf cells with smooth cuticle. ***K. capillaris* ssp. *capillaris* var. *capillaris***
4. Leaf cells with verruculose cuticle ***K. capillaris* ssp. *capillaris* var. *verrucosa***

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ON THE IDENTITY OF *RICCIA FLUITANS* (RICCIACEAE: MARCHANTIOPHYTA) IN INDIA

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Key words: India, Marchantiophyta, Ricciaceae, *Riccia stricta*, *Riccia fluitans*

Abstract: The status of the species *Riccia fluitans* in India is discussed in detail. Most of the Indian specimens described under *R. fluitans* are *Riccia stricta*. Specimens collected from different parts of India were compared with specimens from BM. Photographs are provided for easy identification.

Introduction

Riccia fluitans L. is one among the most common species of the genus *Riccia* L. It is often cited as text book example of a liverwort occurring both as land and aquatic forms and has been reported from most parts of the world. The identity of *Riccia fluitans* L. has been largely debated for a long time (Evans 1921; Gaisberg 1921; Familler 1920; Carter 1935). This was regarded either as a distinct species with aquatic as well as terrestrial forms or as a composite species comprising the aquatic forms of many terrestrial species. Mueller (1940, 1941) has shown that *R. fluitans* is a composite species consisting of four different species, viz., *R. fluitans* L. emend K. Mueller, *R. canaliculata* Hoffm., *R. rhenana* Lorb. and *R. duplex* Lorb. & K. Mueller. This concept was accepted by most hepaticologists (Meijer 1951; Schuster 1953; Klingmueller 1957, 1959). Bapna and Kachroo (1999) mentioned *R. fluitans* in the aquatic forms as cosmopolitan distribution and description closely resembles *R. stricta*. They also mentioned *R. abuensis* Bapna, described from Rajasthan, after the type collection there is no report from other localities and it is closely related with *R.*

stricta in its thallus structure. These species have also been largely misidentified. After studying Malaysian *R. fluitans*, Meijer (1958) suggested that the comments of Mueller (1940, 1941) does not hold good for the tropical habitats. Re-examination in many parts of the world such as Africa (Perold 1990, 1999) also supported these assumptions. All southern and tropical African specimens named as *R. fluitans*, examined by Perold (1990, 1995) were found belonging to *R. stricta* (Gottsche, Lindenb. & Nees) Perold. The situation in other tropical parts such as in India may not be different. Hence we conducted a detailed re-examination of *R. fluitans* known from India.

In India, *Riccia fluitans* L. emend K. Muller was known by the reports of Mitten (1860-1861) from the Himalayas including Nepal, Kumaon and Nilgiris, Stephani (1990) from the Himalayas, Japan, Siberia and other European and American countries, Kashyap (1929) from Jammu Valley, Kashmir, Peshwar, Garhwal, and Madras, Srivastava (1964) from Shillong, Chopra (1943) from Sikkim, Bengal, western Himalayas, South India and Nepal, Singh & Nath (2007) based on Srivastava (1964) from Meghalaya, Nair *et al.* (2005, 2006), Manju & Rajesh (2009) and Manju *et al.* (2009) from Kerala.

Species in the *Riccia fluitans* complex are difficult to distinguish, as the gametophytes are highly sensitive to environmental conditions and the habitat may vary from terrestrial to aquatic. *R. fluitans* is characterised by wider thallus, clearly visible distinct air chambers, apical scale not protruding and the thallus is dioicous (Jovet-Ast 1986).

Methods

Details on the occurrence of *Riccia fluitans* in India were collected by scanning through the literature. In addition to the fresh specimens from southern India the specimens available in various herbaria such as BM, CALI, NBRI were also used for the present study. Photographs were provided for easy identification (Figures 1 & 2).

Results

The species of *Riccia fluitans* and *Riccia stricta* can be distinguished from one another as shown in the key below (see also Table.1). The detailed re-examination revealed that the true *R. fluitans* does not occur in India. The specimens mentioned earlier under the name *R. fluitans* from India belong to *R. stricta*.

- 1a. Thallus with distinct air chambers absent; spore production very often.....***R. stricta***
- 1b. Thallus with small air chambers with distinct areolate walls; spore production very rare ***R. fluitans***



Figure 1. *Riccia stricta* specimens collected from different localities of Western Ghats, A: KPR 106927 (terricolous). B: MCN 84369 (terricolous). C: MCN 84511 (aquatic). D: KPR 99809 (aquatic).

Riccia fluitans auct. mult. non L., Species Plantarum 1139. 1753; emend K.Mueller, Aufl. 6 Bd. 1. Abt. 204. f. 134. 1907. *Ricciella fluitans* (L.) A.Braun, Species Plantarum 1139. 1753. *Riccia canaliculata* Hoffm., Deutsch. Fl. 2: 96. 1795. *R. canaliculata* Hoffm. var. *fluitans* Schiffn., Oester. Bot. Zeitsch. 49: 387. 1899. *Riccia duplex* Lorb. & K.Mueller, Hedwigia 80: 100. 1941. *Riccia media* Klingm., Flora 146: 616. 1958.

Thallus broad, thin, 1-1.5 cm x 0.8-2 mm, dichotomously branched, yellowish-green; terrestrial thallus much broader, apex of thallus wider than rest of the thallus, rhizoids pegged, ventral scales rudimentary; both lacking in free-floating form; thallus segments broadly channelled in free-floating form, spongy, air chambers occur through out thallus. Walls of small air chambers from above is distinctly areolate, clearly visible, grove not very distinct apically, otherwise absent.

The species shows both aquatic and terrestrial forms but the main difference is that *Riccia fluitans* sporulates very rarely and the species is dioecious whereas *Riccia stricta* produces spores very often and it is monoecious. The above description is mainly based on the following specimens from BM.

Specimens examined

Flora Romaniae Exsiccata, A Herbario Universitatis Napocensis Edita 3045 a. *Riccia fluitans* L. as *Ricciella fluitans* (Leg. et. Det. E.I. Nyárády et St. Péterfi, Rev. Tr. Ştefureac) BM000962754; 3045 b. *Riccia fluitans* L. as *Ricciella fluitans* (Leg. et. Det. E.I. Nyarady et St. Rev. Tr. Ştefureac) BM000962755.

Hepaticae Suecicae A Museo Upsaliensi Distributae; VIII. 1880, *Riccia fluitans* (Smaland Par. O Torsas, Sunnansjo Det. C.J. Johansson, BM000962756.

Musci Suecici, Ex. Herb. H.W. Arnell, A Museo Botanico Upsaliensi Distributi (*Riccia fluitans* (Smaland 11. IX 1883, leg. H. Wilh Arnell, BM000962757.

Riccia stricta (Gottsche, Lindenb. & Nees) Perold, Bothalia 20: 197. 1990; Udar & Agarwal, J. Indian Bot. Soc. 64:248. 1985; Bapna & Kachroo, Hep. India, 2: 457. 2000. *Riccia fluitans* var. *stricta* Gottsche, Lindenb. & Nees, Synopsis Hepaticarum 4: 610. 1846. *Fysonia tenera* Kashyap, Liv. W. Him. Punjab Pl. 1: 97. 1929. *Riccia fluitans* auct. mult; Kashyap, Liv. W. Him. Punjab Pl. 1: 96. 1929; Bapna, Bryologist 64: 250. 1961; Bapna & Kachroo, J. Indian Bot. Soc. 54: 221. 1975 & Hepatic. India 2: 452. 2000; Singh & Nath, Hep. Khasi & Jaintia hills 343. 2007; Nair *et al.*, Bryophytes Wayanad W. Ghats 39. 2005 & Geophytology 36: 8. 2006; Manju & Rajesh, Acta Bot. Hungarica 51: 332. 2009; Manju *et al.*, Archive Bryology 42: 5. 2009, non L., 1753 emend K. Muell., 1907.

Thallus spongy, long, 15-20 x 0.2-0.5 mm broad, light greenish, scales absent, air spaces not clearly marked out in distinct air chambers; ventral scales slightly protruding ventrally at apex, other scales paired or single; *Ricciella* type, Monoecious, Sporogonia in 1 or 2 rows, situated anterior, ventrally conspicuously projected; spores brown, 50-76 μm diam., distal face reticulate with 2-4 large reticulations, triradiate mark thick and very prominent, 5 μm wide, in proximal face on each facet 6-10 areolae, some incomplete or subdivided by faint radiating ridges, winged, wings thick, 7.5 μm wide, single pore at marginal angles; distal face large, deep areolae across diameter, 17-20 μm wide, with central boss, walls thick.

