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Diversity of *Coccinella* (Coleoptera: Coccinellidae) insect pests from the Kolhapur region of Maharashtra, India

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Abstract

The present study investigates the diversity, abundance, and ecological significance of *Coccinella* and allied coccinellid beetles (Coleoptera: Coccinellidae) in the Kolhapur region of Maharashtra, India. Field surveys were conducted across major agricultural habitats, including cereal, pulse, vegetable, and horticultural crops, using sweep netting and hand collection methods. A total of 10 coccinellid species belonging to 7 genera were recorded, with predatory species such as *Coccinella transversalis*, *Cheilomenes sexmaculata*, *Propylea dissecta*, and *Hippodamia variegata* being predominant. These species were mainly associated with aphid-infested crops, indicating their important role as natural biological control agents. One phytophagous species, *Henosepilachna nana*, was also observed causing damage to cucurbit vegetables. Predatory coccinellids constituted more than 85% of the total population, reflecting their dominance in the agro-ecosystems of the study area. The study highlights the dual role of coccinellid beetles as beneficial insects and occasional pests, emphasizing the need for species-specific identification in integrated pest management (IPM) programs. This work provides baseline data on *Coccinella* diversity in Kolhapur and supports conservation of beneficial beetles for sustainable agriculture.

Keywords: *Coccinella*, Coccinellidae, species diversity, insect pests, biological control, agro-ecosystems, Kolhapur district, Maharashtra, integrated pest management (IPM)

Introduction

Insects form an integral component of agricultural ecosystems, functioning as pests, predators, parasitoids, and pollinators. Among these, beetles of the family Coccinellidae (Coleoptera), commonly known as ladybird beetles, are of particular importance due to their significant role in biological control. The genus *Coccinella* Linnaeus, along with allied genera, is widely distributed in India and is taxonomically characterized by its rounded body shape, conspicuous coloration, and predatory feeding behavior.

Most species of *Coccinella* are voracious predators of aphids, whiteflies, mealybugs, and scale insects, which are major pests of agricultural crops. Their natural predation helps suppress pest populations, thereby minimizing crop damage and reducing reliance on chemical insecticides. Consequently, *Coccinella* species are considered valuable components of integrated pest management (IPM) systems. In contrast, some members of the family Coccinellidae, particularly those belonging to the subfamily Epilachninae, are phytophagous and cause direct damage to crop plants, highlighting the importance of accurate species identification in agro-ecosystems.

Maharashtra is a major agricultural state in India, encompassing diverse agro-climatic conditions that support rich insect biodiversity. The Kolhapur district, situated in the southwestern part of the state, is characterized by fertile soils, moderate rainfall, and cultivation of crops such as sugarcane, cereals, pulses, vegetables, and horticultural plants. These conditions provide ideal habitats for coccinellid beetles. However, despite their ecological importance, comprehensive studies documenting the diversity and abundance of *Coccinella* species from this region are scarce.

Several studies from other regions of India have reported a high diversity of coccinellid beetles and emphasized their role in natural pest regulation. Nevertheless, regional diversity assessments are essential to understand species composition, habitat association, and pest-

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predator dynamics at the local level. Such information is crucial for strengthening biological control strategies and conserving beneficial insect fauna. The present study was undertaken to assess the diversity of *Coccinella* and allied coccinellid beetles in the Kolhapur region of Maharashtra, with emphasis on their abundance, ecological roles, and relevance in agricultural ecosystems. The findings aim to fill existing knowledge gaps and provide baseline data to support sustainable pest management and biodiversity conservation in the region.

Materials and Methods

Field investigations were conducted in the Kolhapur district of Maharashtra, India (15°43'-16°43' N; 73°40'-74°42' E), characterized by a tropical monsoon climate and diverse agricultural practices. Surveys were carried out from June 2024 to May 2025, covering all major seasons. Sampling was undertaken at 10 representative agricultural sites, including cereal, pulse, vegetable, sugarcane, and horticultural fields, with surveys conducted once every month. Coccinellid beetles were collected using sweep netting (50 sweeps per field), hand picking, and visual searching from aphid-infested plants during morning and evening hours. Collected specimens were preserved using standard dry preservation techniques, mounted on entomological pins or card points, and labeled with date, locality, and host plant details. Identification was carried out using stereo zoom microscopy and standard taxonomic keys (Kapur, 1956; Poorani, 2002) ^[1, 2]. Species diversity was assessed using species richness and relative abundance, and diversity indices such as Shannon-Wiener (H') were

calculated. The proportion of predatory and phytophagous species was analyzed to evaluate ecological roles. Observations on host plant association and feeding behavior were recorded in the field. All collections were conducted ethically, with minimal removal of specimens to avoid disruption of natural populations.

