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DISTRIBUTION OF COCCINELLID SPECIES IN UDHAM SINGH NAGAR (UTTARAKHAND), INDIA

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ABSTRACT

Coccinellids play a crucial role in agriculture and ecosystems, primarily as predators of various pest species, including mites, mealybugs, scale insects, and aphids. Their effectiveness as biocontrol agents makes them valuable components of Integrated Pest Management; however, many of their ecological services remain insufficiently explored. To investigate their species distribution in Udham Singh Nagar (USN), Uttarakhand, India, a two-year extensive survey was conducted from March 2021 to February 2023. USN is located in the Tarai region of the Kumaun Division, lies between latitudes 28°53′ N and 29°23′ N and longitudes 78°45′ E and 80°08′ E. Fourteen coccinellid species belonging to three subfamilies and twelve genera were recorded from various locations of district USN. The subfamily Coccinellinae (Tribe Coccinellini) comprised of *Anegleis cardoni, Cheilomenes sexmaculata*, *Coccinella septempunctata*, *Coccinella transversalis*, *Harmonia dimidiata*, *Hippodamia variegata, Illeis cincta*, *Micraspis allardi, Micraspis univittata Oenopia kirbyi,* and *Propylea dissecta*. *Brumoides suturalis* and *Chilocorus nigritus*, belonged to the subfamily Chilocorinae (Tribe Chilocorini). These species are voracious predators of insect pests infesting economically important crops and -other cultivated plants. Additionally, phytophagous individuals of *Epilachna indica* (Subfamily Epilachninae) were also collected.

Keywords: Coccinellids, biocontrol agents, insect pest management, voracious predators, aphids.

INTRODUCTION

Coccinellids (Coleoptera: Coccinellidae) are among the most abundant groups of predatory beetles (Omkar and Pervez, 2016; Pervez et al., 2020a) and inhabit a wide range of ecosystems, including terrestrial habitats (Skaife, 1979), tundra, forests, grasslands, agroecosystems, and regions extending from plains to mountainous areas (Iperti, 1999; Ahmed et al., 2017). They are commonly associated with diverse vegetation, ranging from trees to shrubs (Burgio et al., 2004). They also serve as valuable indicators of ecosystem health and biodiversity (Andersen, 1999), and play a significant role in biocontrol and integrated pest management as most species are ecofriendly predators feeding on a wide range of agricultural pests, including thrips, mites, mealybugs, scale insects, and aphids (Hodek and Honek, 2009; Khan et al., 2009). Their primary prey consists of homopteran insects and mites (Iperti, 1999). However, feeding habits vary among species; some are phytophagous, whereas others are euryphagous. In addition, several species consume pollen grains during periods of prey scarcity.

The diversity and abundance of coccinellids are dynamic and largely influenced by climatic conditions. Consequently, these beetles are widely recognized as important bioindicators of environmental change and ecosystem quality (Iperti and Paoletti, 1999). Forest ecosystems generally support a greater coccinellid diversity than agroecosystem (Zahoor et al., 2003). The number of coccinellid species reported varies considerably among different geographical regions. Six species were recorded from Pantnagar, USN (Nghia and Srivastava, 2015), whereas 19 species were reported

from Haridwar (Joshi and Sharma, 2008), and 19 species were reported from Nainital, Uttarakhand (Karki et al., 2026). Similarly, numerous species were documented from Lucknow, Uttar Pradesh (Omkar and Bind, 1993; Omkar and Pervez, 1999, 2000, 2002). In Pakistan, 51 species belonging to six subfamilies were recorded from the Mirpur Division of Azad Jammu and Kashmir (Hayat and Khan, 2013), while 22 species were reported from Iran (Biranvand, 2013). Thus, we explored the coccinellid diversity of the USN in this paper.

MATERIALS AND METHODS

Study Area and Duration

The present study was conducted to document the distribution of coccinellid beetles in USN, Uttarakhand, India. Field investigations were carried out from March 2021 to February 2023.

