

January 1969

1. General

The Western Forest Insect Work Conference will be at Coeur d'Alene, Idaho during the week of March 10-14, 1969.

Mr. John W. Dale, Research Fellow, University of Idaho, is currently studying the cone and seed insects of ponderosa pine in Idaho under the guidance of Dr. John A. Schenk.

Alan Hedlin is now conducting studies on cone and seed insects of white spruce. With the completion of these studies, there will be decreased emphasis on cone and seed insect studies at this laboratory. (Hedlin - B. C., Canada)

Mr. Kazumi Kobayashi from Meguro, Tokyo will spend a year in Canada commencing February 1969. His headquarters will be Victoria, B. C., but he will visit a number of other laboratories in North America during the year. His interest is cone and seed insect studies, more specifically chemical control.

One of the objectives of the new seed and cone insect project at Mississippi State University is "to determine the entomophages and host relationship of major pine cone and seed destroying insects". Mr. Clyde Sartor, who holds a M.S. degree from the University of Mississippi, is presently involved in this research project. The title of his dissertation proposal is "The Biological Annotation of Pine Cone Insects in Mississippi". (Neel - Miss.)

"Our studies here at V.P.I. are beginning on southern cone and seed insects. As of now we have no formal projects, but they'll be drawn up this spring." (Heikkenen - Va.)

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<sup>1/</sup>Compiled from information submitted by workers conducting research on cone and seed insects. Not to be published without the consent of the contributor. Assembled by E. P. Merkel, Naval Stores and Timber Production Laboratory, Olustee, Florida.

## 2. Insect Identification

We have devised reliable means to separate adults of two rather similar cone moths, *Eucoema monitorana* and *E. tocullionana*. This will appear in a forthcoming guide to the Olethreutid moths of the upper Midwest. (Miller - Minn.)

Immature forms of all insects from spruce are being reared for adult material and positive identification. (Hedlin - B.C.)

During the fall of 1967, second-year cones were received from industry, state, and federal cooperators from Virginia to Texas. Pine species collected were loblolly (*Pinus taeda* L.), shortleaf (*P. echinata* Mill.), and Virginia (*P. virginia*). Pre-rearing samples indicated that all three pine species were attacked by *Laspeyresia* spp. The remainder of the samples were overwintered in the field, and in early spring brought into the insectory and caged for emergence of parasite and moth adults. Over 244 *Laspeyresia* spp. adults were collected, pinned, and submitted for identification. Post-rearing cone samples indicated an appreciable number of diapausing *Laspeyresia* larvae still within the cones. Samples containing such larvae were retained for further rearing. A similar request for cones has been sent out this year so that this study may be repeated. (Ebel - Ga.)

## 3. Damage

Damage estimates were continued in various ponderosa pine stands throughout the state. Emphasis was placed on *Laspeyresia* spp. (I believe the species to be *L. miscitata* Heinrich, and *L. piperana* (Kearf), but I have not yet received confirmation.) Other species considered wherever encountered were *Dioryctria abietella* (D. & S.) and *D. auranticella* (Grote), *Conothonus ponderosae* Hopkins, and *Leptoglossus occidentalis* Heideman. *Laspeyresia* continued to be the most ubiquitous species with *C. ponderosae* the most damaging where found.

Many of the cones infested with *Dioryctria* partially open to release some seed. Feeding in these cones is usually confined to the scale tissue. A seed germination study is now under way in hopes of gaining some estimate on any effects such feeding might have on seed viability. (Dale - Idaho)

Life table study of cone survival in red pine SPA's (1967-1970).--  
In seven SPA's we have made estimates of the numbers of 2- to 3-week-old conelets, 3-month-old conelets, 11-month-old conelets, mature cones, and seeds surviving per cone. At three of the areas, greatest mortality (35 to 50 percent) occurred during the first 3 months of cone development. Major causes of losses in this period were *Dioryctria disclusa*, *D. zimmermani*, *Conophthorus resinosae*, and *Choristoneura pinus*. At the other areas, the most substantial losses occurred during the last 4 months of cone development, the primary pest being *C. resinosae*. Number of seeds surviving per cone are being analyzed. (Mattson - Minn.)

