TAXONOMIC COMPOSITION, STRUCTURE AND DYNAMICS OF CARABID COMMUNITY (COLEOPTERA: CARABIDAE) IN SELECTED RICE AGRO-ECOSYSTEMS

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For the award of the Degree of

DOCTOR OF PHILOSOPHY IN ZOOLOGY

(Under the Faculty of Science)

By

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Under the Guidance of

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CERTIFICATE

This is to certify that the thesis entitled ***"TAXONOMIC COMPOSITION, STRUCTURE AND DYNAMICS OF CARABID COMMUNITY (COLEOPTERA: CARABIDAE) IN SELECTED RICE AGRO-ECOSYSTEMS"*** *submitted to the University of Calicut for the award of the degree of Doctor of Philosophy in Zoology, is the record of the original work done by Ms. Ashly Kurian in the PG & Research Department of Zoology, St. Joseph's College (Autonomous), Devagiri, Kozhikode, under my supervision and guidance. This work has not been previously formed the basis for any award of degree or diploma.*

Ms. Ashly Kurian has successfully completed the preliminary qualifying examination prescribed by the University of Calicut.

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I also certify that the adjudicators have not suggested any changes/corrections in the thesis and recommend to accept in the present form.

Place: Tenhipalam
Date: 08/06//2023

Dr. Sabu K Thomas
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DECLARATION

I do hereby declare that the thesis entitled ***"TAXONOMIC COMPOSITION, STRUCTURE AND DYNAMICS OF CARABID COMMUNITY (COLEOPTERA: CARABIDAE) IN SELECTED RICE AGRO-ECOSYSTEMS"*** *submitted to the University of Calicut for the award of degree of Doctor of Philosophy in Zoology is an authentic record of the work carried out by me under the supervision and guidance of Dr. Sabu K Thomas, Professor, Department of Zoology, University of Calicut, Tenhipalam, and that no part of this has been published previously or submitted for the award of any degree, diploma, associateship, fellowship, or other similar titles of recognition.*

Place: Devagiri ***Ashly Kurian***

Date:

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Ashly Kurian

Dedicated to my Family and Teachers

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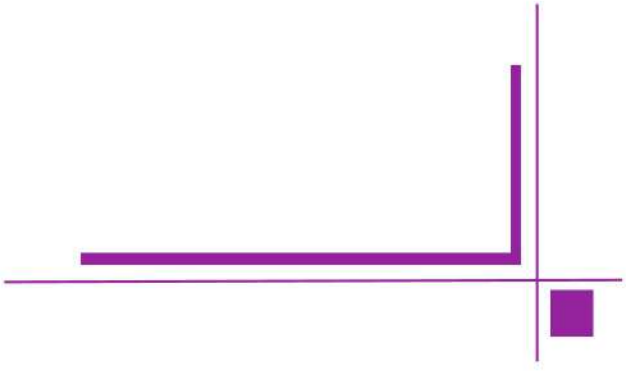
Chapter 1

INTRODUCTION



1. Introduction

1.1 Family Carabidae

1.1.1 Taxonomy

Coleoptera is the largest order of insects with more than 4,20,000 species (Slipinski *et al.,* 2011), constituting about 40% of the insect species discovered (Banerjee 2014). Carabidae (Insecta: Coleoptera) commonly known as ground beetles or carabids is the largest family in the suborder Adephaga, and one of the most species-rich family with an estimated 40,000 known species under 88 tribes and 34 subfamilies across the world (Lorenz 2022, Anichtchenko 2022). Adult beetles of the suborder Adephaga is distinguished by the presence of six abdominal ventrites and pygidial defense glands, and larvae by liquid-feeding mouthparts (Lövei and Sunderland 1996). Family Carabidae was erected by Latreille (1802) with 29 genera (Erwin *et al.,* 2015) and now the number of species exceeds so far up to 40,000 species according to the globally accepted modern classification of Lorenz (2005 and 2022). More than 1,700 species under 48 tribes and 24 subfamilies recorded from India (Andrewes 1930a, Lorenz 2005 and 2022, Anichtchenko 2022). Indian taxonomic works of Carabidae mainly depend on *Fauna of British India, Volume I– Carabinae* (Andrewes 1929) and *Volume 2– Harpalinae* (Andrewes 1935a), which dealt with the species belonging to 14 subfamilies out of the 24 subfamilies recorded from India excluding the ten lesser known subfamilies. After Andrewes (1919–1946), significant contributions to the taxonomy of Indian Carabidae were done by Kirschenhofer (1987–2018), Saha (1984 and 1986), Saha and Biswas (1985), Saha *et al.,* (1992), Abitha *et al.,* (2008

