TAXONOMY AND ECOLOGY OF CARABIDAE (INSECTA: COLEOPTERA) BEETLES IN CHINNAR WILDLIFE SANCTUARY

Thesis submitted to the

UNIVERSITY OF CALICUT

For the award of the Degree of

DOCTOR OF PHILOSOPHY IN ZOOLOGY

(Under the Faculty of Science)

BY

SRUTHI M. C.

Under the Guidance of

DR. SABU K. THOMAS

P.G. & RESEARCH DEPARTMENT OF ZOOLOGY,
ST. JOSEPH'S COLLEGE (AUTONOMOUS), DEVAGIRI, CALICUT,
KERALA
JULY 2022

P.G. & RESEARCH DEPARTMENT OF ZOOLOGY
ST. JOSEPH'S COLLEGE DEVAGIRI (AUTONOMOUS)
KOZHIKODE - 673 008, KERALA
www.devagiricollege.org
email: sabukthomas@gmail.com

Dr. Sabu K. Thomas
Professor

Certificate

Certified that the thesis entitled ***"TAXONOMY AND ECOLOGY OF CARABIDAE (INSECTA: COLEOPTERA) BEETLES IN CHINNAR WILDLIFE SANCTUARY"*** *submitted by Mrs. Sruthi M. C. to the University of Calicut for the award of degree of Doctor of Philosophy in Zoology, is a bona fide record of research work done by her in this department. This work has not been previously formed the basis for any award of degree or diploma.*

Mrs. Sruthi M. C. has successfully completed the preliminary qualifying examination prescribed by the University of Calicut.

Place: Devagiri
Date:

Dr. Sabu K. Thomas
Supervisor & Guide

P.G. & RESEARCH DEPARTMENT OF ZOOLOGY
ST. JOSEPH'S COLLEGE DEVAGIRI (AUTONOMOUS)
KOZHIKODE - 673 008, KERALA
www.devagiricollege.org
email: sabukthomas@gmail.com

Dr. Sabu K. Thomas
Professor

Certificate

Certified that the thesis entitled ***"TAXONOMY AND ECOLOGY OF CARABIDAE BEETLES (INSECTA: COLEOPTERA) IN CHINNAR WILDLIFE SANCTUARY"*** *submitted by Mrs. Sruthi M C to the University of Calicut for the award of degree of Doctor of Philosophy in Zoology, has made the corrections/ suggestions from the adjudicators have been incorporated.*

Place: Devagiri

Date:

Dr. Sabu K. Thomas

Supervisor & Guide

Declaration

I do hereby declare that the thesis entitled "TAXONOMY AND ECOLOGY OF CARABIDAE (INSECTA: COLEOPTERA) BEETLES IN CHINNAR WILDLIFE SANCTUARY" submitted to the University of Calicut for the award of degree of Doctor of Philosophy in Zoology has not been formed the basis for the award of any other Degree, Diploma, Associateship, Fellowship and represents the original work done by me.

Place: Devagiri

Date: ***Sruthi M.C.***

Acknowledgements

I express my sincere gratitude to my Research Guide and Supervisor Dr. Sabu K. Thomas, Professor, Department of Zoology, University of Calicut, Tenhipalam, Kerala. His valuable guidance, vast experience, strong emotional support and constant encouragement throughout the study period helped me to complete it successfully.

I express my sincere gratitude to Dr. Boby Jose, Principal, St. Joseph's College (Autonomous), Devagiri, Kozhikode and Dr. Sabu K. Thomas, Dr. Jose John Mallikasseri, Dr. Sibichen M. Thomas, former Principals for providing institutional facilities during the course of my research work.

I express my sincere thanks to Dr. Vineesh P. J, Head, PG & Research Department of Zoology, St. Joseph's College (Autonomous), Devagiri, Kozhikode, and Dr. Boby Jose, Dr. George Mathew, former HOD for providing me all the required facilities available in the department all through my research period. I wish to express my sincere thanks to all the staff members of the Department of Zoology (Dr. Jisha Jacob, Mr. Joice Tom Dr. Aswathi P. Dr. Arunaksharan Narayanankutty, and Aswathi M K) for all help rendered during the course of my research work.

I thank Council for Scientific and Industrial Research (CSIR, Govt. of India) for the financial assistance provided.

I am thankful to the Kerala Forest and Wildlife Department (Govt. of Kerala) and all the officials henceforth for the permission granted by them to do my work in the forest areas of Kerala.

I thank the Director, Zoological Survey of India (Govt. of India) for allowing me to work with specimens in the national repositories of ZSI Western Ghats Regional Center, Kozhikode.

I am extremely thankful to my friends and colleagues, Dr. Shiju T. Raj., Dr. Nithya Sathiandran., Dr. Sobhana K. A., Dr. Subha BabuJayaprakash., Dr. Seena C. M., Dr. Akhil S. V., Dr. Jithmon V. A., Dr. Binsha P., Dr. Prameela K., Mrs. Divya M., Mrs. Ashly Kurian, Ms. Shigina K., Mrs. Aswathi S. B, Ms. Nijisha K, Ms. Neethu V. P, and Ms. Anagha Sudhakar and all other research scholars in the Entomology Research Lab, St. Joseph's College (Autonomous), Devagiri, Kozhikode, for their help and logistical support throughout my research work.

I wish to express my thanks to the lab assistants in the PG & Research Department of Zoology, St. Joseph's College (Autonomous), Kozhikode, for their valuable co-operation and help.

I owe thanks to a very special person, my husband, Sareesh You were always around at times I thought that it is impossible to continue, you helped me to keep things in perspective. I thankful to my little Daughter Devanshi for bearing my absence and being patient during my research work. I would also like to thank all of my family members for encouraging and supporting me whenever I needed them.

Above all I thank the Almighty for giving me the strength and patience to complete the research work.

Sruthi M. C.

Dedicated to my family and Teachers .....

CONTENTS

Chapter 1

INTRODUCTION

1. INTRODUCTION

1.1. General notes on Carabidae

Carabidae Latreille 1802, belonging to the suborder Adephaga, order Coleoptera is one of the most diverse and abundant families of insects. They are commonly known as ground beetles, constituting a considerable component of the soil fauna. Carabidae differs from other beetles by filiform antennae, five segmented tarsi, and coalescent basal segments of the abdomen and distinct backwardly produced metacoxae (Lindroth 1975). Adults and larvae of most of the ground beetles are well-known predators of insects and other invertebrates, whereas some species of carabids are herbivores, omnivores, or scavengers (Allen 1979). Carabids are found on the ground, under stones or logs, or in leaf litter, but many of them, especially those in the tropics, are arboreal (Capinera 2008; Atamehr 2013). They are usually small to moderate in size, nocturnal insects rich in the field and attract attention with unusual shape and coloration (Larochelle and Larivière 2013). At global level Carabidae comprises 39,358 (Lorenz 2021) species belonging to 34 subfamilies, 92 tribes and 2141 genera. In India there are 1602 species belonging to 305 genera, 54 tribes and 24 subfamilies (Anichtchenko 2022). It clearly shows a lack of taxonomic work on Indian Carabidae.

1.2. Taxonomy of Family Carabidae

The history of carabid classification has been extensively discussed by Ball (1979). As stated by Ball (1979), three main periods of classification are sighted-pre-Linnaean, Linnaean- Fabrician and Latreillean. Other workers who worked broadly towards systems of carabid classification include Dejean (1825–1831), Lacordaire (1854), Chaudoir (1842–1883), Sloane (1923), Andrewes (1919–1947), Jeannel (1942–1949), Erwin (1970–2018) and Lorenz (1998–2021). There are three major types of carabid classification accepted at global level, namely Jeannel (1942–1949), Erwin (1970–2018), and Lorenz (1998–2021) but still there exist some contradictions between them. Classifications of Jeannel and Erwin are difficult to understand while the classification of Lorenz is simple and therefore widely accepted.

Indian taxonomy of Carabidae is mainly based on the works of Andrewes (1929, 1935) - the *Fauna of British India*, Volume 1– *Carabinae* and Volume 2 –*Harpalinae*. Other workers contributed to Indian Carabidae include Jedlička (1928–1969), Chaudoir (1842–1883), Bates (1873–1892), Putzeys (1846–1878), Motschulsky (1844–1866), and Nietner (1856–1858). At present, there are 24 subfamilies (Anthiinae, Apotominae, Brachininae, Broscinae, Carabinae, Ctenodactylinae, Dryptiinae, Harpalinae, Lebiinae, Licininae, Loricerinae, Melaeninae, Nebriinae, Omophroinae, Orthogoniinae, Panageinae, Platyninae, Pseudomorphinae, Psydrinae, Pterostichinae, Rhysodinae, Scaritinae, Siagoninae and Trechinae) in India, among these only 14 subfamilies were discussed in the '*Fauna of British India*' of Andrewes (1929, 1935). The remaining 10 lesser-

known subfamilies were not described in the works of Andrewes 1929 and 1935. After the works of Andrewes (1919a, 1919b, 1919c, 1919d, 1920a, 1920b, 1920c, 1921a, 1921b, 1921c, 1921d, 1922, 1923a, 1923b, 1923c, 1923d, 1923e, 1923f, 1924a, 1924b, 1924c, 1924d, 1924e, 1924f, 1925, 1926a, 1926b, 1926c, 1926d, 1927, 1928, 1929, 1930, 1931a, 1931b, 1931c, 1932a, 1932b, 1933, 1934, 1935, 1936a, 1936b, 1936c, 1936d, 1937, 1938, 1939, 1940a, 1940b, 1941, 1942, and 1947) and Jedlicka (1928, 1931a, 1931b, 1933a, 1934, 1935, 1938, 1940, 1947, 1954, 1955, 1956, 1960, 1963, 1964, 1965 and 1969), only a few papers came from India and that comprise the works of Straneo (1938, 1949, 1957, 1961, 1989, 1995), Saha (1984, 1986), Saha *et al.* (1992), Saha and Biswas (1985), Tian and Deuve (2000, 2005, 2006a, 2006b, 2015, 2016a, 2016b), Abhitha *et al.* (2008, 2009), Sabu *et al.* (2010), Hegde and Kushwaha (2012, 2015), Shiju *et al.* (2012a), Shiju *et al.* (2012a), Jithmon and Sabu (2018), Chanu and Swaminathan (2017), Akhil and Sabu (2019a, 2019b), Akhil *et al.* (2019), Divya and Sabu (2019), Akhil and Sabu (2020), Akhil *et al.* (2020), Divya *et al.* (2020), Akhil and Sabu (2021) and Ashly and Sabu (2021).

1.3. Ecology of Family Carabidae

Carabids are commonly found under stones, logs, leaves, bark, debris or running above the ground. Adults and larvae of most carabids are predators (Kromp 1999), a few species are omnivorous (Balduf 1935; Lund and Turpin 1977a; Larochelle 1990), and a few others feed on seeds (Alcock 1976; Lund and Turpin 1977b; Thiele 1977). They chiefly act as generalist predators in

forest ecosystems (Qodri *et al.* 2016). Darlington (1971) placed Carabidae in three ecological groups, geophiles which live on ground, hydrophiles occur near running water, arboreal forms live on tree trunks or fallen leaves. These beetles are holometabolous insects, having indirect development with four developmental stages in their life cycle (Crowson 1981).

Carabid beetles serve as indicators in seven aspects (Lindenmayer *et al*. 2000; Koivula 2011). (1) indicates richness and abundance of taxa other than carabids (2) functioning as keystone organisms; (3) indicating human-altered abiotic conditions; (4) indicating particular environmental conditions through numerical or biomass dominance; (5) reflecting variation in 'natural' conditions; (6) acting as early-warning signalers; and (7) indicating disturbances and management (Koivula 2011). Carabids have great importance in food webs and potential to suppress agricultural pest populations (Toft and Bilde 2002; Kotze *et al.* 2011). They serve as bio control agents of agricultural pest in temperate region of Northern Hemisphere (Reichardt 1979; Kromp 1999; Sunderland 2002; Kulkarni *et al.* 2015; Francisco 2021). *Scarites orientalis* consumed small slugs, sp. a pest of common bean in Honduras (Bennet and Yaseen 1987; Francisco 2021). Tulli *et al.* (2009) suggested that *Scarites anthracinus* (Dejean 1831) natural enemy of gray field slug a pest in no- till sunflower and soybean crops in Argentina.

Thiele (1977) has given a detailed work on carabid ecology. Desender *et al.* (1999) studied beetle diversity and historical ecology in Flanders. Koivula *et al.*

(1999) studied leaf litter and the small-scale distribution of carabid beetles in the boreal forest. Koivula and Niemelä (2002) studied Boreal carabid Beetles in Managed Spruce Forests– a Summary of Finnish Case Studies. Koivula *et al.* (2002) studied Boreal carabid-beetle (Coleoptera, Carabidae) assemblages along the clear-cut originated succession gradient. Rainio and Niemelä (2003) gave details on Carabidae as biological indicators. Goulet *et al.* (2004) studied on diversity and seasonal activity of ground beetles in Canada. Vanbergen *et al.* (2010) described the carabid beetle responses to habitat and landscape structures in Europe. Tóthmérész *et al.* (2011) has given the responses of carabid beetles to urbanisation in Romania. Maveety *et al.* (2011) worked on the Carabidae diversity along an altitudinal gradient in a Peruvian cloud forest. Moraes *et al.* (2013) studied the carabid beetle assemblages in the Araucaria humid forest of southern Brazil. Worthen and Merriman (2013) studied the relationship between carabid beetle communities and forest stand parameters. Most of the works on ecology of carabid beetles were restricted to the temperate regions. Limited data exists on Carabidae ecology from the Western Ghats including the works of Prasad and Rajagopal (1990), Prasad and Rajagopal (1997), Abhitha *et al.* (2008), Abhitha (2010), Shiju *et al.* (2012), Shiju (2012), Akhil (2019), and Jithmon (2020).

Moist deciduous forests, montane rain forests and semi evergreen forests are the major vegetation types in the Western Ghats (WGs). Dry deciduous forests are rare in the WGs and those in the south WGs are confined to the northern

slope of Anamalai in Chinnar wildlife sanctuary (CWS) in Kerala and Mudumalai wildlife sanctuary, Nilgiris North and Coimbatore forest divisions in Tamil Nadu state (Ghosh and Bhaskaran 2007; Sobhana *et al.* 2013). Among these CWS is an important protected area due to its ecological, floral and geomorphological significance. There is no information about the Carabidae taxonomy and ecology from CWS. Present study aims to analyses the taxonomy, and ecology of carabid beetles from CWS.

1.4. Objectives

1. Taxonomic identification of carabids and record of rare and endemic species.
2. Pictorial key to the genera and species of Carabidae and,
3. Ecology of Carabidae.

Chapter 2

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

2.1. Taxonomy of Indian Carabidae

2.1.1. General status

Linnaeus (1758, 1761 and 1771), the pioneer worker on Indian Carabidae described four species namely *Sphodrus leucophthalmus*, *Syntomus truncatellus*, *Bembidion quadrimaculatum* and *Pheropsophus bimaculatus*. Fabricius (1775–1801) described 26 species of Carabidae from India with the common label '*India orientale'*. Fabricius (1775) described largest Carabidae *Anthia sexguttata* from India as *Carabus sexguttata*; Fabricius (1798) reported *Pheropsophus hilaris* as *Carabus hilaris*. Bonelli (1810) put forward subfamily Brachininae; Bonelli (1813) proposed subfamily Anthiinae. Wiedemann (1819, 1821 and 1823) narrated 34 Carabidae species from India. Dejean (1825, 1826, 1828, 1829 and 1831) reported 54 species of Carabidae from India in five volumes of world fauna of Carabidae. Macleay (1825) in his work '*Annulosa Javanica*' illustrated the natural affinities and analogies of the insects— Geodephaga (Carabidae), Hydradephaga, Philhydrida, Necrophaga and Brachelytra. Hope (1831, 1833, 1838 and 1845) narrated 14 new species of Indian Carabidae. Schmidt-Göebel (1846) in '*Faunula Coleopterum Birmanae*' reported 48 species from India. Motschulsky (1844, 1845, 1851, 1858, 1859, 1861, 1862, 1864, 1865 and 1866) added 46 new species belonging to 7 subfamilies to Indian carabid fauna. LaFerté-Sénectère (1851) in his work '*Revision de la tribu des patellimanes de Dejean, coleopteres pentameres de la famille des carabiques*' described three

new species of Panagaeinae and nine new species of Licininae. Lacordaire (1854) compiled the systems of classification in his work '*Genera des Coleopteres*' which was later elaborated by Schaum (1860) in '*Das system der Carabicinen*'. Nietner (1856, 1857a, 1857b, 1857c and 1858) contributed to the knowledge of Indian Carabidae by adding 20 new species belonging to eight subfamilies. Chaudoir (1842, 1843, 1844, 1846, 1847, 1848, 1850, 1852, 1854, 1855, 1856, 1857, 1859, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876a, 1877, 1878, 1879, 1880, 1882 and 1883) described 184 new species from India belonging to 17 subfamilies of current classification system and provided simple taxonomic keys to many genera of Carabidae. Chaudoir (1869–1882) produced Monographs on *Abacetus* (Chaudoir 1869), *Lebiides* (Chaudoir 1870), *Orthogonides* (Chaudoir 1871), *Pogonoides* (Chaudoir 1872a), *Callidides* (Chaudoir 1872b), *Brachynides* (Chaudoir 1876a), *Chlaeniens* (Chaudoir 1876b), *Masoreus* (Chaudoir 1876c), *Tetragonoderus* (Chaudoir 1876c), *Nematotarsus* (Chaudoir 1876c), *Siagonides* (Chaudoir 1876d), *Panageides* (Chaudoir 1878), *Scaritides* (Chaudoir 1879 and 1881), and *Oodides* (Chaudoir 1882). Putzeys (1846, 1861, 1863, 1866a, 1866b, 1867a, 1867b, 1868a, 1868b, 1870, 1873a, 1873b, 1873c, 1875a, 1875b, 1877a, 1877b, 1878 and 1879) added 40 new species to Indian Carabidae belonging to eight subfamilies. Nietner (1856, 1857a and 1858) reported 20 Carabidae species from India. Bates (1873, 1874a, 1874b, 1876, 1883, 1886, 1889a, 1889b, 1889c, 1891a, 1891b, 1892a and 1892b) added 129 new species of Carabidae belonging to 15 subfamilies from India. Horn (1881) published a monograph on *"Genera*

of Carabidae with special reference to the fauna of Boreal America". Tschitscherine (1894a, 1894b, 1894c, 1894d, 1894e, 1894f, 1895, 1897, 1898, 1899a, 1899b, 1899c, 1900a, 1900b, 1901a, 1901b and 1903) in '*Horae Societatis Entomologicae Rossicae'* narrated 16 new species of Carabidae belonging to four subfamilies from India. Fairmaire (1849a, 1849b, 1873, 1882, 1883, 1887, 1889 and 1901) described 10 species belonging to seven subfamilies from India. Maindron (1898, 1899, 1906 and 1909) described nine species of Indian Carabidae. Fowler (1912) in *'General introduction and Cicindelidae and Paussidae'* provided a historical summary on suborder Adephaga till 1912; and also provided a chapter on Rhysodinae with taxonomic keys to Indian species. Sloane (1923) in '*The Classification of family Carabidae*' gave a key to tribes of family Carabidae, which formed the base for future workers. Csiki (1927, 1928, 1929, 1930, 1931, 1932a, 1932b, 1933a and 1933b) provided useful catalogues for Carabidae of world.

Andrewes (1919–1947) contributed 485 new species to the Indian fauna belonging to 19 subfamilies proposed in the current classification system which is almost one third of the total known Carabidae of India. Andrewes (1919a) synonymized *Anthia orientalis* Hope 1838. Andrewes (1919b) narrated the types of Carabidae in the British Museum and Oxford University Museum. Andrewes (1921d) provided a comprehensive work on genus *Callistomimus* of Oriental region with taxonomic keys. Andrewes (1923b) provided detailed descriptions of the types of 98 species of Carabidae described by Schmidt-Göebel in "*Transactions of the Entomological Society of London".* Andrewes (1925) did a

revision of Oriental species of genus *Tachys.* Andrewes (1928 and 1933) provided detailed papers on the types of Oriental Carabidae described by Motschulsky. Two volumes of '*Fauna of British India including Burma and Ceylon*' – *Part I Carabinae* (1929) and *Part II Harpalinae* (1935) provided detailed description of carabids falling under two subfamilies namely, Harpalinae and Carabinae with modified taxonomic keys of Sloane (1923). Andrewes (1930a) recorded 19 species of Anthiinae, 53 species of Brachininae and 17 species of Orthogoniinae from India. Andrewes (1930b) in "*Catalogue of Indian Insects"* provided catalogue of the carabids described till 1930 including many groups and species not mentioned in Andrewes (1929). Andrewes (1932) provided taxonomic keys to the species of genus *Cymindis*. Andrewes (1933) provided keys and descriptions to species of *Dioryche* and *Phloeozeteus*. Andrewes (1934) described keys to the species of genus *Calathus.* Andrewes (1935a) gave keys and descriptions to species of *Cymindoidea, Platytarus* and *Taridius.* Andrewes (1936b) provided keys and descriptions to species of two genera *Drypta* and *Desera.* Andrewes (1937a, 1937b and 1937c) gave keys and descriptions to genera and species of the Sphodrini group and three genera namely *Feronia, Pericalus* and *Catascopus.* Andrewes (1940a) provided keys and descriptions of genus *Oodes.* Andrewes (1942) gave keys and descriptions to *Abacetus.*

Jedlička (1935, 1938, 1955, 1956, 1960, 1963, 1964, 1965 and 1969) added 29 species of 10 subfamilies to the Indian carabid fauna. Jedlička (1963a) in his '*Monographie der Truncatipennen aus Ostasien*' provided keys to

Palaearctic group of truncatipennes Carabidae. Straneo (1938, 1961, 1989, 1992 and 1994) added 20 species to Indian Carabidae. Quentin (1952) provided details of *Mastax fulvonotata* from south Mysore. Louwerens (1953) described seven new species of *Colpodes*, two new species of *Metacolpodes* and a single new species of *Skorlagad* from India. Mateu (1959, 1960, 1971, 1976, 1978, 1979a, 1979b, 1981, 1984, 1986, 1991 and 1997) added 35 new species to Indian carabid fauna. Saha and Sengupta (1979) described three species of *Chlaenius*, *C. besucheti*, *C. loebli* and *C. mussardi* from south India. Morvan (1979, 1992, 1996, 1997a, 1997b and 1999) described 18 new species of subfamily Platyninae from India. Deuve (1980a, 1980b, 1982a, 1982b, 1982c, 1986 and 2001) added six new species from India from the Paris Museum collections. Deuve (2012) reported *Crepidogaster indica* from south India; Deuve (2015) described two *Crepidogaster* species *C. rougueti* and *C. pseudohumerata* from south India; Deuve and Wrase (2014) provided *Crepidogaster mysorensis* from Ooty, south India. Saha (1984) recorded *Chlaenius puncticephalis* from India. Saha and Biswas (1985) reported 22 species of Carabidae from Arunachal Pradesh. Saha *et al.* (1992) reported 73 species of Carabidae in the collections of Zoological Survey of India from Kolkata. Kumar and Rajagopal (1996) reported 82 species of Carabidae from Karnataka state of India. Jaeger (1997 and 1998) provided description of *Bradycellus bicolor* and *Psychristus andrewesi* from India. Kirschenhofer (1998, 2002 and 2013) reported *Chlaenius seiferti*, *C. panjabensis*, *C. rajasthanensis*, *C. buriensis* and *C. sikkimensis* from India. Kirschenhofer (2000) synonymized three *Chlaenius* species *C. besucheti*, *C.*

loebli and *C.mussardi*. Kataev (2001, and 2002) provided description of three Harpalinae species namely, *Progonochaetus indicus, Harpalus meghalayensis* and *Siopelus tamilnadensis* from India. Tian and Deuve (2000, 2006, 2015, and 2016), worked with Deuve and added 31 new species of Orthogoniinae from India based on the collections at Paris Museum. Balkenohl (2001) provided taxonomic keys to the tribe Clivinini. Lorenz (2005) in '*A systematic list of extant ground beetles of the World*' provided a complete catalogue of World Carabidae. Schmidt (2008) added two new species of tribe Platynini from India. Shiju *et al.* (2012a) provided taxonomy notes on habits and distributional patterns of apterous endemic genus *Omphra*. Anichtchenko (2012) provided description of *Badister indicus* from northern India. Anichtchenko and Shavrin (2013) synonymized *B. indicus* with *B. thoracicus* Wiedemann, 1823. Hackel and Farkač (2013) drafted a world checklist for subfamily Anthiinae. Vaibhao *et al.* (2013) provided a checklist of Carabidae of Melghat Tiger reserve of India. Hegde *et al.* (2015) drafted a checklist of Carabidae from Chhattisgarh state of India. Hegde and Kushwaha (2015) reported 95 species belonging to 36 genera which include 22 first reports from Uttar Pradesh. Jaeger *et al.* (2016) described two new species *Acupalpus andrewesi* from Karnataka and *A. maculipennis* from Rajasthan. Jaeger (2017) described one new species *Anthracus nathani* from Tamil Nadu. Hrdlicka (2017) reported *Styphlomerus bimaculatus* from Rajasthan, India. Chanu and Swaminathan (2017) reported 14 species of *Chlaenius* from Rajasthan state of India with two new species *Chlaenius udaipurensis* and *C. pseudotristis*. Kirschenhofer (2017) synonymized *Chlaenius*

udaipurensis with *C. vulneratus* Dejean, 1831 and *C. pseudotristis* with *C. variipes* Chaudoir, 1856. Anichtchenko and Kirschenhofer (2017) synonymized two species of *Chlaenius* namely *C. panjabensis* with *C. puncticollis* Dejean, 1826 and *C. buriensis* with *C. germanus* Chaudoir, 1876. Jithmon and Sabu (2018) reported a new species *Euschizomerus devagiriensis* from Kozhikode and synonymized *E. schuhi* Kirschenhofer 2000 with *E. indicus* Jedlička, 1955. Akhil and Sabu (2019) reported two new species of *Pheropsophus* namely *P. devagiriensis* and *P. indicus* from south India with a key and descriptions to 22 known Indian species of genus *Pheropsophus*; synonymized *P. discicollis* (Dejean, 1826) with *P.hilaris* (Fabricius 1798); reinstated the species status of *P. sobrinus* (Dejean, 1826) and discovered the lost type of *P. hilaris*. Shiju and Sabu (2019) provided a checklist of 263 species of Indian Lebiinae. Hrdlicka (2019) described *Brachinus geiseri* from central India. Divya and Sabu (2020) provide a checklist of 159 species of Indian Pterostichinae. Divya *et al.* (2020) described a new bombardier beetle species, *Brachinus paikadai* with first report of *B. peltastes* from south India and synonymisation of *B. cinctellus* with *B. limbellus* Chaudoir, 1876. Jithmon and Sabu (2021) provided a checklist of 45 species of Dryptinae and 33 species of Panagaeinae from Indian subcontinent. Akhil and Sabu (2021) described two new species of *Omphra* namely, *O. balli* from the semi-arid region in Central India and *O. erwini* from the semi-arid region in north western India with modified key to the species. Ashly and Sabu (2021) provided a checklist of 188 species of Platyninae from Indian subcontinent.

2.1.2. Taxonomy of Carabidae in the forests of the Western Ghats

Saha (1986) recorded 16 species belonging to 13 genera and seven subfamilies with description of *Oxylobus silenticus* from Silent Valley in moist WGs. Abitha *et al.* (2008) described *Helluodes devagiriensis*, from WGs with generic key and details of phylogenetic relationships of enigmatic tribe Physocrotaphini. Abhitha *et al.* (2009) described a new carabid species *Orthogonius baconioides* from moist WGs with check list and key to the species of *Orthogonius*. Shiju *et al.* (2012b) described a new carabid species of the genus *Macrocheilus* from WGs. Deuve and Wrase (2014) described *Crepidogaster mysorensis* from Pykara near Ooty in moist WGs. Hegde and Manthen (2017) reported 17 *Chlaenius* species from the WGs region of Maharashtra. Akhil *et al.* (2019) described *Macrocheilus bandipurensis* from Bandipur belt in moist WGs. Akhil and Sabu (2019) described *Styphlomerus striatus* from Tholpetty Wildlife Sanctuary in WGs. Akhil (2019) reported 78 species belonging to 11 subfamilies, 21 tribes and 40 genera from Nilgiri Biosphere Reserve integral part of WGs. Jithmon (2020) reported 23 species from Malabar Wildlife sanctuary and surrounding agriculture lands part of moist WGs.

Limited works on Carabidae taxonomy has been reported from dry WGs. Akhil *et al.* (2019) reported one new species *Macrocheilus chinnarensis* from CWS. Shiju and Sabu (2019) in '*Checklist of Indian Lebiinae"* reported two species *Apristus subtransparens, Anchista fenestrate* from CWS. Jithmon and

Sabu (2021) recorded one species *Craspedophorus bifasciatus* from CWS in "*Checklists of subfamilies Dryptinae and Panagaeinae (Insecta: Coleoptera: Carabidae) from the Indian subcontinent".*

2.3. Ecology of Carabidae

Thiele (1977) focussed on the carabid ecology in natural and managed habitats and his work serve as the base for Carabidae ecology. Luff (1978) showed light-dark cycles influence carabid beetle activity. Baars (1979) explained the correlation of mean density and catches in pitfall trap of ground beetles. Refseth (1980) studied ecological analysis of Carabidae communities and its use in biological classification for nature conservation. Kalas (1985) described species composition and seasonal activity patterns of Carabidae in a small deciduous forest in western Norway. Waage (1985) studied the trapping efficiency of ground beetles using plastic and glass pitfall traps containing different solutions. Spence and Niemela (1994) studied sampling of carabid assemblage using pitfall traps. Erwin (1994) provided the character analysis of a group of subarboreal tropical beetles *Xystosomi* with its taxonomy and distribution details. Andersen (1995) stated species favouring more open habitats show a positive response towards direct light, whereas those seeking wetter habitat (forest inhabitants) show a positive orientation towards silhouettes. Eyre *et al.* (1996) studied the potential of carabid beetles for monitoring the environment quality. Lovei and Sunderland (1996) reviewed the ecology and behaviour of Carabidae. Lucky *et al.* (2002) studied temporal, spatial diversity

and distribution of arboreal Carabidae in tropical rainforest. Yu *et al.* (2006, 2007, 2009 and 2010) explained the distribution of carabid beetles along various habitats of China. Nyundo and Yarro (2007) studied the effect of different methods for sampling Carabidae in a montane rain forest. Koivula (2011) studied the use of Carabidae as a model bio indicator organism for reflecting environmental conditions. Brandmayr *et al.* (2013) explained the use of hypogean Carabidae as indicators of global warming. Jung *et al.* (2012, 2014 and 2015) explained community structure, species diversity and distribution pattern of ground beetles of Korea. Zou *et al.* (2014) explained the altitudinal diversity pattern of the ground beetles in Northeast China. Roubah *et al.* (2014) studied the effect of ground beetle body size on strength of prey suppression. Pizzolotto *et al.* (2016) studied the habitat diversity of the Carabidae along an altitudinal sequence of alpine habitats. Qodri *et al.* (2016) studied diversity and abundance of Carabidae in four montane habitat types in South Sulawesi, Indonesia. Li *et al.* (2017) studied the community composition and diversity of the ground beetles in Yaoluoping Natural reserve of China. Pizzolotto *et al.* (2018) studied the use of ground beetles as bioindicators. Kacprzyk *et al.* (2020) studied on the effect of spot burning of logging residues on the mountain forest soil and the occurrence of ground beetles. Shashkov *et al.* (2020) studied on ground beetle communities in broad leaved forests of protected and urban areas of the Kaluga Oblast, Russia. Riley *et al.* (2021) studied ground beetle richness, diversity, and community structure in the flooded and non-flooded Amazonian forests of Ecuador.

Mani (1968 and 1974) narrated behaviour and general ecology of many ground beetles while dealing with '*Ecology and Biogeography of High Altitude Insects'* and '*Ecology and Biogeography of India'*. Prasad and Rajagopal (1990) studied on *Omphra pilosa* revealed their predatory behaviour on termites. Prasad and Rajagopal (1997) studied ecology of carabid fauna of Karnataka. Vennila and Rajagopal (1999) explained the optimum sampling effort for study of tropical ground beetles with pitfall traps. Anu and Sabu (2007) studied the seasonal variation in the litter chemical quality of a wet evergreen forest in the WGs and proposed that variations are related to nutrient source-sink interactions during summer periods and pulse of increased soil nutrient availability and uptake during rainy season. Abhitha *et al.* (2008) explained notes on a curious sexually dimorphic character of species in the tribe Physocrotaphini and on termitophilous and geophilous habits of genus *Helluodes* from WGs. Abhitha (2010) studied forest litter arthropod diversity and abundance in semi-evergreen forest of south WGs. Shiju and Sabu (2010) compare the trapping efficiencies of various methods for sampling various Coleopteran families in moist deciduous forests in the WGs and reported the best methodologies for quantitative and qualitative sampling of Carabidae. Shiju *et al.* (2012) discussed about the geophilus habitat and feeding behaviour of *Omphra* from Indian subcontinent. Shiju (2012) studied abundance of ground dwelling coleopteran in moist deciduous, evergreen and montane cloud forests in the WGs. Akhil (2019) studied on ecology of Carabidae on Nilgiri Biosphere Reserve. Jithmon (2020) studied on ecology of Carabidae on Malabar wildlife sanctuary.

This page intentionally left blank

Chapter 3

MATERIALS & METHODS

3. MATERIALS AND METHODS

3.1 Study area - Chinnar wildlife sanctuary

The Western Ghats (WGs), a chain of mountains of south western India, is one of the last remaining stretches of the bio diverse tropical wet evergreen rainforests in peninsular India and is a global biodiversity hotspot (Myers *et al.* 2000). The Eastern slope of the WGs relies heavily on the northeast monsoon (October-December) for precipitation, as opposed to western scarps that receive almost 80% of the rainfall between May-August, during the southwest monsoon (Anu *et al.* 2009). This variance in monsoon dependence is hypothesized to have led to phenological differences amongst some congeneric populations from the eastern and western slopes (Janani *et al.* 2017; Chaitanya *et al.* 2018). Chinnar wildlife sanctuary (CWS) (Figure.1) situated in eastern slope of south Western Ghats.

Chinnar wildlife sanctuary was declared as a wildlife sanctuary in August 1984. The area falls in the Marayoor and Kanthalloor Panchayat of Devikulam Taluk in Idukki District. It is located between 10° 15’ - 10° 21’ N latitude 77° 05’ - 77° 16’ E longitude, and covering a total area of 90.44km². The Chinnar River and Pambar rivers are the major perennial water resources in the sanctuary. The sanctuary is situated in the rain shadow region and hence the area experiences prolonged hot/dry season from January to September and short rainy season from north-east monsoon during October to December. Annual rainfall ranges from 500 to 800 mm with a minimum and maximum temperature of 12°C

and 36°C, respectively (Kerala Forests and Wildlife Department Management plan of Chinnar wildlife sanctuary 2012 – 13 to 2021 – 22). The dominant vegetation is dry deciduous forests followed by thorny scrub forests and patches of riparian forests linearly spread out along the hill folds (Thomas *et al.* 2018). Specimen collection involved from all the three major forest types.

The rainfall regime of the sanctuary characterised by the highly variable precipitation linked with the cyclonic disturbances affecting the Bay of Bengal during the withdrawal of the monsoon. On the slopes below 650 m of South Western Ghats the dry deciduous formation is generally thorny. Chinnar wildlife sanctuary is an abode of reptilian fauna and the richest in Kerala in terms of the number of species. *Albizia lathamii*, critically endangered species has been reported from the dry forests of Chinnar. It is a well known repository of medicinal plants. The riverine forests along Chinnar and Pambar support a healthy population of Grizzled Giant Squirrel. The famous 'white bison of Manjampatti' has been reported from Chinnar. It has about 1000 species of flowering plants, 28 species of mammals, 225 species of birds, 14 species of fish, 15 species of amphibians, 156 species of butterflies and 52 species of reptiles recorded from the sanctuary (Kerala Forests and Wildlife Department Management plan of Chinnar wildlife sanctuary 2012 – 13 to 2021 – 22).

3.2. Data collection and Analysis

3.2.1. Collection of specimens

Specimens were collected during 2019-2020 period from Chinnar wildlife sanctuary using pitfall traps, traps and hand picking methods. Pitfall trapping is the best known collection method used by carabidologists especially in ecological studies (Lövei and Sunderland 1996; Kotze *et al*. 2011). Pitfall traps captured high numbers of taxa active at ground level but inefficient in capturing either bottom dwellers or those disseminate by flying (Standen 2000; Ward *et al*. 2001; Work *et al*. 2002; Hansen and New 2005; Leather and Watt 2005; Woodcock 2005; Shiju and Sabu 2010). Pitfall trap (Figure.2A) consists of plastic containers having 8 cm width and 10 cm depth buried in soil to its rim in the level of soil surface and half-filled with preservative liquid. Preservative liquid is a mixture of salt and soapwater. Soapwater added to break the surface tension of the liquid to promote quick drowning. The opening is covered by a lid to reduce the amount of rain and debris entering the trap. Traps were placed in a row and separated each other by 20m to avoid "digging in" effects (Nyundo and Yaro 2007; Shiju and Sabu 2010). Thirty traps were placed in forest areas of CWS. Traps were setup in afternoon and collection were done after 48 hours. Trapped beetles were sorted to tribe/genus level, selected the minimum number of representative specimens and rest were released. Specimens meant for lab analysis were washed with freshwater and preserved in 70% ethyl alcohol.

Light trapping is the most frequent and popular sampling technique. Thousands of insect species are nocturnal. These insects are best sampled through light trapping (Szentkiralyi 2002). Carabid beetles are nocturnal and

actively foraging for food at night. This indicates that high collection of carabid fauna using light traps(Abdulla *et al*. 2008). Light trapping is more effective than pitfall trapping in region where moist terrain or high risk of flooding (Jocque *et al*. 2016). Electronic insect light trap (Figure. 2B) (SAFS Timer Insect LED Light trap, Model SAFS_Itrap_01B) having UV-A lighting technology is used for the study. Traps have a tray for holding preservative liquid. Traps were placed with separation of 500m from each other. A total of thirty light traps were placed in forest areas of CWS. Trapped beetles were sorted to tribe/genus level, selected the minimum number of representative specimens and rest were released. Specimens meant for laboratory analysis were preserved in 70% ethyl alcohol.

Handpicking method (Figure. 2C) is the third method of ground beetle collection. Medium sized to large carabids picked up by hand. Success of handpicking method depends on experience of collector (Timm *et al*. 2007). Ground beetles were collected mainly under stones, logs and grass patches.

3.2.2. Taxonomy of family Carabidae

Specimens from various international museums were analysed for taxonomical studies Natural History Museum, Paris, France (MNHN), Museum of the Moscow Lomonosov State University. Classification pattern provided in Lorenz (2005) for subfamilies, tribes, genera, and species was followed. Species-level identification was done with the aid of taxonomic keys in Akhil (2019),

Akhil *et al.* (2019), Akhil and Sabu (2019a), Andrewes (1929, 1935), Balkenohl (2001), Habu (1973), Jithmon (2020), Kataev (2012, 2018), Kataev and Wrase (2016), Roux *et al.* (2016), Sabu (2018), Shiju (2018), Shiju *et al.* (2012a), modified and newly prepared taxonomic keys and by comparing with the holotypes and verified specimens available in the insect depository of Zoological Survey of India, Western Ghats Regional Centre (ZSI-WGRC) Kozhikode ZSI, Calicut station. Images were taken using Leica M 205C Stereo zoom microscope fitted with Leica MC 170 HD digital camera. Body length was measured from tip of the labrum to apex of the elytra (Lawrence *et al*. 1999). All measurements are given in millimetres. Identified specimens are labelled and deposited in ZSI-WGRC.

