ENCALYPTACEAE

Diana G. Horton


Type: Encalypta Schimp.

Gonautoicous, occasionally dioicous. Plants erect, in loose or dense turfs or tufts. Stems simple or branched; central strand usually undifferentiated; axillary hairs usually sparse, short, with few cells, or abundant, elongate and multicellular. Leaves ±twisted and contorted when dry, the laminae generally inflexed to conduplicate, otherwise involute; moist leaves erect-spreading to reflexed, the laminae inflexed to plane; most leaves ±oblanceolate-oblong; apex ±rounded, usually ±broadly obtuse or acute, otherwise narrowly acute, muticous, mucronate, apiculate or hair-pointed; margins mostly plane, or recurved, usually distally minutely (microscopically) crenulate, or minutely bluntly serrulate. Costa strong, ±prominently keeled on the abaxial surface, smooth to ±prorulose or papillose; adaxial surface (T.S.) with a single layer of laminal cells, 1–3 rows of cells with ±large lumina and strongly thickened walls; central strand distinct or undifferentiated, a small cluster of minute thin-walled cells; stereids in a single abaxial band, 2–8 cell rows with heavily thickened walls and minute lumina; abaxial epidermis ±undifferentiated. Distal medial laminal cells chlorophyllose, quadrate to subquadrate or short-oblanceolate, their transverse and longitudinal walls thin or somewhat thickened, usually bulging equally and papillose on both surfaces; papillae 2–8 over the lumina, ±C-shaped, or bulging more on the adaxial surface and bulging less and mamillose on the abaxial; distal marginal cells differentiated in 1 row, usually ovate, the narrow end projecting marginally, papillose or ±homboidal; upper corner projecting marginally; basal cells ±differentiated, ±rectangular, usually non-chlorophyllose, their transverse walls ±thickened, orange to yellow; longitudinal walls thin, hyaline to orange; surface walls usually smooth or papillose on the abaxial, as a group extending higher marginally or medially or not, or ±cholorophyllose, with the transverse and longitudinal walls thin or somewhat thickened, hyaline to pale orange or brownish; basal marginal cells undifferentiated or differentiated in a broad greenish band 2–20 narrow ±oblanceolate cells. Specialised asexual reproduction usually lacking, alternatively as ±dense, filamentous, richly branched, dark brown brood bodies on stems.

Perichaeta terminal, the leaves ±sheathing or undifferentiated. Perigonia usually lateral, minute, bud-like, the leaves ±sheathing and paraphyses with undifferentiated distal cells; terminal perigonia with leaves differentiated or not, the paraphyses with enlarged distal cells. Calyptra persistent, mitrate, elongate-cylindrical, generally extending well below the capsule, smooth to ±prorulose or papillose, basally ±entire or fringed, distally narrowed to a ±elliptic beak. Seta erect, short to elongate, straight to ±flexuose, ±twisted. Capsules stegocarpous, erect, theca cylindrical, occasionally furrowed longitudinally or spirally; neck usually indistinct; annulus usually undifferentiated, massive, glossy, crimson-red, deciduous in large fragments; operculum conical, convex or concave-plane and short- to long-rostrate. Peristome absent or highly variable and with teeth in 1 or 2 concentric layers, ±oblong or ±linear and elongate. Spores highly variable in size, shape, polarity and ornamentation.

The Encalyptaceae comprises two genera, Encalypta and Bryobrittonia Hedw., and perhaps 25 species, mostly in tundra and boreal and temperate regions of the Northern Hemisphere. A few species are found south of the Equator in mountainous regions and other areas where there are rock outcrops. The family is known from all Southern Hemisphere continents.

1 Department of Biology, University of Iowa, Iowa City, IA 52242, U.S.A.

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including Antarctica, and two species are endemic to South America. In Australia, it is represented by a single species. All taxa occur in dense turfs or tufts on disturbed soil or on soil on rock ledges and in crevices. Some are restricted either to calcareous or siliceous substrata, while others are tolerant of a broader pH range (Horton, 1988).

While the two genera of Encalyptaceae are differentiated solely by gametophytic features, remarkably there is congruence in sporophytic structure. This has led some to treat the monotypic Bryobrittonia as a species of Encalypta. Williams (1901) described Bryobrittonia on the basis of sterile plants, whereas Mitten (1864) had described fruiting plants as *E. longipes* Mitt. and erroneously reported the upper laminal cells to be papillose. This was a critical error, because the absence of papillae is one of the most distinctive features of Bryobrittonia. Nyholm (1998) noted that Bryobrittonia is indistinguishable from Encalypta sporophytically and concluded that Mitten’s treatment was correct. However, Steere (1953) felt that the distinctive gametophytic features “more than adequately” justify generic segregation, and Horton (1983) later concurred with his assessment. Bryobrittonia is restricted to tundra and montane boreal regions of North America and Eurasia.

