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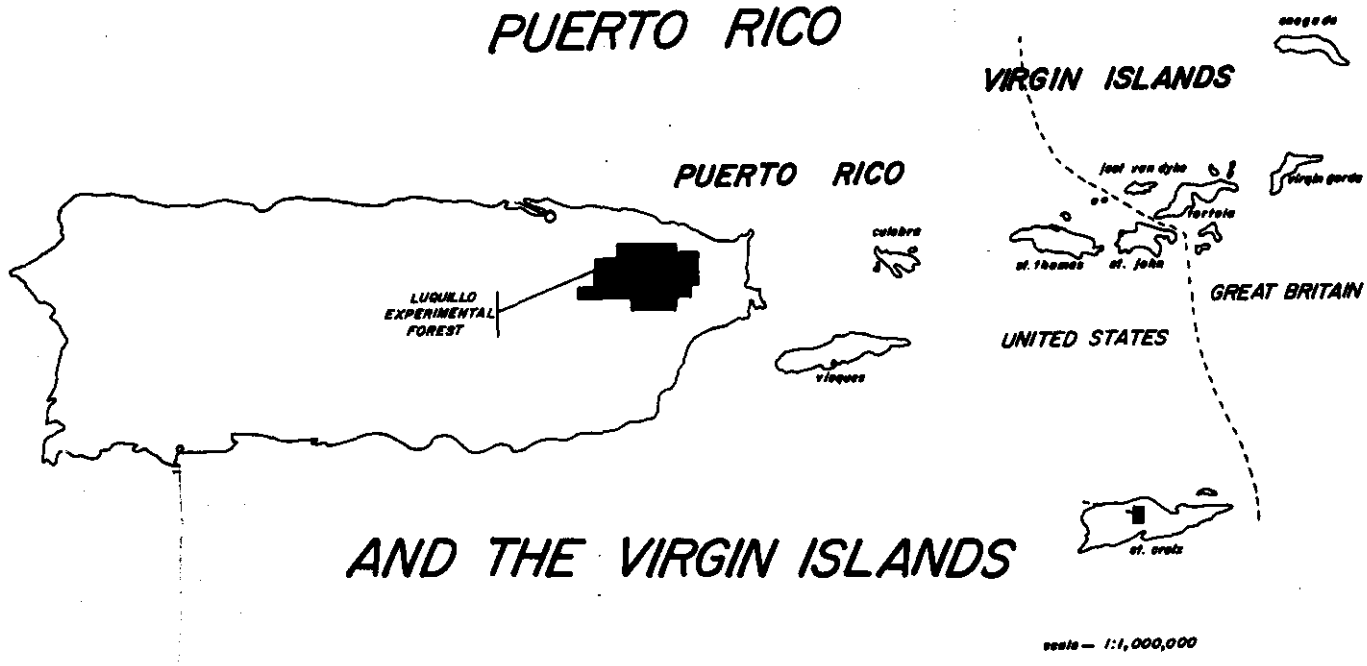
# EVALUATION OF TREE INSECT AND DISEASE PESTS IN PUERTO RICO AND THE VIRGIN ISLANDS

U. S. Forest Service
~~Atlanta, Georgia~~
Asheville NC.




U. S. DEPARTMENT OF AGRICULTURE – FOREST SERVICE
SOUTHEASTERN AREA, STATE AND PRIVATE FORESTRY
FOREST PEST MANAGEMENT GROUP

# EVALUATION OF TREE INSECT AND DISEASE PESTS IN PUERTO RICO AND THE AMERICAN VIRGIN ISLANDS, 1973

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Mr. Thomas H. Flavell and Dr. William R. Phelps of the Forest Pest Management Group, Southeastern Area, spent the period from October 23 to November 3, 1973, in Puerto Rico and the American Virgin Islands (St. Croix, St. Thomas, and St. John) evaluating tree and ornamental insect and disease pests. They were accompanied by members of the Institute of Tropical Forestry and the National Forests in Puerto Rico in their visits to various Federal, Commonwealth, and private installations. This was the second annual evaluation trip of the Forest Pest Management Group.

Previous detection and evaluation surveys were listed in the report by William R. Phelps and Amel E. Landgraf entitled "Evaluation of tree disease and insect pests in Puerto Rico and St. Croix, Virgin Islands, 1972."

Specific tree, shrub, and plant insect and disease problems with suggested recommendations for prevention and/or suppression are listed by individual species as follows:

## MAHOGANY (Swietenia mahogani)

The most destructive pest on mahogany is the mahogany shoot borer, Hypsipyla grandella (Zeller). Damage caused by this insect is so severe as to almost preclude the planting of this valuable timber species (Figure 1).

Substantial efforts toward finding a practical control method are continuing both in South America and Puerto Rico. Currently, emphasis is being placed on finding a satisfactory "time release" pesticide capsule for a systemic compound and in isolating the moth's sex attractant. Silvicultural techniques may also offer some degree of control. It is hoped that these efforts will soon provide the necessary means of controlling this pest.

Another pest of mahogany was found at the Commonwealth Forest Nursery at Monterrey, Puerto Rico. A cutworm, (Lepidoptera: Noctuidae),

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was causing some damage to planting stock. Chlordane is registered at 1 lb. active ingredient per 100 gallons of water and zectran is registered at 1/2 lb. active material per 100 gallons of water for cutworms on trees and ornamentals. Diazinon provides excellent control of cutworms in vegetables and lawn soils. The label could be easily expanded to include cutworms in tree nurseries with several tests.

