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RESEARCH ARTICLE

Efficacy of various insecticidal modules against hoppers in mango

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ABSTRACT

Mango hoppers, *Ideoscopus clypealis* (Leth.) and *Ideoscopus niveosparsus (nititulus)* (Leth.) are serious pests on mango in the flowering and fruiting season. The efficacy of different spray modules were tested against mango hopper on mango cv. Banganpalli under field conditions during 2010-2012 at Fruit Research Station, Sangareddy AndhraPradesh, India.The treatments consisted of Module I : First spray of *Beauveria bassiana* @ 1×10^{7} spores /ml) at panicle emergence stage followed by second spray (after 15 days of first spray) of *Verticillium lecanii* (@ 1×10^{7} spores/ml). Third need based spray of Neem Azal (10000 ppm @ 8 ml/lit. of water). Module II : First spray of Neem Azal (10000 ppm @ 3 ml/lit. of water) at panicle emergence stage followed by second spray (after 15 days of first spray) with Nimbicidene (1500 ppm @ 3ml /l of water) Third spray of Neem Azal (10000 ppm @ 3 ml/lit. of water after 15 days of second spray) and fourth need based spray with Nimbicidene (1500 ppm @ 3ml/l of water). Module III : First spray of Thiamethoxam (0.008 %) at panicle emergence stage followed by second spray (21 days after first spray) of profenophos (0.05%) and third need based spray of Carbaryl (0.15%) Module IV : First spray of Spinosad (0.004%) at panicle emergence stage followed by second spray (21 days after first spray) with Thiamethoxam (0.008%) and third need based spray of Neem Azal (10000 ppm @ 3 ml /l of water. Module V: First spray of Acephate (0.04%) at panicle emergence stage followed by second spray (21 days after first spray) with Spinosad (0.004%) and third need based spray of Carbaryl (0.15%) and control with five replications in a completely randomized block design. The main objective of the study was to change the treatment regime from calendar sprays to need based spray so as to minimize the production cost and pesticide residues. Peak incidence of hoppers were noticed in Jan-Feb coinciding with blossoming and declined thereafter through to April first week. Pre and post spray counts were recorded in all the treatments and analysis of data revealed that Module III was found to be superior in controlling the hoppers followed by module V and Module IV. The hopper population recorded during 2010-11(18.3 hoppers per panicle) compared to the hopper population in 2011-12 (15.7 hoppers per panicle). The yield data of fruit for individual years along with mean value of two years showed that the fruit yields was significantly higher in Module III (125.36 kg/tree) compared to untreated trees.

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INTRODUCTION

The mango (*Mangifera indica* L.) described as "king of fruits" is known for its aroma, delicious taste and high nutritive value is a prominent horticultural crop of India. Andhra Pradesh is the second largest producer state of mango. In proportion to its area of cultivation, its production is very low due to insect pests. Among the various pests that attack, mango hoppers (*Amritodus atkinsoni, Ideoscopus niveosparsus* and *Ideoscopus clypealis*) are most serious and widespread which reduce the yield by non-setting of flower and dropping of immature fruits. Hoppers remain active

throughout the year in cracks and crevices of mango trunk, but they are recorded on twigs when young leaves and inflorescence are available (Patel *et al.*, 1994). Corey *et al.* (1989) determined the economic injury levels of *Ideoscopus clypealis* and observed that an average of 4.21,4.30,4.45 and 4.55 adults/panicle at 2, 10, 18 and 26 days, respectively after flower bud break.

Verghese *et al.* (1998) reported that Imidacloprid @0.2 ml per litre to 1.6 ml per litre effectively controled the two species of *Ideoscopus* for a period of 21 days and had no phytotoxic effect nor did it affect pollination. Nachiappan and Basakran (1986) tested eight insecticides: phosalone, endosulfan, carbaryl, phenthoate, fenitrothion, monocrotophos, quinalphos and phosphamidon. Endosulfan provided the best control when spraying was done one week after flowering and repeated after 14 days.

