

A detailed microscopic image of a plant specimen, likely a moss or similar small plant. The central part is a dark, elongated, fuzzy mass. From this mass, several thin, branching, hair-like structures extend outwards. At the top of these branches, there are clusters of small, bright green, rounded structures, possibly developing sporophytes or gametophytes. The background is a light, slightly textured surface.

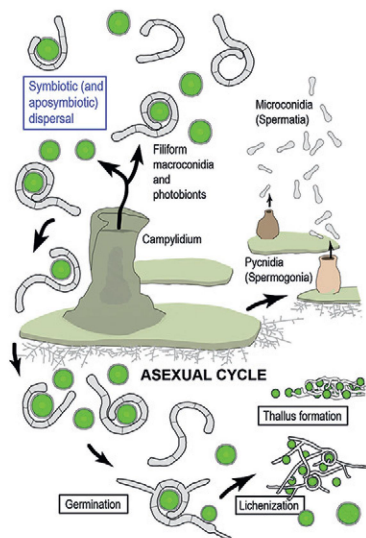
# American Journal of Botany

Celebrating 100 years  1914–2014

November 2014 ♦ Volume 101 ♦ Number 11

Official Publication of the Botanical Society of America, Inc.  
[www.amjbot.org](http://www.amjbot.org)

**Cover Illustration:** Light micrograph of the foliicolous lichen fungus *Calopadia puiggarii* (or a closely related taxon) colonizing a plastic cover slip placed in the field. Ascospores are produced by asci within apothecia, presumably as the result of karyogamy and meiosis. After dispersal, the fungus must acquire compatible algal symbionts for successful establishment and reproduction. In the image, many germination hyphae have emerged from a large, oblong, multicellular ascospore, which is about 65  $\mu\text{m}$  long. At two points quite close to the spore, hyphae have contacted unicellular green algal cells and encircled them with branching hyphae. Division of the surrounded algal cells is further indication that establishment of a lichen symbiosis is underway. Hyphae from germinated ascospores often entrap compatible algal cells nearby, frequently at the surface of the spore itself, before an extensive mycelium has been produced. *Calopadia puiggarii* also forms structures known as campylidia that produce elongate, usually septate macroconidia; these asexual propagules are often dispersed together with algal cells from the parent thallus, at least in the population studied. The co-dispersed algal cells may provide a source of symbionts available not only to the macroconidia, but also to germinating ascospores like the one in this image, which do not carry algal cells with them in dispersal. The lichen fungus also produces pycnidia, from which tiny, unicellular microconidia are liberated; these probably serve as male gametes. All major stages in the life history of *Calopadia puiggarii* were observed on the cover slips. See pp. 1836–1848, "Complete life cycle of *Calopadia puiggarii* documented in situ: propagule dispersal, establishment of symbiosis, thallus development, and formation of sexual and asexual reproductive structures." *Image credit:* William B. Sanders.



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## Abbreviations

**Miscellaneous:** AFLP, amplified fragment length polymorphisms; a.s.l., above sea level; bp, base pair; BP, before present; BSA, bovine serum albumin; cpDNA, chloroplast DNA; CTAB, hexadecyltrimethylammonium bromide; cv., cultivar; ddH<sub>2</sub>O, double-distilled water; dNTP, deoxyribonucleotide E.C., Enzyme Commission; EDTA, ethylene diamine tetra-acetic acid; f. sp., forma specialis; indels, insertions and deletions; ITS, internal transcribed spacer; LM, light microscopy; mya, million years ago; PAGE, polyacrylamide gel electrophoresis; PCR, polymerase chain reaction; RAPD, random amplified polymorphic dimorphism; SDS, sodium dodecyl sulfate; SEM, scanning electron microscopy; s.l., sensu lato; s.s., sensu stricto; subsp., subspecies; TEM, transmission electron microscopy

**Genetics:** *A*, mean number of alleles per locus; *D*, mean genetic distance; CI, consistency index; *F*, fixation index; *F<sub>T</sub>*, total deviation from Hardy-Weinberg expectations; *F<sub>ST</sub>*, genetic diversity among populations; *F<sub>IS</sub>*, inbreeding within populations; *G<sub>ST</sub>*, the proportion of genetic diversity among populations; *H<sub>e</sub>*, Hardy-Weinberg expected heterozygosity; *H<sub>o</sub>*, observed heterozygosity; MP, most parsimonious tree; *n*, individual chromosome number; *N<sub>m</sub>*, mean number of migrants per generation; *P<sub>p</sub>*, percentage of polymorphic loci; RI, retention index; *x*, base chromosome number

**Statistics and math:** ANOVA, analysis of variance; CV, coefficient of variation; df, degrees of freedom; *N*, number of individuals; *p*, probability; *P*, level of significance; PCA, principal components analysis; *r*, coefficient of correlation; SE, standard error; SD, standard deviation