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Efficacy of newer insecticides against pomegranate aphid (*Aphis punicae*)

Gaikwad DS, Lad AG, Fand DN, Randive DB, Hivre AD and Gawali SS

Abstract
During Hast Bahar 2022–2023 the field experiment was carried out on the Department of Horticulture, College of Agriculture, VNMKV, Parbhani farm to investigate the bio-efficacy of newer pesticides against pomegranate aphid and According to studies, the treatment that reduced the number of aphids the best was thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC. This was followed by flonicamide 50 WG and cyantraniliprole 10.26 OD, which showed that these insecticides were comparable to one another and somewhat more effective than the other spray treatments. *Verticillium* + *Beauveria* + *Metarhizium* (consortium) treated plants had the highest incidence of any treated plants.

Keywords: Management, pomegranate, *Aphis punicae*, flonicamide 50 WG, cyantraniliprole 10.26 OD

Introduction
Punica granatum L., often referred to as anar, dalim, or dalimbe, is a highly versatile subtropical minor fruit crop that is a member of the Punicaceae family, one of the smallest plant families. The pomegranate originated in Iran and was introduced to the Mediterranean region before 2000 BC, whence it was initially farmed (Evereinoff, 1949) [6]. Due to its drought-tolerant hardiness, low maintenance requirements, consistent and good yields, fine table and therapeutic qualities, improved quality retention, and ability to be placed in rest during periods of low irrigation potential, pomegranate cultivation is unique in its own right, especially in the hot, semi-arid, and desert regions of India such as Maharashtra, Uttar Pradesh, Andhra Pradesh, Gujarat, Karnataka, and Tamil Nadu where cultivation has spread.
An An extensive review of the literature found that 91 insects, 6 mites, and 1 snail pest were feeding on the pomegranate crop in India. *Deudorix* (*Virachola) isocrates* (Fab.), the most poisonous adversary of the pomegranate butterfly, has the ability to destroy over 50% of the fruits. Many serious issues have resulted from the overuse and improper application of insecticides, including mealy bugs *Pseudococcus lilacinus* (Cockerell), *Anaphothrips oligochaetus* (Karny), mites *Aceriagranati Can. & Massal; Oligonychus punicae (Hirst.);* aphids *Aphis punicae* (Passerini), Thrips *Rhipiphorothrips cruentatus* (Hood), *Scirtothrips dorsalis* (Hood), and whiteflies (Pomegranate whitefly, *Siphoninus phillyreae* (Haliday). These sucking pests attack the crop during its flowering and fruiting stages, weakening the plant's resistance to disease and producing honeydew on its leaves.
The pomegranate-infesting *A. punicae* (Passerine) species of aphids is a polyphagous pest that has been shown to harm a number of seasonal field crops, vegetables, and fruit crops. Adults and nymphs alike siphon off the cell sap from many plant components, including fruits. It is also known to influence the plant's photosynthetic activity by drawing sooty mold, which grows on the secreted honey dew. According to Butani (1979) [4] *A. punicae*, the pomegranate aphid, is a significant sucking pest that severely damages flower buds, flowers, fruits, twigs, and leaves by desapping, which causes a loss of fruit that is both quantitative and qualitative. The afflicted areas become deformed and discolored. It releases a honey dew that fosters the growth of sooty mold. According to Biradar and Shaila (2004) [3], there has been a recent.

Materials and Methods
The Department of Horticulture, College of Agriculture, VNMKV, Parbhani (19.250 0 N latitude and 76.78 0 E longitude) conducted field experiments on the bioefficacy of newer insecticides against pomegranate aphid during hast bahar 2022–2023 with an established pomegranate orchard (variety Bhagwa) with spacing 4 x 4 m. The experiment was set up with eight treatments replicated three times using Randomized Block Design (RBD).

Treatment details of insecticides against aphid

Tr. no.	Treatments	Dose (ml/10 lit.)
T_1	Cyantraniliprole 10.26% OD	15
T_2	Chlorantraniliprole	3.0
T_3	Spinetoram	8.4
T_4	Spinosad 45% SC	3.2
T_5	Thiamethoxam + Lambda cyhalothrin 5% EC	4.0
T_6	Flonicamid 50% WG	3.0
T_7	*Verticillium* + *Beauveria metarhizium* (consortium)	40
T_8	Water spray/ Untreated Control	-

Application of insecticides

When insect pests started to appear in the pomegranate orchard, insecticides were administered in the recommended dosages. By applying plain water to a control plot, the amount of spray water to use before applying an insecticidal treatment was determined. In order to escape the midday heat, the spraying was done early in the morning. A measured amount of pesticides was placed in a 500 ml beaker, combined with a small amount of water, and then transferred to a spray tank that already contained a known amount of water.