Riccia stricta grows on damp soil or mud, mostly in association with other *Riccia* or *Anthoceros* spp. Occasionally it is seen as aquatic and floats in masses on still water. The land form of *R. stricta* sometimes forms bulbils at the apices of the thalli to survive drought conditions. *R. stricta* can generally be recognized by its mostly smooth dorsal surface through which the large air chambers are faintly to fairly clearly visible, by small ventral scales and by small spores with large, deep-walled alveoli containing a central boss on the distal face and, on the proximal face, a prominent triradiate mark.

Distribution: INDIA: Tamil Nadu (Kodaikanal), Kerala (Munnar, Silent Valley), Madhya Pradesh and Uttar Pradesh (Pachmarhi); all over tropical and So-

uth Africa (Wigginton & Grolle 1996). According to Schuster (1992: 469) the tropical American *Riccia stenophylla* Spruce is also synonymous with *Riccia stricta*, hence the species can be considered, as Pantropical.

Specimens examined from Kerala

Wayanad District, Sulthanbathery (920 m) *MCN 84369* (terr.), Kurichiad Range, Chikkanji (900 m) *MCN 84537a, 84538a* (terr.), Begur RF, Tholpetty Range, (830-880 m) *MCN 84570, 84589* (terr.), Muthanga Range, Keeradamkolli, (786m), *MCN 84511* (floating), Ambalavayal (900 m) *KPR 99869* (terr.); Kannur District, Aralam WLS, *Ambalappara* (1400 m), (Aqua.) *KPR 99809, MATTOOL* (sea level) *KPR 84560* (terr.). Idukki District, Chinnar WLS, Pudukkudi, Way to Olikkudy (760-1700 m) *MCN 87669, Saju 84637* (terr.), Palapatty(1420 m) *MCN 87348a*, Ollavayal (1775 m), *MCN 87380, MCN 99466* (terr.) (All specimens deposited in CALI); Idukki District, Neriamangalam (900 m) *Nikesh 2446*, Munnar, Kallar (1800 m) *Nikesh 2450* . (St. Alberts College, Ernakulam).

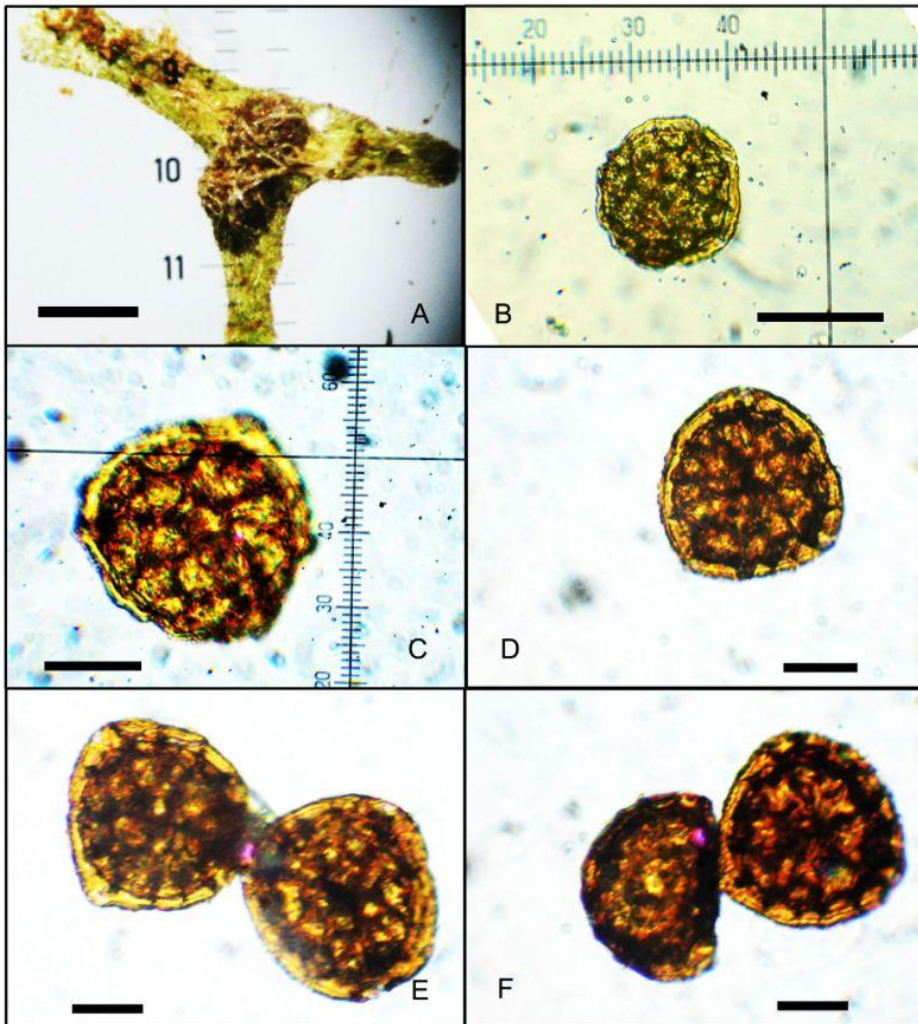


Fig.2. *Riccia stricta* specimens from Africa. A: Thallus with two sporangia, ventral view (scale bar 0.5 mm). B-F: Spori, different views (scale bar in B 50 μm , in the rest 25 μm). A-C: specimen from Tanzania, Rasmussen & W. Esbensen B 85. D-F: specimens from South Africa, F. Eyles 1405.

Other specimens examined

Madhya Pradesh, Pachmarhi, Mahadeo (1,000 m) damp rocks near caves, 17.12.1993, [V. Nath & Asthana, 205644] (NBRI)

Andra Pradesh, Hosely Hills (Chittoor District), [T. Pulliah, S. Sandhya Rani & K.S. Nagesh, 31611]. Tanzania: Kilimanjaro Mts. Mweka, on soil, at 100 m alt. Coll. K. Rasmussen & W. Esbensen B 85 (EGR ex C). South Africa: Port Stephenson Distr., Imberzana, on streambank, at 30 m alt. Coll. F. Eyles 1405 (EGR ex SRGH).

Rehmann, A.: Hepaticae Austro-Africanae, *Riccia fluitans* det, F. Stephani (*Riccia stricta* (Lindenb.) Perold. Det. S.M. Perold, 1990, BM000962749).

Like the other members of the *Riccia fluitans* complex, *Riccia stricta* is highly sensitive to the water availability and humidity. It shows great variation in its morphology, the thalli generally ranging from thicker and narrower in drier localities, to thinner and wider in wetter places.

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TABLE 1.-Comparison of some characters of *R. stricta* and *R. fluitans*
 Characters of *R. fluitans* based on Jovet-Ast (1986)

Characters	<i>Riccia stricta</i>	<i>Riccia fluitans</i>
Habitat	Aquatic and terrestrial	Aquatic and terrestrial
Branch length	15-20 mm	10-15 mm
Branch width	0.2-0.5 mm	0.8-2 mm
Branch thickness	0.25-0.35-0.5 mm	± 0.2 mm
Apex	Slightly narrower than rest of the Thallus, or bulbous, notched	Generally wider than rest of the thallus
Grove	Only visible in living plants	Not very distinct apically, otherwise absent
Walls of air chambers from above	Not clearly marked out in distinct air chambers	Distinctly areolate with walls of rather small air chambers clearly visible
Ventral scales	Slightly protruding ventrally at apex, other scales paired or single	Apical scale not protruding, 2 or 3 others mostly single
Stolons	Sometimes present	Not mentioned
Sexuality	Monoicous	Dioicous
Fertility	Quite often	Extremely rare
Sporangium orientation	Oblique	± horizontal
Spore diameter	(50-)62-70(-76) µm	(50-)56-75(-80) µm
Wing	Thick, 7.5 µm wide, single pore at marginal angles	Fairly distinct, thin, 4-5 µm wide; single pore at marginal angles
Triradiate mark	Thick and very prominent, 5µm wide	Fairly distinct, thin, 4-5 µm high
Proximal face	On each facet 6-10 areolae, some incomplete or subdivided by faint radiating ridges	Up to ±10, mostly incomplete areolae on each facet
Distal face	(4-)5-6(-12) large, deep, complete, often subdivided areolae across diameter, 17-20 µm wide, with central boss, walls thick.	5-7 incomplete areolae across diameter, 8-16(-20) µm wide, mostly empty, walls fairly thick.
Distribution	Common and widespread in tropical countries.	Except in tropical countries, widespread in temperate regions.

