

## ECOLOGY AND PRESENT TAXONOMIC STATUS OF BEETLES IN SHEKHAWATI REGION OF RAJASTHAN

**Madhu Chaudhary**

Associate Professor, Department of Zoology  
Govt. Lohia P.G. College, Churu (Rajasthan) India

**Abstract:** *The order Coleoptera is a group of beetles and weevils is the largest group of comparable units among all animals. The members of this order vary in colour, size, structure and adaptations to a wide range of habitats and are cosmopolitan in distribution. The majorities of beetles are terrestrial, herbivores; many are predatory, frequently with highly specialized host ranges or life cycles. They are economically important in terms of both beneficiary as well as deleterious impacts which they have on ecosystem dynamics and environmental health and hygiene, including agriculture and animal husbandry. The present study is based on collection of different coleopteran genera from Shekhawati region of Rajasthan. Shekhawati region is the part of northern Rajasthan and desert area, where rain is the main source of fresh water, so rainy season (months from July to Sept.) are favourable for floral growth and also favourable for fauna because of rich flora most beetles are harmless and were collected by hand. In the present study 37 genera from 11 families are recorded. Nine genera from Scarabaeidae (scarabs, dung beetles), 12 genera from Tenebrionidae (Darkling beetles), 2 genera from Geotrupidae, 2 genera from Cerambycidae (long horned beetles), 1 genera from Buprestidae (Metallic wood borers, Jewel beetles), 4 genera from Hydrophilidae (Water scavenger beetles), 2 genera from Dytiscidae (Predacious diving beetles, water beetles), 2 genera from Coccinellidae (Lady bird beetles), 1 genera from Bruchidae, 1 genera from Elateridae (click beetles), 1 genera from Melolonthidae (cockchafers) are recorded. In which one genera of Scarabaeidae, two genera of Tenebrionidae, one genera of Hydrophilidae, one genera of Elateridae and one genera of Cerambycidae are not identified.*

**Key words:** Ecology, Taxonomy, Beetles, Environmental, Shekhawati region.

### Introduction

The word "coleoptera" is derived from the Greek *koleos*, meaning "sheath"; and *pteron*, meaning "wing", thus "sheathed wing", because most beetles have two pairs of wings, the front pair, the "elytra", being hardened and thickened into a sheath-like, or shell-like, protection for the rear pair, and for the rear part of the beetle's body. The superficial consistency of most beetles morphology, in particular their possession of elytra, has long suggested that the Coleoptera are monophyletic, but growing evidence indicates this is unjustified, there being arguments, for example, in favour of allocating the current suborder Adephaga their own order, or very likely even more than one.

The Coleoptera include more species than any other order, constituting almost 25 percent of all known types of animal life-forms. About 40 percent of all described insect species are beetles (about 400,000 species), and new species are discovered frequently. Some estimates put the total number of species, described and undescribed, at as high as 100 million, but a figure of one million is more widely accepted. The largest taxonomic family is commonly thought to be the Curculionidae (the weevils or snout beetles), but recently the Staphylinidae (the rove beetles) have claimed this title.

The diversity of beetles is very wide. They are found in all major habitats, except marine and the Polar Regions. They have many classes of ecological effects; particular species are adapted to practically every kind of diet. Some are no specialist detritus feeders, breaking down animal and plant debris; some feed on particular kinds of carrion such as flesh or hide; some feed on wastes such as dung; some feed on fungi, some on particular species of plants, others on a wide range of plants. Some are generalist pollen, flower and fruit eaters. Some are predatory, usually on other invertebrates; some are parasites or parasitoids. Many of the predatory species are important controls of agricultural pests. For example, beetles in the family Coccinellidae ("ladybirds" or "ladybugs") consume aphids, scale insects, thrips, and other plant-sucking insects that damage crops.

Conversely, beetles are prey of various invertebrates and vertebrates, including insects, fish, reptiles, birds, and mammals. The Coleoptera are not generally serious pests, but they include agricultural and industrial pests, such as the Colorado potato beetle (*Leptinotarsa decemlineata*), the boll weevil (*Anthonomus grandis*), the red flour beetle (*Tribolium castaneum*), and the mungbean or cowpea beetle (*Callosobruchus maculatus*). Also included is the death-watch beetle, the larvae of which can cause serious structural damage to buildings by boring into the timbers. Species in the Coleoptera have a hard exoskeleton, particularly on their forewings (elytra, singular elytron). These elytra distinguish beetles from most other insect species, except for the Dermaptera. The hemelytra of Heteroptera have a slight resemblance, but are not the same and their function is largely different.

