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Editors

James J. Stapleton
Charles G. Summers
Beth L. Teviotdale
Peter B. Goodell

REMINDER TO CONTRIBUTORS

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**Cooperative Extension
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Statewide IPM Project**

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PREDICTING DAMAGE IN FRENCH PRUNES CAUSED BY OBLIQUEBANDED LEAFROLLER WITH LARVAL MONITORING, IN-SEASON FRUIT INSPECTION AND PHEROMONE TRAPPING

Carolyn Pickel, UCIPM/UCCE, Sacramento Valley; Bill Olson, UCCE, Butte Co.; Rick Buchner, UCCE, Tehama Co.; Bill Krueger, UCCE, Glenn Co.; Wilbur Reil, UCCE Yolo Co.; and Steve Sibbett, UCCE, Tulare Co.

As French prune growers reduce insecticide use, the obliquebanded leafroller (*Choristoneura rosaceana* Harris) has increasingly become a secondary pest problem. Prune growers typically grow their crop for the dried plum market, but there is an increasing amount being directed to Asia for fresh market prunes. The obliquebanded leafroller (OBLR) has two to three generations per year and causes damage by feeding on the surface of the fruit. This surface damage can affect quality for fresh market prunes, but is not a problem when the fruit is dried.

Pheromones have not proven very useful in predicting population levels of OBLR that might cause economic damage in many orchard crops. In French prunes, the current concentration of pheromone in commercially available lures attracts such high numbers of adult male moths that relating trap catch to potential damage has not been possible. Since OBLR has a wide host range (Chapman and Lienk, 1971), one possible explanation for the large catch is that the high concentration of the commercial lure attracts adult males from an area beyond the orchard being monitored. Information from trials in Pacific Northwest apples has demonstrated that lowering the concentrations of OBLR pheromone in lures improved the predictability of damage in apples. Since dried plum growers can

tolerate much more damage than other crops; the opportunity exists to relate OBLR damage with various pheromone load rates.

This trial evaluated the influence of pheromone concentration (mg/lure) on estimating OBLR population levels and the value of monitoring with pheromone traps to predict damage at harvest. In addition, it contrasted in-season OBLR larval monitoring versus in-season damage evaluations to predict year-end damage estimates.

Procedures

Two experimental load rates from Trece, Inc. (rates were not revealed) were compared to the commercial lure to determine if lower load rates could be used as a predictor of potential damage based on obliquebanded leafroller population levels. Treatments consisted of three lures: 8253P, the low amplitude OBLR lure; 3223 commercial lure (load rate is not public knowledge); and the ultra low 8709 lure. The following procedures were used in 13 prune orchards in Tehama, Butte, Glenn, Sutter, Yuba, Yolo and Tulare Counties, and each was used as an individual site for the correlation. These trials were conducted in orchards using reduced-risk (soft chemical treatments applied based on monitoring) pest management approaches. Traps were placed at least 10 trees from each other and were set out in late April, before the expected biofix, and captured moths were counted and recorded weekly. Weekly larval sampling on 1200 fruit per treatment was conducted from 3/1/2000 through 8/15/2000. During the weekly fruit sampling all OBLR surface damage was recorded. Fruit was considered damaged if OBLR feeding symptoms were similar or worse than surface feeding shown in the IPM for Stone Fruit manual (Strand, 1999). At harvest, 1200 fruit were checked for insect damage, and the damage attributed to OBLR was used for this analysis. All surface damage was recorded, even though it would not affect grade for the dried fruit (fruit destined for the fresh export market can tolerate no OBLR damage). The data were summarized by calculating the total seasonal moth catch, larvae, and in-season fruit damage. Trap catches were correlated with damage at harvest, and correlation coefficients were calculated for seasonal larval totals and in-season fruit damage to harvest damage.

