Bio Assay of new generation Insecticides against Invasive Southeast Asianthrips,*Thrips Parvispinus* (Karny) (Thripidae:Thysanoptera)

ABSTRACT

Aims: Management of invasive southeast Asian thrips, *Thrips parvispinus* under laboratory conditions.

Study design: Completely Randomized Design

Place and Duration of Study: Regional Agricultural Research Station, Guntur, Andhra Pradesh during 2023 (Please mention the season of experiment)

Methodology: Bio assays study was conducted with eleven insecticides for the Management of *Thrips parvispinus* under laboratory conditions following leaf dip method. Mortality and corrected mortality were assessed at 24 and 48 hours after treatment imposition by counting the number of dead and live adults.

Results: Bio assay study revealed thatthe insecticide broflanilide 300 DC @ 64.0 ml/ha recorded significant high percent mortality of 93.3 at 48 hours after exposure. The insecticides fluxametamide 10 EC @ 400 ml/ha, tolfenpyrad 15 EC@ 1000 ml/ha, spinoterom 11.7 SC @ 500 ml/ ha and fipronil 5 SC @1000 ml/ha were at par with broflanilide300 DC with 90.0, 90.0, 86.7 and 86.7 percent mortality, respectively. Lowest mortality of 6.0 percent was observed in untreated control where the leaves were agitated in distilled water. The corrected mortality was calculated and the insecticides broflanilide300 DC (92.59 %), fluxametamide 10 EC (88.9), tolfenpyrad 15 EC (89.3), spinetoram 11.7 SC (85.9) and fipronil 5 SC @400 ml/acre (85.2) recorded high corrected mortality at 48 hours of post treatment.

***Key words**: Thrips parvispinus, South East Asia Thrips, Invasive Thrips, broflanilide, fluxametamide*
(Key words should be given alphabetically)

1. INTRODUCTION

Thrips parvispinus (Karny) commonly called as Southeast Asia thrips is an invasive wide spread pest species first reported in India by Tyagi et al., 2015 on papaya from Bangalore. In the year 2021 an outbreak of *Thrips parvispinus* reported in Andhra Pradesh, Karnataka and Telangana causing 50-80 per cent yield loss in chillicrop.The species *Thrips parvispinus* completely dominated the common thrips species, *Scirtothrips dorsalis*. (Sireesha et al., 2021) in chilli eco system in Andhra Pradesh. During 2022, The thrips species spreads to nine agricultural and horticultural from five Indian states, viz. Andhra Pradesh, Chhattisgarh, Karnataka, Kerala and Tamil Nadu (Rachana et al.2022).Chilli is

the commercial spice crop grown in India for its green and dry chilies accounting 14.66 lakh tonnes of production with productivity of 2716 kg /ha. Major share occupied from Andhra Pradesh with 10.78 lakh tons covering 2.29 lakh ha with high productivity of 4707 kg/ha contributed 5.36% of Indians GDP during 2021-22 (Annonymous, 2023). *Thrips parvispinus* adults and larvae colonize on lower side of the leaves and flowers of chilli crop, suck sap and scrap the tissues resulting in appearance of brownish streaks on flowers. Severe damage results in flower drop, reduction in fruit set && development, ultimately resulting in yield loss. In severe case the yield losses extend upto 85 percent with the invasive pest (Prasanna kumar et al, 2023). To mitigate the pest, farmers spraying innumerable insecticides without knowing their efficacy against the pest with three days spray interval which not only increasing the cost of cultivation but also adding the huge pesticides to the environment. Considering its spread to many horticultural crops in a very short span of time, requires immediate recommendations to save the crops from this pest. Except few studies, information on evidence on insecticide efficacy against this invasive species is scanty. Keep (ing) this in view bio assay studies were conducted with eleven insecticides to generate the efficacy of insecticides which were selected based on the recommendations against other thrips species by Central Insecticide Board & Registration Committee (CIB&RC). The bio assay studies were conducted at entomology lab, Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh.

