

## 6. Keys from orders to genera and isolated species

The orders are arranged alphabetically. ➤ indicates that there is a key to the species in part 7.

### *Anthocerotales*

- 1 – Sporophyte green, erect, narrow, up to 10 cm long, with a short involucre at base; capsule with stomata; pseudoelaters geniculate ..... **2**
  - Sporophyte brown, ± horizontal, short (ca. 1 mm), immersed in an involucre; capsule without stomata; pseudoelaters spherical.. ..... *Notothylas orbicularis*
- 2 – Thallus usually pale green, with crisped margins and mucilaginous inner cavities often containing *Nostoc* colonies; spores blackish..... ➤ *Anthoceros*
  - Thallus usually dark green, with margins usually not crisped and lacking inner cavities; spores yellowish..... ➤ *Phaeoceros*

### *Jungermanniales sensu lato*

(incl. Fossombroniales (*Fossombronina*), Haplomitriales (*Haplomitrium*), Lepicoleales, Pleuroziales, Porellales and Radulales.)

- 1 – Leaves simple, unlobed (in case of doubt, this dichotomy also includes plants with some retuse, emarginate or dentate leaves). ..... **2**
  - Leaves shallowly to deeply 2-4 (-5)-lobed (in case of doubt, this dichotomy also includes plants with all the leaves retuse or shallowly bilobed) ..... **33**
- 2 – Underleaves present, well developed ..... **3**
  - Underleaves absent (sometimes scattered, vestigial or reduced to slime papillae) ..... **16**

- 3 – Plants ± isophyllous; leaves 3-ranked; underleaves identical to leaves ..... *Haplomitriales* / *Haplomitrium hookeri*  
 – Plants anisophyllous; underleaves different from leaves, of various form and size ..... 4
- 4 – Leaves incubous ..... 5  
 – Leaves succubous ..... 6
- 5 – Stem cortical cell walls thickened, brownish; leaf margin crenulate; cuticle roughly papillose ..... *Mnioloma fuscum*  
 – Stem cortical cell neither thickened nor brownish; leaf margin entire; cuticle finely papillose or smooth ..... ➤ *Calypogeia*
- 6 – Leaves opposite; perianth present or lacking (in which case replaced by a fleshy marsupium) ..... 7  
 – Leaves alternate or subopposite; perianth present or reduced (in which case replaced by a perigynium); no fleshy marsupium ... 8
- 7 – Leaves oblong to ovate-oblong; marginal cells not differentiated; well developed triangular underleaves, bilobed or toothed; perianth totally lacking, replaced by a fleshy, rhizoid-covered marsupium. Calcifuge, oceanic ..... *Saccogyna viticulosa*  
 – Leaves ovate-rotundate to nearly circular; marginal cells thick-walled; underleaves long, subulate; perianth free within bracts, only exceptionally replaced by a marsupium. Calciphile, arctic-alpine ..... *Arnellia fennica*
- 8 – Plants very small, 2-7 (-12) mm long, with caducous, obdeltoid or obtuse leaves. Oceanic .....  
 ..... ➤ *Leptoscyphus* p.p. *L. cuneifolius*  
 – Plants larger (up to 1-3 cm long); leaves not caducous, never deltoid or obtuse ..... 9
- 9 – Underleaves bilobed with lateral teeth, connate with both lateral leaves; leaves mostly subopposite ..... 10  
 – Underleaves free or connate with the proximal leaf; leaves clearly alternate (if subopposite, then underleaves small, subulate) ..... 11
- 10 – Leaves ovate-rotundate; margin entire; perianth terminal, flattened. Azores ..... ➤ *Leptoscyphus* p.p. *L. azoricus*  
 – Leaves ovate-rectangular; margin with 2 or more teeth; perianth on short lateral branches, not flattened. Macaronesia .....  
 ..... ➤ *Heteroscyphus*
- 11 – Rhizoids restricted to a small area at the base of underleaves; underleaves bifid, the best developed ones with lateral teeth .....  
 ..... *Chiloscyphus* p.p. *C. semiteres*  
 – Rhizoids scattered on ventral side of stem; underleaves lanceolate, subulate to filiform, never bifid ..... 12
- 12 – Ventral intercalary flagelliform stolons present; gametangia also on ventral intercalary branches; gemmae on juvenile leaves of erect tips of normal shoots; ♂ and ♀ bracts bilobed .....  
 ..... ➤ *Odontoschisma* p.p.  
 – Ventral intercalary stolons absent; gametangia on terminal or lateral branches; gemmae at margin of normal leaves or lacking; ♂ and ♀ bracts lacinate or entire, never bilobed ..... 13

