

Review of Diversity and Abundance of Coleopteran Species in the Vidarbha Region of Maharashtra, India

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Peer Review Information	Abstract
Type: Article Received: 07 June 2026 Revised: 12 July 2026 Accepted: 14 Aug 2026 Published: 11 Sept 2026	Beetles constitute a major component of insect diversity and play important ecological roles in terrestrial and freshwater ecosystems. The order Coleoptera is characterized by hardened forewings, known as elytra, which protect the membranous hind wings. Beetles exhibit diverse feeding habits and occupy a wide range of habitats (Jadhao and Bhongade, 2018; Wankhade <i>et al.</i>, 2014). The diversity of beetles is extensive, and different species are associated with vegetation, soil, litter, dung, decaying organic matter and aquatic habitats (Indurkar, 2023; Shirbhate and Shirbhate, 2020). The order Coleoptera is well represented in terrestrial habitats and has been considered useful in studies of environmental change because of habitat specificity and associations with soil and ground litter (Wankhade <i>et al.</i>, 2014). However, studies on beetle diversity in the Vidarbha region are scattered and concentrated in particular localities. The present review compiles and summarizes published information on coleopteran diversity and abundance from different parts of Vidarbha, including 97 scarab beetle species from different habitats of Vidarbha (Khadakkar <i>et al.</i>, 2018), 26 scarab beetle species from the Kolkas region of Melghat Tiger Reserve (Thakare <i>et al.</i>, 2011), 42 beetle species from the Mul region of Chandrapur district (Ghagargunde and Paingankar, 2024), 27 beetle species from Girgaon in Chandrapur district (Indurkar, 2023), 12 beetle species from the vicinity of Semadoh Makhala Road, Sipna Range, Melghat Tiger Reserve (Thakare and Zade, 2012), 90 beetle species from forest and agricultural areas of Akola district (Shirbhate and Shirbhate, 2020), 36 beetle species from the Southern Satpuda foothills region of Morshi, Amravati (Pidhekar, 2019), and 27 beetle species from the Sawanga Vithoba Lake region of Amravati (Wankhade <i>et al.</i>, 2014). The available literature indicates considerable coleopteran diversity in Vidarbha; however, comprehensive region wide inventories using standardized sampling methods are lacking. The reviewed studies indicate that beetle communities vary among habitats and environmental conditions, with seasonal and habitat related differences reported from several localities of Vidarbha (Wankhade <i>et al.</i>, 2014; Bajad <i>et al.</i>, 2019). The review identifies variations in Vidarbha's beetle diversity and highlights research gaps requiring standardized sampling, taxonomic identification, and long-term monitoring.
	Keywords: Coleoptera; Beetle Diversity; Species Abundance; Vidarbha Region; Habitat Heterogeneity; Seasonal Variation; Biodiversity Conservation

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Introduction

Insects are among the most successful and diverse groups of animals on Earth and occupy a wide range of habitats (Akhare *et al.*, 2021). Coleoptera (beetles) is one of the most diverse orders of Insecta. Beetles possess a hardened exoskeleton and modified forewings, known as elytra, which protect the membranous hind wings. They have biting and chewing mouthparts and undergo complete metamorphosis (Jadhao and Bhongade, 2018). Beetles exhibit considerable ecological diversity and occur in terrestrial and aquatic habitats, where they may function as herbivores, predators, decomposers, scavengers and dung associated insects (Wankhade *et al.*, 2014; Jadhao and Bhongade, 2018). Their ecological roles and association with different habitats make them important components of terrestrial ecosystems. They are functionally important, being the dominant above ground invertebrate in pastures and natural grassland when judged by biomass (Bajad *et al.*, 2019). They may be harmful or beneficial, and play an important role in the ecology of majority of ecosystem. Being abundant and varied, beetles are able to exploit the wide diversity of food sources available in their many habitats. Some beetle species are important agricultural pests, whereas others act as predators and may contribute to biological control. (Jadhao and Bhongade, 2018). The Vidarbha region occupies the eastern part of Maharashtra in Central India and covers approximately one third of the state's geographical area which includes the districts of Nagpur, Wardha, Bhandara, Gondia, Chandrapur, Gadchiroli, Amravati, Akola, Washim, Yavatmal and Buldhana. Despite this ecological potential, beetle diversity in Vidarbha has received considerably less attention than some other insect groups. Therefore, a synthesis of existing information is useful for understanding the current state of knowledge concerning coleopteran diversity and abundance in Vidarbha and for revealing the absence of a unified regional assessment.

