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# Re-evaluation of *Hymenostylium xanthocarpum* (Hook.) Brid., and *Ardeuma* R.H.Zander & Hedd., a new name for all other species of *Hymenostylium* (Pottiaceae, Bryophyta)

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The Old World *Hymenostylium xanthocarpum*, the generitype of *Hymenostylium*, was found to be unrelated to the widespread *H. recurvirostrum* and other species currently placed in the genus. Major distinguishing traits of *H. xanthocarpum* are the presence of a stem central strand, leaves broadest about midleaf and constricted just above the base, distal laminal cells usually ventrally bulging and massively unipapillose, and basal cells differentiated only in the lower 1/5–1/7 of the leaf. A new genus name, *Ardeuma*, is proposed for the remaining species of *Hymenostylium*, and combinations are made for those that are commonly recognized. A key to *Tuerckheimia* species in the New World that may be confused with *H. xanthocarpum* is provided.

**Keywords:** Cameroon, India, La Réunion, Nepal, *Tuerckheimia*

## Introduction

*Hymenostylium* was erected by Bridel (1827) as a monotypic genus to accommodate *Gymnostomum xanthocarpum*—a species described by Hooker (1819) based on material from Nepal. The concept of the genus was later broadened, especially by H. N. Dixon, to accommodate numerous other species, and has been accepted for nearly two centuries much as was characterized by Zander (1993: 123–7).

Examination of recent collections of a distinctive moss from the island of La Réunion that clearly match the type of *Hymenostylium xanthocarpum* (Hook.) Brid. prompted us to re-evaluate the concept of the genus. Given the consistency among species of the genus as typically circumscribed, the generitype is quite different in having a stem central strand, leaves narrowly to broadly elliptical and widest near mid leaf but constricted above the low, sheathing base, with differentiated juxtacostal basal laminal cells restricted to near the insertion, medial laminal cells usually bulging adaxially and only weakly convex abaxially, and laminal papillae usually single and covering half or more of the lumen. Based on

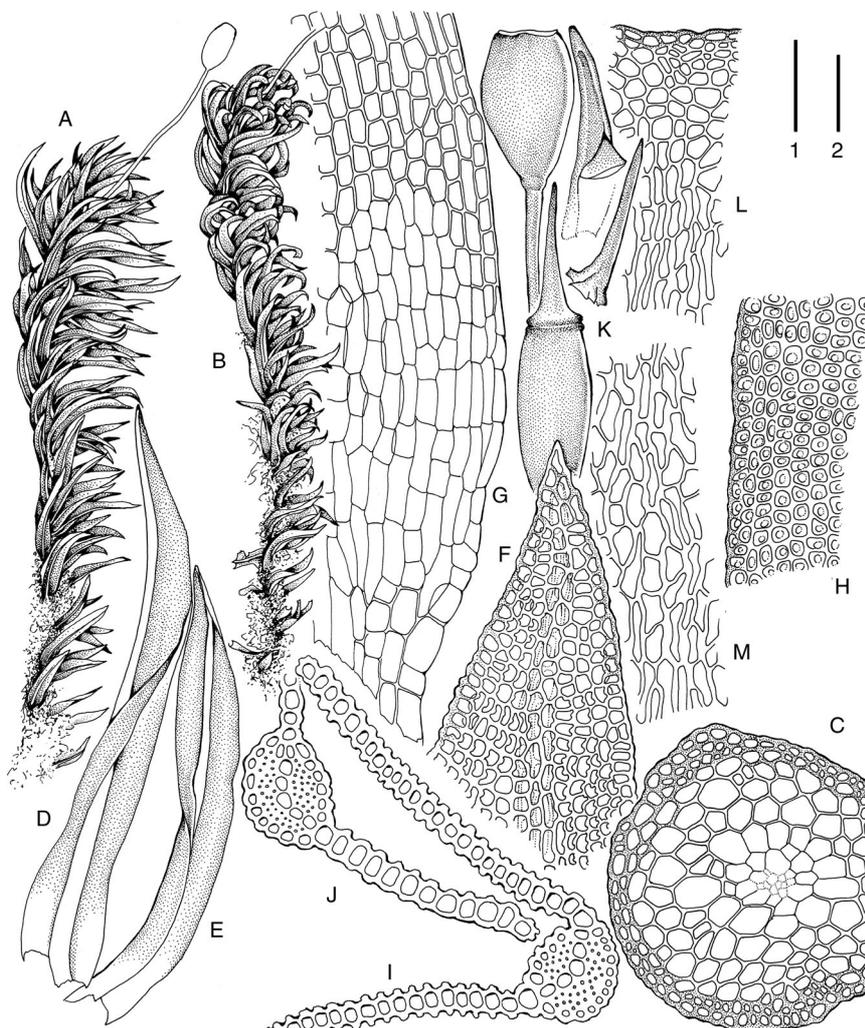
examination of many specimens we conclude that a new genus must be devised for other *Hymenostylium* species, including the well-known and widely distributed *H. recurvirostrum* (Hedw.) Dixon.

