

The Southern Pine Coneworm, *Dioryctria amatella* (Hulst) (Lepidoptera: Pyralidae)¹

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Figs. 1-3. 1) Pitch mass symptomatic of *D. amatella* stem and branch infestations, 2) Adult *D. amatella*, 3) Late-instar larva of *D. amatella*. Photography credits: Charlie Chellman, Fig. 1; Jeff Lotz, Figs. 2-3.

INTRODUCTION: The southern pine coneworm, *Dioryctria amatella* (Hulst), also commonly referred to as a pitch moth, is consistently one of the most damaging insect pests of pine seed orchard crops throughout the southeastern United States (Ebel *et al.* 1980). Less well-recognized is that this widespread and frequently occurring insect also attacks a variety of other parts of pines (*Pinus* spp.) besides cones. Caterpillars can be found feeding on and in buds, male and female flowers, shoots, branches and stems of all ages and sizes, as well as in conelets (*i.e.*, first-year cones) and second-year cones (Ebel 1965; Ebel *et al.* 1980; Goolsby *et al.* 1972). The prevalence and variety of *D. amatella* infestations on forest and shade trees pines throughout the state periodically generates concern over the nature and impact of its injuries. The most noticeable symptom of infestations is large external masses of pitch (Fig. 1) exuding from the feeding sites of caterpillars, hence the name "pitch moth". Reddish-brown frass may also be evident at feeding sites and is often mixed with resin. Pitch masses caused by *D. amatella* may resemble those of the black turpentine beetle (BTB), *Dendroctonus terebrans* (Oliv.); however, the coneworm pitch masses are usually larger, more irregularly shaped and flow for months. BTB pitch masses are typically less than 25 mm in diameter, have an obvious entrance hole, solidify in weeks, and are concentrated on the lower bole of large trees (Barnard and Dixon 1983; Goolsby *et al.* 1972). In addition to reproductive structures, susceptible host material includes: trees under stress, mechanically injured stems or branches, elongating shoots of longleaf (*P. palustris* Mill.) and slash pine (*P. elliottii* Englem.) during the spring, graft and branch unions, conelets infected with the southern cone rust fungus (*Cronartium strobilinum* (Arth.) Hedge & Hahn) and especially galls caused by the fusiform rust fungus (*Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme*) (Barnard and Dixon 1983, Ebel *et al.* 1981, Goolsby *et al.* 1972). Other than the potentially significant losses that can occur in seed orchards due to the destruction of flowers, conelets and cones, damage is rarely

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severe or lethal to trees. The girdling effect of caterpillar feeding, however, can cause dieback of branches, terminals and tree tops (Fig. 7), and additional weakening of previously damaged stems (Barnard and Dixon 1983). Feeding injuries also serve as infection courts for the pitch canker fungus, *Fusarium subglutinans* (Wollenw. and Reinking) Nelson, Toussoun and Aarasas (Foltz and Blakeslee 1989).

IDENTIFICATION: *D. amatella* is one of six species of pine coneworms found in Florida. Others include: the blister coneworm (*D. clarioralis* (Walker)), the webbing coneworm (*D. disclusa* Heinrich), the south coastal coneworm (*D. ebeli* Mutuura & Monroe), the loblolly pine coneworm (*D. merkei* Mutuura & Monroe), and the lesser loblolly pine coneworm (*D. taedivorella* Neunzig & Leidy) (Ebel *et al.* 1980). A seventh species, the baldcypress coneworm (*D. pygmaeella* Ragonot), is only known on junipers and cypress. *D. amatella* can be distinguished from these other species by the distinct characteristics of adults and larvae, and often via differences in damage and biology. Adult moths of *D. amatella* have a wingpan of 27-32 mm, with dark grey, to brown, to nearly black forewings boldly patterned with multiple contrasting white patches and zig-zag crossbands (Fig. 2). The hindwings are nearly uniformly light grey to tan in color. Larvae range from 1.5 mm upon hatching, to *ca.* 25 mm at maturity. When young, their bodies are nearly white with seven longitudinal stripes and a brown head. Older larvae are colored a dark reddish to purplish brown above and are a paler whitish green on the underside (Fig. 3). Abdominal segments exhibit obvious beadlike patterns of small black pits and dark elevated setal bases (Ebel *et al.* 1980).

