

18. ARCHIDIACEAE Schimper

John R. Spence

Plants small to minute, perennial or ephemeral, sometimes with a persistent pale gray, green or red-brown thallose protonemal cushion attached to rhizoids. **Stems** simple or branched, erect or sometimes prostrate, sterile innovations usually produced from axils of distal stem leaves or perichaetial leaves, becoming prostrate, stoloniferous and persistent, giving rise to new shoots. **Leaves** of distal portions of stem and perichaetia erect to spreading; base somewhat clasping; costa in cross section with undifferentiated incrassate cells, or sometimes thin-walled larger cells above and below central incrassate cells; laminal areolation uniform to somewhat differentiated, cells elongate, mostly rectangular to rhomboidal, alar cells often differentiated, somewhat hyaline, limbidium of differentiated cells absent. **Specialized asexual reproduction** rarely present as filiform uniseriate rhizoidal tubers. **Sexual condition** monoicous. **Seta** none. **Capsule** terminal or lateral, sessile, globose, 200–1000 μm , apiculatus absent, cleistocarpous. **Calyptra** ephemeral, falling away as capsule matures, occasionally present as a thin membrane at apex. **Spores** 50–320 μm in longest diameter, rarely much larger, 4–176 per capsule.

Genus 1, ca. 35 species (6 in the flora): worldwide except Antarctica, in subtropical to warm-temperate regions.

Archidiaceae is most diverse in Africa and Australia. It is highly unusual in its sporophyte ontogeny, as the endothecium does not differentiate into a columella and an archesporial layer. The spores are massive, and can develop from any cell in the endothecium. No operculum or peristome is present (capsules are cleistocarpous) and the spores are liberated by the breakdown or tearing of the capsule wall. The family is usually placed in its own order as the Archidiales.

SELECTED REFERENCES Arts, T. 1990. Moniliform rhizoidal tubers in *Archidium alternifolium* (Hedw.) Schimp. *Lindbergia* 16: 59–61. Snider, J. A. 1975. A revision of the genus *Archidium* (Musci). *J. Hattori Bot. Lab.* 39: 105–201.

1. ARCHIDIUM Bridel, *Bryol. Univ.* 1: 747. 1827 • [Greek *arche*, primitive form or nature, alluding to small, simple plants and cleistocarpous capsule]

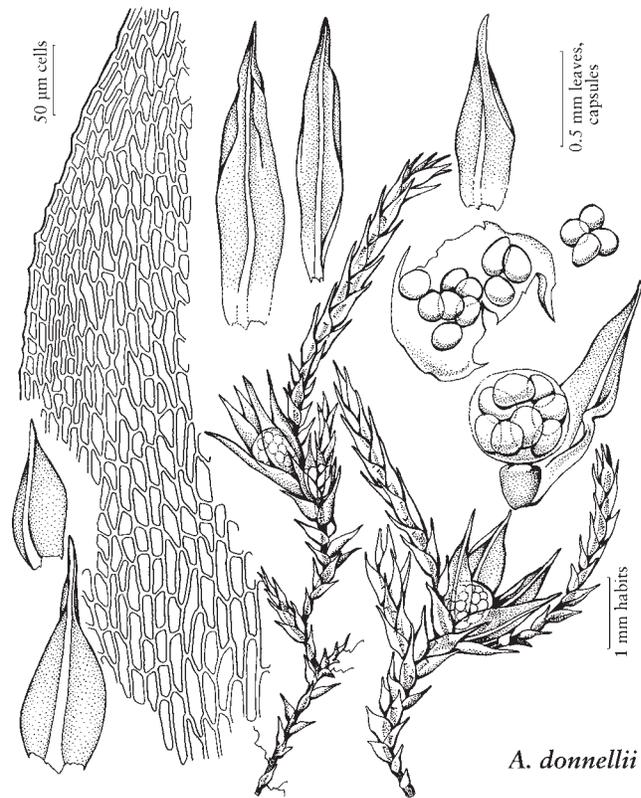
Plants mostly green. **Stems** terete, 1–20 mm. **Leaves** of distal portions of stems and of perichaetia ovate, ovate-lanceolate, linear-lanceolate to triangular, often reduced and distant in proximal

