

## Studies on the Hepaticae of Thailand

### IV. *Anastrophyllum* and allied genera

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(Received April 30, 1981)

Recently I had an opportunity to do a fieldwork in Thailand as a member of the botanical expedition which was financially supported by the Ministry of Education of our Government and organized by the Shinshu University, Matsumoto, under the leadership of Professor T. Shimizu. The expedition lasting from October to December, 1979, was successfully carried out in close cooperation with the Royal Forest Department, Bangkok, and we could botanize a number of places in various quarters of the country (the itinerary was given by Shimizu et al., 1980).

The expedition was the third one to Thailand for me, and this time approximately 1800 packets of bryophytes were collected (1200 of Hepaticae and 600 of Musci). Although this number of specimens is not so large for the three month trip, the collection is rather extensive covering many areas that have been little investigated before. The most important areas explored are Doi Chang (Chiangmai), Khao Soidao North (Chanthaburi), and Khao Pawta Luangkaeo (Ranong), because any other bryologists have not been there but I could botanize up to the summits of these high mountains.

The specimens of the Hepaticae from Thailand have been accumulated at hand by the collections of myself through three expeditions (1965-66, 67, 79), of Dr. A. Touw, Rijksherbarium, Leiden, and of some others. On the basis of these large collections I will continue after an interval of over ten years my serial studies on the Hepaticae of Thailand.

I should like to express my sincere thanks to Dr. Tem Smitinand and his staffs of the Royal Forest Department for their utmost kindness I received during the expedition. Deep gratitude is also due to Prof. T. Shimizu and other members of the expedition for their kind help and encouragement extended to me both in fieldwork and in laboratory research.

#### *Anastrophyllum bidens* (Reinw., Bl. et Nees) Steph.

Spec. Hepat. **2**: 115 (1901). — *Jungermannia bidens* Reinw., Bl. et Nees, Nova Acta Acad. Leop.-Carol. **12**(1): 208 (1824).

Specim. exam. Changrai: Mt. Doi Pacho, ca. 1500 m alt., on fallen log in evergreen forest, N. Kitagawa T3615. Chiangmai: Mt. Doi Suteh, 1500-1685 m alt., on tree-trunk in moist evergreen forest, N. K. T12144. Nakawn Sritamarat: Mt. Khao Luang, 1300-1780 m, on tree-trunk, humus-rich soil, and decaying fallen log, M. Tagawa & N. Kitagawa T4919,

4980, 5177.

Range. Widely distributed in eastern Asia and extending northward to Japan and southward to New Guinea and Solomon Isls.

This species was described and illustrated by Kitagawa (1966) on the basis of Japanese material. The species is characterized by the small plants (less than 10 mm long), the deeply (more than 1/2) bilobed and not closely imbricate leaves whose bases are rather narrow and hardly clasping the stem, and the relatively small trigones of leaf cells. In this species, the leading shoots are sometimes developed into positively geotropic flagella with reduced leaves, just as in *Andrewsianthus*. Indeed, *Anastrophyllum cephalozoides* Schiffn., a synonym of *A. bidens*, was transferred to *Andrewsianthus* by Schuster (1969) but his treatment is untenable as noted by Váňa (1974). Among the specimens cited above, no. T3615 refers to such a form with main shoots often becoming flagelliform. In this case, however, the intercalary branching is not of the *Anomoclada* type but always ventral (of the *Bazzania* type), and this makes it invalid to assign that form to the genus *Andrewsianthus*.

