Effect of Oils and an Insecticide Applied to Snap Beans on Leafminer and Associated Parasitoid Numbers

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Introduction

Oils have recently been noted to disrupt oviposition by *Liromyza* spp. leafminers on certain types of plants. Little information is available for the effect of oils on the parasitic wasps associated with leafminers. This experiment was conducted to obtain some preliminary information about the relationships of parasitoids and leafminers when various oils and insecticides were applied to two varieties of green beans.

Methods and Materials

Four oils and a insecticide-oil treatment (Thiodan 2 C.O. EC) were applied on October 22nd, 1990, with a prototype electrostatic sprayer from Terronics, Inc. of Elwood, IN. Beans were planted August 31st in double rows on beds with 40 inch centers at the Bruce Church of Arizona, Inc. farm located near Poston, AZ. Two rows of each variety were planted side by side in the 4 row block. Beans, especially the 'O-4' variety, were heavily infested with leafminers and much defoliation and lower leaf drop had occurred prior to treatment. Plants were very heavily infested with sweetpotato whiteflies, *Bemisia tabaci* (Gennedius). Plots were 25 ft long by one bed wide and treatments were replicated four times in a randomized complete block design.

Plots were sampled on October 25th for leafminer parasitoids. Parasitoid complex was comprised of mostly *Diglyphus* spp. and *Chrysocharis* spp., and also consisted of 1% *Opius* and 3% *Chrysonotomyia*. Three samples were taken per plot. Samples consisted of placing a 8.5 inch x 17 inch x 1.5 inch deep styrofoam food tray between bed rows, shaking the foliage, and counting the parasitic wasps on the trays. Leafminer samples were obtained by placing 3 trays/plot between rows at 3 days post treatment and leaving them in place for 5 days. Leafminer pupae that had emerged from leaves and collected in trays were counted.

Results

No statistical differences between treatments were noted for either leafminers or their parasitoids, although differences between the two bean varieties for parasitoids numbers were statistically significant, with the O-14 variety having 62.8 parasitoids/sample compared to the 34.7 parasitoids/sample for the O-4 variety (Fig. 2). This may have been due to the 'O-14' variety being larger in size and supporting a larger populations of both whiteflies and leafminers, resulting in more honeydew produced for an energy source for the parasitic wasps, and more leafminer larvae on which parasitoids could feed and parasitize.

A negative correlation existed between adult parasitoid numbers at 3 days post treatment and leaf larvae exiting from leaves and collecting in the trays from days 3-8 post treatment on the O-14 variety although no correlation was noted on the O-4 variety. Leafminers parasitized by *Diglyphus* spp. would not have emerged from leaves and be collected in trays as the leafminer larvae are killed by the parasitoid before leafminer larval feeding was complete. High numbers of parasitoids were correlated with low numbers of parasitoids in this experiment overall with this due mostly to the O-14 variety. Each variety had a different statistical relationship between leafminers and

parasitoids. In the O-4 variety most plots had more leafminers than parasitoids while in the O-14 variety there were more parasitoids than leafminers (Figs. 4, 5). Statistically these relationships are not different as the slopes with their standard errors overlap using parastioids as the independent (or x) variable and leafminer larvae emerging from leaves as the dependent variable. (O-14 variety: slope = -0.32, standard error = 0.09, $P \leq 0.0045$; O-4 variety: slope = 0.12, standard error = 0.48, $P \leq 0.81$). However, when using the leafminers as the independent variable and parasitoid numbers as being dependent upon the treatment (Fig. 3) applied to the beans statistical differences exist for the leafminer-parasitoid relationships between the two bean varieties (O-14 variety: slope = -1.77, S.E. = 0.49; O-4 variety: slope = 0.05, S.E. = -0.20)

No phytotoxicity was noted where treatments were applied at stated rates but this was difficult to detect due to damage from leafminers. Phytotoxicity was noted from oils in areas that received amounts several times higher than those listed.

Conclusions

Use of oils and an insecticide affected parasitoid and resultant leafminer populations. Treatments decreased parasitoid numbers in the O-14 snap bean variety, either by repellency of oils and/or death by insecticide, thereby increasing leafminer numbers which were emerging from bean leaves. This was not true for both varieties involved in this study. The *Diglyphus* sp. parasitoid may be more attracted to the O-14 variety more than O-4 variety for some reason (plant scent, more whiteflies and resultant sugars for food, leafminer density, etc) and parasitism by this insect would kill leafminers prior to emergence from leaves although other parasitoids do not kill the leafminer until after emergence from leaves.

