

Morphological and Taxonomical Descriptions of *Oenopia sauzeti* (Mul.) and *Oenopia kirbyi* (Mul.) (Coleoptera: Coccinellidae) Reported from District Dehradun Uttarakhand, India

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ABSTRACT The present study was carried out to know the distributional pattern, morphological, and taxonomical descriptions of *Oenopia sauzeti* (Mulsant) and *Oenopia kirbyi* (Mulsant) from different study sites of district Dehradun, (Uttarakhand), India. From the above study, it was observed that among both species, *O. sauzeti* Mulsant is the dominant species and distributed in all study sites of district Dehradun. While, *O. kirbyi* (Mulsant) was less dominant species and distributed only in two study sites of district Dehradun. It was also observed that the adult *O. sauzeti* Mulsant is an oval and small beetle measuring about 4.0 mm in length and 3.2 mm in width. The color is yellowish-brown with black markings on pronotum and elytra. While, *O. kirbyi* (Mulsant) is a round, medium-sized ladybeetle measuring about 4.0-4.5 mm in length and 3.2-3.6 mm in width, respectively. The pronotum is black in color and two black spots are present on each elytron and are surrounded by a light color region.

KEY WORDS Ladybirds, Morphological, *Oenopia kirbyi*, *Oenopia sauzeti*, Taxonomical

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INTRODUCTION

The family Coccinellidae comprises 5200 described species worldwide (Hawkeswood, 1987). Ladybirds (Coleoptera: Coccinellidae) are predators of phytophagous pests, such as aphids, diapsid, coccids, adelgids, aleyrodids, pentatomids, thrips, and acarids (Hodek and Honek, 1996; Dixon, 2000). These prey species are, however, not equally suitable for growth, development, and reproduction of ladybirds, with suitability differing in relation to habitat, nutritional requirements of the predator, and the biochemical contents of their prey (Blackman, 1967; Kalushkov and Hodek, 2004). Morphological descriptions of a few species of predatory coccinellids were given by different workers (Omkar and Pervez, 1999; Omkar and Bind, 1995). Singh and Singh (1991) also reported 16 species of aphidophagous coccinellids from Mizoram – a northeastern state of India. Poorani (2002) described the distributional and taxonomic descriptions of 400 species of the coccinellids of the Indian subregion.

Predaceous coccinellids are the eco-friendly substitute of pesticides for the biocontrol of aphids. Predaceous ladybeetles possess various width of prey spectrum and the suitability of accepted prey ranges from essential food (promoting both oviposition and larval development) to toxic food (Hodek and Honek, 1996). Extensive studies have been carried out on prey suitability for several coccinellid species (Agarwala *et al.*, 1988; Rogers *et al.*, 1994; Kalushkov and Hodek, 2004; and Omkar and Bind, 2004). Insect predators can be found throughout the plants, including the parts below ground, as well as in nearby shrubs and trees, including social forest. Some predators are specialized in their choice of prey, others are generalists. Some are extremely useful natural enemies of insect pests. Predatory insects are relatively mobile insects that search out prey. Once they capture, suck out the internal fluids, leaving only the outer shell behind. Other predatory insects (such as ladybird beetles, mantids, and ground beetles) have chewing mouthparts and feed on the entire body of the victim.

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Predators will feed on several victims during their lifetimes (Sharma, 2008). Insect predators can be found in almost all agricultural and natural habitats. Although the life history of some common predators is well studied, information on the biology and relative importance of many predatory species are lacking (Sathe and Bhosale, 2001). The objective of this study was to investigate the distributional pattern, morphological, and taxonomical descriptions of *Oenopia sauzeti* (Mulsant) and *Oenopia kirbyi* (Mulsant) from different study sites of district Dehradun, (Uttarakhand), India.

MATERIALS AND METHODS

Study Area

Dehradun is set in the foothills of Himalayas at the center of the 120 km long Doon Valley, covering an area of about 3088 km² in the western part of Uttarakhand state of India and at the height of 1467 ft msl. It is situated at 28° 53' 24"-31° 27' 50" N latitude and 77° 34' 27"-81° 02' 22" E longitude. The ladybird beetles were collected from four different sites (Table 1) representing four different ecosystems, namely, mixed orchards, agricultural field, garden, and forest ecosystem of Dehradun district. The study area shows three distinct seasons' winter, summer, and monsoon.