*Pegohylemyia* sp. is a serious seed destroyer in white spruce. *Laspeyresia youngana* (Kft.) is also a serious pest. At least three species of cecidomyiids occur in white spruce cones, the most common of these being the axis midge. None of the midges cause direct seed damage. Since seed is not being produced in seed orchards yet these insects are not of real economic importance. *Pegohylemyia*, *Laspeyresia youngana*, and the axis midge are potentially of economic importance. (Hedlin - B.C., Canada)

We have kept records on cone damage in our slash pine seed orchard and three loblolly seed orchards. Losses directly attributable to insects in Texas in 1968 were 3% of the loblolly conelets and 17% of the cones. In slash the losses were zero to conelets and 4% of the cones. Nearly all this damage can be ascribed to *Dioryctria amatella*. (Ollieu - Texas)

Observations were made of 1240 loblolly conelets in the spring and fall of 1968. Mortality factors in combination (insects, abortions and unknowns) caused a 30% reduction of the conelets which reduced the total to 840. Mortality factors in combination caused a 27% loss of the cone crop (second-year fruit) in 1968. Therefore, assuming the cone loss will remain constant next year, we can expect the 1240 conelets to yield 635 cones in 1969. This would be a total reduction over two years of 49%. The same logic applied to the slash crop would show a 45% reduction. (Ollieu - Texas)

An average of 39 percent of the cones were infested by insects in the five shortleaf pine seed production areas on the Clark and Mark Twain National Forests in Missouri. Cones in the one SPA (loblolly pine) on the Shawnee National Forest in Illinois were attacked by seed insects, which infested 11 percent of the cones. For 1969 a moderate infestation in a light cone crop is predicted. In loblolly pine attacks were by representatives of *Laspeyresia* and *Rubsacamenia*. In shortleaf pine most attacks were by insects from the genera *Conophthorus*, *Dioryctria* and *Eucosma*. Species from *Laspeyresia* and *Rubsacamenia* also attacked. (White - Ohio)

One hundred cone-bearing shoots on each of five open-grown shortleaf pine trees were tagged and damage and mortality recorded at 2-week intervals throughout the season. Study trees were divided into four quadrants and three height levels. Preliminary results of this first season may be summarized as follows. The most frequent cause of early season conelet mortality was *Rhyacionia* spp. (25% of conelet mortality). Remainder of the conelet loss was probably due to abortion (cause unknown). *Leptoglossus* nymphs were quite frequently found feeding on conelets and the possibility exists that this may have contributed to this conelet abortion. Only occasional damage by Cecidomiidae and *Dioryctria* spp. was recorded. Second-year cones were damaged by *Eucosma* sp. in May and June only. *Dioryctria* spp., primarily *D. amatella* and *D. sp. nr. zimmermani*, and Cecidomiidae accounted for most of the second-year cone loss throughout the season. Considerable *Leptoglossus* sp. feeding was found throughout the season (primarily adults). Overall impression is that second-year cone losses on study trees during 1968 season were generally light. (Ebel & Yates - Ga.)

A survey at logging operations in several counties in Mississippi during 1967 revealed that the average infestation rate of second-year loblolly pine cones and shortleaf cones partly or completely destroyed by *Dioryctria disclusa* larvae was as follows:

County	Cones Partly or Completely Destroyed	
	Loblolly	Shortleaf
Kemper	3.3%	0.1%
Lauderdale	13.9%	3.8%
Oktibbeha	23.8%	15.8%
Winston	13.0%	6.4%

For this same period of cone inspection (April through August) second-year slash and longleaf cones, collected in Forest County, were infested respectively at the rate of 20.7% and 20.1%. The damage caused to these cones by *D. disclusa* and *D. amatella* was such that no seed production was possible. (Neel - Miss.)

#### 4. Biology, Ecology and Physiology

Biological data has been gathered in conjunction with the collections for damage assessment. Emphasis has been placed on *Laspeyresia* sp. and *C. ponderosae*. The biggest problem has been in obtaining eggs of *Laspeyresia*, and thus far, attempts in the laboratory have been unsuccessful even though matings have been observed.

Studies are under way on the relationship between temperature and diapause in *Laspeyresia* sp.

