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Comparitive efficacy and cost benefit ratio of selected insecticides and biopesticides against chilli Thrips

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Abstract
The field experiment was conducted at central research farm, SHUATS, Prayagraj, U.P. from September 2021 to March 2022. Efficacy of seven treatments *viz*., Spinosad 45 SC, Diafenthurion 50 WP, Acetamiprid 20 SP, Indoxacarb 14.5 SC, Nisco sixer plus, Mech – 333 and Neem oil were evaluated against Chilli thrips, *Scirtothrips dorsalis* 2021. Among the insecticidal treatments Spinosad 45% SC reported best in the population reduction of chillithrips with 95.21% followed by Acetamiprid 20% SP (88.61%), Diafenthiuron 50% WP (86.52%), Nisco sixer plus (85.21%), Indoxacarb 14.5% SC (83.70%) and Mech 333 (81.75%) was next effective treatment. Among all the treatments Neem oil (78.91%) was found least effective but comparatively superior over control (Water spray). All treatments were found at par with control (water spray). The best and economical treatment was Spinosad 45% SC (125q/ha) with C:B ratio 1:23.5 followed by Acetamiprid 20% SP (119 q/ha) with C:B ratio 1:22.4, Diafenthiuron 50% WP (115q/ha) with C:B ratio 1:21.5, Nisco sixer plus (11q/ha) with C:B ratio 1:20.4, Indoxacarb 14.5% SC (100q/ha) with C:B ratio 1:18.7, Nisco Mech – 333 (92q/ha) with C:B ratio 1:17.0, Neem oil (85 q/ha) with C:B ratio 1:15.6 as compared to control (45q/ha) with C:B ratio 1:15.6. On the basis of Cost benefit ratio (CBR), Spinosad 45 SC was found most economical.

Keywords: Chilli, cost benefit ratio, efficacy of insecticides, *Scirtothrips dorsalis*

Introduction
Chilli (*Capsicum annuum* L.) prominently known as 'Mirch' in national language of India, pertaining to the family Solanaceae originated from Latin American region and currently used throughout the world as a spice. *Capsicum* is procured from the Greek word "*Kapsimo*" meaning to bite. The therapeutic effect of chilli is due to capsaicin, protein, fixed oil, thiamine and ascorbic acid (Patil, *et al.,* 2018) [4]. Green fruits are a good source of vitamin A and C besides traditional use of chillies in vegetables, spices, sauces and pickles (Mondal *et al.*, 2012) [2]. The pungency in chillies is due to crystalline volatile alkaloid, 'Capsaicin'. The red colour of chillies is due to the presence of pigment 'Capsanthin' (Tirkey *et al.,* 2020) [10].
India is the world's largest producer, consumer and exporter of chillies. India is the country where major chilli producing states are seen like, Andhra Pradesh(6.30 lakh tones), Telangana (3.04lakh tones), Madhya Pradesh(2.18 lakh tones), Karnataka (1.95 lakh tones) and West Bengal (1.06 lakh tones) accounting of 35, 17, 12, 11 and 6 percent of all India production respectively. Guntur is called as 'Chilli city' of India. Major pests in capsicum were *Scirtothrips dorsalis* (Hood), *Polyphago tarsonemus* latus (Banks) (Roopa and Kumar, 2014) [6]. *Scirtothrips dorsalis* occurs at all stages of the crop growth phase and cause damage on the tender leaves resulting in upward curling, malformation and shrivelling of leaves, buds and fruits. In severe cases, the leaves shed and freshly formed buds and flowers drop down. It is necessary to device a sound eco- based management programme. Now a days a large number of newer chemical insecticides are available in the markets efficacy of these chemicals need to be studied for the effective and economical control of this pest.

Materials and Methods
The experimental trial was conducted at central research farm, SHUATS, Prayagraj, U.P. from September 2021 to March 2022. The experimental trial was laid out in a randomized block design consisting of seven different treatments *viz*., Spinosad 45 SC, Diafenthurion 50 WP, Acetamiprid 20 SP, Indoxacarb 14.5 SC, Nisco sixer plus, Mech – 333 and Neem oil and one control plot in three replications. Seeds were sown in nursery in September and transplanted in November. Seedlings of Chilli variety. VNR-305 transplanted in plot of (2m x 2m) at a spacing of (45x30cm) with recommended package of practices excluding plant protection.

Data collection

Data concern to this field experiment is recorded as spraying was done after the population reaching itsETL (5 thrips/plant). Efficacy of different treatments against the sucking and insect pests were analyzed by analysis of variance. The population of chili thrips was recorded on one day before spraying 3rd day, 7th day and 10th day after insecticidal application. The population of chilli thrips was recorded on 5 randomly selected and tagged plants from each plot and when it was converted into % reduction in population by following formula.

$$\% \text{ Population reduction} = \frac{Ta}{Tb} x \frac{Cb}{Ca} x\ 100$$

Where,

Ta = number of insects in treated plot after insecticides application Tb=number of insects in treated plot before insecticides application Ca= number of insects in Untreated check after insecticide application

Cb= number of insects in untreated check before insecticide application Patel and Kumar (2017) [3].

