



Beetles (Order Coleoptera) diversity and seasonal distribution in Jalna District, (MH) India

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Abstract

Beetles represent one of the most diverse groups of insects and play essential roles in ecosystem functioning as decomposers, predators, herbivores, and pollinators. The present study documents the diversity and seasonal distribution of beetles in Jalna District, Maharashtra, India. Field surveys were conducted across agricultural fields, scrubland, and water-associated habitats during pre-monsoon and monsoon seasons. Standard entomological sampling techniques such as light trapping, pitfall trapping, and hand collection were employed. A total of 42 species, belonging to 31 genera and 9 families, were recorded. Family Scarabaeidae showed maximum species richness, followed by Coccinellidae and Carabidae. Species richness and diversity were higher during the monsoon season compared to pre-monsoon. The study provides baseline data on coleopteran diversity of Jalna District and highlights the importance of habitat heterogeneity for insect conservation.

Keywords: Coleoptera, beetle diversity, jalna district, scarabaeidae, agro-ecosystem, biodiversity

Introduction

Coleoptera is the largest order of insects, comprising nearly one-fourth of all described animal species worldwide. Beetles occupy almost every terrestrial and freshwater habitat and exhibit wide ecological and functional diversity. Beetles occur in most terrestrial, freshwater habitats and marine environments (Bouchard *et al.*, (2017) [5]. The beetles belonging to the dominant order of animal kingdom Coleoptera and found everywhere in natural habitats except marine and the Polar region. About 40% (4, 00,000) of all described insect species are beetles (Hammond, 1992) [10] and approximately 15,088 species were recorded India (Kazmi, 2004) [13]. In India, beetles contribute significantly to ecosystem services such as nutrient recycling, biological control, and pollination. Jalna District, located in central Maharashtra, is characterized by semi-arid climate, agricultural dominance, and scattered scrub vegetation. Despite the ecological importance of insects, systematic documentation of beetle diversity from this region is limited. Previous studies from Maharashtra have reported rich coleopteran fauna, particularly scarabaeid beetles, indicating the potential of Jalna District to support diverse beetle assemblages.

Scarab beetle numbers are highest in tropical regions globally, especially in Africa and East Asia. There are approximately 36,448 species of scarab beetles reported worldwide, comprising 19 subfamilies (GBIF.org, June 4, 2021). India is a major region for the scarab beetle variety, with over 6,598 species belonging to the Aphodiinae, Cetoniinae, Dynastinae, Melolonthinae, Rutelinae, Scarabaeinae, and Orphinae subfamilies (GBIF.org, June 4, 2021). In nature, scarab beetles have a favorable impact on ecosystems and the economy by decomposing organic matter (Li *et al.*, 2010).

The world's largest populations are concentrated in tropical areas, mainly in Africa and Asia. The family Scarabaeidae has around 2,500 species in the Indian subcontinent.

Melolonthinae, Rutelinae, Dynastinae, and Cetoniinae are the most economically significant subfamilies of the Subcontinent, to which the majority of phytophagous scarabs belong to (Ali, 2001) [2]. Scarabaeid insects and their larvae do severe damage to both cultivated and forest plants. Mehta *et al.*, (2008) [15], claim that mature beetles feed on the leaves of various fruit and forest trees between the months of May and June. The white grubs, which are the larvae of scarabaeids, severely harm the roots of cereals, legumes, tiny fruit plants, shrubs, and trees in various parts of the world. According to Mehta *et al.*, (2010) [16], white grubs are a significant national pest in India that severely harm fruit trees and field crops.

The present study aims to (i) document beetle species diversity in Jalna District, (ii) analyze seasonal variation in beetle abundance, and (iii) assess habitat-wise distribution of coleopteran families.

Material and Methods

Study Area: The study was conducted at selected locations in Jalna District, Maharashtra (19.8°N, 75.9°E). Sampling sites included: - Agricultural fields (cotton, soybean, sorghum) - Scrub and grassland areas - Areas near ponds, canals, and seasonal streams

Sampling Period: Sampling was carried out during: - Pre-monsoon season (April–May) - Monsoon season (July–September)

Collection Methods: Light Traps: Used during evening and night hours to collect nocturnal beetles.

