

International Journal of Engineering, Science and Humanities

An international peer reviewed, refereed, open-access journal
Impact Factor 8.3 www.ijesh.com ISSN: 2250-3552

Diversity and Site-Level Distribution of Ladybird Beetles (Coleoptera: Coccinellidae) in Selected Agro-Ecological Habitats of Parbhani, District, Maharashtra, India

Ganesh Kishanrao Lahane

Research Scholar, Department of Zoology, Adarsh College, Hingoli

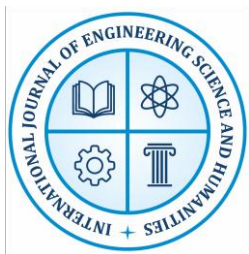
Abstract

Ladybird beetles (Coleoptera: Coccinellidae) are important predatory insects in agricultural ecosystems and have long been investigated as natural enemies of soft-bodied pests. The present field-based study documents the preliminary occurrence of ladybird beetles across selected agro-ecological settings of Parbhani district, Maharashtra, India. Field observations and specimen collection were undertaken across eight localities: Selu, Pathri, Manwat, Purna, Palam, Gangakher, Jintur and Parbhani. The supplied field report records five ladybird beetle species at each of the eight sites. Six sites were located in cotton fields and two in roadside vegetation. Specimens were collected using sweep-netting, visual hand-picking and beat-sheet sampling, preserved in formalin and forwarded to the Department of Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, for taxonomic identification. The data demonstrate broad site coverage and confirm the presence of a recorded coccinellid component in both cultivated and non-crop habitats. However, because the available field record does not contain species-level identifications or replicate abundance data, statistical comparisons of species richness, diversity indices, dominance, or habitat preference cannot yet be justified. The study therefore constitutes a preliminary distributional dataset and provides a baseline for subsequent taxonomic, ecological and biological-control investigations in Parbhani district.

Keywords: Coccinellidae; ladybird beetles; biological control; agroecosystem; cotton; roadside vegetation; Parbhani; Maharashtra.

1. Introduction

Predatory Coccinellidae occupy an important position in the natural-enemy complex of agricultural ecosystems. Their ecological significance is particularly associated with predation on aphids and other soft-bodied arthropods. A review of aphidophagous Coccinellidae has shown that their contribution to pest suppression can range from a minor role to substantial within-season reductions in selected pest populations, depending on crop, prey availability and agro-ecosystem conditions (Obrycki et al., 2009). Indian literature has likewise documented a substantial body of prey records and emphasized the value of coccinellids in biological control (Agarwala & Ghosh, 1988).



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The Indian subcontinent contains a diverse coccinellid fauna, and modern taxonomic work continues to refine species identification, distribution and prey associations. For example, Poorani (2023) provided an illustrated treatment of 119 species in 30 genera of the tribe Coccinellini from the Indian subcontinent. Such taxonomic resources are essential because reliable biological-control recommendations require correct identification of the predator as well as evidence on prey association and ecological performance.

Parbhani district forms part of the Marathwada region of Maharashtra and encompasses nine talukas. The district extends across approximately 18°45'–20°10' N and 76°13'–77°39' E and includes a mixture of cultivated and non-crop landscapes. The present field survey was designed to document ladybird beetles in selected agricultural and roadside habitats as an initial step toward a broader study of their diversity, distribution and potential significance in biological pest control.

2. Objectives

- To conduct field observations and collect ladybird beetle specimens from selected localities of Parbhani district.
- To document the site-wise occurrence recorded during the August 2024 field visit.
- To compare the distribution of surveyed sites across the habitat categories represented in the field report.
- To establish a baseline dataset for subsequent taxonomic, ecological and biological-control investigations.

