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PENGGALANG TAKSONOMI TUMBUHAN INDONESIA

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Floribunda

Floribunda merupakan organ resmi Penggalang Taksonomi Tumbuhan Indonesia, diterbitkan dua kali setahun dan menerbitkan makalah dalam bahasa Indonesia dan Inggris mengenai pelbagai gatra sistematika keanekaragaman flora Malesia pada umumnya dan Indonesia pada khususnya yang berasal dari hasil penelitian, pengamatan lapangan, pengalaman pribadi, telaahan bergagasan, dan tinjauan kritis.

Petunjuk kepada pengarang

Jenis tulisan

Makalah lengkap memuat hasil penelitian floristik, revisi, atau monografi unsur-unsur flora Malesia. Komunikasi pendek mencakup laporan kemajuan kegiatan penelitian, pengembangan dan rekayasa keanekaragaman flora Malesia yang perlu segera dikomunikasikan.

Tulisan lain meliputi obituari tokoh keanekaragaman flora, tinjauan kritis bergagasan, telaahan serta pembahasan persoalan aktual seputar kegiatan penelitian, pengembangan dan rekayasa tetumbuhan Indonesia, serta timbangan buku akan dimuat berdasarkan undangan.

Rujukan pembakuan

Pemakaian Bahasa Indonesia sepenuhnya mengikuti *Pedoman Umum Ejaan yang Disempurnakan, Pedoman Umum Pembentukan Istilah, Kamus Besar Bahasa Indonesia,* serta kamus-kamus istilah yang dikeluarkan Pusat Bahasa. Bahasa Inggris yang dipakai adalah the Queen English dengan berpedoman pada *Oxford Dictionary of the English Language.* Ketentuan-ketentuan yang dimuat dalam *Pegangan Gaya Penulisan, Penyuntingan,* dan *Penerbitan Karya Ilmiah Indonesia,* serta *Scientific Style and Format: CBE Manuals for Author, Editor, and Publishers,* dan buku-buku pegangan pembakuan lain akan sangat diperhatikan. Kepatuhan penuh pada *International Code of Botanical Nomenclature* bersifat mutlak.

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Abstrak informatif supaya diberikan dalam bahasa Indonesia dan Inggris yang masing-masing tidak melebihi 200 kata. Sediakan sekitar 7 kata kunci untuk keperluan pengindeksan dan pemindaian.

Bilamana diperlukan ucapan terima kasih dan bentuk persantunan lain dapat dicantumkan sesudah tubuh teks tetapi sebelum daftar pustaka.

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Gambar dan tabel merupakan pendukung teks sehingga perlu disusun secara logis dalam bentuk teks atau tabel atau sebagai gambar, tetapi tidak dalam bentuk ketiganya sekaligus. Siapkan gambar yang lebarnya dua kolom cetak.

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DIVERSITY OF HORNWORT IN MOUNT SLAMET (CENTRAL JAVA)

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Arin Ulfiana Mubarokah Siagian, Nunik Sri Ariyanti & Nina Ratna Djuita. 2021. Keanekaragaman Lumut Tanduk di Kawasan Gunung Slamet (Jawa Tengah). *Floribunda* 6(7): 264–272. — Eksplorasi dan koleksi lumut tanduk baru-baru ini yang lebih intensif di Gunung Slamet menunjukkan terdapat enam jenis lumut tanduk yang dapat diketahui, yaitu *Anthoceros punctatus, Folioceros fuciformis, Phaeoceros carolinianus, P. exiguus, Dendroceros difficilis,* dan *Megaceros flagellaris*. Dikarenakan semula hanya satu jenis *D. difficilis* dari kawasan ini, berarti lima jenis merupakan catatan baru untuk kawasan tersebut, sedangkan *P. exiguus* bukan hanya catatan baru untuk Jawa, tetapi juga catatan baru untuk Malesia.
Kata kunci: Anthocerotophyta, Jawa Tengah, lumut tanduk, Gunung Slamet.

Arin Ulfiana Mubarokah Siagian, Nunik Sri Ariyanti & Nina Ratna Djuita. 2021. Diversity of Hornworts in Mount Slamet (Central Java). *Floribunda* 6(7): 264–272. — Recent more intensive explorations and collections of hornworts in Mt. Slamet indicated that six species can be recognized, namely *Anthoceros punctatus, Folioceros fuciformis, Phaeoceros carolinianus, P. exiguus, Dendroceros difficilis,* and *Megaceros flagellaris*. Since originally only one species *D. difficilis* was recorded from this area, this means that five species represent new records for the area, whereas *P. exiguus* is not only a new record for Java, but it is also a new record for Malesia.
Keywords: Anthocerotophyta, Central Java, hornwort, Mount Slamet.

Hornworts (Anthocerotophyta) are identified by dorsiventrally flattened thallus with dark to light green color, commonly have one large chloroplast per cell; the green horn-like sporangia are enveloped by involucre at the base and lack of seta (Vanderpoorten & Goffinet 2009; Villarreal *et al*. 2010; Cargill *et al*. 2016). Hornworts often grow on moist to wet soil or rock substrates on the edges of paths or ditches; only a few species are epiphytes. Hornworts consists of 200–220 species grouped in 12–14 genera and distribute worldwide, the highest diversity is in tropical Asia which has 60 species (Villarreal *et al*. 2010; Söderström *et al*. 2016).

