

Differential activity of Eco-Mite+ on Two-spotted spider mites and eggs on potted bush Roma beans and greenhouse cucumbers

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Summary

No choice bioassays were conducted on two-spotted spider mites using botanically derived formulations on potted crops, including bush Roma beans and bush pickling cucumbers. The active components in the formulation tested include rosemary, cottonseed and peppermint oils. Five day bioassays were used to determine the efficacy against nymphs and adult mites, and two-day bioassays were conducted to determine ovicidal activity. The purpose of these studies was to incorporate active components that meet the EPA 25b FIFRA exemption of residue tolerances on applications to food crops. Only a very limited list of active components including cloves and clove oil, cottonseed oil, rosemary oil, peppermint and peppermint oil, and thyme and thyme oil are exempt from pesticide residues requirements. Two bioassays, on beans and on cucumbers, are reported in this paper. Various formulations were compared for miticidal efficacy. The new Eco-Mite+ was active against two-spotted spider mites in these studies.

Methods

No choice bioassays were conducted on two-spotted spider mites using botanically derived formulations on potted crops, including bush Roma beans and bush pickling cucumbers. The 5 day bioassays were designed to determine efficacy against nymph and adult mites, whereas the 2 day bioassays were used to determine ovicidal activity. Spider mites were collected from a crop with a well-established population from outside the lab. Leaf sections were pinned to the underside of the leaves of bush Roma bean or bush cucumber plants started from seed. Treatments were Eco-Mite RTU, and Eco-Mite+ (061913-01), Eco-Mite plus AzaSol and the control, de-ionized (DI) H₂O. Each infested leaf underside was sprayed to wet with ready to use (Eco-Mite, Liquid Lady Bug, no dilution), 5% solutions of Eco-Mite+ or with de-ionized water. The plates were sealed using parafilm and kept in the lab at ambient temperatures for five days. Mite counts were made at 5 DAT. The formulations, active ingredients and percent solution used are presented in Table 1.

Bioassay 1: On 6/20/13 a 5 day bioassay was run, 6 replicates were established per treatment each with mites transferred onto bush bean foliage. Treatments included AzaSol (6% Azadirachtin) plus Eco-Mite RTU, and Eco-Mite+.

Bioassay 2: Pre-treatment and post-treatment counts of live mites and eggs were conducted using 6.45 cm² of foliage of bush cucumber. Bioassays were conducted on 7/10/13 comparing Eco-Mite RTU, Eco-Mite+ and DI water.

Table 1: Formulation, active ingredient and percent solution applied in various bioassays against two-spotted spider mites.

Formulation ID	Active Ingredient	Percent Solution Applied
Eco-Mite RTU	Lemongrass, 1.98% Rosemary Oil, 1.32%	RTU
Eco-Mite+	Rosemary Oil 2.5% Cottonseed Oil 2.5% Peppermint Oil 2.5%	5%
AzaSol plus Eco-Mite RTU	Azadirachtin, 6% Lemongrass, 1.98% Rosemary Oil 1.32%	0.475 g per 100 mL water Azadirachtin, Eco-Mite RTU, 100 mL

Statistical analyses were conducted in Minitab (Minitab, Inc. version 17, State College, PA., USA), using ANOVA and t-tests, with significance accepted when $p < 0.05$ at 95% CI.

Results

Bioassay 1: Statistical differences were observed among treatments, where percent mortality was highest using the botanical formulations (77.5 ± 7.4 to 89.2 ± 2.0) and combination treatments (73.1 ± 4.5) compared to controls (17.4 ± 4.2), (Figure 1)

Bioassay 2: No statistical differences were observed for percent mortality among treatments prior to application. Statistical differences were observed among treatments at 2 DAT, where Eco-Mite RTU and Eco-Mite+ were significantly different than DI water (Figure 2). No statistical differences were observed among treatments for pre- and post-egg counts. However, as one would expect, with increasing mite mortality, post-treatment egg numbers decreased (Figure 3).