There has been a steady decline, dieback, and mortality of West Indies mahogany plantations in the Susua Commonwealth Forest in the southern part of Puerto Rico (Figure 2). This condition has existed since 1956. Although a number of "experts", including nematologists, foresters, and pathologists, have superficially investigated the situation, none could say exactly what was causing the problem. Trees, branches, and roots of dead and declining trees were examined at various intervals of time. A number of theories and suggestions were made as to the cause of the problem, i.e., nematodes, lack of rainfall and other environmental conditions, diseases, insects, etc. Nematocide tests were conducted during the latter part of the 1950's, but no positive results were obtained.

At the time of our visit, trees were continuing to decline and die. Many had already died while others had crowns in various stages of decline and dieback. Trees were approximately 38 years in age and 15 to 50 feet tall. Most of these trees were growing on a very poor site which had shallow, rocky, dry soil. In general, various portions of the plantation had a very unhealthy appearance. In other portions where the soil was deeper and wetter, especially in the alluvial areas next to the river, trees appeared to be more healthy and normally growing. However, along the hillsides individual and groups of larger trees, 30 to 40 feet tall, were dead. Hybrid and Honduras mahogany in the moist alluvial areas were healthy and vigorously growing. Samples from the declining trees were taken for culturing, but no fungal organisms were found.

It is the opinion of the author that further isolations should be made from dead and declining trees to determine exactly what organisms are involved in this complex. It is apparent that the trees growing in the rocky shallow soil are in an unhealthy condition and therefore subject to attack by saprophytic fungi which become parasitic on branches of unhealthy slow growing trees. This in turn causes a state of unhealthiness and so the cycle is annually repeated. There is probably nothing anyone can do to control such a complex, except make future plantings of mahogany on optimum and better planting sites for West Indies mahogany.

## COCONUT PALMS (Cocos nucifera)

A severe infestation of scales on coconut palms, Cocos nucifera, was observed on St. Croix, Virgin Islands (Figure 3). One of the scales involved has been identified as Aspidiotus destructor (Signoret) which is a very serious pest of coconut palms throughout their range. Lever, R.J.A.W. (1969) reports there are about 10 generations of this insect each year. Generally, infestations are most severe in areas of high rainfall where the palms are growing in dense stands. Open grown palms exposed to prevailing winds are reported to be less susceptible to damage.

The damage is characterized by a gradual yellowing of the leaves until they finally die. Close examination of the underside of infested leaves will reveal numerous circular scales 1.5 to 2 mm. in diameter. Heavy populations will almost completely encrust the lower surface of the leaf. Eventually the plant dies due to defoliation. Severe infestations were observed at a number of resorts and along roadsides in St. Croix, Virgin Islands.

Control of this insect is difficult. Malathion is registered for use against scales on ornamentals and has proven effective on young palms in Fiji (Lever, R.J.A.W. 1961. p. 47).

There are numerous parasites and predators of the scale, but none have proven effective in controlling an epidemic even when they destroyed 90 percent of the scale population.

A number of coconut palms were evaluated for the "lethal yellows disease", which is a mycoplasm caused disease that is killing a number of coconut trees in south Florida. There were no trees observed at this time showing symptoms in Puerto Rico or the Virgin Islands. There were a number of new plantings of the dwarf Malayan variety in resorts and on golf courses. This variety is fairly resistant to most insects and diseases including the coconut yellows. All of the trees were growing vigorously and rapidly.

Bud rot (Phytophthora palmivora) of coconut palms still remains to be an isolated problem. Infected trees were noted on the golf courses, in yards, and in resort areas.

A powdery mildew, Phyllosticta sp., was quite evident on the individual leaves of the palm fronds. A number of the individual lesions had coalesced, causing yellowing and necrosis.

A sporophore of Tyromyces graminicola was found growing at the base of a coconut on St. Thomas, Virgin Islands.

## AUSTRALIAN PINE (Casuarina equisetifolia)

Froghopper - Clastoptera undulata

A windbreak planting of Casuarina equisetifolia along the shore line at the Dorado Beach Hotel was infested with a froghopper (Homoptera: Cercopidae), also known as spittle bugs (Figure 4). Species identification will require examination by a specialist in this group.

Large numbers of these insects can cause branch dieback. No such damage was observed, however, at this particular location and none is anticipated. However, if branch dieback does occur, the trees could be sprayed with Chlorpynifos (Dursban®) at 1/2 lb. active/100 gallons water. The spray should be applied uniformly to the entire tree, care being taken to avoid overspraying to the point of excessive runoff. It would be wise to test for phytotoxicity before applying to all of the plantings.

Treatment should be made at the first appearance of spittle on the trees and repeated at 7 to 10-day intervals as required.

The dieback and decline in the Casuarina at Dorado Beach was determined by Liu and Martorell (1973) as Diplodia natalensis. This was a first report on the incidence of this organism on Casuarina. The organism causes top killing by cankers which apparently girdle the tree's main stems, branches, and limbs. Phelps (1972) suggested that a possible control of this disease would be to prune off into healthy wood all infected and dead stems and branches from symptomatic trees. This was done in the fall of 1972 on several group plantings of Casuarina at the Dorado Beach golf course. Although the operation was time consuming and somewhat expensive, observations made one year later showed vigorous, healthy new growth occurring on the trees. It was thick and had a dark green color. It is suggested that several Diplodia infected groups should be pruned each year until all branch and limb infections and infected trees have been removed.

## WHITE CEDAR (Tabebuia pallida subsp. Leterophylla)

In addition to its value as a timber species, white cedar is quite popular for ornamental purposes because of its showy pink flowers. Recent transplants from nearby wooded areas to the fairway of the Dorado Beach golf course were attacked by a shoot borer (Lepidoptera: Pyralidae) probably Pachymorphus subductellus. Repeated heavy attacks by this insect had caused severe dieback of branches at the time of this observation (Figure 5).

