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Unless some individual or organization volunteers to compile the Cone and Seed Insect Newsletter for 1971, it will be discontinued!

Volunteer compilers please contact Ed Merkel, Naval Stores and Timber Production Laboratory, P.O. Box 3, Olustee, Florida 32072.

1. GENERAL

Western Forest Insect Work Conference will be held in Seattle the first week of March.

Dale, Univ. Idaho, Moscow--A general failure of the 1969 ponderosa pine cone crop throughout Idaho, eastern Washington, and western Montana severely restricted research on cone and seed insects on this tree species.

Merkel, U.S.F.S., S.E.F.E.S., Olustee, Fla.--Mrs. Ann Barcia, Secretary, Seed Orchard Insects in the South Research Work Unit, is compiling a bibliography of insects directly affecting the seed production of coniferous forest trees of the United States and Canada. This will include literature published through 1969.

Stoszek, Weyerhaeuser Co., Centralia, Wash.--The main attention is shifting from cone and seed insects on Douglas-fir to seed-destroying insects of ponderosa and lodgepole pine in southeastern Oregon.

Kucera, U.S.F.S., S.A.-S&PF, Pineville, La.--Work is continuing on life tables of loblolly pine cones. One year of field data has been collected and final evaluation will be made in October 1970.

Gibson, U.S.F.S., N.E.F.E.S., Delaware, Ohio--I have switched projects and now work on Forest Disease Research on Insect Vectors of Virus Diseases of Trees.

Yates, U.S.F.S., S.E.F.E.S., Athens, Ga.--Gary DeBarr, formerly with the Seed Orchard Insects Project at Olustee, Florida, has been transferred within the project to the Forestry Sciences Laboratory at Athens. Gary will be studying the translocation, localization, and metabolites of Bidrin[®] systemic insecticide in shortleaf pine.

^{1/} Compiled by E. P. Merkel, Southeastern Forest Experiment Station, Olustee, Florida, from information submitted by workers conducting research on seed-destroying insects. Information in this Newsletter is not to be published without the consent of the contributors.

Yates, U.S.F.S., S.E.F.E.S., Athens, Ga.--Bernard Ebel will begin studies this spring on the biology and damage impact of the seed bug, *Leptoglossus corculus*, on cones of loblolly and shortleaf pines.

Mattson, U.S.F.S., N.C.F.E.S., St. Paul, Minn.--Seed and cone insect research at the North Central Forest Experiment Station will be de-emphasized during the next few years. It is expected that newly organized programs will give emphasis to insects that influence the multiple-use resources of natural forest ecosystems.

2. INSECT IDENTIFICATION

Dale, Univ. Idaho, Moscow--The presence of both *Laspeyresia miscitata* and *L. piperana* on ponderosa pine in the Inland Empire has been definitely established. Spring emergence of adults from cones collected at several sites in Idaho, eastern Washington, and western Montana should provide reasonable estimates of the distribution of these two species within the boundaries of the sampled area.

Gibson, U.S.F.S., N.E.F.E.S., Delaware, Ohio--Currently I am finishing two papers on weevil parasites entitled, "Revision of the *Urosigalphus* of the United States and Canada (Braconidae: Hymenoptera)" and "*Urosigalphus* of the World Excluding the United States and Canada (Braconidae: Hymenoptera)." Also, I am working on another weevil paper, "Monograph of the genus *Curculio* in the New World - Part II, Mexico and Central America."

A paper, "Insects that affect white oak acorns" has been edited and submitted to Forest Science. Another paper, "Acorn Insects of Bur Oak", has been sent to the editor.

Ebel and Yates, U.S.F.S., S.E.F.E.S., Athens, Ga.--Results of a study of *Laspeyresia* spp. attacking loblolly, shortleaf, and Virginia pine cones reveal that *L. toreuta* attacks all three pine species and *L. ingens* attacks only loblolly pine of these three host trees. Loblolly pine cones were more commonly infested by *Laspeyresia* spp. than either shortleaf or Virginia pines. Under conditions of rearing, considerable diapause of seedworm larvae occurred. Adults of both species of *Laspeyresia* and a common braconid parasite, *Phanerotoma* sp., emerged during the year following cone infestation. No second-year diapause was detected.

