LIRIOMYZA MUNDA AND PARASITE MORTALITY FROM INSECT GROWTH REGULATORS[1]

SIDNEY L. POE

University of Florida,
Agriculture Research and Education Center,
Bradenton, Florida 33505

ABSTRACT

Two insect growth regulators (IGR's), ZR-619 (ethyl n-methoxy-3,7,11-trimethyl-(2E, 4E)-2,4-dodecadienethiolate), and ZR-777 (Prop-2 ynyl 3,7,11-trimethyl-(2E, 4E)-dodecadienoate) were tested for control potential against a dipterous leafminer, *Liriomyza munda* Frick, by treatment of puparia and by treatment of soil where puparia form. Both IGR's separately and in combination suppressed adult emergence by 16-23% when puparia were treated and 10 to 14% when soil was treated. All treatments of IGR's reduced *Opius* parasite emergence to 0% from levels as high as 27%. Use of the IGR's in this manner was concluded to be of greater potential harm to biological control agents than benefit to leafminer control.

A dipterous leafminer, *Liriomyza munda* Frick, commonly feeds on many wild and cultivated plants and is frequently a serious pest of many vegetable and ornamental crops grown on the west coast of Florida (Stegmaier 1966). Populations appear to be regulated by climate and by several hymenopterous parasites which are the chief natural enemies of the flies (Griffiths 1962). On commercial crops natural population control must be augmented with chemical insecticides because phytopathogenic organisms may enter the plant through wounds made by the mining larvae.

Leafminers in tomato plants are often parasitized by wasps which inject their egg into the maggot or inside its tunnel. Although 13 parasite species were reared from *L. munda* in Texas (Harding 1965) and 6 species from *L. pictella* (= *L. munda*) in California (Oatman 1965), only 5 species were reared from the leafminer in Florida (Stegmaier 1966). Parasites reared from puparia on the west coast area were identified as *Opius* sp. and *Opius dimidiatis* (Ashmead), Braconidae.

Chemical toxicants are the major cause for parasite mortality in agricultural areas (Wene 1965, Getzin 1960). Selective use of chemicals (Getzin 1960) or use of non chemical, minimally toxic materials could result in conservation of parasites and in leafminer population suppression through integrated efforts. This report describes laboratory-scale evaluations of 2 insect growth regulators (IGR's) against the leafminers.

MATERIALS AND METHODS

The 2 insect growth regulators were ZR-619 (ethyl-11-methoxy-3,7,11-trimethyl-(2E, 4E)-2,4-dodecadienethiolate) Ent. No. 70513; and ZR-777

[1]Florida Agricultural Experiment Stations Journal Series No. 5440.

(Prop-2-ynyl 3,7,11-trimethyl-(2E, 4E)-2,4-dodecadienoate) Ent. No. 70531. These compounds, synthesized by Zoecon Research Laboratory, possess juvenile hormone-like activity (Hendrick et al. 1973). Each was used at 1,250 ppm and dispersed by a CO_2 pressurized, stainless steel sprayer.

Leafminer puparia were obtained as follows: Field infested mature tomato vines were cut at the soil level and placed in 25 gal plastic trash containers, 10 vines in each. The containers were inverted on a wooden rack ca. 4 in. above a sheet of brown paper covered with a 1/16 in. deep layer of washed sand. Mature larvae emerged from the tunnels, dropped onto the sand and formed puparia. Puparia were collected daily from the sand, transferred to the laboratory, and treated.

Two treatment methods were employed. The first method was a spray of the IGR's applied to puparia placed in 4 groups on separate paper towels. Controls were treated with deionized water. This experimental method was repeated 4 times, each with 4 replications. The second method was a spray of the IGR compounds to the sand and paper beneath the container of tomato vines. The larvae dropped onto the IGR-treated sand after 24 hr. Puparia were collected, separated, and placed in 2 in. diam plastic dishes 1 1/2 in. deep, then held for emergence under laboratory conditions (78°F, 50-70% RH). This experimental method was repeated twice, each with 4 replications.