I am also attempting to estimate the populations of *Laspeyresia* sp., *Dioryctria* sp., and *C. ponderosae* at the study sites where they are found. The major hindrance is an easy method for obtaining an estimate of the cone crop. I am now working on a method whereby the total cone population can be easily estimated from observations made while cruising the stands. However, damage by *C. ponderosae* can only be estimated by climbing several trees. (Dale - Idaho)

Population dynamics of *Dioryctria disclusa* on red pine (1968-1970).--  
Samples have been collected for estimation of early larval, late larval, and adult population densities, as well as average fecundity. So far, we have analyzed only late larval and adult population samples. At Birch Hill SPA--60 late-instar larvae/tree, trees averaging 10 cones per branch--50 percent of the larvae survived to the adult stage (=1,700/acre). At Portage Lake SPA--20 late-instar larvae/tree, trees averaging 2 cones per branch--10 percent of the larvae survived to the adult stage (=270/acre). No more than 20 percent of the late-instar larvae in either area were parasitized. (Mattson - Minn.)

Brief life history and behaviour studies are being conducted on *Pegohylemyia*, *Laspeyresia youngana* and the axis midge in white spruce. *Pegohylemyia* and the axis midge occur in both white and black spruce cones. It has not been determined whether or not these are the same species. (Hedlin - B.C., Canada)

Eighteen different parasitic species have been reared from insect-infested pine cones. Hymenopterans belonging to the families Ichneumonidae, Braconidae, Platygasteridae, Megachilidae and Eulophidae, and Dipterans belonging to the families Chloropidae and Tachinidae are parasitizing one or more of the cone insect pests. *Dioryctria* spp. may be serving as an alternate host for introduced and native parasites of a closely related species, the European corn borer, *Ostrina nubilalis* (Hubner) (Lepidoptera: Pyralidae) in this state. An undetermined *Lixophaga* sp. (Diptera: Tachinidae) has been reared from corn borer larvae collected in the northeast part of the state. This is significant in view of the fact that *Lixophaga* spp. have been reared from *Dioryctria* spp. in other states. (Neel - Miss.)

Black light traps were run throughout the 1968 season in three locations in Clarke County, Georgia, to detect seed and cone insect activity. Over 1,000 moths have been pinned and prepared for submission to the U. S. National Museum. Distribution of peak catches of adults suggests: (1) at least two species of *Laspeyresia* are present in this area; (2) *Dioryctria clarioralis* has three generations per season; and (3) *Dioryctria amatella* adults are available throughout the entire season with no distinct peaks. One *Dioryctria abietella* was collected during the season. *Dioryctria* sp. near *zimmermani* occurred only in the fall, indicating a single generation per season. *Nepytia* sp., a known external feeder of pine flowers and foliage, was collected in mid June. *Leptoglossus* sp., a common bug attacking pine cones, was very rarely collected in light traps. (Ebel & Yates - Ga.)

The morphology of the reproductive organs and spermatophore of *Dioryctria abietella* was determined. These organ systems were similar to the general morphological characteristics of other moths. Eggs were found present in the bulla seminalis of many females, but did not cause complete blockage of sperm transmission. The number of oöcytes within each of the eight ovarioles comprising the two ovaries varied from 24 to 62, with newly emerging females containing the greater number. The aperture end of the spermatophore exhibited a small horn with a serrulate surface, which probably serves to maintain its alignment with the opening to the ductus seminalis. Only one spermatophore was found in the bursa copulatrix of each female dissected regardless of the length of time exposed to males within a mating cage. Further experiments are planned to determine whether or not multiple matings occur within this species. (Fatzinger - Fla.)

Studies were conducted this summer to determine the degree of attractancy of the sex pheromone produced by *Dioryctria abietella*. Live virgin females were placed into tanglefoot traps arranged systematically throughout a 6' x 6' x 9' walk-in-type screen cage. The experiment was replicated three times and resulted in an average of 13 percent (range from 10.5- to 15.3 percent) of the males being attracted to the females. One experiment, during which males were placed into the tanglefoot traps and females were released into the cage, indicated that females are not attracted to males. The study is being continued to determine alternate methods of measuring the degree of attractancy, the site of pheromone production in females, time of pheromone production, and behavior of males and females during periods of pheromone production. The effects of seasonal differences in temperature, light and humidity on the degree of attraction will also be examined by conducting the experiments periodically throughout the year. (Fatzinger & DeBarr - Fla.)

