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RESEARCH PAPER

Efficacy of chemical insecticides against pomegranate aphid, *Aphis punicae* (Passerini) (Homoptera: Aphididae) in northern dry region during Ambe bahar

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Abstract : The pomegranate aphid, *Aphis punicae* (Passerini) (Homoptera: Aphididae) is one of the most important pests in Karnataka on pomegranate tree. The study presented in this paper was conducted during 2020 to compare the efficacy and selectivity of chemical insecticides (imidacloprid 17.8 SL, flonicamid 50 WG, acetamiprid 20 SP, thiamethoxam 25 WG, clothianidin 50 WDG and fipronil 5 SC) against *A. punicae*. The results revealed that the selected insecticides were effective in reducing the aphids population over untreated control. Among the different insecticides tested, highest per cent reduction of 87.48% was recorded in imidacloprid 17.8 SL followed by flonicamid 50 WG (85.00%), acetamiprid 20 SP (80.52%) and thiamethoxam 25 WG (78.86%). Whereas, the lowest of 63.01 per cent reduction of aphid was recorded in dimethoate 30 EC treated plot.

Key words: Aphid, *Aphis punicae,* Chemical insecticides, Efficacy, Pomegranate

Introduction

Pomegranate is one of the important fruit crops of India. The maximum area under cultivation is in Maharashtra and Karnataka. In Karnataka, Vijayapur and Bagalkot are the major districts producing pomegranate. The area under pomegranate cultivation, production and export of fruit from India has significantly increased in the last three decades because of its versatility, hardy nature, wider adaptability, drought resistance, higher yields, excellent keeping quality, remunerative prices, less requirement of water and availability of vegetatively propagated planting material (Patil and Karle, 1990). Pomegranate production is associated with many problems like non availability of suitable varieties, environmental vagaries, nutritional deficiencies, physiological disorders, post-harvest glut, post-harvest losses, improper storage, transportation facilities, lack of marketing facilities, price fluctuation and biotic constraints like pest and diseases. Among several factors, the losses due to pests and diseases are very high. The 25 to 30 per cent of total loss due to biotic constraints and it could not be managed effectively (Mote *et al.,* 1992 and Zirpe, 1966).

The pomegranate aphid, *Aphis punicae* (Passerini) (Hemiptera: Aphidiae) feeds on upper surface of the leaves of pomegranate. It also infests twigs and leaves of pomegranate. The aphid caused severe damage to flowers, fruits, twigs and leaves by de-sapping, which results in loss of quality of fruits and reduction in yield (Karuppuchamy *et al*., 1998). This was considered as minor pest of pomegranate. Since when this pest has assumed a serious form and it is occurring regularly throughout the year (Balikai *et al*., 2009). The aphids usually affect new flushes and suck cell sap. The affected parts get discoloured and disfigured. These insects secrete copious amounts of honey dew, on which sooty mold develops. It was also observed that aphid infestation resulted in significant flower and immature fruit drop (Sreedevi and Verghese, 2009). Among the various abiotic factors, minimum temperature and evening humidity influence aphids to the extent of 67 and 32 per cent, respectively. A high aphid activity was observed during the second fortnight of December onwards and reached the peak during the first fortnight of January (Kotikal *et al*., 2009). It is imperative to address the pest incidence during its peak occurrence without allowing it to reach the injury level. Though there are chemicals which have been recommended for the management of sucking pests in pomegranate, there is need to screen the new molecules for their efficacy and economic feasibility under field conditions. In this context, the present investigation was planned to study chemical insecticides in pomegranate for the effective management of *A. punicae* and to evaluate the influence of this molecules on yield and economics of pomegranate production.

Material and methods

The field experiment was laid out in completely randomized block design at farmers field, Managuli, Vijayapura, Karnataka during 2020-21. The pomegranate field of seven year old *var*. Bhagwa planted at 4.5 x 4.5 m spacing was selected. The experiment consisted of eight treatments including untreated check and each treatment was replicated thrice. Two plants of pomegranate were considered as one replication and tagged. Management practices were carried out by following all the recommended package of practices except the plant protection measures against aphids in the pomegranate gardens. Treatments were imposed with the help of knapsack sprayer. The first spray was taken up when the crop is uniformly infested by aphids population. Observation of aphids (nymphs and adults) were carried on ten randomly selected infested pomegranate plants. From each plant, three shoots of 5 cm length were considered and counts were taken on the average number of aphids per shoot. The count of aphids was made, one day before spraying and after treatment imposition at 1, 3, 5 and 10 days after spray. The subsequent spray was taken at 15 days interval. The data was subjected to ANOVA. Further, obtained data was converted into per cent reduction of pest population over control through following formula.

$$\text{Per cent reduction over control} = \frac{\text{Insect pest population in control- Insect pest population in treatment}}{\text{Insect pest population in control}} \times 100$$

Statistical analysis

The statistical analysis of the data was done by using analysis of variance (ANOVA) with Web Agri Stat Package (wasp-2) developed by ICAR, Central Costal Agriculture Research Institute, Goa. Data were transformed by square root transformation before subjecting to DMRT. The interpretation of data was done by using the critical difference was calculated at 0.05 probability level. The level of significance was expressed at 0.05 probability. After analysis, data was tabulated for interpretation of result.

