

ABSTRACTS OF REPORTS FROM THE
52nd ANNUAL WESTERN ORCHARD PEST AND DISEASE MANAGEMENT CONFERENCE

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These abstracts of progress reports on research conducted on the principal insect and disease pests of tree fruits and nuts in the states of California, Colorado, Idaho, Montana, Oregon, Utah and Washington, and the Province of British Columbia, are not intended to be recommendations of the project. Official recommendations can only be made by public service entomologists and plant pathologists from their respective areas.

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Abstracts of Reports from the
52nd Annual Western Orchard Pest and Disease Management Conference

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SECTION I
LEPIDOPTEROUS INSECTS

Discussion Leader -- Bill Hudson

Codling Moth - Apples

H. F. Madsen and B. E. Carty
Agriculture Canada, Summerland, B.C. VOH 120

Two first brood and one second brood sprays of Dimilin (.56 Kg of formulation per ha) or Penncap E (8.4 l of formulation per ha) gave good control of codling moth. Toxicity to mite predators was low phytotoxicity to Spartan, McIntosh and Red Delicious varieties was nil.

M. D. Proverbs
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In 1977, the codling moth sterility program covered 480 ha, 160 ha more than in 1976. In the area covered in 1976, fruit injury at harvest in 1977 was at or below that recorded in 1976. About 12 percent of the new area covered in 1977 required 1-2 cover sprays in addition to release of sterile moths because of high moth populations. Fruit injury in the new area varied from zero in 10% of the orchards to 3% in one orchard. Three orchards comprising 40 ha in which no codling moth injury occurred in 1976 received neither sprays nor release of sterile moths. These orchards were monitored with pheromone traps. In one orchard, 2 first brood and 2 second brood moths were trapped but no fruit injury was found.

H. F. Madsen and B. E. Carty
Agriculture Canada, Summerland, B.C. VOH 120

In a season with conditions ideal for increase of codling moth populations, trapping out male moths with pheromone traps at 10 per ha maintained fruit injury at commercial acceptable levels in two orchards with initial low populations. In an organic farm orchard with initial high populations, 36 traps per ha prevented a population increase over that of the previous year.

Codling Moth - Pears

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Dimilin 25% WP provided good control of codling moth in both dilute and concentrate sprays. Three covers (2 against first and 1 against second brood) at 2 oz/100 gal. provided control equal to 4 Guthion cover sprays at 1/2 lb. 50% WP/100 gal.

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Four parameters affecting pheromone trap catches were investigated: trap height, trap orientation with respect to wind, trap placement within the tree, and trap density. Traps placed at the tops of trees caught significantly more moths than those traps placed at eye level. Traps oriented with the wind were more efficient than those traps oriented perpendicularly to the wind. Traps placed in the lee side of the trees with respect to the wind caught more moths than those traps placed in a position that was directly exposed to the wind. The relative efficiency of different trap densities was investigated using the following ratios of traps/tree: 1/2, 1/4, 1/8, 1/16, 1/32. The optimal densities were 1/2 and 1/4.

An unsprayed orchard with an infestation of 45% in 1976 was used as a mass-trapping orchard in 1977. One trap was placed in every fourth tree. The mass-trapping was only marginally effective as the infestation in 1977 was 25%.

Field validation of the UC Berkeley phenology model was continued. The difference between the predicted and observed dates of the appearance of the first male was only three days in one monitored orchard, while the difference between the observed and predicted dates of the appearance of the first egg was one week and two weeks in two monitored orchards. In all cases, computer predicted events occurred before the observed events.

Pydrin 2.4 EC at 3 oz/100 gal was the most effective of the chemicals tested for codling moth suppression. Dimilin 25 W at 8 oz/100 gal and Ambush 2 EC at 2 oz/100 gal also performed as well as the standard Guthion 50 W at 8 oz/100 gal.

P. H. Westigard, Southern Oregon Experiment Station
569 Hanley Road, Medford, OR 97502

Treatment with Dimilin (0.5 lb a.i./acre) in three coversprays resulted in 6% and 1% fruit infestation on the Bartlett and Bosc varieties respectively. Predator and parasite levels were not significantly different in the above plots compared to the untreated check. Predators in the standard Guthion treatment were reduced ca. 50% over the season.

In other plots, the use of the synthetic pyrethroids, Ambush or Pydrin, resulted in excellent codling moth control. A buildup in spider mite levels accompanied these treatments.

In cooperation with USDA ARS Yakima, codling moth sex pheromone in Conrel fibers was applied to 2 1-acre plots. Three aerial applications were made during the summer. Results indicated that mating inhibition of about 6 weeks duration was achieved. Less than 1% wormy fruit was found at harvest.

J. E. DeTar and Helmut Riedl
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Post-harvest infestations on pears: Large codling moth infestations can readily develop on unpicked fruit after harvest. This might increase the codling moth problem the following year. Post-harvest damage levels can reliably be predicted from seasonal cumulative pheromone trap catch.

Helmut Riedl, S. A. Hoying, W. W. Barnett, R. S. Bethell, C. A. Davis,
J. E. DeTar, Johannes Joos, G. W. Morehead and D. Ewing
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Relationship of pheromone trap catch to early-season egg laying: This study was carried out in six counties. The time interval from first catch to first oviposition ranged from 6 to 17 days, and from first catch to first egg hatch from 18 to 42 days. However, more accurate predictions of egg laying can be made from temperature records by calculating the effective heat units for development. For instance, first egg hatch in the spring occurs on an average 265 heat units (degree days) after first catch. This information is critical for timing of control measures.

Helmut Riedl and S. A. Hoying
University of California, Berkeley, CA 94720

Codling moth control with the synthetic pyrethroid SD-43775: Treatments varied in terms of dosage and the number of sprays applied during the season. One cover spray provided good control (Below .5% damage at harvest). Mite build-up was highest in low-dosage plots which received two cover sprays. When only one delayed-dormant spray was applied no mite damage was evident at harvest.

