

Original Research Article

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## Management of Sucking Pests by Using Newer Insecticides and their Effect on Natural Enemies in Tomato (*Lycopersicon esculentum* Mill.)

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### ABSTRACT

#### Keywords

*Lycopersicon esculentum* Mill., new insecticides, *Aphis gossypii*, *Bemecia tabaci*, *Frankliniella schultzei*.

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A field experiment management of sucking pests by using newer insecticides and their effect on natural enemies in tomato (*Lycopersicon esculentum* mill.) was conducted at Mahatma Phule Krishi Vidyapeeth, Rahuri during the year 2013-2014. Eight insecticides used against the sucking pests viz., aphid, whiteflies and thrips. The result of this study revealed that the spinosad 45 SC @ 125 g a.i./ha emerged as most effective treatment to reduce the aphid (2.09-3.07), whitefly (1.51-2.27), thrips (0.71-1.64) per three leaves/plant and it gave highest marketable yield of tomato (45.47 t/ha) it was followed by cypermethrin 25 EC @ 62.50 g a.i./ha, abamectin 1.9 EC @ 3 g a.i./ha and chlorantraniliprole 18.5 SC @ 30 g a.i./ha. Further the effect of insecticides on natural enemies revealed that the insecticides namely spinosad 45 SC @ 125 g a.i./ha (1.76) and, abamectin 1.9 EC @ 3g a.i./ha (1.69), chlorantraniliprole 18.5 SC @ 30 g a.i./ha (1.62) and novaluron 10 EC @ 75 g a.i./ha (1.51) were found safer to the predatory coccinellids. Whereas, flubendamide 39.35 SC @ 60 g a.i. /ha was moderately toxic to coccinellids. Cypermethrin 25 EC @ 62.50 g a.i./ha was found detrimental to the natural enemies.

### Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of the most popular solanaceous vegetable crops grown all over the world and ranks second in importance after potato. In India, tomato is cultivated in almost all parts of the country and occupy an area of about 8.79 lakh hectares with total production of 182.27 lakh MT and productivity of 20.7 MT/ha (Anonymous, 2013). In Maharashtra, tomato is cultivated over an area of about 0.50 lakh hectares with production of 10.50 lakh tones and the productivity is 21.0 tones/ha (Anonymous, 2013). Tomato growers in Western Maharashtra regularly experienced

the economic damage caused by fruit borer (*Helicoverpa armigera* Hubner), whitefly (*Bemisia tabaci* Gennadius), aphid (*Aphis gossypii* Glover) and thrips (*Frankliniella schultzei* Trybom). These pests are polyphagous in nature and their abundance in nature is throughout the year. Moreover, the cultivation of tomato and availability of alternate hosts encourage the development of pest pressure round the year. The sucking pests viz., thrips, whiteflies and aphids cause severe damage to crop by transmitting virus disease rather than direct feeding.

In sucking pest complex, whitefly is important as it imparts direct damage to the crop by desapping and also acts as vector for transmission of leaf curl virus disease in tomato (De Barro, 1995; Jones, 2003). Yield losses due to direct and indirect damage caused by whiteflies were reported to the extent of 20 to 100 per cent (Papisarta and Garzia, 2002).

## **Materials and Methods**

The field trial was conducted during *rabi* 2013-14 at AICRP on Vegetable crops, Department of Horticulture, MPKV, Rahuri, Dist: Ahmednagar laid out in RBD with nine treatment and three replications including untreated control. Seeds of hybrid tomato 'Namdhari-501' were used for sowing. Seedling was transplanted after one month in the plots having a size of 4.50 X 4.05 m (gross plot) and 3 X 3.15 m (net plot size) at spacing 75 cm x 45 cm between plant to plant and row to row respectively. When on adequate population of sucking pests was grown up, the chemical were sprayed with knapsack sprayer as specific dosages. In trial in all three sprays were taken starting from 45 days after transplanting at 10 days interval. The sticker sandovit (1 ml/lit) was added in spray fluid before spraying in each insecticide. Application of insecticides was done by hand operated knapsack sprayer by using 500 liters of water/hector.

