

Picobryum, a new genus of Pottiaceae (Bryophyta) from South Africa, and an erratum for *Acaulonopsis*

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A new genus, *Picobryum* (Pottiaceae, Bryophyta), including one new species, *Picobryum atomicum*, is described from the western Cape Province of South Africa. The new taxon is somewhat similar to *Syntrichia* gametophytically but differs in the trait combination: stem very short, central strand absent; leaves strongly reflexed to squarrose when moist, usually folded longitudinally on one side, bases sheathing, margins plane throughout, irregularly and weakly bordered in 1(–2) rows with somewhat thick-walled, less papillose cells; papillae large, simple to bifid, 1–2 per lumen; paroicous; seta essentially absent; capsule cleistocarpic, globose, and short-apiculate; calyptra mitrate. Locality data for the type of *Acaulonopsis fynbosensis* R.H.Zander & Hedd. are corrected in an erratum.

Keywords: Allometry, Conservation, Fynbos, *Picobryum atomicum*, Pottiaceae, South Africa, *Syntrichia*

The Cape Floristic Region of South Africa continues to reveal evolutionary novelties among the mosses, particularly in the family Pottiaceae. Another taxon distinct at the genus level was discovered among bryophyte collections made in the lowland Leipoldtville Sand Fynbos, a distinctive South African habitat endangered by agriculture and invasive species. Although South Africa has been floristically fairly well examined for bryophytes, this taxon has been apparently overlooked because of its small size together with the unusual habitat. It is published here as a taxon of conservation concern.

Picobryum atomicum R.H.Zander & Hedd., *gen. et sp. nov.* (Figure 1).

Plantae perpusillae, gregariae, in materia naturali aurantiacae etiam in KOH reagentes; caulis tantum 0.05 cm longus, filo centrali carens; folia madida valde reflexa vel squarrosa, interdum longitudinaliter in latere altero incurvata et in altero recurvata, basi vaginanti, marginibus ubique planis, saepe irregulariter leniterque per series 1(–2) e cellulis saepe elongatis 2 : 1 parietibus crassiusculis minus papillosis compositas marginata; costa strato stereidarum unico complanato praedita, interne leniter distincta, interdum paene homogenea; papillae laminae medianae atque distales magnae, simplices vel bifidae per lumen 1–2(–3); cellulae basales hyalinae, per cellulas brevi-rectangulas medialiter ad

elongatas et parietibus crassis praeditas gradatim transientes; paroicae; seta nulla; capsula cleistocarpica globosa brevi-apiculata; calyptra mitriformis.

Plants very small, gregarious, light-green and commonly reddish. *Stem* not branching, *ca* 0.05–0.1 cm long, transverse section rounded-pentagonal, central strand apparently absent, central cylinder of large cells, cortex of several layers of orange cells with weakly thickened walls, sclerodermis and hyalodermis absent; axillary hairs *ca* 3–5 cells in length, basal cell brownish and more thick-walled than the distal cells; rhizoids common at stem base. *Leaves* appressed below and spreading when dry, often longitudinally broadly recurved on one side of leaf but incurved on other side of leaf so as to form an ‘S’ in section, strongly transversely reflexed or squarrose when moist, ovate, 1.2–1.5 mm in length, upper lamina broadly channelled to weakly keeled, leaf margins plane throughout, distal laminal margins entire or serrulate by hollow papillae to occasionally distantly dentate above, often irregularly and weakly bordered in 1(–2) rows with somewhat thick-walled, less papillose cells, these often elongate 2 : 1; apex broadly acute and mucronate, base elliptical and sheathing stem; *costa* narrow but widening distally and bulging slightly on both sides near apex, excurrent as a broad, sharp or often rather blunt mucro of several cells, these smooth or papillose, or rarely percurrent, superficial cells elongate both ventrally and dorsally, papillose above midleaf, 3–4

