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Pomegranate aphid management with insecticides

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Abstract
A field trial was conducted to management pomegranate aphids *Aphis punicae* Passerine through newer insecticides at Central Horticultural Nursery, Department of Horticulture Vasantrao Naik Marathwada Krishi Vidhyapeeth, Parbhani, Maharashtra. The efficacy insecticides *viz*., clothianidin 50 WDG, thiamethoxam 25 WG, imidacloprid 17.8 SL, fipronil 5 SC, acetamiprid 20 SG, nitenpyram 10 WSG, thiacloprid 21.7 SC, spinosad 45 SC, lamdacyhalothrin 5 EC and dinotefuran 20 SG revealed that all these were significantly superior. The most effective was clothianidin followed by thiamethoxam and imidacloprid. Dinotefuran and lamdacyhalothrin was found least effective but it was significantly superior over control.

Keywords: *Aphis punicae*, clothianidin, thiamethoxam, imidacloprid

Introduction
Pomegranate (*Punica granatum* L.) is one of the most adaptable subtropical minor fruit crops, commonly known as *anar*, *dalim* or *dalimbe*. It belongs to one of the smallest families of plant kingdom. Punicaceae. Pomegranate is native to Iran, where it was first cultivated around 2000 BC and spread to the Mediterranean countries (Evereinoff, 1949) [6]. It is extensively cultivated in Spain, Morocco, Egypt, Iran, Afghanistan, Arabia and Baluchistan. Its cultivation spread further to other countries like China, Japan, USA, USSR, Pakistan and India. During 1986, the area under pomegranate cultivation in India increased was due to the introduction of high yielding soft seeded variety "*Ganesh*" in the states of Maharashtra, Karnataka and Gujarat (Bose, 1986) [4]. The species of aphids (*Aphis punicae* Passerine.) infesting pomegranate is a polyphagous pest known to cause damage to several seasonal field crops, vegetables and fruit crops. Both nymphs and adults of aphids feed by sucking type of mouth parts. They lacerate the surface of developing fruiting parts and cause deformation showing corcky appearance on surface of fruits which ultimately deteriorate the quality, fetching low price in domestic market and not accepted for export.

Materials and Methods
The field experiments on efficacy of newer insecticides against aphids, *Aphis punicae* Passerine of pomegranate were conducted during the *Ambia* and *Hasta* bahar season of 2014 on a five year old orchard of '*Bhagava*' variety with eleven treatment was laid out in a randomized block design and replicated thrice at Central Horticulture Nursery, Department of Horticulture, VNMKV, Parbhani. With the initiation of aphids infestation, the first spray of insecticidal treatment was applied followed by two sprays at an interval of 15 days. The live populations of aphid (nymphs and adults) were recorded on four fruiting twigs representing four directions of each treatments plot. Two plants were selected as one treatment and over all eight fruiting twigs were observed. The count of aphids was recorded one day prior to spray and subsequently at 1, 3, 7 and 14 days after each spray.
The spray volume for treatment application was calibrated by spraying control plants with plain water. Spraying was taken up early in the morning hours. The required quantity of insecticide was mixed in small quantity of water in a beaker and then added to the bucket containing required volume of water. Spraying was done using high volume knapsack sprayer with hollow cone nozzle.

Statistical analysis
The data obtained on population of major sucking pests and natural enemies (mean no. per twig) was compiled.

The data obtained were subjected to √X+0.5 transformations before analysis. The analysis of pooled data of two seasons (*Ambia* and *Hasta bahar* 2014) was carried out to ascertain the relative efficacy of the insecticidal treatments against aphid and thrips. Appropriate statistical methods were employed to work out standard error (SE) and critical difference (CD) for deciding the significance of treatments (Gomez and Gomez, 1984) [7].