Codling Moth-Apple and Pear

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Pydrin gave excellent CM control applied at 0.1 lb ai/100 gal in 4 covers. Dimilin would also be effective in commercial orchards in 3 early-applied covers. Pheromone traps in unsprayed plantings over a 4 year's period indicates a certain level of moth catch may be subeconomic.

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Effect of pheromone trap location on magnitude of catches: Response to pheromone traps placed at various height levels is primarily confined to the canopy with an increase in catches from the lower to the upper half of the tree. Trap elevation for monitoring purposes should be standardized relative to vertical canopy dimensions and not in terms of absolute height. With respect to cardinal direction traps placed in the northern quarter of a tree caught consistently fewer moths than at the other quadrants.

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Daily oviposition rhythm: Similar to flight and mating activity, egg laying begins in early afternoon, peaks with sunset and subsides with darkness. In spring oviposition occurs earlier in the day than during summer. This might be due to temperature effects. Oviposition has been studied in relation to photoperiod, under LL, DD and LD. Results suggest that this activity is under circadian control and it is synchronized with the lights-off stimulus 24 hours prior to the actual expression of this activity. These experiments provide background information for a predictive codling moth model.

H. R. Moffitt & D. O. Hathaway
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P. E. Westigard
Oregon State University, Medford, OR

A test for season-long control of the codling moth on pears was conducted in 1977 in the Medford, Oregon area. The Conrel[®] chopped fiber system containing the sex pheromone was applied by helicopter to 0.4-hectare blocks of pears containing trees of the Bartlett and Bosc varieties. The formulation was applied to yield a pheromone emission rate of 395 mg per hectare per day. Evaluation was on the basis of the response of male moths to pheromone or female-baited traps and the infestation in the fruit prior to and at harvest. Three applications of the pheromone were made during the season, on April 21, May 25, and July 26.

In the two treated plots, control equal to that obtained in a plot treated with a commercial type of chemical control program was achieved. On the earlier maturing Bartletts, the infestation rate at harvest in the pheromone-treated plots was 0.05% while in the later-maturing Boscs, the infestation rate at harvest was 0.4%. In plots in the area in which no insecticides were applied for codling moth control in 1977, an infestation rate at harvest of 4-9% was recorded.

Use of the pheromone as a control of the codling moth through mating disruption shows great promise and research on formulations, application timing and techniques, effects upon existing or potential biological control mechanisms, and other aspects will be continued.

Attractants and Traps for Monitoring Populations
Codling Moth - Apples

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The Kitterman insect trap in various colors was evaluated for codling moth over a two-week period. Evaluation was based on a comparison of catches between the white covered Howell wing and the colored Kitterman traps. The codling moth sex pheromone was used as bait at 1 mg per trap. Five replicates of the Kitterman trap were used for each of seven different colored traps, and five replicates of the white covered wing trap were used at one trap per tree in a two-acre block of apple trees. The number of moths caught in the Kitterman trap was: red, 117; blue, 115; yellow, 63; orange, 86; green, 127; white, 122; and gray, 79. There were 124 moths caught in the white covered wing trap.

The Kitterman trap took more time to put together than the wing trap because we had to make a wire hangar for the trap, however, it is a more permanent trap and overhead sprinkling does not affect the shape of the Kitterman trap as it does that of the wing trap.

Field Implementation of a Codling Moth Phenology Model
in Commercial Pear Orchards

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The use of the "bug-off" model for predicting codling moth development based on temperature was explored in El Dorado County, California, pear and apple orchards. Six temperature collection sites were used representing varying climatic conditions within the county. Temperatures were collected throughout the growing season and analyzed using day-degree charts and a telephone linked computer terminal. The day-degree based computer predictions were utilized in conjunction with pheromone traps and field validation data in making codling moth control recommendations. The use of the model assisted greatly in the pest management decision making process and has considerable potential for future expanded use.

Leafrollers - Apple

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Catches in pheromone traps baited for fruittree leafroller, European leafroller or Pandemus limitata at 1 trap per ha correlated closely with injury by leafrollers at harvest. Traps in adjacent orchards were useful to block off immigration to monitored orchards and to indicate outside sources of infection.

Pest Management - Apples

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Forty-five orchards (700 acres) were monitored for insects and mites in a pilot commercial pest management project using methods of Madsen. Number of sprays applied per orchard averaged about 1 1/2 for codling moth, 3/4 for European red mite eggs, less than 1/2 for summer mites, 1/4 for early-season lepidoptera, 1/6 for aphids, and 1/9 for leafhoppers. Fruit damage was generally below economic levels except for damage by early-season lepidoptera.

H. F. Madsen and B. E. Carty
Agriculture Canada, Summerland, B.C. VOH 1Z0

In 5 orchards under pest management since 1973, pest control costs were reduced 25-50% compared to standard control programs in 1977. Leafroller egg parasites were recorded for the first time in these orchards in 1976-77. Numbers of Pandemis pyrusana, Bruce spanworm, green fruitworm and other cutworms have increased due to the reduced spray programs.

Orange Tortrix - Apples

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Orange Tortrix (Argyrotaenia citrana): OT populations were monitored with Pherocon 1 traps in a commercial orchard with standard spray program (Sevin) and in an organic orchard (Ryania). Traps were placed in the interior of the orchards, at the borders and outside in the surrounding habitat to correlate OT production with specific host plant associations. In both orchards catches were consistently high throughout the season, and it was difficult to predict from the catches when damage would appear. Damage, primarily calyx feeding, was first detected in the middle of June, rose quickly, but stayed at the same level until harvest. This pattern and the magnitude of damage was the same in both orchards in spite of the differences in spray programs. In the commercial orchard, damage was most severe on Newtown Pippins which were not thinned by hand. Red Delicious and thinned Pippins had considerably less damage. Within each orchard there was some correlation between pheromone trap catches and eventual damage. The present monitoring system for OT has several shortcomings, the most important one is related to the trap itself. Even under low densities traps fill up very quickly which would require frequent maintenance. Catch information is therefore unreliable.

