

## CAMPYLOPUS

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*Campylopus* Brid., *Muscol. Recent.*, Suppl. 4: 71 (1818); from the Greek *kampylos* (bent) and *pous* (a foot), in reference to the cygneous setae that characterise *Campylopus* and some related genera.

Type: *C. flexuosus* (Hedw.) Brid.

Dioicous. Plants small to robust, growing in turfs; sterile shoots uniformly foliate; fertile shoots or those with propagulous branches often distinctly comose. Stems simple to sparingly branched, sparingly to densely tomentose; central strand well-developed; rhizoids originating from the central abaxial costa at leaf bases. Leaves erect to appressed when dry, erecto-patent to curved outwards when wet, narrowly ovate-lanceolate to subulate; apex concolorous or hyaline, often with a straight to reflexed hairpoint; margin plane, entire throughout to variably ornamented above; costa very wide, occupying 25–67% of the leaf width, subpercurrent to long-excurrent, smooth to strongly ribbed abaxially, often toothed towards the leaf apex; in cross section differentiated into adaxial tissue, a central layer of guide cells, and abaxial tissue; adaxial tissue a single layer of hyalocysts or other cells with large lumina, or of 1 or more layers of stereids; abaxial tissue differentiated into bundles of stereids or substereids alternating with guide cells; epidermis directly below the guide cells, the epidermis cells alternating with guide cells; abaxial epidermis cells with or without a distinct lumen. Alar patches 1- or 2-layered, slightly excavate, occasionally slightly auriculate, often poorly developed, reaching the costa; cells thin-walled and inflated to thick-walled; basal hyaline cells occupying the entire width of the lamina directly above the alar patches, or forming a short border. Upper laminal cells oval to rhomboidal or rectangular, isodiametric to short-linear, not to conspicuously pitted; chlorophyllose cells in transition from hyaline to chlorophyllose cells, or cells in the widest part of the leaf similar to upper laminal cells or variably larger.

Perichaetia and perigonia on short innovations clustered at shoot apices; perichaetial leaves  $\pm$ similar to vegetative leaves or variously different. Calyptra cucullate, with a fimbriate basal margin. Seta cygneous. Capsules long-exserted, erect to slightly cernuous, ellipsoidal, often slightly asymmetrical; exothecial cells elongate to short-linear, with strongly thickened lateral walls and thin end walls; annulus revoluble. Peristome either *Campylopus*-type or *Thysanomitrium*-type; operculum high-conical to rostrate above the conical base. Spores spherical,  $\pm$ smooth to finely papillose.

*Campylopus*, a large cosmopolitan genus of c. 160 species, is characterised by a very broad costa and a cygneous seta. Traditionally, *Campylopus* has been classified in subfamily Campylopodioideae of the Dicranaceae. However, there is strong evidence from DNA sequences that *Campylopus* and some other genera in Campylopodioideae are more closely related to the Leucobryaceae (La Farge *et al.*, 2000), and in the most recent classification (Goffinet *et al.*, 2012), it has been included in that family.

Two subgenera are recognised, *viz.* subg. *Campylopus* and subg. *Thysanomitrium* (Frahm, 1983), based on the type of peristome. Thus, the *Campylopus*-type peristome is  $\pm$ orange below, colourless above and with narrowly triangular teeth that are asymmetrically split in the distal half to two-thirds. The outer face is striate with cross-connections in the basal half and papillose above, and the inner face is smooth in the basal half and papillose above. In contrast, the *Thysanomitrium*-type peristome is colourless throughout, and the  $\pm$ uniformly papillose teeth are split to the base into two filiform segments of almost equal width. Other characters that  $\pm$ coincide with the subgeneric division, such as the basal laminal cells being

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hyaline or chlorophyllose are less reliable at this taxonomic level. As sporogones are unknown in some Australian taxa, the subgeneric division has not been adopted here.

The Australian species of *Campylopus* have been the subject of two relatively recent revisions (Frahm, 1987, 1994). However, the species circumscriptions in the current treatment differ markedly from those of the earlier treatments. Important diagnostic gametophore characters for the identification of Australian species include (i) the presence or absence of chlorophyllose basal laminal cells; (ii) the presence or absence of hairpoints; (iii) hairpoints being straight or reflexed; (iv) the shape and, especially, the pittedness of the upper laminal cells; (v) shape and pittedness of the transition cells between hyaline and chlorophyllose; and (vi) the presence of adaxial stereids or hyalocysts in the costa. No characters diagnostic at the species level have been found in the sporogone.

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1	Basal lamina directly above alar patches entirely occupied by thin-walled hyaline cells.....	2
1:	Basal lamina directly above alar patches partly occupied by firm- to thick-walled often pitted chlorophyllose cells, often with a hyaline border.....	11
2	Hairpoints reflexed .....	3
2:	Hairpoints straight or lacking.....	5
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4	Upper laminal cells conspicuously pitted; costa very broad, occupying at least 65% of the leaf width ..	<b>4. C. chilensis</b>
4:	Upper laminal cells not or inconspicuously pitted; costa occupying less than 60% (usually less than 50%) of the leaf width .....	<b>9. C. insititius</b>
5	Costa with adaxial stereids, at least in the upper part of the leaf.....	6
5:	Costa abaxially with hyalocysts or cells with a large lumen throughout.....	7
6	Adaxial stereids in a single layer; at least the lower chlorophyllose laminal cells elongate and pitted ..	<b>5. C. clavatus</b>
6:	Adaxial stereids in 2 or more layers; chlorophyllose laminal cells isodiametric to short-oblong, not pitted.....	<b>13. C. purpureocaulis</b>
7	Leaves ±flexuose when dry, subulate; upper laminal cells quadrate to rectangular .....	<b>14. C. torquatus</b>
7:	Leaves straight or curved, not much altered when dry, narrowly ovate-lanceolate; upper laminal cells rhomboidal to oval or rhomboidal to rectangular .....	8
8	Chlorophyllose cells in transition from hyaline to chlorophyllose laminal cells elongate and pitted ...	9
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9	Costa occupying c. two-thirds of the leaf width, abaxially smooth throughout or scabrous at the apex ....	<b>2. C. bicolor</b>
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11	Upper laminal cells ±rectangular; leaves subulate.....	12
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12	Costa in upper half with adaxial stereids.....	<b>6. C. comosus</b>
12:	Costa adaxially with cells with a large lumen throughout .....	<b>8. C. flexuosus</b>
13	Leaf apices obtuse, cucullate (comal leaves can have a hyaline point); costa with conspicuous side nerves.....	<b>11. C. kirkii</b>
13:	Leaf apices acuminate; costa at most with very short side nerves .....	14
14	Costa with adaxial stereids at least in the upper part of leaf (some specimens of <i>C. appressifolius</i> can have stereids only near the leaf apex); lower chlorophyllose laminal cells pitted.....	15
14:	Adaxial cells of costa with a distinct lumen throughout; chlorophyllose cells not pitted .....	16
15	Upper half of costa adaxially with 2 layers of stereids, abaxially with few high ribs 2 cells high; alar patches double-layered .....	<b>15. C. umbellatus</b>
15:	Upper part of costa adaxially with a single layer of stereids, abaxially with many low 1 cell high ribs; alar patches single-layered.....	<b>1. C. appressifolius</b>
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**1. *Campylopus appressifolius* Mitt., in J.D.Hooker, *Handb. New Zealand Fl.* 414 (1867)**

T: Mt Eden, near Auckland, North Island, New Zealand, *Jupp*; lecto: NY (*selected here*); South Island, New Zealand, *Lyll*; syn: BM 852678, 852679.

*Campylopus australis* Catches. & J.-P.Frahm, *J. Bryol.* 13: 360 (1985); *C. angustilimbatus* E.B.Bartram, *Trans. Brit. Bryol. Soc.* 1: 466 (1951), *nom. illeg.* (later homonym). T: Pemberton, W.A., *G.G.Smith* [W.A. Univ. 81]; holo: FH-Bartram 2316; iso: MEL 28909.

Illustrations: D.G.Catcheside & J.-P.Frahm, *J. Bryol.* 13: 362, fig. 2a, b (1985); J.-P.Frahm, *J. Bryol.* 14: 704, fig. 2 (1987), both as *C. australis*.

