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Author(s): Yu Jia and Si He
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New synonyms and new combinations of Himalayan species of *Brotherella* (Sematophyllaceae, Bryopsida)

Yu Jia[1,3] and Si He[2]

[1] *State Key Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Beijing, 100093, China;* [2] *Missouri Botanical Garden, P. O. Box 299, St. Louis, MO 63166-0299, U.S.A.*

Abstract. Morphological features of three species of *Brotherella* Loeske *ex* M. Fleisch. based on their type specimens are found to be inconsistent with their current taxonomic placements. *Brotherella dixonii* Herzog and *Brotherella pallida* (Renauld & Cardot) M. Fleisch. are transferred to *Ectropothecium* and *Wijkia* as *E. dixonii* (Herzog) Y. Jia & S. He *comb. nov.* and *W. pallida* (Renauld & Cardot) Y. Jia & S. He *comb. nov.*, respectively. *Brotherella harveyana* (Mitt.) Dixon is synonymized with *Pylaisiadelpha tenuirostris* (Bruch & Schimp.) W. R. Buck.

Keywords. *Brotherella*, Bryopsida, *Ectropothecium*, *Pylaisiadelpha*, Sematophyllaceae, *Wijkia*.

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During a recent study of Asian species of *Brotherella* Loeske *ex* M. Fleisch. the authors had an opportunity to examine the type specimens of *B. dixonii* Herzog, *B. harveyana* (Mitten) Dixon, and *B. pallida* (Renauld & Cardot) M. Fleischer from BM, FH and JENA. On the basis of the morphological features of these specimens, we reevaluated their taxonomic positions and made the following taxonomic changes.

The Species

Brotherella dixonii Herzog, Ann. Bryol. 12: 95. 1939; *Pylaisiadelpha dixonii* (Herzog) W. R. Buck, Yushania 1(2): 12. 1984. Type: India, Sikkim. *Troll 38* (holotype: JE). **Figs. 1–22**

Discussion: The alar cells of *Brotherella dixonii* are colorless, shortly rectangular or subquadrate, and not distinctly inflated, and hence differ from those of any species of *Brotherella*. The genus is diagnosed by colored and distinctly inflated alar cells (Ando et al. 1989). Additional characters observed in *B. dixonii* provide enough evidence to exclude this species from *Brotherella* and even from the Sematophyllaceae. These features include: the elongate-rhomboidal leaf cells that are clearly prorate, the entire perichaetial leaf margins, the thin-walled exothecial cells, and the pendulous capsules. The species of *Brotherella* usually have long-linear and smooth leaf cells, serrulate perichaetial leaf margins, longitudinally thickened exothecial cell walls, and suberect to inclined capsules. The perfect double peristome with a high basal membrane and 2–3 nodulose cilia coupled with the above-mentioned features found in *B.. dixonii* suggest an affinity with the genus *Ectropothecium* Mitt. of the Hypnaceae. *Ectropothecium* is characterized by often regularly pinnate plants with falcate-secund leaves and scant alar development. The narrowly foliose outer pseudoparaphyllia are very helpful in identification, though admittedly are a tedious character to demonstrate (Buck, 1998).