Hedlin, Canadian F.S., Victoria, B. C.--A dipterous cone borer which is very common in cones of *Picea glauca* and *P. mariana* in British Columbia has been identified as *Hylemya anthracina*. This is the same insect that occurs in Alaska and eastern Canada, previously known as *Pegohylemyia anthracina*. *Hylemya anthracina* and *Laspeyresia youngana* are serious seed destroyers of white spruce in B.C. and could be economic pests in seed orchards.

Nebeker, Utah State Univ., Logan--The following insects were found in or associated with *Pinus flexilis* cones on the Cache National Forest, 1968-'69:

Scolytidae

Conophthorus flexilis Hopkins
Determined by Stephen L. Wood

Dermestidae

Trogoderma parabile Beal
Determined by J. M. Kingsolver

Sciaridae

Bradysia sp.

Cecidomyiidae

Asynapta keeni (Foote)
Determined by R. J. Gagne

Pteromalidae

Hypopteromalus percussor Girault

Eulophidae

Elachertus sp.
Determined by B. D. Burks

Phycitidae

Dioryctria abietella (D. & S.)
Dioryctria sp. near or *disclusa* Heinrich
Determined by D. M. Weisman

Braconidae

Apanteles sp. prob. *starki* Mason
Determined by P. M. Marsh

Trogoderma parabile Beal has created some special interest. Beal in 1969 stated "it is conceivable that *T. parabile* might feed on seeds in the cones and if the cones were stored in a protected and moderately dry situation."^{2/}

Neel, Miss. State Univ., State College--Collections of infested pine cones from eight counties in Mississippi have revealed that 7 common species of insects infest second-year pine cones. *Dioryctria amatella* (Hulst) was found to be a primary pest of loblolly, longleaf and slash pine cones; *Asynapta* near *keeni* (Foote) was found to be a primary pest on loblolly and longleaf cones. *D. disclusa* Heinrich and *A.* near *keeni* have been found to be primary pests of loblolly and shortleaf pine cones. *Laspeyresia ingens* Hein. has been found to be a primary seed destroyer of longleaf pine. *Pityophthorus pulicarius* Aimm., *Ernobius granulatus* Lec. and *Duvita* (Battaristis) *vitella* Bsk. appear to be only secondary pests of pine cones. *Leptoglossus corculus* (Say) (Hemiptera: Coreidae) was found feeding on maturing slash pine cones in southeastern Mississippi.

^{2/}Beal, R. S., Jr. 1969. Personal Correspondence. Oct. 14, 1969.

Several species of parasites emerged from pine cones infested with the primary and secondary pests. Hymenopterans belonging to the families Ichneumonidae, Braconidae and Platygasteridae are apparently parasitizing one or more of the cone insects.

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: Tachinida) 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* sp. have been reared from *Dioryctria* spp. in other states.

An increased emphasis is being placed by private, state, and federal agencies on pine seed production in seed orchards and in seed production areas. Reforestation and tree improvement programs have created a demand for pine seed, especially superior pine seed. In Mississippi, *Dioryctria* spp. and other cone insects are causing an undetermined loss of seed in the aforementioned areas and also in areas where natural reseeding is desired. There is, therefore, a definite need for a study of the extent of damage caused by these insects as well as their host plant preferences, life histories, parasites and predators.

In view of the fact that *Dioryctria* spp. and *O. nubilalis* are increasing in importance in this state, a knowledge of their common parasites could be of value in an integrated control program of any or all of these pests.

3. DAMAGE

Neel, Miss. State Univ., State College--Present study being made on the amount of seed loss due to insects that occurred in one slash pine and on a loblolly pine seed orchard in Mississippi.

Kucera, U.S.F.S., S.A.-S&PF, Pineville, La.--Data indicates that over 70% of the total mortality of second-year loblolly pine cones in one study area is attributed to insects; whereas less than 35% of first-year cone mortality was attributed to insects. Conelet abortion, due to unknown causes was prevalent this year.

Mattson, U.S.F.S., N.C.F.E.S., St. Paul, Minn.--We have now completed 11 life tables for cone populations at seven SPAs (two consecutive generations of cones at four SPAs and three single generations at other areas). Present plans call for completion of six more life tables and then termination of the study. Detailed analysis of data has not begun, but some of the obvious findings are that the number of cones surviving on a tree has little correlation with the number of pistillate strobili that initially emerged. Insects were the primary cause of losses, and they destroyed 45 to 95 percent of the potential cones. Some SPAs clearly have a higher insect species diversity and are more hazardous for cone development than areas with lower insect diversity. We will attempt to relate insect diversity to stand characteristics and surrounding environmental diversity.