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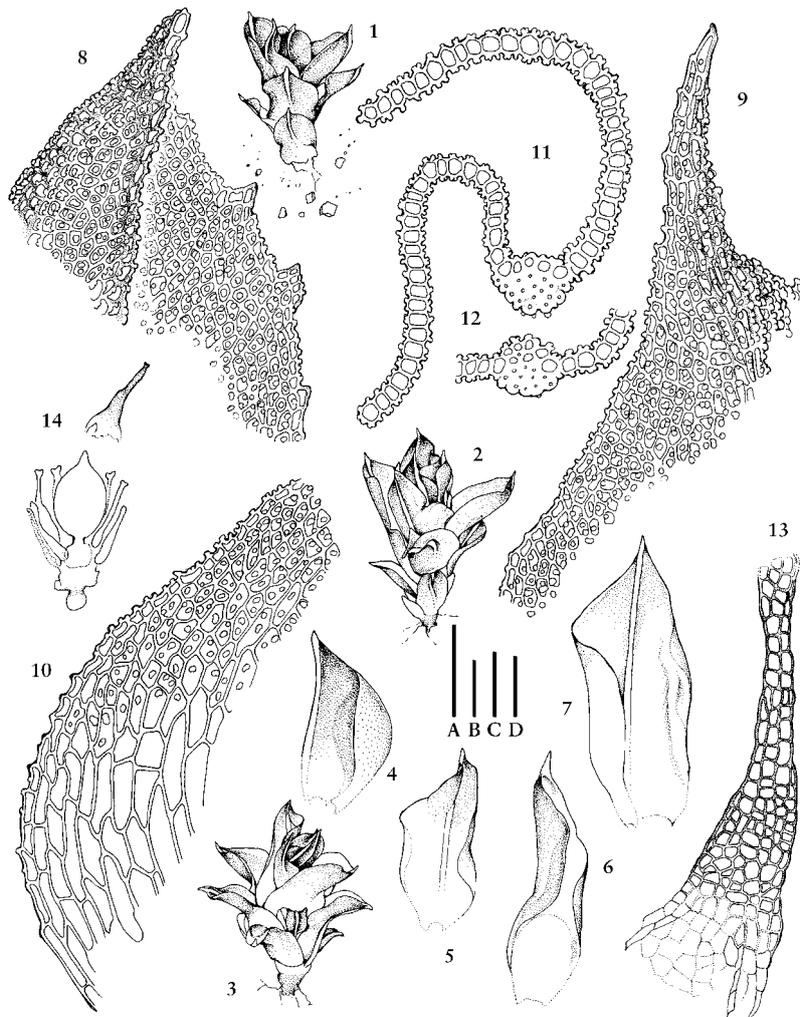


Figure 1 *Picobryum atomicum*. 1–3. Habits. 4–7. Leaves. 8–9. Leaf apices. 10. Leaf margin near base. 11. Transverse section at mid-leaf. 12. Costal section in distal portion of leaf. 13. Calyptra. 14. Capsule, paroicus inflorescence and calyptra. Scale bars: A=0.5 mm, 1–3; B=0.5 mm, 4–7; C=50 μm , 8–13; D=0.3 mm, 14.

rows of cells across costa ventrally at midleaf, transverse section circular to elliptical, essentially homogeneous or sometimes interpretable as stereid bands ventrally absent, dorsally present, of 3–4 stereid cells in 1–2 rows, ventral epidermis not or weakly differentiated, of cells of slightly wider lumens, guide cells 2 in 1 layer but little different from stereids, hydroid strand absent; *upper laminal cells* rounded-quadrate to irregularly rhomboid, ca 12–15(–18) μm in width, 1(–3):1, walls evenly thickened, strongly convex on both sides, papillae large but not crowded, 1–2 per lumen, simple or bifid, usually solid or sometimes hollow; *basal cells* differentiated across base, merging gradually into upper cells, near insertion short-rectangular and thin-walled, 17–25 μm wide, 2–4:1, grading distally into narrowly rectangular and thicker walled cells near leaf middle, these to 7:1. *Paroicus*. *Perichaetia* terminal, inner leaves enlarged and closely sheathing capsule, lower cells hyaline. *Seta* essentially absent. *Capsule* cleistocarpic, globose and bluntly short-apiculate, to 0.4 mm (immature) in diameter, transparent green, exothecial cells irregularly

quadrate, 35–40 μm in diameter, walls thin, stomata apparently absent; annulus and peristome teeth absent. *Calyptra* mitrate, smooth, 350–370 μm in length. *Spores* 25–32 μm in diameter, weakly papillose (immature). *Laminal KOH colour reaction* orange.