Ecological Characteristics of Vidarbha Region

The Vidarbha region contains a variety of habitats, including forest, agricultural, wetland, aquatic and mixed terrestrial environments. The reviewed studies investigated beetle diversity in different habitat types, including forest areas, agricultural fields, lake associated habitats, wetlands, shrub areas, teak dominated areas, dung patches and rocky habitats (Thakare *et al.*, 2011; Thakare and Zade, 2012; Shirbhate and Shirbhate, 2020; Indurkar, 2023; Wankhade *et al.*, 2014). Such habitat diversity provides different microhabitats and resources for coleopteran groups.

Diversity Of Coleopteran Species at Major Study Sites

Thakare *et al.*, (2011) investigated scarab beetle diversity, abundance and composition in the Kolkas region of Melghat Tiger Reserve, Amravati, Maharashtra, during May to October 2009. Beetles were collected using dung baited pitfall traps and handpicking from five transects representing different vegetation types and microhabitats. Overall 14 genera comprising 26 beetle species from 8 subfamilies were recorded. Among the subfamily of Scarabaeidae, the Scarabaeinae was the dominant subfamily in terms of species richness (15 species) followed by Melolonthinae (2 species), Rutelinae (2 species) and Cetoniinae (2 species) and the subfamilies Geotrupinae, Hybosorinae, Orphninae and Dynastinae were represented by only 1 species in the surveyed area. 8 species could be identified to the species level. The *Onthophagus* was the most species rich genus, with 6 species followed by *Onitis* (3 species), *Copris* (2 species), *Anomala* (2 species) and *Catharsius* (2 species). The beetle fauna in the study area was dominated by the subfamily Scarabaeinae, which accounted for 62.8% of the total individuals, followed by Melolonthinae (16.5%). The dominance of dung beetles indicates the importance of soil, dung availability, vegetation structure and mammalian activity in determining scarab assemblages. These findings indicate that Melghat supports beetle communities representing multiple ecological guilds rather than only dung associated scarabs.

Thakare and Zade (2012) studied beetle diversity in the vicinity of Semadoh Makhala Road, Sipna Range, Melghat Tiger Reserve. The investigation was conducted during October and November 2009, covering different habitats including wetlands, dry shrub areas, teak dominated areas, dung patches and rocky habitats. A total of 12 species belonging to 5 different families of beetles viz. Gyrinidae (Whirligig beetles), Tenebrionidae (Darkling beetles), Carabidae (Ground beetles), Scarabaeidae (Scarab beetles) and Meloidae (Blister beetles) were recorded. 5 species of Scarab beetles from the subfamilies Scarabaeinae and Cetoniinae of family Scarabaeidae, 3 ground beetles (Coleoptera: Carabidae) were recorded from the study area. The study recorded beetles from different habitats, indicating variation in coleopteran composition among the surveyed microhabitats.

Shirbhate and Shirbhate (2020) conducted a survey from August 2016 to February 2020 in forest and agricultural areas of Akola district. A total of 68 genera and 90 species belonging to 13 different families of beetles (Coleoptera) viz. Buprestidae (metallic wood boring beetle), Carabidae (ground beetles), Cerambycidae, Chrysomelidae (leaf beetles), Coccinellidae, Dytiscidae, Geotrupidae, Gyrinidae, Hydrophilidae, Hybosoridae, Meloidae (blister beetles), Scarabaeidae, Tenebrionidae (darkling beetles) were identified from various habitats along with their valid scientific names, systematic position, and distribution within agricultural fields and forest areas of Akola district. Beetles were recorded from a variety of habitats and microhabitats, including decayed vegetation, under stones, logs, bark, leaf litter, in logs and fallen trees, ponds, lakes, streams, dung, fungus, carrion, rotten wood, pollen, plant sap, grass, roots, leaves, fruits. These records provide baseline information for further research and may assist in future monitoring and conservation planning of beetle diversity in Akola district.