***Hymenostylium*** Brid., Bryol. Univ. 2: 81. 1827.

Type species: *Hymenostylium xanthocarpum* (Hook.) Brid., Bryol. Univ. 82. Suppl. 3. 1827, here emended.

*Plants* growing in turfs or cushions, dark green, *seldom glossy*, not glaucous above, *light brown below*. *Stems* often branching, 4(–6) cm in length, not papillose, transverse section rounded-pentagonal, *central strand present*, sclerodermis present, *hyalodermis absent; often with a dense red tomentum*. *Leaves* crowded on stem, appressed-incurved, sometimes twisted or lax when dry, spreading from a short base when moist, usually markedly secund at apex, *ligulate to lanceolate to long-elliptic*, ca 2–4 mm in length, *distal lamina broadly channeled*, *margins plane distally*, *weakly narrowly recurved in the proximal 1/3 on one or both sides*, *entire*, unistratose; *apex acute*; *base widened near insertion*; *costa stout*, ending 1–2 cells before apex or percurrent as a sharp mucro, *superficial cells short-rectangular or occasionally quadrate adaxially*, four rows of cells

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**Figure 1.** *Hymenostylium xanthocarpum*. (A) Habit, wet. (B) Habit, dry. (C) Stem transverse section. (D–E) Leaves. (F) Leaf apex. (G) Leaf base. (H) Leaf distal margin with papillae. (I–J) Mid-leaf transverse sections. (K) Capsules, opercula, calyptra. (L) Capsule mouth detail. (M) Exothecial cells. Scale bars: 1 = 5 mm for (A–B); 50 µm for (C, F–J, L–M); 2 = 1 mm for (D–E); 0.7 mm for (K).

across costa ventrally at midleaf, costal transverse section semicircular to round, two stereid bands present, *epidermis present adaxially and abaxially*, guide cells 4 in 1 layer, hydroid strand absent; distal laminal cells usually heterogeneous in size and shape, quadrate to rectangular or rhomboidal, *ca 12.5–15 µm in width, 1:1, walls moderately thick-walled, not porose except occasionally just distal to leaf base, superficially bulging-convex adaxially and weakly convex to flat dorsally but occasionally merely convex on both sides*, unistratose; *papillae large, simple, centered over the lumens*, rarely absent; basal cells differentiated juxtacostally or across leaf, rectangular, somewhat wider than medial cells, 2–4:1, walls thin to porose.

Dioicous. *Perichaetial leaves terminal*, little different from the cauline, narrower. Seta 1–2 per perichaetium, brown, 6–6.5 mm long. Capsule not systylious, brown, ovate to subglobose, macrostomous, theca 0.8–1.5 mm in length; exothecial cell walls thick to internally

irregularly thickened; cells at mouth shorter, stomates phaneropore, at base of capsule. Operculum long-rostrate, oblique, 1.3–1.6 mm long. Calyptra long-cucullate, *ca 1.5 mm in length, smooth*. Spores 13–18 µm in diameter, brown, papillose. Laminal KOH colour reaction yellow.

***Hymenostylium xanthocarpum* (Hook.) Brid.**

(Figure 1)

≡ *Gymnostomum xanthocarpum* Hook., Musci Exotici 2: 153. 1819, basionym. ≡ *Leptostomum xanthocarpum* (Hook.) Spreng., Syst. Veg. [Sprengel] 4: 148. 1927. ≡ *Pottia xanthocarpa* (Hook.) Müll.Hal., Syn. Musc. Frond. 1: 563. 1849. **Type:** Nepal, Hon. D. Gardner, s.n. (BM!—lectotype selected here as H. 1795 ‘origl. spm.’ barcoded BM000867156).