Like all armoured insects, beetles' exoskeletons comprise numerous plates called sclerites, some fused, and some separated by thin sutures. This combines armored defenses with maintaining flexibility. The general anatomy of a beetle is superficially uniform, but specific organs and appendages may vary greatly in appearance and function between the many families in the order, and even more so between the suborders (such as Adephaga) that currently seem increasingly to be separate orders in their own right. All insects' bodies are divided into three sections: the head, the thorax, and the abdomen, and the Coleoptera are no exception. Their internal morphology and physiology also resemble those of other insects. Beetles are endopterygotes; they undergo complete metamorphosis, a biological process by which an animal physically develops after a birth or hatching, undergoing a series of conspicuous and relatively abrupt changes in its body structure. Males may fight for females in various ways, and such species tend to display marked sexual dimorphism.

### **Distribution and diversity**

Beetles are by far the largest order of insects, with 350,000–400,000 species in four suborders (Adephaga, Archostemata, Myxophaga, and Polyphaga), making up about 40 percent of all insect species described, and about 30 percent of all animals. Though classification at the family level is a bit unstable, about 500 families and subfamilies are recognized. One of the first proposed estimates of the total number of beetle species on the planet is based on field data rather than on catalog numbers. The technique used for this original estimate, possibly as many as 12 million species, was criticized, and was later revised, with estimates of 850,000–4,000,000 species proposed. Some 70–95 percent of all beetle species, depending on the estimate, remain undescribed. The beetle fauna is not equally well known in all parts of the world. For example, the known beetle diversity of Australia is estimated at 23,000 species in 3265 genera and 121 families. This is slightly lower than reported for North America, a land mass of similar size with 25,160 species in 3526 genera and 129 families. While other predictions show there could be as many as 28,000 species in North America, including those

currently undescribed, a realistic estimate of the little-studied Australian beetle fauna's true diversity could vary from 80,000 to 100,000.

Patterns of beetle diversity can be used to illustrate factors that have led to the success of the group as a whole. Based on estimates for all 165 families, more than 358,000 species of beetles have been described and are considered valid. Most species (about 62 percent) are in six extremely diverse families, each with at least 20,000 described species: Curculionidae, Staphylinidae, Chrysomelidae, Carabidae, Scarabaeidae and Cerambycidae. The smaller families account for 22 percent of the total species – 127 families with fewer than 1000 described species and 29 families with 1000–6000 described species. So, the success of beetles as a whole is driven not only by several extremely diverse lineages, but also by a high number of moderately successful lineages. The patterns seen today indicate beetles went through a massive adaptive radiation early in their evolutionary history, with many of the resulting lineages flourishing through hundreds of millions of years to the present. The adaptive radiation of angiosperms helped drive the diversification of beetles, as four of the six mega diverse families of beetles are primarily angiosperm-feeders: Curculionidae, Chrysomelidae, Scarabaeidae, and Cerambycidae. However, even without the phytophagous groups, lineages of predators, scavengers, and fungivores are tremendously successful. Coleoptera are found in nearly all natural habitats, including freshwater and marine habitats, everywhere vegetative foliage is found, from trees and their bark to flowers, leaves, and underground near roots- even inside plants in galls, in every plant tissue, including dead or decaying ones.

### **Taxonomy**

About 450,000 species of beetles occur – representing about 40 percent of all known insects. Such a large number of species poses special problems for classification, with some families consisting of thousands of species and needing further division into subfamilies and tribes. This immense number of species allegedly led evolutionary biologist J. B. S. Haldane to quip, when some theologians asked him what could be inferred about the mind of the Creator from the works of His Creation, that God displayed "an inordinate fondness for beetles".