In the experiment Randomized Block Design (RBD) was adopted. The analysis of variance (ANOVA) technique was applied for drawing conclusion from data. The calculated values were compared the tabulated values at 5% level of probability for the appropriate degree of freedom.

Cost benefit ratio of treatments

Cost effectiveness of each treatment will be assessed based on net returns. Net return of each treatmentwill be 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

The B:C ratio can be calculated by formula

$$\text{Benefit Cost Ratio} = \frac{\text{Gross return}}{\text{Total cost}}$$

Where,

BCR = Benefit Cost Ratio

Results and Discussion

Comparative Efficacy of selected chemicals and biopesticides against chilli thrips, [*Scirtothrips dorsali* Hood]

Percentage Population reduction of thrips after spray

The data on percent population reduction of *Scirtothrips dorsalis* over control on third, seventh and tenth day after spraying revealed that all the treatments were significantly superior over control. Among all the treatments T7 Spinosad 0.15ml/l recorded highest reduction of *Scirtothrips dorsalis* population *i.e.*, (95.21%) which was significantly superior over control followed by T4 Acetamiprid 1.0 mg/l (88.61%), T2 Diafenthiuron 0.010 mg/l (86.52%), T6 Sixer plus 2ml/l (85.21%),

T5 Indoxacarb 0.15 ml/l (83.70%), T3 Mech-333 2ml/l (81.75%), and T1 Neem oil 4 ml/l (78.91%) was least effective to control population of *Scirotothrips dorsalis* in comparision to other selected insecticides and biopesticides. All the treatments were found to be significantly superior over control. Spinosad 45%SC was more effective in percentage reduction of thrips with (95.21%) reductions over control. Similar reports are also reported by Patel and kumar (2017) [3] and Shinde *et al.*, (2018) [9] reported that Spinosad 0.2ml/l recorded highest reduction of *Scirtothrips dorsalis* population i.e. (79.79%). The next effective treatment was Acetamiprid 20% SP in which the value obtained in spray was (88.61). These findings were supported by Samota *et al.*, (2017) [7] and Venkateswarlu *et al.*, (2021) [13] and following treatment Diafenthiuron 50%WP supported by Sathyan *et al.*, (2017) [8], Nisco Sixer plus was supported by Gayathri and Kumar (2021) [1], next treatment Indoxacarb was supported by Vanisree *et al.*, (2017) [11], and Ravikumar *et al.*,(2016) [5] also found near results of treatment Neem oil.

Here follows the table to represent data of percent population reduction treatment wise of all 1 DBS, 3DAS, 7DAS and 10 DAS.

Table 1: Percent reduction of *Scirtothrips dorsalis* population due to application of certain chemical insecticides and biopesticides on spray

S. No	Treatment	Dose ml/g/lit	Percent Reduction Of The Thrips / 9 Leaves Per Plant				
			1DBS/9 leaves	3DAS	7DAS	10DAS	MEAN
T0	Control	-	8.00	0	0	0	0
T1	Neem oil	4 ml/ lit	7.60	81.43	76.67	79.30	78.91
T2	Diafenthiuron 50% WP	0.010 mg/ lit	8.20	87.14	86.00	86.78	86.52
T3	Mech – 333	2ml/ lit	7.60	82.85	81.33	81.61	81.75
T4	Acetamiprid 20% SP	1.0 mg/ lit	7.80	88.56	88.67	89.07	88.61
T5	Indoxacarb 14.5% SC	0.15 ml/lit	8.06	84.99	84.67	82.18	83.70
T6	Sixer plus	2 ml/lit	8.60	86.42	85.33	85.06	85.21
T7	Spinosad 45% SC	0.15ml/lit	8.40	97.1	96.00	93.10	95.21
F-Test		-	NS	S	S	S	S
S.Ed.(±)		-	0.397	2.75	1.59	1.86	0.92
C.D. (P = 0.05)		-	0.79	5.09	3.42	3.39	2.00

