Diplophyllum kinabaluense (Scapaniaceae, Marchantiophyta), sp. nov. from Mt. Kinabalu, Malaysian Borneo

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(Accepted on January 9, 2016)

Diplophyllum kinabaluense Furuki & M. Suleiman is described as a new species of the Scapaniaceae, Marchantiophyta, from Mt. Kinabalu in Borneo, Malaysia. This is the second report of the genus Diplophyllum from Malesia in tropical Southeast Asia. The species is compared to the closely related North American Diplophyllum apiculatum (A. Evans) Steph. and the Australasian Diplophyllum domesticum (Gottsche) Steph. It is clearly distinguished from those species by its small, rectangular dorsal leaf lobe with recurved apex, dorsal margin of the dorsal lobe not extending to the opposing one, nearly straight keel of leaves, irregularly crenate margin of leaves with unicellular projections, long perianth with serrate margins. Plants are autoicous.

**Key words:** Bryophytes, Diplophyllum kinabaluense, Malaysia, Marchantiophyta, Mt. Kinabalu, new species, Scapaniaceae.

Diplophyllum nanum Herzog was described from Borneo by Herzog (1951), and it has been known as the only species of the genus Diplophyllum in tropical Southeast Asia. We found another species of the genus in Borneo during a study of the bryophyte flora of Mt. Kinabalu, Malaysia. It is quite different from D. nanum and other species of the genus in morphology, and it is described here as new to science.

**Diplophyllum kinabaluense** Furuki & M. Suleiman, sp. nov. [Figs. 1, 2]

Plants translucent green, not pigmented red, prostrate to ascending, to 5 mm long, 1.0–1.5 mm wide with leaves. Branching often, lateral-intercalary. Rhizoids numerous from ventral part of stem, colorless. Stem 120–150 \( \mu \text{m} \) in diam., orbicular in cross sections; cortex 1–2-stratose, usually bistratose in the ventral portion, thick-walled; medulla 4–8 cells, composed of larger cells, thin-walled. Leaves transversely inserted, decurrent neither dorsally nor ventrally, imbricate to contiguous, contiguous and not extending to the opposing one at dorsal margin of dorsal lobe, widely spreading when fresh, somewhat dorsally assurgent when dry, conduplicate-bilobed; keel 120–200 \( \mu \text{m} \) long, 0.18–0.28 the leaf length, nearly straight; sinus wide. Ventral lobe lanceolate, weakly falcate, concave, 600–800 \( \mu \text{m} \) long, 150–220 \( \mu \text{m} \) wide at middle, entire to weakly crenate of unicellular projection at both ventral and dorsal margins from base to middle, irregularly crenate at both
ventral and ventral margins of upper part, acute at apex. Dorsal lobe rectangular, squarrose, recurved at apex, 200–250 µm long, 120–150 µm wide, nearly entire at margin, rounded at apex. Cells of median portion of ventral lobe short rectangular, 20–40 µm long × 12–20 µm wide, moderately thick to thick-walled, trigones small; subapical and marginal cells subquadrate, isodiametric, in irregular arching tiers, getting smaller from median portion to margin, from 20–25 to 10–15 µm, thick walled, trigones small; cuticle coarsely papillose; papillae rounded to elliptical, 2–7 µm in diam. Oil bodies spherical to oblong, composed of minute, indistinct granules, colorless, variable in size; larger oil bodies 1–5 restricted to median portion of leaves and epidermal cells of stem, 5–12 × 4–10 µm; smaller oil bodies 1–5 in each cell of leaves, sometimes lacking, 1–3 µm. Gemmae not seen.

Plants autoicous. Male bracts terminal on leading stem or lateral short branches, 4–15 pairs, similar to leaves in shape and form except ventricose toward base; antheridium one per bract; stalk uniseriate. Female bracts larger than leaves, similar to leaves except the dorsal lobe; keel of those of innermost series longer and ca. 0.5 the length of the ventral lobe; dorsal lobe of those of innermost series larger and 0.65–0.75 the length of the ventral lobe, usually strongly recurved. Perianth terminal on leading stem or lateral short branches, lanceolate, 1.4–1.6 mm long, 320–350 µm wide, plicate, constricted at the mouth, shallowly pluri-lobed; lobule triangular, serrate with unicellular projections along margin, acute to apiculate at apex; cells very thick-walled.

Capsule dark brown, oblong ca. 400–500 µm long, 200–250 µm wide; valves oblong ca. 400–550 µm long, 120–150 µm wide, bistratose, 13–15 µm thick; outer layer 7.0–8.5 µm thick, thickened on the adaxial and abaxial radial walls and often extending to the inner tangential wall, and slightly extending to the outer tangential wall; inner cell layer 5.5–6.5 µm thick, thickened on the adaxial and abaxial radial walls. Seta 70–80 µm wide, to 2.5 mm long. Elaters 100–200 µm long, 7.5–10 µm wide, 2-spiral. Spores spherical, 8–10 µm in diam., granulate on surface.