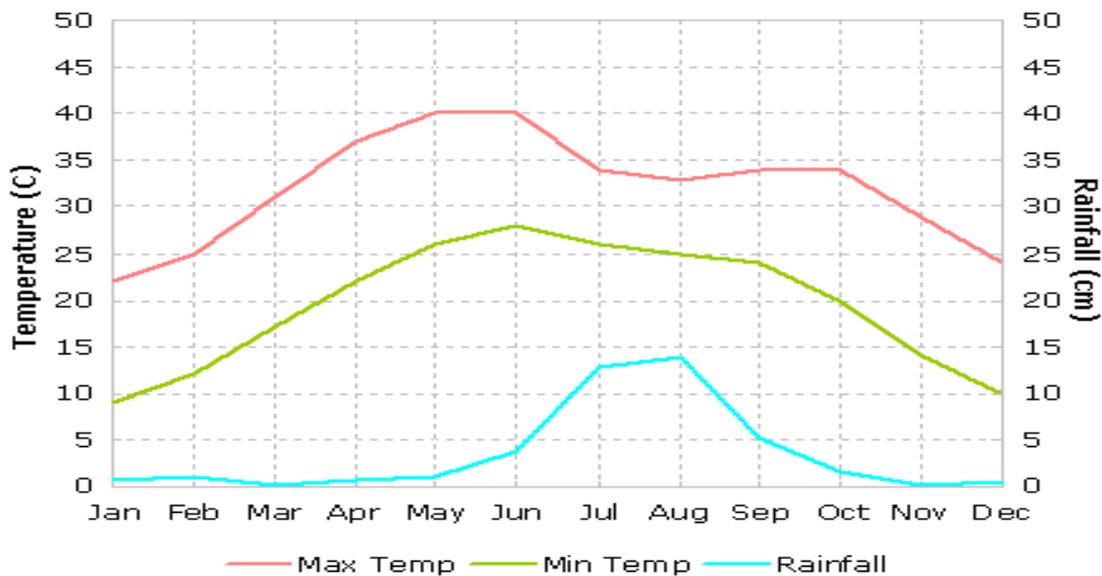
- The Polyphaga are the largest suborder, containing more than 300,000 described species in more than 170 families, including rove beetles (Staphylinidae), scarab beetles (Scarabaeidae), blister beetles (Meloidae), stag beetles (Lucanidae) and true weevils (Curculionidae). These beetles can be identified by the presence of cervical sclerites (hardened parts of the head used as points of attachment for muscles) absent in their suborders.
- The Adephaga contain about 10 families of largely predatory beetles, includes ground beetles (Carabidae), Dytiscidae and whirligig beetles (Gyrinidae). In these beetles, the testes are tubular and the first abdominal sternum (a plate of the exoskeleton) is divided by the hind coxae (the basal joints of the beetle's legs).
- The Archostemata contain four families of mainly wood-eating beetles, including reticulated beetles (Cupedidae) and the telephone-pole beetle.
- The Myxophaga contain about 100 described species in four families, mostly very small, including Hydroscaphidae and the genus *Sphaerius*.

### **Geography and Climatic Conditions**

Shekhawati is a semi-arid historical region located in the northeast part of Rajasthan, India. It mostly encompasses the administrative districts of Jhunjhunu and Sikar. However, some parts of the Churu and Nagaur districts are also considered in the Shekawati region.



Shekhawati is a desert area of Rajasthan and has special importance in the history of India. The natural climatic conditions in the region are very harsh and extreme. The temperature ranges from sub-zero Celsius in winter to more than 50°C in summer. The summer brings hot waves of air called loo. Annual rainfall is very low, around 450 to 600 mm. The ground water is as deep as 200 feet, and in places water is hard and salty



### Material and Methods

For the collection of beetles periodic visits were done in whole region and following procedure were taken to collect to collect beetles.

1. Used simple light trapping method in rainy season.
2. In summer used to do early morning walks because some beetles, which are going to hide under the soil for prevention from heat and predators, can be trapped easily.
3. Net also used to collect beetles.

Many of the specimens were collected in the rainy season, because in desert areas fauna is diverse and rich in rainy season. So July to September, are more suitable for collection due to favourable environmental conditions. The beetles were killed using a Cyanide bottle or by using chloroform. Most were then pinned and preserved in sterilized wooden boxes

naphthalene balls were also used for preservation. Few specimens preserved in 70 percent Alcohol mixed with small amount of acetic acid and Glycerine for diagnostic character study. For taxonomic status used key from E.O. Essig book. For identification help were also taken from the institutes: Agriculture Research institute, Fatehapur; Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur.

## Result and Discussion

In the present investigation 37 species of beetles were identified. The checklist of beetles is given in table 1. Few species were also recorded by Kazmi and Rammamurthy in Shekhawati region are as follows.