3. Materials and Methods

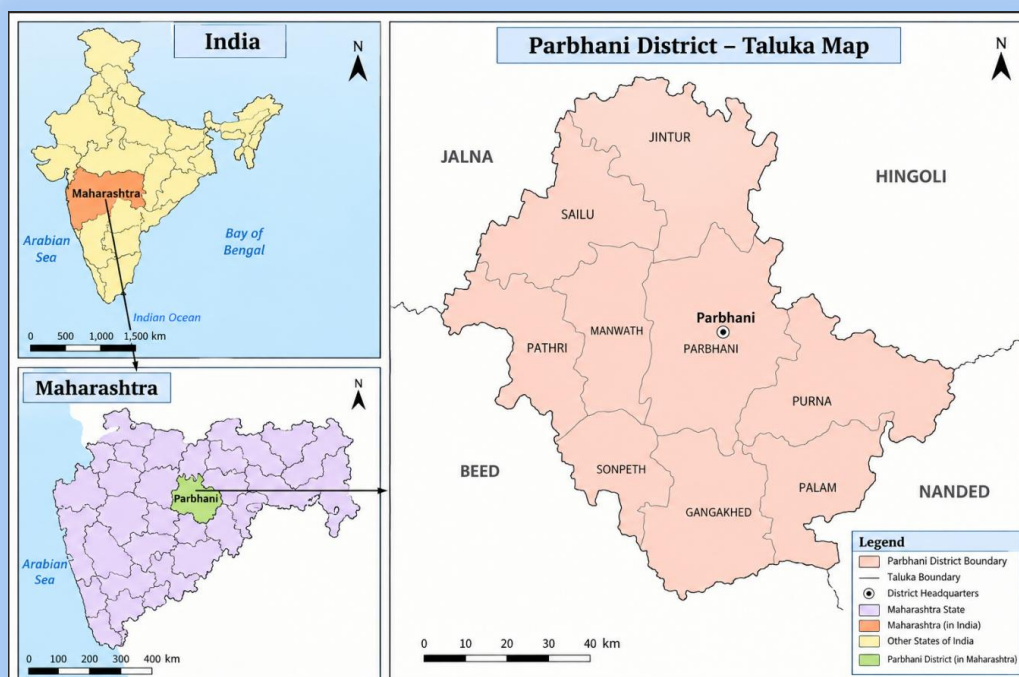
3.1 Study area

The study was conducted in Parbhani district, Maharashtra, India. The field report states that the survey covered eight localities representing seven talukas plus Parbhani city, namely Selu, Pathri, Manwat, Purna, Palam, Gangakher, Jintur and Parbhani. The official district administration currently lists nine talukas in the district, while the field report records observations from the eight localities listed above.



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3.2 Field duration and site selection

The field visit lasted 16 days. According to the supplied report, sites were selected to represent different cropping and vegetation settings. The actual site table records cotton fields at six localities and roadside vegetation at two localities. Although the narrative mentions sorghum and horticultural gardens as possible cropping systems, those habitats do not appear as separate categories in the eight-site results table and are therefore not treated as sampled habitat classes in the present analysis.

3.3 Specimen collection

Three collection approaches were used: sweep-netting across vegetation, visual hand-picking from crop foliage, and beat-sheet sampling under shrubs and trees. Collected specimens were placed in vials containing formalin for preservation. After fieldwork, specimens were catalogued and sent to the Department of Entomology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, for expert taxonomic identification, as stated in the field report.

3.4 Data handling and analytical approach

The present analysis is intentionally conservative. The field report provides one site-level species-count value (5) for each of eight sites. Because species names and individual counts are absent, the value 5 cannot be summed to claim 40 unique species. Instead, the analysis reports



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eight site records, each with a reported count of five species, and describes habitat coverage. Percentages are calculated only for the number of surveyed sites represented by each habitat.

4. Results

4.1 Site-wise field records

No.	Locality	Site type	Reported no. of species	Survey coverage
1	Selu	Cotton fields	5	1 site
2	Pathri	Cotton fields	5	1 site
3	Manwat	Roadside vegetation	5	1 site
4	Purna	Cotton fields	5	1 site
5	Palam	Cotton fields	5	1 site
6	Gangakher	Cotton fields	5	1 site
7	Jintur	Cotton fields	5	1 site
8	Parbhani	Roadside vegetation	5	1 site

Table 1. Site-wise ladybird beetle records reported in the supplied field visit report.

