Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(5): 1752-1754

Received: 28-07-2020
Accepted: 30-08-2020

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Bio-efficacy of selective insecticides against thrips (*Scirtothrips dorsalis* H) in chilli (*Capsicum annum* L.)

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Abstract
Field experiment carried out during *kharif* 2015-16 and 2016-17 at Horticulture Garden, College of Agriculture, Rajendranagar, Hyderabad to evaluate the efficacy of different insecticides on *Scirtothrips dorsalis* population. The first spray was given after 50% flower initiation and treatments was imposed thrice at 10 days intervals as foliar sprays against the thrips. A total of three sprays were given during the experiment. Data on mean population of 1,3,5,7 and 10 days after spraying and per cent reduction over control were calculated after each spray. Cumulative mean of three sprays during *kharif* in 2015-16 and 2016-17 was worked out. Among that, spinosad at 125 g a.i. ha^{-1} was found to be the most effective treatment with 59.09 per cent reduction of *Scirtothrips dorsalis* followed by fipronil at 500 g a.i. ha^{-1} (52.11%), betacyfluthrin + imidacloprid at 30 g a.i. ha^{-1} (49.07%), profenophos at 400 g a.i. ha^{-1} (47.86%), dimethoate at 300 g a.i. ha^{-1} (39.03%), lambda cyhalothrin15.63 g a.i. ha^{-1} (35.91%) and chlorantraniliprole at 30 g a.i. ha^{-1} (8.58%) over control.

Keywords: Chilli, control, efficacy, foliar spray, *kharif*, *Scirtothrips dorsalis* and spinosad

1. Introduction
Chilli (*Capsicum annum* L.), is an important vegetable and condiment crop grown throughout the world and it has immense commercial, dietary and therapeutiuc values. It is a rich source of A, C, E and P and an alkaloid capsacin, which has high medicinal value and is used in many pharmaceutical preparations. Among the different countries India (25%) is the leader in chilli production followed by China (24%) and Pakistan (7.2%). The bulk share of chilli production in the world is held by Asian countries. In India chilli is cultivated in an area of 774.9 lakh ha with an annual production of 1492.1 lakh tones (Horticultural Statistics, India 2015) [4]. Important chilli growing states in India are Andhra Pradesh, Telangana, Karnataka, Maharashtra and Tamil Nadu which constitute nearly 75 per cent of the total area under chilli. Area under chilli crop in Andhra Pradesh and Telangana is around 1.72 lakh ha which is about 25.12 per cent of the total area in India. In Telangana State it is grown in 73,000 hectares with 2,53,000 tonnes production from major chilli growing areas such as Khammam, Warangal, Mahabubnagar and Ranga Reddy districts (*WWW. Indiastat.com*). Although the crop has great export potential besides the domestic requirement, a number of limiting factors contribute to its low productivity. Among these various biotic stresses, ravages caused by insect pests are significant. The pest spectrum in chilli is complex with more than 293 insects and mites species debilitating the crop in field as well as in storage (Butani, 1976) [1]. Among these, chilli thrips, *Scirtothrips dorsalis* Hood has become the most notorious and pernicious pest on chilli. The overall reduction in fruit yield of chilli due to thrips and mites damage was up to 34 per cent (Thania *et al.*, 2011) [10]. These pests not only cause a reduction in yield, but also act as vectors for several viral diseases and cause complete failure of crop Inspite of several insecticidal recommendations against this pest, desirable control has been far away, needing a constant search for effective chemicals is a regular feature of entomological research to offer timely suggestions to the growers. The bio-efficacy of selective insecticides against chilli thrips, *Scirtothrips dorsalis* Hood would give an idea about the developing better pest management strategies.

2. Materials and Methods
To study the Bio-efficacy of selective insecticides against thrips (Scirtothrips dorsalis H) in

Chilli (*Capsicum annum* L), 100 m^2 the chilli crop was grown in the field with a spacing of 45×30 cm. The study was carried out during *kharif* 2015-16 and 2016-17 at Horticulture Garden, College of Agriculture, Rajendranagar, Hyderabad. The seeds of LCA 334 were raised in the nursery and six weeks old seedlings were transplanted in the main field. Test insecticides were applied using a high volume knapsack compression sprayer. Sprayings were undertaken during morning hours and necessary care was taken to prevent the drift of spray fluid reaching the adjacent plots. The first spray was given after 50% flower initiation and treatments was imposed thrice at 10 days intervals as foliar sprays against the thrips. A total of three sprays were given during the experiment. Observations on insect populations of thrips**,** *Scirtothrips dorsalis* Hood, were recorded in five randomly tagged plants, from five terminal leaves per plant. Data on thrips population was recorded at 1,3,5,7 and 10 days after spray by using destructive sampling procedure. The collected leaf samples were brought to laboratory in separate zip-locked poly-bags. Before observation each leaf sample was tapped over a white plain paper and the thrips which fell on the paper and on the leaves were critically recorded with 10x magnifying glass. Per cent reduction over control was calculated by using the following formula (Flemming and Retnakaran, 1985).