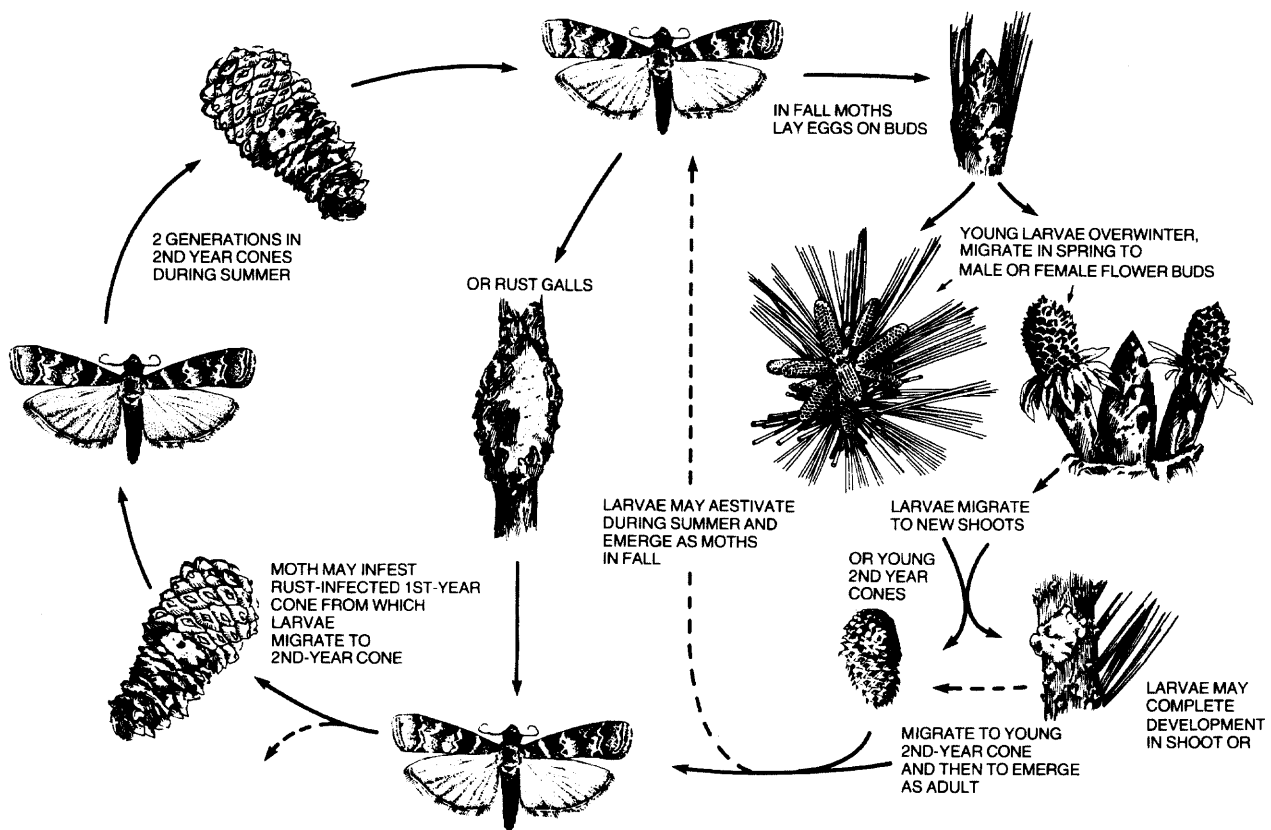


Fig. 4. Diagram of major aspects of complex life cycle of *Dioryctria amatella*. On loblolly pine, the cones-to-gall cycle (left) is typical; in slash and longleaf pines, a variety of additional host parts may be fed upon in the spring (from Hedlin *et al.* 1981).

DISTRIBUTION: *D. amatella* occurs throughout Florida and likely can be found wherever its pine hosts are growing. The natural range of the insect extends across the southeastern U.S., from Maryland south to Florida and west into Texas (Ebel *et al.* 1980).

