

CALYMPERES

William D. Reese† & Ilma G. Stone†

Calymperes Sw., in F. Weber, *Tab. Calyptr. Operc.* [3] (1814); from the Greek *calymma* (a covering), and *peiro* (to pierce through), evidently in reference to the calyptra entirely and permanently covering the capsule and developing fissures through which the spores escape.

Type: *C. lonchophyllum* Schwägr.

Plants mostly small, tufted. Stems erect. Rhizoids predominantly brown, although red to dark purple in a few species. Leaves oblong to lanceolate or linear, often dimorphic; highly modified gemmiferous leaves common and often with distinct gemma receptacles; leaf margins generally thickened, mostly lacking elongate hyaline cells; cells of limb isodiametric or transversely elongate; teniolae common. Gemmae clavate-fusiform, in distinct gemma-receptacles in some species.

Calyptra persistent, spirally furrowed when dry, enclosing the capsule, clasping the operculum by its rostrum and twisting around the seta below, opening by vertical slits above. Seta elongate. Capsules exserted (or emergent in a few species), cylindrical; operculum rostrate. Peristome lacking.

A pantropical genus of c. 40 species, the majority either Neotropical or confined to the Palaeotropics, but a few pantropical. Fourteen species in Australia, all in northern Queensland, the Northern Territory, and the Kimberley region of Western Australia.

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Key

- 1 Cells of limb \pm transversely elongate; leaves narrowly linear2
- 1: Cells of limb \pm isodiametric; leaf shape various but not narrowly linear3
 - 2 Cells of cancellinae sharply demarcated distally from adjacent cells of limb; median and distal cells of axillary hairs c. 4 or more times longer than wide**13. C. lonchophyllum**
 - 2: Cells of cancellinae gradually merging distally with cells of limb; median and distal cells of axillary hairs mostly less than 2 times longer than wide **14. C. serratum**
- 3 Teniolae lacking4
- 3: Teniolae present (sometimes weak, obscure, \pm hidden by papillae, or \pm lacking in some leaves)6
 - 4 Costa shortly excurrent in gemmiferous leaves and bearing gemmae all around its tip in conspicuous pale spherical clusters **11. C. tenerum**
 - 4: Costa at most only percurrent in gemmiferous leaves, bearing gemmae only on the adaxial surface at its tip5
- 5 Vegetative leaves mostly lingulate; gemmiferous leaves mostly constricted only at the apex; apex with its tuft of gemmae often folded down onto the adaxial surface of the leaf when dry**12. C. motleyi**
- 5: Vegetative leaves mostly broadly oblong-linear to lanceolate; gemmiferous leaves mostly \pm narrowed throughout, often strongly so, their tips erect or flexuous but never folded down adaxially
 - 6 Leaf margins grossly tuberculate; leaves narrowly long-acuminate; teniolae obscured by tuberculosities; cancellinae narrowly scalariform **6. C. strictifolium**
 - 6: Leaf margins entire or variously toothed or roughened but not tuberculate; leaf shape various; teniolae distinct (occasionally weakly developed or lacking in some leaves); cancellinae scalariform or rounded7
- 7 Leaves strongly dimorphic; gemmiferous ones stiffly erect and consisting essentially of the narrowly winged costa, lacking saucer-shaped gemma receptacles at their tips8
- 7: Leaves mostly monomorphic or only somewhat dimorphic; gemmiferous ones mostly differentiated only at their tips or narrowed throughout but clearly laminate and similar to vegetative leaves; saucer-shaped gemma receptacles present or absent (if strongly differentiated throughout, then gemmiferous leaves flexuous, not stiffly erect, clearly bearing gemmae only on adaxial surface at apex – *C. moluccense* p.p.)10
 - 8 Plants robust; leaves patent, their margins coarsely toothed above; teeth in a single row **7. C. porrectum**
 - 8: Plants small; leaves erect to spreading, their margins entire above or only inconspicuously toothed ..9
- 9 Cancellinae scalariform distally, ascending higher along costa than along leaf margins; at least some leaves with delicate elongate, often projecting marginal hyaline cells along mid-leaf or below
 5. **C. subintegrum**
- 9: Cancellinae rounded distally; elongate projecting hyaline cells lacking on margins **4. C. couguiense**
- 10 Adaxial distal cells of cancellinae (at least some of them) distinctly mammillose, the mammillae pointing toward the leaf tip; gemmae borne all around the excurrent tip of the costa**3. C. erosum**
- 10: Adaxial distal cells of cancellinae plane; gemmae borne only on adaxial surface of the leaf tip 11
- 11 Gemmae borne in a distinct receptacle 12
- 11: Gemmae not in distinct receptacles 13

- 12 Leaves crispate when dry; gemmiferous leaves typically tightly uncinata at the tips when dry; gemma receptacles folded down onto the adaxial surfaces of leaves **9. C. crassinerve**
- 12: Leaves variously contorted but never crispate; tips of gemmiferous leaves straight or flexuous when dry but never folded down onto the adaxial surfaces of leaves **8. C. moluccense**
- 13 Plants robust, coarse; leaves often coarsely toothed above; cancellinae rounded above, often with files of hyaline cells interlocking among adjacent green cells of limb **2. C. taitense**
- 13: Plants small to medium-sized, scarcely coarse; leaves entire or only weakly toothed; cancellinae scalariform **1. C. afzelii**

1. Calymperes afzelii Sw., *Jahrb. Gewächsk.* 1: 3 (1818)

T: Africa, *Afzelius*; holo(?): BM *n.v.*

Illustrations: S.R.Edwards, *op. cit.* 68, fig. 6; 70, fig. 7; W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 161, fig. 20; A.Eddy, *op. cit.* 115, fig. 239.