portion of stem, flat or somewhat concave, apex acute to acuminate, sometimes incurved or rarely secund, margins plane, recurved or rarely incurved, distal margins smooth to finely serrulate; costa weak and not reaching apex or sometimes absent, to more often strong, single, percurrent to excurrent in a hairpoint; laminal areolation uniform to somewhat differentiated, cells mostly rectangular to rhomboidal, sometimes irregular in median and distal portions, rectangular and rhomboidal cells mixed with short sub-quadrate cells, alar cells similar to adjacent cells or differentiated, hyaline, wide-rectangular to quadrate. **Sexual condition** autoicous, paroicous or synoicous, antheridia often naked in axils of distal stem leaves or outer perichaetial leaves, sometimes enclosed in short shoots with small leaves (bracts). **Perichaetial leaves** often larger and more variable in shape than stem leaves, sometimes broadly ovate to elliptic. **Capsule** immersed in perichaetial leaves, brown or golden at maturity. **Spores** spherical to polyhedral, pale yellow to yellow-brown, golden, orange or red-orange, smooth to finely papillose.

Species 35 (6 in the flora): worldwide except Antarctica, in subtropical to warm-temperate regions.

Superficially, species of *Archidium* can be mistaken for *Pleuridium*, and many collections of the latter genus have been identified as *Archidium*. Both genera consist of very small mosses that typically colonize soil in open sites and have ovate-lanceolate to lanceolate leaves, which are often subulate. However, species of *Pleuridium* have leaves that are often strongly shouldered and long-subulate, a seta, capsules that are typically ovoid (rather than globose) with an apiculate tip, a calyptra, and smaller, more numerous spores. In the descriptions, spore diameters are given for the longest axis (following J. A. Snider 1975).

1. Plants ephemeral, minute, stems mostly smaller than 3 mm, not branched by sterile innovations; leaves oblong to lanceolate, apex acute, costa weak in perichaetial and distal leaves, not reaching apex, sometimes absent; synoicous 5. *Archidium minus*
1. Plants perennial, larger, stems 2–20 mm, commonly branched by sterile innovations; leaves ovate-lanceolate to ovate, apex mostly acuminate; costa strong, percurrent to excurrent; autoicous or paroicous.
 2. Paroicous; antheridia typically naked in axes of perichaetial leaves or distal stem leaves below perichaetium, or sometimes 1–2 small bracts present; sporophytes terminal.
 3. Perichaetial leaves mostly erect, plane, with serrulate distal margins, median laminal cells narrow (8–13 µm), elongate-rhomboidal, 6–10:1 1. *Archidium alternifolium*
 3. Perichaetial leaves often spreading, plane to recurved, with smooth distal margins, median laminal cells wide (15–35 µm), short-rhomboidal, 3–5:1 6. *Archidium tenerrimum*
 2. Autoicous; antheridia in leafy axillary buds; sporophytes terminal or lateral.
 4. Median laminal cells of distal stem and perichaetial leaves very irregular in shape, from subquadrate to short-rectangular or rhomboidal, intermixed; alar cells not much differentiated from adjacent basal cells 2. *Archidium donnellii*
 4. Median laminal cells of distal stem and perichaetial leaves with uniform areolation, either rhomboidal or rectangular, alar cells, especially along margin, quadrate to short-rectangular, differentiated from adjacent basal cells.
 5. Median cells of perichaetial leaves wide (15–28 µm), distal leaf margins of distal and perichaetial leaves recurved 3. *Archidium hallii*
 5. Median cells of perichaetial leaves narrow (9–15 µm), distal leaf margins of distal and perichaetial leaves plane 4. *Archidium ohioense*

*A. alternifolium**A. donnellii*

ARCHIDIUM

1. *Archidium alternifolium* (Dickson ex Hedwig)
Mitten, Ann. Mag. Nat. Hist., ser. 2, 8: 306. 1851 [F]



Phascum alternifolium Dickson ex Hedwig, Sp. Musc. Frond., 24. 1801; *Archidium longifolium* Lesquereux & James

Plants 2–20 mm, perennial, gregarious or in dense short turfs, green or yellow-green. **Stems** simple to branched by several sterile innovations to 15 mm, becoming prostrate with age. **Stem leaves** erect to erect-spreading, ovate-lanceolate to lanceolate or triangular, acuminate to subulate, 0.5–2.5 mm; costa strong, percurrent to short-excurrent, sometimes long-excurrent in long subulate tip; laminal margins plane, smooth or finely serrulate distally; median laminal cells rhomboidal to linear-rhomboidal, 5–15:1, 45–160 × 8–14 µm, becoming somewhat shorter distally, proximal cells rectangular, 3–8:1, 45–90 × 9–18 µm, cells in alar region short-rectangular to quadrate, 1–2:1, in 2–3 rows extending from 3–10 cells distally from base along margin; leaves of innovations similar to stem leaves but smaller, gradually reduced proximally. **Perichaetial leaves** erect, concave, sometimes flexuose, ovate-lanceolate, acuminate to strongly subulate, laminal cells similar to