Results and Discussion

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

a. Overall efficacy against pomegranate aphids *A. punicae* based on pooled data - *Ambia* and *Hasta bahar* -2014

Pooled data on incidence of aphids (No./fruit) of two seasons *viz.*, *Ambia* and *Hasta bahar* -2014 are presented in Table 1. The pre-treatment count of aphids before initiation of the spray treatments was in the range of 10.47 to 14.04 aphids/fruit. Based on the mean of three sprays of both the years, the post-treatment counts of aphid population on untreated control plants were 10.69, 10.78, 10.96 and 12.05 aphids/fruit on 3, 7, 10 and 14 days after spray (DAS), respectively. The aphid incidence in all insecticidal treatments was significantly low indicating that all the insecticides were significantly effective against aphids. The treatments comprised of clothianidin 50 WDG @ 20 g a.i. ha^{-1} (4.49 aphids/fruit), thiamethoxam 25 WG @ 25 g a.i. ha^{-1} (4.75 aphids/fruit), imidacloprid 17.8 SL @ 25 g a.i. ha^{-1} (5.28 aphids/fruit) and fipronil 5 SC @ 50 g a.i. ha^{-1} (6.15 aphids/fruit) were the most effective treatments at 14 DAS followed by and were at par with each other. The graphical comparison of spray treatments based on the incidence of aphids is depicted in Fig. 1. The other insecticides evaluated for their efficacy against aphids also minimized the incidence and the order of effectiveness was acetamiprid @ 20 g a.i. ha^{-1} (6.32 aphids/fruit) > nitenpyram 10 WSG @ 100 g a.i. ha^{-1} (7.23 aphids/fruit) > thiacloprid 21.7 SC @ 27 g a.i. ha^{-1} (7.39 aphids/fruit) > spinosad 45 SC @ 100 g a.i. ha^{-1} (7.66 aphids/fruit) > lamdacyhalothrin 5 EC @ 11 g a.i. ha^{-1} (7.98 aphids/fruit) and there was no statistical difference indicating that these products can be used against aphids on pomegranate crop. Whereas, dinetofuran 20 SG @ 50 g a.i. ha^{-1} was the least effective treatments recording maximum incidence of 8.53 aphids/fruit.

Considering the typical damage caused by aphids on developing fruits of pomegranate responsible for loss in the economic yield of the crop, spraying of these molecules *viz.*, clothianidin @ 25 g a.i. ha^{-1}, thiamethoxam 25 WG @ 25 g a.i. ha^{-1}, imidacloprid @ 25 g a.i. ha^{-1}, fipronil 5 SC @ 50 g a.i. ha^{-1}, acetamiprid @ 20 g a.i. ha^{-1}, nitenpyram 10 WSG @ 100 g a.i. ha^{-1}, thiacloprid 21.7 SC @ 27 g a.i. ha^{-1}, spinosad 45 SC @ 100 g a.i. ha^{-1}, lamdacyhalothrin 5 EC @ 11 g a.i. ha^{-1} and dinetofuran 20 SG @ 50 g a.i. ha^{-1} can be effectively advocated in spray schedules against pomegranate aphids. However, the interval between two sprays should be reduced to 10 days, except clothianidin and thiamethoxam since, aphid population in other treatments raised > 5.00 aphids/fruit at 10 DAS.

The reports of earlier researchers on chemical control of pomegranate aphids (*Aphis punicae*) infesting many field crops are discussed here. Spraying of thiamethoxam 25 WG @ 0.2 g/L and imidacloprid 200 SL 0.25 ml/L was reported to be effective against aphids (Ananda *et al.*, 2009) [2]. In the present study the new compounds clothianidin, thiamethoxam, imidacloprid and fipronil were found better and more consistent against aphids. These compounds are basically claimed to be effective against aphids on other crops as well (Mishra *et al.*, 2002; Dhandapani *et al*., 2002; Patil *et al.*, 2002 and Zade, 2010) [10, 5, 12, 14]. In studies conducted by Biradar and Shaila, (2004) [3] spraying of imidacloprid 05 ml/L at 15 days interval was found effective against cotton aphids. Several other insecticides have shown better efficacy against aphids infesting other field crops (Raghuraman *et al*, 2008; Mohammad Rouhani *et al.*, 2013; Jemimah *et al.*, 2013) [13, 11, 8]. Krambekar, *et al*. (2013) [9] reported that new compounds, thiamethoxam 25 WG @ 0.2 g/l and imidacloprid 70 WG 0.2 g/l were most effective against aphids, *Aphis punicae* infesting pomegranate. Ahmad *et al*,. (2014) [1] revealed that nitenpyram 10 SL, thiacloprid 480 SC, imidacloprid 200 SP and acetamiprid 20 SL were highly effective in controlling sucking insect pests of cotton. The insecticide molecules tested in the present investigation are designated as newer insecticides. Organophosphate insecticides are banned in many developed countries due to their greater risk to user, environment, non-targets, natural enemies and high levels of residues. The test insecticides are the compounds which are effective at low doses, have low impact on human health, environment and non-targets. They have low potential for development of pest resistance and are IPM compatible.

