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A review on diversity of coleoptera in Rajasthan

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Abstract
Rajasthan is very rich in terms of biological diversity due to its unique bio geographic location, diversified climatic conditions and enormous eco-diversity and geo-diversity. Class Insecta play important role in diversity.it is largest class in Kingdom Animalia. In class Insecta most diversified order is Coleoptera. It is estimated that out of about 8, 00,000 described species of insect world over, Coleoptera alone shares about 3, 50,000 that belongs to 4 sub orders and 177 families. At Rajasthan 16 family and 140 species of Coleoptera is reported. Most of diversity are reported by 4 families Scarabaeidae, Curculionidae, Dytiscidae, Hydrophilidae.

Keywords: insects, coleoptera, diversity, Rajasthan

Introduction

Insects are the world's most varied category of creatures. They are the dominant species in every major terrestrial biome and are responsible for many essential ecological processes, (Balbhim *et al*., 2012). Insects are classified as Arthropoda, class Insecta. Coleopteran insects may be found in almost all natural settings with vegetative foliage, from trees and their bark to flowers, leaves, and underground near roots, as well as inside plants such as galls and tissue, even dead or rotting ones (Kumar Arya *et al*., 2016) [3]. Coleopterans are also known as beetles. They have long been a favourite of insect collectors due to their diverse habitats, amazing coloration and sculpting, and economic relevance. Beetles have a significant ecological influence because of their impacts on green plants, their contribution to the decomposition of plant and animal detritus, and their predatory activities (Arya & Joshi 2014) [2]. It is predicted that out of over 8, 00,000 documented insect species worldwide, Coleoptera alone contributes for around 3, 50,000, belonging to four suborders and 177 families, (Trigunayat & Sharma 2017) [18]. More than 22,334 species have been documented from India, (Ghosh *et al*., 2020) [7]. The development of elytra, which protect the folded hindwings and allow adult coleopterans to occupy tiny spaces and concealed habitats, is the most essential factor in the success of coleopterans (Thakare & Zade 2012) [17].

Table 1: Coleoptera diversity in Rajasthan

Name	References
Meloidae	
Mylabris phalerata	(Kazmi & Ramamurthy, 2004)
Mylabris pustulata Thunberg	(Kazmi & Ramamurthy, 2004)
Mylabris rajasthanicus	(Parvez & Srivastava,2010)
Cylindrothorax audoniui	(Kazmi & Ramamurthy, 2004)
Cyaneolytta coerulea	(Kazmi & Ramamurthy, 2004)
Cyaneolytta pictus	(Kazmi & Ramamurthy, 2004) (Parvez & Srivastava,2010)
Cyaneolytta violacea Brandt	(Kazmi & Ramamurthy, 2004)
Pseudosybaris kempi Saha	
Cicindelidae	
Cicindela cancellata Dej.	(Kazmi & Ramamurthy, 2004)
Cicindela minuta Oliver	(Kazmi & Ramamurthy, 2004)
Cicindela sumatrensis var imperfect W. Horn.	(Kazmi & Ramamurthy, 2004)
Carabidae	
Carabus orientalis Hope	(Kazmi & Ramamurthy, 2004)
Anthia sexmaculata	(Kazmi & Ramamurthy, 2004)
Calosoma maderae	(Kazmi & Ramamurthy, 2004)
Hydrophilidae	
Hydrous senegalensis Perch	(Kazmi & Ramamurthy, 2004)
Hydrous olivaceus Fab.	(Kazmi & Ramamurthy, 2004) (Bhargava & Srivastava, 2018) (Singh Tak *et al*., 2015)
Hydrous indicus Bdel.	(Kazmi & Ramamurthy, 2004)
Helochares crematus Regimbart	(Kazmi & Ramamurthy, 2004)
Helochares lentus Sharp	(Kazmi & Ramamurthy, 2004)
Enochrus flavicans Regimbart	(Kazmi & Ramamurthy, 2004)
Coleostoma horni Regimbart	(Kazmi & Ramamurthy, 2004)
Coleostoma stuttum Walker	(Kazmi & Ramamurthy, 2004)
Sternolopus rufipes Fab	(Kazmi & Ramamurthy, 2004) (Bhargava & Srivastava, 2018)
Berosus nigriceps	