Pitfall Traps: Installed for ground-dwelling beetles and checked after 48 hours.

Hand Picking & Sweep Netting: Used during daytime surveys on vegetation and soil surface.

Preservation and Identification: Collected specimens were preserved in 70% ethanol and identified using standard taxonomic keys and published literature. Identification was done up to family/genus/species level wherever possible.

Data Analysis Species richness and abundance were calculated. Diversity indices such as Shannon–Wiener Index (H') were used to compare seasonal diversity.

Results Species Checklist

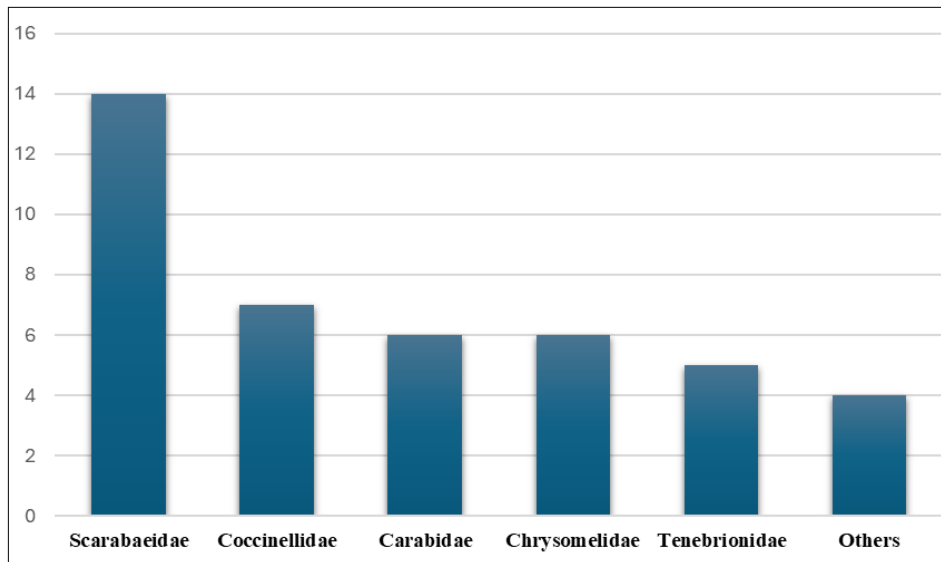
Table 1A: Checklist of beetle species recorded from Jalna District