For recording observations, five plants were selected randomly from each treatment and tagged. On each selected plant, three leaves each from upper, middle and bottom portion were inspected from lower side for presence of sucking pests. In respect of whiteflies only nymphs were counted. However, nymphs as well as adults were recorded in respect of aphids, thrips by using the hand lenses of 10 magnifications. The count of coccinellids was recorded randomly on five plants per treatment plot. Pre-count was taken one day

prior to each spray and subsequent counts were recorded at 3<sup>rd</sup>, 7<sup>th</sup> and 10<sup>th</sup> day after the spray. Observations were recorded early in the morning before 8.00 a.m. as suggested by Mote (1977). The yield of marketable tomato fruits plucked at each picking was recorded separately for each treatment plot and computed yield data of eight pickings were converted into tonn /ha. The data on counts of aphids, thrips, whiteflies were converted to square root transformed values + 0.5 i.e.  $(\sqrt{n+0.5})$  where 'n' is the mean value of actual count of concerned pests.

## **Results and Discussion**

### **Efficacy of insecticidal treatments against sucking pests of tomato**

The data of average of three sprays are presented in table 1.

#### **Aphids**

The treatment with spinosad 45 SC @ 125 g a.i. /ha at three days after sprays recorded least (2.09 aphids/plant) aphids and emerged as the most effective treatment over others. However, this treatment was at par with cypermethrin 25 EC @ 62.50 g a.i./ha (2.16), abamectin 1.9 EC @ 3 g a.i./ha (2.40) and chlorantraniliprole 18.5 SC @ 30 g a.i./ha (2.49 aphids/3 leaves/plant) were equally effective and significantly superior over untreated control. At seven days after spray, all the insecticidal treatments were significantly superior over untreated control in reducing aphid population and recorded the average survival population in the range of 1.31 to 3.51 aphids/3 leaves/plant in various insecticide treatments as against 17.47 aphids in untreated control. The treatment with spinosad 45 SC @ 125 g a.i./ha recorded lowest (1.31 aphids/3 leaves/plant) population of aphid and emerged as the most effective treatment over remaining test insecticides.

The treatment with spinosad 45 SC @ 125 g a.i./ha at ten days after spray recorded minimum of 3.07 aphids/3 leaves/plant and found most effective over other test insecticides except, cypermethrin 25 EC @ 62.50 g a.i./ha (3.13), abamectin 1.9 EC @ 3 g a.i./ha (3.24) and chlorantraniliprole 18.5 SC @ 30 g a.i./ha (3.38) (Fig. 1).

### **Whiteflies**

The treatment with spinosad 45 SC @ 125 g a.i. /ha found very effective against whitefly during ten days after spray interval and recorded the whiteflies population in the range (0.84 – 2.27 whiteflies/3 leaves/plant) as against (12.11 – 13.31 whiteflies/3 leaves/plant). Whereas the treatments of cypermethrin 25 EC @ 62.50 g a.i. /ha, abamectin 1.9 EC @ 3 g a.i. /ha and chlorantraniliprole 18.5 SC @ 30 g a.i. /ha were found at par with this treatment (Fig. 2).

### **Thrips**

All the insecticidal treatments were significantly superior over untreated control. The treatment with spinosad 45 SC @ 125 g a.i. /ha emerged as most effective treatment over other and recorded (0.36 – 1.64thrips/3 leaves/plant) thrips population during the ten days spray interval. However the treatment with cypermethrin 25 EC @ 62.50 g a.i. /ha, abamectin 1.9 EC @ 3 g a.i. /ha and chlorantraniliprole 18.5 SC @ 30 g a.i. /ha was found equally as that of this treatment and registered the average survival population of thrips in rang 0.44 – 2.00 thrips/3 leaves/plant (Fig. 3). The present findings is in agreement with Kalawate and Dethé (2006), Raghuvanshi (2014) who recorded effectiveness of spinosad 45 SC @ 125 g a.i./ha and cypermethrin 25 EC @ 62.50 g a.i./ha against sucking pests. Sarangdevot *et al.*, (2006) reported that cypermethrin showed better efficacy against whitefly on tomato.

