

A collection of botanical illustrations of various plant parts, including flowers, leaves, and stems, arranged in a circular pattern. The illustrations are detailed line drawings with shading to show depth and texture. The central flower has five large, rounded petals. Surrounding it are various other floral and vegetative parts, including a long, slender stem with small, pointed leaves, a cluster of small, star-shaped flowers, a single flower with five petals, a long, narrow leaf with many small, pointed lobes, a cluster of small, star-shaped flowers, a single flower with five petals, a long, slender stem with small, pointed leaves, and a cluster of small, star-shaped flowers. The entire collection is enclosed in a rectangular border.

2013 Minneapolis

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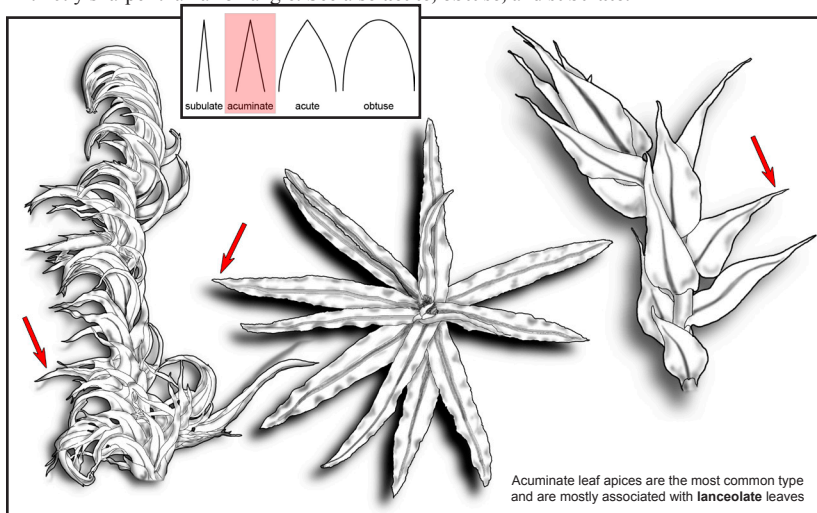
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Cite as: Janssens, J.A. 2014. Illustrated Glossary to the Field Guides of the Mosses & Liverworts of Minnesota. Minnesota Department of Natural Resources, 52 pp.

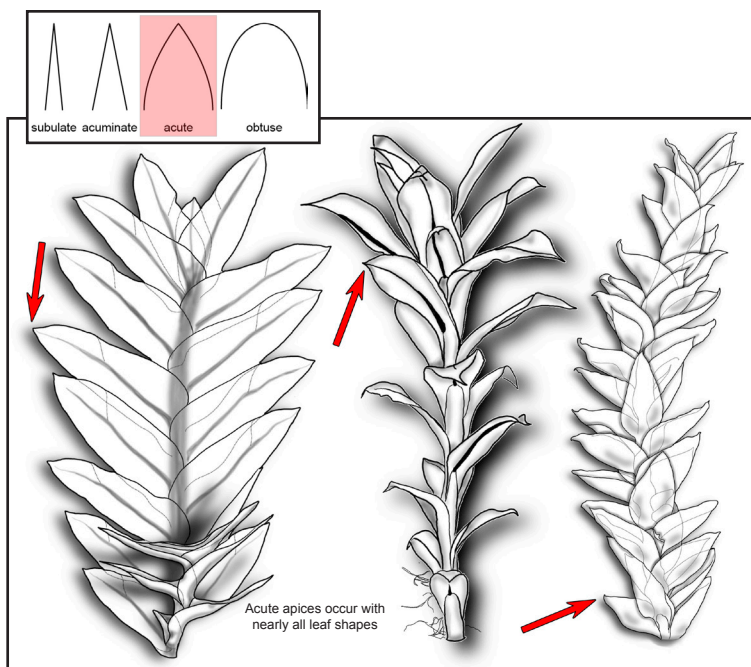
The illustrations in this glossary are based on figures in 'Janssens 2011. Noteworthy Mosses & Liverworts of Minnesota, Part I, Illustrated Field Keys' and on the multi-access XID key 'Janssens 2013. Mosses & Liverworts of Minnesota Field Guide'.

See also 'Malcolm, B. and N. Malcolm. 2006. Mosses and Other Bryophytes: an Illustrated Glossary. Second Edition. Micro-Optics Press, 336 pp.' and 'Magill, R.E. Editor. 1990. Glossarium Polyglottum Bryologiae. Missouri Botanical Garden, St. Louis, MO, USA. 297 pp.'

acuminate. Tapered to a slender point. Leaf apices: the most common, sharp leaf tip, distinctly sharper than a 45° angle. See also **acute**, **obtuse**, and **subulate**.



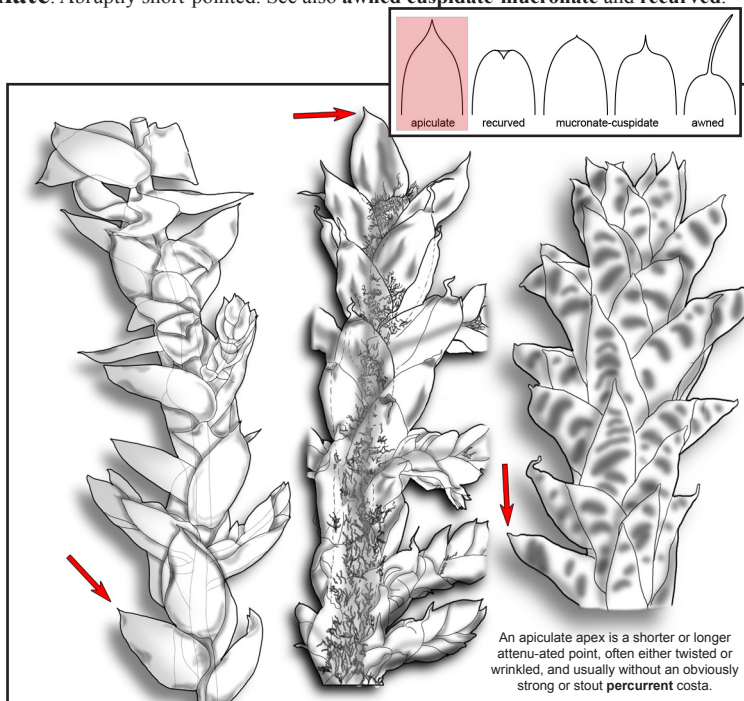
acute. Sharply pointed (less than 90°). Leaf apices: about a 45° angle. See also **acuminate**, **subulate**, and **obtuse**.



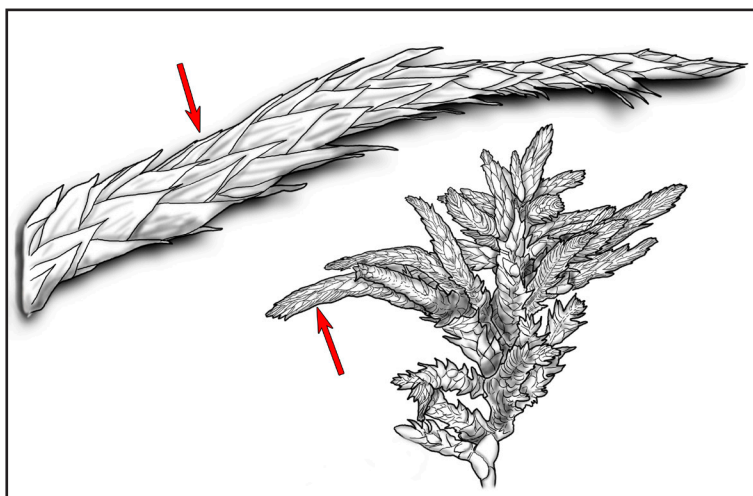
apical bud. The apex of the stem in *Sphagnum*, formed by the growing tip of the stem and consisting of an apical cell, surrounded and protected by enrolled, young stem leaves; this apical or **terminal** bud is more or less obvious among the young branches of the capitulum and its degree of visibility is a reliable taxonomic character.



apiculate. Abruptly short-pointed. See also **awned cuspidate-mucronate** and **recurved**.



appressed. Closely pressed against the stem or branch ($< 20^\circ$). See also **erect**, **erect-spreading**, **imbricate**, **spreading**, **squarrose**, and **squarrose-recurved**.



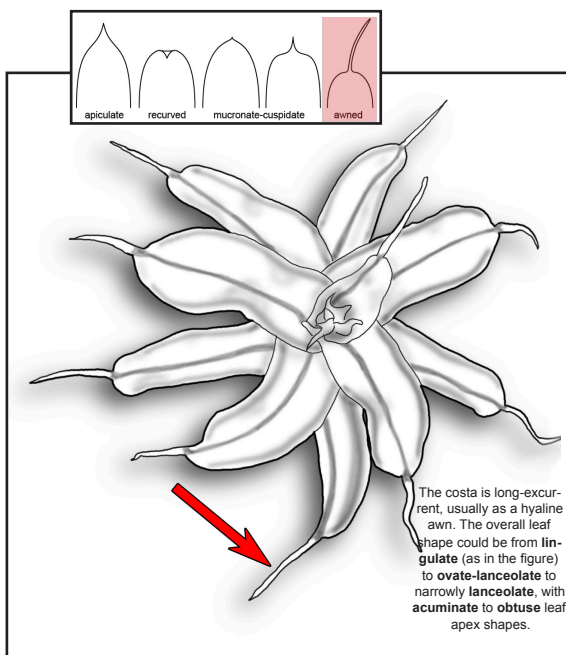
archegoniophore. Specialized structure found in some of the Marchantioid large thalloid liverworts. the sporophytes are formed on the underside of the long-stalked umbrella spokes (not visible in this picture).



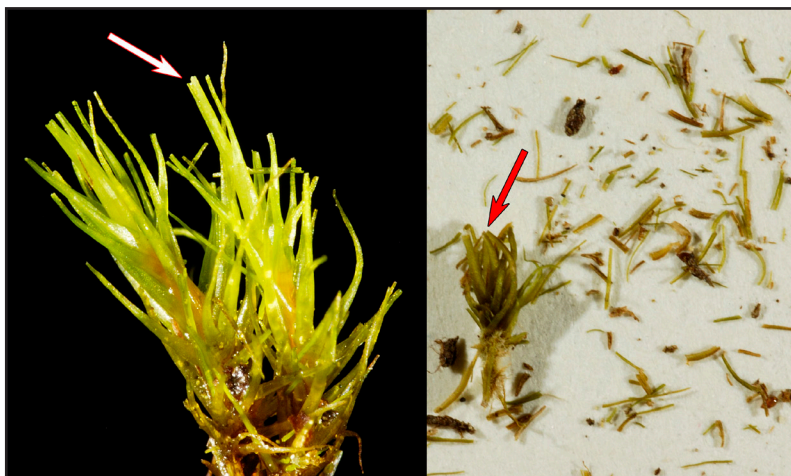
areola. The areolae, on the upper surface of the thallus, are the visible evidence of the underlying air-chambers in the complex thalli of the Marchantiales. There is also a central pore in the middle of the areola. Pl. areolae.



awned. With hairpoint.
See also **cuspidate**,
cuspidate-mucronate
and **recurved**.



broken off. In reference to leaf tips: a large part of the leaf tip of many of the leaves is broken off and fallen away (shake the clone upside down on the palm of the hand and observe the many loose leaf tips: excellent propagula for further vegetative propagation).



A photograph of a plant specimen, likely a root system, showing a dense, tangled mass of yellowish, fibrous roots or stems. A blue arrow points to a specific area on the left side of the specimen.

TREE OF LIFE

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graph TD; Archaea --- Eukaryotes; Eubacteria --- Eukaryotes; Eukaryotes --- Unikonta; Eukaryotes --- Eukaryotes2[Eukaryotes]; Unikonta --- Chromoalveolata; Unikonta --- Excavobionta; Unikonta --- Rhizaria; Eukaryotes2 --- GreenEukaryotes[Green Eukaryotes]; GreenEukaryotes --- Metabionta; GreenEukaryotes --- Chlorobionta; Metabionta --- Rhodobionta; Metabionta --- Streptophyta; Chlorobionta --- Streptophyta; Streptophyta --- Prasimophyta; Streptophyta --- Ulvophyta; Streptophyta --- Klebsormidiophyta; Klebsormidiophyta --- Cholorokybionta; Klebsormidiophyta --- Phragmoplastophyta; Phragmoplastophyta --- Eysenmatophyta; Phragmoplastophyta --- Plasmodesmophyta; Phragmoplastophyta --- Chaetosphaeridiophyta; Chaetosphaeridiophyta --- Charophyta; Chaetosphaeridiophyta --- Parenchymophyta; Parenchymophyta --- Coleochaetophyta; Parenchymophyta --- Embryophyta; Embryophyta --- Marchantiophyta; Embryophyta --- Stomatophyta; Stomatophyta --- Anthocerophyta; Stomatophyta --- Hemitrichophyta; Hemitrichophyta --- Bryophyta; Hemitrichophyta --- Polysporangiotophyta;
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Lecointre, G. and H. Le Guyader. 2006. The Tree of Life, a phylogenetic classification. The Belknap Press of Harvard University Press. Cambridge, Massachusetts & London, England.