- 13 – Leaf cells 50-75  $\mu\text{m}$  or more with bulging trigones; gemmae at tips of normal leaves; antheridial stalk uniseriate; perianth compressed..... **➤ *Mylia***  
 – Leaf cells up to 45  $\mu\text{m}$ , without bulging trigones; gemmae lacking; antheridial stalk biseriate; perianth compressed or not..... **14**
- 14 – Leaf insertion not reaching stem mid-line dorsally; leaves plane or nearly so; margins of some leaves retuse or with a few minute teeth; leaf cells without trigones; perianth compressed. Calciphile ..... ***Pedinophyllum interruptum***  
 – Leaf insertion reaching or crossing the stem mid-line dorsally; leaves plane or concave; margin never toothed; leaf cells with small to large trigones; perianth not compressed. Calcifuge ... **15**
- 15 – Leaves quadrate-rotundate to quadrate-rectangular, or suborbicular to orbicular (in this case leaves somewhat undulate or leaves subopposite); perianth well developed (perigynium absent) with ciliate or dentate mouth (if not, then cuticle coarsely verrucose); ♀ bracts lacinate..... **➤ *Jamesoniella***  
 – Leaves orbicular to orbicular-reniform, not undulate, never subopposite; perianth reduced, replaced by a long perigynium; mouth entire; ♀ bracts never lacinate ..... **➤ *Nardia* p.p.**
- 16 – Leaves opposite ..... **17**  
 – Leaves alternate ..... **18**
- 17 – Cells at base of ventral part of leaf 4-7  $\times$  longer than wide; perianth lacking; ♀ bracts entire; antheridial stalk uniseriate. Calcifuge ..... ***Gongylanthus ericetorum***  
 – Cells at base of ventral part of leaf up to 4  $\times$  longer than wide; perianth present; ♀ bracts toothed; antheridial stalk biseriate. Calciphile ..... **➤ *Southbya***
- 18 – Leaves wavy or crisped; cells large, leptodermous, with numerous (10-30) oil-bodies; rhizoids gen.  $\pm$  purple; gametangia on dorsal side of stem..... **➤ *Metzgeriales* p.p. *Fossombronia***  
 – Leaves not wavy nor crisped; cells with a few (less than 10) oil-bodies; rhizoids colourless, rarely purplish; gametangia never on dorsal side of stem..... **19**
- 19 – Leaf margin dentate or toothed ..... **20**  
 – Leaf margin entire ..... **22**
- 20 – Dorsal leaf margin inflexed. Oceanic ..... ***Adelanthus***  
 – Dorsal leaf margin plane or reflexed ..... **21**
- 21 – Stem cortex with 2-5 layers of thick-walled cells; leaves  $\pm$  convex with dorsal margin reflexed; leaf insertion reaching or crossing dorsal stem mid-line; rhizoids rare or absent ..... **➤ *Plagiochila***  
 – Stem without differentiated cortex; leaves  $\pm$  flat with dorsal margin plane; leaf insertion not reaching the dorsal stem mid-line; rhizoids common..... ***Pedinophyllum interruptum***
- 22 – Leaves transversely or subtransversely inserted ..... **23**  
 – Leaves obliquely inserted..... **25**

- 23 – Leaves subtransversely inserted, subopposite; cuticle coarsely papillose ..... *Jamesoniella* p.p. *J. rubricaulis*  
 – Leaves transversely inserted, alternate; cuticle smooth or nearly so ..... 24
- 24 – Shoots julaceous; leaves imbricate, appressed, broadly ovate; stem not visible..... ➤ *Gymnomitrium* p.p. *G. corallioides*  
 – Shoots not julaceous, leaves stiffly spreading, remote, spoon- or saucer-shaped; stem visible ..... ➤ *Marsupella* p.p. *M. arctica*
- 25 – Leaves very variable in shape and size on the same shoot, sometimes with scattered rhizoids at leaf margins (at least on the oldest ones). Azores..... ➤ *Tylimanthus* p.p. *T. azoricus*  
 – Leaves few or not variable in shape and size on the same shoot, never with rhizoids at leaf margin ..... 26
- 26 – Shoots laterally compressed; leaves ± rotundate or reniform, sometimes longly decurrent dorsally..... 27  
 – Shoots not laterally compressed (leaves at shoot apices sometimes appressed, but then ovate and shortly decurrent dorsally) ..... 28
- 27 – Leaves rotundate or nearly so, shortly decurrent dorsally, subopposite; cuticle coarsely verrucose. Azores.....  
 ..... ➤ *Jamesoniella* p.p. *J. rubricaulis*  
 – Leaves reniform, longly decurrent dorsally, alternate; cuticle smooth. British Isles, Faroes .....  
 ..... ➤ *Plagiochila* p.p. *P. carringtonii*
- 28 – Leaf insertion ± convex ..... ➤ *Plagiochila*  
 – Leaf insertion ± concave ..... 29
- 29 – Ventral intercalary flagelliform stolons present; gametangia also on ventral intercalary branches; ♂ and ♀ bracts bilobed .....  
 ..... ➤ *Odontoschisma*  
 – Ventral intercalary flagelliform stolons absent; gametangia on terminal or lateral branches; ♂ and ♀ bracts unlobed or lacinate, never simply bilobed ..... 30
- 30 – Leaf insertion not reaching the dorsal stem mid-line; perianth compressed..... *Pedinophyllum interruptum*  
 – Leaf insertion reaching the dorsal stem mid-line; perianths not compressed ..... 31
- 31 – Underleaves present at shoot apices; perianth mouth ciliate or dentate; ♀ bracts lacinate or dentate; bracteoles present .....  
 ..... ➤ *Jamesoniella*  
 – Underleaves absent; perianth mouth never lacinate nor dentate; ♀ bracts entire; bracteoles absent..... 32
- 32 – Leaves and ♀ bracts not appressed; perianth, at least partly, emergent from the bracts; no terminal “head” .....  
 ..... ➤ *Jungermannia*  
 – Leaves and ♀ bracts appressed at shoot apices; perianth hidden between large mussel-shaped bracts forming a terminal “head”. Arctic..... *Cryptocolea imbricata*