Studies on the hornworts in Java, Indonesia are quite outdated and most specimens were collected from West Java. Hornworts in Indonesia was firstly published by Campbell (1907) based on the specimens collected from Cibodas and Mount Salak in West Java. Subsequently, hornworts were reported from others regions in Indonesia such as Sumatra, Borneo, and Ambon (Meijer 1954). The report on the hornworts in Java is not only old but also scattered until Söderström *et al*. (2010) publishes the Checklist of the hornworts and liverworts of Java. There are 28 species of hornworts reported in Java, however only 15 species are accepted, the others are treated as synonymy or have unclear taxonomic status (Söderström *et al*. 2010).

The lack of specimens and difficulties in identification caused obstacles in updating our knowledge on hornworts. To enhance and update our knowledge on the hornworts in Java, we conduct exploration works and observation to study the hornworts in Mount Slamet, the second-highest

volcanic mountain in Java after Mount Semeru, with an altitude of 3432 m above sea level. So far, however, only one species of hornwort *Dendroceros difficilis* has been recorded from this mountain (Haerida & Gradstein 2011). Therefore, further explorations to collect specimens of hornworts more intensively from Mount Slamet were conducted to complete the hornwort data and information from this area.

MATERIALS AND METHODS

Collecting trips were undertaken in three study sites, namely Baturraden trails in regency Banyumas, Gunung Malang trails in Purbalingga regency, and Guci trails in Tegal regency (Fig. 1). In each area, samples were taken along the tracks including the river banks and waterfalls, to collect the specimens. The specimens were collected using a sharp knife from the substrates such as soils and rocks. The epiphytic hornworts were collected from tree trunks and branches. The specimen was placed into paper envelopes or small plastic bags. Each specimen received a collection number. All information gathered on the specimens was written in the field notebook. Characteristics of the living hornworts such as color capsule, growth were noted. The data recorded from habitat were substrate, vegetation type, localities, and altitudinal (measured using altimeter). GPS (Global Positioning System) was used for recording the coordinates of the collecting sites.

The collected 120 specimens were observed and identified in the Plant Taxonomy Laboratory of IPB University. The morphological and anatomical details were studied using stereo and compound microscopes, the microscopic photograph was taken with indomicro camera. Identification used both keys and descriptions from available taxonomic literature, mainly Guide to the Liverworts and Hornworts of Java (Gradstein 2011), Notes on Some Malayan Species of Anthoceros I and II (Meijer 1954, 1957), and Taxonomical Studies on Asian Anthocerotae I, II, and V (Hasegawa 1979, 1980, 1983), nomenclature follows Söderström *et al.* (2016). The identified species were described. Species descriptions were provided with specimens cited. All hornwort specimens obtained were deposited in the Laboratory of Division Plant Resources and Ecology, Department of Biology, IPB University, and the Herbarium Bogoriense (BO).

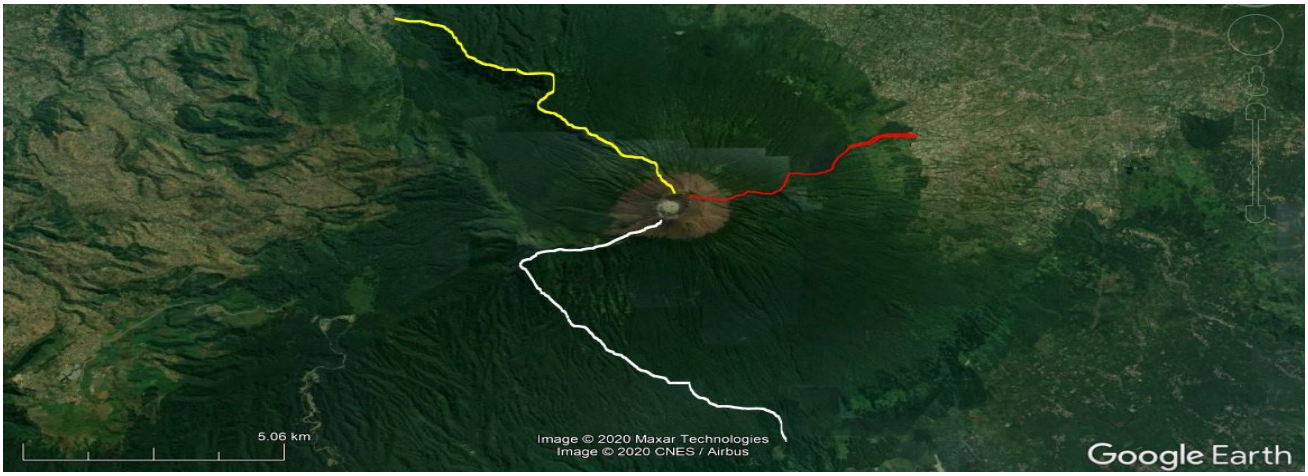

Figure 1. Three study site for collecting hornworts in the Mount Slamet, namely Guci trail (yellow), Gunung Malang trail (red) and Baturraden trail (white).

RESULT AND DISCUSSION

The identified 120 specimens of hornwort collected from three locations in Mount Slamet yielded six species, namely *Anthoceros punctatus* and *Folioceros fuciformis* (Anthocerotaceae), *Phaeoceros carolinianus* and *P. exiguus* (Notothyladaceae), *Dendroceros difficilis,* and *Megaceros flagellaris* (Dendrocerotaceae). Except for *D. difficilis*, the other five species are newly recorded species for Mount Slamet. The species *D. difficilis* were reported to occur in Baturraden (Haerida & Gradstein 2011). Of these, *P. exiguus* represent a new record of hornwort for Malesian bryophyte flora. *P. exiguus* is similar to *P. carolinianus* in having a yellow tip capsule when ripe, but different in having smaller thallus and shorter capsule, smoot, and hyaline spores. The species *P. exiguus* was previously reported found only in Taiwan, New Caledonia, and Thailand (Hasegawa 1993).