2. MATERIALS and METHODS

Bio assay studies were conducted against *Thrips parvispinus* in the laboratory by following the Leaf dip method (Immaraju et al.,1990 and IRAC susceptibility test method 010) with eleven insecticides including untreated control as check (Table 1). Un sprayed plot of chilli was maintained in the research farm for the collection of *T. parvispinus* adults and un contaminated chilli leaves for the study. All the eleven test insecticides formulations were prepared at recommended doses using the distilled water and untreated control with distilled water. Chilli leaves were collected and cleaned under water to remove any dust particles. The leaves were cut and dipped into the insecticidal test solutions for 5 seconds with gentle agitation. After that the leaves were allowed for surface-dry on a paper towel and then placed into the Petri plates (10 cm diameter) containing moistened filter papers to avoid desiccation of leaves. Live adults were collected from the unprotected chilli crop using aspirator. Ten live thrips were released in each petridish representing each treatment and replicated thrice. Insect mortality was assessed under a Stemi 305 stereomicroscope (Zeiss, Germany) at 24 and 48 hours after the release of the insects. Thrips were considered dead if no movement of more than one body length was observed when prodded with a fine brush. Number of dead adults in each dish was recorded at 48 hours of treatment imposition with the recorded data, mortality (%) and corrected mortality (%) were calculated using the following formulas.

Mortality (%) = (No. of dead insects / total no. of insects released) X 100

Corrected mortality = (Test mortality (%) - Control Mortality (%)) / (100 - Control mortality (%))

Table1. Insecticides tested against *Thrips parvispinus* under laboratory conditions.

S. No	Insecticide	Company	Trade Name	Dosage (ml or g) /ha	Dosage (ml or g) /lit of water
1	Spirotetramat 15.31 % OD	Bayer	Momemto	400	0.8
2	Diafenthiuron 50 WP	Syngenta	Pegasus	625	1.25
3	Fipronil 5 SC	Bayer	Regent	1000	2.0
4	Spinosad 45 SC	Corteva	Tracer	160	0.32
5	Spinetoram 11.7 SC	Dow Agro Science	Deligate	500	1.0
6	Tolfenpyrad 15 EC	PI Industries	Keefun	1000	2.0
7	Acetamiprid 20 SP	TATA	Manik	100	0.2
8	Pyriproxyfen 10 EC	sumitomo	Lano	500	1.0
9	Broflanilide 300 g/l SC	BASF	Exponus	64	0.128
10	Fluxametamide 10 EC	Godrej Agrovet	Gracia	400	0.8
11	Azadiractin 10000 PPM	Margo Bio control Limited	Eco Neem	500	1.0
12	Control – water spray	-	-	-	

Data were subjected to a one-way Analysis of Variance. The list of the treatments is mentioned in Table 1. Homogeneity of variances in mean data of percent mortality between treatments was estimated using Tukey's post hoc test. Statistical analyses were done in R studio (R Studio Team 2019).

1. **3. RESULT and DISCUSSION**

In the bio assay study, the insect mortality at 24 hours after the treatment imposition was ranged from 3.0 to 38.0 percent with out significant difference among the treatments. Laboratory bio assay studies revealed that the insecticides broflanilide 300 DC @ 0.128 ml/lit was highly effective against *Thrips parvispinus* which recorded 93.3 percent mortality at 48 hours after exposure. The insecticides tolfenpyrad 15 EC @2.0 ml/lit,fluxametamide 10 EC @ 0.8 ml/lit, Spinetoram11.7 SC @ 1.0 ml/lit and fipronil 5 SC@ 2.0 ml/lit were at par with Broflanilide 300 DC with 90.0, 89.0, 86.0 and 85.0 percent mortality, respectively against *Thrips parvispinus* at 48 hours of the treatment imposition. In untreated

