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An integrated insect pest management system for Louisiana Christmas tree growers

Abe Douglas Oliver

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An Integrated Insect Pest Management System for Louisiana Christmas Tree Growers

Bulletin No. 793
February, 1988

A. D. OLIVER AND J. B. CHAPIN

LOUISIANA AGRICULTURAL EXPERIMENT STATION
LOUISIANA STATE UNIVERSITY AGRICULTURAL CENTER
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*Figures 1 and 9 courtesy of the U.S. Forest Service.*
An Integrated Insect Pest Management System for Louisiana Christmas Tree Growers

A. D. Oliver and J. B. Chapin

This bulletin was prepared for use by producers and others who wish to use an integrated insect pest management system to reduce injury by pests of Virginia pine Christmas trees. Information in the following pages, if used properly, will help growers better understand their pest problems—how they develop, when to expect them, and what can be done to prevent or manage injurious infestations. The information is based primarily on the pine tree insect research and experience of the authors over the past 25 years. Intensive research conducted during the past 5 years on pests affecting Virginia pine grown for Christmas trees is also a primary source of information. In addition, published information was very helpful in making decisions on certain types of problems. References to relevant literature are given on page 28.

Introduction

Production of Christmas trees in Louisiana has increased markedly during the past decade. The Virginia pine, Pinus virginiana Miller, is the principal species grown in Louisiana for Christmas trees. Although Virginia pine is not an indigenous species, it is susceptible to the same insect pest fauna that affect native southern pines. Producers should keep this fact in mind when planning production strategies for each Christmas tree rotation.

A complex of insect pests attack Virginia pine in Louisiana. No part of the tree is immune. Injury caused by a specific pest will vary from year to year, among trees of various ages, by location, and according to activities on properties adjacent to the planting. There is no substitute for anticipation of, and frequent examination for, pest problems. These are necessary production practices to prevent serious injury and maintain market value.

Some pest problems can be prevented by management practices other than the use of insecticides. Others cannot and require direct control efforts. Some pests appear to defy all management and control efforts.

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Reasons for these difficulties are attributable to delayed identification of the problem, weather, tree health, insect resistance to insecticides, resurgent ability of pests, and poor application of direct control measures.

An effective pest management system is dependent on timely initiation of all necessary efforts to grow quality trees. The system is also dependent on the many beneficial organisms which aid in reducing pest population levels. Indiscriminate pesticide use causes heavy losses of both parasites and predators, which is wholly contrary to good pest management. Such action may result in elevating a normal secondary pest species into one of primary importance, which requires still more pesticide use.

The program is greatly enhanced when necessary production practices (e.g., pruning, shearing, and prevention of tree injury) are synchronized with the pest management system. If one desires to grow Christmas trees, an essential part of the effort must be good pest management.

The insects discussed below are those considered to be important pests on Christmas trees grown in Louisiana. Producers should become familiar with their appearance, habits, seasonal occurrence, and injury characteristics so that timely management procedures can be initiated. Each pest is presented in a brief and general manner to aid in making proper control decisions.

**Nantucket Pine Tip Moth, Rhyacionia frustrana (Comstock)**

* (Lepidoptera: Tortricidae).

The Nantucket pine tip moth is the key pest of Virginia pine Christmas trees in Louisiana. This insect is widely distributed in the eastern, central, and southern states where it infests several pine species. As a result, a source of infestation exists in most areas planted in Christmas trees.

Adult moths are micro-lepidopterans colored a mottled reddish-gold, gray, and white (Figure 1). The larvae are relatively small caterpillars with black head capsules and amber-orange colored bodies (Figure 2). When fully developed, a larva is about ¼-inch long and is found inside a young shoot.

**Life History and Habits**

Nantucket pine tip moths overwinter as pupae (Figure 3) in infested stems on the host tree. Adult moths begin to emerge from late January to early March depending on the severity and longevity of winter cold.

Female moths deposit their eggs primarily on needles and needle sheaths. Upon hatching, the very small larvae feed on the surface of needles and young stems for 2 to 4 days. They then bore into the stem where they feed for the remainder of the larval stages. Fully developed larvae pupate inside the stem. There are four complete generations and a partial fifth each year in most of Louisiana.
Injury and Symptoms of Infestation

Larvae injure new pine shoots by boring inside the stems. The tips of the new branches die back to the point of larval feeding (Figure 4). During the feeding period, canopies of resin containing webbing and fecal pellets are formed between the bases of needles and the stem. Ultimately, the center of an infested stem is hollowed out for 1 to several cm. As a result of tip mortality, the infested stems form from one to several new branches proximal to the dead area. This excessive branching may be undesirable on Christmas trees. Trees up to about ten feet tall are subject to infestation. First year seedlings must be protected to enhance the growth of a straight stem which serves as the base of an erected Christmas tree. Trees to be harvested for the next Christmas must be kept free of dead tips. Severity of infestations increases as the growing season progresses, and most injury results from larval broods in June to October.