The current control measures for pests attacking mango still relies on the use of pesticides. Most insecticides and fungicides are applied as calendar spray in an excessive manner resulting to pest resistance, elevation of minor pests to major ones, destruction of natural enemies and contamination of environment. In addition, pesticides are expensive and have caused in increased production inputs. Many of these problems can be minimized though Integrated Pest Management (IPM). Hence, the present study was conducted to study the efficacy of different IPM modules for the management of mango hopper.

MATERIAL AND METHODS

To evaluate the efficacy of different IPM modules against hoppers in mango, field experiments were carried out at Fruit Research Station, Sangareddy during 2010-11 and 2011-12 on mango var. Banganpalli with five modules and untreated control in a Randomized Block Design with three trees each, one tree taken as one replication. The following treatments were implemented during the second fortnight of December :

Module I :

First spray of *Beauveria bessiana* @ 1 × 10 7 spores /ml) at panicle emergence stage followed by second spray (after 15 days of first spray) of *Verticillium lecanii* (@ 1×10^7 spores/ml). Third need based spray of Neem Azal (10000 ppm @ 3 ml/lit. of water).

Module II :

First spray of Neem Azal (10000 ppm @ 3 ml/lit. of water) at panicle emergence stage followed by second spray (after 15 days of first spray) with Nimbecedene (1500 ppm @ 3ml /l of water). Third spray of Neem Azal (10000 ppm @ 3 ml/lit. of water after 15 days of second spray).

Module III :

First spray of Thiamethoxam (0.008 %) at panicle emergence stage followed by second spray (21 days after first spray) of Profenophos (0.05%) and third need based spray of Carbaryl (0.15%).

Module IV :

First spray of Spinosad (0.004%) at panicle emergence stage followed by second spray (21 days after first spray) with Thiamethoxam (0.008%) and third need based spray of Neem Azal (10000 ppm @ 3 ml /l of water.

Module V:

First spray of Acephate (0.04%) at panicle emergence stage followed by second spray (21 days after first spray) with Spinosad (0.004%) and third need based spray of Carbaryl (0.15%).

Control : Untreated

Ten panicles were randomly selected from each tree in four directions and observed for incidence of hoppers. Number of nymphs and adults in a single panicle /inflorescence from each direction of selected tree should be counted. Data on pre spray count of hoppers and post spray hopper counts were collected every week upto 6 weeks on treated trees and untreated control after each spray.

RESULTS AND DISCUSSION

The population of *Ideoscopus* (mango hopper) varied with a peak population during February in both the years. The peak incidence of hoppers (18.3 hoppers /panicle) was observed in the 9th standard week during 2010-11 whereas during 2011-12 peak incidence of hoppers (15.7 hoppers/panicle) was observed in the 6th standard week (Fig. 1 and 2). Maximum number of hoppers (*Amritodus atkinsoni)* was observed during 2010-11 (235.7 hoppers/sqmt on mango bark (Table 1 and 2). The adults of *Amritodus atkinsoni* hibernated, mostly in cracks and crevices of the trunk (Baro *et al.*, 1997). Tandon *et al.* (1983) also reported that hoppers generally become active soon after the emergence of floral buds and start laying eggs on inflorescence. During flowering period preferred food for hoppers is available and their reproductive capacity is increased.

Studies conducted for Integrated Pest Management of mango hopper revealed that amog the five modules tested, all the modules were significantly superior over control. However Module III (First spray of Thiamethoxam (0.008 %) at panicle emergence stage followed by second spray (21 days after first spray) of Profenophos (0.05%) and third need based spray of Carbaryl (0.15%) was effective in management of hopper followed by Module V and Module IV. Minimum number of hoppers were noticed in Module III (1.4 hoppers/panicle) after the third spray. Maximum survival of hoppers were noticed in control(13.84 hoppers/panicle) (Table 3 and Fig. 3). The same

Table 1 : Surveillance of hoppers on mango var. banganpalli during 2010-11 at Fruit Research Station, Sangareddy