Meso, U.S.F.S., R-6, Portland, Ore.--Douglas-fir cone crops were light and scattered throughout Oregon and Washington this season. This was expected after the abundant, widespread 1968 crop. Because of low cone production, impact by *Contarinia* and *Dioryctria* populations was heavy at seed production areas visited. However, lack of pollen contributed to holding *Megastigmus spermatrophus* populations in check by reducing filled seed numbers.

where
Parker, U.S.F.S., R-4, Ogden, Utah--The impact of *Laspeyresia miscitata* Heinrich on a seed crop in a ponderosa pine cone collection area on the Payette National Forest in southwestern Idaho was studied in 1968.

Either pine seedworm larvae or damaged seed, or both, were found in 213 (85%) of 250 cones examined. In spite of the large percentage of infested cones, the percentage of seed loss was not large. All factors included, approximately 70% of the seed was still sound. A resume of these findings follows:

Total		Seed Per Cone				Insect-Damage	
		Sound		Hollow			
Mean	CI*	Mean	CI	Mean	CI	Mean	CI
79.7	±4.6	55.5	±2.6	9.5	±1.2	15.1	±2.6

*Confidence interval on the mean at the 95-percent level of probability.

White, U.S.F.S., N.A.-S&PF, Delaware, Ohio--An average of 36% of sampled shortleaf pine cones was damaged by insects on national forest seed production areas in Missouri in 1969. Insect damage for the 1966-'69 period averaged 18%, with *Dioryctria* spp. causing 71% of the damage. Twenty-one percent of the sampled conelets were damaged in 1969, mainly by the fungus, *Aspergillus wentii*.

Nebeker, Utah State Univ., Logan--The major insect species found destroying the cones and seeds of limber pine, *Pinus flexilis*, on the Cache National Forest are in order of importance: *Conophthorus flexilis* Hopkins, *Dioryctria abietella* (D. & S.) and *Dioryctria* sp. near *disclusa* Heinrich. Analysis of cone damage has not been completed but approximately 24% of the cones dissected were infested with *C. flexilis* and 35% were infested with *Dioryctria*. Although a higher percentage of the cones were infested by *Dioryctria* spp., a higher percentage of the seeds were destroyed by *C. flexilis*.

Ollieu, Texas F.S., Lufkin--Observations of loblolly cones in Texas show damage to be caused by some previously reported insects and some species not reported from the state. *Dioryctria amatella* is the most abundant and destructive. At least two species of Cecidomyiids have been collected with 17 percent of the infested cones attributed to their damage. Two hemipterans, probably *Leptoglossus corculus* and *Tetyra bipunctata* are present. *Pityophthorus pulicarius* are abundant and suspected of contributing to the high loss of loblolly conelets. Thrips are also suspected of causing loblolly and slash conelet mortality. In one instance, an aphid, probably *Cinera* sp., was observed with its stylet sunk into a slash conelet.

Counts were made of conelets and cones at one slash and three loblolly orchards in 1968. Branches with sufficient fruit on them were flagged and counts made in the spring as soon as the conelets were easily identifiable and again in the fall prior to harvest. Observations were made on 1240 loblolly conelets, 773 loblolly cones, 150 slash conelets, and 120 slash cones.

Losses directly attributable to insects were 3 percent in the loblolly conelets, 17 percent in the loblolly cones, zero in the slash conelets and 4 percent in the slash cones. Losses, of course, were considerably higher when one considers the additional cones which were aborted or were killed by unknown causes. Mortality factors *in toto* caused a 30 percent reduction in loblolly conelets, a 27 percent reduction in loblolly cones, a 41 percent reduction in slash conelets and a 7 percent reduction in slash cones.

Dioryctria amatella is the most destructive pest and displays the most easily identifiable damage. A count of loblolly cones in early August showed 83 percent of the infested cones to be attacked by the pest. The remaining 17 percent of the infested cones appeared to be damaged by an unidentified cecidomyiid. Only a rare occurrence of *Laspeyresia* spp. has been observed.

I feel the high percentage of loblolly and slash conelet losses attributed to abortions and unknown causes may well be insect caused. The early abortions could well be caused by thrips as found in the southeast. Only one thrips was observed but resin exudes over the young conelets much like that found by Ebel.