and 2009), Abitha and Sabu (2009), Shiju *et al.,* (2012a and 2012b), Jithmon and Sabu (2018 and 2021), Akhil and Sabu (2019a, 2019b and 2021), Shiju and Sabu (2019), Akhil *et al.,* (2020), Divya and Sabu (2020), Divya *et al.,* (2020), Ashly and Sabu (2022) and Sruthi and Sabu (2022).

Even though taxonomic studies of carabid beetles with species lists from different habitat types is well-known world-wide, studies from the rice agro-ecosystem are minimal, with a few studies from India (Jadhao and Bhongade 2018, Divya 2022). In the present effort, taxonomic data of carabid beetles in the selected rice agro-ecosystems are documented in the form of checklists and taxonomic keys.

1.1.2. Ecology

Carabid beetles are diverse and abundant insects, inhabit almost all terrestrial habitats (Thiele 1977, Holland 2002, Park *et al.*, 2006). Carabids are distributed across the world between 78^{o}N and 55^{o}S latitude (Ball and Bousquet 2001, McCravy and Lundgren 2011). Ground beetles, as the name denotes normally live on the soil surface (Kromp 1999, Jadhao and Bhongade 2018). Slender body, long legs and thread-like antennae allow family level identification easier (Kromp 1999, Goulet 2003). Carabids have several morphological adaptations like long and narrow legs for fast running, strong mandibles for predation, large compound eyes for better vision and antennal cleaning organ for chemosensory reception (Kulkarni *et al.*, 2015). Majority of the species are dark- shiny or dull coloured and some are bright or metallic (Lövei and Sunderland 1996, Riddick 2008). Size ranges from 2 mm to greater

than 50 mm in length (Homburg *et al.*, 2013). Most of the species are good runners and many can fly. Based on the development of hind wings carabids are classified in to three types, macropterous species with well-developed hind wings, brachypterous with reduced wings and apterous with no wings (Kromp 1999).

Carabids are polyphagous, there are carnivores (consume Collembola, earthworms, nematodes, slugs, snails, aphids, eggs and larvae of Diptera and Coleoptera, Lepidoptera pupae) (Kromp 1999, Holland and Luff 2000, Holland 2002, Kulkarni *et al.*, 2015, Matta *et al.*, 2017), herbivores (consume seeds, leaves, pollen, fruits) and omnivores (Rondon *et al.*, 2013, Kulkarni *et al.*, 2015). Most of the species are generalist predators while some are specialists. Most of the ground beetles are nocturnal, they usually locate prey by random search method, in which they detect the prey by physical contact. Diurnal species mainly locate their prey by vision using large compound eyes. Besides these two methods several species use chemical cues produced by the prey to locate them (Riddick 2008). Both internal (hunger) and external factors (availability of food and predation threat) influences the foraging behaviour of carabid beetles which in turn influences the larval growth and sexual maturation (Heij and Willenborg 2020).