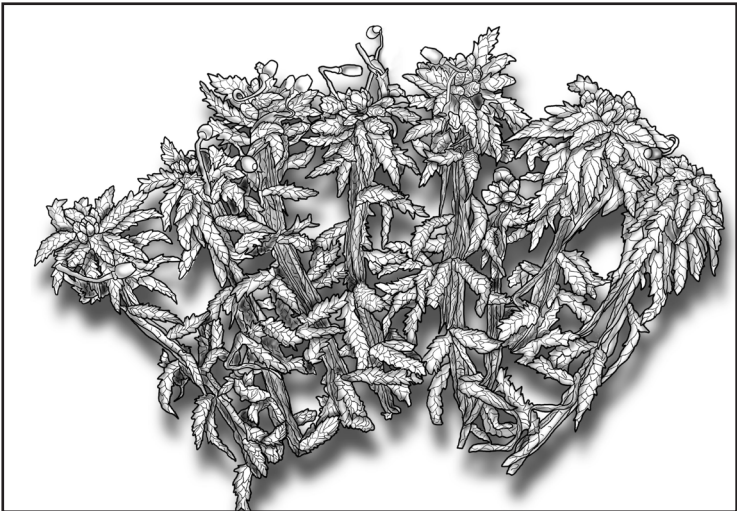
bud. See apical bud.

capitulum. Head-like tufts consisting of clusters of young branches or fascicles at the tip of a the stem of *Sphagnum*; see also **apical bud**.
Capitulum shape: see **curved branches**, **flat**, **hemi-spherical**, **spherical**, and **stellate**.

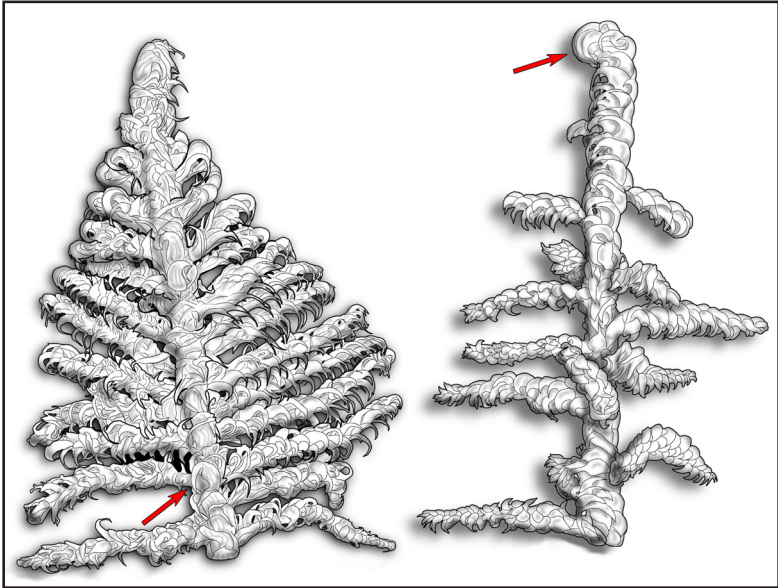


capsule. See **sporophyte**.

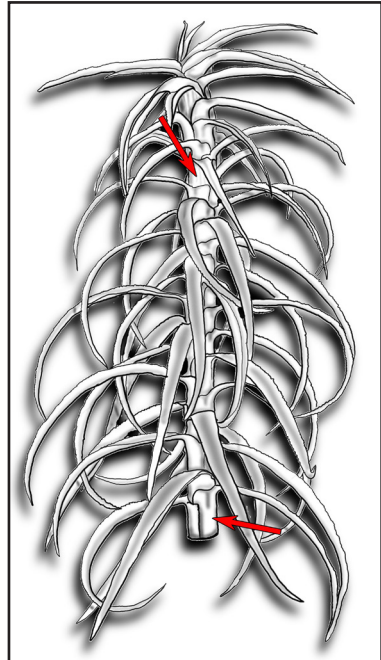
carpet. Tall turf with divergent branches: stems erect with many clusters of branches. Often considered as a separate major growth-form category. Typical for *Sphagnum*. See **growth form**.



circinate. In the case of leaves, curved in a circle. See also **curved-second** and **falcate-second**.

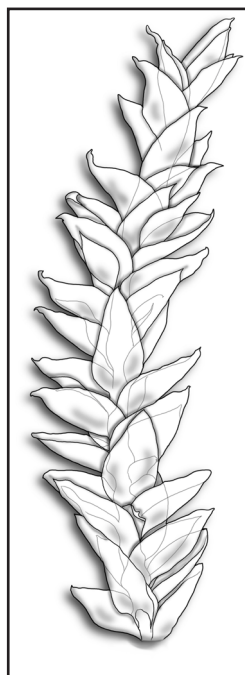


clasping. Surrounding the stem, branch, or seta, usually by the basal part of a leaf or sheath, as in *Polytrichum*; see also **sheathing**.

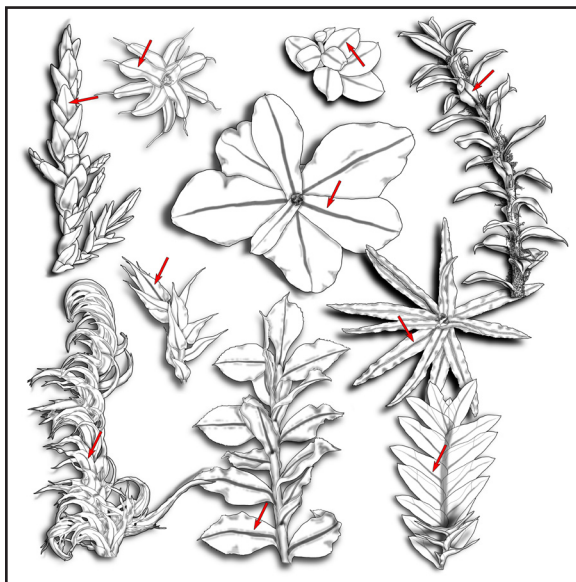


complanate. Flattened together, compressed in a flat plane. See also **distichous** and **helical**.

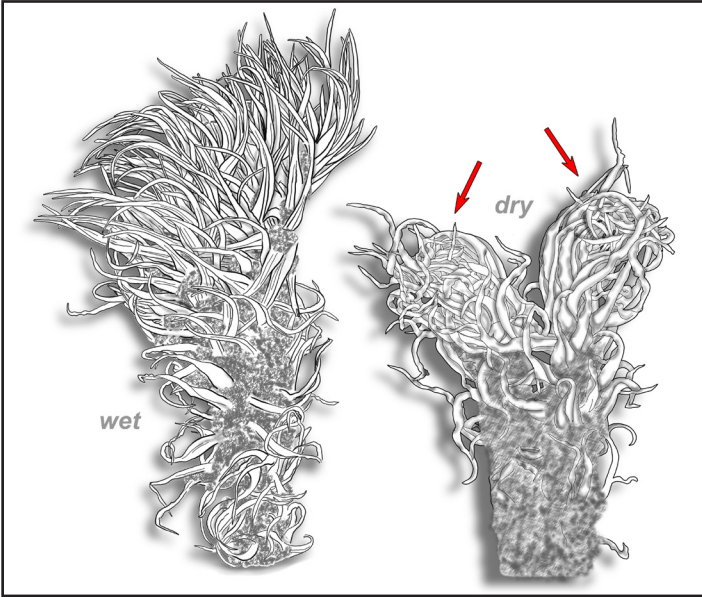
The leaves are still in their basically helical insertion pattern, but they are individually twisted and oriented so that together they form a plane. This plane is often oriented perpendicular to the direction of incoming light. Some such plants are often found in dark recesses. It is important to carefully study plants with leaves in such a flattened plane, to make clear the distinction between **complanate** and **distichous**.



costa. The nerve, or vein, of a moss leaf, sometimes double (when nearly impossible to see with a handlens considered **ecostate**) sometimes single, forming a midrib. **costate.** See **lamina**.



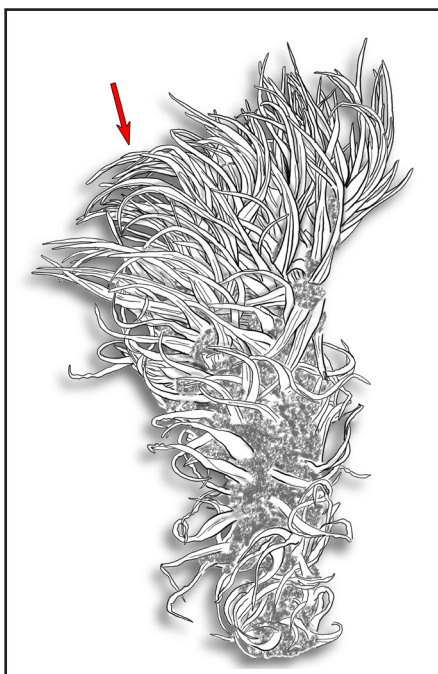
crisped. Highly twisted and contorted: in the case of leaves on dry plants, they form a near spherical cluster at the tips of the stems. See also **imbricate/appressed**, **incurved/catenulate**, and **twisted**.



cucullate. Hooded or hood-shaped: cucullate *Sphagnum* leaves are concave at the apex in a hoodlike manner. See also **obtuse**, **pointed**.

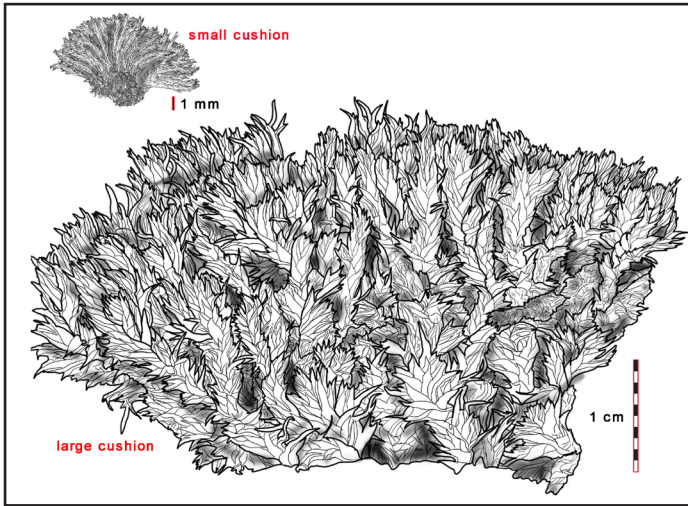


curved branches. The branches in the *Sphagnum* capitulum branches are curved in a horizontal plane. The branch leaves are also curved-secund. Howard Crum compared the look of such capitula with that of small balls of yarn. See also **flat**, **hemi-spherical**, **spherical**, and **stellate**.



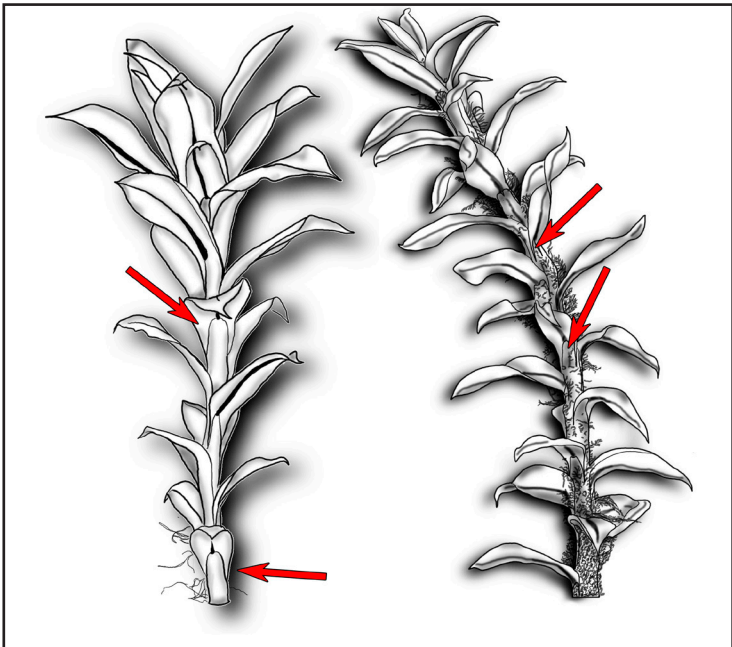
curved-secund. Leaves bend slightly, but less strongly than falcate (sickle-shaped), and swept to one side (the strict meaning of secund) of the plant. See also **falcate-secund** and **circinate**.

cushion. Small, rounded tufts formed of $\pm$ erect stems in a radiating arrangement. See growth form.



