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Diversity and Checklist of Order Coleoptera (Beetles and Weevils) from Jhunjhunu District, Rajasthan, India

Rajmohan Meena*[1], Vinod Kumari[2], Raghu Raj Singodia[3] and Rakesh Kumar Lata[4]

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A B S T R A C T

Jhunjhunu district is one of the semi-arid parts of the Shekhawati region of Rajasthan, India. The collections of coleopteran insects were made from selected study sites of Jhunjhunu from January to December 2021. A total of 214 species of 162 genera belonging to 28 different families of beetles viz. *Scarabaeidae, Carabidae, Coccinellidae, Cerambycidae, Elateridae, Trogidae, Meloidae, Anthicidae, Tenebrionidae, Chrysomelidae, Staphylinidae, Cleridae, Melandryidae, Erotylidae, Bostrichidae, Histeridae, Phalacridae, Oedemeridae, Dermestidae, Aderidae, Colydiidae, Buprestidae, Cantharidae, Lycidae, Nitidulidae, Dytiscidae, Hydrophilidae* and *Curculionidae* were collected from various habitats during the study and a checklist of all collected species was prepared.

***Key words*:** Beetles, Coleoptera, Diversity, Checklist and Jhunjhunu

Insects are the most successful and diverse group of animals on Earth, with 1,020,007 known species holding 66% animals and 82% Arthropods. The diversity assessment of class Insecta is always tangled and grueling, due to a large number of associated species. A Spectacular diversity of Coleopteran insects have been discovered with more than 1 out of every 4 livings creature being a Coleopteran species. Out of 8,00,000 described species of insects worldwide, more than 3,89,487 species belonging to 177 families of the Coleoptera order have been recorded globally [20]. Indian sub-regions have unique and variable ecological conditions, therefore more than 22,334 species of Coleoptera have been recorded [3]. The diversity of Coleopteran insects is very extensive, found with close association of all natural habitats viz. vegetative plant parts such as flowers, fruits, seeds, leaves, twigs, stems, inside galls and dead or decaying tissues [6]. Rapuzzi *et al*. [10], observed longhorn beetle, 56 species of *Cerambycidae* from Pakistan, and Azad Kashmir which of the 15 species were listed first time from Pakistan. In the present study, Coleopteran insects were chosen because of their extreme diversity in form and function however, there has been sparse documentation on the diversity of coleopteran insects in Rajasthan, India. The present study will be helpful in the conservation of coleopteran insect diversity and use of Coleopteran predominant predaceous species for the biological control of insect pest species in agriculture.

* **Rajmohan Meena**
✉ rajmohanmeena27@gmail.com

[1] Department of Zoology, SRRM Government P.G. College, Jhunjhunu - 333 001, Rajasthan, India

[2] Department of Zoology, University of Rajasthan, Jaipur - 302 004, Rajasthan, India

[3] Department of Zoology, SNMT Government P.G. College, Jhunjhunu - 333 001, Rajasthan, India

[4] Department of Zoology, LBS Government P.G. College, Kotputli - 303 108, Rajasthan, India

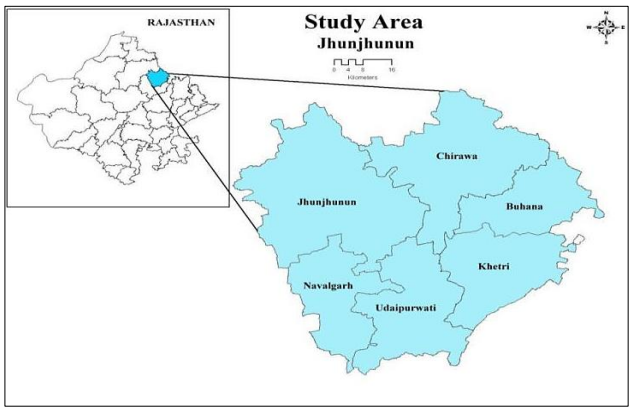

Fig 1 Study area for the sampling of Coleopteran insects in Jhunjhunu district

MATERIALS AND METHODS

A study was conducted from January, 2021 to December, 2021 at four different selected sites of Jhunjhunu district, Rajasthan, India. The geographical location of Jhunjhunu district (the study area) lies in the north-eastern part of Rajasthan between 27º38'-28º31' north latitudes and 75º02'-76º06' east longitudes, with a geographical area of 5,926 sq. km. The district is situated in the Shekhawati region of

Rajasthan. Most part of the Jhunjhunu district is the semi-arid type of climate. December and January are the coldest months of winter and temperatures range from 0ºC - 15ºC. In summer, the temperature lies between 32ºC - 48ºC. The southwest monsoon sets from the middle of June to the end of September.

