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Seasonal Activity and Abundance of Natural Enemies and Performance of *Coccinella septempunctata* on Rose Aphid, *Macrosiphum rosae* (Linn.)

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A B S T R A C T

Different natural enemies recorded from aphid colonies on rose included two coccinellid predators (*Coccinella septempunctata* and *Cheilomenes sexmaculata)*, syrphid fly, spider (*Oxyopes* sp.) and chrysopid (*Chrysoperla carnea*). Among these, ladybird beetle, *C. septempunctata* followed by syrphid fly maggot was found to be the most abundant predator feeding on aphids colony. Among these, ladybird beetle, *C. septempunctata* was the most abundant. Its highest abundance (46.64%) was recorded at experimental site. Syrphid fly was the second most abundant predator with 32.16 per cent abundance followed by *C. sexmaculata* (12.66 %) at experimental site. Remaining predatory fauna were also found intermittently predating upon the aphid populations on rose.

Introduction

Rose is one of the most beautiful ornamental flowers in the world, and as such it can be found in many houses and gardens in cities due to its especial characteristics such as stability, long period of floral initiation, different varieties, and, of course, its beauty. Rose as a plant is found everywhere and is cultivated widely in most parts of the world. Furthermore, cut rose flower is regarded as one of the best cash crop ornamental flowers. Rose is attacked by numerous pests; amongst them, aphids are considered as a major pest. Aphids have a very successful worldwide distribution. Their damages to plants may be direct or indirect: direct damage is due to aphids' intense feeding on plant sap, which will wilt the plant and decrease the yield; indirect damage comes as a result of honeydew excretion and virus transmission. Excretion of honeydew promotes the growth of sooty mould on the plant surface, so photosynthesis will be disturbed and crop yield will be decreased. The rose aphid, *Macrosiphum rosae* (Linnaeus, 1758) is a cosmopolitan species due to the world-wide cultivation of roses (Blackman and Eastop, 2000). This aphid is the most important pest of roses and is probably native to Eurasia and

it causes significant economic damage (Alford, 1999). Ladybird beetles are common biological control agents of aphids in natural field settings (Long and Finke, 2014). Many researcher claim that ladybirds are incapable of regulating aphid populations under natural field conditions for reasons relating to their voracity, search efficiency, predation capacity, and reproductive rate, but there are a few reported examples of apparent regulation. Nevertheless, the ability to regulate aphid populations is not essential if repeated (inundative) releases of ladybirds into a greenhouse delays or prevents aphid outbreaks (Kehrli and Wyss, 2001).

Materials and Methods

Field monitoring was conducted at the experimental site of Jammu to record natural enemies fauna of aphid prevalent in on rosary garden. Aphidophagous predators were observed active throughout the main rose flowering season. For recording natural parasitization by the biological control agents in the field, the visually infected insects were collected and brought to the laboratory for further emergence of parasitoid and their identification.

Predators observed preying upon the aphids in the field condition were also collected and brought to the laboratory to confirm their predation behaviour and potential of predation. Predation by the dominant predators on rose aphids was determined in the laboratory using collected predators from rosary garden. Per cent relative abundance of a predator species was calculated as:

$$\frac{\text{Total number of adults of a predator species}}{\text{Total number of adults of all species of predators recorded}} \times 100$$

Predation by *C. septempunctata*, which is a dominant predator, on rose aphid was determined in the laboratory using different stages of coccinellids collected from rose garden of the experimental sites. The *C. septempunctata* were put separately in mesh cages of size 25 x 25 x 25 cm at different densities of 1, 2, 4 and 6 and the aphids were released into these cages after 12 h of starvation of the adult and grub beetle.