Distribution: Endemic to Mt. Kinabalu, Borneo, Malaysia.

Ecology: On soil and rocks under evergreen montane forest.

Type: MALAYSIA. Borneo, Sabah, Mt. Kinabalu, along Bundu Tuhan View Trail, near the Headquaters, 1650 m alt., on soil on cutting face in evergreen forest, 21 February 2006, T. Furuki and M. Suleiman 21060 (BORH–holotype; CBM–isotype).

Other specimen examined: MALAYSIA. Borneo, Sabah, Mt. Kinabalu, around the Headquaters 1500 m alt., on soil bank along trail, 21 Feb. 2006, H. Akiyama 19673

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The present new species is remarkably characterized by (1) small plants, (2) long lanceolate leaves, (3) small, rectangular dorsal lobes of leaves, (4) recurved apices of dorsal lobes of leaves, (5) dorsal lobes of leaves not imbricated the opposing ones, (6) nearly straight keels of leaves, (7) irregularly crenate margins of leaves with unicellular projections, (8) acute apices of leaves, (9) thick-walled leaf cells with small trigones, (10) papillose cuticle of leaf cells, (11) plants autoicous, (12) long perianths, (13) thick-walled cells of perianths, and (14) serrate mouths of perianths.

The acute and dentate leaves of the present new species remind us of the genus *Douinia*; however, it clearly differs from *Douinia* by its two spiral bands on the elater. *Douinia* has a spiral band on the elater, and only *D. ovata* (Dicks.) H. Buch has been known from Europe and North America.

The genus *Diplophyllum* is mainly distributed in the cool-temperate zone of both Hemispheres, and *D. nanum* Herzog has been known as the only species for the genus in tropical Southeast Asia, which was described from Borneo by Herzog (1951). *Diplophyllum nanum* is also reported from New Guinea (Piippo 1985), India (Srivastava et al. 1990) and Sri Lanka (Onraedt 1981), and it can be critically distinguished from the present new species by the round apices of the leaves and dioicous habit. Among the members of the genus, *D. apiculatum* (A. Evans) Steph. is the most closely related species to the present new species in having acute, dentate ventral lobes, the margin of the dorsal lobe not extending to the opposing ones, papillose cuticle of leaf cells, and autoicous plants. *Diplophyllum apiculatum* is endemic to North America (Schuster 1974) and it distinctly differs from the present new species by the ampliate basal half of the ventral lobe, oil bodies of leaf cells composed of distinct globules, short perianth and ciliate mouth of perianth.

*Diplophyllum domesticum* (Gottsche) Steph. also resembles the present new species in having acute and serrulate ventral lobes, squarrose-recurved dorsal lobes, and papillose surface of leaf cells. *Diplophyllum domesticum* is distributed in New Zealand, Tasmania and Australia (Engel and Smith Merrill 1998), and it differs from the present new species by the arched keel of leaves, appressed dorsal lobes, distinctly crenulate margin of wide dorsal lobes which margins extending to the opposing ones, arched keel of leaves, more serrate leaf margins, rounded female bracts, short perianth and more or less lacinate mouth of perianth with thin-walled cells.

We express our sincere thanks to the director of the Sabah Parks for giving us permission to study the bryophytes of Mt. Kinabalu, and the director and Dr. Akiyama of HYO for the specimen loan.

References
マレーシア・ボルネオ島において蘇苔類の分類学的な研究を進めている中で、タイ植物門ヒシャクゴケ科 Scapaniaceae シロコオイゴケ属 Diplophyllum に未記載種を見出し、分類学的な研究を行った。その結果、新種であるとの結論に達し、新種として Diplophyllum kinabaluense Furuki & M. Suleiman を記載した。シロコオイゴケ属は主に世界の冷温帯に分布しており、これまで東南アジアからは D. nanum Herzog が知られているだけである。D. nanum Herzog は雌雄異株で葉が円頭であるが、本種は雌雄独立同株で葉が尖っていることから、両種は明らかに別種である。また、本種は植物体が小さいこと、葉の腹片の先端が尖ることや、背片の先端が外曲すること、葉縁が不規則な鈍鋸歯状であること、葉身細胞が厚壁でトリゴンが小さいこと、細胞の表面が乳頭状であること、花被が長いこと、花被の先端が鋸歯状であること、花被の細胞が厚壁であることなどの特徴があり、本属の他種から区別できる。

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