Plants to 3–7 cm tall, yellowish to olive-green or dark green, with blackish or brown lower parts; shoots uniformly foliate. Leaves appressed to erecto-patent, often slightly homomallously curved or curved back towards the stem when dry, erecto-patent to patent to slightly curved outwards when moist, narrowly ovate-lanceolate, 4.4–7.2 mm long, 0.6–1.2 mm wide, ending in a concolorous or short straight hyaline point; costa occupying c. 30–50% of the leaf width, abaxially ribbed at least in the upper half, toothed towards the apex, adaxially with cells with a large lumen near the leaf base, more distally with a single layer of stereids. Alar patches single-layered; cells mostly thick-walled, with yellowish brown to reddish brown or dark brown walls; basal hyaline cells restricted to the margin; basal juxtacostal cells chlorophyllose, rectangular, incrassate, mostly strongly pitted. Upper laminal cells rhomboidal with rounded corners, oblong to short-linear, 20–70 × 8–13 µm, mostly conspicuously pitted; cells in the broadest part of the leaf larger and more strongly pitted. Peristome *Campylopus*-type.

Occurs in W.A., S.A., N.S.W, A.C.T., Vic. and Tas. and disjunct in north-eastern Qld; also in New Zealand. Terrestrial and on rocks in dry forest and heath, often in open habitats, up to an altitude of c. 1500 m.

W.A.: Beedelup Falls, NW of Pemberton, *W.A.Weber B33564* (CANB). S.A.: 8 km NE of Gumeracha, Mount Lofty Ra., *H.Streimann 4111* (CANB). Qld: Mt Bartle Frere, *B.O. van Zanten 681474E* (CANB). N.S.W.: Blackheath, Blue Mtns, *N.Klazenga 5886* (MEL). A.C.T.: Black Mtn, Canberra, *N.T.Burbidge 6706* (CANB). Vic.: Kennedy Creek gravel pit, off Princetown Rd, *N.Klazenga 6238* (MEL). Tas.: Table Cape, 2 Jan. 1967, *J.H.Willis s.n.* (MEL).

*Campylopus appressifolius* has been confused with *C. clavatus*, from which it can be distinguished by its chlorophyllose basal juxtacostal cells and thick-walled alar cells. It can be separated from *C. umbellatus* by having more numerous but less prominent ribs on the abaxial side of the costa, and single-layered alar patches. Both *C. clavatus* and *C. umbellatus* have a *Thysanomitrium*-type peristome, while *C. appressifolius* has the *Campylopus* type.

The delimitation of *C. appressifolius* and *C. perauriculatus* is not entirely satisfactory. Thus, there are specimens of *C. appressifolius* with leaf lengths in the lower end of the range, abaxial stereids only at extreme leaf apex, the adaxial costal cells with a distinct to large lumen in the rest of the leaf (as in *C. perauriculatus*), and not or very inconspicuously pitted upper laminal cells. In this treatment, all material that has conspicuously pitted upper laminal cells has been treated as *C. appressifolius*.

**2. *Campylopus bicolor* (Hornsch. ex Müll.Hal.) Wilson, in J.D.Hooker, *Fl. Nov.-Zel.* 2: 69 (1854)**

*Dicranum bicolor* Hornsch. ex Müll.Hal., *Syn. Musc. Frond.* 1: 392 (1848). T: “Nova Hollandia” [Australia], *F.W.Sieber* 9; iso: BM-Wilson 852714, BM-Hooker 852707, BM-Hampe 852707, L 374962.

Illustrations: J.K.Bartlett & J.-P.Frahm, *J. Bryol.* 12: 368, fig. 2a–c, e–g (1983); J.-P.Frahm, *J. Bryol.* 14: 706, fig. 3 (1987); D.Meagher & B.Fuhrer, *Field Guide to the Mosses and Allied Plants of Southern Australia* 139 (2003).

Plants to c. 3.5 cm tall, yellowish brown; sterile shoots uniformly foliate; fertile shoots ±comose. Leaves erect to appressed when dry, erecto-patent when moist, very narrowly ovate, 3.7–4.5 mm long, 0.6–0.9 mm wide; apex hooded, occasionally some leaves with a short hyaline point; costa occupying c. two-thirds of the leaf width, abaxially smooth throughout, slightly scabrous at the extreme apex, adaxially with hyalocysts throughout. Alar

patches weakly demarcated, single-layered; cells hyaline, thin-walled, inflated; basal hyaline cells occupying the entire laminal width directly above the alar patches. Upper laminal cells oval to rounded-rhomboidal, oblong to elongate, oblique,  $17\text{--}50 \times 6\text{--}12 \mu\text{m}$ , very weakly to conspicuously pitted; cells in transition longer, less oblique, thicker-walled and more strongly pitted. Peristome *Campylopus*-type.

Occurs in W.A., S.A., N.S.W., Vic. and Tas; also in New Zealand and South Africa. Terrestrial or on rocks in places that receive run-off or are periodically inundated in otherwise dry vegetation types, at altitudes up to 820 m.

W.A.: Hayward Peak, 22 km ESE of Mt Barker, Porongurup Natl Park, *H.Streimann 54485* (CANB, MEL). S.A.: Lofty Ra., 1848, *F.Mueller* (MEL).

The very broad costa and hooded leaf apices make *C. bicolor* is one of the most distinctive species of the genus. With changing moisture conditions, some leaves can form short hyaline points, and while this variant has been named *C. bicolor* var. *ericeticola* (Müll.Hal.) Dixon, its recognition is unwarranted. Moreover, the type of *C. ericeticola* Müll.Hal. was lost, so it cannot be established that *C. bicolor* var. *ericeticola* really applies to a variety of *C. bicolor*. Specimens in MEL, identified by Dixon as *C. bicolor* var. *ericeticola*, belong to *C. appressifolius* and *C. insititius*.

### 3. *Campylopus catarractilis* (Müll.Hal.) Paris, *Index Bryol.*, Suppl. 1: 90 (1900)

*Dicranum catarractilis* Müll.Hal., *Hedwigia* 38: 79 (1899). T: "Habitatio. Prom. bonae spei, Devilipik ad catarractam", [Devils Peak, Cape of Good Hope, South Africa], Aug. 1875, *A.Rehmann 64*; n.v.

Illustration: J.-P.Frahm, *J. Bryol.* 13: 707, fig. 4 (1987).

Plants to c. 3.5 cm tall, yellowish green to green; shoots uniformly foliate. Leaves appressed to erecto-patent when dry, slightly curved and homomalous when moist, narrowly ovate-lanceolate, 3.8–4.6 mm long, 0.6–0.7 mm wide, ending in a short hyaline point (this occasionally absent or slightly longer); costa occupying c. 50–75% of the leaf width, abaxially with many low ribs, toothed in the upper half, adaxially with hyalocysts throughout. Alar patches well developed in most leaves, single-layered; cells hyaline, thin-walled, inflated; basal hyaline cells occupying the entire laminal width directly above the alar patches. Upper laminal cells rounded-rhomboidal to  $\pm$ quadrate, isodiametric or oblong,  $12\text{--}25 \times 6\text{--}18 \mu\text{m}$ , not pitted; transition cells slightly larger, many cells  $\pm$ rectangular. Gametoecea and sporogones unknown.

Occurs in Qld, N.S.W. and Vic.; also in southern Africa and Madagascar. Terrestrial or, more commonly, saxicolous in mainly dry woodland, especially in and around streams at elevations of 250–1300 m.

Qld: 12 km S of Atherton, on road to Herberton, *G.E.Kantak & S.P.Churchill 719* (CANB). N.S.W.: top of Minjon Falls, Whian Whian S.F., *N.Klazenga 6057* (MEL); Weddin Mountain Ra., 19 km W of Grenfell, *H.Streimann 39606* (CANB, NY). Vic.: Mt Arapiles, 4 July 1998, *Fifth Australasian Bryophyte Workshop* (MEL).

Poorly developed plants of *C. catarractilis* are often difficult to distinguish from equally depauperate *C. introflexus*, as the latter can lack the oval upper laminal cells typical of *C. catarractilis*. Such material with reflexed hairpoints or strongly rhomboidal to oval upper laminal cells is considered to belong to *C. introflexus*, while specimens with leaves having short hyaline points or concolorous tips and with weakly rhomboidal to  $\pm$ rectangular upper laminal cells are referable to *C. catarractilis*.

#### 4. *Campylopus chilensis* De Not., *Mem. Soc. Accad. Sci. Torino*, ser. 2, 18: 453 (1859)

T: southern Chile; *n.v.*

*Campylopus flavonigrinus* Dusén, *Ark. Bot.* 4(13): 8 (1905). T: Islas Guaitecas, Patagonia Occidental, Chile, 30 Apr. 1897, *P.Dusén*; syn: S B56381; Puerto Augusto, Isla Desolacion, Tierra del Fuego, Chile, *P.Dusén* 271; syn: S B56384.