Collection methods

A sampling of the Coleopteran insects was done monthly from selected sites of the study area with methods like handpicking, dip net, light trap, pitfall trap, beating, etc. All the insects thus, collected were then processed for further identification; specimens were narcotized by exposure to chloroform vapor, for maintaining their original color. Following the standard protocols of pinning, each specimen was pinned and stored in wooden boxes with naphthalene balls for further study. The collected specimens were studied with the support of a Stereo Zoom Binocular Microscope (Magnus MSZ- Bi). After Identification, insect images were captured by Redmi mobile (Model-M1901F7S). Identification was done using different taxonomic keys [2] and published articles [1], [17].

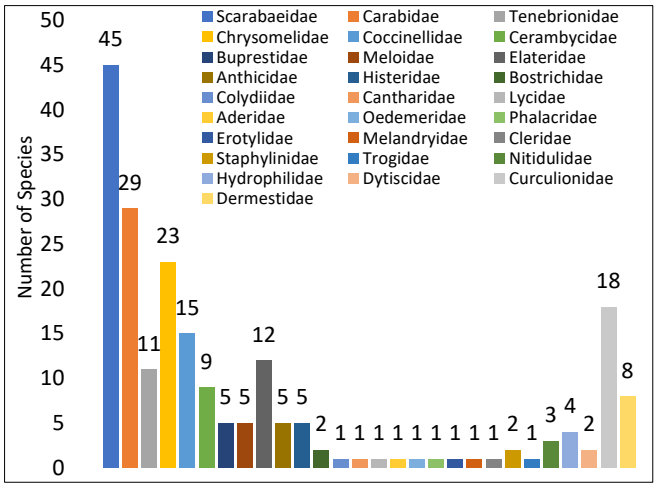

Fig 2 Families of Coleoptera showing number of species in Jhunjhunu district

RESULTS AND DISCUSSION

In the present study and survey a total of 162 genera and 214 species belonging to 28 discrete families of coleopteran insects viz. *Scarabaeidae, Tenebrionidae, Carabidae, Coccinellidae, Cerambycidae, Elateridae, Trogidae, Meloidae, Anthicidae, Chrysomelidae, Staphylinidae, Cleridae, Melandryidae, Erotylidae, Bostrichidae, Histeridae, Phalacridae, Oedemeridae, Dermestidae, Aderidae, Colydiidae, Buprestidae, Cantharidae, Lycidae, Nitidulidae, Dytiscidae, Hydrophilidae* and *Curculionidae* were collected and identified. This is the first record of coleopteran insects along with their scientific names, systematic position, and distribution within the Jhunjhunu district (Table 1 and Figure 2). Based on the total number of species, Scarabaeidae family was the most dominant with 45 species observed in this study, which is according to the previous study [19]. Kazmi and Ramamurthy [7], mentioned ninety- nine species, which belonging to 60 genera associated with 13 families of Coleoptera from Indian Thar desert of Rajasthan Similarly, Sewak [11], reported 12 genera and 85 species of dung beetles from the Thar Desert of Rajasthan and Gujarat. Sharma and Dube [14], explored 11 species of family *Carabidae* from Kota University, Kota. Chaudhary [4], described 37 genera of 11 families (*Scarabaeidae*, *Tenebrionidae*, *Geotrupidae*, *Cerambycidae*, *Buprestidae*, *Hydrophilidae*, *Dytiscidae*, *Coccinellidae*, *Bruchidae*, *Elateridae*, *Melolonthidae*) from the Shekhawati region of Rajasthan. Sharma [12], reported 11 species belonging to five discrete families of beetles viz. *Dytiscus*, *Heloididae*, *Hydrophilidae*, *Hydraenidae*, and *Psephenidae* of Freshwater Lake of Ajmer Similarly, Sharma [13], studied 180 species of beetles belonging to 4 superfamilies (*Tenebrionoidea*, *Cucujoidea*, Elateroidea, *Scarabaeoidea*) in Ajmer, Rajasthan. Trigunayat and Sharma [18], assessed 12 families of beetles viz. *Scarabaeidae*, *Carabidae*, *Melolonthidae*, *Coccinellidae*, *Cerambycidae*, *Dysticidae*, *Hydrophilidae*, *Meloidae*, *Tenebrionidae*, *Lampyridae*, *Cicindellidae*, and *Curculionidae* in and around Keoladeo National Park, Bharatpur, Rajasthan, India. Patole [9], updated a checklist of 15 species of Scarabaeoid beetles belonging to 5 subfamilies (*Scarabaeinae*, *Melolonthinae*, *Dynastinae*, *Rutelinae*, and *Cetoniinae*) from Sakri Tahsil, District Dhulia, Maharashtra. A checklist of longhorn beetles of Lumami, Zunheboto district, Nagaland with 23 new records provided by Mozhui *et al*. [8]. Thakare and Zade [15], studied a total of 13 species of water beetles belonging to three families *Dytiscidae*, *Hydrophilidae* and *Gyrinidae* Similarly, Thakare and Zade [16], collected and identified 12 species of beetles belonging to 5 different families (*Gyrinidae*, *Tenebrionidae*, *Carabidae*, *Meloidae, and Scarabaeidae*) from Melghat Tiger Reserve. Ghosh and Bhunia [5], presented 14 species of scarab beetles belonging to three discrete subfamilies (*Scarabaeinae*, *Dynastinae* and *Rutelinae*) from Salt Lake City, Kolkata, West Bengal.