control, where the leaves were agitated in distilled water recorded 6.0 percent mortality. broflanilide 300 DC @ 0.128 ml/lit recoded 92.59 percent corrected mortality followed by fluxametamide 10 EC @ 0.8 ml/lit (88.9), tolfenpyrad 15 EC@ 2.0 ml/lit (89.3), spinetoram 11.7 SC @ 1.0 ml/lit (85.9) and fipronil 5 SC @ 2.0 ml/lit (85.2). broflanilide insecticide works by preventing transmissions within the nervous system, which over excites the system and incapacitates the insect. The efficacy of broflanilide in the present study was in accordance with Jin-Cui Chen who compared broflanilide with five insecticides resulted in relatively high toxicity to *Thrips palmi* recorded 90.44 per cent to 93.14 per cent control efficacy from day three in field trial. fluxametamide is a novel isoxazoline insecticide has insecticidal activity on a range of insect pest species, such as lepidoptera, thysanoptera, coleoptera and diptera. The unique binding site of fluxametamide in GABA-gated chloride channels, different from those for existing antagonists, makes this molecule effective against fipronil-resistant pest populations (Jeschke, 2021). Shivaleela and Rajesh Chowdary (2020) proved the efficacy of tolfenapyrad against leafhoppers, thrips and red pumpkin beetles in cucumber @ 150 g a.i/ha with high yields of 5.85 t/ha. As per the research done by Mishra and Sahu, 2018 on cucumber revealed that excellent control of the thrips (*Thrips palmi*) was observed in the treatment tolfenpyrad 15 EC @ 150 g a.i./ha at 15 days after spraying registering 82.5 and 83.6 percent reduction in the population over control during *kharif*, 2015 and *rabi*, 2015-16, respectively. The chemical tolfenpyrad 15 EC @ 100.5, 124.5, and 150 g a.i./ha and imidacloprid 17.8 SL @ 22.5 g a.i./ha did not harm the natural enemy, ladybird beetle population at 1, 3, 7 10 and 15 days after each spraying of the chemicals. The efficacy of fipronil 80 WG was proven against *Thrips parvispinus* by Sambaiah et al., 2023 when sprayed using unmanned aerial vehicle (Agricultural drone) in chilli attained 68.8 percent reduction of thrips population in the flower. Murali Mohan et al, 2023 proved the higher efficacy of new generation insecticides viz., broflanilide 30 SC (18.60g a.i/ha) and fluxametamide 10 EC (40 g a.i/ha), spinetoram 11.7 SC (60 g a.i/ha) and tolfenpyrad 15 EC (150 g a.i/ha) against *Thrips parvispinus* population on chilli crop. Supporting to the present findings Manideep et al, 2023 tested chemical insecticides against *Thrips parvispinus* inchrysanthemum andreported high efficacy with spinetoram 11.7%SC (76.245%) > cyantraniliprole 10%OD (73.92%) > fipronil 5% SC (72.24%) > thiamethoxam 25% WG (70.79%) > dinotefuran 20% WG (69.80%) >tolfenpyrad 15% EC (68.02%) under field conditions.

4. CONCLUSION

Southeast Asia thrips, *Thrips parvispinus* (Karny) is an invasive wide spread pest species threatening the chilli crop in India. Bio assays studies with novel insecticides found the high efficacy of broflanilide 300 DC @ 64 ml/ha, fluxametamide 10 EC @ 400 ml/ha, tolfenpyrad 15 EC@ 1000 ml/ha, spinoterom 11.7 SC @ 500 ml/ ha and fipronil 5 SC @1000 ml/ha against *Thrips parvispinus*. As these insecticides are effective against invasive thrips, *T. parvispinus*, it is possible to rotate the insecticides in the same season which will reduce the chance of evolution of resistance in thrips against the novel molecules. Further these results can be used in planning of field evaluation in various host crops for utilizing as one of the components fitting in the Integrated pest management of invasive pest *Thrips parvispinus*.

Table 2. Efficacy of novel insecticides against *Thrips parvispinus* under laboratory conditions.

