

Data to the Malaysian liverwort flora, II

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Abstract – A total of 96 epiphyllous liverwort species and 2 infraspecific taxa were collected, of which 18 are new to Malaysia, one is new to the Asian mainland and one variety is new to science: *Cololejeunea magnilobula* var. *falcidentata*. New synonymy of *Cololejeunea stylosa* and *Cololejeunea papulosa* is established. Illustrations for *Cololejeunea magnilobula* var. *falcidentata* and several taxa new to Malaysia are provided.

Indomalaya / Malaysia / liverwort / Lejeuneaceae

INTRODUCTION

Malaysian liverworts have been collected since the twentieth century. Chuah-Petiot (2011) published the first checklist of the liverworts of Malaysia including the Eastern Malaysian states Sabah and Sarawak, and reported 718 species and 40 infraspecific taxa in 122 genera and 38 families. Subsequent research (Lee *et al.*, 2011; Lee, 2013; Lee & Gradstein, 2013; Lee *et al.*, 2013; Pócs *et al.*, 2014) has added 12 species and 1 variety to the Malaysian liverwort flora. In this paper, we report 233 epiphyllous liverwort specimens belonging to 96 species and 2 infraspecific taxa, 16 representing new records for the Malaysian bryoflora and 6 new records for Peninsular Malaysia. Moreover, we are able to confirm one species as new to the Asian mainland and describe one variety as new to science. With these additions, there are currently 747 species and 42 infraspecific taxa of liverworts known to occur in Malaysia.

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MATERIALS AND METHODS

A total of 233 epiphyllous liverwort specimens were collected and identified during fieldwork in Peninsular Malaysia from October to November 2013. Specimen localities are shown in Fig. 1 and listed in the Appendix. All specimens were collected by G.E. Lee, S. & T. Pócs, and D. Tang and are deposited in the Herbarium of the University Kebangsaan Malaysia (UKMB), with a set of duplicates located in the Herbarium of Eger College (EGR, Hungary).

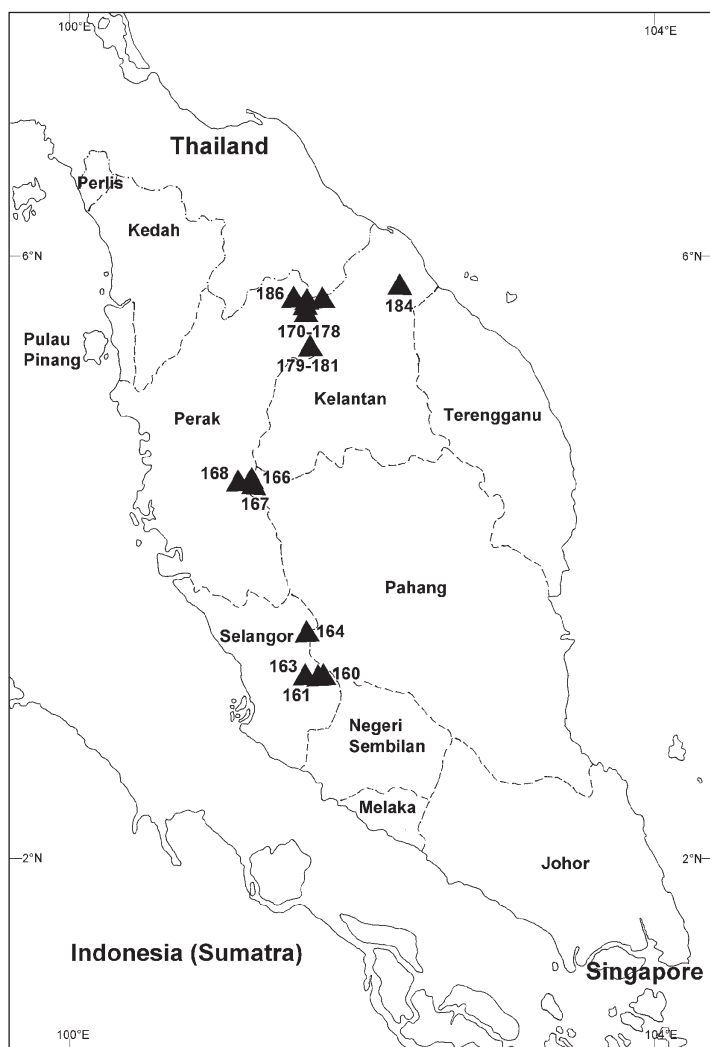


Fig. 1. Map of the localities of epiphyllous collections. On the map only the last three digits of locality numbers are indicated.

RESULTS AND DISCUSSION

Description of the new variety *Cololejeunea magnilobula* var. *falcidentata*

Cololejeunea magnilobula (Horik.) S.Hatt., *Bull. Tokyo Sci. Mus.* 11: 99, 1944.

Basionym: *Physocolea magnilobula* Horik., *J. Sci. Hiroshima Univ. Ser. B, Div. 2, Bot.* 2, 2: 288, 1934 \equiv *Leptocolea magnilobula* (Horik.) P.C.Chen & P.C.Wu, *Acta Phytotax. Sin.* 9(3): 260, 1964. **Type:** Taiwan, Taihoku (Mururaofu), Mt. Taihei, on leaves, *S. Iwamasa 3454* (holotype: HIRO 11488).

var. *falcidentata* Pócs & G.E.Lee. var. nov.**Figs 2-8**

This variety differs from *Cololejeunea magnilobula* var. *magnilobula* by its elongated, falcate first lobule tooth and by the enlarged cells at the leaf base.