= *Merceyopsis robusta* Dixon, Ann. Bryol. 3: 59. 1930. ≡ *Tuerckheimia robusta* (Dixon) R.H.Zander, Bull. Buffalo Soc. Nat. Sci. 32: 94. 1993. **Type:** India, near Poona, Youngson 148, 1915 (BM!—holotype). *Syn nov.*

As the genus is now monotypic, the generic description suffices for the species. The lectotype we selected at BM is labelled H. 1795, 'origl. spm.' Nepal, Hon. D. Gardner, 4/57, near the margin of the rather crowded sheet at about 7 o'clock. The same sheet includes two segregates of the same collection, and other specimens of varied provenance, including, *inter alia*, *Hymenostylium insigne* (Dixon) Podp. It is thus more understandable that Dixon (1927), in response to a query from Andrews (1926), the former having seen the BM material, felt that *H. xanthocarpum* fell within the variation of *H. recurvirostrum*, and sent the former name into synonymy. Aziz and Vohra (1988) asserted, correctly, that *H. xanthocarpum* was indeed a good species quite distinct from *H. recurvirostrum*, emphasizing the lanceolate to spatulate leaf shape, but also describing the thickened laminal papillae, one per cell, subglobose capsule, and stem central strand present. Later, however, Aziz and Vohra (2008) presented *H. xanthocarpum* in India as a synonym of *H. recurvirostrum* but described and illustrated the latter with material mostly of *H. xanthocarpum*.

*Hymenostylium* in the sense circumscribed here has only one species, *H. xanthocarpum*, and differs from other species previously placed in the genus by the stem central strand, distal laminal cells with angular (but not trigonous) cell walls that usually bulge adaxially and are nearly flat distally, the usual presence of 1(–2) lens-like papillae over each lumen, and differentiated basal cells restricted to the proximal 1/6–1/7 of the leaf (Figure 1).

The constriction in the leaf of *H. xanthocarpum* just above the somewhat widened leaf base is quite like that of *Anoetangium* Schwägr. species, e.g., *A. stracheyanum* Mitt., but that genus, apart from being much smaller, differs by the lateral perichaetia, scattered or multiplex laminal papillae and the single stereid band in the costa, which also lacks an adaxial epidermis.

*Hymenostylium xanthocarpum* differs from *Tuerckheimia* Broth. species, which also have a similar leaf shape (long-lanceolate, with differentiated basal cells restricted to very near the leaf base), in that the laminal margins are smooth, the distal laminal papillae often bulge strongly adaxially, and the papillae are smooth, low mounds, not thick and irregular or 2(–3)-fid. *Tuerckheimia robusta* (Dixon) R.H.Zander is a new synonym; leaves and leaf sections were illustrated as *T. robusta* by Zander (1993: 93).

*Trichostomum* Bruch species that are superficially similar, e.g. *T. aequitoriale* Spruce ex Dixon and *T. crispulum* Bruch in F.Müll., differ significantly in having a larger leaf basal cell area that is differentiated in the lower 1/4 of the leaf, and papillae that are either multiplex or simple to bifid and scattered over the

lumens, not massively simple and centered. The broadly incurving distal lamina of *H. xanthocarpum* is probably due to the adaxially bulging distal laminal cells, which are cut more deeply between the cells adaxially than abaxially, and this is also the case in *Trichostomum*, *Weissia* Hedw., and *Weissiodicranum* Reese in Reese & Buck, in which distal laminal cells are often more strongly bulging adaxially than abaxially but which are either obscured by the multiplex laminal papillae or are essentially epapillose.

*Quaesticula* R.H.Zander also has large, thick, simple laminal papillae on both sides of the laminae. It differs immediately in the oblong leaves and rounded apex, which is somewhat cucullate, the leaf margins are clearly incurved, and the laminal cells bulge strongly on both sides of the lamina. The laminal papillae also differ somewhat in being thickened extensions of the bullate laminal cells, while those of *H. xanthocarpum* are distinct, and not always present on all the distal cells of a leaf or even in a plant. *Tuerckheimia calculosa* R.H.Zander is now recognized as *Quaesticula navicularis* (Mitt.) R.H.Zander to account for the well-developed peristome and strongly incurved distal laminal margins.

