

Research Article

Seasonal incidence and natural enemy complex of aphid, *Aphis punicae* Passerini (Hemiptera: Aphididae) infesting pomegranate in Kashmir

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ABSTRACT: Survey on the pest incidence of pomegranate aphid (*Aphis punicae*) and natural enemies associated with it was conducted during 2016 at four locations each in district Srinagar and Baramulla. The studies revealed that the highest mean population of aphids/shoot (33.99) was recorded in Srinagar, whereas, in Baramulla lower population of aphids/shoot (24.10) was recorded in comparison to Srinagar. Data further revealed that among different locations of Srinagar, highest average number of aphids/shoot (40.30) was observed at CITH and minimum (27.54) in Botakadal. Similarly, in district Baramulla highest mean number of aphids/shoot (27.63) was recorded at Sopore, whereas the lowest mean population (21.11/shoot) was observed at Dangerpora. The pest started its activity in 1st week of April and reached to its peak in the 2nd week of May in both the districts. Thereafter, the population of aphids declined gradually. The studies on natural enemies revealed that six coccinellid predators, viz., *Coccinella septempunctata*, *Harmonia eucharis*, *Cheilomenes sexmaculata*, *Adalia tetraspilota*, *Hippodamia variegata* and *Calvia punctata* and two syrphids viz., *Sphaerophoria bengalensis* and *Episyrphus balteatus* were found associated with pomegranate aphids. Among the natural enemies *C. septempunctata* was found to be the most dominant in both the districts. Overall, the abundance of natural enemies associated with pomegranate aphids in Baramulla was comparatively lesser than Srinagar.

KEY WORDS: *Aphis punicae*, incidence, natural enemies, pomegranate

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INTRODUCTION

Pomegranate (*Punica granatum* L.) is a non-climacteric fruit relished for its delicacy and nutritive value. It belongs to genus *Punica* and family Punicaceae. Pomegranate is one of the oldest known cultivated plants (Lye, 2008), known to be native to Central Asia (Holland *et al.*, 2009). In India, it is regarded as a “vital cash crop” grown in an area of 216,000 ha with a production of 26, 13,000 MT (Anonymous, 2016).

Pomegranate fruits have been traditionally known to be beneficial to human health as confirmed by recent scientific findings (Lansky *et al.*, 2005; Haidari *et al.*, 2009) who reported that pomegranate is a good source of antioxidants, vitamins, zinc, etc.

Cultivation of high yielding varieties of pomegranate with intensive care and management in recent past under irrigated condition with early stage exploitation of plant has lead to certain severe pest problem. Of several pests

infesting the pomegranate, the aphid, *Aphis punicae* Passerini (Homoptera: Aphididae) is an economically important pest (Birader, 2001). Though it was considered as minor pest, in recent years, it has assumed a serious form (Balikai *et al.*, 2009). Both nymphs and adults of *A. punicae* colonize on tender shoots, flower buds and suck sap from plant tissues. They pierce through plant tissues and puncture vascular bundles with stylets to suck the sap (El-Kady *et al.*, 1980) which results in stunted growth and drying of tender parts. Aphids also excrete copious amount of honey dew which attracts sooty mould and ants’ thereby hindering photosynthetic activity. As a result the entire tree is devalitized and in case of severe infestation, fruiting capacity of tree is adversely affected.

The aphid prevailing on pomegranate and its extent of damage in Kashmir valley has not been explored so far. To evolve an effective management strategy, knowledge of seasonal incidence is a pre-requisite. Keeping these considerations in view and looking at the economic

importance of the pest, this type of study was carried out.

MATERIALS AND METHODS

In order to achieve the objectives of research problem entitled, "Seasonal Incidence and Management of Pomegranate Aphid in Kashmir" studies were carried out at different field locations in two districts, viz., Baramullah, Srinagar and ICAR-Central Institute of Temperate Horticulture (CITH), Srinagar during 2016. The investigation of the present study includes survey for incidence and natural enemies and management of pomegranate aphid.