The treatment with spinosad45 SC @ 125 g a.i./ha, and abamectin 1.9 EC @ 3 g a.i./ha were found effective treatments for controlling thrips, aphids and whiteflies and recorded significantly yield of tomato. Similar result of effectiveness of these insecticides against these pests was obtained earlier by Premachandra *et al.*, (2005), Prabhatkumar and Poehling (2007) and Nazier (2008). The treatment with chlorantraniliprole 18.5 SC @ 30 g a.i./ha was found to be next effective treatment incontrolling *Bemisia tabaci* and in preventing transmission of the begomovirus *Tomato yellow leaf curl virus* (TYVMV). These results are confirmatory which has been recommended by Schuster *et al.*, (2013).

The treatment with novaluron 10 EC @ 75 g a.i. /ha was noticed relative effective in reducing fruit borer and also affects nymphs of *Bemisia tabaci* population in present investigation. These observations are in conformity with those of Ishaaya *et al.*, (2011) who reported novaluron affects nymphs of *Bemisia tabaci* more than chlorofluazuron and teflubenzurons. Earlier workers Christopher and Cynthia (2007), Raghvani and Posiya (2006); Cordero *et al.*, (2006) and Ishaaya *et al.*, (1996) reported as novaluron as better treatments for controlling sucking pests.

### **Efficacy of insecticidal treatments against coccinellids (*Coccinella septempunctata* L.) on tomato**

The data in table 2 (Fig. 4) revealed that the population of lady bird beetle per five plants did not vary significantly at one day before spraying (pre-count) recording 3.80 to 4.27 LBB/five plants indicating their uniform distribution throughout the experimental plot. The coccinellids observed were *Cheilomenes sexmaculatus* (F.), *Coccinella septempunctata* (L.) among that *Coccinella septempunctata* (L.) was common in tomato field.

**Table.1** Effect of insecticidal treatments against sucking pests of tomato after sprays

Treatment	Av. number of aphids/3 leaves/plant			Av. number of white flies/3 leaves/plant			Av. number of thrips/3 leaves/plant			Yield (t/ha)
	3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS	
Chlorantraniliprole 18.5 SC @ 30 g a.i./ha	2.49 (1.66)	1.78 (1.44)	3.38 (1.93)	1.80 (1.44)	1.07 (1.21)	2.60 (1.70)	1.00 (1.20)	0.60 (1.04)	2.00 (1.57)	46.03
Flubendamide 39.35 SC @ 60 g a.i./ha	4.38 (2.16)	3.16 (1.86)	5.40 (2.41)	3.82 (2.06)	2.73 (1.76)	4.80 (2.28)	2.56 (1.73)	1.76 (1.49)	3.24 (1.92)	44.86
Emamectin benzoate 5 SG @ 10 g a.i./ha	4.56 (2.21)	3.38 (1.92)	5.60 (2.45)	4.00 (2.10)	2.91 (1.81)	4.93 (2.31)	2.76 (1.79)	1.96 (1.56)	3.40 (1.96)	40.21
Spinosad 45 SC @ 125 g a.i./ha	2.09 (1.53)	1.31 (1.28)	3.07 (1.85)	1.51 (1.33)	0.84 (1.11)	2.27 (1.60)	0.71 (1.07)	0.36 (0.91)	1.64 (1.45)	45.47
Indoxacarb 14.5 SC @ 40 g a.i./ha	4.67 (2.23)	3.51 (1.96)	5.76 (2.48)	4.18 (2.14)	3.04 (1.85)	5.09 (2.35)	2.98 (1.85)	2.16 (1.62)	3.62 (2.02)	34.92
Abamectin 1.9 EC @ 3 g a.i./ha	2.40 (1.63)	1.60 (1.38)	3.24 (1.90)	1.67 (1.40)	0.98 (1.17)	2.44 (1.66)	0.89 (1.15)	0.53 (1.01)	1.89 (1.53)	33.86
Novaluron 10 EC @ 75 g a.i./ha	4.24 (2.13)	3.02 (1.83)	5.29 (2.38)	3.67 (2.02)	2.62 (1.73)	4.62 (2.24)	2.22 (1.64)	1.44 (1.39)	3.04 (1.87)	44.00
Cypermethrin 25 EC @ 62.50 g a.i./ha	2.16 (1.56)	1.40 (1.32)	3.13 (1.87)	1.60 (1.37)	0.89 (1.12)	2.36 (1.63)	0.78 (1.10)	0.44 (0.96)	1.80 (1.50)	33.00
Untreated control	16.73 (4.15)	17.47 (4.23)	18.20 (4.32)	12.11 (3.55)	12.89 (3.65)	13.31 (3.71)	9.69 (3.17)	10.33 (3.27)	11.44 (3.44)	28.04
S.E. m. ±	0.15	0.15	0.14	0.16	0.13	0.14	0.15	0.14	0.14	1.47
C.D. at 5%	0.45	0.46	0.42	0.46	0.40	0.42	0.46	0.41	0.41	4.42