Carabids are holometabolous (complete metamorphosis development) insects. They normally lay eggs singly after deciding a suitable oviposition site (soil, leaf litter, crevices or decay wood) by females based on the microclimatic components. Their eggs are white and oval shaped (Lövei and

Sunderland 1996, Trefas and Lenteren 2008, Kulkarni *et al.*, 2015). Parental caring exhibited by some species and which consists of guarding of the egg and collection of seeds for larvae (Lövei and Sunderland 1996). Larva is campodeiform (Crowson 1981, Lövei and Sunderland 1996) with three instars in most of the genera. Pupation occurs in a specifically constructed chamber (Lövei and Sunderland 1996).

Carabid abundance and species richness positively correlated with habitat diversity (Kromp and Steinberger 1992, Cameron and Leather 2012, Bennewicz and Barczak 2020). Temperature or moisture, food availability, competition and climatic seasons influences the habitat preference of carabid beetles (Lövei and Sunderland 1996). Darlington (1971) placed ground beetles under three main ecological groups namely geophiles or mesophiles which live on ground, hydrophiles which live in the edges of water bodies like ponds, streams or in swamps and arboricoles that live above the ground on vegetation (Lövei and Sunderland 1996, Park *et al.*, 2006).

Carabid beetles are highly responsive to environmental changes, which make them a good indicator group (Holland 2002, Kolařík *et al.*, 2014). They can be used to detect the changes in the biotic factors of the environment (PH, humidity, organic matter and temperature) (Rainio and Niemela 2003) and effect of toxic substances (pesticides, herbicides and industrial fertilizers) (Kolařík *et al.*, 2014) and agricultural practices (fragmentation and land management) on organisms (Rainio and Niemela 2003). They indicate habitat changes by means of changes in physiological or morphological characters, number and abundance of

species and ecological interactions (Avgin and Luff 2010). Carabid beetles can regulate insect pest populations (Heij and Willenborg 2020, Cividanes 2021) and weed seeds in agricultural fields (Menalled *et al.,* 2007, Petit *et al.,* 2014). So they are considered as important biological control agents in various habitats. Anti-predator defence mechanisms shown by many of the carabid beetles, which include aposematism (*Lebia*), chemical secretions (genus *Brachinus, Anchomenus dorsalis*) and gregariousness or group formation (*Agonum dorsale, Brachinus crepitans, B. sclopeta, B. explodens, B. variventris*, *Colliuris batesi* and *Nebria brevicollis*) (Lövei and Sunderland 1996, Brandmayr *et al.*, 2007).

1.2. Rice agro-ecosystem

Rice (*Oryza sativa*) is the staple food in East and South Asia, West Indies, the Middle East and Latin America with almost 90% production and consumption in Asian countries. More than half of the world's population considers rice as their main diet (Ali *et al.,* 2019 and 2020). Rice agro-ecosystem is a monoculture agro-ecosystem with rice plant filled rectangular fields surrounded by herbaceous levees. Rice agro-ecosystem include both aquatic and dry phases, can be considered as temporary wetlands, inhabited by a rich arthropod fauna, including prey, predators and decomposers (Bambaradeniya *et al.,* 2004). Arthropod community of the rice fields inhabit in the rice crop and soil surface and their composition varies according to the growth stages of rice crop (Heong *et al.,* 1991, Bambaradeniya and Edirisinghe 2008) and ecological phases (aquatic, semi aquatic and dry land) of the rice field (Bambaradeniya *et al.,* 2004).

