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RESEARCH PAPER

Evaluation of insecticides against thrips (*Thrips tabaci* L) in onion crop

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Abstract: *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) is one of the most destructive pests of onion, causing significant yield losses through direct feeding and transmission of plant pathogens. To safeguard onion productivity, effective management strategies are essential. A field experiment was conducted during *rabi* 2022 at the Main Agricultural Research Station, Dharwad, to evaluate the efficacy of newer insecticide groups against *T. tabaci*. The experiment was laid out in a randomized block design (RBD) with 13 treatments replicated thrice, using the onion variety *Bhima Shakti*. Insecticidal efficacy was assessed by pooling data from the first and second sprays. Results indicated that chlorantraniliprole 8.8 SC + thiamethoxam 17.5 SC (T6) was the most effective treatment, recording 84.31% reduction in thrips population over the untreated control, followed by acephate 50 WG + imidacloprid 5 WG (T10) with 79.90% reduction. Spinosad 45 SC (T1) and spinetoram 11.7 SC (T3) were also highly effective, reducing thrips population by 77.79 and 77.53%, respectively. These findings demonstrate the potential of newer insecticide formulations for managing *T. tabaci* in onion ecosystems and provide valuable insights for strengthening integrated pest management strategies.

Key words: Insecticides, Efficacy, Management, Onion, *Thrips tabci*

Introduction

Onion (*Allium cepa* L.) is an important vegetable crop, popularly known as the "Queen of Kitchen" owing to its versatile use as a food, salad, spice, condiment and medicinal ingredient, making it an integral part of diets worldwide *(Brewster, 2008).* India is one of the leading onion producers, and the crop plays a vital role in the livelihood of millions of small and marginal farmers (FAO, 2021). However, onion productivity is severely constrained by a wide range of insect pests, among which onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae), is the most destructive. *T. tabaci* damages onion plants by lacerating and sucking cell sap from leaves, leading to silvery streaks, curling and premature drying, ultimately resulting in significant yield losses that may reach up to 60-80% under severe infestation (Fekrat *et al*., 2015). In addition, thrips feeding induces ethylene production due to salivary enzymes reacting with damaged tissues, which accelerates leaf senescence and reduces bulb quality *(Kumar et al.,* 2017). Moreover, thrips act as vectors of tospoviruses such as iris yellow spot virus (IYSV), further aggravating crop losses *(Riley et al., 2011).* Chemical insecticides remain the most widely adopted and effective option for thrips management, as they provide rapid control irrespective of crop stage, season, or location *(Nault* and *Shelton, 2010).* Although cultural, biological and botanical alternatives have been explored, the lack of consistently effective microbial or biorational formulations against onion thrips has compelled reliance on synthetic insecticides. However, overuse and indiscriminate application of insecticides has led to resistance development, resurgence and residue-related concerns . In this context, evaluating newer groups of insecticides with novel modes of action is vital for sustainable thrips management in onion ecosystems. The present study was undertaken to assess the bioefficacy of selected insecticides against *T. tabaci* under field conditions, with the aim of identifying safer and effective options for integration into pest management strategies.

Material and methods

A field experiment was laid out following RBD with 13 treatments (Table 1) and three replications. The treatments were evaluated for their efficacy against thrips and compared with untreated check in a plot size of 3 m x 3 m area. Popular onion variety *Bhima Shakti* was used for the experiment during *rabi* 2022. Crop was raised as per the package of practices except insecticide spray. Treatments were imposed when thrips population reaches ETL (30/Plant). Based on population density of thrips during *rabi* 2022 two sprays were taken for management.

Thrips population was recorded a day before spray and 1, 3, 5 and 10 days after spray (DAS) on 5 randomly selected

Table 1. Treatment details

Treatments	Dose (g or ml/l)
Spinosad 45 SC	0.25 ml
Buprofezin 25 SC	1 ml
Spinetoram 11.7 SC	0.5 ml
dinotefuran 20 SG	0.4 g
Diafenthiuron 50 WP	1 g
Chlorantriniliprole 8.8 SC+ thiamethoxam 17.50 SC	0.5 ml
Spirotetramat 11.01 SC+ imidacloprid 11.01 SC	1 ml
Pyriproxyfen 5 EC + fenpropathrin 15 EC	1.5 ml
Profenophos 40 EC + fenpyroximate 25 EC	2 ml
Acephate 50 WG + imidacloprid 5 WG	2 gm
Flonicamide 50 WG	1 ml
Fipronil 5 SC	1 ml
Un treated check	-