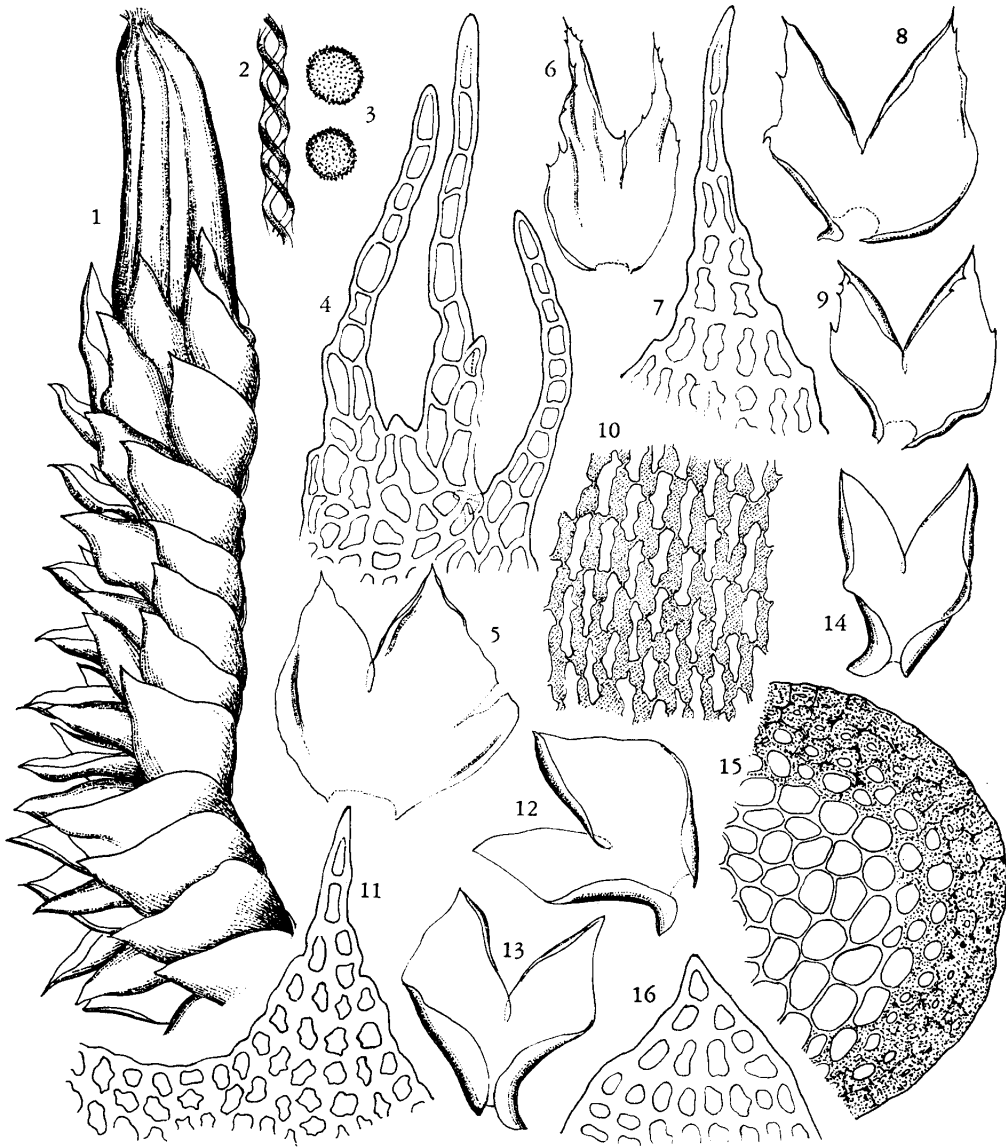
***Anastrophyllum piligerum* (Nees) Spruce**

Journ. Bot. London **14**: 235 (1876). — *Jungermannia piligera* Nees, Nova Acta Acad. Leop.-Carol. **12**(1): 414 (1824).