*Campylopus subappressifolius* Broth. & Geh. ex Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1912: 97 (1913). T: Jones's Track, South Sprent R., Tas., on gravelly buttongrass hills, *T.B.Moore* 59 [*W.A.Weymouth* 2015]; lecto: HO 69593 (*selected here*); Sprent R., West Coast, Tas., *T.B.Moore* 48; syn: HO 75690.

Illustration: J.-P.Frahm, *J. Bryol.* 14: 709, fig. 5 (1987).

Plants to 2–6 cm tall, yellowish green to yellowish brown, with blackish lower parts; shoots uniformly foliate. Leaves appressed to erecto-patent when dry, erecto-patent to slightly curved outwards when moist, narrowly ovate-lanceolate, 6.3–9.2 mm long, 0.8–1.2 mm wide, ending in a recurved to reflexed hairpoint; costa occupying 65–80% or more of the leaf width, abaxially smooth throughout, adaxially with hyalocysts throughout. Alar patches absent to very poorly differentiated; basal hyaline cells occupying the entire laminal width directly above the alar patches. Upper laminal cells elongate to short-linear, oblique, 28–80 × 7–10 μm, conspicuously pitted; transition cells similar, but mostly longer and broader. Gametoecea and sporogones unknown.

Occurs in Tas., on peaty soil in buttongrass sedgeland or heathland, at altitudes of 140–950 m. Also in southern Chile.

Tas.: track at N side of Dove L., Cradle Mountain–Lake St. Clair Natl Park, *N.Klazenga* 5754 (MEL); Gordon River road, *I.G.Stone* 3058 (MEL).

*Campylopus chilensis* is most similar to *C. bicolor* from which it can be distinguished easily by its larger size, the presence of leaf hairpoints, and the elongate, conspicuously pitted, upper laminal cells. It can also be confused with *C. acuminatus* and *C. introflexus* which occasionally exhibit reflexed hairpoints. However, *C. bicolor* can be distinguished from those species by the broader costa and the distinctive upper laminal cells.

#### 5. *Campylopus clavatus* (R.Br. ex Schwägr.) Wilson, in J.D.Hooker, *Fl. Nov.-Zel.* 2: 69 (1854)

*Dicranum clavatum* R.Br. ex Schwägr., *Spec. Musc. Frond.* Suppl. 3, 2: 255a (1829), *nom. cons. prop.* T: *n.v.*

*Campylopus rodwayi* Broth. ex Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1913: 260 (1914). T: Mt Wellington summit, Tas., Nov. 1910, *L.Rodway* [*W.A.Weymouth* 2494]; holo: HO 74022; iso: H-BR.

Illustrations: J.K.Bartlett & J.-P.Frahm, *J. Bryol.* 12: 370, fig. 3 (1983); J.-P.Frahm, *J. Bryol.* 14: 710, fig. 6 (1987); H.Streimann, *Mosses of Norfolk Island* 45, fig. 18 (2002); D.Meagher & B.Fuhrer, *Field Guide to the Mosses and Allied Plants of Southern Australia* 107 (2003).

Plants to 2.5–6.0 cm tall, green to dark green, with dark brown lower parts; sterile shoots uniformly foliate; fertile shoots ±comose, with extensive comal innovation. Leaves appressed to erect, frequently slightly homomallously curved when dry, erecto-patent to patent and often homomallously curved when moist, narrowly ovate-lanceolate, 4.2–6.6 mm long, 0.5–0.9 mm wide; apex concolorous or ending in a straight hyaline hairpoint; costa occupying c. 30–50% of the leaf width, abaxially smooth throughout or weakly ribbed towards the apex, adaxially with hyalocysts throughout. Alar patches mostly well developed, single-layered; cells inflated, with thin colourless to dark reddish walls; basal hyaline cells occupying the entire laminal width directly above the alar patches. Upper laminal cells irregularly rhomboidal to oval, isodiametric to short-linear, 10–60 (–85) × 6–10 (–20) μm, not to conspicuously pitted; cells in transition elongate to short-linear or oblong-rhomboidal, frequently and deeply pitted. Peristome *Thysanomitrium*-type.

Occurs in N.S.W., Vic. and Tas.; also in Lord Howe Island, Norfolk Island, South Africa, New Zealand, southern Chile and the Falkland Islands. Terrestrial or, rarely, on rocks in wet-sclerophyll, montane or snowgum forest or in subalpine vegetation, often on soil banks and road cuttings, at elevations of 200–1750 m.

N.S.W.: Spencers Ck, 8 km ENE of Mt Kosciuszko, Mount Kosciuszko Natl Park, *H.Streimann* 50386 (CANB). Vic.: Brown Town Track, off Lavers Hill–Beech Forest road, *N.Klazenga* 6154 (MEL); Tanjil Bren Rd, between crossing of Tanjil R. and Tanjil Bren, *N.Klazenga* 6061 (MEL). Tas.: Hartz Mountains Natl Park, *D.H.Vitt* 29075 (NSW).

*Campylopus clavatus* has been confused previously with *C. appressifolius* and *C. introflexus*. It can be distinguished from the former by the basal hyaline cells that occupy the entire width of the lamina just above the alar patches. Unlike *C. introflexus*, it has elongate and strongly pitted chlorophyllose cells in the transition from hyaline to chlorophyllose cells.

Many Australian specimens have been incorrectly identified as *C. clavatus* because Scott & Stone (*The Mosses of Southern Australia* 141, 1976) suggested that fragile shoot tips were a useful diagnostic character. However, all species of *Campylopus* can have at least some fragile shoot tips, and most collections that were identified as *C. clavatus* for this reason actually belong to *C. introflexus*.

The elongate, strongly pitted cells can extend to the leaf apex, but more commonly they are replaced higher up in the leaf by much shorter cells that are inconspicuously pitted at best.

## 6. *Campylopus comosus* (Schwägr.) Bosch & Sande Lac., *Bryol. Javan.* 1: 75 (1858)

*Dicranum comosum* Schwägr., *Spec. Musc. Frond.*, Suppl. 2, 2: 114 (1827). T: Java, [Indonesia], *C.G.C.Reinwardt* 63; holo: *G n.v.*; iso: L 60093.

Illustrations: J.-P.Frahm, *J. Bryol.* 14: 711, fig. 7 (1987); A.Eddy, *Handb. Malesian Mosses* 1: 120, fig. 109 (1988).

Plants to c. 2 cm tall, yellowish brown; shoots uniformly foliate. Leaves erecto-patent, curved outwards when moist, ovate-subulate to almost triangular-subulate, (4.8–) 5.3–6.0 mm long, (0.4–) 0.5–0.7 mm wide; leaf tip concolorous, rarely hyaline at the extreme apex; costa occupying c. 50–65% of the leaf width, abaxially smooth throughout or very faintly ribbed in the upper half, adaxially with a single layer of cells with large lumina near the base, with 1 layer of stereids higher up and, eventually, 2 or 3 layers towards the apex. Alar patches  $\pm$ distinct, single-layered; cells firm-walled, with reddish walls; basal hyaline cells restricted to a few marginal rows; basal chlorophyllose cells short-rectangular to rectangular, thick-walled, pitted (thin-walled in youngest leaves). Upper laminal cells quadrate to rectangular with rounded ends, or rhomboidal with straight lateral and oblique end walls, oblate, 15–40 (–55)  $\times$  18–30  $\mu$ m, not pitted. Peristome *Campylopus*-type.

Occurs in north-eastern Qld at altitudes of 780–1100 m; grows on soil in rainforest. Also in continental SE Asia, Malesia and throughout Melanesia.

Qld: Barron S.F., Herberton Ra., 12 km SSW of Atherton, *H.Streimann* 27315 (CANB); near Mt Haig, Lamb Ra., 20 km SE of Mareeba, *H.Streimann* 57680 (CANB).

*Campylopus comosus* is characterised by its long-subulate leaves that lack a hairpoint, and by the presence of multiple layers of adaxial stereids in the upper part of the costa. The habit and cell pattern are most similar in *C. flexuosus*, but that species lacks the adaxial stereids. Australian specimens of *C. comosus* consistently differ from the type by having stereids in 2 or 3 layers.

## 7. *Campylopus excurrens* Dixon, *Proc. Roy. Soc. Queensland* 53: 27 (1941)

T: Brown Bay, Qld, 11 Aug. 1935, *H.Flecker* 7038; holo: BM-Dixon 825388.

