Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2015; 3(4): 42-44

Received: 17-06-2015
Accepted: 19-07-2015

Gholamreza Golmohammadi
Department of Agricultural Entomology, Iranian Research Institute of Plant Protection, Agricultural Research Education & Extension Organization (AREEO)

Ali Mohammadipour
Department of Agricultural Entomology, Iranian Research Institute of Plant Protection, Agricultural Research Education & Extension Organization (AREEO), Tehran, Iran.

Correspondence:
Gholamreza Golmohammadi
Department of Agricultural Entomology, Iranian Research Institute of Plant Protection, Agricultural Research ducation & Extension Organization (AREEO).

Efficacy of herbal extracts and synthetic compounds against strawberry thrips, *Frankliniella occidentalis* (Pergande) under greenhouse conditions

Gholamreza Golmohammadi and Ali Mohammadipour

Abstract
The western flower thrips, *Frankliniella occidentalis* (Pergande), is a serious pest of greenhouse crops that has short generation and high fecundity. This experiment was conducted based on a completely randomized design with seven treatments and four replications in the greenhouses of Varamin (Tehran province) and Karaj (Alborz province). The treatments were as follows: flonicamid, dichlorvos, azadirachtin, pyrethrum and control (water spray). In Tehran, the efficacy persents, 3 days after treatment, were 82.35±3.45 (flonicamid at 300 ppm), 87.03±2.67 (dichlorvos at 1000 ppm), 69.35±3.85 (flonicamid at 250 ppm), 68.53±4.46% (flonicamid at 200 ppm), 56.95±5.27 (azadirachtin at 2500 ppm) and 55.94±4.62 (pyrethrum at 4000 ppm). Seven days after treatment, the highest and lowest efficacies were 85.75±2.17 (flonicamid 300) and 66.37±3.22 (azadirachtin). In Karaj, three days after treatment, the efficacies were 80.46±3.65 (flonicamid 300), 70.46±3.45 (flonicamid 250), 75.38±4.27 (flonicamid 200), 82.14±2.25 (dichlorvos), 61.39±3.52 (azadirachtin) and 47.42±2.14 (pyrethrum). In general, the herbal extracts and the new insecticide, flonicamid, had acceptable control against Strawberry thrips in the greenhouse.

Keywords: greenhouse, flonicamid, Insecticide, strawberry thrips.

1. Introduction
The western flower thrips, *Frankliniella occidentalis* (Pergande), is a key pest of greenhouse crops. In Iran, it was first reported in 2004 [1] from Pakdasht region (Tehran province) where it was observed on ornamental plant such as Saintpaulias, Gerbera and Anthurium. This pest damages crops directly by feeding, and indirectly by transmitting plant diseases pathogens [2]. This pest had a wide host range, including more than 500 species from 50 families of agricultural crops and ornamental plants [3]. As this pest transmits several plant viruses, the best method to control viral diseases is to control the pest [4]. The western flower thrips is a cosmopolitan pest, which has become resistant against different types of insecticides. Due to oligophagy, high compatibility with the habitat and high reproductive rate, the application rate against this pest is high. Moreover, its resistance to the insecticides, short life time and haploid males increases the resistant biotypes emergence [4].
Neemarin® (1500 EC) is an environmentally-safe insecticide which has been registered in Iran against cucumber whitefly at a rate of 2.5 L/1000 L [5]. This insecticide is based on herbal extracts and is produced from one of the components of Neem plant. The efficacy of several herbal extracts including Neemarin® on insect pest has been studied in the laboratory condition [6]. Based on their results, Bioneem® had the best result after deltamethrin. In another study [7], the efficacy of several Neem-based products against *Spodoptera lituralis* has been studied on tobacco. The results showed that Neemarin® and Neemazal® had 90% and 83.33% efficacy against larvae, respectively.
Pyrethrum is an herbal extract and has been registered against greenhouse whitefly in Iran as a 5% emulsion [8]. In a study on efficacy of insecticides against greenhouse white fly, pyrethrum and euphoria had 80% and 60% efficacy against Whitefly, respectively [5].
Flonicamid is a new systemic insecticide which has been introduced by Ishihara Sangyo Kaisha Co. (Japan) in late 1990s. This insecticide has high efficacy against different species of aphids on apples, peach, potato, wheat and greenhouse crops. This insecticide is safe for biological control agents. The efficacy of actamiprid, imidocloprid, thiamethoxam and flonicamid against *Bumbus terrestris* was studied [9] and results shown those 14 days after treatment, flonicamid had the least side effects on the bumble bees.