Abbreviations used

id. "Idem" (the same; as just mentioned)

@ First report from India

First report from South India

* Endemic to the Western Ghats

ssp Subspecies

World Zoogeographical Regions

AUR-Australian Region

IAR-Indo-Australian Region

ORR-Oriental Region

PAR-Palaearctic Region

Geographical symbols

AF-Afghanistan	HUN-Hunan	SC-South Korea
AST-Australia	IDS-Indonesia	SCH-Sichuan
BGD-Bangladesh	IN-Iran	SEA-South East Asia
BT-Bhutan	JA-Japan	SHG-Shanghai
CBD-Cambodia	JIX-Jiangxi	SM-Samoa
CHN-China	LAO-Laos	SRL-Sri Lanka
EAI-East Indies	MAC-Macao	TAI-Thailand
FUJ-Fujian	MLS-Malaysia	TD-Tajikistan
GUA-Guangdong	MM-Myanmar	TM-Turkmenistan
GUI-Guizhou	NC-North Korea	TWN-Taiwan
GUX-Guangxi	NEC-New Caledonia	UZ-Uzbekistan
HAI-Hainan	NP-Nepal	VTN-Vietnam
HKG-Hong Kong	PA-Pakistan	YUN-Yunnan
HUB-Hubei	PP-Philippines	

3.3. Ecological Analysis

Ecological analysis of Carabidae collected from CWS was performed using data obtained through light trap and pitfall methods. Ecological data used to derive its relative abundance, to plot rank-abundance curve, and to study the attributes of diversity, richness and evenness using PAST (PAST version 3.15) software. Graphs and simple statistical data analysis such as percentage and

relative abundance of species using different sampling methods were done with the help of MS-Excel 2010.

3.3.1. Diversity Analysis

Alpha diversity was estimated with the three indices Margalef's species richness index (d), Shannon-Weaver diversity index, Simpson's evenness index.

Margalef's index (d) (Clifford and Stephenson 1975; Magurran 2004) was calculated by using the following formula.

$$d = S - 1 / \log (N)$$

S = total number of species

N = total number of individuals

Shannon-Weaver diversity index (Shannon and Weaver 1949) is the most commonly used diversity index because it incorporates both species richness and evenness, it can also provide heterogeneity of information (Rosenstock 1998; Cheng 1999) and possible to test the differences between two communities using a Shannon *t*-test/ANOVA (Magurran 2004). It is calculated by using the following formula.

$$H' = - \Sigma_i P_i (\log (P_i))$$

Where P_i is the proportion of individuals found in the $_i{}^{th}$ species.

Simpson's evenness index (1-D or 1/D), addresses equitability of the species (Simpson 1949).

$$E_{1/D} = (1/D)/S$$

Where 1/D is the reciprocal form of the Simpson index (D) and 'S' is the number of species in the sample.

$$D = \Sigma\, p_i^2$$

Where P_i = the proportion of individuals in the i^{th} species (Magurran 2004)

Patterns in species composition of the ground beetle assemblages were analyzed by constructing a rank-abundance plot for each method using PAST (PAST version 3.15) software. Rank-abundance plot was plotted with relative abundance of each order against rank of species for the methods.

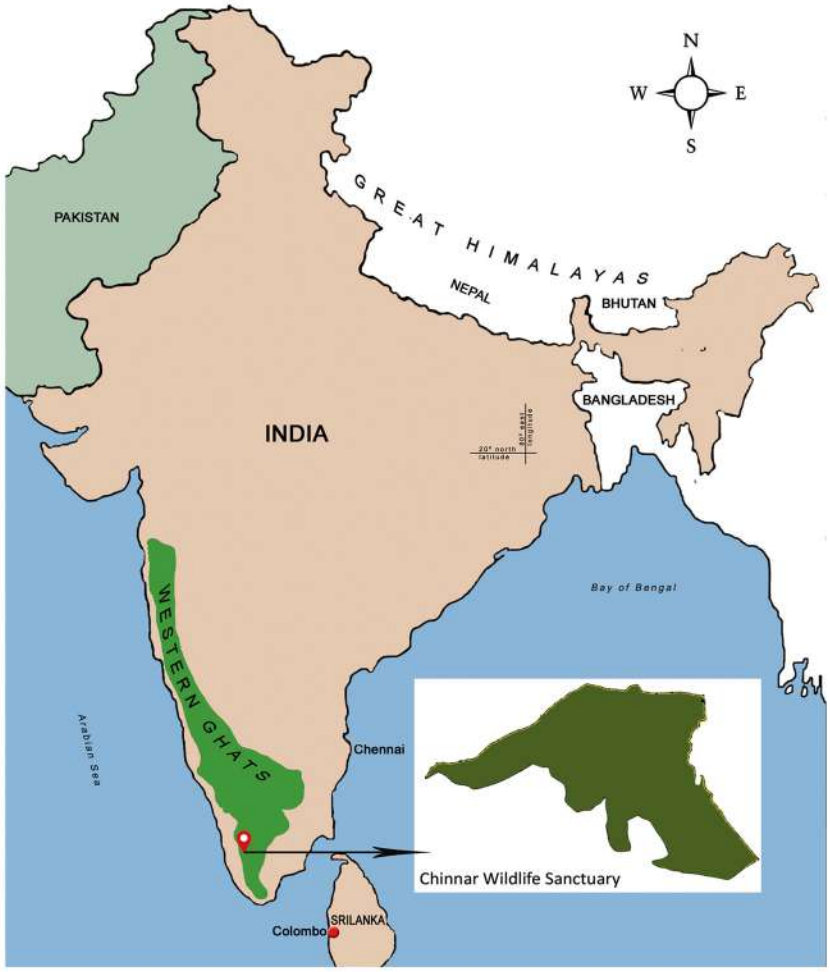
3.3.2 Statistical analysis

Species abundance data used for statistical analysis were tested for normality with Anderson-Darling test. Since data were normally distributed, *t*-test was used to analyse significance levels of variations. For all analyses, significance was determined at $P<0.05$. All statistical and diversity analyses were performed using PAST software version 3.15 (Hammer *et al.* 2001).

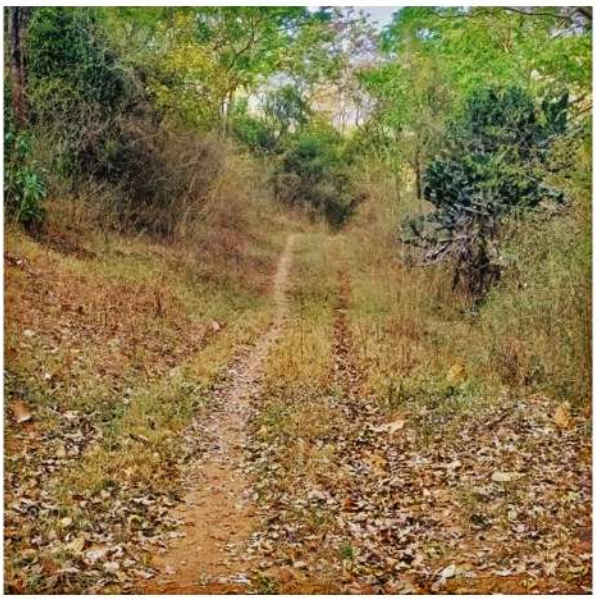
Species were classified as ‘dominant’ if their relative abundance contributed 10% and above. ‘Minor’ species contributed 5-9.99% and the species were classified as ‘rare’ if their relative abundance contributed less than 4.99%.

This page intentionally left blank

A)



B)



C)

D)

Figure 1.
A) Map of Indian subcontinent showing study area- Chinnar wildlife sanctuary (CWS) Vegetation types in CWS
B) Deciduous forest
C) Scrub forest
D) Riparian forest

A)

B)

C)

Figure 2.
Collection Methods

A) Pitfall trap
B) Light trap
C) Hand picking

Chapter 4

RESULTS

4. RESULTS

4.1 Carabidae Taxonomy

4.1.1 Carabidae beetles from Chinnar wildlife sanctuary

Checklist of Carabidae from CWS with 52 species belonging to 11 subfamilies (Harpalinae: 15 species, Lebiinae: 14, Scaritinae: 7, Pterostichinae: 4, Anthiinae: 2, Trechinae: 3, Licininae: 2, Orthogoniinae: 2, Panagaeinae: 1, Brachininae: 1, Dryptinae: 1), 19 tribes and 31 genera are provided (Table: 1). Two species namely *Stenolophus lucidus* (Harpalinae), and *Amblystomus aenescens* (Harpalinae) - are first records from India. Four species namely *Stenolophus bajaurae* (Harpalinae), *Amblystomus indicus* (Harpalinae), *Trigonotoma oberthueri* (Pterostichinae) and *Elaphropus politus* (Trechinae) and - are new records from south India. Five species namely *Ophoniscus puneensis* (Harpalinae), *Caelostomus sculptipennis* (Pterostichinae), *Pseudoclivina costata* (Scaritinae), *Elaphropus nigellus* (Trechinae), *E. nilgiricus* (Trechinae) - are endemic to the WGs and Sri Lanka hotspot of biodiversity. In addition to the checklist, pictorial key to the genera and species, and images of the species collected from CWS are provided.

Table 1: Carabid beetles collected during 2019-2020 from Chinnar wildlife sanctuary			
Subfamily	**Tribe**	**Genus**	**Species**
1. Anthiinae Bonelli, 1813	1. Helluonini Hope, 1838	1. *Macrocheilus* Hope, 1838	1. *M. bensoni* Hope, 1838
		2. *Omphra* Dejean, 1825	1. *O. pilosa* (Klug, 1834)
2. Brachininae Bonelli, 1810	1. Brachinini Bonelli, 1810	1. *Styphlomerus* Chaudoir, 1875	1. *S. striatus* Akhil and Sabu, 2019
3. Dryptinae Bonelli, 1810	1. Dryptini Bonelli, 1810	1. *Drypta* Latreille, 1796	1. *D. lineola* MacLeay, 1825
4. Harpalinae Bonelli, 1810	1. Anisodactylini Lacordaire, 1854	1. *Pseudognathaphanus* Schauberger, 1932	1. *P. rusticus* (Andrewes, 1920)
	2. Stenolophini Kirby, 1837	1. *Stenolophus* Dejean, 1821	#1. *S. bajaurae* Andrewes, 1924
			@2. *S. lucidus* Dejean, 1829
			3. *S.quinquepustulatus* (Wiedemann, 1823)
			4. *S.smaragdulus* (Fabricius, 1798)
	3. Harpalini Bonelli, 1810	1. *Allosiopelus* Ito, 1995	1. *A.punctatipennis* Ito, 1995
		2. *Amblystomus* Erichson, 1837	@1. *A.aenescens* (Motschulsky, 1858)
			2. *A.fuscescens* (Motschulsky, 1858)
			# 3. *A.indicus* (Nietner, 1858)
		3. *Dioryche* MacLeay, 1825	1. *D.cuprina* (Dejean, 1829)

			2. *D.dravidana* Kataev, 2012
			3. *D.torta* MacLeay, 1825
		4. *Ophoniscus* Bates, 1892	*1. *O.puneensis* Kataev, 2018
		5. *Parophonus* Ganglbauer, 1891	1. *P.acutangulus* (Bates, 1891)
			2. *P.indicus* (Andrewes, 1931)
5. Lebiinae Bonelli, 1810	1. Cyclosomini Laporte De Castelnau, 1834	1. *Cyclicus* Jeannel, 1949	1. *C.elegans* (Andrewes, 1931)
			2. *C.fimbriatus* (Bates, 1886)
		2. *Tetragonoderus* Dejean, 1829	1. *T.notaphioides* Motschulsky, 1861
	2. Lebiini Bonelli, 1810	1. *Anchista* Nietner, 1857	1. *A.fenestrata* (Schimdt-Göbel, 1846)
		2. *Anomotarus* Chaudoir, 1875	1. *A.stigmula* (Chaudoir, 1852)
		3. *Apristus* Chaudoir, 1846	1. *A.aeneipennis* (Schmidt-Göbel, 1846)
			2. *A.subtransparens* Motschulsky, 1861
		4. *Catascopus* Kirby, 1825	1. *C.cingalensis* Bates, 1886
			2. *C.cyanellus* Chaudoir, 1848

		5. *Lebia* Latreille, 1802	1. *L.baconi* (Chaudoir, 1871)
			2. *L.calycophora* Schmidt-Göbel, 1846
			3. *L.indica* Liebke, 1938
	3. Odacanthini Laporte De Castelnau, 1834	1. *Pentagonica* Schmidt-Göebel, 1846	1. *P.ruficollis* Schmidt-Göbel, 1846
6. Licininae Bonelli, 1810	1. Chlaenini Brulle, 1834	1. *Chlaenius* Bonelli, 1810	1. *C.hamifer* Chaudoir, 1856
			2. *C.nilgiricus* Andrewes, 1919
7. Orthogoniinae Schaum, 1857	1. Orthogoniini Schaum, 1857	1. *Orthogonius* Macleay, 1825	1. *O.baconi* Chaudoir, 1871
			2. *O.lucidus* Bates, 1891
8. Panagaeinae Bonelli, 1810	1. Panagaeini Bonelli, 1810	1. *Craspedophorus* Hope, 1838	1. *C.angulatus* (Fabricius, 1781)
9. Pterostichinae Bonelli, 1810	1. Abacetini Chaudoir, 1872	1. *Abacetus* Dejean, 1828	1. *A.haplosternus* Chaudoir, 1878
		2. *Cosmodiscus* Sloane, 1907	1. *C.picturatus* Andrewes, 1920
	2. Cratocerini Lacordaire, 1854	1. *Caelostomus* MacLeay, 1825	*1. *C.sculptipennis* (Motschulsky, 1859)
	3. Pterostichini Bonelli, 1810	1. *Trigonotoma* Dejean, 1828	#1. *T.oberthueri* Tschitschérine, 1894
10. Scaritinae Bonelli, 1810	1. Clivinini Rafinasque, 1815	1. *Clivina* Latreille, 1802	1. *C.brevior* Putzeys, 1866

			2. *C.lobata* Bonelli, 1813
		2. *Pseudoclivina* Kult, 1947	*1. *P.costata* (Andrewes, 1929)
			2. *P.memnonia* (Dejean, 1831)
	2. Dyschiriini W. Kolbe, 1880	1. *Dyschirius* Bonelli, 1810	1. *D.paucipunctus* Andrewes, 1929
	3. Scaritini Bonelli, 1810	1. *Oxylobus* Chaudoir, 1855	1. *O.asperulus* Chaudoir, 1857
			2. *O.porcatus* (Fabricius, 1798)
11. Trechinae Bonelli, 1810	1. Bembidiini Stephens, 1827	1. *Elaphropus* Motschulsky, 1839	*1. *E.nigellus* (Andrewes, 1935)
			*2. *E.nilgiricus* (Andrewes, 1925)
			#3. *E.politus* (Motschulsky, 1851)
@ First report from India # First report from South India * Endemic to the Western Ghats			

4.1.2. Taxonomic Keys

4.1.3. Taxonomic keys to the Carabidae species recorded from Chinnar wildlife sanctuary

Key to Tribes recorded from Chinnar wildlife sanctuary

1. Venter with six visible segments---------- 2

- Venter with seven or eight visible segments----------BRACHININI

2. Mandibles with at least one setae in the scrobe ----------BEMBIDIINI

- Mandibles without seta in the scrobe ---------- 3

3. Procoxal cavities enclosed behind----------18

- Procoxal cavities open behind----------4

4. Apical joint of the maxillary palpi attached normally to the penultimate joint - ---------- 5

- Apical joint of the maxillary palpi attached excentrically to the penultimate joint ----------PANAGAEINI

5. Head with one supraorbital seta on each side---------- 13

- Head with two supraorbital setae on each side ---------- 6

6. Elytra with a plica near sides on under surface----------16

- Elytra without an inner plica----------7

7. Joint 1 of the antennae scapiform ----------DRYPTINI

- Joint 1 of the antennae not scapiform ---------- 8

8. Mentum with median tooth----------9

- Mentum without median tooth---------- ORTHOGONIIINI

9. Ligula narrow, paraglossae well-developed----------10

- Ligula wide, paraglossae rudimentary----------HELLUONINI

10. Pronotum distinctly longer than wide---------- 11

- Pronotum not distinctly longer than wide----------12

11. Terminal maxillary and/or labial palpomere trianguloid. Tarsomere 4 notched, bilobed ---------- LEBIINI

- Terminal maxillary and labial palpomere cylindrical, normal. Tarsomere 4 bilobed or entire ---------- ODACANTHINI

12. Labrum average, length less than half the width at base. Head not constricted posteriorly in form of neck---------- CYCLOSOMINI

- Labrum elongate, length more than half the width at base. Head markedly constricted posteriorly, in form of neck---------- LEBIINI

13. Outer part of the metacoxae and first ventral segment not lying in the same plane----------14

- Outer part of the metacoxae and first ventral segment lying in the same plane----------CHLAENIINI

14. Penultimate of the labial palpi with over 3 setae (rarely 3), larger species -----
----------15

- Penultimate of the labial palpi with 2 setae (rarely 3), smaller species----------
---------- STENOLOPHINI

15. Anterior portion of male tarsi with a dense felting of bright bristles, internal apical spur of anterior tarsi spoon shaped, sometimes trifid----------
---------- ANISODACTYLINI

- Anterior portion of male tarsi carrying two rows of adhesive appendages in the form of suckers, internal apical spur of the anterior tarsi conical ----------
----------HARPALINI

16. Antennae filiform ---------- 17

- Antennae moniliform ---------- CRATOCERINI

17. Mentum with simple median tooth ---------- ABACETINI

- Mentum with bifid median tooth ---------- PTEROSTICHINI

18. Buccal fissure extending backwards, at least for a short distance, beyond base of mentum and separating the submentum and paragenae----------
----------SCARITINI

- Buccal fissure not extending backwards beyond base of mentum ---------- 19

19. Elytra with marginal series of pores uninterrupted at middle, prothorax convex, but not usually globose---------- CLIVININI

- Elytra with marginal series of pores widely interrupted at middle, prothorax usually globose ----------DYSCHIRINI

This page intentionally left blank

Pictorial key to the Genera of Carabidae from Chinnar wildlife sanctuary

Tribe Helluonini Hope, 1838

1. Mentum with a well developed stout median tooth---------- ***Omphra***

- Mentum with an elongated spiniform median tooth----------

---------- ***Macrocheilus***

Tribe Brachinini Bonelli, 1810

Mandibular scrobe unisetose----------***Styphlomerus***

Tribe Dryptini Bonelli, 1810

Tarsal claws smooth----------***Drypta***

Tribe Anisodactylini Lacordaire, 1854

Mentum without median tooth----------***Pseudognathaphanus***

Tribe Stenolophini Kirby, 1837

Elytra with scutellary striole---------- ***Stenolophus***

Tribe Harpalini Bonelli, 1810

1. Scutellary striae present between suture and first striae----------***Amblystomus***

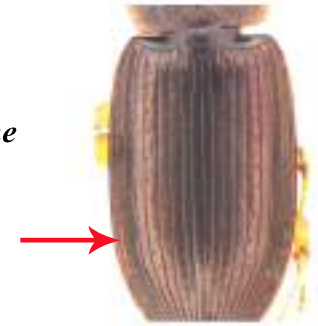
- Scutellary striae present between first and second striae----------**2**

2. Elytra completely pubescent or external intervals pubescent----------**3**

- Elytra glabrous----------***Allosiopelus***

3. Elytra completely pubescent---------- **4**

- External intervals pubescent---------- ***Dioryche***



4. Pronotum with 1-2 long marginal seta at apex----------***Ophoniscus***

- Pronotum without marginal seta at apex---------***Parophonus***

Tribe Cyclosomini Laporte De Castelnau, 1834

1. Last segment of maxillary palpi cylindrical----------
----------***Tetragonoderus***

- Last segment of maxillary palp fusiform----------***Cyclicus***

Tribe Lebiini Bonelli, 1810

1. Antennae pubescent or pubescent only from the 3rd segment----------***Apristus***

- Antennae pubescent only from the 4th segment----------**2**

2. Tarsal claws pectinate----------**3**

- Tarsal claws simple----------***Catascopus***

3. Last segment of the maxillary palp fusiform----------***Lebia***

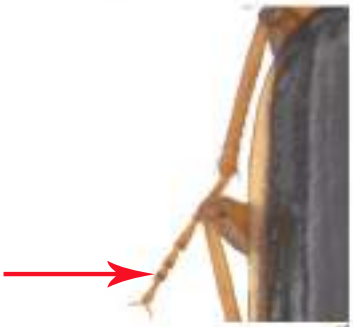
- Last segment of the maxillary palp oval or elongate oval or cylindrical----------4

4. 4th tarsomere deeply bilobed----------*Anchista*

- 4th Tarsomere simple. ----------*Anomotarus*

Tribe Odacanthini Laporte De Castelnau, 1834

4 th tarsal segment not two lobed----------*Pentagonica*



Tribe Chlaenini Brulle, 1834

Antennae with segment three subequal in length with the subsequent segments----------*Chlaenius*

Tribe Orthogoniini Schaum, 1857

4 th segment of all tarsi bilobed; all claws pectinate ----------
----------***Orthogonius***

Tribe Panagaeini Bonelli, 1810

Elytra maculate----------***Craspedophorus***

Tribe Abacetini Chaudoir, 1872

1. Second segment of the antennae attached to the first excentrically ----------***Abacetus***

-Second segment of the antennae attached to the first centrally ----------***Cosmodiscus***

Tribe Cratocerini Lacordaire, 1854

Ultimate segment of the labial palpi longer than penultimate
----------***Caelostomus***

Tribe Pterostichini Bonelli, 1810

3rd interval of elytra without 3 dorsal pores ----------
----------***Trigonotoma***

Tribe Clivinini Rafinasque, 1815

1. Intervals of elytron without setigerous punctures----------
----------***Pseudoclivina***

- Intervals of elytron with setigerous punctures ----------
----------***Clivina***

Tribe Dyschiriini W.Kolbe, 1880

Pronotum globose ---------- ***Dyschirius***

Tribe Scaritini Bonelli, 1810

Mandibles stout with 3 or 4 strong teeth----------***Oxylobus***

Tribe Bembidiini Stephens, 1827

A recurved striole nearly always present on each side at the apex of the elytra ---------- ***Elaphropus***

Pictorial key to the species of Carabidae from Chinnar wildlife sanctuary

Genus Macrocheilus Hope, 1838

Elytra with spots----------***bensoni***

Genus Omphra Dejean, 1825

Elytral apex obliquely truncate and emarginated, elytral setae black or brownish red in colour---------- ***pilosa***

Genus Styphlomerus Chaudoir, 1875

Elytra without spots---------- ***striatus***

Genus Drypta Latreille, 1796

Pronotum cylindrical, Head and pronotum red, Elytra blue black with a red stripe on each ---------- ***lineola***

Genus Pseudognathaphanus Schauberger, 1932

Elytra with several dorsal setigerous pores on various inter-vals----------***rusticus***

Genus Stenolophus Dejean, 1821

1. Elytral apical spot present----------**2**

- Elytral apical spot absent----------**3**

2. Elytral basal spot absent----------***smaragdulus***

- Elytral basal spot present----------***quinquepustulatus***

3. Posterior transverse impression on pronotum strongly marked ----------***bajaurae***

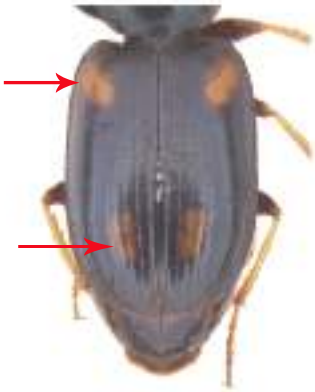
- Posterior transverse impression on pronotum scarcely marked ----------***lucidus***

Genus Allosiopelus Ito, 1995

Elytra with a row of setigerous pores on third and fifth interval- ---------- ***punctatipennis***

Genus Amblystomus Erichson, 1837

1. Elytra with spots----------***indicus***



- Elytra without spots----------**2**

2. Elytra strongly striated---------- ***fuscescens***

- Elytra weakly striated---------- ***aenescens***

Genus Dioryche MacLeay, 1825

1. Intervals flat----------***torta***

- Intervals convex----------**2**

2. Femora pale, brownish yellow, not darker than tibiae----------
----------***cuprina***

- Femora dark, notably darker than tibiae ----------***dravidana***

Genus Ophoniscus Bates, 1892

Head in relation to pronotum smaller, with narrower neck, pronotum uniformly punctate ---------- ***puneensis***

Genus Parophonus Ganglbauer, 1891

1. Clypeo-ocular prolongations absent ----------***indicus***

- Clypeoocular prolongations distinct, at eyes deepened-------
---------- ***acutangulus***

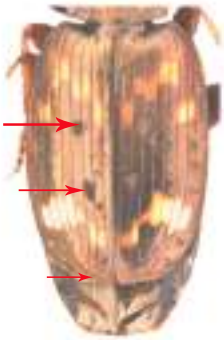
Genus Cyclicus Jeannel, 1949

1. Basal angle of pronotum more angulated----------***elegans***

- Basal angle of pronotum rounded----------***fimbriatus***

Genus Tetragonoderus Dejean, 1829

Elytral interval three with more than two deep punctures---------
---------- ***notaphioides***



Genus Anchista Nietner, 1857

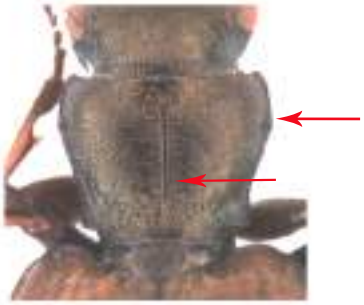
Head and pronotum smooth---------- ***fenestrata***

Genus Anomotarus Chaudoir, 1875

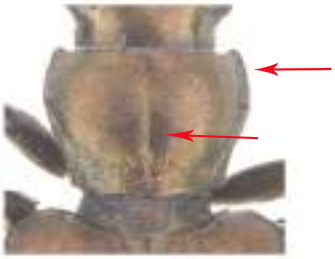
Elytra with two basal spots----------***stigmula***

Genus Apristus Chaudoir, 1846

1. Pronotum transverse, weakly cordiform; median line deep-
----------***aeneipennis***



- Pronotum sub-transverse, cordiform; median line shallow-
----------***subtransparens***



Genus Catascopus Kirby, 1825

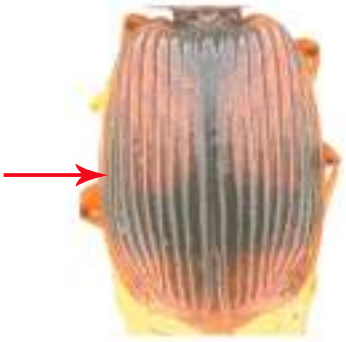
1. Head with a single carina on each side----------
----------***cingalensis***

- Head with atleast two carina on each side---------- ***cyanellus***

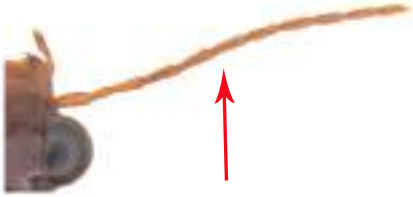
Genus Lebia Latreille, 1802

1. Elytra with a triangular black spot on the disc----***calycophora***

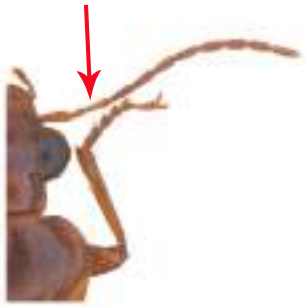
- Elytra with a spot except triangular shape----------**2**



2. Antennae fully testaceous----------***indica***



- First three segments of antennae ferruginous yellow------***baconi***



Genus Pentagonica Schmidt-Göebel, 1846

1. Elytral suture without yellow patch----------***ruficollis***

- Elytral suture with yellow patch----------***venusta***

Genus Chlaenius Bonelli, 1810

1. Comma shaped spot on elytra ----------***hamifer***

- Elytra without spots ----------***nilgiricus***

Genus Orthogonius Macleay, 1825

1. Labrum straight at frontal margin----------***baconi***

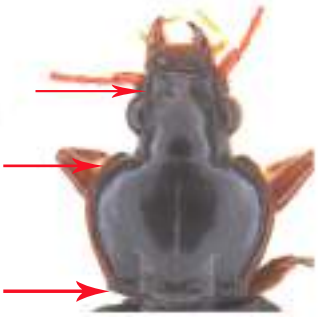
- Labrum emarginated at frontal margin----------***lucidus***

Genus Craspedophorus Hope, 1838

1. Elytral humeral macula with serrate margin----------***angulatus***

Genus Abacetus Dejean, 1828

Head without sulcus on each side in front, base of pronotum as wide as apex----------***haplosternus***

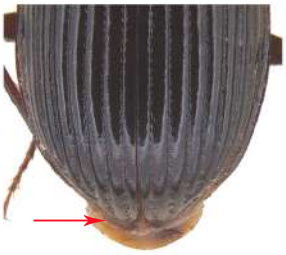


Genus Cosmodiscus Sloane, 1907

Third interval of elytra punctate----------***picturatus***

Genus Caelostomus MacLeay, 1825

Apex of elytra obtuse----------***scultipennis***



Genus Trigonotoma Dejean, 1828

Pronotum basal foveae with aligned points on furrows----------
---------- ***oberthueri***

Genus Clivina Latreille, 1802

1. Venter segments nearly smooth---------- ***lobata***

- Venter segments densely punctate---------- ***brevior***

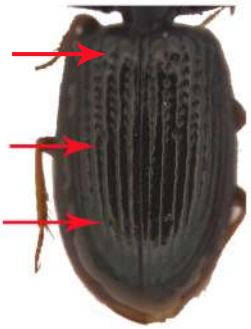
Genus Pseudoclivina Kult, 1947

1. Anterior transverse line of pronotum developed as a line ------ ---------- ***costata***

- Anterior transverse line of pronotum interrupted at middle----- ----------***memnonia***

Genus Dyschirius Jeannel, 1941

Interval three with 3 pores---------- ***paucipunctus***



Genus Oxylobus Chaudoir, 1855

1. Pronotum with a foveole within front angle----------***porcatus***

- Pronotum without a foveole within front angle----------**2**

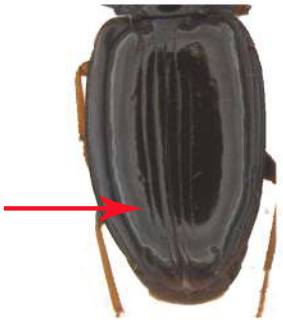
2. Venter smooth along median line---------- ***asperulus***

-Venter coarsely punctate across each segment----------***amyntas***

Genus Elaphropus Motschulsky, 1839

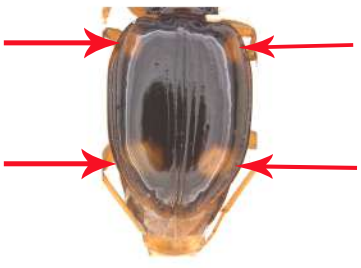
1. Elytra with spot----------**2**

- Elytra without spot----------***nigellus***



2. Elytra with 2 apical spots----------***politus***

- Elytra with 4 spots ----------***nilgiricus***



4.1.4. Checklist of Carabidae recorded from Chinnar wildlife sanctuary

Order Coleoptera

Family Carabidae Latreille, 1802

Subfamily Anthiinae Bonelli, 1813

Tribe Helluonini Hope, 1838

i. Genus *Macrocheilus* Hope, 1838

Macrocheilus Hope, 1838: 166.

= *Acanthogenius* Reiche, 1843

= *Macrochilus* Agassiz, 1847

= *Macrocheilidius* Jeannel, 1949

1. *Macrocheilus bensoni* Hope, 1838

Macrocheilus bensoni Hope, 1838: 166; Andrewes, 1930: 208; Lorenz, 2005: 512; Shiju *et al.* 2012b: 100; Löbl and Löbl, 2017: 577.

= *Carabus trimaculatus* Olivier, 1790 (non Villers, 1789)

= *Helluo quadrimacultus* Guérin-Méneville, 1840

= *Helluo tripustulatus* Guérin-Méneville, 1843(non Dejean, 1825)

= *Macrochilus quadripustulatus* Schmidt-Göebel, 1846

= *Macrochilus infuscatus* Bates, 1892a

= *Macrochilus benarensis* Jedlička, 1963

= *Macrochilus bimaculatus* Jedlička, 1965

= *Macrochilus quadrimaculatus* (Guérin-Méneville, 1840)

= *Macrochilus trimaculatus* (G.A.Olivier, 1790)

Distribution: ORR- India (Assam (Andrewes, 1930: 208), Kerala: Kozhikode, Chinnar, Thamarassery (Shiju *et al.* 2012b: 100)); SRL (Andrewes, 1930: 208); MM (Andrewes, 1930: 208); LAO (Andrewes, 1930: 208); VTN (Andrewes, 1930: 208); PAR- FUJ, GUA, GUI, GUX, HAI, JIX, YUN (Löbl and Löbl, 2017: 577), HKG (Andrewes, 1930: 208); IAR- PP (Andrewes, 1930: 208); MLS (Andrewes, 1930: 208).

ii. Genus *Omphra* Dejean, 1825

Omphra Dejean, 1825: 168, 283; Reiche, 1843: 330; Lacordaire, 1854: 94; Chaudoir, 1872a: 140; Sloane, 1914: 570; Andrewes, 1930: 236; Csiki, 1932b: 1577; Jedlička, 1963: 511; Lorenz, 2005: 511; Zhao *et al*. 2008: 372; Shiju and Sabu, 2012: 2 ; Akhil and Sabu, 2021 : 11.

2. *Omphra pilosa* (Klug, 1834)

Omphra pilosa (Klug) Reiche, 1843: 330; Erichson, 1847: 141; Redtenbacher, 1867: 5; Chaudoir, 1872b: 141; Putzeys, 1875a: 45; Andrewes, 1921a: 163; id. 1923b: 460; id. 1927: 101; id. 1930: 237; Csiki, 1932b: 1578; Jedlička, 1963: 512; Lorenz, 2005: 511; Zhao *et al*. 2008: 371; Shiju and Sabu, 2012a: 8; Löbl and Löbl, 2017: 578.

Helluo pilosus Klug, 1834: 71

= *Galerita attelaboides* Fabricius, 1801

= *Helluo pilosus* Klug, 1834

Distribution: ORR- India (Kerala: Arakulam, Chempery, Chinnar, Alampetty, Kuttiyadi, Kozhikode, Malappuram, Thodupuzha, Mahe (Shiju and Sabu, 2012a: 8)); SRL (Andrewes, 1930: 237); PAR- India (Himachal Pradesh; Uttarakhand (Löbl and Löbl, 2017: 578)); PA (Löbl and Löbl, 2017: 578).

Subfamily Brachininae Bonelli, 1810

Tribe Brachinini Bonelli, 1810

iii. Genus *Styphlomerus* Chaudoir, 1875

Styphlomerus Chaudoir, 1875: 87, 88; Erwin, 1970: 39.

3. *Styphlomerus striatus* Akhil and Sabu, 2019

Styphlomerus striatus Akhil and Sabu, 2019: 468.

Distribution: ORR- India (Tamil Nadu: Rajapalayam, Ettimadai; Kerala: Tholpetty (Akhil and Sabu, 2019: 468))

Subfamily Dryptinae Bonelli, 1810

Tribe Dryptini Bonelli, 1810

iv. Genus *Drypta* Latreille, 1796

Drypta Latreille, 1796: 75; Fabricius, 1801: 230; Latreille, 1810: 117; Dejean, 1825: 182; Schmidt-Goebel, 1846: 22; Lacordaire, 1854: 79; Andrewes, 1924b: 51; id. 1930: 157; Lorenz, 2005: 503; Jithmon and Sabu, 2021: 18560.

4. *Drypta lineola* MacLeay, 1825

Drypta lineola MacLeay, 1825: 27; Dejean, 1825: 184; Redtenbater, 1864: 4; Chaudoir, 1877: 262; Bates, 1883: 279; id. 1891: 336; id. 1892a: 383; Heyne-Tasch, 1895: 13.t.2.f.25; Bouchard, 1903: 173; Andrewes, 1919a: 167; id. 1924c: 469; id. 1923e (1924): 460; id. 1924b: 52; id. 1930: 158; Lorenz, 2005: 503; Jithmon and Sabu, 2021: 18562.

= *Desera lineola* (W.S.MacLeay, 1825)

Distribution: ORR- Throughout South East Asia (Andrewes, 1930: 158) India (Tamil Nadu: Rajapalayam, Kadayam (Jithmon and Sabu, 2021: 18560); Kerala: Padinjarathara (Jithmon and Sabu, 2021: 18560)); MM (Andrewes, 1930: 158); PAR- TWN, YUN (Andrewes, 1930: 158; IAR- IDS (Andrewes, 1930: 158); PP (Andrewes, 1930: 158); MLS (Andrewes, 1930: 158).

Subfamily Harpalinae Bonelli, 1810

Tribe Anisodactylini Lacordaire, 1854

v. Genus *Pseudognathaphanus* Schauberger, 1932

Pseudognathaphanus Schauberger, 1932: 57; Habu, 1973: 62; Noonan, 1973: 344; id. 1976: 12; Löbl and Smetana, 2003: 363; Lorenz, 2005: 351; Park *et al*. 2006: 96; Kataev and Wrase, 2016: 224; Löbl and Löbl, 2017: 508.

= *Hiekea* Ito, 1997

= *Protognathus* Basilewsky, 1950

5. *Pseudognathaphanus rusticus* (Andrewes, 1920)

Pseudognathaphanus rusticus (Andrewes) Löbl and Smetana, 2003: 363; Lorenz, 2005: 351; Kataev and Wrase, 2016: 232; Löbl and Löbl, 2017: 508.

Gnathaphanus rusticus Andrewes, 1920a: 107; id. 1924b: 30; id. 1930: 172; Kushwaha and Hegde, 2015: 403.

= *Gnathaphanus rusticus* Andrewes, 1920

Distribution: ORR- India (New Delhi: Pusa; Uttar Pradesh: Lucknow; Bihar: Chapra, Muzaffarpur, Purnea, Patna, Samastipur; Madhya Pradesh; Odisha: Surada; Gujarat: Surat (Andrewes, 1930: 172); Maharashtra: Mumbai, Pune (Kataev and Wrase, 2016: 232), Chikalda, Nagpur (Andrewes, 1930: 172); Goa (Kataev and Wrase, 2016: 232); Karnataka: Belgaum, Dharwar, North Karnataka (Andrewes, 1930: 172); SRL (Andrewes, 1930: 172); PAR- India (Uttarakhand: Dehradun, Haridwar and Roorkee (Andrewes, 1930: 172)), NP, PA (Löbl and Löbl, 2017: 508).

Tribe Stenolophini Kirby, 1837

vi. Genus *Stenolophus* Dejean, 1821

Stenolophus Dejean, 1821: 15; id. 1829: 405; Lacordaire, 1854: 303; Sloane, 1898: 456; Tschitschérine, 1900a: 364; id. 1901: 246; Andrewes, 1924b: 40; id.

1930: 316; Habu, 1973: 341; Noonan, 1976: 17; Saha, 1995: 67; Saha and Halder, 2000: 15; Löbl and Smetana, 2003: 404; Lorenz, 2005: 353; Park *et al*. 2006: 96; Löbl and Löbl, 2017: 573.

 # 6. *Stenolophus bajaurae* Andrewes, 1924

Stenolophus bajaurae Andrewes, 1924b: 95; id. 1926a: 69; id. 1930: 316; Kataev, 2002: 724; Löbl and Smetana, 2003: 405; Lorenz, 2005: 354; Wrase, 2005: 852; Kataev, 2015: 93; id. 2015: 539; Kushwaha and Hegde, 2015: 401; Jaeger and Ahmed, 2017: 613; Kataev, 2002: 724; Löbl and Löbl, 2017: 574.

