

REVIEW ARTICLE



A review of scarab beetles (Coleoptera: Scarabaeidae) diversity in India

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The diversified geographic location along with climatic conditions has led to the enrichment of fauna species in India. Coleoptera (*Gk. Coleos*–sheath, *ptera*–wing) are the largest group of organisms at the order level and are comprised of beetles. They adapt to a wide range of environmental conditions and are widely distributed. The family Scarabaeidae which is included in the superfamily Scarabaeoidea is one of the largest families. They consist of about 27,800 species worldwide and are further divided into 16 subfamilies, 82 tribes and 94 sub-tribes. They are usually harmful or beneficial in nature with their size being large to small. The research on scarab beetles is necessary to understand their role as pest as well as their adaptation to different anthropogenic activities. Also, the diversified population of scarab beetles along with their similar characters makes it hard for researchers to identify them often leading to misidentification which is why a review is needed. This review summarizes the status, diversity and ecological status of scarab beetles in India.

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Introduction

India has a diversified climatic condition and its unique biogeographic location has led to a richness in terms of biological diversity. About 6.90% of the total number of species of Phylum Arthropoda belongs to India of which 59,393 species belong to class Insecta. Coleoptera (*Gk. Coleos*–sheath, *ptera*–wing) are the largest group of organisms at the order level and are comprised of Beetles. They are cosmopolitan in distribution and show a wide range of adaptations to environmental conditions.¹ Coleoptera consists of about 3,50,000 of the 8,00,000 described insect species which belongs to 4 sub-orders and 177 families.² The forewings of Coleoptera are adapted into defensive covers or

'elytra', their size usually ranges from minute to large insect with prominent compound eyes.³ They play an important role in the terrestrial ecosystem and further studies are required to know their activity in various avian food chains along with anthropogenic activities, vegetation, soil and other biological indicators.¹

The family Scarabaeidae Latreille, 1802 under the order coleoptera is composed of about 91% of all the scarabaeoids and is the richest family under the superfamily Scarabaeoidea and consists of about 27,800 species worldwide.⁴ They are further divided into 16 subfamilies, 82 tribes and 94 sub tribes.⁵ 1590 species under 203 genera are known in India. They

