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CONE AND SEED INSECT NEWSLETTER[1/]

February 1972

1. General

Dr. Clyde Sartor completed his Ph.D. program last May. His dissertation is entitled "Studies of Pine Cone Insects in Mississippi with Special Emphasis on the Impact of *Dioryctria amatella* (Hulst) (Lepidoptera: Phycitidae) on Seed Yields." He is presently Extension Entomologist, Mississippi State University.

Mr. Henry Ray completed his master's program last August. His thesis is entitled "Trunk Implants of Systemic Insecticides in Seed Orchard Slash Pine Trees for Control of the Coneworm, *Dioryctria* sp. Lepidoptera: Phycitidae)." Mr. Ray is presently employed as a research entomologist with Geigy Chemical Company. (Neel - Mississippi)

In June 1971, Gerard ("Gerry") D. Hertel, Research Entomologist, was transferred from the Forestry Sciences Laboratory, Research Triangle Park, N. C., to the Seed Orchard Insects Research Work Unit, Olustee, Fla. The major portion of Gerry's research will be devoted to studies of the impact of forest insects on first-year pine reproduction in the slash pine ecosytem and secondarily, he will work on seed orchard insect problems. Chemical control studies were de-emphasized during 1971 and greater emphasis is being given to biology and behavioral studies in search of alternative methods for control of destructive seed orchard insects. (Merkel - Florida)

Jack Coster has moved from Texas A&M University to Stephen F. Austin State University. (Coster - Texas)

Dr. Stephen Cade has been assigned the responsibility for cone and seed insect research and operational control at Weyerhaeuser's Forestry Research Center at Centralia, Washington. His research will be confined to insect control. (Cade - Washington)

A long-term study of seed and cone insects was initiated in the Intermountain Region, U. S. Forest Service, in 1971. Most of the study sites will be located on the Boise and Payette National Forests in southwestern Idaho. Major study emphasis will be on insect identification, life histories, and damage appraisals. Mr. John W. Dale conducted the study in 1971. (Parker - Utah)

1/ Contributions submitted by cone and seed insect research workers, resource managers, and tree improvement specialists. These unpublished data cannot be used without contributor's approval. Items assembled by S. W. Meso, U. S. Forest Service, Portland, Oregon.

An In-Service report entitled "A Three-Year Evaluation of Douglas-fir Cone and Seed Insects in Montana and Yellowstone National Park, Wyoming," is in the final stages.

Plans for 1972 include a rather extensive survey of the insects of ponderosa pine and Engelmann spruce cones.

Work done with seed and cone insects in Region 1 was conducted under the leadership of Jerald E. Dewey, entomologist. (Ciesla - Montana)

At Athens, Georgia a 25-foot flowering shortleaf pine has been enclosed in an insect-proof cage. This has provided a caged whole-tree sample for studying development, overwintering habits, and biology of known seed and cone insect populations. The cage has survived two severe ice storms during the past two winters. Details on construction can be obtained from B. H. Ebel at Athens. (Yates - Georgia)

Cone and seed insect research in New Mexico was hampered in 1971 by a very poor cone crop in Douglas-fir in the Lincoln, Cibola and Gila National Forests. Also by unusually low temperatures in the Gila and Cibola National Forests that severely limited the overwintering population of *Conophthorus ponderosae* which is the insect on which most research was planned. (Kinzer - New Mexico)

The 1971 cone crop in Utah, Nevada, southern Idaho, and western Wyoming was unusual because so many tree species had abundant crops. Cones were particularly abundant on *Pinus ponderosa, Abies grandis, A. lasiocarpa,* and *Picea engelmannii.*

The outlook for the 1972 cone crop is not favorable for most tree species. (Parker - Utah)

The 1971 Douglas-fir cone crops were medium to heavy west of the Oregon and Washington Cascades. Insect populations were generally dispersed and seed damage relatively light. Greater insect impact is expected in 1972 when cone crops will be light and scattered. Viable seed production will be limited by lack of pollen rather than insect impact. (Meso - Oregon)