Illustration: J.-P.Frahm, *J. Bryol.* 14: 712, fig. 8 (1987), as *C. eberhardtii*.

Plants 1.0–2.5 cm tall, green, often glossy; shoots uniformly foliate. Leaves erect, occasionally  $\pm$ homomallously curved when dry, erecto-patent when moist, narrowly ovate-lanceolate, 2.2–3.7 mm long, 0.4–0.8 mm wide; apex concolorous, brown or hyaline; costa occupying c. 30–50% of the leaf width, abaxially ribbed, toothed in the upper part, adaxially with cells with a large lumen throughout. Alar patches poorly to well defined, single-layered; alar cells with thin colourless to reddish walls; basal hyaline cells lacking or restricted to a few cells in 1 or 2 marginal rows; basal chlorophyllose cells short-rectangular to rectangular, the walls firm but relatively thin, not pitted. Upper laminal cells in a rather lax pattern,

rhomboidal, with the longest side straight to curved, short-oblong to oblong, 13–45 × 6–11 μm, not pitted; transition from rectangular to rhomboidal cells rather abrupt, just below the widest part of the leaf. Gametocidia and sporogones unknown.

Endemic to northern N.T. and north-eastern Qld; terrestrial and on rocks in rather dry forest and more open vegetation at 200–1100 m.

N.T.: Baroalba Ck, 15 km SSE of Jabiru airfield, *H.Streimann* 42371 (CANB). Qld: Windsor Tableland, 37 km NW of Mossman, *H.Streimann* 29748 (CANB); Gillies Rd, between Gordonvale and Atherton, *W.A.Weber* B-32407 (CANB).

*Campylopus excurrens* has been treated as a synonym of *C. eberhardtii*, *C. japonicus* and *C. sinensis*. However, several characters rule out conspecificity with *C. sinensis*, most importantly the shape and pittedness of the upper laminal cells.

This moss is most similar to *C. perauriculatus*, but it has a looser arrangement of the upper laminal cells, it lacks a broad band of subquadrate cells along the margin, the border of hyaline cells is absent or poorly developed, and there is a rather abrupt transition from rectangular basal laminal cells to rhomboidal upper laminal cells just below the widest part of the leaf.

### 8. *Campylopus flexuosus* (Hedw.) Brid., *Muscol. Recent.*, Suppl. 4: 71 (1818)

*Dicranum flexuosum* Hedw., *Spec. Musc.* 145 (1801). T: “145 *Dicranum flexuosum* Dill., t. 47 fig. 33”, *Timm*; lecto: G, *vide* J.-P.Frahm & P.Geissler, *Cryptog. Bryol. Lichénol.* 6: 289 (1985).

Plants to 1.0–2.5 cm tall, yellowish green to brownish green; sterile shoots uniformly foliate; microphyllous branches occasionally present. Leaves erecto-patent when dry and moist, ovate-subulate, 3.6–5.0 mm long, 0.4–0.7 mm wide; apex concolorous; costa occupying 25–50% of the leaf width, occasionally with a few teeth near the apex, adaxially the cells having large lumina throughout. Alar patches single-layered; alar cells with thin colourless to reddish walls; basal hyaline cells restricted to 2 or 3 marginal rows; basal chlorophyllose cells rectangular or more irregularly shaped, incrassate, not or only those closest to the costa weakly pitted; more distal cells ±rectangular; cells in the subula irregularly shaped, ±rectangular to ±rhomboidal, oblong to elongate, 13–30 × 6–12 μm, not pitted. Peristome *Campylopus*-type; sporogones not known in Australian material.

Occurs in northern W.A., northern N.T. and north-eastern Qld; also in Europe, Asia and North America, and in tropical montane areas of Central and South America and Africa. Terrestrial and on rocks in woodland or in more open vegetation; also found in disturbed habitats, at altitudes of 720–1550 m.

W.A.: near waterfall in Glider Gorge, Carson Escarpment, c. 38 km S from Carson River HS, Drysdale River Natl Park, North Kimberley, 11 June 1984, *J.H.Willis* s.n. (MEL). N.T.: c. 65 km S of Jabiru, Kakadu Natl Park, *L.Craven* 6811 (CANB, MEL).

*Campylopus flexuosus* can be distinguished from other species with chlorophyllose basal cells by the subrectangular upper laminal cells and the smooth abaxial costa. Although it shares these characters with *C. comosus*, the adaxial cells of the costa have large lumina throughout the leaf length.

This species is very poorly known in Australia, because it has been rarely collected from a broad range of habitats, and because most collections consist of poorly developed plants. It is likely to be much more common than the small number of collections indicates because it can be found growing in lawns in the tropics.



## 9. *Campylopus insititius* Hook.f. & Wilson, in J.D.Hooker, *Fl. Tasman.* 2: 172 (1859)

T: Browns River, Tas., *A.F.Oldfield 10*; lecto: BM 8526825 (*selected here*); isolecto: BM 825376, BM 852682–4, BM 852689, BM 852691, BM 852696, BM 852699, BM 852701; *loc. id.*, *A.F.Oldfield 11*; syn: BM 825375, BM 852686–8, BM 852690, BM 852692–3; *loc. id.*, *A.F.Oldfield s.n.*; syn: BM 852694, BM 852697; Southport, Tas., *Stuart* (BM 852680, BM 852681, BM 852695).

*Campylopus kirkii* var. *pilosus* J.-P.Frahm, *Lindbergia* 7: 3 (1981). T: Kaiwi swamp, North Island, New Zealand, *J.K.Bartlett*; iso: CHR 540508.

Illustrations: J.-P.Frahm, *Lindbergia* 7: 30, fig. 1.1, 1.2 (1981); J.K.Bartlett & J.-P.Frahm, *J. Bryol.* 12: 375, fig. 2b, c (1983), both as *C. kirkii* var. *pilosus*.

Plants to 1.5–3.5 cm tall, green to yellowish green; lower parts of larger plants often blackish; sterile shoots uniformly foliate; fertile shoots ±comose. Leaves erect to appressed, or with a patent base and the upper part curved towards the stem when dry, erecto-patent when moist, narrowly ovate-lanceolate, 4.0–6.5 mm long, 0.6–1.2 mm wide; apex concolorous or with a straight or reflexed hairpoint; costa occupying 40–60% of the leaf width, abaxially ribbed except in the basalmost part, toothed distally, adaxially with hyalocysts or cells with large lumina throughout. Alar patches rather poorly defined to well developed, single-layered; cells with thin to firm colourless or brown walls, ±inflated; basal hyaline cells occupying the entire laminal width directly above the alar patches. Upper laminal cells rounded-rhomboidal to oval, oblong to elongate, ±straight to oblique, 20–60 (–80) × 7–16 μm, not or inconspicuously pitted; cells in transition shorter to longer, more strongly pitted; innermost rows occasionally almost reaching the alar patches in the widest leaves. Peristome *Campylopus*-type.

Occurs in eastern N.S.W., A.C.T., Vic. and Tas.; also in New Zealand. On soil, rocks and occasionally on logs in places that receive run-off or are periodically under water (or snow) in dry to wet-sclerophyll forest, snowgum woodland or subalpine vegetation, at altitudes up to 1750 m.

N.S.W.: Govetts Leap Lookout-Bridal Veil Falls, near Blackheath, Blue Mountains Natl Park, *V.Stajsic 2636* & *N.Klazenga* (MEL). A.C.T.: Mt Aggie, Brindabella Ra., *D.H.Vitt 28979* (CANB). Vic.: track to Kersop Peak, Wilsons Promontory, *N.Klazenga 6445* (MEL). Tas.: Cradle Mountain Link Rd, Black Bluff Ra., 37km NE of Rosebery, *H.Streimann 59715* (CANB).

*Campylopus insititius* has been misidentified in Australia as *C. acuminatus* var. *acuminatus*, and it can also be confused with *C. introflexus* and *C. chilensis* (all three sometimes having reflexed hairpoints), and with *C. appressifolius*, which can have a similar cell pattern. However, *C. insititius* can be distinguished from *C. introflexus* by the elongate, conspicuously pitted, chlorophyllose laminal cells directly above the hyaline cells, especially along the costa. Moreover, the costa is narrower than in *C. chilensis*, and the upper laminal cells are not or only very inconspicuously pitted.

The global distribution of *C. insititius* might also include southern Chile and the Falkland Islands, but it has not been possible to locate collections labelled *C. acuminatus* var. *acuminatus* from those areas.