Control

Control of the Nantucket pine tip moth throughout the Christmas tree rotation of 4 to 5 years is an absolute necessity for growing quality Christmas trees. Although many beneficial parasites and predators have been identified as aids in suppressing populations of this insect, producers are dependent on well-organized and properly initiated shearing and chemical control measures. Use of the correct insecticides and proper timing of applications cannot be over-emphasized. The need for effective insecticide applications is dictated by increased insect population pressure, especially from June to early October.

Shearing trees to create the desired shape is very helpful in reducing the number of larvae. Most larvae in sheared stems do not survive, although moths do emerge from stems in which pupae have developed. From the time of shearing, 3 to 5 weeks are required for new growth to reach sizes sufficient for larval development. Shearing immediately after egg laying serves as an excellent aid in managing this pest. The smaller the tree, the more difficult it is to effectively manage tip moths with most methods used today. First year seedlings should be examined frequently and treated effectively to avoid excessive main stem injury. Soil applications of systemic insecticides have been especially effective in protecting first- and second-year trees. Applications should be made prior to first generation egg hatch to insure translocation into the tips before larvae appear.
Fig. 1.—Nantucket pine tip moth resting on pine needles. Fig. 2.—Larva of Nantucket pine tip moth dissected from pine branch tip. Fig. 3.—Pupa of Nantucket pine tip moth in stem, where they also overwinter. Fig. 4.—Dead pine tips, resulting from feeding by Nantucket pine tip moth larvae. Fig. 5.—Pine tortoise scale on pine stem. Fig. 6.—Sooty mold growing on honeydew excreted by pine tortoise scales or conifer aphids.
Fig. 7.—Aphids on pine stem. Fig. 8.—Coneworm injury to trunk of pine tree. Fig. 9.—Weevils that injure seedling or sapling pine, top to bottom: deodar, pales, and pitch-eating weevils. Fig. 10.—Weevil debarking seedling stem.
Pine tortoise scale, *Toumeyella parvicornis* (Cockerell) (Homoptera: Coccidae)

The pine tortoise scale, statewide in distribution, is an especially important pest of Virginia pine and spruce pine saplings. It ranks second in importance as a pest of Christmas trees grown in Louisiana. Fully developed female scales on stems (Figure 5) range from oval to convex in shape, and are colored a mottled gray, green, brown, and black with various reticulations. The females on pine foliage are elongate with longitudinal yellow-gray stripes. The dorsum of developing females is covered with white powdery excrement. Male scales are elongate, pinkish in color with a white area on the posterior end, and are much smaller than the females. Newly hatched scales (crawlers) disperse from beneath the mother scale and settle primarily on new twig growth.

**Life History and Habits**

There appear to be continuous and overlapping generations of pine tortoise scales in Louisiana. Developing and reproductive females have been found during all seasons of the year. There are probably four generations in south and three in north Louisiana. The highest populations develop from April to early June during the period of most rapid growth of new branches.

These scale insects are sessile in habit; that is, they remain stationary after newly hatched crawlers settle on young shoots of host trees. Actively feeding broods excrete an abundance of honeydew, which is indicated by the shiny foliage and subsequent growth of sooty mold.

**Injury and Symptoms of Infestation**

The pine tortoise scale is usually overlooked by casual observers until host tree branches have clusters of scales covered with a white powdery material and the foliage is blackened with sooty mold growing on the honeydew (Figure 6) excreted by the insects. The honeydew attracts bees, wasps, flies, etc., which utilize it as food. After eggs hatch, crawler scales settle mostly on the current year’s growth. Being sessile, these insects insert their slender beaks into the soft tissues of new shoots and remove sap as food for the remainder of their developmental period. High populations completely encircle the stems which may cause deformity and slow growth.

Only a small percentage of trees in a plantation become infested at one time. The highest number of infested trees observed has been about twelve percent, which is considered to be a severe infestation. One female per tree may result in virtually complete infestation because she produces a
Fig. 11.—Redheaded pine sawfly larvae clustered on pine stem that has been defoliated. Fig. 12.—Pine colaspis beetle, which defoliates pine in May and June. Fig. 13.—Foliar injury caused by pine colaspis. Fig. 14.—White grubs root-prune pine trees. Fig. 15.—Pine seedlings with roots removed by white grubs.
large number of eggs. Such an infestation renders a tree unfit for sale unless remedial measures are taken to suppress the pest well before sale season.

Control

Parasites and predators are numerous among developing scale broods in the spring. Predators, especially the lady beetles, Hyperaspis inedita Mulsant, H. signata signata (Olivier) and H conviva Casey, and the pyralid moth, Laetitia coccidivora (Comstock), are very effective in suppressing the scale where broad spectrum insecticides have not been used. Because of this scale, use of insect growth regulator (IGR) compounds are recommended when possible for control of Nantucket pine tip moths. These compounds have little if any effect on the beneficial fauna that regulate populations of pine tortoise scale.