Plants large, dull brown in herbarium material, rigid, not varnished, usually forming a large, compact tuft. Shoots suberect, usually more than 30 mm long, 1.5–2.5 mm wide; branching rather sparse, intercalary and ventral; stems blackish brown, stiff, somewhat flattened, 16–22 cells thick, 20–27 cells wide (270–340  $\mu\text{m}$  wide), not differentiated dorsiventrally; cortical cells in 3–4 layers, deep brown, strongly thick-walled with small or vestigial lumens, medullary cells rather pellucid, relatively thin-walled, large, 18–26  $\mu\text{m}$  in cross-section; rhizoids few. Leaves densely imbricate, strongly secund dorsally, erect-spreading with bases clasping the stem, nearly transversely inserted, somewhat asymmetrical (the ventral half is larger than the dorsal), orbicular-ovate in outline (when expanded), 1.8–2.2 mm long and wide, bilobed for 3/5–2/3 the length; lobes triangular-ovate, concave-canaliculate; margins entire or with a few sharp teeth, more or less inflexed; apices subacute to acuminate, often terminated into a setulose cell. Leaf cells regularly seriate longitudinally, of the apex subsodiametric, 10–20  $\mu\text{m}$  (in lumens), of the middle 16–35 $\times$ 7–13  $\mu\text{m}$ , of the base strongly elongate, 40–80 $\times$ 7–13  $\mu\text{m}$ ; trigones very large (larger than lumens), pale brown; cuticle smooth to asperous.

Plants dioicous. Perianth highly emergent, cylindrical-obovoid, 5-plicate nearly for the whole length; mouth long ciliate; bracts somewhat larger than leaves, erect and sheathing the perianth, deeply 2-lobed (rarely 3-lobed), with margins entire or remotely dentate-ciliate; a single subfloral innovation usually present. Spores reddish brown, 12–16  $\mu\text{m}$ , minutely papillate; elaters very long, often over 400  $\mu\text{m}$  long, 6–8  $\mu\text{m}$  thick, bispiral. (Fig. 1).

Specim. exam. Loey: Mt. Phu Luang, 1500 m alt., on rock in shrubby field, M.



**Fig. 1.** *Anastrophyllum piligerum* (Nees) Spruce. 1. Portion of shoot, with a female inflorescence,  $\times 9$ . 2. Median part of elater,  $\times 700$ . 3. Spores,  $\times 700$ . 4. Cells of perianth mouth,  $\times 280$ . 5, 6. Female bracts,  $\times 8$ . 7, 16. Cells of leaf apices,  $\times 280$ . 8, 9, 12-14. Leaves,  $\times 9$ . 10. Cells of leaf middle,  $\times 280$ . 11. Cells of marginal tooth of leaf,  $\times 280$ . 15. Cross-section of stem,  $\times 280$ . Drawn from M. T. & N. K. T4920.

Tagawa & N. Kitagawa T19220. Trang: Mt. Khao Chong, 800-1100 m alt., on tree-trunk in rain forest, M. T. & N. K. T6928. Nakawn Sritamarat: Mt. Khao Luang, 1780 m alt., on tree-trunks and humus-rich soil in moist shrubby forest in the summit area, M. T. & N. K. T4896, 4904, 4920, 4968, 4973, 4979.

Range. Widely distributed in tropical Asia, Oceania, Central and South America.

This species shows a wide range of variation in size, and the above description was made on the basis of robust plants occurring abundant in the summit area of the Khao Luang Mountain. The robust plants correspond well with *Anastrophyllum imbricatum* (Wilson et Nees) Steph. described from Ceylon, which was reduced to a synonym of *A. piligerum* by Stephani (1901)—Schiffner (1900) regarded the robust plants as typical for *A. piligerum*. *Jungermannia incubens* Lehm. et Lindenb. from Tristan d'Acunha, another synonym of *A. piligerum*, represents a small form with widely spreading (often squarrose) leaves and smaller, not so strongly nodulose trigones of leaf cells. The type material of *A. piligerum* from Java represents an intermediate form between them, and a series of various intergrading forms make it impossible to draw a clear line for specific separation among them.

Some plants bear leaves with sharp marginal teeth (Fig. 1, 8, 9)—this character seems to be rather important, as the dentate leaves are rarely found in the subgenus *Anastrophyllum* (although common in the subgenus *Zantenia*) and they are correlated with such other character as the more elongate apices of leaf lobes, the dentate-ciliate margins of female bracts and the longer cilia at the perianth mouth. However, I am not inclined to separate taxonomically such plants from the typical ones with simply bilobed and otherwise entire leaves, because both plants together with various intermediates are often growing side by side in the same tuft.