In the following, a key for the six species, their respective descriptions, illustrations, and notes on their distributions and ecology are presented.

1. a. Capsules with stomata, pseudoelater without spiral thickening 2
   b. Capsules without stomata, pseudoelater with spiral thickening ..... Dendrocerotaceae (5)
2. a. Thallus with mucilage cavities, spores are black-brown to black ..... Anthocerotaceae (3)
   b. Thallus without mucilage cavities, spores are yellows ..... Notothyladaceae (4)
3. a. Thallus rosette; pseudoelater thin-walled; the proximal surface of spores with distinct tri-radiate mark, faveolate-reticulate; the distal surface of spores spinulate ..... *Anthoceros punctatus*
   b. Thallus strap-shaped; pseudoelater thick-walled; proximal surface of spores with indistinct tri-radiate mark, spores papillate, the distal surface of spores baculate ..... *Folioceros fuciformis*
4. a. Capsules less than 10 mm long, bivalve but not twisted; the distal surface of spores roughened and covered with large papilla; pseudoelater hyaline ..... *Phaeoceros exiguus*
   b. Capsule more than 10 mm long, a bivalve with tip twisted; the distal surface of spores papillate and spinulate; pseudoelater yellow ..... *Phaeoceros carolinianus*
5. a. Epiphyte, thallus differentiated into thick costa (multistratose) and thin lamina (unistratose), spores multicellular ..... *Dendroceros difficilis*
   b. Terrestrial, thallus is not differentiated into costa and lamina, multistratose; spores unicellular ..... *Megaceros flagellaris*

Anthoceros punctatus L., Sp. Pl. 2: 1139 (1753).
Fig. 2

Plant small to medium, up to 1.5 cm in diameter, prostrate, dark green while fresh, growing on soil. Thallus rosettes, dichotomously branched; braches lanceolate-oblong, margin entire to crenulate, dorsal surface smooth. Thallus with mucilage cavities; *Nostoc* colonies irregularly found on the ventral side of thallus. Epidermis cell of the dorsal surface of thallus rectangular to irregular, thick-walled, chloroplast one per cell, stomata absent. Rhizoids brown, dark brown to hyaline. Involucres erect, cylindrical, up to 0.5 cm long, surface smooth, green while fresh, and dark brown while drying. Sporophyte: capsule erect, thin-walled, up to 1–2 cm long, apex obtuse, turn black in mature; epidermal cells rectangular or quadrate, up to 79.2 µm long, 63.3–70.8 µm wide, hyaline; stomata abundant, 78.9–87.9 µm long, 52.4–57.1 µm wide, hyaline. Spore blackish, rounded-tetrahedral; equatorial view 58.1–66.5 x 44.2–50.9 µm; distal surface covered with papillae and large baculate, margin with numerous spines; proximal surface with a distinct triradiate mark, faveolate-reticulate, smooth without spines. Pseudoelaters brown to transculent, short to elongate and irregularly bend, up to 1–4 cells in length, 128.2–329.9 µm long, 9.8 –18.2 µm wide, unbranched, thin-walled, surface smooth.

Distribution: Java, Sumatra (Söderström *et al*. 2010), Asia (Furuki & Mizutani 2004) and Europe (Paton 1999; Damsholt 2002).

Specimens examined: Java, Guci track, 1285 m asl, 11 November 2019 Mubarokah 203.

Ecology: This species was found abundantly on the soil close to the waterfall in open vegetation at 1287 m asl.

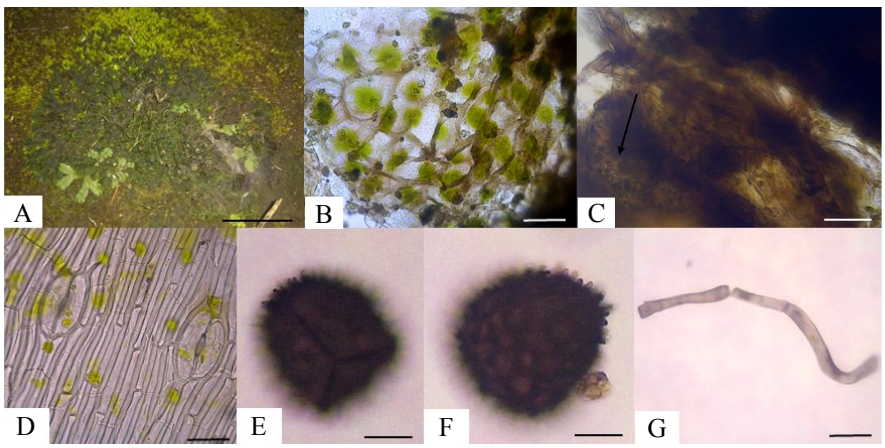

Figure 2. *A. punctatus*. A. gametophyte habit bearing the sporophytes, B. epidermis cells of dorsal thallus, C. *Nostoc* colonies, D. epidermis cells of capsule wall with stomata, E. spore proximal view, F. spore distal view, G. pseudoelater. Scale 5 mm (a), 50 µm (b-g).

Folioceros fuciformis (Mont.) D.C. Bharadwaj, Geophytology. 5(2): 227 (1975). Fig. 3.
Anthoceros fuciformis Mont., Ann. Sci. Nat. Bot. (ser.2) 20: 296 (1844b).