stem leaves except proximal and alar cells long-rectangular, 6–10:1, 90–140 × 14–20 µm, distinctly hyaline, at least in alar region. **Specialized asexual reproduction** occasional, of filiform uniseriate rhizoidal tubers. **Sexual condition** paroicous; antheridia typically naked or occasionally 1–2 small bracts present. **Capsule** terminal, sometimes appearing lateral due to rapid innovation growth, 300–800 µm. **Spores** typically 16 (8–36) per capsule, rounded to polyhedral, 120–260 µm, smooth or finely papillose, pale yellow to golden.

Capsules mature late fall to early spring (Nov–Mar). Common on moist to wet soil, mud and sand around temporary pools, along ditches and roadsides, and in fields; occasional on sandstone and limestone outcrops; 0–700 m; Ala., Calif., Fla., Ga., Kans., La., Miss., Mo., N.C., Ohio, S.C., Tenn., Tex.; Mexico; Europe; n Africa; Atlantic Islands.

Archidium alternifolium is widely distributed in the southeastern region of the United States. It is closely related to *A. tenerrimum*, which differs by much shorter and wider lamina cells and smooth margins of perichaetial leaves. The filiform rhizoidal gemmae are difficult to find, as most collections of the species have abundant uniseriate algae growing among the rhizoids. Recently, material referred to *A. alternifolium* was collected in Santa Cruz County, California. The collection is somewhat different than typical material, however, as it has strongly

subulate perichaetial leaves and much shorter lamina cells, with those in mid-leaf being somewhat irregular in shape and size. Only a few plants were found, and more material is needed to determine their status. However, collections identified as *A. donnellii* and *A. hallii* have recently been reported from the Pacific coast of Baja California, so the presence of *A. alternifolium* is not completely unexpected.

2. *Archidium donnellii* Austin, Bull. Torrey Bot. Club 6: 190. 1877 [F]



Archidium ohioense var. *donnellii*
(Austin) Lesquereux & James

Plants 2–10 mm, perennial, in dense turfs, yellow-green. **Stems** simple or usually branched by several sterile innovations, becoming prostrate with age. **Stem leaves** erect to erect-spreading, lanceolate to narrowly

ovate-lanceolate, acuminate, 1–2.5 mm; costa percurrent or short-excurrent, sometimes somewhat subulate; laminal margins recurved, smooth or finely serrulate distally; median and distal laminal cells irregular in shape, mixed quadrate, trapezoidal, short-rectangular, short- to long-rhomboidal, 14–75 × 8–13 μm, proximal cells quadrate to short-rectangular, similar to median and distal cells; leaves of innovations similar to stem leaves, not much reduced proximally. **Perichaetial leaves** broadly ovate-lanceolate, narrowly acuminate to subulate, sometimes flexuose to secund, same size as stem leaves; costae short to long excurrent, hairpoint pellucid, sometimes finely spinose; laminal margins recurved, smooth to finely serrulate; distal and median laminal cells similar to stem leaves, proximal laminal cells lax, wider, rectangular, 2–4:1, 35–115 × 12–25 μm, sometimes somewhat hyaline. **Specialized asexual gemmae** absent. **Sexual condition** autoicous; antheridia terminating axillary leaf buds. **Capsule** terminal, 425–750 μm. **Spores** typically 28(4–60) per capsule, angular to irregularly polyhedral, 120–230 μm, smooth or finely granulose, yellow to orange-red.

Capsules mature early spring (Mar), more rarely in autumn or winter (Oct–Dec). Uncommon on moist to dry soil along roadsides, in fields, rarely on rock; 0–250 m; Ill., Md., Okla., N.C., S.C., Tex., Va.; Mexico.

Archidium donnellii usually can be distinguished from other species by irregular areolation in median and distal portions of lamina, proximal lamina cells not strongly differentiated, and sexuality autoicous. It tends to grow in drier habitats than do other species of the genus.