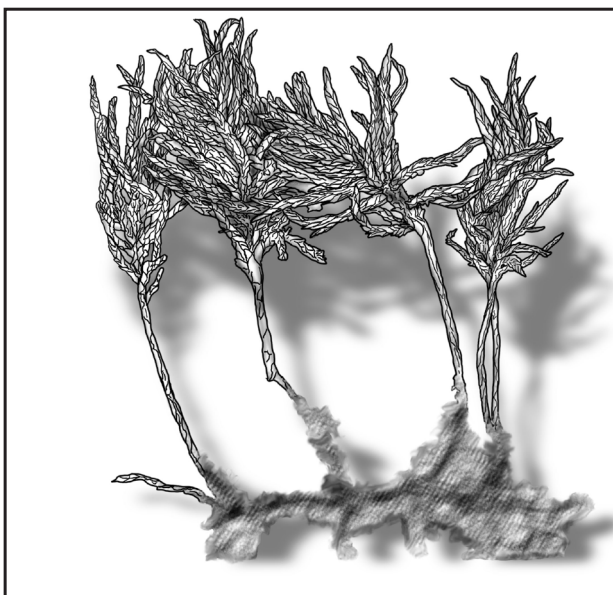
cuspidate. See mucronate-cuspidate.

decurent. With the basal margins extending down the stem below the leaf insertion, sometimes as ridges.



dendroid.

Branched above a trunklike base and resembling a tree. See **growth form**.

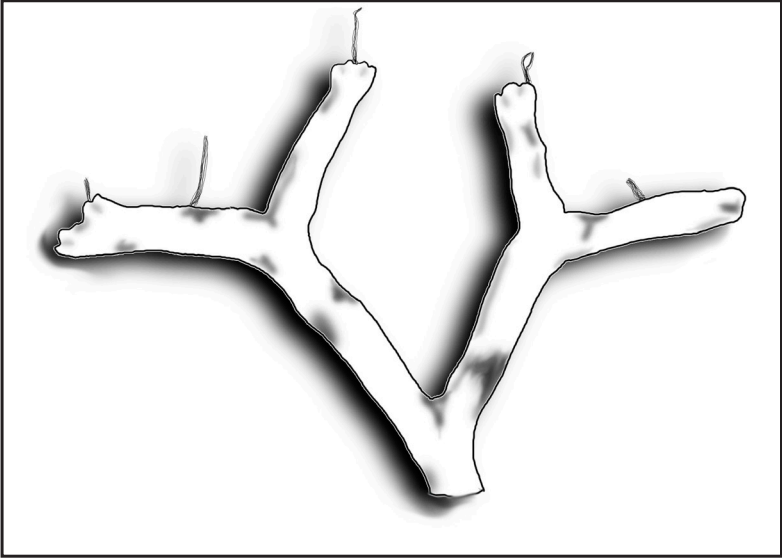


denticulate/serrate. With teeth along the margin of the leaf. The teeth consist of part of a cell (denticulate) or a single or even several cells (serrate).

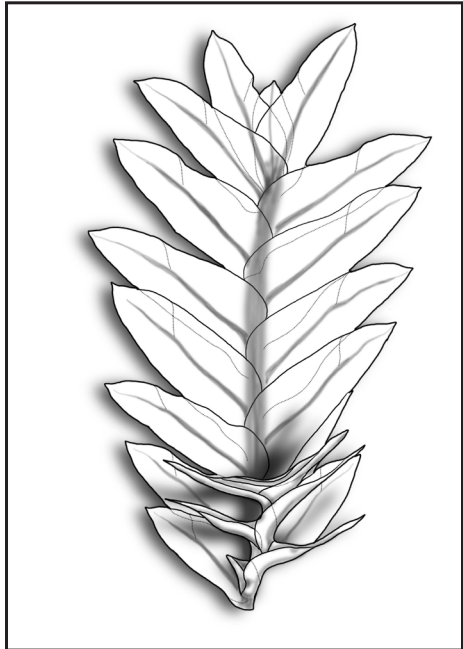
The distinction between denticulate and serrate is tricky to make with the handlens, so both attributes are lumped here. Serrated leaf margins, shown here in the figure, are somewhat more easily observed. Denticulate species will have a slight marginal roughness or fuzziness at the upper part of the leaves, only visible with the highest 20x handlens.



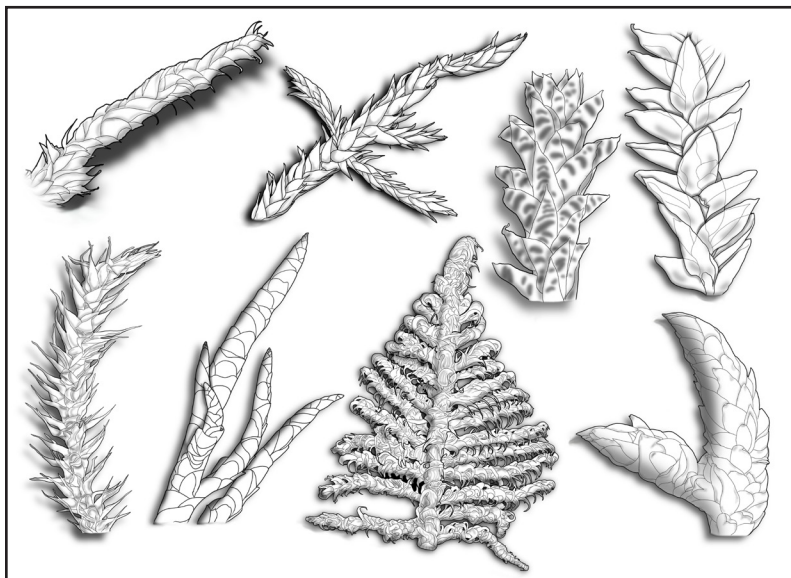
dichotomous. Equally forked, with paired branches.



distichous. Alternate in 2 opposite rows, 2-ranked. See also **complanate** and **helical**.

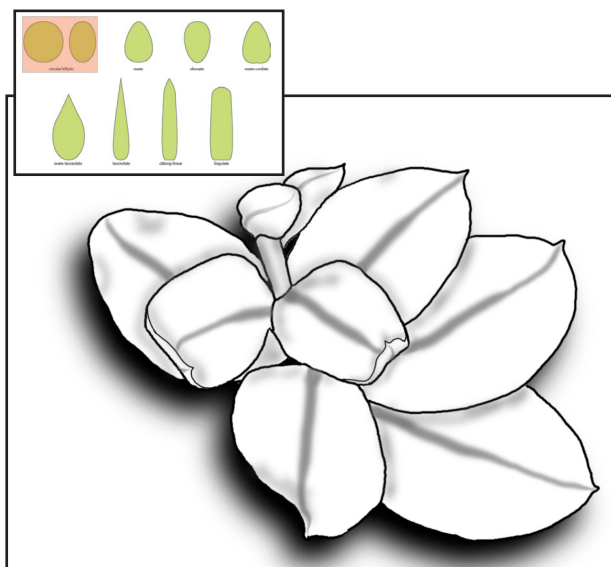


ecostate. Without a costa.

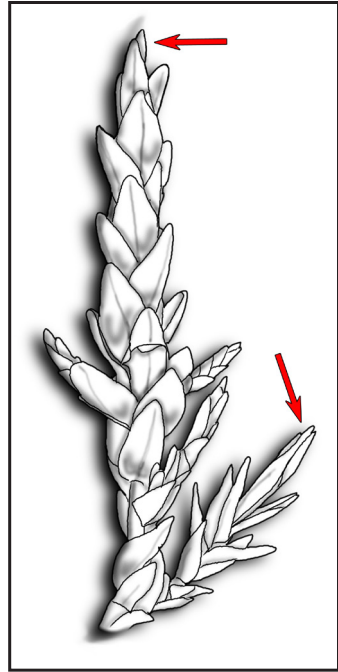


egg. See sporophyte.

elliptic. Having the outline of an ellipse, circular in rare cases. See also **lanceolate**, **lingulate**, **oblong-linear**, **obovate**, **ovate**, **ovate-cordate**, and **ovate-lanceolate**.



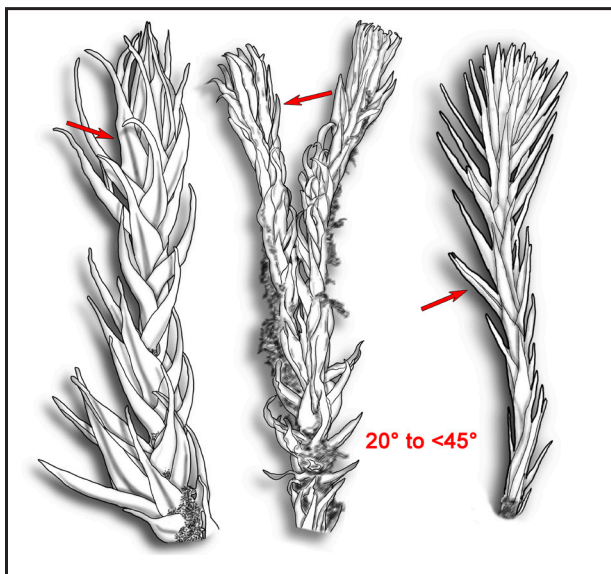
enrolled. Margins curved towards each other on the adaxial side; leaves strongly rolled around the stem and each other, forming a tight tube. See also **pointed**.



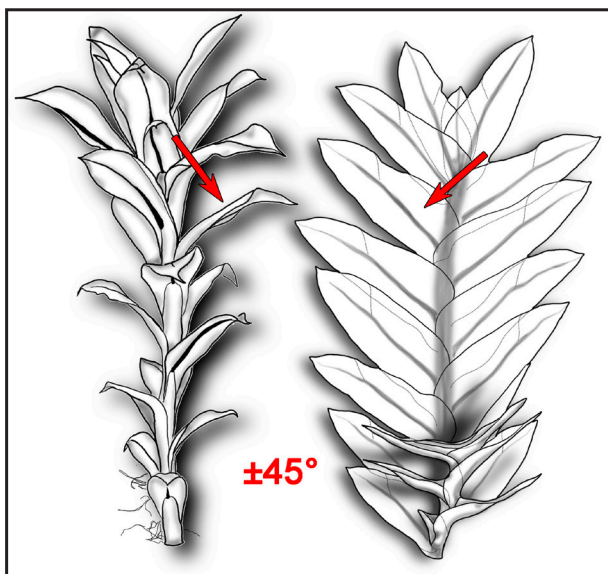
entire. Not toothed, used in reference to leaf margins: see also **denticulate/serrate**. Unbroken in reference to whole leaves, see also **broken off**.



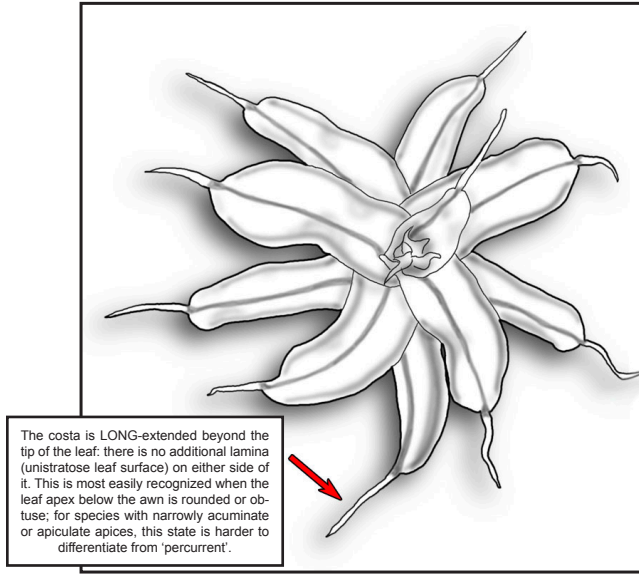
erect. Diverging at an angle of 20° to $<45^{\circ}$. See also **appressed**, **erect-spreading**, **imbricate**, **spreading**, **squarrose**, and **squarrose-recurved**. (Also used for leaf margins, when they are not exactly plane, but very slightly incurved; or with straight, not curved capsules.)



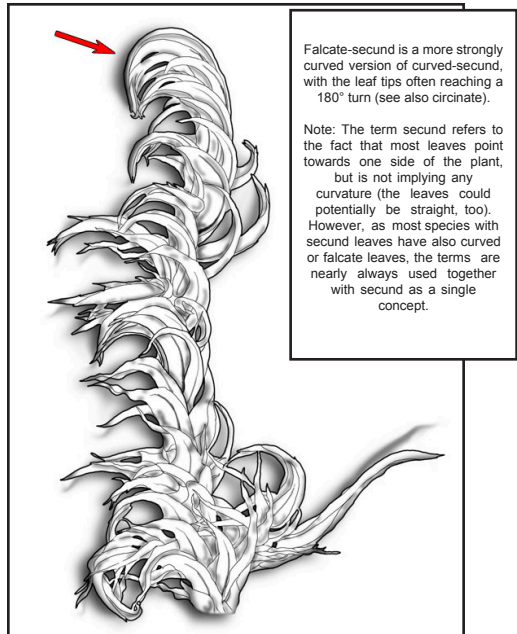
erect-spreading. Diverging at an angle of about 45° . See also **appressed**, **erect**, **imbricate**, **spreading**, **squarrose**, and **squarrose-recurved**.