*Plaubelia* Brid. species have adaxially bulging distal laminal cells that may have papillae that are fairly small, ca 1/5–1/4 the lumen, 1–2 per lumen and occurring only abaxially, but sometimes relatively large 1/3–1/2 the lumen, 1–2 per lumen abaxially, and 1 per lumen adaxially. The genus differs in the spatulate leaf shape, the occasional presence of a hydroid strand in the costa, and the presence of a peristome of 16 short, straight, or weakly twisted teeth.

Among the less well-distributed species with similar areolation, the Asian *Trichostomum bombayense* Müll.Hal. is similar, but differs in the broader upper lamina (20–30 cells from margin to costa at midleaf versus 10–20 in *H. xanthocarpum*), distal laminal cells that appear to be mammillose but which are merely strongly bulging and have distinct multiple small papillae over each lumen.

The genus *Hymenostyliella* Bartr. differs in the involute distal lamina, and the distal laminal cells bulging only adaxially and lacking papillae. *Scopelophila cataractae* (Mitt.) Broth. is similar in leaf shape, but has leaves wider above, lacks papillae, has only one stereid band in the costa, and lacks a stem central strand.

The evolutionary relationships of *Hymenostylium* as here emended are apparently with *Plaubelia* and *Hyophila* Brid., which have similar traits, particularly the basal laminal cells differentiated in a small area across the insertion and the ventrally bulging upper laminal cells, but species of these genera have broadly ligulate leaves and weakly excurrent or

percurrent costa. These relationships may be phylogenetically resolved with molecular data.

The species (and genus) is currently known from Nepal and India, and here newly recorded for La Réunion and Cameroon. This rather anomalous distribution suggests that *Hymenostylium xanthocarpum* might be more widespread in tropical portions of Africa. Many names exist in genera that could plausibly be confused with this species, and an examination of these would help to clarify its distribution.

On La Réunion *H. xanthocarpum* is not uncommon on damp basalt cliffs at mid altitude (700–1300 m), where it can form large cushions on ledges and vertical faces. It also occurs in extensive mats on flat volcanic slabs along river margins. In both situations it can be a rather abundant component of the vegetation. We have little information on its ecology in the rest of its range, but label information for the Cameroon specimen indicates that it grew ‘on wall of gully’—consistent with the habitats that it occupies on Réunion. Other specimens cite ‘dry forest along ravine of small stream, edge of vegetation mats on slabs’, ‘on rock walls along road’, ‘basalt cliffs near roadway’, and ‘damp basalt rock face in small stream ravine.’

**Other specimens examined: Republic of Cameroon:** Victoria, Monyange, S side of Cameroun Mountain, 4°12'N, 9°11'E, 2500 m a.s.l., April 1945, *E. W. Jones 494* (MO, BOL). **La Réunion:** Commune Cilaos, Cirque de Cilaos, Cascade Bras Rouge, 21°06'S, 55°27'27.6"E, 1220 m a.s.l., 4 October 2011, *T. A. Hedderson 17897, 17902* (BOL, MO), 5 December 2014, *T. A. Hedderson 18843, 18845, 18847* (BOL, MO, REU); Rivier Gobert, 1290 m a.s.l., 5 December 2014, *T. A. Hedderson 18847-1, 18850* (BOL, MO, REU); Rivier Fleurs Jaunes, 1300 m a.s.l., 5 December 2014, *T. A. Hedderson 18851* (BOL, MO, REU); Commune La Possession, Cirque de Mafate, Canalisation des Orangers, along trail at turnoff to Îslet des Lataniers, 710 m a.s.l., 13 October 2006, *T. A. Hedderson 16396* (BOL). **Nepal:** sin. loc., sin coll., s.d., *H. 181*, (BM).

*Ardeuma* R.H.Zander & Hedd., **gen. nov.**—Type: *Ardeuma recurvirostrum* (Hedw.) R.H.Zander & Hedd. ( $\equiv$  *Gymnostomum recurvirostrum* Hedw.)