Monoecious. Plant large, 2.5–4 cm long, 0.5–2 cm wide, prostrate, young thallus green and older thallus dark green, brownish to black when dried, growing on soil and rock. Thallus strap-shaped, dichotomously branched; dorsal surface smooth, margin irregularly dissected into the lobe, lobe oblong. Thallus faveolate with large mucilage cavities, large *Nostoc* colonies scattered through the internal chambers in the thallus. Epidermis cell of dorsal surface of thallus rectangular, polygonal, or quadrate, 173.3–311.1 µm long, 92.2–254.9 µm wide, thick-walled, chloroplasts mostly one per cell, stomata absent. Rhizoids are hyaline to dark brown. Antheridia oval to oblong with rather a long stalk, brown when mature, found in the dorsal side thallus. Involucres erect, cylindrical, thin-walled, up to 4.5–8 mm long, surface smooth. The capsule is erect, cylindrical, thin-walled, up to 1–2.5 cm long; apex obtuse and splitting into two valves either by one or two sides, valves frequently remaining attached and twisted when dried; epidermis cells of capsule wall elongate rectangular, 65.7–323 µm x 3.2–11.4 µm, thick-walled, apex obtuse to entire; stomata rare, 1–2 per capsule, 75.7 x 53.5 µm; columella well developed, cylindrical, light brown when young and dark brown when mature. Spores greenish turn brown or blackish when mature, rounded-tetrahedral, 42.8–60.8 x 41.4–59.2 µm in diameter, distal surface rough echinate or papillae; proximal surface with unclear triradiate, smooth to less echinate or papillae. Pseudoelater light brown to black, composed of 1–4 cells, long and narrow, 103.3–500.6 x 5.9–19.3 µm, thin-walled, lumen narrow, surface smooth, branched or unbranched.

Distribution: Java (Bogor, Mount Merapi, Mount Slamet), Sumatra, Borneo, Malaysia and China (Meijer 1954; Desiro *et al*. 2013).

Specimens examined: Java, Baturraden, and Guci track of Mount Slamet, 800–1200 m asl, on closed and open vegetation, 10 November 2019 Mubarakah 161, 162, 174, 206, 210.

Ecology: This species is found along brooklets, near waterfalls, on steep slopes on damp rocks mixed with soil in opened and closed forest at altitude 800-1200 m asl.

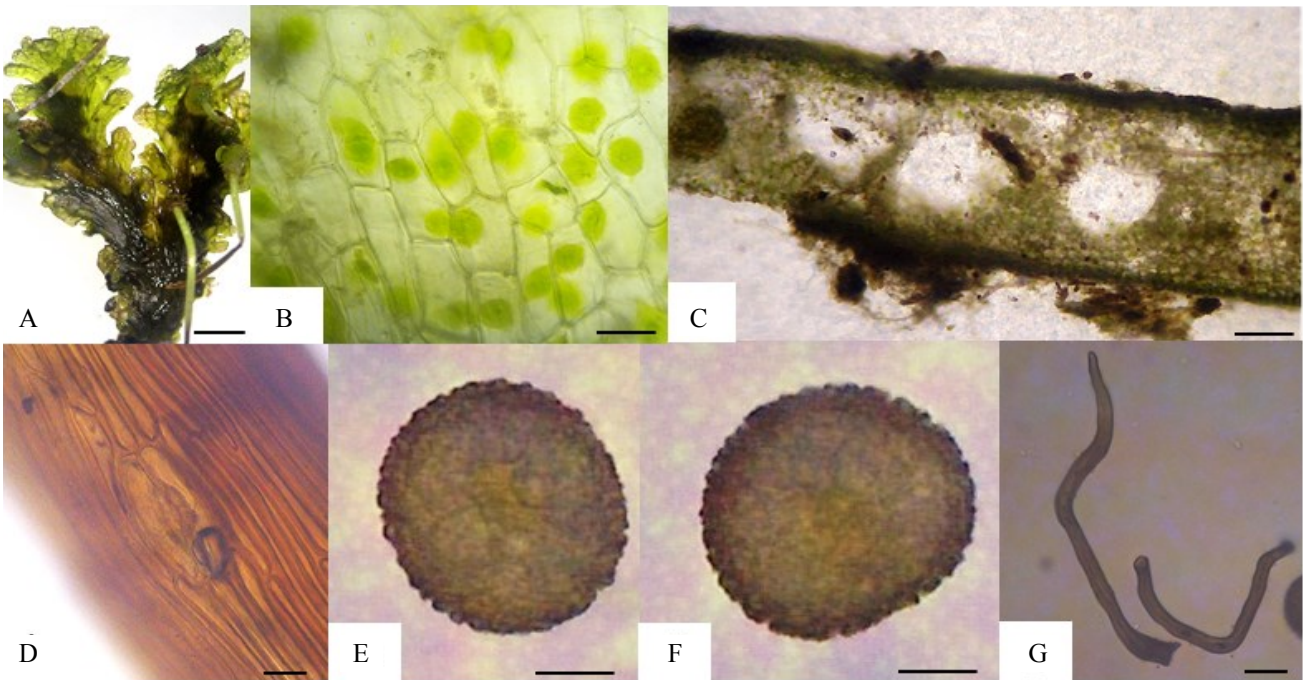

Figure 3. *F. fuciformis*. A. gametophyte habit bearing the sporophytes, B. epidermis cells of dorsal thallus, C. transverse section of thallus, D. epidermis cells of capsule wall with stomata, E. spores proximal view, F. spores distal view, G. pseudoelater. Scale 5 mm (a), 50 µm (b-g).

Phaeoceros carolinianus (Michaux) Prosk., Bull. Torrey Bot. Club 78: 347 (1951). Fig. 4.
Anthoceros carolinianus Michx. Flora Boreali-American 2: 280 (1803).
Phaeoceros laevis (L.) Prosk. subsp. carolinianus (Michaux) Prosk., Rapp. *et* Comm. VIII Congr. Int. Bot. Paris 14-16: 69 (1954).