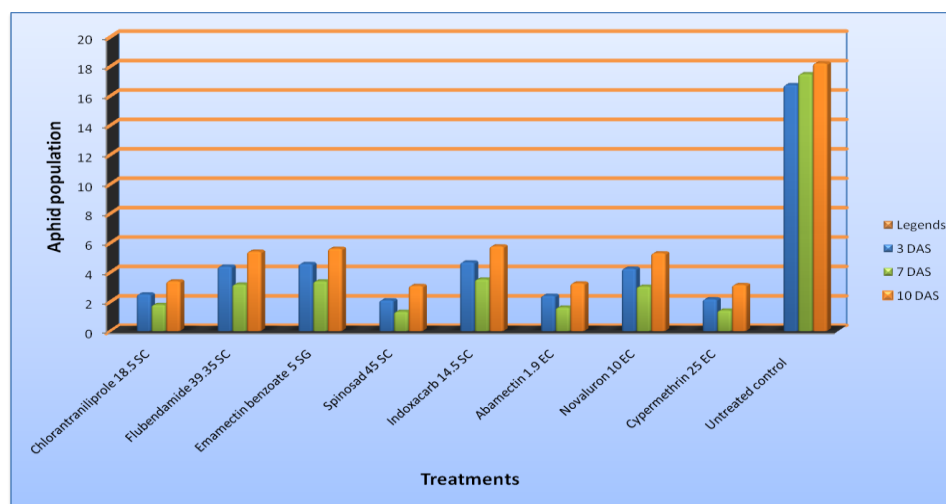
DAS: Days after spray, \* Figures in parentheses are  $\sqrt{n + 0.5}$  transformed values

**Table.2** Cumulative effect of insecticidal treatments on coccinellid beetles in tomato (Average of three sprays)

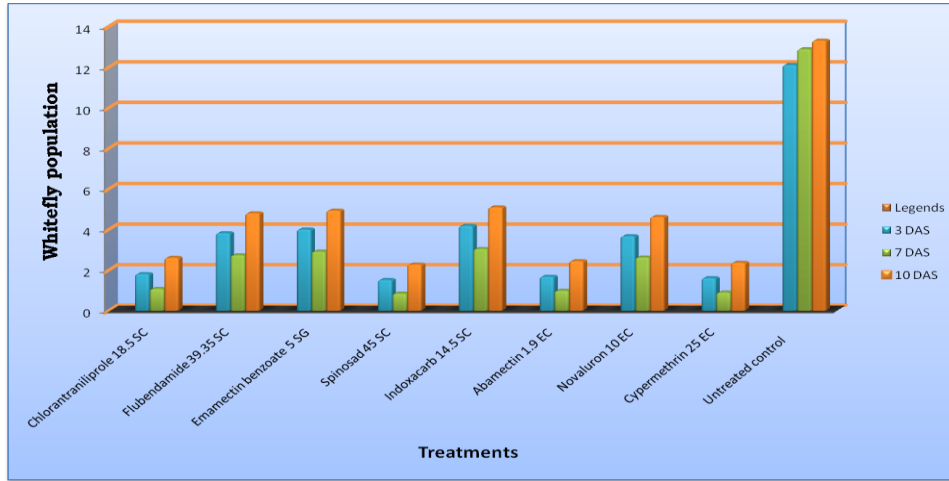
Sr. No.	Treatment	Av. Population of coccinellid beetles/5 plants		
		3 DAS	7 DAS	10 DAS
1	Chlorantraniliprole 18.5 SC @ 30 g a.i./ha	1.44 (1.38)	0.87 (1.16)	1.62 (1.45)
2	Flubendamide 39.35 SC @ 60 g a.i./ha	1.18 (1.28)	0.67 (1.08)	1.20 (1.30)
3	Emamectin benzoate 5 SG @ 10 g a.i./ha	1.04 (1.22)	0.45 (1.00)	1.07 (1.25)
4	Spinosad 45 SC @ 125 g a.i./ha	1.58 (1.43)	0.97 (1.22)	1.76 (1.50)
5	Indoxacarb 14.5 SC @ 40 g a.i./ha	0.67 (1.15)	0.44 (0.96)	0.93 (1.19)
6	Abamectin 1.9 EC @ 3 g a.i./ha	1.08 (1.40)	0.93 (1.19)	1.69 (1.48)
7	Novaluron 10 EC @ 75 g a.i./ha	1.33 (1.34)	0.80 (1.13)	1.51 (1.41)
8	Cypermethrin 25 EC @ 62.50 g a.i./ha	0.76 (1.09)	0.36 (0.92)	0.73 (1.10)
9	Untreated control	5.87 (2.51)	6.31 (2.60)	6.78 (2.69)
	S.E. m. ±	0.10	0.08	0.07
	C.D. at 5%	0.30	0.24	0.22