Collection of Specimens

Coccinellid beetles were collected through frequent surveys conducted across randomly selected habitats, including gardens, agricultural fields, and agroforestry areas. Sampling was carried out during the morning (08:00–10:30 h) and evening (15:00–17:30 h), when ladybird beetles were most active. Most specimens were observed on herbaceous plants. Specimens were collected using manual handpicking, sweep-net sampling, and aerial sweep nets. Insects were collected continuously from March 2021 to February 2023. During the study period, ambient temperatures varied from approximately 6°C to 42°C. A total of 14 species of coccinellid beetles representing twelve genera and three subfamilies were collected.

Identification of Specimens

The collected specimens were identified using standard taxonomic literature and identification keys, including those of Rafi et al. (2005), Shunxiang (2010), Slipinski (2013) and Jouveau (2018).

RESULTS AND DISCUSSION

In present study, a total of 14 species were collected from USN, namely: *Coccinella septempunctata*, *Epilachna indica*, *Menochilus sexmaculatus*, *Propylea dissecta*, *Harmonia dimidiata*, *Micraspis univittata*, *Brumoides suturalis*, *Hippodamia variegata*, *Coccinella transversalis*, *Illeis cincta*, *Micraspis allardi*, *Oenopia kirbyi*, *Anegleis cardoni*, and *Chilocorus nigritus*. Out of these coccinellids, nine species are common. The number of species reported from Pakistan is 75 (Ahmed et al., 2017). *Harmonia* (Fabr.) is predominant in the southern region, whereas *Coccinella septempunctata* was more abundant in the northern and hilly regions (Sharma et al., 2018). In the study by Virteiu et al. (2015), 15 species of coccinellids were identified from the Banat region, Romania. Sixteen species of beetles have been identified up to species level by Mishra and Yousuf (2018), *viz*. *Coccinella septempunctata*, *Epilachna* sp., *Anegleis cardoni*, *Menochilus sexmaculatus*, *Propylea dissecta*, *Harmonia dimidiata*, *Micraspis univittata*, *Brumoides suturalis*, *Hippodamia variegata*, *Coccinella transversalis*, *Illeis cincta*, *Lemnia circumusta*, *Micraspis allardi*, *Oenopia sexareata*, *Aiolocaria hexaspilota*, and *Platynaspidius saundersi*. Except *Epilachna* species, all are common predators of aphids and mealybugs and are generally found in agroforestry and forestry areas. In USN, a study was carried out to explore the biodiversity of beneficial insects associated with cowpea at Pantnagar by Nghia and Srivastava (2015), in which they reported that among the various insects, six species of Coccinellidae, namely *Verania vincta*, *Coccinella septempunctata*, *Harmonia octomaculata, Rodolia* species, *Micraspis* species, and *Menochilus sexmaculatus*, were feeding upon aphids, jassids, and thrips. The active period of coccinellids was from August to October and from March to June (Nghia & Srivastava, 2015). Pervez et al. (2020b) reported 18 species of coccinellids belonging to 15 genera and three subfamilies, namely Chilocorinae, Coccinellinae, and Scymninae, from five geographical sites of Uttarakhand. In Udham Singh Nagar, six species of coccinellids were reported by Pervez et al. (2020), *viz*. *Coccinella septempunctata*, *Menochilus sexmaculatus*, *Propylea dissecta*, *Coccinella transversalis*, *Illeis cincta*, and *Illeis confusa*. Five species were common to the present study, except *Illeis confusa*.

The coccinellids have been reported in a wide variety of habitats. In agroecosystems, they are frequently found in crops such as maize, wheat, coriander, and mustard, as highlighted in this study. The current research also observed their presence in garden ecosystems, including *Abelmoschus esculentus* and *Hibiscus*. Moreover, coccinellids are known to inhabit orchards and forest ecosystems, as documented in Haridwar (Joshi and Sharma, 2008). In the present study, *Harmonia dimidiata* was captured mostly, and *Chilocorus nigritus* was captured exclusively from *Calotropis gigantea*, which is

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present in coastal areas, feeding on *Aphis nerii*, and a few specimens were also collected from *Parthenium hysterophorus*. *Chilocorus nigritus* is a type of ladybird beetle that preys on scale insects. It feeds on members of the family Diaspididae, certain species of Coccidae, and some Asterolecaniidae, exhibiting the ability to thrive in a wide range of tropical and subtropical environments (Samways and Wilson, 1988).