Peach Twig Borer - Peach

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Pheromone traps were used successfully to time spray applications for control of peach twig borer. Two sprays of azinphos-methyl 10 and 31 days after initial trap catches gave excellent control compared to adjacent blocks where sprays were timed according to calendar dates. In a second experiment, one spray of azinphos-methyl at pink and one spray of permethrin 10 days after trap catches indicated approach of peak first brood flight (22 days after initial capture) gave excellent control.

Peach Tree Borer - Peach

F. L. Banham
Agriculture Canada, Summerland, B.C. VOH 120

Permethrin, chlorpyrifor and endosulfan applied as trunk sprays 7 days after pheromone traps caught first moths gave good control.

Navel Orangeworm - Pistachios

R. E. Rice, University of California, Parlier, CA 93648

Guthion 50W at 0.5 lb. and 1.0 lb. a.i./100 gal., and Sevin at 0.5, 1.0, and 2.0 lb. a.i./100 gal. were applied as dilute sprays to pistachios in Kern County for navel orangeworm control. Applications made at 11.0% hullsplit gave reductions in damage ranging between 58.5% and 78.0%; applications at ca. 17.0% resulted in reductions in damage between 55.4% and 67.8%. Monitoring of oviposition with NOW egg traps showed no significant deviations in seasonal egg laying patterns as compared to almonds.

Navel Orangeworm - Almonds

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Field bioassays of ca. 25 chemicals isolated and identified from wheat bran bait showed no significant attraction or oviposition stimulus to female NOW. Preliminary studies on constant temperature requirements for NOW egg development indicated a lower threshold of ca. 58°F and an upper threshold of ca. 95°-100°F.

Differential Transmission of Potato Leaf Roll Virus
by Clones of the Green Peach Aphid

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University of Idaho

About 60 clones of the green peach aphid were tested for efficiency in transmitting potato leaf roll virus. Single aphids were exposed for 48 hrs. on Physalis floridana indicator plants after a 48 hr. acquisition feeding period on infected Russet Burbank potato plants. Most clones transmitted in the range of 20 to 70%. Lengthening the acquisition and inoculation feeding periods did not change the relative transmitting ability of selected high and low transmitting clones. Clones varied significantly in vigor as measured by fertility and survival, but there was no correlation between vigor and transmitting efficiency of clones.

Filbertworm - Factors Influencing Moth Flight

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The flights of the filbertworm adults determined by various environmental factors including temperatures, wind velocity and moonlight. The lower threshold for flight is about 15°C, and the upper threshold about 30°C. The optimum temperature for flight is about 20-25°C. No flights occurred at a wind velocity of 20 mph and over. The optimum was between 4-8 miles/hr. Comparatively fewer moths were trapped during a full moon light. In a dark night, under favorable temperature conditions, the daily flight start within an hour after sunset and continues for about 2-3 hours.

Filbertworm - Predicting Emergence Using A Thermal Summation Scheme

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Duane Hatch, Lane Co. Ext. Agent, Eugene, OR
Wayne Roberts, Yamhill Co. Ext. Agent, McMinnville, OR

The emergence of filbertworm adults is predicted by employing a thermal summation scheme. Light trap data over a 8 year period (1970-1977) was analyzed to determine the number of heat units (day degrees) required for the emergence and seasonal activity. The thermal summation scheme is considerably more accurate than calendar dates.

Chemical Control of Filbert Pests

M. T. AliNiazee, Dept. of Ent., O.S.U., Corvallis, OR 97331

Various pesticides were tested for the control of filbertworm and filbert aphid. Pydrin was the most effective compound against filbertworm. Other tested chemicals, Sevin, Penncap-M, Furadan and Guthion were moderately effective. Among the aphid control materials, Aldicarb 15G at 10 lb/acre rate, applied as soil treatment, and Pirimor at 5 oz AI/acre applied as a ground spray obtained good control.

S E C T I O N I I

ORCHARD MITES

Discussion Leader -- John Joos

European Red Mite - Apples

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European red mites were controlled by a single application of Zardex at 1/2 lb a.i./100 in early July on an 8A. Red Delicious block. Mite counts at application were 20-plus mobiles and 200-plus eggs per leaf. Predator mite survival was equivalent to the Plictran standard.

Prebloom applications of Zardex at 1/2 lb a.i./100 on two blocks did not provide satisfactory summer control of European red mites.

European Red, McDaniel Spider and Predaceous Mites - Apple

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In laboratory tests Zardex was less toxic and PP199 more toxic than Plictran to Typhlodromus occidentalis. PP199 and Plictran gave good control of European red and McDaniel spider mites. Zardex gave poor initial kill but was more persistent than Plictran or PP199. Tolerance to carbaryl in populations of T. occidentalis from orchards with a history of use of carbaryl for thinning was demonstrated.

McDaniel Mite - Apples

Jack D. Eves
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McDaniel mites were controlled by a single application of Zardex at 1/2 lb a.i./100 in early July on a 5A. Golden Delicious block. Mite counts at application were 25-plus mobiles per leaf. Predator mites were not adversely effected.

PP199 at .05, .1, .2, and .4 lb a.i./100 reduced McDaniel mites comparable to the Plictran standard and greater than the check. The higher rate was moderately toxic to predator mites. Data was complicated by integration of the block by predator mites.

McDaniel Mites - Apples (Red Delicious)

Donald W. Davis
Utah State University, Logan, UT

One series of replicated acaricide tests, using mostly unregistered materials, was applied at Farmington, Utah. The mite numbers were very low on July 7, the time of application, but exceeded 100 per leaf in the untreated controls and less effective treatments before the end of August.