Results and Conclusions

Correlations between trap catches with the 3 lure rates and the damage at harvest are shown in Figure 1. The correlation with the ultra low lure, 8709, was the best at $r = 0.71$. The correlations between trap catch and the commercial lure (3223) and the low load lure (8253P) were all less than $r = 0.42$. There was a poor correlation ($r = 0.39$) between fruit damage found in-season and at harvest. The correlation between in-season larvae counts and % damage at harvest had a higher correlation at $r = 0.90$. These results showed there is a higher reliability of predicting damage at harvest when larvae are monitored than on estimates of in-season damage. Although many PCAs prefer to monitor damage because it is faster than looking for larvae, our results indicate that larvae counts may be more reliable.

The ultra low load lure 8709 has shown to be promising as a predictor of OBLR damage in French prunes. With further testing in more crops, the ultra low load rate may also prove to be a useful indicator of OBLR populations. Prunes offer unique opportunities to study the relationship among pheromone trap catches, in-season larvae findings, and damage at harvest. Prunes tolerate more OBLR damage when they are marketed as dried plums than as fresh fruit. Most of the prune orchards in this study were unsprayed, and the damage due to OBLR ranged from 0% to 4.5%. The application of this information for fresh fruit crops would be more difficult, since the tolerance to damage is very low.

Literature Cited

- Chapman, P. J. and S. E. Lienk. 1971. Tortricid Fauna of Apple in New York (Lepidoptera: Tortricidae). Special Publication. March 1971. New York State Agricultural Experiment Station, Dept of Entomology. 122 pages.
- Strand, L. L. 1999. Integrated Pest Management for Stone Fruit. UC Statewide IPM Program. UC DANR Publication 3389, 264 pages.

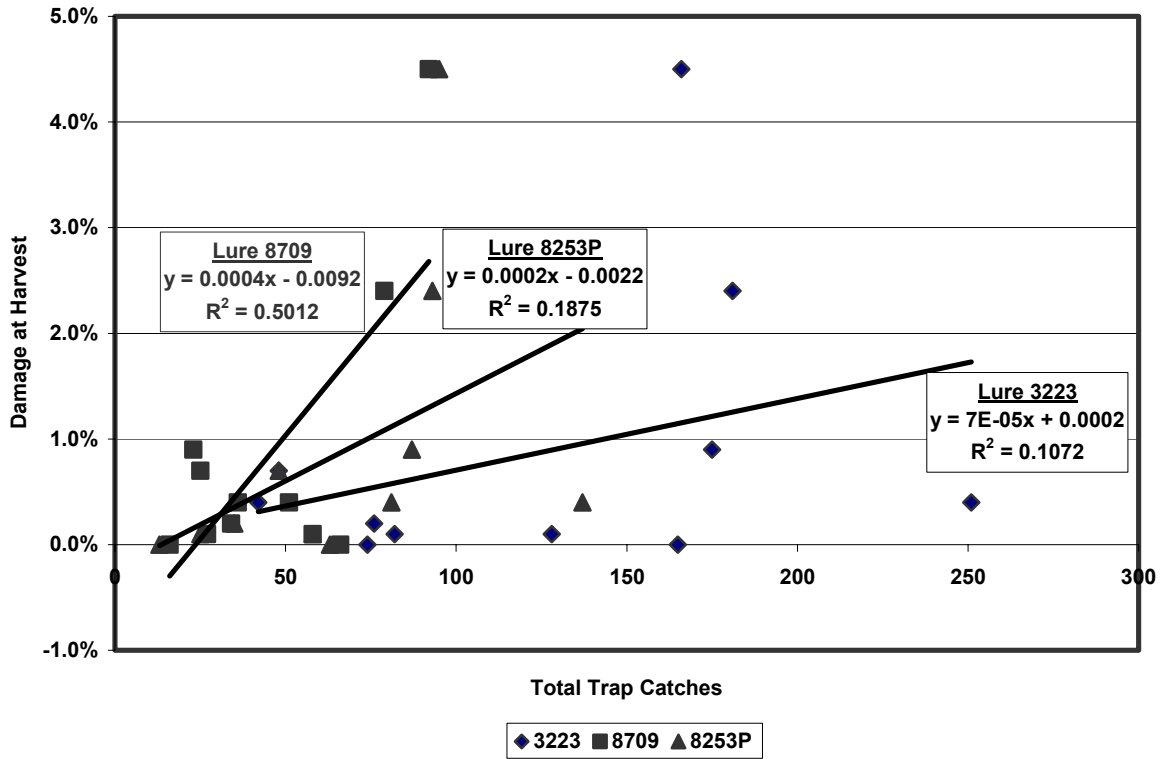


Figure 1. Correlations between the seasonal trap catch in 2000 and the commercial lure 3223, the low load 8253P and the ultra low load 8709.