A meridic medium, termed the WGCS medium, was developed which permits rearing *Dioryctria abietella* through successive generations with higher survival, fecundity and growth rate than when the insect was reared on pine cones. Investigations are currently in progress to determine a method of mass producing *D. abietella* on this medium. Exploratory studies have indicated that larvae of *D. amatella* can also be reared on the WGCS medium with about equal survival to that obtained when reared on pine cones. However, the low fecundity of adults reared prohibits rearing successive generations within the laboratory. The effects of temperature, light, humidity and oviposition surface on fecundity are being investigated to determine methods of increasing egg production. (Fatzinger - Fla.)

Experiments are presently being conducted to determine a method of bioassay for screening feeding stimulants extracted from first-year, slash pine cones for *Dioryctria* spp. larvae. Previous experiments with cone material and artificial media indicated that the need for a feeding stimulant may decrease with increasing larval age. Extracts of cones to locate carrier solvents for the feeding stimulants are being prepared by sequential extraction in Soxhlet extractors using a series of solvents of increasing polarity. Preliminary experiments indicated that an active substance may have been extracted with methanol, but further testing is required. (Fatzinger - Fla.)

## 5. Control

Douglas-fir cone crops were abundant in Oregon and Washington this season. Seed production area and seed orchard managers were anxious to reduce seed losses caused by *Contarinia* species, *Barbara colfaxiana* and *Dioryctria* species. Three helicopter spray projects and one ground hydraulic operation were carried out.

Helicopter spray formulation was more sophisticated this season. It was based on a formulation developed by Dr. Bohdan Maksymiuk for microbial helicopter sprays. Our mixture contained dimethoate, Monawet, MO-70 (one percent active), Antifoam H-10 (0.1 percent active), and Leucophor C-620B (one percent active).

Results were disappointing. The fluorescent tracer could not be located on sprayed conelets or foliage except where large droplets impinged. Bags covering branches with Krome-kote cards attached showed spray deposition very well. Seed yield was not increased. The following table summarizes cone and seed insect helicopter spraying done in this Region since 1965. These data show that spraying can be effective.

	<u>Dimethoate Percent Active</u>	<u>Gallons Per Acre</u>	<u>Droplet Size MMD</u>	<u>Percent Yield Increase</u>
Buckhead - 1965	1-1/2	10	700	63
Minnow Hill - 1966	2	10	700	49
Christie Flat - 1968	1/2	10	450	0
Demie Ahl - 1968				
Area A	1/2	5	450	0
Area B	1/2	10	450	0
Buckhead - 1968				
Area A	1	5	450	0
Area B	1	10	450	0

The hydraulic spray project was more successful. The Muddy Fork seed production area on the Gifford Pinchot was established in 1967. This was the first Douglas-fir cone crop in the area and cones were found infested with *Barbara colfaxiana*. About 180 trees were treated with a one percent active dimethoate spray. Application rate varied between 2 to 3 gallons of spray per tree. Seed yield was increased 43 percent.

Field testing of hydraulic-applied dimethoate is considered successful and recommended for field use in our seed production areas and orchards. Because of economics, we will recommend that trees supporting a minimum of 1 bushel of accessible cones be treated.

Western white pine, blister rust resistant, grafted stock at the Dorena Seed Orchard was treated with two soil-applied systemic insecticides--disulfoton and phorate. Cones are now being evaluated for seed yield and insect control. Seed germination tests will be made next spring. (Meso - Oregon)

Tests were made with 10% granular Thimet and Di-syston at 1/2, 1, 1-1/2 and 2 pounds per tree raked into the soil at the drip line. Trees averaged 35-40 feet tall and were treated in February and March. Results generally were a disappointment. The only hints at control were with Thimet and Di-syston at one pound per tree. The Thimet trees had a 79% sound cone crop, the Di-syston trees 93%, and the check 75%. A two-year study with Thimet at one pound per tree gave an 89% sound cone crop as compared to 66% for the check. Therefore, as other workers have indicated, an accumulative effect may be possible with Thimet. (Ollieu - Texas)

Tests of 10% granular phorate applied from late February to mid-April 1968 at the root collar of individual trees controlled the Nantucket pine tip moth (*Rhyacionia frustrana*) throughout the summer. Uptake and translocation of the insecticide in sufficient amounts for control apparently did not occur until late May regardless of when the phorate was applied within the above given dates.