## 10. *Campylopus introflexus* (Hedw.) Brid., *Muscol. Recent.*, Suppl. 4: 72 (1818)

*Dicranum introflexum* Hedw., *Spec. Musc. Frond.* 147 (1801). T: “Insularum meridionalium incola”; *n.v.*

*Dicranum pudicum* Hornsch. ex Müll.Hal., *Syn. Musc. Frond.* 1: 407 (1848); *Campylopus pudicus* (Hornsch. ex Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1870–71: 435 (1872); *C. introflexus* subsp. *pudicus* (Hornsch. ex Müll.Hal.) Dixon, *Bull. New Zealand Inst.* 3: 90 (1923). T: “Nova Hollandia” [Australia], [New South Wales], *F.W.Sieber 24*; iso: BM-Bescherelle 852667, BM-Hampe 825379, BM-Hooker 852663, L 374963.

*Campylopus australiensis* Duby, *Mem. Soc. Phys. Genève* 20: 360 (1869). T: “Mt Mandon” [Mt Macedon?], Vic., 1869, *F.Mueller s.n.*; holotype: G; iso: S, *fide* J.-P.Frahm, *Tropical Bryol.* 16: 39 (1999).

*Campylopus erythropoma* Duby, *Mem. Soc. Phys. Genève* 20: 360 (1869). T: *s. loc.*, Australia, *coll. unknown*; iso: S, *fide* J.-P.Frahm, *Tropical Bryol.* 16: 24 (1999).

*Dicranum senex* Müll.Hal., *Hedwigia* 36: 351 (1897); *Campylopus senex* (Müll.Hal.) Paris, *Index Bryol.*, Suppl. 97 (1900). T: near Moe R., Gippsland, Vic., *J.G.W.Luehmann s.n.*; iso: MEL 1044927.

*Campylopus introflexus* var. *genuinus* Giacom., *Icon. Musc.*, ser. 5, 13(1): 74 (1955), *nom. illeg.* T: *n.v.*

*Campylopus flindersii* Catches. & J.-P.Frahm, *J. Bryol.* 13: 363 (1985). T: Melrose, Mt Remarkable, Flinders Ra., S.A., *D.G.Catcheside 53169*; holo: AD; iso: BM.

*Campylopus circinatus* J.-P.Frahm, *Cryptog. Bryol. Lichénol.* 19: 28 (1998). T: Distillery Ck, Aireys Inlet, Vic., *Angahook Study Group*; holo: MELU; iso: BONN.

Illustrations: J.K.Bartlett & J.-P.Frahm, *J. Bryol.* 12: 374 (1983); J.-P.Frahm, *J. Bryol.* 14: 717, fig. 12 (1987); D.Meagher & B.Fuhrer, *Field Guide to the Mosses and Allied Plants of Southern Australia* 107 (2003).

Plants to c. 4 cm tall, bright green to brownish green, occasionally appearing greyish due to hyaline hairpoints; sterile shoots uniformly foliate; fertile shoots  $\pm$ comose. Leaves erect and curved towards the stem or homomallously curved when dry, erecto-patent to slightly curved outwards when moist, narrowly ovate-lanceolate, (3.7–) 4.0–6.5 mm long, (0.5–) 0.6–1.2 mm wide, mostly ending in a reflexed hairpoint; costa occupying c. 30–65% of the leaf width, abaxially ribbed throughout, toothed towards the apex, adaxially with hyalocysts throughout. Alar patches often weakly developed, single-layered; cells hyaline, thin-walled, inflated; basal hyaline cells occupying the entire laminal width directly above the alar patches. Upper laminal cells rounded-rhomboidal to oval, oblate to short-oblong, 6–25  $\times$  6–18  $\mu$ m, not pitted; cells in transition slightly larger,  $\pm$ rectangular to rhomboidal. Peristome *Campylopus*-type.

Occurs in W.A., S.A., Qld, N.S.W., A.C.T., Vic. and Tas.; also native to Lord Howe Island, Norfolk Island, Macquarie Island, New Zealand, southern South America and southern Africa, and introduced into western Europe and western U.S.A. In Australia terrestrial and on rocks, occasionally on logs, in all but the driest habitats, mostly in dry-sclerophyll forest or dry grasslands, at altitudes to 1620 m.

W.A.: 12.9 km W of Arthur River on road to Collie, E side of Darling Ra., *G.E.Kantak & S.P.Churchill 623* (CANB). Qld: Paluma, 28 June 2005, *N.Klazenga s.n.* (MEL). N.S.W.: 41 km from Khancoban to Thredbo on Alpine Way, *H.Streimann* (CANB, MEL). A.C.T.: Farrer Ridge, Wanniasa, 2 Oct. 1991, *J.H.Willis* (MEL). Vic.: Gellibrand River road, *N.Klazenga 6229* (MEL). Tas.: Lenah Valley Fire Track, base of Mt Wellington, 28 Nov. 2002, *S.J.McMullan-Fisher s.n.* (MEL).

In its typical form *C. introflexus* is one of the most easily recognisable species because of its reflexed hairpoints and short, oval, strongly incrassate and non-pitted, upper laminal cells. However, many poorly developed plants can lack some or all these usually diagnostic characters. Such plants can lack or have short hyaline hairpoints, or they can exhibit rhomboidal upper laminal cells with rounded corners, not oval and as markedly thick-walled as in typical material. Furthermore, the abaxial ribs on the costa can be rather poorly developed and weakly toothed. Such forms have been recognised in Australia as *C. incrassatus* and *C. flindersii*. While it is possible that a cryptic species exists among these forms, the variation between the typical and poorly developed plants of *C. introflexus* appears to form a continuum. Moreover, some plants among these collections can show hints of typical *C. introflexus*, such as reflexed hairpoints on some leaves or patches of oval upper laminal cells.

## 11. *Campylopus kirkii* Mitt. ex Beckett, *Trans. & Proc. New Zealand Inst.* 26: 280 (1894)

*Campylopus acuminatus* Mitt. var. *kirkii* (Mitt.) J.-P.Frahm, *Bryol. Beitr.* 7: 95 (1987). T: Great Barrier Island, North Island, New Zealand, *T.Kirk*; lecto: CHR-Beckett 564016 (*selected here*); Golden Bay, South Island, New Zealand, *L.Boor*; syn: CHR-Beckett 564014.

*Campylopus denticuspis* Broth., *Proc. Linn. Soc. New South Wales* 41: 575 (1916), *nom. illeg.* (later homonym). T: Wardell, Richmond R., N.S.W., *W.W.Watts 5260*; holo: H-BR; iso: NSW 223649.

*Campylopus denticuspis* var. *lutescens* Broth., *Proc. Linn. Soc. New South Wales* 41: 575 (1916). T: East Ballina, Richmond R., N.S.W., *W.W.Watts 4758*; lecto: H-BR 913020 (*selected here*); isolecto: NSW 294713; *loc. id.*, *W.W.Watts 1739*; syn: H-BR, NSW 223657.

Illustration: J.-P.Frahm, *J. Bryol.* 14: 703, fig. 1 (1987), as *C. acuminatus* var. *kirkii*.

Plants to 1.5–11.0 cm tall, yellowish, with brownish basal parts; sterile shoots uniformly foliate; fertile shoots  $\pm$ comose. Leaves  $\pm$ appressed to erect when dry, erecto-patent to patent when moist, ovate-linear to ovate-lanceolate; apex cucullate, concolorous, occasionally with

a hyaline point in comal leaves; costa occupying c. 12–20% of the leaf width, with conspicuous side nerves, abaxially smooth throughout or slightly scabrous near the apex, adaxially with cells with large lumina throughout. Alar patches well developed, single-layered; alar cells similar to more distal cells, but the walls brown and with fewer pits; basal hyaline cells restricted to the marginal half; basal chlorophyllose cells quadrate to rectangular, thick-walled, pitted. Upper laminal cells elongate to linear, oblique, 30–75 × 8–12 µm, strongly incrassate, conspicuously pitted. Peristome *Campylopus*-type.

Occurs in south-eastern S.A., eastern N.S.W., southern Vic. and western Tas; also in New Zealand, southern South America and southern Africa. Terrestrial in wet or periodically wet places such as bog and peatlands, buttongrass sedgeland, and along puddles in tracks, at altitudes to 800 m.