$$\text{Per cent Population reduction} = 1 - \frac{\text{Post treatment population in treatment}}{\text{Pre treatment population in treatment}} X \frac{\text{Pre treatment population in untreated control}}{\text{Post treatment population in untreated control}} X100$$

Data on mean population of 1,3,5,7 and 10 days after spraying and per cent reduction over control were calculated after each spray. Cumulative mean of three sprays during *kharif* in 2015-16 and 2016-17 was worked out. The observations recorded from the field experiment were subjected to statistical analysis (RBD) to know the significance of difference among different treatments. The values in percentages were transformed to angular values and values in number were transformed into square root values before analysis (Gomez and Gomez, 1984) [3].

Table 1: Details of insecticidal treatments

Treatment	Common Name of Insecticide	Dosage (g a.i ha^{-1})	Trade Name and Formulation
1	Fipronil 5% SC	500	Regent 5% SC
2	Spinosad 45% SC	125	Tracer 45%SC
3	Chlorantraniliprole 20% SC	30	Coragen 20%SC
4	Profenophos 50% EC	400	Curacron 50% EC
5	Lambda - cyhalothrin 5% SC	15.63	Karate 5% SC
6	Betacyfluthrin + imidacloprid 300% OD	30	Solomon 300%OD
7	Dimethoate 30% EC	300	Rogor 30% EC
8	Control (water spray)	-	-

3. Results and Discussion

The data recorded at ten days after final spray *i.e*., third spray during *kharif* 2015-16 and 2016-17 which was considered as cumulative effect of all the sprays (fig 4.1.). All the insecticidal treatments were significantly superior over control. Spinosad at 125 g a.i. ha^{-1} was found to be most effective treatments with 59.09 per cent reduction of *S. dorsalis* population over control and was significantly different from other treatments (Table 4.1).

The next effective treatments were fipronil at 500 g a.i. ha^{-1}, betacyfluthrin + imidacloprid at 30 g a.i. ha^{-1}, profenophos at 400 g a.i. ha^{-1}, dimethoate at 300 g a.i. ha^{-1} and lambda cyhalothrin15.63 g a.i. ha^{-1} reduced the population of *S. dorsalis* to an extent of 52.11, 49.07, 47.86, 39.03 and 35.91 per cent, respectively. The treatments fipronil at 500 g a.i. ha^{-1} was on par with betacyfluthrin + imidacloprid at 30 g a.i. ha^{-1} and profenophos at 400 g a.i. ha^{-1} while, dimethoate at 300 g a.i. ha^{-1} and lambda cyhalothrinat 15.63 g a.i. ha^{-1} were on par with each other in reduction of the chilli thrips population over control.

The least effective treatment was chlorantraniliprole at 30 g a.i. ha^{-1} with population reduction of 8.58 per cent over untreated control. The cumulative efficacy of different insecticidal treatments against *S. dorsalis* at ten days after third spray during *kharif* 2015-16 and 2016-17 was found to be in the following order. T2 > T1 > T6 > T4 > T7 > T5 > T3

The findings of present investigation proved that all the insecticidal treatments were superior over control. The cumulative efficacy of all insecticidal treatments during *kharif* 2015-16 and 2016-17 revealed that spinosad at 125 g a.i. ha^{-1} was found to be most effective treatments with 59.09 per cent reduction of *S. dorsalis* population over control, which was in conformity with the findings of Prasad and Ahmed (2009) [9] who reported that spinosad was superior in reducing thrips, *S. dorsalis* population, while, Hossaini *et al.* (2014) [5] and Srinivas *et al.* (2002) [9] were also observed similar observations.

The present findings on efficacy of spinosad was in conformity with the findings of Vanisree *et al.* (2011) [11], who also reported that spinosad 0.015% was most effective in reduction of thrips, *S. dorsalis* population in chilli in Andhra Pradesh. Kumar *et al.* (2013) [6] reported the effectiveness of spinosad 45 SC @ 0.3 ml l^{-1} on *S. dorsalis* causing adult mortality within ten days and nymph in 15 days of foliar spray on chilli. The superior efficacy of spinosad may due to the excitation of insect nervous system leading to involuntary muscle contraction, prostration with tremors and paralysis. These effects are consistent with the activation of nicotinic acetylcholine receptors by a mechanism that was clearly novel and unique. Spinosad also effects GABA receptor function that may contribute further to its insect activity (Sparks *et al.* 2001) [8].