Malonoben at 2 or 3 oz. AI/100 was only moderately effective, but at 4 oz. AI/100 it was a fairly good acaricide, keeping the mite numbers down for about 5 weeks. At the higher rates it appeared to suppress Typhlodromus numbers.

PP 199 was a highly effective acaricide. At either .1 or .2 lbs. AI/100 there was seasonal McDaniel mite control. The higher rates appear to be detrimental to Typhlodromus.

Plictran at 3 oz. AI/100 was more effective than Omite at 6 oz. AI/100 plus being less harmful to predatory mites.

McDaniel Mite - Sour Cherries

Donald W. Davis
Utah State University, Logan, UT

One series of acaricide tests was applied at Orem, Utah on June 28.

Plictran at 3 oz. AI/100, Omite at 6 oz. AI/100 and Malonoben at 4 oz. AI/100 were effective for nearly two months.

Malonoben at 2 oz. AI/100 reduced the spider mite numbers for 4 weeks, then failed completely.

Mesuro1 at 8 oz. AI/100 reduced the spider mite numbers for about 5 weeks, but by late August their numbers exceeded those of the untreated control by several fold.

Typhlodromus predators were present, but in fewer numbers than normally found on apple trees.

Orchard Mites - Apples

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The population dynamics of orchard mites were studied under various field conditions in the three major apple growing regions of northern California. Particular emphasis was placed on the collection and identification of the phytoseiid predators encountered because of their potential importance in an integrated pest management program. The most common phytoseiid predator found in the Watsonville and Sebastopol regions was Typhloseiopsis arborus (Garman & McGregor) in both sprayed and unsprayed situations. Metaseiulus occidentalis (Nesbitt) was the only phytoseiid found in the Placerville area in sprayed situations; M. mcgregori (Chant) in unsprayed situations. Pesticide spray schedules were correlated to changes in predator and prey densities.

Two-Spotted Spider Mite - Pears

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Summer sprays of PP199, DPX 3792, R677 (0.13 lb a.i.), Malonoben (0.25 lb a.i.) and XE 333 provided economic suppression of the two-spotted mite for a 3-4 week period. Only PP199 (0.20 and 0.40 lb a.i.) gave control for a 4-5 week period.

Spider Mites - Apple

R. W. Zwick and G. J. Fields
Mid-Columbia Experiment Station, Hood River, OR 97031

PP-199, RH-6564, DPX 3792, and Maloneben gave effective control of spider mites.

Spider Mites - Cherry

R. W. Zwick and G. J. Fields
Mid-Columbia Experiment Station, Hood River, OR 97031

Vendex at 1 lb/A was effective against a moderate McDaniel mite infestation but allowed some resurgence after 4 weeks of a high population at 2.5 lb/A.

Integrated Mite Control - Apple

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Predatory mites are surviving early dinocap and carbaryl sprays well in commercial orchards and contributing to biological control of spider mites later in the season if reduced rates of Imidan or phosalone are used in covers. Azinphosmethyl in multiple cover sprays, even at low rates, prevented effective predator buildup in 1 orchard.

S E C T I O N III

OTHER INSECT PESTS

Discussion Leader -- Ralph Downing

Pear Psylla - Pears

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The application of the plant growth regulator, Alar, to Bartlett pear trees reduced terminal growth and resulted in a 50-60% reduction in pear psylla density. Psylla damage to pears was 2.7% in the Alar treatment compared to 8.2% in the non-treated plot.

G. J. Fields and R. W. Zwick
Mid-Columbia Experiment Station, Hood River, OR 97031

A dormant oil reduced oviposition 95% or more for up to 5 weeks and in combination with an adulticide plus oil at delayed dormant and pink of Morestan produced excellent prebloom psylla control. Dilute or concentrate ground applications of dormant oil were much more effective than aerial application in delaying oviposition. BAAM gave better summer nymph control but honeydew russet was not noticeably lighter on the BAAM plots. One prebloom plus 1 cover of Pydrin at 0.33 lb ai/A gave excellent seasonal psylla control without a noticeable spider mite buildup.

Helmut Riedl, and S. A. Hoying
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Psylla control with the synthetic pyrethroid SD-43775: Treatments varied in terms of dosage (.034, .067, .135 gm a.i./liter) and the number of applications (delayed dormant, 2 cover sprays). All three rates provided good control of adult and immatures, although the .034 gm/liter treatment (3 applications) showed a slight increase during the extended period between the final cover and harvest. This suggested that the application interval needed to be shortened at this rate. The .067 and .135 gm/liter treatments with a delayed dormant and 2 cover sprays gave adequate control through harvest. A delayed dormant application alone (all three rates) did not control adults or immatures through harvest. Populations of two-spotted mites were evident in all treated areas at harvest, but not before. Highest build-up occurred in the low dosage plots and presence of mites was inversely related to the rate applied. This indicated some acaricidal activity at the higher rates. The delayed dormant treatments alone (all rates) caused no appreciable mite outbreaks.

In addition, studies were conducted on the seasonal distribution of immature stages on leaves, terminals and spurs. Seasonal abundance of adults (including several natural enemies) was monitored with a beating tray.

Jack D. Eves
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Three summer applications of Ambush at .25 and .50 lb a.i./100 did not satisfactorily control pear psylla nymphs as compared to Baam and Fundal standards. Pear psylla adults were reduced initially after each application but soon moved back in.

Two post-harvest applications of Ambush at .05 and .1 lb a.i./100 in late October and early November provided 94% and 99% control of pear psylla adults on 5A blocks. Hardshells were only 33 and 66% reduced after the 2nd application.

Everett Burts
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The synthetic pyrethroids, Pydrin and Ambush, were the only outstanding chemicals tested for control of overwintered adult pear psylla as dormant sprays. PP199 reduced adult populations as a dormant spray but did not provide commercial control. Pydrin was more effective than Ambush at equal dosage ai. Research to date indicates that these materials may be most useful as dormant sprays either in aerial or ground equipment applications for pear psylla control.