*Caulis filo centrali nullo, tomento brunnescente praeditus. Folia ligulata vel lanceolata vel lineari-lanceolata, lamina distali carinata ad basim latissima, marginibus planis vel proximaliter per latus alterum vel ambo late recurvatis, plerumque integris, apice saepius longe acuto, interdum obtuso vel rotundo; base ovali vel rectangulari, costa saepius in mucronem latem excurrente, epidermide adaxialiter nullo, funiculo hydroideo nullo, cellulis distalibus laminarum latitudine usque 8–10  $\mu$ m, 1–3:1, utrinque aequiconvexis, papillis*

*humilibus, simplicibus vel granularibus. Perichaetia terminalia. Peristomium absens.*

*Plants* growing in turfs or cushions, often flagellate, light green, *often glossy*, occasionally glaucous above, light brown below. *Stems* often branching, to 3(–8) cm in length, occasionally papillose, *transverse section rounded-pentagonal to triangular, central strand absent*, sclerodermis present, *hyalodermis usually absent; with a brownish tomentum*. *Leaves* often distant on stem, appressed-incurved, sometimes twisted or lax when dry, spreading from a moderately sheathing base, occasionally squarrose when moist, *ligulate to lanceolate or linear-lanceolate, ca 2–3(–3.5) mm in length, distal lamina keeled, margins plane to broadly recurved* (occasionally revolute) *along 1 or both sides proximally, entire or rarely serrulate near apex by projecting cell walls, rarely bistratose in patches along margins or medially; apex usually long-acute, occasionally obtuse or rounded; base oval or rectangular, occasionally narrowly decurrent; costa often stout*, sometimes ending 1–2 cells below apex or percurrent or more usually excurrent as a broad mucro, often ‘scalloped’ along margins by projecting cell walls, *superficial cells usually elongate ventrally, 2–4 or occasionally several rows of cells across costa ventrally at midleaf, two stereid bands usually present, the dorsal crescent-shaped, epidermis absent adaxially, often absent abaxially, guide cells 2–4 in 1 layer, hydroid strand absent; distal laminal cells usually heterogeneous in size and shape, quadrate to rectangular or rhomboidal, ca 8–10  $\mu$ m in width, 1–3:1, walls thin-walled to trigonous, often porose, superficially flat to somewhat convex, seldom bistratose in patches; papillae low, simple to granular, centered to scattered, rarely absent; basal cells differentiated across leaf, rectangular, little wider than medial cells, 2–4:1, walls thin to porose.*

Dioicous. *Perichaetia terminal*, inner leaves weakly differentiated. Seta to 10 mm in length, 1 per perichaetium, reddish or yellowish-brown. Capsule occasionally systylious, theca *ca 1 mm in length, yellowish or reddish-brown, ovoid to short-rectangular, exothecial cells thin- to thick-walled, stomates phaneropore, at base of capsule, annulus weakly vesiculose; peristome absent. Operculum narrowly rostrate, occasionally long-conic from a flaring base, oblique, ca 0.5–1 mm in length, cells straight. Calyptra cucullate, smooth, ca 1–1.5 mm in length, smooth. Spores 12–14  $\mu$ m in diameter, brown, weakly papillose. Laminal KOH colour reaction yellow.*

*Ardeuma* is proposed as a euphonious replacement generic name for species of *Hymenostylium* other than the unique *H. xanthocarpum*. These are characterized by a lack of a stem central strand, laminal cells not adaxially bulging, laminal papillae small and multiple over each lumen, basal laminal cells gradually

differentiated in a high leaf base, and leaves widest at base. The name is from the Greek *ardeuma*, a watering (Brown, 1956: 854), and is neuter in both Greek and Latin. New combinations with this name are given for all combinations in *Hymenostylium* that are commonly accepted, i.e., most have an exclamation mark signifying general acceptance in the listings for the genus *Hymenostylium* in Tropicos. The South American species *Hymenostylium contextum* Herzog, *H. kunzeanum* (Müll.Hal.) Müller, and *Hymenostylium longopulvinatum* Dusén were recently considered synonyms of *Hymenostylium recurvirostrum* by Cano and Jiménez (2013), and are not transferred to *Ardeuma* here.