Noctuidae) has been causing serious problems (Figure 6).

Trichlorson (Dylox® ) is registered for climbing cutworms on ornamentals and trees at the rate of 1 to 1-1/2 lbs. active per 100 gallons of water. Plants should be sprayed until thoroughly wet. Applications should be made as necessary. A test for phytotoxicity should be made before extensive use. This can be done by spraying several plants with the recommended dosage and observing them for 4 or 5 days for any signs of foliage burn. Zectran and chlorpyrifos (Dursban® ) are also registered for cutworms on ornamental trees at 1/2 lb. active per 100 gallons of water.

A twig borer (Coleoptera: Cerambycidae) probably Lepturges guadeloupensis, was also observed. No chemical controls are available for this insect. On ornamental plantings, root feeding as described for Tabebuia sp., may help to alleviate the problem. In addition, infected twigs should be removed and burned.

Fifteen year old Mahoe trees were observed in field plantations. A number of the trees were blown over and were lying on the ground. Inspection of these showed they had all the roots rotted and rot and brown discoloration extended into the butt log (Figure 7). Tree leaves were still green and were attached to the branches. Infected trees showed a ridging and bark discoloration. No symptomatic sporophores of any fungal organisms were seen. Wood samples for culturing were made, but did not stay in good condition for culturing at a later date. It is suggested that further samples be taken and cultures be made at the University of Puerto Rico plant pathology laboratory at Rio Piedras. There is an apparent serious root rot problem occurring in these plantations.

## EUCALYPTUS (Eucalyptus sp.)

Eucalyptus plantations were observed on the Toro Negro Commonwealth Forest in Puerto Rico. Approximately 25 percent of the trees were affected by a black gumosis throughout the stem of the tree. Black resinous pockets were noticed throughout a cross section of stem when a tree was cut. These appeared as black bleeding streaks on the outer bark (Figure 8). Growth and vigor appeared to be affected in trees showing these symptoms. In addition, several trees in the same plantation were displaying a basal canker and root and butt rot. At a research planting of eucalyptus, three to four year old trees were showing canker and dieback symptoms. This material was cultured and the organism Septobasidium curtisii was isolated. Eucalyptus

has been reported to be attacked by Botryosphaeria ribis which causes cankers on branches and stems and may cause a dieback. This organism may cause stem cankering. A similar problem has been occurring in eucalyptus plantations in south Florida. This has just been brought to our attention. A thorough investigation of this problem will be made during the latter part of February. There appears to be quite a similarity between Florida and Puerto Rico eucalyptus dieback and canker. Eucalyptus is also affected by the trunk rots Polyporus schweinitzii and Fomes applanatus and robustus. These organisms may cause sap and heart rot.

The best control of the black gumosis problem is thinning of the affected trees. This is presently being done. In young trees that show dieback and cankers, pruning of the affected stem or branch into healthy tissue should be done. This could possibly save the tree from mortality.

In the meantime, a concerted effort will be made by Southeastern Area pathologists on their next visit to Puerto Rico to take fresh samples and culture these immediately at the University of Puerto Rico pathology laboratory to determine the causal agent.

## FLAMBOYANT (Delonix regia)

This beautiful large orange-red flowered small tree is one of the most widely planted shade and ornamental trees in Puerto Rico and the Virgin Islands. It is also found as an escape along roadsides and in fields. This tree is quite susceptible to a number of root and butt rot fungi. At the present a number of these trees are dying or declining in the islands. Fruiting bodies of Fomes portoricensis (Overh.) were observed growing at the base and lower trunk of several trees (Figure 9). Another organism found fruiting on the trunk of a dead flamboyant was Ganoderma applanatum (Figure 10).

There is no control of these diseases once a tree has become infected. It would be best to cut and remove infected trees and roots as soon as possible. Once sporophores appear, the tree is in such a diseased condition that it would only be a matter of time before the tree dies. Planting of different tree species not susceptible to the above organisms would be the only effective control measure since replanting the flamboyant would result in death as the tree roots come in contact with the fungal mycelium found in the soil. The only other possibility would be soil sterilization of the planting hole with a soil fumigant.

## BLACK OLIVE (Gre Gre) (Bucida luceras)

This is a widely spread timber, ornamental, and shade tree found over the islands and southern Florida. The tree was found to have a root and trunk rot Polyporus luteorumbrinus (Rom.) Socc. & Syd., on St. John, Virgin Islands. Several trees at Caneel Bay Plantation, although still alive, had most of the basal trunk rotted completely out by this organism. Fruiting sporophores were found at the base of the trees and on several exposed roots.

This organism appears to be not as pathogenic as the other Fomes species found in the islands since the black olive is completely infected, but still remains living. Entrance of this organism into the tree appears to be through wounds and breaks in the roots and bark. However, as the trunk becomes rotted very little support is left to the tree and a heavy wind could cause a blow down. There is no direct control of this disease once a tree has become infected; avoiding bark and root injuries, proper fertilization, and watering will reduce chances of infection.

## CASIA (Cassia sp.); GUABA (Inga vera); MANJACK (Cordia sp.); ACACIA (Abbizzia lebbeck)

These trees are found throughout Puerto Rico and the Virgin Islands as shade, ornamental, and forest trees. Polyporus lucidus (Leys ex Fr.) sporophores have been found on all the above tree species which were dead or in a state of decline (Figure 11). They have been found at the base of the trunk or on exposed wounded roots. Evidence showed that most of these trees had mechanical wounds in the trunk or on the exposed roots where the fungus had entered the tree. It was also evident that the organism, once it had gained entrance to the root system, had spread to other healthy trees by root grafts. There is no direct control of this disease once it has entered the tree. However, by avoiding bark and root injuries, proper fertilization and watering should reduce incidence of infection. When these trees are used as ornamentals in yards and on golf courses extreme care should be taken when grass cutters or mowers are used, since any wounds caused by this equipment would open up infection points for invasion by this fungal organism.