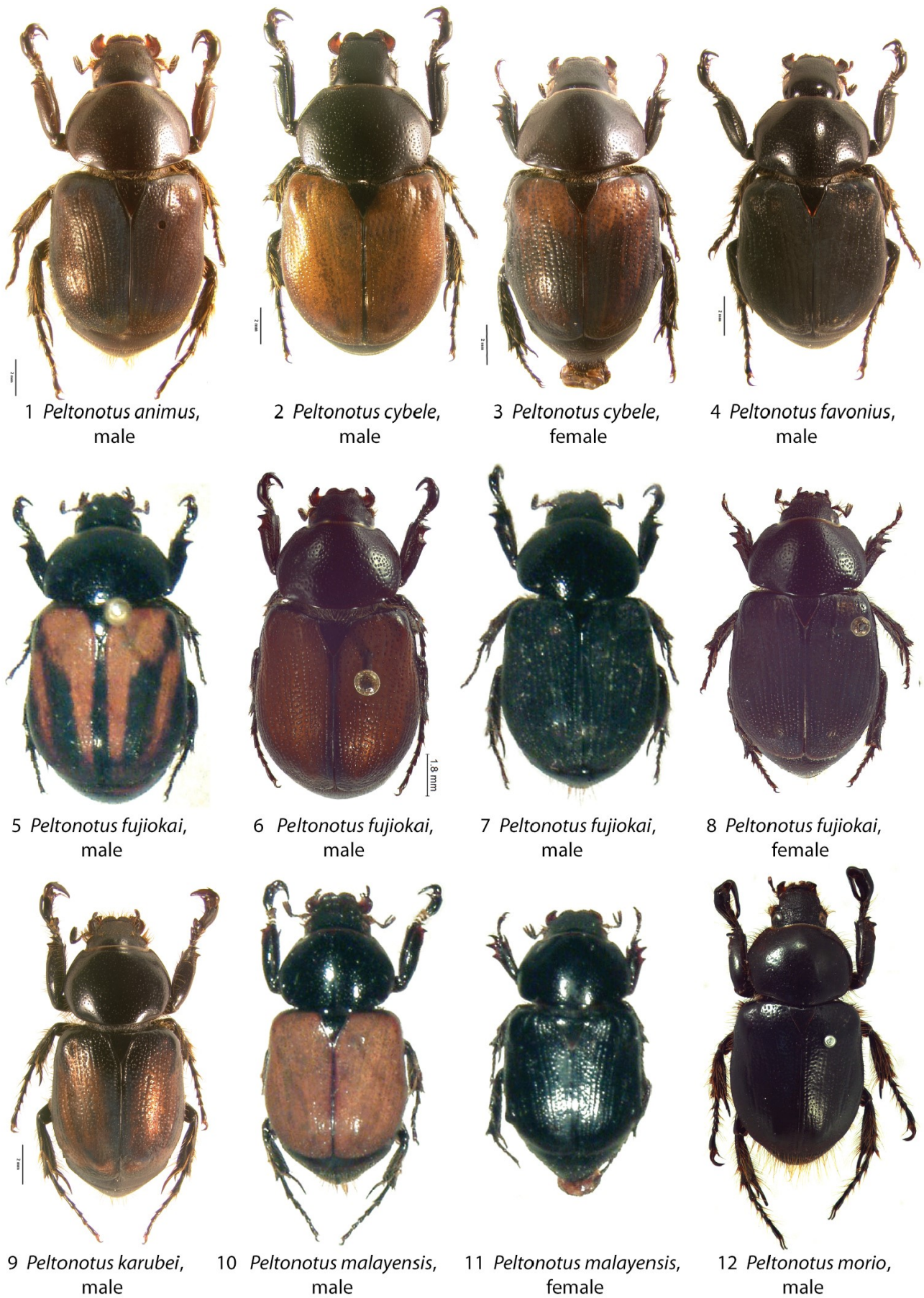


Figure 1 | Some scarab beetles. Jameson and Drumont (2013), *ZooKeys* 320: 63-95. doi: 10.3897/zookeys.320.5352 CC-BY SA 3.0).

are usually small to large in size and are easily recognized by the shape of their antennae. They are a serious pest of forestry, agriculture and some fruit trees and they are economically important. Scarab family are usually beneficial or harmful in nature.⁶ The subfamily Scarabaeinae are called dung beetles and are beneficial, they are coprophagous and feed on dung and carrion. They play an important role in nutrient cycling and also decrease flies present in dung along with parasitic worms. The other subfamilies like Rutelinae, Dynastinae, Melolonthinae and Caetoniinae are called chafers, they are phytophagous and harmful and usually feed on various commercial crops acting as pests.⁴ They constitute about three fourth of the beetle species and harmful both in the larval and adult stage.⁷

The difference in vegetation, soil, altitude along with the crops grown has influenced the diversity of beetles.⁸ The decrease in dung due to the decrease in the number of cattle, habitat loss, environmental changes, increase human interference, use of antibiotics and loss of food quality due to pollutants has led to the decrease in the diversity of dung beetles.⁴ The variation in climatic conditions along with different parameters such as wind speed, rainfall, humidity, moisture and temperature has a great influence on the diversity of these scarab beetles.⁹ The diversity along with its ecology and biology is of great interest because of their economic importance, their role in the ecosystem, forest biodiversity as well as their grubs and larvae serving as food in some insectivorous bird food chain.¹⁰

India

Due to the different geographic regions along with the variation in latitude and altitude, scarab beetles are present in different parts of India. The diversity of Indian beetles was first known when Leroy published his work named Indian Insect life in 1909.¹¹ Later in 1931, Arrow mentioned his work on Indian Coprinae under the series Fauna of British India.¹² Balthasar then later published his work on Scarabaeidae of the Oriental and Palaearctic region.¹³ The report on the diversity of Scarabaeidae in different Indian states viz. West Bengal, Arunachal Pradesh, Delhi, Tripura, Manipur, Sikkim, Meghalaya and North East India was carried out by Biswas.¹⁴⁻¹⁸ In 1985 and 1986, the diversity of dung beetles from Gujarat and Rajasthan was reported by Sewak.¹⁹⁻²⁰ Sewak also studied dung beetles from five districts of western Uttar Pradesh.²¹ The different types of dung beetles from Bangalore and different parts of Karnataka was studied by Veenakumari and Veeresh.²² They also studied three species of Scarabaeinae from Bangalore in the following year.²³ Chattarjee and Biswas also made notable contributions.²⁴ In 2000, Chattarjee and Biswas reported the fauna of *Scarabaeidae: Coprinae* from

