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Woolly Pine Scale

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The woolly pine scale, *Pseudophilippia quaintancii* Cockerell, is a soft scale insect (Heteroptera: Coccidae) which infests pines in the southeastern United States. The woolly pine scale generally is not considered economically important in forest environments, but problems may occur in areas receiving insecticide treatments, including seed orchards, Christmas tree plantations, and ornamental plantings. Woolly pine scales are often found cohabiting the shoots with the striped pine scale, *Toumeyella pini* (King), the pine tortoise scale, *T. parvicornis* (Cockerell), and a mealybug, *Oracella acuta* (Lobdell).

Range and Host Trees

The recorded hosts of the woolly pine scale are loblolly pine *(Pinus taeda* L.), slash pine (*P. elliottii* Engelm. var. *elliottii*), shortleaf pine (*P. echinata* Cockerell), longleaf pine (*P. palustris* Mill.), pitch pine (*P. rigida* Mill.), sand pine (*P. clausa* (Chapm.)), mugo pine (*P. mugo* Turra), table mountain pine (*P. pungens* Lamb.), and Caribbean pine (*P. caribaea* Morelet). Infestations have been found only in the eastern United States from New York to Florida and west to Louisiana. Though host pines occur in Texas, there have been no reports of woolly pine scale infestations.

Life History and Description

The woolly pine scale has two generations per year. Overwintered females at the shoot tip begin oviposition when the first cycle of shoot elongation begins. The eggs

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hatch almost immediately, and the first instars, known as crawlers, emerge. The crawlers are the mobile stage, and have six legs. They are small with an elongate oval shape, and are yellow to red in color. First generation crawlers quickly settle on the new growth, covering the shoot above the parent female. The settled scale insects begin secreting a white wax covering almost immediately, giving the new shoot a woolly appearance (Figure 1).

Females have four instars. Once settled, the females do not move, as their legs become greatly reduced after the crawler stage. Second instar females are small, yellowish, and oval (Figure 2), but adults become plump and circular when swollen with eggs, and their exoskeleton hardens and turns dark brown. A majority of the first generation scales are females, but a few males are also produced, settling among the females on the new growth.

The males have five instars, including a prepupal and pupal stage. Males develop within an elongate, waxy covering called a test. First generation adult males are wingless, brown, and have a short, pointed aedeagus, or sex organ (Figure 3). They are smaller than the mature females and are most often observed trapped in the woolly covering of the females.

Females begin egg production around one week after mating. It is unknown if unmated females will produce viable eggs. Oviposition lasts from mid-May through June in south Georgia, and occurs several weeks later in the northern parts of the range. Dispersal takes place in the second generation, as there is little or no room on the infested shoots for female crawlers to settle. The female crawlers are blown by the wind or crawl to uninfested new shoot growth to settle. It is possible that crawlers are carried by other insects or animals to new host trees. Second generation females generally settle at the shoot tip and initially can be detected by their woolly secretions.

A large number of second generation males are also produced, and first instar males crawl directly down the shoot and settle near the base of the previous year's needles. Woolly pine scale infestations are easily recognizable during the second generation, as the males on the old needles secrete copious amounts of woolly wax (Figure 4), giving the tree a flocculent

Figure 1. First generation females on a pine shoot.

appearance (Figure 5). The adult males emerge after several weeks. Emergence peaks in early July in south Georgia and is 3-3 1/2 weeks later farther north. The second generation males are winged (Figure 6), and fly to dispersed females to mate. Males of both generations will mate with multiple females.

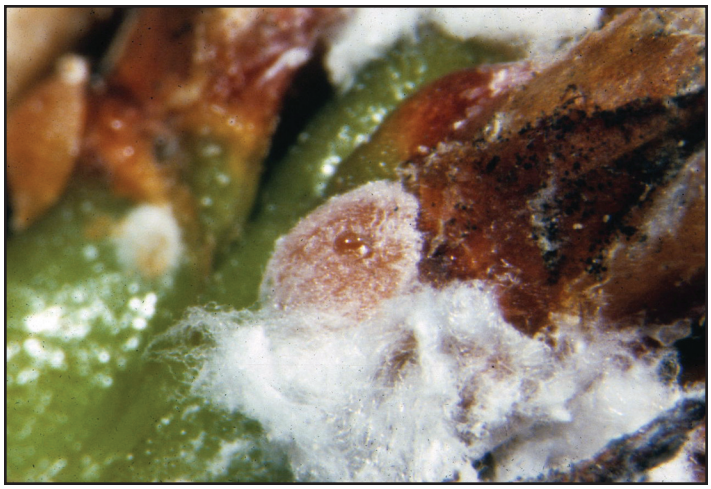

Figure 2. Recently settled female woolly pine scale.

The second generation females appear to remain dormant until the following spring. Their woolly covering often disappears during the fall and winter, and survivors are difficult to detect. Mortality rates of females during the extended second generation can reach 85 percent.

Damage

Damage by the woolly pine scale is mostly cosmetic, though heavy populations may cause stunted shoot growth. The scales are sucking insects, and the removal of the sap from feeding on both the shoots and needles may weaken or stress the tree. The scales also produce honeydew, a sweet, sticky substance which provides a growth medium for sooty mold fungi. Sooty mold growth, coupled with the waxy secretions produced by the scales, may retard photosynthetic activity and lead to reduced tree growth. The honeydew also attracts bees, ants, and wasps which can become a nuisance to orchard workers or homeowners.

