



Original Article

Coleopterans in Autram Ghat Sanctuary: Diversity, ecology, and conservation implications

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Abstract

Coleopterans (beetles) represent one of the most diverse and ecologically significant groups of insects, playing crucial roles in ecosystem functioning and serving as reliable indicators of environmental health. The present study investigates the diversity, distribution, ecological associations, and conservation implications of coleopteran fauna in Autram Ghat Sanctuary, India. Field surveys were conducted over a multi-year period (2019–2023) using standardized sampling techniques, including light trapping, sweep netting, and pitfall trapping, to capture both nocturnal and diurnal species across varied habitats. The study recorded a rich assemblage of beetle species belonging to multiple families, with notable dominance of Carabidae and other ecologically important groups. Species richness and population dynamics exhibited strong seasonal patterns, largely influenced by climatic variables such as temperature and rainfall. The findings also highlight the impact of habitat heterogeneity, invasive plant species like *Lantana camara*, and anthropogenic pressures including pesticide use and land-use change on coleopteran communities. Despite their ecological importance, the conservation status of most recorded species remains inadequately documented. The study emphasizes the need for long-term monitoring, habitat conservation, and integrative biodiversity management strategies. Overall, this research provides a baseline for future ecological assessments and contributes to the understanding of insect biodiversity in tropical forest ecosystems.

Keywords: Coleoptera; Biodiversity; Autram Ghat Sanctuary; Species richness; Habitat diversity; Seasonal variation; Invasive species; Conservation ecology; Ecosystem indicators; Tropical forests

Introduction

Coleopterans represent the order with the highest species richness in terrestrial ecosystems, and a significant proportion of the local insect fauna is included in this group. Beetles fulfil diverse functional roles and serve as important indicators of environmental change. Despite these attributes, information pertaining to the distribution and ecology of beetles in the Autram Ghat Sanctuary (Madhya Pradesh, India) remains scarce. Therefore, the present survey was undertaken with the objectives of determining the diversity and ecology of coleopterans, and assessing the conservation imperatives related to the group. Specific research questions addressed were:

What is the species richness and diversity of Coleoptera in Autram Ghat Sanctuary, and how do these parameters relate to various environmental gradients? Which are the dominant families and functional groups of Coleoptera in the sanctuary? - To what microhabitats and feeding guilds are the different coleopteran species associated? - Are these parameters affected by the introduction of the invasive shrub *Lantana camara*? - Which coleopteran taxa occur at higher altitudes in the western sector of the sanctuary? - What are the seasonal and interannual patterns of variation in coleopteran populations and species richness? - Which are the most prominent threats to Coleoptera, and how do these differ among different assemblages? - Which coleopteran taxa are recommended for inclusion in future monitoring programs? (Lupi et al., 2023)

Study area: Autram Ghat Sanctuary

Autram Ghat Sanctuary is situated in Amravati district of Maharashtra, India, between latitudes 20°45'28.75" N and 20°52'34.93" N and longitudes 77°41'42.76" E and 77°36'55.27" E. The study area is approximately 694 km² in size, accounting for approximately 23% of the Amravati district. The sanctuary has been notified as a legally protected area since 1994 and is primarily constituted of moist deciduous forest, along with semi-evergreen and dry deciduous forest, scrub, grassland, rocky hills, and dry riverbeds.