DAS: Days after spray, \* Figures in parentheses are  $\sqrt{n + 0.5}$  transformed values

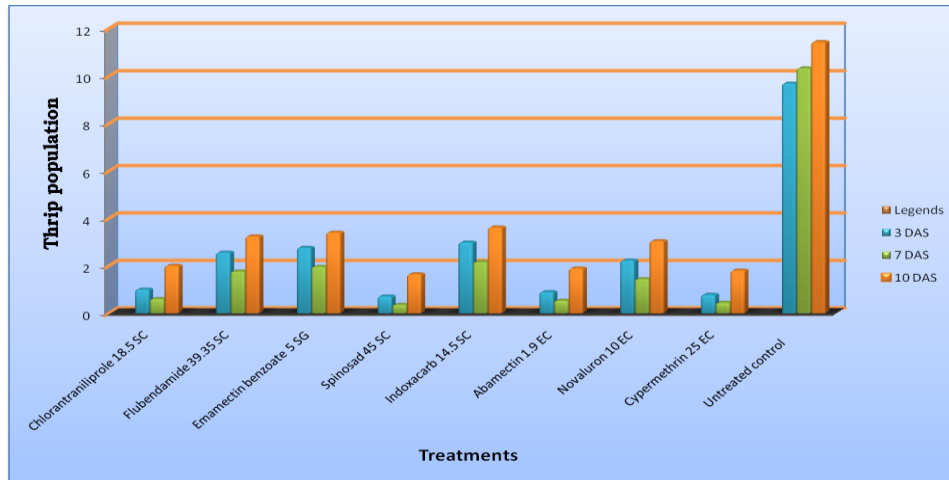
**Fig.1** Effect of newer insecticides against aphids (*A. gossypii*) on tomato (Average of three sprays)



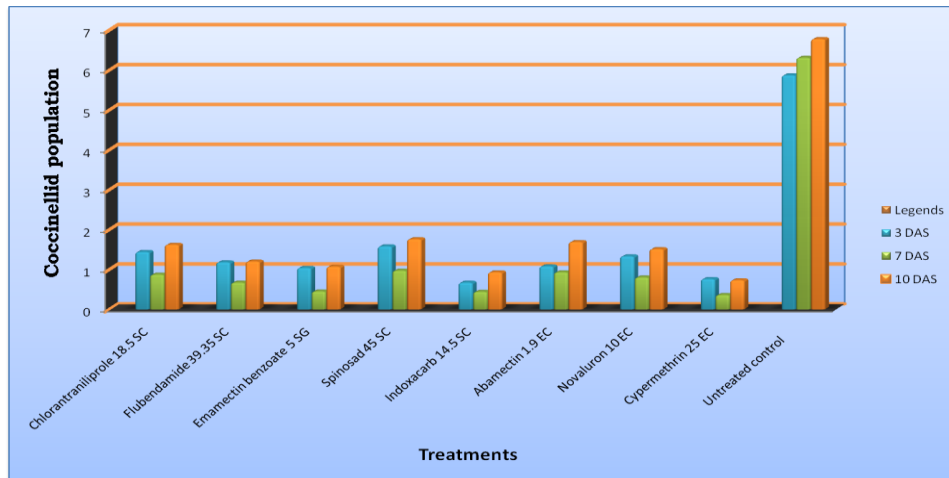
**Fig.2** Effect of newer insecticides against whiteflies (*B. tabaci*) on tomato (Average of three sprays)