In a series of 3 summer sprays against all stages of pear psylla, chemicals in descending order of effectiveness were Pydrin EC, Pydrin WP and PP199. Several other materials showed little or no activity against this insect. Pear clean, a surfactant, was partially effective in controlling nymphs. Two summer sprays of Ambush 25% WP 1.6 lb/100 gal. did not control pear psylla nymphs.

Summer sprays of Ambush and Pydrin caused serious resurgence of two-spotted mites.

Pear Psylla - Pears (Bartlett)

Donald W. Davis
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One series of replicated insecticide applications was made at Orem, Utah to control the pear psylla. Effectiveness was measured using both egg and nymphal counts at weekly intervals following the spray application on June 22.

Guthion and Imidan, each at 8 oz. AI/100 gallons were much less effective than they were during the 1970 and 1971 experiments. Both reduced the psylla numbers, but Imidan gave effective control for not more than 2 weeks and Guthion for about 3 weeks.

BAAM at 8 oz. AI/100 highly effective for 4 weeks with substantial control for 6 weeks. Thiodan at 8 oz. AI/100 was nearly as effective as BAAM.

Ambush (synthetic pyrethroid) was used at both .1 and .2 lb. AI/100. Control was highly effective for about 6-7 weeks, with substantial control for the entire season. We did not have the mite build-up recorded in other areas.

In several areas of Utah, the native predators, primarily Anthocoridae, continue to keep the pear psylla at very low levels throughout most of the season.

San Jose Scale - Peaches

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Chemical control of San Jose scale males in March was compared to control of first generation crawlers in May on Fay Elberta peaches. Diazinon 50W was applied by handgun at 0.5 lb. a.i./100 gal. dilute spray in 9-tree replicated blocks. Treatments for males were applied at 1st male flight (3/22/77) and at 7 and 14 days after 1st flight. The May spray was applied 11 days after 1st crawler emergence. Evaluations in June based on numbers of scale on terminal twig growth showed population reductions of 89.5-95.0% in the male control treatments and 99.4% in the crawler treatment. Counts made in September showed reductions of only 38.6-57.9% in the male treatments and 70.8% in the crawler treatments. Potential problems associated with early season sprays timed to male emergence include interference with bloom and pollinators, and relatively severe effects on overwintered female phytoseiid mites. Fay Elberta peaches were in full bloom on March 13, 1977, with 95% petal fall occurring on March 20.

San Jose Scale - Pheromone Research

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Seasonal monitoring of San Jose scale males with virgin female pheromone traps again showed four distinct male flight periods between March 20 and November 18. Male emergence in the first flight (overwintered generation) was completed in ca. 15 days, while male emergence from the first generation flight in June covered ca. 45 days. Temperature thresholds for male scale flight appear to be in the 60°-65°F range, as males flew to traps on only 2 days when sunset temperatures were below 65°F. Chemical isolation, bioassay, and identification of the San Jose scale sex pheromone is proceeding; mass spectrometry and NMR identifications of active fractions are presently being conducted at Cornell University.

Western Cherry Fruit Fly - Cherry

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Two applications of dialifor or oxydemeton-methyl gave effective control but 3 sprays of permethrin were required. Visible residues on fruit resulted from the dialifor W.P. applications.

A Phenological Model for Predicting Biological Activities
of the Western Cherry Fruit Fly

M. T. AliNiazee, Dept. of Ent., O.S.U., Corvallis, OR 97331

A computerized model based on a time-temperature relationship has been developed for the western cherry fruit fly. The model predicts the occurrence of various biological events such as emergence levels, mating, oviposition, larval appearance, etc. with high accuracy. These events are predicted as a function of summation of thermal units starting March 1. For example, emergence begins at 462 TU, oviposition at 541 TU, and hatch at 594. The model was validated by actual field observations during 1976 and 1977 seasons. The model is a useful tool in pest management programs on cherries.

An Area Wide Management Program for Cherry Fruit Flies

M. T. AliNiazee, Dept. of Ent., O.S.U., Corvallis, OR 97331

An area wide management program was initiated against the western cherry fruit flies during 1976 season. Approximately 1-2 acre blocks were selected in 12 orchards distributed throughout the Willamette Valley. Spherical balls were used as trapping devices at a rate of 8/acre. The fly emergence was monitored 3 times a week. Because of a low tolerance level, the sprays were applied at a level of 1 female or 2 male flies/acre. The program was well accepted by the growers. Out of the 12 growers involved in the program, 4 growers did not have to apply any pesticides because no flies were trapped, thus saving 4-5 sprays. Among the rest, 3 growers saved 50% of the sprays, and 5 growers saved about 25%.

Chemical Control of Cherry Fruit Flies

M. T. AliNiazee, Dept. of Ent., O.S.U., Corvallis, OR 97331

Three experimental compounds were tested for the control of the western cherry fruit fly. Three sprays were applied at 10 day intervals starting June 8, 1977 using a hand gun. All 3 compounds, chlorthiophos at 0.5 lb., Pydrin at 6 oz., and Penncap-M at 2 qts., obtained excellent control of the cherry fruit flies.

Feasibility of Sterile Insect Technique (SIT)
Against the Western Cherry Fruit Fly

M. T. AliNiazee, Dept. of Ent., O.S.U., Corvallis, OR 97331

The western cherry fruit fly appears to an ideal candidate for control using sterility technique. It has a suitable radio-biology and can easily be reared in large numbers using a field rearing technique. It is possible that SIT could become a part of integrated program against this insect. SIT would have many advantages over a conventional chemical program.