Berosus pulchellus Mcleay	(Kazmi & Ramamurthy, 2004)
Berosus indicus Mots	(Kazmi & Ramamurthy, 2004) (Bhargava & Srivastava, 2018)
Berosus fairmairizait	(Kazmi & Ramamurthy, 2004)
Tropisternus	(Bhargava & Srivastava, 2018)
Tropisternus lateralis	(Singh Tak *et al*., 2015)
Enochrus esuriens	(Bhargava & Srivastava, 2018)
Haliplidae	
Halipus (Liaplus) pulchellus indicus Regimbart	(Kazmi & Ramamurthy, 2004)
Haliplus sp.	(Bhargava & Srivastava, 2018)
Peltodytes sp.	(Bhargava & Srivastava, 2018)
Gyrinidae	
Orectochilus (Patrus) limbatus Regimbart	(Kazmi & Ramamurthy, 2004)
Dytiscidae	Click or tap here to enter text.
Guignotus pendjabensis Guignot	(Kazmi & Ramamurthy, 2004)
Guignotus flammulatus (Reigmbart)	(Kazmi & Ramamurthy, 2004)
Herophydrus musicus Klug	(Kazmi & Ramamurthy, 2004)
Hyphoporus kempi Gschwendtner	(Kazmi & Ramamurthy, 2004)
Hyphoporus severini Regimbart	(Kazmi & Ramamurthy, 2004)
Hyphoporus flavicans Regimbart	(Kazmi & Ramamurthy, 2004)
Laccophilus sp.	(Naz *et al*., 2021)
Laccophilus flexuosus Aube	(Kazmi & Ramamurthy, 2004)
Laccophilus sharpi Regimbart	(Kazmi & Ramamurthy, 2004)
Laccophilus parvulus Aube	
Laccophilus chinensis inefficiens Walker	(Kazmi & Ramamurthy, 2004)
Laccophilus anticatus	(Bhargava & Srivastava, 2018)
Laccobius sp.	(Bhargava & Srivastava, 2018)
Canthydrus laetabilis (Walker)	(Kazmi & Ramamurthy, 2004)
Erectes sticticus Linn	(Kazmi & Ramamurthy, 2004)
Hydaticus fabricii Macleay	(Kazmi & Ramamurthy, 2004) (Singh Tak *et al*., 2015)
Hydaticus vittatus Fab	(Kazmi & Ramamurthy, 2004)
Hydaticus histrio Clark	(Kazmi & Ramamurthy, 2004)
Cybister (Meganectes) tripunctatus asiaticus Sharp	(Kazmi & Ramamurthy, 2004)
Rhantus congestus	(Kazmi & Ramamurthy, 2004)
Cybister regulosus	(Bhargava & Srivastava, 2018)
Captotomus interrogatus	(Bhargava & Srivastava, 2018) (Singh Tak *et al*., 2015)
Dytiscus verticalis	(Bhargava & Srivastava, 2018)
Hydaticus fabricii	(Bhargava & Srivastava, 2018)
Coccinellidae	
Coccinella septempunctata Linnaeus	(Kazmi & Ramamurthy, 2004)
Coccinella septempunctata var divaricata	(Kazmi & Ramamurthy, 2004)
Coccinella septempunctata	(Sharma & Meena, 2019) (Parvez & Srivastava,2010)
Cycloneda carolinae Muls	
Thea bisoctonota Muls.	(Kazmi & Ramamurthy, 2004)
Adonia variegata (Goeze) Coelophora sp.	(Kazmi & Ramamurthy, 2004)
Menochilus (=Chilomenes) sexmaculata undulata Fab	(Kazmi & Ramamurthy, 2004) (Sharma & Meena, 2019)
Henosepilachna (=Epilachna) vigintioctopuntata Fabricius	(Kazmi & Ramamurthy, 2004)
Henosepilachna (=Epilachna) indica Muls	(Kazmi & Ramamurthy, 2004)
Curculionidae	
Myllocerus undecimpustulatus Fst.	(Kazmi & Ramamurthy, 2004) (Parvez & Srivastava,2010)
Myllocerus viridanus Fabricius	(Kazmi & Ramamurthy, 2004)
Myllocerus discolor Boh	(Kazmi & Ramamurthy, 2004)
Myllocerus fabricii Gur	(Kazmi & Ramamurthy, 2004)
Myllocerus severini Mshl	(Kazmi & Ramamurthy, 2004)
Myllocerus pustulatus var maculosus Desbr	(Kazmi & Ramamurthy, 2004)
Myllocerus pubescens Faust	(Kazmi & Ramamurthy, 2004)
Myllocerus sabulosus Mshll	(Kazmi & Ramamurthy, 2004)
Crytozemia dispar Pasc.	(Kazmi & Ramamurthy, 2004)
Amblyrrhinus poricollis Bohem	(Kazmi & Ramamurthy, 2004)
Lixus sp.	(Bhargava & Srivastava, 2018)
Lixus (=Hypolixus) trancatulus Fabricius	(Kazmi & Ramamurthy, 2004)
Chlonius duvauceli	(Parvez & Srivastava,2010)
Hypolixus truncatulus	(Parvez & Srivastava,2010)
Paramecops farinosa	(Parvez & Srivastava,2010)
Cleonus sannio	(Parvez & Srivastava,2010)
Tenebrionidae	
Pimelia inexpectata Sen	(Kazmi & Ramamurthy, 2004)