LEJEUNEACEAE (MARCHANTIOPHYTA) OF THE WESTERN GHATS, INDIA

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Keywords: Lejeuneaceae, India, Western Ghats, Distribution

Abstract: The present study reports 76 species of Lejeuneaceae present in the Western Ghats. Among these three species viz. *Archilejeunea abbreviata* (Mont.) Vanden Berghen, *Otolejeunea semperiana* (Gottsche et Steph.) Grolle and *Tuyamaella angulistipa* (Steph.) Schust. & Kachroo are new to India. One species viz., *Lejeunea cocoes* Mitt., is a new record for Southern India and three species viz., *Archilejeunea minutilobula* Udar & U.S.Awasthi, *Cololejeunea appressa* (A.Evans) Benedix and *Cololejeunea udarii* G. Asthana & S.C. Srivast. are new records for Kerala.

Introduction

The Western Ghats, also known as the Sahyadri Hills, are well known for their rich and unique assemblage of flora and fauna. Norman Myers included the Western Ghats amongst the 25 biodiversity hot-spots identified in the world. Geologically the Western Ghats may be divided into two segments. The hills north of the Krishna basin (largely Maharashtra and Gujarat) with fragile basaltic rocks are results of the same processes that gave rise to the Deccan trap. Isolated, conical, flat-topped hills occur here with steep sides, marked with striations. They seldom rise beyond 1500 m. South of the Krishna basin is the region of precambrian archaic crystalline hard rocks (nearly 2000 million years old granites, schists, gneisses, quartzites, etc). Soils vary from humus rich peat in the montane areas to laterite in the lower elevation and high rainfall belts. Soils are generally acidic.

Arising abruptly from the narrow Konkan and Malabar coasts, these hills run 1600 km north-south between the river Tapti in Gujarat and Kanyakumari in Tamil Nadu covering an area approximately equal to 160,000 sq km. In the east, they slope gently towards the Deccan Plateau. The northernmost segment that extends into Gujarat merges in the east with the Surat Dangs. In the Nilgiris, Palanis and parts of Karnataka, the Western Ghats extend considerably eastwards, locally merging with the Eastern Ghats. Towards the south, the hill chain is divided into two by the Palghat Gap (a mere 13 km gap at its narrowest) rendering a physically homogeneous high altitude plateau into two rather distinct biogeographic units viz., the Nilgiris complex in the north and the Anaimalai-Palnis complex in the south. Here are found the highest peaks viz., Anaimudi (Anaimalai Hills) and Doddabetta (Nilgiri Hills), reaching well over 2695 and 2637m ASL respectively. Apart from these, a number of peaks reaching heights of over 2000 m are present in the southern half as that in Tamilnadu (Palnis) and Kerala (eg. High Wavy Mountains and Grass Hills).

Climatic conditions in the Western Ghats vary with the altitude and physical proximity to the Arabian Sea and the equator. Although the Western Ghats experience a tropical climate - being warm and humid during most of the year with mean the temperature ranging from 20⁰C in the south to 24⁰C in the north, the higher elevations experience subtropical climates and on occasions frost. Further, it has been observed that the coldest periods in the southern Western Ghats coincide with the wettest.

Whereas rainfall peaks of 9000 mm and above per year, are known locally, annual rainfall as low as 1000 mm are frequent in the east bringing the average to around 2500 mm. Interestingly, the total amount of rainfall received and the spread are not often correlated. Areas in the northern Western Ghats (in the State of Maharashtra) receiving the highest rainfall (locally over 9000 mm) experience dry weather over more than half the year. On the contrary, areas receiving much less rainfall in Kerala and closer to the equator experience rain almost all through the year. Much of the rainfall is received during the southwest monsoon season. Peak period of rainfall is July-August.

List of the Lejeuneaceae species of the Western Ghats.

The taxa are arranged alphabetically. For each species representative specimens with the following data are included as far as possible; locality, habitat, altitude, collector, collection number and range of the species. We considered as new to the area those species which are not represented in Bapna & Kachroo 2000, Daniels 2010, Manju *et al.* 2008, 2009, Manju & Rajesh 2011 and Pócs *et al.* 2007. The photographs of some species is provided in Plate 1&2.

Archilejeunea abbreviata (Mitt.) Vanden Berghen, Rev. Bryol. Lichénol. 20: 117. 1951.

Representative specimen/s examined: Thiruvananthapuram, Agasthyamalai BR (1000-1300 m) On bark, Sreenivas 106638 (CALI).

Range: Widespread in tropical Africa (Wigginton 2009). New to India (Kerala).

Archilejeunea apiculifolia Steph., Species Hepaticarum 6: 558. 1924.

Representative specimen/s examined: Tamil Nadu, On the way to Avalanche (2439 m), R. Udar 73 S/A (LWU) [Udar and Awasthi 1981].

Range: India (Tamil Nadu, Kerala: var. *dentifolia* Awasthi and Srivastava, 1985)

Archilejeunea minutilobula Udar & U.S.Awasthi, Geophytology 11: 77. f. 18-38. 1981.

Representative specimen/s examined: Kerala, Kannur, Aralam WLS (60 m) On bark, MANJU 087589 (CALI); Tamil Nadu, Mettupalayam, ca 500 m., 28 Dec 1965, R. Udar & S.C. Srivastava 200/65.

Range: India (Maharashtra, Tamil Nadu, Kerala). Western Ghats endemic. The present collection is a new record for Kerala.

Caudalejeunea reniloba (Gott.) Steph., Species Hepaticarum 5: 16. 1912.

Representative specimen/s examined: Kerala, Kasaragod, Kammadam Kavu (150), Epiphytic, K.P. Rajesh, 80050/a (CALI).

Range: Widespread from India to the Pacific islands.

Cheilolejeunea birmensis (Steph.) Mizut., J. Hattori Bot. Lab. 27: 139. 1964.

Representative specimen/s examined: Kanyakumari Dist., W. Ghats, Muthukuzhivayal, ca 1250 m., 26 Jan 2001, Daniels 1433 p.p. (MH, SCCN) [Daniels 2003]

Range : India (Tamil Nadu, Kerala, Karnataka), Myanmar.

Cheilolejeunea ghatensis G.Asthana, S.C.Srivast. & A.K.Asthana, Lindbergia 20: 132. f. 4. 1995[1996].

Representative specimen/s examined: Kerala, Thiruvananthapuram, Ponmudi (1200 m) R.Udar & Party, 6412/82 (LWU).

Range: This Indian endemic species is distributed in Kerala only (Asthana *et al.* 1995).

Cheilolejeunea intertexta (Lindenb.) Steph., Bull. Herb. Boiss 5: 79. 1897.

Representative specimen/s examined: Kerala, Kasaragod, Kammadam Kavu (150), K.P.Rajesh, 80050/b; Wayanad, Chandanathode (950 m), Corticolous, MCN 80083b; MCN 06476 b CALI; Tamil Nadu, Kanyakumari Dist., W. Ghats, Klamalai, ca 450 m., 18 Oct 1999, Daniels 792 (MH, SCCN) [Daniels 2003].

Range: Distributed from Africa through tropical Asia to Tahiti.

Cheilolejeunea krakakammae (Lindenb.) R.M.Schust., Beih. Nova Hedwigia 9: 112. 1963.

Representative specimen/s examined: – Kerala, Wayanad, Mananthavady (900 m); On bark, *Manju 80132* (CALI); Kanyakumari Dist., W. Ghats, Klamalai, ca 450 m., 18 Oct 1999, *Daniels 792* (MH, SCCN) [Daniels 2003].

Range: Widespread in tropical Africa, Asia and Oceania (see full synonymy and distribution in Zhu, 2006).

Cheilolejeunea laeviuscula (Mitt.) Steph., *Species Hepaticarum* 5: 668. 1914.

Representative specimen/s examined: – Dodabetta, Ootacamund, 24 Aug 1991, *D.Sharma, R.Dixit & A.Srivastava 9982/91* [Asthana *et al.* 1995].– Tirunelveli Dist., W. Ghats, Mancholai, ca 1100 m., 24 Aug 2001, *Daniels 1779* (MH, SCCN) [Daniels 2003].

Range: Nepal, Bhutan: Hatisar, India: Sikkim Himalaya, West Bengal (Bapna & Kachroo 2000), Karnataka and Tamil Nadu. Endemic to Indian subcontinent.

Cheilolejeunea mariana (Gottsche) B.Thiers & Gradst., *Mem. New York Bot. Gard.* 52: 75. 1989.

Representative specimen/s examined: – Kotagiri, *Sedgwick*, 1916, 223, det. F. Verdoorn [Chopra 1938: 249, as *Archilejeunea mariana*].