two North East states viz. Tripura and Meghalaya.²⁵ Mittal reported the presence of about 30,000 species of scarabaeid beetles from India.²⁶ Sewak also published his work on the fauna of *Scarabaeidae: Coprinae* from Gujarat.²⁷ Singh and his co-workers studied the distribution of white grub fauna in Garhwal hills of western Himalaya.²⁸ The Scarabaeidae: Coprinae fauna of Thar desert, Rajasthan and Arunachal Pradesh were studied by Sewak. He reported the presence of 73 species of laparostict scarabs belonging to 14 genera from Arunachal Pradesh with no records on pleurostict scarabs.²⁹⁻³⁰ However in 2012, Chandra and Gupta reported 12 species of pleurostict scarabs from Arunachal Pradesh.³¹ They also reported 43 species of scarab beetles belonging to 25 genera, 16 tribes and eight subfamilies in two families from Chhattisgarh, India in which 31 species are new to the scarab fauna.³²

Chandra reported the presence of 2,500 species of scarabaeid beetles from India with most of them being phytophagous leaf and fruit feeders. He reported the diversity of scarabaeid beetles from Madhya Pradesh which consists of 94 taxa belonging to 9 subfamilies.³³ The scarabid beetles of Pench Tiger Reserve (Seoni), Madhya Pradesh was also studied by Chandra.³⁴ The Scarabaeid beetles of Bandhavgarh National Park and Kanha Tiger Reserve, Madhya Pradesh was studied by Chandra and Ahirwar. They revealed 44 species belonging to 24 genera and 8 subfamilies from Bandhavgarh National Park and a total of 61 species of Scarabaeidae beetles belonging to 27 genera under 8 subfamilies from Kanha Tiger Reserve. They also report the fauna of Scarabaeidae family from Madhya Pradesh and Chattisgarh and recorded 124 species/subspecies belonging to 45 genera in 11 subfamilies.³⁵⁻³⁷ Singh *et al.* reported 12 species of the family Scarabaeidae from 70 species of beetles (Coleoptera) in Kane Wildlife Sanctuary from Arunachal Pradesh.³⁸ 59 species of scarabaeid beetles were collected in and around Amba Reserved forest of Western Ghat region Kolhapur district, Maharashtra by Aland *et al.*³⁹

29 species of Scarabaeidae family was reported by Bhawane *et al.* with most of them being polyphagous and serious pest.⁴⁰ He also reported 26 species of dung beetles belonging to Scarabaeinae subfamily from Sindhudurg district, Maharashtra.⁴¹ David and Petr in 2013 also reported 29 species of beetles belonging to the family Scarabaeidae from the state of Rajasthan, Maharashtra and Goa.⁴² 61 species of scarabaeid beetles was updated and reported from Pench Tiger Reserve, Madhya Pradesh which belongs to 30 genera, 19 tribes, 3 families and 7 subfamilies.⁴³ One species of genus *Bolbogonium* Boucomont, 1911 and 4 species of genus *Bolbohamatum* Krikken, 1980 from Central India was reported by Kailash Chandra and Devanshu Gupta.⁴⁴ They also reported 52 scarab beetles belonging to

24 genera and 5 subfamilies from Achanakmar–Amarkantak Biosphere Reserve, Chhattisgarh.⁴⁵ 22 scarab species of beetles were also reported by Chandra and Singh from Achanakmar Wildlife Sanctuary, Chhattisgarh.⁴⁶ The diversity of scarab beetles from Govind Wildlife Sanctuary was reported by Chandra *et al.* which consists of 11 species belonging to 2 families of superfamily Scarabaeoidea.⁶ 53 species, 27 genera and 6 subfamilies of scarab beetles from Sidhi district of Madhya Pradesh was reported by Chandra *et al.*⁴⁷ 32 species of scarab beetles were recorded from Melghat Tiger Reserve, Vidarbha, Maharashtra by Thakare *et al.* which belongs to 22 genera, 8 subfamilies and 3 families under superfamily Scarabaeoidea.³ 89 species of scarabaeid beetle in 32 genera and 6 subfamilies were reported by Jadhav *et al.* from Maharashtra in 2012. In 2018, Khadakar *et al.* reported the presence of 97 species of scarabaeidae family under 39 genera belonging to 7 subfamilies from Maharashtra taking into account the previous work done by Jadhav *et al.*⁴⁸⁻⁴⁹