[3] Corresponding author e-mail: yjia@ibcas.ac.cn
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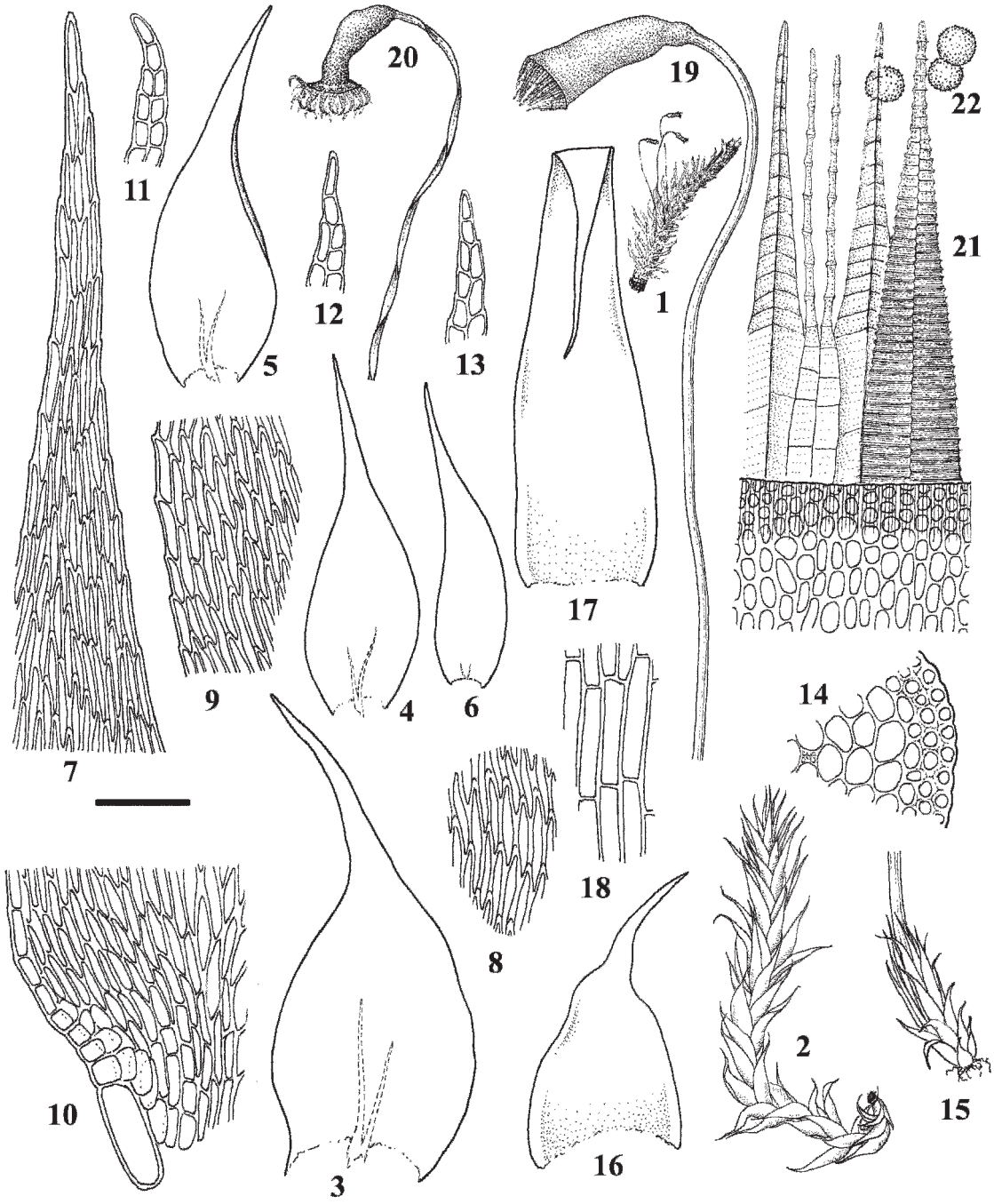


Figures 1–22. *Ectropothecium dixonii*. **1.** Plants with sporophytes. **2.** Branch. **3–6.** Leaves. **7.** Apical leaf cells. **8.** Median leaf cells. **9.** Median leaf cells and margin. **10.** Basal leaf cells. **11–13.** Pseudoparaphyllia. **14.** A portion of cross section of stem. **15.** Perichaetium and a portion of seta. **16.** Outer perichaetial leaf. **17.** Inner perichaetial leaf. **18.** Perichaetial leaf cells. **19.** Seta and capsule (when wet). **20.** Seta and capsule (when dry). **21.** A portion of peristome. **22.** Spores. Scale bar = 10 mm (1); bar = 0.6 mm (2); bar = 0.2 mm (3–6, 16–17); bar = 36 μm (7–13, 18); bar = 52 μm (14); bar = 0.8 mm (15, 19); bar = 0.9 mm (20); bar = 53 μm (21); bar = 85 μm (22). All drawn from the holotype, *Troll 38* (JE).