Infested trees should be flagged and special effort made to control pine tortoise scale as early as possible after detection. Some insecticides used for Nantucket pine tip moth control are also effective against this scale insect. Timing of an application to coincide with the presence of the crawler stage is most effective in suppressing the population. Repeated applications are usually necessary to control high populations of this important scale insect pest.

Aphids (Homoptera: Aphididae)

The Carolina conifer aphid, Cinara atlantica (Wilson), is a soft-bodied insect, grayish to almost black in color, and 3 to 5 millimeters long (Figure 7). Aphids have a pair of dorsal tubular structures referred to as cornicles and piercing-sucking mouth parts that enable them to extract large amounts of sap from succulent stems. Immature forms have a powdery white to gray secretion on their bodies. This aphid is found throughout the state. Other aphid species also occur in Louisiana and have caused stem injury.

Life History and Habits

Aphids develop very high populations because of their rapid rate of reproduction. Although aphids have been found on Christmas trees throughout the year, peak populations usually occur in late winter and spring (March to May), during the time of most rapid terminal growth. Clusters of aphids form on shoots to feed and excrete honeydew, which collects on the foliage and attracts many other insects. Honeydew also serves as a medium for sooty mold growth, a good indication of either an infestation of aphids or scales. Both pests may be detected on the same tree.
Injury and Symptoms of Infestations

Aphids seem to prefer short leaf pine species such as Virginia and spruce pines. Their feeding may stunt growth, deform twigs, cause off-color foliage, and a buildup of honeydew on which sooty mold fungi grow. Trees with this problem are unsightly and lose their esthetic value. These insects are also important nuisance pests when left on trees that are decorated in homes at Christmas time.

Control

Lady beetles and hymenopterous parasites usually reduce populations to low numbers by early June. When broad spectrum insecticides are used for controlling other pests, however, most beneficial species are eliminated. If aphid populations prevail, remedial control with organophosphate insecticides may be necessary to prevent trees from becoming blackened with sooty mold. If aphids remain on trees after the regular season insect control program ends in the early fall, a special effort should be made to remove them from trees that are to be sold by Christmas time. Blowing and shaking to remove dead needles during harvest in November and December removes many aphids and other insects classified as nuisance pests. Otherwise the insects become a problem in homes when they leave erected Christmas trees.

Coneworms, *Dioryctria* spp. (Lepidoptera: Pyralidae)

The pine coneworms, *Dioryctria* spp., are caterpillars with green to pinkish-gray colors. When fully developed, they are about 1 cm long. They appear to be greasy as a result of burrowing beneath resin pockets in the inner bark of pine trees (Figure 8). Four species, *Dioryctria amatella* (Hulst), *D. abietivorella* (Grote), *D. clarioralis* (Walker), and *D.zimmermani* (Grote) may infest Christmas trees in Louisiana.

Life History and Habits

Coneworm larvae and pupae winter in the host tree bark, stems, or cones. After pupation, adults (moths) emerge in late April and May, mate, and deposit eggs for the next brood. Under favorable conditions, there may be three or more generations during the year. Coneworms, found throughout Louisiana, infest all southern pine species and are major pests of Christmas trees.

Injury and Symptoms of Infestation

The larvae, especially destructive to developing pine cones, also infest tips and crotches, tree wounds, and callus tissue. They are often detected around pruning scars and wounds on the main bole of Virginia pine.
These caterpillars mine (feed) in the live bark adjacent to such areas, which results in masses of oleoresin exuding to the outer bark surface. Such symptoms are much like the pitch tubes resulting from bark beetle infestations. Small trees or branches on larger trees may die as a result of larvae girdling the live bark. Larvae require 4 to 5 weeks to complete development. Shearing trees creates an attractive medium for moth activity in Christmas tree plantations. Producers should be very observant for coneworm infestations on trees with injury from any source.

Control

In Christmas trees, most larvae are found in the lower tree bole down to the soil line. Tip moth and scale insect control is helpful in protecting terminals of the tree crown from coneworms. Considerable benefit is obtained from biological control agents. Parasitic hymenopterans and tachinid flies have been collected from larvae.

Frequent surveys are highly recommended to detect developing infestations on trees scattered throughout a plantation. One should be especially observant during extended dry periods. Prevention of infestation is highly recommended. Injury to trees with mowing and spray machinery should be avoided, and weakened and diseased trees should be removed. Control of coneworms will be necessary in some situations when high populations develop as a result of tree wounds or invasion from nearby natural stands of pines with cones and a high percentage of fusiform canker infection. One plantation examined after inundation by flood water was severely attacked by coneworms after the water receded. Thorough spraying of the main bole with an effective insecticide was necessary to suppress this infestation.

