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Evaluation of different integrated pest management modules against *Thrips parvispinus* Karny in chilli

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ABSTRACT: The present investigation was carried out to evaluate effectiveness of different integrated management strategies against *Thrips parvispinus* Karny. The experiment was conducted at, Horticultural Research Station, Dr. Y.S.R Horticultural University, Lam, Guntur during the year, 2021-22 with three replications in Randomized Block Design. Total seven modules including control were evaluated for management of *Thrips parvispinus*. Results revealed that Module-IV was most effective. Higher chilli yield of 32.22 q/ha with 87.08 % increase over untreated control was observed in M-IV (Mulch + blue sticky traps along with need based application of insecticides viz., fipronil 80WG @ 0.2 g/L, spinetoram 11.7SC @ 1 ml/L, spirotetramat 240SC @ 0.8ml/L, acetamapride 20%SP @ 0.2g/L, thiomethaxam 25%WG @ 0.2g/L, dimethoate 30%EC @ 2ml/L sprayed sequentially at 10 days interval) followed by Module-I and Module-III and they were at par with each other with recorded yield of 30.55 q/ha and 27.77 q/ha respectively with 86.37% and 85.01% increase over control.

Keywords: Chilli, integrated pest management modules, *Thrips parvispinus*

INTRODUCTION

Chilli is an important vegetable and spice crop grown throughout the world and it has immense commercial, dietary and therapeutic values. India is the largest producer, consumer and exporter of chilli in the world and cultivated in an area of 7.32 lakh hectares with a production of 19.88 lakh tonnes in 2020-21. In India, major chilli producing states are Andhra Pradesh, Telangana, Madhya Pradesh, Karnataka and West Bengal. In Andhra Pradesh chilli is cultivated in an area of 1.8 lakh hectares with a production of 8.36 lakh tonnes (2020-21) (www.dasd.gov.in) and contributes 75% to India's Chili exports. Guntur district in Andhra Pradesh alone contributes 30% of total chilli production in India, contributing major share in production and export of chilli (Mehta, 2017). The pest spectrum in chilli is over 293 insects and mite species debilitating the crop in the field as well as in storage (Anon, 1987). Butani (1976) reported more than 20 insect species in chilli from India of which thrips (*Scirtothrips dorsalis*), mites (*Polyphagotarsonemus latus*) and aphids (*Aphis gosypii* and *A. craccivora*) are the most damaging pests. Among the sucking pests, chilli thrips *Scirtothrips dorsalis* (Thripidae: Thysanoptera) was considered as the most important and serious pest as it attacks the crop from nursery till the harvest of the crop. But in the year 2021 a newly introduced invasive pest species *Thrips parvispinus* Karny was observed in chilli fields and subsequently this species has dominated and displaced the well-established chilli thrips, *Scirtothrips dorsalis* which was a regural pest on chilli (Sridhar *et al.,* 2021). *T. parvispinus*, is a member of "Thrips orientalis group" (Mound and Masumoto, 2005) and widespread pest species of quarantine importance. As chilli is being cultivated under high input pressure with huge investment and in larger areas (1.8lakh ha) in Andhra Pradesh most of the farmers worried about the crop loss and financial burden. Keeping this in view present investigation on evaluation of different integrated pest management modules against chilli flower thrips *T. parvispinus* was carried out.

MATERIALS AND METHODS

An experiment was conducted under open field conditions at Horticultural Research Station, Dr. Y.S.R Horticultural University, Lam, Guntur on evaluation of efficiency of different Integrated Pest Management modules against chilli flower thrips. For this experiment, variety LCA-620 was selected. The experiment was laid out in a randomized block design in an area of 500m^2 with seven modules including an untreated check. Experimental area was divided into three blocks and each module was replicated thrice for recording observations

Table 1. Evaluation of different integrated management modules against *Thrips parvispinus*