Bajad *et al.*, (2019) investigated the incidence, seasonal activity and diversity of scarab beetles at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during the kharif season of 2014. Scarab beetle activity was recorded from the second week of June to the third week of October, with peak activity during the 30th meteorological week (21–27 July). Four families of Scarabaeoidea, namely Scarabaeidae, Hybosoridae, Geotrupidae and Trogidae, were recorded. Scarabaeidae was the dominant family and contributed 84.58% of the total scarabaeoid fauna, followed by Hybosoridae (7.31%), Geotrupidae (4.74%) and Trogidae (3.35%). Within Scarabaeidae, Scarabaeinae contributed 36.56%, Cetoniinae 18.97%, Rutelinae 16.40% and Melolonthinae 12.64% of the total scarabaeoid fauna. Scarab beetle population showed a significant positive relationship with minimum temperature, relative humidity and rainfall, whereas maximum temperature, evaporation and bright sunshine hours showed negative relationships. The study indicated that seasonal weather parameters influenced scarab beetle activity in the Akola region.

Khamankar and Deshmukh (2021) conducted a survey of aquatic beetles around Wani Tehsil from September 2011 to August 2015. A total of 38 specimens belonging to 6 genera and 11 species of two families, Dytiscidae and Hydrophilidae, were recorded. The species recorded included *Cybister convexus*, *Cybister limbatus*, *Cybister tripunctatus*, *Eretes griseus*, *Hydaticus fabricii*, *Hydaticus luczonicus*, *Hydaticus vittatus*, *Sandracottus dejeanii*, *Sandracottus festivus*, *Hydrophilus olivaceus* and *Sternolophus rufipes*. The authors concluded that Dytiscidae was the dominant family in the study area.

Ghagargunde and Paingankar (2024) investigated beetle diversity in Mul city and surrounding areas of Chandrapur district using various trapping techniques. A total 42 species belonging to 14 families, and 32 genera were recorded from the Mul region. Among 14 families family Carabidae is found the largest and dominant family due to rich rice fields, the dense forest of Tadoba Andhari Tiger Reserve, and the nearby Uma River basin which supports the growth of a variety of beetle species with 9 species, with 6 species Chrysomelidae family is found second largest and 5 species were from Tenebrionidae family. Three species were recorded from the Buprestidae, Coccinellidae, Curculionidae, Dytiscidae, and Scarabaeidae family each. A single species were recorded of Cerambycidae, Cleridae, Geotrupidae, Meloidae, and Staphylinidae family each. The maximum beetles are found during monsoon season due to favorable conditions and the richness of resources required for their growth and survival. Beetle diversity was greatest during the monsoon season. This study is particularly important because it broadens the taxonomic coverage beyond Scarabaeidae and demonstrates that local beetle communities may contain numerous families that remain poorly documented in Vidarbha. This study will be helpful to check diversity loss and to decide conservation strategies. Due to lack of literature on beetle diversity of Mul region this data will provide scope for further research.

Pidhekar (2019) reported 36 species were from Southern Satpuda foot hills region two sub order, Adephaga and Polyphaga and eight families. Suborder Adephaga includes family Carabidae which represent 10 species. Suborder Polyphaga includes seven families namely Scarabaeidae, Coccinellidae, Lampyridae, Chrysomelidae, Meloidae, Elateridae and Cerambycidae. Suborder Polyphaga represents 26 species out of which family Scarabaeidae contains 16 species, Coccinellidae includes 3 species, Lampyridae contains 2 species, Chrysomelidae 2 species, Meloidae, Elateridae and Cerambycidae represents only one species each. Most diverse family is the Scarabaeidae containing 16 species; least diverse families are Meloidae, Elateridae and Cerambycidae including only one species each. Out of two suborder studied, the dominant suborder is Polyphaga (26 species) as compared to the suborder Adephaga (10 species). Family Scarabaeidae are most dominant due to the noticeable and site due to their large size, bright color, often with elaborate ornamental. Elateridae are less reported less as compared to other family of Beetles. This diversity may be due to high diversity of flora in the present study area with favorable environmental conditions. The Satpuda Range are the major hotspot of biodiversity of many vertebrates and invertebrate.

