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Comparative field efficacy of selected insecticides against chilli thrips (*Scirtothrips dorsalis* Hood) on chilli at Naini, Prayagraj (U.P.)

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Abstract
A field trail was conducted at Central Research Farm, SHUATS, Naini, Prayagraj during *rabi* season. Two applications of seven insecticides were used against *Scirtothrips dorsalis.* Result revealed that among the different treatments Fipronil 5% SC (94.06%) proved to be the most effective treatment followed by Spinosad 45% SC (93.16%), Imidacloprid 17.8% SL (92.27%), Nisco Sixer plus (87.34%), Nisco MECH 333 (84.68%), Profenophos 50% EC (84.37%), where as Neem oil 1500 ppm (60.69%) was found to be least effective against this pest. The plot treated with Fipronil 5% SC show highest yield (87.9 q/ha) followed by Spinosad 45% SC (82.2 q/ha). Among the treatments the best and most economical treatment was Fipronil 5% SC (1:11.36) followed by Spinosad 45% SC (1:10.64) and Imidacloprid 17.8% SL (1:10.32).

Keywords: Chilli, chilli thrips, evaluation, insecticides, *Scirtothrips dorsalis*

Introduction
Chilli (*Capsicum annuum*: Solanaceae) is one of the most important profitable spices crop grown all over India (Sarkar *et al*. 2014) [18]. It is an important condiment used for imparting pungency and colour to the food being rich in vitamin A, B, C, oleoresin and red pigment (Hossain *et al*., 2020) [6]. The Indian chilli is considered to be world famous for two important commercial qualities namely, its colour and pungency levels (Balraj and Arockiasamy 2018) [2]. The world production of chilli crop to around 7 million tones, which is cultivated on 1.5 million hectares of land. India is the world leader in chilli production followed by China and Pakistan (Balraj and Arockiasamy 2018) [2]. In India, chilli is cultivated in an area of 7.67 lakh hectares and the production is estimated at 12.34 lakh tones (Priyadarshini *et al*. 2019) [14].

The major growing states for chilliare Andhra Pradesh (46%), Karnataka (15%), Maharashtra, Madhya Pradesh, Orissa, West Bengal, Rajasthan and Tamil Nadu. In Uttar Pradesh, it is estimated that, the production during 2016- 17 was 11.34 million tonnes of chilli from an area of 13.23 hectares (Patel and Kumar 2017) [13]. Among various insect pests attacking chilli crop, thrips *Scirtothrips dorsalis* is a major pest causing huge economic losses to chilli growers (Reddy and Sreehari 2009) [16]. Chilli thrips considered as one of the most destructive pest of this crop. Thrips cause necrosis of tissues by extracting contents from the epidermal cells. Both nymphs and adults suck the sap from tender crop canopy, resulting in shriveling of leaves, heavy infestation of chilli thrips causes “chilli leaf curl” also called “Murda disease” (Priyadarshini *et al*. 2019) [14]. In the affected leaves are black dirt of thrips. Paroxysm occurs when thrips act as vectors of viruses that cause disease in chilli plants (Tirkey *et al*. 2019) [21]. Chemicals is one of the most common and popular methods of thrips control on chilli crop and in recent times, a large number of newer insecticides are available in the market for use.

Materials and Methods
The experiment was conducted during *rabi* season 2021-22 at Central Research Field (CRF) of Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, Uttar Pradesh, India, in a randomized block design with eight treatments replicated three times using variety G4, Surajmukhi seeds in a plot size of 2m×2m at a spacing of 45cm × 30cm with a recommended package of practices excluding plant protection.

The soil of the experimental site was well drained and medium high. The observations on population of chilli thrips were recorded visually using a magnifying lens of 10x early on three leaves at top, middle and bottom canopy from five randomly selected and tagged plants in each plot. The insecticides were sprayed at recommended doses when thrips reaches its ETL level. The population were recorded a day before spray and 3, 7 and 14 days after spray and the per cent reduction were worked out using the formula. Reduction of pest population in different treatments over control was calculated from the following formula as described by Fleming and Retnakaran (1985).

$$\% \text{ population reduction} = 100 \times \left[1 - \frac{T_a \times C_b}{T_b \times C_a} \right]$$

Where
Ta = Post-treatment population in treatment
Tb= Pre-treatment population in treatment
Ca= Post-treatment population in untreated control
Cb= Pre-treatment population in untreated control

Maity *et al*. (2015) [9]

Benefit Cost Ratio
Cost effectiveness of each treatment was assessed based on net returns. Net return of each treatment was worked out by deducting total cost of the treatment from gross returns. Total cost of production included both cultivation as well as plant protection charges.