Plants to 10 mm tall, yellowish to brownish green, gregarious or in thin to dense turfs or tufts. Stems erect, simple or forked. Rhizoids reddish to yellowish brown. Leaves essentially monomorphic, slightly curved or contorted when dry, ascending when moist, oblong-lanceolate from a broader base, 3–6 mm long; margins entire, or serrate (especially above); cells of limb almost smooth to finely papillose abaxially, bulging-papillose adaxially; teniolae mostly distinct and conspicuous; cancellinae mostly scalariform; gemmiferous leaves usually constricted at the tips and forming a distinct ‘proboscis’ with narrowly revolute margins. Gemmae common, adaxial on tips of gemmiferous leaves. Sporogones not seen in Australian material.

This pantropical moss occurs in Melville Island, N.T. and north-eastern Qld from Cape York to Proserpine; grows on tree trunks, roots, rocks, soil, rarely on logs, at elevations up to c. 1000 m.

N.T.: Melville Is., *J.Russell-Smith 1303, 1304* (DNA, MELU). Qld: 7 km S of Cape York, *I.G.Stone 25577* (MELU); Daintree River road, 29 km NNW of Mossman, *H.Streimann 45965* (CANB, KRAM, MHA, MO, NY); Stoney Ck, Cardwell, *I.G.Stone 14857* (BRI, MEL, MELU); Conway S.F., 18 km ENE of Proserpine, *H.Streimann 37357* (CANB)

Calymperes afzelii is rather common, but rarely abundant in north-eastern Queensland. *Calymperes erosum* is superficially similar, but it differs in having the adaxial distal cells of the cancellinae mammillose and in bearing gemmae all around on the tip of the excurrent costa that is not incorporated into a proboscis. See also comments under *C. taitense*.

2. Calymperes taitense (Sull.) Mitt., *J. Linn. Soc., Bot.* 10: 172 (1868)

Syrhropodon taitensis Sull., *U.S. Explor. Exped., Musci* 6 (1860). T: Tahiti [French Polynesia], *coll. unknown*; holo: FH; iso: BM.

Illustrations: W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 161, fig. 21; H.O.Whittier, *op. cit.* 144, fig. 41; A.Eddy, *op. cit.* 113, fig. 238; W.D.Reese & P.-J.Lin, *op. cit.* 336, fig. 33–37.

Plants robust, dark green to blackish, mostly 10–25 mm tall, forming loose tufts and mats. Stems uncinata, often sprawling, simple or forked. Rhizoids brown to reddish brown or dark purple. Leaves monomorphic, loosely contorted-curved when dry, spreading-ascending when moist, 5–7 mm long, linear from a slightly broader base; margins thickened, often conspicuously toothed above; cells smooth or minutely papillose abaxially, bulging adaxially; teniolae very conspicuous, often marginal or nearly so at the leaf shoulders; cancellinae rounded distally, often with files of hyaline cells extending up among green cells of the limb; gemmiferous leaves with a well-developed ‘proboscis’ having narrowly revolute margins. Gemmae on adaxial surface at leaf tips. Sporogones not seen in Australian material.

Occurs in north-eastern Qld from Bloomfield River south to Ingham; on tree trunks and boulders in rainforest along streams, to c. 1000 m. Also in the Comoros, the Seychelles, Madagascar, the Andamans Islands, SE and E Asia, Malesia (including Papua New Guinea), the Philippines and Oceania.

Qld: Donovan Ck, between Cape Tribulation and Bloomfield, *W.D.Reese 17386* (LAF, MELU); 24 miles [c. 39 km] N of Mossman, *D.H.Norris 42676* (CANB, BRI); 20 km S of Gordonvale, *G.E.Kantak & S.P.Churchill 964* (CANB, LAF, NY); Mt Mackay, near Tully, *I.G.Stone 22511* (MELU); Seaview Ra., Ingham, *I.G.Stone 21299 p.p.* (MELU).

Typical *C. taitense* is very distinctive due to the dark, robust plants growing in streamside habitats. However, there appears to be intergradation with its close relative *C. afzelii*. The scalariform cancellinae of the latter, usually not interlocking with the limb, the absence of coarse marginal teeth, and the smaller size of the plants and leaves are usually sufficient to distinguish *C. afzelii* from *C. taitense*.

3. *Calymperes erosum* Müll.Hal., *Linnaea* 21: 182 (1848)

T: "prope fl. Toultonne" (?), "Dutch Guiana" [Surinam], *Kegel 539*; iso: PC.

Calymperes kennedianum Hampe, *Linnaea* 40: 303 (1876). T: Rockingham Bay, Qld, *Kennedy*; holotype: BM; iso: S.

Illustrations: S.R.Edwards, *op. cit.* 58, fig. 1c; 74, fig. 8; 75, fig. 9 *p.p.*; W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 165, figs 27–28; A.Eddy, *op. cit.* 117, fig. 240.