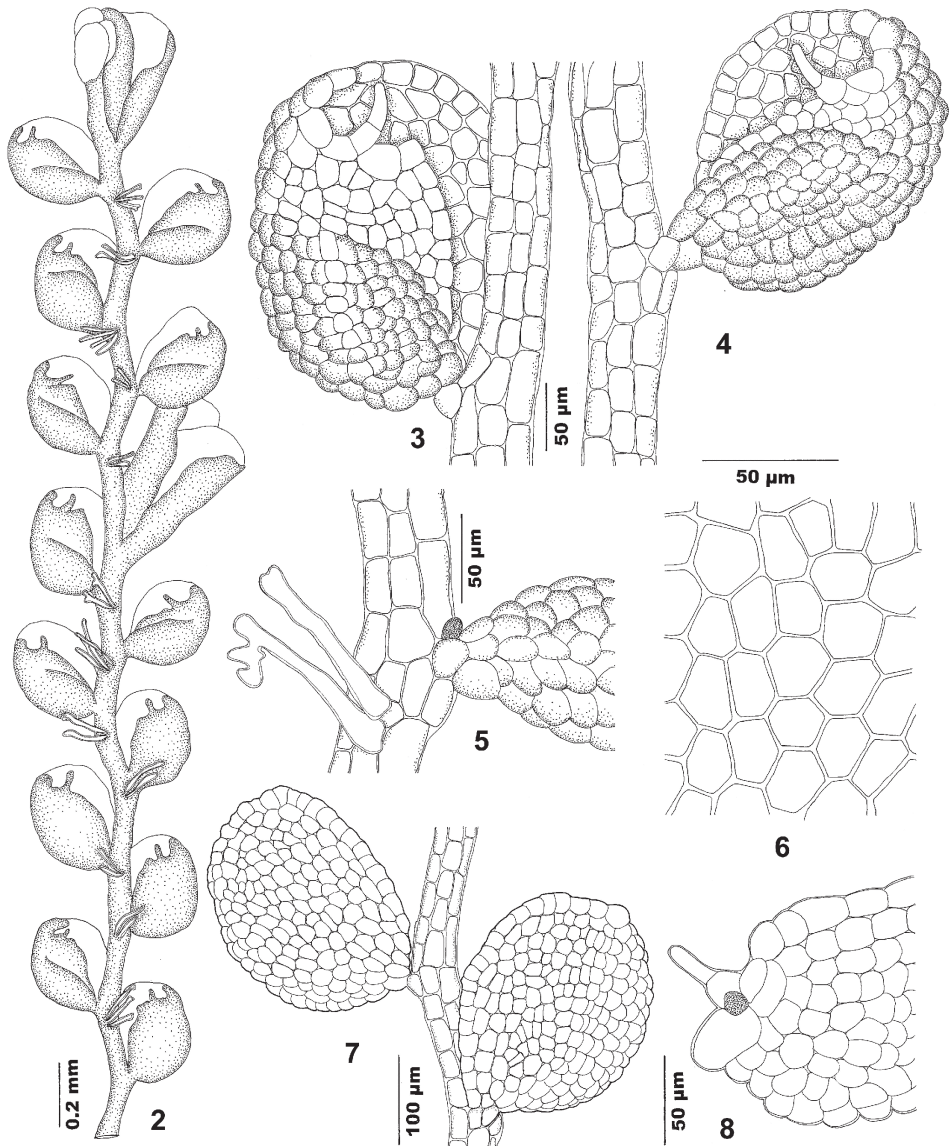
Type: Malaysia, Kelantan State, above the KUNCI AIR SUNGAI LONG dam, at the high part of the ridge, 840-880 m alt., 05°36.467'N, 101°43.314'E. Epiphyllous in submontane rainforest. *S. & T. Pócs, G.E. Lee and D. Tang, 13177/Q*, 6. Nov. 2013 (holotype: UKMB).

Minuscule, pale green epiphyllous plant without branching. *Shoot* 300-400 μm wide and up to 3 mm long. *Stem* diameter 40-50 μm , with one ventral merophyte. *Leaves* distant, 200-250 \times 180-240 μm ; directed forward, 30-45° angle to the stem; subsphaeric with rounded, hooded or involute apex formed by the lobe and lobule; margin entire, apex broadly rounded. Lobe cells isodiametrical to hexagonal, 15-25 μm , trigones indistinct, thin walls without intermediate thickenings, cuticle smooth. Lobule cells somewhat smaller, their outer walls mammillose protuberant. Ocelli absent. *Lobules* semicircular, almost as long as the lobe, forming with it a cucullate, rounded apex. Lower half of lobule inflated, the lobule margin cell below the teeth usually enlarged, free margin incurved at the base, keel curved; the first tooth linear, straight or falcate, almost reaches the lobe margin (never so in var. *magnilobula*), consists of two cells; the second tooth triangular or obsolete; hyaline papilla small, on the ventral base of first tooth; stylus hyaline, unicellular. *Underleaves* absent; rhizoids hyaline, sparsely developed near the base of each leaf, without rhizoid disc. On the plantlet at hand only two young female perichaetia can be seen with 300-500 μm long, elongately ovate bracts and lanceolate lobules.

Etymology: The variety epithet refers to the falcately elongated first lobule tooth.

Distribution: *Cololejeunea magnilobula* was previously considered a Chinese endemic and known only from Taiwan and in mainland China from Zhejiang and Guizhou (Zhu & So, 2001), hence this species is **new to Malaysia**. The new variety seems to be endemic for Malaysia.

Discussion: A striking property of this plant is the subsphaeric leaf, which is not unique among Lejeuneaceae. We can find similar leaf organization for example in *Cololejeunea subsphaeridea* (R.M.Schust.) Pócs and *Microlejeunea strasbergii* J.Bardat & C.Ah-Peng. It is probably the result of homoplasy, an adaptation for better water retention among epiphyllous conditions. The globose leaf shape provides the largest water capacity compared to other leaf surfaces. *Cololejeunea magnilobula* is closely related to *C. minutissima* (Zhu & So, 2001). The latter was transferred into the genus *Myriocoleopsis* Schiffn., as *Myriocoleopsis minutissima* (Sm.) R.L.Zhu, Y.Yu & Pócs (Yu *et al.*, 2014). Therefore *C. magnilobula*, together with a group of species related to *C. minutissima*, likely also belongs to *Myriocoleopsis* (Pócs *et al.*, 2014), but this assumption should be validated by molecular methods.



Figs 2-8. *Cololejeunea magnilobula* var. *falcidentata* Pócs & G.E.Lee. 2. Part of plant in ventral view; 3,4. Leaves; 5. Stem portion and the base of leaf lobule (stylus shown in gray); 6. Median cells of leaf lobe; 7. Part of plant in dorsal view; 8. Upper part of the leaf lobule when flattened (hyaline papilla shown in gray). All figures drawn from the holotype, S. & T. Pócs, G.E. Lee and D. Tang, 13177/Q (UKMB).