Sampling and Preservation of Insects

Sampling of coccinellid beetles was conducted at an interval of 30 days for 3 years from July 2016 to June 2019. The insects were collected by the visual hand picking method. The collected insects were transferred into jars containing ethyl acetate soaked cotton. These jars were brought to the laboratory and the insects were stretched and pinned. The entomological pins No. 2 (Asta Ento Pins 3493 Mfg. by Newey Goodman Ltd. Tipton DY 4 8AH, England) were used according to the size of the specimen. These were oven dried at 60°C for 72 h to preserve them and then set into wooden boxes and labeled according to their systematic position.

Taxonomic Study of Coccinellids

The adult specimens (male and female) were carefully studied for all details under a binocular microscope. The insects were separated into different species with the help of available keys.

Morphometric Parameter

The body size of male and female adults was also measured from head to end of abdomen, with the help of micrometer (Mari *et al.*, 2004).

RESULTS AND DISCUSSION

Distributional Pattern of Ladybeetles of Genus

Oenopia

During the study period of 3 years, *O. sauzeti* (Mulsant) was collected from all four sites/ecosystems, namely, mixed orchards (11), agriculture field (54), garden (36), and forests ecosystems (07), while *O. kirbyi* (Mulsant) was collected from only two sites/ecosystems, namely, agriculture field (17) and garden ecosystem (11) of district Dehradun (Uttarakhand), India. From the above study, it was observed that among both species, *O. sauzeti* Mulsant is the dominant species (total 108 individuals in 1 year) and distributed in all study sites of district Dehradun. While, *O. kirbyi* (Mulsant) was the less dominant species (total 28 individuals in 1 year) and distributed only in two study sites of district Dehradun (Table 1).

Morphological Descriptions of *O. sauzeti* (Mul.) and *O. kirbyi* (Mul.)

The detailed morphological descriptions of both the species of lady beetles are as follows (Table 2).

O. sauzeti (Mulsant)

It is an oval and small beetle measuring about 4.0 mm in length and 3.2 mm in width. The color is yellowish-brown/red with black markings on pronotum and elytra. The elytral

Table 1. Distributional pattern of Genus *Oenopia* in different ecosystems of district Dehradun during 2016-2019

S. No.	Coccinellidae species	District – Dehradun				Total no. of individuals in one year (average of three years)
		S-1	S-2	S-3	S-4	
	Subfamily: Coccinellinae					
	Tribe coccinellini					
1.	<i>Oenopia sauzeti</i> Mulsant	11	54	36	07	108
2.	<i>Oenopia kirbyi</i> (Mulsant)	00	17	11	00	28
	Total no. of species	1	2	2	1	

S-1: Site no.1 (mixed orchards), S-2: Site no.2 (agriculture field), S-3: Site no.3 (garden), S-4: Site no.4 (forests)

Table 2. Morphological descriptions of genus *Oenopia* in different sites of district Dehradun during 2016-2019

S. No.	Coccinellidae species	Length (in mm)	Width (in mm)	Body characteristics
	Subfamily: Coccinellinae			
	Tribe coccinellini			
1.	<i>Oenopia sauzeti</i> Mulsant	4.0	3.2	It is an oval, small-sized beetle. The color is yellowish-brown with black markings on pronotum and elytra
2.	<i>Oenopia kirbyi</i> (Mulsant)	4.0-4.5	3.2-3.6	This ladybeetle is round and medium in size. The head is broad and quadrate with eyes located anterolaterally, antennae broadly separated. The pronotum is black in color, two black spots are present in each elytron and are surrounded by a light color region

pattern shows minimal variation and is quite characteristic and diagnostic. *O. sauzeti* Mulsant is abundant in agriculture ecosystem and adults have been found feeding on cotton aphid *Aphis gossypii* (Fig. 1) almost throughout the year.

O. kirbyi (Mulsant)

This ladybeetle is round and medium-sized about 4.0-4.5 mm in length and 3.2-3.6 mm in width, respectively. The head is broad and quadrate with eyes located anterolaterally and antennae broadly separated. The pronotum is black in color, and two black spots are present in each elytron and are surrounded by a light color region. It has a close morphological resemblance with *O. sauzeti* with respect to the patches over pronotum and spots and color of elytra. While, in *O. sauzeti*, the black spots located on midpoint at centrally connected elytra (or meeting point of both elytra) are bigger in size in comparison to spots located at the midpoint of both elytra in *O. kirbyi*. The adults have been found feeding on aphids *Myzus persicae* and cotton aphids *A. gossypii* (Fig. 2).

Taxonomic Descriptions of *O. sauzeti* (Mul.) and *O. kirbyi* (Mul.)