Gross return = Marketable yield × Market price
Net return = Gross return – Total cost

$$BCR = \frac{\text{Gross return}}{\text{Total cost}} \times 100$$

Where
BCR = Benefit Cost Ratio

(Sujay *et al*. 2010) [20]

Results and Discussion
The data on the mean per cent population reduction of first spray and second spray overall mean revealed that all the treatments except untreated control are effective and at par. Among all the treatments lowest per cent reduction of chilli thrips was recorded in Fipronil 5% SC (94.06%). Similar findings made by Venkateswarlu *et al*. (2021) [24] with (93.82%), Babu *et al*. (2021) [1] with 92.86%, Indumathi *et al*. (2017) [7], Tukaram *et al*. (2017) [22]. Spinosad 45% SC (93.16%) was found to be the best treatment which is in line with the findings of Lakshmi and kumar (2021) [8] with (91.41%), Ravikumar *et al*. (2016) [15], Patel and Kumar (2017) [13], Manjunatha *et al*. (2018) [10] highest per cent reduction of chilli thrips. Present finding is in conformity with Venkateswarlu *et al*. (2021) [24], Chinniah *et al*. (2016) [4] reported that Imidacloprid 17.8% SL (92.27%), Profenophos 50% EC (84.37%) was found effective in reducing thrips population. Chinniah *et al*. (2016) [4] who reported that Profenophos showed the effectiveness against thrips reduction. Neem oil 1500ppm (60.69%) was found to be least effective but comparatively superior over the control, these similar findings are supported by Barot and Patel (2012) [3] and Meena and Tayde (2017) [11] resulting (55.64%) percent reduction in chilli thrips.

Economics of various treatments
The yields among the treatments were found to be significant. The highest yield was recorded in Fipronil 5% SC (87.9 q/ha) which is in line with the similar findings of Sasmal *et al*. (2020) [19] with pooled data (87.9 q/ha), Maity *et al*. (2015) [9] with (88.67 and 84.79 q/ha), Mondal *et al*., (2021) [12] with (86.94 q/ha). Spinosad 45% SC (82.2 q/ha) which is in line with the similar findings of Samota *et al*. (2017) [17] with (84.74 a/ha), Imidacloprid 17.8% SL (76 q/ha) which is in line with the similar findings of Vanisree *et al*. (2017) [23] with (77.28 q/ha), Nisco Sixer Plus (68.4 q/ha), Nisco MECH 333 (62.6 q/ha), Neemoil 1500ppm (54.2 q/ha) with similar findings of Barot and Patel (2012) [2] with (55.65 q/ha) as compared to control plot (32 q/ha).
When cost benefit ratio was worked out, interesting result were achieved. Among the treatment studied, the best and most economical treatment was Fipronil 5% SC (1:11.36) with the similar findings of Samota *et al*. (2017) [17] with (1:10.90) followed by spinosad 45% SC (1:10.64) with the similar findings of Meena and Tayde (2017) [11] with (1:11.36). Imidacloprid 17.8% SL (1:10.32) with the similar findings of Meena and Tayde (2017) [11] with (1:10.80), Nisco Sixer Plus (1:8.70), Nisco MECH 333 (1:8.09), Profenophos 50% EC (1:7.79) with similar findings of Tirkey *et al*. (2019) [21] with (1:7.08), Neem oil 15000 ppm (1:7.03) with the similar findings of Patel and Kumar (2017) [13] with (1:7.79) as compared to Control (1:4.50).