## KAPOK (Ceiba pentandra)

An unknown insect has caused serious defoliation of Kapok in St. John, Virgin Islands, both at Caneel Bay Plantation and the Virgin Islands National Park. Unfortunately, the feeding period was apparently over at the time of this observation. Only large trees were observed to have been attacked and they suffered about 50 percent defoliation. Since it was impossible to get to the crown of the trees, close examination of the damage was impossible.

Efforts should be made to collect specimens of the insect causing the damage. Unless similar damage is observed on smaller Kapok trees in the area, it will be necessary to sample the larger trees. This could be done most satisfactorily by an agile climber. Once the causal agent has been determined, suitable action can be taken.

## BUCARE (Erythrina indica)

Two caterpillars (Lepidoptera: Pyralididae subfamily Pyraustinae) were found boring in shoots of Erythrina indica at Dorado, Puerto Rico. Two species are mentioned by Wolcott as doing this type of damage in Erythrina species Agathodes designalis and Terastia meticulosalis. Both of these insects can cause severe damage to the shoots. In addition to boring into the shoots, A. designalis acts as a leaf roller and causes defoliation.

No chemicals are registered for controlling these insects, but some control may be achieved on ornamentals by pruning infested shoots and destroying them. If chemical control is considered essential, tests should be conducted to satisfy registration requirements. Two chemicals which, in the author's opinion, would warrant testing are dursban and carbofuran. The latter is a systemic and may kill larvae after they have entered the shoot.

What is probably the black scale, Saissetia oleae (Bernard), was found on twigs of E. indica at Dorado, Puerto Rico. This scale is a serious pest of citrus trees in California, but according to Wolcott (1948) has never been a serious problem in Puerto Rico.

Malathion is registered for black scale crawlers, if control should become necessary. This may be formulated by mixing 2.5 pints of malathion and 57 percent E.L. with enough water to make 100 gallons of spray. Carbophenothion (Trithion® ) is also registered for this use at 3/4 to 1 lb. active per 100 gallons of water.

Application must be made when the crawlers are active and repeated once or twice in 10 day intervals. This pesticide is not effective against adult scales.

## KADAM (Anthocephalus cadamba)

Damage to leaves of kadam, Anthocephalus cadamba, was observed on the Liquillo National Forest, Puerto Rico (Figure 12). This damage was reported on by Geary, T.F., 1970 (unpublished report) and Phelps, W.R. and Landgraf, A.E., 1972; and is of concern because of possible impact on the growth rate and/or survival of this valuable timber species.

Geary reported that this species of thrips, Selenothrips rubrocinctus (Giard) attacks physiological old leaves of cocoa and cashew in Trinidad. This same pattern of attack seemed to occur on kadam in Puerto Rico. According to people familar with the problem, the thrip attacks do not become noticeable until the leaves are nearly ready to drop. Under such circumstances, the impact on the tree should be minimal. This could be checked by a routine growth study to check height and diameter changes with time. If it is determined that the thrips damage is causing a significant reduction in growth, possible solutions are growing kadam in mixed stands and/or selection of resistant clones. The latter has apparently been successfully done with cacao in Trinidad to reduce damage by this species of thrips.

Chemical control does not appear necessary at this time since it would not be economically practical or justifiable economically. Registered pesticides which could be used include sevin, malathion and guthion.

## ROSEWOOD (Pterocarpus indicus)

Rosewood is an introduced ornamental and shade tree into Puerto Rico. The tree is nearly evergreen and has fragrant white flowers. It is an important timber tree in the Far East.

Several of these trees were observed at Palmas del Mar resort where they had been transplanted into an arboretum. Each tree had an elongated canker several feet in length on the main trunk girdling the tree about 50 percent (Figure 13). There is an apparent fungal organism causing rot and decay; however, no sporophores were evident. It would be necessary to culture infected wood to be able to identify the causal organism.

The only possible way to eliminate this canker disease would be by mechanical excision. Diseased wood should be cut away from the margin of the canker into healthy tissue and then a good wound paint should be applied to the cut surfaces. Since this is a rapid growing tree, good callus tissue should be formed quite rapidly.

There was a caterpillar feeding on the leaves of the trees. This was identified as belonging to the family Sthingidae. There are no registered pesticides for control of this pest.

Oleander sp.

Larvae of the moth Empyreuma pugione (Linnaeus) (Lepidoptera: Amatidae) have been causing serious defoliation of Oleander sp. planted in a reflection pool at the entrance to the Cerromar Beach Hotel, Dorado, Puerto Rico. This insect is reported to be specific to Oleander (Figure 14).

Adult female moths deposit their round yellow eggs at regular intervals on the underside of leaves. After an unspecified length of time the hairy caterpillars hatch out and begin their feeding. The larval stage lasts about 26 days. As a general rule, most of the noticeable defoliation caused by caterpillars occurs during the last third or quarter of the larval development. On completion of their development, the larvae metamorphose into the pupal stage which lasts for about 13 days. There is no record on the number of generations this insect has per year.