Ectropothecium is similar to *Hypnum* in appearance, but distinctive features include the small, ovoid capsules not much longer than broad and deeply constricted below the mouth when dry and alar cells with a single, strongly enlarged cell at the extreme angles. *Brotherella dixonii* clearly fits well with the generic concept of *Ectropothecium* as defined by Iwatsuki (1992) and Nishimura & Ando (1994). The following new combination is proposed:

Ectropothecium dixonii (Herzog) Y. Jia & S. He, *comb. nov.*

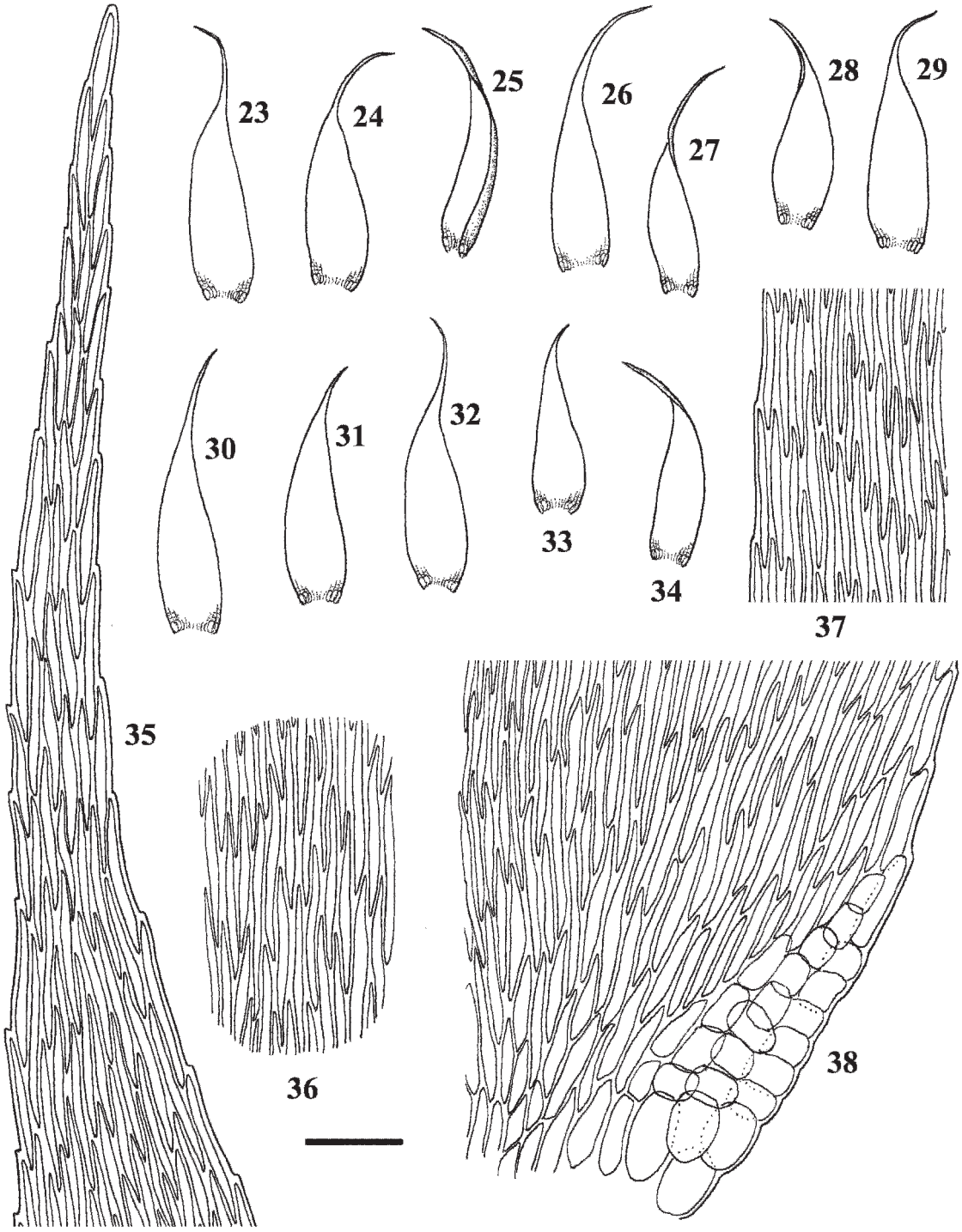
***Diagnosis*:** Plants gracile, golden yellow, glossy, corticolous, in dense tufts. Main stems creeping, irregularly branched, often with erect branches, 3.5–5.0 mm long, 0.7–1.0 mm wide; round in cross section, ca. 0.2 mm in diameter, cortical cells in three layers, irregularly oval, thick-walled; central strand absent. Stem and branch leaves similar, more or less homomallous, erect-patent when dry, loosely arranged on stems and branches, triangular-lanceolate, 0.4–0.5 mm long, 0.1–0.2 mm wide at base, long acuminate at apex; margins partly involute on one side; costae very