Monoicous. Plant small to medium, 1–3 long, 1–2.5 cm wide, prostrate, light green to dark green when fresh, brown to black when dried, growing on the wet stone. Thallus rosette, surface smooth, margin entire. Thallus solid without large mucilage cavities; *Nostoc* colonies scattered on the ventral side of the thallus. Epidermis cells of dorsal surface thallus rectangular, pentagonal, or hexagonal, 45.9–117.0 x 30.1–104.0 µm, thin-walled, chloroplast one per cell with a pyrenoid, stomata absent. Rhizoids 456–1191.6 µm long; hyaline, black or brown. Antheridia globular to ovate, orange-yellow to brownish, scattered on the ventral side of the thallus. Involucres erect, conical-cylindrical, up to 7–15 x 3–5 mm, surface smooth. Sporophyte: capsule exerted, up to 4–7.5 cm long, opened into 2 valves and twisted when dry, surface smooth; well-developed columella; thin-walled, epidermis cells of capsule wall rectangular to elongated, 42.9 –320.5 x 21.1–55.4 µm; thin-walled, wall hyaline when a young to brown color when mature; stomata present. Spores bright yellow, rounded-tetrahedral equatorial, 25.4–90.1 x 25.7–70.7µm, distal surface covered with small verrucae to spines, marginal surface entire to spinose; proximal surface with unclear triradiate mark, covered by button-like papillae with small baculate and margin spores entire to spines. Pseudoelater up to 1–5 cells in length, 41.1–175.0 x 3.6–29.9 µm, hyaline and thin-walled, yellow to brownish by margin brown color, frequently branched.

Distribution: Java (West Java, Central Java, and East Java), Sumatra, Malaysia. and spread in the whole Asia Region (Meijer 1954). Thailand, Australia, and Carolina.

Specimens examined: Java, Baturraden track, Gunung Malang track, and Guci track at Mount Slamet, altitude 1500–2000 m asl, on vegetation-covered and open shades, 10–11 November 2019 Mubarokah 145, 195, 211.

Ecology: This species is found on rock cliffs along hiking-track in closed vegetation and on soil in the open area of the agricultural fields at 1500–200 m asl.

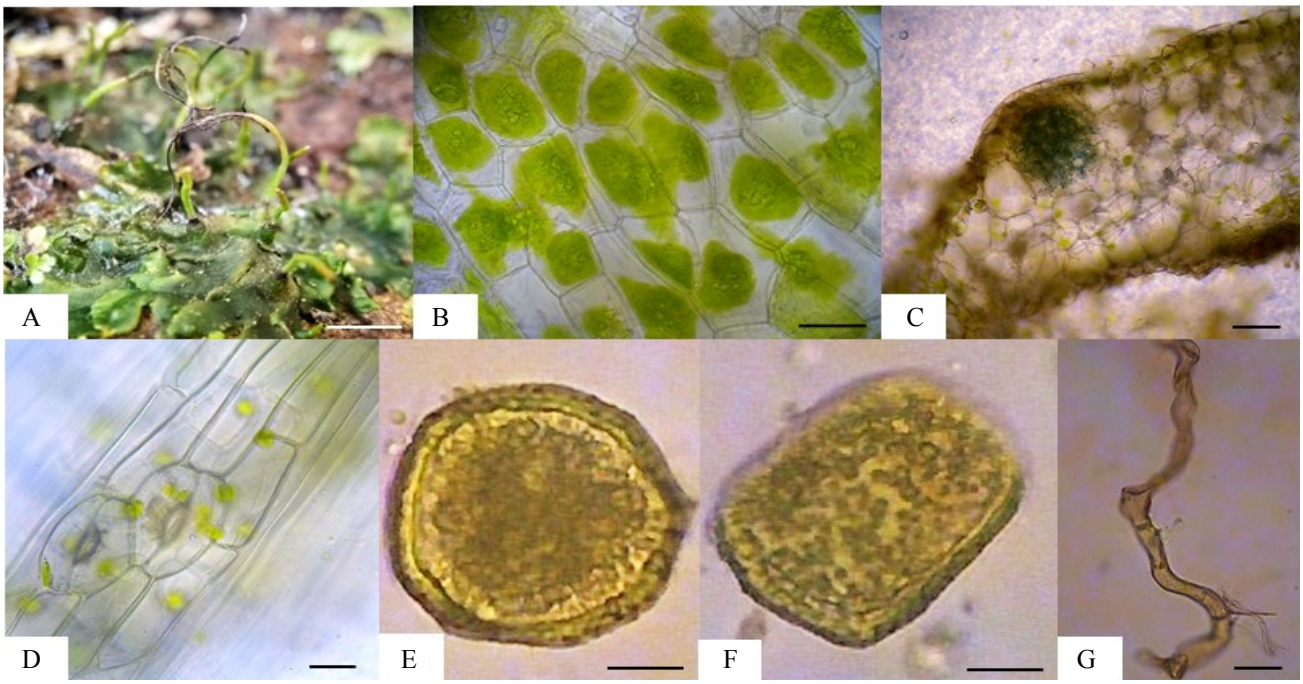

Figure 4. *P. carolinianus* A. gametophyte habit bearing the sporophytes, B. epidermis cells of dorsal thallus, C. transverse section of thallus, D. epidermis cells of capsule wall with stomata, E. spores proximal view, F. spores distal view, G. pseudoelater. Scale 10 mm (a), 25 µm (b-g).

Phaeoceros exiguus (Steph.) Haseg., J. Hattori Bot. Lab. 60: 387 (1986). Fig. 5.
Anthoceros exiguus Steph., Sp. Hepat. 5: 988 (1966).