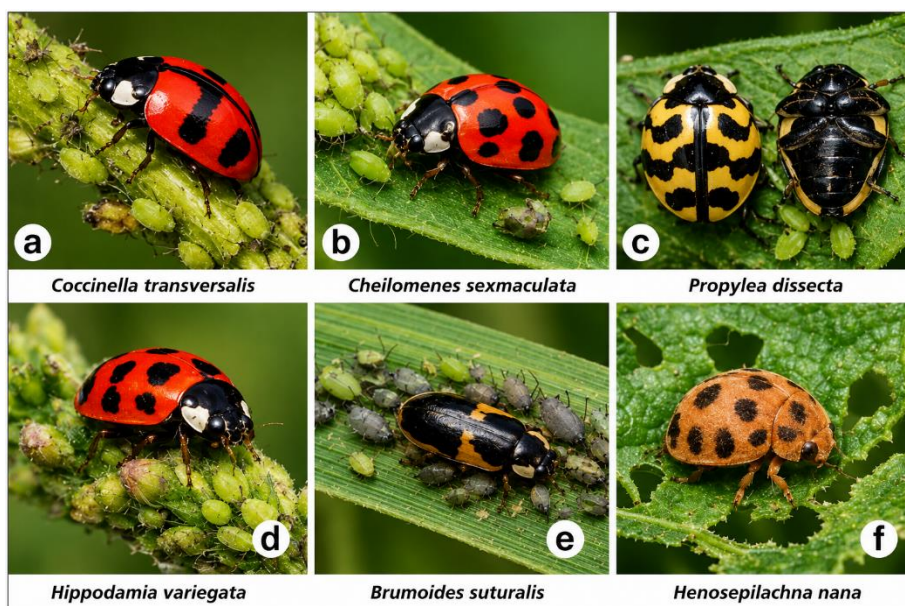
Results

The survey conducted in different agro-ecosystems of the Kolhapur region revealed a considerable diversity of *Coccinella* and allied coccinellid beetles. A total of 10 species belonging to 7 genera under the family Coccinellidae were recorded during the study period. Predatory species were dominant and widely distributed across all crop types, whereas phytophagous species were limited in occurrence. Predatory coccinellids were mainly associated with aphid-infested crops such as pulses, vegetables, cereals, and sugarcane. Among them, *Coccinella transversalis* and *Cheilomenes sexmaculata* were the most frequently observed species throughout the study period. The phytophagous species *Henosepilachna nana* was recorded only from cucurbit vegetable fields, where it caused noticeable foliar damage.

Seasonal observations indicated higher abundance of coccinellid beetles during the monsoon and post-monsoon seasons, coinciding with increased pest populations. Predatory species constituted approximately 85-90% of the total coccinellid population, emphasizing their ecological importance in natural pest regulation within the agro-ecosystems of Kolhapur.

Table 1: Diversity of *Coccinella* and Allied Coccinellid Beetles Recorded from Kolhapur District, Maharashtra