Although I am no longer fully engaged in cone insect research, I am still intrigued by the great possibilities it affords for studying fundamental ecological relationships and principles. Cones and cone insects represent an easily defined subsystem that is similar to but much less complex than the larger forest ecosystem. Cone insects have basically the same problems as any forest phytophage except for the fact that their food supply is more limited and variable (considering both time and space). As a result, we should expect keen competition among the insects for food, development of special cone finding or detecting mechanisms, and probably simplified population dynamics that are closely tuned to availability of food. The influence of cone insects on the physiological processes

of the trees should not be overlooked, nor should other factors (climatic variables, forest defoliators, etc.) that affect the trees' physiological status and thereby affect the food supplies (quantity and quality) of cone insects. Undoubtedly, the most fruitful cone insect research program would be one that is part of a larger systems study of bud primordia initiation, differentiation, and maturation. (Mattson - Minnesota)

2. Insect identification and Biology

With the assistance of members of the Entomology Research Institute, Ottawa, it has been established that a single species of *Laspeyresia* (*L. youngana*) infests cones of the four species of spruce, *Picea glauca, P. engelmannii, P. sitchensis* and *P. mariana* which are native to British Columbia. *L. bracteatana*, previously reported in cones of *P. sitchensis* does not occur in that species.

Laboratory studies are being conducted on the effect of temperature and day length as factors affecting termination of diapause in *Laspeyresia youngana, L. piperana* and *Barbara colfaxiana*

An undescribed species of *Barbara* has been reared from cones of *Abies grandis*. (Hedlin - British Columbia, Canada)

Work done in the Northern Region in 1971 with cone and seed insects was limited because of other work priorities. However, we collected ponderosa, Douglas-fir, Engelmann spruce, subalpine fir, and limber pine cones from several locations in the Region for insect rearing. Most of the insects collected are still at the Museum being identified.

Western spruce budworm were reared from Douglas-fir, Engelmann spruce, and subalpine fir cones. The latter two are new host records as far as we have been able to ascertain. (Ciesla-Montana)

The following insects were reared from bristlecone pine (*Pinus aristata* Engelm.) cones which were collected in Escalante Canyon near Antimony, Utah:

COLEOPTERA

Lathridiidae
Corticaria sp. (Determined by J. M. Kingsolver)

Scolytidae
Conophthorus edulis Hopkins (Determined by S. L. Wood)

DIPTERA

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

Chamaemyiidae
Leucopis sp. (Determined by G. Steyskal)

HYMENOPTERA

Braconidae
Apanteles aristoteliae Viereck (Determined by P. M. Marsh)
Bracon sp. (Determined by P. M. Marsh)

Pteromalidae
Acerocephala atroviolacea (Crawford) (Determined by B. D. Burks)

Dr. Woods stated that although *Conophthorus edulis* Hopkins normally occurs in pinyon pine, bristlecone pine is a new, and probably accidental host. Dr. Gagne reported the *Asynapta keeni* (Foote) collection is a first record from this host; however, this midge has been reared from cones of most *Pinus* spp. in western North America. (Moyer - Utah)

A report in the 1970 newsletter on a pinyon pine, *Pinus edulis*, cone damage survey listed *Hedulia injectiva* Heinrich as the damaging insect (Determined by D. M. Weisman). However, a later determination (by G. T. Okumura) revealed that the larvae were not this species. Adults have been reared from cones and sent to D. R. Davis for further determination. (Stipe - Utah)

The *Dioryctria* spp. of loblolly pine in east Texas were surveyed during 1970. Four species were identified: *D. amatella*, *D. clarioralis*, and two new species. One of the new species was determined to be identical to the so-called southern *D. zimmermani*. The results of the study have been accepted for publication in the Journal of Economic Entomology and should appear shortly after the first of the year. Drs. Akira Mutuura and Eugene Munroe are co-authors. (Coulson - Texas)

Adults of 16 parasitic insects were collected from rearing cages that contained insect-infested pine cones. *Exeristes comstockii* (Cress) (Ichneumonidae), *Macrocentris dioryctriae* Mues. (Ichneumonidae) and *Blondeliini* sp. (Tachinidae) were the most common parasites collected from insect-infested cones; more individuals of all the parasites were collected from insect-infested slash pine cones than from the cones of any of the other pines. This latter phenomenon might have been correlated with the relatively high infestation rate of slash pine cones by *D. amatella*. (Neel and Sartor - Mississippi)

3. Damage

Mean infestation rates of second-year cones by *Dioryctria amatella* in two loblolly pine seed orchards were 10.57% and 23.78% and in one slash pine seed orchard the mean infestation rate was 25.76%. These infestation rates fluctuated within seasons and varied significantly among the quadrants of loblolly pine.

