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Integrated Pest Management (IPM) for Thrips and Mites Management in Chilli

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ABSTRACT
Chilli (Capsicum annuum L.) is one of the most important widely cultivated spice and vegetable crop grown all over India. The pest spectrum in chilli is complex, Chilli thrips (Scirtothrips dorsalis Hood) and yellow mite (Polyphagotarsonemus latus Banks) are considered as the most devastating pests. During the last two decades, insecticidal control of chilli pests especially in the irrigated crop has been characterized by high pesticides use; this has led to problems of residues in the fruits. Among bio pesticide control, Integrated Pest Management and Chemical control, Rational use of crop protection chemicals through Integrated Pest Management approach reduce the sucking pest complex more effectively and improve the yields. Integrated Pest Management recorded higher values for Cost Benefit Ratio.
Keywords: IPM, Capsicum annuum, yellow mite, Chilli thrips

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INTRODUCTION

Chilli (*Capsicum annuum* L.) belongs to the family Solanaceae and is one of the most important widely cultivated spice and vegetable crop grown all over India. Besides traditional use of chilli as vegetables, spices, condiments, sauces and pickles it is also being used in pharmaceuticals, cosmetics and beverages [9]. India is a major producer, exporter and consumer of chillies in the world. India produces an annual production of 10.5 lakh tonnes from an area of about 9.6 lakh ha. Chillies constitute about 20% of Indian spice exports in quantity, and about 14% in value. Though the crop has great export potential (besides a huge domestic market), it suffers from low productivity. The pest spectrum in chilli is complex, with more than 293 insect and mite species debilitating the crop both in the field and in storage [1]. Among these, aphids: *Myzus persicae* Suler., *Aphis gossypii* Glover; thrips: *Scirtothrips dorsalis* Hood., yellow mite, *Polyphagotarsonemus latus* Banks, and the fruit borer, *Helicoverpa armigera* Hubner, are the most important. Chilli thrips (*Scirtothrips dorsalis* Hood) and yellow mite (*Polyphagotarsonemus latus* Banks) are considered the most devastating pests. A total of 39 and 57 insect pests were recorded in chilli nursery and in main field respectively [8].

The farmers always give priority to protecting such a high value crop from any type of damage caused by insects-pests and others. They often use huge amount of pesticides without proper diagnosis results in pest resurgence, phytotoxicity, infertility/low fruit setting due to killing of pollinators and presence of high amount of pesticidal residue on harvested fruits. During the last two decades, insecticidal control of chilli pests especially in the irrigated crop has been characterized by high pesticides use; this has led to problems of residues in the fruits [7, 5].

An On Farm Trial on Integrated Pest Management (IPM) in Chilli was conducted with a special objective of educating chilli farmers in selected villages on the rational use of crop protection chemicals through integrated pest management approach, thereby mitigating the problem of pesticide residues in harvested produce.

MATERIAL AND METHODS

The F1 chilli hybrid, Indam- 67 is very popular and is widely cultivated in Gadwal district of Telangana. The plant is very tall and highly vigorous. Fruits are dark green, glossy with smooth surface. Ripened fruits have excellent red colour. The hybrid is susceptible to thrips and mites.

An On Farm Trial on Integrated Pest Management (IPM) in Chilli was conducted in Gadwal District for the 3 years 2015-16, 2016-17, 2017-18 in two villages, viz., Maddelabanda and Dharmavaram (16.1218° N latitude, 77.6980° E longitude). The soil of the experimental trials was sandy loam in the texture with medium fertility status. The experiment was laid out in completely randomized block design having 3 treatments in 7 locations. T 1 represents bio pesticide control. The treatment T2 represents both bio pesticide and chemical control. T3 represents chemical control. The crop was raised in the nursery and 35 day old seedlings were transplanted in the main field with 45 cm x 60 cm spacing. Standard agronomic practices were followed to grow the crop.

Table 1. Details of different pest management treatments followed for sucking pest management

Treatments	
T1	Seed treatment + Neem cake @ 500 kg /Ha (Basal) + 2 weeding (15 and 30 DAT) + Yellow sticky traps @ 50 per ha + Blue sticky traps @ 25 per ha + Garlic extract 10% + NSKE 5%
T2	Seed treatment + 5 rows of sorghum as border crop + Neem cake @ 500 kg /Ha (Basal) + 2 weeding (15 and 30 DAT) + Yellow sticky traps @ 50 per ha + Blue sticky traps @ 25 per ha + Garlic extract 10% @ 25 DAT + NSKE 5% @ 35 DAT + Triazophos @ 1.5 ml/L at 50 DAT + Imidacloprid@ 0.3 ml/L + NSKE 3% at 65 DAT + Fipronil @ 2 ml /L at 80 DAT + Difenthurion @1.0 gm/L + NSKE 3% at 90 DAT
T3	Seed treatment + Monocrotopos @ 1.6 ml at 15 DAT + Acephate @ 1.5 gm at 25 DAT + Chloropyripos @ 2.5 ml at 35 DAT + Thiodicarb @ 1.0 gm at 45 DAT + Lamdacyhalothrin @ 1.0 ml at 55 DAT + Dichlorovas @ 1.0 ml at 65 DAT + Fipronil @ 2 ml /L at 70 DAT + Difenthurion @1.5 gm /L at 75 DAT + Difenthurion @1.5 gm/L 80 DAT