plants and expressed as number per plant. The mean data on population of thrips was processed with RBD principles and data was subjected for suitable transformation before analysis. Per cent reduction over control was calculated using following modified Abbot's formula (Fleming and Ratnakaran, 1985)

$$P=100\{\frac{1-(Ta \times Cb)}{(Tb \times Ca)}$$

Where, P= Per cent population reduction over control

T_a = population in treatment after spray

C_b = Population in control before spray

T_b = Population in treatment before spray

C_a = Population in treatment after spray

Results and discussion

In assessing the effectiveness of various insecticides on onion thrips, data from the first and second sprays were pooled for analysis. One day after spraying, T_6 (chlorantriniliprole 8.8 SC + thiamethoxam 17.50 SC) demonstrated the highest efficacy with 11.80 thrips per plant and which was followed by T_{10} with 13.47 thrips per plant. Least effectiveness was observed in T_7 and T_8, which respectively recorded 25.80 and 25.57 thrips per plant. At 3 DAS, T_6 continued to be the most effective with 5.62 thrips per plant, followed by T_{10} with 8.53 thrips per plant. T_1 and T_3 supported respectively, 9.57 and 9.67 thrips per plant. While,T_8 and T_7 were less effective with 16.88 and 16.08 thrips per plant, respectively. Likewise similar trend in treatment efficacy was observed at 5 and 10 DAS (Table 2).

Highest per cent reduction of thrips population (84.31%) was recorded in T_6 (chlorantriniliprole 8.8 SC + thiamethoxam 17.50 SC), followed by T_{10} (Acephate 50 WG + imidacloprid 5 WG at 2g) with 79.90 per cent. Spinosad 45 SC (T_1) and spinetoram 11.7 SC (T_3) respectively, showed 77.79 and 77.53 per cent reduction over untreated check, While pyriproxyfen 5 EC + fenpropathrin 15 EC (T_8) and spirotetramat 11.01 SC + Imidacloprid 11.01 SC (T_7) had the least reduction of 64.31 and 65.22 per cent, respectively (Table 2).

Thiamethoxam, a second generation neonicotinoid insecticide, acts agonistically on insect nicotinic acetylcholine receptors (nAChRs). It is rapidly metabolized to clothianidin in both plants and insects, which shows a high affinity for nAChRs at the postsynaptic junction of insect neurons (Nauen *et al.,* 2003). Chlorantraniliprole, belonging to the new class chemical class of anthranilicdiamides, has a novel mode of action as an

Table 2. Efficacy of insecticides against thrips in onion (2022)