short, double, indistinct, or absent; apical leaf cells narrowly rhomboidal, 23–34 μm × 2.6–5.3 μm; median leaf cells slightly longer and wider, 19–40 μm × 3.2–5.5 μm, thin-walled, clearly prorate; basal leaf cells 17–32 μm × 2.8–5.5 μm; alar cells consisting of a small group of colorless, subquadrate cells, extending 6–8 cells along the margins. Autoicous. Perichaetial leaves ovate-lanceolate with a long acuminate apex, entire, 0.8–1.4 mm long, 0.2–0.3 mm wide at base. Setae 1.1–1.5 cm long, reddish, twisted above when dry; capsules pendulous, reddish brown, cylindrical, ca. 1.4 mm × 0.5 mm, becoming discoid at mouth when dry; operculum and annulus not seen; exothecial cells thin-walled; peristome double, perfect; exostome teeth curved when dry, narrowly triangular, ca. 430 μm long, yellowish, bordered, papillose above, densely cross-striolate below; endostome segments erect when dry, lanceolate, ca. 440 μm long, lightly yellowish, hyaline, minutely papillose, keeled; basal membrane high, ca. 1/3–1/2 as high as the segments; cilia 2–3. Calyptrae not seen. Spores spherical, 18–22 μm in diameter, coarsely papillose.