Plants green to yellowish or blackish, occasionally with a pinkish tinge, to 10 mm tall, in low dense tufts or turfs. Stems erect, often curved, simple or forked. Rhizoids reddish brown. Leaves somewhat dimorphic, mostly 3–4 mm long, contorted-curved to nearly straight when dry, ascending when moist, lanceolate to acuminate above a broader base; margins slightly thickened, finely serrate; cells of limb minutely papillose abaxially, bulging adaxially; teniolae usually distinct, occasionally weak or lacking in some leaves or entire plants; cancellinae mostly rounded above, the distal cells mammillose adjacent to the green cells of the limb, or at least toward the margins; gemmiferous leaves contracted above with the costa shortly or long excurrent. Gemmae common, reddish, borne all around the tip of the costa in spherical clusters. Sporogones not seen in Australian material.

Occurs in the Kimberley region of W.A., in northern N.T. and north-eastern Qld from Cape York to Proserpine; grows on trees (including mangroves), roots, rock, soil and humus in monsoon and rainforest from sea level to c. 1000 m. Pantropical.

W.A.: Kununurra, Kimberley, *I.G.Stone 23497* (MELU). N.T.: 'Pethericks Rainforest', 39 km ESE of Batchelor, *H.Streimann 48174* (CANB, KRAM, MHA, MO, NY). Qld: Silver Plains Stn, MacIlwraith Ra., *J.R.Clarkson 2635, 2643a* (BRI, MELU); Donovan Ck. between Cape Tribulation and Bloomfield, *W.D.Reese 17384* (LAF, MELU); Waterfall Ck, Cardwell, *I.G. & A.G.Stone 16261* (MELU); 13 km SE of Proserpine, *H.Streimann* (CANB).

Calymperes erosum is not often abundant or conspicuous in northern N.T. and Qld. However, in Edmund Kennedy National Park, near Cardwell, it forms conspicuous colonies on sandy soil at tree bases along paths in low evergreen forest on old dunes. This species often resembles *C. afzelii* macroscopically; see comments under the latter for distinguishing characters.

4. *Calymperes couguiense* Besch., *Ann. Sci. Nat., Bot.*, sér. 5, 18: 206 (1873)

T: Monte Cougui, New Caledonia, *Balansa*; holotype: BM.

Illustrations: W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 159, figs 12–13 (1986); H.O.Whittier, *op. cit.* 118, figs 31o–r, 36, as *C. pseudopodianum* E.B.Bartram; A.Eddy, *op. cit.* 109, fig. 235.

Plants dark green, to c. 5 mm tall, in loose tufts and turfs. Stems erect, simple. Rhizoids brown. Leaves strongly dimorphic; vegetative ones c. 3 mm long, loosely curled when dry, straight when moist, oblong-lanceolate from a broader base; margins slightly thickened, essentially entire; cells sharply papillose on both surfaces; teniolae present but often obscured by involution of leaves; cancellinae rounded to almost scalariform above; gemmiferous leaves rough, stiffly erect when wet and dry, the lamina reduced to narrow wings or ridges. Gemmae common, in a well-defined but evanescent cup-shaped receptacle at the leaf apex. Sporogones unknown.

Occurs in north-eastern Qld between the Daintree River and near Townsville; grows on tree trunks, rotting logs, and rock in forests up to an altitude of c. 500 m. Also in Java, New Guinea and Oceania.

Qld: Cilento property W of Miallo, *I.G.Stone* 24554 (MELU); Cascades, Freshwater Ck, Cairns, *I.G.Stone* 15334 p.p., 15349 p.p. (MELU); trail to Majuba Ck, Bellenden Ker Natl Park, *W.D.Reese* 17455 (LAF, MELU); Kennedy Bay Reserve 229, *I.G.Stone* 18577 (MELU); Crystal Ck, Mount Spec Natl Park, NE Townsville, coll. *unknown* (HSC).

This species, together with *C. subintegrum* and *C. strictifolium* (below), form a natural group as shown by their general similarity. *Calymperes couguiense* lacks the gross tuberculosities on its leaf margins typical of *C. strictifolium*, and it lacks the delicate, hyaline marginal cells of *C. subintegrum*. Colonies of *C. couguiense* often appear bristly due to the stiffly erect gemmiferous leaves, as do those of *C. subintegrum*. In *C. couguiense* the cancellinae are usually rounded distally but in *C. subintegrum* they are acute distally. Plants of *C. couguiense* are generally larger and coarser in every way than those of *C. subintegrum*.

5. *Calymperes subintegrum* Broth., in E.J.Schmidt, *Bot. Tidsskr.* 24: 119 (1901)

T: Lem Dan, Koh Chang, Thailand, "ad trunc. arb. in silv. litor.", 7 Jan. 1900, *J.Schmidt* 23; holo: H; iso: NY, S, US.

[*Calymperes schmidtii* auct. non Broth.: L.T.Ellis, *op. cit.* 589 (1991)]

Illustrations: W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 159, figs 14–16, as *Calymperes schmidtii*.

