Pome Fruits—Chemical Control

Apple, Effects of Insecticides on the Survival of *Pnigalio flavipes,* a Parasite of Western Tentiform Leafminer

J.F. Brunner and J.J. Brunner
Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

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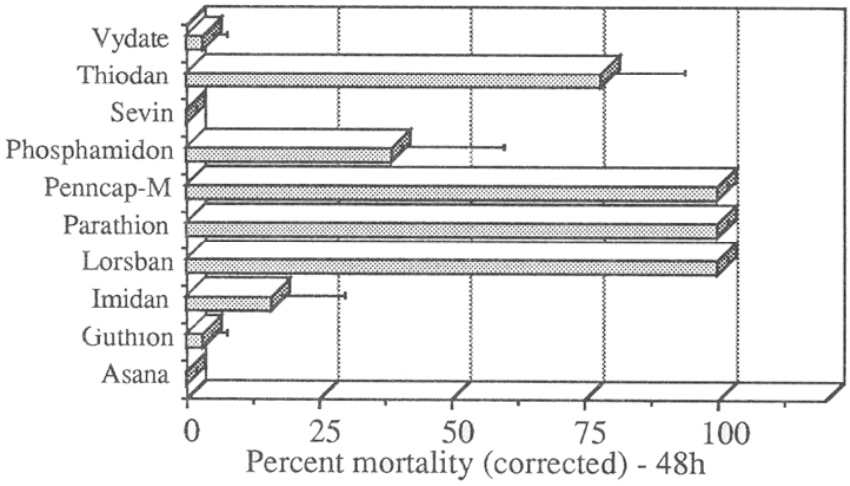
The primary natural enemy of WTLM in Washington is an ectoparasitic Eulophid, *Pnigalio flavipes* (PF). Apple leaves containing tissue-feeding mines of WTLM were collected in orchards near Wenatchee. Mines were opened in the laboratory and parasite pupae removed with a small camel's hair brush and placed in a petri dish (15 x 150 mm). The petri dish was placed inside a zip-lock plastic bag with a moistened piece of cotton dental wick, then sealed to keep humidity high. The petri dishes containing parasites were kept in a growth chamber at 15°C and long-day photoperiod [16h:8h]. Petri dishes were examined daily and newly emerged parasites removed after anesthetization with CO_2. Parasites were sexed and placed in separate holding containers [small plastic cups] until use in bioassays that same day. Insecticides were diluted to the proper concentration in a 500 ml container that was constantly stirred. In 1990, insecticides were applied in a fine spray (5 seconds at 5 meters/second) to the surface of a one ounce plastic jelly cup and lid using a glass atomizer modified to work in a horizontal position. After spraying with an insecticide plus a wetting agent (0.1% B-1956) the plastic cup and lid were allowed to dry at room temperature. Controls were prepared by spraying jelly cups and lids with water plus the wetting agent. If the jelly cups were not used the same day they were treated, they were stored inside a zip-lock plastic bag in a freezer. Two days was the longest that jelly cups were stored before being used. Newly emerged female parasites (4 to 5) were placed into the cup and the lid put in place. A one inch cotton wick was inserted through a 1 cm hole in the lid. The cup was inverted and placed over a container so that the wick was immersed in sugar-water (1%). Parasites were checked after 24, 48, and 72 hours and mortality recorded. In 1991, the substrate to which insecticides were applied was changed to filter paper (7 cm). The filter paper was dipped three times in the insecticide solution then allowed to air dry on paper toweling. Filter paper disks were stored inside a zip-lock plastic bag in a freezer until use. Parasites were exposed to filter paper containing insecticides in the same arena used in 1990, a 1 ounce plastic jelly cup. The filter paper was folded twice and then opened to make a cone. The cone was placed into the jelly cup. Newly emerged female parasites (4 to 5) were placed into the cone. The lid of the jelly cup was put in place, wick inserted and placed over a container of sugar-water as described above. Parasites were checked after 6, 24 and 48 hours and mortality recorded. An untreated control (filter paper dipped only in water) was set up each time a series of cups containing parasites exposed to insecticides was set up. In a second bioassay, apple leaves collected from an unsprayed orchard were dipped in an insecticide diluted in 500 ml water as described above. Leaves were dried and two punches (2 cm in diameter) were taken from each. Four leaf punches were placed in a plastic petri dish with a tight sealing lid (Falcon 1006 petri dish 50 x 9 mm). Female parasites collected and handled as described above were transferred to

the petri dish containing the leaf punches and the lid was put in place. Parasites were checked after 6, 24 and 48 hours and mortality recorded.

Results from the 1990 bioassay indicated chlorpyrifos (Lorsban), parathion, phosphamidon, endosulfan (Thiodan), and oxamyl (Vydate) were very toxic to PF. Carbaryl (Sevin) and azinphosmethyl (Guthion) were moderately toxic and phosmet (Imidan) was essentially non-toxic (data not shown). In the 1991 bioassay using filter paper the same relative results were obtained with the exception that oxamyl was much less toxic to PF. In fact, its toxicity was similar to esfenvalerate (Asana), azinphosmethyl, phosmet and carbaryl, that being very low. Endosulfan and phosphamidon toxicity to PF was moderate using the filter paper bioassay technique and chlorpyrifos, parathion, and encapsulated methyl-parathion toxicity was high (Fig. 1). Results using the leaf disk bioassay method (Fig. 2) agreed well with the other bioassay methods except for esfenvalerate which was more toxic with the leaf disk than the filter paper method. The discrepancies in toxicity for the same chemical in different bioassay methods demonstrate the importance of substrate effects on these types of tests. It will be important to find a bioassay method that best reflects field impact of chemicals on PF.

Figure 1. *Pnigalio flavipes* mortality after 48 h exposure to field rate insecticide residues on filter paper.



[Field rate of insecticides were: Vydate - 150ppm, Thiodan - 450ppm, Sevin - 300ppm, Phosphamidon - 150ppm, Penncap-M - 625ppm, Parathion - 450ppm, Lorsban - 450ppm, Imidan - 900ppm, Guthion - 315ppm, Asana - 25ppm]

Figure 2. *Pnigalio flavipes* mortality after 48h exposure to field rate insecticide residues on leaf disks.