Monoecious. Plant small, 5–10 x 4–10 mm, prostrate, patches or mats, light green to dark when fresh, brown to black when drying, growing on rock and cliff. Thallus rosettes, furcate to irregularly branched, margin entire, roughly covered with scale-like structure. Thallus solid, without mucilage cavities; *Nostoc* colonies scattered in the thallus. Epidermis cells of dorsal thallus rectangular to pentagonal, 43.9–90.6 x 32.4–59.0 µm, thin-walled, chloroplast one per cell with a pyrenoid, light green color to dark green; stomata absent. Rhizoids light brown, black, to hyaline. Antheridia globular to ovate, hyaline to light green, 165.5 x 150.5 µm, scattered on the dorsal side of thallus. Involucre erect, barrel-shaped to conical-cylindrical, up to 7–15 x 3–5 mm, surface rough. Sporophyte: capsule short, 0.3–10 mm long, thin-walled, surface smooth, splitting into 2 valves at maturity but not twisted, light yellow at the tip when mature; well-developed columella; epidermis cells of capsule wall elongated rectangular, 25.9–310.5 x 19.0–30.3 µm, hyaline thin-walled, stomata present. Spores pale yellow, rounded-tetrahedral equatorial, 25.0–92.1 x 26.7–71.7 µm, distal surface rough, covered with large baculate and concave, margin entire, thin-walled; proximal surface with a distinct triradiate mark, covered by densely papillate and margin spores entire. Pseudoelater hyaline and thin-walled, hyaline to pale yellow, linear or rectangular, short, up to 1–3 cell in length, at tips entire, unbranched, 28.9–150.0 x 4.0–30.9 µm.

Distribution: Java (Central Java, Mount Slamet), New Caledonia, Taiwan (Hasegawa 1993).

Specimens examined: Java, Baturraden track at Mount Slamet, 700–860 m asl., 11 November 2018 Mubarokah 70, 75, 180, 181, 182.

Ecology: Terrestrial, found growing on the rock near rivul*et al*ong the mountain track.

Note: This species has never been recorded before in the bryophyte flora of the Malesian Region.

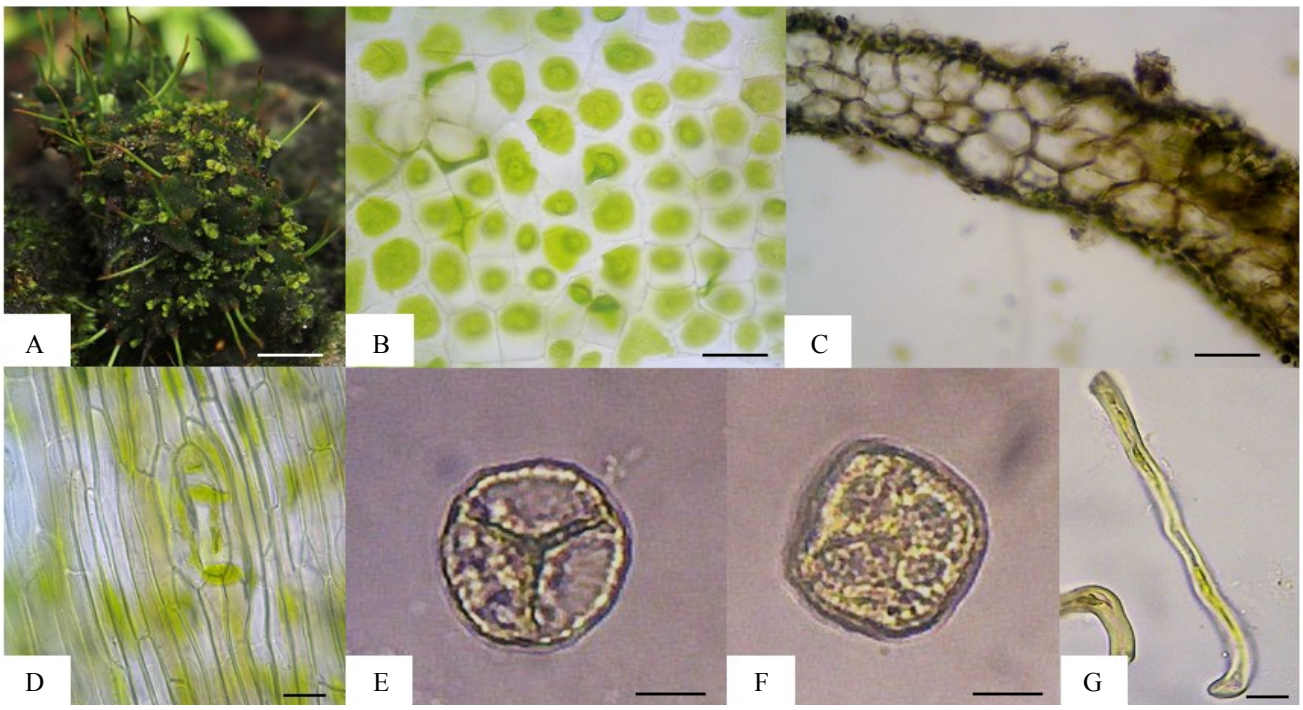

Figure 5. *P. exiguus* A. gametophyte habit bearing the sporophytes, B. epidermis cells of dorsal thallus, C. transverse section of thallus, D. epidermis cells of capsule wall with stomata, E. spores proximal view, F. spores distal view, G. pseudoelater. Scale 10 mm (a), 25 µm (b-g).

Megaceros flagellaris (Mitt.) Steph., Sp. Hepat. (Stephani) 5: 951, 1916. Fig. 6.
Anthoceros flagellaris Mitt., Fl. vit. 419, 1871 (1873).