Type: South Africa, Western Cape Province, Oliphants River Mountains, Porterville Area, Beaverlac, road between campsites and Oliphant's River, along Ratel's River, 32°52'27"S, 19°05'10"E, disturbed areas and patches of clayey mineral soil in fynbos, ca 300 m elevation, T.A.J. Hedderson 13969a, 23 June 2001 (holotype: BOL; isotype: MO); same locality, T.A.J. Hedderson 13964, 23 June 2001 (paratypes: BOL, MO).

The genus name reflects the minute size of the plants (Ital., *piccolo*, small; in the International System 10⁻¹², *pico* being smaller than *nano* but larger than *femto*); the epithet reflects the difficulty of sectioning the stem (Gk., *a not, tomos* cut).

The important characters that in combination distinguish this genus from similar genera (especially *Syntrichia* Brid.) in the Pottiaceae are small plants

(1–3 in Figure 1), gregarious, orange; stem only 0.05 cm long, with central strand apparently absent; leaves strongly reflexed to squarrose when moist (4–7 in Figure 1), usually curved longitudinally in different directions on each side (11 in Figure 1), 1.2–1.5 mm long, leaf bases very broad for the length of the leaf and sheathing, margins plane throughout, occasionally dentate above (8 in Figure 1), often irregularly and weakly bordered in 1(–2) rows with somewhat thick-walled, less papillose cells, these often elongate 2:1 (8–10 in Figure 1); costa usually of nearly homogeneous cells with epidermal cells sometimes with wider lumens (11 and 12 in Figure 1); upper laminal cells medially rounded-quadrate to rhomboid, rather small, *ca* 12–15 μm in width, 1:1, with evenly thickened walls, papillae large, simple to bifid, 1–2 per lumen; hyaline, short-rectangular basal cells grading to elongate, thick-walled cells medially; paroicous; seta absent; capsule cleistocarpic, globose and short-apiculate with a mitrate calyptra (13 and 14 in Figure 1). There was nothing found with these trait combinations in the literature or in collections at BOL or MO.

Picobryum atomicum is apparently closely related to certain austral (mainly southern South America, New Zealand, and South Georgia) species of *Syntrichia*, including such species as *S. gromschii* (Thér.) R.H.Zander, *S. robusta* (Hook. & Grev.) R.H.Zander, *S. rubra* (Mitt.) R.H.Zander, and *S. saxicola* (Cardot) R.H.Zander. These species share with the new genus a suite of features that contribute to a distinctive appearance of the upper lamina. These are subquadrate to irregularly rhomboid laminal cells with evenly thickened walls and large, simple to bifid papillae, the marginal laminal cells often differentiated as a border, being less papillose or smooth, somewhat more thick-walled and deeper in colour, irregularly elongate to 2:1; the leaf margins are often entire but serrulate by hollow papillae at the distal portion of the marginal cells grading to irregularly denticulate or even distantly dentate.

As noted by Zander (1993), the species of *Syntrichia* are notable in not being interpretable as a reduction series in sporophyte characteristics, i.e. there is no correlated shortening of seta and capsule, peristome shortened or lacking, and stegocarpic grading to cleistocarpic. Such reduction series (usually coupled with short stems and small leaves) are found in related genera such as *Hennediella* Paris (orange to red colour with KOH, strong marginal border of elongate cells, many papillae per lumen) and *Tortula* Hedw. (large laminal cells). There are, however, distinctive genera related to *Syntrichia* that include or are composed of reduced species, including *Acaulon* Müll.Hal. (capsules without apiculus), *Chenia* R.H.Zander (upper laminal cells extremely