The location of these Oleander bushes in a reflection pool containing fish and other desirable aquatic life makes control with conventional pesticides risky. If practical, the caterpillars could be picked off by hand and destroyed or knocked off with a high pressure stream of water. Alternatively, Dylox® is one of the few pesticides which might be safely used to control the caterpillars without destroying the delicate natural balance established in the pool. It is not registered for use against this insect or for this host, however. If resorting to a pesticide is the only practical approach, it is suggested that a test be conducted to determine the efficacy of this pesticide for controlling E. pugione. The test must be designed to provide the manufacturers with information on the degree of control, phytotoxicity and impact on other organisms.

YELLOW POINSETTIA

A wood borer, Apate monacha Fabricius (Coleoptera: Bostrychidae) was found causing serious damage to yellow poinsettia nursery stock at the Palmas del Mar resort, Humacao, Puerto Rico.

This insect is quite widespread, being commonly found boring in the trunks and branches of dying trees. Normally, attacks are restricted to recently cut or dying material; but when the population is high, living trees are readily infested.

Adult females lay their eggs in the large galleries they construct into the heartwood of the host tree (Figures 15 & 16). On hatching, the larvae mine through the heartwood until their development is completed. They then emerge to attack other trees in the immediate vicinity.

Mortorell, 1948, suggested several methods of controlling this pest which, in light of the restrictions on the use of pesticides, are as sound today as when he made them. First, he suggested destroying all brush in the area suitable for the insect's development. This should have a substantial impact on the population and reduce the pressure on the few remaining individuals to attack living trees. Secondly, adults can be killed while in their galleries by using a soft wire (No. 6 or 8) to "spear" them. For effective control, the adults must be killed before laying their eggs. This requires constant vigilance when a population is known to exist in the area. Chlordane has a registration for borers in poinsettias at the 1 lb. active/100 gals. rate.

Some systemic pesticides would probably be effective against this insect also, but again, this would require testing designed to collect efficacy data for eventual registration of the compound. One such compound is carbofuran (Furadan) which has been shown to be effective against some boring insects.

## Canna sp.

A species of Canna, a rush-like aquatic plant, had been attacked by an unknown Lepidopterous defoliator. The plants were located in the reflection pool at the entrance to the Cerromar Beach Hotel where the use of pesticides might destroy the fish and other aquatic life essential to the pool environment.

In the absence of a registered pesticide, the caterpillars could either be knocked off with a high pressure stream of water or picked off by hand. Alternatively, a test could be conducted to collect efficacy data on a pesticide, such as Dylox, which has a minor impact on fish and aquatic insects.

## LUCKYNUT (Thevetia thevetia)

A caterpillar, possibly Diaphania flegia Cramer, was found defoliating the luckynut tree on St. John, Virgin Islands. No pesticides are registered for use against this type of insect on ornamentals.

On high-value ornamentals, the caterpillars could be dislodged with either a high-pressure stream of water or by vigorously shaking small trees or shrubs. To be effective, these techniques should be used when the larvae are about half grown but before they enter their main feeding period. Once on the ground the larvae should be destroyed by crushing, etc.

## SEA GRAPE (Coccolobis uvifera)

Several insects were found on sea grape, Coccolobis uvifera, which is a very valuable plant for windbreaks and beach erosion control in Puerto Rico and the Virgin Islands.

The most common insect was a leaf-rolling weevil, Euscelus coccolobae Wolcott. This insect did not appear to be causing any serious damage to the host plant and its rather interesting habits may make it of interest to tourists visiting the area.

A Lepidopterous tip moth was found infesting the terminals of sea grapes on the Virgin Islands National Park, St. John, Virgin Islands (Figure 17). At the time of this observation the infestation was relatively light. A severe infestation, however, could weaken the host plant by continually killing back new growth. It is the author's opinion that such an occurrence is unlikely and that control measures are unnecessary.

A leaf miner, probably Eunebristis zingarella, on young sea grapes was observed at the Palmas del Mar resort at Humacao, Puerto Rico (Figure 18). This insect would probably not reach high enough population levels to cause serious damage to the host, but may be objectionable from an aesthetic standpoint. Chlordane is registered for leaf miners at the 1 lb. active/100 gals. water rate on shrubs and trees and could be used if necessary.

Perhaps the most serious pest of sea grape is a stem borer tentatively identified as Psychonoctua personalis (Lepidoptera: Cossidae) (Figures 19 & 20). Stem borers were observed in the main trunks of large sea grapes at Caneel Bay Plantation, St. John, Virgin Islands. The damage cuased by these insects results in structural weakness of the plant

and opens it up to decay organisms. Infested plants might be expected to suffer breakage in light to moderate winds.

One of the best ways of controlling borers such as this is to insert a soft wire into the hole made by the borer in an effort to stab the caterpillar. Although it sounds rather primitive, it is a very effective technique. This is particularly true because these insects are seldom present in great numbers and their attacks are quite readily seen. Chlordane and lindane are both registered for borers in trees and could be used if necessary.

### Cassia javanica (syn. nodosa)

A small lepidopterous larvae was observed feeding on this species at the Commonwealth Forest Nursery at Monterrey, Puerto Rico. Damage was of the leaf roller and/or tier type. Carbaryl (Sevin) is registered for leaf rollers and could be used for this type of insect.

## STARGRASS

A pasture at the Commonwealth's Monterrey Nursery was infested by at least four species of caterpillars (Lepidoptera: Noctuidae and Geometridae). Occasionally damage caused by these insects reached intolerable levels and required control.

Diazinon is registered for armyworms and cutworms in turf and should provide satisfactory control. The pesticide should be applied at the first sign of these insects and repeated as necessary. Care should be taken to follow the label directions strictly. Zectran 2E is also registered for armyworms and cutworms in turf and ground covers. A spray solution can be made by mixing 1.5 quarts of Zectran 2E per 100 gallons of water. Treatment should be made after a rain or a thorough watering of the turf. The spray should be applied at the rate of 1 gallon per 130 to 180 square feet. Children and animals should be kept out of the area until the spray has dried.