Results and discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads:

Population of aphid (*Aphis punicae*)

First spray

A day before imposition of treatments there was non-significant difference among various treatments indicating the homogeneity in aphid population. The mean population varied from 38.47 to 39.01 aphids per shoot (Table 1).

One day after spraying the aphid population varied from 9.09 to 39.01 among different treatments; while it was 39.01 aphids per shoot in the untreated control. All the treatments were significantly superior over control in reducing the aphid population. The treatment with imidacloprid 17.8 SL was found to be significantly superior in reducing the aphid population from 38.67 to 9.09 per shoot. The next best treatments were flonicamid 50 WG (12.00 aphids/shoot), acetamiprid 20 SP (13.79 aphids/shoot), thiamethoxam 25 WG (14.05 aphids/shoot), clothianidin 50 WDG (20.25 aphids/shoot) and fipronil 5 SC (21.49 aphids/shoot). Dimethoate 30 EC was found to be least effective and recorded 24.97 aphids per shoot. Similar trend for aphids population was observed at three and five days after spraying.

At ten days after spray, aphids population increased slightly in all the treatments. All the treatments were retained its superiority over the control. The least number of aphids were recorded in imidacloprid 17.8 SL (4.25 aphids/shoot) which was on par with flonicamid 50 WG (4.78 aphids/shoot) and acetamiprid 20 SP (5.52 aphids/shoot).

Table 1. Efficacy of chemical insecticides against pomegranate aphids during *Ambe bahar* 2021

Treatments	Dosage (g or ml/l)	Number of Aphids / Shoot										Mean	Per cent reduction over control
		1st spray					2nd spray						
		1 DBS	1 DAS	3 DAS	5 DAS	10 DAS	1 DBS	1 DAS	3 DAS	5 DAS	10 DAS		
Acetamiprid 20 SP	0.2 g	38.98	13.79 (6.28)	9.88 (3.78)^{d}	5.21 (3.22)^{c}	5.52 (2.39)^{ef}	24.48 (2.45)^{d}	14.97 (4.99)	10.85 (3.93)^{d}	4.12 (3.37)^{d}	4.50 (2.15)^{c}	8.61 (2.24)^{c}	80.52
Imidacloprid 17.8 SL	0.3 ml	38.67	9.09 (6.26)	5.21 (3.09)^{e}	3.18 (2.39)^{d}	4.25 (1.92)^{f}	18.95 (2.18)^{d}	8.55 (4.41)	6.75 (3.01)^{e}	3.28 (2.69)^{e}	4.01 (1.94)^{d}	5.54 (2.12)^{d}	87.48
Flonicamid 50 WG	0.3 g	38.85	12.00 (6.27)	6.98 (3.54)^{d}	3.78 (2.73)^{d}	4.78 (2.07)^{f}	22.07 (2.30)^{d}	9.72 (4.75)	7.41 (3.20)^{e}	3.99 (2.81)^{e}	4.21 (2.12)^{d}	6.61 (2.17)^{d}	85.00
Fipronil 5 SC	1.0 ml	38.79	21.49 (6.27)	16.00 (4.69)^{c}	8.07 (4.06)^{b}	8.85 (2.93)^{c}	29.08 (3.06)^{bc}	20.52 (5.44)	15.68 (4.58)^{bc}	10.10 (4.02)^{c}	10.91 (3.26)^{c}	13.95 (3.38)^{c}	68.47
Clothianidin 50 WDG 0.17 g	39.01	20.25	15.35 (6.29)	7.92 (4.56)^{c}	8.42 (3.98)^{b}	28.32 (2.90)^{cd}	20.08 (2.99)^{c}	15.15 (5.37)	10.01 (4.54)^{c}	11.5 (3.96)^{c}	13.58 (3.24)^{c}	69.35 (3.46)^{c}	
Dimethoate 30 EC	1.8 ml	38.47	24.97 (6.24)	17.45 (5.05)^{b}	10.07 (4.24)^{b}	10.47 (3.25)^{b}	31.87 (2.62)^{b}	22.47 (5.69)	18.69 (4.79)^{b}	13.10 (4.38)^{b}	13.89 (3.69)^{b}	16.39 (3.79)^{b}	63.01
Thiamethoxam 25 WG 0.25 g	38.73	14.05	10.84 (6.26)	6.04 (3.81)^{d}	6.38 (3.37)^{c}	25.95 (2.56)^{de}	16.01 (2.62)^{d}	11.84 (5.14)	4.66 (4.06)^{d}	4.91 (3.51)^{d}	9.34 (2.27)^{d}	78.86 (2.33)^{d}	
Control	-	38.90	39.01 (6.28)	40.25 (6.29)^{a}	41.25 (6.38)^{a}	44.58 (6.46)^{a}	44.64 (6.71)^{a}	44.50 (6.72)	46.95 (6.71)^{a}	48.74 (6.89)^{a}	49.87 (7.02)^{a}	44.39 (7.1)^{a}	-
S.Em.±	-	NS	1.35	1.32	1.21	1.22	1.76	1.54	1.32	1.09	1.12	-	-
C D (P=0.05)	-	NS	4.05	3.96	3.63	3.66	5.30	4.63	3.98	3.29	3.38	-	-
CV (%)	-	8.10	9.92	10.76	8.03	10.01	11.10	8.41	9.78	10.67	9.47	-	-