Parasitoid numbers were lowest overall in the insecticide treated plots. Higher number of leafminers may have been expected in these treatments from low parasitoid numbers but some leafminer control from the insecticide propbably also occurred.

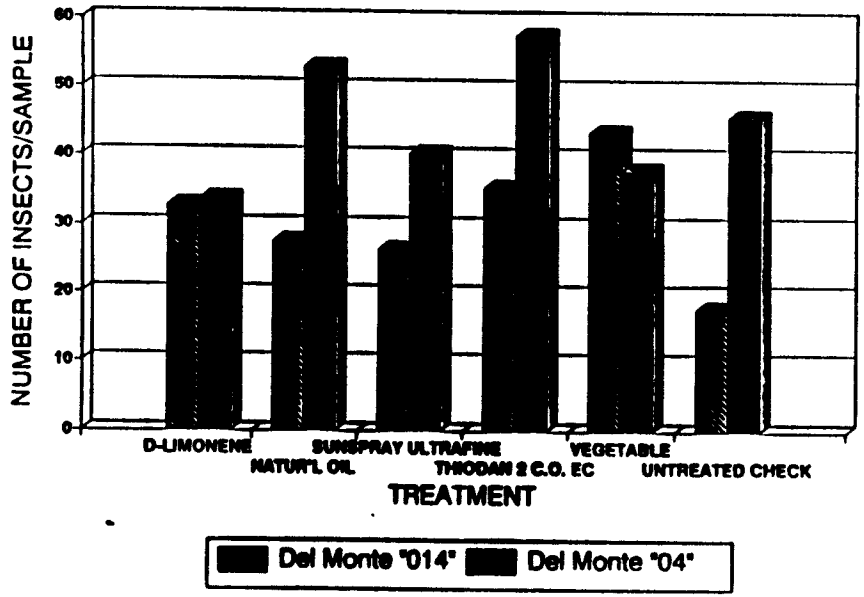
Use of oils for leafminer control in snap beans is not effective based the the results of this experiment. Use of oils may increase the leafminers emerging from leaves as the oils and insecticides appear to deter the beneficial insects that help keep the leafminers in check. Insecticides that are specific for leafminers with no effect on parasitic wasps would be expected to be the most effective in the future.

LEAFMINER AND PARASITOID NUMBER IN TWO SNAP BEAN VARIETIES FOLLOWING OIL AND INSECTICIDE TREATMENTS

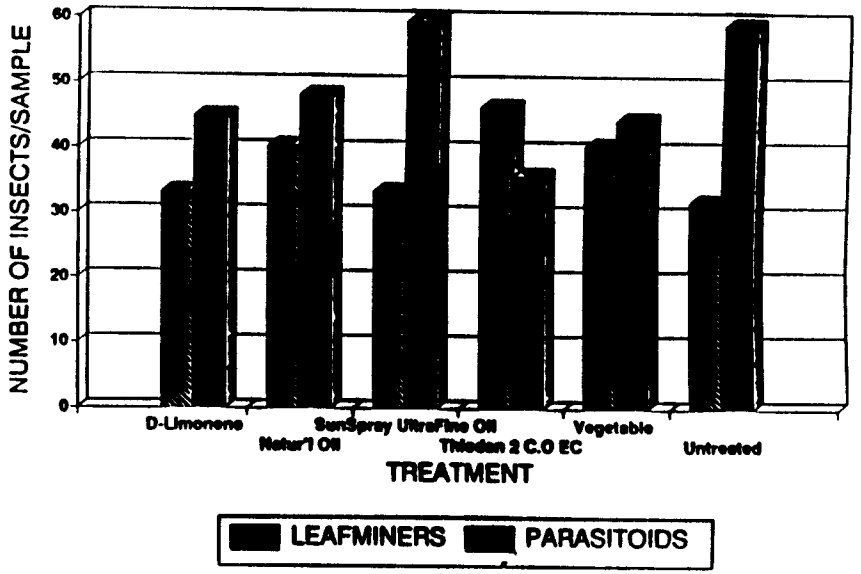
		Del Monte O-4		Del Monte O-14	
		Mean number of insects/tray		Mean number of insects/tray	
Treatment	Rate (lb ai/acre)	leafminers	parasitoids	Leafminers	Parasitoids
D-Limonene	1.25 gal	33.5 a	46.3 a	32.7 a	45.2 a
Natur'l Oil	1.25 gal	52.8 a	34.0 a	27.5 a	62.3 a
SunSpray UltraFine	1.25 gal	40.3 a	42.8 a	26.3 a	76.2 a
Thiodan 2 C.O. EC	0.34	57.5 a	28.3 a	35.3 a	43.2 a
Vegetable Oil Concentrate	1.25 gal	37.8 a	32.5 a	43.3 a	56.0 a
Untreated Check	1.25 gal	45.7 a	24.0 a	17.7 a	94.0 a

Means in columns followed by the same letter are not statistically significant at the $p \leq 0.05$ level (Student-Newman-Keuls Test).