Synonymization of *Cololejeunea stylosa* and *C. papulosa*

Cololejeunea stylosa (Steph.) A.Evans, *Trans. Connecticut Acad. Arts* 10: 454, 1900
 ≡ *Lejeunea stylosa* Steph., *Hedwigia* 27: 289, 1888 “*Cololejeunea*” ≡ *Physocolea stylosa* (Steph.) Steph., *Sp. Hepat.* 5: 906, 1916. Type: Philippines, Luzon, *Micholitz* 28, 1886 (holotype: G-1958).

= *Leptocolea liukiensis* Horik., *Bot. Mag. (Tokyo)* 46: 179, 1932 ≡ *Cololejeunea liukiensis* (Horik.) Mizut., *J. Hattori Bot. Lab.* 24: 282, 1961.

= *Cololejeunea bokorensis* Tixier, *Bryophyt. Biblioth.* 18: 64, 1979.

= ***Cololejeunea papulosa*** Tixier, *Ann. Fac. Sci. Phnom Penh* 1: 58-60, 1968. Type: Cambodia, Koh Cong, Kirirom, Phnom Prom, forêt dense, *Tixier* 2502, 18 Apr. 1967 (? holotype: PC 0103370), *syn. nov.*

See further synonyms in Zhu & So (2001: 271).

Tixier (1968) already recognized the close relationship of *Cololejeunea papulosa* to *Cololejeunea stylosa*. Zhu and So (2001) also suggested their conspecificity. Tixier (1968, 1985) used the papillosity of the lobe cells for the distinction of his species from the widespread *C. stylosa*. This character is very variable and occurs in different degrees in almost all specimens of *C. stylosa* we examined, including those from Kelantan state (13177/S and 13179/P). Apart from this, all characters are identical in the specimens described under these names. Therefore we consider *C. papulosa* to be a synonym of *C. stylosa*.

Species list***Cheilolejeunea* (Steph.) Schiffn.**

Cheilolejeunea nipponica (S.Hatt.) S.Hatt., 1361/P.

Distribution: New to **Malaysia**. S-China: Hainan, Guizhou, Hong Kong; Japan: Honshu, Kyushu, Ryukyu (Mizutani, 1982; Zhu & So, 2002). A Southeast-Asian species (Fig. 21).

Cheilolejeunea streimannii Pócs et Ninh, 13168/AB & AJ.

Distribution: New to **Malaysia**. Previously known from Australia: Queensland, Vietnam, Thailand, and Sri Lanka (Pócs & Podani, 2015). It is distinguished from *Cheilolejeunea trapezia* (Nees) R.M.Schust. & Kachroo by the numerous, often flagelliform, caducous branches serving vegetative propagation, which are rare in the genus, only known in *Cheilolejeunea intertexta* (Lindenb.) Steph. according to Mizutani (1982). Another distinguishing character is the straight or often reflexed, arcuate lobule keel. The species is probably more common in tropical Asia but has been overlooked (Pócs & Ninh, 2005).

***Cololejeunea* (Spruce) Schiffn.**

Cololejeunea amphibola B.M.Thiers, 13161/K, 13163/T, 13166/DL, 13175/AJ p.p.

Fig. 15

Distribution: New to **Peninsular Malaysia**. Known from Borneo (Sarawak), Sulawesi, New Guinea, Australia, and Fiji (Eggers *et al.*, 1998; Pócs & Piippo, 1999; Pócs *et al.*, 2011) (Fig. 22). A relatively rare species easily recognizable by its very large, inflated lobule often exceeding half of the length of the lobe.

Cololejeunea bidentula (Steph.) E.W.Jones, 13160/AD **Figs 9-10**

Distribution: New to **ASIA**. Previously known only from tropical Africa: Ethiopia, Uganda, Kenya, Tanzania, Madagascar, Réunion, and Mauritius (Wigginton, 2009). A species well characterised by its leaf shape, lobule extending almost to half of the length of the lobe with a strongly arched keel, truncate apex, prominent, bicellular first tooth and obsolete or obtuse second tooth (Jones, 1954).

Cololejeunea ceatocarpa (Ångstr.) Steph., 13166/DK, 13167/BB, 13175/X. **Figs 11-12**

Distribution: New to **Malaysia**. Hitherto known from Réunion, Bangladesh, Vietnam, New Caledonia, Fiji, Tonga, Samoa, and the Hawaii Islands (Pócs & Ninh, 2012).

Cololejeunea diaphana A.Evans, 13172/K, 13175/AD.

Distribution: New to **Peninsular Malaysia**. Previously known under the name of *Aphanolejeunea proboscoidea* (K.I.Goebel) R.M.Schust. from Sarawak in Malaysia (Eggers *et al.*, 1998). Widespread pantropical species (Pócs *et al.*, 2011), in Asia better known under the name of *Aphanolejeunea truncatifolia* Horik. (Pócs & Bernecker, 2009).

Cololejeunea latilobula (Herzog) Tixier, 13179/V.

Distribution: New to **Malaysia**. Pantropical species, common in Africa and Indomalaysia, rare in the Neotropics.

Cololejeunea ocellata (Horik.) Benedix, 13166/DX.

Distribution: New to **Malaysia**. Known from Bhutan, China, Japan, Thailand, and Vietnam (Zhu & So, 2001). A typical Southeast-Asian species (Fig. 1).

Cololejeunea pacifica Pócs, 13186/AD (only on microslide in EGR)

Distribution: New to **Malaysia**. Known only from Tonga, Fiji, and Thailand. This species is closely related to the almost pantropical *Cololejeunea cardiocarpa* (Mont.) A.Evans, occurring in Southeast Asia and in the Pacific (Chantanaorrapint & Pócs, 2014).

Cololejeunea papillosa (K.I.Goebel) Mizut., 13168/AZ. **Fig. 13**

Distribution: New to **Peninsular Malaysia**. Widespread pantropical species. It was known in Asia as *Aphanolejeunea borneensis* (Herzog) Pócs. Distinguishing characters are the urn shaped lobules almost as long as the obtusely rounded and papillose lobe.

Cololejeunea pseudostephanii Tixier, 13168/AG.

Distribution: New to **Malaysia**. Hitherto known only from the Lang Bian Mountains and Bidoup-Nui Bá National Park in southern Vietnam (Tixier, 1969; Pócs *et al.*, 2013). The occurrence of a subhyaline margin with short, elongate cells in one row and the striking, long vitta are characteristics of the species.

Cololejeunea smitinandii Tixier, 13172/N.