Table 1 Diversity of Coleopteran species collected from Jhunjhunu district, Rajasthan, India from January to December 2021

Classification:
Phylum-Arthropoda, Subphylum-Hexapoda, Class-Insecta, Order- Coleoptera (Beetles and Weevils)

Family	Subfamily	Genus and species	Major habitats
Scarabaeidae	Scarabaeinae (Dung beetles)	*Onthophagus taurus* Schreber, 1759 *Onthophagus vladimiri* *Onthophagus tweedensis* Blackburn *Onthophagus mopsus* Fabricius, 1792 *Onthophagus* sp. Latreille, 1802 *Digitonthophagus gazella* Fabricius *Euonthophagus crocatus* Mulsant *Catharsius calaharicus* Kolbe, 1893 *Catharsius philus* Kolbe, 1893 *Catharsius pithecius* Fabricius, 1775 *Catharsius molossus* Linnaeus, 1758 *Onitis alexis* Klug, 1835 *Heliocopris hamadryas* Fabricius, 1775	dung, rotten wood, carrion, decayed vegetation, pollen, plant sap, fungus

		Gymnopleurus miliaris Fabricius, 1775	
		Euoniticellus intermedius Reiche, 1849	
	Melolonthinae (May and June beetles)	*Anoxia villosa* Fabricius, 1782	on leaf, flower
		Rhizotrogus marginipes Mulsant, 1842	
		Serica brunna Linnaeus, 1758	
		Phyllophaga vetula Horn, 1887	
		Maladera castanea Arrow, 1913	
		Diplotaxis sp. Kirby, 1837	
	Dynastinae (Rhinoceros beetles)	*Cyclocephala borealis* Arrow, 1911	on leaf, flower
		Cyclocephala lurida Bland, 1836	
		Pentodon algerinus Fuessly, 1788	
		Heteronychus arator Fabricius, 1775	
		Oryctes rhinoceros Linnaeus, 1758	
	Cetoniinae (Fruit and Flower chafers)	*Euphoria aestuosa* Horn, 1880	on leaf and flower
		Euphoria sepulcralis Fabricius, 1801	
		Protaetia alboguttata Vigors, 1826	
		Protaetia aurichalcea Fabricius, 1775	
		Gametis versicolor Fabricius, 1775	
	Rutelinae (Shining leaf chafers)	*Adoretus sinicus* Burmeister, 1855	On leaf
		Adoretus versutus Harold, 1869	
		Anoplognathus sp. Leach, 1819	
		Anomala sp. Samouelle, 1819	
	Aphodiinae (Small scarab beetles)	*Aphodius prodromus* Brahm, 1790	on dung
		Aphodius sticticus Panzer, 1798	
		Aphodius biguttatus Germar, 1824	
		Aphodius pusillus Harbst, 1789	
		Aphodius sp. Illiger, 1798	
		Mecynodes striatulus Waltl, 1835	
		Psammodium asper	
		Rhyssemus germanus Linnaeus, 1767	
	Hybosorinae	*Hybosorus illigeri* Reiche, 1853	on leaf
	Eremazinae	*Eremazus cribratus* Semenov, 1893	
Carabidae (Ground beetles)	Brachininae (Bombardier beetle)	*Pheropsophus verticalis* Dejean, 1825	moist soil, leaf litter, understones
		Pheropsophus sp.	
		Pheropsophus sp.	
	Scaritinae (Big- headed ground Beetle)	*Scarites buparius* Forster, 1771	moist soil, understones, leaf litter
		Scarites quadriceps Chaudoir, 1843	
		Scarites subterraneus Fabricius, 1775	
		Scarites sp. Fabricius, 1775	
	Trechinae	*Bembidion tetracolum* Say, 1825	logs, debris, sand beaches, cracks of coastal cliffs
		Bembidion ambiguum Dejean, 1831	
		Bembidion biguttatum Fabricius, 1779	
		Bembidion deletum Audinet-Serville	
		Bembidion petrosum Gebler, 1833	
		Bembidion obtusum Audinet-Serville	
		Bembidion sp.	
	Harpalinae	*Harpalus caliginosus* Fabricius, 1775	leaf litter, under stones
		Chlaenius naeviger Morawitz, 1862	
		Acupalpus dubius Schilsky, 1888	
		Microlestes plagiatus Duftschmid	
		Pterostichus singularis Tschitscherine	
		Tetragonoderus intermedius Solsky	
		Stenolophus sp. Dejean, 1821	
	Lebiinae	*Dromius quadrimaculatus* Linnaeus	leaf litter
		Apristus latens LeConte, 1846	
	Paussinae	*Paussus favieri* Fairmaire, 1851	ant-nest
	Anthiinae	*Anthia sexguttata* Fabricius, 1775	leaf litter, cracks of ground
	Carabinae	*Calosoma sayi* Dejean, 1826	leaf litter
	Pterostichinae	*Amara fulva* Muller, 1776	moist soil
	Cicindelinae	*Lophyra differens* Horn, 1892	on ground
	Platyninae	*Platynus assimilis* Paykull, 1790	moist soil
Tenebrionidae (Darkling beetles)	Tenebrioninae	*Alphitobius diaperinus* Panzer, 1797	grain products, cornmeal, creals
		Tenebrio molitor Linnaeus, 1758	
		Cheirodes sardous Gene, 1839	dried fruits
		Gonocephalum simplex Fabricius, 1801	Understones
	Pimeliinae	*Pimelia ascendens* Wollaston, 1864	leaf litter, under