In Iran, diclrovus, heptenfus and malation are registered insecticides against thrips. Due to high potential of resistant in this thrips, studying efficacy of new insecticides is essential.

2. Materials and Methods

This experiment was conducted based on a completely randomized design with seven treatments and four replications in the greenhouses of Varamin (Tehran province) and Karaj (Alborze province) in 2013-2014 years. The treatments were as follows:

1- Flonicamid (Teepeki® 50 WG, at 0.2, L/1000 L)
2- Flonicamid (Teepeki® 50 WG, at 0.25 L/1000 L)
3- Flonicamid (Teepeki® 50 WG, at 0.30 L/1000 L)
4- Dichlorvos (DDVP® 50 EC at 1 L/1000 L)
5- Azadirachtin (Neemarin® 1500 EC at 2.5 L/1000 L)
6- Pyrethrum (Pyrethrum® 5 EC at 4 L/1000 L)
7- Control (water spray)

The experiment was conducted in two 1000-m^2 greenhouses in which 'Gavita variety' strawberry. Each experimental plot included a 10- m row on which strawberries were planted at 30 cm distance. Distance between rows was 70 cm. There was a border plot between each two plots. Moreover, five plants from the beginning and end of each row was considered as border line. Two rows which were beside the greenhouse walls were not included in the test. When spraying was done, there were seven adults per plant. A 100-liter motorized sprayer was used. For each experimental plot, four liters of the solution was applied. Sampling was done one day before treatment, and also 3, 7 and 14 days after treatment. For sampling, 10 plants were selected from each plot and two flowers per plant were excided and the total number of adults and nymph thrips was counted. The efficacy was calculated based on Henderson-Tilton [10]:

Efficacy %= (1-(Ta×Cb/Tb×Ca)) ×100

Where, Ta=number of thrips after spraying in the treated plot, Ca= number of thrips after spraying in the control plot, Tb= number of thrips before spraying in the treated plot, and Cb= number of thrips before spraying in the control plot. Analysis of variance of mean efficacy of treatments was done in SAS 9.2, followed by Duncan's Multiple Range Test.

3. Results

3.1 *Varamin (Tehran province)*

There was a significant difference among treatments 3 days (ANOVA: $df_{5, 18}$ F=9.75, P < 0.0001) and 7 days after treatment (ANOVA: $df_{5, 18}$ F=4.25, P =0.035). Mean efficacies were not different 14 days after treatment (ANOVA: $df_{5, 18}$ F=0.24, P =0.8526). Three days after treatment (Table 1), dichlorvos had the highest efficacy (87.3%) while the herbal extract, azadirachtin, had the least efficacy (55.94%). Seven days after treatment, the efficacy of insecticides increased. The highest and lowest efficacies were for flonicamid (at 0.3 L/1000 L) and pyrethrum, which were 85.75% and 59.34% respectively. In general, the efficacies reduced 14 days after treatment.

Table 1: Mean (± SE) efficacy of different insecticides against *F. occidentalis* on after days after treatment in Varamin.

Treatments	Dose (ppm)	Mean ± SE*		
		+3	+7	+14
Flonicamid	200	68.53±4.64 b	78.49±3.21 ab	64.22±4.25 b
Flonicamid	250	69.35±3.58 b	84.10±3.13 a	57.49±4.17 b
Flonicamid	300	82.35±3.45 ab	85.75±2.17 a	68.43±3.64 b
Dichlorvos	1000	87.03±2.67 a	75.65±3.41 ab	85.33±3.79 a
Azadirachtin	2500	56.95±5.27 b	66.37±3.22 b	58.13±4.29 b
Pyrthrum®	4000	55.94±4.62 b	69.34±3.52 b	54.61±4.89 b

*Means within each column followed by the same letter(s) are not significantly different based on Duncan's Multiple Range Test (P > 0.05).