Twenty-eight clones of loblolly pine were screened in two orchards and 44 clones of slash pine were screened in one seed orchard for resistance to *D. amatella* infestation of second-year cones. Some clones in each orchard appeared resistant, and some clones appeared highly susceptible.

Data on seed production from *D. amatella*-infested and non-infested cones of loblolly, slash and longleaf pines were obtained from two seed orchards and one seed production area. Infested loblolly cones yielded an average of 6.16 seeds per cone, and non-infested cones yielded an average of 37.37 seeds per cone.

Infested slash cones yielded an average of 4.96 seeds per cone, and non-infested cones yielded an average of 45.63 seeds per cone. Infested longleaf cones yielded an average of 4.94 seeds per cone, and non-infested cones yielded an average of 62.98 seeds per cone. (Neel and Sartor - Mississippi)

Since the cessation of regular spraying of both hand and wind-pollinated cones used in the genetics program here, the germinable seed collected has decreased very noticeably, necessitating in many cases an additional 1 or 2 year wait before adequate amounts of seed can be obtained for progeny testing or other purposes. (Coyne - Mississippi)

A limited survey of insect damage to cones of ponderosa pine was made in the Lincoln, Cibola, and Gila National Forests. The moderate to poor cone crop in these areas was severely affected as shown in the table below.

Summary of damage caused by seed and cone insects to ponderosa pine in the Lincoln, Cibola, and Gila National Forests, New Mexico, 1971.

Forest	No. Samples	Cones infested with respective insects: Conophthorus ponderosae	Dioryctria auranticella	Laspeyresia piperana	Megastigmus albifrons	Cecidomyiidae
		- - - Percent - - -				
Gila	20	17	12	4	8	2
Cibola	8	6	-	16	-	-
Lincoln	12	55	10	2	-	-

(Kinzer - New Mexico)

Mr. John W. Dale conducted evaluations of damage by seed and cone insects in southern Idaho in 1971. An overall average for the percent of insect infested cones by tree species follows: ponderosa pine, 18 percent; Douglas-fir, 33 percent; Engelmann spruce, 11 percent; grand fir, 8 percent; subalpine fir, 11 percent; lodgepole pine, 2 percent; and limber pine, 5 percent. Seed loss was considerably less. The most damaging insects were *Laspeyresia* spp. in ponderosa pine, *Barbara colfaxiana* (Kearfott) in Douglas-fir, *Laspeyresia youngana* (Kearfott) in Engelmann spruce, and unidentified Diptera in grand and subalpine fir, an unidentified Lepidoptera in lodgepole pine, and a *Dioryctria* sp. in limber pine. (Parker - Utah)

Two cone and seed insect studies were initiated in 1971. The first of these was designed to determine the effect of nitrogen and phosphorus fertilizer on Douglas-fir cone and seed insect damage. Sixteen hundred cones (50 per tree) were collected from 32 36-year-old trees on 1/4 acre fertilizer plots near Yacolt, Washington. Fertilizer treatments had been applied annually between 1965 and 1970 on a plot basis as follows: (1) 70 lbs. phosphorus/acre; (2) 200 lb. nitrogen/acre; (3) 70 lb. phosphorus plus 200 lb. nitrogen/acre; and (4) untreated. All cones were sliced and the number of seed (filled and unfilled) and number of insects on each cut surface recorded. Only cone midges (*Contarinia* spp.) were found in substantial numbers. Results were as follows:

Treatment	Av. no. of midges per cut surface	Insect-damaged seed 1/ %
Phosphorus	2.7	24.1
Nitrogen	1.8	13.8
Phosphorus + nitrogen	1.9	19.2
Control	1.2	19.5
Mean	1.9	19.1

1/ Calculated as number of filled seed adjacent to one or more midge galls as a percent of filled seed with no adjacent galls.

The differences among mean number of seed or number of midges was not significant at the 5 percent level. (Computed F for midge data = 3.33; tabular F = 3.86.) Variability was understandably high due to the heavy cone crop in 1971.