## ORNAMENTAL SHRUBS

### Chrysolidocarpus lutescens, Gliricidia sepium, and Claeodendrum xylocarpum

A variety of scales (Homoptera: Coccoidea) were observed on these plant species. Some plants were heavily infested and may suffer branch dieback or die completely. Other plants were covered with "sooty mold", a fungus (Capnodium) which grows on the "honeydue" excreted by the scales. This mold makes the plant quite unattractive

and is therefore objectionable from an aesthetic point of view.

On ornamental flowers, shrubs, vines, trees (shade and flowering), and evergreens, Zectran 2E can be used against aphids, soft scales, scale crawlers, mealybugs, whiteflies, and mites. This should be mixed in the proportion of 1.5 quarts of Zectran 2E per 100 gallons of water. Plants must be thoroughly wetted on both the upper and lower leaf surfaces. The latter is particularly important with regard to scale crawlers. It would be prudent to test for phytotoxicity before making general applications.

Zectran is a very short-lived compound. It is therefore essential that the spray be timed to coincide with scale crawler emergence. Re-treat as necessary. Carbaryl, Trithion®, or Malathion are also registered for this use and could be used if necessary.

## POOR MAN'S ORCHID (Bauhinia monandra)

A twig girdler (Coleoptera: Cerambycidae) was collected from Bauhinia monandra on St. John, Virgin Islands. Damage was not severe at the time of this observation, but could become so if the attacks persist (Figure 21).

It is difficult to control insects causing this type of damage with pesticides. Under the circumstances, trees and shrubs infested by this insect should have the infested twigs pruned off and burned. Maintaining the vigor of the tree with a root feeding program should also help reduce the impact of this insect on its host.

A number of tree leaves were showing a stunting, yellowing, and mottling. These are typical virus-like symptoms. Trees showing these signs should be rogued from the nursery and burned.

## MONTERREY COMMONWEALTH NURSERY

The Monterrey Nursery located near Dorado Beach is a commonwealth Department of Agriculture installation. Many kinds of tropical fruit trees, shrubs, and improved vegetable seed are grown here for sale to the public. The nursery also grows some forest trees such as mahogany, mahoe, casuarina, and tropical pines (Pinus caribaea). (There were a number of insect and several disease pests observed here. These have been described under the headings of the tree species affected.) Much of the tree culture here is in cans or plastic packets containing soil (Figure 22). The pine seedlings are germinated and then planted into individual packets and allowed to grow. No fertilizer

or pesticides were used. The general appearance of most of the seedlings was not too good. They were yellowed and stunted. A large area where they were being held, while growing, showed some seedlings healthy while others were stunted and yellowed. Seedlings growing next to a lathe windbreak looked the best while those in the center of the area were unhealthy. Some advice has been given by the Institute of Tropical Forestry in how to grow good healthy seedlings for public distribution, but a good complete nursery program should be outlined and given to the nursery manager, especially for pine trees. Forest trees apparently play a secondary role to growing orchard and other ornamental shrubs and trees.

## ENVIRONMENTAL POLLUTION

As was stated in the report by Phelps and Landgraf (1972), air and water pollution problems are becoming quite evident in Puerto Rico and St. Croix, Virgin Islands. Many new industrial complexes and electrical generating plants have been built in and around San Juan and Ponce, Puerto Rico, and a petroleum refinery near Christiansted, St. Croix, Virgin Islands. Air Pollution problems were already evident with smoke, acrid mists and odors from oil and gas refineries, and dust particles from cement plants (Figure 23).

The area around Ponce, Puerto Rico, was especially affected by air pollution. Numerous dark acrid smoke plumes were noticeable from burning petroleum refining complexes and natural gas wells. Large clouds of smoke and dust particles were being emitted from cement plants. Thousands of acres of vegetation were noticeably affected by these air pollutants near Ponce. A large electric generating plant and a cement factory were emitting great plumes of smoke and dust near San Juan. A number of roadside trees had been killed near a sugar mill which emits large amounts of smoke when bagasse is being burned for power. As the islands become more industrialized, increased air pollution problems will become more evident.

## GENERAL COMMENTS AND RECOMMENDATIONS

Now that we have a good idea of the types of insect and disease problems on trees and ornamentals one might encounter in Puerto Rico and the Virgin Islands, we are in a better position to make several general recommendations on how to handle these problem areas. The majority of problems in this area are shade and ornamental trees with plantation forest trees next. There are very few areas in the world which could claim higher values on shade and ornamental trees and

shrubs than these Caribbean Islands. Despite this, no one is working in this field of entomology/pathology. Entomologists and pathologists currently employed by the University of Puerto Rico and the U.S. Department of Agriculture are mainly concerned with agricultural and orchard insects and diseases. The University of the Virgin Islands on St. Thomas does not have anyone in the pest control field. There is a dire need and a more than sufficient workload on non-agricultural insects and diseases in Puerto Rico and the Virgin Islands to justify a pest management specialist. It is our opinion that the Southeastern Area administration take a hard look at this situation and either through a cooperative agreement with the Commonwealth of Puerto Rico (University of Puerto Rico) or the Virgin Islands Department of Agriculture place a qualified entomologist/pathologist at the Institute of Tropical Forestry, the University of Puerto Rico or the University of the Virgin Islands.

