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Diversity of Natural Enemies on Different Ornamental Plants at Palampur, Himachal Pradesh, India

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A B S T R A C T

During survey a total of thirteen species were found belonging to orders viz. Coleoptera, Diptera, Hemiptera and Aranea. The maximum number (10) of species was found of the order coleoptera and maximum number of natural enemies was recorded on rose. The identified species of natural enemies were *Coccinella septempunctata*, *Oenopia kirbyi*, *Oenopia sauzeti*, *Hippodamia variegata*, *Cheilomenes sexmaculata*, *Chilocorus infernalis*, *Coccinella transversalis*, *Coelophora bissellata*, *Metasyrphus confrater*, *Orius insidiosus* and spiders. Most abundant natural enemy was syrphid followed by *Coccinella septempunctata* and *Hippodamea variegata*.

Introduction

Palampur is located at 32.6^0 N, 76.3^0 E, at an elevation of 1290 meters above mean sea level and represents mid hill sub-humid zone of HP (Singh et al, 2016). This region is suitable for growing different types of ornamental plants and trees, which have great aesthetic value and are grown for commercial value as cut flower, loose flowers and seed purpose. Many different kinds of insects and mites feed on ornamental plants which hamper their aesthetic and economic value (Pal and Sarkar, 2009). To combat these pests, usually insecticides are recommended but by keeping in view the harmful effects of the chemicals on environment and non-target organisms, there is a need to develop some alternate control strategies. Various workers have reported different species of natural enemies on ornamental crops from different regions (Nisha and Gupta, 2010; Sood and Kakar, 1990).

The most abundant group of natural enemies are eulophids, anthocorid bugs, predatory mites, coccinellids, neuropterans, cecidomyiid and spiders (Yee *et al.*, 2000). But from this region, no earlier reports are present on this aspect. In view of this, the present investigation was carried out to study the diversity of the natural enemies in different ornamental crops in the mid hill conditions of Himachal Pradesh.

Materials and Methods

The present study for determining the distribution, diversity and abundance of natural enemies was conducted on different ornamental plants in the university campus of CSKHPKV, Palampur. Different ornamental crops (Table 1) were sampled to assess the presence of different natural enemies at weekly interval from 7-09-2015 to 28-12-2015.

Sampling method

At sampling site, five plants or trees were randomly selected for sampling. From each plant five leaves or flowers were selected randomly for sampling. Selected leaves/flowers were examined and the natural enemies present were counted and identified. Natural enemies were identified with the identified reference specimens present in the laboratory. The data was recorded on weekly intervals from 7-09-2015 to 28-12-2015. For estimating the diversity of natural enemies, the data of individual plants/trees of ornamental plants was pooled together and only the number of adults were counted in all the natural enemies and number of larvae were also taken in case of syrphid flies. For calculation following formula was used:

Relative proportion of ith species =

$$\frac{\textit{Total number of individuals of ith species}}{\textit{Total number of individuals of all the species}}$$

Diversity indices

Diversity indices like Shannon diversity index, maximum diversity, species evenness and species dominance was calculated as per procedure given by Shannon (1948) which is described as under:

Shannon diversity index (H) = $-\sum pi \log_e pi$; where pi = fraction of ith species

Maximum diversity index ($H_{max.}$) = $\log_e k$; k = total number of species

Species evenness(J) = $\frac{H}{H_{max.}}$

Species dominance (D) = 1-J

Results and Discussion

A total of thirteen species of thrips belonging to four orders i.e. Coleoptera, Diptera, Hemiptera and Aranae in five families viz., Coccinelidae, Staphylinidae, Syrphidae, Anthocoridae and one unidentified family were recorded from different ornamental crops surveyed (Table 2). Among these, eight were identified to species level, two to family level while one was identified to order level. Survey results showed that all sampled crops were harbouring natural enemies.