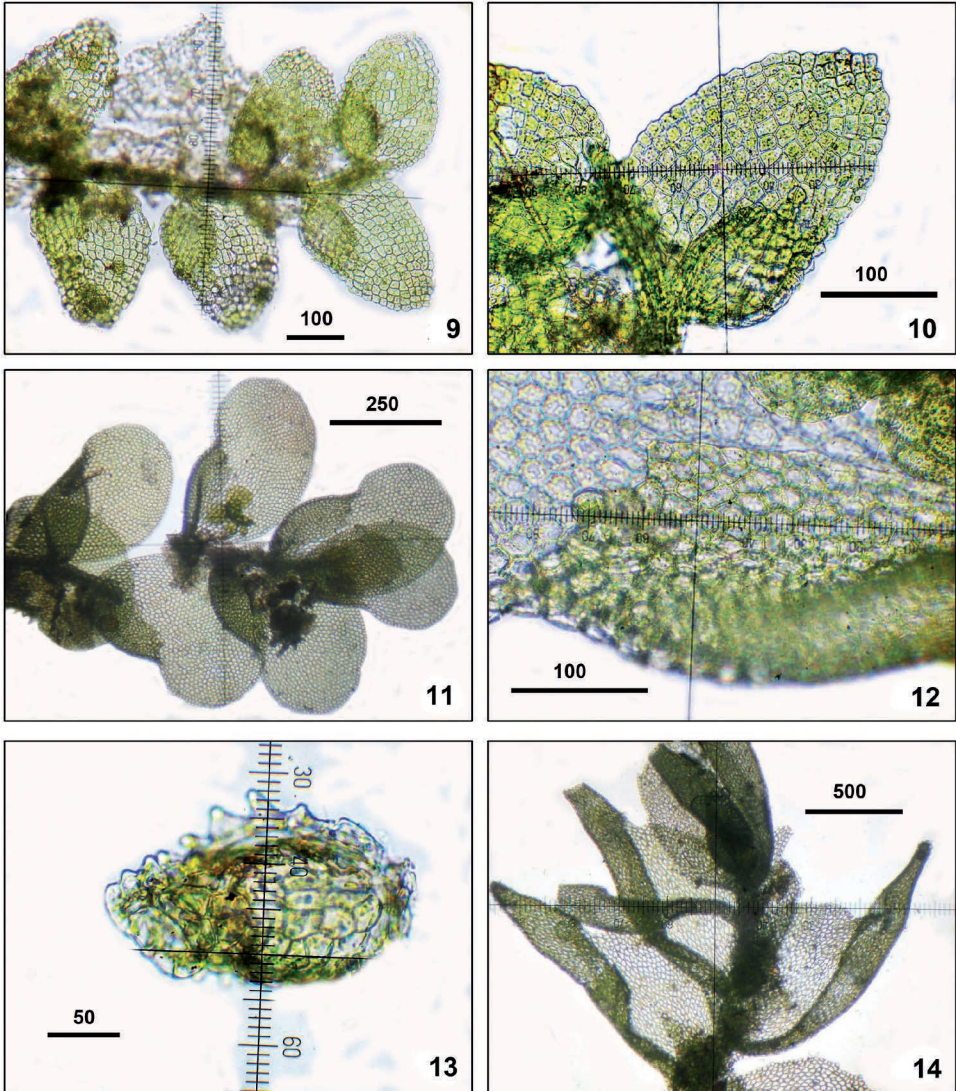
Distribution: New to **Malaysia**. Known only from its type locality in Thailand: Pitsanulok (Tixier, 1985; Lai *et al.*, 2008). A species similar to *Cololejeunea lanciloba* Steph. but differing in its lobule base adnate to the inner lobe surface.

Cololejeunea spathulifolia (Steph.) H.A.Miller, 13175/AJ. **Figs 15-16**

Distribution: New to **Malaysia**. Previously known only from Solomon Islands (a poorly defined species, see comment in Pócs & Piippo, 2011).

Cololejeunea veillonii Tixier, 13166/DR.

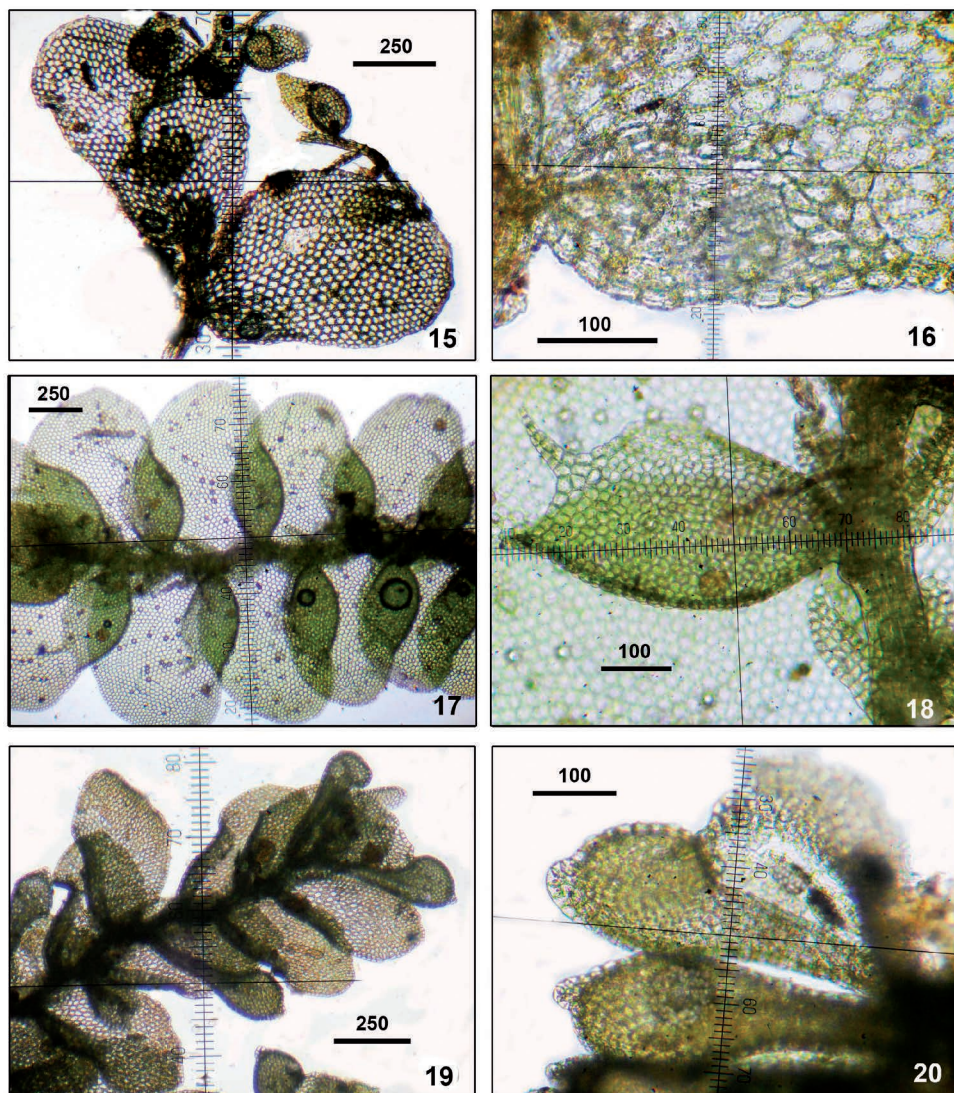
Distribution: New to **Malaysia**. Known from the Philippines: Mindanao; New Guinea and New Caledonia (Pócs & Piippo, 1999). The character of this species is its fenestrate lobe apex. A Malaysian-Pacific species (Fig. 22).