Results and Discussion

Data are reported only on puparia from larvae which emerged during the first 4 days since the numbers recoverable from the vines diminished substantially after ca 4 days. In the first experimental method where puparia were sprayed, total emergence from the control was 76%; 62% were flies, 14% were parasites (Table 1). Adult fly emergence from the IGR treatments compared to the control was significantly suppressed, 23% by ZR 619, 17% by ZR 777, and 16% by the 2 materials combined (Table 1). Emergence of parasites was suppressed 99 to 100% by the IGR's and only 3 wasps were recovered from 850 puparia. Suppression of fly emergence by 17, 16, and 23% seems less significant when the loss of potential control by parasites (14%) is considered.

TABLE 1. Emergence of *Liriomyza* and *Opius* from insect growth regulator-treated puparia and sand.

Insect Growth Regulator (1,250 ppm)	No. puparia treated	% *Liriomyza* emerged	% Parasites emerged
Experimental Method 1 (puparia treated)			
Check	294	62a*	14a*
ZR-619	293	39b	0b
ZR-777	292	45b	1b
ZR-619 + ZR-777	285	46b	0b
Experimental Method 2 (Sand treated)			
Check	30	70a*	27a*
ZR-619	20	60a	0b
ZR-777	54	56a	0b

*Values in each column for a given experiment not followed by the same letter are significantly different at a 95% level of probability. Duncan's MRT.

The second experimental method, in which larvae formed puparia on treated sand, gave data similar to those of the first experiment (Table 1). Although the number of individuals recovered was small, the percent emergence of adults in the control (97%) was greater than that in the first experiment. This difference was due to greater recovery of parasites. Percent emergence of flies from puparia formed on treated sand did not diminish significantly. When ZR 777 was applied only a small difference in suppression was noted between the treatment values obtained and the control when the 2 experiments are compared. But, for ZR 619 the difference was greater (23% in Experimental Method 1 and 10% in Experimental Method 2). Even though there was an observed difference in chemical suppression of leafminer emergence (Method 1 compared to Method 2), the effect on parasite emergence was the same: no parasites were recovered from puparia formed on IGR treated sand. No data were obtained to indicate if such an effect persisted for more than 24 hr. Parasite emergence was reduced from 14% to 0 or 1% when puparia were treated (Experimental Method 1) and from 27% to 0% when puparia formed on treated sand (Experimental Method 2).

The benefits of the use of these IGR materials in an integrated program for control of dipterous leafminer when weighed against the loss sustained by biological agents appear limited. Although no data were obtained for the specific time or method of parasite mortality in this experiment, in a similar experiment (Poe 1974) the tomato pinworm parasites *Apanteles dignus* Musebeck and *A. scutellaris* Musebeck failed to form pupae and died as prepupae within their cocoons.

It is imperative from this experiment and others (Poe 1974) that the use of highly active juvenile hormone-like compounds in management studies must be evaluated not only for their impact on the target species at various rates and time intervals but also for the possibly much greater impact on natural enemies.

Literature Cited

Getzin, L. W. 1960. Selective insecticides for vegetable leafminer control and parasite survival. J. Econ. Ent. 53:872-875.

Oatman, E. A. 1960. Parasitism of overwintering pupae of the melon leafminer, *Liriomyza pictella*. J. Econ. Ent. 53:682.

Poe, S. L. 1974. Emergence of *Keiferia lycopersicella* (Lepidoptera: Gelechiidae) and *Apanteles* sp. (Hymenoptera: Braconidae) from pupae and soil treated with insect growth regulators. Entomophaga (in press).

Stegmaier, C. E., Jr. 1966. Host plants and parasites of *Liriomyza munda* in Florida (Diptera: Agromyzidae). Fla. Ent. 49:82-86.

Wene, G. P. 1955. Effect of some organic insecticides on the population levels of the serpentine leafminer and its parasites. J. Econ. Ent. 48:596-7.

Griffiths, C. D. 1962. Breeding leafmining flies and their parasites. Ent. Record 74:178-85.

Harding, J. A. 1965. Parasitism of the leafminer, *Liriomyza munda,* in the winter garden area of Texas. J. Econ. Ent. 58:442-3.

Hendrick, C. A., G. B. Staal, and J. B. Siddall. 1973. Alkyl 3,7,11-trimethyl-2,4-dodecadienoates, a new class of potent insect growth regulators with juvenile hormone activity. J. Agr. Food Chem. 21:354-9.