Pimelia indica Sen	(Kazmi & Ramamurthy, 2004)
Oxycara tharensis Klgr.	(Kazmi & Ramamurthy, 2004)
Opatroides vicinus Fairm	(Kazmi & Ramamurthy, 2004)
Gonocephalum sp.	(Kazmi & Ramamurthy, 2004)
Spyrathus sp.	(Kazmi & Ramamurthy, 2004)
Rhytinota impolita Fairm	(Kazmi & Ramamurthy, 2004)
Arthrodes sp.	(Kazmi & Ramamurthy, 2004)
Setenis semiopaca Stebbing	(Kazmi & Ramamurthy, 2004)
Scarabaeidae	
Scarabaeus cristatus Fabricius	(Kazmi & Ramamurthy, 2004)
Scarabaeus gangeticus Cast.	(Kazmi & Ramamurthy, 2004)
Scarabaeus brahminus Cestlenau	(Kazmi & Ramamurthy, 2004)
Scarabeus andrewesi	(Parvez & Srivastava,2010)
Trox indicus Har.	(Kazmi & Ramamurthy, 2004)
Onthophagus catta Fabricius	(Kazmi & Ramamurthy, 2004)
Onthophagus bonasus Fab.	(Kazmi & Ramamurthy, 2004) (Parvez & Srivastava,2010)
Onthophagus sp.	(Kazmi & Ramamurthy, 2004) (Parvez & Srivastava,2010)
Onthophagus oculatus	(Parvez & Srivastava,2010)
Gymnopleurus cyaneus (Fabricius)	(Kazmi & Ramamurthy, 2004)
Hybosorus orientalis (Westwood)	(Kazmi & Ramamurthy, 2004)
Hybosorus illigeri Reiche	(Kazmi & Ramamurthy, 2004)
Holotrichia consanguinea	(LAL JAKHAR *et al*., 2021) (Kumar *et al*., 2017)
Holotrichia serrata	(LAL JAKHAR *et al*., 2021) (Kumar *et al*., 2017)
Holotrichia reynaudi	(Kumar *et al*., 2017)
Holotrichia fissa Brenske	(Kumar *et al*., 2017)
Adoretus sp.	(Kazmi & Ramamurthy, 2004)
Adoretus binarginatus Ohaus	
Adoretus punjabensis Arrow	(Kazmi & Ramamurthy, 2004)
Adoretus lasiopygus Burmeister	(Kumar *et al*., 2017)
Adoretus testaceus (Hope)	(Kumar *et al*., 2017)
Adoretus versutus Harold	(Kumar *et al*., 2017)
Rhinyptia laeviceps Arrow	(Kazmi & Ramamurthy, 2004)
Ochodaeus sp.	(Kazmi & Ramamurthy, 2004)
Copris furciceps Felsche	(Kazmi & Ramamurthy, 2004)
Apogonia ferruginea Fab.	(Kazmi & Ramamurthy, 2004) (Parvez & Srivastava,2010)
Apogonia sp.	(Kazmi & Ramamurthy, 2004)
Schizonycha ruficollis (Fabricius)	(Kazmi & Ramamurthy, 2004) (Parvez & Srivastava,2010) (Kumar *et al*., 2017)
Schizonicha sp	(LAL JAKHAR *et al*., 2021)
Autoserica insanabilis Brsk.	(Kazmi & Ramamurthy, 2004)
Catharsius pithecus Fab.	(Kazmi & Ramamurthy, 2004)
Catharsius sp.	(Kazmi & Ramamurthy, 2004)
Maladera carninata	(LAL JAKHAR *et al*., 2021)
Maladera insanabilis	(LAL JAKHAR *et al*., 2021) (Kumar *et al*., 2017)
M. species	(LAL JAKHAR *et al*., 2021)
Pentadon bipiniforns	(Parvez & Srivastava,2010)
Phyllognathus dionysius (Fabricius)	(Kumar *et al*., 2017)
Anomala bengalensis	(Parvez & Srivastava,2010) (LAL JAKHAR *et al*., 2021) (Kumar *et al*., 2017)
A. dimidiata	(LAL JAKHAR *et al*., 2021)
Pachyrrhinadoretus frontatus	(LAL JAKHAR *et al*., 2021)
Sternocera sp.	(Bhatnagar *et al*; 2018)
Chrysomelidae	
Clytra succineta Lacord	(Kazmi & Ramamurthy, 2004)
Raphilopalpa foevicollis	(Sharma & Meena, 2019)
Elateridae	
Cardiophorus sp.	(Kazmi & Ramamurthy, 2004)
Silensis inficetus Candze	(Kazmi & Ramamurthy, 2004)
Psephenidae	
Eubranax sp.	(Bhargava & Srivastava, 2018)
Helodidae	(Bhargava & Srivastava, 2018)
Scirtes nigropunctatus	(Bhargava & Srivastava, 2018)
Hydraenidae	
Hydraena quadricollis	(Bhargava & Srivastava, 2018)