Genus: *Oenopia* Mulsant, 1850

Oenopia Mulsant, 1850: 374, 420; 1866: 279. Crotch, 1874: 158. Korschefsky, 1932: 287 (cat.). Timberlake, 1943:



Fig. 1. *Oenopia sauzeti* Mulsant.



Fig. 2. *Oenopia kirbyi* Mulsant.

56. Iablokoff-Khnzorian, 1979: 69; 1982: 398. Vandenberg, 1996: 385. Type species: *Oenopia cinctella* Mulsant, by subsequent designation of Sicard, 1907c: 134. (Korschefsky [1932] wrongly designated *Oenopia (Aza) kirbyi* Mulsant, 1850 as type).

Synharmonia Ganglbauer, 1899: 994 (as *Coccinella* [Synharmonia]). Type species: *Coccinella conglobata* Linnaeus, 1758, by subsequent designation of Chapin, 1965b. Synonymized by Iablokoff-Khnzorian, 1979: 69.

Protocaria Timberlake, 1943: 28. Type species: *Protocaria scalaris* Timberlake, 1943, by original designation. Synonymized by Iablokoff-Khnzorian, 1979: 69.

Gyrocaria Timberlake, 1943: 39. Bielawski, 1964b: 83. Type species: *Coelophora guttata* Blackburn, by original designation. Synonymised by Iablokoff-Khnzorian, 1979: 69.

Pseudoharmonia Savojskaja, 1963: 37. Kuznetsov, 1997: 186. Type species *Pseudoharmonia montana* Savojskaja, 1963, by monotypy. Synonymised by Iablokoff-Khnzorian, 1979: 69.

Paramulsantina Hoang, 1982: 10. Type species *Paramulsantina gratiosa* Hoang, 1982, by original designation. Synonymised by Jadwiszczak and Pokojowczyk, 1990: 54-55.

O. sauzeti Mulsant

O. sauzeti Mulsant, 1866: 281; 1870: 55 (lectotype; UCCC). Crotch, 1874: 158. Korschefsky, 1932: 288 (cat.). Kapur, 1958: 331; 1963b: 27. Bielawski, 1972: 302; 1979: 117. Gordon, 1987; 19 (Lectotype designation).

Gyrocaria sauzeti: Miyatake, 1967: 76; 1985: 15 (habitus, male genitalia illustr.).

Distribution: India (MA, SK, UP, WB, HP, AS, J&K.), Bhutan, Pakistan, Nepal, Myanmar, Thailand, China.

O. kirbyi (Mulsant)

O. kirbyi Mulsant, 1850, 1866; Crotch, 1874; Korschefsky, 1932; Booth and Pope, 1989 (Lectotype designation), *Gyrocaria kirbyi*: Miyatake, 1965.

Distribution: India (MA, SK, UP, WB, J&K,) China, Myanmar, Thailand.

A survey of the available literature revealed only a few studies on the species composition, morphology, and taxonomy of coccinellid beetles in India, particularly from Uttarakhand, India. However, Omkar and Bind (1993) have reported six species of coccinellids from the Lucknow region of Central U.P., Joshi and Sharma (2008) have reported 31 species of coccinellid beetles from district Haridwar with 19 new records. Sharma and Joshi (2019) have discussed the distributional pattern, morphological, and taxonomical descriptions of *Micraspis discolor* Fabricius and *Micraspis vincta* Gorham from district Haridwar (U.K.), India. This is the most common Indian species, widely spread in the north and the northeastern regions and the Himalayas.

Predaceous coccinellids are the eco-friendly substitutes of pesticides for the biocontrol of aphids (Hodek, 1962, 1993; Hodek and Honek, 1996). The management of insect pests rarely relies on a single control practice; usually, a variety of tactics are integrated to maintain pests at economic threshold levels.

The goal of integrated pest management is not to eradicate but to control the pest population since the availability of pests below the economical threshold level is essential to maintain the natural enemy population remains in the crop. The chances of disturbances in the agriculture ecosystem are high because it is a target of a lot of pesticides that also affect the non-target fauna of that ecosystem. Any change and interference may cause the migration and disappearance of coccinellid species. As a result, the size of the coccinellid community may be reduced (Sharma and Joshi, 2019).

CONCLUSION

The findings thus suggest that among both species, *O. sauzeti* Mulsant is a dominant species and distributed in all study sites of district Dehradun. While, *O. kirbyi* (Mulsant) is a less dominant species and distributed only in two study sites of district Dehradun. This study may be helpful in the identification of bio-control agents for effective managements of aphids, thrips, and other pests under field conditions. Further, a detailed survey is needed in those areas that were not covered in this study to fully explore predatory and phytophagous ladybird beetles of district Dehradun.

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