Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(4): 1034-1036

Received: 16-05-2018
Accepted: 18-06-2018

RP Dongarjal
Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Md. Ilyas
Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

SA Shendge
Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Correspondence
RP Dongarjal
Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Bioefficacy of newer insecticides on thrips of pomegranate

RP Dongarjal, Md. Ilyas and SA Shendge

Abstract
The present investigation was undertaken regarding evolution of newer insecticides against thrips (*S. dorsalis*) on pomegranate at Department of Horticulture, VNMKV, Parbhani. The different newer insecticides were acephate, buprofezin, clothianidin, diafenthiuron, fipronil, flonicamid, spiromesifen and thiamethoxam were used. The pooled data of *Ambia* and *Hasta* bahar showed that fipronil was statistically superior over other treatments and at par with thiamethoxam and clothianidin. The next promising treatment were flonicamid, acephate, diafenthiuron, buprofezin and spiromesifen. Control treatment recorded significantly maximum population of thrips on pomegranate for the year 2014-15.

Keywords: *S. dorsalis,* bioefficacy, fipronil, clothianidin, thiamethoxam

Introduction

Pomegranate cultivation is unique in its own way because of its drought tolerant hardy nature, low maintenance cost, steady and good yields, fine table and therapeutic values, better keeping quality and possibilities of throwing the plant into rest during period when irrigation potential is low, especially in the hot semi-arid and desert regions of India, Maharashtra, Uttar Pradesh, Andhra Pradesh, Gujarat, Karnataka and Tamil Nadu its cultivation has spread extensively. In Maharashtra area about 78.00 thousand ha and production 408.00 thousand tonne. In Maharashtra area under commercial production of pomegranate is steadly increasing mainly in Solapur, Nashik, Ahamednager, Pune, Sangali, Satara, Aurangabad, Jalna, and Parbhani districts (Anonymous 2005) [2].

Through scanning of the literature revealed a total of 91 insects, 6 mites and 1 snail pest feeding on pomegranate crop in India. The most obnoxious enemy is pomegranate butterfly, *Deudorix* (*Virachola*) *isocrates* (Fab.) which may destroy more than 50% of fruits. Overuse and improper use of insecticides has led to many serious problems like whiteflies (Pomegranate whitefly, *Siphoninus phillyreae* (Haliday); Spiralling whitefly, *Aleurodicus dispersus* Russell), mealybug (*Pseudococcus lilacinus* (Cockerell)) Thrips (*Rhipiphoro thrips cruentatus* Hood; *Scirtothrips dorsalis* Hood; *Anaphothrips oligochaetus* Karny), aphid (*Aphis punicae* (Passerini)) and mites, *Aceria granati* Can. & Massal; *Oligonychus punicae* (Hirst.). These sucking pests occur during the flowering and fruiting stage of the crop and thereby reduce the vigour of the plant in addition to excretion of honeydew on the leaves and development of sooty mould on leaves and fruits (Ananda *et al.* 2009) [1]. Gilbert (1986) [3] reported that thrips, *Scirtothrips dorsalis* (H.) is one of the most important pests infesting pomegranate crop. It feeds on the foliage as well as fruits deteriorating quality of the fruits. At International level thrips are considered as a potential pest in pomegranate being responsible for deteriorating quality of the fruits (Wang, 1994) [7].

Materials and Methods

Experimental details

The details of experiment are given below.
Experimental Design: Randomized Block Design
Replications: Three
Treatments: Ten
Spacing: 4 m x 4 m
Crop: Pomegranate
Variety: Bhagwa
Distance between two replications: 4m
Distance between two plots: 4m

Treatment details of insecticides for sucking pests

T. no.	Treatments	Dose (g.a.i./ha)
T_1	Acephate 75% WP	584 gm
T_2	Buprofezin 25% SC	250 ml
T_3	Clothianidin 50% WDP	20 gm
T_4	Diafenthiuron 50% WP	300 gm
T_5	Fipronil 5% SC	50 ml
T_6	Flonicamid 20% WP	50 gm
T_7	Spiromesifen 22.9% SC	96 ml
T_8	Thiamethoxam 70% WS	25 gm
T_9	Control	----

Methods of observations

Three observation plants were selected randomly from the net plot of each treatment in each replication. They were properly labeled. While thrips were observed on the fruits and the observation was observed at one day before and 1, 3, 7 and 14 days after application of insecticides.

Results and Discussion

The data presented in the (Table 1 and 2) shows the pooled population of thrips on pomegranate during *Ambia bahar* and *Hasta bahar* during the year 2014-15.

A. Performance after first spray

Pooled data after 1 DAS showed that the promising treatment was fipronil (1.71 and 1.96 thrips /fruit) followed by thiamethoxam (2.58 and 2.92 thrips / fruit) and clothianidin (2.83 and 3.13 thrips / fruit) were found at par with each other.