Table 2: Cumulative efficacy of different insecticides against *Scirtothripsdorsalis* on chilli during *kharif* 2015-16 and 2016-17

Treatment	Concentration (g a.i. ha^{-1})	Mean % reduction over control				
		1DAS	3 DAS	5 DAS	7 DAS	10DAS
T_1 - Fipronil 5% SC	500	66.81^{b} (54.83)	69.99^{b} (56.80)	77.18^{b} (61.50)	71.67^{ab} (57.86)	52.11^{b} (46.21)
T_2 - Spinosad 45% SC	125	70.96^{a} (57.41)	76.61^{a} (61.10)	81.30^{a} (64.43)	75.17^{a} (60.16)	59.09^{a} (50.23)
T_3 –Chlorantraniliprole 20% SC	30	10.82^{e} (19.07)	11.95^{e} (20.15)	14.02^{e} (21.89)	12.43^{f} (20.58)	8.58^{d} (16.80)
T_4 - Profenophos 50% EC	400	61.33^{c} (51.57)	67.02^{b} (54.96)	71.52^{c} (57.77)	66.22 (54.47)	47.86^{b} (43.77)
T_5 - Lambda cyhalothrin 5% SC	15.63	44.09^{d} (41.60)	43.69^{d} (41.37)	45.44^{d} (42.38)	42.07^{e} (40.43)	35.91^{c} (36.80)
T_6 - Betacyfluthrin + imidacloprid 300% OD	30	62.40^{c} (52.20)	70.51^{b} (57.14)	73.99^{bc} (59.38)	69.54^{bc} (56.51)	49.07^{b} (44.47)
T_7 - Dimethoate 30% EC	300	46.58^{d} (43.03)	49.06^{e} (44.46)	49.26^{d} (44.58)	50.35^{d} (45.20)	39.03^{c} (38.65)
T_8 - Control		0.00	0.00	0.00	0.00	0.00
SEm±		0.85	0.88	0.92	1.03	0.98
CD (P= 0.05%)		2.54	2.63	2.75	3.07	2.93

DAS – Days after Spraying
Figures in parentheses are angular transformed values

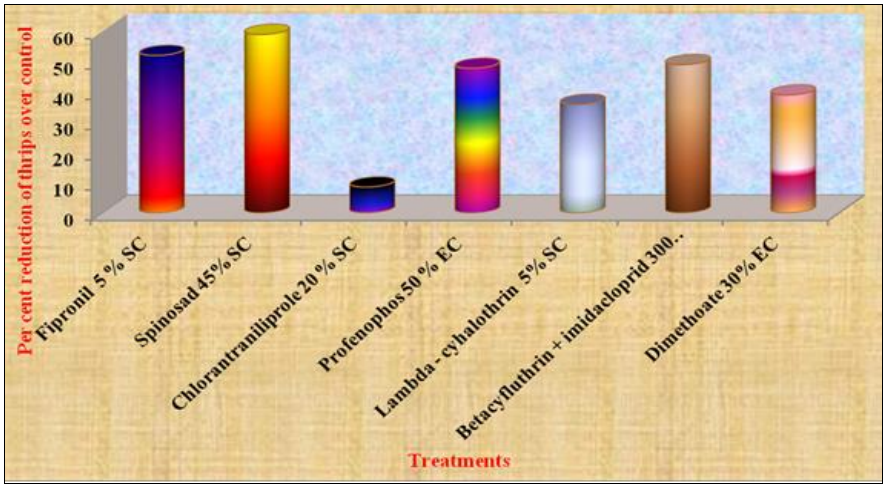

Fig 1: Cumulative efficacy of different insecticides against *Scirtothrips dorsalis* on chilli during *kharif* 2015-16 and 2016-17

4. Conclusion

The present study was conducted during *kharif* 2015-16 and *kharif* 2016-17 to observe the efficacy of different insecticides on *Scirtothrips dorsalis* population revealed that, spinosad at 125 g a.i. ha^{-1} was found to be the most effective treatment with 59.09 per cent reduction of *Scirtothrips dorsalis* followed by fipronil at 500 g a.i. ha^{-1} (52.11%), betacyfluthrin + imidacloprid at 30 g a.i. ha^{-1} (49.07%), profenophos at 400 g a.i. ha^{-1} (47.86%), dimethoate at 300 g a.i. ha^{-1} (39.03%), lambda cyhalothrin15.63 g a.i. ha^{-1} (35.91%) and chlorantraniliprole at 30 g a.i. ha^{-1} (8.58%) over control.

5. Acknowledgements

The study is a part of Ph.D (Ag). dissertation of the first author and the facilities provided by Department of Entomology, College of Agriculture, Rajendranagar, Hyderabad, Professor Jayashankar Telangana State Agricultural University is greatly acknowledged.

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