***Differentiation*:** *Ectropothecium dixonii* is a species of small, slender plants. Herzog (1939) noted that the general habit of this species was comparable to *Isopterygium pulchellum* (Hedw.) A. Jaeger [=*Isopterygiopsis pulchella* (Hedw.) Z. Iwats.]. *Ectropothecium dixonii* clearly differs from *I. pulchella* by the presence of pseudoparaphyllia, the prorate leaf cells, and the differentiated alar region with subquadrate cells. In *I. pulchella*, the pseudoparaphyllia are absent, the leaf cells are smooth, and the alar region is barely differentiated.

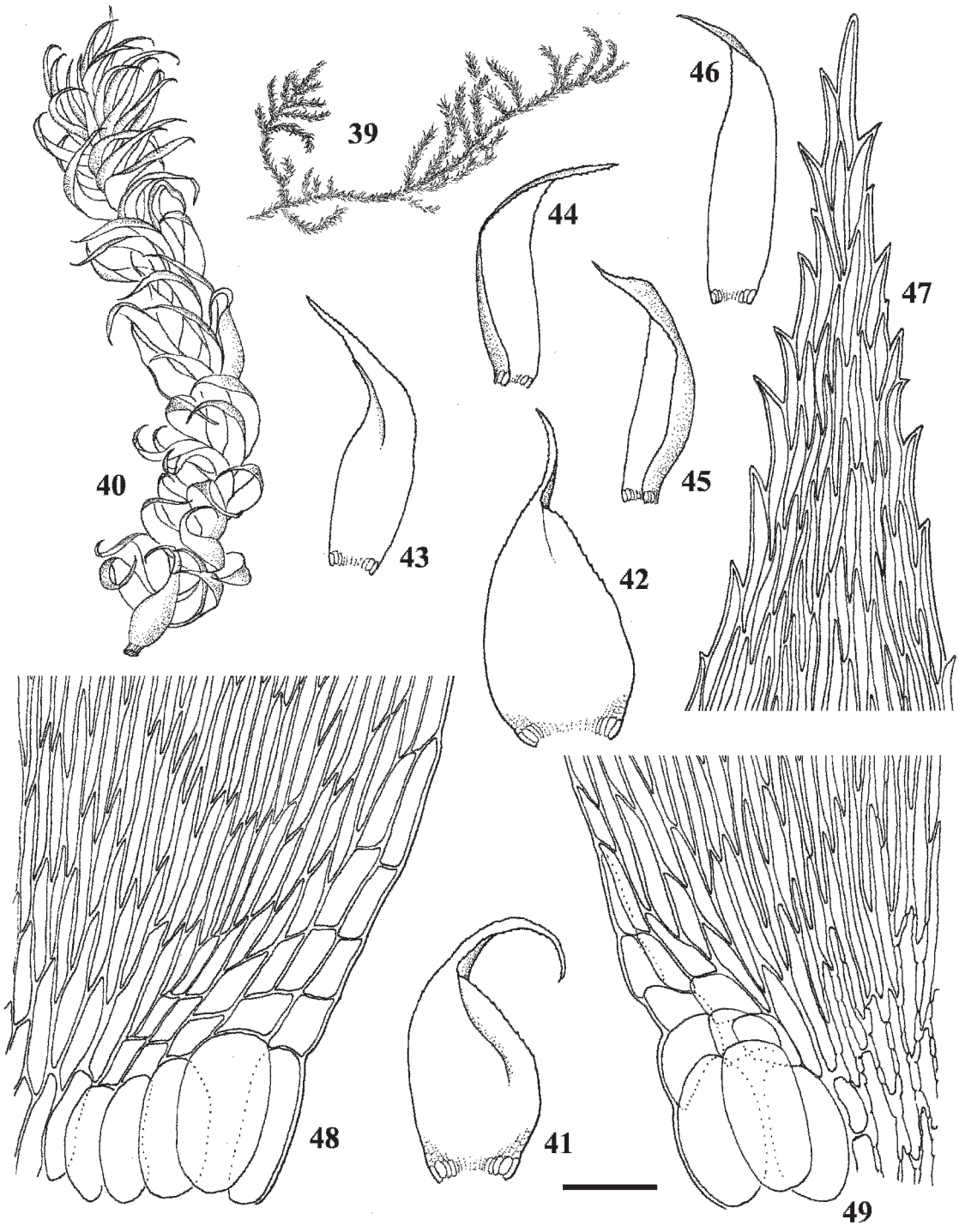
Brotherella harveyana (Mitt.) Dixon, Notes Roy. Bot. Gard. Edinburgh 19: 298. 1938; *Stereodon harveyanus* Mitt., J. Proc. Linn. Soc., Bot., Suppl. 102. 1859;. Type: Nepal. *Wallich s.n.* (holotype BM), *syn. nov.* = ***Pylaisiadelpha tenuirostris*** (Bruch & Schimp.) W. R. Buck **Figs. 23–38**

***Discussion*:** Dixon (1938) transferred *Stereodon harveyanus* to *Brotherella* without giving any reason, but only citing "This, which is certainly a *Brotherella*, has been omitted by Brotherus." Gangulee (1980) continued to recognize this species as a *Brotherella*. Our examination of the type reveals that it falls beyond the generic delimitation of *Brotherella*, but it fits within that of *Pylaisiadelpha* Cardot. *Pylaisiadelpha* includes four species (Crosby et al., 1999). Examining all the type specimens of *Pylaisiadelpha*, we considered that the most important character for recognizing species in this genus was the shape of leaf, but not the alar cells. Ando et al. (1989) noted that peristome of *Pylaisiadelpha* was rather imperfect. However, the peristome of *Pylaisiadelpha* appears to be normal in the Chinese specimens, and not imperfect. We did not find sporophytes in type specimens, although Gangulee (1980) provided an illustration of a peristome. It is here considered to be a synonym of *Pylaisiadelpha tenuirostris* (Bruch & Schimp.) W. R. Buck. The main features in supporting this argument are its weakly differentiated alar cells consisting of 2–3 hyaline, somewhat enlarged cells at extreme angle along with a few irregularly quadrate cells above them and its leaves that are slenderly acuminate and clearly falcate. These features are identical to those of *P. tenuirostris*.