***Andrewsianthus puniceus* (Nees) Schust.**

Rev. Bryol. Lichénol. **30**: 66 (1961). — *Jungermannia punicea* Nees, Hepat. Jav. 32 (1830).

Specim. exam. Chiangmai: Mt. Doi Suthep, 1570 m alt., on tree-trunk in hill evergreen forest, N. Kitagawa T24213; Mt. Doi Chang, 1700 m alt., on tree-trunk in dense evergreen forest, N. K. T24525. Nakawn Sritamarat: Mt. Khao Luang, 1600–1780 m alt., on tree-trunks and rocks in moist shrubby forest, M. Tagawa & N. Kitagawa T4908, 4909, 4929, 4959, 5039.

Range. Thailand, Ceylon, Sumatra, Celebes, N. Borneo, New Guinea, Micronesia (Ponape Isl.).

This species was fully described by Schuster (1961) when he proposed a new genus *Andrewsianthus* for it. The diagnostic characters of the genus are the *Anomoclada*-type branching (intercalary and from the antical end of the leaf axil) and the positively geotropic flagella bearing reduced leaves.

The species shows a considerable range of variation even among a small number of specimens cited above. In the specimens from the Khao Luang Mountain lying in the southern, peninsular region, the plants are relatively large, olive-green, often developing perianths, and bearing rather wide (broadly ovate) leaves, while, in those from the Doi Suthep and Doi Chang Mountains situated in the dry region of northern Thailand, the

plants are very small and reddish brown, and with narrow (oblong-ovate) leaves. In all specimens from both regions, the leaves are in most cases shallowly bilobed with crescent sinuses and subacute to acute lobes but sometimes they are merely retuse to truncate or even rounded at apices.

***Denotarisia linguifolia*** (De Not.) Gro.

Feddes Repert. **82**(1): 6 (1971). — *Plagiochila linguifolia* De Not., Mem. Real. Accad. Sci. Torino, ser. 2, **28**: 277 (1874).

Specim. exam. Loey: Mt. Phu Luang, ca. 1500 m alt., on tree-trunk in shrubby field in its ridge, M. Tagawa & N. Kitagawa T1669.

Range. Widely distributed in tropical Asia and extending to New Caledonia, Fiji and Tasmania.

This species has been repeatedly described and illustrated; by De Notaris (1874) under the name of *Plagiochila linguifolia*, by Schiffner (1893) under *Jungermannia (Jamesoniella) ovifolia*, by Kitagawa (1970) under *Jamesoniella pulchra*, and by Grolle (1971) under *Denotarisia linguifolia*.

A single collection was made in Thailand and a few plants were found in a mat associated with *Jamesoniella flexicaulis*, *Bazzania bilobata*, *Thysananthus spathulistipus*, etc. The material is sterile but the identification is warranted by the postical flagella with reduced leaves and especially by the characteristic structure of leaf cells (each trigone of leaf cells is strongly nodulose and bear triradial canals).