These are compounds belonging to different groups *viz.*, Neonecotenoid – acetamiprid, dinotefuron, clothianidin, thiamethoxam, thiacloprid and nitenpyram, chloronecotinyl neonicotinoid-imidacloprid, phenylpyrazole - fipronil, naturayte - macrocyclic lactone – spinosad and synthetic pyrethroid – lamdacyhalothrin. These compounds are systemic in their mode action against the target pest except lamdacyhalothrin that affects the sucking insect by strong contact action. Aphids, with their piercing and sucking type of mouth parts feed on the cell sap from the developing leaves of pomegranate and also secrete honey dew on which the black sooty mould grows and adversely affect the photosynthesis of the crop.

The tested insecticides were found effective on this pest. However, clothianidin, thiamethoxam, imidacloprid and fipronil were highly effective. However, the rest of the molecules also proved their efficiency against this pest. These molecules are selective, environmentally safe due to low persistence, less harmful to non-targets. Moreover, these test molecules can be advocated to the growers but the spray interval between two successive sprays should be reduced to 10 days except clothianidin, thiamethoxam, imidacloprid and fipronil because rest of the molecule could not Proved it's persistence at 14 DAS.

Table 1: Overall efficacy of newer insecticides against aphids on pomegranate based on pooled data (*Ambia* and *Hasta* bahar 2014)

Treatments	Dose g.a.i/ha	Pre-count	Average no. of aphids/fruit			
			1 DAS	3 DAS	7 DAS	14 DAS
T_1 Clothianidin 50 WDG	20	10.47 (3.34)	1.32 (1.15)	1.33 (1.15)	2.28 (1.51)	4.49 (2.12)
T_2 Acetamiprid 20 SG	20	10.98 (3.31)	1.73 (1.32)	1.76 (1.33)	3.22 (1.79)	6.32 (2.51)
T_3 Dinotefuran 20 SG	50	11.91 (3.45)	2.37 (1.54)	2.81 (1.68)	4.60 (2.15)	8.53 (2.92)
T_4 Nitenpyram 10 WSG	100	11.85 (3.44)	1.80 (1.34)	1.86 (1.36)	3.39 (1.84)	7.23 (2.69)
T_5 Thiacloprid 21.7 SC	27	11.88 (3.45)	1.97 (1.40)	1.94 (1.39)	3.53 (1.88)	7.39 (2.72)
T_6 Thiamethoxam 25 WG	25	11.01 (3.32)	1.46 (1.21)	1.53 (1.24)	2.67 (1.64)	4.75 (2.18)
T_7 Imidacloprid 17.8 SL	25	11.18 (3.34)	1.53 (1.24)	1.58 (1.26)	2.78 (1.67)	5.28 (2.30)
T_8 Fipronil 5 SC	50	11.32 (3.36)	1.64 (1.28)	1.68 (1.30)	2.94 (1.72)	6.15 (2.48)
T_9 Lamdacyhalothrin 5 EC	11	11.51 (3.39)	2.25 (1.50)	2.64 (1.62)	3.99 (2.00)	7.98 (2.82)
T_{10} Spinosad 45 SC	100	11.54 (3.40)	2.06 (1.43)	2.03 (1.43)	3.78 (1.94)	7.66 (2.77)
T_{11} Untreated control	-	14.04 (3.75)	10.69 (3.27)	10.78 (3.28)	10.96 (3.31)	12.05 (3.47)
S.E. +	-	0.33	0.13	0.09	0.14	0.12
C.D. at 5%	-	NS	0.39	0.26	0.43	0.38

*Figures in parentheses are root transformation *DAS: Days After Spray * NS: Non Significant

