RACOPILUM

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Racopilum P.Beauv., *Prodr. Aethéogam.* 36 (1805); from the Greek *rhaco* (lacerate) and *pilos* (hair), in reference to the lacerate, pilose calyptra.

Orthographic variant: *Rhacopilum*.

Lecto: *R. mnioides* P.Beauv. [= *R. tomentosum* (Hedw.) Brid.]

Dwarf male plants on female plant leaves (phyllodioicous); normal-sized male plants rare. Lateral leaves oblong-ovate, obtuse to acute, spreading laterally when moist, curved upwards and longitudinally convolute when dry, 1–2 mm long (excluding arista), 0.3–0.9 mm wide; margin plane or slightly undulate near leaf base, unbordered, serrulate to serrate towards the apex, rarely almost entire; costa excurrent as a smooth arista of variable length; laminal cells irregular, (sub)isodiametric, short-rhomboidal to hexagonal, often in oblique rows (then shape more regular), (8–) 10–22 (–30) µm long, thin- to firm-walled, both sides smooth or unimammillose; cells at basal margins and towards base short-rectangular; dorsal leaf shape and size very variable, symmetrical, obliquely forward-pointing, narrowly triangular to ovate.

Perichaetial leaves sheathing, broadly ovate, c. 1.5–1.8 mm long; costa long-excurrent; laminal cells rectangular, 60–80 µm long; paraphyses hair-like, often projecting beyond bracts. Setae 7–30 mm long, yellowish or reddish, twisted to the right in upper part and to the left in lower part. Capsules inclined or horizontal, rarely ±erect, (2.0–) 2.5–3.5 (–4.5) mm long (excluding lid), curved or nearly straight, a small bend just below the oblique orifice; neck short, strumose or not, deeply grooved, with stomata; operculum 0.7–1.8 mm long, rostrate from a convex-conical base; rostrum erect or oblique, (0.5–) 0.7–0.9 (–1.0) mm long, straight or hooked. Exostome brownish; teeth narrowly lanceolate, transversely striate, with a zig-zag median line on outer face, barred on inner face, papillose above; endostome segments well developed; basal membrane c. half the exostome height, smooth; segments broad, keeled, broadly perforated, as long as exostome or slightly shorter; cilia 2 or 3, well developed, nodose or appendiculate.

This predominantly tropical and subtropical genus of about 15 species occurs in both hemispheres and in temperate regions of the Southern Hemisphere; species diversity is greatest in the Malesian region. Two non-endemic species and an additional variety are known from Australia.

The genus is often spelled as "*Rhacopilum*", which is linguistically correct, but the original spelling by Palisot de Beauvois is followed here.

References

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Capsules not strumose; setae 0.15–0.20 mm thick; calyptra cucullate; hairs few to numerous; laminal cells smooth or mammillose ..... **1. R. cuspidigerum**

Capsules strumose; setae 0.2–0.4 mm thick; calyptra mitrate; hairs numerous; laminal cells mammillose ..... **2. R. strumiferum**

1. **Racopilum cuspidigerum** (Schwägr.) Ångstr., *Öfvers. Förh. Kongl. Svenska Vetensk.-Akad.* 29(4): 10 (1872)

Hypnum cuspidigerum Schwägr., *in* Gaudichaud, *in* Freycinet, *Voy. Uranie, Bot.* 229 (1828). T: Hawaiian Is., *Gaudichaud*; syn: BM.

Laminal cells (10–) 12–18 (–30) µm long, smooth to strongly mammillose. Calyptra cucullate; hairs erect, few to numerous. Setae (10–) 12–25 (–30) mm long, 0.15–0.20 mm thick. Capsule neck rather short, not strumose; rostrum erect or oblique, straight or hooked, 0.5–0.8 mm long. *n* = 10, *fide* H.P.Ramsay, *in* A.Löve, *Taxon* 16: 557 (1957); *Austral. J. Bot.* 22: 321 (1974).

Two varieties are recognised.

Laminal cells smooth or only weakly mammillose; paraphyses not or only slightly projecting beyond perichaetial bracts ..... **1a.** var. **cuspidigerum**

Laminal cells distinctly mammillose; paraphyses usually projecting beyond perichaetial bracts ..... **1b.** var. **convolutaceum**

1a. **Racopilum cuspidigerum** (Schwägr.) Ångstr. var. **cuspidigerum**

Racopilum amboinense Broth., *Phillip. J. Sci*., Sect. C, 12: 79 (1917). T: Ambon, [Indonesia], *Robinson 2286, 2299*; syn: H.

Racopilum purpurascens Hampe, *Linnaea* 40: 326 (1876). T: Mt Elephant, Vic., *F.Mueller*; holo: BM; iso: MEL.

[*Racopilum tomentosum auct. non* (Hedw.) Brid.: F.M.Bailey, *Compr. Cat. Queensland Pl.* 663 (1913)]

Illustrations: M.Fleischer, *Musci Buitenzorg* 4: 1623 (1923); T.Koponen & D.H.Norris, *Acta Bot. Fenn.* 133: 88, fig. 3a–l (1986).