= *Egadroma bajaurae* (Andrewes, 1924)

Distribution: ORR- India (Delhi (Kushwaha and Hegde, 2015: 401); Uttar Pradesh: Fyzabad (Andrewes, 1930: 316); Jharkhand: Sarju valley (Andrewes, 1930: 316)); PAR- India (Jammu-Kashmir (Andrewes, 1930: 316), Himachal Pradesh: Kangra, Bajaura, Spiti, Manikaran (Andrewes, 1930: 316); Uttarakhand: Kumaon (Andrewes,1930: 316)); AF; NP; PA; TD; TM; UZ (Löbl and Löbl , 2017: 574).

@7. *Stenolophus lucidus* Dejean, 1829

Stenolophus lucidus Dejean, 1829: 419; Andrewes, 1930: 317; Löbl and Smetana, 2003: 405; Lorenz, 2005: 355; Löbl and Löbl, 2017: 574.

= *Egadroma lucida* (Dejean, 1829)

Distribution: ORR- EAI (Andrewes, 1930: 317); PAR- BT; FUJ; GUA; GUX; HAI; TWN; YUN; JA; NP (Löbl and Löbl , 2017: 574).

8. *Stenolophus quinquepustulatus* (Wiedemann, 1823)

Stenolophus quinquepustulatus (Wiedemann); Dejean, 1829: 414; Bates, 1873: 270; Putzeys, 1875a: 49; Bates, 1889: 272; id. 1891a: 333; Bouchard, 1903: 172; Lesne, 1904: 76; Sloane, 1920a: 321; Andrewes, 1921a: 171; id. 1924c: 469; id. 1930: 317; Habu, 1973: 382; Saha, 1995: 68; Löbl and Smetana, 2003: 405; Lorenz, 2005: 355; Park *et al*. 2006: 96; Jaeger and Ahmed, 2017: 614; Löbl and Löbl, 2017: 574.

= *Badister quinquepustulatus* Wiedemann, 1823

= *Stenolophus rectifrons* Bouchard, 1903 (non Bates, 1892)

= *Stenolophus connexus* Schauberger, 1928

= *Stenolophus apicalis* Jedlička, 1952

= *Stenolophus tripustulatus* Jedlička, 1952

= *Stenolophus conjunctus* Jedlička, 1956

= *Stenolophus unipustulatus* Jedlička, 1952

= *Acupalpus connexus* (Schauberger, 1928)

= *Egadroma quinquepustulata* (Wiedemann, 1823)

Distribution: ORR- India (Uttar Pradesh; West Bengal: Singur, Hooghly (Saha, 1995: 68)); MM (Habu, 1973: 382); SRL (Habu, 1973: 382); TAI (Habu, 1973: 382); VTN (Park *et al*. 2006: 96); PAR- FUJ, GUI, GUX, HAI, HKG, HUB, HUN, JIX, MAC; TWN; YUN, NP, SC, SCH, SHG (Löbl and Löbl, 2017:

574)); JA (Habu, 1973: 382); PA (Habu, 1973: 382); IAR- SM (Habu, 1973: 382); IDS (Habu, 1973: 382), MLS (Habu, 1973: 382), PP (Habu, 1973: 382); AUR- AST (Habu, 1973: 382).

9. *Stenolophus smaragdulus* (Fabricius, 1798)

Stenolophus smaragdulus (Fabricius); Bates, 1886: 80; id. 1891a: 333; id. 1892a: 349; Bouchard, 1903: 172; Sloane, 1920: 321; Andrewes, 1921a: 160; id. 1924b: 40; id. 1930: 318; Habu, 1973: 377; Saha, 1995: 69; Saha and Halder, 2000: 16; Löbl and Smetana, 2003: 405; Lorenz, 2005: 355; Park *et al*. 2006: 96; Jaeger and Ahmed, 2017: 614; Löbl and Löbl, 2017: 575.

Carabus smaragdulus Fabricius, 1798: 60; id. 1801: 209; Dejean, 1829: 418; Hope, 1838: 93; Schaum, 1847: 49; Motschulsky, 1855: 43.

= *Carabus smaragdulus* Fabricius, 1798

= *Egadroma smaragdula* Motschulsky, 1864

= *Harpalus trechoides* Hope, 1845

= *Harpalus stolidus* Walker, 1858

= *Egadroma apicalis* Motschulsky, 1864

= *Stenolophus transmutans* Bates, 1886

= *Stenolophus chalceus* Lesne, 1904 (non Bates, 1873)

= *Egadroma smaragdula* (Fabricius, 1798)

= *Stenolophus apicalis* (Motschulsky, 1864)

= *Stenolophus stolidus* (Walker, 1858)

= *Stenolophus trechoides* (Hope, 1845)

Distribution: Throughout the whole of South East Asia extending from JA in the North to Queensland in South (Andrewes, 1930: 318); ORR- India (West Bengal: Kolkata, Kharagpur, Purulia, Medinipur (Saha, 1995: 69); Meghalaya: Khasi, Jayantia Hill (Saha and Halder, 2000: 16)); MM (Habu, 1973: 377); SRL (Habu, 1973: 377); TAI (Habu, 1973: 377); VTN (Park *et al*. 2006: 96); PAR- India (Himachal Pradesh (Löbl and Löbl, 2017: 575); West Bengal: Darjeeling District (Saha, 1995: 69)); BT; FUJ; GUA; HAI; HKG; JIX; MAC; NP; PA; TWN; YUN (Löbl and Löbl, 2017: 575); JA (Habu, 1973: 377); IAR- IDS (Habu, 1973: 377); MLS (Habu, 1973: 377); PP (Habu, 1973: 377); AUR- AST (Habu, 1973: 377).

Tribe Harpalini Bonelli, 1810

vii. Genus *Allosiopelus* Ito, 1995

Allosiopelus Ito, 1995: 153; Lorenz, 2005: 376.

10. *Allosiopelus punctatipennis* Ito, 1995

Allosiopelus punctatipennis Ito, 1995: 154; Lorenz, 2005: 376.

Distribution: ORR- India (Tamil Nadu: Tharangambadi; Pondicherry (Ito, 1995: 154)).

viii. Genus *Amblystomus* Erichson, 1837

Amblystomus Erichson, 1837: 59; Lacordaire, 1854: 301; Reitter, 1883: 139; Tschitschérine, 1900a: 348; Sloane, 1920: 131; Andrewes, 1924b: 33; id. 1930: 17; Habu, 1973: 15; Noonan, 1976: 54; Saha, 1995: 56; Löbl and Smetana, 2003: 360; Lorenz, 2005: 384; Park *et al*. 2006: 95; Löbl and Löbl, 2017: 502.

= *Hispalis* Rambur, 1838

= *Artizoum* Gistel, 1857

= *Megaristerus* Nietner, 1858

= *Notophilus* Blackburn, 1888

= *Thenarotidius* Sloane, 1898

= *Psilonothus* Sloane, 1900

= *Entomorrhinus* Jeannel, 1948

@ 11. *Amblystomus aenescens* (Motschulsky, 1858)

Amblystomus aenescens (Motschulsky); Andrewes, 1928: 21; id. 1930: 17; id. 1933: 7; Lorenz, 2005: 384.

= *Hispalis aenescence* Motschulsky, 1858

Distribution: ORR- EAI (Andrewes, 1930: 17).

12. *Amblystomus fuscescens* (Motschulsky, 1858)

Amblystomus fuscescens (Motschulsky); Bates, 1892a: 334; Lesne, 1904: 73; Andrewes, 1919a: 198; id. 1928: 21; id. 1930: 18; Kapur, 1955: 326; Lorenz, 2005: 384.

= *Hispalis fuscescens* Motschulsky, 1858

Distribution: ORR- India (Assam; Manipur: Imphal Valley; Karnataka: Mysore (Kapur, 1945: 326)); EAI (Andrewes, 1930: 18); SRL (Andrewes, 1930: 18); MM (Andrewes, 1930: 18); TAI (Andrewes, 1930: 18).

 # 13. *Amblystomus indicus* (Nietner, 1858)

Amblystomus indicus (Nietner); Bates, 1886: 76; id. 1889: 271; id. 1891a: 331; id. 1892a: 336; id. 1892b: 231; Sloane, 1920: 321; Andrewes, 1927: 103; id. 1930: 19; Lorenz, 2005: 384; Kushwaha and Hegde, 2015: 402; Löbl and Löbl, 2017: 502.

= *Megaristerus indicus* Nietner, 1858

= *Entomorrhinus indicus* (Nietner, 1858)

Distribution: ORR- India (Uttar Pradesh: Jalaun, Orai, Jhansi; Madhya Pradesh: Pathrora (Kushwaha and Hegde, 2015: 402); Jharkhand: Chota Nagpur, Tetara (Andrewes, 1930: 19)); MM (Kushwaha and Hegde, 2015: 402); VTN (Kushwaha and Hegde, 2015: 402); SRL (Andrewes, 1930: 19); AUR- AST (Andrewes, 1930: 19).

ix. Genus *Dioryche* MacLeay, 1825

Dioryche MacLeay, 1825: 21; Lacordaire, 1854: 300; Bates, 1873: 271; Alluaud, 1917: 321; Andrewes, 1919a: 156; id. 1924b: 32; id. 1930: 146; Noonan, 1976: 47; id. 1985: 34; Saha, 1995: 62; Löbl and Smetana, 2003: 369; Lorenz, 2005: 376; Kataev, 2012: 112; Kushwaha and Hegde, 2015: 402; Löbl and Löbl, 2017: 518.

= *Hypodioryche* Schauberger, 1935

14. *Dioryche cuprina* (Dejean, 1829)

Dioryche cuprina (Dejean); Kataev, 2012: 114; Löbl and Löbl, 2017: 518.

= *Selenophorus cuprinus* Dejean, 1829

= *Harpalus colombensis* Nietner, 1857a

= *Cardiaderus scitus* Walker, 1858

= *Dioryche colombensis* (Nietner, 1857)

= *Dioryche scita* (Walker, 1858)

= *Selenophorus colombensis* (Nietner, 1857)

Distribution: ORR- India (Goa ; Karnataka : Kanara ; Tamil Nadu: Chennai, Kariakal, Coimbatore; Pondicherry; Kerala: Thiruvananthapuram, Mahe, Kozhikode, Kallar (Kataev, 2012: 114)); SRL (Kataev, 2012: 114); TAI (Kataev, 2012: 114); PAR- NP (Kataev, 2012: 114); PA (Löbl and Löbl, 2017: 518).

15. *Dioryche dravidana* Kataev, 2012

Dioryche dravidana Kataev, 2012: 123.

Distribution: ORR- India (Karnataka: Mysore, Shimoga; Tamil Nadu: Shambaganur, Madura (Kataev, 2012: 123)).

16. *Dioryche torta* MacLeay, 1825

Dioryche torta MacLeay, 1825: 21; Hope, 1838: T. 2; Bates, 1873: 271; Andrewes, 1919a: 154; id. 1926a: 68; id. 1930: 148; Noonan, 1985: 35; Saha, 1995: 63; Lorenz, 2005: 376; Löbl and Smetana, 2003: 369; Lorenz, 2005: 376; Löbl and Löbl, 2017: 518.

Distribution: ORR- All the Indian States (Saha, 1995: 63) India (West Bengal: Murshidabad (Saha, 1995: 63)); SRL (Andrewes, 1930: 148); MM (Andrewes, 1930: 148); PAR- GUA; HAI, NP; PA; YUN (Löbl and Löbl, 2017: 518); IAR- IDS (Andrewes, 1930: 148).

x. Genus *Ophoniscus* Bates, 1892

Ophoniscus Bates, 1892a: 337; Andrewes, 1923b: 446; id. 1930: 242; id. 1939: 136; Noonan, 1976: 46; id. 1985: 31; Saha, 1995: 63; Löbl and Smetana, 2003: 388; Kataev, 2005: 269; Lorenz, 2005: 376; Kataev and Wrase, 2012: 215; Löbl and Löbl, 2017: 546; Kataev, 2018: 319.

***17. *Ophoniscus puneensis* Kataev, 2018**

Ophoniscus puneensis Kataev, 2018: 321.

Distribution: ORR- India (Maharashtra: Mulshi environment (Kataev, 2018: 321)).

xi. Genus *Parophonus* Ganglbauer, 1891

Parophonus Ganglbauer, 1891a: 340; Jeannel, 1942: 625; Noonan, 1976: 45; id. 1985: 19; Löbl and Smetana, 2003: 392; Lorenz, 2005: 373; Kataev, 2010: 278; Löbl and Löbl, 2017: 553.

18. *Parophonus acutangulus* (Bates, 1891)

Parophonus acutangulus (Bates); Andrewes, 1930: 184; Kataev, 2010: 296; Löbl and Löbl, 2017: 553.

= *Hypolithus acutangulus* Bates, 1891

= *Hyperpalus gracilis* Andrewes, 1947

= *Parophonus gracilis* (Andrewes, 1947)

= *Trichotichnus javanus* (Gory, 1833)

Distribution: ORR- India (Delhi; Uttar Pradesh: Allahabad, Sitapur; Jharkhand: Chota Nagpur- Tetara; Madhya Pradesh: Mhow; Gujarat: Surat; Maharashtra: Mumbai; Tamil Nadu: Coimbatore, Tharangambadi (Andrewes, 1930: 184)); MM (Kataev, 2010: 296); SRL (Andrewes, 1930: 184); PAR- India (Jammu Kashmir (Kataev, 2010: 296); Uttarakhand: Dehra Dun (Andrewes, 1930: 184); West Bengal: Barodabri (Kataev, 2010: 296)); NP (Kataev, 2010: 296), PA (Kataev, 2010: 296); IAR- IDS (Andrewes, 1930: 184).

19. *Parophonus indicus* (Andrewes, 1931)

Parophonus indicus (Andrewes); Noonan, 1985: 22; Lorenz, 2005: 374; Kataev, 2010: 283 ; Löbl and Löbl, 2017: 553.

= *Hyparpalus indicus* Andrewes, 1931a

= *Hypolithus cyaneotinctus* Bates, 1891 [non Bates, 1889]

= *Trichotichnus indicus* (Andrewes, 1931)

Distribution: ORR- India (Uttar Pradesh; Bihar: Monghyr; Jharkhand: Chota Nagpur-Tetara, Barwa, Konbir, Ranchi; Madhya Pradesh: Balaghat, South Mandla (Andrewes, 1931a: 516), Motinala, Seoni, Khawasa (Kataev, 2010: 283); Karnataka: Mysore, Bangalore, Nandidrug, Chikkaballapura (Andrewes, 1931a: 516)); SRL (Kataev, 2010: 283); PAR- India (Jammu Kashmir (Kataev, 2010: 283); Uttarakhand: Dehra Dun (Andrewes, 1931a: 516); Sikkim (Andrewes, 1931a: 516)); PA (Kataev, 2010: 283).

Subfamily Lebiinae Bonelli, 1810

Tribe Cyclosomini Laporte De Castelnau, 1834

xii. Genus *Cyclicus* Jeannel, 1949

Cyclicus Jeannel, 1949: 865, 870; Basilewsky, 1953: 117; id. 1956: 464; Lorenz, 2005: 452.

= *Metacyclicus* Jeannel, 1949

20. *Cyclicus elegans* (Andrewes, 1931)

Cyclicus elegans (Andrewes); Lorenz, 2005: 452; Shiju and Sabu, 2019: 11.

= *Tetragonoderus elegans* Andrewes, 1931a

Distribution: ORR- India (Kerala: Charalmedu, Nedumkayam (Shiju and Sabu, 2019: 11)); PAR- India (Uttarakhand: Bindal River, Chakata Range, Dehra Dun, Deoba Nadi River, Hathibarkala, Kali Valley, Nandhaur River, West Almora (Andrewes, 1931a: 524)).

21. *Cyclicus fimbriatus* (Bates, 1886)

Cyclicus fimbriatus (Bates); Lorenz, 2005: 452; Shiju and Sabu, 2019: 11.

Tetragonoderus fimbriatus Bates, 1886: 202; Andrewes, 1930: 344; Löbl and Löbl, 2017: 498.

= *Tetragonoderus punctatus* Schmidt-Göbel, 1846 (non Wiedemann, 1823)

= *Cyclicus fimbriatus* (Bates, 1886)

Distribution: ORR- India (Karnataka: North Karnataka, Belgaum, Managanali, Mysore- Teppukadu (Andrewes, 1930: 344); Tamil Nadu: Nilgiri Hills- Hill Grove (Andrewes, 1930: 344), Srivilliputhur (Shiju and Sabu, 2019: 11), Tiruchirappally (Andrewes, 1930: 344); Kerala: Bhawani Valley (Andrewes, 1930: 344), Kozhikode, Nedumkayam (Shiju and Sabu, 2019: 11)); SRL (Andrewes, 1930: 344); MM (Andrewes, 1930: 344); PAR- CHN (Löbl and Löbl, 2017: 498).

xiii. Genus *Tetragonoderus* Dejean, 1829

Tetragonoderus Dejean, 1829: 485; Schmidt-Göbel, 1846: 92; Lacordaire, 1854: 132; Chaudoir, 1876a: 33; Horn, 1882: 127; Andrewes, 1924b: 60; id. 1930: 343; Blackwelder, 1944: 52; Jeannel, 1949: 865; Basilewsky, 1956: 463; Jedlička, 1963: 291; Saha *et al*. 1992: 49; Lorenz, 2005: 453; Löbl and Löbl, 2017: 498.

22. *Tetragonoderus notaphioides* Motschulsky, 1861

Tetragonoderus notaphioides Motschulsky, 1861: 99; Chaudoir, 1876a: 54; Bates, 1886: 201; Andrewes, 1928: 24; id. 1930: 345; Lorenz, 2005: 453; Shiju and Sabu, 2019: 12.

Distribution: ORR- India (Odisha: Berhampur, Puri, Rambha- Ganjam, Barkuda Island- Chilka Lake; Maharashtra: Bhandara, Karnataka: North Karnataka; Tamil Nadu: Chennai, Tiruchirappally, Thrangambadi, Palni Hills (Andrewes, 1930: 345); Kerala: Kozhikode, Ambalavayal (Shiju and Sabu, 2019: 12)); SRL (Andrewes, 1930: 345).

Tribe Lebiini Bonelli, 1810

xiv. Genus *Anchista* Nietner, 1857

Anchista Nietner, 1857c: 523; id. 1857b: 374; Chaudoir, 1877: 236; Andrewes, 1926b: 346; id. 1930: 22; Csiki, 1932b: 1455; Jedlička, 1963: 449; Habu, 1967: 137; Darlington, 1968: 139; id. 1970: 45; Habu, 1982: 102; Kirschenhofer, 1994: 1006; Lorenz, 2005: 491; Löbl and Löbl, 2017: 623.

= *Paraphaea* Bates, 1873

23. *Anchista fenestrata* (Schimdt-Goebel, 1846)

Anchista fenestrata (Schmidt-Göbel); Chaudoir, 1872b: 168; Bates, 1892a: 424; Andrewes, 1923a: 20; id. 1930: 23; Csiki, 1932b: 1456; Jedlička, 1963: 449; Lorenz, 2005: 491; Shi *et al*. 2013: 27; Löbl and Löbl, 2017: 623; Shiju and Sabu, 2019: 40.

= *Plochionus fenestrata* Schmidt-Göbel, 1846

Distribution: ORR- India (Rajasthan; Bihar; Jharkhand: Singbhum (Andrewes, 1930: 23); Karnataka: Gundelpet (Shiju and Sabu, 2019: 40); Tamil Nadu: Alwarkurichi, Srivalliputhur, Thambaram (Shiju and Sabu, 2019: 40); Pondicherry (Andrewes, 1930: 23); Kerala: Charalmedu, Chinnar-Alampetty; Koorachundu, Nedumkayam, Thamarassery (Shiju and Sabu, 2019: 40)); SRL (Andrewes, 1930: 23); MM (Andrewes, 1930: 23); PAR- India (Uttarakhand: Dehra Dun; West Bengal), NP (Löbl and Löbl, 2017: 623).

xv. Genus *Anomotarus* Chaudoir, 1875

Anomotarus Chaudoir, 1875: 48; Sloane, 1917: 435; id. 1920b: 170; Andrewes, 1930: 27; Jedlička, 1963: 450; Lorenz, 2005: 497; Löbl and Löbl, 2017: 580.

24. *Anomotarus stigmula* (Chaudoir, 1852)

Anomotarus stigmula (Chaudoir); Andrewes, 1930: 28; Jedlička, 1963: 451; Lorenz, 2005: 497; Löbl and Löbl, 2017: 580; Shiju and Sabu, 2019: 42.

= *Cymindis stigmula* Chaudoir, 1852

Distribution: ORR- India (Assam: Gauhati (Andrewes, 1930: 28); Maharashtra: Mumbai- Khandesh, Nagpur; Karnataka: Belgaum (Andrewes, 1930: 28), Gundelpet (Shiju and Sabu, 2019: 42), Mysore- Nandidurg; Tamil Nadu: Chennai (Andrewes, 1930: 28), Srivilliputhur (Shiju and Sabu, 2019: 42); Kerala: Charalmedu, Eravikulam National Park, Koorachundu, Nedumkayam, Thamarassery, Vazhachal, Vettiozhinjathottam (Shiju and Sabu, 2019: 42)); MM (Andrewes, 1930: 28); SRL (Andrewes, 1930: 28); PAR- India (Himachal Pradesh (Löbl and Löbl, 2017: 580); Uttarakhand: Dehra Dun (Andrewes, 1930: 28)); JA (Andrewes, 1930: 28); NP; PA (Löbl and Löbl, 2017: 580); TWN (Jedlička, 1963: 451); IAR- IDS (Andrewes, 1930: 28); NEC (Andrewes, 1930: 28).

xvi. Genus *Apristus* Chaudoir, 1846

Apristus Chaudoir, 1846: 62; Lacordaire, 1854: 123; Horn, 1882: 133; Andrewes, 1930: 33; Ganglbauer, 1892: 397 and 401; Jedlička, 1933a: 87; Blackwelder, 1944: 59; Jedlička, 1963: 427; Gueorguiev and Gueorguiev, 1995: 32 and 229; Kryzhanovskij *et al*. 1995: 165; Lorenz, 2005: 472; Park *et al*. 2006: 100; Löbl and Löbl, 2017: 595.

= *Crepnos* Baudi Di Selve, 1864

= *Crephnos* Jakobson, 1908

25. *Apristus aeneipennis* (Schmidt-Göbel, 1846)

Apristus aeneipennis (Schmidt-Göbel); Chaudoir, 1850: 67; Motschulsky, 1855: 50; Fairmaire, 1888: 335; Andrewes, 1923a: 15; id. 1930: 33; Jedlička, 1963: 430; Lorenz, 2005: 472; Park *et al*. 2006: 100; Shiju and Sabu, 2019: 26.

= *Lionychus aeneipennis* Schmidt-Göbel, 1846

Distribution: ORR- India (Maharashtra: Lonavla; Karnataka: Mysore-Teppukadu (Andrewes, 1930: 33)); MM (Andrewes, 1930: 33); VTN (Andrewes, 1930: 33).

26. *Apristus subtransparens* Motschulsky, 1861

Apristus subtransparens Motschulsky, 1861: 104; Bates, 1886: 206; id. 1892b: 233; Andrewes, 1928: 21; id. 1930: 34; Lorenz, 2005: 472; Löbl and Löbl, 2017: 596; Shiju and Sabu, 2019: 27.

Distribution: ORR- India (Kerala: Chinnar, Koottar, Nedumkayam, Thamarassery (Shiju and Sabu, 2019: 27)); SRL (Andrewes, 1930: 34); NP; PA (Löbl and Löbl, 2017: 596).

xvii. Genus *Catascopus* Kirby, 1825

Catascopus Kirby, 1825: 94; Latreille et Dejean, 1824: 115; Macleay, 1825: 14; Dejean, 1825: 328; Schmidt-Göbel, 1846: 80; Lacordaire, 1854: 145; Chaudoir, 1861: 116; id. 1872b: 244; Andrewes, 1924b: 62; id. 1926b: 348; id. 1930: 74; id. 1931b: 62; id. 1937: 187; Jedlička, 1935: 9; Jeannel, 1942: 1017; Blackwelder, 1944: 57; Basilewsky, 1956: 485; Jedlička, 1963: 379; Lorenz, 2005: 454; Löbl and Löbl, 2017: 620.

27. *Catascopus cingalensis* Bates, 1886

Catascopus cingalensis Bates, 1886: 203; Andrewes, 1924b: 117; id. 1930: 75; Lorenz, 2005: 454; Shiju and Sabu, 2019: 15.

= *Catascopus reductus* Chaudoir, 1861 [nec Walker, 1858]

= *Catascopus severini* Bates, 1891

Distribution: ORR- India (Jharkhand: Chota Nagpur- Tetara; Madhya Pradesh: Mhow; Odisha: Surada; Karnataka: Chikkaballapura; Tamil Nadu: Nilgiri Hills (Andrewes, 1930: 75)); SRL (Andrewes, 1930: 75).

28. *Catascopus cyanellus* Chaudoir, 1848

Catascopus (s.str.) *cyanellus* Chaudoir, 1848: 113; id. 1861: 118; Andrewes, 1930: 75; Lorenz, 2005: 454; Löbl and Löbl, 2017: 620; Shiju and Sabu, 2019 : 15.

= *Catascopus reductus* Walker, 1858

Distribution: ORR- India (Maharashtra: Dapoli; Karnataka : North Karnataka; Tamil Nadu: Coimbatore (Andrewes, 1930: 75)); PAR- India (Uttarakhand: Dehra Dun (Andrewes, 1930: 75)); NP (Andrewes, 1930: 75).

xviii. Genus *Lebia* Latreille, 1802

Lebia Latreille, 1802: 85; Dejean, 1825: 253; Schmidt-Göbel, 1846: 43; Lacordaire, 1854: 127; Chaudoir, 1871a: 111–255; id. 1871b: 1–87; Horn, 1882: 130; Fowler, 1887: 136; Ganglbauer, 1892: 397; Silvestri, 1904: 68–84;

Andrewes, 1930: 191; Alluaud, 1936: 8; Jedlička, 1933b: 144; Jeannel, 1942: 1028; id. 1949: 882, 902; Jedlička, 1963: 314; Blackwelder, 1944: 52; Mateu, 1984: 398; Gueorguiev and Gueorguiev, 1995: 31, 221; Kryzhanovskij *et al*. 1995: 161; Hůrka, 1996: 468, 470; Lorenz, 2005: 481; Park *et al*. 2006: 102; Löbl and Löbl, 2017: 611.

29. *Lebia baconi* (Chaudoir, 1871)

Lebia baconi (Chaudoir); Andrewes, 1930: 191; Lorenz, 2005: 487; Löbl and Löbl, 2017: 616; Shiju and Sabu, 2019: 37.

= *Nematopeza baconi* Chaudoir, 1871a

Distribution: ORR- India (Bihar: Chapra; Madhya Pradesh: Hoshangabad (Andrewes, 1930: 191); Tamil Nadu: Srivilliputhur (Shiju and Sabu, 2019: 37)).

30. *Lebia calycophora* Schmidt-Göbel, 1846

Lebia (Poecilothais) calycophora Schmidt-Göbel, 1846: 44; Bates, 1892a: 427; Andrewes, 1923a: 21; id. 1930: 191; Jedlička, 1963: 322–325; Lorenz, 2005: 488; Park *et al*. 2006: 102; Löbl and Löbl, 2017: 616; Shiju and Sabu, 2019: 37.

= *Lebia comitata* Bates, 1873

= *Lebia farai* Jedlička, 1951

Distribution: ORR- India (Nagaland: Naga Hills; Assam: Khasi Hills, Patkai Hills (Andrewes, 1930: 191); Kerala: Aralam (Shiju and Sabu, 2019: 37)); MM (Andrewes, 1930: 191); TAI (Andrewes, 1930: 191); VTN (Jedlička, 1963: 322–

325); PAR- CHN (Jedlička, 1963: 322–325); FUJ; HUN; PA; TWN (Löbl and Löbl, 2017: 616); IAR- IDS (Jedlička, 1963: 322–325); MLS (Jedlička, 1963: 322–325).

31. *Lebia indica* Liebke, 1938

Lebia indica Liebke, 1938: 109; Lorenz, 2005: 487; Löbl and Löbl, 2017: 616; Shiju and Sabu, 2019: 37.

= *Nematopeza decora* Chaudoir, 1871c (nec Steinheil, 1869)

= *Lebia decora* (Chaudoir, 1871)

= *Nematopeza indica* (Liebke, 1938)

Distribution: ORR- India (Tamil Nadu: Alwarkurichi, Sankarankovil (Shiju and Sabu, 2019: 37))

Tribe Odacanthini Laporte De Castelnau, 1834

xix. Genus *Pentagonica* Schmidt-Göebel, 1846

Pentagonica Schmidt-Göebel, 1846: 47; Lacordaire, 1854: 133; Schaum, 1863: 74; Bates, 1873: 321; Chaudoir, 1877: 212; Sloane, 1898: 494 and 513; Dupuis, 1913a: 2; Andrewes, 1926b: 353; id. 1930: 259; Jeannel, 1942: 1017; Blackwelder, 1944: 63; Jeannel, 1949: 768; Basilewsky, 1956: 472; Jedlička, 1963: 505; Darlington, 1968: 192; id. 1970: 46; Lorenz, 2005: 445; Park *et al*. 2006: 103; Löbl and Löbl, 2017: 640.

= *Rhombodera* Reiche, 1842 (preocc.)

= *Didetus* LeConte, 1853

= *Elliotia* Nietner, 1856

= *Trichothorax* Montrouzier, 1860

= *Xenothorax* Wollaston, 1867

= *Wakefieldia* Broun, 1880

32. *Pentagonica ruficollis* Schmidt-Göebel, 1846

Pentagonica ruficollis Schmidt-Göebel, 1846: 48; Bates, 1892a: 426; Dupuis, 1913a: t. 5, f. 9–11; Andrewes, 1923a: 23; id. 1926b: 353; id. 1930: 261; Jedlička, 1963: 509; Lorenz, 2005: 446; Park *et al*. 2006: 104; Löbl and Löbl, 2017: 641; Shiju and Sabu, 2019: 8.

= *Pentagonica dichroa* Sloane, 1903

Distribution: ORR- India (Assam: Patkai Hills; Tamil Nadu: Aratapara, Nilgiri Hills (Andrewes, 1930: 261)); SRL (Andrewes, 1930: 261), MM (Andrewes, 1930: 261); VTN (Andrewes, 1930: 261); PAR- GUA, HKG, YUN; NP, TWN (Löbl and Löbl, 2017: 641); IAR- IDS (Andrewes, 1930: 261); AUR- AST (Andrewes, 1930: 261).

33. *Pentagonica venusta* Andrewes, 1933

Pentagonica venusta Andrewes, 1933: 17; Lorenz, 2005: 446; Shiju and Sabu, 2019: 8.

Distribution: ORR- India (Karnataka: Belgaum, Coorg, Mysore- Nandidurg, South Mangalore; Tamil Nadu: Nilgiri Hills-Kallar (Andrewes, 1933: 17)); SRL (Andrewes, 1933: 17).

Subfamily Licininae Bonelli, 1810

Tribe Chlaenini Brulle, 1834

xx. Genus *Chlaenius* Bonelli, 1810

Chlaenius MacLeay, 1825: 13; Dejean, 1826: 297, 368; Schmidt-Göbel, 1846: Cover page; Chaudoir, 1850: 407; LaFerté-Sénectère, 1851: 212, 233, 238, 263, 293; Lacordaire, 1854: 213, 217, 219, 220, 221, 223, 224, 235; Chaudoir, 1856: 192; Motschulsky, 1860: 515; id. 1864b: 334, 347; Chaudoir, 1876a: 10, 11, 12, 16; Bates, 1892a: 309; Sloane, 1910: 437; Andrewes, 1919c: 91; id. 1923a: 58; id. 1924b: 24; id. 1930: 82; Lorenz, 2005: 328.

34. *Chlaenius hamifer* Chaudoir, 1856

Chlaenius hamifer Chaudoir, 1856: 209, 210; id. 1876: 62; Bates, 1889b: 265; id. 1892b: 311; id. 1892c: 230; Bouchard, 1903: 171; Lesne, 1904: 69; Sloane, 1910: 439; id. 1920a: 322; Andrewes, 1919a: 140; id. 1924b: 24; id. 1930: 94; Lorenz, 2005: 330; Löbl and Löbl, 2017: 494.

= *Chlaenius bihamatus* Chaudoir, 1856

= *Chlaenius colombensis* Jedlička, 1964

= *Chlaenius queenslandicus* Sloane, 1910

= *Dinodes bihamatus* (Chaudoir, 1856)

= *Dinodes hamifer* (Chaudoir, 1856)

= *Pachydinodes hamifer* (Chaudoir, 1856)

Distribution: ORR- India (Kerala: Tholpetty (Akhil, 2019: 115)); SRL (Andrewes, 1930: 94), MM (Andrewes, 1930: 94), TAI (Andrewes, 1930: 94); PAR- BT, IN, JA, NC, HKG, NP, PA, SC, SCH (Löbl and Löbl, 2017: 494), TWN (Andrewes, 1930: 94); IAR- IDS (Andrewes, 1930: 94).

35. *Chlaenius nilgiricus* Andrewes, 1919

Chlaenius nilgiricus Andrewes, 1919c: 9; id. 1930: 99; Lorenz, 2005: 335.

Distribution: ORR- India (Tamil Nadu: Coimbatore, Nilgiri Hills (Andrewes, 1930: 99)).

Subfamily Orthogoniinae Schaum, 1857

Tribe Orthogoniini Schaum, 1857

xxi. Genus *Orthogonius* Macleay, 1825

Orthogonius Macleay, 1825: 26; Dejean, 1825: 169, 269; Schmidt-Göbel, 1846: 55, 61; Lacordire, 1854: 269; Walker, 1858: 203; Chaudoir, 1850: 434; id. 1871b: 98; Andrewes, 1924b: 58; id. 1930: 245; Csiki, 1932b: 1586; Jedlička, 1963: 269; Tian and Deuve, 2000: 2; Lorenz, 2005: 391.

= *Aspectra* Schmidt-Göbel, 1846

= *Haplopisthius* Chaudoir, 1850

= *Maraga* Walker, 1858

36. *Orthogonius baconi* Chaudoir, 1871

Orthogonius baconi Chaudoir, 1871d: 109; Bates, 1892a: 401; Andrewes, 1930: 246; Csiki, 1932b: 1587; Lorenz, 2005: 391; Akhil, 2019: 121.

Distribution: ORR- India (Tamil Nadu: Nilgiri Hill; Kerala: Muthanga (Akhil, 2019: 121)) MM (Andrewes, 1930: 246); PAR- India (Uttarakhand: Almora, Bengal (Andrewes, 1930: 246)).

37. *Orthogonius lucidus* Bates, 1891

Orthogonius lucidus Bates, 1891: 324–340; Andrewes, 1924b: 59; id. 1930: 248; Lorenz, 2005: 392; Abhitha *et al*. 2009: 372.

Distribution: ORR- India (Jharkhand: Chota Nagpur: Konbir, Tetara, Ranchi; Odisha: Surada; Maharashtra: Mumbai, Igatapuri (Andrewes, 1930: 248); Karnataka: Belgaum, North Karnatakara (Andrewes, 1930: 248), Bengal: Raniganj (Andrewes, 1930: 248); Kerala: Kannur, Kozhikode, Thamarassery, Wayanad: Muthanga, Idukki, Thodupuzha (Abhitha *et al*. 2009: 372)).

Subfamily Panagaeinae Bonelli, 1810

Tribe Panagaeini Bonelli, 1810

xxii. Genus *Craspedophorus* Hope, 1838

Craspedophorus Hope, 1838: 165; Lacordaire, 1854: 210; Chaudoir, 1878: 90; Andrewes, 1919a: 126; id. 1924b: 22; id. 1930: 133; Kirschenhofer, 2000: 328;

Lorenz, 2005: 320; Hackel and Kirschenhofer, 2014: 276; Fedorenko, 2016: 2; Löbl and Löbl, 2017: 638.

= *Camptoderus* Hope, 1838

= *Eudema* Laporte De Castelnau, 1840

= *Isotarsus* LaFerté-Sénectère, 1851

= *Epicosmus* Chaudoir, 1846

= *Brachyonychus* Chaudoir, 1879

= *Brachycosmus* Jeannel, 1949

= *Acanthocosmus* Jeannel, 1949

38. *Craspedophorus angulatus* (Fabricius, 1781)

Craspedophorus angulatus (Fabricius); Andrewes, 1919a: 125; id. 1921a: 154; id. 1924b: 115; id. 1924d: 462; id. 1930: 133; Jedlička 1965: 3; Kirschenhofer, 2000: 323; Baehr, 2003: 446; Lorenz, 2005: 320; Pang and Tian, 2012: 265; Hackel and Farkac, 2012: 78; Hackel and Kirschenhofer, 2014: 276 and 357; Fedorenko, 2016: 4; Manthen and Hegde, 2018: 206; Jithmon and Sabu, 2021: 18566.

Carabus angulatus Fabricius, 1781: 302; id. 1787: 197; id. 1792: 148

= *Carabus angulatus* Fabricius, 1781

= *Pimelia fasciatus* Fabricius, 1781

= *Cychrus reflexus* Fabricius, 1801 (nec Fabricius, 1781)

= *Panagaeus tomentosus* Vigors, 1825

= *Eudema bifasciatum* Chaudoir, 1879 (err.)

= *Panagaeus michardi* Fairmaire, 1880

= *Craspedophorus bifasciatus* (Chaudoir, 1879)

= *Craspedophorus fasciatus* (Fabricius, 1781)

= *Craspedophorus michardi* (Fairmaire, 1880)

= *Craspedophorus reflexus* (Fabricius, 1801)

= *Craspedophorus tomentosus* (Vigors, 1825)

= *Epicosmus bifasciatus* (Chaudoir, 1879)

= *Eudema michardi* (Fairmaire, 1880)

Distribution: ORR- India (Andra Pradesh; Karnataka: Shivamoga, Mysore (Hackel and Kirschenhofer, 2014: 357); Tamil Nadu: Coimbatore (Hackel and Kirschenhofer, 2014: 276 and 357); Pondicherry (Hackel and Farkac, 2012: 78); Kerala: Bonacaud (Jithmon and Sabu, 2021: 18566)), SRL (Andrewes, 1930: 133), BGD (Hackel and Farkac, 2012: 78), MM (Hackel and Farkac, 2012: 78).

Subfamily Pterostichinae Bonelli, 1810

Tribe Abacetini Chaudoir, 1872

xxiii. Genus *Abacetus* Dejean, 1828

Abacetus Dejean, 1828: 195; Lacordaire, 1854: 315; Chaudoir, 1859: 126; id. 1869: 355; Tschitschérine, 1898: 519, 531 and 538; id. 1902: 506; Andrewes, 1924b: 44; id. 1930: 1; id. 1939: 129; Jeannel, 1948: 420; Löbl and Smetana, 2003: 346; Lorenz, 2005: 255; Löbl and Löbl, 2017: 480.

39. *Abacetus haplosternus* Chaudoir, 1878

Abacetus haplosternus Chaudoir, 1878: 25; Andrewes, 1930: 4; id. 1942b: 25; Lorenz, 2005: 258; Divya and Sabu, 2020: 9.

Distribution: ORR- India (Madhya Pradesh: Hoshangabad; Maharashtra: Nagpur (Andrewes, 1930: 4)); TAI (Andrewes, 1930: 4); PAR- India (Himachal Pradesh: Katrain; Uttarakhand: Almora, Ranikhet, Haldwani (Andrewes, 1930: 4)); IAR- IDS (Andrewes, 1930: 4).

xxiv. Genus *Cosmodiscus* Sloane, 1907

Cosmodiscus Sloane, 1907: 371; Andrewes, 1920b: 445; id. 1930: 131; Löbl and Smetana, 2003: 443; Lorenz, 2005: 260; Kushwaha and Hegde, 2015: 396, 401; Löbl and Löbl, 2017: 481.

40. *Cosmodiscus picturatus* Andrewes, 1920

Cosmodiscus picturatus Andrewes, 1920b: 447; id. 1921c: 345; id. 1930: 131; Lorenz, 2005: 260; Kushwaha and Hegde, 2015: 396, 401; Divya and Sabu, 2020: 11.