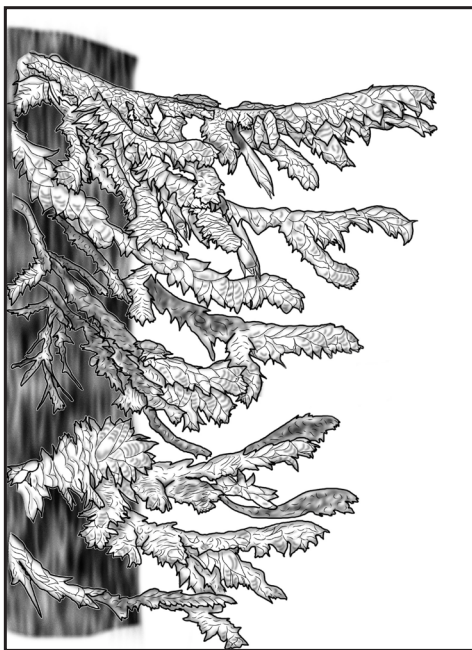
excurrent. Projecting beyond the apex; used in reference to the costa. See also **percurrent** and **subpercurrent**.



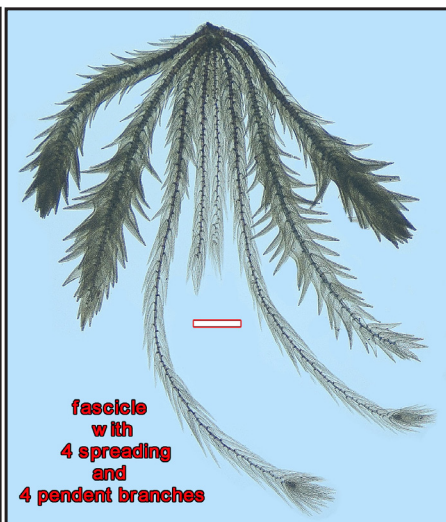
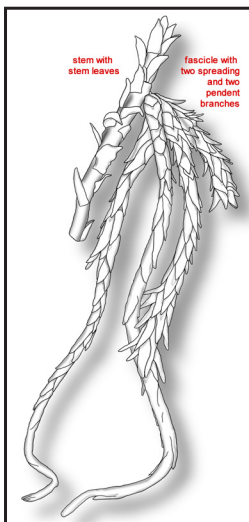
falcate-secund. Leaves curved like the blade of a sickle and swept to one side (the strict meaning of secund) of the plant. See also **curved-secund** and **circinate**.



fan. A mat-like growth form with the tips of the pendent branches curving outward, away from the substrate. See **growth form** and **mat**.



fascicle. A cluster of adjoined branches, a term specifically used for the configuration of branching along the stem of *Sphagnum*. See also **pendent** and **spreading** branch. In *Sphagnum wulfianum* the total number of spreading and pendent branches in a single fascicle often exceeds 6 (right image).



five-ranked. Leaf tips in five longitudinal rows along the branch or stem; frequently used in reference to *Sphagnum* branch leaves; result of 2/5 **phyllotaxy**; with torsion sometimes preserved (see inset).



five-starred. A 5-pointed pattern obvious when some *Sphagnum* plants in larger clones are looked at from above, caused by the regular spacing of the fascicles around the stems.



flagelliform. Bearing flagella. / **flagellum.** A slender branch; referring to small, axillary brood branches and sometimes to long, slender, tapering stems or branches. Pl. flagella.

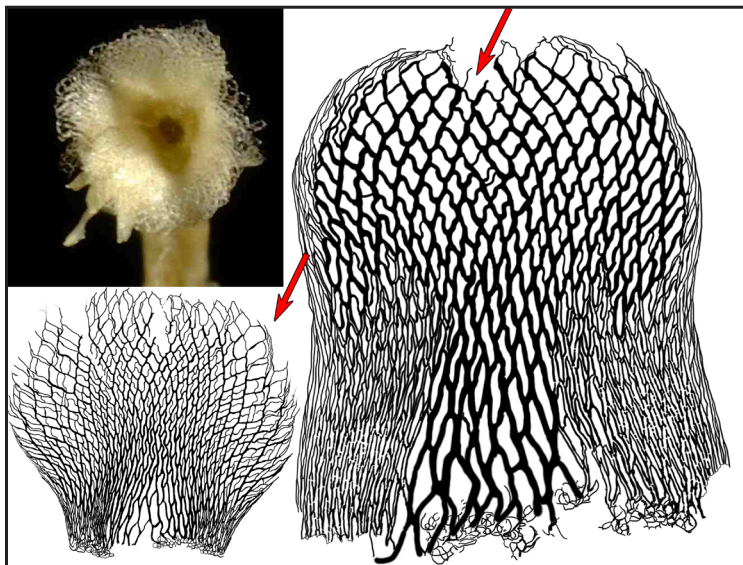


flat. The top of the *Sphagnum* capitulum is flat. Many of these capitula seen from above have also a **stellate** or star-shaped appearance (with five radii formed by spreading branches). See also **curved branches**, **hemi-spherical**, **spherical**, and **stellate**.



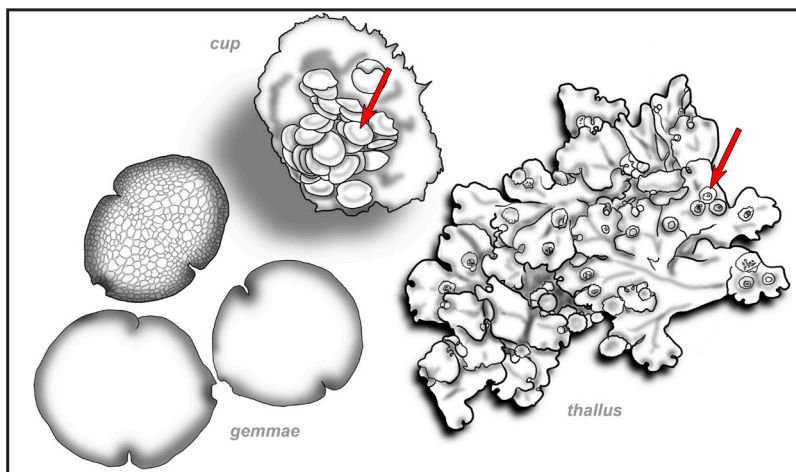
foot. See sporophyte.

fringed. Aspect of the margin or apex of a leaf, when the marginal cells are partly resorbed and fibril-like remnants are remaining. An extreme case (below left) is termed **lacerate**.



gemma. Usually a globose, cylindrical, or discoid brood body consisting of a single to multiple undifferentiated cells, serving as a propagule for vegetative reproduction.

gemmae cup. A structure enclosing or presenting a cluster of gemmae.



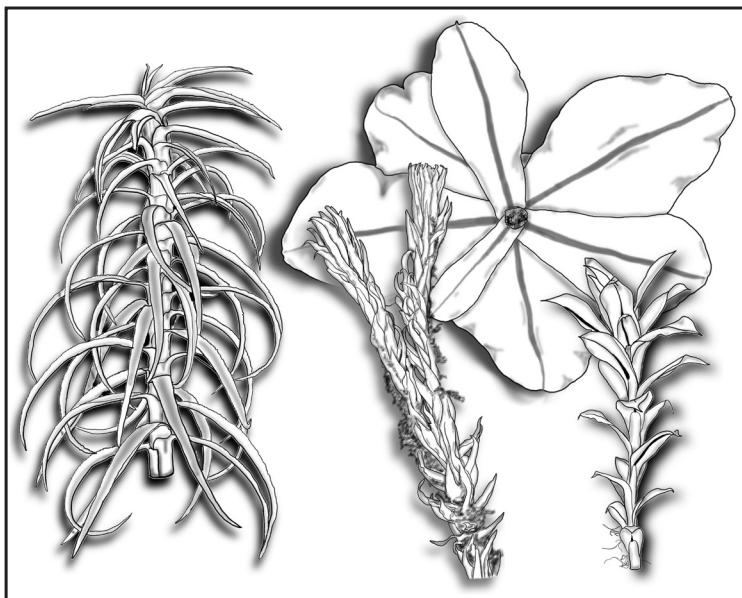
growth form. The branching pattern of a bryophyte clone. See also **carpet**, **cushion**, **dendroid**, **fan**, **mat**, **turf**, and **weft**.

Cushions	Domes, shoots radiating from central point of origin	
	Small cushion	Shoots short, a few cm at most.
	Large cushion	Shoots often 1 to several dm tall.
Turfs	Upright shoots, parallel shoots, growth vertical	
	Short turf	Turfs up to a few cm tall.
	Tall turf	Turfs up to several dm tall.
	Carpet	Tall turfs with divergent branches.
	Dendroid	Stems unbranched below, branches clustered above.
Mats	Horizontal stems, branches interwoven	
	Thalloid mat	branched thalli growing closely appressed.
	Smooth mat	Shoots and branches growing appressed to the substrate, often attached to it by rhizoids.
	Rough mat	Main shoots adhering to the substrate, but branches growing in oblique or vertical directions.
	Fan	Shoots and branches draping downward from a tree trunk and curving outward.
	Weft	Loose intertwining and straggling shoots and branches, laterals often ascending and arching.

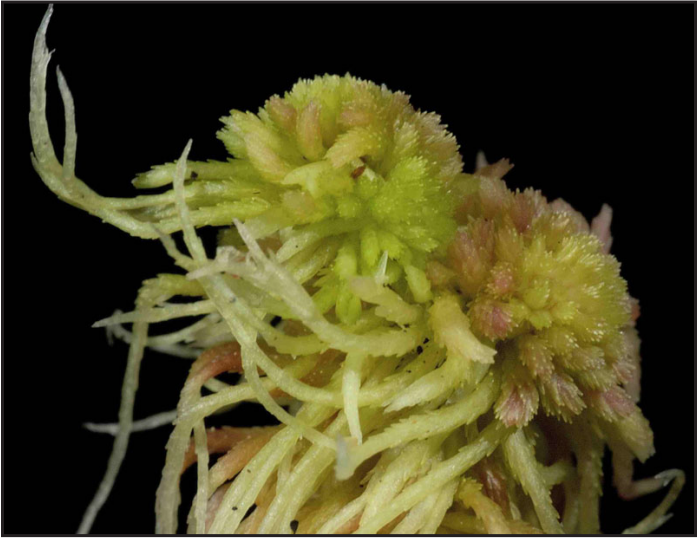
hairpoint. Excurrent costa, frequently hyaline. See **awned**.

hanging branch. See **pendent branch**.

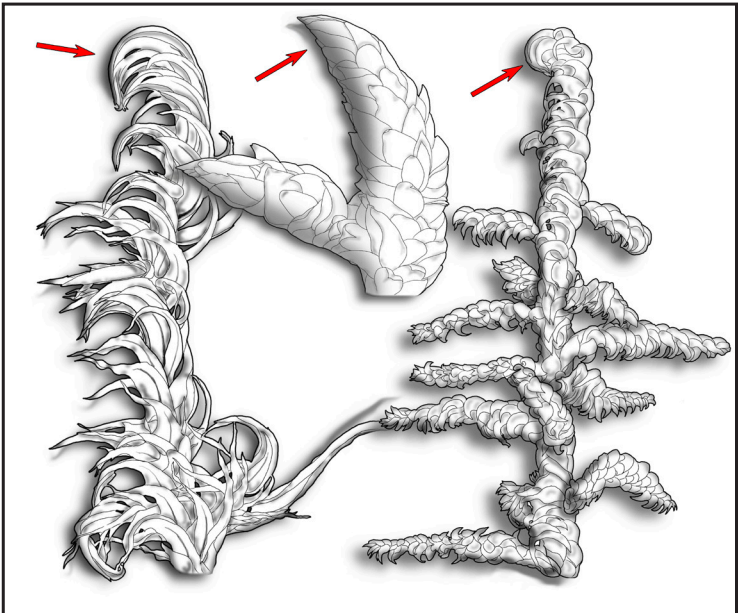
helical. Spirally, twisted, and stretched out along a longitudinal axis, such as the insertion of leaves on a stem in most mosses. See also **five-ranked**.



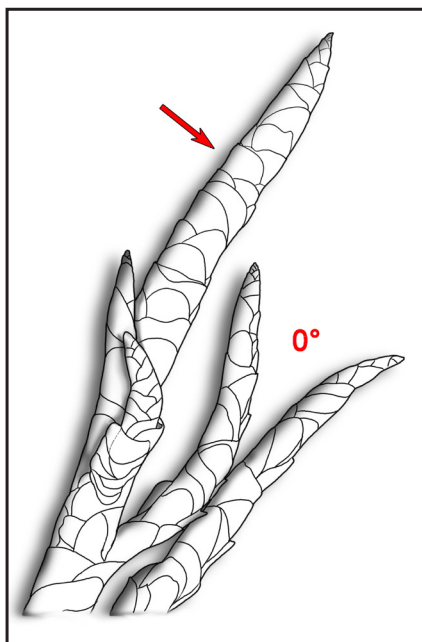
hemi-spherical. Shaped like the top half of a sphere, referring to the bulbous capitula of certain *Sphagnum* species. See also **curved branches**, **flat**, **spherical**, and **stellate**.



hooked. A more pronounced curved- to falcate-secund cluster of leaves is obvious near the tips of stem and branches. See also **curved-secund** and **falcate-secund**.