Debarking Weevils (Coleoptera: Curculionidae)

There are three species of weevils that can cause injury to Christmas tree pines in Louisiana. These are the pales weevil, Hylobius pales (Herbst) (Figure 9-middle), the pitch-eating weevil, Pachylobius picivorus (Germar) (Figure 9-bottom), and the deodar weevil, Pissodes nemorensis Germar (Figure 9-top). All three species have elongated snouts for feeding and making cells in bark for laying eggs. The weevils, mottled (speckled) brown, gray, and white, are about eight mm long.

Life History, Habits, and Injury

These weevils breed among fresh logging debris such as green stumps and bolts of rejected wood. The deodar weevil will also reproduce in fast growing sapling pines, especially those under stress.

Pales weevils mate and deposit their eggs in such places as the live
bark of fresh stumps. Larvae feed and develop until early fall. When fully developed, larvae construct pupal cells (chipped cocoon) on the wood surface beneath the bark. Adults emerge from these cocoons in late August to October and feed on the tender bark of seedling stems (Figure 10), then hibernate for the winter in the soil. Overwintered weevils emerge from hibernation in late March to June and again feed on the bark of seedling stems. They then move to logging debris to mate and lay their eggs. There is one and a partial second generation each year.

Pitch-eating weevil activities are very similar to those of the pales weevil. The most severe injury occurs in early spring (April to May) following the planting of seedlings. The stems may be completely severed at the soil line. Losses are greatest 3 to 4 months after the establishment of breeding sites that result from logging operations. These two weevils are most troublesome in north Louisiana.

The deodar weevil also is a problem on seedlings and saplings. They may attack pruning scars and trees weakened by drought and wind storms. After pupation in March and April, adults emerge in April and May. They feed on twigs, aestivate until fall, then actively feed on young shoots and the inner bark of larger stems. On three occasions, the deodar weevil was found to cause mortality to relatively large sapling pines during periods of dry weather. Eggs were deposited in the inner bark where larvae tunneled and fed, constructed pupal cells, and overwintered. This weevil is a problem statewide but most serious infestations examined were found in the southern half of the state.

Control

Where logging has recently occurred or will occur during the first year after planting seedlings, there is a potential for seedling losses as a result of weevils debarking the main stems. A 1-year delay in planting near fresh logging sites will allow degradation of breeding sites and dispersal of adult weevils away from the area. The need for this strategy can be anticipated and will likely prevent replanting or the use of more expensive and undesirable control methods. Producers should also be concerned with development of debarking weevils in stumps remaining after Christmas tree harvest. Although small compared to the stumps left in sawlog forest land, this residue is sufficient for weevil development. These stumps can be removed from the site during land preparation for replanting, or if left on site, treated with effective chemicals to enhance rapidity of decay and control of developing weevil brood. When seedlings become infested, the basal portion of the stems should be treated immediately with a recommended insecticide to reduce probable mortality.
Conifer Sawflies (Hymenoptera: Diprionidae)

Three species of conifer sawflies occurring in Louisiana are the most important defoliators of pine trees. Larvae of these sawflies are caterpillar-like and most often feed in clusters on pine needles. They have seven pair of abdominal prolegs, which distinguish them from true caterpillars. The redheaded pine sawfly, Neodiprion lecontei (Fitch) (Figure 11), is the most important species relative to injuring Christmas trees. The larva has a reddish-brown head, a white body with six longitudinal rows of black spots, and is about 25 mm long when fully developed.

Life History and Habits

Adult redheaded pine sawflies emerge in the spring, and females deposit about 100 eggs each in pine needles. Upon hatching, the larvae feed in groups and, as they grow and deplete foliage on a branch, they move to another branch and eventually to another tree. When fully developed, they move to ground litter, spin a tight silken cocoon, and pupate. They overwinter as pre-pupae. Each brood of larvae requires about 3 weeks for development. There are 3 to 4 generations each year in Louisiana.

Importance and Distribution

The redheaded pine sawfly is distributed throughout the eastern United States. All pine tree species grown in Louisiana serve as hosts. Larvae are usually found on relatively small pine trees in residential areas, along forest borders and in plantations of young trees. Defoliation of a tree or branch of a tree can render it unfit for sale as a Christmas tree for a year. Christmas trees of sale size should be examined frequently to make sure that defoliation is not occurring. Because of its distribution, high reproductive potential, and preference for young trees and open-spaced canopies, this is the most injurious sawfly attacking Christmas trees.

The blackheaded pine sawfly, Neodiprion excitans Rohwer, is another species with some potential to defoliate Christmas trees in Louisiana. It is distributed from Virginia to Texas and prefers short leaf pinies as hosts. Larvae are green with black heads and have two longitudinal lines down the back with spots along the sides. Fully developed larvae are about 25 mm long. The seasonal history and feeding activity are very similar to the redheaded pine sawfly. Biological control agents are usually very effective in reducing high populations.