***Jamesoniella contracta*** (Reinw., Bl. et Nees) N. Kitag.

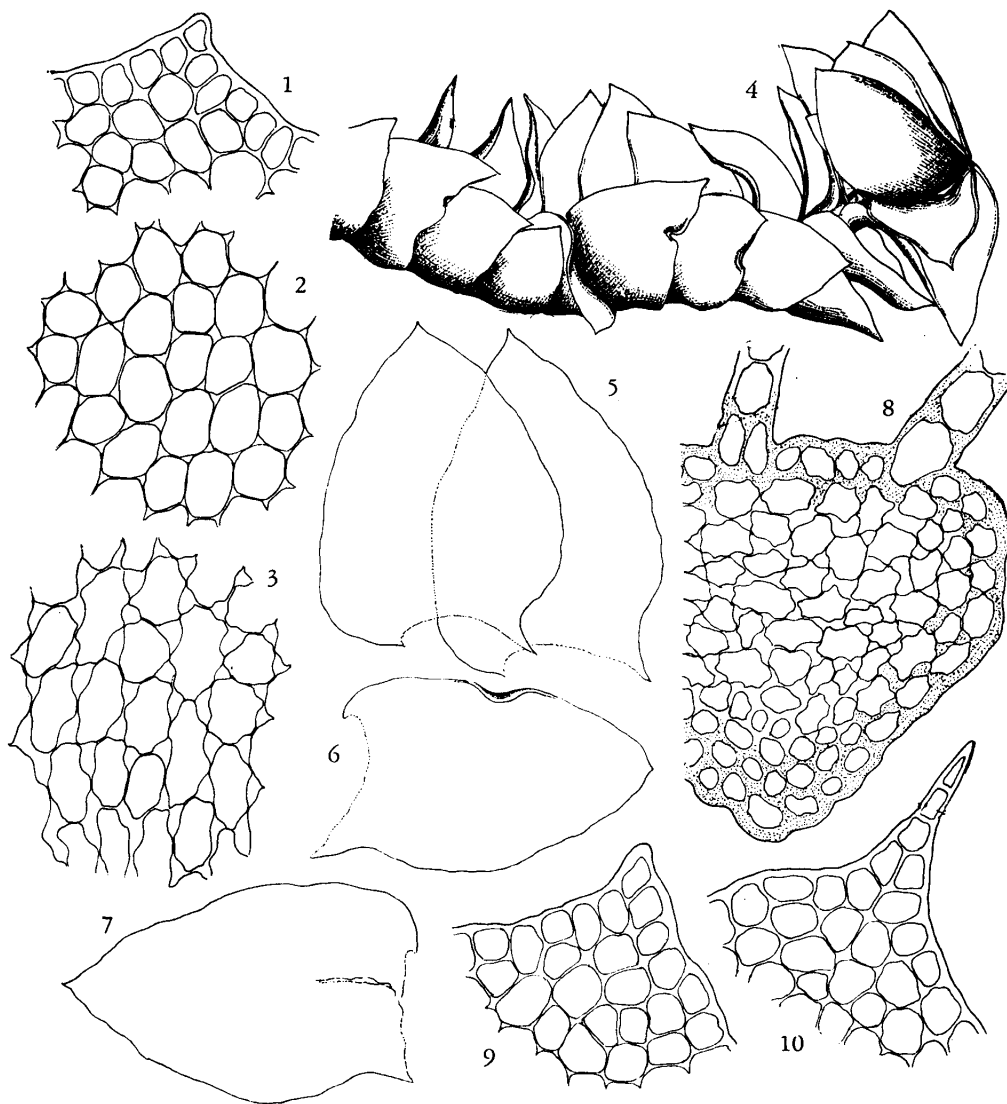
comb. nov. — *Jungermannia contracta* Reinw., Bl. et Nees, Nova Acta Acad. Leop.-Carol. **12**(1): 223 (1824). — *Cuspidatula contracta* (Reinw., Bl. et Nees) Steph., Spec. Hepat. **2**: 223 (1901).

Plants rather large, yellowish brown to reddish brown in herbarium material, fragile, weakly varnished, usually in dense, thin mats. Shoots prostrate with ascending tips, 15-30 mm long, 1.5-2.3 mm wide; branching sparse, mostly terminal and of the *Frullania*-type; stems pale brown, somewhat flattened, 10-13 cells thick, 10-15 cells wide (250-380  $\mu$ m wide), slightly differentiated dorsiventrally; cortical cells in 1-2 layers, with very thick and pale brown walls, the dorsal cortical cells 15-22  $\mu$ m, the ventral smaller, 12-18  $\mu$ m, medullary cells larger, 22-33  $\times$  12-20  $\mu$ m, thin-walled and with large, bulging trigones; rhizoids often abundant below, hyaline, rather short, often with branched tips adhering closely to the substrata. Leaves rather densely imbricate, secund dorsally, widely spreading, weakly concave, obliquely and widely inserted, nearly symmetrical, unlobed, ovate to oblong ovate, 1.1-1.6 mm long, 0.8-1.3 mm wide; the distal portion often broken off (fragmentation occurring along the middle lamellae of cells); apices subacute to acuminate, occasionally obtuse to rounded; margins nearly entire (the ventral margin rarely with a blunt tooth or edge); dorsal bases short decurrent. Underleaves absent. Cells of the leaf middle 22-30  $\times$