Months	Standard week	Hopper population		Temperature		Relative humidity		Rainfall
		Panicle	Trunk	Maximum	Minimum	Morning	Evening	
December	49	0	8	11	30	84	74	0
	50	0	20.3	13	27	86	72	0
	51	0	35.5	15	27	85	75	0
	52	0	55.4	13	35	89	78	0
January	1	0	64.6	14.32	30.24	86	78	0
	2	0	85.3	16.3	30.34	88	76	0
	3	0	110.6	13.74	30.56	80	64	0
	4	0	125.3	13.24	33.34	82	54	0
February	5	0	156.8	15.95	35.47	76	62	0
	6	4.32	180.6	17.56	34.3	72	53	0
	7	11.3	235.7	17.15	33.6	73	69	0
	8	15.86	185.4	17.95	35.65	75	64	0
	9	18.30	123.9	17.34	37.96	72	58	0
March	10	14.9	57.5	19.14	38.38	66	50	0
	11	5.08	22.6	18.73	35.7	71	63	0
	12	0	9.0	20.64	36.72	73	65	0

Table 2 : Surveillance of hoppers on mango var. Banganpalli during 2011-12 at Fruit Research Station, Sangareddy

Months	Standard week	Hopper population		Temperature		RH	RH	Rain fall
		Panicle	Trunk per 100 sqcm	Min	Max	Morning	Evening	
December	49	0	0	13.1	33.6	95.1	79.3	0
	50	0	0	13.2	32.8	94.1	77.8	0
	51	0	0	11.2	32.4	96.1	80.1	0
	52	0	0	10.6	32.0	87.0	53.5	0
January	1	0	0	18.2	34.7	93.3	79.5	0
	2	3.2	0	12.6	31.3	86.4	55.0	0
	3	7.4	8.0	9.6	33.0	77.4	58.2	0
	4	8.2	20.7	14.9	33.0	83.3	67.4	0
February	5	10.3	35.5	14.9	32.6	89.3	73.4	0
	6	15.7	55.6	14.7	34.7	74.0	67.0	0
	7	11.2	33.0	18.4	35.7	77.9	69.4	0
	8	8.6	12.6	15.0	37.6	65.9	56.7	0
March	9	5.0	7.9	14.9	37.9	49.4	48.2	0
	10	4.2	2.0	15.0	37.7	56.3	45.5	0
	11	2.4	0	18.7	38.9	61.1	44.5	0
	12	1.6	0	17.7	41.6	50.1	40.2	0

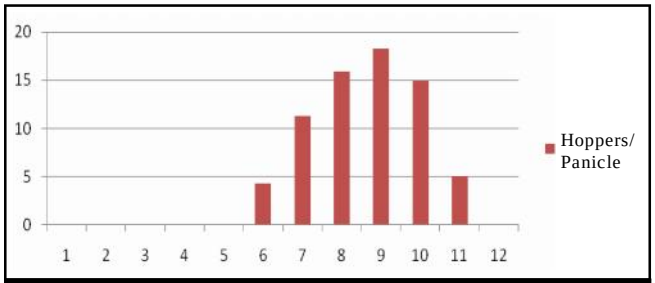

Fig. 1 : Surveillance of mango hoppers on mango var. Banganpalli during 2010-11 at FRS, Sangareddy

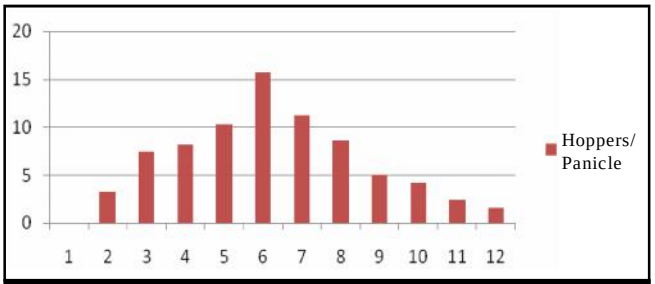

Fig. 2 : Surveillance of mango hoppers on mango var. Banganpalli during 2011-12 at FRS, Sangareddy

Table 3 : Effect of different IPM Modules on hopper population in mango during the year 2010-11 at FRS, Sangareddy