The loblolly pine sawfly, N. taedae linearis Ross, also occurs in Louisiana but will cause the least damage to Christmas trees. It prefers larger trees and is most likely to occur in the northern half of the state.
Parasites, predators, and diseases prevail among high populations of sawflies and aid materially in the suppression of infestations. Hardwoods near Christmas trees should be removed to prevent shading, a condition that the redheaded pine sawfly prefers. When an infestation is detected, remedial control is necessary to prevent defoliation. Chemicals used for controlling the Nantucket pine tip moth are effective against sawflies.

**Pine Colaspis, *Colaspis pini* Barber (Coleoptera: Chrysomelidae)**

Pine colaspis beetles (Figure 12) are about 5 mm long, light brown in color and with a greenish sheen on the venter. The dorsum (back) bears several longitudinal ridges. Larvae are dull white with light brown heads.

**Life History and Habits**

There is one generation each year with a major part of the time spent as larvae in the soil. Adult beetles begin emerging from the soil in early May with peak emergence occurring in late May and early June. Upon emergence, beetles move to pine trees where they feed profusely on needles. The population begins to diminish by mid-June with all adult feeding and egg-laying activity completed by early July.

Each female deposits approximately 125 eggs in the duff and soil of grassy and weedy areas near pine trees. The eggs hatch in about a week. Larvae feed on roots of weeds and grasses and overwinter in the soil. In the spring they resume feeding until fully developed. They then pupate, and adults begin to emerge about a week later. The young beetles congregate on pine foliage, feed, copulate, and disperse to egg-laying sites.

Areas of sod, pastureland, and other grass and weed areas serve as ideal habitats for development of immature stages. Such areas may have yearly emergences of beetles as long as pine hosts are available.

**Importance and Distribution**

Pine colaspis beetles feed on all pine tree species grown in the state and are increasing in importance as pests of Christmas trees. They prefer trees in small groups, along forest edges, shade trees and small saplings in plantations. This beetle has been detected in small areas of Christmas trees during the past 3 years. Each year they have increased in population size and area of infestation. Residual foliage injured by this beetle remains on the tree and may reduce its sale and esthetic value.

An early indicator of impending infestation is the presence of adult beetles flying about the canopy of a pine tree. Foliar injury (Figure 13) results from beetles congregating on the needles and cutting a series of saw-toothed notches from the apex inward. The injured needles die and...
tum brown, and the entire tree canopy appears to have been singed by fire. High beetle populations feed on foliage of all ages, but low populations feed primarily on new foliage. Either type of injury is harmful to the esthetics of Christmas trees. Foliar injury also results in slower growth and makes trees more susceptible to bole feeding pests during dry weather.

**Control**

The pine colaspis tends to remain in an area year after year. Therefore, the problem can be anticipated to occur from mid-May through June each year. Christmas trees in infested areas and especially those of sale size will need protection. Some of the insecticides used to control other pest species can be used for controlling this beetle. Because the beetles emerge over a relatively long period, a second application may be necessary. When possible May shearnings should be delayed until this beetle has completed its feeding activity.

**White Grubs (Coleoptera: Scarabaeidae)**

The immature stages of May beetles and June beetles are referred to as white grubs (Figure 14). The typical white grub is primarily white with a brown head capsule. The body is C-shaped and has three pairs of thoracic legs. Most species grow to about 25 mm long. The genus *Phyllophaga* contains about 100 species, several of which are important pests of plants. Among these are *Phyllophaga prununculina* (Burmeister), *P. crenulata* (Froelich), and *P. forsteri* (Burmeister), which feed on roots of pine in Louisiana. Other white grubs in the genus *Polyphylla* also may feed on pine tree roots.

**Life History and Habits**

White grubs are primarily soil inhabiting insects with much of the developmental time spent as larvae in the soil where they feed on roots of various plants. The life cycle requires 1 to 3 years depending on the species, location, and food source.

The adult beetles emerge in May and June, feed in swarms at night on broad leaf foliage, then mate and burrow into the soil to deposit their eggs in masses near a food supply. Upon hatching, the young grubs feed and develop on the roots of plants within its range of movement.

Abandoned farmland, pastureland, and other areas without tillage are favorite sites for white grubs. Such areas are also often planted in Christmas trees. In such situations, pine seedling mortality may exceed 50 percent if grubs are present and no effort is made to reduce the population. Preplant surveys should be made to determine if the grub population is
sufficient to cause significant seedling loss. A population of one grub per 30 cm square can significantly reduce seedling stands.