Laminal cells smooth or only weakly mammillose. Leaf margin not or faintly undulate near the base when moist. Perichaetial paraphyses hair-like, not or slightly projecting beyond the bracts. Calyptra usually with few hairs, but sometimes distinctly hairy. Rostrum usually oblique, hooked or straight.

Common in eastern Qld, N.S.W. and A.C.T.; also (sub)tropical SE Asia, Oceania and Costa Rica. Grows on a broad range of substrata (rocks, boulders, tree bases, rotting wood and soil) in wet- and dry-sclerophyll forest and rainforest from sea level to c. 1250 m; it also tolerates rather dry, ±exposed sites.

Qld: Mt Bartle Frere, 29 Nov. 1936, *H.Flecker* (BM). N.S.W.: Cox Rd, Toonumbar State Forest, 29 km NW of Kyogle, *H.Streimann 6988* (CANB, GRO). A.C.T.: Molonglo Gorge, *N.T.Burbidge 7125* (CANB).

This dioicous taxon is sometimes misidentified as *R. tomentosum* (Hedw.) Brid., a similar but monoicous, tropical American species which does not occur in Australia.

Transitional forms with var. *convolutaceum* are common in N.S.W. and southern Qld and rare elsewhere in Australia. They are also rare in Malesia, Sri Lanka, southern India, the Ryu-Kyu Is. and several Pacific islands.

An aberrant specimen was misidentified as *R. robustum* Hook.f. & Wilson by Catcheside (S.A.: Bagot's Gymnosperm Garden, Aldgate, southern Lofty, *D.G.Catcheside 31176*, AD) probably because of its subisophyllous leaves. This New Zealand species, however, is less branched, and its larger lateral leaves are 2–3 mm long.

Vegetative reproduction by means of caducous leaves, which readily produce new plants from the base of the costa, is frequently observed in var. *cuspidigerum* from the Malesian region. This phenomenon was not observed in Australian plants.

Rare specimens from north-eastern Qld (mainly in the Cairns area) have a very short-excurrent costa and a rounded leaf apex. In some cases, these branches are connected to

stems with more acute leaf apices and longer-excurrent costae. Moreover, all such specimens were collected in river beds indicating that these characteristics may have been induced by moist conditions. These specimens cannot be distinguished from *R. amboinense* Broth., a species synonymised with *R. cuspidigerum* by Koponen & Norris (1986).

The type of *R. purpurascens* is characterised by smooth, thin-walled laminal cells that are very variable in size (to 30 µm long). The basal juxtacostal cells are rectangular, very lax, up to 40 µm long and shrivelled when dry. These characteristics are probably induced by the moist habitat of the type, i.e. irrigated basaltic rock. Scott & Stone (1976) suggested that *R. purpurascens* was conspecific with *R. convolutaceum*. However, I feel that its smooth laminal cells indicate conspecificity with *R. cuspidigerum* var. *cuspidigerum*.

1b. Racopilum cuspidigerum var. **convolutaceum** (Müll.Hal.) Zanten & Dijkstra, *Fragm. Florist. Geobot.* 40: 411 (1995)

Hypopterygium convolutaceum Müll.Hal., *Syn. Musc. Frond.* 2: 13 (1850); *Racopilum convolutaceum* (Müll.Hal.) Reichardt, *Reise Novara, Pilze, Leber-Laubm.* 1(3): 194 (1870). T: "Nova Hollandia, Isle de King", [W.A.], *L.Preiss*; holo: B *n.v.* (probably destroyed); neo: BM, East Gippsland, Vic., *F.Mueller*, Herb. Hampe 1881, *fide* B.O. van Zanten, *op. cit*. 411 (1995).

Racopilum cristatum Hook.f. & Wilson, *in* J.D.Hooker, *Fl. Nov.-Zel.* 2: 121 ('1855') [1854]. T: Tehawera forest, North Is., New Zealand, *W.Colenso 2540*; holo: BM.

Racopilum crinitum Hampe, *Linnaea* 36: 525 (1870). T: Porongorups, W.A., Oct. 1867, *F.Mueller*; holo: BM; iso: MEL, NY.

Illustrations: D.G.Catcheside, *Mosses of South Australia* 292, fig. 175 (1980); H.Streimann, *The Mosses of Norfolk Island* 136, fig. 61 (2002), as *R. cuspidigerum*.

Laminal cells distinctly mammillose; cells of leaf base and margin smooth. Leaf margin often somewhat undulate near base. Perichaetial paraphyses hair-like, usually projecting beyond bracts. Calyptra with few or numerous hairs. Rostrum erect or oblique, straight, rarely hooked.

A common variety in southern W.A., eastern S.A., Qld (rare and usually at higher elevations in tropical Qld), N.S.W., A.C.T., Vic. and Tas.; also in New Zealand (rather rare), some Pacific islands (Lord Howe, Norfolk, Kermadec, Cook and Austral Is.) and central Chile (probably introduced on timber imported from Australia). The ecology is very similar to that of var. *cuspidigerum*.