Treatments	Hopper population panicle^{-1}							Yield kg/tree	Avoidable loss
	Pre-spray	Ist week	IInd week	IIIrd week	IVth week	Vth week	VIth week		
Module–I	41.30	31.00	30.53	26.52	23.13	18.14	11.24	81.40	14.17
Module-II	41.10	31.57	31.55	20.84	18.71	10.38	5.76	86.08	18.80
Module-III	39.08	5.08	6.84	14.25	1.32	1.4	1.28	125.36	44.27
Module-IV	40.86	4.48	6.95	10.57	2.20	3.24	2.08	118.30	40.94
Module-V	39.54	5.44	6.48	11.03	4.69	5.24	3.38	122.23	42.84
Control	37.6	42.71	47.90	50.84	31.55	24.94	13.84	69.86	–
C.D. (P=0.05)	NS	2.14	2.072	2.132	1.62	1.28	1.441	6.38	–

NS=Non-significant

Table 4 : Effect of different IPM Modules on hopper population in mango during the year 2011-12 at FRS, Sangareddy

Treatments	Hopper population panicle^{-1}						Yield kg/tree	Avoidable loss
	Pre-spray	Ist week	IInd week	IIIrd week	IVth week	Vth week		
Module–I	26.28 (5.18)	15.94 (4.04)	16.76 (4.15)	14.88 (3.91)	11.04 (3.39)	7.98 (2.91)	75.23	16.92
Module-II	25.62 (5.10)	16.42 (4.17)	18.60 (4.36)	10.45 (3.30)	7.34 (2.79)	6.06 (2.55)	77.80	19.66
Module-III	25.94 (5.14)	5.3 (2.43)	7.00 (2.73)	7.78 (2.87)	1.98 (1.56)	1.24 (1.31)	112.23	44.31
Module-IV	24.06 (4.95)	11.50 (3.43)	13.14 (3.69)	8.22 (2.95)	1.40 (1.36)	1.30 (1.33)	103.33	39.5
Module-V	26.96 (5.17)	15.0 (3.95)	16.34 (4.09)	13.36 (3.70)	3.80 (2.07)	2.98 (1.86)	109.20	42.7
Control	27.0 (5.23)	29.94 (5.47)	31.14 (5.62)	32.8 (5.76)	33.68 (5.89)	23.36 (4.8)	62.50	–
C.D. (P=0.05)	NS	0.23	0.242	0.303	0.253	0.219	4.83	–

NS=Non-significant

trend was observed during both the years. The present findings are in conformity with Patel *et al.* (2003) who stated that two sprays of Thiomethoxam at 50 g ai/ha or Carbaryl 0.2 per cent during the flowering of mango crop at an interval of 15 days, effectively prevented the population build up of hopper.

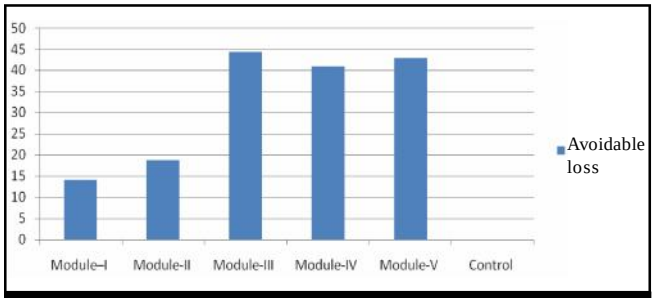

Fig. 3 : Efficacy of different IPM modules on mango hopper during 2010-11 at FRS, Sangareddy

Maximum yield was observed in Module III (125.36 kg/tree) which was statistically superior over other treatments followed by Module V (122.23 kg/tree). Lowest yield was recorded in control (69.86 kg/tree). The avoidable loss in Module III was 44.27 during 2010-11 and 44.31 during 2011-12 (Table 3 and 4).

Module I and II though were superior in controlling hoppers compared to control but less than the chemical treatment modules. Verghese *et al.* (2000) observed that efficacy of the azadirachtin (3000 and 1000 ppm) seemed to depend on the level of hopper density. At lower densities (<4 per panicle), they were as effective as the synthetic chemicals.

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