Monoecious. Plant large, 2.5–6.9 x 2.5–5.5 cm, prostrate, light green to dark green when fresh, brown to black when drying, growing on tree bark and fallen tree, the root of tree and soil. Thallus dichotomously branched; variable in shape from broad irregularly like fans, strap, cushion; margin entire to irregularly crenate, or lobed 0.5–1.5 cm width; surface smooth. Thallus solid, mucilage cavities absent, *Nostoc* colonies in the internal chambers or scattered at inner of the thallus. Epidermis cells of dorsal thallus pentagonal, quadrate or rectangular, isodiametric, 20.1–112.0 x 15.1–100 µm, thin-walled, chloroplasts 1–2–4(–8) per cell; stomata presence. Rhizoid scattered, 55.8–464.6 µm long, hyaline to pale brown. Archegonia is scattered at the dorsal side of the thallus. Involucre erect, cylindrical, 5–1.7 x 0.3–0.7 cm, surface smooth, light green. Sporophyte: capsule exerted, cylindrical, up to 2.5–5 cm long, thick-walled, open by splitting into either one or both sides when the spores mature, becoming twisted when dry, columella developed well, becoming brown and then chestnut red to brown with maturity at the apex; epidermis cells of capsule wall elongated-rectangular, 76.0–265.0 x 6.4–20.0 µm, thick-walled, stomata absent. Spores hyaline to pale brown, rounded-tetrahedral to concave or irregularly, 30.7–78.6 x 25.3–64.3 µm, thick-walled, chloroplast present, distal surface protuberance at the central; proximal surface with unclear triradiate mark, smooth with verrucae button-shaped confined to the center of each triradiate surface, equatorial girdle marked with a reticulated shaped or tessellated pattern of curved ridges. Pseudoelater 125–433 x 7.5–17.5 µm, unbranched, hyaline and thin-walled, pale brown to a golden brown, spiral thickening band, outer surface smooth.

Distribution: Java (Mount Salak, Mount Gede Pangrango, Mount Slamet), Thailand, Australia.

Specimens examined: Java, Baturraden track at Mount Slamet, 1500–3000 m asl.) on vegetation closed, 10 November 2019 Mubarokah 109, 110, 111, 112, 113, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130.

Ecology: This species is found on tree bark and fallen tree, on the soil at cliff along footpath side and riverside, moist rocks along-track mount. The population scattered in the heterogynous forest between *Fagaceae* forest range at 1500 m asl, *Nothofagus* forest at 1700 m asl, *Ericaceae* forest 1500–2000 m asl, and *Araucaria* forest at 1500–2000 m asl.

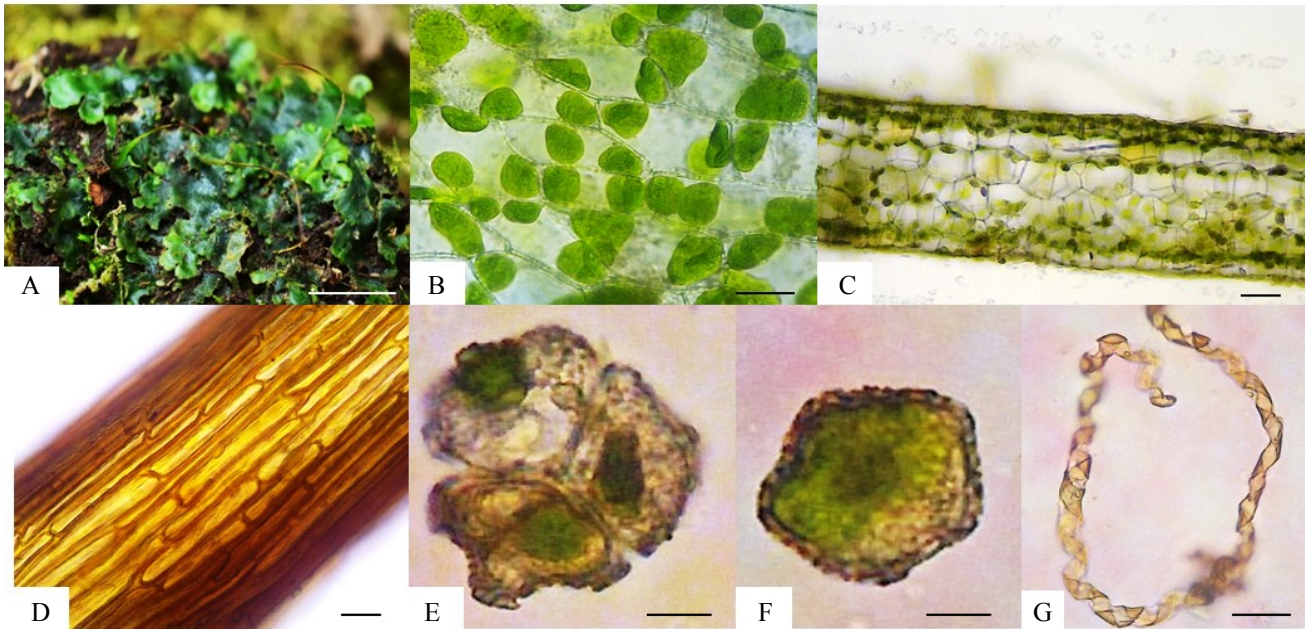

Figure 6. *M. flagellaris* A. gametophyte habit bearing the sporophytes, B. epidermis cells of dorsal thallus, C. transversal section of thallus, D. epidermis cells of capsule wall, stomata absent, E. mature tetraspores, spore with chloroplast, F. spore distal view, G. pseudoelater. Scale 5 mm (a), 50 µm (b-g).