3. *Archidium hallii* Austin, Bull. Torrey Bot. Club 6: 145. 1877



Plants 3–10 mm, perennial, in dense short turfs, pale-green to yellow-green. **Stems** branched by several innovations from axils of stem leaves or outer perichaetial leaves, often becoming prostrate with age. **Stem leaves** erect-spreading, lanceolate to ovate-lanceolate, acuminate, 0.7–1.5

mm, becoming reduced proximally; costa percurrent to slightly excurrent; laminal margins smooth, weakly recurved; median and distal laminal cells rhomboidal to hexagonal, 3–4:1, 35–70 × 12–18 μm, proximal cells rectangular, 2–4:1, 40–70 × 18–24 μm, short-rectangular to quadrate in alar region in 2–6 rows extending 7–15 cells along proximal laminal margin; leaves of innovations similar to distal stem leaves except being smaller, gradually reduced proximally. **Perichaetial leaves** larger, 1.5–3 mm, elongate-triangular, lanceolate or ovate-lanceolate, gradually acuminate; costa percurrent to short-excurrent; laminal margins smooth, weakly recurved distally; median and distal laminal cells uniformly rhomboid to hexagonal, 3–7:1, 35–130 × 15–28 μm, proximal cells rectangular, 4–6:1, 70–140 × 15–28 μm, sometimes hyaline in alar region but cells not strongly differentiated. **Specialized asexual reproduction** absent. **Sexual condition** autoicous, antheridia terminating axillary leaf buds. **Capsule** terminal, 450–700 μm. **Spores** typically 20(8–36) per capsule, triangular to rounded-polyhedral, 140–250 μm, smooth to granulose, yellow.

Capsules mature early spring (Mar) or rarely late fall (Nov). Uncommon to rare on moist open sandy or loamy soil, along roadsides and in grassy often disturbed areas; 0–200 m; Fla., Ga., Tex.; Mexico; South America.

Archidium hallii can be distinguished from similar-looking forms of *A. tenerrimum* by autoicous sexuality and leafy bracts enclosing the antheridia.

4. *Archidium ohioense* Müller Hal., Syn. Musc. Frond. 2: 517. 1851



Archidium floridanum S. A. Cain

Plants 2–20 mm, perennial, sometimes gregarious but mostly in dense short turfs, green to yellow-green. **Stems** variable, simple, with few innovations, or often short and multi-branched by numerous innovations from axils of stem leaves or exterior perichaetial leaves, often becoming prostrate with age, innovations fragile and often detached. **Stem leaves** erect

to erect-spreading, lanceolate, triangular or ovate-lanceolate, narrowly acuminate to subulate, 0.5–2 mm, becoming reduced proximally; costa percurrent to distinctly excurrent in hairpoint; laminal margins plane, smooth or finely serrulate distally; median laminal cells rhomboidal to prosenchymatous, 4–8:1, 45–90 × 9–15 µm, somewhat shorter distally and along margin, proximal cells short-rectangular to rectangular, 2–4:1, 25–60 × 12–16 µm, short-rectangular to quadrate in alar region in 2–6 rows extending 6–15 cells along proximal lamina margin; leaves of innovations similar to distal stem leaves except smaller, often sharply reduced proximally. **Perichaetial leaves** variable in shape, ovate, oblong, ovate-lanceolate to lanceolate, larger, 1–2 mm, short- to long-acuminate; costa percurrent to long-excurrent, often forming pellucid hairpoint; laminal margins smooth, plane or rarely weakly recurved; median laminal cells rhomboidal, linear-rhomboidal to prosenchymatous, 4–8:1, 45–140 × 9–15 µm, shorter distally and along margin, proximal cells hyaline, lax, rectangular to rhomboidal, 4–6:1, 50–90 × 12–18 µm. **Specialized asexual reproduction** absent. **Sexual condition** autoicous, antheridia terminating axillary leaf buds. **Capsule** lateral, or both lateral and terminal, 270–600 µm. **Spores** typically 16(4–60) per capsule, rounded-triangular to polyhedral, 110–320 µm, pale yellow, smooth to papillose.

Capsules mature fall through spring (Oct–May). Common on moist open sandy, loamy, or clay soils, mud, and rock outcrops in a wide variety of open habitats, including roadsides, ditches, meadows, prairies, sand dunes, and creeks; 0–600 m; Ala., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Md., Mich., Minn., Miss., N.J., N.Y., N.C., Ohio, Okla., Pa., R.I., S.C., Tenn., Tex., Va.; Mexico; West Indies; Asia; Africa; Indian Ocean Islands; Pacific Islands.