Walnut Husk Fly - Walnuts

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Emergence, flight activity and oviposition were monitored in two unsprayed walnut groves (Los Altos and Lafayette). Emergence at Lafayette from the soil below walnut trees began toward the end of June, reached the 50% point by the end of July and continued until early September. Catches in Frick AC (ammonium carbonate) and Zoecon AM traps gave an accurate estimate of first emergence. Both trap types gave similar cumulative catch curves. However, the AM trap caught a significantly higher number of flies. The 50% catch point was ca. 3 weeks after the 50% emergence point and flight activity continued until early October. Oviposition started shortly after the first flies were caught in the traps and peaked at the same time as the catches. The patterns of emergence, catches and oviposition were similar at Los Altos, but ca. two weeks earlier. Egg sampling was carried out at two height levels and at the four cardinal points to obtain information on within-tree egg distribution.

Monitoring with Frick traps: a replicated field test was conducted to determine the optimum ammonium carbonate charge. Ammonia release is very high during the first few days, but levels off and is almost linear after the first rapid loss. Analysis of data is still incomplete.

Chemical Control of Wireworms in Potatoes

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Two experiments, one testing terbufos and fonofos and another fonofos only, were carried out in potatoes at Cloverdale to control the European wireworm Agriotes obscurus. Each insecticide was applied by three methods: in the furrow with the seed, at 1.1 and at 2.2 kg ai/ha; as a sidedress on both sides of the row 2.5 cm below the seed and 5 cm away from the seed, at 2.2 kg ai/ha; and broadcast at 5.6 kg ai/ha and rototilled to a depth of 10 cm. In the untreated plots 46% of the tubers were unmarketable in one experiment and 34% in the other. The furrow treatments with fonofos or terbufos at either 1.1 or 2.2 kg ai/ha gave the best control, reducing the number of unmarketable tubers by 76 to 85%. Fonofos broadcast at 5.6 kg ai/ha, the current recommendation for the control of wireworms in British Columbia, gave inconsistent results in the two experiments. It reduced the number of unmarketable tubers by 81% in one experiment but only 36% in the other. Terbufos, broadcast at 5.6 kg ai/ha, reduced the number of unmarketable tubers by 71% but it was tested only once. Fonofos sidedress reduced the number of unmarketable tubers by 62% in one experiment but only 14% in the other. Terbufos sidedress gave 55% reduction in unmarketable tubers.

Cutworms - Apples and Pears

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The nematode DD-136 gave good control of western yellow striped armyworm in mint. However, DD-136 failed to control alfalfa looper on cabbage although effective against the insect in the laboratory. The nematode was apparently isolated from the insect larvae. The insects secluded themselves on the underside of the leaves, a dry area not wetted by the spray or irrigation which protected them from the nematode. DD-136 failed to control variegated cutworm on mint in an exploratory test and the reasons are not clear. Lab tests to determine susceptibility of the variegated cutworm have not been made.

An effective method of storing the nematode DD-136 has been developed and a publication is in preparation.

Wasp attractants have been observed to attract noctuids. Four of the more attractive compounds were tested in the spring as attractants for the spotted cutworm with negative results (attractants supplied by Dr. Harry Davis).

Acetate and alcohol mixtures of the spotted cutworm attractant were tested for improved attractancy; Z7-14:Ac + Z7-12:Al, Z7-14:Ac + Z7-14:Al, and Z7-14:Ac + Z7-16:Al were more attractive than Z7-14:Ac + Z9-14:Al and Z7-14:Ac + Z11-16:Al. The attractants were provided by Dr. Les McDonough.

Efficacy data and residue_R samples were obtained for a minor use registration program for using Lorsban^R for cutworm control on apples. At 1/2, 1, or 2 lb a.i./100 gallons water, the mortality of spotted cutworm was 65, 85, and 95% respectively. Similar data were obtained on pears for both spring and summer generations of cutworms.

Shell SD-43775 gave control of both spotted cutworm and bertha armyworm comparable to that of Lorsban in pear plots. SD-43775 was an effective ovicide for psylla eggs; 96% of the treated eggs failed to hatch.

The drought did not reduce spotted cutworm populations. Winter survival was higher than usual. The opposite was the case for bertha armyworm; winter survival was reduced. Summer populations were low for both species. The 2nd generation larvae were not numerous enough to cause economic damage.

A Root Boring Weevil, *Pseudobaris nigrina* (Say), Damaging to Mint

Guy W. Bishop and Mohammed Baruni
University of Idaho

Infestations of *Pseudobaris nigrina*, a root boring weevil, were observed in peppermint and spearmint fields throughout Western Idaho. Up to 60% infested plants were found in fields in the Caldwell area. Secondary rotting organisms were consistently associated with larval tunnels resulting in plant wilting and death. Infested plants were also subject to lodging. There is apparently a single generation annually with the adult overwintering.

S E C T I O N I V

CONCENTRATE SPRAYING RESIDUES AND PHYTOTOXICITY

Discussion Leader -- Don Berry

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Mid-Columbia Experiment Station, Hood River, OR 97031

Aerial fixed wing dormant oil sprays averaged 50% of the residue of comparable rates applied by air carrier sprayers on dormant pear fruit spurs.

Microencapsulated Methyl Parathion and Bee Poisoning

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Bee poisoning by Pennacp-M in the field was quickly associated with pollen contamination because of the killing of newly-emerged workers, break in the brood cycles, and ultimate dwindling of the colonies. During last May, we ran some tests on rapeseed fields in northern Idaho. Colonies of honey bees with false-bottom pollen traps and dead bee traps attached were placed next to each 20-acre plot. Additional colonies were brought in 1 day and 3 days after application. Initial kill of the field force was moderate to high in the Pennacp-M plot (543 to 1,775 dead bees/colony), while initial kill was low to severe on the Pennacp-M plus sticker plot (232 to 4,431/colony). Actually, weather conditions were bad and the severely killed colony had been in place for both the second and third applications.