All eight surveyed localities have the same reported site-level value of five species. Therefore, no site-to-site difference in the recorded species count is visible in the supplied dataset. The appropriate interpretation is that the field report documents a uniform reported count across the eight sampled localities, not that 40 different species were necessarily collected.

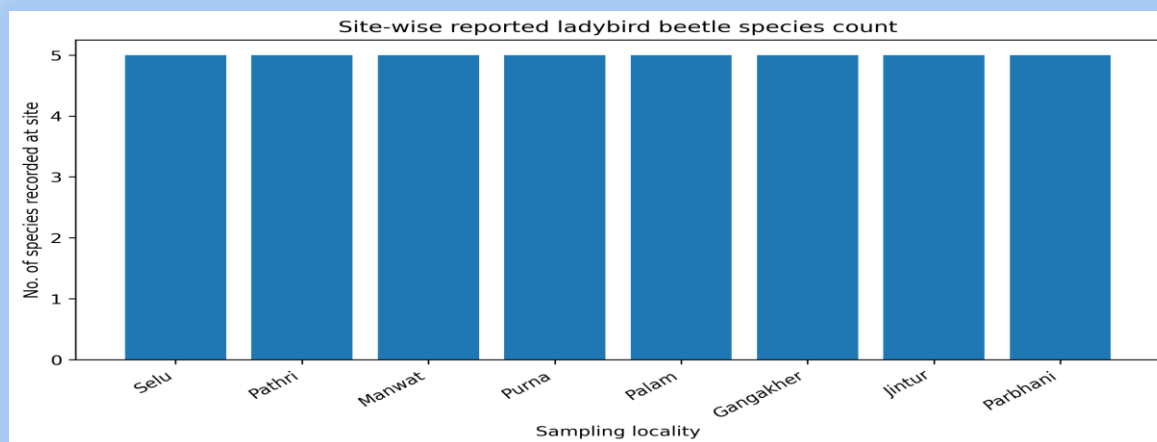


Figure 2. Reported ladybird beetle species count at the eight surveyed localities.



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4.2 Habitat representation

Habitat	Sites	Percentage of surveyed sites	Localities
Cotton fields	6	75.0%	Selu; Pathri; Purna; Palam; Gangakher; Jintur
Roadside vegetation	2	25.0%	Manwat; Parbhani

Table 2. Habitat distribution of the eight surveyed sites.

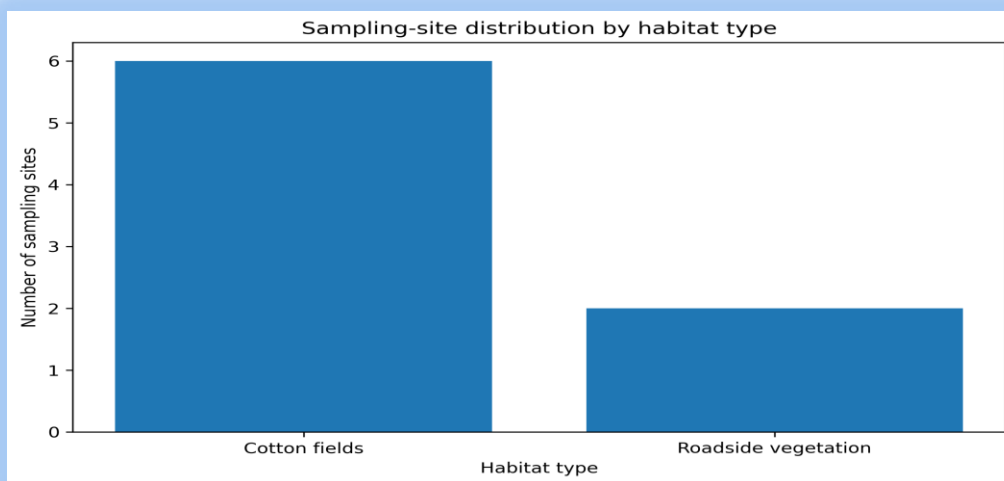


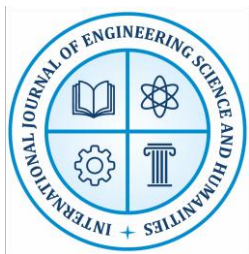
Figure 3. Distribution of surveyed sites by habitat type.