Plants c. 5 mm tall, mostly dark green, forming low loose or compact sods or tufts. Stems erect, simple. Rhizoids brown. Leaves strongly dimorphic; vegetative ones involute, 2–3 mm long, loosely uncinately to curled-contorted when dry, straight and involute when moist, oblong-lanceolate from a slightly broader base; margins unistratose, entire to slightly erose above, entire or toothed by delicate protruding hyaline cells below; cells of limb smooth to sharply papillose abaxially, bulging-mammillose adaxially; teniolae delicate, best developed above shoulders; cancellinae narrowly scalariform; gemmiferous leaves 4–6 mm long, narrow, stiffly erect wet and dry or flexuous, essentially elminate. Gemmae common, borne adaxially on slightly expanded apices of gemmiferous leaves. Sporogones not seen in Australian material.

Occurs in north-eastern Qld from the Daintree River to Mackay; usually on soil and rock, sometimes on tree bases and rotted wood in rainforest and wet-sclerophyll up to c. 850 m. Also in Thailand, Malesia and Oceania.

Qld: Whyanbeel Rd to mountains W of Miallo, *W.D.Reese* 17432 (LAF, MELU); The Boulders, 6 km W of Babinda, *H.Streimann* 45659 (CANB, KRAM, PRE); track to North Shepherd Beach, Hinchinbrook Is., *I.G.Stone* 22597 (MELU); Stoney Ck, Cardwell, *I.G.Stone* 18651 (MELU); Cape Hillsborough Natl Park, NE of Mackay, *D.H.Norris* 39097 (HSC, LAF).

Although similar in a general way to *C. couguiense*, *C. subintegrum* differs in its smaller stature and, especially, in having delicate, hyaline, marginal cells projecting to form teeth at midleaf or below. The hyaline cells may not be present on every leaf. The stiffly erect gemmiferous leaves give colonies of this moss a bristly appearance, as in *C. couguiense*.

Ellis (1991) demonstrated that *C. subintegrum* is the correct name for the species that has been treated under the name *C. schmidtii* Broth. by recent authors, e.g., Menzel & Schultze-Motel (1990) and Reese *et al.* (1986). According to Ellis, the name *C. schmidtii* Broth. applies to another species of *Calymperes*, distinct from *C. subintegrum*.

6. *Calymperes strictifolium* (Mitt.) G.Roth, *Hedwigia* 51: 127 (1911)

Syrhropodon strictifolius Mitt., *Fl. Vit.* 388 (1873). T: Tutuila, Samoa, *T.Powell s.n.*; holo: NY; iso: BM, FH, H, S.

Illustrations: W.D.Reese, T. Koponen & D.H.Norris, *op. cit.* 161, figs 17–19; A.Eddy, *op. cit.* 112, fig. 237; W.D.Reese & P.-J.Lin, *op. cit.* 338, figs 38–41.

Plants to c. 10 mm tall, glaucous green, in dense wiry tufts. Stems erect, forked. Rhizoids brown. Leaves erect-flexuous when wet and dry, dimorphic, but most plants with all or

mostly gemmiferous leaves; vegetative leaves 3–5 mm long, linear from a broader base; margins thickened and densely beset with tuberculosities; cells of limb with tall multifid papillae on both faces; teniolae usually obscured by tuberculosities; cancellinae scalariform; gemmiferous leaves subulate, roughened, with a very small but distinct gemma receptacle. Gemmae reddish, common, adaxial on tips of gemmiferous leaves. Sporogones not seen.

Rare on trees in north-eastern Qld between Cairns and Innisfail. Also in Sumatra, Borneo, the Philippines, Papua New Guinea and Oceania.

Qld: near Cairns, Aug. 1890, *C.Wild* (BRI); Mt Bellenden Ker, *W.D.Reese 17111* (LAF); Woopen Creek Rd near Innisfail, *I.G.Stone 18138* (MELU).

Narrow, mostly gemmiferous leaves with the margins roughened by gross tuberculosities, scalariform cancellinae, and the teniolae often obscured by tuberculosities characterise the uniquely distinctive *C. strictifolium*.

7. *Calymperes porrectum* Mitt., *J. Linn., Soc. Bot.* 10: 172 (1868)

T: Tutuila, Samoa, *T.Powell 10*; holo: NY; iso: BM.

Illustrations: W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 161, figs 22–23; H.O.Whittier, *op. cit.* 118, fig. 31L–N; A.Eddy, *op. cit.* 106, fig. 233; 107, fig. 234.

Plants pale green, darker in older parts, to 3 cm tall, in loose or compact tufts and cushions. Stems mostly simple, erect. Rhizoids reddish brown. Leaves strongly dimorphic; vegetative ones 3–5 mm long, patent when dry, spreading-ascending when wet, oblong-lanceolate from a broader base; leaf margins slightly thickened, coarsely toothed with large single teeth; cells of limb smooth; teniolae prominent; cancellinae distinct, rounded to scalariform; gemmiferous leaves stiffly erect when wet and dry, narrow, virtually elminate distally, with swollen rough tips; gemma receptacle not developed. Gemmae reddish, in tight clusters on tips of gemmiferous leaves. Sporogones unknown.

Occurs in northern N.T. and north-eastern Qld; grows on tree trunks and moist rock ledges in perennial seep in vine forest, at low altitudes. Also in India, Sri Lanka, Sumatra, Java, Sulawesi, Malaysia, Borneo, the Philippines, Papua New Guinea and Oceania.

N.T.: 7 km N of Ngilipitji Outstation, Bath Ra., Arnhem Land, *J.Russell-Smith & Lucas 3201, 3203, 3224* (CANB). Qld: Noah Ck, Cape Tribulation, *I.G.Stone 19318* (MELU).