At 3 DAS fipronil proved the best treatment to control (1.92 and 2.13 thrips /fruit) which was found at par with thiamethoxam and clothianidin which controlled (2.83 and 3.13 thrips /fruit) and (3.08 and 3.33 thrips /fruit).

At 7 DAS, the results showed that the treatment of fipronil was most effective in minimizing thrips population (2.13 and 2.79 thrips/fruit) followed by thiamethoxam (3.13 and 3.50 thrips/fruit) and clothianidin (3.33 and 3.75 thrips/fruit). There was no statistical difference in their effectiveness against thrips and found at par.

The data recorded on 14 DAS showed that fipronil was the superior treatment (3.38 and 3.67 thrips /fruit) followed by thiamethoxam and clothinidin (5.00 and 5.58 thrips /fruit) (5.33 and 5.92 thrips /fruit). Whereas highest incidence was found on the untreated plant with spiromesifen (7.08 and 6.88 thrips /fruit). It indiated that those three insecticides were at par with each other and comparatively more effective than rest of the spray treatments.

B. Performance after second spray

All insecticidal treatments were significantly superior over untreated control in minimizing the pest incidence. The data recorded at 1 DAS revealed that fipronil treated plants showed lowest incidence (1.46 and 1.71 thrips /fruit), followed by thiamethoxam (1.96 and 2.54 thrips /fruit) and clothianidin (2.13 and 2.79 thrips /fruit) which were statistically at par with each other and significantly superior over other test insecticides.

The observations recorded on 3 DAS showed that fipronil was the superior treatment (1.71 and 1.88 thrips /fruit). The next promising treatments were thiamethoxam and clothianidin recording (2.38 and 2.38 thrips /fruit) and (2.54 and 3.04 thrips /fruit), respectively.

The observations recorded on 7 DAS showed that fipronil was the superior treatment (2.08 and 2.42 thrips /fruit). The next promising treatments were thiamethoxam and clothianidin recording (2.75 and 3.17 thrips /fruit) and (2.89 and 3.46 thrips /fruit), respectively.

The data recorded on 14 DAS showed that fipronil was the superior treatment (3.00 and 3.21 thrips /fruit) followed by thiamethoxam and clothinidin (4.25 and 4.54 thrips /fruit) and (4.42 and 4.75 thrips /fruit). Whereas highest incidence was found on the plant treated with spiromesifen (5.58 thrips /fruit). It Indicated that those three insecticides were at par with each other and comparatively more effective than rest of the spray treatments.

C. Performance after third spray

According to the observations recorded on 1 DAS fipronil was found to be the most superior treatments (0.75 and 1.04 thrips /fruit). Next promising treatments were thiamethoxam (1.08 and 1.46 thrips /fruit), clothianidin (1.21 and 1.58 thrips /fruit).

The post treatment count of live population of aphids at 3 days after third spray clearly indicated the superiority of fipronil 5 SC @ 50 ml a.i. ha^{-1} (0.92 and 1.25 thrips /fruit), over other treatments followed by thiamethoxam 70 WG @ 25 g a.i. ha^{-1} (1.25 and 1.63 thrips /fruit) and clothianidin 50 WDP @ 20 g a.i. ha^{-1} (1.46 and 1.83 thrips /fruit), respectively. These three treatments were statistically at par with each other and were significantly superior over rest of the treatments in minimizing thrips incidence.

The post treatment count of live population of thrips at 7 days after third spray clearly indicated the superiority of fipronil 5 SC @ 50 ml a.i. ha^{-1} (1.33 and 1.63 thrips /fruit), over other treatments followed by thiamethoxam 70 WG @ 25 g a.i. ha^{-1} (1.63 and 1.92 thrips /fruit) and clothianidin 50 WDP @ 20 g a.i. ha^{-1} (1.96 and 2.17 thrips /fruit), respectively. These three treatments were statistically at par with each other and were significantly superior over rest of the treatments in minimizing thrips incidence.

The data recorded on 14 DAS showed that fipronil was the superior treatment (2.33 and 2.50 thrips /fruit) followed by thiamethoxam, clothinidin and flonicamid (3.00 and 2.96 thrips /fruit), (3.38 and 3.13 thrips /fruit) and (3.67 and 3.38 thrips /fruit). It Indicated that those three insecticides were at par with each other and comparatively more effective than rest of the spray treatments.