Colura (Dumort.) Dumort.*Colura brevistyla* Herzog, 13175/AF.**Fig. 14***Distribution:* New to **Malaysia**. Known from Sri Lanka, Thailand, Philippines, Mariana, and Fiji Islands (Chantanaorrapint & Pócs, 2014).

Figs 9-14. **9-10.** *Cololejeunea bidentula* (Steph.) E.W.Jones, from S. & T. Pócs, G.E. Lee and D. Tang, 13177/Q (UKMB). **9.** Shoot, ventral view. **10.** Leaf, ventral view. **11-12.** *Cololejeunea ceatocarpa* (Ångstr.) Steph., from S. & T. Pócs, G.E. Lee and D. Tang, 13166/DK (UKMB). **11.** Shoot, ventral view. **12.** Lobule, ventral view. **13.** *Cololejeunea papillosa* (K.I.Goebel) Mizut., from S. & T. Pócs, G.E. Lee and D. Tang, 1368/AZ (EGR), lobulate leaf, ventral view. **14.** *Colura brevistyla* Herzog, from S. & T. Pócs, G.E. Lee and D. Tang, 13175/AF (UKMB). (Scale bars indicated in μm).

***Colura mosenii* Steph., 1316/AW, 13183/C.**

Distribution: New to **Malaysia**. Previously known only from Java (Jovet-Ast, 1954) and from Caroline Islands (Inoue & Miller, 1965), but likely is a more widespread and overlooked Malaysian-Pacific species. It is closely related to the Neotropical *Colura cylindrica* Herzog (Jovet-Ast, 1954) and maybe be conspecific with this species.



Figs 15-20. **15-16.** *Cololejeunea spathulifolia* (Steph.) H.A.Miller, from S. & T. Pócs, G.E. Lee and D. Tang, 13175/AJ (UKMB). **15.** Fragment of shoot, with intermixed small specimens of *Cololejeunea amphibola* B.M.Thiers. **16.** Lobule, ventral view. **17-18.** *Diplasiolejeunea rudolphiana* Steph., from S. & T. Pócs, G.E. Lee and D. Tang, 13171/K (UKMB). **17.** Shoot, ventral view. **18.** Lobule, ventral view. **19-20.** *Colura speciosa* Ast, from S. & T. Pócs, G.E. Lee and D. Tang, 13181/F (UKMB). **19.** Shoot, ventral view. **20.** Leaves, ventral view. (Scale bars indicated in µm).

Colura speciosa Ast, 13181/F.

Figs 19-20

Distribution: New to **Malaysia**. Hitherto known only from E Borneo (Samarinda District, Jovet-Ast, 1954). A rare species distinguished by its entire lobes and its lobule sac rounded or apiculate or ended in a small entire crest.

***Diplasiolejeunea* (Spruce) Schiffn.**

Diplasiolejeunea rudolphiana Steph., 13171/K.

Figs 17-18

Distribution: New to **Malaysia**. While widespread in the Neotropics, rare in Africa, where it is known only from Mauritius (Tixier & Guého, 1997) and Madagascar (Dong *et al.*, 2012; Pócs & Váňa, 2015), and occurring in Asia in Cambodia, Vietnam, Sri Lanka, and China: Hainan (Zhu & So, 2001; Schäfer-Verwimp, 2006).

***Drepanolejeunea* (Spruce) Schiffn.**

Drepanolejeunea brunnea Mizut., 13166/EC.

Distribution: New to **Peninsular Malaysia**. It is known only from its type from Malaysia: Sabah, E foot of Mt. Kinabalu (Mizutani, 1970). The larger size, brownish color and open V shaped, large underleaves with acute apex distinguishes it from the common *Drepanolejeunea vesiculosa* (Mitt.) Steph. As the specimen was sterile, the flattened perianth was not visible.

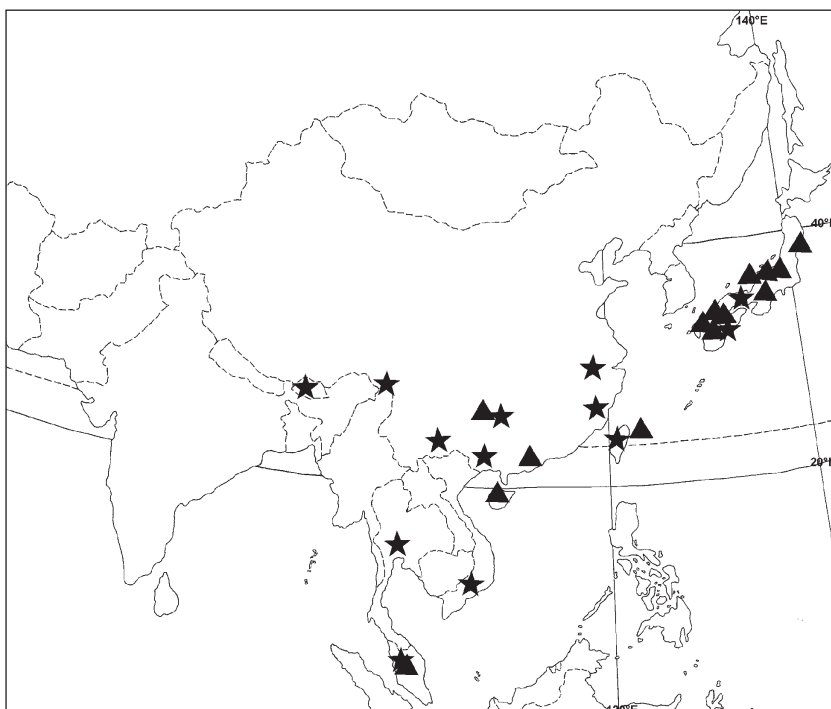


Fig. 21. Distribution of Southeast-Asian species. Triangle: *Cheilolejeunea nipponica* (S.Hatt.) S.Hatt. Asterisk: *Cololejeunea ocellata* (Horik.) Benedix.