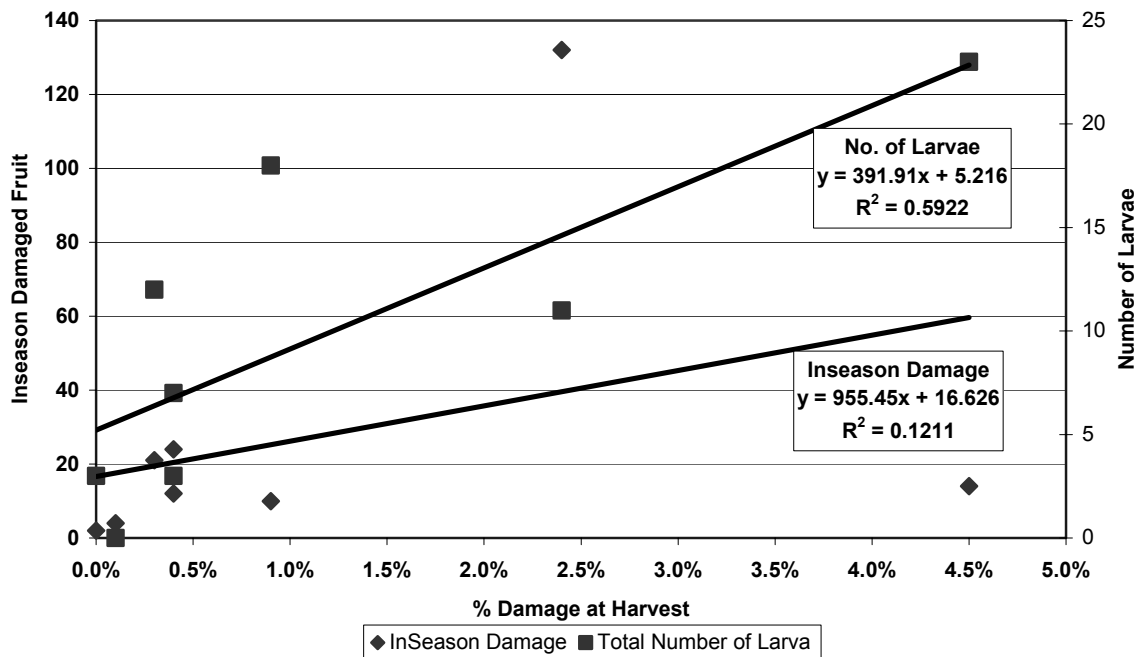


Figure 2. Correlation ($r = 0.90$) of mean obliquebanded leafroller in-season larvae numbers and % damaged fruit at harvest from the larvae and fruit damage sample in 2000.

ABSTRACTS

AMERICAN PHYTOPATHOLOGICAL SOCIETY,
PACIFIC DIVISION, JUNE 22-24, 2002, SAN JOSESpatiotemporal Analysis of Population Structure of
Botryosphaeria dothidea from California Pistachios

Z. Ma, Y. Luo and T. J. Michailides, Dept. of Plant Pathology, University of California, Davis, at U.C. Kearney Agricultural Center