Table 1 : Temporal distribution of coccinellids beetle with host plant.

No.	Coccinellids species	Host plants	Collection period
1.	*Brumoides suturalis*	*Calotropis gigantean. Cannabis sativa, Hibiscus rosa sinensis*	March
2.	*Coccinella septempunctata*	*Triticum aestivum, Zea mays, Triticum aestivum, Silybum marianum, Brassica campestris, Parthenium hysterophorus Trifolium alexandrinum*	July to November and February to mid April
3.	*Coccinella transversalis*	*Trifolium alexandrinum, Parthenium hysterophorus, Silybum marianum, Foeniculum vulgare, Zea mays, Triticum aestivum, Hibiscus rosa sinensis, Brassica campestris, Cannabis sativa*	August to November, and February to mid April
4.	*Harmonia dimidiata*	*Helianthus annuus*	September to November and March
5.	*Menochilus sexmaculatus*	*Foeniculum vulgare, Triticum aestivum, Zea mays, Triticum aestivum, Brassica campestris, Parthenium hysterophorus, Trifolium alexandrinum, Cannabis sativa, Silybum marianum*	July to November and February to mid April
6.	*Propylea dissecta*	*Foeniculum vulgare, Triticum aestivum, Zea mays, Triticum aestivum, Brassica campestris, Medicago sativa and Trifolium alexandrinum*	August to November, and February to mid April
7.	*Micraspis allardi*	*Zea mays, Triticum aestivum, Brassica campestris, Silybum marianum*	November and February
8.	*Chilocorus nigritus*	*Calotropis gigantean*	October
9.	*Micraspis univittata*	*Triticum aestivum, Brassica campestris*	December and January
10.	*Illeis cincta*	*Hibiscus rosa sinensis*	March
11.	*Oenopia kirbyi*	*Helianthus annuus*	March
12.	*Hippodamia variegata*	*Brassica campestris, Medicago sativa, Trifolium alexandrinum Triticum aestivum and Zea mays*	February to March
13.	*Anegleis cardoni*	*Hibiscus rosa sinensis*	March, September
14.	*Epilachna indica*	*Trifolium alexandrinum*	Throughout the year

Morphology and Global Status

Brumoides suturalis

USN (present study); Pantnagar (Sreedhar et al., 2022); Uttarakhand (Mishra and Yusuf, 2018); Haridwar, Uttarakhand (Joshi and Sharma, 2008); Karnataka (Ankalgi and Jadesh, 2016); Tripura (Majumder et al., 2013); Jharkhand (Choudhary et al., 2014); Pakistan (Zahoor et al., 2003; Hayat and Khan, 2013).

Coccinella septempunctata: USN (present study) (Ahmad and Khan, 2020); Pantnagar (Sreedhar et al., 2022); Uttarakhand (Mishra and Yusuf, 2018); Tripura (Majumder et al., 2013); Kashmir (Khan et al., 2009); Jharkhand (Jaipal S. Choudhary et al 2014); Pakistan (Zahoor et al., 2003; Hayat and Khan, 2013); Iran (Biranvand, 2014); South Africa (Makwela, 2019); and Himachal Pradesh (Sanjta et al., 2018).

Coccinella transversalis: USN (present study); Pantnagar (Sreedhar et al., 2022; Ahmad and Khan, 2020); Uttarakhand (Mishra and Yusuf, 2018); Karnataka (Ankalgi and Jadesh, 2016); Tripura (Majumder et al., 2013); Pakistan (Hayat and Khan, 2013); and Himachal Pradesh (Sanjta et al., 2018).