Detailed developmental and structural analyses were the basis for Stone’s (1977) suggestion that a third genus, the monotypic Bryobartramia Sainsbury, might belong in the Encalyptaceae. However, she concluded that detailed studies of Pottiaceae, in particular, are necessary “before any valid assessment can be made”. Zander (1993) placed Bryobartramia in the Encalyptaceae based on shared characteristics of a large calyptra and large, coarsely papillose upper laminal cells that have a yellow KOH reaction. In contrast, Buck & Goffinet (2000) included only Encalypta and Bryobrittonia in the Encalyptaceae in the monotypic order Encalyptales and placed the monotypic Bryobartramiacae in the Pottiaceae. The Encalyptaceae and Bryobrittonia were among the outgroups included by Hedelston et al. (2004) in a phylogenetic analysis of haplolepideous mosses based on the chloroplast-encoded rps4 gene, and their data indicated that Bryobrittonia is closely related to the Encalyptaceae. At the same time, Goffinet & Buck (2004) included Bryobartramia within the Encalyptaceae; however, more recently, Goffinet et al. (2008, 2012) treated Bryobartramia as a monotypic family in the Encalyptales.

The diversity of peristome structure among species of Encalypta, which Philibert (1884–90) interpreted as representing nematodontous and arthrodontous, diplolepideous and haplolepideous peristomes, led him to treat the Encalyptaceae as a basal group from which other mosses had diverged. Philibert suggested closest relationships with Polytrichaceae, Tetraphidaceae-Buxbaumia-Diphasciaceae, Orthotrichaceae and Pottiaceae. Subsequently, the Encalyptaceae generally were placed close to Pottiaceae-Calymperaceae or Orthotrichaceae-Grimmiaceae until Edwards (1979, 1984) reported that the 2:3 pattern characteristic of haplolepideous mosses is not present in the Encalyptaceae species he examined and that the Encalypta species Philibert considered nematodontous actually are arthrodontous. In 1984, Vitt proposed a new classification of Bryopsida in which he recognised two fundamental lineages of arthrodontous mosses with the link between the two being groups with diplolepideous peristomes in which the segments are opposite the teeth, including Funariinae, Buxbaumiinae and Encalyptineae. He placed the Encalyptineae just above the Buxbaumiinae, the base of the otherwise haplolepideous lineage, and Funariinae at the base of the diplolepideous lineage. Subsequent studies have borne out Vitt’s (1984) recognition of close relationships among Encalyptaceae. Funariaceae and Buxbaumiaceae/Diphasciaceae, and a near-basal phylogenetic position of Encalyptaceae among Bryopsida. Newton et al.’s (2000) analyses of combined morphological and molecular data placed Encalypta and Bryobrittonia as a sister group to the haplolepideous mosses in an arthrodontous clade derived from three taxa (Diphasciaceae basal, with Funaria and then Timmia above) with diplolepideous, opposite peristomes. Analyses of nucleotide sequences from one nuclear and two chloroplast loci by Goffinet & Cox (2000) placed Encalyptineae as a sister group to Funariaceae in the lineage of arthrodontous mosses with opposite peristomes. Buck & Goffinet (2000) placed Encalyptales within the Funariidae beside Timmiaceae and Funariaceae. Later, Goffinet & Buck (2004) similarly included Encalyptales in the Funariidae, but next to Gigaspermatales and Funariaceae and placed Timmiaceae in the Timmiidae. They noted the general incongruence of gametophytic and sporophytic structure between Encalyptales and Funariaceae, but suggested that the latter might be most closely related to Encalyptales and the
evidence for this could lie in development of the amphithecium. The Encalyptales are treated similarly by Goffinet et al. (2008, 2012). Further molecular support for the placement of Encalypta, Bryobrittonia and Bryobarthria in the Funariidae and Encalyptales is that these three taxa share with eight genera of Funariaceae and Discelium the 71-kb inversion in the large single copy of the plastid genome (Goffinet et al., 2007).

References

Catcheside, D.G. (1980), Mosses of South Australia 48, 205–207.
ENCALYPTA

Encalypta Hedw., Sp. Musc. Frond. 60 (1801); from the Latin prefix en- (with or in) and calyptras (covered or enveloping), in reference to the calyptra that completely covers the capsule.

Lecto: E. ciliata Hedw.

Leersia Hedw. ex Batsch, Tab. Afd. 264 (1802), nom. illeg. incl. gen. prior (Leersia Sw.).

Leaves with inflexed to conduplicate laminae when dry; margins minutely crenulate distally; distal medial leaf cells bulging equally and papillose on both surfaces; distal marginal cells ovate, their narrow ends projecting marginally, papillose; basal cells ±markedly differentiated, non-chlorophylllose, their transverse walls orange to dark orange or yellow, their longitudinal walls hyaline to dark orange.

Perigonal paraphyses with undifferentiated distal cells.