Indurkar (2023) investigated beetle diversity in three habitats of Girgaon region, Tehsil Nagbhir, District Chandrapur, comprising agricultural, forest and lake associated sites. A total 27 species, 11 distinct families and 23 genera were recorded from forest, agricultural and lake associated habitats. This area was rich in beetles families, with Carabidae (ground beetle) being most represented family, Coccinellidae (lady bird beetle), Chrysomelidae (potato beetle), Tenebrionidae (flour beetles) and other family of beetles such as, Curculionidae (weevils, snout beetles), Scarabaeidae (dung beetles), Staphylinidae (rove beetles), Dytiscidae (aquatic diving beetles), Hydrophilidae (water scavenger beetles), Ciidae (tree fungus beetles) and Anthicidae (ant like flower beetles). The Carabidae family is the most represented family in Girgaon region represented by 6 species of Coleoptera. Coccinellidae and Chrysomelidae family was represented by 4 species (15%). Hydrophilidae and Tenebrionidae family was represented by 3 species (11%). Curculionidae family was represented by 2 species (7%), Anthicidae (3%), Ciidae, Dytiscidae, Scarabaeidae and Staphylinidae (4%) were represented by one species each. On the basis of field observations, it is concluded that beetles are most populous during the winter. Their population declines noticeably in summer. Perhaps, many a species hibernate or aestivate to overcome the unfavorable climatic condition. The diversity has great value to human welfare and it is a need to examine the present status i.e., how many species of plants, animals and microbes occur on the planet Earth, Therefore, the major concern today is to make the inventory of diversity of a given ecosystem which will help to make the review of loss of diversity of an area and it will also help to make the solid step to conserve and to prevent the diversity loss.

Khadakkar et al. (2018) compiled scarab beetle records from different habitats and localities across the Vidarbha region during 2013 to 2018. A total of 97 species belonging to 39 genera and seven subfamilies were identified, including 10 species newly recorded from the region. Scarabaeinae was the dominant subfamily with 57 species belonging to 18 genera, followed by Melolonthinae with 13 species, Rutelinae with 10 species and Cetoniinae with nine species. The coprophagous subfamilies Scarabaeinae and Aphodiinae together contributed 61 species. *Onthophagus* was the dominant genus, with 21 species. The Scarabaeinae assemblage was further categorized into tunnelers, rollers and dwellers, with tunnelers contributing 77.19%, rollers 14.04% and dwellers 8.77% of the species composition. The authors emphasized the importance of standardized sampling, including light traps and dung baited pitfall traps, to reduce sampling bias and recommended continuous monitoring of scarab diversity in representative localities. The major reason behind the dominance of coprophagous beetles can be that they are easy to collect by handpicking as compared to anthrophagous and phytophagous beetles. Vidarbha region of Maharashtra harbors a diverse community of scarab beetles. The majority of the species in this checklist belong to subfamily Scarabaeinae which is a group of purely coprophagous beetles. Forest habitats such as Melghat Tiger Reserve and Bor Wildlife Sanctuary show rich diversity of scarabs as evident from the collection data. Thorough use light traps and dung baited pitfall traps are suggested for comprehensive diversity study and to overcome the collection bias. As the larvae and adults of scarabs are pest of various cash crops along with other crops, location specific occurrence data will be useful in determining control strategies of these pests. Considering the importance of scarab beetles as indicators of environmental change, continuous monitoring of the diversity of these species among representative localities will be beneficial ecologically. The high representation of dung associated scarabs demonstrates the importance of livestock associated habitats and forest ecosystems in maintaining nutrient-recycling beetle communities. This checklist can be considered as a preliminary study of scarab diversity of Vidarbha.

Wankhade *et al.*, (2014) recorded 27 beetle species belonging to seven families. The study emphasized that Coleoptera are closely associated with soil, leaf litter and vegetation and may respond strongly to environmental changes. The presence of beetles around a lake ecosystem demonstrates that coleopteran diversity in Vidarbha is not restricted to forests or agricultural land. Wetland margins, terrestrial vegetation and surrounding soil provide additional resources and microhabitats. Scarabaeidae was the dominant family with 11 species, representing approximately 41% of the recorded beetle species. Cerambycidae and Meloidae each contributed five species, while Tenebrionidae contributed three species. Chrysomelidae, Buprestidae and Gyrinidae were represented by one species each. The presence of several beetle families in a wetland associated landscape illustrates the importance of habitat heterogeneity. Although many beetles are terrestrial, lake margins provide vegetation, soil, organic matter and microhabitats that can support diverse terrestrial arthropod assemblages.