Spatiotemporal population structure of *Botryosphaeria dothidea*, the causal agent of panicle and shoot blight of pistachio, was analyzed using microsatellite-primed (MP)-PCR, partial sequences of RNA polymerase II (RBP2) gene, and vegetative compatibility groups (VCGs). In this study, 390 isolates were examined which included 378 isolates recovered from pistachio in seven counties of California from 1990 to 2001, and 12 outgroup isolates recovered from peach, apple, and sycamore in Georgia, North Carolina, and other states. Six microsatellite primers generated a total of 116 polymorphic DNA bands. Analysis of the MP-PCR data set showed that very high levels (> 98%) of genetic identity among the *B. dothidea* populations collected from commercial pistachio orchards in seven counties of California. These nearly identical populations were further demonstrated by partial sequences of RBP2 gene using representative isolates from each population. Although we observed little genetic variation (haplotypic diversity [H_s] < 0.0243) within each of the populations originally from commercial pistachio orchards consisting of two cultivars, relatively high genetic diversity ($H_s = 0.0886$) was observed in the population recovered from the USDA Germplasm Repository in Chico, where more than 20 cultivars of *Pistacia* were planted. The results of VCG tests showed that 98% of *B. dothidea* isolates from commercial pistachio orchards belonged to only two VCGs.

Sensitivity to iprodione, vinclozolin, and tebuconazole
and characters of iprodione-resistant isolates of
Alternaria spp. from pistachio

T. H. Lim, D. P. Morgan, and T. J. Michailides, Dept. Plant Pathology, University of California, Davis, at U.C. Kearney Agricultural Center; and B. M. Pryor, University of Arizona, Tucson

Among 60 isolates of *Alternaria* spp. collected from pistachio, only one (25C2) had high resistance to iprodione and vinclozolin. The EC₅₀ of 25C2 was 146 µg a.i. iprodione and 70.4 µg a.i. vinclozolin/ml. The EC₅₀ of the other 59 isolates ranged from 0.1 - 1.4 µg a.i.

iprodione/ml, 1.8 - 5.8 µg a.i. vinclozolin/ml, and 0.02 - 1.8 µg a.i. tebuconazole/ml. Isolates with laboratory induced iprodione resistance (IIR) had EC₅₀ of 447.6 and 205 µg a.i. iprodione/ml and had cross resistance to vinclozolin. Both IIR and field iprodione resistant (FIR) isolates showed higher osmotic sensitivity than the sensitive (S) isolates. The EC₅₀ of IIR and FIR isolates declined, after successive sub-culturing on fungicide-free PDA medium, and their fitness was similar to that of S isolates. Application of 100 µg a.i. iprodione/ml solution controlled only the S isolates. Although iprodione-resistant isolates are rare in the field, the results suggest that these *Alternaria* isolates may eventually be a problem in pistachios.

A preliminary decision support system for IPM of brown
rot of dried plum

Y. Luo and T. J. Michailides, Dept. Plant Pathology, University of California, Davis, at U.C. Kearney Agricultural Center

Brown rot caused by *Monilinia fructicola* is an important disease of stone fruits. IPM of this disease aims to reduce fungicide application(s) in combination with appropriate cultural practices. Data of multi-year laboratory and field experiments were analyzed and used to establish a preliminary decision support system for IPM of brown rot of dried plum in California (DSS-DPBR). The DSS-DPBR currently contains two subsystems for decision supports on fungicide application to reduce risks of blossom blight and latent infection. Based on the inputs by the system users that include weather forecast for the following 5 days, an estimate of inoculum potential, and the current blossom stage, the system could provide spray recommendations at bloom. Based on an estimation of proportion of fruit with latent infection and the corresponding calendar date, the system could provide decision supports on fungicide spray for the mid-season. This system, as well as extension topics relevant to IPM of brown rot of stone fruits, is now available (<http://tjm.uckac.edu>) and open to suggestions for improvement.