		Erodius orientalis Brulle, 1832	stones,
		Microdera convexa Tauscher, 1812	
		Hymatismus villosus Rutenberg, 1870	
		Trachyderma hispida Forskal, 1775	
		Diaphanidus ferrugineus Waldheim	
	Lagriinae	*Luprops tristis* Fabricius, 1801	on foliage, under Stones, fallen tree
Chrysomelidae (Leaf beetles)	Galerucinae	*Medythia nigrobilineata* Motschulsky	on flower & foliage, on
		Oides palleata Fabricius, 1781	cucurbit leaf, root
		Longitarsus belgaumensis Jacoby, 1896	on corn
		Psylliodes punctulatus Melsheimer	
		Aulacophora sp.	
	Cryptocephalinae	*Clytra laeviuscula* Ratzeburg, 1837	on leaf, leaf
		Cryptocephalus notatus Fabricius, 1787	litter
	Orsodacninae	*Orsodacne cerasi* Linnaeus 1758	On leaf
		Orsodacne atra Ahrens, 1810	
	Bruchinae	*Amblycerus robiniae* Fabricius, 1781	on leaf & foliage
		Bruchus loti Paykull, 1800	
		Acanthoscelides obtectus Say, 1831	
		Caryedon serratus Olivier, 1790	
		Algarobius prosopis LeConte, 1858	
		Callosobruchus maculatus Fabricius	
	Criocerinae	*Lema diversipes* Pic, 1921	on leaf, shoots,
		Lema postrema Bates, 1866	growing plants
		Neolema ovalis White, 1993	
		Neolema sp. Monros, 1951	
	Cassidinae	*Charidotella sexpunctata* Fabricius	on leaf
		Hispa atra Linnaeus, 1767	
	Chrysomelinae	*Leptinotarsa decemlineata* Say, 1824	on potatoes
	Alticinae	*Aphthona* sp. Chevrolat, 1836	on leaf
Coccinellidae (Ladybird beetles)	Coccinellinae	*Coccinella septempunctata* Linnaeus	on leaf, foliage
		Coccinella hieroglyphica Linnaeus	
		Coccinella novemnotata Herbst, 1793	
		Cheilomenes sexmaculata Fabricius	
		Hippodamia variegate Goeze, 1777	
		Psyllobora bisoctonotata Mulsant	
	Epilachninae	*Epilachna indica*	on leaf, garden pest
		Henosepilachna vigintioctopunctata Fabricius, 1775	
		Henosepilachna vigintisexpunctata Boisduval, 1835	
		Epilachna chrysomelina Fabricius, 1775	
		Subcoccinella vigintiquattuorpunctata Linnaeus, 1758	
	Scymninae	*Scymnus nubilus* Mulsant, 1850	on leaf, foliage
		Scymnus latemaculatus Motschulsky	
		Stethorus punctum LeConte, 1852	
	Chilocorinae	*Brumoides suturalis* Fabricius, 1789	on leaf
Cerambycidae (Long-horned beetles)	Lamiinae	*Nupserha bicolor* Thomson, 1857	in vegetation,
		Niphona fuscatrix Fabricius, 1793	under bark
		Graphisurus fasciatus Degeer, 1775	
		Olenecamptus bilobus Fabricius, 1801	
		Apomecyna saltator Fabricius, 1781	
		unidentify sp.	
	Cerambycinae	*Trichoferus campestris* Faldermann	
	Spondylidinae	*Arphopalus rusticus* Linnaeus,1758	
	Prioninae	*Acanthophorus serraticornis*	
Buprestidae (Metallic wood- boring beetles)	Julodinae	*Sternocera Chrysis* Fabricius, 1775	on trees, dying logs and
		Sternocera basalis	branches
		Sternocera laevigata Olivier, 1790	
	Buprestinae	*Anthaxia* sp. Eschscholtz, 1829	on leaf, foliage
	Agrilinae	*Trachys minutus* Linnaeus, 1758	on leaf
Meloidae (Blister beetles)	Meloinae	*Mylabris pustulata* Thunberg, 1821	on flowers
		Mylabris cichorii Linnaeus, 1767	
		Hycleus scabiosae Olivier, 1811	
		Epicauta pensylvanica De Geer, 1775	