Range: Widespread Indomalayan-Oceanian species distributed from Sri Lanka and India to the Society Islands. The tropical Asian distribution is to be clarified (Zhu and So 2001).

Cheilolejeunea serpentina (Mitt.) Mizut., *J. Hattori Bot. Lab.* 26: 171. 1963.

Representative specimen/s examined: India, Kerala, Pakshipadalam, Wayanad (1100 m), epiphytic, *K.P.Rajesh 99749*; Ponkuzhi, wayanad (880 m), On tree trunk, *Manju 84384a*; Wayanad, Mananthavady (750 m), On rocks and soil near stream; Palakkad, Parambikulam WLS (1150 m) On Bark, *Manju 106817, Manju 106213b* (CALI).

Range: In India this species is distributed in Eastern Himalaya, Kerala and Tamil Nadu; Sri Lanka (Asthana, Srivastava & Asthana 1995). Widespread in the palaeotropics from Africa throughout tropical Asia to the Caroline Islands.

Cheilolejeunea subopaca (Mitt.) Mizut., *J. Hattori Bot. Lab.* 26: 183. 1963.

Representative specimen/s examined: India, Kerala, Kozhikode, Vellarimala (1950 m) Epiphyllous on *Leptochilus* sp., *Satheesh 87209* (CALI).

Range: India (Kerala, Sikkim, Assam, West Bengal), Nepal, Bhutan. Endemic to the Indian subcontinent.

Cheilolejeunea trapezia (Nees) Kachroo & R.M.Schust., *J. Hattori Bot. Lab.* 24: 282. 1961.

Representative specimen/s examined: Tamil Nadu, Dodabetta, Ootacamund, 25 Sep 1983, *R. Udar & party*, 10 collections as *C. imbricata* (LWU),

- [Asthana *et al.* 1995]. – Kanyakumari Dist., W. Ghats, Muthukuzhivayal, ca 1250 m., 26 Jan 2001, *Daniels 1433* p.p. (MH, SCCN) [Daniels 2003].
Range: Widespread palaeotropical species distributed from Africa through tropical and subtropical Asia to Oceania.
- Cololejeunea appressa*** (A.Evans) Benedix, Feddes Repert. Spec. Nov. Regni Veg. Beih. 134: 31. 1953[1953].
Representative specimen/s examined: India, Kerala, Kozhikode, Kakkavayal Reserve Forest (100m) *Jitha, Manju & Rajesh 395, 396* (ZGC); Tamil Nadu, Nilgiris, W. Ghats, Avalanche, ca 2439 m., 2 Jan 1972, *R. Udar & party 117S/72* (LWU); Palnis, W. Ghats, Kodaikanal, ca 2153 m., *R. Udar & party 7257/83, 7266/83* (LWU).
Range: In India this species is distributed in Kerala, Karnataka, Meghalaya, Tamil Nadu, Andaman and West Bengal; the present collection is a new record for Kerala. A Pantropical species.
- Cololejeunea cardiocarpa*** (Mont.) A.Evans, Hedwigia 29: 91. 1890.
Representative specimen/s examined: Tamil Nadu, Palnis, W. Ghats, Kodaikanal, Periakulam, ca 2000m., 1 Oct 1983, *R. Udar & party 7250/83, 7262/83, 7264/83* (LWU).
Range: Widespread in South India (Asthana & Srivastava, 2003). Pantropical species.
- Cololejeunea ceratilobula*** (P.C.Chen) R.M.Schust., Beih. Nova Hedwigia 9: 179. 1963.
Representative specimen/s examined:– Tamil Nadu, Palnis, W. Ghats, Kodaikanal, Periakulam, ca 2000m., 1 Oct 1983, *R. Udar & party 7255/83, 7256/83, 7266/83* (LWU).
Range: Sri Lanka, India (Kerala), Vietnam, Japan, Indonesia, Malaysia and Borneo
- Cololejeunea foliicola*** Srivastava & Srivastava, Proc. Indian Acad. Sci., Pl. Sci. 99: 86. f. 21--49. 1989.
Representative specimen/s examined: India, Kerala, Kannur, Aralam WLS (750 m); Foliicolous on *Mallotus* sp., *Manju 99719* (CALI).
Range: Earlier this species was known only from Karnataka, the present report extends its distribution range to Kerala also. (Endemic to South India)
- Cololejeunea furcibulata*** (Berrie & E.W.Jones) R.M.Schust., Beih. Nova Hedwigia 9: 178. 1963.
Representative specimen/s examined: Kerala, Kannur, Aralam WLS (60 m), ramicolous; *K.P.Rajesh 80377/b, K.P.Rajesh 87579* (CALI); Kozhikode, Kakkavayal Reserve Forest (100 m) *Jitha, Manju & Rajesh 1058* (ZGC); Tamil Nadu, Kanyakumari Dist., W. Ghats, Mahendragiri, ca 450 m., 5 Aug 1995, *Daniels 2, 3* (SCCN), [Daniels 2001].

Range: Scattered over tropical Africa and India (Karnataka & Kerala [Asthana and Srivastava 2003]).

Cololejeunea hasskarliana (Lehm. & Lindenb.) Steph., Hedwigia 29: 72. 1890.

Representative specimen/s examined: Kerala, Aralam WLS, Ambalappara (1450 m); On the leaf of *Leptochilus*, *K.P. Rajesh 99844* (CALI).

Range: India (Kerala, Tamil Nadu, Karnataka), in Africa only Réunion and Seychelles, Widespread in tropical and subtropical Asia, Australia and Oceania.

Cololejeunea kashyapii Udar & Srivastava, Geophytology 15: 64. f. 1--22. 1985.

Representative specimen/s examined: India, Kerala, Kannur, Aralam WLS (400 m) *Manju & K.P. Rajesh 87629, 87630* (CALI).

Range: Earlier this species was known only from Karnataka, the present report extends its distribution range to Kerala also. (Endemic to South India). A species very near to *Cololejeunea triapiculata* (Herz.) Tixier known from Sri Lanka to Java, Malaysia and Fiji Islands.

Cololejeunea lanciloba Steph., Hedwigia 34: 250. 1895.

Representative specimen/s examined: Kerala, Kannur, Aralam WLS (40m); on leaf of *Mangifera indica* *Manju 99709*; Thiruvananthapuram, Agasthyamalai BR (1000 m) *Manju & K.P. Rajesh 106673* (CALI); Tamil Nadu, Kanyakumari Dist., W. Ghats, Muthukuzhivayal, ca 1250 m., 26 Jan 2001, *Daniels 1332* p.p. (MH, SCCN).

Range: In India: Kerala, Andaman & Nicobar Islands, Meghalaya, Eastern Hiamalayas and Mysore. A widespread Palaeotropic species distributed from tropical Africa and Asia, Australasia and Oceania.

Cololejeunea latilobula (Herzog) Tixier, Bryophyt. Biblioth. 27: 156. 1985.

Representative specimen/s examined: Kerala, Thrissur, Peechi (100 m), on leaves of *Mangifera indica*, *Manju 84647*; Kasaragod, Kammadam Kavu (100 m) epiphyte on *Myristica* sp. *K.P. Rajesh, 80052/a*; Tamil Nadu, Ootacamund, Coonoor Sims Park, ca 2000 m, *R.Udar & party 7218/83, 7220/83* (LWU); Palnis, Kodaikanal, Periakulam, ca 2000 m., 1 Oct, *R. Udar & party 7266/83* (LWU).

Range: Palaeotropic species distributed from Africa to China and Vietnam and Fiji Islands, widespread in India.

Cololejeunea longifolia (Mitt.) Benedix, Feddes Repert. Spec. Nov. Regni Veg. Beih.134: 15. 1953.

Representative specimen/s examined: Kerala, Aralam WLS, Ambalappara (1450 m) On bark, *K.P. Rajesh 99768* (08.10.2005) (CALI).

Range: India (Sikkim, Arunachal Pradesh, Kerala), Japan, Korea, Formosa, China, Malay Peninsula, Bangladesh, Thailand, Sri Lanka, Bhutan, New Caledonia, New Guinea and Fiji Islands.

Cololejeunea madothecoides (Steph.) Benedix, Feddes Repert. Spec. Nov. Regni Veg. Beih. 134: 81. 1953.

Representative specimen/s examined: Kerala, Kasaragod, Kammadam Kavu (150 m) Epiphyllous, *K.P. Rajesh 99768* (CALI); Kozhikode, Peruvannamuzhi, Pannikottoor Reserve Forest (50m), *Leena 864/per 15b, 866/Per5* (ZGC, CALI); Tamil Nadu, Palnis, W. Ghats, Kodaikanal, Periakulam, ca 2133 m., 1 Oct 1983, *R. Udar & party 7599/83* (LWU).