Importance and Distribution

White grubs cause pine seedling mortality by root pruning (Figure 15) especially during the first year after planting. Seedlings without roots will die. The reason for seedling mortality is often alleged to be drought, improper planting, poor soil, or poor seedlings. After a year, the danger from grub-caused mortality is much less because of better root establishment and the use of chemicals for control of other pests. White grubs are found throughout the state, and producers would be remiss if preplant surveys were not made to determine if a white grub hazard is present. Land that has been in cultivation is less likely to harbor a serious white grub problem.

Control

When surveys reveal that an injurious white grub population is present on land to be planted to seedlings, tillage with disc or bottom plows from July to September prior to planting will destroy host material and expose grubs to predators, e.g., birds and ants. Chemical control should not be necessary. Planting will also be enhanced through improved soil conditions. If tillage is not possible, another method of grub control is the broadcast application of an effective insecticide.

Nuisance Pests

There are several arthropods that move into the dense foliage of Christmas trees for the winter months. Aphids, spiders, stink bugs, and daddy-longlegs are some that are most likely to be in the foliage at cutting time. If not removed at harvest time by blowing and shaking or by spraying the inner canopy thoroughly with an effective insecticide before cutting, these nuisances are carried into homes with the tree. When the tree is set up for decorating, these arthropods become warm and move onto walls, ceilings, and furniture. Most people find such a situation undesirable especially at Christmas time. Though no serious harm results, the nuisance of crawling "bugs" in the home makes this a problem which should be prevented.

Surveys for Christmas Tree Pests

An old surveyor once stated, "You have to go look before you can see and then know or find out what you saw." This procedure is very appropriate in determining pest problems on Virginia pine Christmas trees. Economic injury thresholds have not been established for most
Christmas tree insects. Opinions on need for direct control will vary among producers; some tolerate no infestation if possible while others are much less concerned about a few injured trees. The value of a grade 1 tree is sufficient to warrant its protection; a cull tree should be removed from the field. Good common sense should reign in assessing any particular situation and making control decisions. Insect problems affecting a small percentage of trees (e.g., coneworms) have to be dealt with differently than a problem involving all trees in a field (e.g., the Nantucket pine tip moth). Individual tree treatment for control of occasional pests such as pine tortoise scale and coneworms should be applied differently than that for foliage and new terminal pests. Only by frequent surveys and examinations can infested trees scattered throughout a planting be detected before injury occurs. The producer knows best his investment in one tree or ten trees in the field and whether it warrants the necessary effort to eliminate an insect infestation and keep the tree(s) in the sale inventory. There is no substitute for detection before lasting injury occurs. The following survey procedures will aid materially in determining the presence of various pests in Christmas tree plantings. Figure 16 indicates where important pest species feed and develop.

**Nantucket pine tip moth:** This key pest of Christmas trees overwinters as pupae in the stems where larvae developed the previous summer and fall. When 70 to 80 percent of the moths have emerged in late February to early March, an application of a recommended chemical may be justified to avoid high numbers of larvae from boring into the stems. Determine the percent emergence by dissecting three or four stems per tree from about ten trees per acre and examine for empty pupal cases. Pheromone traps can be used effectively to monitor moth activity. The overlap in late generations may reduce the effectiveness of this approach but visual examination of tips will aid in determining the status of the population and control needs. Omnidirectional traps [Hercon's Omnitrap, Zoecon's Pherocon® Adult Monitoring (A.M.) Trap (Trece Inc.), and Sentry's Wing Trap] may be placed in the field for moth catches. Two traps per ten acres hung on stakes about crown height serve well in monitoring moth flight. An insecticide application 10 to 12 days after the peak flights of the first and second generations and about six days after the peak flights of the third and fourth generations should be effective in controlling young larvae while on stem and needle surfaces. Larvae have usually bored into the stems within 4 days after hatching; therefore, prompt timing is essential to obtain the best control.

**Pine tortoise scales and aphids:** Most scale insects have poor mobility and therefore remain on the same plant until removed by some agent. Christmas trees with one or more female pine tortoise scales should be flagged to enhance prompt recognition during insecticide applications.
Figure 16.—Diagram of a Virginia pine Christmas tree showing where the primary insect pests are found and where they feed.
Tree foliage with developing tortoise scale brood will appear shiny because of honeydew excretion. This medium also attracts many scavenging bees, wasps, ants, and flies. Sooty mold fungi also flourish on honeydew. These conditions are sure indicators that pine tortoise scales are developing on the shoots or that aphids, which also excrete honeydew, are present. Aphids are mobile and can be easily seen moving up and down the shoots and needles. In either case, the presence of beneficial insects such as lady beetles will often suppress the pest population satisfactorily. If aphid and scale populations continue to increase into the summer months, an application of an effective insecticide may be indicated. This is often the case where insecticides have been used for control of other pest species.