Module	November (30DAT)	December (60DAT)	January (90DAT)	February (120DAT)	March (150DAT)	Mean
	Thrips population per terminal leaves					
Module I	11.80 (3.58)	22.67 (4.85)	19.43 (4.51)	14.90 (3.98)	10.03 (3.32)	15.77
Module II	8.53 (3.08)	32.63 (5.79)	17.30 (4.27)	17.63 (4.31)	14.10 (3.88)	18.04
Module III	5.33 (2.51)	25.10 (5.10)	15.23 (4.02)	15.40 (4.04)	13.70 (3.83)	14.95
Module IV	11.27 (3.50)	20.07 (4.58)	17.33 (4.28)	13.00 (3.74)	11.93 (3.59)	14.72
Module V	14.20 (3.90)	27.33 (5.31)	21.87 (4.77)	18.90 (4.46)	15.37 (4.04)	19.53
Module VI	12.33 (3.65)	29.30 (5.50)	21.30 (4.72)	17.50 (4.29)	15.00 (3.99)	19.09
Module VII	14.93 (3.99)	34.73 (5.97)	28.97 (5.46)	20.90 (4.67)	16.17 (4.14)	23.14
CD	0.27	0.63	0.38	0.53	0.37	
CV	4.34	6.57	4.61	6.99	5.30	
SE (m)	0.09	0.2	0.12	0.17	0.12	

Table 2. Effect of IPM modules on yield and B:C

IPM module	Yield (q/ha)	increase in yield over control (%)	B:C Ratio
Module I	30.55	86.37	2.78
Module II	23.33	82.16	1.73
Module III	27.77	85.01	2.22
Module IV	32.22	87.08	2.80
Module v	4.72	11.74	0.59
Module VI	7.61	45.27	0.95
Module VII	4.16	0	0.56
C.D.	3.97		
SE(m)	1.28		
SE(d)	1.8		
C.V.	11.87		

and statistical analysis. Chilli seedlings of 45 days old were considered for transplanting. The population count of thrips (*Thrips parvispinus*) was taken at 30, 60, 90, 120 and 150 DAT (Days After Transplanting) and mean population was worked out. For counting thrips ten plants were selected randomly in each plot and tagged. The experiment was laid out with seven modules comprising of physical barriers (Mulch, Blue cover and white Non-oven 17 GSM plant cover made of polypropylene), biopesticides and botanical insecticides along with an untreated check. The IPM modules were randomized completely and each treatment was replicated thrice. For each treatment ten plants were labeled to record observations. The experimental details were as follows.

Treatment details

Module I: Mulch + need based application of insecticides *viz.,* Fipronil 80 WG @ 0.2g/L, Spinetoram 11.7SC @ 1ml/L - Spirotetramat 240SC @ 0.8ml/L - Acetamaprid 20%SP @ 0.2g/L-Thiomethaxam 25%WG @ 0.2g/L - Dimethoate 30%EC@ 2ml/L.

Module II: Mulch + Crop surrounded by plant cover (blue) + Need based application of Insecticides *viz.,* Fipronil 80 WG @ 0.2g/L - Spinetoram 11.7SC @ 1ml/L - Spirotetramat 240SC @ 0.8ml/L - Acetamaprid 20%SP @ 0.2g/L - Thiomethaxam 25%WG@ 0.2g/L - Dimethoate 30% EC @ 2ml/L sprayed sequentially with 10 days interval.

Module III: Mulch + Crop surrounded by plant cover (white) + Need based application of Insecticides *viz.,* Fipronil 80 WG @ 0.2g/L - Spinetoram 11.7SC @ 1ml/L - Spirotetramat 240SC @ 0.8ml/L - Acetamaprid 20%SP @ 0.2g/L - Thiomethaxam 25%WG @ 0.2g/L - Dimethoate 30%EC @ 2ml/L sprayed sequentially with 10 days interval.

Module IV: Mulch + Installation of blue sticky traps.+ Need based application of Insecticides *viz.,* Fipronil 80 WG @ 0.2g/L - Spinetoram 11.7SC @ 1ml/L - Spirotetramat 240SC @ 0.8ml/L -Acetamaprid 20%SP@ 0.2g/L - Thiomethaxam 25%WG @ 0.2g/L - Dimethoate 30%EC @ 2ml/L sprayed sequentially with 10 days interval.

Module V: Application of entomopathogens viz. *Beauveria bassiana*, *Lecanicillium lecani* and *Metarhizium anisopliae* @ 5g per litre applied alternatively at an interval of 10 days.

Module VI: Application of Neem oil @ 1 ml per litre and pongamia oil @ 1 ml per liter applied alone and in combination at an interval of 10days.

Module VII: Untreated check.

Chilli fruit yield

Harvesting of red chilli was done during 2022 Rabi season. The total fruit yield from each plot was taken and expressed in terms of dry chilli fruit yield per hectare basis and subjected for statistical analysis. Benefit cost ratio was calculated for all treatments.