Figures in parentheses are "x + 0.5 transformed values; Means in the columns followed by the same alphabet do not differ significantly by DMRT (P = 0.05); DBS-Day before spray; DAS-Days after spray;

The next best treatments in the order of control of aphid population were thiamethoxam 25 WG (6.38 aphids/shoot), clothianidin 50 WDG (8.42 aphids/shoot), fipronil 5 SC (8.85 aphids/shoot) and dimethoate 30 EC (10.47 aphids/shoot). On the contrary, the highest population of aphids was recorded in the untreated control (48.58 aphids/shoot) as compared to other treatments (Table 1)

Second spray

There was non significant difference among the treatments with respect to number of aphids per shoot before imposition of treatments and population varied from 18.95 to 44.64 aphids per shoot (Table 1).

All insecticidal treatments were found significantly superior over control in minimizing the pest incidence. The data recorded at one days after spraying (1 DAS) revealed that imidacloprid 17.8 SL treated plants showed lowest incidence of 8.55 aphids per shoot followed by flonicamid 50 WG (9.72 aphids/shoot) and acetamiprid 20 SP (14.97 aphids/shoot) which were statistically on par with each other and significantly superior over other test insecticides. thiamethoxam 25 WG (16.01 aphids/shoot), clothianidin 50 WDG (20.08 aphids/shoot) and fipronil 5 SC (20.52 aphids/shoot) showed as next best treatments. The maximum number of aphids population of 22.47 aphids per shoot were recorded in dimethoate 30 EC treated plant. Similar trend was also observed at three and five days after spraying.

The observations recorded on 10 DAS showed that imidacloprid 17.8 SL was the superior treatment (4.01 aphids/shoot) and it was on par with flonicamid 50 WG (4.21 aphids/shoot). The next promising treatments were acetamiprid 20 SP and thiamethoxam 25 WG which recorded 4.50 and 4.91 aphids per shoot, respectively. Whereas, dimethoate 30 EC treated plot showed maximum aphid population of 13.89 per shoot (Table 1).

Mean population and per cent reduction over untreated control

The data after pooling first and second spray, the selected insecticides were effective in reducing the aphids population over untreated control. The lowest number of aphids was recorded in imidacloprid 17.8 SL (5.54 aphids/shoot) followed by flonicamid 50 WG (6.61 aphids/shoot). Whereas, untreated control recorded the highest population of 44.39 aphids per shoot (Table 1).

Among the different treatments, highest per cent reduction of 87.48 was recorded in imidacloprid 17.8 SL followed by flonicamid 50 WG (85.00%), acetamiprid 20 SP (80.52%) and thiamethoxam 25 WG (78.86%). Whereas, the lowest of 63.01 per cent reduction of aphid was recorded in dimethoate 30 EC treated plot.

The present investigation is in line with Biradar and Shaila (2004) and Ananda *et al*. (2009) revealed that new generation insecticides *i.e*., imidacloprid and thiamethoxam were most effective in controlling pomegranate aphids than dimehoate. Neonicotinoids are insecticides that target insect nicotinic acetylcholine receptors (nAChRs), exhibiting high selective toxicity to insects over vertebrates and good systemic activity in crop plants. Bartual *et al*. (2012) also documented that neonicotinoid insecticides *viz*., imidacloprid, flonicamid and acetamiprid were more effective in controlling pomegranate aphids. Kambrekar *et al*. (2013); Mohammad *et al*. (2013) and Abd-Ella (2015) evaluated efficacy of imidacloprid, thiamethoxam, acetamiprid and flonicamid on mortality of pomegranate aphid and they also revealed that the sensitivity of the insects to the pesticides was *imidacloprid > thiamethoxam > acetamiprid > flonicamid.*

Conclusion

Pomegranate is an export oriented crop and it prone to attack by many sucking insect pests. These pests not only reduce the yield but also deteriorates the quality of fruits. Intensive cultivation of a fruit crop of ten leads to pest build up necessitating more rigid pest control. Pomegranate growers depend on insecticides for their management and take number of sprays at regular intervals that pose many problems including resistance to insecticides and resurgence of secondary pests. From the present study it was evident that evaluated chemicals were significantly effective against aphids. The minimum population of aphids was observed in plants treated with imidacloprid 17.8 SL @ 0.3 ml/l, flonicamid 50 WG @ 0.3 g/l, acetamiprid 20 SP @ 0.2 g/l, thiamethoxam 25 WG @ 0.25 g/l, clothianidin 50 WDG @ 0.17 g/l, fipronil 5 SC @ 1.0 ml/l and dimethoate 30 EC @1.8 ml/l.

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