Sl. No.	Treatments	Thrips/plant Precount	1 DAS	3 DAS	5 DAS	10 DAS	Mean	Per cent reduction over control
T_1	Spinosad 45 SC @ 0.25 ml	31.78 (5.68)^d	15.50 (4.00)^g	9.57 (3.17)^f	11.51 (3.46)^f	15.5 (4.00)^{gh}	13.02	77.79
T_2	Buprofezin 25 SC @ 1 ml	34.17 (5.89)^b	22.83 (4.83)^c	13.37 (3.72)^c	15.03 (3.94)^d	19.6 (4.48)^{cd}	17.71	69.79
T_3	Spinetoram 11.7 SC @ 0.5 ml	32.18 (5.72)^{cd}	15.53 (4.00)^g	9.67 (3.19)^f	11.63 (3.48)^f	15.9 (4.04)^{fgh}	13.17	77.53
T_4	Dinotefuran 20 SG @ 0.4 g	34.13 (5.89)^{bc}	18.90 (4.40)^e	12.17 (3.56)^d	13.83 (3.78)^{de}	18.2 (4.32)^{de}	15.76	73.11
T_5	Diafenthiuron 50 WP @ 1 g	34.33 (5.90)^b	23.71 (4.92)^c	14.25 (3.84)^c	16.59 (4.13)^c	21.2 (4.65)^{bc}	18.93	67.70
T_6	Chlorantriniliprole 8.8 SC + thiamethoxam 17.50 SC @ 0.5 ml	31.47 (5.65)^d	11.80 (3.51)^i	5.62 (2.47)^h	7.06 (2.75)^h	12.3 (3.58)^i	9.20	84.31
T_7	Spirotetramat 11.01 SC + imidacloprid11.01 SC @ 1ml	34.43 (5.91)^b	25.80 (5.13)^b	16.03 (4.07)^b	17.61 (4.25)^{bc}	22.1 (4.75)^b	20.39	65.22
T_8	Pyriproxyfen 5 EC + fenpropathrin 15 EC @1.5 ml	33.93 (5.87)^{bc}	25.53 (5.10)^b	16.88 (4.17)^b	18.28 (4.33)^b	23.0 (4.85)^b	20.92	64.31
T_9	Profenophos 40 EC + fenpyroximate 25 EC @ 2 ml	32.87 (5.78)^{bcd}	18.374.3 4)^{ef}	10.97 (3.39)^e	12.88 (3.66)^e	17.2 (4.21)^{ef}	14.86	74.65
T_{10}	Acephate 50 WG + imidacloprid 5 WG @ 2 g	31.57 (5.66)^d	13.47 (3.74)^h	8.53 (3.01)^g	10.21 (3.27)^g	14.9 (3.83)^h	11.78	79.90
T_{11}	Flonicamide 50 WG @ 1 ml	32.53 (5.75)^{bcd}	20.40 (4.57)^d	13.63 (3.76)^c	15.08 (3.95)^d	19.6 (4.48)^{cd}	17.18	70.70
T_{12}	Fipronil 5 SC @ 1 ml	32.17 (5.72)^{cd}	17.10 (4.19)^f	10.67 (3.34)^e	12.59 (3.62)^{ef}	16.7 (4.14)^{efg}	14.26	75.67
T_{13}	Untreated check	49.32 (7.06)^a	52.97 (7.31)^a	57.97 (7.65)^a	61.47 (7.87)^a	62.1 (7.91)^a	58.62	-
S.E m±		0.62	0.50	0.41	0.45	0.56		
C.D.@5%		1.80	1.46	1.21	1.31	1.63		
C.V. (%)		6.12	6.99	7.68	7.51	7.52		

Values in the column followed by common letters are non-significant at p = 0.05 as per DMRT;
DAS= Days after spray;Figures in the parenthesis indicate "x+0.5 transformed values

activator of insect ryanodine receptors. This action leads to an influx of calcium ions, causing rapid muscle dysfunction, paralysis and death in the insect (Hannig *et al.,* 2009).These findings are in line with findings of Renkema *et al.* (2020), who observed that the application of chlorantraniliprole + thiamethoxam combination effectively reduced *Scirtothrips dorsalis* populations. The combination of chlorantraniliprole + thiamethoxam proved effective for both preventive and curative control of *Scirtothrips dorsalis* for more than ten days after treatment (Kumar *et al.,* 2017).

Acephate is a highly versatile, broad spectrum organophosphate insecticide, effective against a wide range of sucking and chewing insects. It acts as an acetylcholinesterase (AChE) inhibitor, providing systemic, contact and stomach action with rapid results and ovicidal properties. Imidacloprid, on the other hand, is a systemic insecticide from the neonicotinoid class, targeting the central nervous system of insects. It disrupts nerve signal transmission by blocking nicotinic acetylcholine receptors, which prevents acetylcholine from transmitting impulses between nerves. This leads to paralysis and eventual death of the insect. This pre mixed insecticides might offer higher effectiveness in managing a broad spectrum of insect pests. Furthermore, pre mixed insecticides exhibit residual activity, ensuring continued pest control even after the initial application.

Spinosad is primarily absorbed through ingestion, with only minimal absorption occurring *via* direct contact with the insect's cuticle. Spinosyns, the active compounds in spinosad, have a unique mode of action, mainly targeting binding sites on nAChRs in the insect nervous system. According to Iglesias *et al.* (2021), spinosad is the most effective bioinsecticide for thrips control in onion crops, as it greatly reduces thrips densities and feeding damage. In the same way, Sahoo and Tripathy (2020) observed reduced leaf damage in spinosad treatment. Additionally, spinetoram is a viable option for organic onion cultivation, since *T. tabaci* is susceptible to it as observed by Yannuzzi *et al.* (2021) and Allam (2023).

Conclusion

The study demonstrated that chlorantraniliprole 8.8 SC + thiamethoxam 17.5 SC was the most effective treatment against *Thrips tabaci* in onion, followed by acephate 50 WG + imidacloprid 5 WG. Spinosad and spinetoram also showed promising efficacy, making them suitable options for thrips management. These findings highlight the importance of newer and premixed insecticides in providing effective, sustainable, and integrated control of onion thrips under field conditions.

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