DBS* =Day before spray DAS* = Days after spray

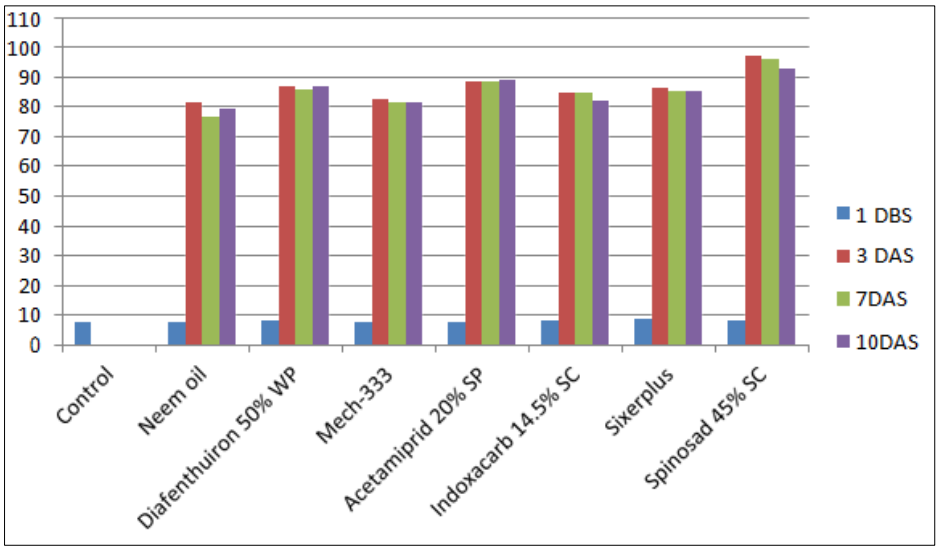

Fig 1: Graphical representation on field efficacy of insecticides against chilli thrips *Scirtothrips dorsalis* in chilli % population reduction on spraying.

Benefit Cost Ratio (BCR)

The data on cost benefit ratio of the treatments are presented in tables.

Table 2: Economics of cultivation

Sl No	Treatment	Yield q/ha	Cost of Yield Rs/q	Total cost of Yield in Rs	Common output cost inRs	Treatment cost in Rs	Total Cost in Rs	Net returns in Rs	C:B ratio
T1	Neem oil	85	6000	510000	30850	1675	32525	477475	1:15.6
T2	Diafenthiuron 50 WP	115	6000	690000	30850	1172	32022	657978	1:21.5
T3	Mech -333	92	6000	552000	30850	1482	32332	519668	1:17.0
T4	Acetamiprid 2 SP	119	6000	714000	30850	953	31803	682197	1:22.4
T5	Indoxacarb 14. SC	100	6000	600000	30850	1187	32037	567963	1:18.7
T6	Sixer plus	110	6000	660000	30850	1460	32310	627690	1:20.4
T7	Spinosad 45%SC	125	6000	750000	30850	992	31842	718158	1:23.5
T0	Control	45	6000	270000	30850	0.00	30850	239150	1:8.7

The cost of chilli per quintal is 6000₹ (Feb 2022)

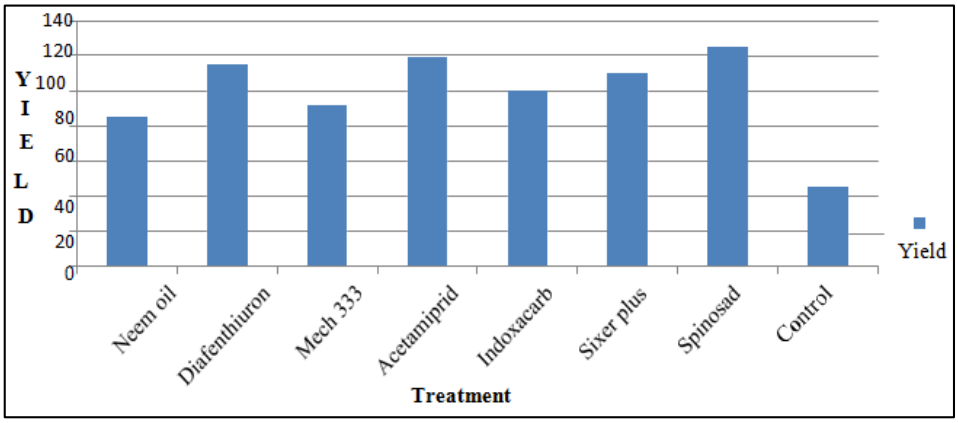

Fig 2: Graphical representation of effect of treatments on production of chilli

Economics of various Treatments

The yields among the treatments were significant. The highest yield was recorded in Spinosad 45%SC (125q/ha) followed by Acetamprid 20%SP (119q/ha), Diafenthiuron 50%WP (115 q/ha), Sixerplus (110 q/ha), Indoxacarb14.5%SC (100 q/ha), Mech - 333(92 q/ha), Neem oil (85 q/ha) as compared to control T0 (45 q/ha). When cost benefit ratio was worked out, interesting result was achieved. Among the treatment studied, the best and most economical treatment was Spinosad 45%SC 0.15ml/lit (1:23.5) followed by Acetamprid 1.0mg/lit (1:22.4), Diafenthiuron 0.010mg/lit (1:21.5), Sixerplus 2ml/lit (1:20.4) Indoxacarb 0.15ml/lit (1:18.7), Mech – 333 2ml/lit (1:17.0), Neem oil 4ml/lit (1:15.6) as compared to control T0 (1:8.7). The statistical analysis of data showed that all the treatments are significantly recorded highest marketable yield compared to control. Vanisree *et al.* (2013) [12] they reported that Spinosad was found most effective in reducing the population of *Scirtothrips dorsalis* as well as in increasing yield. This result supported by Patel and Kumar (2017) [3].

Conclusion

Results showed that among all the treatments T7 Spinosad

recorded highest reduction of *Scirtothrips dorsalis* population *i.e.*, (95.21%) which was significantly superior overcontrol followed by T4 Acetamiprid 1.0 mg/l (88.61%) in controlling the Chilli thrips due to theirmode of action compare to other selected Insecticides and Biopesticides.

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