Distribution: ORR- India (Uttar Pradesh: Fyzabad, Odisha: Rambha: Ganjam, Barkuda and Gopkuda Island: Lake Chilka; Maharashtra: Nagpur; Andhra

Pradesh: Jammelamadugu (Andrewes, 1930: 131); Kerala: Kozhikode (Divya and Sabu, 2020: 11)).

Tribe Cratocerini Lacordaire, 1854

xxv. Genus *Caelostomus* MacLeay, 1825

Caelostomus MacLeay, 1825: 23; Andrewes, 1924b: 44; id. 1930: 55; Jeannel, 1948: 383; Löbl I and Smetana, 2003: 471; Lorenz, 2005: 249; Faisal and Singh, 2014: 342; Löbl and Löbl, 2017: 678.

*** 41. *Caelostomus sculptipennis* (Motschulsky, 1859)**

Caelostomus sculptipennis (Motschulsky) Chaudoir, 1872c: 13; Tschitschérine, 1900b: 263 (note); Andrewes, 1928: 22; id. 1930: 57; Straneo, 1938: 56; Lorenz, 2005: 250; Divya and Sabu, 2020: 12.

= *Stomonaxus sculptipennis* Motschulsky, 1859

= *Stomonaxus sculpticollis* Motschulsky, 1859

= *Caelostomus sculpticollis* (Motschulsky, 1859)

Distribution: ORR- India (Thamil Nadu: Nilgiri Hills (Straneo, 1938: 56)); SRL (Andrewes, 1930: 57).

Tribe Pterostichini Bonelli, 1810

xxvi. Genus *Trigonotoma* Dejean, 1828

Trigonotoma Dejean, 1828: 182; Brulle, 1834: 333; Chaudoir, 1852: 71; Lacordaire, 1854: 311; Chaudoir, 1868: 158; Tschitschérine, 1900b: 180;

Kuntzen, 1911: 182; id. 1914: 60; Andrewes, 1930: 352; id. 1939: 138; Saha and Halder, 2000: 20; Löbl and Smetana, 2003: 520; Lorenz, 2005: 300; Dubault *et al*. 2008: 240; Kushwaha and Hegde, 2015: 396, 401; Löbl and Löbl, 2017: 755.

#42. *Trigonotoma oberthueri* Tschitschérine, 1894

Trigonotoma oberthueri Tschitschérine, 1894b: 444; Kuntzen, 1914: 63; Andrewes, 1930: 355; Löbl and Smetana, 2003: 520; Lorenz, 2005: 300; Löbl and Löbl, 2017: 755; Divya and Sabu, 2020: 22.

Distribution: PAR- India (West Bengal: Pedong, Gopaldhara, Mungphu, Kurseong, Lebong (Andrewes, 1930: 355)).

Subfamily Scaritinae Bonelli, 1810

Tribe Clivinini Rafinasque, 1815

xxvii. Genus *Clivina* Latreille, 1802

Clivina Latreille, 1802: 96; Bonelli, 1813: 480; Dejean, 1825: 411; Schmidt-Göebel, 1846 (cover); Motschulsky, 1861: 101; Putzeys, 1863: 29 and 68; id. 1867a: 94; id. 1868a: 10; id. 1873a: 15; Fleisch, 1899: 33; Tschitschérine, 1904: 258; Andrewes, 1919b: 470; id. 1924b: 11; id. 1926c: 372; id. 1929: 344, 351; id. 1930: 110; Balkenohl, 2001: 13; Lorenz, 2005: 141.

43. *Clivina brevior* Putzeys, 1866

Clivina brevior Putzeys, 1866a: 126; Bates, 1892a: 277; Andrewes, 1926c: 375; id. 1929: 355, 378; id. 1930: 112; Balkenohl, 2001: 14; Lorenz, 2005: 142; Abhitha, 2010: 105.

Distribution: ORR- India (New Delhi: Pusa (Andrewes, 1930: 112); Kerala: Kozhikode: Kuttikattoor, Medical College, Thamarassery (Abhitha, 2010: 105)); MM (Andrewes, 1930: 112); IAR- MLS (Andrewes, 1930: 112).

44. *Clivina lobata* Bonelli, 1813

Clivina lobata Bonelli, 1813: 481; Dejean, 1825: 414; Putzeys, 1861: 50; id. 1867a: 121, 122, 125; id. 1868a: 1, 8; Bates, 1892a: 276; Andrewes, 1919a: 209; id. 1921c: 340; id. 1922: 392; id. 1924b: 11, 462; id. 1926c: 875; id. 1929: 355, 375; id. 1930: 114; Lorenz, 2005: 143; Abhitha, 2010: 107; Löbl and Löbl, 2017: 255.

Distribution: ORR- India (Kerala: Kozhikode: Thamarassery, Wayanad: Thirunelli (Abhitha, 2010: 107)); MM (Andrewes, 1930: 114); TAI (Andrewes, 1930: 114); PAR- JA (Löbl and Löbl, 2017: 255).

xxviii. Genus *Pseudoclivina* Kult, 1947

Pseudoclivina Kult, 1947: 30; id. 1951: 18; Balkenohl, 2001: 18; Lorenz, 2005: 145; Löbl and Löbl, 2017: 258.

***45. *Pseudoclivina costata* (Andrewes, 1929)**

Pseudoclivina costata (Andrewes); 1929: 354, 364; id. 1930: 113; Kult, 1951: 18; Bakenohl, 2001: 18; Lorenz, 2005: 145.

= *Clivina costata* Andrewes, 1929: 354

Distribution: ORR- India (Tamil Nadu: Nilgiri Hills (Andrewes, 1930: 113)).

46. *Pseudoclivina memnonia* (Dejean, 1831)

Pseudoclivina memnonia (Dejean); Kult, 1947: 30; id. 1951: 18; Balkenohl, 2001: 19; Lorenz, 2005: 145; Abhitha, 2010: 108; Löbl and Löbl, 2017: 259. *Clivina memnonia*, Dejean, 1831: 503; Putzeys, 1846: 588; Bouchard, 1903: 169; Andrewes, 1919a: 187, 206; id. 1924b: 115; id. 1926c: 373; id. 1927: 105; id. 1929: 354, 362; id. 1930: 115; Saha and Biswas, 1985: 120.

= *Clivina memnonia*, Dejean, 1831

= *Clivina indica* Putzeys, 1846

= *Clivina rugosifrons* Nietner, 1856

= *Clivina recta* Walker, 1858

= *Pseudoclivina indica* (Putzeys, 1846)

= *Pseudoclivina recta* (Walker, 1858)

= *Pseudoclivina rugosifrons* (Nietner, 1856)

Distribution: ORR- India (Kerala: Idukki: Chinnar; Kozhikode: Thamarassery, Engapuzha; Kasargod: Periya; Wayanad: Sulthan Bathery, Ambalavayal, Panamaram, Thirunelli, Muthanga, Tholpetty (Abhitha, 2010: 108)); SRL (Andrewes, 1930: 115); MM (Andrewes, 1930: 115); PAR- GUA, HAI, YUN (Löbl and Löbl, 2017: 259); IAR- IDS (Andrewes, 1930: 115).

Tribe Dyschiriini W. Kolbe, 1880

xxix. Genus *Dyschirius* Bonelli, 1810

Dyschirius Bonelli, 1810: Panzer, 1813: 67; Stephens, 1827: 37, 40; Putzeys, 1846: 524; Lacordaire, 1854: 202; Putzeys, 1867a: 32; Fleischer, 1899: 8; Andrewes, 1919: 99; Müller, 1922: 33; Andrewes, 1926c: 377; id. 1929: 390; id. 1930: 159; Jeannel, 1941: 250, 260, 275; id. 1946: 213, 215, 218; Moore and Brown, 1979: 123; Clopton, 1991: 53, 59; Saha *et al.* 1992: 9; Balkenohl, 1994: 27; Fedorenko, 1996: 5, 9, 11; Lorenz, 2005: 151; Bulirsch, 2009: 559; id. 2011: 1; Bousquet, 2012: 431; Allegro and Bulirsch, 2012: 235; Hogan, 2012: 106, 111, 116, 231; Kushwaha and Hegde, 2015: 399, 419; Fedorenko, 2016: 439; Ghannem *et al*. 2016: 69; Bulirsch and Stachowiak, 2017: 137; Löbl and Löbl, 2017: 263; Bulirsch, 2018: 229.

47. *Dyschirius paucipunctus* Andrewes, 1929

Dyschiriodes paucipunctus (Andrewes) Lorenz, 2005: 154.

Dyschirius mahratta Var. *paucipunctus* Andrewes, 1929: 392, 397; id. 1930:160.

= *Dyschiriodes paucipunctus* (Andrewes, 1929)

Distribution: ORR- India (Maharashtra: Pune; Karnataka: Belgaum (Andrewes, 1930:160)); SRL (Andrewes, 1930:160).

Tribe Scaritini Bonelli, 1810

xxx. Genus *Oxylobus* Chaudoir, 1855

Oxylobus Chaudoir, 1855: 5; id. 1879: 129; Andrewes, 1924b: 8; id. 1929: 292; id. 1930: 252; Lorenz, 2005: 141.

48. *Oxylobus asperulus* Chaudoir, 1857

Oxylobus asperulus Chaudoir, 1857: 58; id. 1879: 133; Andrewes, 1922: 215; id. 1924b: 129; id. 1929: 296, 311. id. 1930: 252; Lorenz, 2005: 141.

Distribution: ORR- India (Andra Pradesh: Chittur district, Horseley Konda; Karnataka: Mysore; Tamil Nadu: Pillur, Kodaikanal, Yercaud, Madura, Nilgiri Hills, Shembaganur; Kerala: Dhoni forest, South Malabar (Andrewes, 1930: 252)); SRL (Andrewes, 1930: 252).

 # ssp. *Oxylobus asperulus amyntas* Andrewes, 1924

Oxylobus amyntas Andrewes, 1924b: 70; id. 1929: 296, 313. id. 1930: 252; Lorenz, 2005: 141.

Distribution: ORR- India (Madhya Pradesh: Majgaon, Motinala, Mukhi (Andrewes, 1930: 252)).

49. *Oxylobus porcatus* (Fabricius, 1798)

Oxylobus porcatus (Fabricius) Heyne-Taschenberg, 1894: 3: 32; id. 1895: 20; Andrewes, 1921a: 157; id. 1924b: 8; id. 1929: 295, 305; Andrewes, 1930: 254; Lorenz, 2005: 141.

Scarites porcatus Fabricius, 1798: 43; Hope, 1838: 95; Motschulsky, 1855: 40.

= *Scarites porcatus* Fabricius, 1798

= *Oxylobus costatus* Chaudoir, 1879

= *Oxylobus minor* Tschitschérine, 1894a

= *Oxylobus obliterates* Andrewes, 1929

Distribution: ORR- India (Punjab: Baddia; West Bengal: Sahibganj, Rajmahal, Giridih; Jharkhand: Chakardharapore, Konbir, Chota Nagpur- Tetara, Tinpahar; Madhya Pradesh: Jubbulpore, Majgaon, Motinala; Chhattisgarh: Chitrakot; Odisha: Barkuda Island, Barkul, Chilka lake; Andra Pradesh: Visakhapatnam, Chittoor, Horseley Konda; Karnataka: Belgaum; Tamil Nadu: Coimbatore, Nilgiri Hills, Shevaroy Hills, Madura, Palni Hills, Kallar, Pillur, Ootacamund, Shembagannur; Kerala: Malabar Coast (Andrewes, 1930: 254)); SRL (Andrewes, 1930: 254).

Subfamily Trechinae Bonelli, 1810

Tribe Bembidiini Stephens, 1827

xxxi. Genus *Elaphropus* Motschulsky, 1839

Elaphropus Motschulsky, 1839: 73; Erwin, 1975: 1; Kopecky, 2002: 63; Lorenz, 2005: 207; Löbl and Löbl, 2017: 342.

*** 50. *Elaphropus nigellus* (Andrewes, 1935)**

Elaphropus nigellus (Andrewes) Lorenz, 2005: 210.

= *Tachys nigellus* Andrewes, 1935

= *Tachyura nigella* (Andrewes, 1935)

Distribution: ORR- India (Tamil Nadu: Chennai, Nilgiri Hills; Kerala: Nilambur (Andrewes, 1935: 277)).

*** 51. *Elaphropus nilgiricus* (Andrewes, 1925)**

Elaphropus nilgiricus (Andrewes) Lorenz, 2005: 210.

Tachys nilgiricus Andrewes, 1925: 446; id. 1930: 334; id. 1935: 265.

= *Tachys nilgiricus* Andrewes, 1925

= *Tachys unisculptus* Andrewes, 1925

= *Elaphropus unisculptus* (Andrewes, 1925)

= *Tachyura nilgirica* (Andrewes, 1925)

Distribution: ORR- India (Karnataka: Mysore (Andrewes, 1930: 334); Tamil Nadu: Nilgiri Hills (Andrewes, 1935: 446)); SRL (Andrewes, 1930: 334).

 # 52. *Elaphropus politus* (Motschulsky, 1851)

Elaphropus politus (Motschulsky) Lorenz, 2005: 210; Kushwaha and Hegde, 2015: 395.

Tachys politus Motschulsky, 1851: 509; Putzeys, 1875b: 743; Bouchard, 1903: 170; Andrewes, 1919a: 199; id. 1921a: 146; id. 1925: 448; id. 1930: 338; id. 1935: 269.

= *Tachys politus* Motschulsky, 1851

= *Tachyura polita* (Motschulsky, 1851)

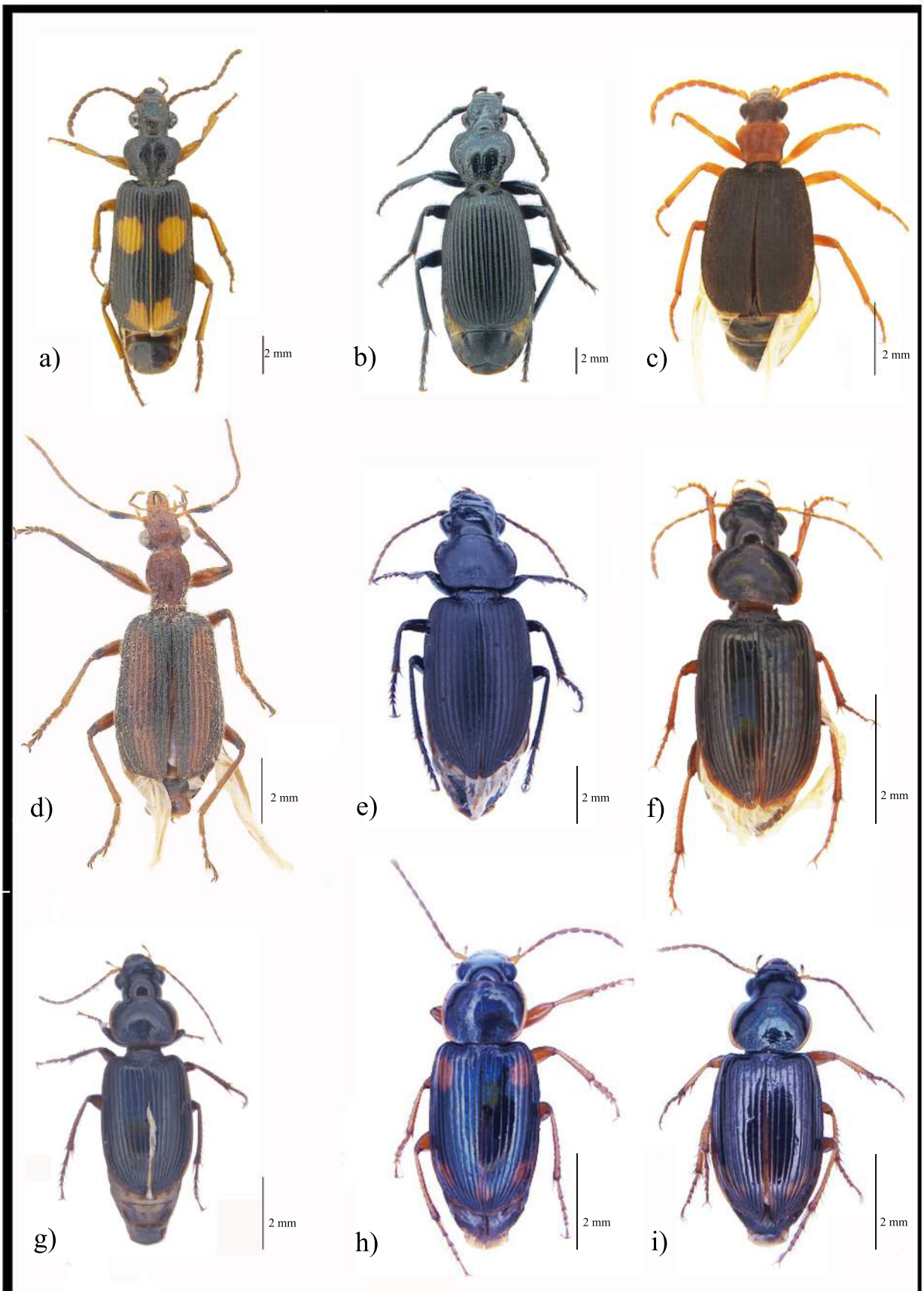


Plate 1: Habitus of a) *Macrocheilus bensoni* Hope, 1838 , b) *Omphra pilosa* (Klug, 1834), c) *Styphlomerus striatus* Akhil & Sabu, 2019, d) *Drypta lineola* MacLeay, 1825, e) *Pseudognathaphanus rusticus* (Andrewes, 1920), f) *Stenolophus bajaurae* Andrewes, 1924, g) *S. lucidus* Dejean, 1829, h) *S. quinquepustulatus* (Wiedemann, 1823), i) *S. smaragdulus* (Fabricius, 1798).

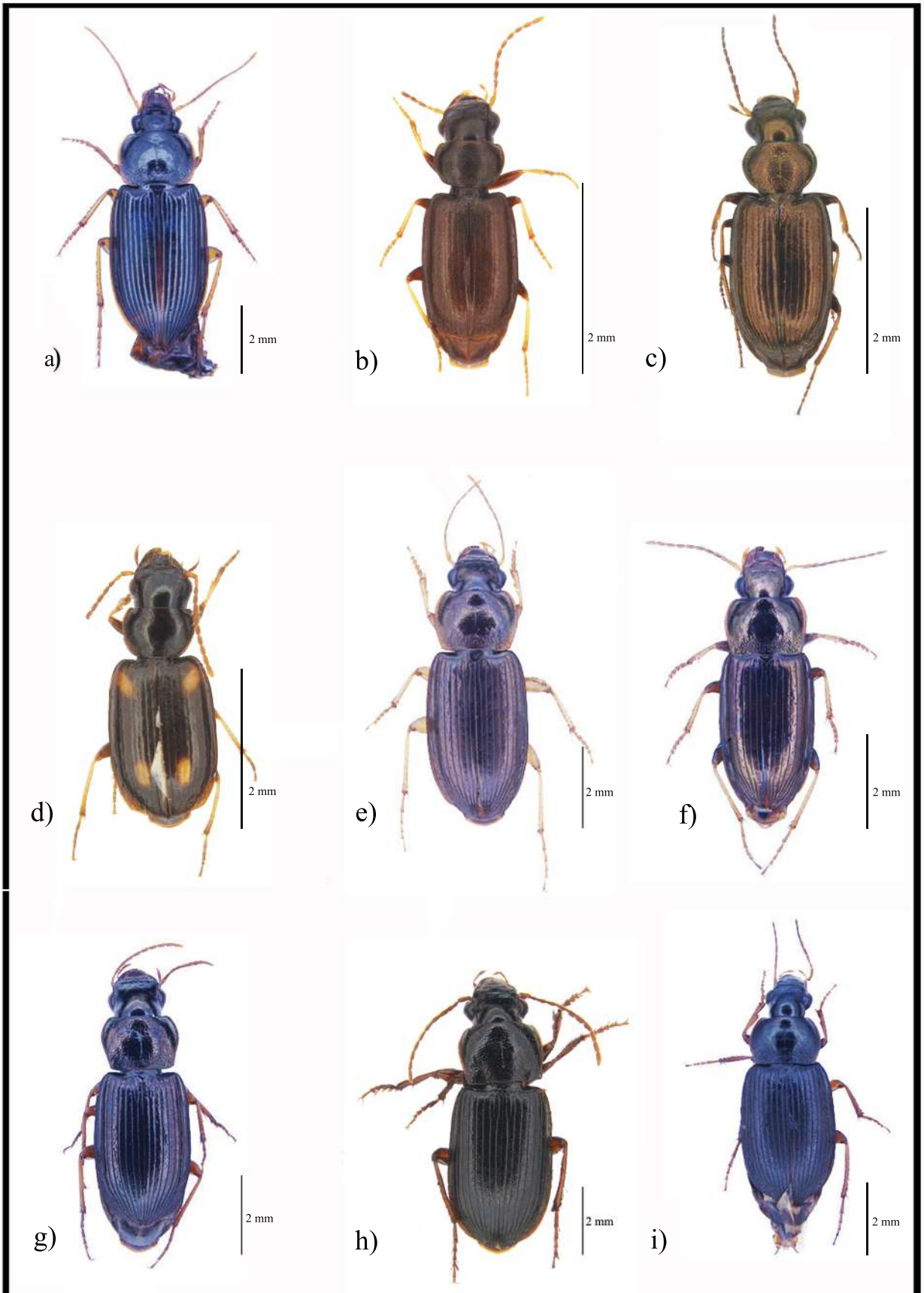


Plate 2: Habitus of a) *Allosiopelus punctatipennis* Ito, 1995, b) *Amblystomus aenescens* (Motschulsky, 1858), c) *A. fuscescens* (Motschulsky, 1858), d) *A. indicus* (Nietner, 1858), e) *Dioryche cuprina* (Dejean, 1829), f) *D. dravidana* Kataev, 2012, g) *D. torta* MacLeay, 1825, h) *Ophoniscus puneensis* Kataev, 2018, i) *Parophonus acutangulus* (Bates,1891).

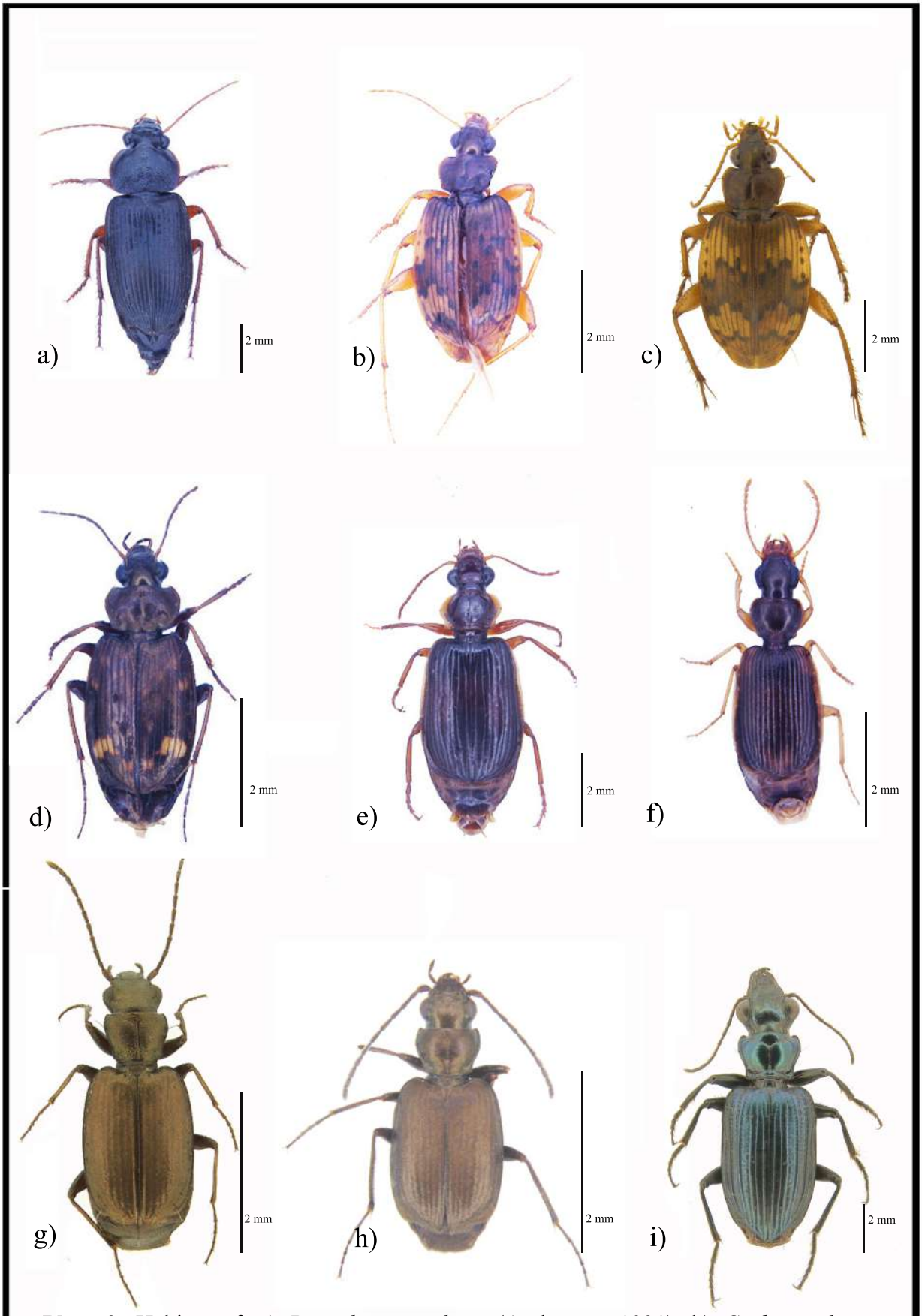


Plate 3: Habitus of, a) *Parophonus indicus* (Andrewes, 1931), b) *Cyclicus elegans* (Andrewes, 1931), c) *C. fimbriatus* (Bates, 1886), d) *Tetragonoderus notaphioides* Motschulsky, 1861, e) *Anchista fenestrata* (Schimdt-Goebel, 1846), f) *Anomotarus stigmula* (Chaudoir, 1852), g) *Apristus aeneipennis* (Schmidt-Göbel, 1846), h) *A. subtransparens* Motschulsky, 1861, i) *Catascopus cingalensis* Bates, 1886.

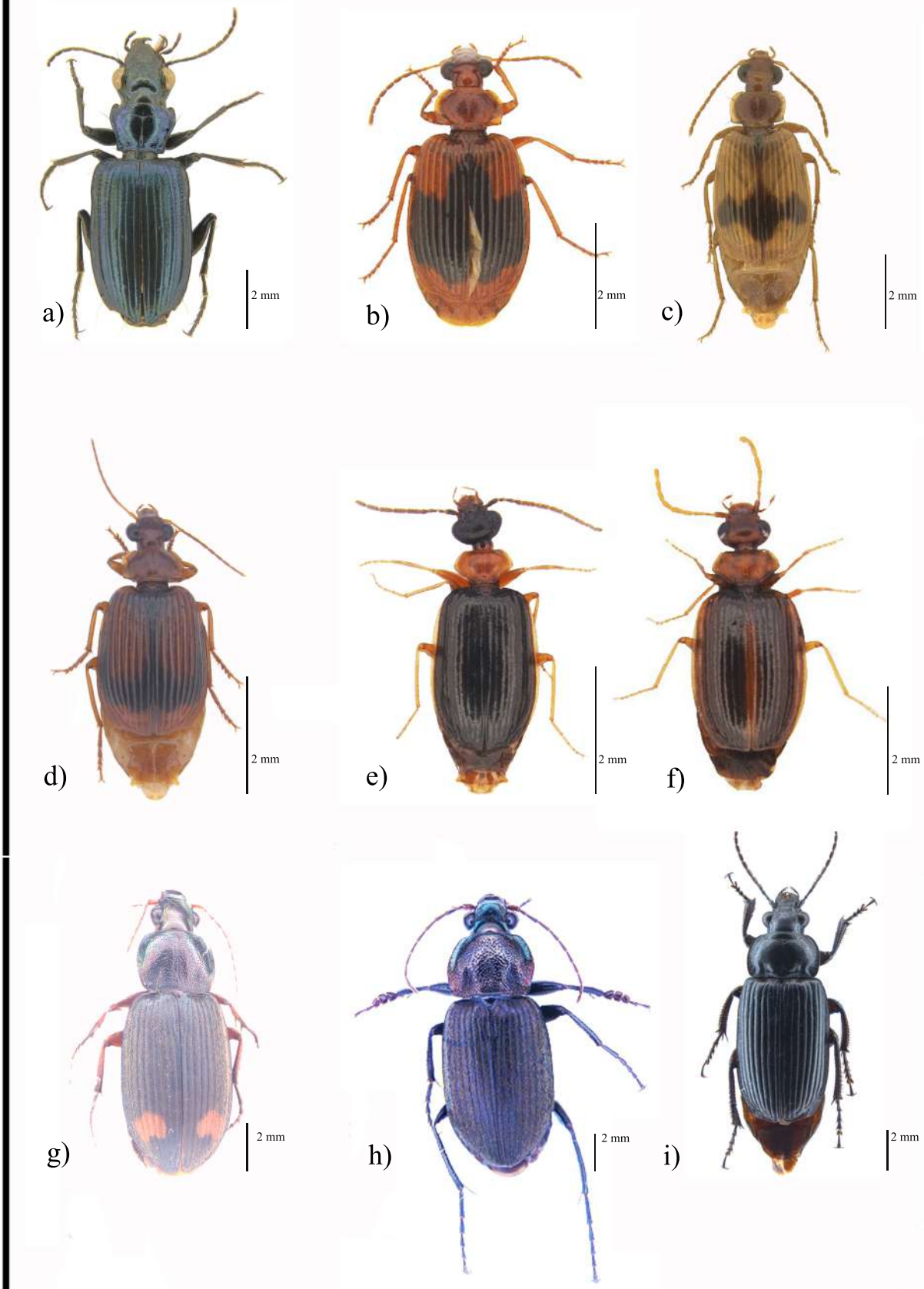


Plate 4: Habitus of, a) *Catascopus cyanellus* Chaudoir, 1848, b) *Lebia baconi* (Chaudoir, 1871), c) *L. calycophora* Schmidt-Göbel, 1846, d) *L. indica* Liebke, 1938, e) *Pentagonica ruficollis* Schmidt-Göebel, 1846, f) *P. venusta* Andrewes, 1933, g) *Chlaenius hamifer* Chaudoir, 1856 , h) *C. nilgiricus* Andrewes, 1919, i) *Orthogonius baconi* Chaudoir, 1871.

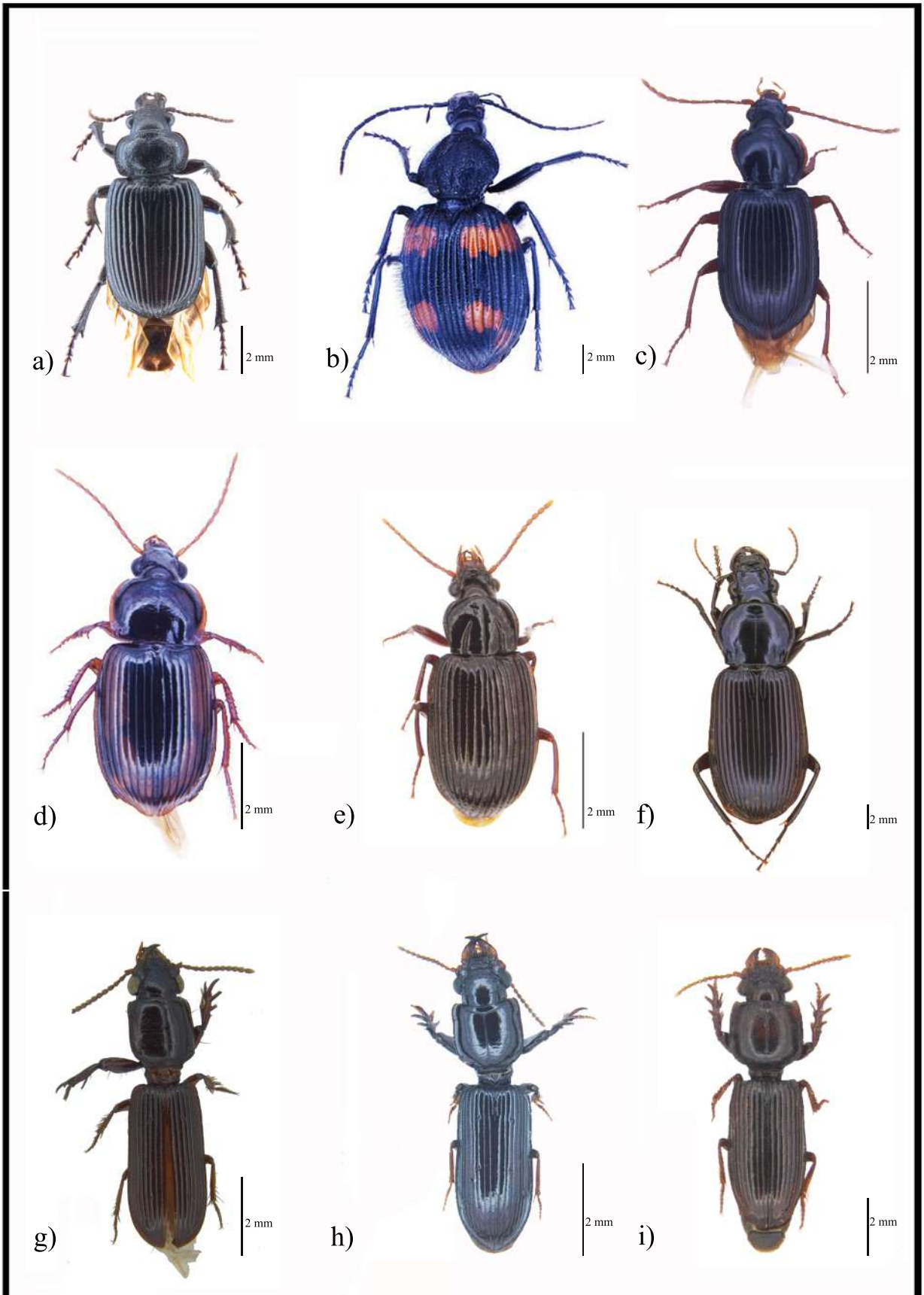


Plate 5: Habitus of , a) *Orthogonius lucidus* Bates, 1891, b) *Craspedophorus angulatus* (Fabricius, 1781) c) *Abacetus haplosternus* Chaudoir, 1878, d) *Cosmodiscus picturatus* Andrewes, 1920, e) *Caelostomus sculptipennis* (Motschulsky, 1859), f) *Trigonotoma oberthueri* Tschitscherine, 1894, g) *Clivina brevior* Putzeys, 1866, h) *C. lobata* Bonelli, 18138, i) *Pseudoclivina costata* (Andrewes, 1929).

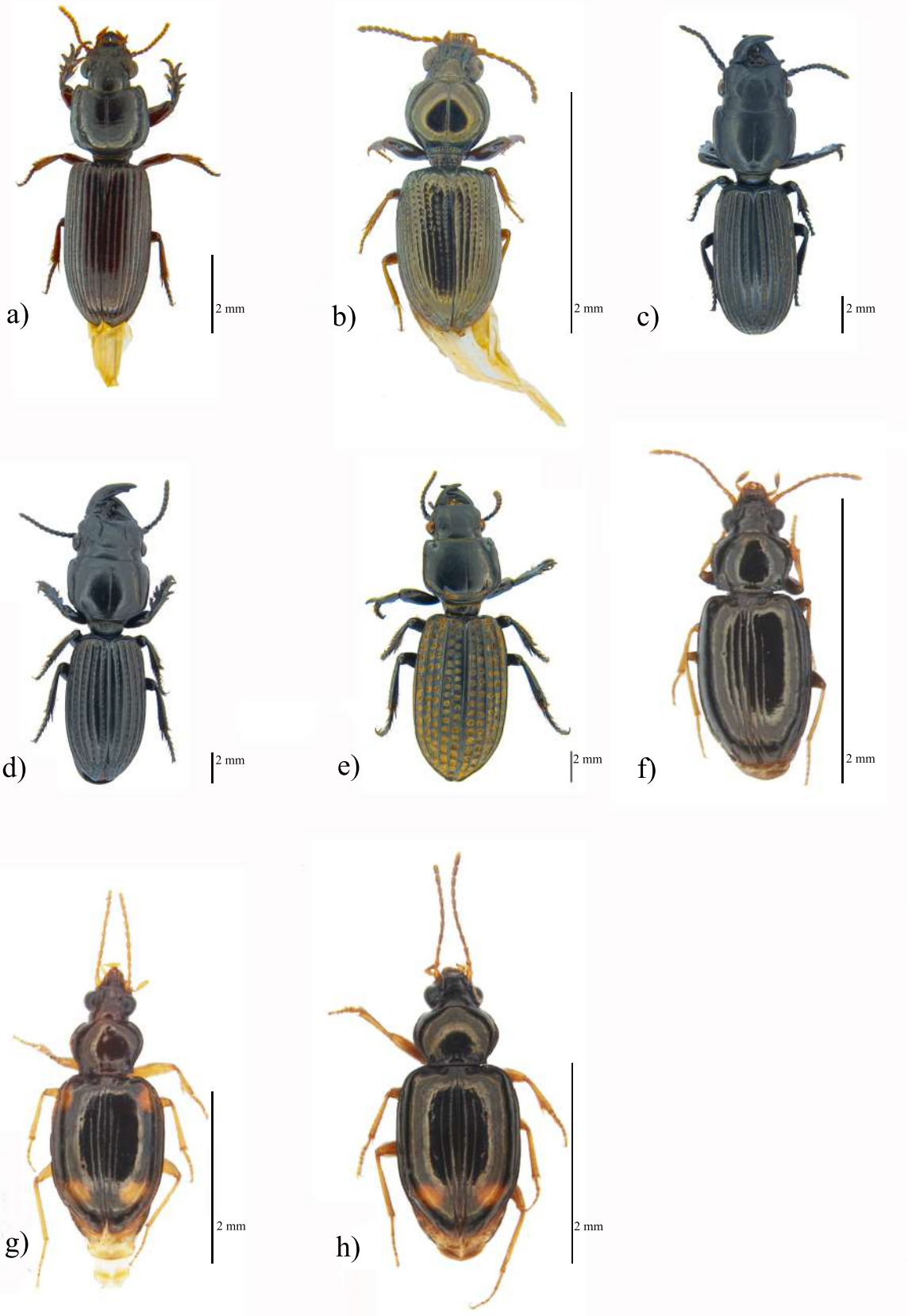


Plate 6: Habitus of, a) *Pseudoclivina memnonia* (Dejean, 1831), b) *Dyschirius paucipunctus* Andrewes, 1929, c) *Oxylobus asperulus* Chaudoir, 1857, d) ssp *Oxylobus asperulus amyntas* Andrewes, 1924, e) *O. porcatus* (Fabricius, 1798), f) *Elaphropus nigellus* (Andrewes, 1935), g) *E. nilgiricus* (Andrewes, 1925), h) *E. politus* (Motschulsky, 1851)

Distribution: ORR- India (Uttar Pradesh: Auraiya, Fatehpur, Muradganj, Mathura, Kishori Kunj, Jhansi, Shahjahanpur (Kushwaha and Hegde, 2015: 395)); SEA (Andrewes, 1935: 448).