In the meantime, insect and disease problems require immediate attention and because Forest Pest Management specialists make only one evaluation trip each year it is suggested that someone in Puerto Rico be trained to handle routine pest problems. This individual could collect specimens and samples and ship these to our Asheville, North Carolina, field office. He could also be the liaison between the requester and our pest management people, requesting the necessary information they need. Mr. Jose Zambrana, State and Private forester at the Institute of Tropical Forestry, would be an excellent man for such a position and has expressed interest in doing this type of work. By providing technical backstopping to someone like Mr. Zambrana, we could greatly increase our ability and effectiveness in providing expertise and service to the Caribbean area. He should spend several weeks at our Asheville field office learning what he can about techniques and methodology in insects and diseases. He would then become a big asset in our pest management program in the islands. We will inform him when the best time would be to spend some time in Asheville. This would probably be this spring or early summer.

A second area of concern is the lack of registered pesticides for many of the insect problems that we observed. A great deal of testing needs to be done in order to comply with present pesticide legislation. One alternative to accomplishing this job is to get pesticide manufacturers in contact with field people, resort horticulturists, university entomologists and pathologists in Puerto Rico and the Virgin Islands so they can pursue field tests without our direct involvement. Perhaps the pesticide coordinator of the Environmental Quality Evaluation Group could give some help in these areas.

There are several disease problem areas that must be investigated on the ground in Puerto Rico. This means that a pathologist must spend at least a month collecting samples for laboratory culturing on the spot. This could be done with the cooperation of the University of Puerto Rico, Plant Pathology Department. The specific areas are (1) decline and mortality of West Indies Mahogany in the Susua, (2) gumosis, rot, and decay of Eucalyptus on the Toro Negro, in addition to canker and dieback in young plantations, (3) root rot of Mahoe, (4) canker disease of Pterocarpus indicus, and (5) other miscellaneous problem areas.

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Figure 1. A fresh attack by Hypsipyla grandella on a young cedrella tree, St. Croix, Virgin Islands.

Figure 2. Dieback and decline of West Indies mahogany at Susua Commonwealth Forest, Puerto Rico.

Figure 3. A row of coconut palms displaying symptoms of an infestation of the scale Aspidiotus destructor, St. Croix, Virgin Islands.

Figure 4. The small white frothy mass in the center of the photo indicates the presence of froghopper nymphs, Dorado, Puerto Rico.

Figure 5. Repeated attacks by a shoot borer, possibly Pachymorphus subductellus, have drastically reduced the photosynthetic area of this white cedar and left its survival in doubt.

Figure 6. Damage to leaves of mahoe, Hibiscus elatus, caused by a climbing cutworm.

Figure 8. Eucalyptus showing black gumosis streaking in bark and cross section of trunk.

Figure 9. Fruiting bodies of Fomes portoricensis on Flamboyant.

Figure 10. Fruiting bodies of Ganoderma applanatum on Flamboyant.

Figure 11. Fruiting bodies of Polyporus lucidus on Albizzia lebbeck.

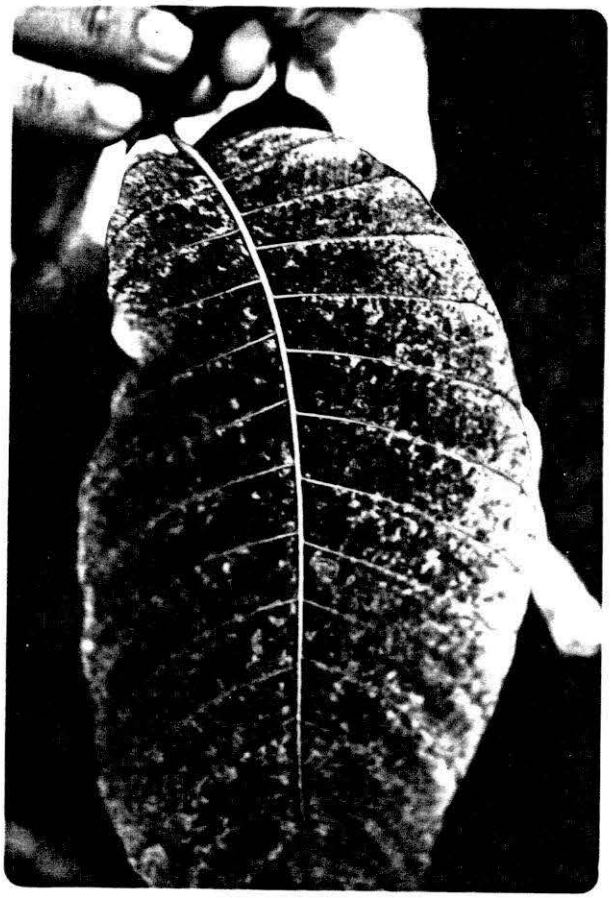

Figure 12. Typical damage to leave of kadam caused by Selenothrips rubrocinctus.

Figure 13. Canker on main stem of Pterocarpus indicus.