**AMERICAN PHYTOPATHOLOGICAL SOCIETY,
JULY 27-31, 2002, MILWAUKEE, WI**

Relationship between Botryosphaeria blight severity and changes in carbohydrate content in pistachio

N. Ntahimpera, D. G. Felts, and T. J. Michailides. Dept. of Plant Pathology, University of California, Davis, at U.C. Kearney Agricultural Center

Effect of changes in carbohydrate content of pistachio fruit on infection and symptom development of Botryosphaeria blight caused by *Botryosphaeria dothidea* has not been studied. To determine the relationship between Botryosphaeria blight and changes in carbohydrate content in pistachio hulls under field conditions, wounded and non-wounded pistachio fruit were inoculated with *B. dothidea* periodically in an orchard at the Kearney Agricultural Center in 2001. Disease progression was evaluated weekly and the relative AUDPC were calculated. Fruit characteristics were determined for each inoculation date. Fruit reached its final size in early July when the kernel occupied 90% of the shell cavity. Inoculations performed early May on wounded and non-wounded immature fruit resulted in higher severity than those performed later. The percentage of soluble solids ranged between 12 and 14%. Analysis of corresponding carbohydrate content is under investigation. Results will be discussed in relation to various disease control strategies.

Dynamics of inoculum Potential of *Monilinia fructicola* in Relation to Cultural Practices in Prune Orchards

Y. Luo, T. J. Michailides and D. P. Morgan, Dept. Plant Pathology, University of California, Davis, at U.C. Kearney Agricultural Center; W.H. Krueger, UCCE, Glenn County; and R.P. Buchner, UCCE, Tehama County

Spore density (ascospores and conidia) of *Monilinia fructicola* in the air was investigated daily using spore traps in two prune orchards in California, from mid March to mid August. Effects of fruit thinning, irrigation and fungicide application on sporulation of thinned fruit were also studied. The spore densities in the air were at a low level in early bloom, increased to a high level at full bloom, and decreased to a lowest level at the end of bloom. The irrigation immediately after fruit thinning created favorable conditions for sporulation on thinned fruit. Spore density in the air increased during a 7 – 10 day period after each time of irrigation. Prolonging the drying process of thinned fruit significantly decreased fruit infection. Spraying thinned fruit with iprodione significantly reduced latent infections of fruit on trees.

Threshold conditions leading latent infection to prune fruit rot caused by *Monilinia fructicola*

Y. Luo and T. J. Michailides. Dept. Plant Pathology, University of California, Davis, at U.C. Kearney Agricultural Center

Inoculations were performed in 10 prune orchards in California eight times during the growing season. Branches with blossoms or fruit were sprayed with 5,000, 20,000, and 50,000 conidia/ml of *Monilinia fructicola*. Each inoculated branch was covered with a plastic bag to keep high humidity for about 14-16 h. The incidence of latent infection (ILI) on the fruit and the percentage of branches with fruit rot (PBFR) were determined 2 weeks before harvest. A linear correlation between ILI and PBFR was obtained. Conditions leading latent infection to fruit rot included level of latent infection, fruit development stage, inoculum concentration, total hours of RH greater than 90%, and hours of dew from mid-July to mid-August. Three levels of PBFR, 1, 5, and 10%, were assigned and threshold conditions leading to these levels of PBFR were determined. The relative possibility of latent infection becoming fruit rot (r_{PBFR}) and PBFR were used in a preliminary decision support model and recommendations on fungicide application could be provided based on input information supplied by the grower.

Effect of buried drip irrigation on reducing fungal fruit decay in fig orchards

M. A. Doster, T. J. Michailides, and D. A. Goldhamer. Dept. Plant Pathology and Dept. Land, Air, and Water Resources, respectively, University of California, Davis, at Kearney Agricultural Center

Buried drip irrigation was compared to the common practice of surface drip irrigation in two commercial fig orchards (cv. Conadria and cv. Black Mission) in California in 1998 and 1999. Surface drip irrigation caused the soil surface surrounding the water emitters to become wet, resulting in figs sitting on the wet soil before harvest. In contrast, where the drip lines were buried, the soil surface remained dry. The levels of decay fungi (*Alternaria/Ulocladium*, *Aspergillus* sections *Nigri* and *Flavi*, *Fusarium*, and *Penicillium*) were quantified in the soil, on leaves, and in the figs. Although in the soil and on the leaves the densities of decay fungi did not differ significantly between the two irrigation treatments, fruit from the wet areas under the trees irrigated with surface drip tended to have a higher incidence of decay, especially on the external fruit surface, than fruit from dry areas. In addition to increasing irrigation efficiency, the use of buried drip

irrigation should result in fewer culls and less fruit decay.