A second study was initiated in 1971 to examine clonal differences in cone and seed insect damage at Weyerhaeuser's McDonald Seed Orchard. Cones were collected from eight clones (50 cones per tree, 5 trees per clone) and examined for insect damage. Average number of midges (*Contarinia* spp.) and chalcids per cut cone surface were as follows:

Clone No.	Chalcids	Midges	Insect-damaged seed (% of filled seed)
1	0.02	2.01	14.3
2	0.43	2.11	18.1
6	0.04	0.34	4.5
8	0.06	0.68	5.1
9	0.04	0.62	9.5
10	0.02	0.76	6.2
16	0.02	0.51	3.0
20	0.04	2.02	14.4
Mean	0.08	1.04	9.4

Statistical analysis has not been completed on the above data, but clones 1, 2, and 20 appeared to be unusually susceptible to midge attacks; in addition, clone 2 sustained a substantially higher chalcid population than any of the other clones. Approximately 10 percent of the seed in the orchard was estimated to be non-extractable due to chalcid and midge damage. No control measures were applied in the orchard this year. (Cade - Washington)

Work on cone insects has been deemphasized, but I still carry on small-scale ecological studies of *Conophthorus resinosae*. Mathematical models (systems of difference equations) have been developed to describe the interrelationships between flowering, flower survival, and insect damage to cones. I am attempting to incorporate important climatic variables into these models through their influence on flowering. The material will be published in about a year. (Mattson - Minnesota)

4. Control

Research on the use of blacklight traps for the survey and/or control of cone-infesting Lepidoptera is continuing. During 1971 studies were initiated to evaluate the effectiveness of various trap designs and trap location on moth catches.

A long-term study was established in cooperation with the International Paper Company, Mobile, Alabama, to evaluate the effects of a hardwood barrier-strip on the incidence of insect-caused cone and seed losses in a slash pine seed orchard. (Merkel - Florida)

Dioryctria coneworm control results are summarized as follows.

Two 0.5 percent Gardona hydraulic sprays in the spring gave good control of *Dioryctria* coneworms (1.9 percent damaged cones vs. 17.5 percent for untreated checks) in loblolly pine seed orchards in eastern Virginia. Neither 0.5 percent Sevin hydraulic or 1.5 percent Gardona mist blower sprays were effective. (Basis - 25 trees per treatment with an average of 68 cones/tree.)

Early May treatments with Bidrin injected in bore holes, ala E. P. Merkel, gave good control of *Dioryctria* coneworms in a loblolly pine seed production area. Three grams of technical Bidrin per diameter inch reduced total damaged cones to 7.5 percent and 3.9 percent when applied in 1 and 2 bore holes, respectively. Check trees had a total of 31.6 percent damaged cones. Lesser rates were not as effective. (Basis - 6 trees per treatment with an average of 137 cones/tree.) (Copony - Virginia)

Trunk implants of systemic insecticides were made in seed orchard slash pine trees in an effort to reduce *Dioryctria* sp. infestations of cones. Azodrin and Bidrin were injected on May 7, 1970, the Meta-Systox-R was injected on June 2. Forty trees representing five clones were included in this test. The average percents of cones infested at harvest from each of the four treatment groups were as follows: Azodrin 11.0%; Bidrin 20.0%; Meta-Systox-R 33.8%; and untreated control 39.1%.

The best treatment, Azodrin, yielded 55.1 seed/cone compared to 39.6 for the untreated control. Differences in seed yields among the clones were non-significant at $p<.05$.