Sr. No.	Family	Genus	Species	Habitat
1	Scarabaeidae	<i>Holotrichia</i>	<i>H. serrata</i>	Agricultural fields
2	Scarabaeidae	<i>Anomala</i>	<i>A. bengalensis</i>	Crop fields
3	Scarabaeidae	<i>Oryctes</i>	<i>O. rhinoceros</i>	Orchards
4	Scarabaeidae	<i>Onthophagus</i>	<i>O. gazella</i>	Dung rich areas
5	Scarabaeidae	<i>Phyllognathus</i>	<i>P. dionysius</i>	Grassland
6	Coccinellidae	<i>Coccinella</i>	<i>C. septempunctata</i>	Croplands
7	Coccinellidae	<i>Menochilus</i>	<i>M. sexmaculatus</i>	Vegetable fields
8	Coccinellidae	<i>Cheilomenes</i>	<i>C. sexmaculata</i>	Agricultural fields
9	Carabidae	<i>Calosoma</i>	<i>C. sp.</i>	Grassland
10	Carabidae	<i>Pheropsophus</i>	<i>P. sp.</i>	Soil surface
11	Chrysomelidae	<i>Aulacophora</i>	<i>A. foveicollis</i>	Cucurbit crops
12	Chrysomelidae	<i>Altica</i>	<i>A. sp.</i>	Crop vegetation
13	Tenebrionidae	<i>Opatrum</i>	<i>O. sp.</i>	Dry scrubland
14	Tenebrionidae	<i>Gonocephalum</i>	<i>G. sp.</i>	Dry soil
15	Scarabaeidae	<i>Maladera</i>	<i>M. insanabilis</i>	Crop fields
16	Scarabaeidae	<i>Apogonia</i>	<i>A. sp.</i>	Agricultural land
17	Scarabaeidae	<i>Adoretus</i>	<i>A. sp.</i>	Orchards
18	Scarabaeidae	<i>Heteronychus</i>	<i>H. sp.</i>	Grassland
19	Coccinellidae	<i>Hippodamia</i>	<i>H. variegata</i>	Croplands
20	Coccinellidae	<i>Brumoides</i>	<i>B. suturalis</i>	Crop vegetation
21	Coccinellidae	<i>Scymnus</i>	<i>S. sp.</i>	Agricultural fields
22	Carabidae	<i>Brachinus</i>	<i>B. sp.</i>	Soil surface
23	Carabidae	<i>Harpalus</i>	<i>H. sp.</i>	Grassland
24	Carabidae	<i>Amara</i>	<i>A. sp.</i>	Crop margins
25	Chrysomelidae	<i>Cassida</i>	<i>C. sp.</i>	Weedy vegetation
26	Chrysomelidae	<i>Galerucella</i>	<i>G. sp.</i>	Crop fields
27	Chrysomelidae	<i>Monolepta</i>	<i>M. signata</i>	Agricultural crops
28	Tenebrionidae	<i>Blaps</i>	<i>B. sp.</i>	Dry habitat
29	Tenebrionidae	<i>Tribolium</i>	<i>T. castaneum</i>	Stored grains
30	Tenebrionidae	<i>Alphitobius</i>	<i>A. diaperinus</i>	Poultry litter
31	Elateridae	<i>Agriotes</i>	<i>A. sp.</i>	Crop soil
32	Elateridae	<i>Melanotus</i>	<i>M. sp.</i>	Agricultural land
33	Cerambycidae	<i>Batocera</i>	<i>B. rufomaculata</i>	Trees
34	Cerambycidae	<i>Aeolesthes</i>	<i>A. holosericea</i>	Orchards
35	Curculionidae	<i>Sitophilus</i>	<i>S. oryzae</i>	Stored grains
36	Curculionidae	<i>Myllocerus</i>	<i>M. discolor</i>	Crop plants
37	Curculionidae	<i>Hypomeces</i>	<i>H. squamosus</i>	Trees
38	Hydrophilidae	<i>Hydrophilus</i>	<i>H. sp.</i>	Water bodies
39	Dytiscidae	<i>Cybister</i>	<i>C. sp.</i>	Ponds
40	Staphylinidae	<i>Paederus</i>	<i>P. fuscipes</i>	Moist fields
41	Staphylinidae	<i>Philonthus</i>	<i>P. sp.</i>	Soil litter
42	Dermestidae	<i>Dermestes</i>	<i>D. maculatus</i>	Animal remains

Species Composition: A total of 42 beetle species belonging to 31 genera and 9 families were recorded during the study period.

Table 1: Family-wise distribution of beetles recorded from Jalna District

Family	Number of Species	Dominant Habitat
Scarabaeidae	14	Agricultural fields, dung rich areas
Coccinellidae	7	Croplands
Carabidae	6	Grassland, soil surface
Chrysomelidae	6	Crop vegetation
Tenebrionidae	5	Dry soil, scrubland
Others	4	Mixed habitats



Graph 1: Showing the abundance of Beetles coleoptera insect family recorded in Jalan district

Seasonal Variation: Beetle diversity was higher during the monsoon season compared to pre-monsoon, with increased abundance of scarabaeid and chrysomelid beetles.

