

Pome Fruits—Pesticide Resistance

Bioassay, Conventional Insecticides Against Leafrollers, 1992

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Using a leaf-disk bioassay, Guthion and Lorsban were evaluated for their effect on PLR and OBLR larvae. Table 1 gives the source, location and management history of leafroller populations tested for resistance during 1992. A population of PLR collected from an organic orchard in Yakima in 1991 (USDA-PLR) has been maintained in the laboratory on a pinto bean diet for 12 generations. An OBLR population was obtained from Agriculture Canada in 1991 (Canada-OBLR) and has been maintained on a pinto bean diet for 12 generations. Leafrollers from other sites were collected as larvae in the field in either the spring or summer of 1992. These larvae were reared to the adult stage. Moths from different sites were kept separate and placed in a one-gallon container lined with waxed paper. Moths mated and laid egg masses on the waxed paper. Egg masses were cut from waxed paper, dipped in a mild bleach solution and then washed in distilled water. Egg masses were placed into small petri dishes (Falcon 1006, 50 x 9 mm) along with a small plug of bean diet and placed in a growth chamber at 75°F ($\pm 2^\circ\text{F}$) constant temperature and 16:8 photoperiod. Upon hatching, larvae were used in the leaf-disk bioassay or used to increase colony size for future testing. Bioassays on all 1992 field-collected leafroller populations were conducted using larvae arising from adults of the field-collected cohort (F1) or from larvae of the next generation (F2).

Apple leaves were collected from untreated Red Delicious trees at the WSU Tree Fruit Research and Extension Center, Wenatchee. Insecticides were diluted in 500 ml of water plus 2 μl of X-77, a wetting agent added to aid leaf wetting. An untreated control was prepared using water plus the wetting agent only. Leaves were dipped, then allowed to dry. Two punches (2.3 cm diameter) were taken from each leaf. Four punches were placed in a petri dish (Falcon 1006, 50 x 9 mm). Five one- to two-day-old leafroller larvae were placed on the leaf disks, and the petri dish lid was put in place. Ten dishes were used for each insecticide and rate (50 larvae per treatment). Dishes were placed inside a food storage container with a wet paper towel to maintain a high humidity and kept at 75°F ($\pm 2^\circ\text{F}$) constant temperature and 16:8 photoperiod. Dishes were examined after 48 hours to determine larval survival. Data were analyzed using PROC PROBIT in SAS.

The LC_{50} value for Guthion of the Birchmont-PLR population was 5.5 times higher than the LC_{50} value for the USDA-PLR population, and the LC_{90} value was 3.5 times higher. The LC_{50} values for Guthion of the TFREC and Marley-PLR populations were 4.7 and 3.6 times higher than the LC_{50} value for the USDA-PLR population. It is uncertain if these differences express actual resistance levels since the USDA-PLR population may not be a naturally susceptible PLR population. However, the LC_{50} and LC_{90} values of the USDA-PLR were significantly different from the other populations tested based on non-overlapping fiducial limits. The recommended field concentration for Guthion is 300 ppm (AI). With LC_{90} values of 223-

288 ppm (Fig. 1) for newly hatched PLR larvae from the Birchmont, Marley and TFREC populations, there is little doubt that these populations would not be adequately controlled by Guthion in the field.

The LC₅₀ value for Guthion of the Canada-OBLR population was 5.0 ppm. The LC₅₀ value for Guthion of the Wondra and Davis OBLR populations from Milton-Freewater, Oregon, was 12.5 and 7.8 times higher, respectively, than the LC₅₀ for the Canada-OBLR population. The Milton-Freewater apple growing district has had a history of problems controlling OBLR. The Wondra population originated from an abandoned orchard (2 years) but was in an area where OBLR has been difficult to control. The Davis population originated from a young Fuji orchard (2 years) and was in an area of intense management where OBLR has been difficult to control. The LC₉₀ value for Guthion of the Wondra population was 667 ppm or more than twice the recommended concentration for field use of this insecticide (Fig. 2).

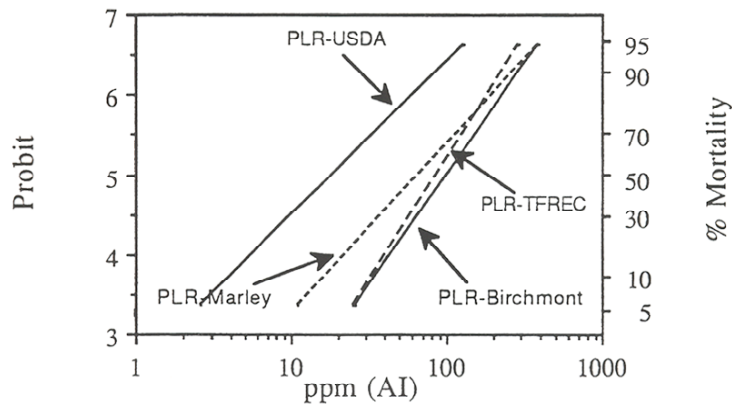


Figure 1. Concentration-mortality curves for PLR larvae exposed to Guthion.

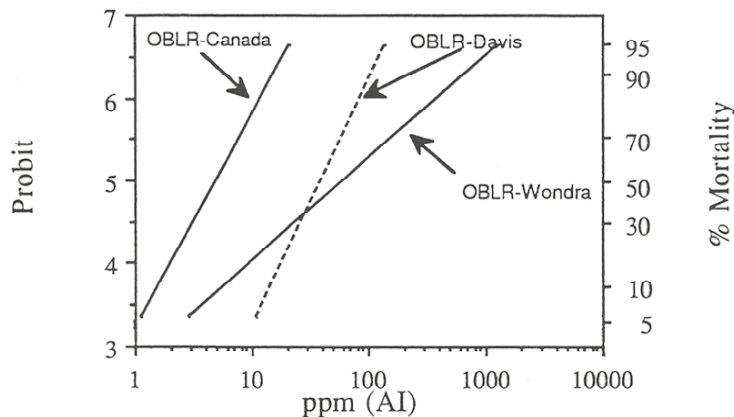


Figure 2. Concentration-mortality curves for OBLR larvae exposed to Guthion.