Archidium ohioense is the most widespread and variable species in the genus. J. A. Snider (1975) assigned many names to the synonymy of this species. In the United States, the plants vary from rather tall, lax, weakly branched forms with longer leaves in wet sites to short, strongly branched forms with shorter leaves in drier sites. The perichaetial position is also highly variable. Future work may show the species to consist of a series of closely similar species, as suggested by the rather anomalous and scattered world distribution. *Archidium ohioense* is most easily confused with *A. alternifolium* and *A. tenerrimum*, but can be distinguished from them by a combination of primarily lateral capsules, antheridia enclosed in leafy bracts, and sexuality autoicous.

5. *Archidium minus* (Renauld & Cardot) Snider, J. Hattori Bot. Lab. 39: 127. 1975 [E] [F]



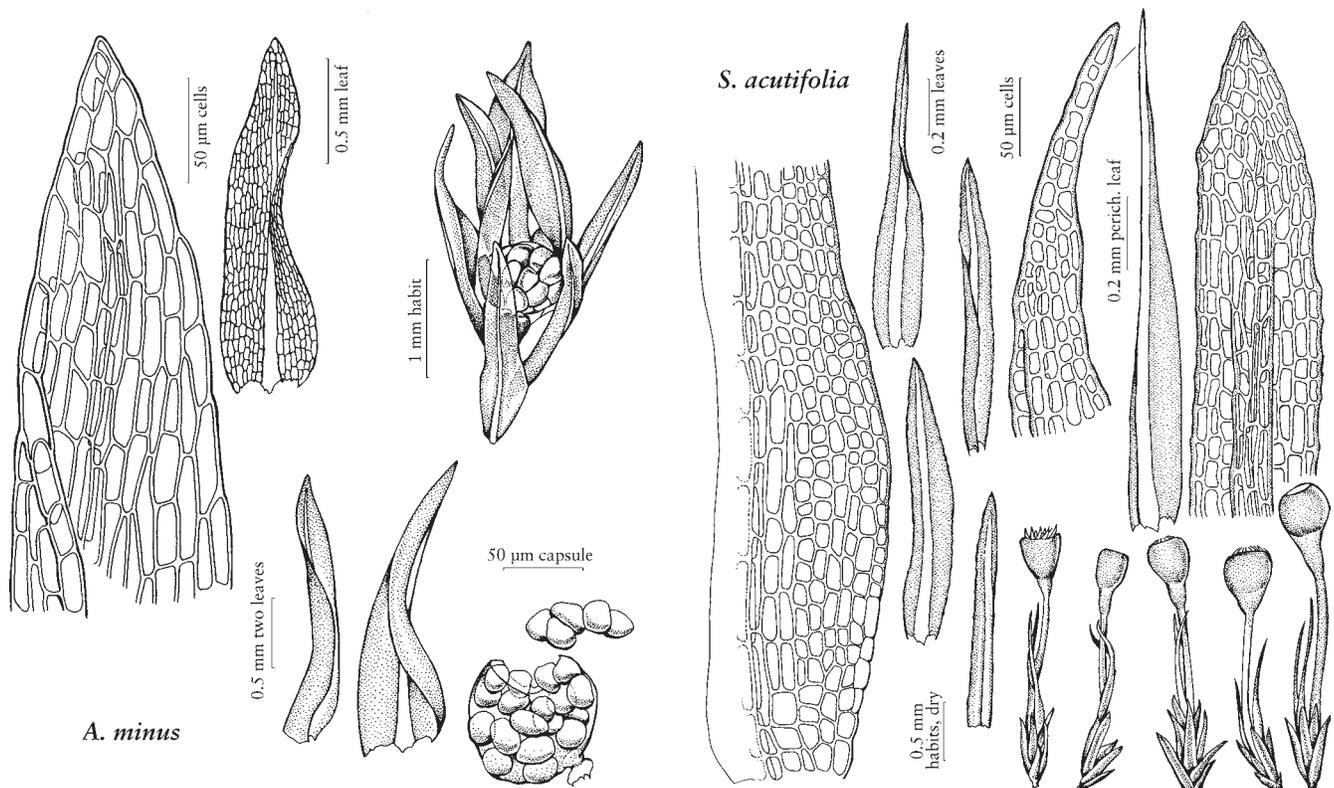
Archidium hallii var. *minus* Renauld & Cardot, Bot. Gaz. 19: 237. 1894