Table 1. Taxonomic composition of Coleoptera reported from Vidarbha

Taxonomic group/family	Study locations where reported	Major habitat association	Relative importance/observation
Scarabaeidae	Vidarbha, Kolkas, Akola, MTR, Morshi, Girgaon, Sawanga Vithoba	Forest, agriculture, dung associated, lake margins	One of the most frequently reported groups; particularly dominant in scarab focused studies
Carabidae	Akola, Mul, Girgaon, Morshi, MTR	Forest, agricultural land, soil/ground litter	Dominant in Mul and Girgaon
Chrysomelidae	Akola, Mul, Girgaon, Morshi	Agricultural and vegetated habitats	Important herbivorous group
Tenebrionidae	Akola, Mul, Girgaon, MTR, Sawanga	Soil, litter, decaying material	Commonly recorded in terrestrial habitats
Coccinellidae	Akola, Mul, Girgaon, Morshi	Vegetation/agricultural habitats	Important predatory beetle group
Cerambycidae	Akola, Girgaon, Morshi, Sawanga	Trees, wood and vegetation	Associated with woody vegetation
Dytiscidae	Akola, Wani, Girgaon	Aquatic habitats	Dominant aquatic group at Wani
Hydrophilidae	Akola, Wani, Girgaon	Aquatic habitats	Aquatic beetle group
Meloidae	Akola, MTR, Morshi, Sawanga	Vegetation/terrestrial habitats	Recorded from several localities
Buprestidae	Akola, Mul, Sawanga	Trees/wood	Wood-associated group
Gyrinidae	Akola, MTR, Sawanga	Aquatic habitats	Associated with water surfaces

Other families	Akola, Mul, Girgaon, MTR, Morshi	Various	Indicate broad taxonomic and habitat diversity
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Seasonal Variation

The available studies indicate a clear seasonal component in beetle diversity and abundance. The monsoon appears to be particularly favourable for beetles in several Vidarbha studies. At Mul, maximum beetle occurrence was reported during the monsoon, attributed to favourable environmental conditions and greater availability of resources (Ghagargunde and Paingankar, 2024). Possible reasons include: increased soil moisture, increased vegetation, greater availability of organic matter, increased fungal activity, increased dung decomposition, emergence of adults, improved conditions for larvae, increased availability of food resources. For scarab beetles, rainfall can also increase dung availability and improve soil conditions for burrowing and reproduction. In the Akola study, scarab beetle activity was recorded from the second week of June to the third week of October, with peak activity during 21–27 July, and population showed significant relationships with minimum temperature, relative humidity and rainfall (Bajad *et al.*, 2019). In winter Girgaon study reported that beetles were most populous during winter, with a noticeable decline during summer (Indurkar, 2023). This is an interesting contrast to Mul. It demonstrates that seasonal patterns may differ between localities and ecological groups. Winter conditions in some parts of Vidarbha may provide relatively moderate temperatures and suitable moisture conditions compared with the extreme summer heat. Summer appears to be the least favourable period in some terrestrial studies, particularly where temperatures become high and moisture availability declines. However, this should not be generalized to every beetle family because different species have different life cycles and adaptations. But the exact seasonal peak varies according to: habitat, family, species, rainfall, temperature, food availability, reproductive cycle, sampling method.

Table 2. Seasonal variation in beetle occurrence in selected Vidarbha locations

Study location	Season/period	Observed pattern	Possible associated factors
Akola	Monsoon/kharif season	High scarab activity; peak around July	Rainfall, humidity and favourable temperature
Mul	Monsoon	Maximum beetle occurrence	Favourable environmental conditions and resource availability
Girgaon	Winter	Beetles reported as most populous	Favourable seasonal conditions
Girgaon	Summer	Noticeable decline in beetle population	Unfavourable climatic conditions
Kolkas, Melghat	May to October	Variation among transects	Habitat, vegetation and soil differences

Factors Affecting Coleopteran Diversity And Abundance

The major factors can be divided into natural/environmental factors and anthropogenic factors.