For recording the seasonal incidence of pomegranate aphid, field surveys were conducted at weekly interval from April to October in major pomegranate growing localities of district Srinagar (Shalimar, ICAR-CITH, Rajbagh and Botakadal) and Baramullah (Wadura, Sopore, Nathipore and Dangerpora). During each visit, ten pomegranate trees were examined randomly from each location for the infestation of aphid. Incidence was recorded by counting the number of aphids per five randomly selected terminals (each of 3.5 cm shoot length) in each plant.

The natural enemy complex was recorded by carrying out regular field survey was also carried out at weekly intervals in the same locations and plants for which incidence was recorded. For this purpose the aphids collected from two districts viz., Srinagar and Baramullah were preserved in 70 per cent ethyl alcohol. Also natural enemies were properly processed and both the specimen's were identified from the experts at SKUAST-K, Shalimar, Srinagar and NBAIR, Bengaluru.

The observations recorded were i) incidence of aphids: average number of aphids/3.5 shoots length and ii) natural enemies associated with the aphid.

RESULTS AND DISCUSSION

The survey for recording the seasonal incidence of pomegranate aphid and its natural enemies was conducted in district Srinagar and Baramulla from April to October during 2016. The data (Table 1 and Table 2) revealed that the pomegranate aphid, by and large is prevalent, with varied incidence from location to location. Earlier reports (Bhagat, 1986; Karuppuachamy *et al.*, 1998; Biradar, 2001; Amal Al-Barty, 2011) noted that pomegranate trees were found to be greatly damaged by *Aphis punicae* in different parts of world. During the present study it was found that incidence of pomegranate aphid was observed from April to August with its peak in the 2nd week of May whereas no population could be recorded in the month of September and October. This finding is more or less in conformity with the

report of Bhagat (1986) who reported that this pest started its activity in the month of April and further reported that it was widely prevalent during late April. However, Biradar (2001) reported the occurrence of *A. punicae* throughout the year with more abundance in winter. Mohammed and Abdullah (1989) observed that infestation of *A. punicae* on pomegranate begin in the first week of March and reached peak in the fourth week of April and the first week of May subsequently disappearing in the third week of May. In the present study, it was observed that the infestation by aphids was the maximum in the early growing period. This finding can be attributed to the fact that in the early growing season there is availability of new foliage coupled with favourable weather parameters like congenial temperatures which is supported by many workers. In April and May, temperature is relatively less as compared to other months. According to Bayhan *et al.*, (2005), the optimal temperature for *A. punicae* growth, development, and reproduction was 22.5-25°C. The timing of population densities and peak densities of aphids was governed primarily by abiotic factors (Slosser *et al.*, 1998). The results in the present findings further revealed that the mean pest incidence/shoot ranged from 1.86 -118.16, 1.53-85.35 in district Srinagar and Baramulla respectively. The highest mean incidence/shoot (33.99) was recorded in Srinagar, followed by Baramulla which recorded 24.10 mean pest incidence/shoot. The difference in per cent incidence may be due to altitude difference and varied climatic factors. Under present investigation, the pest incidence was found higher in district Srinagar which is at lower altitude as compared to district Baramulla. Amal Al-Barty (2011) reported that that an average number of aphids on leaves ranged between 268.6 and 326 individuals/40 leaves/shoots. Sreedevi and Verghese (2007) observed that aphid population started building up in December and slowly reached peak during February (52.44/shoot) and declined by second fortnight of March. Such variations in aphid infestation might be due to the changes in fruiting periods and climatic conditions in different parts of the country as also reported by Shevale and Khaire (1999).

The studies on natural enemies (Table 3) revealed that six coccinellid predators, viz., *Coccinella septempunctata*, *Harmonia eucharis*, *Cheilomenes sexmaculata*, *Adalia tetraspilota*, *Hippodamia variegata* and *Calvia punctata* and two syrphids, viz., *Sphaerophoria bengalensis* and *Episyrphus balteatus* were found associated with pomegranate aphids. Among the natural enemies *C. septempunctata* was found to be the most dominant in both the districts. Overall, the abundance of natural enemies associated with pomegranate aphids in Baramullah were comparatively lesser than Srinagar which can be attributed to the fact that Baramullah district comprise largely rural areas where farmers use most of the pesticides for the management of various pests which ultimately have adverse effects on natural enemies. The present finding is in