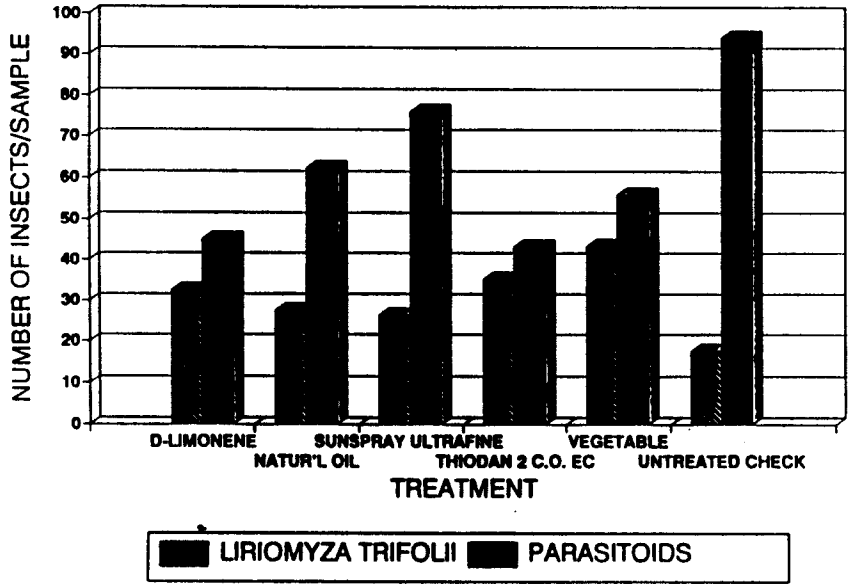
LEAFMINERS EMERGING FROM TWO SNAP BEAN VARIETIES AFTER OIL TREATMENTS



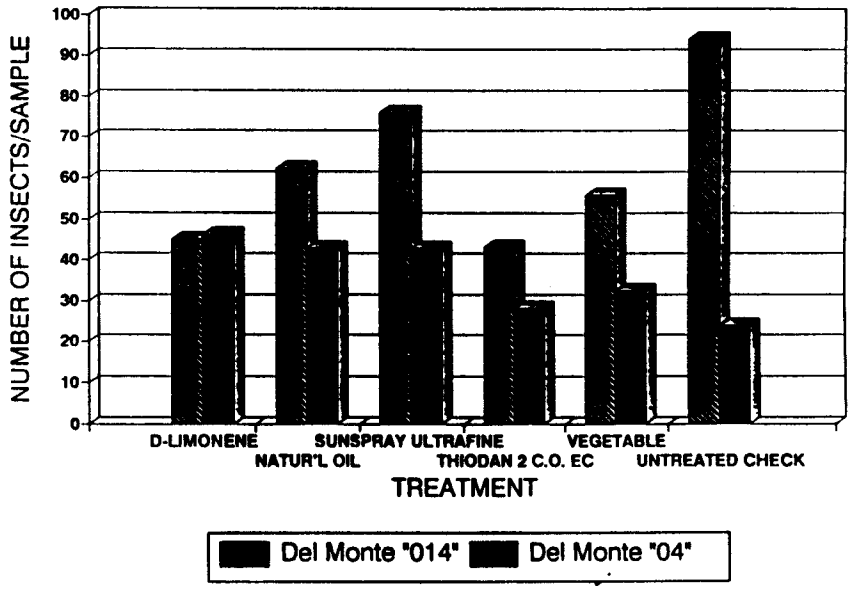
MEAN NUMBER OF LIRIOMYZA TRIFOLII AND PARASITOIDS FOLLOWING OIL TREATMENTS

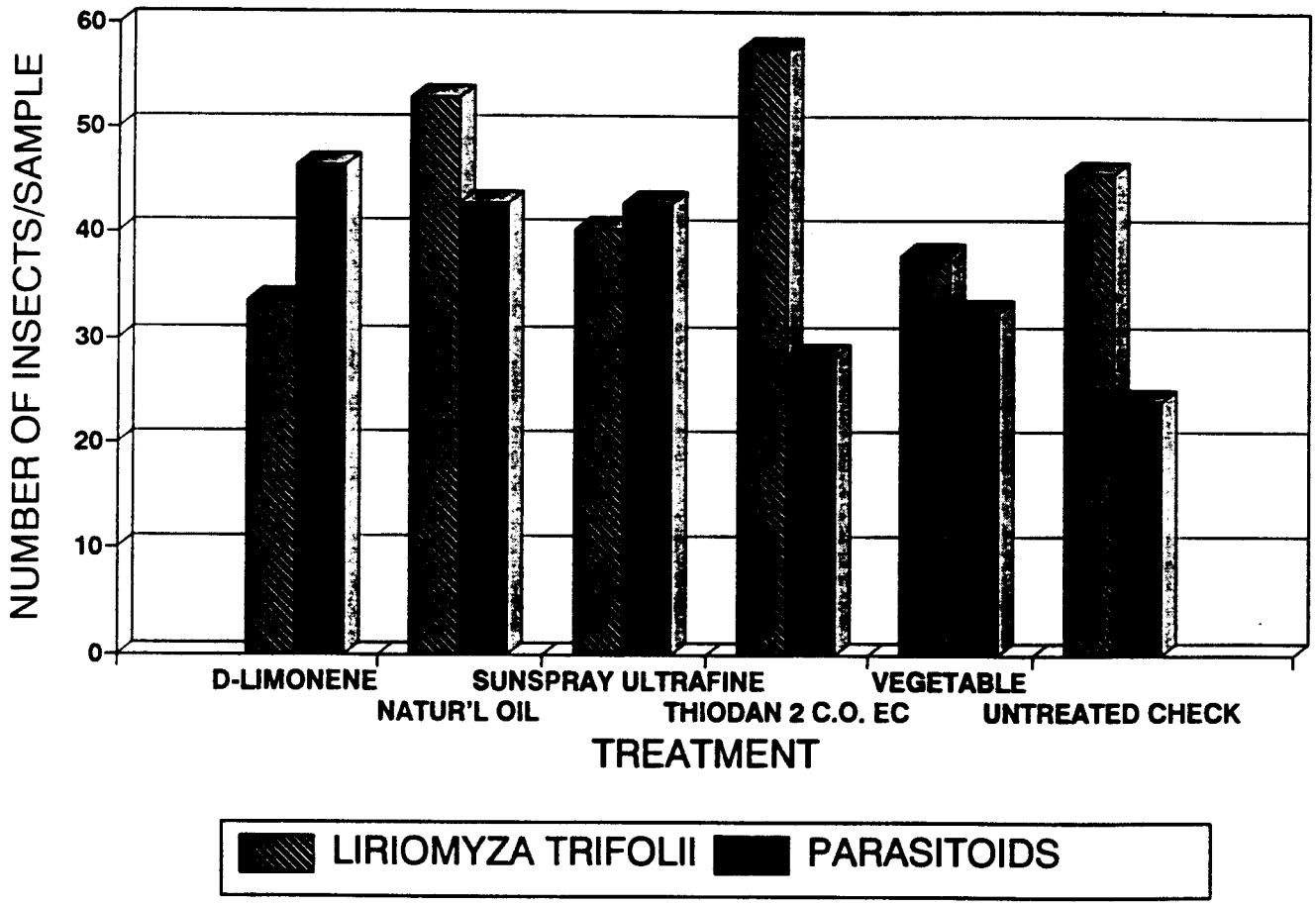


LEAFMINERS AND PARASITOIDS ON DEL MONTE "014" SNAP BEANS AFTER OIL TREATMENTS



LEAFMINER PARASITOID NUMBERS IN SNAP BEAN VARIETIES AFTER OIL TREATMENTS




LEAFMINERS AND PARASITOIDS ON DEL MONTE
"04" SNAP BEANS AFTER OIL TREATMENTS
NUMBER OF INSECTS/SAMPLE
60
50
40
30
20
10
0
D-LIMONENE
NATUR'L OIL
SUNSPRAY ULTRAFINE
THIODAN 2 C.O. EC
VEGETABLE
UNTREATED CHECK
TREATMENT
LIRIOMYZA TRIFOLII
PARASITOIDS