The slash pine trees were not re-injected in 1971. However, the mature second-year cones from these trees were examined in the fall of 1971. There is evidence to indicate from field collected data (presented in the following tabulation) that a residual effect of Azodrin and Meta-Systox-R was carried over into the second year:

Treatment	Total 2nd-year cones	Percent infested	Non-infested 2nd-year cones
Azodrin	201	19	162
Bidrin	107	30	75
Meta-Systox-R	151	20	121
Control	116	28	83

Three soil-applied applications of carbofuran (April 1, June 10 and July 8, 1971) applied to sandy soil in the Erambert Seed Orchard reduced *D. amatella* second-year cone infestations in the ramets of one loblolly clone, South Mississippi loblolly number 9. No appreciable control of this insect was obtained on the ramets of another clone, South Mississippi loblolly number 8. The granules were applied uniformly with a lawn fertilizer applicator under the dripline of each tree. They were worked into the soil to a depth of 1-2 inches. (Neel and Sartor - Mississippi)

Whereas we're not doing a great deal with cone and seed insects now we do have some results from a test we put in this spring. This is a repeat of one that we reported on last year. The 0.6 percent water solution of Azodrin applied in early May and again in late June reduced the cone and seed insect infestation (primarily *Dioryctria*) from 42 percent in the controls to 10.6 percent. Infestations in parts of the orchard that were sprayed standard sprays (BHC at 2 week to 1 month intervals) varied from 20 to 28 percent. It appears that this material has promise since it has done a good job 2 years in a row, however, safe techniques of application need to be worked out before we will recommend its use operationally. (Johnson - Arkansas)

A chemical control experiment was conducted by MacMillan Bloedel Ltd. on eight Douglas-fir seed production areas totaling 46 acres in area. Dimethoate at different concentrations and dilutions was applied by helicopter. Cones were infested by *Barbara colfaxiana* and several other species to a lesser extent. There was little, if any, indication of positive results. (Hedlin - British Columbia, Canada)

Dimethoate is the only insecticide registered for Douglas-fir cone and seed insect control. Application rate for hydraulic applied sprays is 0.5 percent. Analyses of past and 1971 data indicates that a one percent application rate could buy more harvestable seed. See the following table.

There has been a direction change in our Douglas-fir tree improvement program. Instead of relying on a few selected second-growth seed production areas to meet specific needs, emphasis has now shifted to individual genetically superior trees scattered over several seed zones and elevation bands. The expected goal will be to permanently locate and collect improved seed from 30,000 trees on 10 National Forests to meet reforestation needs. Because of tree accessibility and height, hydraulic spraying will be limited. Dimethoate is registered for hydraulic application only.

A pilot field test implanting dimethoate was made in 1971 under temporary registration to accumulate control data for a

Hydraulic Applied Dimethoate for Douglas-fir Cone and Seed Insect Control

Area	Year	Spray	Seed loss			Viable seed
			Midges	Moths	Chalcid	
			- - - Percent - - -			
Buckhead						
treated	1967	1.0	1.5**	1.4**	12.5 n.s.	16.8*
untreated			18.2	33.3	35.3	6.0
Muddy Fork						
treated	1968[1/]	1.0	0.7 n.s.	0.9**	0.1 n.s.	61.2**
untreated			2.5	34.8	0.1	33.6
Hayes Hill						
treated	1971[1/]	0.5	0.4**	0.8**	4.7 n.s.	48.7 n.s.
untreated			3.0	13.0	15.2	32.8
High Prairie						
treated	1971[1/]	0.5	1.2 n.s.	0.1 n.s.	7.2 n.s.	43.8 n.s.
untreated			1.8	0.1	4.5	52.1
Minnow Hill						
treated	1971[1/]	0.5	0.2*	0.1*	0.3 n.s.	58.6 n.s.
untreated			1.2	1.4	0.5	60.0

1/ Heavy cone year
** 1.0% level
* 5.0% level
n.s. - No significant difference

(Meso - Oregon)

permanent label. However, the potential market might not be sufficient to interest the formulator in securing permanent registration. Trees were treated at two grams active per diameter inch measured at breast height.

Injected Dimethoate for Douglas-fir Cone and Seed Insect Control-1971

Area	Seed loss: Midges	Moths	Chalcid	Yield
	- - - Percent - - -			
Muddy Fork				
treated	0.1**	1.7**	0.0 n.s.	+17.4
untreated	4.0	15.6	0.5	

** 1.0% level
n.s. - No significant difference

A two man treating crew using a gasoline powered drill treated 89 trees scattered over 45 acres within 7 hours actual field time. Tree diameter averaged about 13 inches d.b.h. Because of the heavy cone crop adjacent to Muddy Fork, cone and seed impact was reduced. This field test will be repeated in 1972 and emphasis will be on seed yield increase. (Meso - Oregon)

5. Publications

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