*Ardeuma aurantiacum* (Mitt.) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium aurantiacum* Mitt., J. Proc. Linn. Soc., Bot., Suppl. 1: 32. 1859, basionym. = *Hymenostylium congoanum* Dixon & Naveau. **syn. nov.**

*Ardeuma crassinervia* (Broth. & Dixon) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium crassinervium* Broth. & Dixon, Smithsonian Misc. Collect. 69: 12. 1918, basionym.

*Ardeuma dicranelloides* (Broth. ex Dixon) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium dicranelloides* Broth. & Dixon, Bryologist 30: 109. 1928, basionym.

*Ardeuma diversifolium* (J.Froehl.) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium diversifolium* J.Froehl., Ann. Naturhist. Mus. Wien 67: 152. 1964, basionym.

*Ardeuma filiforme* (Dixon) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium filiforme* Dixon., Ann. Bryol. 3: 54. 1930, basionym.

*Ardeuma grandirete* (Dixon) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium grandirete* Dixon, Anniv. Vol. Bot. Gard. Calcutta 178. 1942, basionym.

*Ardeuma hildebrandtii* (Müll.Hal.) R.H.Zander & Hedd., **comb. nov.**

*Weissia hildebrandtii* Müll.Hal., Linnaea 40: 298. 1876, basionym.

*Ardeuma insigne* (Dixon) R.H.Zander & Hedd., **comb. nov.**

*Weissia recurvirostra* var. *insignis* Dixon, J. Bot. 40: 377. 1902, basionym.

*Ardeuma papillinerve* (Dixon) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium papillinerve* Dixon, Kongel. Norske Vidensk. Selsk. Skr. (Trondheim) 1932(4): 21. 1932, basionym.

*Ardeuma recurvirostrum* (Hedw.) R.H.Zander & Hedd., **comb. nov.**

*Gymnostomum recurvirostrum* Hedw., Sp. Musc. Frond.: 33. 1801, basionym.

*Ardeuma rigescens* (Müll.Hal.) R.H.Zander & Hedw., **comb. nov.**

*Weissia rigescens* Müll.Hal., Syn. Musc. Frond., 1: 659. 1849, basionym.

*Ardeuma scaturiginosum* (Besch.) R.H.Zander & Hedd., **comb. nov.**

*Gymnostomum scaturiginosum* Besch., Ann. Sci. Nat., Bot., sér. 6, 9: 300. 1880, basionym.

*Ardeuma sinense* (Sakurai) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium sinense* Sakurai, Bot. Mag. (Tokyo) 62: 104. 1949, basionym.

*Ardeuma subcrispulum* (Thér.) R.H.Zander & Hedd., **comb. nov.**

*Hymenostylium subcrispulum* Thér., Recueil Publ. Soc. Havraise Études Diverses 92: 15. 1926, basionym.

The name *Gymnoweissia* (Bruch & Schimp.) Mont., based on *Gymnostomum* subg. *Gymnoweisia* Bruch & Schimp, has been placed in the synonymy of *Hymenostylium*, and we have evaluated its availability. Examination of the protologue showed that *Gymnostomum* subg. *Gymnoweissia* included two species, *Gymnostomum bicolor* B. & S. [= *Barbula bicolor* (Bruch & Schimp.) Lindb.] and *Gymnostomum tenue* Schrad. ex Hedw. [= *Gyroweisia tenuis* (Schrad. ex Hedw.) Schimp.]. The former is the type of *Gymnobarbula* J.Kučera, an unrelated genus, which may be antedated by *Gymnoweissia*. The latter is the lectotype of the genus *Gyroweisia* Schimp. Thus, *H. recurvirostrum* and relatives have no available alternative genus name.

The fact that *Ardeuma* includes three species, *A. aurantiacum*, *A. insigne*, and *A. recurvirostrum*, that are well-characterized in sharing apparently advanced traits of lack of stem central strand, and Leptodontoid leaf section and shape (Zander, 1977; Cano & Jiménez, 2013), makes it easier to see these three as part of an integral genus of the dissilent sort (Zander, 2013: 83), evolutionarily isolated from *H. xanthocarpum*. Chen (1941) illustrates, in his treatment of *Gymnostomum* Hedw. in China, *A. aurantiacum*, *A. insigne* (as *G. subrigidulum*), *A. recurvirostrum*, and *H. xanthocarpum* (this last not presently known for China) each with their distinctive areolation and leaf shape. The five specimens of *Hymenostylium recurvirostrum* cited by Zander (1977) as having a central strand are all, alas, misidentifications. *Anoetangium aestivum* by its broadly lanceolate leaf shape and angular lumens may seem much like *H. aurantiacum* or *H. xanthocarpum*, having a central strand in the stem and smallish scattered laminal papillae, but it has only one, central stereid band in the costa. (Example, Haiti, Bartlett

17818, MICH, cited by Zander, 1977, as *H. recurvirostrum*.)