Brotherella pallida (Renauld & Cardot) M. Fleisch., Nova Guinea 12: 120. 1914;



Figures 23–38. *Pylaisiadelpha tenuirostris.* **23–34.** Leaves. **35.** Apical leaf cells. **36.** Median leaf cells. **37.** Median leaf cells and margin. **38.** Basal leaf cells. Scale bar = 0.4 mm (23–34); bar = 36 μm (35–38). All drawn from the holotype of *Stereodon harveyanus, Wallich s.n.* (BM).



Figures 39–49. *Wijkia pallida.* **39.** Plant. **40.** Branch. **41–42.** Stem leaves. **43–46.** Branch leaves. **47.** Apical leaf cells. **48–49.** Basal leaf cells. Scale bar = 10 mm (39); bar = 0.8 mm (40); bar = 0.4 mm (41–46); bar = 36 μm (47–49). All drawn from the isotype, *Q. A. Miller 1901* (FH).

Acanthocladium pallidum Renauld & Cardot, Bull. Soc. Roy. Bot. Belgique 41: 93. 1905. TYPE: India, Sikkim, Dareeling, *Q. A. Miller, 1901*. (isotype FH). **Figs. 39–49**

***Diagnosis*:** Plants relatively large, yellowish brown, glossy, main stems prostrate, irregularly branched, 3.0–4.5 cm long with branches 3.0–7.0 mm long, ca. 0.2 mm in diameter. Leaves densely arranged on stems and branches, erect-spreading when dry, somewhat falcate; stem leaves 1.3–1.7 mm long, 0.5–0.8 mm wide, broadly ovate, long acuminate at apex; margins weakly serrulate above; costae absent; leaf cells linear to fusiform, or narrowly rhomboidal, thin-walled, smooth, 40–80 × 1.8–5.5 μm; basal cells with one row of evidently inflated golden yellowish or hyaline cells at insertion; alar cells oblong, inflated, usually 3–4, lightly yellow or hyaline, 45–65 × 18–37 μm; branch leaves smaller, clearly differentiated from stem leaves in shape, narrowly oblong with shortly acuminate apices, 1.1–1.3 mm long, 0.3–0.4 mm wide; leaf cells and alar cells similar to those of stem leaves. Inner perichaetical leaves narrowly triangular-lanceolate, entire. Sporophytes not seen.

Discussion*:** Fleischer (1914) transferred *Acanthocladium pallidum* to *Brotherella*. We define *Brotherella* as having more or less similar stem and branch leaves and having inner perichaetial leaves with serrulate margins. The differentiation of branch and stem leaves in *B. pallida* is reminiscent of the genus *Wijkia* H. A. Crum. Buck (1986) gave a detail description for *Wijkia*. Regarding the branching pattern, he noted "…. stem creeping, irregularly to subpinnately to irregularly branched,…", and only in section *Tanythrix* of *Wijkia*, plants are regularly pinnate to bipinnate branched (Buck, 1986). We observed many specimens of *Wijkia* from South America, Africa and Asia, and most, including the type specimens, were irregularly or subpinnately branched. Buck (1986) did not describe the inner perichaetical leaves. Our survey reveals that inner perichaetical leaves are almost entire in *Wijkia*. *Brotherella pallida* has differentiated stem and branch leaves and entire perichaetial leaf margins. In addition, a few irregularly rectangular cells occur above 2–3 inflated, hyaline alar cells. We therefore propose to transfer this species to *Wijkia* and the following new combination: ***Wijkia pallida (Renauld & Cardot) Y. Jia & S. He, *comb. nov*.

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