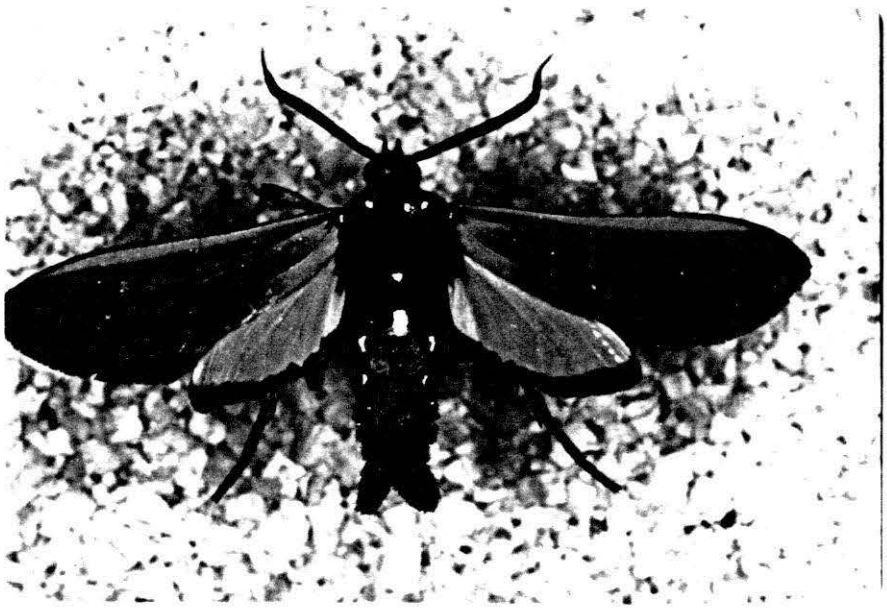

Figure 14. The adult moth E. pugion. Larvae of this moth causes serious defoliation of Oleander.

Figure 15. Dark spots on stem indicate entrance holes of the wood borer, Apate moncha.

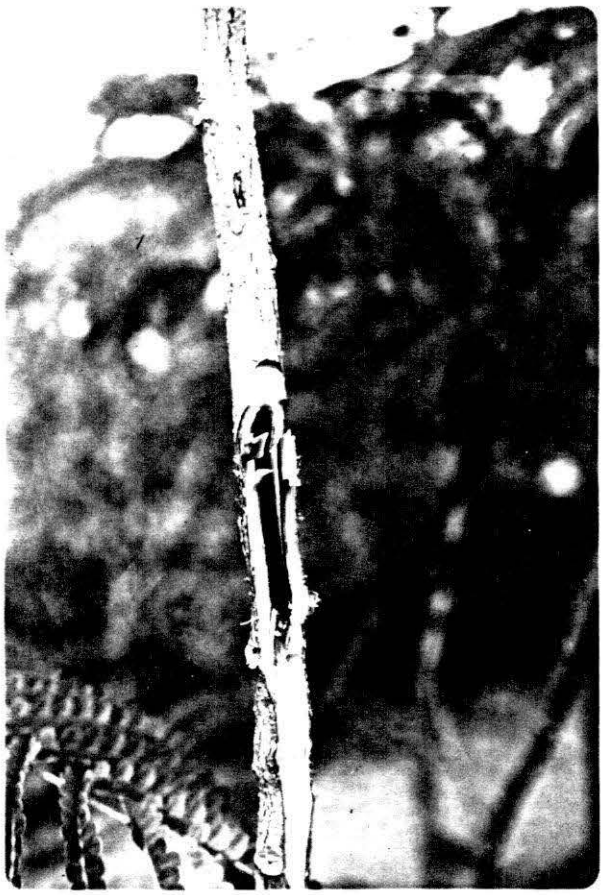

Figure 16. Section of stem showing length of gallery constructed by adults A. moncha.

Figure 17. This shoot on a sea grape, Coccolobis unifera, was killed back by an unknown lepidopterous borer.

Figure 18. Mines of what is probably Eunebristis zingarella in leaves of a young sea grape.

Figure 19. Canker-like wounds and surrounding stain caused by a stem borer, possibly Physhonoctua personalis, in sea grape.

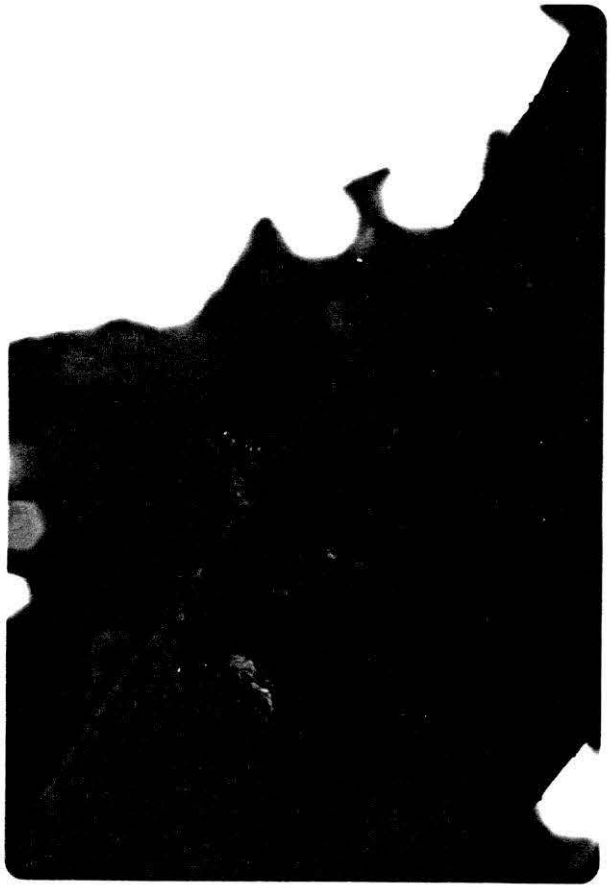

Figure 20. A pupal case of a moth, possibly P. personalis, protruding from the main stem of a sea grape.

Figure 21. Damage to main leader of Bauhinia monandra caused by an unknown twig girdler.

Figure 22. Pinus caribeae growing in plastic packets at the Monterrey Nursery, Puerto Rico.

Figure 23. Sources of air pollution in Puerto Rico.

Figure 24. Fruiting bodies of trunk and butt rot on Tamarind.

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