20–30  $\mu\text{m}$ , thin-walled and with acute to slightly bulging trigones, of the base very large, 35–70  $\times$  25–30  $\mu\text{m}$ , with large, strongly bulging trigones separated by thin walls; cuticle faintly striate-verrucose. (Fig. 2).

Specim. exam. Nakawn Sritamarat: Mt. Khao Luang, 1200 m alt., on tree-trunk in rain forest, M. Tagawa & N. Kitagawa T5244, on decaying log, M. T. & N. K. T5191.

Range. Widely distributed in tropical Asia and extending to Fiji, Samoa, Tahiti and



**Fig. 2.** *Jamesoniella contracta* (Reinw., Bl. et Nees) N. Kitag. 1, 9, 10. Cells of leaf apices,  $\times 280$ . 2. Cells of leaf middle,  $\times 280$ . 3. Cells of leaf base,  $\times 280$ . 4. Portion of shoot,  $\times 14$ . 5–7. Leaves,  $\times 28$ . 8. Cross-section of stem,  $\times 280$ . Drawn from M. T. & N. K. T5191.

Seychelles.

I have noticed that *Cuspidatula contracta* is very closely related to *Jamesoniella flexicaulis* and there occur some intermediates between both species (Kitagawa 1970). Although the former is typically distinguished by the pointed leaf apices, but this distinction is not always reliable—the leaves of the former are occasionally obtuse to rounded at apices, while those of the latter are rarely pointed as noted by Grolle (1971). Indeed, I have several specimens of intermediate forms from Thailand, which can not be determined definitely. As it is not reasonable to separate so closely interrelated species into different genera, I propose here to transfer *Cuspidatula contracta* to the genus *Jamesoniella*. This treatment makes inevitably the genus *Cuspidatula* a synonym of *Jamesoniella*, because Grolle (1971) designated this species (*Jungermannia contracta*) as the lectotype of *Cuspidatula*. Therefore another species *C. monodon* (Hook. f. et Tayl.) Steph. is also to be transferred to *Jamesoniella* [***Jamesoniella monodon*** (Hook. f. et Tayl.) N. Kitag., comb. nov.—*Jungermannia monodon* Hook. f. et Tayl., Journ. Bot. London **3**: 559 (1844)]. *Jamesoniella monodon* widely distributed in Oceania and disjunctively in Peru is different from *J. contracta* in the smaller plants, the more sharply pointed, elongate leaf apices and the larger, strongly nodulose trigones of leaf cells.

***Jamesoniella flexicaulis* (Nees) Schiffn.**

Consp. Hepat. Arch. Ind. 78 (1898). — *Jungermannia flexicaulis* Nees, Linnaea **6**: 604 (1831).

Specim. exam. Loey: Mt. Phu Luang, 1400–1500 m alt., on rocks and tree-trunks in shrubby field along ridge, M. Tagawa & N. Kitagawa T1321, 1331, 1631, 1633, 1658, 1731. Nakawn Sritamarat: Mt. Khao Luang, 1780 m alt., on tree-trunks in shrubby forest in the summit area, M. T. & N. K. T4894, 5202.

Range. Widely distributed in tropical Asia and extending to New Caledonia, Tahiti and Caroline Isls.

This species was fully described and illustrated by Grolle (1971). Among the above specimens, T4894 is different from others in the leaves which are very densely imbricate, strongly secund dorsally and so extremely fragile that their distal halves even of shoot apices are mostly broken off—the leaves are easily fragmented into pieces exclusively along the middle lamellae of cells as in the case of *Jamesoniella contracta*.

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