3.2 *Karaj (Alborz province)*

There was a significant difference among treatments 3 days (ANOVA: Fdf $_{5, 18}$ F=5.89, P =0.001), 7 days (ANOVA: $df_{5, 18}$ F=11.23, P =0.001) and 14 days after treatment (ANOVA: $df_{5, 18}$ F=26.42, P < 0.0001). Three days after treatment (Table 2), dichlorvos, flonicamid (at 0.2, 0.25 and 0.3 L/1000L) had the highest efficacy (82.41%, 80.46%, 75.38% and 70.46%, respectively) while the herbal extracts, azadirachtin and pyrethrum, had the least efficacy (61.39% and 47.42%, respectively). Seven days after treatment, the lowest efficacies were for herbal extracts, while flonicamid at 0.25 and 0.3 L/1000L had the highest efficacies (73.21% and 72.42% respectively). The efficacies reduced incredibly 14 days after treatment. The efficacy of herbal extracts, azadirachtin and pyrethrum, reached 19.23% and 15.54%, respectively. Flonicamid t 0.25 and 0.3 L/1000L had the highest efficacies (53.83% and 68.15% respectively).

Table 2: Mean (± SE) efficacy of different insecticides against *F. occidentalis* on after days after treatment in Karaj

Treatments	Dose (ppm)	Mean ± SE*		
		+3	+7	+14
Flonicamid	200	75.38±4.27 ab	62.60±3.76 a	41.80±3.45 b
Flonicamid	250	70.46±3.45 b	73.21±3.87 a	83.83±4.89 a
Flonicamid	300	80.46±3.65 ab	72.42±3.21 a	68.15±4.76 ab
Dichlorvos	1000	82.14±2.25 a	66.88±2.94a	48.10±3.15 b
Azadirachtin	2500	61.39±3.52 b	48.31±3.69 b	19.23±4.14 c
Pyrthrum®	4000	47.42±2.14 c	41.59±2.84 b	15.54±3.11 c

*Means within each column followed by the same letter(s) are not significantly different based on Duncan's Multiple Range Test (P > 0.05).

4. Discussion

Our results showed, three days after application, the efficacy of flonicamid at 0.3 L/1000 L was similar to efficacy of the efficacious phosphorous insecticide, dichlorvos. Seven days after treatment, there was significant difference among treatments. After 14 days, the efficacy of all insecticides decreased incredibly and there was no difference among treatments. The rate of decrease in efficacy was lower in

Alborz province compared to Tehran province. The lowest efficacy in Tehran was 15.54% which was observed for pyrethrum, while the lowest efficacy if Alborz, for which it was observed again in pyrethrum treatment, was 54.61%. Flonicamid mode of action is blocking feeding activity of sucking insects; this compound has along-lasting effect. In our study, flonicamid showed a good efficacy up to 7 days after treatment. Due to its special site of action, there has not been any report on cross-resistance due to application of flonicamid. This insecticide has a high efficacy against different types of sucking insects such as: aphids on apple, peach, potato, wheat and greenhouse crops. Based on other studies, flonicamid had low side effects on biological control agent, even 14 days after treatment [9].

The efficacy of several sucking insect species against flonicamid, imidaclopride, pimethtozine, flofenexoran, pyryperoxifen and nimazal on artificial media was studied [11]. The results showed that these species were very sensitive to flonicamid. One the important result of this study is that although there are several years those dichlorvoses is applied against strawberry thrips; In the Tehran and Alborz provinces, there has not been any report on resistant biotypes of western flower trips. Therefore, dichlorvos can be applied in rotation with other insecticides against strawberry thrips. Azadirachtin and pyrethrum had a moderate efficacy (ca. 55-65%) against strawberry thrips, which is probably due to its mode of action which is different from synthetic compounds. For example, the efficacy of several Neem-based formulations and also synthetic compounds against Cabbage butterfly, *Pieris brassicae* has been studied [12]; the results showed all synthetic compounds had 100% efficacy after 72 hours treatment, which were more than Neem-based compounds. Among the Neem-based compounds, neemarin®, with ca. 50% mortality, has the best efficacy. Similar results were found by application of neemarin against the butterfly *Leucinodes orbonalis* that reduced the damage by 78.5%; that did not have an efficacy as high as synthetic compounds [13].