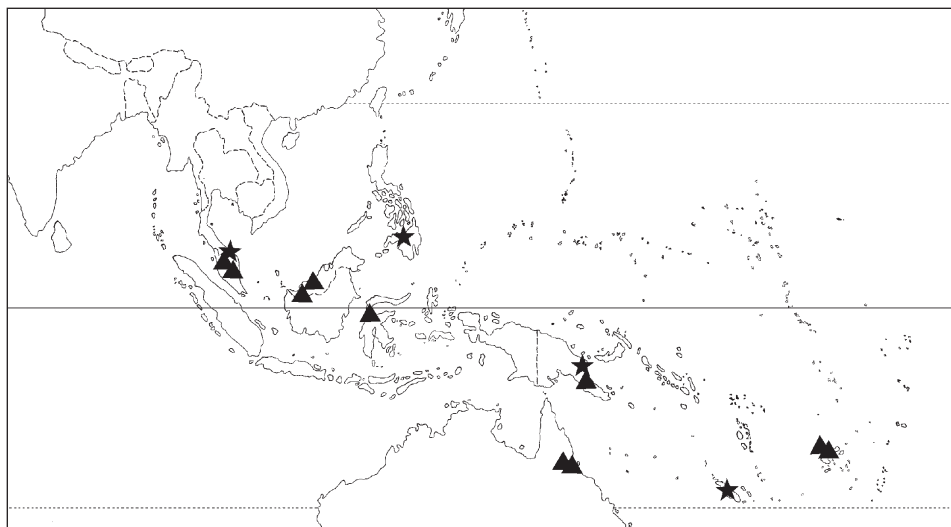


Fig. 22. Distribution of Malaysian-Pacific species. Triangle: *Cololejeunea amphibola* B.M.Thiers. Asterisk: *Cololejeunea veillonii* Tixier.

Drepanolejeunea fissicornua Steph., 13161/Y, 13166/DB, 13167/AS, 13168/AT, 13175/N.

Distribution: New to **Peninsular Malaysia**. Known from Java, Sumatra, and in Malaysia from Sabah, Mt. Kinabalu (Mizutani, 1990). Perianth with five equal, fimbriate wings and roughly serrulate-dentate leaf lobes are distinguishing characters of the species.

Lejeunea Lib.

Lejeunea gradsteinii G.E.Lee *et al.*, 13166/DF.

Distribution: New to **Peninsular Malaysia**. It was conspicuous with its whitish, translucent leaves on darkened, dead fern leaves. The strongly inflated bases and flat free margins of lobules are striking features. Previously known only from Sabah, Mt. Kinabalu (Lee *et al.*, 2011; Lee, 2013).

Leptolejeunea (Spruce) Schiffn.

Leptolejeunea apiculata (Horik.) S.Hatt., 13166/AZ.

Distribution: New to **Malaysia**. Southeast Asian species occurring in China: Xizang, Yunnan, Hainan, Taiwan; Laos, Vietnam, Thailand, and Japan: Ryukyu (Zhu & So, 2001; Pócs, 2012; Pócs *et al.*, 2013).

Microlejeunea Steph.

Microlejeunea filicuspis (Steph.) Heinrichs *et al.*, 13183/K.

Distribution: New to **Peninsular Malaysia**. Previously known under the name of *Harpalejeunea filicuspis* (Steph.) Mizut. from Sabah in Malaysia. Widespread from

the East African islands through Indonesia to New Guinea, Australia, New Zealand, Fiji Islands, and Samoa (Mizutani, 1973; Miller *et al.*, 1983; Wigginton, 2009; Pócs *et al.*, 2011).

Microlejeunea punctiformis (Taylor) Steph., 13175/R.

Distribution: New to **Malaysia**. One of the smallest epiphyllous species in Malaysia. Widespread Indo-Malaysian element distributed from Sri Lanka and India to China, Japan, and Australia (Zhu & So, 2001 as *Lejeunea punctiformis*; Dey & Singh, 2012).

DISCUSSION

The above list shows a very diverse composition of the liverwort flora of Malaysia. Among the species new to Malaysia are a few endemics, for instance *Cololejeunea magnilobula* var. *falcidentata*, *Drepanolejeunea brunnea*, and *Lejeunea gradsteinii*. The species *C. pseudostephanii* and *C. smitinandii* can be considered Indochinese subendemics. The Indo-Malaysian, Malaysian, and Malaysian-Pacific floristic elements seem to dominate as demonstrated by the presence of *Cololejeunea amphibola*, *C. ceatocarpa*, *C. gottschei*, *C. pacifica*, *C. spathulifolia*, *C. veillonii*, *Colura brevistyla*, *C. mosenii*, *C. speciosa*, and *Drepanolejeunea fissicornua*. Southeast Asian species are *Cheilejeunea nipponica*, *Cololejeunea ocellata*, and *Leptolejeunea apiculata*. *Cololejeunea bidentula* and *Microlejeunea filicuspis* are of Palaeotropical distribution while there are a few pantropical elements such as *Cololejeunea diaphana*, *C. latilobula*, *C. papillosa*, and *Diplasiolejeunea rudolphiana*. The large proportion of taxa new to the bryoflora of Malaysia (18 of 98 species or infraspecific taxa) indicates that there are still poorly collected areas in the country worthy of investigation.

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REFERENCES

- CHANTANAORRAPINT S. & PÓCS T., 2014 — Southern Thailand bryophytes I, with description of *Cololejeunea ramronensis*. In: Telnov D. (ed.): *Biodiversity, biogeography and nature conservation in Wallacea and New Guinea*. Riga, the Entomological Society of Latvia. Vol. 2: 113-122.
- CHUAH-PETIOT M.S., 2011 — A checklist of Hepaticae and Anthocerotae of Malaysia. *Polish botanical journal* 56(1): 1-41.
- DEY M. & SINGH D.K., 2012 — *Epiphyllous liverworts of Eastern Himalaya*. Kolkata, Botanical Survey of India.