Family

Coleoptera order show very diversification. It is represented by 16 families that reported by several researcher at Rajasthan.

Families of order Coleoptera

Meloidae: In this family, eight species have been reported: seven by (Kazmi & Ramamurthy, 2004) two by (Parvez & Srivastava, 2010) [13] and several by (Meena *et al*., 2017) [12].

Cicindelidae
(Kazmi & Ramamurthy, 2004) discovered three species in this family.

Carabidae.
(Kazmi & Ramamurthy, 2004) described three species from this family.

Hydrophilidae
There have been sixteen species reported from this family, twelve by (Kazmi & Ramamurthy, 2004) five by (Bhargava & Srivastava, 2018) [15], and two by (Singh Tak *et al*., 2015) [16].

Haliplidae
Three species have been described from this family, one by (Kazmi & Ramamurthy, 2004) and two by (Bhargava & Srivastava, 2018) [15]

Gyrinidae
One species from this family was described by (Kazmi & Ramamurthy, 2004)

Dytiscidae
The second most common sp. in this family. This family has twenty-four species reported. (Kazmi & Ramamurthy, 2004) identified seventeen species; (Bhargava & Srivastava, 2018) [15] identified six species, one sp. (Naz *et al*., 2021) and three species (Singh Tak *et al*., 2015) [16]

Coccinellidae
Nine species have been reported from this family. Eight by (Kazmi & Ramamurthy, 2004), one by (Parvez & Srivastava, 2010) [13], two by (Sharma & Meena, 2019) [14], and several by (Meena *et al*., 2017) [12]

Curculionidae
This family has nine species, eight of which were reported by (Kazmi & Ramamurthy, 2004) one by (Parvez & Srivastava, 2010) [13], two by (Sharma & Meena, 2019) [14], and several by (Meena *et al*., 2017) [12].

