

MULTICLAVULA IN NEWFOUNDLAND AND LABRADOR

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A lichen is an organism created by a physical and physiological incorporation of two or more organisms into one new structure, resulting in a different morphological shape from that of the component organisms; one of the partners (symbionts) is always a fungus and the other(s) an alga and/or a cyanobacterium¹. The lichen is known by the name of the fungus because the fungus is the dominant partner in this arrangement: it encloses its smaller symbiont(s) in fungal tissue to form the new organism and determines the shape of the lichen thallus (lichen “leaf”). The partners may be able to exist independently, although in most cases they are obligate associates, unable to live without a symbiont. Because both partners as well as their associations have evolved in varied ways at varied times, lichens do not form a phylogenetic, evolutionary or taxonomic group, but are defined by their physiology. Most of the fungi that form lichens are ascomycetes (sac fungi); about one-half of all ascomycetes are only found as lichens. Only some 20 basidiomycetes (fungi that usually make fruiting bodies with a cap and stem—mushrooms) form lichens.

Genus *Multiclavula* was proposed by Ron Petersen, a member of our Foray faculty in 2006, to include a group of club shaped mushrooms with some microscopic similarities, all but one seemingly obligate associates of other organisms². The lichenized members of the genus straddle the lichen border: they enclose their algal partners in small capsules of mycelial tissue, but virtually unstructured, these algal capsules appear as a green granular scum on the surfaces where the mushroom fruits³ (Botrydina in older lichen texts). Both symbionts remain recognizable by their separate morphology. Thus, as far as the definition of lichen is concerned, the combination of obligate symbionts is present, but the relationship is so loose that it is doubtful whether this combination can

be considered a new organism, as opposed to two closely allied but separate organisms.

We probably have only two species of this small genus in Newfoundland and Labrador, *M. mucida* and *M. vernalis*. The former is sufficiently common to be described in texts for our region by Barron⁴ and McNeil⁵, as well as in many texts from other regions in North America. Rare in Europe and threatened in many countries⁶, it seems to be found on all continents, save Antarctica. *M. vernalis* is also reported globally, but limited to arcto-alpine habitats, often as a pioneer species in moist pioneer soils. (Pioneer soils are soils newly formed from the crumbling of rock caused by constant freeze and thaw, and pioneer species are the first species of complex organisms to move into these soils, after algae and bacteria.) In North America, it is an eastern species and has been reported from western Labrador in 1963⁷.

In 2008 we collected *M. mucida* from the Corduroy Pond Trail near Grand Falls-Windsor and the Notre Dame Park Ski Trail, both in central Newfoundland, and *M. vernalis* from two places in central Labrador, both within 3 km of our base camp at Konrad Brook Pond (56° 13' 08.4" N, 62° 46' 37.6" W). Both were in depressed moist areas of relatively bare soil, although not true pioneer soil. Figure 1 shows both species in situ. We offer this communication because both

1. occupy an interesting place at the edges of the lichen world,
2. are likely the only species of the genus in our province and
3. are rare: *M. mucida* in much of the world and *M. vernalis* here.

Multiclavula mucida (Fries) Petersen

Cap: 0.2-0.5 x 0.5-1.5 mm, fusiform, occasionally branched, often bent, sticky (note adherence of small debris) pale yellow or pinkish with darker pointed tip. Stem: white translucent, about one-half as thin and short as cap, arising from small



Figure 1. *Multiclavula mucida*, top, photographed in Central Newfoundland and *M. vernalis*, bottom, photographed in central Labrador.

area of white mycelium. Habitat: hardwood or mixed forest. Substrate: barkless log, probably hardwood, covered with green scum of *Coccomyxa*. Habit: Gregarious. Season: Throughout the season, summer and fall.

***Multiclavula vernalis* (Schweinitz) Petersen**
Cap: 1-8 x 10-27 mm, clavate to truncate, with furrows and knobs, glabrous, pale orange, tip sometimes white. Stem: 2-5 x 5-10 mm, cylindrical,

often bent, white, arising from very small area of white mycelium. Habitat: moist areas of bare soil. Substrate: bare soil covered with green scum of *Coccomyxa*. Habit: Gregarious. Season: entire season (short summer).

Discussion

The question of whether these organisms are true lichens or not may be somewhat confusing. Perhaps it is easier to consider them as an extreme form of

ectomycorrhizal fungi. Ectomycorrhizal fungi form a mutualistic relationship with plants (symbionts), most commonly trees. They give water and minerals from the soil to the tree in return for some sugars. This exchange occurs through the mycelial mantle around root tips, a covering of these by a layer of mycelial tissue. Obviously, this is not possible if the symbiont is a unicellular organism like an alga. In this case, might the thin envelope around the entire organism be the equivalent of the mycelial mantle? Genetic studies have placed *Multiclavula* in the Cantharellales—the cantharelloid clade—a group containing the genera *Cantharellus*, *Clavulina*, *Craterellus*, *Hydnum*, *Sistotrema* and others⁸. All of the other genera in that clade are ectomycorrhizal fungi. A lichen might seem an odd misfit in that company until one accepts the idea that in the case of *Multiclavula* the ectomycorrhizal association is modified for a unicellular organism.

For a fertile imagination, aided by similar speculations of Kuo⁹, these two multiclavulas provide fodder to ponder mushroom evolution further. The step from a “true” coral mushroom to a single-stranded coral like *M. mucida* is easy to accept. Since both are multiclavulas, the step from *M. mucida* to *M. vernalis* is a given. The similarity of some of the stouter, more furrowed *M. vernalis* to the larger *Clavariadelphus pistillaris* and *C. truncatus* is difficult to miss. It seems a small step from the clefts and their intervening ridges of *M. vernalis* to the more defined ones of *C. pistillaris* and from there to the defined folds of *Gomphus*. The step from *Gomphus* to *Cantharellus* is again small. Finally, by this stage the progress from chanterelle to a gilled mushroom does not require much additional imagination.

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Summary

Two members of the small genus *Multiclavula*, one relatively common and one relatively uncommon,

found in Newfoundland and Labrador in 2008, are reported. Contemplation on their physiology and morphology opens some questions, if not insights, into the nature of lichens and allows for some speculation about the evolutionary relationships of fungi.

References

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Legend

Figure 1. *Multiclavula mucida*, top, photographed in Central Newfoundland and *M. vernalis*, bottom, photographed in central Labrador. Note the green scum (*Botrydina*) covering the substrate in both cases, unmistakable but less obvious on the mud of the lower photo. Also note the similarity of some of the more mature *M. vernalis* specimens to *Clavariadelphus pistillaris* or *truncatus*.