Statistical analysis

Data obtained from management studies was subjected to suitable transformation and were analyzed by using ANOVA.

RESULTS AND DISCUSSION

Results (Table 1) indicated that during the vegetative stage (30DAT) Module III- {Mulch + Crop surrounded by plant cover (White) + Need based application of Insecticides *viz.,* Fipronil 80 WG @ 0.2g/L - Spinetoram 11.7SC @ 1ml/L - Spirotetramat 240 SC @ 0.8ml/L - Acetamaprid 20% SP @ 0.2g/L - Thiomethaxam 25% WG @ 0.2g/L - Dimethoate 30% EC @ 2ml/L } was effective in reducing the thrips population (5.33/terminal) followed by Module II- {Mulch + Crop surrounded by plant cover (Blue) + Need based application of Insecticides} (8.53/terminal). These two modules i.e., Module III and Module II were followed by Module IV {Mulch with blue sticky traps along need based application of Insecticides}, Module I - {Mulch+ Need based application of Insecticides}, Module VI {Application of Neem oil @ 1 ml per lit and pongamia oil @ 1 ml per liter applied alone and in combination} and these three modules were found to be at par with each other.

Similarly 60 DAT data indicated that that Module IV consisting mulch and blue sticky traps found to be effective over other treatments and which was at par with Module I - {Mulch+ Need based application of Insecticides} and Module III - {Mulch + Crop surrounded by plant cover (White) + Need based application of Insecticides}. Results after 90 DAT showed that the three modules Module III, Module IV, Module II were found to be superior over other treatments and were on par with each other. These three treatments were closely followed by Module I - {Mulch+ Need based application of Insecticides}.

After 120 DAT Module IV {Mulch + Installation of blue sticky traps.+ Need based application of Insecticides} was found to be effective in reducing the thrips population (13.00/terminal) which was at par with Module I (14.90/terminal) and Module III (15.40/terminal) all these three treatments Module IV, I, III were at par with each other.

At 150 DAT it was observed that the treatment Module I - {Mulch alone with need based application of Insecticides} 10.03/terminal was found to be effective which was at par with Module IV - {Mulch + blue sticky traps along with need based application of Insecticides} 11.93/terminal. However the thrips population was declined towards the month of March. Module II - {Mulch + Crop surrounded by blue cover (physical barrier) + Need based application of Insecticides} and Module III- {Mulch + Crop surrounded by plant cover (white) + Need based application of Insecticides} found to be effective upto vegetative stage of the crop growth. In case of Module II and Module III the plants nearer to the barrier showed change in height of plant due to difference in light intensity otherwise no difference was observed in plant growth compared to open field conditions. Once after reaching the flowering and fruiting stage no difference was observed between treatments with physical barriers and open field conditions. Salas *et al.* (2015) studied the effect of physical barrier and insect growth regulator on whitefly population and yield of pepper and observed that 50 mesh nylon net was effective in preventing the entry of whitefly and also observed that 27% decline in chilli yield. Scott *et al.* (1959) reported effectiveness of aluminium coloured mulch in *Frankiniella fusca, F.tritici* and *Scirtothrips dorsalis* in tomato. Greenough (1985) also reported significantly fewer thrips on tomato crop grown on aluminium coloured mulch. In the present study

Table 3. Effect of IPM modules on natural enemies

IPM module	Spiders / plant			Chrysopids / plant		
	60DAT	90DAT	Mean	60DAT	90DAT	Mean
Module I	0.4 (1.18)	0.30 (1.14)	0.35 (1.16)	0.13 (1.06)	0.03 (1.02)	0.08 (1.04)
Module II	0.43 (1.20)	0.23 (1.11)	0.33 (1.16)	0.27 (1.13)	0.13 (1.06)	0.20 (1.10)
Module III	0.53 (1.24)	0.33 (1.15)	0.43 (1.20)	0.20 (1.10)	0.10 (1.05)	0.15 (1.08)
Module IV	0.53 (1.24)	0.30 (1.14)	0.42 (1.19)	0.10 (1.05)	0.10 (1.05)	0.10 (1.05)
Module v	0.60 (1.26)	0.30 (1.14)	0.30 (1.20)	0.30 (1.14)	0.23 (1.11)	0.27 (1.13)
Module VI	0.73 (1.32)	0.37 (1.17)	0.55 (1.25)	0.17 (1.08)	0.17 (1.08)	0.17 (1.08)
Module VII	0.50 (1.22)	0.23 (1.11)	0.37 (1.17)	0.20 (1.10)	0.07 (1.03)	0.14 (1.07)
SE(m)	0.032	0.027	0.022	0.022	0.032	0.027
C.D.	NS	NS	NS	NS	NS	NS

