

STRIGULA FRIES, THE PLANT PARASITIC LICHEN

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Associations between algae and fungi are commonplace and vary widely in their degree of intimacy. The most complex of these associations is a lichen, which can be defined as a long-lived, morphologically distinct thallus composed of an alga and a fungus, within which there is physical and physiological integration, by strictest definition, of benefit to both organisms (4). Ever since the dual nature of lichens was established in 1867 by Schwendener (12), there have been disagreements as to whether the association is truly a mutualistic symbiosis or rather a case of mild parasitism of an alga by a fungus. Though these arguments may be semantic, most lichenologists attribute the following benefits to the symbionts: for the alga, a) protection from adverse environmental conditions such as excess light, desiccation, and mechanical injury; and b) minerals and other inorganic substances for growth; for the fungus, a) vitamins; and b) organic substances derived from algal photosynthesis (1).

Lichens are capable of growing on practically any surface that endures long enough for the slow growing thallus to become established and where competition from other plants is minimal. Rocks, tree trunks, and branches are favorite habitats. Observation of lichens on plant hosts has often spawned concern for the health of the host plant. The only possible damage resulting from the vast majority of lichen growths on plant parts is interference with gas exchange of host tissues covered by the epiphyte (2). Within the past year, several plant specimens have been submitted to the Bureau of Plant Pathology bearing thalli of the only known plant parasitic lichen, *Strigula* Fries.

TAXONOMY OF STRIGULA. The genus *Strigula* contains a number of species of plant parasitic lichens which occur on leaves and very rarely on stems. The algal component of *Strigula* is the well-known causal agent of algal leaf spot or green scurf, *Cephaleuros virescens* Kunze. The parasitic capability of the lichen itself is attributable mainly to *C. virescens*. Fungal associates of *Strigula* are known from several genera of fungi; the ascomycetes *Massaria* and *Microthyriella* are most commonly reported. Taxonomic classification in the lichens currently is based primarily on the fungal component of the lichen (6), therefore upon taxonomic revision, the taxon *Strigula* may in the future be separated into several new genera to accommodate each of the fungal components.

IS STRIGULA A PARASITE? Review of the limited literature available on *Strigula* reveals conflicting information concerning this lichen's parasitic capabilities (3,5,7,11,13,14). This disagreement is understandable since the degree of parasitism by *Cephaleuros* varies widely, depending largely on the host plant and the environment (7,9,10). Recent ultra structural studies of *Strigula elegans* (Fee) Mull. Arg., a common species of *Strigula*, have verified the parasitic capabilities of the lichen on *Magnolia grandiflora* L., as evidenced by dead epidermal and parenchyma cells in the leaf tissues beneath the lichen (3). *Strigula*'s status as a true lichen might also be questioned, as *Cephaleuros* can thrive independently in nature, quite apart from the mutual benefits afforded by lichenization. Again, this may be a matter of semantics, or a function of environment, identity of the fungal associates, and perhaps the vigor of the host plant (8).



Fig. 1 *Strigula* on *Magnolia grandiflora*;

A) upper leaf surface showing gray-white spots;

B) typical hand lens view showing black fungal fruiting structures within some of the leaf spots.

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SYMPTOMS, LIFE CYCLE OF STRIGULA. The life cycle of the lichen usually commences with an existing algal thallus becoming lichenized via colonization by a compatible fungus. On most of the specimens submitted to the Bureau of Plant Pathology, both *Strigula* and typical, non-lichenized thalli of *Cephaleuros* can be observed. The lichens are subcuticular gray-white crusts, 1-10 mm in diameter on the upper leaf surface (fig. 1A), supporting black fungal fruiting structures (fig. 1B). Often, necrosis is present beneath the lichen, but the necrosis seldom penetrates the leaf. Unlike most lichens, *Strigula* does not produce soredia, (vegetative propagules containing both viable fungal and algal cells). Reproduction of *Strigula* evidently depends upon chance encounters of the separate organisms which reproduce normally, *Cephaleuros* by zoospores from sporangia, and the fungus by conidia or ascospores from pycnidia or perithecia, respectively.

HOST RANGE OF STRIGULA. Presumably, the host range of *Cephaleuros* determines the host range of *Strigula*. The host range of *Cephaleuros* in Florida has been updated recently (9), and all hosts listed could be considered potential hosts for *Strigula*. Host plants have more or less coriaceous, persistent leaves. The literature records the following hosts in the Gulf States: *Camellia japonica* L., *Cinnamomum camphora* (L.) Nees & Eberm., *Eugenia* sp., *Illicium floridanum* Ellis, *Ligustrum* sp., *Magnolia grandiflora* L., *Michelia figo* (Lour.) K. Spreng., *Osmanthus fragrans* Lour., *Quercus falcata* Michx. var. *pagodifolia* Elliott, and *Sabal minor* Jacq. (15). From the Division of Plant Industry files, the following hosts can be added: *Brassaia actinophylla* Endl., *Citrus aurantium* L., *Ilex cassine* L., *Parmentiera edulis* DC., *Psidium cattleianum* Sabine, *Psidium guajava* L., *Syzygium jambos* Alston.

CONTROL. Chemical controls effective against *Cephaleuros* should perform well on the lichen, *Strigula*. Fixed or neutral copper sprays at the rate of 1 lb Cu/100 gal water will control the alga (8), but such sprays are not registered for control of either algal leaf spot or *Strigula*. Cultural control measures directed at improving host plant vigor are effective in controlling *Cephaleuros*, and hence *Strigula*. Removal or correction of the limiting factors of plant development should be given first consideration when disease control is deemed necessary.

SURVEY AND DETECTION. Look for small (1-10 mm) gray-white spots on the upper leaf surfaces of plants which have leathery and persistent leaves. Hand lens viewing may reveal black fungal fruiting structures within the leaf spots.

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