**Fig.3** Effect of newer insecticides against thrips (*F. schultzei*) on tomato (Average of three sprays)



**Fig.4** Effect of insecticidal treatments on coccinellid beetles in tomato (Average of three sprays)



All the insecticidal treatments excluding, the treatment with indoxacarb 14.5 SC @ 40 g a.i./ha and cypermethrin 25 EC @ 62.50 g a.i./ha were found equally in cumulative effect at third days after spray and observed the population of coccinellids in the range (1.04-1.58 beetles) as against (5.87 beetles/5 plant) in untreated control. In cumulative impact on natural enemies at seventh and ten days after spray in the treatments with spinosad 45 SC @ 125 g a.i./ha, abamectin 1.9 EC @ 3 g a.i./ha, chlorantraniliprole 18.5 SC @ 30 g a.i./ha, novaluron 10 EC @ 75 g a.i./ha and flubendamide 39.35 SC @ 60 g a.i./ha was found more or less similar in all the treatments and are safest insecticides recorded the coccinellids population in the range 0.67 to 0.98 beetles/5 plants and 1.20 to 1.76 beetles/5 plants as against (6.31) and (6.78) beetles/5 plants in untreated control, respectively. The cumulative data on the abundance of coccinellids per five plants recorded for three sprays and it was revealed from that the treatment with cypermethrin was found to be the most toxic to predatory spiders while spinosad appeared to be the safest recording highest population of coccinellids (0.97 to 1.76) to that recorded in untreated plot (5.87 to 6.78) per five plant. Similar observations in respect of spinosad were also reported by earlier research workers like Duffle *et al.*, (1997); Murray and Lloyd (1997); Miles and Dutton (2000) and Medina *et al.*, (2002) reported that spinosad exhibited marginal to excellent selectivity to lady bird beetle.

Efficacy of novaluron also safer to natural enemies recommended by Murthy *et al.*, (2009), in the present study, the plot treated with cypermethrin 25 EC @ 62.50 g a.i./ha recorded least number of coccinellids per five plants. These results are in agreement with the earlier reports in respect of synthetic pyrethroids including cypermethrin causing higher mortality of spiders and other beneficial reported by Duffle *et al.*, (1997) and Murray and Lloyd (1997). The result of this study provided the useful information that the spinosad 45 SC @

125 g a.i./ha emerged as most effective treatment to reduce the aphid(2.09-3.07), whitefly (1.51-2.27), thrips (0.71-1.64) per three leaves/plant and it gave highest marketable yield of tomato(45.47 t/ha) it was followed by cypermethrin 25 EC @ 62.50 g a.i./ha, abamectin 1.9 EC @ 3 g a.i./ha and chlorantraniliprole 18.5 SC @ 30 g a.i./ha. Secondly the insecticides namely spinosad 45 SC @ 125 g a.i./ha (1.76) and, abamectin 1.9 EC @ 3g a.i./ha (1.69), chlorantraniliprole 18.5 SC @ 30 g a.i./ha (1.62) and novaluron 10 EC @ 75 g a.i./ha (1.51) were found safer to the predatory coccinellids. Whereas, flubendamide 39.35 SC @ 60 g a.i. /ha was moderately toxic to coccinellids. Cypermethrin 25 EC @ 62.50 g a.i. /ha was found detrimental to the natural enemies.

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