4.2 Carabidae Ecology

4.2.1 Species abundance and diversity

Thirty nine species belonging to nine subfamilies, 15 tribes and 23 genera collected using light trap method. List of species and their abundance are given in **Table: 3.** Most abundant species in the light trap were *Amblystomus indicus* (0.22±0.72: 11.02%), *A. fuscescens* (0.22±0.69: 11.02%), followed by *Elaphropus nigellus* (0.20±0.61: 10.17%). These three species are the dominant species among light attracted Carabidae and constitute 10 % and above of the overall abundance and are the major species. Four species (*Anchista fenestrata, Elaphropus politus, Cyclicus elegans, E. nilgiricus*) contributed 5- 9.99% of the overall abundance and are the minor species among the light attracted Carabidae. The remaining 32 species (*Amblystomus aenescens, Abacetus haplosternus, Orthogonius lucidus, Dyschirius paucipunctus, Allosiopelus punctatipennis, Cosmodiscus picturatus, Dioryche cuprina, Lebia calycophora, Orthogonius baconi, Stenolophus quinquepustulatus, Styphlomerus striatus, Anomotarus stigmula, Caelostomus sculptipennis, Clivina brevior, C. lobata, Cyclicus fimbriatus, Dioryche torta, Drypta lineola, Lebia baconi, L. indica, Macrocheilus bensoni, Ophoniscus puneensis, Parophonus acutangulus, P. indicus, Pentagonica ruficollis, P. venusta, Pseudoclivina costata, P. memnonia,*

Pseudognathaphanus rusticus, Stenolophus bajaurae, S. lucidus, S. smaragdulus) were contributed less than 4.99% and are the rare species at CWS.

Thirteen species belonging to four subfamilies, five tribes and nine genera were collected using pitfall method. List of species and their abundance are given in **Table: 4.** *Omphra pilosa* (0.27±0.55: 34.04%) and *Cyclicus elegans* (0.10±0.48: 12.77%) constituted 10 % and above of the overall abundance and are the major species. Four species (*Amblystomus fuscescens, Anchista fenestrata, Elaphropus nigellus, E. politus*) were contributed 5- 9.99% of the overall abundance and are the minor species and the remaining seven species (*Amblystomus indicus, A. aenescens, Tetragonoderus notaphioides, Dioryche dravidana, D. torta, Lebia calycophora*) were contributed less than 4.99% and are the rare species. Rank abundance plot of species in CWS is represented in **Figure 3.**

Five species namely *Ophoniscus puneensis, Caelostomus sculptipennis, Pseudoclivina costata, Elaphropus nigellus, E. nilgiricus* were endemics to the WGs and Sri Lanka hotspot of biodiversity.

Shannon-Weaver diversity index (H') value of 3.32, Margalef richness index (d) value of 7.97 and Simpson's evenness index (E1/D) value of 0.95 were recorded for the Carabidae community collected from the Chinnar wildlife sanctuary using light traps (**Table:2**).

4.2.2 Seasonality

Overall abundance of Carabidae showed variation with seasons using light trap (p value <0.05; **Table: 7**). Out of the 39 species collected, two species

Cyclicus elegans and *Elaphropus nigellus* were seasonal species (*p* value <0.05; **Table: 5**) and their abundance was high during wet season. Nine species (*Abacetus haplosternus, Amblystomus aenescens, A. fuscescens, A. indicus, Anchista fenestrate, Dyschirius paucipunctus, Elaphropus nilgiricus, E. politus,* and *Orthogonius lucidus*) were aseasonal (*p* value > 0.05). Others (28 species) with mean value less than 0.1 and not considered for estimation of seasonality due to low abundance. Among the 39 species collected in light trap, twenty nine species were recorded in wet season and 17 species were recorded in dry season. Seven species, (*Amblystomus fuscescens, A. indicus, Anchista fenestrata, Cyclicus elegans, Elaphropus nigellus, E. nilgiricus and E. politus*) present in both seasons. *Elaphropus nigellus* (0.37±0.81: 12.5%) and *Amblystomus fuscescens* (0.33±0.88: 11.36%) were the dominant species in wet season and *A. indicus* (0.20±0.76: 20%) followed by *A. aenescens, A. fuscescens, Orthogonius lucidus* (0.10±0.40: 10%) were the dominant species in dry season collections. Season wise rank abundance of species is represented in **Figure: 4.**

Overall abundance of Carabidae collected with pitfall traps showed no seasonal variation in abundance (*p* value > 0.05; **Table: 8**). Four species (*Omphra pilosa, Amblystomus fuscescens, Cyclicus elegans, Anchista fenestrata*) were aseasonal (*p* value > 0.05; Table: 6). Others (9 species) with mean value less than 0.1 not considered for estimation of seasonality due to low abundance. Among the 13 species collected in pitfall traps, 11 species and eight species were obtained in wet and dry seasons respectively. *Omphra pilosa, Amblystomus fuscescens, Elaphropus nigellus, E. politus, C. elegans* and *Anchista fenestrata*

were present in both seasons. *Omphra pilosa* (0.27±0.52: 27.59%) and *Cyclicus elegans* (0.13±0.57: 13.79%) were the abundant species in wet season collections using pitfall trap. *O. pilosa* (0.27±0.58: 47.06%), followed by *A. fenestrata* (0.07±0.37: 11.76%) and *E. nigellus* (0.07±0.25: 11.76%) were abundant species in dry season collections using pitfall method. Season wise rank abundance of species is represented in **Figure: 5.**

Table: 2. Shannon-Weaver diversity, Margalef richness and Simpson's evenness indices of Carabidae collected with light trap in the Chinnar wildlife sanctuary

Region	**Shannon-Weaver diversity index (H')**	**Margalef richness index (d)**	**Simpson's evenness index ($E_{1/D}$)**
Chinnar wildlife sanctuary	**3.32**	**7.97**	**0.95**

Table: 3. Abundance (Mean ± SD and percentage) of Carabidae collected from Chinnar wildlife sanctuary with light trap during 2019-2020 period

No.	**Species**	**Mean ± SD**	**%**
1.	*Amblystomus fuscescens*	0.22±0.69	11.02
2.	*Amblystomus indicus*	0.22±0.72	11.02
3.	*Elaphropus nigellus*	0.20±0.61	10.17
4.	*Anchista fenestrata*	0.18±0.77	9.32
5.	*Elaphropus politus*	0.15±0.71	7.63
6.	*Cyclicus elegans*	0.12±0.37	5.93

7.	*Elaphropus nilgiricus*	0.10±0.44	5.08
8.	*Amblystomus aenescens*	0.05±0.29	2.54
9.	*Abacetus haplosternus*	0.05±0.29	2.54
10.	*Orthogonius lucidus*	0.05±0.29	2.54
11.	*Dyschirius paucipunctus*	0.05±0.39	2.54
12.	*Allosiopelus punctatipennis*	0.03±0.26	1.69
13.	*Cosmodiscus picturatus*	0.03±0.26	1.69
14.	*Dioryche cuprina*	0.03±0.26	1.69
15.	*Lebia calycophora*	0.03±0.26	1.69
16.	*Orthogonius baconi*	0.03±0.26	1.69
17.	*Stenolophus quinquepustulatus*	0.03±0.26	1.69
18.	*Styphlomerus striatus*	0.03±0.26	1.69
19.	*Anomotarus stigmula*	0.02±0.13	0.85
20.	*Caelostomus sculptipennis*	0.02±0.13	0.85
21.	*Clivina brevior*	0.02±0.13	0.85
22.	*Clivina lobata*	0.02±0.13	0.85
23.	*Cyclicus fimbriatus*	0.02±0.13	0.85
24.	*Dioryche torta*	0.02±0.13	0.85
25.	*Drypta lineola*	0.02±0.13	0.85
26.	*Lebia baconi*	0.02±0.13	0.85
27.	*Lebia indica*	0.02±0.13	0.85
28.	*Macrocheilus bensoni*	0.02±0.13	0.85
29.	*Ophoniscus puneensis*	0.02±0.13	0.85
30.	*Parophonus acutangulus*	0.02±0.13	0.85
31.	*Parophonus indicus*	0.02±0.13	0.85
32.	*Pentagonica ruficollis*	0.02±0.13	0.85

33.	*Pentagonica venusta*	0.02±0.13	0.85
34.	*Pseudoclivina costata*	0.02±0.13	0.85
35.	*Pseudoclivina memnonia*	0.02±0.13	0.85
36.	*Pseudognathaphanus rusticus*	0.02±0.13	0.85
37.	*Stenolophus bajaurae*	0.02±0.13	0.85
38.	*Stenolophus lucidus*	0.02±0.13	0.85
39.	*Stenolophus smaragdulus*	0.02±0.13	0.85

Table: 4. Abundance (Mean ± SD and percentage) of Carabidae collected from Chinnar wildlife sanctuary using pitfall trap during 2019-2020 period

No.	Species	Mean ± SD	%
1.	*Omphra pilosa*	0.27±0.55	34.04
2.	*Cyclicus elegans*	0.10±0.48	12.77
3.	*Amblystomus fuscescens*	0.07±0.41	8.51
4.	*Anchista fenestrata*	0.07±0.41	8.51
5.	*Elaphropus nigellus*	0.07±0.31	8.51
6.	*Elaphropus politus*	0.07±0.31	8.51
7.	*Amblystomus indicus*	0.03±0.18	4.26
8.	*Tetragonoderus notaphioides*	0.03±0.26	4.26
9.	*Amblystomus aenescens*	0.02±0.13	2.13
10.	*Dioryche dravidana*	0.02±0.13	2.13
11.	*Dioryche torta*	0.02±0.13	2.13
12.	*Lebia calycophora*	0.02±0.13	2.13
13.	*Macrocheilus bensoni*	0.02±0.13	2.13

Table: 5. Seasonal abundance (Mean ± SD) of Carabidae assemblage collected with light trap during 2019-2020 period from Chinnar wildlife sanctuary (S= seasonal, AS= aseasonal)

No.	Species	Wet season (Mean ± SD)	Dry season (Mean ± SD)	Seasonality	t-test (*P* value)
1.	*Cyclicus elegans*	0.20±0.48	0.03±0.18	S	0.04
2.	*Elaphropus nigellus*	0.37±0.81	0.03±0.18	S	0.01
3.	*Abacetus haplosternus*	0.1±0.40	0.00 ± 0.00	AS	0.09
4.	*Amblystomus aenescens*	0.00 ± 0.00	0.10±0.40	AS	0.08
5.	*Amblystomus fuscescens*	0.33±0.88	0.10±0.40	AS	0.09
6.	*Amblystomus indicus*	0.23±0.68	0.20±0.76	AS	0.43
7.	*Anchista fenestrata*	0.30±1.06	0.07±0.25	AS	0.12
8.	*Dyschirius paucipunctus*	0.10±0.55	0.00 ± 0.00	AS	0.16
9.	*Elaphropus nilgiricus*	0.17±0.59	0.03±0.18	AS	0.12
10.	*Elaphropus politus*	0.23±0.93	0.07±0.37	AS	0.18
11.	*Orthogonius lucidus*	0.00 ± 0.00	0.10±0.40	AS	0.09
12.	*Allosiopelus punctatipennis*	0.07±0.37	0.00 ± 0.00		
13.	*Anomotarus stigmula*	0.03±0.18	0.00 ± 0.00		
14.	*Caelostomus sculptipennis*	0.00 ± 0.00	0.03±0.18		
15.	*Clivina brevior*	0.03±0.18	0.00 ± 0.00		
16.	*Clivina lobata*	0.03±0.18	0.00 ± 0.00		
17.	*Cosmodiscus picturatus*	0.07±0.37	0.00 ± 0.00		
18.	*Cyclicus fimbriatus*	0.00 ± 0.00	0.03±0.18		

19.	*Dioryche cuprina*	0.07±0.37	0.00 ± 0.00		
20.	*Dioryche torta*	0.00 ± 0.00	0.03±0.18		
21.	*Drypta lineola*	0.03±0.18	0.00 ± 0.00		
22.	*Lebia baconi*	0.03±0.18	0.00 ± 0.00		
23.	*Lebia calycophora*	0.07±0.37	0.00 ± 0.00		
24.	*Lebia indica*	0.00 ± 0.00	0.03±0.18		
25.	*Macrocheilus bensoni*	0.00 ± 0.00	0.03±0.18		
26.	*Ophoniscus puneensis*	0.00 ± 0.00	0.03±0.18		
27.	*Orthogonius baconi*	0.07±0.37	0.00 ± 0.00		
28.	*Parophonus acutangulus*	0.03±0.18	0.00 ± 0.00		
29.	*Parophonus indicus*	0.03±0.18	0.00 ± 0.00		
30.	*Pentagonica ruficollis*	0.03±0.18	0.00 ± 0.00		
31.	*Pentagonica venusta*	0.03±0.18	0.00 ± 0.00		
32.	*Pseudoclivina costata*	0.00 ± 0.00	0.03±0.18		
33.	*Pseudoclivina memnonia*	0.03±0.18	0.00 ± 0.00		
34.	*Pseudognathaphanus rusticus*	0.00 ± 0.00	0.03±0.18		
35.	*Stenolophus bajaurae*	0.03±0.18	0.00 ± 0.00		
36.	*Stenolophus lucidus*	0.03±0.18	0.00 ± 0.00		
37.	*Stenolophus quinquepustulatus*	0.07±0.37	0.00 ± 0.00		
38.	*Stenolophus smaragdulus*	0.03±0.18	0.00 ± 0.00		
39.	*Styphlomerus striatus*	0.07±0.37	0.00 ± 0.00		

Table: 6. Seasonal abundance (Mean ± SD) of Carabidae assemblage collected with pitfall trap during 2019-2020 period from Chinnar wildlife sanctuary (S= seasonal, AS= aseasonal)

No	**Species**	**Wet season (Mean ± SD)**	**Dry season (Mean ± SD)**	**Seasonality**	**t-test (*P* value)**
1.	*Omphra pilosa*	0.27±0.52	0.27±0.58	AS	0.41
2.	*Amblystomus fuscescens*	0.1±0.55	0.03±0.18	AS	0.06
3.	*Cyclicus elegans*	0.13±0.57	0.03±0.19	AS	0.16
4.	*Anchista fenestrata*	0.1±0.55	0.07±0.37	AS	0.36
5.	*Amblystomus aenescens*	0.00 ± 0.00	0.03±0.18		
6.	*Amblystomus indicus*	0.07±0.25	0.00 ± 0.00		
7.	*Dioryche dravidana*	0.03±0.18	0.00 ± 0.00		
8.	*Dioryche torta*	0.03±0.18	0.00 ± 0.00		
9.	*Elaphropus nigellus*	0.07±0.37	0.07±0.25		
10.	*Elaphropus politus*	0.07±0.37	0.03±0.18		
11.	*Macrocheilus bensoni*	0.03±0.18	0.00 ± 0.00		
12.	*Tetragonoderus notaphioides*	0.07±0.37	0.00 ± 0.00		
13.	*Lebia calycophora*	0.00 ± 0.00	0.03±0.18		

Table 7. Statistical analysis of the seasonal variation in the overall abundance of Carabide collected with light traps during 2019-2020 period at Chinnar wildlife sanctuary

t-test				
	Mean	**Variance**	**t**	***P* value**
WET	2.26	8.46	2.94	0.004
DRY	0.77	1.55		

Table 8. Statistical analysis of the seasonal variation in the overall abundance of Carabidae collected with pitfall traps during 2019-2020 period at Chinnar wildlife sanctuary

t-test				
	Mean	**Variance**	**t**	***P* value**
WET	2.23	4.36	1.11	0.276
DRY	1.31	4.56		

Chapter 5

DISCUSSION

5. DISCUSSION

5.1. Taxonomy

First taxonomic report of the ground beetles from a dry deciduous forest (Chinnar wildlife sanctuary: CWS) in India and the Western Ghats (WGs) with a checklist and key to the species and species details with images are provided. The checklist provides information on the composition of the ground beetle fauna of CWS in the south WGs and the pictorial key to the species, and species details with images will enable easier identification of the Carabidae in the dry belts in the south Western Ghats. Fifty-two species belonging to 11 subfamilies (Harpalinae: 15 species, Lebiinae: 14, Scaritinae: 7, Pterostichinae: 4, Anthiinae: 2, Trechinae: 3, Licininae: 2, Orthogoniinae: 2, Panagaeinae: 1, Brachininae: 1, Dryptinae: 1), 19 tribes and 31 genera were recorded. Harpalinae, Lebiinae, and Scaritinae are the speciose subfamilies in the study region, with 15, 14, and 7 species respectively.

Two species, *Stenolophus lucidus* (Harpalinae) and *Amblystomus aenescens* (Harpalinae), are new to India, having previously been reported from the Indes Orientals. (Dejean, 1829, Andrewes, 1930, Motschulsky, 1858, Andrewes, 1928; 1933). Four species, *Stenolophus bajaurae* (Harpalinae), *Amblystomus indicus* (Harpalinae), *Trigonotoma oberthueri* (Pterostichinae), and *Elaphropus politus* (Trechinae), are first reports from south India. *Amblystomus indicus* was reported earlier from Sri Lanka, Eastern and Western India (Bates 1886, 1892; Andrewes 1930), and the record in south India is significant

indicating its continuous distribution in Sri Lanka and south India. *Trigonotoma oberthueri*, a species with earlier reports only from the Palearctic region in the central and eastern Himalayan region (Andrewes 1930; Löbl and Löbl 2017) and its record from south India and the Oriental region is noted.

Five species, *Ophoniscus puneensis* (Harpalinae), *Caelostomus sculptipennis* (Pterostichinae), *Pseudoclivina costata* (Scaritinae), *Elaphropus nigellus* (Trechinae), *E. nilgiricus* (Trechinae) are endemic to the WGs and Sri Lanka hotspot of biodiversity. *Macrocheilus chinnarensis* is a recently discovered new local endemic species (Akhil *et al.* 2019). *Ophoniscus puneensis* is recorded for the first time from south WGs after its discovery in the North WGs (Kataev 2018). *Pseudoclivina costata* and *E. nigellus* are endemic to the WGs and recorded from the moist western slopes (Andrewes 1925, 1929, 1930, 1935) and it is the first record of the species from the eastern slopes of the WGs. *Caelostomus sculptipennis* and *E. nilgiricus* are known only from south WGs and Sri Lanka (Andrewes 1925, 1928, 1930, 1935; Straneo 1938; Divya and Sabu 2020).

Fifty two species reported from CWS. Out of these 52 species, 17 species namely *Abacetus haplosternus, Allosiopelus punctatipennis, Amblystomus aenescens, A. fuscescens, A. indicus, Apristus subtransparens, Craspedophorus angulatus, Dioryche cuprina, Dyschirius paucipunctus, Elaphropus politus, Parophonus acutangulus, P. indicus, Pseudognathaphanus rusticus, Stenolophus bajaurae, S. lucidus, S. quinquepustulatus, Trigonotoma oberthueri* were not

recorded from moist south WGs and are present in dry south WGs. Remaining 34 species namely *Anchista fenestrate, Anomotarus stigmula, Apristus aeneipennis, Caelostomus sculptipennis, Catascopus cingalensis, C. cyanellus, Chlaenius hamifer, C. nilgiricus, Clivina brevior, C. lobata, Cosmodiscus picturatus, Craspedophorus bifasciatus, Cyclicus elegans, C. fimbriatus, Dioryche dravidana, D. torta, Drypta lineola, Elaphropus nigellus, E. nilgiricus, Lebia baconi, L. calycophora, Lebia indica, Macrocheilus bensoni, Omphra pilosa, Ophoniscus puneensis, Orthogonius baconi, O. lucidus, Oxylobus asperulus, O. porcatus, Pentagonica ruficollis, P. venusta, Pseudoclivina costata, P. memnonia, Stenolophus smaragdulus, Styphlomerus striatus, Tetragonoderus notaphioides* (Andrewes 1935, Kataev 2018, Akhil 2019, Shiju and Sabu 2019, Jithmon 2020, Divya and Sabu 2020, Jithmon and Sabu 2021) - are present in moist and dry WGs.

5.2. Ecology

5.2.1. Species abundance and diversity

Ecological analysis of Carabidae community present in a dry forest (Chinnar wildlife sanctuary: CWS) in India and the Western Ghats (WG) is provided. The assemblage consisted of 52 species which is high when compared with the dry forests in Colombia with 24 species (Ariza *et al.* 2021a). *Amblystomus indicus* (11.02%), *A. fuscescens* (11.02%) and *Elaphropus nigellus* (10.17%) were the dominant species in light trap in the dry forest habitat of Chinnar. In CWS, carabid beetles assemblage is dominated by small species,

these results are similar to results from the tropical dry forest in Colombia (Ariza *et al.* 2021b). The small size of individual may be one reason for their great success, and may enable them to live in the presence of dominant ants more successfully than slightly larger Carabidae (Darlington 1971). Ariza *et al.* (2021b) suggested that smaller bodied beetles can benefit from a broader prey selection to satisfy their energetic requirements.

Dominant subfamilies in CWS in light trap collection were Harpalinae (14 species, 36.44%), Trechinae (3 species, 22.88%) and Lebiinae (9 species, 22.03%) with species *Amblystomus indicus* (11.02%), *A. fuscescens* (11.02%), *Elaphropus nigellus* (10.17%) and *Anchista fenestrata* (9.32%). Further Species specific data on life biology, feeding preferences, prey resources of dominant carabid species in the dry forest of south WGs regions is required to reach at conclusions about the reasons for their dominance. Most Harpalinae species are moisture-loving (hygrophilous), living at the soil surface and in leaf litter, most are dominant on grassland and open places, some in rain forest, some in caves (*Syllectus, Pholeodytes*), some occurs at high altitudes on the Himalayas and on mountains in Formosa, Sumatra, Java, the Philippines, and New Guinea (*Chydaeus*) and some occasionally on plants and trees (Darlington 1971; Larochelle and Larivière 2005). Abundance of subfamily Harpalinae could be attributed to the presence of the streams, and open places in the study region. Subfamily Trechinae includes dominant small-bodied carabids best represented in the warmer regions of the world (Darlington 1971). Most of the

representatives of genus *Bembidion* and *Tachys* are found along the banks of streams and lakes, or at least in moist localities and are carnivores (*Elaphropus*) (Lepping 2009; Tiofilova 2017), and the abundance of subfamily Trechinae could be attributed to the presence of the streams in the study region.

Habitat of members of Lebiinae vary considerably. The ground dwelling species (*Paradromius*, *Microlestes*, *Syntomus*, *Lionychus* and *Cymindis*) of Lebiinae are mostly xerophilous (Tamutis and Barsevskis 2014), occurring only in dry, open areas (Lindroth 1975). Abundance of Lebiinae could be attributed to the presence of dry habitat conditions in CWS.

Dominant subfamilies in pitfall collection in CWS were Anthiinae (2 species, 36.17%), Lebiinae (4 species, 27.66%) with species *Omphra pilosa* (34.04%), and *cyclicus elegans* (12.77%). Dominance pattern of these species in the dry forest of south WGs regions requires species-level data on their life biology, feeding preferences, prey resources. *Omphra* is unique for its endemism in the Indian subcontinent. In addition, *Omphra* is distinctive for its geophilus habit and aptery. The abundance of *Omphra* is supported with plenty of prey resources like ground and surface-dwelling ants and termites (Prasad and Rajagopal 1990; Shiju *et al.* 2012a), and their high abundance could be attributed to the existence of such habitat conditions in CWS. *Cyclicus* is winged, small vigorous beetle and difficult to catch, especially as its colour blends firmly with the dry sand in which it lives and the numerous small stones under which it conceals itself and is widely distributed in warmer parts of world

(Andrewes 1929; Darlington 1971). The dominance of *cyclicus elegans* in the dry forest is attributed to the presence of small stones in the open dry forests at CWS.

Fourty two species were collected with both light and pitfall traps. Five species (11.9%) (*Ophoniscus puneensis, Caelostomus sculptipennis, Pseudoclivina costata, Elaphropus nigellus, E. nilgiricus)* were endemic to the WGs and Sri Lanka hotspot of biodiversity. *Ophoniscus puneensis* is recorded for the first time from south WGs after its discovery in the North WGs (Kataev 2018). *Pseudoclivina costata* and *E. nigellus* are endemic to the WGs and recorded from the moist western slopes (Andrewes 1925, 1929, 1930, 1935), and it is the first species record from the eastern slopes of the WGs. *Caelostomus sculptipennis* and *E. nilgiricus* are known only from south WGs and Sri Lanka (Andrewes 1925, 1928, 1930, 1935; Straneo 1938; Divya and Sabu 2020).

Knowledge about the species and studies on the ecological and behavioural characteristics of each species is the first step in finding species indicators to assess the conservation status of a particular ecosystem (Brown 1997). However, there is a lack of specific information from CWS and data about ecological and behavioural characteristics of various Carabidae species, which will aid in the ongoing conservation efforts in CWS. Seventeen species namely *Abacetus haplosternus, Allosiopelus punctatipennis, Amblystomus aenescens, A. fuscescens, A. indicus, Apristus subtransparens, Craspedophorus angulatus, Dioryche cuprina, Dyschirius paucipunctus, Elaphropus politus,*

Parophonus acutangulus, P. indicus, Pseudognathaphanus rusticus, Stenolophus bajaurae, S. lucidus, S. quinquepustulatus, Trigonotoma oberthueri- were not reported from wet forests of WGs and indicated that these species are adapted for the dry habitat conditions.

The rank abundance curve of light trap showed that only 12% of the species (*Amblystomus fuscescens, A. indicus, Anchista fenestrate, Elaphropus nigellus, Elaphropus politus*) were collected with more than eight individuals, while 70% were single individuals (singletons) or two individuals (doubletons). Rank abundance curve of pitfall traps showed that only 15% (*Omphra pilosa, Cyclicus elegans*) of the species were collected with more than five individuals, whereas 54% were singletons or doubletons. Rarity may be common in tropical ecosystems, the pattern we observed could appear as a consequence of an inappropriate sampling method and/or intensity (Magurran and Henderson 2011; Ariza *et al.* 2021a). The high diversity and evenness of the Carabidae community in the CWS indicate that the assemblage is well preserved with the present habitat conditions and it is necessary to maintain the same habitat conditions in CWS.

5.2.2. Seasonality

The overall abundance of Carabidae peaked during the wet season. Similar patterns of high abundance during the wet season have been reported from the Colombian tropical dry forest ecosystem (Ariza *et al.* 2021a; Ariza *et al.* 2021b). Ariza *et al.* (2021a) suggested that canopy cover, litter depth, soil and

air temperatures were important in structuring the Carabidae assemblages in Colombia. These factors were not verified in our study. Rainfall and temperature are the basic factors influencing abundances of most of the carabid species (Rainio 2013). These factors may play an important role in dry habitat of Chinnar. The population of ground beetles increases with precipitation and is significant during wetter months, and rainfall is related to abundance in terms of leaf fall, litter moisture and decomposition of litter (Reshma *et al.* 2020).

Cyclicus elegans and *Elaphropus nigellus* were the seasonal species which showed higher dominance in the wet season in CWS. Currently, no details are known about the life biology, prey resources, and feeding preferences of Carabidae at species level in CWS. More specific information is needed for ascertaining the causes of seasonal variation in the study region.

Chapter 6

CONCLUSION

6. CONCLUSION

6.1. Taxonomy

First time data on taxonomy of Carabidae in a dry deciduous forests in Chinnar region of south WGs also from Indian subcontinent is provided. A checklist and pictorial key of the Carabidae is also provided.

Checklist reveals the presence of 52 species, comprising 11 subfamilies, 19 tribes and 31 genera. Two first reports (*Stenolophus lucidus*, *Amblystomus aenescens*) from India and four first south Indian records (*Stenolophus bajaurae, Amblystomus indicus, Trigonotoma oberthueri, Elaphropus politus*) reveals that similar studies in other dry forests in the WGs might disclose new additions to the species lists for the south Indian region. Verified specimens are deposited at Western Ghats Regional Centre (ZSI-WGRC) Kozhikode ZSI, Calicut station.

Five species (*Ophoniscus puneensis, Caelostomus sculptipennis, Pseudoclivina costata, Elaphropus nigellus, E. nilgiricus*) endemic to the WGs were recorded from the study region.

Seventeen species (*Abacetus haplosternus, Allosiopelus punctatipennis, Amblystomus aenescens, A. fuscescens, A. indicus, Apristus subtransparens, Craspedophorus angulatus, Dioryche cuprina, Dyschirius paucipunctus, Elaphropus politus, Parophonus acutangulus, P. indicus, Pseudognathaphanus rusticus, Stenolophus bajaurae, S. lucidus, S. quinquepustulatus,* and

Trigonotoma oberthueri) not recorded from moist south WGs and present in dry WGs.

6.2. Ecology

First time data on community dynamics of Carabidae in a dry forest in the Chinnar region of south WGs also from Indian mainland is provided. Study reveals the community composition of Carabidae in dry forest in the WGs. Thirty nine species were reported with light trap method. *Amblystomus indicus, A. fuscescens,* and *Elaphropus nigellus, Anchista fenestrata* are the dominant species and, Harpalinae, Trechinae and Lebiinae are the dominant subfamilies in the light trap collections in CWS.

Thirteen species collected using pitfall method in CWS. *Omphra pilosa* and *Cyclicus elegans* are the dominant species, Anthiinae, Lebiinae are the dominant subfamilies in the pitfall trap collections in CWS.

Overall abundance of Carabidae exhibited distinct seasonality with high abundance during wet seasons in CWS. Based on literature temperature, rainfall, light intensity, soil humidity, and availability of prey resources are the major factors influencing the abundance of Carabidae. No details are known about the life biology, prey resources, or feeding preferences of Carabidae at species level in CWS. Species specific information is needed to understand the reasons for the seasonal variation and dominance of specific species and subfamilies in the study region.

Chapter 7

RECOMMENDATION

7. RECOMMENDATION

7.1 Taxonomy

First time data on taxonomy of Carabidae in the dry deciduous forest region in the Western Ghats from the Indian subcontinent is provided. Present study reveals the presence of 52 species in the dry deciduous forests of Chinnar with 17 species were recorded from the dry WGs region are not reported from the moist part of WGs. Five endemic species from the WGs region, two first reports of Carabidae from India and four first reports from south India are recorded. Similar studies on the Carabidae from the different forest vegetation types in India are recommended and will disclose new additions to the species lists from India.

7.2 Ecology

For the first time, data on the Ecology of Carabidae from the dry deciduous forests in the Western Ghats and from Indian mainland is provided. The present study showed that overall abundance of Carabidae exhibited distinct seasonality with high abundance during wet season. Carabid abundance and richness are related to biotic and abiotic factors such as, temperature, rainfall, light intensity, soil humidity, and availability of prey resources. Further ecological studies on the relationship between above parameters are needed. Species specific information on the life biology of the dominant species is needed to understand the reasons for dominance in the study region.

This page intentionally left blank

Chapter 8

REFERENCES

8. REFERENCES

Abdullah, F., and Shamsulaman, K. (2010). Ground Beetle (Coleoptera: Carabidae) at Lanjak Entimau, Sarawak, Malaysia. *Journal of Entomology*, 7: 44–53.

Abhitha, P. (2010). Forest litter faunal diversity and abundance in relation to litter chemical quality and systematics of Carabid beetles. PhD Thesis. Forest Research Institute University Dehra Dun, Uttarakhand, 176 pp. (Unpublished)

Abhitha, P., Sabu, K.T., and Tian, M. (2009). Termitophilous *Orthogonius* from South India. *Oriental Insects*, 43: 369–378.

Abhitha, P., Sabu, K.T., and Zhao, D. (2008). A new *Helluodes* Westwood species from Western Ghats with notes on habitat, distribution and phylogenetic relationships of genera *Helluodes* Westwood and *Physocrotaphus* Parry of the tribe Physocrotaphini Chaudoir (Insecta: Coleoptera: Carabidae: Anthiinae). *Zootaxa*, 1745: 30–46.

Akhil, S.V. (2019). Taxonomy, Ecology and DNA barcoding of Carabidae (Insecta: Coleoptera) of Nilgiri Biosphere Reserve. PhD Thesis. University of Calicut, 277pp. (Unpublished)

Akhil, S.V., and Sabu, K.T. (2019a). New Species of bombardier beetles of the genus *Styphlomerus* Chaudoir, 1875 (Coleoptera: Carabidae) from Southern India, with a Key to the Indomalayan and Palearctic Species. *The Coleopterists Bulletin*, 73(2): 465–471.

Akhil, S.V., and Sabu, K.T. (2019b). Bombardier beetles of the genus *Pheropsophus* Solier, 1833 (Carabidae: Brachininae: Brachinini) from Indian Subcontinent. *Zootaxa*, 4608 (1): 065–089. https://doi.org/10.11646/zootaxa.4608.1.3

Akhil, S.V., and Sabu, K.T. (2020). *Physoglossus:* A new ground beetle genus of the enigmatic tribe Physocrotaphini Chaudoir, 1862 (Carabidae: Anthiinae) from the Western Ghats, a global hotspot of Biodiversity in south west India. *Journal of Insect Biodiversity*, 015(2):060–065.

Akhil, S.V., and Sabu, K.T. (2021). Two new species of apterous endemic ground beetle genus *omphra* Dejean (Carabidae: Anthiinae: Helluoniini) from India. *Oriental Insects*: 2–14.

Akhil, S.V., and Sabu, K.T. (2021). Two new species of apterous endemic ground beetle genus omphra Dejean (Carabidae: Anthiinae: Helluoniini) from India. *Oriental Insects:* 2–14.

Akhil, S.V., Divya, M., and Sabu, K.T. (2019). Two new species of *Macrocheilus* Hope (Carabidae: Anthiinae: Helluonini) from the south Western Ghats of India. *Journal of Insect Biodiversity*, 009 (1): 028–033.

Akhil, S.V., Divya, M., and Sabu, K.T. (2020). Bombardier beetles of genus *Brachinus* Weber, 1801 (Carabidae : Brachininae : Brachinini) from India. *Zootaxa*, 4816(4) :576–600.

Alcock, J. (1976). The behaviour of the seed-collecting larvae of a carabid beetle (Coleoptera). *Journal of Natural History*, 10: 367–375.

Allegro, G., and Bulirsch, P. (2012). Catalogo topografico dei Dyschiriini del Piemonte (Italia nord-occidentale), con tabella di determinazione delle specie presenti in Italia (Coleoptera: Carabidae: Scaritinae). *Rivista piemontese di Storia natural*, 33: 235–267.

Allen, R.T. (1979). *The occurrence and importance of ground beetles in agricultural and surrounding habitats.* In: T. L. Erwin, G. E. Ball, and D. R. Whitehead (eds.), Carabid Beetles: Their Evolution, Natural History and Classification. Dr. W. Junk Publ., The Hague-Boston- London, pp. 485–505.

Alluaud, C. (1917). Les carabiques de la faune alpine des hautes montagnes de l'Afrique orientale. *Annales de la Société Entomologique de France*, 86: 73–116.

Alluaud, C. (1936). Carabidae recueillis à Madagascar par MM. Seyrig, G. Olsoufieff, Vadon, R. Catala, etc. *Afra, Cahiers d'Entomologie*, 11: 1–13.

Andersen, A.N. (1995). A Classification of Australian Ant Communities, Based on Functional Groups Which Parallel Plant Life-Forms in Relation to Stress and Disturbance. *Journal of Biogeography*, 22(1): 15–29.
Andrewes, H.E. (1919a). On the Types of Oriental Carabidae in the British Museum, and in the Hope Department of the Oxford University Museum. *The Transactions of the Entomological Society of London*, 119–216.
Andrewes, H.E. (1919b). Papers on Oriental Carabidae- I. *The Annals and Magazine of Natural History* 9, 3(47): 469–483.
Andrewes, H.E. (1919c). Note on Bonelli's "Tableau Synoptique." *Transactions of the Entomological Society of London*, 89–92.
Andrewes, H.E. (1919d). Papers on Oriental Carabidae II. *The Annals and magazine of natural history*: 1–16.
Andrewes, H.E. (1920a). Notes sur les carabiques orientaux. II. *Annales de la Société Entomologique de Belgique*, (60): 106–111.
Andrewes, H.E. (1920b). Papers on Oriental Carabidae - IV. *Annals and Magazine of Natural History*, 9: 445–455.
Andrewes, H.E. (1920c). Papers on Oriental Carabidae - V. *The Annals and Magazine of Natural History*, 9: 493–506.
Andrewes, H.E. (1921a). Notes on synonymy and on some types of Oriental Carabidae in various foreign collections. *The Transactions of the Entomological Society of London*: 145–195.
Andrewes, H.E. (1921b). Notes sur les carabiques orientaux. III. *Annales de la Société Entomologique de Belgique*, 61: 202–210.
Andrewes, H.E. (1921c). The fauna of an island in the Chilka Lake. Carabidae. *Records of the Indian Museum*, 22: 339–348.
Andrewes, H.E. (1921d). The Oriental species of the Genus *Callistomimus* (Coleoptera, Carabidae). *Proceedings of the Zoological Society of London*: 233–248.
Andrewes, H.E. (1922). Papers on Oriental Carabidae–VII. *The Annals and Magazine of Natural History*, 9(52): 161–169, 281–295.
Andrewes, H.E. (1923a). On the types of Carabidae described by Schmidt-Göbel in his Faunula Coleopterorum Birmaniae. *The Transactions of the Entomological Society of London*, 1–63.
Andrewes, H.E. (1923b). Papers on Oriental Carabidae- XI. *The Annals and Magazine of Natural History*, 9: 442–455.
Andrewes, H.E. (1923c). Papers on Oriental Carabidae - IX. *The Annals and magazine of natural history:* 335–344.
Andrewes, H.E. (1923d). Papers on Oriental Carabidae - X. *The Annals and Magazine of Natural History including Zoology, Botany and Geology*, 9 (12): 212 – 223.
Andrewes, H.E. (1923e). Descriptions of some new Carabidae from Ceylon (Part I). *Spolia Zeylanica (The Ceylon Journal of Science, Section B - Zoology and Geology)*, 12(1) (1922): 223–251.
Andrewes, H.E. (1923f). Papers on Oriental Carabidæ.—XII. *Annals and Magazine of Natural History, Series 9*, 12: 72, 679–690.
Andrewes, H.E. (1924a). Papers on Oriental Carabidae- XIV. *The Annals and Magazine of Natural History*, 9: 585–593.
Andrewes, H.E. (1924b). *Mission Guy Babault dans les provinces centrales de l'Inde et dans la région occidentale de l'Himalaya 1914. Insectes coléoptères Carabidae*. Paris, Lahure, 125 pp, 4 pls.
Andrewes, H.E. (1924c). Part 2: Systematic list and description of a new species. Pp. 468–472. In: Andrewes H.E. and Scott H.: A list of Carabidae from Macao, South China, with a description of a new species and biological notes. *The Annals and Magazine of Natural History*, 13: 466–472.

Andrewes, H.E. (1924d). On the Oriental Carabidae of the "Reise Novara". *The Transactions of the Entomological Society of London*, 459–468.
Andrewes, H.E. (1924e). A list of Carabidae from Macao, South China, with a description of a new species and biological notes. *The Annals and Magazine of Natural History including Zoology, Botany and Geology*, 9 (13): 466–472.
Andrewes, H.E. (1924f). Description of some new Carabidae from Ceylon Part II. *Spolia Zeylanica (The Ceylon Journal of Science, Section B - Zoology and Geology)*, 13(1): 129–141.
Andrewes, H.E. (1925). A revision of Oriental species of genus *Tachys*. *Annali del Museo Civico di Storia Naturale "Giacomo Doria",* 51: 327–502, pls III, IV.
Andrewes, H.E. (1926a). On a collection of Carabidae from Kumaon–Tibetan frontier. *The Entomologist's Monthly Magazine*, (62): 65–80.
Andrewes, H.E. (1926b). A Catalogue of Philippine Carabidae. *The Philippine Journal of Science*, 31: 345–361.
Andrewes, H.E. (1926c). Papers on Oriental Carabidae – XVII. *The Annals and Magazine of Natural History*, 17: 371–381.
Andrewes, H.E. (1926d). Papers on Oriental Carabidae- XVI. *The Annals and Magazine of Natural History*, 17: 252–259.
Andrewes, H.E. (1927). Papers on Oriental Carabidae- XIX. *The Annals and Magazine of Natural History*, 9: 97–111.
Andrewes, H.E. (1928). On the types of Oriental Carabidae described by V. de Motchulsky. *The Transactions of the Entomological Society of London*, 76: 1–24.
Andrewes, H.E. (1929). *The fauna of British India, including Ceylon and Burma. Coleoptera. Carabidae. Vol. 1. Carabinae.* London, Taylor and Francis, xviii + 431 pp, 10 pls, 1 map.
Andrewes, H.E. (1930). *Catalogue of Indian Insects (Part 18: Carabidae).* Government of India Central Publication Branch, Calcutta, xxi+389 pp.
Andrewes, H.E. (1931a). Papers on Oriental Carabidae- XXV. *The Annals and Magazine of Natural History* 10, 7: 513–528.
Andrewes, H.E. (1931b). Some keys to the Sumatran Carabidae, together with descriptions of further new species. *Zoologische Mededelingen*, 14: 54–78.
Andrewes, H.E. (1931c). On the Carabidae of Mt. Kinabalu. *Journal of the Federated Malay Museums*, 16: 431–485.
Andrewes, H.E. (1932a). Papers on Oriental Carabidae.– XXVI. *The Annals and Magazine of Natural History*, 9 (10): 133–146.
Andrewes, H.E. (1932b). Keys to some Indian genera of Carabidae. – I. Genus Cymindis. *Stylops*, 1: 126–127.
Andrewes, H.E. (1933). Entomological investigations on the spike disease of sandal (8). Carabidae (Col.). *The Indian Forest Records* (Entomology), 18: 1–21, 3 pls.
Andrewes, H.E. (1934). Keys to some Indian genera of Carabidae (Col.). IV. The genus *Calathus*. *Stylops*, 3: 209–222.
Andrewes, H.E. (1935). *The fauna of British India, including Ceylon and Burma. Coleoptera. Carabidae. Vol. II. Harpalinae*. Taylor & Francis, London, 323pp.
Andrewes, H.E. (1936a). Descriptions of some new Carabidae from Ceylon (Part III). *Spolia Zeylanica*, 19: 201–209.
Andrewes, H.E. (1936b). Keys to some Indian genera of Carabidae (Col.) VI. The genera *Drypta* and *Desera*. *Proceedings of the Royal Entomological Society of London, ser. B*, 5: 134–136.
Andrewes, H.E. (1936c). On some new species of Carabidae, chiefly from Java (II). *Treubia*, 15 (3): 211-224.
Andrewes, H.E. (1936d). Papers on Oriental Carabidae.– XXX. *The Annals and Magazine of Natural History*, 18(10): 54–67.