To study mite population five plants were selected randomly from each field and tagged. The plants were again untagged after recording the thrips population to avoid observation from the same plant. Six leaves from each plant (two each from bottom, middle and top canopy) were plucked and kept in properly labelled polypropylene bag. Later, these selected leaves were examined under stereo-binocular microscope for counting the number of mites per leaf. To study the thrips population another five plants were selected randomly from each field. A pot containing kerosinized water was placed under the selected plant and each twig was shaken gently, and thrips which fell on the water were noted down. Observations were recorded at seven days interval starting from 14 days after transplanting (DAT) up to last harvesting of fruits. First plucking of fruits was made at 65 DAT and successive plucking was done at an interval of 20 days. Fruit yield of each field was taken from whole population separately and yield of each treatment was calculated by cumulating the successive plucking from respective fields. Data were subjected to analysis of variance after making necessary transformation whenever required [4]. Thrips and mite infested plants were observed minutely and the symptoms were recorded in different stages of crop growth.

Benefit Cost Ratio

The fruit yield per field was recorded and computed to tonne per hectare. The data were tabulated, pooled and ranked on the basis of their yield performance. The benefit-cost ratio (BCR) of different treatments was calculated by estimating different cost of cultivation and return from fruit yield after converting them to one hectare of land. The average market price of chilli was rupees 60 per kg during the experimental period. Benefit-cost ratio was calculated using the following formula:

$$BCR = \frac{\text{Gross returns}}{\text{Total cost of cultivation}}$$

RESULTS AND DISCUSSION

Thrips were recorded on the upper surface of leaves. The insect lacerates the epidermis and suck sap. The white minute, streaky spots were commonly noticed on infested leaves which curled upward, thickened and crinkled. In severe infestation, margin of the leaves showed burnt appearance and dried up.

On the other hand, the adults and nymphs of mites generally suck sap from leaves, petioles and tender twigs. The margin of the young leaves curled downwards in an inverted boat shaped manner. The leaves look shiny, and silvery lining was recorded on the ventral surface. However, the older leaves and petioles were found elongated. In severely infested plant, leaves and terminal twigs become hardened, twisted

and thickened. Infested plant produced very small sized leaves. In such a plant most of the young fruits look silvery and shiny, and in later stage the fruits become cracked and deformed. Besides, bud and flower shedding were also noted down but fruit shedding was observed rarely.

Perusal of Table 2 revealed the overall picture of level of pest infestation in chilli at different treatments. T2 recorded minimum number of thrips per twig per plant and mites per leaf per plant which is significantly differ from T1 and T3. Results on thrips population in different physiological growth stages of the crop showed that initial population of insect was relatively lower in T2 compared to T1 and T3 during the experimental period. The border crop reduced the sucking pest infestation in T2 compared to T1 and T3. In later period of crop growth i.e. from pre-flowering to fruiting stages slightly higher population of insect was observed in T1 which might be due to failure of NSKE and garlic extract to control thrips and mites for longer period of time probably less persistency of these bio-products. More or less similar observations were recorded for mite population also. Debnath and Baidya [2] also recorded the ineffectiveness of NSKE to suppress chilli mite population in totally matured crop. The findings are well corroborated with the earlier works of Karmakar [6] and Gerson [3].

Table 2. Pooled mean population of thrips and mites in different treatments for the years 2015-16, 2016-17, 2017-18

Treatments	Thrips (No. / twig / plant)	Mites (No. / leaf / plant)
T1	2.50	12.75
T2	0.55	1.50
T3	1.55	7.55
CD(p=0.05)	0.75	2.33
SEm(±)	0.21	0.66

Benefit Cost Ratio

The details of cost of cultivation analysis have been presented in Table 3. Based on fruit yield, the treatment T2 ranked first followed by T3 and T1. Similar trend was also followed in BCR of different treatments. It can be concluded that treatment T2 may be considered for sustainable production of chilli.

Table 3. Analysis of cost of cultivation for different pest management modules

Treatments	Production cost without Plant Protection (Rs./ha)	Cost of Plant Protection (Rs./ha)	Total cost (Rs./ha)	Fruit yield (Q/ha)	Returns @ Rs.6,000/Q	Profit (Rs./ha)	BCR
T1	1,15,000	18,000	1,33,000	25	1,50,000	17,000	1:1.13
T2	1,15,000	35,000	1,50,000	45	2,70,000	1,20,000	1:1.8
T3	1,15,000	52,000	1,62,000	35	2,10,000	48,000	1:1.3

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