- Habitat heterogeneity-Habitat heterogeneity appears to be an important factor associated with beetle diversity in the reviewed studies. The Sawanga Vithoba Lake region contains forests, bushes, sandy areas and water associated habitats, providing different microhabitats for beetles. The authors associated the observed beetle diversity with plant diversity and habitat complexity (Wankhade *et al.*, 2014).
- Vegetation diversity-Vegetation diversity can provide different food resources and microhabitats for beetles. The Sawanga Vithoba study associated beetle diversity with high floral diversity and habitat complexity (Wankhade *et al.*, 2014).
- Soil conditions-Soil characteristics are relevant to beetle diversity, particularly for groups associated with soil, dung and ground litter. Variation in soil characteristics and vegetation was suggested as one factor associated with differences in beetle assemblages among transects at Kolkas (Thakare *et al.*, 2011).
- Rainfall and humidity-Rainfall and relative humidity were important environmental variables in the Akola scarab study. Scarab beetle population showed significant positive relationships with minimum temperature, relative humidity and rainfall, whereas maximum temperature and evaporation showed negative relationships (Bajad *et al.*, 2019).
- Temperature-Temperature may influence beetle activity and abundance. In the Akola study, scarab beetle population showed a positive relationship with minimum temperature and a negative relationship with maximum temperature (Bajad *et al.*, 2019).
- Food availability-Availability of food and other resources is likely to influence the occurrence of different beetle groups. The reviewed studies recorded beetles associated with dung, vegetation, decaying material, aquatic habitats and agricultural environments (Thakare *et al.*, 2011; Shirbhate and Shirbhate, 2020; Khamankar and Deshmukh, 2021).

- Livestock and mammalian activity-Livestock and mammalian activity can be particularly relevant to dung associated scarabs because dung provides an important resource. The representation of dung associated scarabs in the Vidarbha literature highlights the ecological importance of dung availability in scarab assemblages (Thakare *et al.*, 2011; Khadakkar *et al.*, 2018)

Agricultural practices

Agricultural landscapes were included among the habitats investigated in several reviewed studies. Beetle diversity recorded from agricultural areas indicates that such habitats support coleopteran assemblages; however, the effects of specific agricultural practices on beetle diversity require further investigation (Shirbhate and Shirbhate, 2020; Indurkar, 2023; Ghagargunde and Paingankar, 2024).

Table 3. Factors affecting Coleopteran diversity and abundance

Factor	Effect on Coleopteran community	Evidence from reviewed studies
Rainfall	Generally favours activity and abundance of several beetle groups	Akola; Mul
Relative humidity	Positive association with scarab activity	Akola
Temperature	Different temperature variables affect abundance differently	Akola
Soil characteristics	Influence composition of ground/dung-associated beetles	Kolkas
Vegetation structure	Provides food, shelter and breeding resources	Kolkas, Akola, MTR
Dung availability	Supports coprophagous scarabs	Vidarbha scarab study, Kolkas
Habitat heterogeneity	Increases availability of different microhabitats/resources	MTR, Mul, Girgaon, Sawanga
Agricultural practices	Can provide resources but may also create disturbance	Akola and agricultural studies
Habitat disturbance	Can alter beetle composition and abundance	Kolkas
Water availability	Determines aquatic beetle habitat	Wani, Sawanga

Ecological Importance of Coleopterans

Coleoptera are ecologically important because different families perform different ecosystem functions.

- Decomposition-Dung associated beetles participate in the removal and burial of dung and therefore contribute to decomposition and organic matter processing (Thakare *et al.*, 2011; Khadakkar *et al.*, 2018).
- Nutrient cycling-Dung beetles contribute to nutrient redistribution by burying and relocating dung in the soil. The strong representation of dung associated Scarabaeinae in the Vidarbha literature highlights their ecological importance in nutrient cycling and organic matter processing (Thakare *et al.*, 2011; Pidhekar, 2019).
- Soil ecosystem functioning-Burrowing and dung associated scarabs can influence soil processes through tunnelling and relocation activities. Pidhekar (2019) associated scarab activity with ecological functions including nutrient dispersal, nutrient cycling and bioturbation.
- Biological control-Predatory beetles, particularly members of Carabidae, can contribute to biological control in agricultural ecosystems by feeding on insect pests (Jadhao and Bhongade, 2018).
- Agricultural importance-Some coleopteran species are agricultural pests, whereas predatory beetles may provide biological control services. Therefore, documentation of beetle diversity is relevant to agricultural pest monitoring and integrated pest management (Jadhao and Bhongade, 2018).
- Environmental indicators-Beetles have been considered useful indicators of environmental change because many species are associated with particular habitats and environmental conditions. Changes in beetle assemblages may therefore provide useful information for monitoring habitat and environmental changes (Wankhade *et al.*, 2014).