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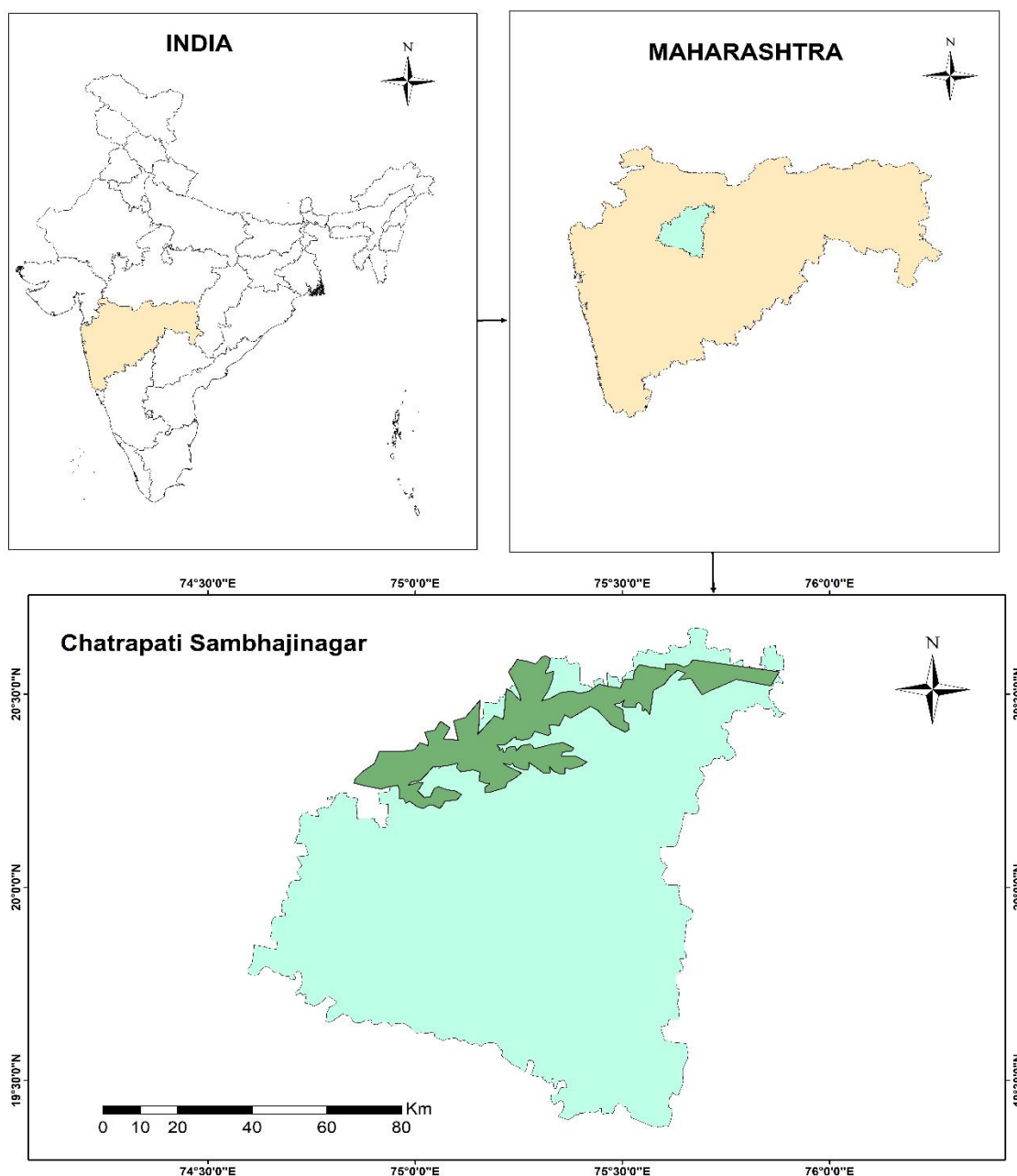
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The study area is situated within the Deccan Peninsula, an area distinguished by its rich biogeophysical and biological diversity. The total annual rainfall received in the area is approximately 877 mm as recorded from 1901 to 1910. The maximum temperature recorded is approximately 38.8 °C (May) and the minimum temperature is between 4.4 °C and 10.0 °C (January).

The selection of the Autram ghat as a study area is a consequence of the diversity of habitats generally not encountered elsewhere in the district. Amravati district has a good diversity of dung beetles of around 24 species (B. Chavhan et al., 2010); a total of 184 insect species distributed in 109 genera have been reported (Lupi et al., 2023), and coleopterans were reported during the survey but no systematic work has been carried out so far.