**Coneworms:** Coneworms are serious pests of pine cones in all pine tree areas of the state. Therefore, they are most often plentiful in Christmas tree growing areas and are attracted to the field as a result of shearing and pruning trees. Patches of resin on the bark surfaces around wounds, crotches, and at the base of the main stem indicate the probability of coneworm infestation. Trees under stress from drought, sun scald and mechanical injury should be examined frequently for boring excrement on the bark surfaces. Early detection will afford time to initiate effective insecticidal control and prevent serious tree injury.

**Weevils:** Pales and pitch eating weevils, and to a lesser extent the deodar weevil, develop large populations in logging debris such as fresh stumps and chunks. One can anticipate that these insects may kill a considerable number of seedlings planted near such breeding sites. Chipped cocoons (pupal cells made of shredded wood) on the hard wood surface beneath the bark are indicators of weevil presence. From such sites, the adult weevils move to live stems to feed. One weevil can girdle several seedlings within a few nights of feeding. These weevils are nocturnal feeders and hide in the debris near the seedling base during the day.

Deodar weevil brood develops around pruning scars, in drought-stressed trees, and trees injured by storms. Adults feed on new terminals just after emerging as adults. The conditions described above dictate that appropriate and frequent surveys be made to ascertain the potential for weevil injury to Christmas trees.

**Sawflies:** Sawflies very frequently re-infest trees in an area with a previous problem. Surveying for adults or eggs of the redheaded pine sawfly would be time consuming and unproductive. The appearance of a dead clump of foliage (flag) on a branch indicates that a cluster of very young sawfly larvae have hatched and fed. More foliage will be consumed as the larvae develop giving the tree a striped appearance. Infested trees should be identified as soon as possible and spot treatment initiated to
prevent esthetic damage and the loss of the sale of that tree for a year.

*Pine colaspis:* This beetle should be expected from the second week of May until the first week of July. The probability of an impending defoliation may be determined by looking for light brown beetles resting on twigs and injured needles with saw-tooth notches. Areas with previous infestations can be expected to have an annual problem.

*White grubs:* White grubs are soil-dwelling insects. Soil samples 30 centimeters (cm) square and about 3 to 16 cm deep should be taken with a shovel and examined for white grubs the year prior to planting. Five samples per acre will give ample information on the incumbent white grub population. One white grub per 30 cm square is sufficient to cause heavy seedling mortality. It is not unusual to have localized grub populations exceeding five per 30 cm square. Where injurious populations have been found, preplant remedies should be carried out.

*Occasional miscellaneous pests:* The pine needle scale, *Chionaspis pinifoliae* (Fitch) (Homoptera: Diaspididae), is an armored scale that infests needles of all pine tree species grown in Louisiana. Less than a dozen Virginia pine Christmas trees have been detected by the authors with an infestation of this insect. Pine foliage with an infestation has a white speckled appearance with scales that are usually found on most needles of a branch. This insect does not excrete honeydew, therefore there will be no sooty mold on the needles as a result of its feeding. Control measures used for other insect pests, especially the pine tortoise scale, will control this species.

Pine spittlebugs, *Aphrophora* spp. (Homoptera: Cercopidae), are distributed throughout the state but have not been a serious problem on Christmas trees. Immature spittlebugs develop in masses of frothy liquid (spittle) on grasses or in the axil of pine tree branches.

The pine webworm, *Tetralopha robustella* Zeller (Lepidoptera: Pyralidae), is found throughout the state. The larvae feed on needles and construct nests of cut needles and excrement webbed together on branch terminals. The larvae live within these nests but move out to feed at night. An infested branch is easily detected by the appearance of the nest which is usually about 2 centimeters in diameter. Controlling the Nantucket pine tip moth usually eliminates any need for specific control of this pest.

Various species of pine bark beetles, pine sawyers, and flatheaded pine borers have been found in Christmas trees. In a majority of such cases, these insects were definitely secondary invaders that attacked trees weakened or injured by drought, machinery, diseases, or primary insect pest species such as the coneworms. Maintenance of tree health and control of primary pest species prevent most infestations of these miscellaneous pests.
Nuisance pests: Trees to be cut in late November and December for Christmas sale should be closely examined for hibernating pests in late October and early November. Examination of the inner canopy where dead needles have accumulated will reveal whether or not a problem with nuisance pests exists. The different species rest in these dense clumps of lodged foliage. Aphids are often found on the stems near the upper main tree trunks.

Beneficials: Many insects found on Christmas trees are the producer’s best friends. Some of the most beneficial species, such as parasites, are so small they are seldom seen. Others, such as the predaceous lady beetles and assassin bugs, are easily observed on outer branches and foliage. The beneficial fauna should be conserved and promoted as much as possible because they destroy more pests than do sprays. Use of IGR compounds for tip moth control especially in early season in lieu of broad spectrum compounds is a good example of retaining beneficials for scale and aphid control.