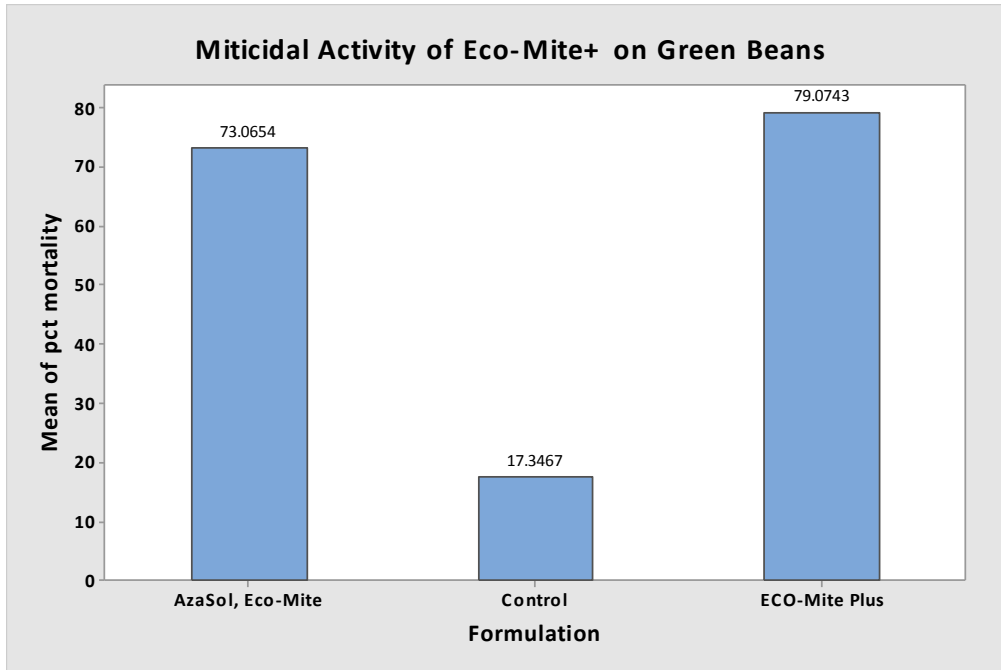


Figure 1. Percent mortality was significantly different for AzaSol plus Eco-Mite or Eco-Mite+ only, compared to the DI water controls at 5 DAT.

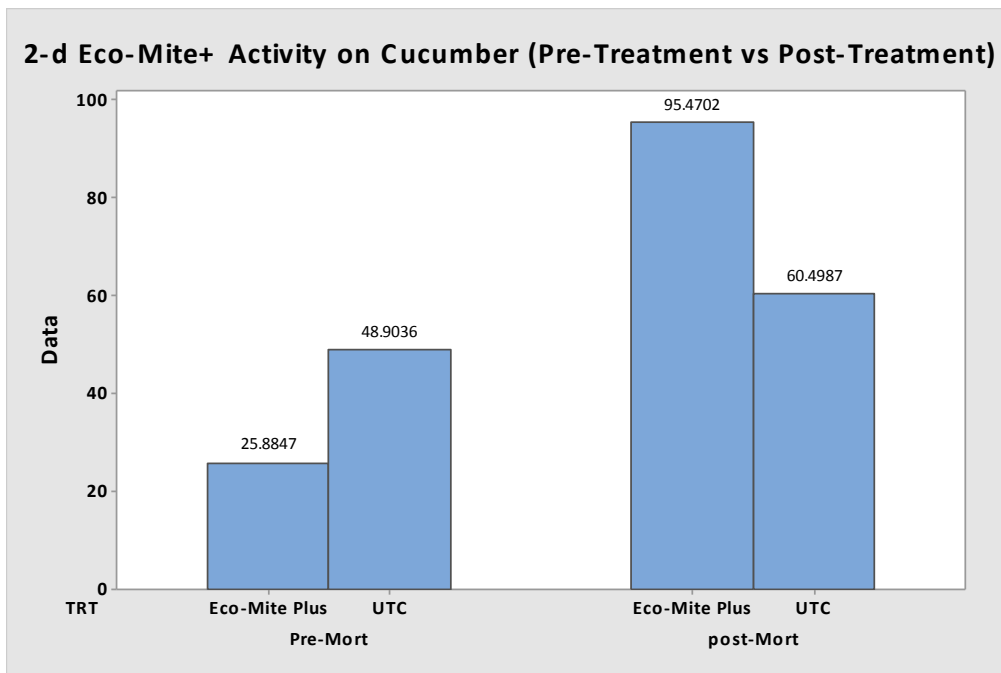


Figure 2 Pre- and post-treatment on cucumber for two-spotted spider mite. No significance was observed prior to treatment. Significant mortality was observed in the Eco-Mite+ treatments compared to the untreated controls at 2 DAT.