- DONG S., SCHÄFER-VERWIMP A., MEINECKE P., FELDBERG K., BOMBOSCH A., PÓCS T., SCHMIDT A.R., REITNER J., SCHNEIDER H. & HEINRICHS J., 2012 — Tramps, narrow endemics and morphologically cryptic species in the epiphyllous liverwort *Diplasiolejeunea*. *Molecular phylogenetics and evolution* 65: 582-594.
- EGGERS J., FRAHM J.P. & PURSELL R.A., 1998 — New bryophyte taxon records for tropical countries II. *Tropical bryology* 14: 81-84.
- INOUE H. & MILLER H.A., 1965 — Hepaticae from Kusaie, Caroline Islands. *Bulletin of the National Science Museum, Tokyo* 8(2): 139-160.
- JONES E.W., 1954 — African Hepatics X. *Leptocolea* and *Cololejeunea*. *Transactions of the British bryological society* 2: 408-438.
- JOVET-AST S., 1954 “1953” — Le genre *Colura*, Hepatiques, Lejeuneacées, Diplasiae. *Revue bryologique et lichénologique* 22: 206-312.
- LAI M.J., ZHU R.L. & CHANTANAORRAPINT S., 2008 — Liverworts and hornworts of Thailand: an updated checklist and bryofloristic accounts. *Annales botanici Fennici* 45: 321-341.
- LEE G.E., PÓCS T., DAMANHURI A. & LATIFF A., 2011 — *Lejeunea gradsteinii* (Lejeuneaceae), a new liverwort species from Mt. Kinabalu, Sabah. *Acta biologica plantarum Agriensis* 1: 29-36.
- LEE G.E., 2013 — A systematic revision of the genus *Lejeunea* Lib. (Marchantiophyta: Lejeuneaceae) in Malaysia. *Cryptogamie, Bryologie* 34: 381-484.
- LEE G.E. & GRADSTEIN S.R., 2013 — Distribution and habitats of the Malaysian species of *Lejeunea* (Marchantiophyta: Lejeuneaceae), with description of *Lejeunea tamaspocsi* sp. nov. *Polish botanical journal* 58: 59-69.
- LEE G.E., GRADSTEIN S.R., SÖDERSTRÖM L. & LATIFF A., 2013 — Catalogue of the Lejeuneaceae of Malaysia. *Malayan nature journal* 65: 81-129.
- MILLER H.A., WHITTIER H.O. & WHITTIER B.A., 1983 — Prodrum Flora Hepaticarum Polynesiae. *Bryophytorum bibliotheca* 25: 1-423.
- MIZUTANI M., 1970 — Lejeuneaceae, subfamilies Lejeuneoideae and Cololejeuneoideae from Sabah (North Borneo). *Journal of the Hattori botanical laboratory* 33: 225-265.
- MIZUTANI M., 1973 — The genus *Harpalejeunea* from Sabah (North Borneo). *Journal of the Hattori botanical laboratory* 37: 191-203.
- MIZUTANI M., 1982 — Notes on the Lejeuneaceae. 6. Japanese species of the genus *Cheilolejeunea*. *Journal of the Hattori botanical laboratory* 51: 151-173.
- MIZUTANI M., 1990 — Notes on the Lejeuneaceae. 16. *Drepanolejeunea thwaitesiana* and its related species from Asia. *Journal of the Hattori botanical laboratory* 68: 367-380.
- PÓCS T. & PIIPPO S., 1999 — Bryophyte flora of the Huon Peninsula, Papua New Guinea. LXIV. *Aphanolejeunea* (Lejeuneaceae, Hepaticae). *Acta botanica Fennica* 165: 85-102.
- PÓCS T. & NINH T., 2005 — Contribution to the bryoflora of Vietnam, VI. On the liverwort flora of Vu Quang Nature Reserve. *Acta botanica Hungarica* 47(1-2): 151-171.
- PÓCS T. & BERNECKER A., 2009 — Overview of *Aphanolejeunea* (Jungermanniopsida) after 25 years. *Polish botanical journal* 54: 51-53.
- PÓCS T. & PIIPPO S., 2011 — Bryophyte flora of the Huon Peninsula, Papua New Guinea. LXXIV. *Cololejeunea* (Lejeuneaceae, Hepaticae). *Acta bryolichenologica Asiatica* 4: 59-137.
- PÓCS T., SASS-GYARMATI A., NAIKATINI A., TUIWAWA M., BRAGGINS J., PÓCS S. & VON KONRAT M., 2011 — New liverwort (Marchantiophyta) records for the Fiji Islands. *Teloepa* 13: 455-494.
- PÓCS T., 2012 — New or little known epiphyllous liverworts, XVI. A small collection from Laos. *Acta biologica plantarum Agriensis* 2: 5-10.
- PÓCS T. & NINH T., 2012 — New or little known epiphyllous liverworts, XVII. Records from the Cát Tiên National Park, southern Vietnam. *Acta biologica plantarum Agriensis* 2: 11-19.
- PÓCS T., LUONG T-T. & HO B-C., 2013 — New or little known epiphyllous liverworts, XVIII. Records from the Bidoup-Núi Bà National Park, Vietnam, with the description of *Drepanolejeunea bidoupsensis*, sp. nov. *Cryptogamie, Bryologie* 34(3): 287-298.
- PÓCS T., MOHAMED H., YONG K-TH. & CHEAH Y-H., 2014 — Data to the Malaysian liverwort flora, I. *Polish botanical journal* 59(2): 215-220.
- PÓCS T. & PODANI J., 2015 — Southern Thailand bryophytes II. Epiphylls from the Phang-Nga area. *Acta botanica Hungarica* 57(1-2): 183-198.
- PÓCS T. & VÁNA J., 2015 — East African bryophytes XXX. New liverwort records. *Acta biologica plantarum Agriensis* 3: 3-21.
- SCHÄFER-VERWIMP A., 2006 — A new species of *Diplasiolejeunea* (Lejeuneaceae, Jungermanniopsida) from Sumatra, and a key for the genus in Asia. *Herzogia* 19: 239-244.
- TIXIER P., 1968 — Bryophytae Indosinicae. Inventaire bryologique du massif de Kirirom