Table 1. Monthly distribution of incidence of pomegranate aphid, *Aphis punicae* at various locations of district Srinagar during 2016

Month	Experimental locations (Mean aphid/shoot)				Mean
	Shalimar	CITH	Rajbagh	Botakadal	
April	10.32 (3.22)	13.96 (3.74)	10.89 (3.31)	8.79 (2.97)	10.99 ^b (3.32)
May	122.85 (11.80)	132.60 (11.48)	116.26 (10.75)	100.95 (9.95)	118.16 ^d (10.87)
June	38.74 (6.22)	45.82 (6.76)	28.39 (5.32)	21.42 (4.62)	33.59 ^c (5.22)
July	4.10 (2.07)	6.71 (2.56)	5.73 (2.35)	4.89 (2.18)	5.35 ^{ab} (2.28)
August	2.04 (1.42)	2.41 (1.54)	1.31 (1.13)	1.69 (1.27)	1.86 ^a (1.36)
Mean	35.61 ^b (5.97)	40.30 ^b (6.34)	32.51 ^b (5.70)	27.54 ^a (5.24)	33.99

The population of aphids could not be observed during September and October (C.D ≤ 0.05): month: 1.24; locations: 0.45; figures in parentheses are square root values; means followed by the same letter are not significantly different at 5 % level

Table 2. Monthly distribution of incidence of pomegranate aphid, *Aphis punicae* at various locations of district Baramulla during 2016

Month	Experimental locations (Mean aphid/shoot)				Mean
	Wadura	Sopore	Nathipore	Dangerpore	
April	7.50 (2.73)	10.69 (3.27)	8.56 (2.93)	6.93 (2.63)	8.42 ^b (2.91)
May	87.70 (9.37)	92.54 (9.62)	83.12 (9.12)	77.99 (8.84)	85.35 ^d (9.24)
June	22.75 (4.17)	28.88 (5.38)	20.14 (4.49)	16.47 (4.06)	22.06 ^c (4.69)
July	3.01 (1.73)	3.94 (1.98)	2.92 (1.72)	2.89 (1.71)	3.14 ^a (1.78)
August	1.52 (1.22)	2.12 (1.44)	1.21 (1.10)	1.27 (1.12)	1.53 ^a (1.24)
Mean	24.49 ^c (4.94)	27.63 ^c (5.25)	23.23 ^b (4.81)	21.11 ^a (4.59)	24.10

The population of aphids could not be observed during September and October (C.D ≤ 0.05): month: 1.06; locations: 0.31; figures in parentheses are square root values; means followed by the same letter are not significantly different at 5 % level

Table 3. List of various natural enemies associated with pomegranate aphid, *Aphis punicae* in district Baramullah and Srinagar during 2016

District	Locations	Month (Natural enemies associated)						
		April	May	June	July	August	Sep.	Oct.
Baramullah	Wadura	<i>Coccinella septempunctata</i>	<i>Coccinella septempunctata</i> , <i>Harmonia eucharis</i> , <i>Cheilomenes sexmaculata</i> , <i>Calvia punctata</i>	<i>Episyrphus balteatus</i> , <i>Harmonia eucharis</i>	<i>Coccinella septempunctata</i>	-	-	-
	Sopore	<i>Cheilomenes sexmaculata</i>	<i>Coccinella septempunctata</i> , <i>Cheilomenes sexmaculata</i> , <i>Adaliae traspilota</i>	<i>Coccinella septempunctata</i> , <i>Episyrphus balteatus</i>	<i>Cheilomenes sexmaculata</i> , <i>Episyrphus balteatus</i>	<i>Coccinella septempunctata</i>	-	-