Natural Enemies

The woolly pine scale shares natural enemies with other soft scales of

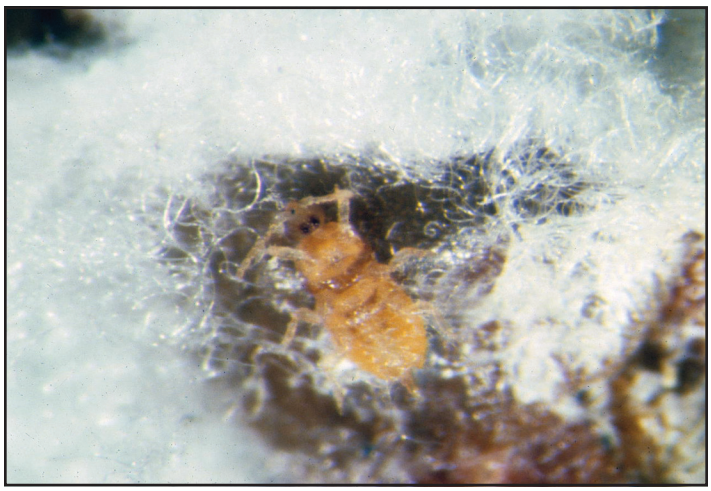

Figure 3. Wingless, first generation male.

Figure 4. Second generation males on older needles beneath first generation females on new growth.

southern pines, including the striped pine scale and the pine tortoise scale. Predators of the woolly pine scale include green lacewings, *Chrysopa* spp., and a pyralid larva, *Laetilia coccidivora* (Comstock). The identified parasitoids are an aphelinid, *Coccophagus lycimnia* Walker,and an encyrtid, *Metaphycus* sp.

Causes of Outbreaks

Woolly pine scales are secondary pests, and populations normally occur at non-damaging levels. Though it is assumed that natural enemies help prevent woolly pine scale outbreaks in southern pine forests, it is unknown which species are the most important in regulating populations at low levels.

Woolly pine scales usually attain pest status only after some factor, generally the application of pesticides to control other species, disrupts the normal host-natural enemy balance. Insecticide applications may decimate the mobile parasites and predators, while adult scale insects are often unaffected due to their sedentary nature and the position of the spiracles and feeding stylets beneath the body. Woolly pine scales are further protected from the sprays by their wax secretions. The use of pyrethroid insecticides in particular appears to lead to scale insect outbreaks on southern pines, and aerial applications are more likely to fuel infestations than ground applications. During outbreaks, the reported parasitism rates of the woolly pine scale were under 5%, lending credence to the disruption of the natural enemies as a major factor in population eruptions.

Figure 5. Pine infested by woolly pine scale.

Woolly pine scale outbreaks often appear as delayed problems, occurring one or two years after the initiation of insecticide treatments. This apparent delay may be due to the fact that there are only two generations per year, therefore population numbers take time to increase. Other secondary pests in southern pines may have 4-5 generations per year, and outbreaks can occur rapidly.

Fertilization, irrigation, and even insecticide application have been shown to increase egg production of scale insects, but their effects on woolly pine scale fecundity are unknown. Climatic conditions that favor increased survival, especially of dispersing second generation males and females, may be a factor in population increases. The woolly pine scale only has two generations per year throughout its range, so increased temperatures do not result in increased numbers of their

Figure 6 Second generation males.

generations. However, warmer temperatures for extended periods of time could increase the number of generations and activity of their natural enemies, leading to quicker woolly pine scale population declines.

Management

No control is generally recommended for woolly pine scale infestations. Outbreaks are substantially reduced by natural enemies and perhaps environmental factors after one to two years if left untreated by insecticides. If spraying is necessary to control other pests, insecticides should be selected which have little residual activity and are the least toxic to the natural enemy population. Ground applications should be favored over aerial spraying, and treatments should be scheduled during periods of crawler activity when feasible.

If severe infestations occur, insecticidal treatments against wooly pine scales may become desirable. Applications should coincide with crawler emergence, approximately 4 days to 1 week after the first hatch. Targeting the first generation crawlers is recommended, as their emergence is fairly synchronous and occurs just after new shoot growth in the spring. Second generation crawlers may emerge over a more extended period of time. One application should suffice for first generation crawlers, while several applications would be required for the second generation. An insecticide registered for scale insect control in the specific treatment area (seed orchard, ornamental, etc.) should be selected. Organophosphate insecticides have demonstrated higher toxicity to crawlers of other southern pine scale insects than pyrethroid insecticides, but these broad spectrum insecticides have greater negative impacts on beneficial natural enemies.

Heavy, drenching sprays of insecticides may kill adults, but this technique is not advised due to incomplete control of the scale insects, treatment costs, environmental hazards, and the potential for future pest problems. Horticultural oils also can be applied to suppress adult populations, and have fewer negative consequences for non-target organisms. Systemic insecticides applied as a soil drench around the base of the tree may be an option for infested ornamental pines. Consult a local agricultural or forestry extension agent for recommendations on which type of oil or systemic insecticide to use and when to apply.

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Photo Credits.

Figure 1 –Steve Bambara, Dept. of Entomology, NCSU; cover photo plus Figures 4 and 5 – Mark Raines, Georgia Forestry Commission; all others by the author.

Additional Information

Private landowners can get more information, including currently registered and effective insecticides from County Extension Agents, State Forestry Departments, or State Agriculture Departments. Federal resource managers should contact USDA, Forest Service, Forest Health Protection (www.fs.fed.us/foresthealth/). This publication and other Forest Insect and Disease Leaflets can be found at www.fs.fed.us/r6/nr/fid/wo-fidls/.

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Pesticides used improperly can be injurious to humans, animals, and plants. Follow the directions and heed all precautions on the labels. Store pesticides in original containers under lock and key--out of the reach of children and animals--and away from food and feed. Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues. Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container. If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly. Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides. Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place. NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the Federal Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

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