Tr. No	Insecticide	Dose ml or g /ha	Mortality (%) * 24	48 hours	Corrected mortality (%) * 24 hours	48 hours-
1	Spirotetramat 15.3 OD	400	14.00	43.33 41.17) [c]	11.34	38.89 (38.58) [c]
2	Diafenthiuron 50 WP	625	22.00	40.00 (39.23) [c]	19.59	35.19 (36.38) [c]
3	Fipronil 5 SC	1000	30.00	86.67 (68.58) [ab]	27.84	85.19 (67.36) [ab]
4	Spinosad 45 SC	160	18.00	66.67 (54.74) [b]	15.46	64.44 (53.40) [b]
5	Spinetoram 11.7 SC	500	25.00	86.67 (68.58) [ab]	22.68	85.93 (67.97) [ab]
6	Tolfenpyrad 15 EC	1000	27.00	90.00 (71.57) [ab]	24.74	89.26 (70.87) [ab]
7	Acetamiprid 20 SP	100	16.00	26.67 (31.09) [d]	13.40	21.48 (27.61) [d]
8	Pyriproxyfen 10 EC	500	22.00	46.67 (43.09) [d]	19.59	42.96 (40.95) [c]
9	Broflanilide 300 DC	64	38.00	93.33 (75.04) [a]	36.08	92.59 (74.21) [a]
10	Fluxametamide 10 EC	400	35.00	90.00 (71.57) [ab]	32.99	88.89 (70.53) [ab]
11	Neem oil 10000 ppm	500	9.00	33.33 (35.26) [cd]	6.19	28.15 (32.04) [cd]
12	control	-	3.00	6.67 (14.96) [e]	0.00	0.00 (0.00) [e]
	CV (%)		9.8	12.3	10.3	11.9

** Values in the parenthesis are angular transformation values.*

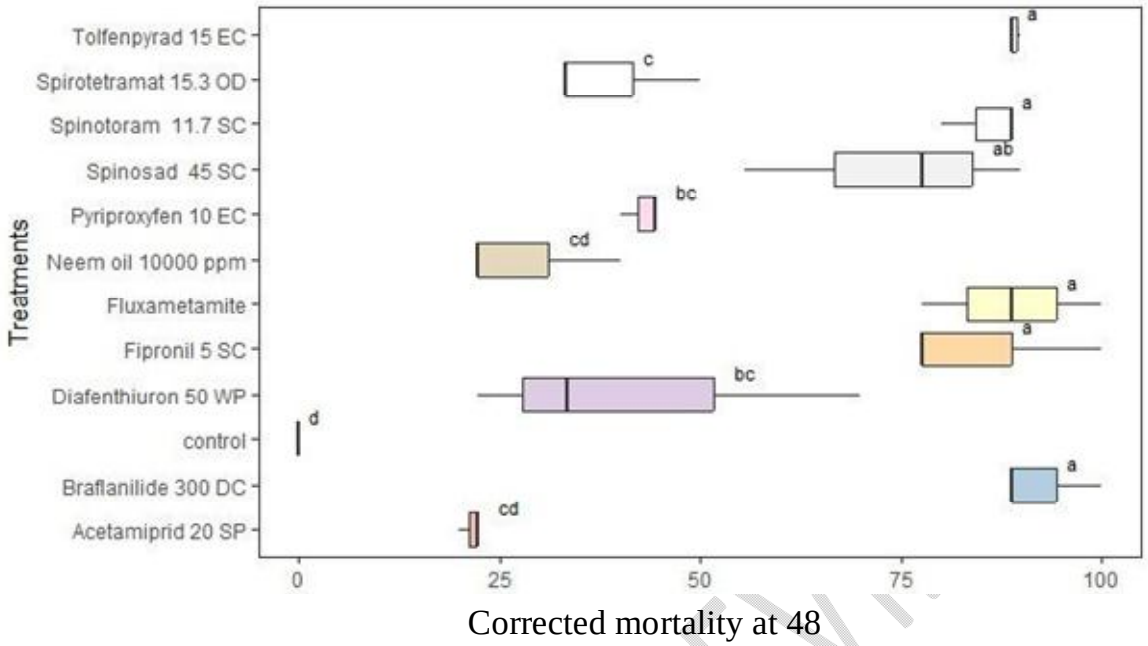

Fig. 1 Effect of insecticides on mortality (Corrected) of *Thrips parvispinus*

***Fig.2. Thrips parvispinus collected from chilli*flowers**

Fig.3.Laboratory bio assay studies on efficacy of insecticides against Thrips parvispinus

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