Scarabaeidae
Most reported sp. is from family Scarabaeidae. Total forty one sp. reported from this family, in which twenty two species by (Kazmi & Ramamurthy, 2004), eight sp. by (Parvez & Srivastava, 2010) [13], nine sp. By (LAL JAKHAR *et al*., 2021) [8], twelve sp. By (Kumar *et al*., 2017) [10], Sternocera sp. by (Bhatnagar *et al*; 2018) [4], some sp. by (Meena *et al*., 2017) [12] and (Ganesh *et al*., 2017) [6].

Chrysomelidae
Two species have been reported from this family, one by (Kazmi & Ramamurthy, 2004) and one by (Sharma & Meena, 2019) [14]. Sp. from this family have also been observed by (Meena *et al*., 2017) [12] and (Ganesh *et al*., 2017) [6].

Elateridae
(Kazmi & Ramamurthy, 2004) and (Parvez & Srivastava, 2010) [13] reported two species from this family. (Ganesh *et al*., 2017) [6] observe sp. of this family as well.

Psephenidae
(Bhargava & Srivastava, 2018) [15] identified one species in this family.

Helodidae
(Bhargava & Srivastava, 2018) [15] discovered one species in this family.

Hydraenidae
One species from this family was described by (Bhargava & Srivastava, 2018) [15] and (Singh Tak *et al*., 2015) [16]

Bruchidae
Sp. from this family was described by (Meena *et al*., 2017) [12].

Brentidae
From this family sp. reported by (Ganesh *et al*., 2017) [6].

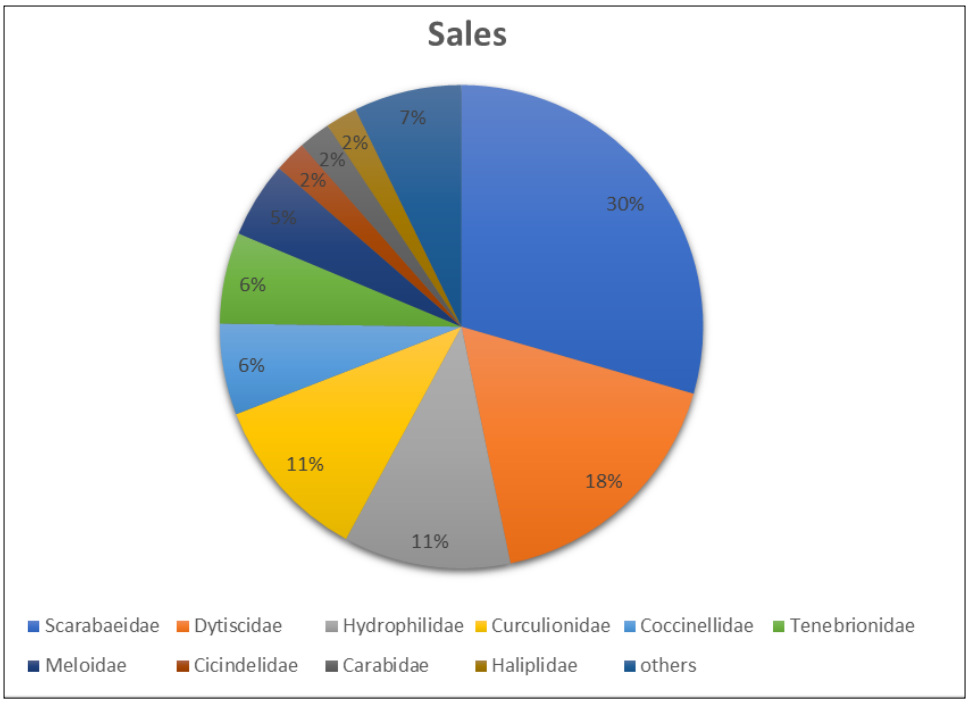

Fig 1: Graphic representation of diversity of Coleoptera

Conclusion

This review aims to compile Coleoptera diversity in the state of Rajasthan, India. Rajasthan has a diverse topography such as Thar desert, Aravalli region, plain areas, lakes etc as well as climatic condition such as temperature, humidity, rainfall, soil factor. Many researchers have stated the presence of 16 families and 140 species from the region. Scarabaeidae family reported highest diversity with 41 species followed by Dytiscidae 24, Hydrophilidae 16, Curculionidae 16, Coccinellidae 9, Meloidae 8 and others.

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