Similar finding was observed by the earlier research workers Patil *et al*. (2009) [6] observed significantly lower population of thrips, leafhopper, aphid in fipronil 5 SC (800 g /ha) as compared to acetamaprid 20 SP (100 g / ha) and imidacloprid 200 SL. Kadam *et al.* (2012) [4] studied that the thrips incidence in all insecticide treatments was significantly low indicating that all the insecticides were significantly effective against thrips. Spinosad @ 56.25 g a.i. ha-1 was the most effective treatment (4.26 thrips/fruit) at 14 DAS on par with fipronil @ 25 g a.i. ha-1 (4.42 thrips/fruit) followed by lambda cyhalothrin (6.35 thrips/fruit) and imidacloprid (6.37 thrips/fruit). All the treatments were superior to control (19.84 thrips/fruit). Bioefficacy of newer insecticidal molecule was studied against thrips, *Thrips tabaci* (Linnman) infesting cotton showed fipronil 200 SC at 375 ml/ha caused the highest percent reduction of thrips followed by fipronil 200 SC at 300 ml/ha at 3, 7 and 10 days after first and second spray, respectively. The insecticidal treatment Regent 5% SC at 1500 ml/ha and Imidacloprid 200 SL at 125 ml/ha also recorded lower population of thrips and was significantly superior over other treatments (Mahla *et al*. 2013) [5]. Jadhav (2015) reported that the spray treatment indicated that the order of efficacy of insecticides was spinosad, fipronil, lamdacyhalothrin, clothianidin and thiamethoxam (3.44, 3.45, 3.64, 3.88 and 4.31 thrips/fruit), respectively. High incidence was found on the plants treated with thiacloprid and dinotefuran (6.06 and 6.16 thrips/fruit).

Table 1: Bioefficacy of newer insecticides against thrips infesting pomegranate Pooled (*Ambia bahar*-2014 & 15)

Treatments	Dose g.a.i/ha	Average no. of thrips/ fruit												
		Pre-count	1st spray				2nd spray				3rd spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
T_1 Acephate	584 gm	10.04 (3.25)	3.21 (1.91)	3.63 (2.03)	4.08 (2.13)	6.38 (2.61)	2.54 (1.73)	2.96 (1.86)	3.21 (1.92)	4.92 (2.32)	1.63 (1.45)	1.92 (1.55)	2.58 (1.73)	4.38 (2.19)
T_2 Buprofezin	250 ml	9.58 (3.17)	3.67 (2.03)	4.00 (2.12)	4.67 (2.27)	6.88 (2.70)	2.96 (1.86)	3.46 (1.98)	3.63 (2.03)	5.42 (2.42)	2.04 (1.57)	2.38 (1.68)	3.21 (1.88)	5.17 (2.37)
T_3 Clothianidin	20 gm	10.25 (3.28)	2.83 (1.81)	3.08 (1.88)	3.58 (2.01)	5.33 (2.39)	2.13 (1.61)	2.54 (1.74)	2.89 (1.84)	4.42 (2.21)	1.21 (1.29)	1.46 (1.39)	1.96 (1.54)	3.38 (1.94)
T_4 Diafenthiuron	300 gm	11.08 (3.40)	3.42 (1.96)	3.79 (2.07)	4.42 (2.21)	6.58 (2.65)	2.79 (1.80)	3.29 (1.94)	3.46 (1.99)	5.13 (2.37)	1.83 (1.52)	2.21 (1.64)	2.88 (1.82)	4.75 (2.27)
T_5 Fipronil	50 ml	10.88 (3.37)	1.71 (1.47)	1.92 (1.52)	2.29 (1.64)	3.38 (1.94)	1.46 (1.36)	1.71 (1.48)	2.08 (1.59)	3.00 (1.84)	0.75 (1.11)	0.92 (1.19)	1.33 (1.35)	2.33 (1.67)
T_6 Flonicamid	50 mg	11.25 (3.43)	3.00 (1.86)	3.38 (1.96)	3.83 (2.08)	6.17 (2.56)	2.38 (1.67)	2.79 (1.81)	3.04 (1.88)	4.63 (2.26)	1.38 (1.36)	1.67 (1.47)	2.38 (1.67)	3.67 (2.03)
T_7 Spiromesifen	96 ml	10.08 (3.25)	3.88 (2.09)	4.17 (2.16)	4.83 (2.31)	7.08 (2.74)	3.17 (1.90)	3.71 (2.05)	3.88 (2.09)	5.58 (2.46)	2.21 (1.63)	2.58 (1.76)	3.63 (2.01)	5.42 (2.43)
T_8 Thiamethoxam	25 gm	10.96 (3.38)	2.58 (1.75)	2.83 (1.82)	3.38 (1.96)	5.00 (2.32)	1.96 (1.55)	2.38 (1.69)	2.75 (1.80)	4.25 (2.18)	1.08 (1.26)	1.25 (1.31)	1.63 (1.43)	3.00 (1.85)
Untreated Control	--	10.83 (3.37)	10.63 (3.33)	11.21 (3.42)	12.17 (3.56)	13.96 (3.79)	12.63 (3.61)	12.88 (3.69)	13.54 (3.74)	14.25 (3.84)	11.96 (3.52)	12.38 (3.59)	11.79 (3.50)	13.92 (3.79)
S.E.±		0.07	0.12	0.12	0.12	0.15	0.09	0.10	0.09	0.12	0.10	0.08	0.09	0.11
C.D. at 5%		N.S.	0.37	0.38	0.37	0.49	0.28	0.33	0.28	0.37	0.30	0.24	0.29	0.36