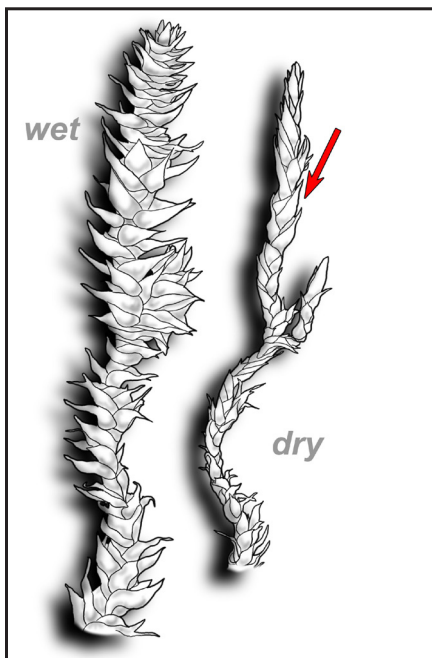


imbricate. Closely appressed and overlapping, referring to the aspect of leaves on stem or branch (0°). See also **appressed**, **erect**, **erect-spreading**, **spreading**, **squarrose**, and **squarrose-recurved**.

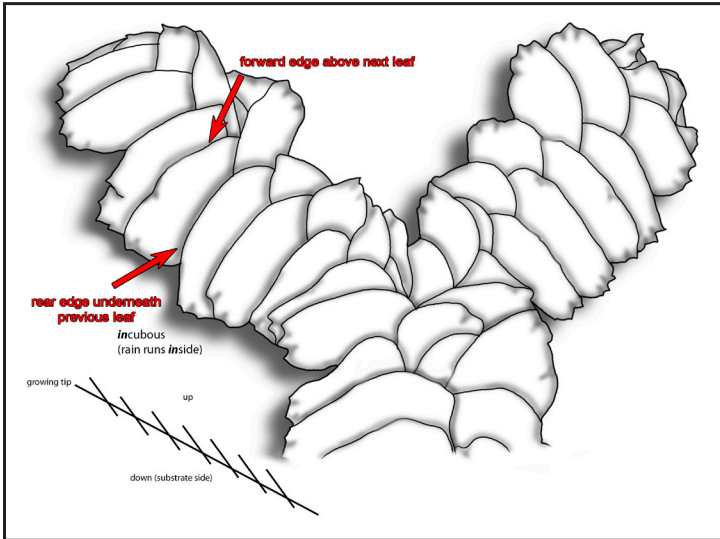


imbricate/appressed (dry leaves).

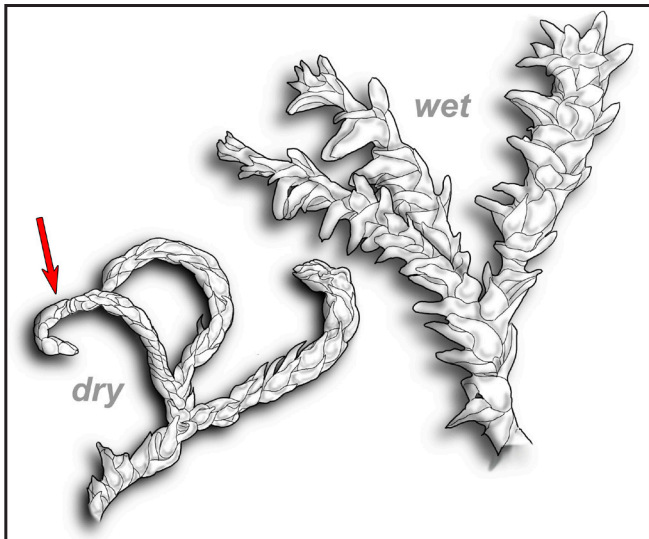
In case of leaves, they become tightly pressed against the stem or branch. Sometimes the change from a dry to wet look is very rapid when the plants are misted (less than a second). See also **crisped**, **incurved/catenulate**, and **twisted**.



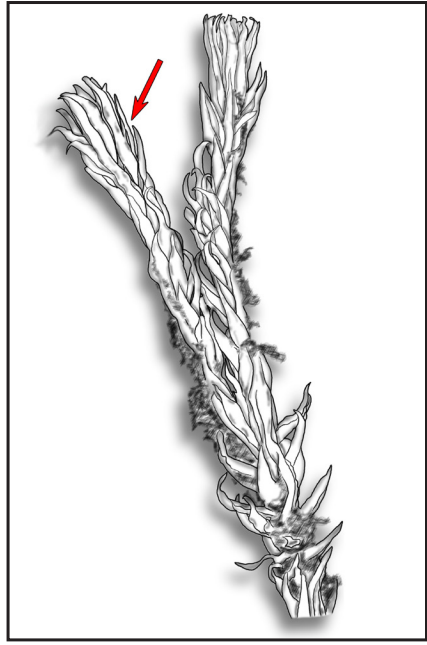
incubous. A special way of distichous insertion in leafy liverworts, where the leaf-insertion scars are oblique to the long axis of the stem. In the incubous arrangement the forward border of a leaf overlaps the rearward border of the next leaf up the stem. See also **succubous**.



incurved/catenulate. In reference to drying leaves: the distal half of the leaves curves inward toward the stem or branch. On those species that have fairly long internodes, this creates a catenulate look: the branches and stems look like little chains, the links formed by the inward-curving leaves. See also **crisped**, **imbricate/appressed**, and **twisted**.

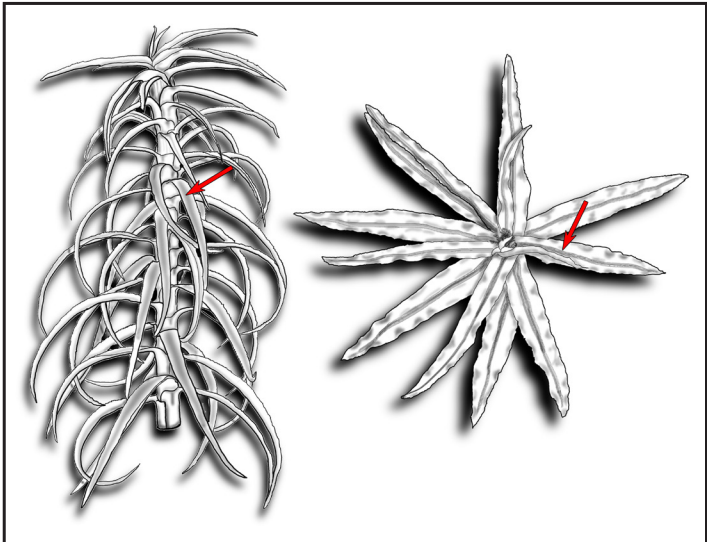


innovation. A new shoot, a branch formed after the maturity of sex organs, usually just below the inflorescence. Quickly grow upward and overtop the older ones. There is no clear structural difference between the older and newer stems. These species usually form cushions and turfs.

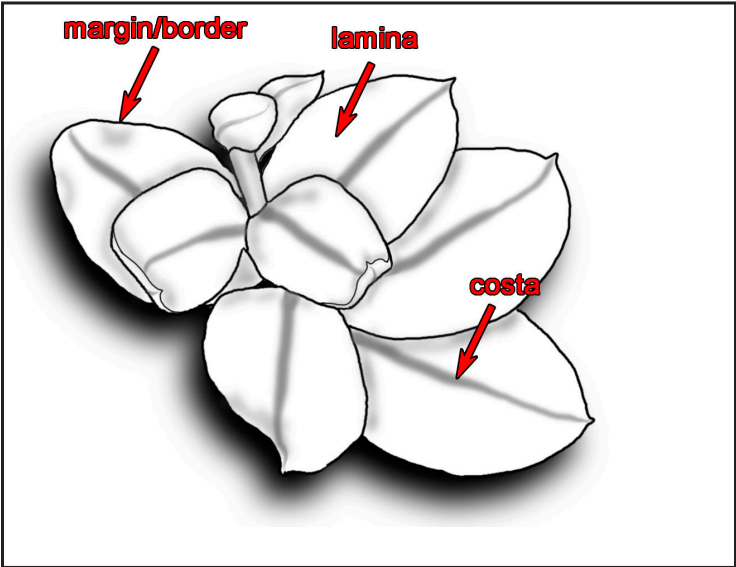


lacerate. Deeply and irregularly slashed or torn or fringed. See **fringed**.

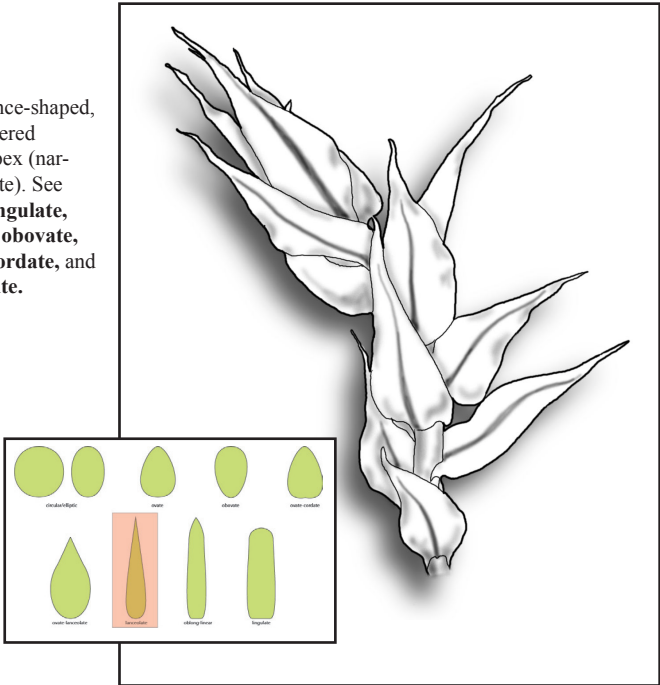
lamellae. Green ridges or platelike projections on the costa or the lamina of some moss leaves (Polytrichales covered in the field guide)



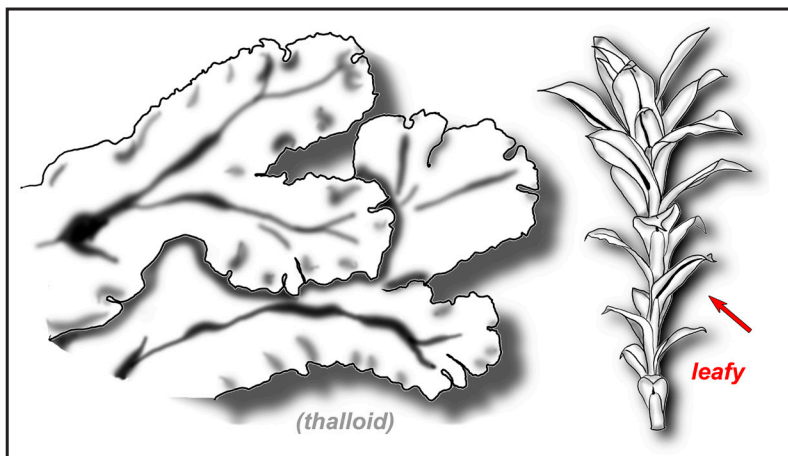
lamina. The leaf blade as distinguished from costa and border. Pl. laminae. See also **costa**.



lanceolate. Lance-shaped, narrow and tapered from base to apex (narrower than ovate). See also **elliptic**, **lingulate**, **oblong-linear**, **obovate**, **ovate**, **ovate-cordate**, and **ovate-lanceolate**.

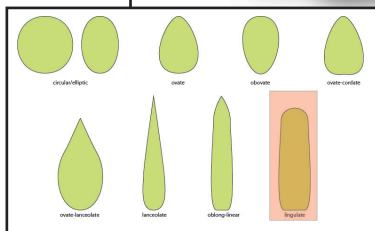
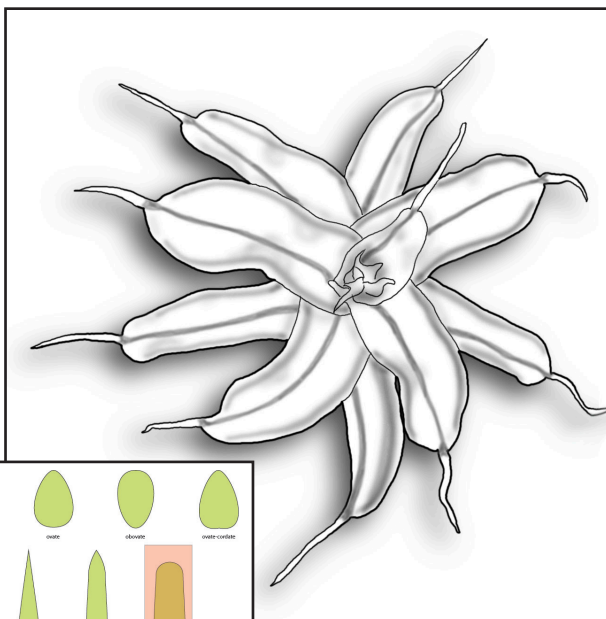


leafy/leaves. With leaves, usually consisting of a one-cell thick **lamina** and thicker **costa**, as opposed to **thalloid**.