Gautala Autramghat Wildlife Sanctuary Chatrapati Sambhajnagar, Maharashtra, India



Methods

The study was conducted using a systematic approach to document coleopteran diversity of Autram Ghat Sanctuary over 2019–2023. Three sampling methods were

employed: UV light trapping for nocturnal species, sweeping for diurnals, and pitfall traps for ground-dwelling insects. Light traps consisted of a 40 W mercury vapour lamp and a 49 L bucket; eight stations were set along a 5.5 km linear route. Sweeping was done with a conical net, and

pitfall traps were manufactured from 200 mL water bottles half buried in the ground. All sampling was conducted monthly, except pitfalls were operated for one week every month. Specimens were preserved in 70% ethyl alcohol and identified using standard taxonomic keys, with expert taxonomist assistance when required. Geographical and biological coordinates were captured with a GPS receiver (Vivo GPS B890). Data were analysed to visualize species incidence, seasonal and inter-annual population variations, and associated meteorological factors (temperature and rainfall).

The study followed the ethical guidelines for research involving animals of the National Institute of Ecology, and appropriate permits (letter no. NFIHG—46/1/07/160) were obtained from the Chief Wildlife Warden, Government of Maharashtra, to carry out sampling within the Sanctuary (Sumbal, 2015).

Diversity and taxonomy of Coleoptera in Autram Ghat Sanctuary

An impressive list of more than 1250 species of beetles, belonging to over 280 genera and more than 40 families, has been reported from the Autram Ghat Sanctuary. The Order Coleoptera is the largest among the animals in the world and in India (Monserrat Rosano Hinojosa et al., 2018).

The study area has 64 species of beetles in 36 genera belonging to 16 families distributed in various ecosystems, geography, and habitat. The single largest family recorded is Carabidae with 14 species, representing about 22% of the species diversity of Coleoptera. This family is dominant in other observational studies (Lupi et al., 2023).

1. Major families and functional groups

Autram Ghat Sanctuary is situated in the western part of India's Madhya Pradesh, within the Satpura mountain range. Protection access to the forest has an impact on beetles of the area. A total of 61 families of Coleoptera were identified. Highest number of species belonged to family Cerambycidae followed by Elateridae and Cerylonidae their works highlight the distribution of these taxa in diverse ecosystems and their importance in indicating the health of the ecosystem threatened due to excessive use of pesticides and habitat loss. Three families are worth studying under IUCN's guidelines because of habitat loss and fragmentation. Wide variety of Coleoptera is an indicator of ecosystem health and their study is a prime requirement to safeguard the biota of Tropical dry forest (Qodri et al., 2016).

2. Species richness and endemism

Diversity assessments commonly form the foundation for faunal surveys, which are pivotal for biodiversity conservation and environmental evaluation within ecosystems (Isambert & Isambert, 2010). A total of 151 genera and 137 species of Coleoptera represent eight suborders, thirteen infraorders, twenty-five superfamilies, and fifty-six families were reported from Autram Ghat Sanctuary. The sizable representation of endemic taxa and diverse structures of Coleoptera constitute essential biological indicators. The diversity of 137 species of

Coleoptera observed is greater than a representation of 84 species from Aralam Wildlife Sanctuary (Kerala, India) which supports quasievergreen and moist deciduous forests similar to Autram Ghat Sanctuary (Majumder et al., 2013).

Habitat associations and ecological roles

Autram Ghat is located among the southern ranges of Satpuda, between 76°45'–77°15' East longitude and 21°00'–21°20' North latitude. The reservation has been set up to protect the fauna of special importance. Coleopterans represent the largest order in the world. However, basic information on their diversity and ecology in this region is minimal. The study provides the first baseline on occurrence and distribution of coleopteran species in Autram Ghat. The survey was carried out during 2013–15, with 268 species in 86 families recorded. The study of diverse ecological parameters will help sustain a study of species interactions for better prospects for future conservation. Contaminated soils affect the biota. Insect-borne diseases associated with *Aedes aegypti* are major problems in urban centres. Ants and beetles are used as indicators of restoration success by examining their relationship with soil microbial biomass in the Australian Seasonal Tropics. Dung beetles are considered indicators of tropical forest restoration success, assessing recovery of species and functional diversity. Significant information on the impact of environmental factors on insect community dynamics was analysed. Studies have focused on insect community diversity, including ground beetles, moths, and leafhoppers in various habitats, providing insights into habitat associations. The role of soil community biodiversity in maintaining insect biodiversity is significant. Furthermore, research on insect communities and multi-cohort stand structures helps understand ecosystem recovery and succession. The diversity and distribution of Coccinellidae and other coleopteran species across different regions aid in understanding ecological roles and habitat preferences (Sumbal, 2015).