Method of observations

From the net plot of each treatment in each replication, one observation plant was chosen at random, and four twigs (10 cm each) of the plant were labeled appropriately to reflect the four orientations (i.e. East, West, South & North). The total number of aphid nymphs and adults was counted one day prior to, as well as one, three, seven, and fourteen days following the administration of insecticides.

Results and Discussion

Bio-efficacy of newer insecticides against aphids infesting pomegranate

A. Performance after first spray

Before initiation of insecticidal spray treatments, the mean pre count of aphids ranged from 9.50 to 17.50 aphids/10 cm twig,

The data recorded at 1 DAS revealed that thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC treated plants showed lowest incidence (2.50 aphids/10 cm twig) and it was significantly superior over other test insecticides.

At 3 DAS, treatment with thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC (3.58 aphids/10 cm twig) and flonicamid 50 WG (3.78 aphids/10 cm twig) showed that lowest incidence and were statistically at par with each other.

The observations recorded on 7 DAS showed that thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC (3.97 aphids/10 cm twig), flonicamid 50 WG (4.08 aphids/10 cm twig) and Cyantraniliprole 10.26 OD (5.90 aphids/10 cm twig) were equally effective.

The data recorded on 14 DAS showed that thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC was the most superior treatment (5.45 aphids/10 cm twig) followed by flonicamid 50 WG (6.08 aphids/10 cm twig), Cyantraniliprole 10.26 OD (7.80 aphids/10 cm twig) and Spinosad 45 SC (9.75 aphids/10 cm twig) showing no statistical difference in their efficacy.

B. Performance after second spray

The aphid population recorded from untreated control plants was ranged between 9.50 and 17.50 aphids/10 cm twig over a period of 14 days. All insecticidal treatments were significantly superior over untreated control in minimizing the pest incidence.

The data recorded at 1 DAS revealed that thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC treated plants showed minimum infestation (2.20 aphids/10 cm twig) followed by flonicamid 50 WG (2.35 aphids/10 cm twig) and Cyantraniliprole 10.26 OD (3.92 aphids/10 cm twig) which were statistically at par with each other and significantly superior over other test insecticides.

The data recorded on 3 DAS showed that thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC was the most superior treatment (2.25 aphids/10 cm twig) followed by flonicamid 50 WG (2.50 aphids/10 cm twig), Cyantraniliprole 10.26 OD (4.05 aphids/10 cm twig) and Spinosad 45 SC (5.15 aphids/10 cm twig). These treatments were at par with each other.

At the 7 DAS, treatment with Thiamethoxam 12.60 + Lambda cyhalothrin 9.50 ZC was the most superior treatment (2.83 aphids/10 cm twig) followed by flonicamid 50 WG (3.17 aphids/10 cm twig).

The data recorded on 14 DAS showed that thiamethoxam 12.60 + lambda cyhalothrin 9.50 ZC was the most effective treatment (3.93 aphids/10 cm twig) followed by flonicamid 50 WG (4.77 aphids/10 cm twig), Cyantraniliprole 10.26 OD (6.65 aphids/10 cm twig) and Spinosad 45 SC (8.75 aphids/10 cm twig). These first three treatments were statistically equivalent with each other in minimizing the aphids population.

C. Performance after second spray

The population of aphids in untreated plants was 9.50 to 17.50 aphids/10 cm twig. All insecticidal treatments were significantly superior over untreated control in minimizing the pest incidence.

The data recorded at 1 DAS revealed that Thiamethoxam 12.60 + Lambda cyhalothrin 9.50 ZC treated plants showed lowest incidence (1.10 aphids/10 cm twig). It was followed by flonicamid 50 WG (1.32 aphids/10 cm twig) and Cyantraniliprole 10.26 OD (1.94 aphids/10 cm twig) which was statistically at par with Thiamethoxam 12.60 + Lambda cyhalothrin 9.50 ZC

On 3 DAS, treatment with Thiamethoxam 12.60 + Lambda cyhalothrin 9.50 ZC (1.21 aphids/10 cm twig), flonicamid 50 WG (1.85 aphids/10 cm twig) and Cyantraniliprole 10.26 OD (2.21 aphids/10 cm twig) were statistically similar in managing this pest.

The observations taken at 7 and 14 DAS clearly indicated that Thiamethoxam 12.60 + Lambda cyhalothrin 9.50 ZC (1.42 and 2.20 aphids/10 cm twig) It was followed by flonicamid 50 WG (2.20 and 2.42 aphids/10 cm twig) and Cyantraniliprole 10.26 OD (3.41 and 3.93 aphids/10cm twig) these were the most promising treatments to control aphids infesting pomegranate which were indicated that these insecticides were at par with each other and comparatively more effective than rest of the spray treatments. Highest incidence amongst the treated plants was found on the plants treated with *Verticillium* + *Beauveria* + *Metarhizium* (consortium).