In 2019, Aparna reported five new records of dung beetles from two subfamilies of scarabaeidae and the current scarab beetle diversity from Maharashtra stands at 102 species in 43 genera.⁵⁰ Tom and Kaippallil reported a total of 51 species of Coleopterans from Kerala out of which 4 species belong to the scarabaeidae family.⁵¹ Thakkar and Parikh in 2016 reported 177 species of coleopteran beetles from Gujarat out of which 38 species belong to scarabaeidae family.⁵² Chandra and Gupta reported 669 beetles from Singhori Wildlife Sanctuary, Raisen, Madhya Pradesh representing 26 species of scarabaeid beetles belonging to 12 genera and two subfamilies. They reported 24 species of the subfamily scarabaeinae.⁵³ 10 species of scarabaeid beetles belonging to 8 genera under 3 subfamilies was reported from Salt Lake City, Kolkata by Ghosh and Bhunia in 2016.⁵⁴ A new species of scarab beetle *Pukupuku* Muramoto, 2006 was reported from Arunachal Pradesh in 2016 by Gupta *et al.*⁵⁵ In 2019, a new species *Enoplotrupes tawangensis* belonging to scarabaeidae family was again described by Gupta *et al.* from Arunachal Pradesh.⁵⁶

An updated checklist of coleoptera diversity from Chhattisgarh was reported by Gajendra and Prasad. They reported 194 species of beetles belonging to 6 families and 23 subfamilies with Scarabaeidae family consisting of 78 species belonging to 7 subfamilies.⁵⁷ Bhattacharyya *et al.* studied the diversity and abundance of scarab beetles from Assam and reported 44 species of scarabs belonging to 6 subfamilies out of which 41 species are new records. He also mentioned that out of these 44 species, 5 are coprophagous while the other 39 species are phytophagous.⁵⁸ Patole reported 15 species of scarabaeid beetles belonging to 14 genera in 5 subfamilies *viz.*, Dynastinae, Scarabaeinae, Rutelinae,

Cetoniinae and Melolonthinae from Sakri, Dist–Dhulia, Maharashtra.⁴ Thomas Latha and Thomas K. Sabu reported 34 species of scarab beetles belonging to 11 genera from Nelliampathi, South Western Ghats in 2018. They also provide pictorial keys for rapid and baseline identification of dung beetles. *Onthophagus deflexicollis* (Lansberge, 1883), *O. manipurensis* (Arrow, 1907) and *Tibiodrepanussinicus* (Harold, 1868) were found to be the first report from the South Indian region.⁵⁹ Srinivasa surveyed the different agroecological regions of Western Ghats in Karnataka revealing the occurrence of 18 species of scarabaeid beetles. He reported that species richness was found to be negatively and significantly correlated with altitude and suggests that low temperature at high altitudes inhibit the development and growth of beetles.⁶⁰ Venugopal *et al.* reported 519 dung beetles from the Malabar coast in southern India which represents 26 different species belonging to 8 genera and five tribes. An assessment on the community structure and diversity of dung beetles associated with semiurban agricultural land was also done by them which reveals that urbanization has affected the community structure and led to a decrease in the diversity of dung beetles as compared to regional forests.⁶¹

Conclusion

The diverse physical features along with different climatic conditions of India helps in sustaining and harboring high biodiversity. Beetles belong to the order coleoptera and are ubiquitous. The family scarabaeidae under coleoptera is the largest family of insects. This review was made to gather all the information on the diversity and ecological status of scarabaeidae in India. The diversity and its role in the different ecological systems were studied and explained by different authors. Reports have been made that the diversity of the scarab beetles have been significantly correlated with altitude which results in the inhibition of growth and development of these beetles. The coprophagous scarab beetles play an important role in nutrient cycling and some works have been done regarding their role in the ecosystem. However, the phytophagous scarab beetles as reported are more in number and they usually serve as pests during their larval as well as their adult stage. Further studies are still required to know their role in the ecosystem as well as their feeding behaviour in serving as pests to different crops, plants and fruits. Reports have also been made that the diversity of these scarab beetles are declining due to urbanization. However, scanty works are available to know the effects of urbanization regarding their diversity as well as their adaptation to anthropogenic activities. Therefore, the study and survey of scarabaeid beetles in India need to be considered due to their large impact on

the biodiversity of India.

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