

## *Leptographium* Root Infections of Pines in Florida<sup>1</sup>

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Pines (*Pinus* spp.) in Florida are subject to infection by a variety of root-infecting and root disease fungi (Barnard *et al* 1985; Barnard *et al* 1991). Among the least known and perhaps most poorly understood of these root-inhabiting fungi are members of the ascomycete genus *Ophiostoma*, with anamorphs belonging to the more commonly observed form-genus *Leptographium*. This highly complex and internationally distributed group of fungi includes organisms with suspect, potential, variable, and well-documented pathogenicity (Alexander *et al* 1988; Harrington 1988, 1993; Wingfield *et al* 1988). Most, if not all, of these fungi are associated with, and often distributed by, one or more of a variety of bark-feeding, bark-boring, or wood-boring insects (Alexander *et al* 1988; Harrington 1988, 1993; Malloch and Blackwell 1993; Wingfield *et al* 1988).

This circular is not intended to provide a detailed discussion of the biology of these interesting and perhaps locally important root-infecting fungi; two excellent and comprehensive treatises have been recently published (Harrington and Cobb 1988; Wingfield *et al* 1993). Rather, it is provided as a synoptic overview of what is known about these organisms in pines in Florida, and as an aid to the recognition of insect-associated *Leptographium* infections.

**THE FLORIDA SITUATION:** *Leptographium procerum* (Kendrick) M.J. Wingfield has been reported from resin-soaked and/or bluish-black-stained roots (Fig. 1) of both sand pine (*Pinus clausa* [Chapm. ex Engelm.] Vasey ex Sarg.) and slash pine (*P. elliotii* Engelm.) in northern Florida (Barnard *et al* 1985; Barnard *et al* 1991). Subsequently, we have isolated what appeared to be *L. procerum* and a possibly different *Leptographium* sp. from bluish-black-stained roots of dead and dying trees in commercial plantations of slash pine in Glades Co. (south-central Florida). We also have isolated what appears to be the latter *Leptographium* sp. from the roots of declining south Florida slash pines (*P. elliotii* var. *densa* Little and W. Dorman) in an urban/wildland interface setting in Palm Beach Co. (southeastern Florida). In most of these cases, symptomatic roots from which the *Leptographium* isolates were obtained exhibited evidence of oviposition wounds and feeding damage (Fig. 1) apparently caused by regeneration weevils (Coleoptera: Curculionidae: *Hylobius pales* (Herbst) and/or *Pachylobius picivorus* (Germar)) and/or colonization by the black turpentine beetle (Scolytidae: *Dendroctonus terebrans* (Olivier)) or other root bark beetles (Scolytidae: *Hylastes* spp.) (Fig. 2). Most recently, we have isolated a *Leptographium* sp. from bluish-black-stained xylem tissues in fire-traumatized and insect colonized (regeneration weevils and Cerambycid beetles) roots of longleaf pine (*P. palustris* Mill.) in north central Florida. All of the above mentioned insects have been implicated elsewhere as associates or actual vectors of *Leptographium* spp. in pines (Harrington and Cobb 1988; Wingfield *et al* 1993).

**CONTROL:** Specific fungus-directed control measures for *Leptographium* spp. are nonexistent. Damage can be minimized by avoiding tree injuries and stresses which attract insects and create insect breeding habitats. In some situations, control of *Leptographium*-associated and/or vectoring insects through the use of chemical insecticides may be warranted.

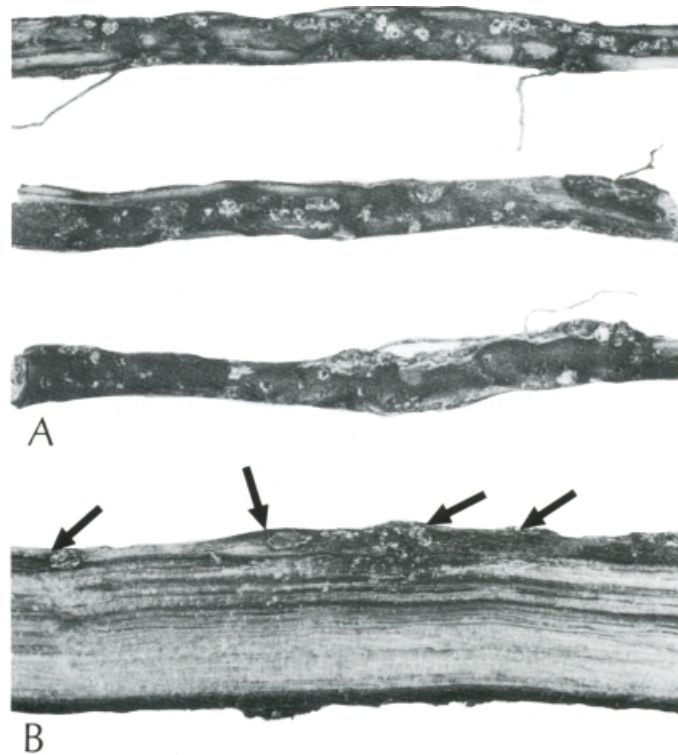
**SURVEY AND DETECTION:** Expose one or more roots of suspect trees. Carefully examine root surfaces for evidence of insect oviposition and feeding wounds or boring activity (often accompanied by distinct aggregates of resin-impregnated soil adhering to root surfaces due to associated resin exudation). Excise insect-damaged root segments. Split or cut root segments with a sharp knife, and examine xylem tissues for evidence of resin impregnation and/or characteristic blue-black staining. Staining may appear in pie-shaped "wedges" when roots are