- TIXIER P., 1969 — *Cololejeunea* de l'Asie du Sud-Est. I. Leonidentés et espèces affines. *Revue bryologique et lichénologique* 36: 543-594.
- TIXIER P., 1985 — Contribution à la connaissance des Cololejeunoideae. *Bryophytorum bibliotheca* 27: 1-439.
- TIXIER P. & GUEHO J., 1997 — *Introduction to Mauritian Bryology*. A check-list of mosses and liverworts. Réduit, Mauritius Sugar Industry Research Institute.
- WIGGINTON M.J., 2009 — Checklist and distribution of the liverworts and hornworts of sub-Saharan Africa, including the East African islands (edition 3, 24 January 2009). *Tropical bryology research reports* 8: 1-116. <http://www.tropicalbryologyresearch.co.uk/>
- YU Y., PÓCS T. & ZHU R.L., 2014 — Notes on Early Land Plants Today. 62. A synopsis of *Myriocoleopsis* (Lejeuneaceae, Marchantiophyta) with special reference to transfer of *Cololejeunea minutissima* to *Myriocoleopsis*. *Phytotaxa* 183(4): 293-297.
- ZHU R.L. & SO M.L., 2001 — Epiphyllous liverworts of China. *Beihefte zur Nova Hedwigia* 121: 1-418.
- ZHU R.L. & SO M.L., 2002 — The genus *Cheilolejeunea* (Hepaticae, Lejeuneaceae) in China. *Nova Hedwigia* 75(3-4): 387-408.

APPENDIX

The localities of epiphyllous collections

- No.13160: SELANGOR, around SUNGAI GABAI waterfall near HULU LANGAT town 20 km E of Kuala Lumpur. Degraded lowland rainforest at 160-200 m alt. Date: 26. Oct. 2013.
- No.13161: SELANGOR, PANGSUN valley around the waterfall, near PADANG village, 25 km NE of Kuala Lumpur. 03°12.200' N, 101°50.097' E, 165-200 m alt. Primary lowland rainforest. Date: 26. Oct. 2013
- No.13163: SELANGOR, PANGSUN valley near the waterfall, NNW of PADANG village, 25 km NE of Kuala Lumpur. 03°12.500' N, 101°50.095' E, 165-200 m alt. Primary lowland rainforest. Date: 27. Oct. 2013.
- No.13164: PAHANG, GENTING Highlands 25 km NE of Kuala Lumpur. Sharp ridge leading northwards, at 1750-1760 m. 03°26.367' N, 101°46.996' E. Elfín forest rich in bryophytes. Date: 29. Oct. 2013.
- No.13166: At the border of PAHANG and PERAK states, CAMERON Highlands, GUNUNG BRINCHANG summit ridge 3 km NNW of BERINCHANG town, at 1985-2031 m alt. 04°31.086-31.456' N, 101°22.921-971' E. Mossy cloud forest, rich in epiphylls. Date: 31. Oct. 2013.
- No.13167: PAHANG, CAMERON Highlands, ROBINSON Falls near TANAH RATA town, at 1300-1400 m alt. 04°27.718-935' N, 101°23.163-232' E. Lower montane rainforest at streamside. Date: 1. Nov. 2013
- No.13168: PAHANG, CAMERON Highlands, PARIT Falls 1 km NE of TANAH RATA town, at 1430 m alt. 04°28.445' N, 101°23.034' E. Lower montane rainforest. Date: 1. Nov. 2013.
- No.13170: KELANTAN, Gunung RENG near BATU MELINTANG town, at 102 m alt. 05°42.905' N, 101°44.778' E. Limestone rock with cave, surrounded by degraded lowland rainforest. Date: 5. Nov. 2013.
- No.13171: KELANTAN, near PERGAU town along the road between Gerik and Jeli towns, alt. 825-890 m alt. 05°36.005' N, 101°44.778' E. Submontane rainforest on schistaceous bedrock. Date: 5. Nov. 2013.
- No.13172: KELANTAN, near HENTIAN BATU 13 campsite along the road between Gerik and Jeli towns, 480-495 m alt. 05°38.234' N, 101°42.676' E. Collin rainforest on granitic bedrock. Date: 5. Nov. 2013.
- No.13173: KELANTAN, few km W of JELI town near SG. MEKONG, at 130 m alt. 05°42.504' N, 101°45.953' E. Old rubber plantation replacing lowland rainforest, rich in epiphytes. Date: 5. Nov. 2013.
- No.13175: KELANTAN, near the KUNCI AIR SUNGAI LONG No.1 water intake, at 660 m alt. 05°36'05" N, 101°44'18"E. Submontane rainforest. Date: 6. Nov. 2013.
- No.13177: KELANTAN, above the KUNCI AIR SUNGAI LONG dam, at the high part of the ridge, 840-880 m alt. 05°36.467' N, 101°43.314' E. Submontane rainforest. Date: 6. Nov. 2013.

- No.13179: KELANTAN, Gunung BASOR, halfway between DABONG and JELI towns near BKT. GERONGAN village at Renyok No.1 water intake, at 670 m alt. 05°31.642'N, 101°46.295'E. Submontane rainforest at cataracts. Date: 7. Nov. 2013.
- No.13180: KELANTAN, Gunung BASOR, halfway between DABONG and JELI towns near BKT. GERONGAN village at Renyok No.3 water intake, at 670-680 m alt. 05°31.171'N, 101°46.940'E. Submontane rainforest at cataracts. Date: 7. Nov. 2013.
- No.13181: KELANTAN, Gunung BASOR, halfway between DABONG and JELI towns near BKT. GERONGAN village along the road to KUALA BELAH, at ca. 450 m alt. 05°31.642'N, 101°46.295'E. Colline rainforest around a small waterfall. Date: 7. Nov. 2013.
- No.13184: KELANTAN, N foot of BUKIT BAKAR, ESE from MACHANG town, at 70-80 m alt. 05°43.112'N, 102°15.665'E. Lowland rainforest. Date: 8. Nov. 2013.
- No.13186: KELANTAN, at the highest point of the road between GERIK and JELI towns, on the summit with aerial near Hotel „Titiwangsa”. 05°36.361 N, 101°31.527 E. 1053-1119 m alt. Submontane rainforest with few epiphytes. Date: 9. Nov. 2013.