Propylea dissecta: USN (present study) (Ahmad and Khan, 2020); Pantnagar (Sreedhar et al., 2022); Uttarakhand (Mishra and Yusuf, 2018); Pakistan (Hayat and Khan, 2013); and South Africa (Makwela, 2019).

Micraspis univittata: USN (present study); Pantnagar (Sreedhar et al., 2022); Uttarakhand (Mishra and Yusuf, 2018); Tripura (Majumder et al., 2013).

Menochilus sexmaculatus: USN (present study) (Ahmad and Khan, 2020); Uttarakhand (Mishra and Yusuf, 2018); Karnataka (Ankalgi and Jadesh, 2016); Kashmir (Khan et al., 2009); Pakistan (Zahoor et al., 2003); and Himachal Pradesh (Sanjta et al., 2018).

Micraspis allardi: USN (present study); Pantnagar (Sreedhar et al., 2022); Uttarakhand (Mishra and Yusuf, 2018); Tripura (Majumder et al., 2013).

Harmonia dimidiata: USN (present study); Pantnagar (Sreedhar et al., 2022); Uttarakhand (Mishra and Yusuf, 2018); Haridwar, Uttarakhand (Joshi and Sharma, 2008); Kashmir (Khan et al., 2009); and Pakistan (Hayat and Khan, 2013).

Illeis cincta: USN (present study; Pervez et al., 2020); Haridwar, Uttarakhand (Joshi and Sharma, 2008); Tripura (Majumder et al., 2013).

Hippodamia variegata: USN (present study); Uttarakhand (Mishra and Yusuf, 2018); Tripura (Majumder et al., 2013); Kashmir (Khan et al., 2009); Iran (Biranvand, 2014); South Africa (Makwela, 2019); and Himachal Pradesh (Sanjta et al., 2018).

Oenopia kirbyi: USN (present study); Tripura (Majumder et al., 2013); and Himachal Pradesh (Sanjta et al., 2018).

Henosepilachna vigintioctopunctata: USN (present study); Uttarakhand (Mishra and Yusuf, 2018).

Anegleis cardoni: USN (present study); Pantnagar (Sreedhar et al., 2022); Uttarakhand (Mishra and Yusuf, 2018).

Chilocorus nigritus: USN (present study); South Africa (Samways and Wilson, 1988); Andhra Pradesh (Vasista et al., 2020).

The current survey identified 14 species of coccinellid beetles in Udham Singh Nagar, including *Coccinella septempunctata*, *Brumoides suturalis*, *Coccinella transversalis*, *Propylea dissecta*, *Micraspis univittata*, *Menochilus sexmaculatus*, *Micraspis allardi*, *Harmonia dimidiata*, *Illeis cincta*, *Hippodamia variegata*, and *Oenopia kirbyi*. Notably, *Chilocorus nigritus* and *Oenopia kirbyi* were newly reported species from this district, expanding the known distribution of these beetles. Given that biodiversity is dynamic, a review of the existing literature on the faunal diversity of the region indicates a clear need for more extensive surveys. The biodiversity of Udham Singh Nagar, particularly its insect fauna, remains understudied and requires further exploration to comprehensively document the region's ecological richness.

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a *b* *c* *d*

e *f* *g* *h*

i *j* *k* *l*

m *n*

Plate 1. a. Brumoides suturalis, b. Coccinella septempunctata, c. Coccinella transversalis. d Harmonia dimidiata, e. Menochilus sexmaculatus, f. Propylea dissecta, g Micraspis allardi, h. Chilocorus nigritus i. Illies cincta j. Micraspis univittata, k. Oenopia kirbyi, l. Hippodamia variegata, m. Anegleis cardoni, n. Epilachna indica

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Conclusion: This survey underscores the need for continued biodiversity assessments in USN to better understand and conserve its faunal diversity. Newly reported species highlight the district's ecological significance, and further studies are essential to inform conservation and sustainable agricultural practices.

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