The amount of phorate applied varied according to tree size. In the following list of treatments (minimum of fifteen trees each), all gave satisfactory control of the tip moth.

1. Twenty grams phorate to trees less than five feet tall.
2. Forty grams phorate to trees five to eight feet tall.
3. Eighty grams phorate to trees eight to fifteen feet tall.
4. One hundred sixty grams phorate to trees fifteen to thirty feet tall.

Although control of coneworms (*Dioxyetria* spp.) did occur in the larger cone-bearing trees (treatment 3 and 4 above) the degree of success remains unknown due to generally low numbers of cones present per tree and low population of coneworms in the check trees. It is hoped that similar studies in 1969 will shed more light on coneworm control. It is felt that two factors, sandy soils and adequate spring rains, contributed to the success of these 1968 tests. Heavier soils and/or inadequate spring rains probably will have an adverse effect on control. Similar tests of phorate applied to shortleaf trees did not control tip moth. It is felt that this control failure was due to the fact that the shortleaf is growing on a much heavier soil than the loblolly. (Frazier - Va.)

In the third week of June 1968, an attempt was made to inject Meta-Systox-R into young ponderosa by using Mauget units. However, resinosis prevented uptake. Various solvents (benzene, xylene, acetone, ethyl ether, chloroform, and turpentine) were used in a 1:5 solvent to systemic ratio. Uptake still was not obtained. Only pure turpentine was taken up.

In 1969, injection will be tried again in May when conelet elongation commences. In addition, the drill-hole method will also be used. If uptake is obtained, residue analyses will be run on seed tissue. Methodology will be based on that developed by the Chemagro Laboratory for analysis of walnut meats. (Dale - Idaho)

During 1968 a cooperative study was conducted in 3 slash pine clonal seed orchards to evaluate the effectiveness of granular phorate for cone and seed insect control. A single application of phorate was made during the second week in April using a small fertilizer spreader to apply 1, 5, or 10 lbs. of 10% active phorate to the soil within the drip-line of each tree crown. The treatment layout in each orchard was a randomized complete block, utilizing clones as blocks.

*Dioryetria* control was achieved in only one of the three orchards in the study. In Union Camp Corporation's Bellville Seed Orchard an average of 13% of the second-year cones were infested with *Dioryetria*. The applications of 1, 5, and 10 lbs. of phorate/tree reduced the infestation by 51%, 74%, and 88%, respectively. A Duncan's Multiple Range Test indicated that the 5# and 10# per tree treatments significantly reduced *Dioryetria* attacks, but that the two treatments were not significantly different from each other.

Percentage of Second-year Cone Crop Infested By  
*Dioryetria* spp. - 1968

Orchard	Lbs. Phorate/tree <sup>1/</sup>			
	0	1	5	10
Gateswood, Mobile, Ala.	8.6	13.6	13.5	9.4
McColskey Still, Lake City, Fla.	11.0	5.6	4.5	4.5
Bellville, Bellville, Ga.	12.9	6.3	3.1	1.6

<sup>1/</sup>Thimet 10 G. (10% active granules).

In the U.S. Forest Service's McColskey Still Seed Orchard, 11% of the mature cone crop was infested by *Dioryetria* spp. The phorate treatments reduced the infestation from 50-60%, but these reductions were not significant. All 3 phorate treatments failed to reduce *Dioryetria* in International Paper Company's Gateswood Seed Orchard.

A significant F value for blocks (clones) was obtained for all 3 orchards in the study. This supports our decision to block treatments by clones. We can conclude with 95% confidence that the clones in this study differed in their susceptibility to *Dioryetria* spp.

The effectiveness of the phorate treatments in reducing seed losses due to seedworms, the seed bugs, and the flower thrips is also being investigated. In addition, seed yields, seed-set, and seed germination are being checked to detect possible phytotoxic effects of phorate. (DeBarr & Merkel - Ga., Fla., Ala.)