Andrewes, H.E. (1937). Keys to some Indian genera of Carabidae (Coleoptera): the genera *Pericalus* and *Catascopus*. *Proceedings of the Royal Entomological Society of London* B, 6: 185–190.
Andrewes, H.E. (1938). Papers on the Oriental Carabidae. XXXV. On the types of Indian genera. *The Annals and Magazine of Natural History*, 3: 128–139.
Andrewes, H.E. (1939). Papers on the Oriental Carabidae. XXXV. On the types of Indian genera. *Annals and Magazine of Natural History*, 11(3): 128–139.
Andrewes, H.E. (1940a). Keys to some Indian Genera of Carabidae X. Genus *Oodes. Proceedings of the Royal Entomological Society of London*: 203–208.
Andrewes, H.E. (1940b). Papers on Oriental Carabidae XXXVI. *The Annals and Magazine of Natural History*, 11(5): 536.
Andrewes, H.E. (1941). Papers on Oriental Carabidae–XXXVII. *Annals & Magazine of Natural History*, 11(7): 307–317.
Andrewes, H.E. (1942). Keys to some Indian genera of Carabidae (Col.). XI. The genus *Abacetus. The Proceedings of the Royal Entomological Society of London (B)*, 11: 21–35.
Andrewes, H.E. (1947). Entomological results from the Swedish expedition 1934 to Burma and British India. Coleoptera: Carabidae. Collected by René Malaise. *Arkiv för Zoologi*, 38: 1–49.
Anichtchenko, A. (2012). A new species of the genus *Badister* (s. str.) Clairville, 1806 (Coleoptera: Carabidae: Licinini) from North India. *Kavkazkiy Entomologicheskiy Byulleten*, 8(2): 203–204.
Anichtchenko, A. (2022). Carabidae of the World. Available from: http://carabidae.org/ (accessed 3 March 2019)
Anichtchenko, A., and Kirschenhofer, E. (2017). To the knowledge of Oriental species of subgenus *Pseudochlaeniellus* Jeannel, 1949 (Coleoptera, Carabidae, Chlaenius). *Zootaxa*, 4231 (2): 187–202.
Anichtchenko, A., and Shavrin, A.V. (2013). The type specimens of Coleoptera (Insecta) deposited in the beetle collection (DUBC) of Daugavpils University, Latvia. *Acta Biologica Universitatis Daugavpiliensis*, 13(2): 1–10.
Anu, A., Sabu, K.T., and Vineesh, P.J. (2009). Seasonality of litter insects and relationship with rainfall in a wet evergreen forest in the south Western Ghats. *Journal of Insect Science*, 9:46.
Ariza, G.M., Jácome, J., and Kotze, D.J. (2021b). Carabid beetles of tropical dry forests display traits that cope with a harsh environment. *International Journal of Tropical Insect Science*, 41:3011–3021.
Ariza, G.M., Jácome, J., Esquivel, H.E., and Kotze, D.J. (2021a). Early successional dynamics of ground beetles (Coleoptera, Carabidae) in the tropical dry forest ecosystem in Colombia. *ZooKeys*, 1044: 877–906.
Ashly, K., and Sabu, K.T. (2021). The Indian Platyninae- A Checklist (Coleoptera: Carabidae). *Indian Journal of Entomology*, 1–29.
Atamehr, A. (2013). Ground beetles (Coleoptera: Carabidae) of Azarbaijan, Iran. *Turkish Journal of Zoology*, 37: 188–194.
Baars, M.A. (1979). Catches in pitfall traps in relation to mean densities of carabid beetles. *Oecologia* (Berl.): 41, 25–46.
Baehr, M. (2003). On a collection of ground beetles from Gambia (Insecta, Coleoptera, Carabidae). *Entomofauna*, 28: 397–424.
Balduf, W.V. (1935). *The bionomics of entomophagous Coleoptera*. New York. John S. Swift, 220pp.
Balkenohl, M. (1994). New species and records of Scaritinae from the Himalayas (Coleoptera, Carabidae). *Revue Suisse de Zoologie*, 101: 19–41.

Balkenohl, M. (2001). *Key and Catalogue of the Tribe Clivinini from the Oriental realm with revisions of the genera Thliboclivina Kult and Trilophidius Jeannel (Insecta, Coleoptera, Carabidae, Scarititae).* Pensoft Publishers, Sofia-Moscow, 83 pp.

Ball, G.E. (1979). *Conspectus of carabid classification: history, holomorphology, and higher taxa.* Pp. 63–111. In: Erwin, T. L., Ball, G. E., Whitehead, D. R., and Halpern, A. L. (Eds). *Carabid beetles: their evolution, natural history, and classification.* Proceedings of the First International Symposium of Carabidology Smithsonian Institution, Washington D.C. August 21, 23, and 25, 1976. Dr W. Junk bv Publishers, The Hague. 635 pp.

Basilewsky, P. (1953). *Carabidae (Coleoptera Adephaga).* Exploration du Parc National de l'Upemba. Mission G.F.de Witte en collaboration avec W. Adam, A. Janssens, L. Van Meel et R. Verheyen (1946–1949). Fasicule 10, Institut des Parcs Nationaux du Congo Belge, Bruxelles, 252 pp, 10 pls.

Basilewsky, P. (1956). Coléoptères Carabidae recueillis par Mr. et Mme. J. Bechyné en Afrique Occidentale Française. *Entomologische Arbeiten aus dem Museum G. Frey Tutzing bei München*, 7: 439–489.

Bates, H.W. (1869). On Coptodera and the allied genera. *Entomologists Monthly Magazine*, 6: 69–80.

Bates, H.W. (1873). On the Geodephagous Coleoptera of Japan. *Transactions of the Entomological Society of London*: 219–322.

Bates, H.W. (1874a). Notes on Cicindelidae and Carabidae, and descriptions of new species (No. 17). *The Entomologist's Monthly Magazine*, 11: 22–28.

Bates, H.W. (1874b). Notes on Cicindelidae and Carabidae, and descriptions of new species (No. 18). *The Entomologist's Monthly Magazine,* 11: 95–101.

Bates, H.W. (1876). Additions to the list of Geodephagous Coleoptera of Japan, with synonyms and other remarks. *Transactions of the Entomological Society of London*, 1–5.

Bates, H.W. (1883). Supplement to the geodephagous Coleoptera of Japan, chiefly from the collection of Mr. George Lewis, made during his second visit, from February, 1880, to September, 1881. *The Transactions of the Entomological Society of London*: 205–290, pl. xiii.

Bates, H.W. (1886). On the geodephagous Coleoptera collected by Mr. George Lewis in Ceylon. *The Annals and Magazine of Natural History*, XVII (5) 17: 68–212.

Bates, H.W. (1889a). Viaggio di Leonardo Fea in Birmania e regioni vicine. XVI. On some Carabidae from Burma collected by Mr. L. Fea. *Annali del Museo Civico di Storia Naturale di Genova*, 27: 100–111.

Bates, H.W. (1889b). Contributions à la faune Indo-Chinoise. 3e mémoire. *Annales de la Société Entomologique de France*, 9*(*6): 261–286.

Bates, H.W. (1889c). On new species of the coleopterous family Carabidae, collected by Mr. J. H. Leech in Kashmir and Baltistan. *Proceedings of the Zoological Society of London*, 57: 210–215.

Bates, H.W. (1891a). List of the Carabidae (Ord. Coleoptera) obtained by père Cardon in Chota-Nagpore. *Annales de la Société Entomologique de Belgique, Comptes-Rendus des Séances*, 35: 323–340.

Bates, H.W. (1891b). *Coleoptera In: Supplementary appendix to travels amongst the Great Andes of the Equator by Edward Whymper with contributions by H.W. Bates, T.G. Bonney, G.A. Boulenger, Peter Cameron, F. Day, W.L. Distant, A.E. Eaton, F.D. Godman, H.S. Gorham, Martin Jacoby, E.J. Miers, A. Sidney Ollif, O. Salvin, David Sharp, T.R.R. Stebbing. Illustrated.* John Murray, London: 7–39.

Bates, H.W. (1892a). Viaggio di Leonardo Fea in Birmania e regioni vicine. XLIV. List of the Carabidae. *Annali del Museo Civico di Storia Naturale di Genova*, 32: 267–428.

Bates, H.W. (1892b). Coléoptères du Bengale occidental. 20e mémoire. Seconde liste des Carabidae. *Annales de la Société Entomologique de Belgique*, 36: 230–233.

Baudi di Selve, F. (1864). Coleopterorum messis in insula Cypro et Asia minore ab Eugenio Truqui congregatae recensitio: de Europaeis notis quibusdam additis. Pars prima. *Berliner Entomologische Zeitschrift*, 8: 195–233.

Bennett, F.D., and Yaseen, M. (1987). Investigations for the possibilities of bio-logical control of slugs in Honduras. Progress report for October 1984–April 1985. *CEIBA*. 28: 229–234.

Blackburn, T. (1888). Further notes on Australian Coleoptera, with descriptions of new species. *Transactions and Proceedings and Report of the Royal Society of South Australia,* 10: 177–287.

Blackwelder, R.E. (1945). Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America, Part I. *Bulletin of the United States National Museum*, 185: 1–188.

Bonelli, F.A. (1810). Observations entomologiques. Premiere partie (Cicindéletes et portion des carabiques) (with the "Tabula synoptica exhibens genera carabicorum in sectiones et stirpes disposita"). Turin. 58 pp. + 1 table. Note. The paper was reissued in 1812, without the "Tabula Synoptica," in *Memorie della Reale Accademia della Scienze di Torino*, 18: 21–78.

Bonelli, F.A. (1813). Observations entomologiques. Deuxieme partie. *Memorie della Reale Accademia della Scienze di Torino*, 20: 433–484.

Bouchard, J. (1903). Insectes recueillis par M. le Professeur Dr Forster à Bornéo, Java et Sumatra (Palembang). Coléoptères carabiques. *Annales de la Société Entomologique de France*, 72: 169–176.

Bousquet, Y. (2012). Catalogue of Geadephaga (Coleoptera, Adephaga) of America, north of Mexico. *ZooKeys*, 245: 1–1722.

Brandmayr, P., Giorgi, F., Casale, A., Giorgio, C., Mariotti, L., Taglianti, A., Weber, F., and Pizzolotto, R. (2013). Hypogean carabid beetles as indicators of global warming?. *Environmental Research Letters*, 8(4): 11.

Broun, T. (1880). *Manual of the New Zealand Coleoptera [Part I]*. Colonial Museum and Geological Survey Department, Wellington, xix: 651 pp.

Brown, K.S.J. (1997). Diversity, disturbance, and sustainable use of Neotropical forests: Insects as indicators for conservation monitoring. *Journal of Insect Conservation*, 25–42.

Brullé, A. (1834). In: Audouin J.V. and Brullé G.A.: *Histoire naturelle des insectes, traitant de leur organisation et de leurs moeurs en général, et comprenant leur classification et la description des espèces. Tome IV. Coléoptères.* I. Paris, F.D. Pillot, 8 + 479 pp.

Bulirsch, P. (2009). Contribution to the Asian and Afrotropical species of the genus Dyschiriodes (Coleoptera: Carabidae: Scaritinae). *Acta Entomologica Musei Nationalis Pragae*, 49(2): 559–576.

Bulirsch, P. (2011). Notes on Afrotropical species of the genus *Dyschiriodes* (Coleoptera: Carabidae: Scaritinae) with descriptions of three new taxa**.** *Studies and Reports Taxonomical Series*, 7 (1–2): 1–12.

Bulirsch, P. (2018). Three new species of the tribe Dyschiriini (Coleoptera: Carabidae: Scaritinae) from Asia. *Studies and Reports Taxonomical Series*, 14 (2): 229–236.

Bulirsch, P., and Stachowiak, M. (2017). Overview and new records of the species of the tribes Dyschiriini and Clivinini from Iraq (Coleoptera: Carabidae: Scaritinae*). Zookeys*, 672: 135–144.

Capinera, J.L. (2008). *Encyclopedia of Entomology. 2nd Ed*. Springer Science & Business Media, Heidelberg, 2061pp.

Castelnau, F.L.de Laporte (1835). Études entomologiques, ou description d'Insectes nouveaux et observations sur leur synonymie. *Première partie. Méquinon-Marvis*, Paris, 1–159.

Castelnau, F.L.de Laporte (1840). *Histoire Naturelle des Insectes, Animaux articules. Coleopteres.Volume 1*. Paris: Duménil, cxxv + 24 pp.

Chaitanya, R., Akshay, K., Daniel, G.C., Nilanjan, M., Avrajjal, G., and Varad, G. (2018). Herpetofauna of the Meghamalai Wildlife Sanctuary, Southern Western Ghats, India: An updated checklist with annotations on taxonomy and nomenclature. *Journal of the Bombay Natural History Society*, 115: 21–37.

Chanu, N.Y., and Swaminathan, R. (2017). "Notes on Species of the Genus *Chlaenius* Bonelli, 1810 (Coleoptera: Carabidae, Chlaeniini) from Four Agro-climatic Zones of Rajasthan, with Description of Two New Species." *Zootaxa*, 4237 (3): 545–566.

Chaudoir, M. de. (1856). Memoire sur la famille des carabiques. 6-e partie. *Bulletin de la Socitte' Impe'riale des Naturalistes de Moscou,* 29 (3): 187–291.

Chaudoir, M.de. (1842). Description de quelques genres nouveaux de la famille des carabiques. *Bulletin de la Societe Imperiale des Naturalistes de Moscou*, 15: 832–857.

Chaudoir, M.de. (1843). Carabiques nouveaux. *Bulletin de la Société Impériale des Naturalistes de Moscou,* 16: 671–791.

Chaudoir, M.de. (1844). Trois mémoires sur la famille des Carabiques. *Bulletin de la Société Imperiále des Naturalistes de Moscou*, 17: 415–479.

Chaudoir, M.de. (1846). Carabiques nouveaux de la Crimée. Pp. 227–234. In: Chaudoir M. de and Hochhuth H.: *Énumération des carabiques et hydrocanthares, recueillis pendant un voyage au Caucase et dans les provinces transcaucasiennes par Baron M. de Chaudoir et le Baron A. de Gotsch.* Kiew, J. Wallner, 268 pp.

Chaudoir, M.de. (1847). Observations I. Kiew: J. Wallner, 16 pp.

Chaudoir, M.de. (1848). Mémoire sur la famille des carabiques. Première partie. *Bulletin de la Société Impériale des Naturalistes de Moscou,* 21(1): 3–134.

Chaudoir, M.de. (1850). Mémoire sur la famille des carabiques. 2e partie. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 23(1): 1–460.

Chaudoir, M.de. (1852). Mémoire sur la famille des carabiques. 3 Partie. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 25 (1): 1–259.

Chaudoir, M.de. (1854). Mémoire Sur la Famille des Carabiques. *Bulletin de la Société Impériale des Naturalistes de Moscou,* 27 (2): 325.

Chaudoir, M.de. (1855). Mémoire sur la famille des carabiques. 5-ème partie. *Bulletin de la Société Impériale des Naturalistes de Moscou,* 28: 1–110.

Chaudoir, M.de. (1856). Mémoire sur la famille des carabiques. 6-e partie. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 29(3): 187–291.

Chaudoir, M.de. (1857). Mémoire sur la famille des carabiques. 6-e partie. (Continuation.). *Bulletin de la Société Impériale des Naturalistes de Moscou,* 30 (3): 1–64.

Chaudoir, M.de. (1859). Beitrag zur Kenntnis der europäischen Feroniden. *Stettiner entomologische zeitschrift*, 20: 126.

Chaudoir, M.de. (1861). Beitrag zur Kenntnis einiger Carabicinen- Gattungen. *Berliner Entomologische Zeitschrift*, 5: 116–131.

Chaudoir, M.de. (1862). Matériaux pour servir l'etude des Cicindélètes et Carabiques 3-e partie. *Extraits du Bulletin de la Société Impériale des Naturalist de Moscou,* 35(4): 275–320.

Chaudoir, M.de. (1863). Description de quelques nouvelles especes de Cicindeletes et de carabiques. *Annales de la Societe Entomologique de France*, 4(3): 447–450.

Chaudoir, M.de. (1864). Notes sur les genres Dromica, Trycondila et Collyris. *Revue et Magasin de Zoologie Pure et Appliquée*, (2) 16: 7–11, 37–43, 72–77, 104–108.

Chaudoir, M.de. (1865). *Catalogue de la collection de cicindélètes de M. le baron de Chaudoir.* Bruxelles: J. Nys., 64 pp

Chaudoir, M.de. (1866). Monographie du genre Platyderus. *Annales de la Société Entomologique de France*, (4) 6: 105–115.

Chaudoir, M.de. (1867). Description de carabiques nouveaux. *Annales de la Société Entomologique de France*, (4) 7: 259–262.

Chaudoir, M.de. (1868). Révision des Trigonotomides. *Annales de la Société Entomologique de Belgique*, 11: 151–165.
Chaudoir, M.de. (1869). Essai monographique sur le genre Abacetus Dejean. *Bulletin de la Societe imperial des naturalistes de Moscou*, 42(2): 355–401.
Chaudoir, M.de. (1870). Monographie des Lébiides. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 43(3): 111–255.
Chaudoir, M.de. (1871a). Monographie des Lébiides. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 43 (3–4): 111–255.
Chaudoir, M.de. (1871b). Monographie des Lébiides (Continuation). *Bulletin de la Société Impériale des Naturalistes de Moscou*, 44: 1–87.
Chaudoir, M.de. (1871c). Remarques sur le catalogue de Mm. de Harold et Gemminger. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 44: 279–287.
Chaudoir, M.de. (1871d). Essai monographique sur les orthogoniens. *Annales de la Société Entomologique de Belgique*, 14: 95–130.
Chaudoir, M.de. (1872a) Essai monographique sur le groupe des pogonides. *Annales de la Societe Entomologique de Belgique*, 14: 21–61.
Chaudoir, M.de. (1872b). Descriptions d'espèces nouvelles de carabiques de la tribu des troncatipennes, et remarques synonymiques. *Revue et Magasin de Zoologie Pure et Appliquée*, (2) 23: 101–107, 138–143, 168–172, 212–221, 241–250.
Chaudoir, M.de. (1872c). Essai monographique sur les drimostomides et les cratocérides et description d'un genre nouveau de morionides. *Annales de la Société Entomologique de Belgique*, 15: 5–24.
Chaudoir, M.de. (1873). Monographie des callidides. *Annales de la Societe Entomologique de Belgique*, 15: 97–204.
Chaudoir, M.de. (1874). Matériaux pour servir à l'étude des féroniens. Suite. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 48(1): 1–34.
Chaudoir, M.de. (1875). Genres aberrants du groupe des Cymindides. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 49(3): 1–61.
Chaudoir, M.de. (1876a). Monographie de Brachynides. *Annales de la Société Entomologique de Belgique*, 19: 11–104.
Chaudoir, M.de. (1876b). Monographie des Chléniens. *Annali del Museo Civico di Storia Naturale di Genova*, 8: 3–315.
Chaudoir, M.de. (1876c). Etude monographique des masoréides, des tetragonodérides et du genre Nematotarsus. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 51(3): 1–84.
Chaudoir, M.de. (1876d). Monographie des siagonides. *Bulletin de la Societe Imperiale des Naturalistes de Moscou*, 50(1): 62–125.
Chaudoir, M.de. (1877). Genres nouveaux et espèces inédites de la famille des Carabiques. Troncatipennes. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 52(2): 188–268.
Chaudoir, M.de. (1878). Essai monographique sur les Panageides. *Annales de la Societe Entomologique de Belgique*, 21: 83–186.
Chaudoir, M.de. (1879). Monographie des Scaritides (Scaritini). Premiere partie. *Annales de la Societe Entomologique de Belgique*, 22: 124–182.
Chaudoir, M.de. (1880). Essai monographique sur les Morionides. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 55(2): 317–384.
Chaudoir, M.de. (1881). Monographie des Scaritides (Scaritini). Deuxieme partie. *Annales de la Societe Entomologique de Belgique*, 23: 5–130.
Chaudoir, M.de. (1882). Monographie des oodides. 1re partie. *Annales de la Société Entomologique de France*, (6) 2: 317–378.

Chaudoir, M.de. (1883). *Description de carabiques nouveaux. Pp. 17–39. In: Coleopterorum novitates. Recueil spécialement consacré à l'étude des coléoptères.* Tom. I, livr. I. Rennes: Oberthür, 48 pp., 2 pls.

Cheng, W. (1999). Rhizosphere feedbacks in elevated CO2. *Tree Physiology*, 19: 313– 320.

Clifford, T.H. and Stephenson, W. (1975). *An Introduction to Numerical Classification.* Academic Press. New York- San Fransisco – London.

Clopton, R.E. (1991). A review of the Scaritinid beetles (Coleoptera: Carabidae: Scaritini) of Nebraska. *Transactions of the Nebraska Academy of Sciences*, 18: 53–65.

Crowson, R.A. (1981). *The Biology of the Coleoptera*. New York: Academic Press. 802 pp.

Csiki, E. (1927). *Carabidae: Carabinae. In Junk W, Schenkling S (Eds). Coleopterorum catalogus. Partes 91 et 92.* Junk, Berlin: 621 pp.

Csiki, E. (1928). *Carabidae: Mormolycinae, Harpalinae. In Junk W, Schenkling S (Eds). Coleopterorum catalogus. Partes 97 et 98.* W. Junk, Berlin: 345 pp.

Csiki, E. (1929). *Harpalinae III. (Pars 104). Pp. 348-527. In: Junk W. & Schenkling S.(eds): Coleopterorum Catalogus auspiciis et auxilio* W. Junk, Volumen III. Berlin: W. Junk: 1022 pp.

Csiki, E. (1930). *Carabidae: Harpalinae IV. In Junk W, Schenkling S (Eds). Coleopterorum catalogus. Pars 112*. W. Junk, Berlin: 529–737

Csiki, E. (1931). *Carabidae: Harpalinae V (Pars 115). In: Schenkling, S. (ed.): Coleopterorum Catalogus, Vol. 2, Carabidae 2,* W. Junk, Berlin: 739–1022.

Csiki, E. (1932a). *Carabidae: Harpalinae VI. In Junk W, Schenkling S (Eds). Coleopterorum catalogus. Pars 121*. W. Junk, Berlin: 1023–1278 224.

Csiki, E. (1932b). *Carabidae: Harpalinae VII. (Pars 124), W. Junk and S. Schenkling, eds., Coleopterorum catalogus, Volumen III. Carabidae III.* W. Junk, Berlin: 1279–1598.

Csiki, E. (1933a). *Carabidae: Harpalinae VIII. In Junk W, Schenkling S (Eds). Coleopterorum catalogus. Pars 126.* W. Junk, Berlin: 1599–1933.

Csiki, E. (1933b). *Carabinae: corrigenda et addenda. In Junk W, Schenkling S (Eds). Coleopterorum catalogus. Pars 127*. W. Junk, Berlin: 623–648.

Darlington, P.J. (1968). Carabid beetles of New Guinea, part 3 (covering tribes following Agonini in the order of the Junk-Schenkling Catalog). *Bulletin of the MCZ,* 137: 1–253.

Darlington, P.J. (1970). Coleoptera: Carabidae Including Cicindelinae. *Insects of Micronesia*, 15(1): 1–49.

Darlington, P.J. (1971). The carabid beetles of New Guinea. Part IV. General considerations; analysis and history of fauna; taxonomic supplement. *Bulletin of the Museum of Comparative Zoology*, 142: 129–337.

Dejean, P.F.M.A. (1821). *Catalogue de la collection de coléoptères de M. le Baron Dejean*. Crevot, Paris, viii + 136 + [2] pp.

Dejean, P.F.M.A. (1825). *Species général des coléoptères, de la collection de M. le Comte Dejean. Tome premier*. Crevot, Paris, xxx + 463 pp.

Dejean, P.F.M.A. (1826). *Species général des coléoptères, de la collection de M. le Comte Dejean. Tome second.* Crevot, Paris, viii + 501 pp.

Dejean, P.F.M.A. (1828). *Species général des coléoptères, de la collection de M. le Comte Dejean. Tome troisième. Méquignon-Marvis,* Paris, vii + 556 pp.

Dejean, P.F.M.A. (1829). *Species général des coléoptères, de la collection de M. le Comte Dejean. Tome quatrième.* Paris, Méquignon-Marvis, vii + 520. pp.

Dejean, P.F.M.A. (1831). *Species général des coléoptères, de la collection de M. le Comte Dejean. Tome cinquième*. Paris, Méquignon-Marvis, viii + 883 pp.

Desender, K., Ervynck, A., and Tack, G. (1999). Beetle diversity and historical ecology of woodlands in Flanders. *Belgian Journal of Zoology,* 129(1): 139–156.

Deuve, T. (1980a). Description d'un Imaibius nouveau du Cachemire. *Bulletin de la Societe Entomologique de Mulhouse,* 37.

Deuve, T. (1980b). Description d'un Trechus Clairv. nouveau du Cachemire et notes sur quelques especes asiatiques mal connues (Col. Carabidae). *Nouvelle Revue d'Entomologie,* 10: 247–250.
Deuve, T. (1982a). Carabes nouveaux ou peu connus de l'Himalaya occidental (Col. Carabidae). *Bulletin de la Societe Entomologique de Mulhouse*, 1982: 7–8.
Deuve, T. (1982b). Deux nouveaux Trechus de l'Himalaya occidental (Col. Caraboidea Trechinae). *Nouvelle Revue d'Entomologie*, 12: 25–27.
Deuve, T. (1982c). Un Trechus nouveau du Cachemire Indien (Col. Caraboidea). *Nouvelle Revue d'Entomologie*, 12: 223–224.
Deuve, T. (1986). Deux nouveaux coleopteres carabiques de la region Himalayenne (Coleoptera, Caraboidea, Harpalidae). *Revue Francaise d'Entomologie* (N.S.), 8: 16–164.
Deuve, T. (2001). Nouveaux Trechinae des Philippines, du Sikkim, du Nepal, de la Chine et de l'Equateur (Coleoptera, Trechidae). *Bulletin de la Societe Entomologique de France*, 106: 43–50.
Deuve, T. (2012). Deux nouvelles Crepidogaster Boheman, 1848, de Sri Lanka et de l'Inde (Col., Caraboidea, Brachinidae). *Bulletin de la Société entomologique de France*, 117 (2): 18–186.
Deuve, T. (2015). Deux nouvelles Crepidogaster Boheman, 1848, de l'Inde méridionale (Coleoptera, Caraboidea, Brachinidae). *Coléoptères*, 21(14): 167–170.
Deuve, T., and Wrase, D.W. (2014). Une nouvelle Crepidogaster Boheman, 1848, de l'Inde méridionale (Col., Caraboidea, Brachinidae). *Bulletin de la Société entomologique de France*, 119 (4):471–472.
Divya, M., and Sabu, K.T. (2020). Checklist of Indian Pterostichinae Bonelli, 1810 (Coleoptera: Carabidae). *Oriental Insects,* 55(2): 216–253.
Divya, M., Ashly K., and Sabu, K.T. (2020). A new bombardier beetle species of the genus *Brachinus* (Coleoptera: Carabidae: Brachininae) from the Western Ghats in south west India with a new synonymy. *Oriental Insects*, 1– 10.
Dubault, G., Lassalle, B., and Roux, P. (2008). Les genres des "Trigonotomi": Pareuryaptus n. gen. et révision des Euryaptus Bates, 1892 (Coleoptera, Pterostichidae). *Bulletin de la Société Entomologique de France*, 113: 239–248.
Dupuis, P. (1913a). Coleoptera, Adephaga, Family Carabidae, Subfamily Pentagonicinae. *Genera Insectorum*, 145: 1–5.
Erichson, W.F. (1837). *Die Käfer der Mark Brandenburg. Erster Band*. *Erster Band*. *Erste Abtheilung*. F.H. Morin, Berlin, viii + 384 pp.
Erichson, W.F. (1847). Einige Erörterungen zu den Bemerkungen über Fabricische Käfer. *Entomologische Zeitung, Stettin,* 8: 141–142.
Erwin T.L. (1994). Arboreal Beetles of tropical forests: The Xystosomi group, Subtribe Xystosomina (Coleoptera: Carabidae: Bembidiini). Part I. Character Analysis, Taxonomy, and Distribution. *The Canadian Entomologist,* 126: 549–666.
Erwin, T.L. (1970). A reclassification of Bombardier beetles and a taxonomic revision of the North and Middle American species (Carabidae: Brachinida). *Quaestiones Entomologicae*, 6: 4–215.
Erwin, T.L. (1971). Notes and corrections to a reclassification of Bombardier beetles (Carabidae, Brachinida). *Quaestiones entomologicae*, 7: 281.
Erwin, T.L. (1974). Studies of the subtribe *Tachyina* (Coleoptera: Carabidae: Bembidiini) supplement a: lectotype designations for new world species, two new genera, and notes on generic concepts. *Proceedings of the Entomological Society of Washington*, 76(2): 123–155.
Erwin, T.L. (1975). *Studies of the subtribe Tachyina (Coleoptera: Carabidae: Bembidiini) Part III. Systematics, phylogeny, and zoogeography of the genus Tachyta Kirby*. Smithsonian Contribution to Zoology No 208, Washington, 68 pp.

Erwin, T.L. (1979). A review of the natural history and evolution of ectoparasitoid relationships in carabid beetles. *In:* Erwin TL, Ball GE, Whitehead DL, Halpern AL, (eds.) *Carabid Beetles: Their Evolution, Natural History and Classification*. Junk, The Hague: 479–484.

Erwin, T.L. (1985). The taxon pulse: a general pattern of lineage radiation and extinction among carabid beetles. pp. 437–472. *In:* Ball, G.E. (Ed.). *Taxonomy, phylogeny and zoogeography of beetles and ants. A volume dedicated to the memory of Philip Jackson Darlington, Jr. (1904–1983).* Series Entomologica, volume 33. Dr W. Junk Publishers, Dordrecht / Boston / Lancaster. 514 pp.

Eyre, M.D., Lott, D.A., and Garside, A. (1996). Assessing the potential for environmental monitoring using ground beetles (Coleoptera: Carabidae) with riverside and Scottish data. *Annales Zoologici Fennici*, 33: 157–163.

Fabricius, J.C. (1775). *Systema Entomologiae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus.* Officina Libraria Kortii, Flensburgi et Lipsiae (Flensburg and Leipzig, Germany): xxxii + 832.

Fabricius, J.C. (1781). *Species Insectorum enhibentes eorum differenties specifi cas, synonyma, auctorum, loca natalia, metamorphosim adiectis observationibus, descriptionibus. Tomus I*. Hamburg et Kilonii, C.E. Bohn,viii + 552 pp.

Fabricius, J.C. (1787). *Mantissa Insectorum sistens eorum species nuper detectas adiectis characteribus genericis, differentiis specificis, emendationibus, observationibus. Tom. I.* Hafniae, C.G. Proft, xx + 348 pp.

Fabricius, J.C. (1792). *Entomologia systematica emendata et aucta, secundum classes, ordines, genera, species, adiectis synonymis, locis, observationibus, descriptionibus.* Tomus I. Pars I. Hafniae: C. G. Proft, xx + 330 pp.

Fabricius, J.C. (1798). *Supplementum entomologiae systematicae*. Hafniae, C. G. Proft et Storch, ii+572 pp.

Fabricius, J.C. (1801). *Systema Eleutheratorum secundum ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus.* Kiliae: Bibliopolii Academici Novi, Tomus, 1: xxiv + 506 pp.

Fairmaire, L.M.H. (1849a). Insectes de Taiti des Marquises et des îles voisines. *Revue et Magasin de Zoologie Pure et Appliquée,* (2)1: 34–36.

Fairmaire, L.M.H. (1849b). Essai sur les Coléopteres de la Polynésie. *Revue et Magasin de Zoologie Pure et Appliquée,* (2)1: 277–281.

Fairmaire, L.M.H. (1873). [new species]. In: Fairmaire L. & Raffray A.: Coleopteres du nord de l'Afrique. *Revue et Magasin de Zoologie Pure et Appliquee,* (3) 1: 331–385.

Fairmaire, L.M.H. (1880). Diagnoses de Coleopteres de Madagascar. *Le Naturaliste: journal des echanges et des nouvelles,* 2 (39): 307–308.

Fairmaire, L.M.H. (1882). Notes sur quelques coleopteres du Soudan et de l'Inde boreale recueillis par MM. Stanislas et Constantin Rembielinski. *Annales de la Societe Entomologique de France,* (6) 2: 65–68.

Fairmaire, L.M.H. (1883). [new species]. *Bulletin de la Societe Entomologique de Belgique*: clvi.

Fairmaire, L.M.H. (1887). Coleopteres de l'interieur de la Chine. *Annales de la Societe Entomologique de Belgique*, 31: 8–136.

Fairmaire, L.M.H. (1888). Descriptions de coléoptères de l'Indo-Chine. *Annales de la Société Entomologique de France*, (6) 8: 333–378.

Fairmaire, L.M.H. (1889). Descriptions de coleopteres de l'Indo-Chine. *Annales de la Societe Entomologique de France*, (6) 8: 333–378.

Fairmaire, L.M.H. (1901). Materiaux pour la faune Coleopterique de la region Malgache (11e note). *Revue d'Entomologie*, 20: 101–248.

Faisal, M. and S. Singh (2014). Carabid (Coleoptera) type collection at National Forest Insect Collection (NFIC), Forest Research Institute, Dehradun (India). *Zootaxa,* 3786 (3): 331–358.

Fedorenko, D. (1996). *Reclassification of world Dyschiriini, with a revision of the Palaearctic fauna (Coleoptera, Carabidae).* Pensoft Series Faunistica, Pensoft Publishers, Sofia, Moscow, St. Petersburg, 224 pp.

Fedorenko, D. (1999). Description of three new species of the genus *Dyschiriodes* Jeannel, 1941, from South America, with a review of the *pampicola*-group (Coleoptera Carabidae Dyschiriini). *Advances in Carabidology*, 139–152.

Fedorenko, D. (2016). Notes on *Craspedophorus* (Coleoptera: Carabidae: Panagaeini) from Vietnam, with description of new species and subspecies. *Russian Entomological Journal*, 25(1): 1–34.

Fleischer, A. (1899). *Bestimmungs-Tabellen der europäischen Coleopteren. XXXIX. Heft. Enthaltend: Carabidae: Abtheilung: Scaritini.* Paskau, Edm. Reitter, 38 pp.

Fowler, W.W. (1887). *The Coleoptera of the British Islands. A descriptive account of the families, genera, and species indigenous to Great Britain and Ireland, with notes as to localities, habitats, etc. Vol. I. Adephaga Hydrophilidae.* L. Reeve and Co, London, xxxii + 269 pp, 38 pls.

Fowler, W.W. (1912). *The fauna of British India including Ceylon and Burma*. *Coleoptera. General introduction and Cicindelidae "and Paussidae*. London: Taylor and Francis, xx + 529 pp.

Francisco, J.C. (2021). Carabid beetles (Coleoptera: Carabidae) and biological control of agricultural pests in Latin America. *Annals of the Entomological Society of America*, XX(X): 1–17. doi: 10.1093/aesa/saaa051

Ganglbauer, L. (1891). *Die Käfer von Mitteleuropa. Die Käfer der österreichisch-ungarischen Monarchie, Deutschlands, der Schweiz, sowie des französischen und italienischen Alpengebietes. Erster Band. Familienreihe Caraboidea.* Carl Gerold's Sohn, Wien, 557 pp.

Ganglbauer, L. (1892). *Ein neuer Anophthalmus aus der Herzegowina. Wiener Entomologische Zeitung*, 11: 233.

Ghannem, S., Bejoui, M., Gahdab, C., and Boumaiza, M. (2016). Taxonomic notes on the ground beetles (Coleoptera: Carabidae) of Tunisia. *Arquivos Entomolóxicos*, 15: 65–82.

Ghosh, A., and Bhaskaran, N. (2007). Southern India Project Elephant Evaluation Report.http://www.asiannature.org/sites/default/files/2007%20Review_%20PE_%20South_India_2007.pdf Accessed on Sept 9th 2013.

Gistel, J.N.F.X. (1857). *Achthundert und zwanzig neue oder unbeschriebene wirbellose Thiere. Pp. 513–606. In: Vacuna oder die Geheimnisse aus der organischen und leblosen Welt. Ungedruckte Originalien-Sammlung von grösstentheils noch lebenden und verstorbenen Gelehrten aus dem Gebiete sämmtlicher Naturwissenschaften, der Medizin, Literaturgeschichte, des Forst- und Jagdwesens, der Oekonomie, Geschichte, Biographie, und der freien schönen Künste.* Zweiter Band. Straubing, Schorner, 1031 pp. [also issued as separate, in same year, by Schorner, 1–94 pp]

Goulet, H., Lesage, L., Bostanian, N.J., Vincent, C., and Lasnier, J. (2004). Diversity and Seasonal Activity of Ground Beetles (Coleoptera: Carabidae) in Two Vineyards of Southern Quebec, Canada. *Annals of the Entomological Society of America*, 97(6): 1263–1272.

Guéorguiev, V., and Guéorguiev, B. (1995). *Catalogue of the ground-beetles of Bulgaria (Coleoptera: Carabidae)*. Sofia, Pensoft, 279 pp.

Guérin-Méneville, F.É. (1840). Coléoptères nouveaux du Plateau des Neelgherries dans les Indes Orientales, découvertes par M. Adolphe Delessert. *Revue Zoologique*, 37–42.

Habu, A. (1967). Carabidae, Truncatipennes group (Insecta: Coleoptera). *Fauna Japonica Biogeographical Society of Japan*. Tokyo, xiv + 338 pp, 27 pls.

Habu, A. (1973). *Fauna Japonica. Carabidae: Harpalini (Insecta, Coleoptera).* Tokyo, Keigaku Publishing Co, xiii + 430 pp.

Habu, A. (1982). Revised and supplementary notes on and descriptions of the Truncatipennes group of Japan- (1) (Coleoptera, Carabidae). *The Entomological Review of Japan*, 36: 85–142.

Hackel, M., and Farkac, J. (2012). A checklist of the subfamily Panagaeinae Hope, 1838 of the World (Coleoptera: Carabidae). *Studies and Reports, Taxonomical series*, 8 (1–2): 67–116.