Equipment: Persons responsible for making surveys should have a good hand lens with 10X magnification, a sharp knife for cutting stems and peeling off bark, and a small shovel for digging. Flagging tape is very useful for marking trees with pest problems such as scale insects and coneworm infestations. When one is unable to make positive identification of an insect, he should place it in a container (e.g., glass vial with alcohol) and label it as to (1) host, (2) part of host infested, (3) location of host (parish, town, or distance from a particular point), (4) date of collection, and (5) the surveyor’s name. These data are very important when making identifications. Proper identification is basic to any control effort; therefore, get competent help when unsure of the insect’s identity. Louisiana Cooperative Extension Service (County Agent) personnel in each parish can help with proper identification and can refer the producer to persons elsewhere who can be of help.

Managing Christmas Tree Insect Pests

Managing Christmas tree insect pests effectively is a relatively complex procedure, which requires good organization and extensive effort. A producer must take advantage of weaknesses in developmental cycles of the pest species. Though he may not realize the many benefits received from beneficial species, every problem would be magnified at least ten times without their presence. An example of pest suppression by beneficials is the Nantucket pine tip moth. The female moth deposits her eggs primarily on the pine needles where many are exposed to predators and parasites. Less than half of the eggs survive and hatch. Predation, parasitism, and diseases of overwintering pupae reduce the numbers of
80 percent depending on the effects of late season spray programs and weather.

There is currently no method for production of quality trees without some proper direct control of pests with insecticides. Effective use of these chemicals is dependent on proper timing and method of application. For example, one thorough application of an insecticide for pine tortoise scale control when the insect is in the crawler stage is more effective than three applications to control the adult stage. A similar situation is that of newly hatched Nantucket pine tip moth larvae on stem and needle surfaces compared with late stages that are within the stems. First, young larvae are more sensitive to insecticides than are late stage larvae. Second, late stage larvae are protected from direct contact with spray material, and, as a result, many continue to develop and cause terminal injury. It would be of no benefit to spray trees for pine colaspis control in late July when the beetles have done the damage and departed to oviposition sites in a grass meadow. The need to know when, how and how often to apply control measures cannot be overemphasized.

The tendency toward frequent and widespread insecticide use is contrary to good pest management. There is no better way to aggravate insect problems than with excessive use of pesticides. An insect that is not there cannot be killed with an insecticide. Make surveys to determine the need for application. The developmental stage(s) present, the location of each pest stage on the tree, and injury tolerance of the trees greatly influence effectiveness and need for application.

Specific recommendations for use of insecticides vary from state to state and region to region. The users of insecticides should pay specific attention to the recommendations available for his or her area and its pest problems.

For Louisiana, a guide has been prepared to cover most insect control problems. This guide is distributed by the Louisiana Agricultural Extension Service to all County Agents in the parish seats. Each year, in January and February, research entomologists meet with Extension entomology specialists for the specific purpose of updating this guide for use during the year.

Effective control of the Christmas tree insect complex dictates that several different insecticides be recommended for use. Producers should become familiar with these and use them only according to recommendations and label restrictions. Insecticides are available in several formulations. Proper preparation of each formulation is essential to insure effective application. Some insecticides need a spreader-sticker added to enhance their residual efficacy. This need is stated on the label. Wettable powder formulations must be vigorously agitated to obtain and maintain the suspension necessary to flow evenly through the sprayer system. Emulsifiable concentrates usually come with the necessary adjuvants in
them. One should never mix more formulation than will be needed for an immediate application. Leaving unused material in the spray tank following an application results in clogged nozzles, damage to the sprayer, degradation of the insecticide, increased hazard in cleaning, and unnecessary expense. Insecticides are excellent tools for use by man—but he should use them wisely.

Insect activity in south Louisiana precedes that in north Louisiana by about 10 to 14 days. Surveys should be made prior to any application of insecticide to ascertain whether pest activity will justify application any place in the state. The graph on seasonal occurrence (Figure 17) indicates with vertical lines when the various insects can be expected to cause injury and the time frame for application of appropriate control measures. Winter temperatures influence the time when insect activity first begins and should be considered when planning surveys and management strategies.
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Figure 17. Graph depicting seasonal cycles of the injurious stages of ten important insect pests of Virginia pine Christmas trees grown in Louisiana. Vertical shaded areas indicate time of year when the various pests may cause injury; the higher the bars the higher the pest populations.

(Abbreviations: AA—adult activities; AE—adult emergence; AF—adult feeding; AFL—active feeding larvae; APD—aphid population fluctuations; G—generation; LDP—larval development period; NDF—nymphal development period; OWL—overwintering larvae; OWQ—overwintering quarters; PPP—preplant land preparation; RNGP—rapid new growth period.)
Selected References


Gargiullo, P. M. and C. W. Berisford. 1983. Life tables for the Nantucket pine tip moth, Rhyacionia frustrana (Comstock), and the pitch pine tip moth, R.