Plants minute, 1–3(–5) mm, ephemeral, solitary or gregarious, yellow-green to pale green. **Stems** mostly simple or sometimes with 2–4 short fertile branches from distal stem leaves, sterile innovations absent. **Stem leaves**

similar to perichaetial leaves but usually smaller, reduced proximally to bracts, erect-spreading or loosely spreading, triangular to linear-lanceolate, acute or broadly obtuse; costa weak, not reaching apex or occasionally absent; laminal margins plane, smooth; median and distal laminal cells of distal stem leaves rectangular, 3:1, 35–45 × 15–20 µm, slightly broader and laxer proximally but not conspicuously different. **Perichaetial leaves** erect-spreading or loosely spreading, triangular to linear-lanceolate, acute or broadly obtuse; costa weak, not reaching apex or occasionally absent; laminal margins plane, smooth; median and distal laminal cells elongate-rectangular to rhomboidal, 3–5:1, 50–130 × 13–24 µm, distally somewhat smaller, proximal cells rectangular, wider than median and distal cells. **Specialized asexual reproduction** absent. **Sexual condition** synoicous, antheridia and archegonia intermixed. **Capsule** terminal, 350–650 µm. **Spores** typically 32(16–48) per capsule, 115–175 µm, smooth or papillose, pale green to yellow or yellow-brown.

Capsules mature fall to spring (Sep–Apr). Uncommon on moist open sandy or loamy soil, along roadsides and in grassy often disturbed areas, or crevices and pockets in rock; 0–100 m; Fla., Ga., La.

Archidium minus is easily distinguished from other species of the genus by its small size, synoicous sexuality, and the bluntly acute, mostly lanceolate leaves with weak costa. Unlike the other species, it is ephemeral and does not produce the sterile prostrate innovations that give rise to next season's fertile shoots. It is not closely related to any other *Archidium* species in North America.



ARCHIDIUM • SELIGERIA

6. *Archidium tenerrimum* Mitten, J. Linn. Soc., Bot. 8: 17. 1864



Archidium ravenelii Austin

Plants 3–10 mm, perennial, solitary or in dense mats, green or yellow-green. **Stems** simple to more often branched, varying from short to tall and somewhat flexuose, sterile innovations to 10 mm, becoming prostrate with age.

Stem leaves small and distant on

short plants to longer, erect-spreading on taller plants, ovate, ovate-lanceolate to lanceolate, acuminate to subulate, 0.5–1.5 mm; costa percurrent to short excurrent; laminal margins plane, smooth or finely serrulate distally; median laminal cells rhomboidal, 3–5:1, 50–90 × 14–25 µm, becoming somewhat shorter distally, proximal cells rectangular, similar to median cells, cells in alar region short-rectangular to quadrate, 1–2:1, in 2–3 rows extending from 3–10 cells distally from base along margin; leaves of innovations similar to stem leaves but smaller, gradually reduced abaxially. **Perichaetial leaves** variable in shape, erect-spreading to spreading, somewhat concave, sometimes flexuose, ovate to obovate, acute to short-acuminate or ovate-lanceolate and long-acuminate, 1–3 mm; costa percurrent to short-excurrent; laminal margins smooth, mostly recurved in longer leaves; median

laminal cells rhomboidal to prosenchymatous, 3–5:1, 55–130 × 15–35 µm, somewhat shorter distally, proximal cells lax, rectangular, 4–6:1, 70–200 × 22–32 µm, hyaline in the alar region. **Specialized asexual reproduction** absent. **Sexual condition** paroicous; antheridia typically naked or rarely 1–2 small bracts present. **Capsule** terminal, sometimes appearing lateral due to rapid innovation growth, 450–800 µm. **Spores** typically 24 (4–48) per capsule, rounded to polyhedral, 125–225 µm, smooth, pale yellow to yellow-orange.

Capsules mature late fall to early spring (Oct–Mar). Common to uncommon on dry to moist sand, soil, in clearings, along roadsides, creek banks, open forests, pastures, often on soil of limestone and sandstone outcrops; 0–200 m; Ala., Ark., Fla., Ga., La., Miss., N.C., S.C., Tex.; Mexico; Europe; n Africa; Atlantic Islands.

Archidium tenerrimum is very closely related to *A. alternifolium*, but is more variable in leaf and stem characters. It can usually be identified by its spreading perichaetial leaves with wider and more lax median lamina cells and the recurved margin. Short, dense and branching forms with broader leaves from drier habitats have been named *A. ravenelii*. However, these forms seem to intergrade with the taller narrower-leaved forms. More work is needed on the distinction between these two forms, as they tend to have different distributions as well as ecology.