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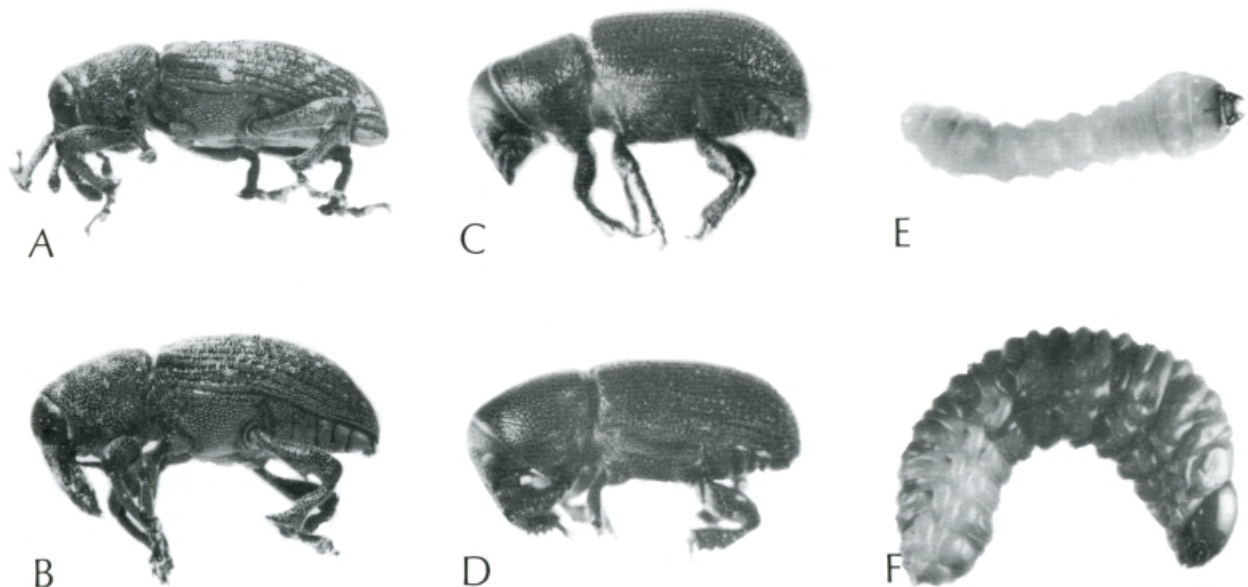
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observed in cross section and may be associated with insect galleries or tunnels. Confirmation of *Leptographium spp.* requires laboratory isolation and microscopic observation.



**Fig. 1.** Association between insect feeding damage and infection of pine roots by *Leptographium spp.* A) Oviposition wounds and/or adult feeding damage typical of that caused by regeneration weevils on roots of slash pine. Note the small circular pockets gouged in the bark and the associated aggregates of crystallized resin. B) Interior resin impregnation and blue-black staining of xylem tissues typical of *Leptographium* infections associated with insect wounds (arrows). Photography credit: Jane Windsor (DPI File No. 702371).



**Fig. 2.** Common insect vectors and/or associates of *Leptographium* infections in roots of pines in Florida. A) Adult pales weevil, *Hylobius pales* (Herbst), actual size 7-12 mm. B) Adult pitchheating weevil, *Pachylobius picivorus* (Germar), actual size 7-12 mm. C) Adult black turpentine beetle, *Dendroctonus terebrans* (Olivier), actual size 5-10 mm. D) Adult root bark beetle, *Hylastes* sp. actual size 2-5 mm. E) Larva of a Cerambycid beetle, actual size 10 mm. F) Larva of a regeneration weevil, actual size 10 mm. Photography credit: Jane Windsor and Jeffrey W. Lotz (DPI File Nos. 702444-4, 702444-5, and 95001).

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