Fully developed loblolly conelets died in groups in 1968 and *Pityophthorus pulicarius* adults and larvae were found in most. Dead conelets which contained no *P. pulicarius* gave the impression that the beetle was secondary. Yearian reported the pest as being primary in Arkansas and I feel further study would help clarify the issue.

There are numerous encounters with two hemipterans which are probably *Leptoglossus corculus* and *Tetyra bipunctata* as reported by DeBarr. *L. corculus* immatures and adults have been observed with their mouthparts sunk deep into loblolly cones.

Tip moths and, I assume, *Dioryctria clarioralis*, mine terminals and cause cone mortality indirectly. However, in Texas seed orchards, there has been only an occasional dead terminal.

There are a variety of insects which could cause an impact on seed. For instance, sawflies can strip pines clean and *Pissodes* weevils cause needle drop. We do not know what effect these insects have on seed. This spring a tortricid defoliated at least 100,000 acres of live and post oak just northwest of Houston. Acorn crops must be affected. cursory observations last fall indicated that a high percentage of acorns are lost to a weevil, probably *Curculio* spp.

4. BIOLOGY

Fatzinger, U.S.F.S., S.E.F.E.S., Olustee, Fla.--The mating behavior of *Dioryctria abietella* was investigated during 1969. Females exhibited a definite periodicity of their calling behavior during diel light-dark (L:D) cycles of 12L:12D at 27°C. Calling behavior was initiated about 6-1/2 hrs after the onset of the dark cycle, reached a peak of activity about 2 hrs later, and ceased just prior to the onset of the light cycle. Mating occurred most frequently during peak periods of calling, and copulation lasted about 1 hr 40 min. Females usually mated once, but were occasionally observed to mate twice and deposited viable eggs after each mating. Males were observed to mate with as many as 4 females.

The behavior of *Dioryctria abietella* during pupation and emergence was investigated. Last-instar larvae usually spin a silken cocoon after they cease feeding. Within the cocoon, they changed to a greenish-white color prior to pupation. Newly-emerged pupae were also greenish-white and could be easily sexed by the presence or absence of the brilliant red testes of males which could be seen through the integument of the newly-emerged pupa. The color of pupae shifted from greenish-white at emergence to tan to dark brown or black just prior to moth emergence. The cocoon served as an aid to emergence by providing a suitable surface upon which the cremastral spines of the pupa could be attached enabling the moth to pull free of the pupal case, and as a textured surface upon which the emerging moth could obtain a foothold. Wing expansion required an average time of 4.5 min.

Mattson, U.S.F.S., N.C.F.E.S., St. Paul, Minn.--The red pine cone beetle attacks and oviposits in second-year cones over a period of 2-1/2 months while cones are completing growth. Studies in one seed-production area have shown that length of egg galleries and number of eggs laid per cone are linear functions of cone length. Survival of immature beetles is also related to cone size. Presently, we are developing a computer model that predicts the numbers of attacked cones and provides insight into the relationship between cone density and beetle population size.

5. CONTROL

Dale, Univ. Idaho, Moscow--Mauget® units again proved unsatisfactory for implantation of Meta-Systox-R in ponderosa pine even though the systemic was mixed with equal parts of (1) dimethyl sulfoxide (DMSO), and (2) cellosolve. The drill-hole method gave satisfactory uptake of the 50% technical material without the addition of solvents. Unfortunately, there were no cones for test purposes in 1969. Mauget injector units will again be tried for implantation of Meta-Systox-R into the root crown and large roots. A surface treatment will also be used on the larger roots near the root crown.

Stoszek, Weyerhaeuser Co., Centralia, Wash.--Even though systemics are the primary hopefuls for damage prevention, other, purely managerial approaches to increase the yield of viable seed will be studied. Plans include studies to determine if (a) the spectrum of insect species and their (b) impact on seed yield is related to: (1) site conditions under which cone-bearing trees are growing; and (2) cultural treatments that selected stands, groups, or individual trees have received.

Tentative plans include projects to: (1) develop techniques best suited for the application of systemic insecticides to young Douglas-fir trees in seed orchards; and (2) determine the eventual impact of systemic insecticides on the performance of seedlings (primarily in terms of their photosynthetic efficacy) grown from seeds of treated cones.