Hackel, M., and Farkač, J. (2013). A checklist of the subfamily Anthiinae Bonelli, 1813 of the World (Coleoptera: Carabidae). *Studies and Reports, Taxonomical Series,* 9(2): 261–366.

Häckel, M., and Kirschenhofer, E. (2014). A Contribution to knowledge of the subfamily Panagaeinae Hope, 1838 from Asia. Part 2. East Palearctic and Oriental species of the genus *Craspedophorus* Hope, 1838, and the genus *Tinoderus* Chaudoir, 1879 (Coleoptera: Carabidae). *Studies and Reports, Taxonomical Series*, 10(2): 275–392.

Hammer, Ø., Harper, D.A.T., and Ryan, P.D. (2001). PAST (version 3.15): Paleontological statistics software package for education and data analysis. *Palaeontologia Electronica,* 4(1): 9 pp.

Hansen, J.E., and New, T.R. (2005). Use of barrier pitfall traps to enhance inventory surveys of epigaeic Coleoptera. *Journal of Insect Conservation*, 9(2):131–136.

Hegde, V.D., and Kushwaha, R.K. (2012). New record of *Siagona* species (Coleoptera: Carabidae: Siagoninae: Siagonini) from Uttar Pradesh. *Zoo's Print,* 27(11): 16–17.

Hegde, V.D., and Kushwaha, R.K. (2015). Fauna of Utterpradesh (Insecta: Coleoptera: Carabidae). *Zoological Survey of India, State Fauna Series*, 22 (Part 2): 395–426.

Hegde, V.D., and Shripad Manthen. (2017). To the knowledge of the genus *Chlaenius* Bonelli, 1810 (Coleoptera: Carabidae: Chlaeniini) from Maharashtra state (India). *Zoology and Ecology*, 1–4.

Heyne, A., and Taschenberg, O. (1895). *Die Exotischen Käfer in Wort und Bild*. Esslingen und München, J. F. Schreiber, 524 pp.

Hogan, J.E. (2012). Taxonomy, Systematics and Biogeography of the Scaritinae (Insecta, Coleoptera, Carabidae). PhD Thesis. Oxford Brookes University, 288pp.

Hope, F.W. (1831). Synopsis of the new species of Nepal insects in the collection of Major General Hardwicke. *Zoological Miscellany*, 1: 21–32.

Hope, F.W. (1833). Characters and Descriptions of several New Genera and Species of Coleopterous Insects. *Transactions of the Zoological society of London*, 1: 91–111.

Hope, F.W. (1838). *The coleopterist's manual, part the second, containing the predaceous land and water beetles of Linnaeus and Fabricus*. London, H.G. Bohn, xvi + 168 pp, + [1], 4 pls.

Hope, F.W. (1845). On the entomology of China with descriptions of the new species sent to England by Dr. Cantor from Chusan and Canton. *The Transactions of the Royal Entomological Society of London*, 4: 14–15.

Horn, G.H. (1881). On the genera of Carabidae with special reference to the fauna of boreal America. *Transactions of the American Entomological Society and Proceedings of the EntomologicalSection of the Academy of Natural Sciences*, 9 (1881–82): 91–196.

Horn, G.H. (1882). Synopsis of the species of the tribe Lebiini. *Transactions of the American Entomological Society*, 10: 126–163.

Hrdlička, J. (2017). *Brachininae. In: Löbl, I. & Löbl, D. (Eds.), Catalogue of Palaearctic Coleoptera. Volume 1. Archostemata—Myxophaga—Adephaga. Revised and Updated Edition.* Brill, Leiden/Boston, 471–480.

Hrdlička, J. (2019). A contribution to the tribe Brachinini (Coleoptera: Carabidae) - VIII. A new species of Brachinini from South and South-East Asia and New Guinea. *Studies and Reports, Taxonomic Series*, 15 (1): 75–89.

Ito, N. (1995). A new genus and two new species of the Selenophori Group (Harpalini, Carabidae, Coleoptera). *Japanese Journal of Systematic Entomology*, 1: 153–159.

Jaeger, B. (1997). Revision der Himalaya–Arten der Gattung Psychristus Andrewes 1930 (Col., Carabidae). *Linzer Biologische Beitrage*, 29: 63–93.
Jaeger, B. (1998). Bradycellus bicolor n. sp., eine neue Art der Untergattung Bradycellus s. str. aus Darjeeling (Col., Carabidae). *Entomologische Nachrichten und Berichte*, 42: 11–13.
Jaeger, B., and Ahmed, Z. (2017). Preliminary Checklist of the Stenolophina species of Pakistan (Coleoptera, Carabidae, Harpalini, Stenolophina). *Linzer biologische Beträge*, 49(1): 609–617.
Jaeger, B., Kataev, B.M., and Wrase, D.W. (2016). New synonyms, and first and interesting records of certain species of the subtribe *Stenolophina* from the Palaearctic, Oriental and Afrotropical regions (Coleoptera, Carabidae, Harpalini, Stenolophina). *Linzer Biologische Beitrage*, 48(2): 1255–1294.
Jakobson, G.G. (1908). Fasc. 6: pp. 401–480. In: *Zhuki Rossii i Zapadnoi Evropy*. Sankt-Petersburg: A.F. Devrien, 1024 pp, lxxxiii pls.
Janani, S.J., Vasudevan, K., Prendini, E., Dutta, S.K. and Aggarwal, R.K. (2017). A new species of the genus *Nasikabatrachus* (Anura, Nasikabatrachidae) from the eastern slopes of the Western Ghats, India. *Alytes*, 34: 1–19.
Jeannel, R. (1941). *Coléoptères carabiques. Première partie.* Faune de France 39. Paris, Librairie de la Faculté des Sciences, 571 pp.
Jeannel, R. (1942). *Coléoptères carabiques. Deuxiéme partie.* Faune de France 40. Paris: Librairie de la Faculté des Sciences, 572–1173.
Jeannel, R. (1946). *Faune de l'empire français. VI. Coléoptères carabiques de la région Malgache (première partie).* Paris, Office de la Recherche Scietifique Coloniale, 372 pp.
Jeannel, R. (1948). *Faune de l'empire français. X. Coléoptères carabiques de la région Malgache (deuxième partie).* Paris: Office de la recherche scientifique coloniale, pp. 373–765.
Jeannel, R. (1949). Coléopteres carabiques de la région Malgache (troisième partie). Faune de l'Empire Français XI. *Muséum national d'Histoire naturelle, Paris*: 767–1146.
Jedlička, A. (1928). Noví palaearktičtí Carabicidi (III.). Neue palâarctische Carabiciden (III. Folge). *Časopis Československé Společnosti Entomologické*, 25: 75–80.
Jedlička, A. (1931a). Neue Carabiden aus China-Szetschuan. *Acta Societatis Entomologicae Cechoslovenicae*, 28: 21–30.
Jedlička, A. (1931b). New Carabids from south China: Prov. Yunnan. (Part I). *Czechoslovak Society Entomological Journal*, 28: 61–63.
Jedlička, A. (1933a). Carabiden aus Ost-Asien- 4. *Teil Entomologische Nachrichtenblatt*, 8(3): 85–88.
Jedlička, A. (1933b). Carabidi z východní Asie. Carabiden aus Ostasien (5. Teil). *Časopis Československé Společnosti Entomologické*, 30: 144–150.
Jedlička, A. (1934). Table of contents of the species Risophilus. *Acta Societatis Entomologicae Cechosloveniae*, 31: 164– 170. (in German)
Jedlička, A. (1935). *Neue Carabiden aus Ostasien*. (10. Teil.). Prague, A. Jedlička, 20 pp.
Jedlička, A. (1938) *Versuch einer Bestimmungstabelle der mir bekannten Pterostichus -Arten aus Ostasien.* Praha: A. Jedlička, 12 pp.
Jedlička, A. (1940). *Neue Carabiden aus Ostasien. (Hauptsächlich von der Insel Formosa.) (XIII. Teil.).* Praha: A. Jedlička, 18 pp.
Jedlička, A. (1947). Novi Strevlici Sveta. (Carab. Col.) Nouveaux Carabides du Monde. (Col.). Unnouveau Haptoderus de l'Asie mineure (avec un tableau analytique). *Acta Societatis Entomologicae Čechosloveniae*, XLIV: 15–20.
Jedlička, A. (1951). Novi střevlici z vychodni Asie. Les carabides nouveaux de l'Asie orientale. (Col.) *Časopis Československe Společnosti Entomologicke,* 48: 108–116.

Jedlička, A. (1955). Přispěvek k poznani palearktickych Carabidů. Beitrag zur Kenntnis der palearktischen Carabiden, (Coleoptera). *Sbornik entomologickeho oddĕleni Narodniho Musea v Praze (Acta entomologica Musei nationalis Pragae),* 30 (453): 207–220.

Jedlička, A. (1956). Příspěvek k poznání palearktických Carabidů. Beitrag zur Kenntnis der palearktischen Carabiden. (Coleoptera). *Sborník Entomologického Oddělení Národního Musea v Praze,* 30: 207–220.

Jedlicka, A. (1960). Neue Carabiden aus den Sammlungen des Museums Frey. *Entomologische Arbeiten aus dem Museum G. Frey Tutzing bei München*, 587–598.

Jedlička, A. (1963). Monographie der Truncatipennen aus Ostasien. Lebiinae –Odacanthinae – Brachyninae (Coleoptera, Carabidae). *Entomologische Abhandlungen und Berichte aus dem Staatlichen Museum fur Tierkunde in Dresden*, 28: 269–304.

Jedlička, A. (1964). Neue Carabiden aus Indien (Coleoptera – Carabidae). *Entomologische Arbeiten aus dem Museum G. Frey,* 15: 305–318.

Jedlička, A. (1965). Monographie des Tribus Panagaeini aus Ostasien (Col. Carabidae). *Annotationes Zoologicae et Botanicae*, 12: 1–15.

Jedlička, A. (1969). Neue Carabiden ans der Zoologischen Sammlung des Bayerischen Staates (Col., Carabidae). *Opuscula Zoologica (Muenchen),* 108: 1–7.

Jithmon, V.A. (2020). Taxonomy, Ecology and DNA Barcoding of Carabidae (Insecta: Coleoptera) in Malabar wildlife sanctuary. PhD Thesis. University of Calicut, 229pp. (Unpublished)

Jithmon, V.A., and Sabu, K.T. (2018). Taxonomy of *Euschizomerus* Chaudoir 1850 (Coleoptera: Carabidae: Panagaeinae) from India with a new species and new synonym. *Zootaxa*, 4471 (2): 361–368.

Jithmon, V.A., and Sabu, K.T. (2021). Checklist of subfamilies Dryptinae and Panagaeinae (Insecta: Coleoptera: Carabidae) from the Indian subcontinent. *Journal of Threatened Taxa,* 13(6): 18559–18577. https://doi.org/10.11609/jott.6203.13.618559-18577

Jocque, M., Teofilova, T.M., and Kodzhabashev, N.D. (2016). Light Trapping as a Valuable Rapid Assessment Method for Ground Beetles (Carabidae) in a Bulgarian Wetland. *Acta Zoologica Bulgarica*, 68 (4): 529-534.

Jung, J.K., Kim, S.T., Lee, S.Y., Park, C.G., Park, J.K., and Lee, J.H. (2012). Community structure of ground beetles (Coleoptera: Carabidae) along an altitudinal gradient on Mt. Sobaeksan, Korea. *Journal of Asia-Pacific Entomology*, 15: 487–494.

Jung, J.K., Kim, S.T., Lee, S.Y., Park, C.G., Park, J.K., and Lee, J.H. (2014). A comparison of diversity and species composition of ground beetles (Coleoptera: Carabidae) between conifer plantations and regenerating forests in Korea. *Ecological Research*, 29: 877–887.

Jung, J.K., Lee, J.H., Lee, S.Y., and Kim, S. T. (2015). Distribution of ground beetles (Coleoptera: Carabidae) in Naejangsan National Park, Korea. Korean Journal of Environment and Ecology, 29(2), 200–209.

Kacprzyk, M., Blonska, E., and Lasota, J. (2020). Effect of spot burning of logging residues on the properties of mountain forest soils nd the occurrence of ground beetles (Coleoptera, Carabidae). *Journal of Mountain Science*, 17: 31–41.

Kalas, J.A. (1985). Species Composition and Seasonal Activity Patterns of Carabidae (Col.) in a Small Deciduous Forest in Western Norway, Fauna Norvegica (Oslo). *Ser B,* 32(1): 28–32.

Kapur, A.P. (1955). Contribution to a knowledge of the fauna of Manipur state, Assam. *Records of the Indian Museum*, 52: 313–348.

Kataev, B.M. (2001). To the knowledge of species of the subgenus *Pseudoophonus* (genus *Harpalus*) from the Himalayan region and Southern China (Coleoptera: Carabidae). *Zoosystematica Rossica*, 9: 391–407.

Kataev, B.M. (2002). Taxonomic, faunistic, and nomenclatural notes on certain Palaearctic and Oriental Harpalini (Coleoptera, Carabidae). *Linzer Biologische Beiträge,* 34 (1): 721–736.

Kataev, B.M. (2005). On the Ophoniscus-complex of the Selenophori genus group (Coleoptera, Carabidae, Harpalini). Pp. 261-288. In: Konstantinov, A., Tishechkin A. and Penev L. (eds). *Contributions to systematics and biology of beetles. Papers celebrating the 80th Birthday of Igor Konstantinovich Lopatin.* Pensoft Publishers, Sofia-Moscow, 450 pp.

Kataev, B.M. (2010). A taxonomic review of the subgenus *Hyparpalus* Alluaud, 1930 (genus *Parophonus* Ganglbauer, 1892) of the Oriental and Australian regions (Coleoptera, Carabidae, Harpalini). *Zoosystematica Rossica*, 19 (2): 277–300.

Kataev, B.M. (2012). Species of the genus *Dioryche* similar to D. cuprina (Dejean, 1929) comb. nov. (Coleoptera: Carabidae: Harpalini). *Zoosystematica Rossica*, 21: 112–130.

Kataev, B.M. (2015). New data on distribution of ground-beetles of the tribe Harpalini in the Palaearctic, Oriental Region and in Australia (Coleoptera, Carabidae, Harpalini). *Entomologicheskoe obozrenie*, 94(1): 90–99(in Russian). *Entomological Review*, 95: 536–543.

Kataev, B.M. (2018). Description of two new species and a new subspecies in the genus Ophoniscus Bates, 1892 (Insecta: Coleoptera: Carabidae, Harpalini) from Nepal and India. *Biodiversität und Naturausstattungim Himalaya IV – Biodiversity and natural heritage of the Himalaya*, 6: 319–327.

Kataev, B.M., and Wrase, D.W. (2012). *Additional data on the genus Ophoniscus Bates, 1892, with a description of a new species from Nepal, and notes on the taxonomic position of Parophonus rectangulus Ito, 1994 (Insecta: Coleoptera: Carabidae, Harpalini).* Pp. 215-223. In: Hartmann M. und Weipert J. (eds.). Biodiversität und Naturausstattung im Himalaya IV. Erfurt, Verein der Freunde und Förderer des Naturkundemuseums Erfurt e. V, 492 pp, 39 pls.

Kataev, B.M., and Wrase, D.W. (2016). A new species of the genus Pseudognathaphanus from Nepal, with a short review of the Oriental species (Coleoptera, Carabidae, Harpalini). *Entomologische Blätter und Coleoptera*, 112 (1): 223–236.

Kerala Forests and Wildlife Department Management Plan of Chinnar Wildlife Sanctuary 2012–2013 to 2021–2022.

Kirby, W. (1825). A description of some insects which appear to exemplify Mr. William S. Mac-Leay's doctrine of affinity and analogy. *Transactions of Linnaean Society of London*, 14: 93–100.

Kirschenhofer, E. (1994). Neue und wenig bekannte Carabidae aus der paläarktischen und orientalischen Region (Col. Carabidae, Lebiinae, Odacanthinae, Brachininae, Panagaeinae). *Linzer Biologische Beiträge*, 26: 999–1067.

Kirschenhofer, E. (1998). Neue Chlaeniinae der palaearktischen und orientalischen Region. *Entomofauna*, 19: 317–332.

Kirschenhofer, E. (2000). Neue und wenig bekannte Panagaeini der östlichen Paläarktis sowie der Orientalis. *Entomofauna*, 21: 321–371.

Kirschenhofer, E. (2002). Uber die Subgenera Pachydinodes Kuntzen 1919, Leptodinodes Jeannel, 1949, Ocybatus LaFerte-Senectere, 1851 und Paralissauchenius subgen.n. des Genus Chlaenius Bonelli, 1810 sowie einie weitere Chlaeniinae der palaearktischen und orientalischen Region. (Coleoptera, Carabidae: Chlaeniini). *Loened Aziad*, 8: 1–53.

Kirschenhofer, E. (2013). Ein Beitrag zur Kenntnis der Tribus Chlaeniini sensu Brulle, 1834 (= Callistini sensu auct.) der palaarktischen, afrotropischen und orientalischen Region (Coleoptera: Carabidae). *Zeitschrift der Arbeitsgemeinschaft Osterreichischer Entomologen*, 65: 23–36.

Kirschenhofer, E. (2017). Synonymic notes in the genus Chlaenius Bonelli, 1810 (Coleoptera: Carabidae: Chlaeniini). *Zootaxa*, 4258 (6): 579–580.

Klug, J.C.F. (1834). Uebersicht der Carabici der Sammlung. Pp. 48–82. In: Klug F. (ed.): *Jahrbücher der Insectenkunde, mit besonderer Rücksicht auf die Sammlung im Königlich Museum zu Berlin. Erster Band.* Berlin: Theod. Chr. Friedr. Enslin, 396 pp, 2 pls.

Koivula, M. (2011). Useful model organisms, indicators, or both? Ground beetles (Coleoptera, Carabidae) reflecting environmental conditions. *ZooKeys*, 100: 287–317.

Koivula, M., and Niemelä, J. (2002). Boreal Carabid Beetles (Coleoptera, Carabidae) in Managed Spruce Forests – a Summary of Finnish Case Studies. *Silva Fennica*, 36(1): 423–436.

Koivula, M., Kukkonen, J., and Niemelä, J. (2002) Boreal carabid-beetle (Coleoptera, Carabidae) assemblages along the clear-cut originated succession gradient. *Biodiversity and Conservation*, 11: 1269–1288.

Koivula, M., Punttila, P., Haila, Y., and Niemelä, J. (1999) Leaf litter and the small-scale distribution of carabid beetles (Coleoptera, Carabidae) in the boreal forest. *Ecography*, 22: 424–435.

Kolbe, H.J. (1880). Natürliches System der cavernicolen Coleoptera. *Deutsche Entomologische Zeitschrift*, 24: 258–280.

Kopecký, T. (2003). *New nomenclatorial and taxonomic acts: Carabidae: Tachyina. P. 21. In: Löbl I. and Smetana A. (eds.): Catalogue of Palearctic Coleoptera. Volume 1. Archostemmata-Myxophaga-Adephaga*. Stenstrup, Apollo Books, 819 pp.

Kotze, D. J., Brandmayr, P., Casale, A., Dauffy-Richard, E., Dekoninck, W., Koivula, M.J., Lövei, G.L., Mossakowski, D., Noordijk, J., and Paarmann, W. (2011). Forty years of carabid beetle research in Europe from taxonomy, biology, and ecology and population studies to bioindication, habitat assessment and conservation. *ZooKeys*, 100: 55–148.

Kromp, B. (1999). Carabid beetles in sustainable agriculture: a review on pest control efficacy, cultivation impacts and enhancement. *Agriculture, Ecosystems & Environment*, 74: 187–228.

Kryzhanovskij, O.L., Belousov, L.A., Kabak, I.I., Kataev, B.M., Makarov, K.V., and Shilenkov, V.G. (1995). *A Checklist of the Groundbeetles of Russia and adjacent lands (Insecta, Coleoptera, Carabidae)*. Pensoft. Series faunistica, Sofia-Moscow, 3, 271 pp.

Kulkarni, S.S., Dosdall, L.M., and Willenborg, C.J. (2015). The role of ground beetles (Coleoptera: Carabidae) in weed seed consumption: a review. *Weed Science*, 63: 355–376.

Kult, K. (1947). Třetí studie o střevlících tribu Clivinini (Col.). The 3rd study to the knowledge of tribus Clivinini (Col., Carab.). (18th contribution to the knowledge of Carabidae). *Časopis Československé Společnosti Entomologické*, 44: 26–37.

Kult, K. (1951). Revision of the genus Clivina, Latr., from Oriental region. Revise rodu Clivina Latr. z orientální oblasti. (Col. Carabidae). (24th Contribution – 24. studie.). *Časopis Československé Společnosti Entomologické*, 48: 16–32.

Kuntzen, H. (1911). Bemerkungen über einige Trigonotominen des indomalayischen Gebietes. *Entomologische Rundschau*, 28: 164–165, 175–176, 182–183.

Kuntzen, H. (1914). Die tiergeographischen Verhältnisse im Pterostichinen–Subtribus Trigonotomini (Coleoptera: Carabidae). *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin*, 1914: 41–78.

Kushwaha, R.K., and Hegde, V.D. (2015). Insecta: Coleoptera: Carabidae. *Zoological Survey of India, Fauna of Uttar Pradesh, State Fauna Series*, 22(Part 2): 395–426.

Lacordaire, J.T. (1854). Genera des coléoptères, ou exposé méthodique et critique de tous les genresproposés jusqu'ici dans cet orde d'insectes. *Histoire Naturelle des Insectes. Coléoptères*, 1: 1–486.

LaFerté-Sénectère, F.T.de. (1851). Révision de la tribu des patellimanes de Dejean, coléoptères pentamères de la famille des carabiques. *Annales de la Société Entomologique de France*, (2) 9: 209–294.

Larochelle, A. (1990). The food of carabid beetles. *Fabreries*, Supplement, 5: 1–132.

Larochelle, A., and Larivière, M.C. (2013). Carabidae (Insecta: Coleoptera): synopsis of species, Cicindelinae to Trechinae (in part). *Fauna of New Zealand*, 69: 193 pp.

Latreille, P.A. (1796). *Précis des charactères génériques des insectes, disposés dans un ordre naturel*. Paris, Bordeaux, Brive, xiii + 201 + [7] pp.

Latreille, P.A. (1802). *Histoire naturelle, générale et particulière des crustacés et des insectes. Ouvrage faisant suite à l'histoire naturelle générale et particulière, composée par Leclerc de Buffon, et partie du cours complet d'histoire naturelle rédigée par C.S. Sonnini, membre de plusieurs sociétés savantes. Familles naturelles des genres. Tome troisième.* Paris, F. Dufart, xii + pp. 13–467 + [1] pp.

Latreille, P.A. (1810). *Considérations générales sur l'ordre naturel des animaux composant les classes des crustacés, des arachnides, et des insectes; avec un tableau méthodique de leurs genres, disposés en familles.* Paris, F. Schoell, 444 pp.

Latreille, P.A., and Dejean, P.F.M.A. (1824). In: Latreille P.A. and Dejean P.F.M.A.: *Histoire naturelle et iconographie des insectes coléoptères d'Europe.* Paris: Crevot, 198 pp, 15 pls.

Lawrence, J.F., Hastings, A.M., Daiiwitz, M.J., Paine, T.A., and Zurcher, E.J. (1999). Beetles of the World. CSIRO Publishing. [CD-ROM publication]

Leather, S.R., and Watt, A.D. (2005). Sampling theory and practice. In: Leather, S.R., (eds.). *Insect sampling in forest ecosystems*: 1-15. Blackwell publishing.

LeConte, J.L. (1853). Notes on the classification of the Carabidae of the United States. *Transactions of the American Philosophical Society*, (2) 10: 363–403.

Lepping, M.D. (2009). Ground dwelling beetles as bioindicators in transgenic Corn. PhD Thesis. Submitted to the Faculty of the Graduate School of the University of Maryland, College, Park. 213pp.

Lesne, P. (1904). Famille des Carabides *In*: Pavie, A. (ed.) *Mission Pavie Indo–Chine 1879–1895. Etudes Diverses. Tome III. Recherches sur l'Histoire Naturelle de l'Indo–Chine Orientale.* Ernest Leroux, Paris: 62–81.

Li, Wen-Bo., Nai-Yi, Liu., Yun-He, Wu., Yu-Cai, Zhang., Qin Xu., Jun Chu., Shu-Yan, Wang., and Jie Fang. (2017) Community composition and diversity of ground beetles (Coleoptera: Carabidae) in Yaoluoping National Nature Reserve. *Journal of Insect Science*, 17(6), 114: 1–8.

Liebke, M. (1938). Denkschrift über die Carabiden-Tribus Colliurini. *Festschrift zum 60. Geburtstage von Professor Dr. Embrik Strand*, 4: 37–141.

Lindenmayer, D.B., Margules, C.R., and Botkin, D.B. (2000). Indicators of biodiversity for ecologically sustainable forest management. *Conservation Biology*, 14: 941–950.

Lindroth, C.H. (1975). *Coleoptera Carabidae*. *Handbooks for the Identification of British Insect.* Royal Entomological Society Of London . Vol. IV. Part 2.

Linnaeus, C.von. (1758). Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima, reformata. Tomus I. Laurentii Salvii, Holmiae. [4] + 823 + [1] pp.

Linnaeus, C.von. (1761). Fauna Suecica sistems Animalia Sueciae. Regni: Mammalia, Aves, Amphibia, Pisces, Insecta, Vermes. Distributa per Classes et Ordines, Genera et Species, cum Differentiis Specierum, Synonymis Austorum, Nominibus, Incolarum, Locis Natalium, Descriptionibuss: 48+578.

Linnaeus, C.von. (1771). Mantissa plantarum: Generum editionis VI. et specierum editionis II. Holmiæ :Impensis Direct. *Laurentii Salvii*, 1–588.

Löbl, I., and Löbl, D. (2017). *Catalogue of Palaearctic Coleoptera. Vol. 1. Archostemata-Myxophaga -Adephaga.* Revised and Updated Edition. Leiden-Boston, Brill, 1443 pp.

Löbl, I., and Smetana, A. (2003). *Catalogue of Palaearctic Coleoptera*. *Vol. 1. Archostemata-Myxophaga-Adephaga.* Denmark, Apollo Books, Stenstrup, 819 pp.

Lorenz, W. (1998). *Nomina Carabidarum – a directory of the scientific names of ground beetles (Insecta, Coleoptera "Geadephaga": Trachypachidae and Carabidae incl. Paussinae, Cicindelinae, Rhysodinae).* Tutzing: W. Lorenz, iv + 937 pp.

Lorenz, W. (2005). *A systematic list of extant ground beetles of the World (Insecta, Coleoptera, Adephaga: Trachypachidae & Carabidae incl. Paussinae, Cicindelinae, Rhysodinae). 2nd edition.* Tutzing: published by the author, 1–530 pp.

Lorenz, W. (2021). CarabCat: Global database of ground beetles (version Oct 2017). In: Species 2000 and ITIS Catalogue of Life, 2019 Annual Checklist (Roskov Y., Ower G., Orrell T., Nicolson D., Bailly N., Kirk P.M., Bourgoin T., DeWalt R.E., Decock W., Nieukerken E. van, Zarucchi J., Penev L., eds.). Digital resource at www.catalogueoflife.org/annual-checklist/2019. Species 2000: Naturalis, Leiden, the Netherlands. ISSN 2405-8858.

Louwerens, C.J. (1953). The oriental species of Colpodes Macleay. *Treubia*, 22, Part 1: 75–151.

Lövei, G.L., and Sunderland, K.D. (1996). Ecology and Behaviour of Ground Beetles (Coleoptera: Carabidae). *Annual Review of Entomology*, (41): 231– 256.

Lucky, A., Erwin, T.L., and Witman, J.D. (2002). Temporal and Spatial Diversity and Distribution of Arboreal Carabidae (Coleoptera) in a Western Amazonian Rain Forest. *Biotropica*, 34(3):376–386.

Luff, M.L. (1978). Diel activity patterns of some field Carabidae. *Ecolological Entomology*, 3, 53–62.

Lund, R.D., and Turpin, F.T. (1977a). Serological investigation of Black Cutworm larval consumption by ground beetles. *Annals of the Entomological Society of America*, 70: 322–324.

Lund, R.D., and Turpin, F.T. (1977b). Carabid damage to weed seeds found in Indiana cornfields. *Environmental Entomology*, 6: 695–698.

MacLeay, W.S. (1825). *Annulosa Javanica, or an attempt to illustrate the natural, affinities and analogies of the Insects collected in java by Thomas Horsfield and deposited by him in the museum of the Honourable East-India Company*. Published by Kingsbury, Parbury, and Allen, Leadenhall Street, London, 1: 50 pp.

Magurran, A.E. (2004). *Measuring Biological Diversity*. Blackwell Publishing, Oxford: 256 pp.

Magurran, A.E., and Henderson, P.A. (2011). *Commommess and rarity. In: Magurran AE, McGill BJ (Eds) Biological Diversity Frontiers in Measurement and Assess.* Oxford University Press, New York, 97–104.

Maindron, M. (1898). Description de deux espèces nouvelles de Carabiques de l'Inde orientale. *Bulletin de la Société entomologique de France*, 130–131.

Maindron, M. (1899). Description d'une nouvelle espèce de Coléoptère Carabique recueillie dans le Sind (Inde occidentale). Bulletin de la Société entomologique de France: 16–17.

Maindron, M. (1906). Description d'une nouvelle espèce de Pheropsophus et remarques sur ce genre. *Bulletin de la Société entomologique de France*, 15– 16.

Maindron, M. (1909). Communications. Descriptions de quelques Callistini nouveaus de l'Afrique occidentale et de l'Asie orientale. *Bulletin de la Societe entomologique de France*, 274–277.

Mani, M.S. (1968). *Ecology and Biogeography of High Altitude Insects*. Dr. W. junk Publishers, The Hague: 527pp.

Mani, M.S. (1974). *Ecology and Biogeography in India.* Dr. W. Junk, Publishers, The Hague: 773pp.

Manthen S.V., and Hegde, V.D. (2018). The genus Craspedophorus Hope, 1838 (Coleoptera: Carabidae: Panagaeinae) from Maharashtra, with a new state record. *Records of Zoological Survey of India*, 118 (2): 206–207.

Mateu, J. (1959). Sur les *Microlestes* Schmidt–Goebel de l'Asie méridionale. *Revue Française d'Entomologie*, 26(3): l35–157.

Mateu, J. (1960). Deuxième contribution à la connaissance des Microlestes de l'Asie méridionale. *Bulletin de la Société Entomologique de France*, 65: 2l2–217.

Mateu, J. (1971). Nuevos datos sobre los *Microlestes* Schmidt-Goebel d'Asie (Col. Carabidae*). Arqivos do Museu Bocage*, 2(3): 51–90.

Mateu, J. (1976). Nouvelles Donnees Concernant les *Microlestes* Schimdt-Goebel de l'Asie sub-occidentale (Coleoptera: Carabidae). *Bulletin & annales de la Société royale d'entomologie de Belgique*, 112: 243–258.

Mateu, J. (1978). Nouvelles espèces de Lebiens appartenant au British Muséum de Londres (Coléoptères-Carabidae). *Nouvelle Revue d'Entomologie,* 8(3): 261–266.
Mateu, J. (1979a). Insects of Saudi Arabia. Coleoptera: Fam. Carabidae, Subfam. Lebiinae. *Fauna of Saudi Arabia,* 1: 147–155.
Mateu, J. (1979b). Sur quelques Microlestes Schmidt-Goebel, d'Asie, appartenant au British Muséum de Londres (Col. Carabidae). *Bulletin et annales de la Société royale belge d'entomologie*, 115(3): 38–55.
Mateu, J. (1981). A propos des Leleupidiini Basilwesky (sic!) en Asie (Col. Carabidae). *Revue suisse Zoologie*, 88: 715–722.
Mateu, J. (1984). Description de nouveaux taxa du genre *Dromoceryx* Schmidt-Goebel (Coleoptera, Carabidae). *Bolletino del Museo regionale di Scienze Naturali Torino*, 2(1): 397–410.
Mateu, J. (1986). Sur quelques espèces inédites du genre Metadromius Bedel. *Nouvelle Revue d'Entomologie,* 3(2): 215–226.
Mateu, J. (1991). Quarte nouvelles especes asiatiques du genre Apristus Chaudoir (Insecta, Coleoptera, Carabidae). *Spixiana,* 14: 267–273.
Mateu, J. (1997). Nouvelle espèce asiatique appartenant aux genres Paradromius Fowler et Dromius Bonelli (II) (Coleoptera, Carabidae, Lebiinae). *Spixiana,* 20(3): 235–244.
Maveety, S.A., Browne, R.A., and Erwin, T.L. (2011). Carabidae diversity along an altitudinal gradient in a Peruvian cloud forest (Coleoptera). In: Erwin T (Ed) Proceedings of a symposium honoring the careers of Ross and Joyce Bell and their contributions to scientific work. Burlington, Vermont, 12–15 June 2010. *ZooKeys*, 147: 651–666.
Montrouzier, P. (1860). Essai sur la faune entomologique de la Nouvelle-Calédonie (Balade) et des îles des Pins, Art, Lifu etc. *Annales de la Société Entomologique de France,* (3) 8: 229–308.
Moore, B.P., and Brown, W.V. (1979). Chemical composition of the difensive secretion in *Dyschirius* Bonelli (Coleoptera: Carabidae: Scaritinae) and its taxonomic significance. *Journal of the Australian Entomological Society*, 18 : 123–125.
Moraes, R.M., Milton de Souza Mendonça Jr., and Ricardo Ott. (2013). Carabid beetle assemblages in three environments in the Araucaria humid forest of southern Brazil. *Revista Brasileira de Entomologia,* 57(1):67–74.
Morvan, D.M. (1979). Ergebnisse der Bhutan–Expedition 1972 des Naturhistorischen Museums in Basel. Coleoptera: Fam. Carabidae, tribus Sphodrini. *Entomologica Basiliensia*, 4: 31–42.
Morvan, D.M. (1992). Contribution a la connaissance des Colpodes du Nepal (Coleoptera, Caraboidea, Platynina). Description d'un genre nouveau et de dix especes nouvelles. *Bulletin de la Societe Entomologique de France*, 96(4): 331.
Morvan, D.M. (1996). The genus *Batenus* Motschulsky, 1864, redefinition; descriptions of new species from Asia (Coleoptera, Carabidae, Platynina). *Bulletin de la Societe Entomologique de France*, 101: 35–48.
Morvan, D.M. (1997a). Etude faunistique des coleopteres du Nepal avec extension aux pays limitrophes et orientaux. Genre Lepcha Andrewes. *Loened Aziad Amprevaned Feuraskelleged C'Hwiledig*, 1: 1–20.
Morvan, D.M. (1997b). Etude faunistique des coleopteres du Nepal avec extension aux provinces chinoises du Yunnan et du Sichuan. Genre Andrewesius Jedlicka et Vacinius Casale. *Loened Aziad Amprevaned Feuraskelleged C'Hwiledig*, 2: 1– 23.
Morvan, D.M. (1999). Nouveaux genres et nouvelles espèces de Platynina et de Sphodrina de l'Himalaya oriental. Coleoptera Carabidae Platynina. *Loened Aziad amprevaned feuraskelleged c'hwiledig*, 4: 1–44.
Motschulsky, V. (1839). Coléoptères du Caucase et des provinces transcaucasiennes (Continuation). *Bulletin de la Société Impériale des Naturalistes de Moscou,* 12: 68–93.

Motschulsky, V. (1844). Insectes de la Sibérie rapportés d'un voyage fait en 1839 et 1840. *Mémoires présentés à l'Académie Impériale des Sciences de St Pétersbourg par divers savans et lus dans ses assemblées*, 5: 1–274 + xi + 10 pls.
Motschulsky, V. (1845). Remarques sur la collection de coléopteres Russes de Victor de Motschoulsky. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 18 (1): 3–127.
Motschulsky, V. (1851). Énumération des nouvelles espèces de coléoptères rapportés par M. Victor Motschoulsky de son dernier voyage. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 24: 479–511.
Motschulsky, V. (1855). Sur les collections coléoptèrologiques de Linné et de Fabricius. *Études Entomologiques*, 4: 25–71.
Motschulsky, V. (1858). Synonymie et critique. Coléoptères. *Études Entomologiques*, 7: 153–158.
Motschulsky, V. (1859). Entomologie spéciale. Insectes des Indes orientales, et de contrées analogues. 2: de série. *Études Entomologiques*, 8: 25–118.
Motschulsky, V. (1860). Coléoptères de la Sibérie orientale et notamment en particulier des rives de l'Amour. Pp. 77–257, errata, pls 6–11, 1 map. In: Schrenck L. von (ed.): *Reisen und Forschungen im Amur-Lande in den Jahren 1854–1856 im Auftrage der Kaiserl. Akademie der Wissenschaften zu St. Petersburg. Band II. Zweite Lieferung. Coleopteren. Mit 28 colorierten Tafeln und 3 Karten.* St. Petersburg, Kaiserliche Akademie der Wissenschaften, 976 pp.
Motschulsky, V. (1861). Essai d'un Catalogue des Insectes de l'ile Ceylan. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 95–155.
Motschulsky, V. (1862). Entomologie spéciale. Remarques sur la collection d'insectes de V. de Motschulsky. *Coléoptères- Études Entomologiques*, 11: 15–55.
Motschulsky, V. (1864). Énumération des nouvelles espèces de coléoptères rapportés de des voyages. 4-ème article. Carabicines. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 37: 171–240.
Motschulsky, V. (1865). Enumération des nouvelles especes de coléopteres rapportés de ses voyages. 4-eme article. (Suite). *Bulletin de la Société Impériale des Naturalistes de Moscou*, 37 (4): 297–355.
Motschulsky, V. (1866). Essai d'un Catalogue des Insectes de l'ile de Ceylan. Supplement. *Bulletin de la Societe des Naturalistes de Moscou*, 39 (1): 394.
Müller, J.G. (1922). Bestimmungstabelle der Dyschirius- Arten Europasund der mirbekannten Artenausdemübrigen palaearktischen Faunengebiet. *Koleopterologische Rundschau*, 26–117.
Myers, N., Mittermeier, R., Mittermeier, C., Fonseca, G., and Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403: 853–858.
Nietner, J. (1856). Entomological papers, being chiefly descriptions of new Ceylon Coleoptera with such observations on their habits etc., as appear in any way interesting. *Journal of the Asiatic Society of Bengal*, 25: 381–394, 523–554.
Nietner, J. (1857a). Descriptions of new Ceylon Coleoptera. *The Annals and Magazine of Natural History*, (2) 20: 272–282, 368–374.
Nietner, J. (1857b). Entomological Papers by John Nietner, Colombo, Ceylon. *The Journal of the Asiatic Society of Bengal*, 26: 132–153.
Nietner, J. (1857c). Entomological papers, being descriptions of new Ceylon Coleoptera with such observations on their habits as appear in any way interesting. *The Journal of the Asiatic Society of Bengal*, 25: 381–394, 523–554.
Nietner, J. (1858). Descriptions of new Ceylon Coleoptera. *The Annals and Magazine of Natural History*, 3(2): 171 – 183, 418–431.
Noonan, G. R. (1973). The Anisodactylines (Insecta: Coleoptera: Carabidae: Harpalini): classification, evolution, and zoogeography. *Quaestions Entomologicae*, 9(4): 266–480.

Noonan, G.R. (1976). Synopsis of the supra-specific taxa of the tribe Harpalini (Coleoptera: Carabidae). *Quaestions Entomologicae*, 12: 3–87.

Noonan, G.R. (1985). Classification and names of the Selenophori group (Coleoptera: Carabidae: Harpalini) and of nine genera and subgenera placed in incertae sedis within Harpalina. *Milwaukee Public Museum, Contributions in Biology and Geology*, 64: 1–92.

Nyundo, B.A., and Yarro, J.G. (2007). An assessment of methods for sampling carabid beetles (Coleptera: Carabidae) in a montane rain forest. *Tanzania Journal of Science*, 33.