Cotton fields represented 75% of the surveyed sites, while roadside vegetation represented 25%. This distribution indicates that the present field dataset is weighted toward cultivated cotton habitats. Consequently, the available data are not balanced sufficiently to infer habitat preference by ladybird beetles.

5. Discussion

The field survey provides a useful preliminary record of ladybird beetles across multiple localities of Parbhani district. The inclusion of both cotton fields and roadside vegetation is ecologically relevant because beneficial insects may use non-crop vegetation as refuge, feeding or dispersal habitat while moving through agricultural landscapes. However, the present dataset does not measure abundance, prey density, vegetation structure or seasonal variation, so these ecological mechanisms cannot be tested directly.

The biological-control relevance of Coccinellidae is well established in the broader literature. Obrycki et al. (2009) emphasized that aphidophagous coccinellids can contribute to within-



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season pest suppression, while Indian reviews have documented diverse prey associations and the importance of coccinellid predators in agricultural systems. These findings support the rationale for surveying coccinellids in Parbhani, but they do not establish that the specimens collected in this field visit controlled a particular pest. A causal biological-control claim would require predator-prey observations, feeding assays, or replicated field experiments.

A major strength of the present work is its geographic coverage: eight localities distributed across the district were visited within a defined 16-day field period. A major limitation is the lack of species-level results in the supplied field report. Taxonomic identification was delegated to an expert facility, but the identified species list is not included in the available document. Therefore, species-level diversity indices such as Shannon, Simpson and Margalef indices, species accumulation curves, and similarity measures among localities cannot be calculated responsibly from the current record.

6. Data-quality and methodological limitations

- ❖ Species identities are not provided in the field report; therefore taxonomic composition cannot be independently analysed.
- ❖ The report gives a count of five species at every locality but does not provide individual specimen abundance.
- ❖ Sampling effort, number of sweeps, transect length, sampling time, weather variables and number of sampling replicates are not reported.
- ❖ The habitat dataset is unbalanced, with six cotton sites and two roadside sites.
- ❖ The field report mentions sorghum and horticultural gardens in site-selection planning, but these categories are not represented in the final eight-site table.
- ❖ GPS coordinates of the actual collection points are absent; the map in this manuscript uses independent locality reference coordinates only.
- ❖ The field visit occurred during one short period in August 2024, so seasonal distribution patterns cannot be inferred.

7. Recommended next phase for a Scopus-level empirical study

For a stronger species-diversity and biological-control paper, the next phase should retain the eight localities but standardize sampling effort and record species-level and specimen-level observations. Each site should ideally have replicated sampling units, exact GPS coordinates, date/time, crop growth stage, temperature/humidity, vegetation description, prey occurrence and number of adults/larvae. Specimens should be identified to species using current taxonomic keys and, where necessary, genital or molecular confirmation. The resulting dataset would support alpha-diversity indices, beta-diversity comparisons, habitat associations and multivariate ecological analysis.



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8. Conclusion

The August 2024 field survey documented ladybird beetle occurrence at eight selected localities in Parbhani district, with five species reported at each site in the supplied field record. Six sites were in cotton fields and two were in roadside vegetation. The survey therefore establishes a preliminary spatial dataset showing that ladybird beetles were recorded in both cultivated and non-crop settings. The results should be interpreted as a baseline field record rather than a complete estimate of district-wide coccinellid diversity. Incorporation of the pending taxonomic identifications, specimen abundances, standardized sampling effort and precise GPS locations will substantially strengthen the study and permit rigorous ecological and biological-control analyses.

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