Range: India (Assam, Tamil Nadu, Kerala), from Indochina to Japan and Borneo.

Cololejeunea minutissima (Sm.) Schiffn., Hepat. (Engl.-Prantl 122. 1893.

Representative specimen/s examined: Neel-Gherries, *Perrottet s.n.* [Montagne 1842b: 14 as *Lejeunea minutissima*; Mitten 1861: 115; Ootacamund, Emerald, *R. Udar & party*, 26 Oct 1983, *R. Udar & party 7077/83, 7093/83* (LWU); Kodaikanal, Bear Shola, ca 2000m., 1 Oct 1983, *R. Udar & party 7669/83* (LWU); Kanyakumari Dist., W. Ghats, Muthukuzhivayal, ca 1250 m., 26 Jan 2001, *Daniels 1332* (SCCN); Tirunelveli dist., W. Ghats, Agasthyamalai, Vanathirtham ca. 300 m, 28 Apr. 2002. *Daniels 2200, 2201* (SCCN).

Range: India (Tamil Nadu; Neelgiri hills, Kodaikanal, Tirunelveli, Agasthyamalai). Pantropical and oceanic temperate.

Cololejeunea mizutaniana Udar & Srivastava, Misc. Bryol. Lichenol. 9: 138. f. 1. 1983.

Representative specimen/s examined: India, Kerala, Kannur, Aralam WLS (400 m) *Manju & K.P. Rajesh 87632b* (CALI).

Range: Earlier this species was known only from Karnataka, the present report extends its distribution range to Kerala also. (Endemic to South India)

Cololejeunea nilgiriensis Asthana & Srivastava, Bryophyt. Biblioth. 60: 27. 2003.

Representative specimen/s examined: India, Kerala, 099762; – Avalanche, Nilgiri hills, *R. Udar et al. 75S/72* (holotype), (LWU). Endemic to the Nilgiri Hills.

Range: Earlier this species was known only from Tamil Nadu, the present report extends its distribution range to Kerala too.

Cololejeunea planissima (Mitt.) Abeyw., Ceylon J. Sci., Biol. Sci. 2: 73. 1959.

Representative specimen/s examined: Kerala, Kozhikode, Kakkavayal Reserve Forest (100m) On bark, *Jitha, Manju & Rajesh 390, 397* (ZGC); CU Campus, (40 m) on small branches, *Manju 106385* (CALI); Tamil Nadu, Palnis, W. Ghats, Kodaikanal, ca 2133 m., 1 Oct 1983, *R. Udar & party 7709/83* (LWU)

Range: In India this species is distributed in Kerala, Tamil Nadu, Eastern Himalayas and Meghalaya. A palaeotropic species distributed from East

Africa through tropical and subtropical Asia to Australasia and Micronesia.

Cololejeunea pseudofloccosa (Horik.) Benedix, Feddes Repert. Spec. Nov. Regni Veg. Beih. 134: 36. 1953.

Representative specimen/s examined: India, Tamil Nadu, Avalanche, ca 2439 m., 2 Jan 1972, R. Udar & party 88S/72, 117S/72, 120S/72 (LWU).

Range: Distributed from Sri Lanka and India through tropical and subtropical Asia to Australia.

Cololejeunea raduiloba Steph., Hedwigia 34: 251. 1895.

Representative specimen/s examined: Kerala, Wayanad, Chembra hills (1720 m) Epiphyllous on *Trichomanes proliferum*, Manju 99681; Kannur, Aralam WLS, (60 m); Epiphyllous on *Trichomanes indicum*, K.P. Rajesh 80398 (CALI).

Range: India (Assam, Kerala), Nepal. From the East African islands through China, Japan, Vietnam, Taiwan, to Australia, New Caledonia and Fiji Islands (Pócs *et al.* 2011).

Cololejeunea spinosa (Horik.) S.Hatt., J. Indian Bot., 22: 166. 1942.

Representative specimen/s examined: Kanyakumari Dist., W. Ghats, Muthukuzhivayal, ca 1250 m., 26 Jan 2001, Daniels 1333, 1336, 1338 (MH, SCCN) [Daniels 2003].

Range: India (Eastern Himalayas, West Bengal, Arunachal Pradesh), Japan, China, Korea, Nepal, Philippines.

Cololejeunea udarii G. Asthana & S.C. Srivast., Bryophytorum Bibliotheca 60: 40. 2003.

Representative specimen/s examined: Kerala, Kozhikode, Kakkavayal Reserve Forest (100m), On fronds of *Angiopteris indica*, Jitha, Manju & Rajesh 389, 400 (ZGC); Tamil Nadu, Ootacamund (Dodabetta peak), Nilgiri hills, R. Udar *et al.* 6863/83 (holotype), 6892/83, 6900/83, 6908/83, 6923/83, 6965/83 (LWU) [Asthana *et al.* 1995].

Range: This Indian endemic species is distributed in Kerala, Karnataka, Tamil Nadu, Arunachal Pradesh and Assam. The present collection is a new record for Kerala.

Drepanolejeunea angustifolia (Mitt.) Grolle, J. Jap. Bot. 40: 206. 1965.

Representative specimen/s examined:— Kerala, Idukki, Eravikulam NP, Amarshole (2000 m), epiphytic; Manju 80241/b (CALI); Dodabetta, alto. 2670 m., 5 Jan 1972, R. Udar 132/72 (LWU) [Udar & Awasthi 1982b].

Range: India (Kerala, Tamil Nadu), Bhutan, Thailand, Cambodia, Vietnam, China and Japan, Indonesia, New Guinea, Philippines, New Caledonia .

Drepanolejeunea sikkimensis (Udar & U.S.Awasthi) Grolle, J. Hattori Bot. Lab., 55: 503. 1984.

Representative specimen/s examined:— Tamil Nadu, Kanyakumari Dist., W. Ghats, Upper Kodaiyar, ca 1250 m., 9 Nov 2000, Daniels 1246 p.p.

Range: Endemic to India: Sikkim, Tamil Nadu.

Drepanolejeunea ternatensis (Gottsche) Steph., *Hedwigia* 29: 73. 1890.

Representative specimen/s examined:– Tamil Nadu, Nilgiri Hills, on the way to Avalanche, 2439 m., 2 Jan 1972, R. Udar 57S/72, 68S/72, 86S/72 (LWU);

Range: India (Tamil Nadu). Widespread Palaeotropic species from East Africa through tropical Asia to Australia, New Guinea and Samoa.

Frullanoides tristis (Steph.) van Slageren, *Meded. Bot. Mus. Herb. Rijks Univ. Utrecht* 544: 110. 1985.

Representative specimen/s examined–Ernakulam, *Thattekkad Bird Sanctuary* (100m), *Nikesh, 101* (CALI) – Nilgiri Mountains, *Strachy s.n.* (NY, U) [Van Slageren 1985].

Range: India (Kerala, Tamil Nadu, Meghalaya [Singh & Asthana 2005]). Pantropical species distributed from tropical America through Africa to India and Nepal.

Lejeunea cavifolia (Ehrh.) Lindb., *Acta Soc. Sci. Fenn.*, 10: 43. 1871.

Representative specimen/s examined: Kotagiri, *Sedgwick*, 1916, 226; Kodaikanal, *Foreau*, 1934, 2163 [Chopra 1938: 250].

Range: India (Uttar Pradesh, Sikkim Himalaya, Assam-Shillong, Tamil Nadu), Nepal, China, Siberia, Caucasus, Europe and United States.

Lejeunea cocoes Mitt., *J. Proc. Linn. Soc. Bot.* 5: 114. 1861.

Representative specimen/s examined: India, Kerala, Kozhikode, Malabar Wildlife Sanctuary, Peruvannamuzhi (400 m), *Leena 723/L 10c* (ZGC, CALI); Kakkavayal Reserve Forest (100m), On bark and on small branches *Jitha, Manju & Rajesh 1069b, 1071b* (ZGC).

Range: India (Eastern Himalayas: Khasi hills, Cherrapunji), Diego Garcia, Chagos, Sri Lanka, China incl. Taiwan, Java, Sarawak and Fiji Islands (Pócs *et al.* 2011). New to Southern India.

Lejeunea discreta Lindenb., *Syn. Hepat.* 361.1845.