W.A.: Pemberton, *G.G.Smith 82* (FH, MEL). S.A.: Aldgate, *L.D.Williams 649* (MEL). Qld: Murphies Ck, 16 km NE Toowoomba, *H.Streimann 369* (CANB). N.S.W.: Larrys Mtn, 10 km NW of Moruya, *H.Streimann 3666* (CANB, GRO). A.C.T.: Tidbinbilla Nature Reserve, *H.Streimann 1415* (CANB). Vic.: Tarwin R., *F.Mueller 16* (MEL). Tas.: Mt Dromedary, *R.A.Bastow 640* (MEL).

There is a clear correlation between the mammillosity of the laminal cells and geographical location. Thus, cells are smooth in tropical Qld, distinctly mammillose in southern Australia, with intermediate forms (along with smooth and mammillose-celled plants) occurring in N.S.W. and southern Qld. These intermediates often have smooth and mammillose-celled leaves on the same plant, and they also occur rarely in Vic. and Tas. and in northern Qld where they are restricted to higher altitudes. Because of these intermediates, *R. convolutaceum* is considered to be only a variety of *R. cuspidigerum*.

There is a tendency for the curvature of the capsules to be somewhat more pronounced in var. *convolutaceum* than in var. *cuspidigerum*, and a hooked rostrum is more often present in the latter. Specimens from W.A. are characterised by a narrower leaf apex combined with very strongly mammillose laminal cells.

2. Racopilum strumiferum (Müll.Hal.) Mitt., *J. Proc. Linn. Soc., Bot.* 4: 93 (1860)

Hypopterygium strumiferum Müll.Hal., *Bot. Zeitung (Berlin)* 9: 563 (1851). T: prope Kaipara, New Zealand, *S.Mossman 732*; holo: B *n.v.* (probably destroyed); iso: BM, NY.

Racopilum australe Hook.f. & Wilson, *in* J.D.Hooker, *Fl. Nov.-Zel.* 2: 121 ('1855') [1854]. T: South Is., New Zealand, *W.Colenso 105*; holo: BM.

Illustrations: G.O.K.Sainsbury, *Bull. Roy. Soc. New Zealand* 5: 325, pl. 49, fig. 3 (1955); J.Beever, K.W.Allison & J.Child, *Mosses of New Zealand*, 2nd edn 111, fig. 51 (1992), as *R. convolutaceum*.

Laminal cells (8–) 10–14 (–16) µm long, strongly mammillose. Lower leaf margin usually ±undulate.

Perichaetial paraphyses hair-like, projecting beyond bracts. Calyptra mitrate; hairs numerous, erect. Setae 7–18 (–20) mm long, 0.2–0.4 mm thick. Capsules slightly to strongly curved, distinctly strumose; rostrum erect, straight, (0.5–) 0.7–1.0 (–1.1) mm long. *n* = 10, *fide* H.P.Ramsay, *in* A.Löve, *Taxon* 16: 557 (1957); *Austral. J. Bot.* 22: 321 (1974).

Known from S.A. and Tas.; also very common in New Zealand. Ecological data are not available for Australian specimens. However, in New Zealand it grows in rainforest on various substrata (soil, rock, bark, rotting wood, rarely epiphyllous) from sea level to c. 1000 m.

S.A.: Waterfall Gully, Mt Lofty Ra., 10 km SE of Adelaide, *H.B.S.Womersley 12* (AD); Waterfall Gully, at the second waterfall, *D.E.Symon 51, 52* (Herb. C.C.Townsend). Tas.: locality unknown, *W.Archer* (BM); locality unknown, *R.A.Bastow 68 p.p.* (S) [mixed with *R. cuspidigerum* var. *convolutaceum*, this specimen is labelled "Australia", but probably comes from Tasmania as Bastow collected there (incl. Mt Dromedary) in 1886].

Specimens without sporophytes cannot be distinguished with certainty from *R. cuspidigerum* var. *convolutaceum*. The laminal cells of *R. strumiferum* are generally smaller, but there is such a degree of overlap that this character is of little use in separating the taxa. The rostrum is almost always erect in *R. strumiferum*, never hooked and often slightly longer than in *R. cuspidigerum*. To determine the presence of a struma it is necessary to examine mature, wet capsules because the plicae of dry capsules extent to the neck and can easily be mistaken for a struma. The presence of a struma is usually a reliable indicator of *R. strumiferum*.

Differences in the calyptra are even more reliable. In *R. cuspidigerum*, this has one fissure even when still cylindrical. When the calyptra widens the entire basal part is involved, leaving the mature calyptra conical and ultimately cucullate. By contrast, the calyptra of *R. strumiferum* lacks fissures in the cylindrical phase; when it widens only the section above the base is involved. This results in a ±narrowly pear-shaped calyptra. As the widening progresses the base ruptures in several fissures, and the calyptra becomes mitrate.