INTERNATIONAL HORTICULTURAL CONGRESS, AUGUST 11-17, 2002, TORONTO, CAN

Non-Chemical Insect and Disease Management In Cucurbit Production Systems

C. G. Summers, J. P. Mitchell, and J. J. Stapleton, Dept. of Entomology, Dept. of Vegetable Crops, and Statewide IPM Project, University of California, Davis, at U.C. Kearney Agricultural Center

Keywords: *Aphis gossypii*, *Bemisia argentifolii*, aphid-borne viruses, UV reflective mulch, cover crops, biological mulch, squash silverleaf

We conducted experiments in 2000 and 2001 in California's San Joaquin Valley to evaluate the effectiveness of wheat straw and UV reflective plastic mulches for the management of silverleaf whitefly, *Bemisia argentifolii* Bellows and Perring, and several aphid-borne virus diseases of zucchini squash. The effectiveness of these mulches was compared to a pre-plant application of imidacloprid (Admire[®]) insecticide and an unmulched, untreated control. Symptoms of both squash silverleaf, induced by nymphal whitefly feeding, and virus infection were significantly delayed and reduced by the baled wheat straw that was scattered over the beds and by the UV reflective plastic. Wheat straw mulch obtained by planting winter (December) wheat, threshing the grain (June) and cutting the stubble (August) prior to squash planting discolored between harvest and squash planting and did not provide the high degree of reflectivity observed in straw that has been cut immediately after harvest, baled and then scattered prior to planting. Pre-plant Admire insecticide was not as effective in managing either whiteflies or the virus diseases as were the mulches. Yield of marketable fruit was significantly ($P < 0.05$) higher in 2000 from plants growing over the scattered wheat straw and the UV reflective plastic mulches than from those growing in the Admire treated or the control plots. In 2001 plants growing over the scattered wheat straw produced yields significantly ($P < 0.05$) greater than those from all other treatments. These data indicate that acceptable squash yields can be obtained without using chemical insecticides.

FOURTH INTERNATIONAL CONGRESS OF NEMATODOLOGY, June 8-13, 2002, TENERIFE, SPAIN

Effect of Oxycom[™] on growth of tomato and reproduction of *Meloidogyne incognita*.

S. A. Anwar and M. V. McKenry, Dept. of Nematology, University of California, Riverside, at U.C. Kearney Agricultural Center; and Yang Kwang-Yeol and A. J. Anderson, Dept. of Biology, Utah State University

The effects of single or multiple applications of Oxycom[™] (peroxyacetic acid plus chemicals that stimulate plant resistance) were examined on 15-day-old susceptible tomato plants inoculated with 1500 J2 of *M. incognita*. Forty pots were dipped into 2500 ppm (v/v) Oxycom[™], and 20 in water. Twenty of the 40 pots received four additional Oxycom[™] applications at 10-day intervals. Plants were harvested at 60 days after inoculation to assess the effect of treatments on plant growth and on nematode development and reproduction. A single treatment of Oxycom[™] just prior to nematode inoculation significantly increased tomato top weight but not other growth parameters. Associated with increased top weight was a significant increase in the number of root knot females per total root system. Multiple treatments of Oxycom[™] significantly reduced leaf area, top weight and root weight while significantly increasing the number of galls, females and J2 per plant or per gram of root. This study demonstrates that Oxycom[™] stimulates plant growth and earlier fruiting while hastening nematode development. Proper timing and frequency of applications is important. No treatment reduced nematode population levels in this 60-day trial. Although Oxycom[™] treatment initiated resistant gene expression associated with acquired systemic resistance (e.g. PR and PAL gene transcripts and activation of the salicylic acid-MAPK pathway), the response observed was of tolerance to the nematodes rather than resistance.