Representative specimen/s examined: Kerala, Idukki, Eravikulam NP, Amarshole (2050 m), epiphytic; *Manju & Saju 80232*; Wayanad, Ponkuzhi (880 m) *Manju 84383* (CALI); Kodaikanal, 1909, *G. André s.n.*, syntype of *L. stahlia* (G-14272) [Mizutani 1971: 448].

Range: Indomalaysian species extending from India to Australia, New Guinea and Fiji Islands.

Lejeunea eifrigii Mizut., *J. Hattori Bot. Lab.* 33: 244. 1970.

Representative specimen/s examined: Thiruvananthapuram, Athirumala, (1200 m), on base of trees, *Sequera 80320/4* (CALI).

Range: In India it is reported only from Kerala (Pócs *et al.* 2007). Indomalaysian species, previously known from Malaysia to Papua New Guinea and to New Caledonia.

Lejeunea exilis (Reinw. *et al.*) Grolle, *J. Hattori Bot. Lab.* 46: 353. 1979.

Representative specimen/s examined: India, Kerala, Wayanad district, Chembra hills (1770 m) *Manju* 99679 (CALI, EGR); Idukki, Eravikulam National Park (2250 m) *Manju* 80243c (CALI, EGR).

Range: India (Kerala). Indomalayan-Oceanian species distributed from Réunion through Asia and Australia to the Fiji Islands and to Samoa (Pócs *et al.* 2011).

Lejeunea flava (Sw.) Nees, Naturgesch. Eur. Leberm. 3: 277. 1838.

Representative specimen/s examined: Kerala, Kannur, Aralam WLS (1100 m) *K.P.Rajesh* 99845/b; Wayanad, Sulthan Batheri (933 m) Epiphytic, *Manju* 84364 (CALI).

Range: Widespread Pantropical species.

Lejeunea helenae (Pears.) Pearson, Forh. Vidensk.-Selsk. Krist. 1886(3): 6. 1886.

Representative specimen/s examined: Kerala, Wayanad, Kalpetta (450 m) on logs, *Manju* 99665b (CALI).

Range: The known distribution of *L. helenae* is from Uganda and Malawi in Africa. Nair *et al.* (2005) recorded this species as new for India.

Lejeunea lowriana Steph., Sp. Hepat. 5: 779. 1915.

Representative specimen/s examined: Tamil Nadu, Kotagiri, *Sedgwick*, 1916, 224 [Chopra 1938: 250].

Range: Endemic to South India.

Lejeunea neelgherriana Gottsche, Syn. Hepat. 354. 1845.

Representative specimen/s examined:— Kerala, Idukki, Eravikulam NP, Amarshola (2050 m) Epiphytic, *Manju* & *Saju* 80241 (CALI); Neel-Gherries (in montibus Nilgiriensibus), *Perrottet s.n.*, (holo)type (?G) [Montagne 1842b, as *Lejeunea inflexa*?; Mitten 1861: 115, as *Lejeunea nilgiriana*]. *Lejeunea olivacea* (Steph.) Steph. [non (Hook.f. & Taylor) Gottsche *et al.*] = *Lejeunea subolivacea* Mizut. [Mizutani 1965]

Range: Sri Lanka, India (Tamil Nadu, Kerala, Sikkim), Nepal, Bhutan and China, Japan and Korea (Zhu & So 2001).

Lejeunea obfusca Mitt., J. Proc. Linn. Soc. London 5: 114. 1861.

Representative specimen/s examined: Kerala, Thiruvananthapuram, Agasthyamalai BR (1300 m) *SVK* 106620/c, 106636 (CALI)

Range: India (North-east India, Kerala, Tamil Nadu, Karnataka), Nepal and Sri Lanka. Very close to and maybe synonymous with *Lejeunea eifrigii* Mizut., which is distributed in China, Malaysia, Papua New Guinea and in the Philippines (Mizutani 1970, Zhu and So 2001).

Lejeunea pallide-virens S.Hatt., J. Hattori Bot. Lab. 12: 80. 1954.

Representative specimen/s examined: Kerala, Kasaragod, Kammadam Kavu (100 m) Epiphytic, *K.P.Rajesh* 80055; Wayanad, Ponkuzhi (880 m) Epiphytic, *Manju* 84383 (CALI).

Range: Distributed in India (Kerala), China and Japan.

Lejeunea perrottetii Steph., Hedwigia 29: xvii, 5. 1889.

Representative specimen/s examined: Nilgiri hills, *Perrottet s.n.* (G), holotype [Stephani 1917: 785].

Range: Endemic to South India.

Lejeunea phyllobola Nees & Mont., Hist. Phys. Cuba, Bot., Pl. Cell., 9: 471. 1842.

Representative specimen/s examined: Tamil Nadu, Avalanche, 2 Jan 1972, R. Udar & S.C. Srivastava 805/72 (LWU) [Srivastava & Agarwal 1986, as *Rectolejeunea brittoniae*].

Range: A Pantropical species, widespread in tropical America and Africa, in Asia only in India: Eastern Himalaya and Tamil Nadu.

Lejeunea princeps (Steph.) Mizut., J. Hattori Bot. Lab. 34: 454. 1971.

Representative specimen/s examined: Kerala, Kozhikode, Kakkayam (800 m) on small branches, *Manju 120134* (CALI).

Range: Endemic to the Indian subcontinent: India (West Bengal, Assam, Sikkim, Kerala) and Nepal.

Lejeunea stevensiana (Steph.) Mizut., J. Hattori Bot. Lab. 34: 452. 1971.

Representative specimen/s examined: Kerala, Kozhikode, Kakkayam (850m) on rocks, *Manju 120125* (CALI).

Range: India (Sikkim, Himalayas, Khasi hills, Kerala), China, Bhutan and Nepal.

Lejeunea subacuta Mitt., J. Proc. Linn. Soc. Bot. 5: 113. 1861

Representative specimen/s examined: Kerala, Kozhikode, Kakkayam (770 m) *Manju 120137*; Thrissur, Athirappalli (700 m); Follicolous on *Liparis viridiflora*, *Manju 106203* (CALI).

Range: China, India (Sikkim, Kerala), Nepal, Sri Lanka.

Lejeunea tuberculosa Steph., Sp. Hepat. 5: 790. 1915.

Representative specimen/s examined: Kerala, Wayanad, Mananthavady (700 m) *Manju 80113b*. (CALI); Tamil Nadu, Kanyakumari Dist., W. Ghats, Upper Kodaiyar, ca 1250 m., 19 Apr 2002, *Daniels 2003* p.p. (MH, SCCN) [Daniels 2003].

Range: India (Sikkim, Kerala, Tamil Nadu), China, Bhutan, Nepal, Java, Philippines and Africa.

Leptolejeunea balansae Steph., Hedwigia 35: 105. 1896.

Representative specimen/s examined: Kerala, Kasaragod, Kammadam Kavay (100 m) Epiphyllous, *KP. Rajesh 80052 b* (CALI); Kanyakumari Dist., W. Ghats, Upper Kodaiyar, ca 1250 m., 9 Nov 2001, *Daniels 1802* (MH, SCCN) [Daniels and Daniel 2004].

Range: Widespread in Andaman Islands, Malaysia, Indonesia, China to Vietnam and India (Kerala).

Leptolejeunea elliptica (Lehm. & Lindenb.) Schiffn., Hepat. (Engl.-Prantl., 126. 1893.

Syn.: *Leptolejeunea subacuta* Steph. ex A. Evans, Proc. Wash. Acad. Arts Sci. 8: 149 (1906).

Representative specimen/s examined: Kodaikanal, 17 Dec 1971, *K.P. Singh 323/71* (LWU) [Awasthi 1986: 123]. – Kanyakumari Dist., W. Ghats, Upper Kodaiyar, ca 1250 m., 19 Apr 2002, *Daniels 1609,1611* (SCCN) [Daniels 2003]. Kerala, Aralam WLS, Ambalappara (1450 m); On bark, *K.P.Rajesh 99877*, *K.P. Rajesh 099885*; Palakkad, Parambikulam WLS (1150 m) On Bark, *Manju 106817*, *Manju 10620*; Kozhikode, Kakkayam (100 m) On bark, *Manju 120170* (CALI).

Range: Pantropical.

Leptolejeunea foliicola Steph. Hedwigia 106. 1896.

Representative specimen/s examined: Kerala, Kozhikode, Kakkavayal (100 m) Foliicolous, Jitha, *Manju & Rajesh 393* (ZGC).

Range: In India it is distributed in Kerala and Tamil Nadu. Also distributed in Japan, Java and Philippines.

Leptolejeunea maculata (Mitt.) Schiffn., Consp. Hepat. Arch. Ind., 275. 1898.