Table 1: Efficacy of selected insecticides on the population of chilli thrips (*S.dorsalis*) during first and second spray

S. No.	Treatments	Population of *Scirtothrips dorsalis* / 3leaves	Per cent population reduction of *Scirtothrips dorsalis* / 3 leaves						
			First spray			Second spray			Overall mean
		1DBS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS	
T1	Imidacloprid 17.8% SL	8.60	93.5	91.76	87.2	95.33	93.96	91.90	93.73
T2	Fipronil 5% SC	8.13	94.23	93	89.63	96.33	96.53	94.70	95.85
T3	Profenophos 50%EC	7.86	81.41	81.63	79.96	88.16	86.66	88.40	87.74
T4	Spinosad 45% SC	8.40	93.50	92.4	88.46	95.83	96.13	92.70	94.88
T5	MECH 333	7.86	82.13	81.63	79.36	89.40	88.90	86.70	88.33
T6	Sixer Plus	8.26	86.4	85.46	81.76	90.83	90.93	88.70	90.15
T7	Neem oil 1500 ppm	8.60	50.01	54.42	52.70	67.63	70.46	68.98	69.02
T0	Control	8.73	0	0	0	0	0	0	0
	F-test	NS	S	S	S	S	S	S	S
	S. Ed (±)	0.57	1.76	1.81	1.71	1.26	1.11	1.10	0.67
	C.D. (P = 0.5)	1.21	3.79	3.89	3.68	2.71	2.40	2.38	1.46

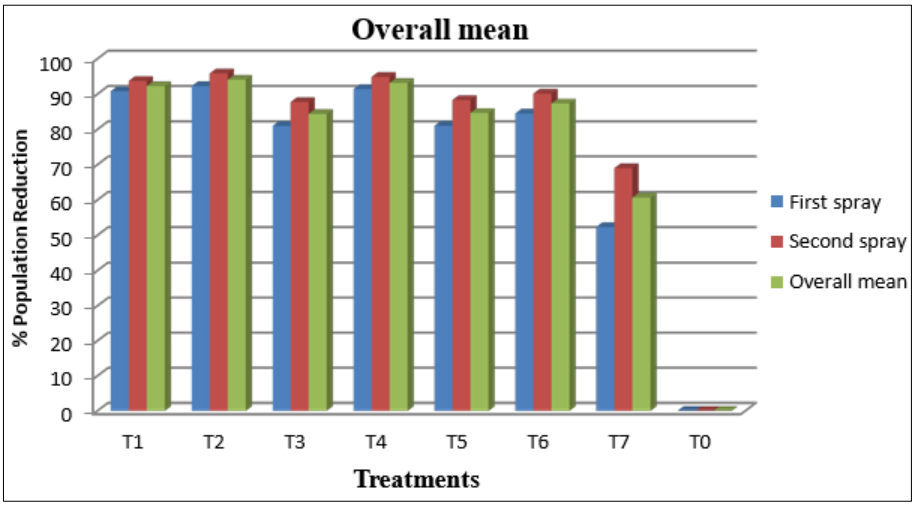

Fig 1: Field evaluation of selected insecticides against chilli thrips (*Scirtothrips dorsalis*) (Mean)

Table 2: Economics of Cultivation

S. No	Treatment s	Yield of q/ha	Cost of yield / ₹/q	Total cost of yield (₹)	Common cost (₹)	Treatment cost (₹)	Net return (₹)	Total cost (₹)	C:B ratio
1	Imidaclopri d 17.8% SL	76	4250	323000	30166	1125	263781	31291	1:10.32
2	Fipronil 5% SC	87.9	4250	373575	30166	2700	302484	32866	1:11.36
3	Profenophos 50% EC	59.8	4250	254150	30166	2450	188304	32616	1:7.79
4	Spinosad 45% SC	82.2	4250	349350	30166	2640	279904	32806	1:10.64
5	MECH 333	62.6	4250	266050	30166	2688	201424	32854	1:8.09
6	Sixer Plus	68.4	4250	290700	30166	4192	224574	34358	1:8.70
7	Neem oil 1500ppm	54.2	4250	230350	30166	2600	126904	32766	1:7.03
8	Control	32	4250	136000	30166	0	78254	30166	1:4.50

Conclusion

From the experiment discussed above, the results revealed that the most effective insecticide against *Scirtothrips dorsalis* was found to be Fipronil 5% SC @ 2ml/lit followed by Spinosad 45% SC @ 0.3ml/lit. Fipronil had the best cost-benefit ratio followed by Spinosad, Imidacloprid and Sixer Plus. Recommended dose of chemicals may be useful in devising integrated pest management strategy against chilli thrips.

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