Dendroceros difficilis Steph. Sp. Hepat. 5: 1009. 1917. Fig. 7.

Monoecious. Plant small to medium size, 15–30 mm long, 2–6 mm wide, light green when fresh, brown to black when drying, growing on tree bark. Thallus is clustered, costa broad with large lacunae 14.5–52.1 µm, margin entire to crenate. Lamina unistratose, crispate or forming structure like a hood, surface smooth. Costa multistratose, with many large mucilage cavities, *Nostoc* colonies in the internal chambers at the dorsal side of the thallus. Epidermis cells of dorsal surface thallus isodiametric, 20–25 x 25–35 µm, slightly thick-walled with small to large trigone, 1 chloroplast one per cell with a protruding pyrenoid, stomata absent. Involucre erect, cylindrical, 3–5 mm long, thin-walled, surface rough (with small cuticles). Sporophyte: capsule slender, up to 2–10 mm, thin-walled, becoming brown and then chestnut red to brown with maturity at the apex, splitting into two valves by either one or two sides; columella developing well; epidermis cells of capsule wall rectangular, 35–55 x 20–20 µm, thick-walled, stomata absent. Multicellular spores, 110.0–148.7 x 74.4–160.7 µm, of up to 5–7 cells; spore 110.0–148.7 x 74.4–160.7, chloroplast present, thick-walled, wall hyaline to pale brown; distal surface smooth, proximal surface reticulated or tessellated at margin side. Pseudoelater 135.2–453.6 µm long, unbranched, pale brown to gold brown, the wall with spiral thickening band, surface smooth.

Distribution: Java (Bogor, Mount Slamet), Thailand.

Specimens examined: Java, Baturraden track at Mount Slamet, 700–750 m asl, 10 December 2017 Mubarokah 90, 91.

Ecology: Growing epiphytically on tree bark in canopied forest and open vegetation area at 700–750 m asl.

Note: The occurrence of this species in Mt. Slamet was already recorded by Haerida & Gradstein (2011).

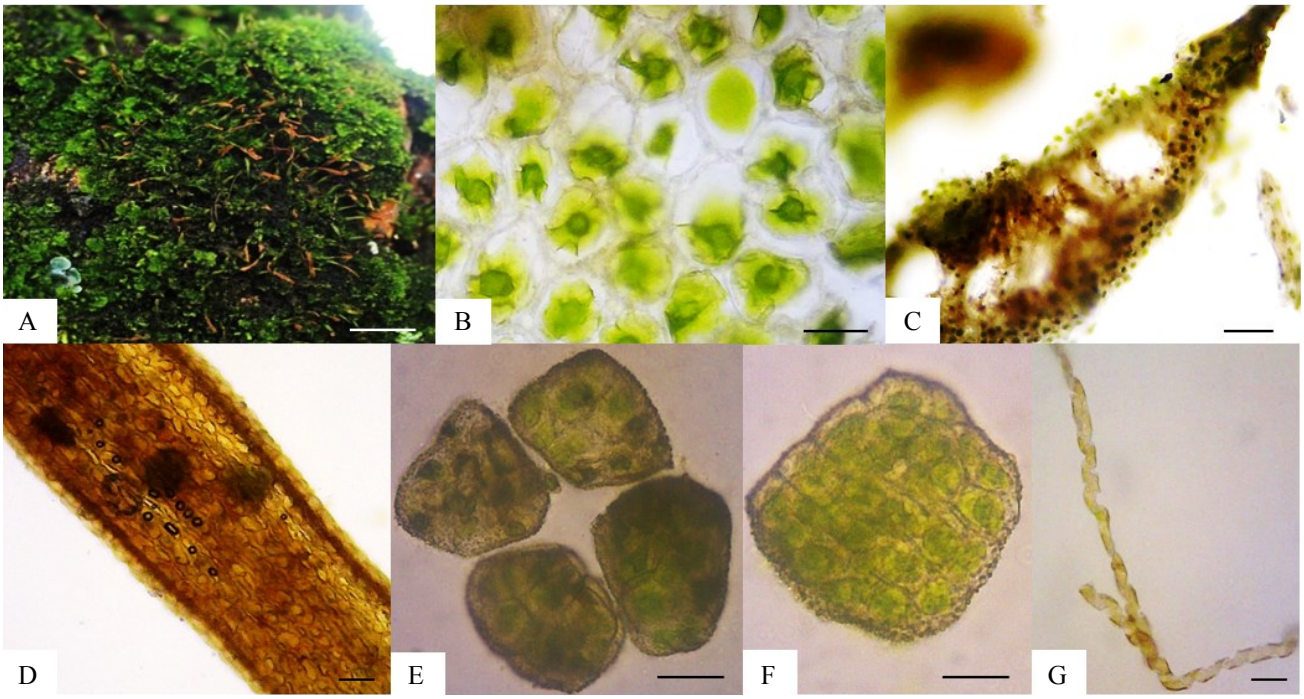

Figure 7. *D. difficilis* A. gametophyte habit bearing the sporophytes, B. epidermis cells of dorsal thallus, C. transversal section across the costa show mucilage vesicles, D. epidermis cells of capsule wall, E. mature tetraspores, spore with chloroplast, F. multicellular spore distal view, G. pseudoelater. Scale 5 mm (a), 50 µm (b-g).

CONCLUSION

We added five species, namely *A. punctatus, F. fuciformis, P. carolinianus, M. flagellaris,* and *P. exiguus* to the hornworts list in Mount Slamet since previously covered only *D. difficilis.* Therefore, currently, the diversity of hornworts in Mount Slamet comprise 6 species. We also reported for the first time the distribution of *P. exiguus* in Malesia.

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