Although *C. porrectum* is currently known in Australia from only a few collections, it will likely turn up in other localities in northern Queensland and the Northern Territory, because it is widespread and common in tropical areas to the north of Australia. The dimorphic leaves, with the vegetative ones patent when dry and the gemmiferous ones erect when wet and dry make this moss easy to recognise at low magnification. Under the microscope the coarsely toothed vegetative leaves with the teeth single, smooth cells, and prominent teniolae are diagnostic.

8. *Calymperes moluccense* Schwägr., *Sp. Musc. Frond.* Suppl. 2, 1: 99 (1824)

Calymperes palisotii Schwägr. subsp. *moluccense* (Schwägr.) M.Menzel, in M.Menzel & W.Schultze-Motel, *Willdenowia* 19: 489 (1990). T: Rauwack, [Maluku Islands (Moluccas), Indonesia], *Gaudichaud*; holo: G; iso: BM, FH, L, NY.

Calymperes nigrescens Broth. & Geh., *Öfvers. Förh. Finska Vetensk.-Soc.* 42: 97 (1899). T: Bellenden Ker Range, Qld, *Mrs Gribble*; holo: H; iso: FH.

Illustrations: L.T.Ellis, *op. cit.* 686, fig. 1; 687, fig. 2; W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 179, figs 39–40 (as *C. palisotii* Schwägr.); A.Eddy, *op. cit.* 123, fig. 244.

Plants 5–15 mm tall, often glossy, dark green to brownish or blackish, in dense tufts, cushions and turfs. Stems erect or curved, simple or forked. Rhizoids brown to reddish brown. Leaves somewhat dimorphic; vegetative ones c. 3 mm long, involute and curved when dry, straight when moist, oblong-ligulate to broadly linear above the broader base, the shoulders often flaring; margins slightly thickened above, entire; cells of limb smooth to distinctly papillose abaxially, noticeably bulging to sharply mammillose-papillose adaxially; teniolae usually distinct at leaf shoulders but often weak and sometimes \pm lacking in some

leaves; cancellinae rounded or truncate distally; gemmiferous leaves little differentiated or very narrow and stiffly erect when wet and dry, commonly with (occasionally without) a distinct gemma receptacle. Gemmae glossy, reddish to dark red or blackish, in often hairbrush-like tufts adaxially at tips of gemmiferous leaves.

Very rarely fruiting in Australia. Calyptra c. 3.5 mm long. Seta yellow to red, 2–3 mm long. Capsules c. 2 mm long; operculum c. 0.75 mm long. Spores 24–40 µm diam., finely granular.

Occurs in Qld from Goode Island and Cape York down the east coast to Mackay. Grows on trees and rocks from sea level (including mangrove swamps) to c. 600 m. Also in Sri Lanka, the Andamans Islands, SE Asia, southern China (Hainan Island), Malesia (including Papua New Guinea), the Philippines and Oceania.

Qld: Goode Is., nr Thursday Is, *W.Powell*, 1881, 1883 (MEL, NY); 7 km S of Cape York, *I.G.Stone* 25599 (MELU); Mt Tozer, *J.R.Clarkson* 2913 (BRI, MELU); Mount Tyson Track, 2 km W of Tully, *H.Streimann* 45619 (CANB, MHA, NY); Conn Ck, S of Cardwell, *I.G.Stone* 16351 (MELU).

The firm texture and dark color of *C. moluccense* are distinctive, as are the gemmiferous leaves with the gemmae in hairbrush-like tufts and usually in a distinct receptacle. This is a very common and often abundant moss at low elevations, particularly along the coast. Plants of *C. graeffeanum* can be similar, but their leaves lack teniolae. Some specimens of *C. crassinerve* can also be similar; see comments under that species. This taxon was treated by Reese *et al.* (1986) as being synonymous with *C. palisotii* Schwägr., which occurs in the Americas, Africa, and elsewhere. However, Ellis (1987) pointed out that *C. palisotii* and *C. moluccense* differ in various ways and reinstated the latter at the specific level.

9. *Calymperes crassinerve* (Mitt.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturw. Ges.* 1871–1872: 481 (1873)

Thyridium crassinerve Mitt., *J. Linn. Soc., Bot.* 10: 189 (1868). T: Tutuila, Samoa, on bark, *T.Powell* 129; holo: NY.

Illustrations: H.A.Miller, H.O.Whittier & C.E.B.Bonner, *Bryoflora of the Atolls of Micronesia* pl. 9 (1963), as *C. moorei* E.B.Bartram; W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 165, figs 37–38; H.O.Whittier, *op. cit.* 139, fig. 38; 141, fig. 39 (1976), as *C. moorei* E.B.Bartram.

Plants small, to c. 5 mm tall, green to yellowish green, forming low dense sods. Stems erect or repent, mostly simple. Rhizoids brown to dark reddish brown. Leaves dimorphic; vegetative ones 1–2 mm long, blunt, crispate when dry, folded or flat when wet, oblong above a broader base, shoulders often flaring; margins unistratose, entire; cells of limb bulging on both surfaces; teniolae distinct, mostly 1 cell wide and 1 cell inside margin at the shoulders; cancellinae typically obliquely truncate distally; gemmiferous leaves contracted below an expanded saucer-shaped gemma receptacle. Gemmae small, pale green, in hairbrush-like tufts adaxially on leaf tips, the gemma receptacle with its tuft of gemmae uncinat and folded onto adaxial surface of leaf when dry, concealing the gemmae.