Kill of foraging bees dropped off in 3 to 4 days, but picked up on the 4th or 5th day with 80 to 90 percent of the dead being newly-emerged workers. The brood cycle was broken after 28 days in the severely killed Pennacp-M plus sticker colony. It was not broken in the Pennacp-M colony which was in place before the last applications. We noted that the bees simply did not forage well in the treated plot in this case. The brood cycles were broken after 12 and 19 days for the colonies placed on the Pennacp-M plot 1 and 3 days after applications, respectively.

The unique characteristics of Pennacp-M in regard to bee poisoning hazard are as follows:

1. Sevin dust is the only other organic insecticide formulation proven to remain as a contaminant in stored pollen from one season to the next.
2. Sevin dust is the only other organic insecticide formulation which typically caused a delayed break in the brood cycle about 2 weeks after application.
3. Pennacp-M is potentially more hazardous than Sevin dust because it shows a special tendency to adhere to foraging bees as they contact contaminated flowers.

Effect of Overtree Sprinkler Irrigation on Pear Pest Control - Pears

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Application of water through overtree sprinklers in an irrigation schedule (6 applications, 2-3 weeks apart) reduced psylla honeydew injury by about 85% compared to undertree sprinkler irrigation. There was no significant difference in pear psylla densities in the above two treatments. In these trials, codling moth damage was measured at 2.1% in the overtree sprinkled and 4.8% in the undertree sprinkled plots respectively.

Phytotoxicity with Dormant Oil Treatments - Pears

P. H. Westigard, Southern Oregon Experiment Station
569 Hanley Road, Medford, OR 97502

Effects of pre-bloom oil sprays of from 1%-32% concentrations were measured on various pear varieties both under laboratory and field conditions. In laboratory tests damage to first buds was observed at oil concentrations of 8% and above. Vegetative buds were damaged at 4% and above. Field tests failed to produce injury at rates up to 16%. Fruit set due to oil treatment was not significantly different from untreated pear trees.

S E C T I O N V

PHEROMONES

Powdery Mildew of Sweet Cherry in California

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Powdery mildew infections of sweet cherry leaf and fruit occur sporadically in certain areas of California. In 1975, a Bing cherry orchard in the Suisun Valley suffered a 54% crop loss. Leaf infections were not severe at the time of fruit infection. The causal organism on the fruit was identified as Podosphaera oxyacanthae (= P. clandestina). Cleistothecia which developed on the fruit and leaves were compared and found to be identical. The first known report of P. oxyacanthae fruit infection in the United States was by Harley English in 1947. Infection was most common on the shoulder of the fruit at the stem end. Small field trials were conducted in 1976 and 1977 to control fruit infection. Disease development was suppressed with EL 222, EL 228 and Bayleton fungicides (Table 1).

Table 1. Efficacy of fungicides in reducing powdery mildew of Bing cherry fruit.

Treatment	Kg/Hectares a.i.	% Fruit With Mildew at Harvest			
		1976		1977	
		Small	Large	Small	Large
Fenarimol (EL 222)	0.124 (1.8 oz/acre)	21.3	0.7 a	4.3 a	1.3
Nuarimol (EL 228)	0.124 (1.8 oz/acre)	24.7	1.0 a	-	-
Triadimefon (Bayleton)	0.561 (8 oz/acre)	20.0	1.0 a	3.3 a	0.7
Sulfur	20.6 (18.4 lb/acre)	-	-	3.0 a	1.0
Check	-	22.7	22.3 b	14.3 b	4.7

Little Cherry Disease - Cherry

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The results of vector tests conducted in 1976 point strong suspicion towards the apple mealybug or a rust mite common to sweet cherry as the vector of little cherry disease. Other tests since 1974 with a large number of species of leafhoppers, aphids and other sucking insects have given negative results.

The Efficacy of Benomyl-Captan Combination Sprays
On Control of Benomyl-Tolerant Strains of *Monilinia fructicola*

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This research was conducted while the senior author was on sabbatical at the New York State Agricultural Experiment Station, Geneva, New York 14456.

A comparative study was made under controlled conditions on the efficacy of benomyl, captan and their mixture on control of brown rot blossom blight on sour cherries. The brown rot inocula used in the experiment were benomyl sensitive, benomyl tolerant and the mixture of each. The host was sour cherry trees planted in 15-cm pots which stood about one meter in height.

The procedure used was as follows: Trees in cold storage were removed to the greenhouse for the blossoms to develop to full bloom. Three single-tree replications were used for each treatment. The chemical spray treatments were applied on June 1 (9 a.m.) with a hand atomizer to drip stage and air dried until 5 p.m. when spores produced on canned peaches (30,000/ml and 60,000 in mixture) were sprayed. The trees were immediately placed in a water mist chamber and held at 22 C for 24 hr and removed to the greenhouse. Within 24 hr infections of anthers and stamens were clearly visible with some infections of the floral tube. Final counts of floral tube and peduncle infections were made after 48-hr incubation in the greenhouse.

Infection of the nontreated blossoms was over 80 percent with no significant difference in pathogenicity between the benomyl-sensitive and tolerant strains. The benomyl treatment prevented infections by the benomyl sensitive strain but only reduced the number of infections by the benomyl tolerant as well as the mixture of strains. Both captan and captan plus benomyl treatments were effective in the control of tolerant and sensitive strains. Although full dosage of each chemical was used in the combination sprays, additional benefits were not observed when benomyl-tolerant strains were part of the inoculum.

Isolations were made from the blossoms to determine their sensitivity to 10 ppm benomyl incorporated DIFCO potato-dextrose agar medium. Blossoms inoculated with benomyl-sensitive strain remained sensitive; those inoculated with benomyl-tolerant strain remained tolerant but tissue transfers directly from diseased blossoms onto benomyl media were not always successful as the fungus failed to develop. When a 50-50 mixture of sensitive to tolerant spores was inoculated only 25% of isolations were tolerant on nonsprayed blossoms.