Representative specimen/s examined: Kanyakumari Dist., W. Ghats, Upper Kodaiyar, ca 1250 m., 26 Jan 2001, *Daniels 1331, 1335, 1336, 1337* (MH, SCCN) [Daniels 2003].

Range: Widespread Pantropical species.

Leucolejeunea xanthocarpa (Lehm. & Lindenb.) A.Evans, Torreyia 7: 229. 1907.

Representative specimen/s examined:– Kodaikanal, Dec 1970–Jan 1971, *K.P. Singh 5362/70* (LWU) [Udar & Nath 1971: 638; Udar & Awasthi 1983]. – Kodaikanal, Dec 1970–Jan 1971, *K.P. Singh s.n.* [Udar & Nath 1976]. – Kanyakumari Dist., W. Ghats, Muthukuzhivayal, ca 1250 m., 26 Jan 2001, *Daniels 1394* (SCCN) [Daniels 2003].

Range: Widespread.

Lopholejeunea nigricans (Lindenb.) Schiffn., Consp. Hepat. Arch. Ind. 293. 1898.

Representative specimen/s examined: Kerala, Kannur, Aralam WLS (180 m), on small branches, *Manju 87541*; Palakkad, Parambikulam WLS, (1400 m) Epiphytic, *Manju 10671*, *Manju 106819* (CALI).

Range: A widespread pantropical species distributed in Southern India (Kerala, Tamil Nadu), North-east India (Himalayas, Assam), Japan, China, Papua New Guinea, Brazil, Bolivia, Kenya and Africa.

Lopholejeunea subfusca (Nees) Steph., Hedwigia 29: 16. 1890.

Representative specimen/s examined: Kerala, Wayanad, Begur RF (845 m) *Manju 84596*; Kozhikode, Kakkayam (100 m) On bark, *Manju 120161* (CALI).

Range: A widely distributed species.

Mastigolejeunea auriculata (Wilson & Hook.) Schiffn., Hepat. (Engl.-Prantl) 129. 1893.

Representative specimen/s examined: Kerala, Kozhikode, Guruvayurappan College Campus (70 m) On bark and branches of *Plumeria alba*, *Savitha 111606* (ZGC, CALI); Tamil Nadu, Kanyakumari Dist., W. Ghats, Edaicode, ca 50 m., 9–10 June 2002, *G. Shilu 167A, 175* (SCCN); Tirunelveli Dist. Chengaltheri, ca 650 m., Aug 1995, *Daniels 5* (SCCN) [Daniels 2003].

Range: A widely distributed pan tropical species.

Mastigolejeunea auriculata (Wilson & Hook.) Schiffn. var. *ciliata* (U.S.Awasthi & Udar)

A.E.D.Daniels & P.Daniel, Bull. Bot. Sur. India 49: 231. 2007.

Representative specimen/s examined:– Kanyakumari Dist., W. Ghats, Klamalai, ca 450 m., 18 Nov 1999, *Daniels 792* (SCCN) [Daniels 2003; Daniels & Daniel 2007a].

Range: Widespread.

Mastigolejeunea humilis (Gott.) Schiffn., in Engl. & Prantl, Nat. Pfl.-fam.1,3: 129. 1895.

Representative specimen/s examined: Kerala, Kakkayam (750 m) On bark *Manju 120110* (CALI).

Range: A widely distributed species India (Kerala, Meghalaya), Nepal, Japan, Java, Formosa and Ryukyu.

Mastigolejeunea indica Steph., Sp. Hepat. 4: 776. 1912.

Representative specimen/s examined: Kerala, Thrissur, Peechi (100 m), on bark, *Manju 80145* (CALI).

Range: A species known from Kerala, Andaman & Nicobar Islands and Thailand through Southern China to the Philippines and Australia.

Mastigolejeunea ligulata (Lehm. & Lindenb.) Schiffn., Consp. Hepat. Arch. Ind. 299. 1898.

Representative specimen/s examined: Kerala, Kasaragod, Kammadam Kavu (150 m), Epiphytic, *K.P.Rajesh, 80050/c* (CALI).

Range: Widespread in the Indo Pacific region, from India to New Guinea and to Australia.

Mastigolejeunea repleta (Taylor) A.Evans, Mem. Torrey Bot. Club, 8: 131. 1902.

Representative specimen/s examined: Madras, *Dr Wight*, (Hook. Herb. ?holotype of *Lejeunea repleta*) (G-1924, isotype) [Taylor 1846: 392; Mitten 1861: 110, as *Lejeunea repleta*; Verdoorn 1934: 109; Kitagawa 1973: 268]. – Perumalmalai, *Foreau 128* (NY) [Mizutani 1986: 285].

Range: China, Thailand, Malaysia, New Guinea, India (Arunachal Pradesh, Assam, Tamil Nadu)

Microlejeunea punctiformis (Taylor) Steph. Hedwigia 29:90. 1890.

- (Syn.: *Lejeunea punctiformis* Taylor, London J. Bot. 5 : 398. 1846).
Representative specimen/s examined: Kerala, Kozhikode, Kakkayam (850 m) on rocks, *Manju 120164*; Idukki, Eravikulam NP (2100 m) On bark, *Manju & Saju 80373/b* (CALI)
Range: Sri Lanka, India, Nepal, Bhutan, China incl. Taiwan, Thailand and Vietnam (Zhu and So 2001).
- Microlejeunea ulicina*** (Taylor) Steph., Hedwigia 29: 88. 1890.
Representative specimen/s examined: Tamil Nadu, Palni Hills, *Foreau*, 1934, 2123 [Chopra 1938: 250].– Kanyakumari Dist., W. Ghats, Klamalai, ca 1250 m., 26 Jan 2001, *Daniels 1332, 1433*.
Range: Northern temperate species distributed in Eurasia and North America.
- Otolejeunea semperiana*** (Gottsche *et* Steph.) Grolle, Haussknechtia 2: 53. 1985.
Representative specimen/s examined: India, Kerala, Kannur, Aralam WLS (400 m) *Manju & K.P. Rajesh 87633/a* (CALI).
Range: New record for India. Indomalayan species known from southern China, Indonesia, Malaysia, the Philippines and from Papua New Guinea.
- Ptychanthus striatus*** (Lehm. & Lindenb.) Nees, Naturgesch. Eur. Leberm., 3: 212. 1838.
Representative specimen/s examined: Idukki, Eravikulam NP, Erumapetty mala (2350 m) Epiphytic, *Manju 80211, 80217* (CALI).
Range: Widespread in the whole Indopacific region.
- Schiffneriolejeunea polycarpa*** (Nees) Gradst., J. Hattori Bot. Lab. 38: 335. 1974.
Representative specimen/s examined: Kerala, Parambikulam (1450 m) Palakkad, Epiphytic, *Manju 106717* (CALI); Neel-Gherries, *Perrottet s.n.* [Montagne 1842b: 15, as *Lejeunea polycarpa*]. – Nilgiri Hills, Naduvattam, ca 1982 m., 3 Jan 1972, *R. Udar et al 125S/72* (LWU) [Udar & Awasthi 1982c]. – Tirunelveli Dist., W. Ghats, Naalumukku, ca 130 m., 8 Nov 2000, *Daniels 1081*; Mancholai, ca 1100 m., 24 Aug 2001, *Daniels 1774C* (SCCN) [Daniels 2003].
Range: In India: Tamil Nadu, Kerala. A Pantropical species distributed from tropical America through Africa to Sri Lanka and southern India.
- Schiffneriolejeunea pulopenangensis*** (Gottsche) Gradst., J. Hattori Bot. Lab. 38: 335. 1974.
Representative specimen/s examined: – Kerala, Kozhikode, Guruvayurappan College Campus (60 m) On bark of *Polyalthia longifolia*, *Savitha 111626* (ZGC, CALI); Tamil Nadu, Kotagiri, *Sedgwick*, 1916, 233-237 [Chopra 1938: 249, as *Ptychocoleus pulopenangensis*]. – Tirunelveli Dist., W. Ghats, Mancholai, ca 1100 m., 24 Aug 2001, *Daniels 1775* (SCCN) [Daniels 2003, as *S. indica*].

Range: India (Kerala, Tamil Nadu, Karnataka), Sri Lanka, Malaysia, North Borneo, Moluccas and Japan.

Spruceanthus polymorphus (Sande Lac.) Verd., Ann. Bryol., Suppl. 4: 155. 1934.

Representative specimen/s examined: Kerala, Idukki, Eravikulam NP (2250 m) Epiphytic on *Ilex wightianum*, Manju 80216 (CALI).