Sr. No.	Species Name	Genus	Feeding Habit	Crop / Host Association	Relative Abundance
1	<i>Coccinella transversalis</i> Fabricius (Fig. a)	<i>Coccinella</i>	Predatory	Aphids on cereals, pulses	High
2	<i>Cheilomenes sexmaculata</i> (Fabricius)(Fig. b)	<i>Cheilomenes</i>	Predatory	Aphids on vegetables, legumes	High
3	<i>Propylea dissecta</i> (Mulsant) (Fig. c)	<i>Propylea</i>	Predatory	Aphids on mixed crops	Moderate
4	<i>Hippodamia variegata</i> (Goeze) (Fig. d)	<i>Hippodamia</i>	Predatory	Aphids on pulses and oilseeds	Moderate
5	<i>Brumoides suturalis</i> (Fabricius) (Fig. e)	<i>Brumoides</i>	Predatory	Sugarcane and vegetables	Low
6	<i>Harmonia octomaculata</i> (Fabricius)	<i>Harmonia</i>	Predatory	Soft-bodied pests	Low
7	<i>Scymnus nubilus</i> Mulsant	<i>Scymnus</i>	Predatory	Mealybugs and aphids	Moderate
8	<i>Nephus regularis</i> (Sicard)	<i>Nephus</i>	Predatory	Scale insects	Low
9	<i>Illeis cincta</i> Fabricius	<i>Illeis</i>	Predatory	Leguminous crops	Low
10	<i>Henosepilachna nana</i> (Kapoer) (Fig. f)	<i>Henosepilachna</i>	Phytophagous	Cucurbit vegetables	Low



Discussion

The present study demonstrates a rich assemblage of *Coccinella* and allied coccinellid beetles in the agro-ecosystems of Kolhapur district, emphasizing the predominance of predatory species. Similar patterns have been documented across Indian agricultural landscapes, where coccinellids form a major component of natural pest regulation (Kapur, 1956; Poorani, 2002) ^[1, 2]. The observed species richness reflects the heterogeneous cropping systems and favorable climatic conditions prevailing in the region.

The dominance of *Coccinella transversalis* and *Cheilomenes sexmaculata* aligns with previous studies reporting these species as key aphid predators in India (Omkar & Bind, 1993; Patil & Gaikwad, 2019) ^[3, 5]. Their higher abundance during monsoon and post-monsoon seasons can be attributed to increased prey availability, higher humidity, and suitable microhabitats, which promote predator survival and reproduction. Comparable seasonal trends have been reported in both tropical and temperate agro-ecosystems (Dixon, 2000; Hodek *et al.*, 2012) ^[9, 11].

The occurrence of the phytophagous species *Henosepilachna nana*, although limited, is noteworthy. Species of this genus are recognized pests of vegetables, particularly cucurbits and solanaceous crops (Ghorpade, 1981) ^[7]. Its restricted distribution in the present study suggests localized infestation; however, changing agricultural practices and climate variability may influence its future pest status, warranting regular monitoring.

International studies have emphasized that diversified cropping systems favor beneficial coccinellid populations and enhance ecosystem services such as biological control (Obrycki & Kring, 1998; Hodek & Evans, 2012) ^[10, 11]. The findings of the present study support this view and highlight the need for conservation-oriented pest management strategies. Excessive pesticide use can disrupt predator populations and weaken natural pest suppression.

Although the study provides valuable baseline data, it is limited by its reliance on morphological identification and a single-year survey. Future studies incorporating long-term monitoring, molecular tools, and quantitative prey-predator analyses would further strengthen understanding of coccinellid ecology in the region.

Overall, the diversity and abundance of *Coccinella* species in Kolhapur underline their ecological importance and potential for integration into sustainable pest management programs, forming a strong basis for conservation-based IPM approaches.

Conclusion

The present investigation highlights the diversity and ecological importance of *Coccinella* and allied coccinellid beetles in the agro-ecosystems of the Kolhapur region of Maharashtra. The dominance of predatory species, particularly aphidophagous taxa such as *Coccinella transversalis* and *Cheilomenes sexmaculata*, underscores their vital role in natural pest regulation. Seasonal abundance patterns indicate a strong relationship between predator populations and prey availability within local cropping systems.

The restricted occurrence of the phytophagous species *Henosepilachna nana* emphasizes the necessity of accurate species-level identification to distinguish beneficial insects from potential pests. Conservation of predatory coccinellids through reduced pesticide application and adoption of

environmentally sound farming practices can significantly enhance sustainable pest management.

The baseline information generated from this study contributes to regional biodiversity knowledge and provides a foundation for future research incorporating long-term ecological monitoring, advanced taxonomic tools, and integrated pest management strategies aimed at promoting sustainable agriculture in Maharashtra.

Conflicts

The authors declare that they have no conflicts of interest regarding the publication of this research.

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