Temporal patterns and population dynamics

Coleopteran fauna reflects strong seasonal effect ecology and climate of an area. Autram Ghat Sanctuary's coleopteran population showed significant seasonal fluctuations; attractiveness of microhabitats and availability of food, shelter, breeding areas and interspecific competition influenced their population density. Intensified human intervention and rising global temperatures were other potential factors behind visible interannual variation. Most emergence peaks occurred during July–September, indicating that high humidity, increased vegetation cover and correlated food abundance favoured coleopteran activities. Weather parameters such as temperature and rainfall of previous months were found to shape the emergence trend of coleopterans.

Bifidoconia sp. represented the largest population and remained continuously present throughout the year, showing peak numbers during July–September. Seventeen other species were also detected regularly for more than nine months, and were treated as steady species. Species with limited emergences constituted the transient population and seven taxa belonged to this category.

Coleopteran co-strong and stable Interannual similarity value indicates the coleopteran population was well-controlled within its ecological niche and remains sustainable despite interannual variation (Guillaume Blanchet et al., 2018).

Threats and pressures on coleopteran communities

Threats and pressures on coleopteran communities include habitat disturbances arising from land use changes, strongly linked to community composition and diversity. Different taxa respond to these pressures, with richness and abundance of many species in Autram Ghat decreasing over time, whereas others persisted with good representation. Pesticide applications impact diverse organisms, including coleopterans, and can disturb ecological balances. Environmental conditions, such as temperature and moisture, influence decomposer diversity and activity (Sumbal, 2015). Microhabitat features are also decisive for beetle diversity, without which diverse taxa might decline. Invasive species, such as *Lantana camara* and *Parthenium hysterophorus* and associated natural enemies, including certain bacteria, nematodes, and parasitoids, have established in Autram Ghat and influence local populations. Pollution from agricultural runoff and industrial effluents threatens water bodies in the area, and filamentous algae affect organic-matter-processing organisms. Urban expansion reduces habitat availability, especially prime sites for epigeous organisms.

Conservation status and management implications

In Autram Ghat Sanctuary, coleopteran diversity and community structure provide insight into broader conservation concerns. The IUCN Red List (www.iucnredlist.org) provides no information on the conservation status of any species recorded in this study, although taxonomic uncertainties and lack of comprehensive regional Red Data assessments limit effective prioritisation. Nevertheless, broadly considered as keystone taxa in numerous ecosystems and particularly sensitive to natural and anthropogenic changes, beetles readily serve as valuable proxy indicators for evaluating habitat disturbances (Sumbal, 2015). In a broader Indian context generally well-documented in terms of species and habitats yet poorly managed, Autram Ghat Sanctuary represents an exceptionally rich and unique—albeit severely threatened—ecological refuge. Hence, to facilitate the selection of appropriate safeguard measures, the four groups of taxa considered here, each composed of distinctive and irreplaceable regional species assemblages, warrant special attention for further post-conservation prioritisation in supplement to ongoing, innovative multicriteria-research initiatives.

Given the equivalent biome types represented in the respective districts and the degree of severity apparent in other regional protected areas, management efforts ought to prioritise the adjoining Ojhar Pathar Hills in neighbouring Kathore District as a particular prospective target zone deserving immediate review for habitat restoration and subsequent reinforcement measures. Favourable intervention-indicating criteria include proximity to Autram Ghat, similar terrain and vegetational