		Pyrota sp. Dejean, 1834	
Elateridae	Elaterinae	*Agriotes lineatus* Linnaeus, 1767	on flowers, under bark,
(Click beetles)		*Agriotes oblongicollis* Melsheimer	roots
		Ampedus nigricollis Herbst, 1806	
		Adrestus pallens	
		Anchastus binus Say, 1839	
	Agrypninae	*Lacon punctatus* Herbst, 1779	on flower, leaf and on
		Conoderus tabidus Erichson, 1842	roots
		Conoderus sp.	in soil
		Lanelater schottii Macleay, 1872	
		Agrypnus sp.	
	Cardiophorinae	*Austrocardiophorus sp.*	on leaf
		Coptostethus sp. Wollaston, 1854	
Anthicidae	Anthicinae	*Notoxus monoceros* Linnaeus, 1760	on flower and
(Ant like flower beetles)		*Omonadus formicaris* Goeze, 1777	foliage, in debris
		Sapintus fulvipes	
		Anthicus cervinus	
		Malporus formicarius	
Histeridae	Histerinae	*Margarinotus confusus* Wenzel, 1944	in dung
(Clown beetles)	Saprininae	*Chalcionellus aemulus* Illiger, 1807	
		Chalcionellus libanicola Marseul, 1870	
	Abraeinae	*Teretrius nigrescens* Lewis, 1891	
		Teretrius montanus Horn, 1880	
Bostrichidae	Bostrichinae	*Sinoxylon anale* Lesne, 1897	in bark
(Auger beetles)		*Sinoxylon* sp.	
Colydiidae	Colydiinae	*Colobicus parilis* Pascoe, 1860	under bark, fungus
(Bark beetle)			
Cantharidae	Chauliognathinae	*Chauliognathus tricolor* Castelnau	
(Soldier beetles)			
Lycidae		*Lycostomus* sp. Laporte, 1836	on leaf
(Net-winged beetle)			
Aderidae		*Aderus populneus* Panzer, 1796	on leaf
(Ant like leaf beetle)		*Euglenes pygmaeus* De Geer, 1775	
Oedemeridae	Oedemerinae	*Ananca bicolor* Fairmaire, 1849	on vegetation
(False blister beetle)			
Phalacridae	Phalacrinae	*Stilbus* sp. Seidlitz, 1872	on flower
(Shining flower beetles)			
Erotylidae	Xenoscelinae	*Cryptophilus integer* Heer, 1841	on fungus
(Pleasing fungus beetles)			
Melandryidae	Melandryinae	*Orchesia undulata* Kraatz, 1853	in vegetation
(False darkling beetle)			
Cleridae or Melyridae	Malachiinae	*Collops* sp. Erichson, 1840	in vegetation
(Soft-wing flower beetles)			
Staphylinidae (Rove beetles)	Paederinae	*Paederus fuscipes* Curtis, 1826	in Moist soil
	Staphylininae	*Tasgius ater* Gravenhorst, 1802	
Trogidae (Hide beetle)	Troginae	*Omorgus suberosus* Fabricius, 1775	Carrion feeders
Nitidulidae	Carpophilinae	*Carpophilus lugubris* Murray, 1864	on corn, fungi, pollen
(Sap beetle)		*Carpophilus dimidiatus* Fabricius, 1792	
	Epuraeinae	*Epuraea* sp. Erichson, 1843	On flower
Hydrophilidae	Hydrophilinae	*Berosus frontifoveatus* Kuwert, 1888	Ponds, steams
(Water scavenger beetles)		*Hydrophilus triangularis* Say, 1823	