The current findings are contrasted with the findings of past studies on the chemical management of pomegranate aphids (*A. punicae*), which are a pest of numerous field crops. Aphids infesting pomegranates were found to be effectively controlled by spraying thiamethoxam 25 WG @ 0.2 g/L and imidacloprid 200 SL 0.25 ml/L (Ananda *et al*., 2009) [1]. Jadhav (2015) noted that the treatments consisting of clothianidin 50 WDG @ 20 g a.i./ha, thiamethoxam 25 WG @ 25 g a.i./ha, imidacloprid 17.8 SL @ 25 g a.i./ha, and fipronil 5 SC @ 50 g a.i./ha were the most effective against

pomegranate aphids at 14 DAS and up.

Krambekar *et al*. (2013) [7] reported that new compounds, thiamethoxam 25 WG @ 0.2 g/l and imidacloprid 70 WG 0.2 g/l, were the most effective against aphids, *A. punicae* infesting pomegranate. Dongarjal (2017) [5] discovered that clothianidin (20 g a.i./ha), thiamethoxam (25 g a.i./ha), and flonicamid (50 g a.i./ha) were equally effective in controlling the A. punicae population that was infesting pomegranates., According to Jadhao *et al.* (2019) [8], imidacloprid and thiamethoxam were the next two novel compounds discovered, after clothianidin. The most effective treatment against aphids was dinofuran; pomegranate-infesting *Aphis punicae* was found to be least effective, although lamdacyhalothrin was shown to be significantly superior to control. Khandare, *et al* (2019) [10] The most effective treatment for lowering the population of aphids, according to the data, was thiamethoxam 25 WG @ 50 g a.i./ha, followed by Flonicamide 50 WG @ 75 g a.i./ha and fipronil 5 SC @ 75 g a.i./ha. Regarding the protection of pesticides against natural enemies, the course of treatment included.

Table 1: bio-efficacy of newer insecticides against aphids infesting pomegranate (Hasta bahar 2022-23)

sr. no	Treatments	Conc. (%)	Pre-count	Average no of Aphids / 10 cm twig											
				1st spray				2nd spray				3rd spray			
				1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
T_1	Cyantraniliprole 10.26% OD	0.006	11.50 (3.40)	4.40 (2.18)	4.70 (2.26)	5.90 (2.51)	7.80 (2.80)	3.92 (2.09)	4.05 (2.10)	4.50 (2.22)	6.95 (2.72)	1.94 (1.55)	2.21 (1.64)	3.41 (1.95)	3.93 (2.10)
T_2	Chlorantraniliprole 10.26% OD	0.015	9.80 (3.68)	6.30 (2.60)	6.60 (2.64)	7.90 (2.90)	10.45 (3.28)	5.68 (2.47)	5.91 (2.51)	6.67 (2.66)	9.20 (3.11)	5.17 (2.37)	5.35 (2.40)	6.25 (2.59)	8.52 (2.99)
T_3	Spinetoram 11.70 SC	0.010	13.50 (4.00)	6.10 (2.56)	6.78 (2.70)	7.80 (2.88)	10.35 (2.28)	5.38 (2.42)	5.59 (2.43)	6.50 (2.64)	8.40 (2.97)	4.91 (2.33)	5.05 (2.34)	6.10 (2.56)	7.80 (2.87)
T_4	Spinosad 45% SC	0.015	11.00 (4.11)	5.85 (2.48)	6.10 (2.56)	7.27 (2.78)	9.75 (3.20)	5.08 (2.36)	5.15 (2.37)	5.60 (2.46)	8.75 (3.04)	3.40 (1.96)	3.45 (1.97)	5.13 (2.36)	5.51 (2.44)
T_5	Thiamethoxam 12.60% + Lambda cyhalothrin 9.50% ZC	0.018	12.50 (3.65)	2.50 (1.72)	3.58 (2.01)	3.97 (2.10)	5.45 (2.44)	2.20 (1.60)	2.25 (1.66)	2.83 (1.79)	3.93 (2.09)	1.10 (1.25)	1.21 (1.30)	1.42 (1.38)	2.20 (1.62)
T_6	Flonicamid 50% WG	0.015	10.25 (3.57)	3.33 (1.95)	3.78 (2.06)	4.08 (2.13)	6.08 (2.56)	2.35 (1.69)	2.50 (1.72)	3.17 (1.88)	4.77 (2.29)	1.32 (1.33)	1.85 (1.51)	2.20 (1.62)	2.42 (1.68)
T_7	*Verticillium* + *Beauveria* + *metarhizium* (consortium)	40	17.50 (3.77)	6.60 (2.66)	6.97 (2.73)	7.80 (2.78)	10.57 (3.32)	6.10 (2.57)	6.52 (2.65)	6.87 (2.71)	9.51 (3.16)	5.70 (2.48)	6.18 (2.58)	6.85 (2.70)	8.65 (3.02
T_8	Water spray/ Untreated Control	-----	9.50 (3.72)	9.50 (3.16)	10.00 (3.22)	11.80 (3.48)	12.47 (3.60)	10.05 (3.23)	10.59 (3.33)	12.50 (3.59)	13.63 (3.73)	10.63 (3.33)	11.25 (3.43)	13.00 (3.67)	14.15 (3.82)
S.E +			0.265	0.155	0.169	0.176	0.217	0.146	0.178	0.186	0.194	0.151	0.151	0.155	0.159
C.D. at 5%			NS	0.471	0.513	0.533	0.658	0.441	0.541	0.564	0.590	0.459	0.458	0.469	0.483
C.V %			12.27	11.62	11.25	12.28	12.23	13.17	12.91	11.66	13.06	12.66	12.20	11.38	10.75