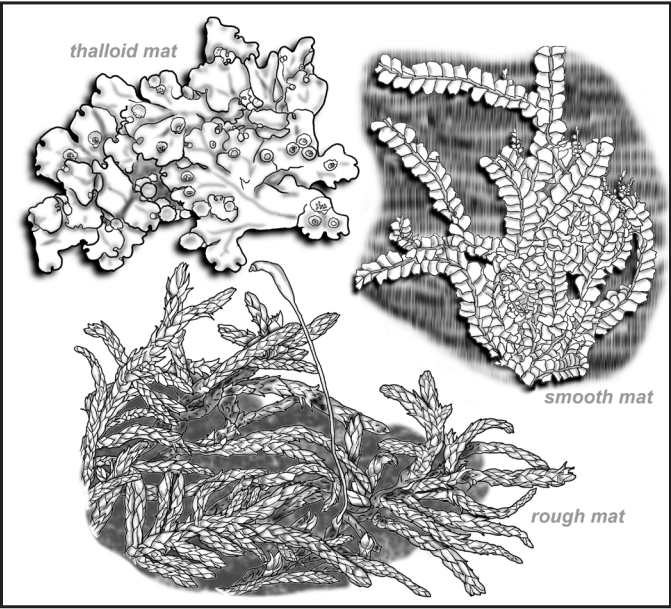


lingulate.

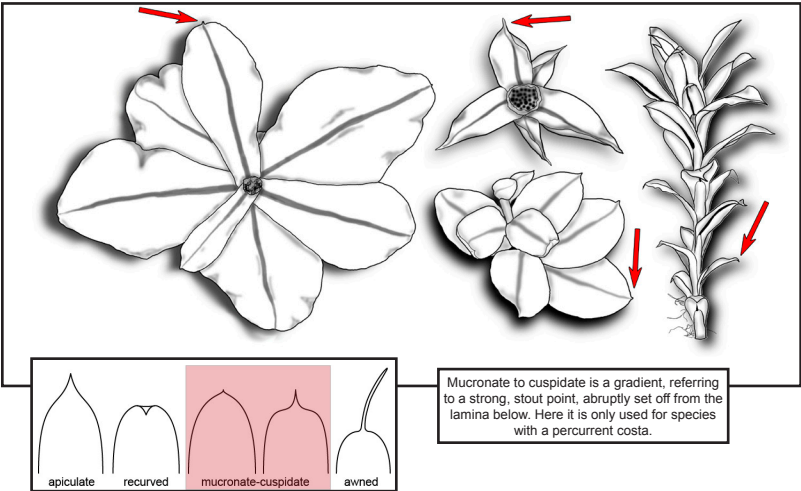
Tongue-shaped, oblong with a broad apex. See also **elliptic**, **lanceolate**, **oblong-linear**, **obovate**, **ovate**, **ovate-cordate**, and **ovate-lanceolate**.



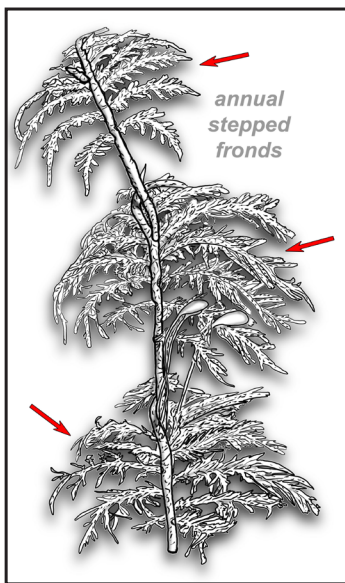
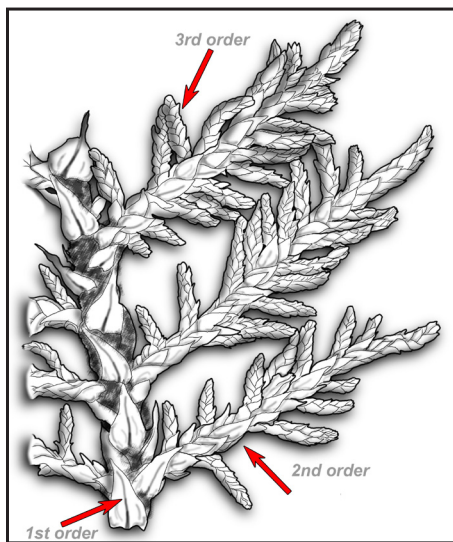
mat. A densely interwoven, horizontal form of growth. See **growth form**.



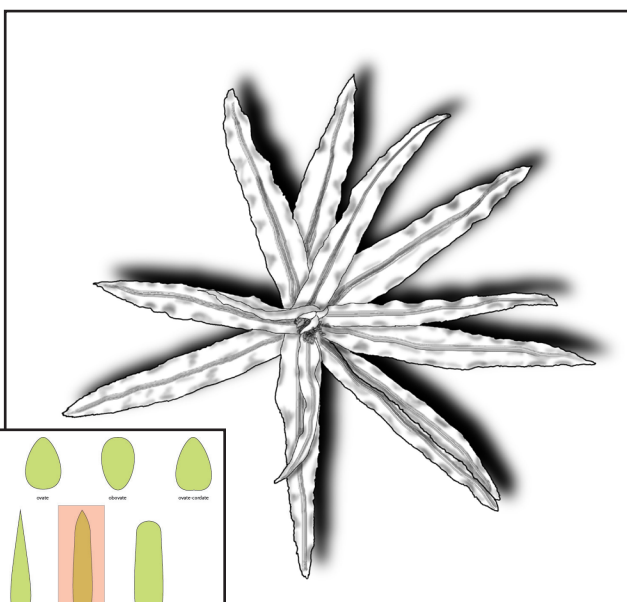
mucronate-cuspidate. Ending abruptly in a stout, often rigid point (a toothlike cusp). See also **acuminate** and **recurved**. See also **awned**, **cuspidate**, and **recurved**.



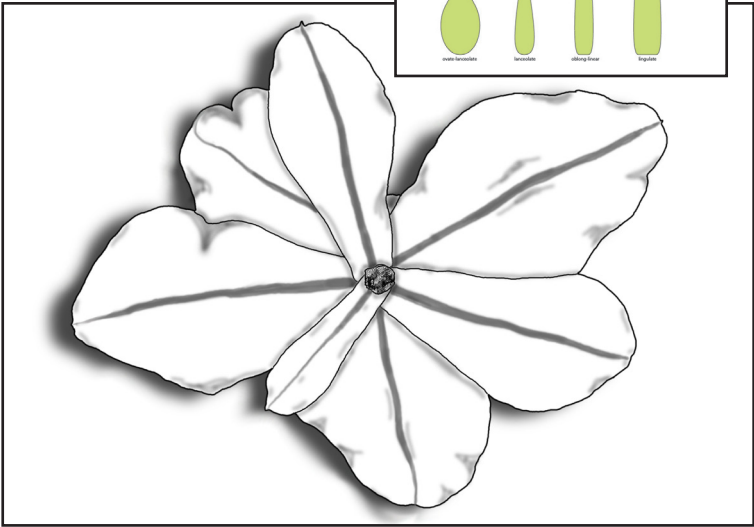
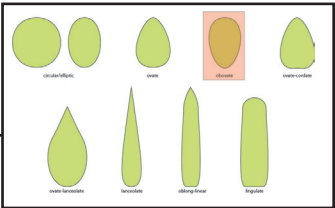
multi-pinnate. See **pinnate**, but with multiple orders of branching. Sometimes differentiated in annual fronds.



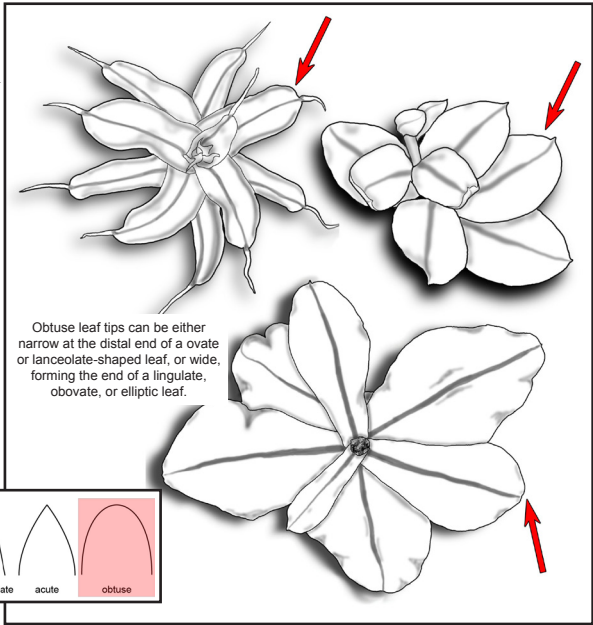
oblong-linear. Longer than broad, with the sides nearly parallel, rectangular, with rounded corners or acute tips. See also **elliptic**, **lanceolate**, **lingulate**, **obovate**, **ovate**, **ovate-cordate**, and **ovate-lanceolate**.



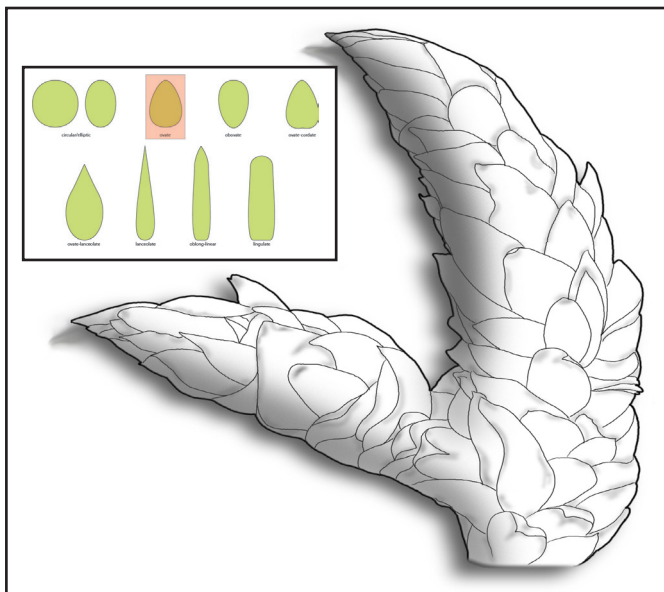
obovate. Egg-shaped, with the broader portion at the apex rather than the base. See also **elliptic**, **lanceolate**, **lingulate**, **oblong-linear**, **ovate**, **ovate-cordate**, and **ovate-lanceolate**.



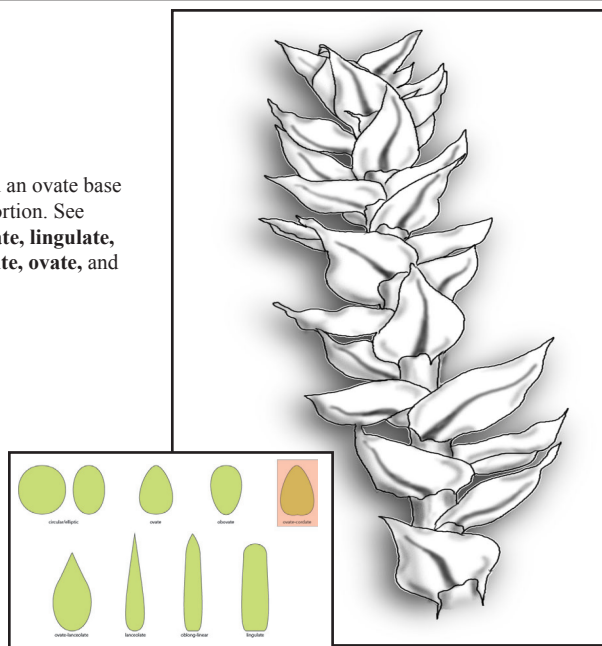
obtuse. Broadly pointed (more than 90°), sometimes used to mean blunt or rounded at the end. See also **acuminate**, **acute**, and **subulate**.



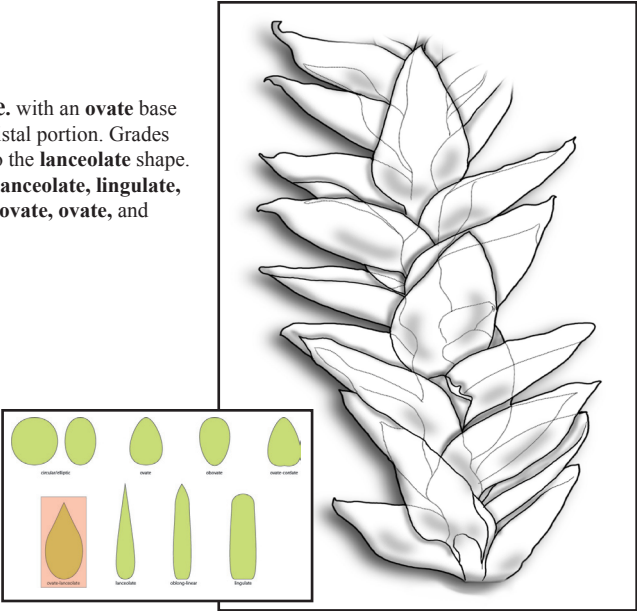
ovate. With the outline of an egg, with the base broader than the apex (broader than lanceolate). See also **elliptic**, **lanceolate**, **lingulate**, **oblong-linear**, **obovate**, **ovate-cordate**, and **ovate-lanceolate**.



ovate-cordate. With an ovate base and elongate distal portion. See also **elliptic**, **lanceolate**, **lingulate**, **oblong-linear**, **obovate**, **ovate**, and **ovate-lanceolate**.



ovate-lanceolate. with an **ovate** base and an elongate distal portion. Grades imperceptibly into the **lanceolate** shape. See also **elliptic**, **lanceolate**, **lingulate**, **oblong-linear**, **obovate**, **ovate**, and **ovate-cordate**.