HOST PLANTS: All species of *Pinus* native to the state are utilized as hosts by *D. amatella*. This list includes: loblolly (*P. taeda* L.), longleaf, pond (*P. serotina* Michx.), sand (*P. clausa* (Chapm. ex Englem.)), shortleaf (*P. echinata* Mill.), slash and spruce (*P. glabra* Walt.) pines. Virginia pine, *P. virginiana* Mill., which is sometimes illadvisedly grown in Florida for Christmas trees, is often infested by *D. amatella*. Eastern white pine, *P. strobus* L., is the only *Pinus* which occurs in the state that is not a suitable host (Ebel *et al.* 1980). Within slash pine, and probably other host species, individual trees exhibit pronounced differences in their inherent degree of susceptibility or resistance to *D. amatella* infestations (Merkel *et al.* 1965).

BIOLOGY AND DAMAGE: In Florida, the southern pine coneworm produces from one to four generations per year, depending on whether larval diapause occurs during the spring, early summer, or at all. The resulting abundant overlap of life stages among generations typically yields varying degrees of adult moth activity from early April through early November in North Florida (Merkel and Fatzinger 1971). The insect overwinters predominantly as early instar larvae, at the base of persistent cones, under bud scales and in fusiform galls on branches and stems. As larvae become active in January, they may continue to feed in overwintering sites or often migrate to feed on developing male and female flowers and vegetative buds. Following flower and bud feeding, larvae usually migrate a second time, infesting expanding shoots (Fig. 5) or young second-year cones (Fig. 6) during early spring. Once in shoots, larvae may undergo diapause, complete their development or migrate again to young second-year cones. When larvae eventually pupate, *D. amatella* is the only pine coneworm in the south that does so within infested material (Ebel 1965). In April and May, the next generation of caterpillars readily infests conelets infected with southern cone rust, as well as healthy second-year cones. These larvae, as well those of subsequent generations, also may migrate from infested to uninfested cones before pupating. Later generations continue to infest second-year cones from summer through fall (Ebel 1965). This relatively complex cycle is depicted in Fig 4. In cones, larval feeding causes damage ranging from evident tunnels to wholly excavated cavities within, resulting in partial to complete seed loss of infested individuals (Ebel *et al.* 1980). Other forms of damage were previously mentioned and are pictured, in part, in Figs. 1 and 5-7. Foltz and Blakeslee (1989) found that the abundance of *D. amatella* infestations in young, experimental slash pine plantations increased with the intensity of applied cultural practices (*e.g.*, fertilization, competition control, and irrigation); and recently, a four year-old longleaf plantation on a scalped agricultural field in Lafayette County exhibited an estimated 5% terminal dieback due to shoot infestations (Fig. 5). The unknown ramifications of trends towards more intensive, high-yield management of many loblolly, slash and longleaf plantations may alter the pest status and management considerations for *D. amatella* in the future.



Figs. 5-7. 5) *D. amatella* larva causing terminal (shoot) dieback on young longleaf pine; 6) second-year slash pine cone infested by *D. amatella*, note resin and frass mixture evident on upper-third of cone; and 7) Top-dieback of sand pine caused by multiple stem infestations of *D. amatella*. Photography credits: Jim Meeker, Figs. 5 & 7; Wayne Dixon, Fig. 6.

CONTROL: Various insecticides are currently registered for and routinely used in intensively managed pine seed orchards to successfully prevent and/or minimize seed losses due to coneworms. The presence and timing of *D. amatella* and most other coneworms can be determined by using commercially available pheromone lures and traps. Without the use of insecticides in an integrated pest management system, seed orchards in North Florida could expect to annually lose between 20-40% of their crop to coneworms (Goolsby *et al.* 1972). In most conventional forestry and shade tree settings, there is little practical potential for insecticide use due to: the random nature of attacks, the inability of most insecticides to control existing infestations, the relatively limited impact of damage, and the high cost-benefit ratio. Recommended management strategies include promoting and maintaining tree health and vigor, and removal and destruction of seriously infested and/or rust infected stems and branches. Avoid mechanical injuries to branches and stems because of *D. amatella*'s attraction to volatiles emanating from wounds (Hanula *et al.* 1985). In Florida, eight species of Hymenoptera (3 braconids, 3 ichneumonids and 2 eulophids) and 2 species of tachinid flies have been reported as natural enemies of *D. amatella* larvae or pupae. It appears, however, that the combined impact of these parasitoids is not enough to substantially reduce or control populations of this coneworm (Belmont and Habeck 1983, Ebel 1965).

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