**Table 1: Checklist of beetles collected from the field area**

Specimen No.	Family	Sub-Family	Genus	Species
1	Scarabaeidae	Scarabaeinae	Heliocopris	Sp.
2	Tenebrionidae	Pimeliinae	Craniotus	Sp.
3	Tenebrionidae	Amphidorini	Dleodes(Blaptylis)	Sp.
4	Tenebrionidae	Amphidorini	Unidentified	Unidentified
5	Tenebrionidae	Pimeliinae	Eusottus	Sp.
6	Geotrupidae	Bloboceratinae	Bolbocerus	Sp.
7	Tenebrionidae	Pimeliinae	Rhytinota	Sp.
8	Scarabaeidae	Coprinae	Catharsius	Sp.
9	Scarabaeidae	Rutelinae	Rhyniptia	Indica
10	Scarabaeidae	Cetoniinae	Spilophorus	Moculatus
11	Cerambycidae	Cerambycinae	Monochamus	Ps.
12	Tenebrionidae	Tenebrioninae	Gonocephalum	Sp.
13	Buprestidae	-	Starnocera	Unidentified
14	Tenebrionidae	Tenebrioninae	Blaps	Orientalis
15	Scarabaeidae	Scarabaeinae	Onthophagus	Sp.
16	Tenebrionidae	Unidentified	Unidentified	Unidentified
17	Scarabaeidae	Aphodiinae	Aphodius	Sp.
18	Hydrophilidae	-	Unidentified	Unidentified
19	Scarabaeidae	Scarabaeinae	Onthophagus	Sp.
20	Scarabaeidae	Aphodiinae	Unidentified	Unidentified
21	Geotrupidae	Geotrupinae	Geotrupes	Sp.
22	Cerambycidae	Cerambycinae	Unidentified	Unidentified
23	Scarabaeidae	Scarabaeinae	Onthophagus	Sp.
24	Coccinellidae	-	Coccinella	Septempunctata
25	Bruchidae	-	Callosobruchus	Chinensis
26	Elateridae		Unidentified	Unidentified
27	Melolonthidae		Holotrichia	Consanguinea
28	Tenebrionidae		Tribolium	Castaneum
29	Hydrophilidae		Berosus	Nigriceps
30	Hydrophilidae		Berosus	Pulchellus
31	Hydrophilidae		Berosus	Fairmairizait
32	Dytiscidae		Erectes	Sticticus
33	Dytiscidae		Cybister	Tripunctatus
34	Tenebrionidae		Pimelia	Inexpectata
35	Tenebrionidae		Pimelia	Indica
36	Tenebrionidae		Oxycara	Tharensis
37	Coccinellidae		Henosepilachna	Vigintioctopuntata

**Table 2: Number of genera according to families**

S. No.	Family	Number of genera
1.	Scarabaeidae (Scarab beetles, Dung rollers)	09
2.	Tenebrionidae (Darkling beetles)	12
3.	Geotrupidae	02
4.	Cerambycidae (Long horned beetles)	02
5.	Hydrophilidae (Water scavenger beetles)	04
6.	Buprestidae (Metallic wood borers, Jewel beetles)	01
7.	Dytiscidae (Predacious diving beetls, water beetls)	02
8.	Coccinellidae (Lady bird beetls)	02
9.	Bruchidae	01
10.	Elateridae (Click beetles)	01
11.	Melolonthidae (Cockchafers beetles)	01

09 genera from 5 sub-families of scarabaeidae [Scarabaeinae (4), Coprinae (1), Rutelinae (1), Cetoniinae (1), Aphodiinae (2) One genera not identified], 12 genera from 3 sub-families of tenebrionidae [Pimeliinae (5), Amphidorini (2) 1 genera not identified, Tenebrioninae (2), 1 genera unidentified, sub-families of two genera's are also not identified], 2 genera from 2 sub-families of geotrupidae [Bolboceratinae (1), Geotrupinae (1)], 2 genera from Cerambycidae in which 1 from Cerambycine sub-family and other unidentified, 1 genera from Buprestidae, 4 genera from Hydrophilidae in which one unidentified, 2 genera from Dytiscidae, 2 genera from Coccinellidae, 1 genera from Bruchidae, 1 unidentified genera from Elateridae, 1 genera from Melolonthidae are recorded in present study.

- Scarabaeidae:
  - Heliocopris sp.
  - Catharsius sp.
  - Rhyniptia indica
  - Spilophorus maculates
  - Onthophagus sp.
  - Aphodius sp.
  - Onthophagus sp.
  - Onthophagus sp.
- Tenebrionidae:
  - Craniotus sp.
  - Eleodes (Blaptylis) sp.
  - Eusattus sp.
  - Rhytinota sp.
  - Gonocephalum sp.
  - Blaps orientalis
  - Pimelia inexpectata
  - Pimelia indica
  - oxycara tharensis
  - Tribolium Castaneum
- Geotrupidae:
  - Bolbocerus sp.
  - Geotrupes sp.
- Cerambycidae:
  - Monochamus sp.
- Hydrophilidae:
  - Berosus nigriceps
  - Berosus pulchellus
  - Berosus fairairzait
- Buprestidae:
  - Sternocera sp.

- Dytiscidae:
  - Erectes sticticus
  - Cybister tripunctatus
- Coccinellidae:
  - Coccinella septempunctata
  - Henosepilachna vigintioctopunctata
- Bruchidae:
  - Callosobruchus chinensis
- Melolonthidae:
  - Holotrichia consanguinea

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