Research Gaps

- Lack of region wide systematic surveys-The available studies are concentrated in particular localities. There is no sufficiently standardized survey covering all districts of Vidarbha using the same methodology.
- Scarab beetles are better documented than total Coleoptera-The 97-species study provides substantial information on Scarabaeidae across different habitats of Vidarbha (Khadakkar *et al.*, 2018). In comparison, the available literature is more limited for several other coleopteran families and for many localities of the region. Studies such as those from Akola, Mul and

Girgaon demonstrate that local beetle assemblages include several families beyond Scarabaeidae (Shirbhate and Shirbhate, 2020; Ghagargunde and Paingankar, 2024; Indurkar, 2023). Further studies are therefore required to document the diversity and distribution of less-studied coleopteran groups across Vidarbha.

- Lack of standardized sampling methods-Different studies used different methods such as hand collection, light traps, pitfall traps, dung-baited traps, aquatic collection. Consequently, species richness recorded by different studies should be compared cautiously because sampling methods, effort, duration and habitats differed among studies.
- Limited long-term monitoring-Although some studies covered multiple years, long term standardized monitoring across the same localities remains limited. Differences in sampling duration and study period make it difficult to distinguish seasonal variation from longer-term changes in beetle populations.
- Limited molecular identification-Many studies depend primarily on morphological identification. Further taxonomic studies are required to resolve species-level identification problems, difficult genera and taxonomic uncertainties, particularly in less-studied coleopteran groups.
- 6. Limited information on habitat-specific species
- Limited information on habitat-specific species-Information remains limited regarding the habitat specificity of individual beetle species, including their association with forest, agricultural, wetland, aquatic and disturbed habitats. Further studies should document species level habitat associations using standardized sampling across representative localities.

Conclusion

The available literature demonstrates that Vidarbha supports a considerable and ecologically diverse coleopteran fauna distributed across forest, agricultural, aquatic, wetland and mixed habitats. The available studies have documented substantial species richness, including 97 scarab species from different habitats of Vidarbha, 90 species from forest and agricultural habitats of Akola, 42 species from Mul, 36 species from the Southern Satpuda foothills, 27 species from Girgaon, 27 species from Sawanga Vithoba Lake, 26 scarab species from Kolkas in Melghat and 11 aquatic beetle species from Wani. The reviewed studies collectively suggest that habitat heterogeneity is an important factor associated with differences in coleopteran diversity among Vidarbha localities. Forests, agricultural fields, river basins, lakes and their surrounding vegetation provide different resources and microhabitats, resulting in distinct beetle assemblages. Scarabaeidae, particularly Scarabaeinae, is highly represented in the available literature, while Carabidae becomes prominent in some forest-agricultural landscapes such as Mul and Girgaon. Aquatic habitats support specialized groups such as Dytiscidae.

Seasonal variation is also evident. Monsoon conditions appear favourable for beetle activity and diversity in some locations, particularly Mul, whereas the Girgaon study reported greater beetle abundance during winter and a decline during summer. These differences indicate that seasonal responses are likely to vary according to habitat, species biology and environmental conditions rather than following one uniform regional pattern. The strong representation of dung associated scarabs is ecologically important because these beetles participate in dung removal, decomposition, nutrient redistribution and soil modification (Thakare *et al.*, 2011; Pidhekar, 2019). Other coleopteran groups function as predators, herbivores, decomposers, scavengers and agricultural pests. Consequently, beetle communities contribute substantially to ecosystem functioning and can potentially serve as indicators of environmental change.