		Hydrophilus caschmirensis	
		Redtenbacher, 1844	
	Sphaeridiinae	*Cercyon quisquilius* Linnaeus, 1761	Ponds
Dytiscidae	Dytiscinae	*Cybister fimbriolatus* Say, 1825	Ponds, lakes, streams
(Predaceous diving beetles)	Hydroporinae	*Neoporus* sp. Guignot, 1931	
Curculionidae	Entiminae	*Myllocerus marmoratus* Faust, 1897	Roses, greenhouse plants,
(Weevils)		*Myllocerus* sp.	roots, under stones
		Myllocerus sp.	
		Artipus floridanus Horn, 1876	
		Naupactus leucoloma Schoenh, 1840	
		Polydrusus impressifrons Gyllenhal	
	Hyperinae	*Hypera postica* Gyllenhal, 1813	on clover leaf
		Hypera zoilus Scopoli, 1763	
		Hypera sp. Germar, 1817	
	Lixinae	*Lixus (Phillixus) subtilis* Boheman, 1835	in roots of plants

		Atactogaster zebra Chevrolat, 1873	on weeds, sunflower
		Cleonis pigra Scopoli, 1763	
	Cyclominae	*Listroderes difficilis* Germain, 1895	on leaf
		Listroderes costirostris Schonherr, 1826	
		Ethemaia sp. Pascoe, 1865	
	Alcidinae	*Alcidodes karelinii* Boheman, 1844	on leaf
	Dryophthorinae	*Scyphophorus acupunctatus* Gyllenhaal, 1838	on leaf
	Curculioninae	*Pseudopoophagus longipes* Marshall	on leaf
Dermestidae (Skin beetle)	Dermestinae	*Dermestes maculatus* De Geer, 1774	stored foods, meats, cheese
		Dermestes peruvianus Laporte, 1840	
		Dermestes sp. Linnaeus, 1758	
	Attageninae	*Attagenus trifasciatus* Fabricius, 1787	on flowers
		Attagenus lobatus Rosenhauer, 1856	
	Megatominae	*Phradonoma nobile* Reitter, 1881	skin, furs, leathers
		Anthrenus coloratus Reitter, 1881	
	Anthreninae	*Trogoderma megatomoides* Reitter	stored foods

CONCLUSION

In the present study, a total of 162 genera along with the number of 214 species belonging to 28 different families are reported as presented in table-1. It may be concluded that the Jhunjhunu district harbors a good number and diversity of coleopteran insects. Coleopteran insects play various ecological services in the stability and balance of an ecosystem and also may be significant in the context of the present deterioration of coleopteran insects due to anthropogenic pressures. Coccinellid beetles are predaceous on soft-bodied insects in both larval and adult stages. Therefore, they play an important role in the biological control of insect pest species. This study will provide preliminary baseline data on the coleopteran families in the Jhunjhunu district, which may be beneficial for future study in respect of diversity, conservation techniques, and biological control practices.

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