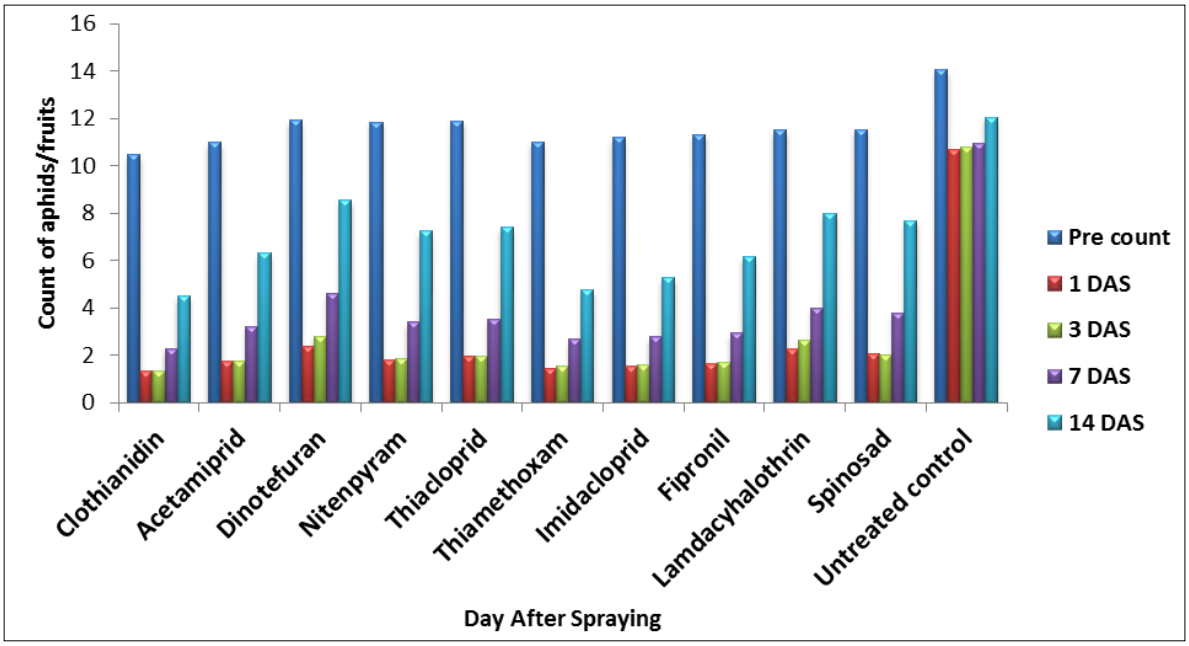

Fig 1: Overall efficacy of newer insecticides against aphids on pomegranate– *Ambia* and *Hasta bahar*- 2014

Conclusions

Pomegranate crop is prone to attack by many insect pests particulary, aphids, *Aphis punicae* These pests not only reduce the yield but also deteriorates the quality of fruits. Intensive cultivation of a fruit crop often 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. The present study was designed to study the bioefficacy of acetamiprid, clothianidin, dinotefuran, fipronil, imidacloprid, lambda-cyhalothrin, nitenpyram, spinosad, thiamethoxam and thiacloprid against infestation of aphids on pomegranate.

Efficacy of newer insecticides against pomegranate aphids

Ten insecticides acetamiprid 20 SP 20 g a.i. ha^{-1}, clothianidin 50 WDG 20 g a.i. ha^{-1}, dinotefuran 20 SG 50 g a.i. ha^{-1}, fipronil 5 SC 50 g a.i. ha^{-1}, imidacloprid 17.8 SL 25 g a.i. ha^{-1}, lambda-cyhalothrin 5 EC 11 g a.i. ha^{-1}, nitenpyram 10 WSG 100 g a.i. ha^{-1}, spinosad 45 SC 100 g a.i. ha^{-1}, thiamethoxam 25 WG 25 g a.i. ha^{-1} and thiacloprid 21.7 SC 27 g a.i. ha^{-1} were studied for their bioefficacy against aphids on developing fruits of pomegranate during *Ambia* and *Hasta bahars* of 2014. The count of aphids in the insecticide treatments was significantly lower indicating that all evaluated insecticides were significantly effective against both the pests. The minimum population of aphids was observed in plants treated with clothianidin 50 WDG @ 20 g a.i. ha^{-1} followed by thiamethoxam 25 WG @ 25 g a.i. ha^{-1}, imidacloprid 17.8 SL @ 25 g a.i. ha^{-1} and fipronil 5 SC @ 50 g a.i. ha^{-1}. These treatments were found most significant in controlling aphids and at par with each other.

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