S.A.: Mt Compass, Southern Lofty Ra., *L.D.Williams 1096* (MEL). N.S.W.: Govetts Leap Lookout-Rodriguez Pass, near Blackheath, Blue Mountains Natl Park, *V.Stajsic 2630* & *N.Klazenga* (MEL). Vic.: Chapplevale gravel pit, Lavers Hill–Cobden road, just E of Grass Tree Plain, *N.Klazenga 6234* (MEL). Tas.: road to Strahan, near Queenstown, *W.A.Weber & D.McVean B-33355* (CANB).

*Campylopus kirkii* has previously been recognised at the varietal level as *C. acuminatus* var. *kirkii*, i.e. var. *kirkii* having leaves with hooded apices and var. *acuminatus* having leaves with acute apices or with hairpoints. What has been identified as *C. acuminatus* var. *acuminatus* in Australia and New Zealand is here recognised as *C. insititius*. Apart from the leaf apices, differences between *C. kirkii* and *C. insititius* include hyaline cells occupying the entire width of the lamina just above the alar patches in the latter, but restricted to a rather broader border, while the basal juxtacostal cells are chlorophyllose, thick-walled and strongly pitted in *C. kirkii*. Furthermore, the upper laminal cells of *C. insititius* are elliptical and not or inconspicuously pitted, as opposed to obliquely elongate to short-linear, very strongly incrassate and conspicuously pitted in *C. kirkii*. These characters are more constant than the shape of the leaf apex, and they indicate that the two taxa warrant recognition at the species level.

Among Australian *Campylopus* species, *C. kirkii* is likely to be confused only with *C. bicolor*, with which it shares hooded leaf apices. This is especially likely near the northern limit of its range, where plants tend to have rather narrow leaves. However, *C. kirkii* can always be distinguished from *C. bicolor* by the strongly spurred costa and by the chlorophyllose basal juxtacostal cells.

## 12. *Campylopus perauriculatus* Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 42: 93 (1900)

*Campylopus robillardii* Besch. var. *perauriculatus* (Broth.) J.-P.Frahm, *Bryol. Beitr.* 7: 89 (1987). T: Granvaile Rd, near Bangalow, Richmond River, N.S.W., 11 Aug. 1898, *W.W.Watts 2100*; holotype: H-BR; isotype: MEL 33326, NSW 223662.

*Campylopus wattsi* Broth., *Proc. Linn. Soc. New South Wales* 43: 547 (1918). T: Second Falls, Frenchmans Creek, Cairns, Qld, *W.W.Watts 366*; lectotype: H-BR (*selected here*); isotype: MEL 33302, NSW 294844, NSW 22365; “on rocks above Falls, near Major’s”, Ravenshoe, Qld, *W.W.Watts 484 p.p.*; synonym: NSW 223664, NSW 294843. Note: The residual syntype, *Watts 484*, belongs to *C. catarractilis*.

*Campylopus brassii* E.B.Bartram, *Farlowia* 4: 236 (1952). T: Mt Finnigan [“Finnegan”], Qld, *L.J.Brass 20106*; holotype: FH-Bartram.

Illustration: J.-P.Frahm, *J. Bryol.* 14: 720, fig. 14 (1987).

Plants to 5 cm tall, green; shoots uniformly foliate. Leaves erect to appressed, slightly homomallous when dry, erecto-patent and homomallous when moist, narrowly ovate-lanceolate, 3.8–5.0 mm long, 0.5–0.9 mm wide; apex concolorous, rather blunt; costa occupying c. 40–50% of the leaf width, abaxially ribbed, toothed in the upper part, adaxially with cells with large lumina throughout. Alar patches well developed, single-layered; alar cells with thin colourless to reddish walls, ±inflated; basal hyaline cells restricted to 3–7 marginal rows; basal chlorophyllose cells rectangular, rather thin-walled to incrassate, not pitted. Leaves with an initially intramarginal band of 6–8 rows of much smaller quadrate to somewhat rhomboidal cells, tapering into the margin some distance above the point where the border ends. Upper laminal cells rhomboidal to irregularly oval, occasionally almost

rectangular, isodiametric to oblong, 9–25 × 7–12 (–15) µm wide, not pitted. Peristome *Campylopus*-type.

Endemic to north-eastern and south-eastern Qld and north-eastern N.S.W. Terrestrial, rarely on rocks in rainforest or along streams at altitudes of 550–1400 m.

Qld: Big Tableland, 26 km S of Cooktown, *H.Streimann 30753* (CANB); Tully Falls, *I.G.Stone 8696* (MEL).

*Campylopus perauriculatus* has previously been recognised in Australia as *C. robillardii* Besch. The difference in ornamentation of the leaf margin, serrate in the exclusively African *C. robillardii* and entire in *C. perauriculatus*, and the fact that they occur on different continents in my opinion warrants recognition at the species level.

*Campylopus perauriculatus* can be difficult to distinguish from *C. excurrens* and *C. appressifolius*. Differences are discussed under those species.

### 13. *Campylopus purpureocaulis* Dusén, *Ark. Bot.* 4(13): 11 (1905)

T: Isla Desolacion, Magellanes, Chile, Apr. 1896, *P.Dusén s.n.*; syn: S B57290; Puerto Angosto, Magellanes, Chile, Apr. 1896, *P.Dusén s.n.*; syn: S B57294; Puerto Angosto, Magellanes, Chile, 22 Mar. 1896, *P.Dusén 279*; syn: S B57292, S B57293, S B57296; L. Llanquihue, Chile, 15 Dec. 1896, *P.Dusén s.n.*; syn: S B57291, B57295.

*Campylopus arboricola* Cardot & Dixon, in H.N.Dixon, *Bull. New Zealand Inst.* 3: 90 (1923). T: Te Aroha, [Auckland, North Island], New Zealand, *Leland & Chase s.n.*; syn: BM-Dixon 825381, BM 825384; *loc. id.*, *D.Petrie s.n.*; syn: BM-Dixon 825382.

Illustration: J.K.Bartlett & J.-P.Frahm, *J. Bryol.* 12: 367, fig. 1 (1983), as *C. arboricola*.

Plants to c. 3.5 cm tall, light green; shoots uniformly foliate. Leaves erect, often homomallously curved when dry, erecto-patent, curved outwards when moist, narrowly ovate-lanceolate, (3.6–) 6.2–7.0 mm long, (0.4–) 0.7–1.0 mm wide, ending in a straight hairpoint; costa occupying c. 40–50% of the leaf width, abaxially ribbed, rather weakly toothed towards the apex, adaxially with 2 layers of stereids. Alar patches weakly to well developed, single-layered; cells inflated, with thin yellowish brown to reddish walls; basal hyaline cells occupying the entire laminal width directly above the alar patches. Upper laminal cells rounded-obrectangular to rectangular, or with somewhat oblique end walls, 7–15 × 7–10 µm, not pitted; cells in transition larger, more rhomboidal. Peristome *Campylopus*-type. Sporogones not known from Australian material.

Occurs in Tas.; also in New Zealand, Islas Juan Fernández, far-southern South America and Marion Island in the southern Indian Ocean. Found on logs in cool-temperate rainforest or on presumably highly organic soil above the treeline, at 500–1000 m.

Tas.: Growling Swallet, Mount Field Natl Park, 4 Dec. 2007, *N.Klazenga s.n.* (MEL); Eagle Tarn, 5 km WSW of Mt Field East, *A.Moscal 1360* (CANB).

*Campylopus purpureocaulis* can be distinguished from *C. introflexus* by its straight hairpoints, subquadrate upper laminal cells and adaxial costal stereids, and from *C. clavatus* by the shape of the chlorophyllose laminal cells, which are non-pitted throughout the leaf.

### 14. *Campylopus torquatus* Mitt., in J.D.Hooker, *Fl. Tasman.* 2: 173 (1859)

T: Westend Rivulet, Tas., *W.Archer*; holo: NY; iso: BM-Hooker 852643.

*Campylopus capillatus* Hook.f. & Wilson, in J.D.Hooker, *Fl. Tasman.* 2: 172 (1859). T: Browns River, Tas., *A.F.Oldfield 11*; syn: BM-Hooker 825385; Southport, Tas., *Stuart s.n.*; syn: BM-Hooker 825386, BM-Hooker 825387.

*Campylopus novae-valesiae* Broth., *Öfvers. Förh. Finska Vetensk.-Soc.* 40: 163 (1898). T: Bulli Pass, N.S.W., *W.W.Watts 96*; holo: H-BR; iso: NSW(?).

*Campylopus lenormandii* Thér., *Bull. Soc. Bot. Genève* 26: 76 (1936). T: Mt Macedon, Vic., *F.Mueller ex Hb Lenormand 19*; iso: H-BR, *fide* J.-P.Frahm, *Tropical Bryol.* 16: 53 (1999).