Sporogones very rare in Australia. Calyptra c. 2.5 mm long, its base not or scarcely exceeding the tips of perichaetial leaves. Seta reddish, 1.5–2.0 mm long. Capsules emergent, 1.0–1.5 mm long; operculum c. 0.75 mm long. Spores 34–36 µm diam., finely granular.

Occurs in north-eastern Qld from Cape York to Cardwell; grows on trees including mangroves, stumps and rotted logs, rarely on rock, mostly at or near sea level but up to c. 500 m. Also in the Andamans Islands, Sumatra, Java, Malaysia, the Philippines, Papua New Guinea and Oceania.

Qld: 7 km S of Cape York, *I.G.Stone* 25601 (MELU); Beatrice Rd, Stewart Ck, 17 km NNW of Mossman, *H.Streimann* 45952 (CANB, NY); Graham Range Natl Pk, 27 km NNE Innisfail, *W.D.Reese* 17082 (LAF); Kennedy Reserve 229, *I.G.Stone* 18579 (BRI, MEL, MELU); Edmund Kennedy Natl Park, Cardwell, *I.G.Stone* 18768 (MELU).

This minute moss is easily recognised by its leaves ±crispate when dry and with the gemmiferous ones having the brush-like tuft of gemmae folded down onto the adaxial surface of the leaf when dry. In some respects, *C. moluccense* is similar, but it differs most noticeably in its gemmiferous leaves with erect, rather than downfolded, tips. *Calymperes motleyi* is very similar, but it lacks teniolae.

10. Calymperes graeffeanum Müll.Hal., *J. Mus. Godeffroy* 3(6): 64 (1864)

T: Upolu, Samoa, on mangroves, *Graeffe*; iso: BM, FH, NY.

[*Calymperes dozyanum* auct. non Mitt.: W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 168 (1986)]

Illustrations: L.T.Ellis, *J. Bryol.* 15: 135, fig. 2 (1988); W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 165, figs 35–36 (1986), as *C. dozyanum*.

Plants small, often wiry, to c. 5 mm tall, pale green to darker, forming loose to compact tufts and sods. Stems mostly simple, erect or curved. Rhizoids brown to reddish brown. Leaves usually strongly dimorphic; vegetative ones mostly 2–3 mm long, involute and contorted when dry, mostly involute or folded when wet, oblong to linear from broader base; margins uni- to multistratose, entire above, occasionally toothed at the shoulders; cells of limb smooth to unipapillose abaxially, bulging-mammillose adaxially; teniolae mostly lacking, rarely vestigial at the shoulders; cancellinae broad, distinct, scalariform to rounded distally; gemmiferous leaves usually narrow and erect, the gemma receptacle often well developed and saucer-shaped but occasionally reduced or lacking. Gemmae common, glossy, red to reddish green, in dense tufts adaxially on the tips of gemmiferous leaves. Sporogones not seen.

Occurs in northern N.T. and in eastern Qld as far south as Townsville; grows on tree trunks, logs and boulders in complex mesophyll and vine forests; also on mangroves, mostly at or near sea level, but up to c. 400–500 m. Widespread in the Palaeotropics, from Madagascar far into Oceania.

N.T.: NE Arnhem Land, 7 km SE of mouth of Giddy R., *J.Russell-Smith 4885* (CANB, DNA, NY). Qld: 7 km S of Cape York, *I.G.Stone 25617 p.p.* (MELU); Grass Tree Pocket Rd, 40 km S of Cooktown, *H.Streimann 46277* (CANB, COLO, KRAM, MHA, NY); Emmagen Ck, N of Cape Tribulation, *I.G.Stone 19435* (MELU); Porter Ck, S of Cardwell, *I.G.Stone 23131* (BRI, MEL, MELU, NSW).

This moss is usually easily recognised by its very narrow, often stiffly-erect gemmiferous leaves bearing gemmae only on the adaxial surface of the tips, as in *C. moluccense*, which, among other differences, regularly has teniolae. However, leaves of occasional specimens of *C. graeffeanum* bear traces of teniola-like cells in the shoulder regions. *Calymperes tenerum* and *C. motleyi* are similar in some respects to *C. graeffeanum* (see below).

11. Calymperes tenerum Müll.Hal., *Linnaea* 37: 174 (1872)

T: Calcutta, India, *Kurz*; iso: BM.

Calymperes tenerum Müll.Hal. var. *edamense* M.Fleisch., *Musci Fl. Buitenzorg* 1: 275 (1904). T: Java, [Indonesia], auf der insel Edam in der Bai von Batavia an Baumrinde, Feb. 1898, *M.Fleischer [Musci Frond. Arch. Indici, ser. 2, 63 (1899)]*; holo: FH; iso: CHE, DUKE, H, NY.

Illustrations: S.R.Edwards, *op. cit.* 84, fig. 12; W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 165, figs 31, 32; H.O.Whittier, *op. cit.* 118, fig. 31H–K.