In another study [5], 7 days after treatment, pyrethrum reduced the population of the Whiteflies by 80% in the fields, which were different from our results. The difference may be due to difference of the species, application methods and feeding activity.

In general, the new insecticide, flonicamid, had a good control level at 0.25 and 0.3 L/1000L, three and seven days after treatment, against strawberry thrips. Due to mode of action of flonicamid, which is blocking the potassium ion canals and resulting in irreversible stop of feeding activity, there has not been any report on the cross-resistance of flonicamid. However, it is recommended to be applied in rotation with other insecticides. The phosphorous insecticide, dichlorvos, has been applied for a long time against strawberry thrips; however, the studied populations did not show resistance to it. Therefore, it can be applied in rotation with other insecticides. Moreover, dichlorvos has a short pre-harvest time, which is suitable for greenhouse crops.

Insecticides with herbal origin, such as azadirachtin and pyrethrum, 3 and 7 days after treatment, had 47% and 66% efficacy, respectively. Although, these compounds are not registered against thrips, due to short pre-harvest time and low side-effects on biological control agents, they may control the pest at low population levels. More research is needed to prove these hypotheses.

References

1. Jalili-Moghadam M, Azmayesh-Fard P. Thrips of ornamantal plants in Tehran and Mahallat. Proceedings of the 16th Iranian Plant Protection Congress 2004; I:160.
2. Espinosa PJ, Bielza P, Contreras J, Lacasa A. Field and laboratory selection of *Frankliniella occidentalis* (Pergande) for resistance to insecticides. Pest Management Science 2002; 58:920-927**.**
3. Lewis T. Thrips their biology, ecology and economic importance. Academic Press, London, 2003, 349.
4. Kirk WDJ, Terry LI. The spread of the western flower thrips *Frankliniella occidentalis* (Pergande*).* Agricultural and Forest Entomology 2003; 5:301-310**.**
5. Golmohammadi Gh, Hossiengharalari A, Fassihi MT, Arbabtafti R. Efficacy of one botanical and three synthetic insecticides against silverleaf whitefly, *Bemisia* tabaci (Hem.: Aleyrodidae) on cucumber plants in the field. Journal of Crop Protection. 2014; 3:35-41.
6. Gupta RK, Neerja A, Pandey SD, Srivastava JP. Management of mustard aphid *Lipaphis erysimi* Kalt using botanical pesticides. Journal of Flora and Fauna. 2001; 7(2):107-109.
7. Kumar R, Mohan K, Upadhyay KD. Toxic effect of some commercial neem formulations against tobacco caterpillar, *Spodoptera litura* Fabr. International Journal of Farm Sciences. 2003; 12:50-51.
8. Norbakhsh S, Sarahian H, Sorush MJ, Rezai EV, Fothuhi A. List of pests, diseases, weeds of agricultural products, pesticides and recommended methods for controlling them. Plant Protection Organization, 2011, 196.
9. Fanigliulo A, Filì V, Pacella R, Comes S, Crescenzi A. Teppeki, selective insecticide about *Bombus terrestris*. Common Agricultural Applied Biological science 2009; 74:407-10.
10. Henderson CF, Tilton EW. Tests with acaricides against the brow wheat mite. Journal of Economic Entomology. 1955; 48:157-161.
11. Sadeghi A, Van Damme JM, Smagghe G. Evaluation of the susceptibility of the pea aphid, *Acyrthosiphon pisum*, to a selection of novel biorational insecticides using an artificial diet. Journal of Insect Science. 2009; 9(65):1-8.
12. Singh AK, Kumar M. Efficacy and economics of neem based products against cotton jassid, *Amrasca biguttulla biguttulla* Ishida in okra. Journal of Crop Research. 2003; 26:271-274.
13. Gautam CPN, Verma RA, Gautam RD, Khan MA. Comparative efficacy of insecticiedes, biopesticides and botanicals against *Leucinodes orbonalis* Guenee infesting brinjal. Annals of Plant Protection Sciences 2008; 16:309-311.