A field screening test was conducted at Olustee, Florida in 1968 to evaluate the effectiveness of several systemic insecticides on the control of *Dioryetria* coneworms and *Laspeyresia amaranjada* attacking slash pine second-year cones. The following systemics were applied in drill holes spaced at 5-inch intervals around the trunk circumference at breast-height: (1) Monitor® (OR-9006) at 2 gm. toxicant per inch d.b.h.; (2) Monitor® at 5 gm./inch; (3) Meta-Systox-R® at 2 gm./inch; (4) Meta-Systox-R® at 5 gm./inch; (5) dimethoate at 5 gm./inch; and (6) Bidrin® at 5 gm./inch. A minimum of 6 replicates (trees) were used per treatment and 15 untreated check trees were included. The experiment was a completely randomized design. All treatments were applied May 8, 1968. Study trees averaged 13-inches d.b.h. and 40 feet in total height. Results are summarized in the following tables.

Effects of Trunk Implantation of Systemic Insecticides  
On The Control of *Dioryetria* coneworms on  
Slash Pine Cones - Olustee, Fla., 1968

Treatments <sup>1/</sup>	: Amount of :	Repli- cates (trees)	: Mean 2nd- yr. cone damage <sup>2/</sup> per tree	: Reduction in cones damaged
	: toxicant : per inch : d.b.h. :		Percent	Percent
	Grams	Number		
None (check)	0	15	10.0	
Meta-Systox-R®	2	7	9.3	7
Monitor®	2	7	6.6	34
"	5	7	2.0	80
Dimethoate	5	6	2.0	80
Meta-Systox-R®	5	6	1.8	82
Bidrin®	5	8	1.1	89

<sup>1/</sup>All chemicals were applied May 8, 1968 in drill holes placed at 5-inch intervals around tree circumference at breast-height.

<sup>2/</sup>Means not followed by the same line are significantly different from each other at the 1-percent probability level by Duncan's multiple range test.

Effects of Trunk Implantation of Systemic Insecticides  
On the Control of *Laspeyresia anaranjada* On Slash  
Pine Cones - Olustee, Fla., 1968

Treatments <sup>1/</sup>	: Amount of : toxicant : per inch : d.b.h.	: Replicates (trees)	: Mean : cones : infested : per tree <sup>2/</sup>	: Reduction : in cones : infested
	Grams	Number	Percent	Percent
None (check)	0	15	23.3	
Monitor <sup>®</sup>	2	7	13.1	44
Meta-Systox-R <sup>®</sup>	2	7	13.0	44
Dimethoate	5	6	12.7	46
Monitor <sup>®</sup>	5	7	10.0	57
Meta-Systox-R <sup>®</sup>	5	7	1.1	95
Bidrin <sup>®</sup>	5	8	0.8	97

<sup>1/</sup>All chemicals were applied May 8, 1968 in drill holes placed at 5-inch intervals around tree circumference at breast-height.

<sup>2/</sup>Means not followed by the same line are significantly different from each other at the 1-percent probability level by Duncan's Multiple range test.

Based on a 100% tally of second-year cones at cone harvest (September 1968), all insecticides applied at the 5 gram-per-inch dosage level resulted in significantly fewer *Dioryctria* cone attacks than the checks or either of the 2 gram-per-inch dosage treatments. Differences were statistically significant at the 1-percent probability level. There was no significant difference in coneworm control among the 5 gram-per-inch treatments; and coneworm control for these treatments ranged from 80 to 89 percent with Bidrin<sup>®</sup> being the best.

As in the case of the *Dioryctria* control evaluation, the 5-gram dosage levels of Bidrin<sup>®</sup> and Meta-Systox-R<sup>®</sup> resulted in the best control of the slash pine seedworm, i.e., 97- and 95-percent control, respectively. The Monitor<sup>®</sup> (5 gram/inch) treatment resulted in seedworm control that was statistically different from the check at the 1-percent level but this amounted to only 57-percent control. All other treatments were not effective against the seedworm. (Merkel - Fla.)