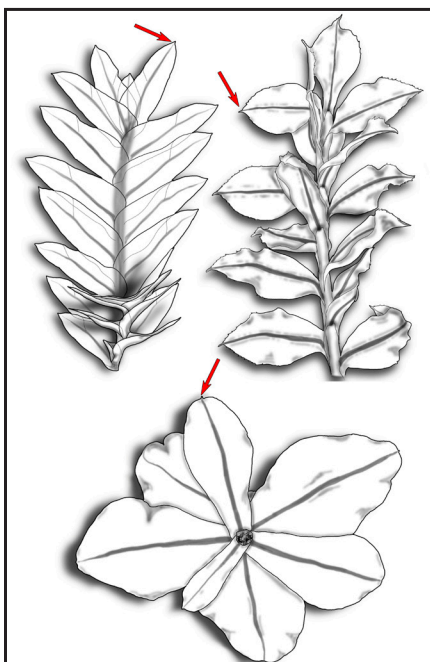
paraphyllia. Small, green, filiform, lanceolate or leaf-like, sometimes branched scales produced on stems and branches of some pleurocarpous mosses.



pendent branch. A branch from the **fascicle** that hugs closely to the stem, in contrast with the **spreading branch**. The pairing of a pair of pendent branches are the easiest to observe when they just emerge from between the radii of the **capitulum**.



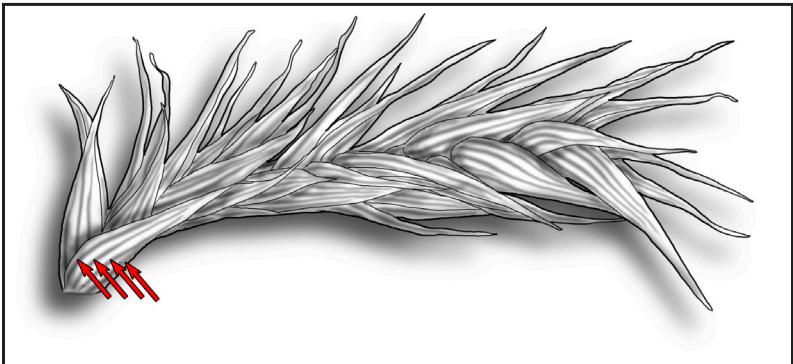
percurrent. Extending to the apex: the costa ends clearly in the apex tip, converging with the lamina of the leaf. See also **excurrent** and **subpercurrent**.



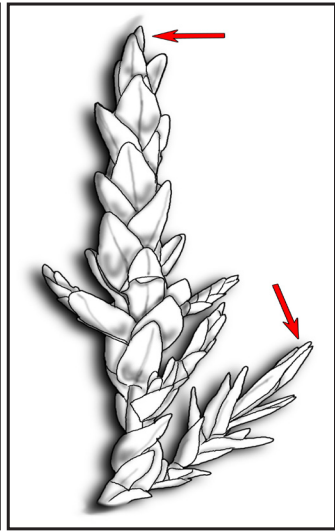
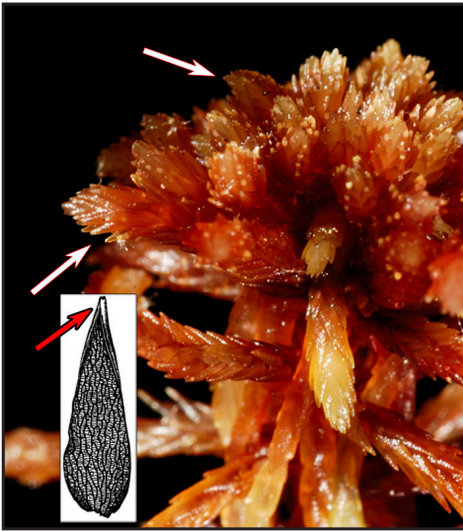
pinnate. With branches spreading on both sides of the axis (sometimes crowded and regularly spaced in a featherlike fashion).



plicate. Folded in longitudinal pleats (plicae).



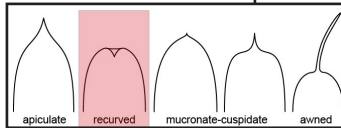
pointed. In reference to *Sphagnum* branch leaves: the points are sharply pointed rather than **obtuse** or **cucullate**. Also stem and branches with tightly **enrolled** leaves.



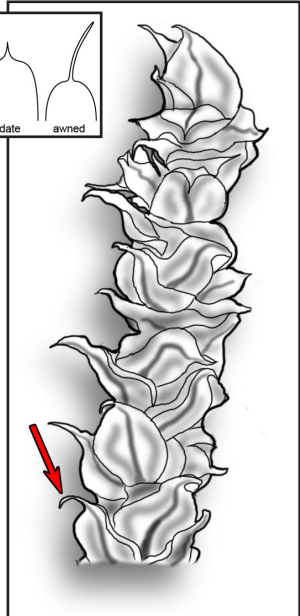
polysetous. With multiple sporophytes derived from several different archegonia within the same perichaetium (a cluster of bracts surrounding the archegonia or female gametangia or sex organs).



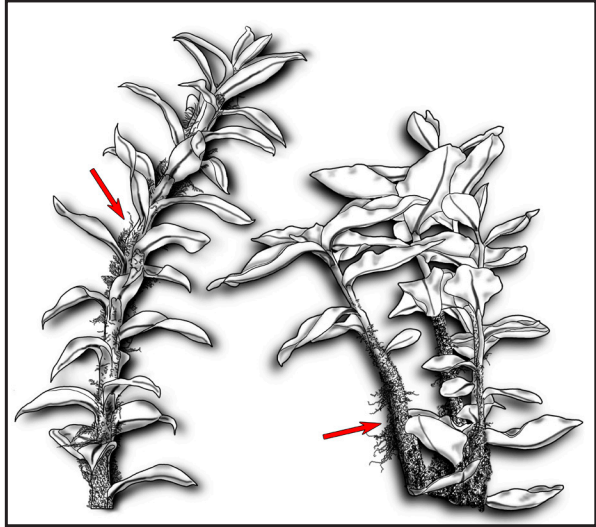
propagule. A reduced bud, branch, or leaf serving in asexual reproduction, a specialized type of brood body. Pl. Propagula. See also **gemma**.



recurved. Curved downward (abaxially) or backward, referring either to leaf margins or the upper part of leaves (see fig.). See also **awned**, **cuspidate**, and **mucronate**.



rhizoids. Simple or branched filaments, appearing dead at maturity, attaching the plant to the substrate, sometimes $\pm$ covering stems, rarely found at back of costa or at leaf tips.



secund. Conspicuously turned to 1 side. See **circinate**, **curved-secund** and **falcate-secund**.

seta. See **sporophyte**.

sheathing. See **clasping**.

spherical. Having the form of a sphere or part of one. See also **curved branches**, **flat**, **hemispherical**, and **stellate**.

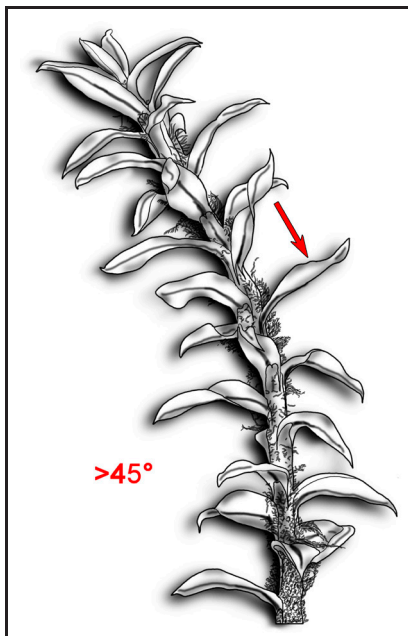


spirally. See **Helical**.

sporophyte. The diploid, spore-bearing generation, produced by the fertilization of an **egg**, remaining attached to the gametophyte in bryophytes, and partially dependent on it (or, in liverworts, parasitic), typically consisting of **foot** (hidden in gametophore), **seta** (the stalk supporting the capsule; persistent in most mosses, but ephemeral in most leafy liverworts.), and **capsule** (or sporangium, often differentiated into an upper spore-bearing urn and a sterile basal neck (which may be considerably differentiated as a broad apophysis, or hypophysis). Below: often abundantly produced by colonizing mosses.



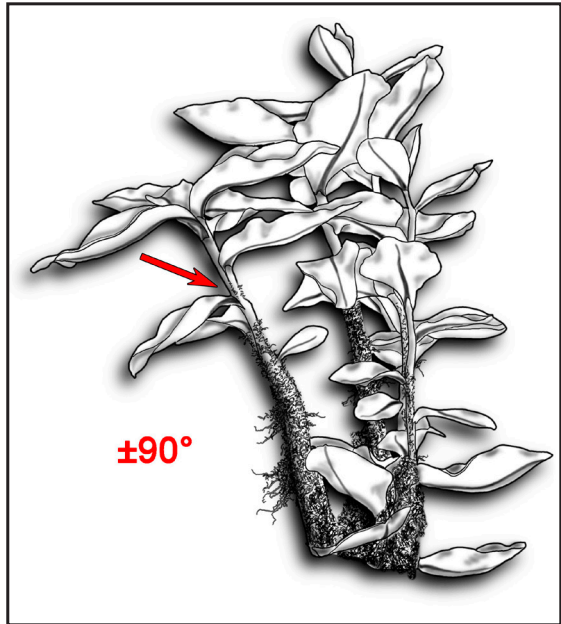
spreading. At an angle of $> 45^\circ$. See also **appressed**, **erect**, **erect-spreading**, **imbricate**, **squarrose**, and **squarrose-recurved**.



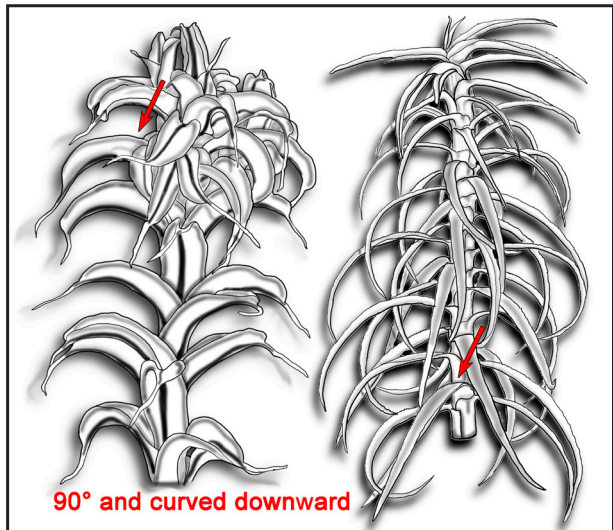
spreading branch. A branch from the **fascicle** that sticks out at nearly right angles to the stem, in contrast with the **pendent branch**.



squarrose. Spreading at angles of approximately 90° . See also **appressed**, **erect**, **erect-spreading**, **imbricate**, **spreading**, **squarrose**, and **squarrose-recurved**.



squarrose-recurved. Spreading at right angles (squarrose) AND with the tips curved even farther downward. See also **appressed**, **erect**, **erect-spreading**, **imbricate**, **spreading**, **squarrose**, and **squarrose-recurved**.



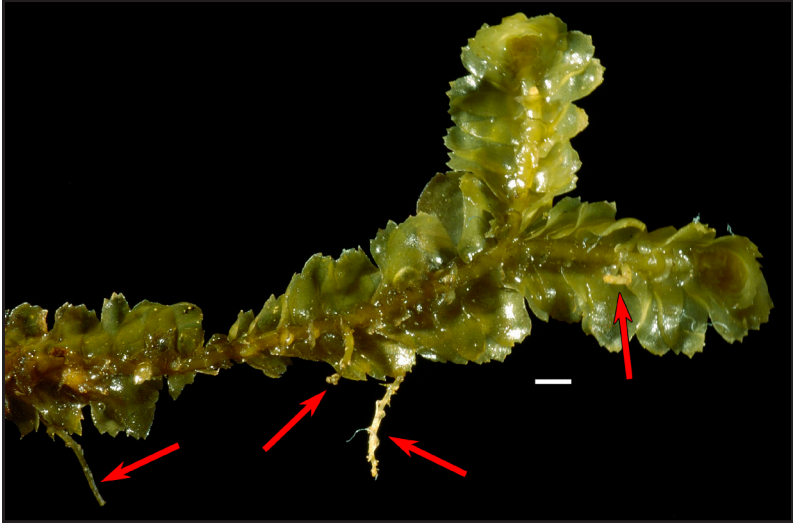
stellate. Star-shaped appearance of *Sphagna* capitula, with the longer spreading branches clearly visible. See also **curved branches**, **flat**, **hemi-spherical**, and **spherical**.