Range: A species with wide Indopacific distribution from Sri Lanka to the Solomon Islands.

Spruceanthus semirepandus (Nees) Verd., Ann. Bryol. Suppl. 4: 153. 1934.

Representative specimen/s examined: Kerala, Thiruvananthapuram, Agasthyamalai BR (1450 m) Manju & K.P.Rajesh 106658 (CALI); Wayanad, Chembra (1770 m), Manju 120260 (CALI).

Range: It is distributed in South India (Kerala, Karnataka, Tamil Nadu), Northeast India (Western Himalaya, Sikkim, Meghalaya, Darjeeling), Sri Lanka, Japan, China, Java, Borneo, Philippines and Taiwan.

Trocholejeunea sandvicensis (Gottsche) Mizut., Misc. Bryol. Lichenol. 2: 169. 1962.

Representative specimen/s examined: Perumalmalai, Palni Hill, Foreau, 1924, 1932 [Verdoorn 1934: 56, as *Brachiolejeunea sandvicensis*]. – Kodaikanal, Foreau, 1934, 2158; Perumalamalai, Foreau, 1934, 2159 [Chopra 1938: 249]. – Madras, Kodaikanal, Georges Poreau s.n. [Mizutani 1989: 277]. *Tylimanthus indicus* Steph. = *Plagiochila ghatiensis* Steph. [Inoue 1975]

Range: Widely distributed in India, Pakistan, Bhutan, China, Vietnam, Japan, Korea, Malaysia.

Tuyamaella angulistipa (Steph.) Schust. & Kachroo, J. Linn. Soc., Bot., 56: 508. 1961.

Representative specimen/s examined: India, Kerala, Kannur, Aralam WLS (400 m) Manju & K.P.Rajesh 87633 b (CALI).

Range: New to India. Known from Malaysia (Pahang, Sabah), Vietnam and Java.

Discussion

The forests of the Western Ghats support unique assemblages of biodiversity. The distribution of the Lejeuneaceae members is also unique in many respects, especially in supporting many endemics. Out of the 76 members studied in this paper, nine are Western Ghats endemics (Fig. 1). Five species are endemic to Indian subcontinent which include Nepal and Bhutan. One species, *Lejeunea obfusca* is confined to India and Sri Lanka. *Cheilolejeunea birmensis* is known to occur in India and Myanmar. Twelve species are Indo Malesian in distribution.

The present work also adds one more African element, ie., *Archilejeunea abbreviata*, to India with other two, viz., *Cololejeunea furcilibulata* and *Lejeunea helenae*, totaling the number to three. The occurrence of *Microlejeunea ulicina*, the Northern temperate species distributed in Eurasia and North America is another notable feature of phytogeographical significance.

Seventeen paleotropical species occur in this region. Three species of Pacific-Oceania region are also present in the Western Ghats. Twenty six members of Lejeuneaceae of the Western Ghats, are Pantropical and enjoys widespread occurrence in areas, such as India-Sri Lanka to Pacific Islands through Africa.

In India most of the members were earlier known from the Himalayan area. The recent explorations resulted in recording many of them from the Western Ghats. The occurrence of Indo-Malesian elements, is represented by thirteen species, including the two species, *Otolejeunea semperiana* and *Tuyamaella angulistipa* added during the present study.

Fig. 1. Distribution pattern of Lejeuneaceae of the Western Ghats

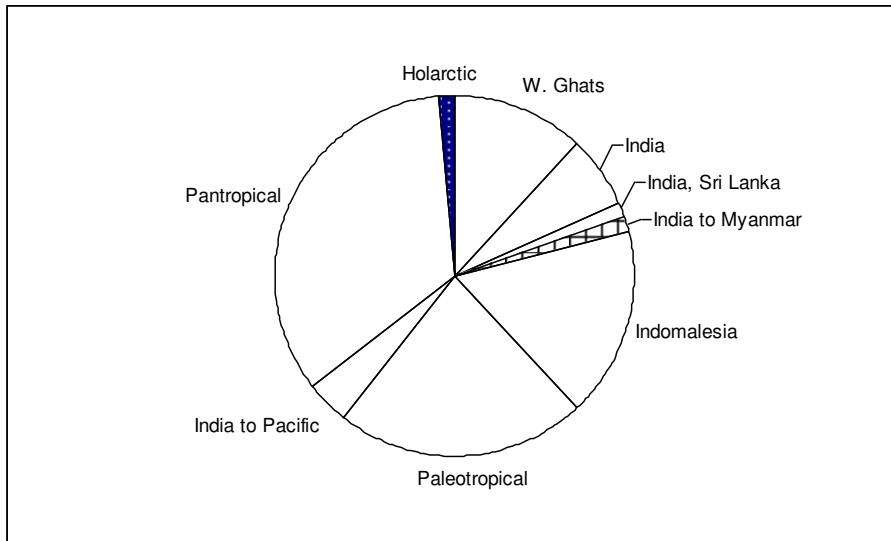




Plate 1

Plate 1: A: *Cheilolejeunea giraldiana*. B: *Cheilolejeunea serpentina*. C: *Cololejeunea hasskarliana*. D: *Cololejeunea foliicola*. E: *Cololejeunea madothecoides*. F: *Cololejeunea lanciloba*. G: *Cololejeunea latilobula*. H: *Cololejeunea nilgiriensis*.

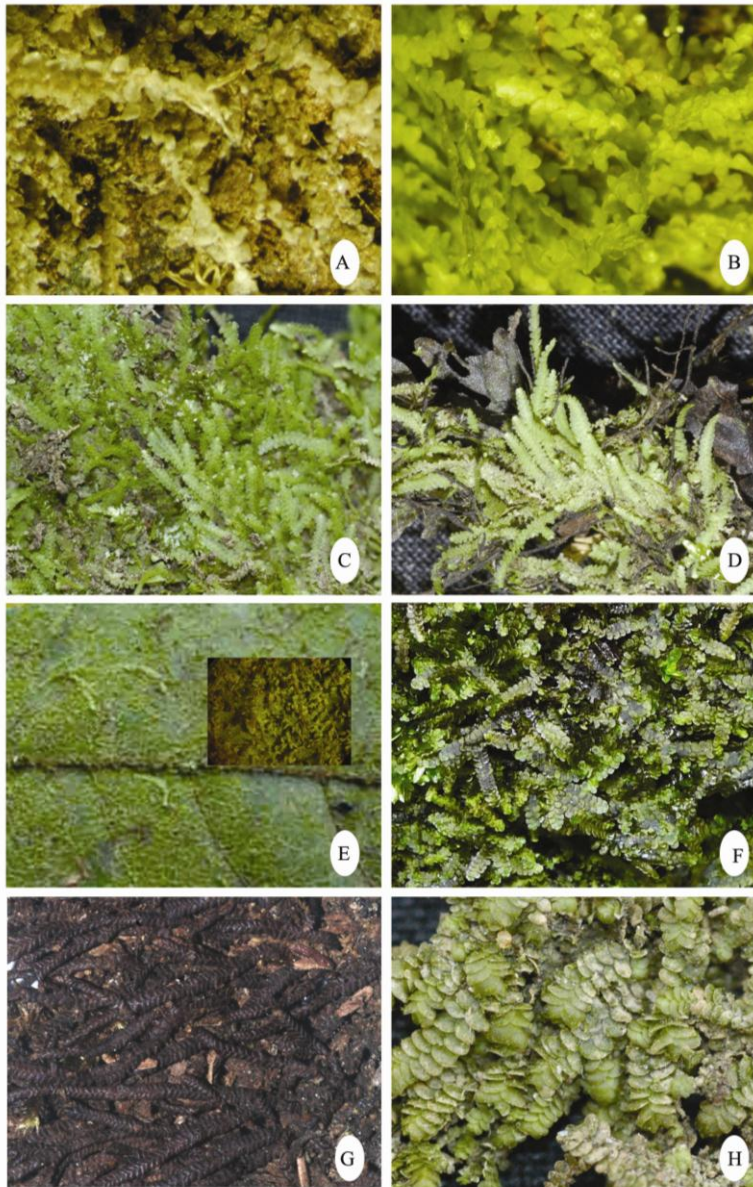


Plate 2

Plate 2: A.: *Lejeunea helenae*. B: *Lejeunea stevensian.*, C: *Lejeunea tuberculosa*. D: *Lejeunea flava.*, E: *Leptolejeunea subacuta*. F: *Lopholejeunea sikkimensis*. G: *Schiffneriolejeunea polycarpa*. H: *Schiffneriolejeunea pulopenangensis*.

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