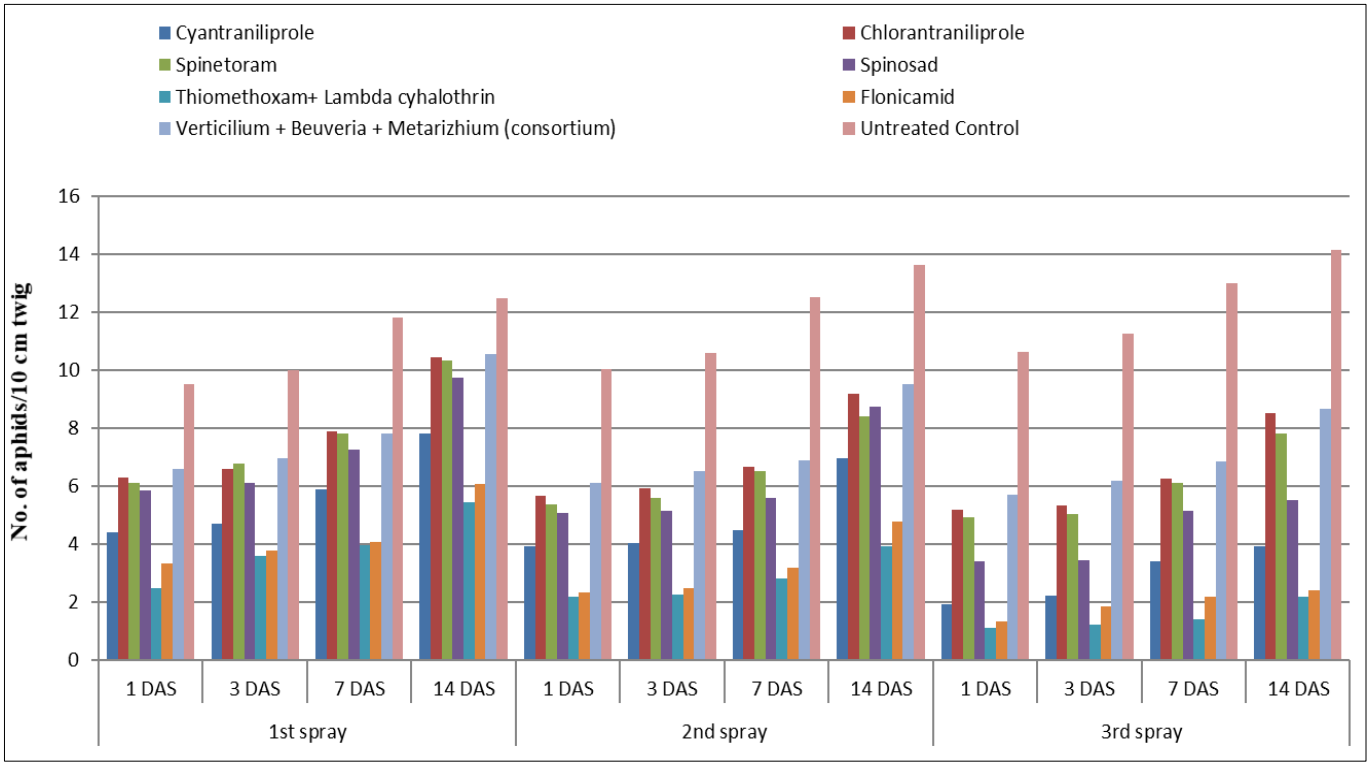

Fig 1: Bio-efficacy of newer insecticides against aphids infesting pomegranate (Hasta bahar 2022-23)

Summary and Conclusion

According to the trial's findings Thiamethoxam 12.60 + Lambda cyhalothrin 9.50 ZC, flonicamid 50 WG, and cyantraniliprole 10.26 OD were the most effective

insecticides to reduce the incidence of pomegranate aphids and they were statistically at par with each other for in managing pomegranate aphid

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