Effects of Organic Pesticides on Predacious Phytoseiid Mites

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Abstract

This project reports laboratory studies conducted to evaluate the effects of organic pesticides on the survival and reproduction of a predatory phytoseiid mite. The pesticide Agree® (*Bacillus thuringiensis*) caused the highest survival rate (65%), followed by the control (47%), Molt-X™ (neem) (34%), Pyganic® (pyrethrum) (25.7%) and Entrust® (spinosad) (25.3%). Agree® causes the highest reproduction followed by Molt-X™. In addition we also evaluated the phytoseiids that were missing under each organic pesticide; this can be an indicator of insecticide repellency. More phytoseiid were missing on the Entrust treatments compared with other products used here.

Introduction

Spider mites cause damage to plants by sucking cell content from leaves. This causes the leaves to turn yellowish or reddish and fall off and then kills the plant. Phytoseiids are predatory beneficial mites; they feed on spider mites, small insects, honeydew or pollen. They have short generations that reproduce in about a week. High fertility rate 40-60 off spring per female. Phytoseiids have hearty appetites, they eat about 20 spider mites a day while developing and 10 a day for 2-3 weeks as an adult. These mites are tiny and range from a clear color to yellow. Few studies have been conducted to evaluate the effects of organic insecticides on predatory phytoseiid mites.

Objectives

To test the survival and oviposition of phytoseiids using different organic insecticides.

Materials and Methods

Insecticides were used in this study:

- Agree® (*Bacillus thuringiensis)*, a bacterium that effectively works to kill the larva of insects.
- Molt-X™ (azadirachtina) is a repellent, antifeedant ovipositional deterrent insecticide. Insects become sluggish, stop feeding and fail to mature and reproduce. The active ingredient component is obtained from neem trees.
- Pyganic® (Pyrethrin), attacks the nervous system of insects, it kills the insect immediately.
- Entrust ® (spinosad*)*, a fungus that attacks the nervous system causing the loss of muscle control . Causes insects to die of exhaustion within 1-2 days.

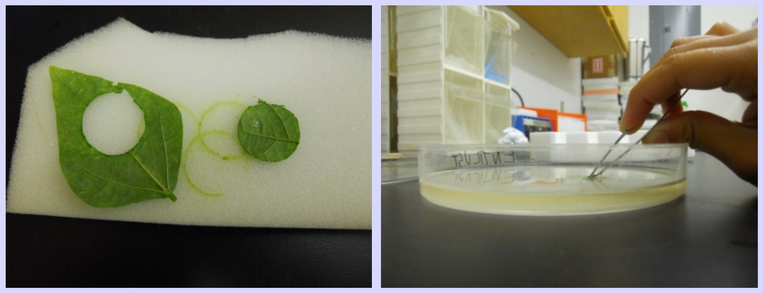
Table 1. Insecticides and rates used

Pesticide	Active ingredient	Doses (g/ 100ml)	
Molt-X™	Azadirachtin	Low	0.1
		Medium	0.2
		High	0.4
Pyganic®	Pyrethrin	Low	0.028
		Medium	0.056
		High	0.112
Entrust®	Spinosad	Low	0.1
		Medium	0.2
		High	0.6
Agree®	*Bacillus thuringiensis*	Low	0.1
		Medium	0.2
		High	0.4
Control			0

Steps followed to conduct these studies:

1. Prepare 5 Petri dishes (14-cm diam.) to contain a moist foam pad and a cotton strip. Label each Petri dish
2. Place a foam pad with cotton (on top) into a dish, and add water to keep cotton and foam pad moist
3. Cut out six leaf disks from lima bean leaves for each Petri dish (1-cm diameter).

Figure 1. (a) Leaf disk (1 cm diam), and (b) Petri dish (14 cm diam)



4. Dip six of the disks in a pesticide for five seconds. Then repeat this for each group of six with a different pesticide and leave 6 disks for the untreated control.
5. Place the six leaf disks on the strip of cotton equidistant from each other with the bottom part of the leaves facing up. Leave disks to air dry
6. Then, place two phytoseiid females adding oak pollen on each of the leaf disks.
7. After all steps above were completed, place Petri dish in an incubator. At 23º C and 75% RH.
8. Record data every 24-hours for 72 hours recording the number of live, dead, or missing phytoseiids and the number of eggs oviposited.
9. All experiments were replicated 6 times.