District	Locations	Month (Natural enemies associated)						
	Wadura	April	May	June	July	August	Sep.	Oct.
Baramullah	Nathipore	<i>Cheilomenes sexmaculata</i> , <i>Coccinella septempunctata</i>	<i>Coccinella septempunctata</i> , <i>Adalia tetraspilota</i> , <i>Episyrphus balteatus</i>	<i>Coccinella septempunctata</i> , <i>Episyrphus balteatus</i>	<i>Coccinella septempunctata</i>	-	-	-
	Dangepora	<i>Coccinella septempunctata</i> , <i>Harmonia eucharis</i>	<i>Coccinella septempunctata</i> , <i>Harmonia eucharis</i> , <i>Cheilomenes sexmaculata</i>	<i>Sphaerophoria bengalensis</i> , <i>Episyrphus balteatus</i>	<i>Coccinella septempunctata</i>	-	-	-
Srinagar	Shalimar	<i>Coccinella septempunctata</i> , <i>Harmonia eucharis</i>	<i>Coccinella septempunctata</i> , <i>Harmonia eucharis</i> , <i>Adalia tetraspilota</i> , <i>Hippodamia variegata</i> , <i>Calvia punctata</i>	<i>Coccinella septempunctata</i> , <i>Episyrphus balteatus</i> , <i>Sphaerophoria bengalensis</i>	<i>Cheilomenes sexmaculata</i> , <i>Coccinella septempunctata</i>	<i>Coccinella septempunctata</i>	-	-
	CITH	<i>Coccinella septempunctata</i> , <i>Harmonia eucharis</i>	<i>Coccinella septempunctata</i> , <i>Sphaerophoria bengalensis</i> , <i>Harmonia eucharis</i> , <i>Calvia punctata</i>	<i>Coccinella septempunctata</i> , <i>Sphaerophoria bengalensis</i>	<i>Sphaerophoria bengalensis</i> , <i>Harmonia eucharis</i>	<i>Coccinella septempunctata</i>	-	-
	Rajbagh	<i>Coccinella septempunctata</i>	<i>Calvia punctata</i> , <i>Coccinella septempunctata</i> , <i>Harmonia eucharis</i>	<i>Sphaerophoria bengalensis</i> , <i>Harmonia eucharis</i>	<i>Harmonia eucharis</i>	-	-	-
	Botakadal	<i>Coccinella septempunctata</i>	<i>Coccinella septempunctata</i> , <i>Sphaerophoria bengalensis</i> , <i>Harmonia eucharis</i> , <i>Calvia punctata</i>	<i>Sphaerophoria bengalensis</i> , <i>Coccinella septempunctata</i>	<i>Coccinella septempunctata</i>	-	-	-

conformity with Bhagat (1986) who reported that the common predators associated with *A. punicae* were unidentified syrphid flies and coccinellid predators. Karupuchamy (1994) and Ananda *et al.* (2009) also recorded the natural enemies, *C. sexmaculata* and *C. septumpunctata* associated with *A. punicae*. Khan and Abas (2017) also reported *Hippodamia variegata*, *Adaliate traspilota* and syrphid flies to feed on *A. punicae*. In the present study the abundance of natural enemies was found ranging from 2-3/shoot with regard to different natural enemies in the month of May and thereafter their population declined and in the month of August only a few *C. septempunctata* (1-2/shoot) could be noticed. Also, more population of syrphids was observed in the month of June. Amal Al-Barty (2011) reported that (syrphid fly) appeared in the end of May with low numbers, then a sharp increase in the population density was observed in the

beginning of June (Summer) which is in conformity with the present findings.

CONCLUSION

Survey for recording pomegranate aphid incidence conducted during April-October revealed that the pomegranate aphid, by and large is prevalent, with varied incidence from location to location. The pest started its activity in 1st week of April and reached to its peak in the 2nd week of May in both the districts. Thereafter, the population of aphids declined gradually. Among the various coccinellids observed, *Coccinella septempunctata* was found to be the most dominant one. The diversity of coccinellids in Kashmir is rich and conservation of these beetles is also important for their use in future as a natural tool for control of aphids,

affecting various fruit crops. Among various pesticides, the new generation insecticide viz., Thiamethoxam 25 WG applied @ 0.40 g/litre and Imidochlorprid 17.8 SL @ 0.25 ml/ of water proved to be the most effective in reducing the mean aphid population.