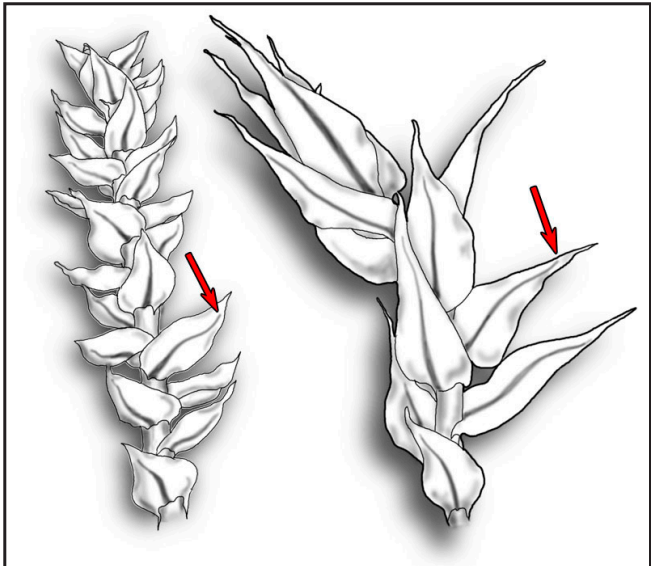
stem. main or branch axis bearing leaves.

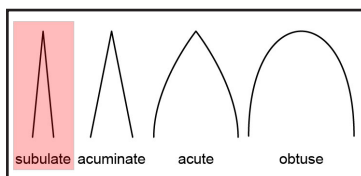


stolon. Branch with nearly naked subterranean stems with very minute microscopic leaves
Probably not a specialized means of vegetative reproduction, but one to strengthen the coherence of the clone.

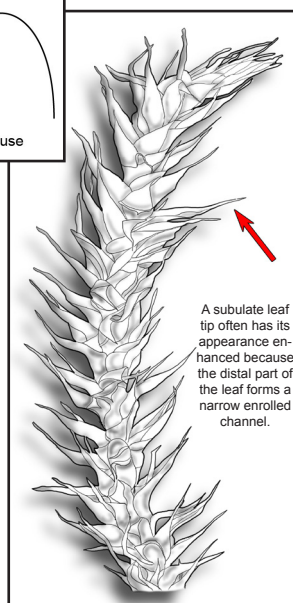


subpercurrent. Stopping shortly before the apex: costa ends clearly before the extreme tip of the leaf. It can be quite short, only reaching the middle of the leaf. See also **excurrent** and **percurrent**.



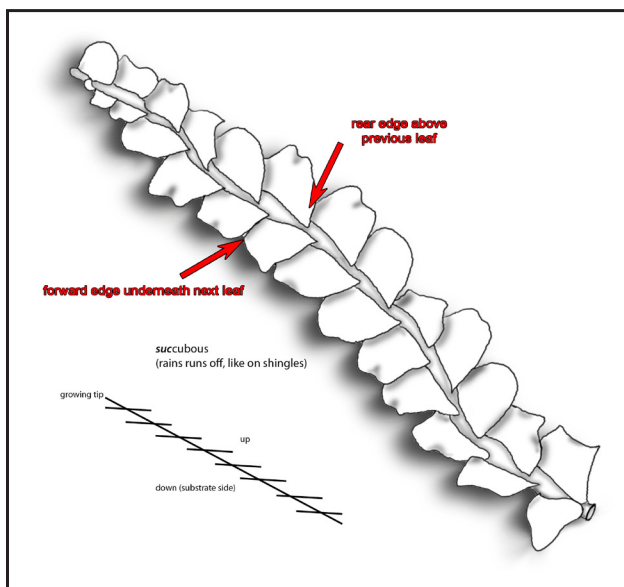


subulate. Slenderly long-acuminate, shaped like a needle or an awl. See also **acuminate**, **acute**, and **obtuse**.



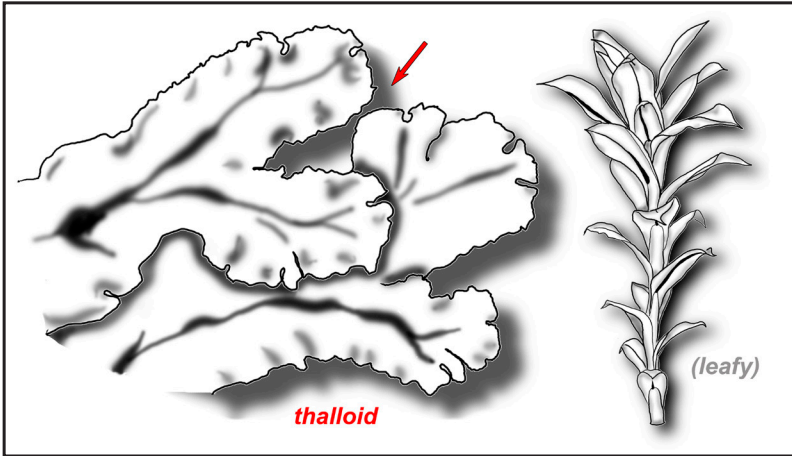
succubous.

A special way of distichous insertion in leafy liverworts, where the leaf-insertion scars are oblique to the long axis of the stem. In the succubous arrangement the rearward border of a leaf overlaps the forward border of the next leaf down the stem.

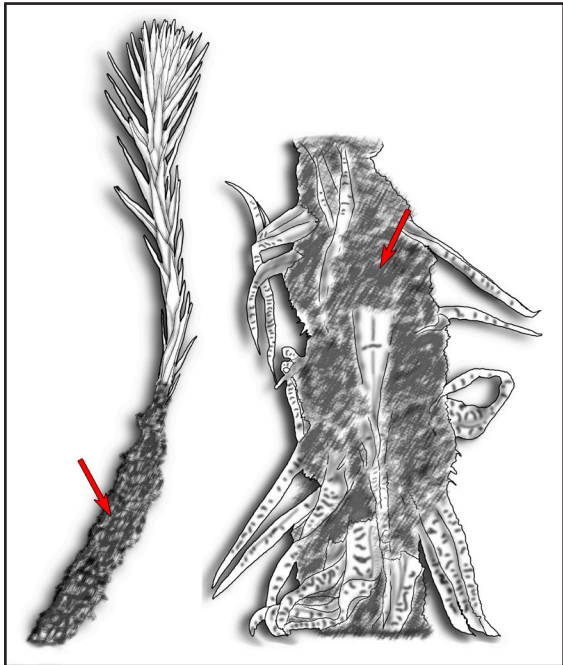


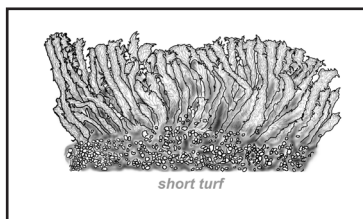
terminal bud. See apical bud.

thalloid. With a plant body not differentiated in **stem** and **leaves**; ribbon-like.

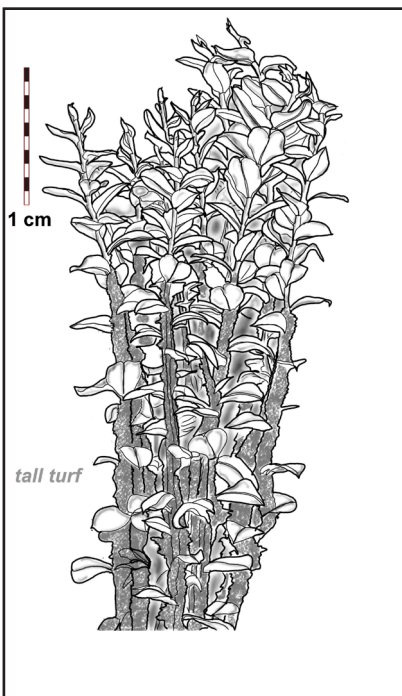


tomentum. Thick woolly, densely radiculose layer formed by rhizoids.

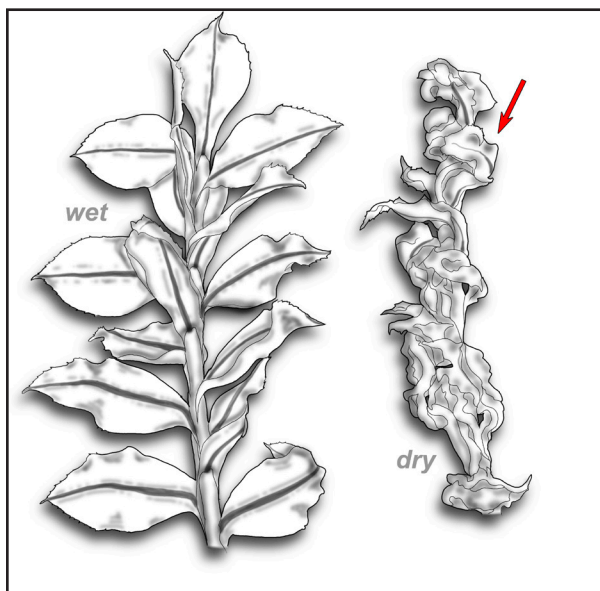




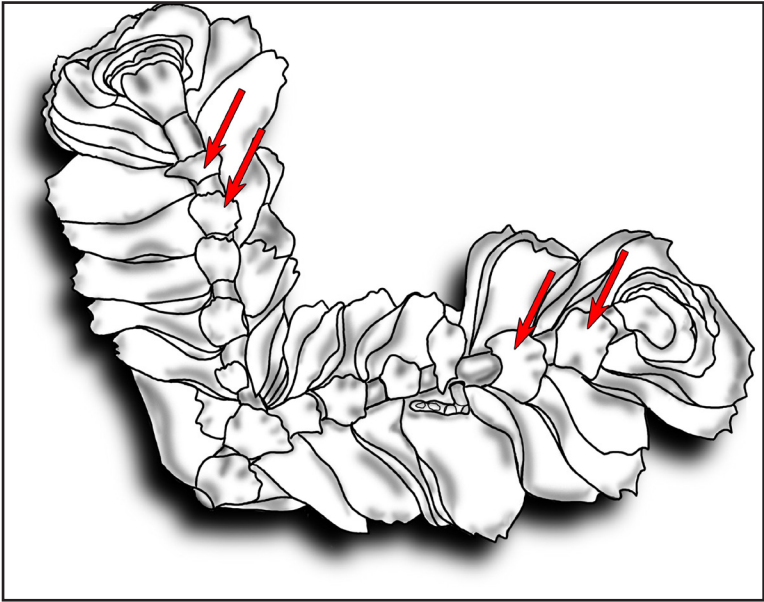
turf. A tufted form of growth, with stems erect and parallel, often in extensive and dense clones. See **growth form**.



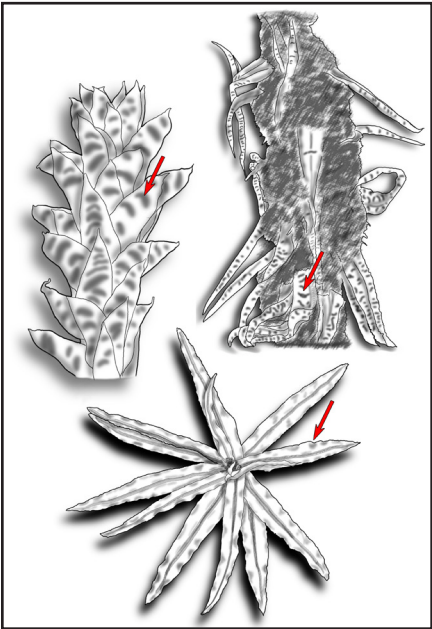
twisted. Distorted when dry, often bending in many different ways. In the case of leaves, sometimes the twisting is in the same direction, so the entire plant looks spirally contorted. See also **crisped**, **imbricate/appressed**, and **in-curved/catenulate**.



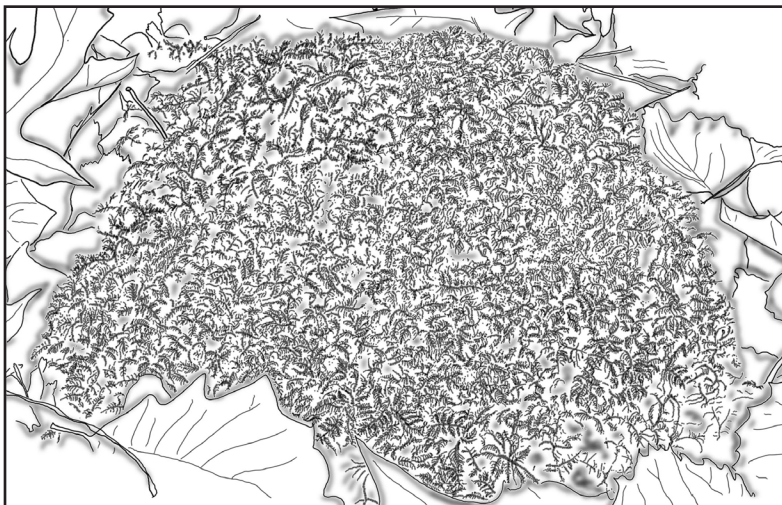
underleaves. Third row of usually smaller leaves along the underside of prostrate liverwort stems and branches.



undulate. Wavy; rugose refers to a more pronounced waviness.



weft. A loosely interwoven, often ascending **growth form**.



woody central cylinder. The outer part of the central cylinder of the stem consists of many thick-walled woody cells, forming a very stiff supporting structure. The plants are able to grow at their own variable pace, and thus the carpet has a rough surface structure.