In conclusion, benomyl applied to blossoms with benomyl-tolerant *M. fructicola* reduces blossom blight but not effectively. To monitor for benomyl tolerance, it is suggested the fungus be isolated first on medium without benomyl and then on 10 ppm benomyl medium. Captan alone was as effective as the combination, benomyl-captan, in preventing infections from benomyl-tolerant strains.

Table 1. Comparisons of benomyl and captan alone or in combination on percent Monilinia blossom infection of sour cherries in pots^a.

Chemical ^b	oz per 100 gal spray	Inoculum Sensitivity to Benomyl		
		Sensitive	Tolerant	Mixture
Control	--	93	84	92
Benomyl	6	0	25	11
Captan	32	5	2	3
Benomyl plus captan	6 and 32	trace ^c	3	2

^aBlossom infection was recorded when necrosis was visible on the floral tube or the peduncle.

^bProprietary compounds of benomyl and captan were both 50% formulations. Blossoms on potted trees were sprayed to drip stage with hand atomizer. After drying for 8 hr spores were applied (30,000/ml and 60,000/ml for mixture). Trees were placed in mist chamber at 22 C for 24 hr. Trees were placed in greenhouse for 4 days.

^cOne blossom infected.

S E C T I O N VI

DECIDUOUS ORCHARD DISEASES

Discussion Leader -- Dale Ravetto

Apple Scab - Apples

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A chemical control trial was conducted on McIntosh in Creston, B.C. Chemicals tested were Benlate, Cyprex and Difolatan. The main purpose of the trial was to test the effectiveness of delayed sprays of Benlate. Regularly scheduled sprays were applied immediately following an infection period, with the Benlate treatments six and nine days after the infection period.

<u>Treatment (Rates Per 100 Gal.)</u>	<u>Average Number of Fruit With Scab Lesions Per 100 Fruit</u>
1. Check	86.3 a*
2. Cyprex 65 W (12 oz.) - regular schedule	1.3 b
3. Benlate 50 W (8 oz.) - 9 day delay	0.6 b
4. Benlate 50 W (8 oz.) - 6 day delay	2.2 b
5. Difolatan 4.8 F (1 gal.) + Cyprex 65 W (8 oz.)	1.2 b

* The small letters indicate Duncan's Multiple Range groupings of treatments which do not differ significantly at the 5% level.

The level of leaf infection at harvest was extremely high in treatment 1 (check). Leaf infection levels were low in all chemical treatments.

All chemical treatments gave significant control of fruit scab with no significant difference between chemical treatments. Delayed applications of Benlate have given good control of apple scab for three consecutive years.

Mildew - Apples

Jack D. Eves
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Pink, petal fall, and 14 days after petal fall applications of Bayleton at 2 oz a.i./100 gave excellent control of mildew on Jonathon apple foliage as compared to Karathane.

Apple Disease Management in El Dorado County, California

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In 3 years of monitoring and 2 years of making grower recommendations, direct pesticide costs have been reduced by an average of \$15.30/acre. The average number of yearly applications has been reduced from 5.8 to 4.3. In both cases, almost 100% of the reduction has been due to decreased scab and mildew control measures, based primarily on scab spore release monitoring and field evaluation of mildew levels. Scab damage levels have been reduced dramatically. Although 1976 and 1977 were drought years in California, much of the rain that did fall in El Dorado County came during periods when fruit and foliage are susceptible to infection. Rainfall during this time was as frequent and heavy as in past years when high damage levels occurred.

Grower communication was accomplished by direct phone contact and by Code-a-phone messages.

Fireblight - Pears

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Commencing applications of a bactericide spray or dust program following any daily mean temperature that exceeded a straight and slightly declining line (March 1 mean temperature equals 62°F and May 1 mean temperature equals 58°F) continued to give control comparable to a normal spray program commencing at 5% bloom. Delaying applications until after *Erwinia amylovora* bacteria were detected in the orchard failed to give adequate control in two of five tests conducted in 1977. This past season ideal conditions existed for bacterial development and infection to occur before blossom sampling and plate incubation was completed, due to a four day warm weather period followed by rain within 48 hours. These conditions caused development of fireblight in the treatments where sprays were started following *E. amylovora* detection in blossom samples before any protective sprays were applied.

1977 Comparison of blight incidence in plots treated commencing after the following criteria were met: 5% bloom, mean temperature exceeding the threshold line, and *E. amylovora* detection in blossom samples.

<u>Treatment</u>	<u>County Where Orchard Is Located</u>				
	<u>Solano</u>	<u>Sacramento</u>	<u>Yuba</u>	<u>Napa</u>	<u>Mendocino</u>
	Strikes Per 10 Trees (Number of Applications)				
5% Bloom	16 a (7)	9 a (9)	9 (a) (13)	17 (7)	0 (12)
Mean Temperature	20 a (6)	12 a (8)	12 (a) (11)	18 (8)	0 (10)
<i>E. amylovora</i> detection	24 a (3)	28 b (6)	32 (b) (10)	35 (4)	0 (8)
Check	76 b (0)	38 (0)	33 (0)	31 (0)	0 (0)

List of Chemicals

<u>Trade Name or Number</u>	<u>Common Name</u>	<u>Manufacturer</u>
Ambush	PP557 or permethrin	ICI America
BAAM	amitraz	Upjohn Co.
Dimilin	difluron	Thompson-Hayward Co.
Guthion	azinphos-methyl	Chemagro
Imidan	phosmet	Stauffer Co.
Malonoben	GCP-5126	Gulf Corp.
Mesuro1	methiocarb	Chemagro
Omite	propargite	Uniroyal Co.
Plictran	cyhexatin	Dow Co.
PP199 *	no other names	ICI America
Pydrin	fenvaterate	Shell Development Co.
Thiodan	endosulfan	FMC Corporation

* 2'-chloro-2, 4-dinitro-5', 6-di-(triflouromethyl) diphenylamine