Plants small, mostly less than 5 mm tall, dark green, in thin to compact sods. Stems very short, erect. Rhizoids reddish brown. Leaves 1–2 mm long, nearly monomorphic, involute and curved (often secund) when dry, straight when wet, oblong to lanceolate; margins unistratose to slightly thickened, entire, composed of small green quadrate cells along the sheath; cells of the limb smooth to papillose abaxially, bulging adaxially; teniolae lacking; cancellinae small, narrow, rectangular, truncate or rounded distally; gemmiferous leaves often narrower than vegetative leaves and with costa shortly excurrent; gemma receptacle lacking. Gemmae green, in pale spherical golfball-like clusters all around the tips of excurrent costae.

Sporogones rare in Australia. Calyptra 2.5–3.0 mm long, its base not or scarcely exceeding the tips of perichaetial leaves. Seta reddish yellow, very short, 1.5–2.0 mm long. Capsules emergent, c. 2 mm long; operculum c. 0.5 mm long. Spores 30–52 µm diam., finely granular or smooth.

This pantropical moss occurs in the Kimberley region of north-western W.A., in northern N.T. and north-eastern Qld from Cape York to Mackay. Grows on trees (including

mangroves), palms and shrubs, primarily in low, coastal vegetation but also inland, to 400–500 m.

W.A.: Camp Creek, Mitchell Plateau, North Kimberley, *K.F.Kenneally* 8694 (PERTH). N.T.: Bathurst Is., *J.Russell-Smith* 1302 (DNA, MELU); 51 km S of Darwin, *H.Streimann* 8739 (CANB). Qld: Frenchmans Ck, S of Cairns, *W.W.Watts* Q393 (NSW); Cardwell, *I.G.Stone* 14956 (MELU); 17 km SE Proserpine, *H.Streimann* 37586, 37592, 37600 (CANB).

The small size, the absence of teniolae, narrow truncate cancellinae, quadrate marginal cells on the sheath, and dense pale spherical clusters of gemmae borne all around the tip of the costa are diagnostic. Even when the gemmae have fallen, the naked excurrent costa tip of gemmiferous leaves is distinctive. Among Australian *Calymperes*, only the teniolate *C. erosum* also bears gemmae all around a naked excurrent costa tip. *Calymperes graeffeanum* and *C. motleyi* are similar in some respects, but they bear gemmae only on the adaxial surface of the leaf tips.

Calymperes motleyi and *C. graeffeanum* are more likely to be confused with *C. tenerum* if gemmiferous leaves are lacking. However, the cancellinae of *C. graeffeanum* are broader and rounded to scalariform distally, rather than truncate as in *C. motleyi* and *C. tenerum*, and the leaf shoulders are often somewhat toothed in *C. graeffeanum*. Non-gemmiferous *C. motleyi* and *C. tenerum* are probably indistinguishable, but most specimens bear gemmae.

12. *Calymperes motleyi* Mitt., in F.Dozy & J.H.Molkenboer, *Bryol. Javan.* 1: 48 (1856)

T: near Tanjung Kaebong, Labuan, Borneo, [Malaysia], *Motley*; holotype: NY; isotype: BM, L.

Calymperes panduraefolium Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 40: 165 (1898). T: Cape York, Qld, Aug. 1872, *W.Micholitz* 210; holotype: H; isotype: BM, FH, S.

Illustrations: H.A.Miller, H.O.Whittier & C.E.B.Bonner, *Bryoflora of the Atolls of Micronesia* pl. 7 (1963), as *C. motleyi* and *C. volkensis* Broth.; H.O.Whittier, *op. cit.* 143, fig. 40, as *C. quaylei* E.B.Bartram; W.D.Reese, T.Koponen & D.H.Norris, *op. cit.* 165, figs 33–34.

Plants very small, dark green, to 5 mm tall, but mostly shorter; in thin to dense turfs. Stems erect, mostly simple. Rhizoids reddish brown. Leaves somewhat dimorphic; vegetative ones 1–2 mm long, contorted-curved when dry, folded and curved when wet, oblong or bluntly pointed above the base; margins unistratose, entire; cells of limb smooth to bluntly papillose abaxially, markedly bulging adaxially; teniolae lacking; cancellinae distinct, narrow, truncate (sometimes obliquely) distally; gemmiferous leaves constricted at the tips around included tip of costa. Gemmae small, green to reddish, in brush-like tufts adaxial on costa tip, the leaf tip with its tuft of gemmae often folded onto the adaxial surface of leaf as in *C. crassinerve*.

Sporogones rare. Calyptra c. 2 mm long. Seta reddish yellow, 1–2 mm long. Capsules 0.5–1.0 mm long, scarcely exerted; operculum c. 0.5 mm long. Spores 26–31 µm diam., finely granular.

Occurs in northern N.T. and north-eastern Qld as far souther as Mackay; on trees, rarely on dead wood and rock, mainly in low coastal and near-coastal forests, including mangroves, but up to c. 400 m inland. Its range lies ±along the equator from the Seychelles to Oceania.

N.T.: Melville Is., *J.Russell-Smith* 1305 (DNA, MELU); Nourlangie, Kakadu Natl Park, *I.G.Stone* 23388 (BM, DNA, MEL, MELU, NSW). Qld: Lockerbie, Cape York, *I.G.Stone* 25573 (MELU); c. 14 km N of Cape Tribulation, *W.D.Reese* 17381 (LAF, MELU); 7 km S of Port Douglas, *H.Streimann* 31074 (CANB).