Illustrations: J.K.Bartlett & J.-P.Frahm, *J. Bryol.* 12: 379, fig. 9 (1983); J.-P.Frahm, *J. Bryol.* 14: 721, fig. 15 (1987), both as *C. pyriformis*.

Plants to 1–3 cm tall, light green; shoots uniformly foliate. Leaves erect to erecto-patent when dry and with the tips curved in all directions, occasionally slightly flexuose, erecto-patent to homomallously curved or curved outwards when moist, ovate-subulate, 4.3–8.2 mm long, 0.3–1.0 mm wide; apex concolorous or, occasionally, with a hyaline point; costa occupying c. 40–60% of the leaf width, abaxially weakly ribbed in the upper part, with some scattered teeth near the apex, adaxially with hyalocysts throughout. Alar patches not or poorly differentiated, single-layered; cells hyaline, thin-walled, inflated; basal hyaline cells occupying the entire laminal width above the alar patches. Upper laminal cells quadrate to rectangular or with oblique end walls, 6–30 × 5–8 µm, not pitted; cells in transition similar but often slightly larger. Peristome *Campylopus*-type.

Occurs in south-western W.A., eastern Qld, N.S.W., Vic. and Tas.; also in Lord Howe Island, Norfolk Island, Macquarie Island and New Zealand. Terrestrial or on rocks in all but the driest habitats, mostly in dry-sclerophyll forest or dry grasslands, at altitudes to 1750 m.

W.A.: Gleneagle Forest, Albany Hwy, *I.G.Stone 4743* (MEL). Qld: Mt Lewis, near Mossman, *B.O.Van Zanten 681200* (CANB). N.S.W.: Gloucester Tops, 37 km WSW of Gloucester, *H.Streimann 1571* (CANB). Vic.: Errinundra Valley Rd, Ada R. campground, junction of Errinundra and Ada Rivers, *N.Klazenga & A.C.Cochrane 5240* (MEL). Tas.: Middle Island Fire Trail, base of Mt Wellington, 31 Oct. 2002, *S.J.McMullan-Fisher s.n.* (MEL).

*Campylopus torquatus* has previously been misidentified as *C. pyriformis* in Australia. Furthermore, Australian plants named as *C. fragilis* and *C. fragilis* subsp. *zollingerianus* (syn. *C. boswellii*) are also referable to this species. Based on molecular sequences, Stech & Wagner (2005) demonstrated that Australian and New Zealand specimens identified as *C. pyriformis* or *C. fragilis* are not closely related to material of those species from other parts of the world. Consequently, the Australasian material is treated here as a distinct species. In contrast to *C. fragilis* and *C. pyriformis*, the leaves of *C. torquatus* can have hyaline points.

*Campylopus torquatus* is reminiscent of a *Dicranella*, and it can be distinguished from all other species of *Campylopus* by having leaves that are ±flexuose when dry.

### 15. *Campylopus umbellatus* (Schwägr. & Gaudich. ex Arn.) Paris, *Index Bryol.* 264 (1894)

*Thysanomitrion umbellatum* Schwägr. & Gaudich. ex Arn., *Mém. Soc. Linn. Paris* 5: 263 (1827). T: Hawaiian Islands, *Gaudichaud s.n.*; holo: PC.

*Campylopus geniculatus* Ångstr., *Oefvers. Förh. Kongl. Svenska Vetensk.-Akad.* 29(4): 80 (1872), *nom. illeg.* (later homonym). T: Honolulu, [Oahu], Hawaiian Islands, *Anderson s.n.*: holo: S-holo; iso: B, *fide* J.-P.Frahm, *Tropical Bryol.* 16: 44 (1999).

Illustrations: J.-P.Frahm, M.Giese, M.Padberg, T.Koponen & D.H.Norris, *Acta Bot. Fenn.* 131: 84, figs 77–83 (1985); J.-P.Frahm, *J. Bryol.* 14: 723, fig. 17 (1987); A.Eddy, *Handb. Malesian Mosses* 1: 136, fig. 122 (1988).

Plants to 1.5–6.0 cm tall, yellowish to blackish green; taller plants with blackish brown lower parts; sterile shoots uniformly foliate; fertile shoots comose. Leaves appressed when dry, erecto-patent when moist, narrowly ovate-lanceolate, 4.0–4.8 mm long, 1.0–1.3 mm wide, ending in a short hyaline point; costa occupying c. 20% of the leaf width, abaxially ribbed, the ribs 2 cells high, toothed in the upper half, adaxially with 2 layers of stereids, except near the insertion where cells have distinct lumina. Alar patches well developed, double-layered; cells slightly inflated, with thin colourless to reddish walls; basal hyaline cells lacking or restricted to the margin; basal chlorophyllose cells rectangular, conspicuously pitted. Upper laminal cells oval-rhomboidal, 16–38 × 7–10 µm, not conspicuously pitted; cells in and below widest part of the leaf longer and conspicuously pitted. Comal leaves broadly ovate, with broad marginal patches of basal hyaline cells. Peristome *Thysanomitrion*-type.

Occurs in the north-eastern Qld; also in Malesia and continental SE Asia, East Asia, the Hawaiian Islands and Polynesia. Found on rocks in streams in rainforest, at altitudes of 50–750 m.

Qld: Mobo Ck, 21 km NE of Atherton, *H.Streimann 16943* (CANB); The Boulders Scenic Reserve, 6 km W of Babinda, *G.E.Kantak & S.P.Churchill 930* (CANB).

*Campylopus umbellatus* is a very distinctive species that can only be confused with *C. appressifolius*. Their differences have been discussed under the latter species.

### Names of uncertain status

Types could not be located for the following names:

*Campylopus acuminatus* Mitt., J. Linn. Soc., Bot. 12: 90 (1869)

T: Mt Forster, Hermite Island, Fuegia, Chile, *J.D.Hooker*.

*Campylopus ericeticola* Müll.Hal., *Abh. Naturwiss. Vereine Bremen* 16(3): 496 (1900)

*Campylopus bicolor* var. *ericeticola* (Müll.Hal.) Dixon, *Bull. New Zealand Inst.* 3: 87 (1923). T: Chatham Island, New Zealand, 1897, *Schauinsland*.

*Campylopus leptocephalus* (Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1870–71: 435 (1872) [Ad. 1: 139]

*Dicranum leptocephalum* Müll.Hal., *Bot Zeitung (Berlin)* 9: 551 (1851). T: between Waitemata and Kaipara R., New Zealand, *S.Mossman* 726.

*Campylopus nigroflavus* (Müll.Hal.) Paris, *Index Bryol., Suppl.* 94 (1900)

*Dicranum nigroflavum* Müll.Hal., *Hedwigia* 36: 349 (1897), as *nigroflavus*. T: Mt Lindsay, W.A., 1882, *Webb in Hb Melbourne*.

*Campylopus pallidus* Hook.f. & Wilson, in *J.D.Hooker, Fl. Nov.-Zel.* 2: 68 (1854)

T: East Coast and Auckland, North Island, New Zealand, *Colenso; loc. id., Sinclair*.

*Campylopus tasmanicus* Paris, *Index Bryol., Suppl.* 98 (1900)

*Dicranum tasmanicum* Müll.Hal., *Hedwigia* 36: 351 (1897), *nom. illeg.* (later homonym). T: *n.v.*

*Campylopus viridicatus* (Müll.Hal.) Paris, *Index Bryol., Suppl.* 1: 99 (1900)

*Dicranum viridicatum* Müll.Hal., *Hedwigia* 36: 352 (1897). T: North Shore, Sydney, N.S.W., July 1884; Northwood, near Sydney, N.S.W., June 1884, *T.Whitelegge in Hb. Melbourne; s. loc., Qld, F.M.Bailey* (Hb. Brotherus).

*Campylopus woollsii* (Müll.Hal.) Paris, *Index Bryol., Suppl.* 1: 99 (1900)

*Dicranum woollsii* Müll.Hal., *Hedwigia* 36: 348 (1897). T: Sydney, N.S.W., 1881, *W.Woolls in Hb. Melbourne; Brisbane, Qld, 1888, F.M.Bailey* (Hb. Brotherus).

*Campylopus woollsii* var. *cylindrica* Paris, *Index Bryol., Suppl.* 1: 99 (1900)

T: *n.v.*

### Australian reports require confirmation

*Campylopus clemensiae* E.B.Bartram, *Rev. Bryol. Lichénol.* 30: 187 (1962)

T: along track to Marimuni from the Upper Ambun Valley, Wabag Area, Western Highlands, Papua New Guinea, *R.G.Robbins 3025a*; holo: FH-Bartram; iso: CANB 165066, L 60092.