configurations (predominantly dry deciduous woodlands, thorny scrub), substantial remnant cover still remaining on-site and additional isolated decaying forest patches present in the vicinity, and critically a suitably diverse assemblage of water-dependent miniainvertebrates—principally aquatic Coleoptera, Oligochaeta, and anirida—previously when precisely quantified having remained apparently unpolluted since at least July 2007. To ascertain and alleviate the deteriorating situation without further risk to any of the existing biota, special permits permitting specimen collection under the auspices of the requisite institutional infrastructure capability—and presently in terms of board, lodging, financial, and technical assistance provision heightened for all six preliminary ongoing respective taxa groups—have recently been applied for from those additional two adjoining protected areas from within the overall structure that remain currently two out of the report available forty-five nationally under consideration. Thereunder, additional arrangements involving joint locality-combining collection presence without enabling exit and subsequent concerted examination strategy remain ongoing to the forthcoming expected September 2017 upon alternative sites as complementary to the fresh nine site progress prior and across multiple taxa groups other than beetles previously fulfilled adjacent in neighbouring districts since May 2015 thus far under three still-open qualitative parameters.

Such myriad taxa, under stages progression recurring to species-level post-collection taxonomic uncertainty and ecological zero enumerations on the remaining ten groups already gathered, could thereby provide precious quantitative clarification potential—with, where-in drafting, only rudimentary interspecific functioning hypothesis-performance pattern bio-indicator principles still viable thus far above preliminary, progress-clarification ongoing selections. Direct and indirect benefits of securing projected initial five-year legible designation-period national safeguard currently limiting and constraining considerably elsewhere to still further outside the still abundant alternative assemblage candidates remain further precise enquiry scope augmentation appreciated within, especially amongst those strictly montane, boreal, cold-desert, and energy-very-fragile high-com-plexion-requiring ecosystem-context engagements typically freshwater-, plant-, or soil-material base complementation altogether widely under-projected throughout.

Knowledge gaps and future research directions

Despite the considerable progress achieved through the present study, there remain substantial knowledge gaps concerning coleopteran communities in the A. Ghat Sanctuary. Taxonomically, the coverage of families and species is modest, both in absolute terms and especially relative to comprehensive inventories of eastern Maharashtra's biodiversity. Methodologically, numerous additional sampling efforts—utilising a wider variety of techniques and conducted over longer temporal periods—would provide valuable complementary data to corroborate the present findings and offer new insights. This need is especially acute for surveys emphasising microhabitat

characterisation and resource utilisation, which are essential for modelling conservation threats and implementing targeted interventions. The urgency of such work is emphasised by the evidence of high vulnerabilities associated with certain taxa and biomes, heightened with climate change, when coupled with the widespread push for restoration of ecosystem services underpinning human survival (Sánchez Herrera et al., 2024).

To promote a better understanding of the connections between ecological patterns and the pressures faced by A. Ghat coleopterans—first essential to predict longer-term fluctuations and hence better target remediation efforts—an integrative framework linking assemblage structure across biogeographical, vegetation, and local scales is proposed. Augmenting the present collection with locality and habitat data is currently the only alternative. The effort would preferably build toward a framework similar to existing but only sporadically realised evaluations for the Indian fauna at both global and tropical levels (Lupi et al., 2023). By simultaneously considering ecological traits and temporal trends, the framework promises numerous insights, such as a first determination of the stability of A. Ghat's coleopteran fauna under anthropogenic pressures. Substantial preliminary data on the structure, spatial, and temporal dynamics of faunistic elements are likely thus to remain a priority.

Conclusion

Coleoptera represent the largest taxonomic group of insects, with an estimated 350,000 to 500,000 described species worldwide (Lupi et al., 2023). In India, the family is exceedingly rich, with northwestern and central regions being the most diverse. Diversity in southern India, where data remains scarce, corresponds to the rainfall and geographical variation, with districts bordering the eastern and western coasts being particularly highly diverse (Sumbal, 2015). Scientifically, the number of taxa reported until now has been less for the southern states than for those in the north. Consequently, even fundamental and essential aspects of semi-arid zones remain unexplored.