Module IV {Mulch + blue sticky traps along with need based application of Insecticides) recorded significantly less thrips population which was at par with Module I – {Mulch+ Need based application of Insecticides} and Module II - {Mulch + Crop surrounded by plant cover (blue) + Need based application of Insecticides} compared to other Module V – {Application of entomopathogens *viz., Beauveria bassiana*, *Lecanicillium lecani* and *Metarhizium anisopliae*} was found to be less effective it may be due to lack of congenial conditions for their multiplication and due to severe pest build up. Present findings are in line with the observations made by Devi and Roy, (2017) stated that blue sticky traps can be use for mass trapping and monitoring of *Thrips tabaci* as a part of IPM component. Though the Module V could reduce the population but it was not as good as other modules, still this can be included in the management of *Thrips parvispinus* keeping in view of repellent action and safer to environment. In IPM module the treatments with entomopathogens or biopesticides like neem and pongamia oil can be used either in combination or can be alternated with pesticides to manage the resistance buildup in the pest population. Similar observations were made by Kardinam and Maris, (2021) on the ability of biopesticides to reduce the intensity of pest attack and also observed the inability of biological pesticides in reducing pest population of thrips. Kurbett *et al.* (2018) studied the effectiveness of different IPM modules and found that the chemi-intensive was most effective.

Yield

The results on fruit yield showed that Module IV - {Mulch + blue sticky traps along with need based application of Insecticides} has highest yield of 32.22 q/ha with 87.08 % increase over untreated control. Further, Module I - {Mulch+ Need based application of Insecticides} (30.55 q/ha) and Module III- {Mulch + Crop surrounded by plant cover (white) + Need based application of Insecticides} (27.77 q/ha) were equally effective with 86.37% and 85.01% increase over untreated control followed by Module II - {Mulch + Crop surrounded by blue cover (physical barrier) + Need based application of Insecticides} with 23.33 q/ha with 82.16% increase over untreated control. Module VI {Application of Neem oil @ 1 ml per lit and pongamia oil @ 1 ml per liter applied alone and in combination} (7.61 q/ha) with 45.27% and Module V – {Application of entomopathogens *viz., Beauveria bassiana*, *Lecanicillium lecani* and *Metarhizium anisopliae*} recorded lowest yield 4.72 q/ha with 11.74% increase over control but statistically on par with control (4.16) from (Table 2).

Natural enemies

Natural enemies spiders and chrysopids were observed in the crop ecosystem and recorded the data at 60DAT and 90DAT on number of spiders and chrysopids observed per module. Results stated that their was significant difference among the population of natural enemies with regard to

IPM modules and DAT since very fewer population was present. Stating that IPM modules has no effect on the natural enemies population (Table 3).

Economics

Among the modules, highest B: C ratio (2.80) was obtained with Module IV - {Mulch + blue sticky traps along with need based application of Insecticides} with a net return of Rs. 414440 which also obtained the highest yield (32.22 q/ha) when compared to other modules, followed by Module I - {Mulch+ Need based application of Insecticides} with B: C ratio of 2.78 with net returns of 391000. Based on the results with Module IV - {Mulch + blue sticky traps along with need based application of Insecticides *viz.,* Fipronil 80 WG @ 0.2g/L - Spinetoram 11.7SC @ 1ml/L - Spirotetramat 240 SC @ 0.8ml/L - Acetamaprid 20% SP @ 0.2g/L - Thiomethaxam 25% WG @ 0.2g/L - Dimethoate 30% EC @ 2ml/L} has been considered as effective for IPM of flower thrips in chilli (Table 3).

CONCLUSION

Based on experimental results it can be concluded that the treatments with Mulching and need based application of insecticides proved to be better compared to biopesticides and neem oil or pongamia oil alone or in combination. Hence, for the management of *Thrips parvispinus* Integrated Pest Management module consisting of mulch + Installation of blue sticky traps with need based application of insecticides proved to be effective instead of depending solely on spraying of insecticides.

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