Hedlin, Canadian F.S., Victoria, B.C.--The systemic insecticides Meta-Systox-R®, Anthio®, and dimethoate were all effective in considerably reducing insect-caused seed losses in white spruce in experiments conducted in 1969. Materials were applied with a hand sprayer to cones and foliage at concentrations of 0.5% and 1.0% active ingredient. The insecticides had no apparent harmful effect to cones. Germination tests will be conducted on seeds.

McCowan, U.S.F.S., N.A.-S&PF, Amherst, Mass.--Eastern white pine, near Canterbury, N.H., have been implanted with Bidrin® systemic insecticide in a seed tree harvest area to control *Conophthorus coniperda*. The objective of this pilot test is to determine whether or not significantly more white pine reproduction results under treated trees than under untreated trees.

Meso, U.S.F.S., R-6, Portland, Ore.--During lean cone years, the Buckhead seed production area on the Willamette consistently has groups of producing trees. This area was used to field test Merkel's tree injection method described in our last newsletter and subsequent publication.

Bidrin, Cygon 267, and Meta-Systox-R was directly injected into trees using the drill-hole method. Applications were made with the Hauptner automatic multidose syringe which was suggested by Merkel. This device precisely measured each application. This tool also worked very well for applying Meta-Systox-R in measured amounts as a "bark paint" to Douglas-fir sapling stems for control of needle miner, *Contarina* species.

At Buckhead, 25 cone bearing trees were selected and treatment was randomly assigned. Trees ranged in size from 15 to 40 feet in height and 7 to 15 inches d.b.h. Test objectives were: (1) to compare control effectiveness of three injected insecticides; (2) to determine whether injections would cause phytotoxicity; and (3) to evaluate seed germination for all treatments. Target insects included *Contarina oregonensis*, *Contarinia washingtonensis*, *Barbara colfaxiana*, *Dioryctria* species, and *Megastigmus spermotrophus*. In the table below, data for both *Contarinia* species are included under midges and data for both *Barbara* and *Dioryctria* are combined under moths. Each treatment was comprised of five trees and 20 cones were selected from each tree for evaluation. Dosage rate was two grams active insecticide per diameter inch at breast height.

Results when Douglas-firs are trunk
inoculated with three systemic insecticides for
cone and seed insect control

Treatment	Insect seed loss			Seed yield ^{1/}
	Midges	Moths	Chalcid	
	Percent			
Bidrin	1.3	0.8	4.6	+ 100.0
Cygon 267	1.2	0.3	2.7	+ 92.5
Meta-Systox-R	0.1	1.4	10.3	+ 50.4
Control	36.6	9.1	6.4	

^{1/}Yield based on harvestable filled seeds.

No visible treatment phytotoxicity was found on old foliage or new growth. There were no significant measurable cone length differences between treatments. Tree cambial phytotoxicity at the injection holes will be more apparent in early spring 1970 when active growth resumes. Seed germination tests were not made because of premature seed release.

Further Douglas-fir tree inoculations are planned using Bidrin, Cygon 267, and Meta-Systox-R at various dosage rates. These treatments will be followed up with phytotoxicity determinations and seed germination tests.

Field observations are being planned at an industrial Douglas-fir seed orchard to determine whether field cultural practices can influence *Contarinia*, *Dioryctria*, and *Megastigmus* populations.

Ollieu, Texas F.S., Lufkin--The Texas Forest Service has had less than the best results with any spray program against cone and seed insects. Drenches at monthly intervals with .5% BHC and Malathion or monthly mist blower applications of BHC did not lower damage significantly. Therefore, in 1967 it was decided to begin field tests on granular systemics. Ten percent granular Thimet showed promising results in control of tip moth on young pine and the one application per year was a strong factor for systemics. Unfortunately, all results to date have again been less than hoped for.

Last year at the Fastrill seed orchard, a test with Thimet and Di-Syston at different dosages was made. Forty-five trees were selected with 5 getting a 1/2 lb. application of Thimet, another five 1 lb., the next 1-1/2 lbs, and the last 2 lbs. This treatment was repeated with Di-Syston on another 20 trees and another five trees were chosen as checks. Results were too poor to even report. This year, I doubled each dosage in hopes that the increased level would help and in hopes that a residual benefit might be derived from the previous year's tests.