Although it is true that certain species of the genera *Oxystegus* (Limpr.) Hilp. and *Tortella* (Lindb.) Limpr. may vary in expression of a stem central strand, this is not the case in *Ardeuma*. At least in the three most common and well-known species, *A. aurantiacum*, *A. insigne*, and *A. recurvirostrum*, a central strand is never present (Cano & Jiménez, 2013). Given that there is a clear relationship with the genus *Leptodontium* (Müll.Hal.) Hampe ex Lindb. (Zander, 1993), this is hardly surprising. In a paper examining the relationships of *Gymnostomum* and *Hymenostylium* using molecular data, Köckinger and Kučera (2011) found that a new species, *Hymenostylium xerophilum* Köckinger & J.Kučera, and a known species, *Gymnostomum gracillimum* Nees & Hornsch. (synonym *Gymnostomum boreale* Nyholm & Hedenäs) were sister groups on a cladogram, and both proved much closer to *Hymenostylium* than to *Gymnostomum*. This was the case even though both had stem central strands while *Hymenostylium* had none. The senior author of the present paper has written at length (e.g., Zander, 2013) on how a molecular cladogram may be interpreted in terms of serial descent such that ancestral taxa with several molecular races might give rise to descendants with inferred shared descent different than the expected, including high Bayesian posterior probabilities. Given the constancy of the absence of the central strand in *Ardeuma*, the broadly ligulate-lanceolate shape of the leaf with its dense, low papillae in *Hymenostylium xerophilum*, and the illustration by Köckinger and Kučera (2011) of the typically *Gyroweisia* weakly branching brood body of *Hymenostylium gracillimum* (Nees & Hornsch.) Köckinger & Jan Kučera, these two central strand-bearing species are here considered not to belong in *Ardeuma*, and need further study. The key to *Ardeuma*, *Hymenostylium*, and *Trichostomum* species in Africa and Asia below does not include certain little-understood species that require revision. For instance, *Ardeuma crassinervia* seems to be intermediate between *A. aurantiacum*, *A. recurvirostrum*, and *A. insigne* in its straight, narrowly lanceolate leaf shape, costa thick, and excurrent in a cylindric mucro, nearly isodiametric laminal cells that have weakly irregularly thickened walls, and laminal papillae large, one or two per lumen.

#### Key to *Ardeuma*, *Hymenostylium*, and *Trichostomum* in Africa and Asia

1. Stem with central strand, leaves usually broadest at or above mid leaf, occasionally narrowed just above the leaf base; laminal cells either greatly bulging adaxially, and nearly flat abaxially, or equally convex on both sides of lamina..... 2.
1. Stem without central strand, leaves usually broadest at or near base; laminal cells equally convex on both sides of lamina .....3.
2. Cauline leaves differentiated only in lower 1/6–1/7 of leaf; distal laminal cell walls commonly more strongly bulging adaxially than abaxially, papillae 1(–2) per lumen, lens-like, usually present ..... *Hymenostylium xanthocarpum*
2. Cauline leaves with basal cells differentiated in lower 1/4 of leaf; distal laminal superficial walls equally flat or bulging on both surfaces, papillae several per lumen, or absent, granular ... *Trichostomum* spp.
3. Leaves linear to elliptic-lanceolate from a weakly differentiated base ..... *Ardeuma aurantiacum*
3. Leaves lanceolate-acuminate from a broader base ..... 4.
4. Leaves longitudinally evenly recurved ..... *Ardeuma recurvirostrum*
4. Leaves longitudinally strongly reflexed at top of widened base ..... *Ardeuma insigne*