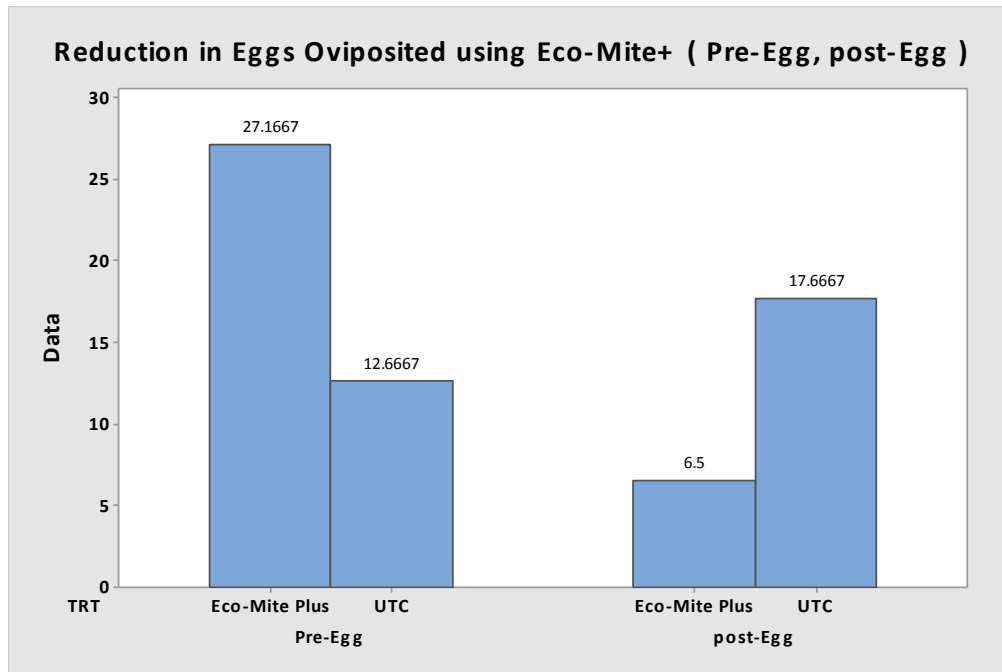


Figure 3. Pre- and post-treatment egg counts on cucumber leaves treated with Eco-Mite+ or DI water (controls). Mean number of eggs oviposited on cucumber was statistically lower in the Eco-Mite+ treated plants compared to the pre-treated plants ($p=0.034$).

Conclusions

We tested the modified Eco-Mite formulation (Eco-Mite+) against two-spotted spider mite on beans and on bush cucumber. The new formulation replaces lemongrass with peppermint oil (derived from *M. x piperata*). In bioassays, the new Eco-Mite+ was equivalent in miticidal activity to the previous Eco-Mite formulation. The primary mode of action observed was against live mites (including nymphs and adults). Although we did not observe statistically significant differences in post treatment egg numbers between treatment and checks, there was a significant reduction between pre- and post- Eco-Mite+ treatment number of eggs oviposited. Eco-Mite plus AzaSol and Eco-Mite+, only were statistically similar in miticidal activity. The combined spray has the potential advantages of: 1. Eco-Mite contains a natural emulsifier (soap) which functions as a spreader/sticker for the AzaSol, and, 2. broader spectrum of insect control. An advantage of this new botanical is that application may be made to farm and home vegetable garden plots without issue of pesticide residue tolerances. Eco-Mite+ is a botanical, contact miticide, therefore leaf coverage must be thorough and the product reapplied to protect new growth.