* Figures in parentheses are √x+0.5 transfer values *DAS: Days after Spray * NS: Non Significant

Table 2: Bioefficacy of newer insecticides against thrips infesting pomegranate (Pooled *Hasta bahar*-2014-15)

Treatments	Dose g.a.i/ha	Average no. of thrips/ fruit												
		Pre-count	1st spray				2nd spray				3rd spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
T_1 Acephate	584 gm	11.83 (3.51)	3.58 (2.02)	3.96 (2.10)	4.17 (2.16)	6.21 (2.58)	3.17 (1.91)	3.42 (1.98)	4.00 (2.12)	5.25 (2.39)	1.96 (1.53)	2.29 (1.66)	2.63 (1.75)	3.63 (2.02)
T_2 Buprofezin	250 ml	13.00 (3.67)	4.04 (2.13)	4.41 (2.21)	4.63 (2.26)	6.67 (2.67)	3.54 (2.00)	3.88 (2.08)	4.38 (2.19)	5.63 (2.47)	2.38 (1.66)	2.79 (1.81)	3.04 (1.87)	4.13 (2.14)
T_3 Clothianidin	20 gm	13.21 (3.70)	3.13 (1.89)	3.33 (1.95)	3.75 (2.06)	5.75 (2.50)	2.79 (1.81)	3.04 (1.88)	3.46 (1.98)	4.75 (2.29)	1.58 (1.41)	1.83 (1.52)	2.17 (1.62)	3.13 (1.89)
T_4 Diafenthiuron	300 gm	11.75 (3.50)	3.83 (2.07)	4.25 (2.17)	4.42 (2.22)	6.46 (2.63)	3.38 (1.97)	3.67 (2.03)	4.21 (2.17)	5.42 (2.41)	2.33 (1.64)	2.46 (1.70)	2.79 (1.80)	3.83 (2.05)
T_5 Fipronil	50 ml	12.25 (3.57)	1.96 (1.56)	2.13 (1.58)	2.79 (1.80)	3.67 (1.96)	1.71 (1.48)	1.88 (1.54)	2.42 (1.70)	3.21 (1.92)	1.04 (1.23)	1.25 (1.31)	1.63 (1.43)	2.50 (1.72)
T_6 Flonicamid	50 mg	12.88 (3.65)	3.42 (1.97)	3.71 (2.05)	3.96 (2.11)	5.92 (2.53)	3.00 (1.86)	3.25 (1.93)	3.75 (2.06)	5.04 (2.34)	1.79 (1.47)	2.08 (1.59)	2.46 (1.70)	3.38 (1.95)
T_7 Spiromesifen	96 ml	12.33 (3.58)	4.29 (2.19)	4.63 (2.26)	4.79 (2.30)	6.88 (2.71)	3.75 (2.06)	4.13 (2.15)	4.50 (2.24)	5.79 (2.50)	2.54 (1.69)	2.96 (1.83)	3.25 (1.93)	4.33 (2.18)
T_8 Thiamethoxam	25 gm	12.13 (3.54)	2.92 (1.84)	3.13 (1.90)	3.50 (1.99)	5.58 (2.45)	2.54 (1.74)	2.83 (1.82)	3.17 (1.91)	4.54 (2.23)	1.46 (1.37)	1.63 (1.44)	1.92 (1.54)	2.96 (1.85)
Untreated Control	--	12.79 (3.65)	12.29 (3.57)	12.88 (3.66)	13.38 (3.72)	14.17 (3.83)	12.42 (3.59)	12.67 (3.63)	12.46 (3.60)	12.96 (3.66)	11.08 (3.37)	11.54 (3.45)	12.92 (3.65)	14.29 (3.84)
S.E.±		0.08	0.10	0.13	0.10	0.18	0.12	0.11	0.10	0.13	0.07	0.07	0.07	0.08
C.D. at 5%		N.S.	0.33	0.39	0.32	0.57	0.37	0.36	0.32	0.40	0.22	0.23	0.22	0.27

* Figures in parentheses are √x+0.5 transfer values *DAS: Days after spray * NS: Non significant

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