Australian specimen: Qld: Ravenshoe, *W.W.Watts 459* (NSW) (Frahm, 1994: 319).

*Campylopus laxoventralis* Herzog ex J.-P.Frahm, *Nova Hedwigia* 31: 428 (1979)

T: Tigre Zapallar, Fray Jorge, Chile. in open forest, terrestrial, *G.H.Schwabe* 232; holo: JE.

Australian specimens: N.S.W.: Wilsons Ck, near Mullumbumby, *W.A.Watts* 3225 (NSW); Wingham District, 1915, *J.L.Boorman s.n.* (NSW); North Willoughby, 1885, *coll. unknown* (NSW) (Frahm, 1994: 323).

*Campylopus modestus* Cardot, *Bull. Herb. Boissier*, sér. 2, 5: 1000 (1905).

T: Port Stanley, Falkland Islands, *C.Skottsberg [Svenska Sudpolarexpeditionen 1901–03, No. 215]*; iso: S B56866; S B56869.

Australian specimens: N.S.W.: Manly, *W.A.Watts* 3326 (NSW); Woollondilly River via Longreach, *W.W.Watts* 9056 (NSW) (Frahm, 1994: 323).

### Doubtful record

*Campylopus involutus* (Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1870–71: 418 (1872)

*Dicranum involutum* Müll.Hal., *Bot. Zeitung (Berlin)* 11: 34 (1853). T: Nilghiri Mtns, India, *Schmid*; iso: H-BR, *fide* J.-P.Frahm, *Tropical Bryol.* 16: 49 (1999).

*Campylopus involutus* was reported from Australia by Frahm (1987: 719) based on *Godwin C2488* (MELU). Unfortunately, the specimen has since been lost, so this report could not be verified.

### Excluded taxa

*Campylopus ericoides* (Griff.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1870–71: 424 (1872)

*Dicranum ericoides* Griff., *Calcutta J. Nat. Hist.* 2: 499 (1842). T: India, Assam, Khasia Mtns, Myrung Wood, *Griffith* 65; lecto: BM 852673; *loc. id.*, *Griffith* 66; syn: BM 852672; *loc. id.*, *Griffith* 67; syn: BM 852671; *loc. id.*, *Griffith s.n.*; syn: BM 842674, *vide* Frahm, *J. Hattori Bot. Lab.* 71: 140 (1992).

The occurrence of *Campylopus ericoides* in Australia is based on Frahm's (1987) report of *C. involutus*. *Campylopus involutus* has since been synonymised with *C. ericicola* Müll.Hal. (Frahm, 1992). However, while *C. ericoides* is considered to belong to subg. *Thysanomitrium* (Frahm, 1992), the type material of *C. ericoides* has *Campylopus*-type peristomes. The Australian report is based on a specimens that were reported to have a *Thysanomitrium*-type peristome (Frahm, 1987: 719).

*Campylopus fragilis* (Brid.) Bruch & Schimp., *Bryol. Europ.* 1: 114 (1847)

*Dicranum fragile* Brid., *J. Bot. (Schrader)* 1800: 296 (1801). T: locality unknown, *Hb. Dickson*; lecto: BM, *fide* J.-P.Frahm, *Tropical Bryol.* 4: 42 (1999).

*Campylopus fragilis* subsp. *zollingerianus* (Müll.Hal.) J.-P.Frahm, *Tropical Bryol.* 4: 61 (1991)

*Dicranum zollingerianum* Müll.Hal., *Syn. Musc. Frond.* 2: 599 (1851). T: Indonesia, Sumbawa, *Zollinger 1184*; holo: B, destroyed; lecto: L, *vide* Frahm (1999: 88).

*Campylopus boswellii* (Hampe ex Müll.Hal.) Paris, *Index Bryol.*, Suppl. 1: 89 (1900)

*Dicranum boswellii* Hampe ex Müll.Hal., *Flora* 82: 442 (1896). T: Hawaii, 1879, *Wheeler*; *loc. id.*, *Boswell* (Hb. Geheeb).

*Campylopus pyriformis* (Schultz) Brid., *Bryol. Univ.* 1: 469 (1826)

*Dicranum pyriforme* Schultz, *Prodr. Fl. Stargard*, Suppl. 73 (1819). T: Ballin, [Germany], *n.v.*

*Campylopus torfaceus* Bruch & Schimp., *Bryol. Europ.* 1: 164 (fasc. 41, Mon. 4) (1847)

T: n.v.

See discussion under *Campylopus torquatus*.

*Campylopus incrassatus* Müll.Hal., *Linnaea* 18: 686 (1845).

T: Chili, *Poeppig s.n.*; holo: B, destroyed; iso: L, S B89234, S B89235.

*Campylopus flavoviridis* Dusén, *Ark. Bot.* 4 (13): 2 (1905)

T: E Patagonia, Puerto Bueno, 31 May 1896, *P.Dusén 103*; lecto: S B56389 (*selected here*); isolecto: S B56386; S B56387; *ibid.*, *P.Dusén s.n.*; syn: S B56385, S B56390.

Australian specimens identified as either *Campylopus flavoviridis* or *C. incrassatus* are here considered to be poorly developed forms of *C. introflexus*.

*Campylopus laxitextus* Sande Lac., *Verh. Kon. Akad. Wetensch., Afd. Natuurk.* 13: 10 (1872)

T: Java, [Indonesia], Herb. Van de Sande Lacoste ex herb. Dozy & Molkenboer; iso: L 60107.

Australian records of *Campylopus laxitextus* have been re-identified as *C. flexuosus* (mostly) and *C. excurrens*.

*Campylopus schmidii* (Müll.Hal.) A.Jaeger, *Ber. Thätigk. St. Gallischen Naturwiss. Ges.* 1870–71: 439 (1872)

*Dicranum schmidii* Müll.Hal., *Bot. Zeitung (Berlin)* 11: 37 (1853). T: India, Nilghiri Mtns, *Schmid*; iso: BM, L.

Australian records of *Campylopus schmidii* have been re-identified as *C. introflexus*.

*Campylopus sinensis* (Müll.Hal.) J.-P.Frahm, *Ann. Bot. Fenn.* 34: 202 (1997)

*Dicranum sinense* Müll.Hal., *Nuovo Giorn. Bot. Ital.*, n.s., 4: 249 (1897). T: China, Schan-kio, Aug. 1895, [Rev. J. Giraldi, comm. Dr. E. Levier]; lecto: H-BR; Schen-si Prov., Ki-san, Sept. 1895; syn: not located.

Reports of this name for Australia were made under the assumption that *C. excurrens* was a synonym. However, *C. excurrens* is recognised here as a distinct species.

*Campylopus japonicus* Broth., *Hedwigia* 38: 207 (1899)

T: Japan. *Ankarcrona s.n.*; syn: not located; Shikohu, Tosa, *Miyoshi*; syn: H-BR.

Reports of this name for Australia were made under the assumption that *C. excurrens* was a synonym. However, *C. excurrens* is recognised here as a distinct species.

*Campylopus eberhardtii* Paris, *Rev. Bryol.* 35: 43 (1908)

Type: Vietnam, Vinh Yen Prov., Tam Dao Range, “cascade d’Argent”; holo: PC.

Reports of this name for Australia were made under the assumption that *Campylopus excurrens* was a synonym. However, *C. excurrens* is recognised here as a distinct species.

*Campylopus robillardii* Besch., *Ann. Sci. Nat., Bot.*, sér. 6, 9: 323 (1878)

T: Mauritius, *Robillard s.n.*; iso: PC.

*Dicranum inchangae* Rehmman ex Müll.Hal., *Hedwigia* 38: 83 (1899), as *inerangae*; *Campylopus inchangae* (Rehmman ex Müll.Hal.) Paris, *Index Bryol.*, Suppl. 1: 92 (1900). T: Inchange, Natal, South Africa, *A.Rehmman s.n.* [*Musc. Austro. Afr. No. 42*]; iso: BM, *fide* J.-P.Frahm, *Tropical Bryol.* 4: 48 (1999).

*Campylopus robillardii* can be said to occur in Australia only if *C. perauriculatus* is treated as a synonym or recognised as a variety. However, *C. perauriculatus* is treated here as a distinct species. *Campylopus inchangae* is a synonym of *C. robillardii*.