Olivier, A.G. (1790). *Encyclopédie méthodique, ou par ordre de matieres; par une société de gens de lettres, de savans et d'artistes; précédée d'un vocabulaire universel, servant de table pour tout l'ouvrage, ornée des portraits de Mm. Diderot and d'Alembert, premiers éditeurs de l'Encyclopédie*. *Histoire naturelle. Insectes*. *Tome cinquieme*. *Livraison 41*. Paris, C.J. Panckouche, 793 pp.

Olivier, A.G. (1795). *Entomologie, ou Histoire naturelle des insectes, Avec leurs caracteres generiques et specifi ques, leur description, leur synonymie, et leur figure eluminee. Coleopteres.Tome troisieme.* Paris, Lanneau, 557 pp+ 65 tab.

Pang, J. M., and Tian, M. (2012). One new species of the genus *Craspedophorus* Hope, 1838 (Coleoptera: Carabidae: Panagaeini) from Jianfengling Nature Reserve of Hainan Province. *Journal of South China Agricultural University*, 33 (2): 264–269.

Panzer, G.W.F. (1813). *Index entomologicus, sistens omnes insectorum species in G.W.F. Panzeri Fauna Insectorum Germanica descriptas atque delineatas secundum methodum Fabricianam: adjectis emendationibus, observationibus.* Pars I, Eleutherata, Norimbergae, Felsecker, viii + 216 pp.

Park, J.K., Trac, D.H., and Will, K. (2006). Carabidae from Vietnam (Coleoptera). *Journal of Asiatic-Pacific Entomology*, 9(2): 85–105.

Pizzolotto, R., Albertini, A., Gobbi, M., and Brandmayr, P. (2016). Habitat diversity analysis along an altitudinal sequence of alpine habitats: the carabid beetle assemblages as a study model. *Periodicum Biologorum*, 118: 241– 254.

Pizzolotto, R., Mazzei, A., Bonacci, T., Scalercio, S., Iannotta, N., and P. Brandmayr. (2018). Ground beetles in Mediterranean olive agroecosystems: Their significance and functional role as bioindicators (Coleoptera, Carabidae). *PLOS ONE*, 13(3): e0194551.

Prasad, K., and Rajagopal, D. (1990). Carabid beetle, *Omphra pilosa* Klug (Coleoptera Carabidae) a Potential Predator on Termites. *Journal of Biological Control*, 4 (2), 105–108.

Prasad, K., and Rajagopal, D. (1996). Carabid Beetles (Coleoptera: Carabidae) of Karnataka with their Prey and Ecological Notes. *Karnataka Journal of Agricultural Science*, 9(4): 610–615.

Prasad, K., and Rajagopal, D. (1997). Carabid Fauna (Coleoptera: Carabidae: Harpalini) of Karnataka and Their Ecology. *Karnataka Journal of Agricultural Sciences*, 10(2): 322–325.

Putzeys, J.A.A.H. (1846). Monographie des Clivina et genres voisins, précédée d'un tableau synoptique des genres de la tribu des Scaritides. *Mémoires de la Société Royale des Sciences de Liége*, 2: 521–663.

Putzeys, J.A.A.H. (1861). *Postcriptum ad clivinidarum monographiam atque de quibusdam aliis. Mense Novembris 1861*. Leodii: H. Dessain, 78 pp., 2 pls.

Putzeys, J.A.A.H. (1863). Postscriptum ad Clivinidarum Monographiam atque de quibusdam aliis. *Mémoires de la Société royale des sciences de Liège*, 18: 1–78.

Putzeys, J.A.A.H. (1866a). Étude sur les Amara de la collection de Mr. le Baron de Chaudoir. *Mémoires de la Société Royale des Sciences de Liège*, 1(2): 171–283.

Putzeys, J.A.A.H. (1866b). Coleopteres trouves en Espagne pendant l'excursion de la Societe en 1865. Amarides et Clivinides. *Annales de la Societe Entomologique de France*, (4) 6: 349–354.

Putzeys, J.A.A.H. (1867a). Révision générale des clivinides. *Annales de la Sociéte Entomologique de Belgique*, 10: 1–242.
Putzeys, J.A.A.H. (1867b). Additions aux Amara. *Entomologische Zeitung (Stettin)*, 28: 169–178.
Putzeys, J.A.A.H. (1868a). Supplement a la revision generale des clivinides. *Annales de la Societe Entomologique de Belgique*, 11: 7–22.
Putzeys, J.A.A.H. (1868b). Les broscides. *Entomologische Zeitung (Stettin)*, 29: 305– 379.
Putzeys, J.A.A.H. (1870). Trechorum oculatorum monographia. *Entomologische Zeitung, Stettin*, 31: 7–48.
Putzeys, J.A.A.H. (1873a). Deuxieme supplement a la revision generale des clivinides. *Annales de la Societe Entomologique de Belgique*, 16: 10–18.
Putzeys, J.A.A.H. (1873b). Monographie des Calathides. *Annales de la Societe Entomologique de Belgique*, 16: 19–96.
Putzeys, J.A.A.H. (1873c). Celia nitidiuscula. *Anales de la Sociedad Espanola de Historia Natural*, 2: 51–52.
Putzeys, J.A.A.H. (1875a). Descriptions de Carabiques nouveaux ou peu connus. *Annali di Museo Civico di Storia Naturale di Genova*, 1: 721–748.
Putzeys, J.A.A.H. (1875b). Notes sur les Carabiques recueillis par M. Jean Van Volxem a Ceylan, a Manille, en Chine et au Japon (1873-1874). *Annales de la Société Entomologique de Belgique*, 18: 45–55.
Putzeys, J.A.A.H. (1877a). Carabiques nouveaux du nord de l'Inde (Darjeling). *Entomologische Zeitung (Stettin)*, 38: 100–103.
Putzeys, J.A.A.H. (1877b). Description de quelques clivinides de l'Inde. *Bulletin de la Societe Entomologique de Belgique*, xl–xlvii.
Putzeys, J.A.A.H. (1878). [new species]. In: Chaudoir M.: Enumeration des cicindeletes et des carabiques recueillis par M.A. Raffray dans les iles de Zanzibar et de Pemba, ainsi qu'a Bagamoyo, Mombaze et sur les montagnes de Schimba, avec la description des especes nouvelles. *Revue et Magasin de Zoologie Pure et Appliquee*, (3) 6: 69–103.
Putzeys, J.A.A.H. (1879). Morio - Platynodes. *Entomologische Zeitung, Stettin*, 7(9): 285.
Qodri, A., Raffiudin, R., and Noerdjito, W.A. (2016). Diversity and Abundance of Carabidae and Staphylinidae (Insecta: Coleoptera) in Four Montane Habitat Types on Mt. Bawakaraeng, South Sulawesi. *HAYATI Journal of Biosciences*, 23: 22–28.
Quentin, R.M. (1952). Deux Mastax nouveaux d'Asie. *Revue Française d'Entomologie*, 19: 53–55.
Rainio, J. (2013). Seasonal Variation of Carabid Beetle (Coleoptera: Carabidae) Abundance and Diversity in Ranomafana National Park, Madagascar. *Journal of Entomology and Zoology Studies*, 1 (5): 92–98.
Rainio, J., and Niemelä, J. (2003). Ground beetles (Coleoptera: Carabidae) as bioindicators. *Biodiversity and Conservation*, 12: 487–506.
Rambur, J.P. (1838). *In: Faune entomologique de l'Andalousie. Volume 1.* Paris, A. Bertrand, 144 pp, 4 pls.
Redtenbacher, L. (1867). *Zoologischer Theil. Zweiter Band. I. Abtheilung A. 1. Coleopteren. In: Reise der österreichischen Fregatte Novara um die Erde in der Jahren 1857, 1858, 1859 unter den befehlen des Commodore B. von Wüllerstorf-Urbair*. Wien, Karl Gerold's Sohn, iv + 249pp, 5 pls.
Refseth, D. (1980). Ecological analyses of carabid communities– potential use in biological classification for nature conservation. *Biological Conservation*, 17: 131–141.
Reichardt, H. (1977). A synopsis of the genera of Neotropical Carabidae (Insecta: Coleoptera). *Quaestiones entomologicae*, 13: 346–493.
Reichardt, H. (1979). The South American carabid fauna: endemic tribes and tribes with African relationships, pp. 319–325. InT. L.Erwin, G. E.Ball, and D. R.Whitehead (eds.), *Carabid beetles: their evolution, natural history, and classification*. The Hague, Dr. W. Junk, Boston.

Reiche, L.J. (1842). Coléoptères de Colombie. *Revue Zoologique,* 5: 238–242, 272–276, 307–314, 374–378.
Reiche, L.J. (1843). Recherches sur les Helluonides, ou Révision du genre Helluo, Bonelli et Dejean. *Annales de la Société Entomologique de France*, 11: 323–344.
Reitter, E. (1883). Revision der europäischen Amblystomus-Arten. *Wiener Entomologische. Zeitung,* 2: 139–143.
Reshma, S., Nasreen, M., and Aiman, A. (2020). Seasonal variation and diversity of carabid beetles fauna (Coleoptera: Carabidae) in coastal areas of Sindh, Pakistan. *Pure and Applied Biology*, 9(2):1556–1567. http://dx.doi.org/10.19045/bspab.2020.90163
Riley, P.K.N., Browne, R.A., and Erwin, T.L. (2021). Carabid beetle (Coleoptera, Carabidae) richness, diversity, and community structure in the understory of temporarily flooded and non-flooded Amazonian forests of Ecuador. *ZooKeys,* 1044: 831–876.
Rosenstock, S.S. (1998). Influence of Gambel Oak on breeding birds in ponderosa pine forests of northern Arizona. *Condor*, 100: 485–492.
Roubah, A., Lasserre-Joulin, F., Amiaud, B., and Plantureux, S. (2014). Emergent effects of ground beetles size diversity on the strength of prey suppression. *Ecological Entomology*, 39: 47–57.
Roux, P., Lassalle, B., and Dubault, G. (2016). *Les Trigonotomi Révision.* B. Lassalle et P. Roux, France, 569 pp.
Sabu, K.T. (2018). Taxonomy and Barcoding of south Indian Carabidae. Final Technical Report submitted to Department of Science and Technology, Govt. of India, 274pp.
Sabu, K.T., Shiju, T.R., and Anu, A. (2010). Effectiveness of Pitfall Trapping, Winkler and Berlese Extraction Methods for Sampling Ground Dwelling Coleoptera in Tropical Montane Cloud Forests. *Oriental Insects*, 44: 345–360.
Saha, S.K. (1984). On some new and rare species of *Chlaenius* Bonelli of the Indian subregion in the Natural History Museum; Vienna (Carabidae: Coleoptera). *Koleopterologische Rundschau*, 57: 97–106.
Saha, S.K. (1986). Ground beetles (Insecta: Coleoptera: Carabidae) of Silent Valley (Kerala, India). *Records of the Zoological Survey of India*, 84(1–4): 67–77.
Saha, S.K. (1995). Fauna of West Bengal, Part 6A (Insecta: Coleoptera). *State Fauna Series,* 3: 447.
Saha, S.K., and Biswas, S. (1985). Zoological survey of India: Insecta: Coleoptera. Carabidae & Cicindelidae (Part 1). *Records of the Zoological Survey of India*, 82: 117–127.
Saha, S.K., and Halder, S.K. (2000). Insecta: Coleoptera: Adephaga: Carabidae. *Zoological survey of India*. *Fauna of Meghalaya. State Fauna Series,* 4 (Part 5): 1–40.
Saha, S.K., and Sengupta, T. (1979). On a collection of Indian *Chlaenius* Bonelli (Chlaeniini: Carabidae: Coleoptera) in Museum d' Histoire naturelle de Genève with descriptions of three new species. *Revue suisse de Zoologie*, 86(2): 419–425.
Saha, S.K., Mukherjee, A.K., and Sengupta, T. (1992). Carabidae (Coleoptera: Insecta) of Calcutta. *Records of the Zoological Survey of India*, 144: 1–63.
Schauberger, E. (1928). Beitrag zur Kenntnis der paläarktischen Harpalinen, IV. *Coleopterologisches Centralblatt*, 3: 65–85.
Schauberger, E. (1932). Zur Kenntnis der paläarktischen Harpalinen (Neunter Beitrag). *Koleopterologische Rundschau*, 18: 49–64.
Schauberger, E. (1935). Zur Kenntnis der indo-orientalischen Harpalinen (Sechster Beitrag). *Entomologischer Anzeiger*, 15: 93–110, 145–148.
Schaum, H.R. (1847). Bemerkungen über Fabricische Käfer. *Entomologische Zeitung, Stettin*, 8: 39–57.
Schaum, H.R. (1848). Nachträge und Berichtigungen zu einigen fruheren Aufsätzen. *Entomologische Zeitung, Stettin,* 9: 333–338.
Schaum, H.R. (1860). Notes 1° Note sur les genres Singilis et Phloeozeteus, etc.; 2° sur les Xylonotrogus et Elaphropus, ainsi que sur diverses observations de M. de Motschulsky

insérées dans le Bulletin du 4e Trimestre 1860. Séance du 14 Mars 1860. *Annales de la Société Entomologique de France*, 9: 633.
Schaum, H.R. (1863). Descriptions of four new genera of Carabidae. *The Journal of Entomology, Descriptive and Geographical*, 28: 74–78.
Schiødte, J.M.C. (1861). Danmarks Harpaliner. *Naturhistorisk Tidsskrift*, 1(3): 149–192.
Schmidt, J. (2008). Two new species of platynine carabid beetles from the Indian subcontinent, and remarks on synonymy and systematics of the genus Orthotrichus Peyron, 1856 (Coleoptera: Carabidae: Platynini). *Annals of Carnegie Museum*, 77(1): 195–203.
Schmidt-Göebel, H.M. (1846). *Faunula coleopterum Birmaniae, adjectus nonnulus Bengaliae indigenis. Med Dr. Johann Wilhelm Helfer's hinterlassene Sammlungen aus Vorder– und Hinter–Indien. Nach seinem Tode im Auftrage des böhm. National Museums unter Mitwirkung Mehrerer bearbeitet und herausgegeben*. *von Herm. Max. Schmidt-Göbel, Med. Dr. 1. Lfg.* Prag, G, Haase Söhne, viii + 94 pp, pls. 1–3.
Shannon, C.E., and Weaver, W. (1949). *The Mathematical Theory of Communication.* Urbana, IL: The University of Illinois Press: 1–117.
Shashkov, M., Alexeev, S., and Ivanova, N. (2020). Communities of ground beetles (Carabidae, Coleoptera) in broad-leaved forests of protected and urban areas of the Kaluga Oblast (European Russia). *Biodiversity Data Journal*, 8(1): e58688.
Shi, H., Zhou, H., and Liang, H. (2013). Taxonomic synopsis of the subtribe Physoderina (Coleoptera, Carabidae, Lebiini), with species revisions of eight genera. *ZooKeys*, 284: 1–129.
Shiju, T.R. (2012). Ground dwelling Coleoptera in the forest types of the moist south Western Ghats and taxonomy of the Tribe: Helluonini (Coleoptera: Carabidae). PhD Thesis. University of Calicut. 134 pp.
Shiju, T.R. (2018). Taxonomy of the subfamily: Lebiinae (Coleoptera: Carabidae) in south India with special emphasis on the south Western Ghats. Final Technical Report submitted to Kerala State Council for Science, Technology and Environment, 251pp. (Unpublished)
Shiju, T.R., and Sabu, K.T. (2010). Efficacy of pitfall trapping, Winkler and Berlese extraction methods for measuring ground dwelling arthropods in moist deciduous forests in the Western Ghats. *Journal of Insect Science*, 10(98): 1–17.
Shiju, T.R., and Sabu, K.T. (2019). Checklist of Indian Lebiinae Bonelli, 1810 (Coleoptera: Carabidae). *Journal of Insect Biodiversity*, 010 (1): 001–063.
Shiju, T.R., Madani, J.I., and Sabu, K.T. (2012b). A new carabid species of the genus *Macrocheilus* (Coleoptera) from India. *Oriental Insects*, 46(2): 97–106.
Shiju, T.R., Sabu, K.T., and Zhao, D. (2012a). The apterous endemic genus *Omphra* Dejean (Coleoptera: Carabidae: Helluonini) of the Indian subcontinent: taxonomy with notes on habits and distribution patterns. *Insecta Mundi*, 0206: 1–15.
Silvestri, F. (1904). Contribuzione alla conoscenza della metamorfosi e dei costume della *Lebia scapularis* Fourc. con descrizione dell' apparato sericipare della larva. *Redia*, 2: 68–84.
Simpson, E.H. (1949). Measurement of diversity. *Nature*, 163–688.
Sloane, T.G. (1898). On Carabidae from West Australia, sent by Mr. A.M. Lea (with descriptions of new genera and species synoptic tables, andc). *The Proceedings of the Linnean Society of New South Wales*, 23: 444–520.
Sloane, T.G. (1900). Studies in Australian Entomology No. IX. New species of Carabidae (with notes on some previously described species, and synoptic lists of species). *The Proceedings of the Linnean Society of New South Wales*, 24: 553–584.
Sloane, T.G. (1903). Studies in Australian entomology. No xii. New Carabidae (Panagaeini, Bembidiini, Pogonini, Platysmatini, Platynini, Lebiini, with revisional lists of genera and species, some notes on synonymy, andc.). *The Proceedings of the Linnean Society of New South Wales*, 28: 566–642.
Sloane, T.G. (1907). Studies in Australian Entomology. No. XV. New genera and species of Carabidae, with some notes on synonymy (Clivinini, Scaritini, Cunipectini,

Trigonotomini and Lebiini). *The Proceedings of the Linnean Society of New South Wales*, 32: 346–381.
Sloane, T.G. (1910). Revisional notes on Australian Carabidae. *The Proceedings of the Linnean Society of New South Wales*, 35: 435–480.
Sloane, T.G. (1914). Revisional notes on Australian Carabidae. Part V. *The Proceedings of the Linnean Society of New South Wales*, 39: 568–614.
Sloane, T.G. (1917). Carabidae from tropical Australia (New genera and species, notes on synonymy, and synoptic tables. Tribes Scaritini, Harpalini, Odacanthini, Lebiini and Helluonini). *The Proceedings of the Linnaean Society of New South Wales*, 42: 406–443.
Sloane, T.G. (1920). A list of the species of Australian Carabidae which range beyond Australia and its dependent islands. *The Proceedings of the Linnean Society of New South Wales*, 45: 320–323.
Sloane, T.G. (1923). Studies in Australian Entomology, New genera and species of Carabidae (Scaritini, Pterostichini, Merizodini, Bembidiini, Trechini, Odacanthini, Panagaeini, Licinini and Lebiini). *Proceedings of the Linnean Society of New South Wales*, 48(18): 17–39.
Sobhana, K.A., Sabu, K.T., and Benny, T.M. (2013). Checklist of Dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) associated with a dry deciduous forest in the South Western Ghats. *Hexapoda*, 20: 94–97.
Spence, J.R., and Niemelä, J. (1994). Sampling carabid assemblages with pitfall traps: the madness and the method. *Canadian Entomologist*, 126: 881–894.
Standen, V. (2000). The adequacy of collecting methods for estimating species richness of grassland invertebrates. *Journal of Applied Ecology*, 37: 884–893.
Stephens, J.F. (1827). *Illustrations of British entomology; or, a synopsis of indigenous insects: containing their generic and specific distinctions; with an account of their metamorphoses, times of appearance, localities, food, and economy, as far as practicable. Embellished with coloured figures of the rarer and more interesting species. Mandibulata.* Vol. I. London, Baldwin and Cradock, i–iv + 186 pp, 2 pls.
Straneo, S.L. (1938). Studi sulle specie orientali del genere Caelostomus MacL. (Coleopt. Carabid.). *Annali del Museo Civico di Storia Naturale "Giacomo Dorio"*, 60: 5–100.
Straneo, S.L. (1949). Due nuovi Pterostichini ciechi dell'Africa orientale (Coleoptera: Carabidae). *Bollettino della Societa Entomologica Italiana*, 79: 23–26.
Straneo, S.L. (1957). Nuovi Pterostichini. VII (Coleopt. Carab.). Doriana. *Supplemento agli Annali del Museo Civico di Storia Naturale "Giacomo Doria"*, 2(73): 1–8.
Straneo, S.L. (1961). Some new Callida (Coleoptera, Carabidae) in the collections of the British Museum. *Annals and Magazine of Natural History*, 13: 245–247.
Straneo, S.L. (1989). Nuovi Pterostichini asiatici (Coleoptera, Carabidae). *Bollettino del Museo Regionale di Scienze Naturali, Torino*, 7: 273–286.
Straneo, S.L. (1992). Note su alcuni Pterostichini d'Asia, II (Coleoptera, Carabidae). *Giornale Italiano di Entomologia*, 6 (32): 179–185.
Straneo, S.L. (1994). Sulle specie orientali del genere Catascopus Kirby, 1825 (Coleoptera: Carabidae). *Elytron*, 8:141–172.
Straneo, S.L. (1995). Sulle specie orientali del genere Catascopus Kirby, 1825 (Coleoptera, Carabidae). *Elytron*, 8: 141–172.
Sunderland, K.D. (2002). Invertebrate pest control by carabids, pp. 165–214. *In* J. M.Holland (ed.), *The agroecology of carabid beetles*. Intercept, Andover, United Kingdom.
Szentkirály, F. (2002). Fifty-Year-Long Insect Survey In Hungary: T. Jermy's contributions to Light-Trapping. *Acta Zoologica Academiae Scientiarum Hungaricae*, 48: 85–105.
Tamutis, V., and Barsevskis, A. (2014). A faunistic review of ground beetles of Lebiinae Bonelli, 1810 (Coleoptera: Carabidae) of Lithuania. *Entomologica Fennica*, 25:68–85.
Thiele, H.U. (1977). *Carabid Beetles in Their Environments*. Springer, Berlin, 372 pp.

Thomas, K., Vinodkumar, D.K., John, J.M., Shaji, M., and Nameer, P.O. (2018). A report on the possible interbreeding between Grizzled Giant Squirrel Ratufa macroura and Indian Giant Squirrel Ratufa indica from Chinnar Wildlife Sanctuary in the southern Western Ghats, India. *Journal of Threatened Taxa*, 10(15): 13024–13028.

Tian, M., and Deuve, T. (2000). Contributions to the knowledge of genus Orthogonius Macleay 1825, in China (Coleoptera, Caraboidea). *Nouvelle Revue d'Entomologie*, 17(4): 293–304.

Tian, M., and Deuve, T. (2005). Species of the genus *Orthogonius* Macleay (Coleoptera, Caraboidea) from Bhutan and Sikkim. *Acta Zootaxonomica Sinica*, 30: 601–605.

Tian, M., and Deuve, T. (2006a). Contribution to the knowledge of the tribe *Orthogoniini* of the Oriental Region. I (Coleoptera, Caraboidea). *Coleopteres*, 12(8): 69–110.

Tian, M., and Deuve, T. (2006b). Contribution to the knowledge of the tribe *Orthogoniini* of the Oriental Region. II (Coleoptera, Caraboidea). *Coleopteres*, 12(9): 111–154.

Tian, M., and Deuve, T. (2015). Four new *Brachinus* species (Coleoptera: Carabidae: Brachininae) from Indo-Burma Region. *Oriental Insects*, 49: 233–242.

Tian, M., and Deuve, T. (2016a). A review of the *baconii* species group of the termitophilous genus *Orthogonius* MacLeay (Coleoptera: Carabidae: Orthogoniini). *Zootaxa,* 4093(1): 118–126.

Tian, M., and Deuve, T. (2016b). Definition of the jianfengling species group of the ground beetle genus *Orthogonius* MacLeay (Coleoptera, Carabidae, Orthogoniini). *ZooKeys*, 615: 95–117.

Timm A., Dayan, T., Levanony, T., Wrase, D.W., and Assmann, T. (2007). Towards combined methods for recording ground beetles: Pitfall traps, hand picking and sifting in Mediterranean habitats of Israel. *Proceedings ofthe XIII European Carabidologists Meeting Blagoeograd,* 397–408.

Tiofilova, T. (2017). A contribution to the study of ground beetles (Coleoptera: Carabidae) in the Western Rhodope Mts. (Bulgaria). *Journal of BioScience and Biotechnology*, 6(3):203–209.

Toft, S., and Bilde, T. (2002) Carabid diets and food value. In: Holland JM (Ed) The Agroecology of Ground Beetles. *Intercept, Andover*, 81–110.

Tóthmérész, B., Máthé, I., Balázs, E., and Magura, T. (2011). Responses of carabid beetles to urbanization in Transylvania (Romania). *Landscape and Urban Planning,* 101(4):330–337.

Tschitschérine, T. (1894a). Note sur quelques espèces de la tribu des Scaritides. *Horae Societatis Entomologicae Rossicae,* 28: 224–235.

Tschitschérine, T. (1894b). Description de deux nouvelles espèces de la tribu des Trigonotomides. *Horae Societatis Entomologicae Rossicae*, 28: 444–448.

Tschitschérine, T. (1898). Quelques observations sur le. Descriptive Catalogue of the Coleoptera of South Africa de M. L. Péringuey, part. II Par T. Tschitschérine. *Horae Societatis Entomologicae Rossicae,* 515–548.

Tschitschérine, T. (1900a). Mémoire sur la tribu de Harpalini. *Horae Societatis Entomologicae Rossicae,* 34: 335–370.

Tschitschérine, T. (1900b). Notes sur les Platysmatini du Muséum d'Histoire Naturelle de Paris. II. *Horae Societatis Entomologicae Rossicae*, 34: 153–198.

Tschitschérine, T. (1901). Platysmatini (Coleoptera, Carabidae) nouveaux ou peu connus de l'Asie orientale. *Russkoe Entomologicheskoe Obozrenie,* 1: 239–250.

Tschitschérine, T. (1902). Notes sur les Platysmatini de l'Australie. *Horae Societatis Entomologicae Rossicae,* 35: 502–534.

Tschitschérine, T. (1904). Dyschirius unicolor Motsch. et ses races (Coleoptera, Carabidae). *Russkoe Entomologicheskoe Obozrenie*, 4: 266–267.

Tschitscherine, T.S. (1894a). Note sur quelques especes de la tribu des Scaritides. *Horae Societatis Entomologicae Rossicae,* 28: 224–235.

Tschitscherine, T.S. (1894b). Diagnoses de quelques nouvelles especes de la tribu des Feroniens. *Horae Societatis Entomologicae Rossicae*, 28: 254– 258.
Tschitscherine, T.S. (1894c). Description de deux nouvelles especes du genre Harpalus Latr. *Horae Societatis Entomologicae Rossicae*, 28: 259–261.
Tschitscherine, T.S. (1894d). Description d'une nouvelle espece du genre Nebria Latr. *Horae Societatis Entomologicae Rossicae*, 28: 28–288.
Tschitscherine, T.S. (1894e). Materiaux pour servir a l'etude des Feroniens. II. *Horae Societatis Entomologicae Rossicae*, 28: 366–435.
Tschitscherine, T.S. (1894f). Description de deux nouvelles especes de la tribu des Trigonotomides. *Horae Societatis Entomologicae Rossicae*, 28: 444–448.
Tschitscherine, T.S. (1895). Description de deux nouvelles especes du genre Bembidium Latr. *Horae Societatis Entomologicae Rossicae*, 29: 298–302.
Tschitscherine, T.S. (1897). Materiaux pour servir a l'etude des feroniens. III. *Horae Societatis Entomologicae Rossicae*, 30: 260–351.
Tschitschérine, T.S. (1898). Quelques observations sur le. Descriptive Catalogue of the Coleoptera of South Africa de M. L. Péringuey, part. II Par T. Tschitschérine. *Horae Societatis Entomologicae Rossicae*, 515–548.
Tschitscherine, T.S. (1899a). Diagnoses de quelques nouvelles especes de la famille des carabiques. *Horae Societatis Entomologicae Rossicae*, 32: 318–324.
Tschitscherine, T.S. (1899b). Note sur un nouveau genre de la tribu des Harpaliens. *Horae Societatis Entomologicae Rossicae*, 32: 60–603.
Tschitscherine, T.S. (1899c). Carabiques nouveaux de Darjeeling rapportes par M. le capitaine B. Nowitzky. *Horae Societatis Entomologicae Rossicae*, 32: 657–662.
Tschitscherine, T.S. (1900a). Memoire sur la tribu des Harpalini. *Horae Societatis Entomologicae Rossicae, Trudy Russkogo ėntomologicheskogo obshchestva*, 34: 335–370.
Tschitschérine, T.S. (1900b). Notes sur les Platysmatini du Muséum d'Histoire Naturelle de Paris. VII. *Horae Societatis Entomologicae Rossicae*, 34: 448–478.
Tschitscherine, T.S. (1901a). Genera des Harpalini des regions palearctique et paleanarctique. *Horae Societatis Entomologicae Rossicae Trudy Russkogo ėntomologicheskogo obshchestva*, 35: 215–251.
Tschitscherine, T.S. (1901b). Note sur quelques Platysmatini nouveaux ou peu connus. *Horae Societatis Entomologicae Rossicae*, 35: 51, 502, 506, 507.
Tschitscherine, T.S. (1903). Notice sur divers Notiophilus Dum. *Horae Societatis Entomologicae Rossicae*, 36: 108–117.
Tulli, M.C., Carmona, D.M., Lopez, A.N., Manetti, P.L., Vincini, A.M., and Cendoya, G. (2009). Predation on the slug *Deroceras reticulatum* (Pulmonata: Stylommatophora) by *Scarites anthracinus* (Coleoptera: Carabidae). *Ecología Austral*, 19: 55–61.
Vaibhao, G.T., Varsha, S.Z., and Hegde, V.D. (2013). Ground beetles (Coleoptera: Carabidae) of Melghat Tiger Reserve, Central India. *Journal on New Biological Reports*, 2(2): 173–176.
Vanbergen, A.J., Woodcock, B.A., Koivula, M., Niemelä, J., Kotze, D.J., Bolger, T., Golden, V., Dubs, F., Boulanger, G., Serrano, J., Lencina, J.L., Serrano, A., Aguiar, C., Grandchamp, A.C., Stofer, S., Szél, G., Ivits, E., Adler, P., Markus, J., and Watt, A.D. (2010) Trophic level modulates carabid beetle responses to habitat and landscape structure: a pan-European study. *Ecological Entomology*, 35: 226–235.
Vennila S., and Rajagopal, D. (1999). Optimum sampling effort for study of tropical ground beetles (Carabidae: Coleoptera) using pitfall traps. *Current Sciences*, 77: 281–283.
Vigors, N.A. (1825). Descriptions of some rare, interesting, or hitherto uncharacterized subjects of Zoology (cont.). *Zoological Journal*, 1: 526–542.
Waage, B.E. (1985). Trapping efficiency of carabid beetles in glass and plastic pitfall trap containing different solutions. Fauna Norvegica (Oslo). *Ser B*, 32: 33–36.

Walker, F. (1858). Characters of some apparently undescribed Ceylon Insects. *The Annals and Magazine of Natural History*, 3(2): 202–209.
Ward, D.F., New, T.R., and Yen, A.L. (2001). Effects of pitfall trap spacing on the abundance, richness and composition of invertebrate catches. *Journal of Insect Conservation*, 5: 47–53.
Wiedemann, C.R.W. (1819). Neue Kafer aus Bengalen und Java. *Zoologische Magazin*, 1: 157–183.
Wiedemann, C.R.W. (1821). Neue exotische Käfer. *Magazin der Entomologie*, 4: 107–183.
Wiedemann, C.R.W. (1823). Zweihundert neue Kafer von Java, Bengalen und dem Vorgebirge der guten Hoffnung. *Zoologisches Magazin*, 2(1): 1–164.
Wiedemann, C.R.W. (1823). Zweihundert neue Käfer von Java, Bengalen und dem Vorgebirge der guten Hoffnung. *Zoologisches Magazin*, (2): 1–135, 162–164.
Wollaston, T.V. (1867). *Coleoptera Hesperidum, being an enumeration of the coleopterous insects of the Cape Verde Archipelago.* John Van Voorst, London, xxxix + 285 pp.
Woodcock, B.A. (2005). Sampling theory and practice. *In:* Leather, S. R, (eds.). *Insect sampling in forest ecosystems*: 37–57. Blackwell publishing.
Work, T.T., Buddle, C.M., Korinus, L.M., and Spence, J.R. (2002). Pitfall trap size and capture of three taxa of litter-dwelling arthropods: Implications for biodiversity studies. *Environmental Entomology*, 31: 438–448.
Worthen, W.B., and Merriman, D. (2013). Relationships between Carabid Beetle Communities and Forest Stand Parameters: Taxon Congruence or Habitat Association?. *Southeastern Naturalist*, 12: 379–386.
Wrase, D.W. (2005). Nomenclatorial, taxonomic and faunistic notes on some Palaearctic genera and species of ground-beetles (Coleoptera, Carabidae: Apotomini, Chlaeniini, Cyclosomini, Harpalini, Lebiini, Licinini, Platynini, Pterostichini, Siagonini, Sphodrini). *Linzer Biologische Beiträge*, 37(1): 815–874.
Yu, X., Luo, T., and Zhou, H. (2006). Habitat associations and seasonal activity of carabid beetles (Coleoptera: Carabidae) in Dongling Mountain, North China. *Entomologica Fennica*, 17: 174–183.
Yu, X., Luo, T., and Zhou, H. (2009). Distribution of carabid beetles (Coleoptera: Carabidae) across ecotones between regenerating and mature forests in southwestern China. *Environmental Entomology*, 38: 1053–1060.
Yu, X., Luo, T., and Zhou, H. (2010). Distribution of ground-dwelling beetle assemblages (Coleoptera) across ecotones between natural oak forests and mature pine plantations in North China. *Journal of Insect Conservation*, 14: 617–626.
Yu, X., Luo, T., Zhou, H., and Yang, J. (2007). Distribution of Carabid Beetles (Coleoptera: Carabidae) across a Forest Grassland Ecotone in Southwestern China. *Environmental entomology*, 36: 348–55.
Zou, Y., Sang, W., Zhou, H., Huang, L., and Axmacher, J.C. (2014). Altitudinal diversity patterns of ground beetles (Coleoptera: Carabidae) in the forests of Changbai Mountain, Northeast China. *Insect Conservation and Diversity*, 7: 161–171.
Zhao, D., Deuve, T., and Tian, M. (2008). A review of the genus Omphra Reiche (Coleoptera: Carabidae: Helluonini). *Oriental Insects*, 42: 367–378.

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 August 2022 | 14(8): 21619–21641

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

https://doi.org/10.11609/jott.7613.14.8.21619-21641

#7613 | Received 09 August 2021 | Final received 20 June 2022 | Finally accepted 04 August 2022

OPEN ACCESS

COMMUNICATION

Checklist of Carabidae (Coleoptera) in the Chinnar Wildlife Sanctuary, a dry forest in the rain shadow region of the southern Western Ghats, India

M.C. Sruthi [1] & **Thomas K. Sabu** [2]

[1] Entomology Research Unit, Post Graduate & Research Department of Zoology, St. Joseph's College, Devagiri, Kozhikode, Kerala 673008, India.

[2] Department of Zoology, University of Calicut, Tenhipalam, Kerala 673635, India,

[1] sruthimangichalil@gmail.com, [2] sabukthomas@gmail.com (corresponding author)

Abstract: The first report on the composition of carabids from a natural forest in peninsular India as well as from a dry forest belt in the rain shadow region of the Western Ghats is provided, with data on the subfamilies, tribes, genera, species, geographic range, collection techniques, and the relevant literature details for all the listed species. Fifty-four species belonging to 11 subfamilies and 31 genera were recorded. Harpalinae, Lebiinae, and Scaritinae with 15, 14, and seven species, respectively, are the species-rich subfamilies. The species list also includes two first records from India, four first records from southern India, and six species endemic to the Western Ghats and Sri Lanka biodiversity hot spot.

Keywords: Carabids, Eastern slope, endemism, first Indian record, ground beetles, peninsular India.

സംഗ്രഹം: ഉപകുടുംബങ്ങൾ, ഗോത്രങ്ങൾ, ജനുസ്സുകൾ, സ്പീഷിസുകൾ, ഭൂമിശാസ്ത്രപരമായ ശ്രേണികൾ, ശേഖരണ സാങ്കേതികതകൾ, ലിസ്റ്റ് ചെയ്ത എല്ലാ ജീവജാലങ്ങളുടെയും പ്രസക്തമായ സാഹിത്യ വിശദാംശങ്ങൾ എന്നിവയെക്കുറിച്ചുള്ള അടിസ്ഥാനവിവരം സഹിതം, ഇന്ത്യൻ ഉപദ്വീപിലെ ചിന്നാർ വന്യജീവി സങ്കേതത്തിൽ നിന്നും പശ്ചിമഘട്ടത്തിലെ മഴനിഴൽ മേഖലയിലെ വരണ്ട വനമേഖലയിൽ നിന്നുമുള്ള കാരബിഡുക (Carabidae) ളുടെ ഘടനയെക്കുറിച്ചുള്ള ആദ്യ റിപ്പോർട്ട് നൽകിയിരിക്കുന്നു. 11 ഉപകുടുംബങ്ങളിലും 31 ജനുസ്സുകളിലുമായി 54 ഇനം രേഖപ്പെടുത്തിയിട്ടുണ്ട്. യഥാക്രമം 15, 14, 7, ഇനങ്ങളുള്ള ഹാർപാലിനേ (Harpalinae), ലെബിനേ (Lebiinae), സ്കാരിറ്റിനേ (Scaritinae) എന്നിവ ഇനങ്ങളാൽ സമ്പന്നമായ ഉപകുടുംബങ്ങളാണ്. സ്പീഷിസ് ലിസ്റ്റിൽ ഇന്ത്യയിൽ നിന്നുള്ള 2 ആദ്യ റെക്കോർഡുകളും ദക്ഷിണേന്ത്യയിൽ നിന്നുള്ള 4 ആദ്യ റെക്കോർഡുകളും പശ്ചിമഘട്ടത്തിലും ശ്രീലങ്കയിലെയും ജൈവവൈവിധ്യ ഹോട്ട് സ്പോട്ടിൽ മാത്രം കാണപ്പെടുന്ന 6 സ്പീഷിസുകളും ഉൾപ്പെടുന്നു.

Editor: Anonymity requested.

Date of publication: 26 August 2022 (online & print)

Citation: Sruthi, M.C. & T.K. Sabu (2022). Checklist of Carabidae (Coleoptera) in the Chinnar Wildlife Sanctuary, a dry forest in the rain shadow region of the southern Western Ghats, India. *Journal of Threatened Taxa* 14(8): 21619–21641. https://doi.org/10.11609/jott.7613.14.8.21619-21641

Funding: Council for Scientific and Industrial Research.

Competing interests: The authors declare no competing interests.

Author details: M.C. Sruthi works as CSIR-SRF under the guidance of Dr. Sabu K. Thomas. Her area of specialisation is the taxonomy of Carabidae. Sabu K. Thomas, is currently a professor interested in the ecology & taxonomy of dung beetles & Carabidae and home invading nuisance pest, *Luprops tristis*. He is currently engaged with updating the taxonomy of Indian Carabidae. He has discovered 18 new Carabidae species and 11 dung beetle species.

Author contributons: SKT and MCS reviewed the earlier works and discussed the distribution patterns. MCS conducted the field studies and prepared the images and the specimens.

Acknowledgements: Financial support received from the Council for Scientific and Industrial Research by the first author (CSIR, Govt. of India; Fileno: 08/453(0007)/2017-EMR-I) and the infrastructure facilities from DST SERB funded major research project to second author are gratefully acknowledged. We thank and acknowledge the Kerala Forest and Wildlife Department for sample collection permissions; Beulah Garner, curator, BMNH London, Thierry Deuve, Azadeh Taghavian Azari, Curator, MNHN Paris, Aleksey A. Gusakov, MS Zoologist, curator of Coleoptera Zoological Museum of the Moscow Lomonosov State University, for locating and sending photographs; Akhil S.V., Jithmon V.A., Divya M., Ashly Kurian, Shigina K., Aswathi S.B., and Nijisha K. (St. Joseph's College, Devagiri, Kozhikode) for their logistic support.