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REFERENCES

- Amal MF, Al-Barty. 2011. Survey and enumeration of pests on pomegranate tree with reference to its parasite in Al-Taif City. *Aust J Basic Appl Sci.* **5**: 1086-1093.
- Anonymous. 2016. Horticulture Development in Himachal Pradesh-At a Glance. Retrieved from: <http://www.hpgrisnet.gov.in>
- Ananda N, Kotikal YK, Balikai RA. 2009. Sucking insect and mite pests of pomegranate and their natural enemies. *Karnataka J Agri Sci.* **22**: 781-783.
- Balikai RA, Prasanna PM, Kotikal YK. 2009. Status of pomegranate pests and their management strategies in India, p. 127. In: 2nd International Conference on Pomegranate and minor including Mediterranean fruits. 23-27 June, 2009. University of Agricultural Sciences, Dharwad, Karnataka, India.
- Bayhan E, Ölmez-Bayhan S, Ulusoy MR, Brown JK. 2005. Effect of temperature on the biology of *Aphis punicae* (Passerini) (Homoptera: Aphididae) on pomegranate. *Environ Ent.* **34**: 22-26. <https://doi.org/10.1603/0046-225X-34.1.22>
- Bhagat RC. 1986. Aphid pests of fruit trees and their natural enemies in Kashmir valley. *Indian J Agri Sci.* **56**: 532:534.
- Biradar AP. 2001. Aphid menace on pomegranate. The Hindu: (19-04-2001).
- EL-Kady EA, Amin A, Habib SA, Emam AK. 1980. Feeding sites of six aphid species of genus *Aphis* L. on their host plants in Egypt. *Bull Entomol Soc Egypt* **63**: 163-174.
- Haidari M, Ali M, Casscells SW, Madjid M. 2009. Pomegranate (*Punica granatum*), purified polyphenol extract inhibits influenza virus and has a synergistic effect with oseltamivir. *Phytomedicine* **12**: 1127-1136. <https://doi.org/10.1016/j.phymed.2009.06.002> PMID:19586764
- Holland D, Hatip K, Bar Y. 2009. Pomegranate: Botany, Horticulture and Breeding, pp. 127-191. Janick J (Ed.). In: *Horticulture Reviews*. John Wiley & Sons Inc, UK. <https://doi.org/10.1002/9780470593776.ch2>
- Karuppuchamy P, Balasubramanian G, Sundra Babu PC. 1994. *Studies on the management of pests of pomegranate with special reference to fruit borer, Virachola Isocrates (Fab.)*. Ph. D. thesis, Tamil Nadu Agri. Univ., Coimbatore, Tamil Nadu, India.
- Karuppuchamy P, Balasubramanian G, Sundra Babu PC. 1998. The biology of pomegranate fruit borer, *Deudorix isocrates*. *Madras Agri J.* **85**: 256-259.
- Khan AA, Shah MA. 2017. Records of aphids and their natural enemies in agro-ecosystem with special reference to horticultural ecosystem of Kashmir. *J Entomol Zool Stud.* **4**: 189-203.
- Lansky EP, Jiang W, Mo H, Bravo L, Froom, P, Yu W, Harris NM, Neeman I, Campbell MJ. 2005. Possible synergistic prostate cancer suppression by anatomically discrete pomegranate fractions. *Invest New Drug.* **23**: 11-20. <https://doi.org/10.1023/B:DRUG.0000047101.02178.07>
- Lye C. 2008. Pomegranate: Preliminary assessment of the potential for an Australian industry. Rural industries Research and Development Corporation of Australian Government RIRDC Publication No.08/153, P.17.
- Mohammad MA, Abdullah SA. 1989. Ecological and biological studies on pomegranate aphid, *Aphis punicae* in Mosul Region. *Mesopotamia J Agri.* **21**: 26.
- Shevale BS, Khair VM. 1999. Seasonal abundance of pomegranate butterfly, *Deudorix isocrates*. *Entomon* **24**: 27-31.
- Slosser JE, Pinchak WE, Rummel DR, Dugger P, Richter D. 1998. Abiotic and biotic regulation of cotton aphid population in the Texas rolling plains. Proc Beltville Cotton Conference, San Diego, California, USA. 5-9 January, 1998, 2: 1065-1067.