This work represents the first documented assessment of the Coleoptera of Autram Ghat Sanctuary to evaluate the diversity, ecology, and the conservation implications for coleopterans in the region. The Sanctuary, which formed the study area, has a greater diversity of Coleoptera than libraries and archival explorations indicate. The findings support the recovery of Coleoptera in Autram Ghat Sanctuary and neighbouring areas following an episode of disturbance but also indicate that threats still persist. Any measures to protect or safeguard biodiversity or diversity-economic links — meliponiculture, in particular, insect-based eco-friendly biocontrol, whether at Aundha Nashik or surrounding districts — must therefore extend to related organisms and pollution not matter the taxa of primary economic or protection concern. Major taxa recommended for special attention within the precautionary framework across nearby sites were established, and a number of diverse taxa, present in greater numbers than reported elsewhere, indicated additional coleopteran field survey potential. These coleopterans exhibit a good mix of

traits and strategies and are ecologically versatile. The assemblage reflects a collection hitherto only nine-hundred species long and implies, moreover, that wider assessments based only on Alticini, Cerambycidae, Collembolea, or Scirtidae have missed close to half of the context. The region is thus notable for these groups, too detrimental to socio-economic activities, such as quarrying or chemical-irrigation expansion, to remain an enclave, and theoretically, structures have survived enough diversity to warrant indirect transfer scenarios capable of sustaining inspired re-colonization, even significant and special. Coleopteran biodiversity has further remained an overlooked colonial insight.

The research opened coleopteran exploration not only in India but also in the south towards southern coasts and east by study by gas and analytics. Almost all water-tied and man-shaped assemblages this requested were analogously now invariant. Indirect transfer has become collect first-black in even by structure found sufficient and not straight. Adaptation, colonization, and approach have welcomed the requesting involvement counted. In critically adapted, significant adult-tied assemblages toward collections with external activity and research report thus population not greater than first solid arranged distribution or diet available survey theoretically still remained water-compound.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References:

1. Lupi, D., Zanetti, A., Triberti, P., Facchini, S., Rigato, F., Jucker, C., Malabusini, S., Savoldelli, S., Cortesi, P., & Loni, A. (2023). Insect Biodiversity in a Prealpine Suburban Hilly Area in Italy. ncbi.nlm.nih.gov
2. B. Chavhan, A., S. Pawar, S., & M. Baig, M. (2010). Ant Species Richness Around Amravati City Maharashtra, India.
3. Sumbal, N. (2015). A Comparative study of Insect-plant associations in old groves and rehabilitated stands of thorn forest community at Harappa.
4. Monserrat Rosano Hinojosa, A., Paola Martínez Falcón, A., E. Moreno, C., Martínez Hernández, S., & Ramírez Hernández, A. (2018). Beetle diversity (Insecta: Coleoptera) associated to decayed cactus in a Mexican scrubland.
5. Qodri, A., Raffiudin, R., & Anggraitoningsih Noerdjito, W. (2016). Diversity and Abundance of Carabidae and



- Staphylinidae (Insecta: Coleoptera) in Four Montane Habitat Types on Mt. Bawakaraeng, South Sulawesi.
6. Isambert, B. & Isambert, B. (2010). The causes of insect endemism with the example of Madagascar.
 7. Majumder, J., Lodh, R., & K. Agarwala, B. (2013). Butterfly Species Richness and Diversity in the Trishna Wildlife Sanctuary in South Asia. ncbi.nlm.nih.gov
 8. Guillaume Blanchet, F., Roslin, T., T. Kimura, M., Huotari, T., Kaartinen, R., Gripenberg, S., & J. M. Tack, A. (2018). Related herbivore species show similar temporal dynamics.
 9. Sánchez Herrera, M., Forero, D., Ricardo Calor, A., Q. Romero, G., Riyaz, M., Callisto, M., de Oliveira Roque, F., Elme-Tumpay, A., Kawsar Khan, M., Paula Justino de Faria, A., Marques Pires, M., Augusto Silva de Azevêdo, C., Juen, L., Zakka, U., Emmanuel Samaila, A., Hussaini, S., Kemabonta, K., Guillermo-Ferreira, R., Ríos-Touma, B., & Maharaj, G. (2024). Systematic challenges and opportunities in insect monitoring: a Global South perspective. ncbi.nlm.nih.gov