However, the present review also reveals a major limitation: knowledge of Coleoptera in Vidarbha remains fragmented. Existing studies differ in sampling methods, sampling duration, habitats investigated and taxonomic coverage. Species richness is reported more frequently than quantitative abundance, making direct comparison between localities difficult. Furthermore, research has concentrated on particular localities and groups, especially Scarabaeidae, while several districts and coleopteran families remain poorly investigated.

Future studies should therefore focus on standardized, region wide and long term sampling, quantitative assessment of abundance, seasonal monitoring and habitat specific comparisons. Studies specifically examining the effects of agricultural practices, habitat disturbance and land use change would further improve understanding of coleopteran diversity in Vidarbha. Such efforts would provide a stronger baseline for assessing changes in beetle populations and developing conservation strategies. Overall, Vidarbha should be considered an important region for coleopteran biodiversity research in central India. The existing records already demonstrate substantial diversity, but they probably represent only a portion of the actual fauna. A coordinated and standardized regional inventory is therefore essential for understanding the true diversity, abundance, ecological functions and conservation status of Coleoptera in Vidarbha.

References

1. Shirbhate, M. and A. Shirbhate, 2020. Diversity and checklist of beetles (Arthropoda: Coleoptera) from forest areas and agricultural areas of District Akola, Maharashtra, India. *Environment Conservation Journal*, 21(1&2): 89-94.
2. Khamankar, D.B. and C.K. Deshmukh, 2021. Diversity and checklist of aquatic beetles from various regions of Wani Tehsil, District Yavatmal, Maharashtra. *International Journal of Researches in Biosciences, Agriculture and Technology*, Special Issue 18: 111-114.

3. Bajad, V.V., D.B. Undirwade, S.V. Dhonde and S.M. Dadmal, 2019. Incidence of scarab beetles collected through light trap at Akola vicinity of Maharashtra with reference to Scarabaeidae of Coleoptera. *Journal of Entomology and Zoology Studies*, 7(2): 405-409.
4. Pidhekar, S.M., 2019. Preliminary study check list of beetles (Order-Coleoptera) from foot hills region of Southern Satpuda Range, Morshi, Amravati, Maharashtra-444602 (India). *International Journal of Research and Analytical Reviews*, 6(1): 540-545.
5. Indurkar, U., 2023. Studies on diversity of beetles in Girgaon region, District Chandrapur, Maharashtra, India. *International Journal of Science and Research*, 12(5): 1075-1077.
6. Thakare, V.G., V.S. Zade and K. Chandra, 2011. Diversity and abundance of scarab beetles (Coleoptera: Scarabaeidae) in Kolkas region of Melghat Tiger Reserve (MTR), District Amravati, Maharashtra, India. *World Journal of Zoology*, 6(1): 73-79.
7. Wankhade, V., N. Manwar and A. Malu, 2014. Preliminary studies on diversity of Order Coleoptera at Sawanga-Vithoba Lake Region, District Amravati, Maharashtra, India. *Journal of Entomology*, 11(3): 170-175.
8. Thakare, V.G. and V.S. Zade, 2012. Diversity of beetles (Insecta: Coleoptera) from the vicinity of Semadoh-Makhala Road, Sipna Range, Melghat Tiger Reserve, (M.S.) India. *Bioscience Discovery*, 3(1): 112-115.
9. Ghagargunde, P.G. and M.S. Paingankar, 2024. Diversity of beetles from the Mul region of Chandrapur District (M.S.) India. *Indian Journal of Applied & Pure Biology*, 39(3): 1840-1845.
10. Khadakkar, S.S., A.D. Tiple and A.M. Khurad, 2018. Scarab beetles (Coleoptera: Scarabaeoidea: Scarabaeidae) of Vidarbha, India, with notes on distribution. *Proceedings of the National Academy of Sciences, India, Section B: Biological Sciences*, 89(4): 1239-1249.
11. Akhare, Y.D., Khadim, M. and Patharikar, H.A., 2021. Variability of nocturnal insects in Sant Gadge Baba Amravati University Campus, Amravati. *International Journal of Scientific Research in Science and Technology*, 8(5): 157-193.
12. Jadhao, M.F. and Bhongade, A.H., 2018. Occurrence of carabid beetles (Coleoptera: Carabidae) in rice fields during kharif season. *International Journal of Researches in Biosciences, Agriculture & Technology*, Special Issue (May): 6-10.