Table 2: Seasonal variation in beetle diversity

Season	Species Recorded	Shannon Index (H')
Pre-monsoon	24	2.31
Monsoon	38	2.89

Discussion

In the present investigation we conduct survey, collect and record the various beetles. The beetle assemblage of Jalna District exhibited moderate to high diversity, as indicated by the Shannon–Wiener diversity index values recorded during the study. The Shannon index value of 2.31 during the pre-monsoon season reflects moderate species richness with relatively lower evenness, likely due to harsh climatic conditions and reduced vegetation cover. In contrast, the higher Shannon index value of 2.89 during the monsoon season indicates increased species richness and a more even distribution of individuals among species.

Dabhade *et al.*, (2012) [8] studied 25 beetle species belonging to the 8 super families and 11 families from Mangrulpir Tahsil, Dist. Washim, Maharashtra.

Bhawane *et al.*, (2012) [1] recorded 29 species under 22 genera distributed in 4 subfamilies of family Scarabaeidae Kolhapur district, Maharashtra. Chandra and Gupta (2013) [6] observed 43 species belonging to 25 genera, 16 tribes and 8 subfamilies in 2 families, Hybosoridae and Scarabaeidae of the superfamily Scarabaeoidea of Barnawapara Wildlife Sanctuary, Chhattisgarh, India.

Thakare and Zade (2012) [19] noticed 10 species belonging to 6 different Tenebrionidae, families Carabidae, *viz.* Grindie, Scarabaeidae, Meloidae and Buprestidae of beetles from various habitats at Melghat Tiger Reserve, Maharashtra. The work on beetle diversity of Melghat area was done by Thakare *et al.*, (2012). Chandra *et al.*, (2012) [19] recorded some new species of beetles of Jabalpur, Madhya Pradesh (India).

Aland *et al.*, (2012) [1] surveyed 152 species under 101 genera belonging to 25 families of beetles, they concluded family Scarabaeidae to be dominant with 65 species from Amba Reserve Forest, Western Ghat, Kolhapur. Banerjee

(2014) [3] reported 9 families of Coleoptera from Durgapur, West Bengal, India.

The dominance of Scarabaeidae throughout the study period highlights the suitability of agricultural and dung-rich habitats in Jalna District for scarab beetles.

In current study, the subfamily Scarabaeinae was recorded most abundant with 14 in number followed by Coccinellidae recorded 7 in number Carabidae was recorded 6 in number, Chrysomelidae was recorded 6 in number. The Tenebrionidae family was recorded 5 in number and other family was also recorded 4 in number.

These findings are accordance with Murthy (2020) [17], who reported the Scarabaeinae 17.64%, and Dynastinae 5.88% Scarab beetles in South Indian states. Also, Jakhar *et al.*, (2021) [12], captured 5917 total numbers of scarab beetle individuals in the semi-arid agro-ecosystem of Jaipur, Rajasthan and Prajapat *et al.*, (2022) [18] collected 258 scarab beetle individuals of the Aravalli Range, Jaipur, Rajasthan.

In the present investigation the highest beetle diversity and abundance are observed during the rainy season (monsoon), followed by the pre-monsoon period. The higher abundance during monsoon and followed pre-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) [7, 11]. Similar patterns have been reported in the present studies. The increased occurrence of Coccinellidae during monsoon underscores their role as natural predators in agro-ecosystems, particularly in controlling aphid populations. Ground-dwelling beetles belonging to Carabidae and Tenebrionidae were more frequently encountered in scrubland and dry habitats, reflecting their adaptation to soil surface activity and xeric conditions.

The presence of aquatic beetles such as *Hydrophilus* and *Cybister* near water bodies further emphasizes habitat heterogeneity as a key driver of beetle diversity in the region. Overall, the observed seasonal variation in beetle diversity corresponds well with ecological theories linking insect abundance to climatic factors, vegetation complexity, and resource availability. The Shannon index values recorded in this study fall within the range reported for

comparable agro-ecosystems in India, suggesting a relatively stable coleopteran community in Jalna District.

Conclusion: This study provides the first consolidated account of beetle diversity from Jalna District. The findings serve as baseline data for future ecological, agricultural, and conservation-oriented research. Protection of habitat diversity and reduced pesticide usage are recommended to conserve beneficial beetle fauna.

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