Encalypta vulgaris Hedw., Sp. Musc. Frond. 60 (1801)


Encalypta vulgaris Hedw. var. tasmanica Hampe, Linnaea 26: 491 (1853), nom. inval. in synon. [= E. tasmanica Müll.Hal. & Hampe].

Encalypta australis Mitt., Fl. Tasman. 2: 182 (1859). T: near the Cataract, Launceston, Tas., and on the fossiliferous limestone near Cheshunt, W.Archer; lecto: BM-Hooker (here chosen); “Encalypta australis M. Near the Cataract Launceston Tasmania 1 Aug. Mr. Archer” (BM-Hooker); isolecoto: “Encalypta australis Mitten Tasmania Mr. Archer” (BM-Hooker).


Goniatoicous. Stems with an undifferentiated central strand; axillary hairs sparse. Leaves oblong to narrowly ovate, 2.2–3.1 (~4.0) mm long, 0.9–1.2 mm wide; apex broad, ± rounded, muticous; margins plane; abaxial surface of costa prominently keeled even near apex, sparsely prorulose, glossy, yellow to brown. Distal medial laminal cells 11–18 (~21) × (9–) 13–18 (~21) μm wide, with 3–7 papilae; basal cells 22–80 × 9–18 μm [L:W 2.5–4.5:1], as a group extending higher marginally or medially or not; transverse walls pale orange; longitudinal walls hyaline; surface walls smooth; basal marginal cells in a band 4–6 cells wide. Specialised asexual reproduction absent.

Perichaetia terminal. Perigonia lateral. Calyptra 3–6 mm long, extending well below capsule, glossy, golden, faintly translucent, smooth to ± papillose, basally ± erose; back 0.9–1.8 mm long, narrow. Seta 2–11 mm long, untwisted or with 1 or 2 dextrorse twists at the capsule base, dull to ± glossy, red below, orange to yellow near the capsule. Capsules 1–4 mm long, golden with a narrow bright red rim; theca occasionally slightly narrowed at the mouth, delicately puckered, sometimes delicately longitudinally striate; neck indistinct; annulus undifferentiated; operculum concave-plane and rostrate. Peristome usually absent, or with teeth poorly developed, evanescent, white. Spores 35–40 μm diam., brown, heteropolar; proximal face ± smooth centrally or with low gemmae, ± radially plicate; distal face with large hollow gemmae 5–6 μm diam.

Occurs on soil and on soil over rock in S.A., N.S.W., A.C.T., Vic. and Tas.; also in North America, Eurasia, Africa and New Zealand.


The most obvious, immediately recognisable, diagnostic character is the persistent, mitrate, elongate-cylindrical and rostrate calyptra. All Australian specimens seen by me have sporophytes, and calyptrae are absent from only two or three. Vegetatively, E. vulgaris is most likely to be confused with members of the Pottiaceae, particularly species of Tortula and Syntrichia. The most obvious feature that differentiates E. vulgaris is the pale orange transverse walls of the basal laminal cells, whereas those of Pottiaceae lack orange colouration.

**Doubtful Names**


T: “Priori intermixta [a reference to the preceding species, *E. novae-valisiae* (as *E. novae-valisiae*), specimen parvulum invenit, ab ea differ.” n.v.


*Encalypta ciliata* Hedw., *Spec. Musc.* 61 (1801)

According to Mitten (*in* Paris, *Index Bryol.*, 2nd edn, 2: 120, 1904), *E. ciliata* is known from eastern Australia, and this is the likely basis for the record in *Index Muscorum* 2: 198 (1962). However, I have seen no Australian specimens of *E. ciliata*.

*Encalypta vulgaris* Hedw. var. *mutica* Brid., *Mant. Musc.* 28 (1819)

Wilson’s (1859) treatment of the Musci in Hooker’s *Flora Tasmaniae* included Mitten’s description of *E. australis*, while Wilson also reported *E. vulgaris* var. *obtusa* Nees, Hornsch. & Sturm. However, when Nees *et al.* (*Bryologia Germanica*, 1827) described the latter taxon, they listed *E. vulgaris* var. *mutica* Brid. as a synonym. Since Bridel’s name was described earlier (Bridel, *Musciologiae Recentiorum Supplementum*, Mantissa, 1819), it has priority, so
Wilson’s record is the likely source of later reports of *E. vulgaris* var. *mutica* from Tasmania and Australia in Paris (*Index Bryol.*, 2nd edn, 2: 125, 1904), *Index Muscorum* 5: 587 (1969), Streimann & Curnow (Catalogue of Mosses of Australia, 1989), Dalton et al. (Checklist of Tasmanian mosses, 1991), Streimann & Klazenga (Catalogue of Australian Mosses, 2002) and Klazenga (http://www.rbg.vic.gov.au/dbpages/cat/index.php/mosscatalogue/name/844, 2012). In any event, it is doubtful that this variety warrants taxonomic recognition; it likely represents part of the variation of *E. vulgaris* var. *vulgaris*. 