The identified species of natural enemies were *Coccinella septempunctata*, *Oenopia kirbyi*, *Oenopia sauzeti*, *Hippodamia variegata*, *Cheilomenes sexmaculata*, *Chilocorus infernalis*, *Coccinella transversalis*, *Coelophora bissellata*, *Metasyrphus confrater*, *Orius insidiosus* and spiders.

Nisha and Gupta (2010) recorded two species of predacious anthocorid bugs, namely *Orius niger* Wolff and *O. bifilarus* Ghauri on jasmine from Solan. Sanjta (2014) reported that among natural enemies *Orius* sp. occurred in rose, chrysanthemum and dahlia and spiders were present on bougainvillea, helichrysum and rose. *Coccinella septempunctata* was found on rose, helichrysum and nastruitium, whereas, *Oenopia kirbyi* was collected from helichrysum and calendula.

Table.1 Ornamental crops surveyed

Sr no.	Common name	Scientific name
1.	Rose	*Rosa* sp.
2.	Marigold	*Tagetus* spp.
3.	Zinnia	*Zinnia elegans*
4.	Hydrangea	*Hydrangea macrophylla*
5.	Calendula	*Calendula officinalis*
6.	Silver oak	*Grevillea robusta*
7.	Spirea	*Spiraea corymbosa*
8.	Sweet william	*Dianthus barbatus*

Table.2 Distribution of Natural enemies

Order	Family	Species	Crop
Coleoptera	Coccinelidae	*Coccinella septempunctata* (Linnaeus)	Rose, marigold, zinnia, calendula, sweet william,
		Oenopia kirbyi Mulsant	Rose, zinnia
		Oenopia sauzeti Mulsant	Rose
		Hippodamia variegata (Goeze)	Rose, zinnia, sweet william
		Cheilomenes sexmaculata Fabricius	Rose
		Chilocorus infernalis Mulsant	Rose
		Coccinella transversalis Fabricius	Rose
		Coelophora bissellata Mulsant	Hydrangia,
		Unidentified	Spirea
	Staphylinidae	Unidentified	Sweet william, calendula
Diptera	Syrphidae	*Metasyrphus confrater*	Rose
Hemiptera	Anthocoridae	*Orius* sp.	Marigold, sweet William, calendula
Aranea	Unidentified	Spiders	Rose, marigold, spirea, silveroak

Table.3 Diversity of natural enemies on ornamentals

Species	Relative proportion (%)
Coccinella septempunctata	18.48
Oenopia kirbyi	8.7
Oenopia sauzeti	4.35
Cheilomenes sexmaculata	10.87
Chilocorus infernalis	1.09
Coccinella transversalis	1.09
Hippodamia variegata	13.04
Coelophora bissellata	1.09
Unidentified coccinellid	1.09
Unidentified stayphilinid	1.09
Syrphid	30.43
***Orius* sp.**	6.52
Spiders	6.52
Total	100
Shanon index(H)	**1.89**
Hmax	**2.56**
Evenness(J)	**0.74**
Dominance(D)	**0.26**

When the relative proportion of the recorded species was calculated, *Coccinella septempunctata*, *Oenopia kirbyi*,*Oenopia sauzeti*, *Cheilomenes sexmaculata*, *Chilocorus infernalis*, *Coccinella transversalis*, *Hippodamia variegata*, *Coelophora bissellata*, unidentified coccinellid, unidentified stayphilinid, *Metasyrphus confrater*, *Orius* sp. and spiders contributed 18.48, 8.7, 4.35, 10.87, 1.09, 1.09, 13.04, 1.09, 1.09, 1.09, 30.43, 6.52 and 6.52 per cent relative proportion, respectively Shanon index (H), H_{max}, evenness (J) and dominance (D) were 1.89, 2.56, 0.74 and 0.26, respectively (Table 3). Sanjta (2014) observed the highest relative proportion of *Coccinella septempunctata* among the recorded natural enemies on ornamental plants while in the present study syrphid fly's relative proportion was highest.

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