Calymperes motleyi is easy to recognise when bearing gemmiferous leaves because of the characteristic shouldered appearance of the gemmiferous leaf tips with the apex of the costa included within the margins of the leaf tip. When lacking gemmiferous leaves, it can be confused with *C. tenerum* and *C. graeffeanum* and such specimens may not be identifiable with certainty.

13. *Calymperes lonchophyllum* Schwägr., *Sp. Musc. Frond.* Suppl. 1, 2: 333 (1816)

T: “In arboribus Guyanne” [French Guiana], *Richard*; isotype: PC.

Illustrations: S.R. Edwards, *op. cit.* 86, fig. 13; 87, fig. 14 (1980); W.D. Reese, T. Koponen & D.H. Norris, *op. cit.* 157, figs. 4–7; H.O. Whittier, *op. cit.* 118, fig. 31A–D, as *Syrhodon mooreae* (Besch.) H. Whittier; A. Eddy, *op. cit.* 97, fig. 226.

Plants pale to dark green, in low tangled springy mats. Stems erect, very short to conspicuously elongate. Rhizoids light brown. Leaves monomorphic, mostly 8–15 mm long, with conspicuous fascicles of paraphysis-like axillary hairs, linear, curled or contorted when dry, straight when wet; margins of limb thickened, mostly variously double-toothed above; margins of sheath entire, or serrate due to 1 or more marginal rows of delicate protruding hyaline cells, but these often lacking; cells of limb transversely elongate, smooth, often irregularly bistratose; teniolae lacking; cancellinae distinct, sharply demarcated distally from green cells, rounded or somewhat scalariform distally. Axillary hairs numerous, their median and distal cells mostly c. 4 times longer than wide. Gemmae reddish, sparse, inconspicuous, warty, adaxial on leaf tips, also abaxial and adaxial along costa and margins of older leaves. Sporogones not seen.

Occurs in north-eastern Qld from Cape Tribulation to Cardwell; on tree trunks and rocks in forest, mostly along streams, to c. 600 m elevation. Pantropical.

Qld: along Whyanbeel Rd into mountains W of Miallo, *W.D. Reese 17427* (LAF, MELU); 2 miles [c. 3.2 km] W of Mossman, *D.H. Norris 42602* (BRI, HSC); Sullivans Track, c. 6 km WNW of Cardwell, *I.G. Stone 24347, 24524, 24532, 24671* (MELU); *loc. id.*, *W.D. Reese 17167* (LAF).

Linear leaves with transversely elongate cells distinguish *C. lonchophyllum* from all other Australian species apart from *C. serratum*. In the latter, the distal cells of the cancellinae gradually blend in with the adjacent green cells of the limb, in contrast to the sharply demarcated cancellinae of *C. lonchophyllum*, and the median and distal cells of the axillary hairs are much shorter than those of *C. lonchophyllum*. Furthermore, the rhizoids of *C. serratum* are dark red-purple rather than brown as in *C. lonchophyllum*.

14. *Calymperes serratum* A. Braun ex Müll. Hal., *Syn. Musc. Frond.* 1: 527 (1849)

T: Java, [Indonesia], *F.W. Junghuhn*; iso: H.

Illustrations: W.D. Reese, T. Koponen & D.H. Norris, *op. cit.* 157, figs 1–3; A. Eddy, *op. cit.* 100, figs 228–229; W.D. Reese & P.-J. Lin, *op. cit.* 230, figs 10–15.

Plants dark green, forming low tangles and springy mats. Stems erect, forked, very short or elongate. Rhizoids dark red to blackish purple. Leaves monomorphic, linear, mostly 5–10 mm long, curled when dry, straight when wet, with conspicuous clusters of axillary hairs; margins thickened, ±serrate above; cells of limb smooth or slightly bulging, at least in part transversely elongate; teniolae lacking; cancellinae indistinct, merging gradually distally with cells of limb. Axillary hairs numerous, their median and distal cells mostly less than 2 times longer than wide. Gemmae scarce, small, inconspicuous, reddish, on leaf tips as well as on costa and margins, on both surfaces, in at least the upper third of the leaf.

Sporogones rare. Calyptra c. 4 mm long. Seta red to dark red, 4–6 mm long. Capsules emergent, c. 2 mm long; operculum c. 1 mm long. Spores 26–36 µm diam., smooth to inconspicuously granular.

Occurs in north-eastern Qld from the Windsor Tableland to Tully; on trees in rainforest to c. 1000 m elevation. Also in West Africa, Japan, Malesia (including Papua New Guinea), Japan, the Philippines and Oceania.

Qld: Windsor Tableland, *I.G. Stone 15976* (MELU); Rex Ck, Mossman Gorge, *I.G. Stone 24540* (MELU); Malanda, *W.W. Watts Q497, Q530* (MEL); track to Majuba Ck, Mt Bartle Frere, *W.D. Reese 17451, 17452* (LAF, MELU); Eungella Natl Park, NW of Mackay, *D.H. Norris 38817* (LAF).

This species is very similar in appearance to *C. lonchophyllum*, but differs conspicuously by its indistinctly demarcated cancellinae and the short cells of its axillary hairs. It is unusual for gemmae to arise other than at leaf tips in *Calymperes*, so that their presence well down along the leaf in some specimens (e.g. *D.H. Norris 38817*, HSC, LAF) is striking. The same phenomenon occurs in *C. lonchophyllum*.