All the different treatments involving different densities of the predator population were replicated thrice. In each replication the aphids densities released were 40. Number of aphids consumed was recorded daily up to 7 days and the aphids population density in each replication of different treatments was maintained by daily replacements. The killing efficiency of *C. septempunctata* collected from various locations at different densities was calculated by using the formula given by Hessell (1971).

$$K = \log_e \left[\frac{Ni}{Nf} \right]$$

Where,

Ni = initial population of host density
Nf = final population of host density

Results and Discussion

Natural enemy fauna recorded against rose aphids and their relative abundance

Field monitoring was conducted at the experimental site of Jammu to record natural enemies of aphid on rose. Aphidophagous predators were observed active throughout the main rose flowering season. Different natural enemies recorded from aphid colonies on rose included two coccinellid predators (*Coccinella septempunctata* and *Cheilomenes sexmaculata*), syrphid fly, spider (*Oxyopes* sp.) and chrysopid (*Chrysoperla carnea*) and their details are presented in Table 1.

Table.1 Seasonal activity and abundance of natural enemy recorded against rose aphid

S. No.	Scientific name	Activity period	Order	Family	Relative abundance of predator species (%)*
1	Lady bird beetle, *Coccinella septempunctata*	January-April	Coleoptera	Coccinellidae	46.64
2	Lady bird beetle, *Cheilomenes sexmaculata*	March-May	Coleoptera	Coccinellidae	12.66
3	Syrphid fly	January- May	Diptera	Syrphidae	32.16
4	Green lace wing, *Chrysoperla carnea*	March-May	Neuropetera	Chrysoidae	2.57
5	Spider, *Oxyopes* spider	March-May	Oxyopidae	Aranae	5.62
6	Aphid parasitoid, *Aphidius* sp.	February-April	Hymenoptera	Aphelinidae	-

*Mean of three replications

Table.2 Performance of *Coccinella septempunctata* at different densities in terms of percent predation of rose aphid per day

***Coccinella septempunctata* population density**	*** Mean percentage (%) predation by adults of *C. septempunctata* per day**	***Killing efficiency (K) of adult predator**	***Mean percentage (%) predation by grub per day**	***Killing efficiency (K) of grubs of *Coccinella septempunctata* predator**
1	7.333	0.202	10.667	0.310
2	10.33	0.299	14.667	0.457
4	18.33	0.614	22.667	0.836
6	12.66	0.381	16.667	0.539

*Mean of three replications

Among these, ladybird beetle, *C. septempunctata* followed by syrphid fly maggot was found to be the most abundant predator feeding on aphids colony. Among these, ladybird beetle, *C. septempunctata* was the most abundant. Its highest abundance (46.64%) was recorded at experimental site. Syrphid fly was the second most abundant predator with 32.16 per cent abundance followed by *C. sexmaculata* (12.66 %) at experimental site. Remaining predatory fauna were also found intermittently predating upon the aphid populations on rose. Our results are in line with that of Mehrparvar *et al.,* (2016), who also reported that natural enemies of the rose aphid include four species of Coccinellidae and three species of Syrphidae.

Performance of *C. septempunctata* in terms of predatism of rose aphid per day

Among all the predatory species recorded on rose aphid in rosary garden, *C. septempunctata* was found to be the most abundant coccinellid predator during the period of study at the experimental site. Thus, the studies were further extended from field to laboratory to study the performance of *C. septempunctata* in terms of predatism of rose aphid per day in laboratory conditions and the results obtained were presented in Table 2. The predatory coccinellids collected from experimental sites were pooled to study the predatism performance. The maximum mean per cent predation was observed to be 18.33 per cent by adults and 28.33 per cent predation per day by grubs on aphids at 4 beetle density of *C. septempunctata*. The corresponding value of killing efficiency was 0.614 and 0.836, respectively (Table 2). The given number of aphid (n = 40) were maintained every day after consumption by replacing that many aphids. At all density levels, per cent consumption increased with time and prey density. But, the killing efficiency of the predator (adults and grubs) decreased with increasing the density of aphids. The killing efficiency of the predator was maximum when the one predator was released, recording 0.202 and 0.310 with aphids. From the results obtained it was evident that the mean per cent predation was recorded to be maximum in case of grubs on aphids than the adults. Our results are in line with that of Ali and Rizvi (2007), who reported that the grubs consumed maximum *H. coriandri*, whereas, adult preferred *L. erysimi*. The last larval stage (grub 4), irrespective of aphid species, devoured more aphids than the other grub stages.

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