Figure 2. (a) Placement of leaf disks on top of moist cotton stripe, and (b) Petri dishes with disks and mite prior to be placed in incubator

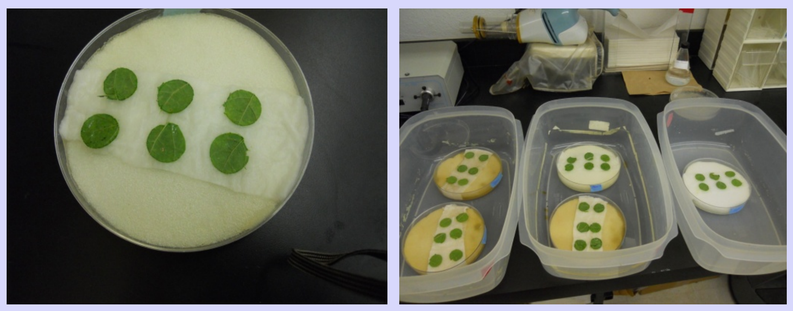


Figure 3 Female phytoseiid preying on spider mite and field view of microscope during evaluation of study

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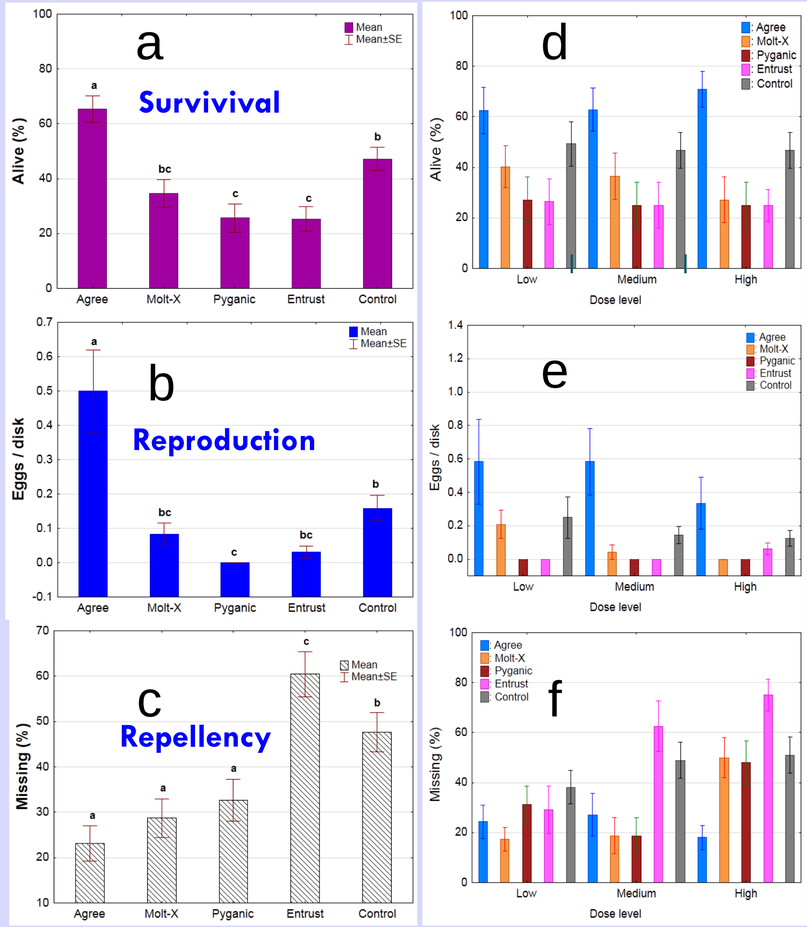
Results and Discussions

The survival of phytoseiid females was the highest on leaf disks dipped on Agree® (Fig. 4a). This treatment also resulted on the highest oviposition compared with the rest of treatments (Fig. 4b).

Pyganic® and Entrust® had the lowest survival of female phytoseiids, and reduced oviposition. The result with the pyrethroid coincides with the reduction of natural enemies including phytoseiids when this type of insecticides are used. Similarly, recent studies have shown that Entrust®, a fungus had negative effects on natural enemies. In addition, Entrust® appear to have some repellency effect as more phytoseiid were missing in this treatment (4c).

All these results shown the same trend across all the different doses used for each insecticide (figs 4d, 4e, and 4f).

Figure 4. Mean numbers (± SEM) of (a) live phytoseiids, (b) eggs oviposited/female, and (c) missing phytoseiid females after 72 hours across all doses employed by insecticide (on the left). The right charts (d, e, and f) shown similar results for live, eggs and missing phytoseiids, respectively, for the averages of the low, medium and high dosages per each insecticide, respectively.



Conclusion

This study is beneficial for organic agriculture production because it provides information about the most common organic insecticides used. These results shown that some of these materials keep the phytoseiid mites alive. Thus, phytoseiids can prey and kill the damaging spider mites. Agree® was proven to have the less negative effect on the phytoseiids. It did not decline reproduction. Entrust® appears to have a repellent effect on phytoseiids.

These also shown that some organic products can affect beneficial organisms.