#### Key to *Tuerckheimia* species of the New World, and *Hymenostylium xanthocarpum*

1. Distal leaf margins coarsely dentate ..... *Tuerckheimia valeriana*
1. Distal leaf margins entire or minutely crenulate by papillose cells ..... 2
2. Leaves long-elliptical, constricted above leaf base, apex acute at 45°; costa percurrent; laminal papillae lens-shaped, one per lumen; capsule short-ovate ..... *Hymenostylium xanthocarpum* (*Tuerckheimia robusta*, a synonym)
2. Leaves narrowly lanceolate-linear, not medially constricted, apex narrowly acute at 30° or less; costa percurrent or excurrent; laminal papillae multiplex as single thickenings over each lumen with irregular tops; capsule cylindric ..... 3
3. Costa percurrent; peristome present, minimally as remnants of a basal membrane ..... *Tuerckheimia guatemalensis*.
3. Costa usually excurrent as a mucro; peristome absent ..... *Tuerckheimia svihlae*

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Taxonomic Additions and Changes: *Ardeuma aurantiacum* (Mitt.) R.H.Zander & Hedd., *comb. nov.* (*Hymenostylium congoanum* Dixon & Naveau. *syn. nov.*); *Ardeuma crassinervia* (Broth. & Dixon) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma dicranelloides* (Broth. ex Dixon) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma diversifolium* (J.Froehl.) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma filiforme* (Dixon) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma grandirete* (Dixon) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma hildebrandtii* (Müll.Hal.) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma insigne* (Dixon) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma papillinerve* (Dixon) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma recurvirostrum* (Hedw.) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma rigescens* (Müll.Hal.) R.H.Zander & Hedw., *comb. nov.*; *Ardeuma scaturiginosum* (Besch.) R.H.Zander & Hedd., *comb. nov.*; *Ardeuma sinense* (Sakurai) R.H.Zander & Hedd.,

*comb. nov.*; *Ardeuma subcrispulum* (Thér.) R.H.Zander & Hedd., *comb. nov.*

## References

- Andrews, A.L. 1926. *Hymenostylium longopulvinatum*. *Bryologist*, 29: 69–70.
- Aziz, M.N. & Vohra, J.N. 1988. A note on the identity of *Hymenostylium xanthocarpum* (Hook.) Brid. *Botanical Survey of India*, 30: 185–7.
- Aziz, M.N. & Vohra, J.N. 2008. *Pottiaceae (Musci) of India*. Dehra Dun, India: Bishen Singh Mahendra Pal Singh.
- Bridel, S.E. 1827. *Bryologia universa seu systematica ad novam methodum disposito, historia et descriptio omnium muscorum frondosorum hucusque cognitorum cum synonymia ex auctoribus probatissimis*. Vol. 2. Lipsiae.
- Brown, R.W. 1956. *Composition of scientific words*. Rev. ed. Baltimore, MD: Published by the author.
- Cano, M.J. & Jiménez, J.A. 2013. A taxonomic revision of the tribe Pleuroweisiae (Pottiaceae, Bryophyta) in South America. *Phytotaxa*, 143(1): 1–42.
- Chen, P.-C. 1941. Studien über die ostasiatischen Arten der Pottiaceae, I-II. *Hedwigia*, 80: 1–76; 141–322.
- Dixon, H.N. 1927. *Hymenostylium xanthocarpum* (Hook.) Brid. *Bryologist*, 30: 106–9.
- Hooker, W.J. 1819. *Musci Exotici*. London: Longman, Hurst, Rees, Orme, and Brown.
- Köckinger, H. & Kučera, J. 2011. *Hymenostylium xerophilum*, *sp. nov.*, and *H. gracillimum*, *comb. nov.*, two neglected European mosses and their molecular affinities. *Journal of Bryology*, 33(3): 195–209.
- Zander, R.H. 1977. The tribe Pleuroweisiae (Pottiaceae, Musci) in Middle America. *Bryologist*, 80: 233–69.
- Zander, R.H. 1993. Genera of the Pottiaceae: mosses of harsh environments. *Bulletin of the Buffalo Society of Natural Sciences*, 32: 1–378.
- Zander, R.H. 2013. *A framework for post-phylogenetic systematics*. St. Louis, MO: Zetetic Publications, CreateSpace Independent Publishing, Amazon.