Systemic insecticides dimethoate, Meta-Systox-R and Bidrin were used in a small pilot experiment against white spruce cone insects. The first two materials were applied at 1% and 0.5% active ingredient. Bidrin was applied at 0.5%. Dimethoate 1% gave good indications of control. Insecticide applications were made with an 1-gallon hand-pump sprayer. Materials were applied to cones and foliage until wet and dripping. All formulations were prepared from emulsifiable concentrates. (Hedlin - B.C., Canada)

Three insecticides--lindane, Zectran, and dimethoate--were applied to 60- to 80-foot ponderosa pine trees at the rate of 2 gallons of 1 percent water emulsion per tree to test their effectiveness for control of cone and seed insects. The sprays were applied on May 8 and May 22. Four trees received each insecticide on either date, and four trees were treated with each insecticide on both dates. Eight unsprayed check trees were included in the study.

The treatments were inconclusive with regard to control of *Conophthorus ponderosae*. Promising results were obtained in respect to control of *Laspeyresia* spp. Trees receiving the May 22 dimethoate spray had 0.82 *Laspeyresia* larvae per cone; those receiving both dimethoate sprays, 0.72; and those receiving both Zectran sprays, 0.71. Unsprayed trees averaged 2.18 larvae per cone.

Observations on cone survival show the sprays have no adverse effect on the cones. Germination tests will be conducted to check on possible adverse effects on seed quality. Plans for next summer are uncertain but probably will include another series of insecticide tests. (Koerber - Cal.)

## 6. Work Planned

The control project will be continued. Damage estimates will also continue. An attempt will be made to gain the life history and behavior data which has thus far proven elusive. The food (seed) preference of *Leptoglossus occidentalis* will be studied along with the effect of feeding intensity on seed viability. (Dale - Idaho)

Completion of controlled temperature rearing on *Barbara colfaxiana* in diapause studies. Completions of studies on white spruce cone insects including more detailed chemical control experiments. (Hedlin - B.C., Canada)

A study of the life histories of the major pests will be made along with the determination of some of their parasites and predators. Parasitism of the European corn borer will also be studied in order to determine if this species has the same parasites as the *Dioryetria* spp. in this state. (Neel - Miss.)

A program to make dimethoate-applied helicopter sprays more effective for Douglas-fir cone and seed insect control should get under way early this year. Objectives will include (1) foliage phytotoxicity related to spray concentration determination, (2) optimum droplet size choice, (3) desirable application rate, (4) droplet and spray coverage assessment methods, and (5) screen surfactants for increased spray efficiency.

Cultural control methods will be investigated this fall to determine what impact this will have on overwintering populations of *Contarinia* species, *Barbara colfaxiana* and *Megastigmus spermotrophus*. (Meso - Oregon)

## 7. Publications

- Coyne, John F. 1968. *Laspeyresia ingens*, a seedworm infesting cones of longleaf pine. *Ann. ent. Soc. Am.* 61: 1116-1122.
- DeBarr, Gary L. 1969. The damage potential of a flower thrips, *Gnophothrips fuscus* (Morgan), in slash pine seed orchards. *J. Forestry*. (In press)
- DeBarr, Gary L., and E. P. Merkel. 1969. A seed orchardist's guide to the handling of insecticides and the calibration of spray equipment. U.S. Forest Serv., Southeast. For. Exp. Stn Paper. (In press)
- DeBarr, Gary L., and M. T. Proveaux. 1969. A new table model cone cutter. *Tree Planters' Notes*. (In press)
- Fatzinger, C. W., and G. L. DeBarr. 1969. How to distinguish attacks of the black turpentine beetle and *Dioryetria amatella* on southern pines. U.S. Forest Serv., Southeast. For. Exp. Stn Res. Note SE-101. (In press)
- Hedlin, A. F., and N. E. Johnson. 1968. A new species of *Camptomyia* (Diptera: Cecidomyiidae) from Douglas-fir cones. *Can. Ent.* 100: 532-535.
- Hedlin, A. F., and D. S. Ruth. Sex attraction in the Douglas-fir cone moth *Barbara colfaxiana* (Kft.). *Can. Bi-Monthly Res. Notes* 24(1): 7-8, Jan.-Feb.

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