thin-walled), *Microbryum* Schimp. (papillae several per lumen, lamina with deep red reaction to KOH), *Phascopsis* I.G.Stone (costa massive, upper laminal cells thin-walled, multipapillose), and *Stonera* R.H.Zander (strongly concave lamina, often swollen costa). A recently described much reduced genus, *Neophoenix* R.H.Zander & Düring, also from southern Africa, differs in its trichostomoid leaves with multipapillose upper laminal cells and basal cells that reach up the margins, commonly merging with a indistinct border of less papillose, somewhat elongate cells, and has much the same aspect as *Aschisma* Lindb. (Zander & Düring 1999) Although *Neophoenix* has transparent capsules, the opacity of the capsule wall of the new genus cannot be ascertained with certainty because of the immature sporophytes.

Syntrichia may be viewed as a fairly recent taxon because a reduction series (assuming no reversibility) is not yet evident though many species occur in arid lands. It might well be that *Picobryum* is an extremely strongly reduced taxon rapidly evolved from an immediate *Syntrichia* ancestor in response to some extreme selective pressure in South Africa. This same pressure, unique to South Africa, may have mediated speciation of other reduced Pottiaceae distinct at the generic level, such reduction being so fast that parts of the sporophyte have lagged in rate of reduction. In recently described (Hedderson & Zander, 2007, 2008a, b; Zander & Hedderson, 2009) genera of Pottiaceae endemic to South Africa, the capsules exhibit what is apparently differential rates of change in reduction and some specialization, unlike the usual modification of general reduction in all parts seen in taxa of this subfamily elsewhere in the world. *Ludorugbya* Hedd. & R.H.Zander has a short seta and reduced peristome but retains a conic operculum. *Vrolijkheidia* Hedd. & R.H.Zander has a globose cleistocarpic capsule but retains elongate medial cells, fragmenting in circles around the capsule. *Algaria* Hedd. & R.H.Zander has a short seta and eperistomate capsule, but the operculum is unusually flat and merely umbonate. *Acaulonopsis* R.H.Zander & Hedd. is superficially quite similar in the short, apically recurved leaves but has a cleistocarpic capsule that is entirely spheric, lacking the evolutionarily rather conservative apiculus, the leaves are clear red in KOH, and the leaf margins are not distally denticulate but are either recurved or if plane, then the plant is rhizautoicous. A key to species similar to *Picobryum* is given by Zander & Hedderson (2009). Comparative allometric analysis (Niklas, 1994; Sweet, 1980) may prove valuable in analysis of the evolutionary pressures associated with floristic changes unique to South Africa, and perhaps indicate the identities of less reduced genera or species of morphology ancestral to that of *Picobryum*.

The only known locality for the genus is in the Oliphant's River section of Leipoldtville Sand Fynbos (vegetation types follow Mucina & Rutherford, 2006). While most fynbos units, especially those associated with mountains, are well protected, many lowland types are under severe threat. Although Leipoldtville Sand Fynbos is endangered, with 55% of its area already transformed and invasive aliens a growing threat over a large portion of the remainder, it is not represented in either statutory or private reserves (Mucina & Rutherford, 2006). *Picobryum* provides additional evidence (if more were necessary) that these lowland fynbos vegetation units merit more protection than they currently receive.

Erratum: Inadvertently the locality description for the type of *Acaulonopsis fynbosensis* R.H.Zander & Hedd. (Zander & Hedderson, 2009) was given incorrectly, although the actual collection number is correct as published. The corrected label data are: **Type:** South Africa, Northern Cape Province, R354 between Sutherland and Calvinia, ca 32 km from Sutherland, on the farm Matjiesfontein, 32°12'58.6"S, 20°30'19.2"E, sheltered, clayey soil in Roggeveld, 1300 m, *T.A.J. Hedderson 16061* (holotype: BOL, isotype: MO). **Paratypes:** same locality, *T.A.J. Hedderson 16049, 16057a* (BOL, MO).

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Taxonomic Additions and Changes: *Picobryum* R.H.Zander & Hedd., *gen. nov.*; *Picobryum atomicum* R.H.Zander & Hedd., *sp. nov.*

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