In early August 1969, fifty cones were counted on each tree when possible and divided into sound and infested groups. Results can be seen in the table below. The check trees averaged 25% infestation, whereas the best chemical and dosage appeared to be Thimet at either 3 or 4 lbs. per tree.

Results from Systemic Insecticide Applications
to Loblolly Orchards in Texas

	10% Granular Thimet				10% Granular Di-Syston				Check
	1#	2#	3#	4#	1#	2#	3#	4#	
Percent infestation	29	15	9	12	15	13	32	39	25

If these results are valid, one might expect a 50% reduction in the percent of infestation if a 3-4 lb. dosage of Thimet were applied per tree. Left-over Thimet and Di-Syston were applied to single trees for two consecutive years at 4 lbs. per tree. The Thimet-treated tree showed 11 percent of its cones to be infested, whereas, the Di-Syston-treated tree showed 61% of its cones to be infested.

Though control through use of granular systemics has not come from my tests, I am not disheartened. The potential lies untapped and only further testing will reveal the proper techniques if these insecticides are to be of value. Granular systemics offer a number of advantages which justify their study. They have the advantage of protecting the plant from the inside, therefore negating weather factors and being equally poisonous to all insects feeding on the plant. Applications may well only be required once or twice a year which would reduce that biggest of expenses, manpower. Chemical costs are low and relatively simple, inexpensive equipment is required for application. The use of systemics may also be the greatest single factor in promotion of biological control. Non-target insects such as parasites and predators can search cone and seed insects without being killed from external poisons.

Merkel, U.S.F.S., S.E.F.E.S., Olustee, Fla.--Three years data on the effects of Bidrin stem implantation for the control of *Dioryctria* spp. and *Laspeyresia anaranjada* on large slash pine seed production area trees is being summarized for publication. Slash pines implanted with Bidrin for three consecutive years, at dosages from 1.5- to 5.0-grams per inch of diameter, showed no decrease in seed viability. Current research is being directed toward the determination of the longevity of effectiveness of single Bidrin implants in different months. We are also trying to develop methods of bioassaying systemic insecticide residues in slash and longleaf pine cones, using laboratory-reared *Dioryctria abietella* larvae as test insects.

Experiments will be initiated this year to evaluate the effects of Pinolene as an extender for residues of carbaryl water suspensions on slash and longleaf pine cones.

Chevron's systemic insecticide, Monitor-6, was applied to the lower boles of slash pine seed orchard trees as a drench at concentrations of 1 pt./100 gal. water and 2 pts./100 gal. water. The stem drenches were applied in early April, June, July and August. These treatments had no effect in reducing cone infestation by *Dioryctria* spp. Seedworm cone-infestation data is still being gathered and summarized.

6. RECENT PUBLICATIONS

- Coulson, R. N., and R. T. Franklin. 1968a. Dispersion of seed and cone insects within the crown of shortleaf pine. J. Ga. Entomol. Soc. 3(4): 159-162.
- Coulson, R. N., and R. T. Franklin. 1968b. Frequency of occurrence of cone- and seed-destroying insects on shortleaf pine in the Georgia Piedmont. J. Econ. Ent. 61: 1026-1027.
- DeBarr, G. L., and E. P. Merkel. 1970. A seed orchardists' guide to the handling of insecticides and calibration of spray equipment. Unnumbered Station Paper. (In press)
- Franklin, R. T., and R. N. Coulson. 1968. Insects affecting seed production of shortleaf pine in the Georgia Piedmont. Can. Ent. 100: 807-812.
- Gibson, Lester P. 1969. Monograph of the genus *Curculio* in the new world - Part I, United States and Canada. Entomol. Soc. Amer. Misc. Publ. 6(5): 241-285.
- Hedlin, A. F., and D. S. Ruth. 1969. A Douglas-fir twig mining beetle, *Pityophthorus orarius* Bright (Coleoptera: Scolytidae). Can. Ent. (In press)
- Merkel, E. P. 1969. Insect control in forest tree seed orchards. J. Forestry 67: 748-750.

Neel, W. W., and C. F. Sartor. 1969. Notes on insects infesting pine cones in Mississippi. Entomol. News 80(6): 159-167.

Ruth, D. S., and A. F. Hedlin. 1969. Rearing the Douglas-fir cone moth, *Barbara colfaxiana* (Kearfott), on an artificial diet in the laboratory. Hour. Entomol. Soc. B.C. 66: 22-25.