1.2.1. Predators in the rice agro-ecosystem

Natural enemies are the biotic components in an agro-ecosystem which regulate pest populations. Both predators and parasitoids act as natural enemies in rice agro-ecosystem (Isnawan and Ramadhanti 2021). There are several works across the world on the diversity and role of spiders as predators in rice agro-ecosystems (Sahu *et al.*, 1996, Sigsgaard 2000, Drechsler and Settele 2001, Lee and Kim 2003, Motobayashi *et al.*, 2006, Rodrigues *et al.*, 2009, Radermacher *et al.*, 2020), and it is well explored in India (Pathak and Saha 1999, Bhattacharya 2000, Vanitha 2000, Jayakumar and Sankari 2010, Patel *et al.*, 2013, Chandra *et al.*, 2017, Saha *et al.*, 2020, Ravi *et al.*, 2022) including Kerala (Sunil *et al.*, 2002, Sudhikumar *et al.*, 2005, Sebastian *et al.*, 2005, John and Tom 2018, Malamel *et al.*, 2018). Besides spiders, rove beetles (Staphylinidae) (Jadhao and Shukla 2016, Isnawan and Ramadhanti 2021), dragonfly and damselfly species (Odonata), ant species (Formicidae), ladybird species (Coccinellidae), Carabidae (Ghahari *et al.*, 2008) and parasitic hymenopterans (Ghahari *et al.*, 2008, Rajmohana 2014, Daniel and Ramaraju 2019) are also act as natural enemies in the rice agro-ecosystem. The role of carabid beetles as predators in the rice agro-ecosystem is little explored.

1.2.2. Carabid beetles in the rice agro-ecosystem

Carabid beetles are the natural enemies in the rice ecosystem, can be used to regulate pest population effectively. They predate on many rice insect pests (aphids, fly maggots, grubs, and slugs) and maintain an equilibrium by regulating their number, acting as a keystone taxon in the rice agro-ecosystem (Bambaradeniya *et al.*, 2004, Ali *et al.*, 2018). Species of the tribe Zabrini

(subfamily Pterostichinae) and Harpalini (subfamily Harpalinae) act as weed seed predators in the rice agro-ecosystem. Carabid beetles regulate both weed and insect pest populations of the rice agro-ecosystem (Adhikari and Menalled 2018).

1.2.3. Rice agro-ecosystems in Kerala

Rice is the important crop and staple diet for the majority of the populations in India. India is first position in the rice cultivation area and second in the rice production among the countries (Kala and Leena 2018). Kerala state is located in the tropical region of Indian Peninsula between 8°17' to 12°27' N latitude and 74°51' to 77°24' E longitude, have an area of about 38863 km^2 (Padmalal *et al.*, 2011). Kerala is a state with varying landforms and climatic factors, thus rice cultivation in the state is strongly influenced by these factors. The state is topographically divided into three zones, lowland, midland and highland. Paddy cultivation in Kerala ranges from lowland regions (3 m below MSL) to high ranges (800-1500 m above MSL) (Kumar and Kunhamu 2021). Palakkad district is located in the middle of Kerala state (10°46'27.84" N latitude & 76°39'22.50" E longitude). Palakkad contains both midland and highland regions and Pattambi of the Palakkad district comes under the midland zone and is a part of Palakkad gap. The Palakkad gap and physiography of the district influences the climate (rainfall, temperature) of the district and makes favourable conditions for paddy cultivation seasons in Palakkad. Wayanad is a high range agro-climatic zone with an altitude of 700 m MSL to 2100 m MSL. District is characterized by several hills and valleys, and paddy is cultivated in the broad valley bottoms (Kumar and Kunhamu 2021). District has 2,322 mm mean rainfall & 18°C to 29°C mean temperature

(Prajeesh *et al.,* 2014). These physiographic and climatic factors of the district makes a favourable condition for rice cultivation. Paddy is cultivated in two seasons in Wayanad, ie. 1) nancha cultivation (winter), which is sown in June-July and harvested in November-December & puncha (summer) cultivation, sown in December-January and harvested in April-May (Gaetaniello *et al.,* 2014).

Studies on the predators in the rice agro-ecosystems of Kerala mainly focused on the spider fauna and their predatory efficacy, which includes the predatory potency of spiders on the insect pests of the rice agro-ecosystems in Kuttanad (Malamel *et al.,* 2018), spider fauna associated with the rice agro-ecosystems of high range, midland and lowland regions in the central Kerala (Sebastian *et al.,* 2005), the diversity of spiders in the rice agro-ecosystems of Thiruvananthapuram district (Joseph and Premila 2016) and Kumarakom in the Kottayam district (John and Tom 2018) and spider abundance in different seasons in the rice agro-ecosystem of Kuttanad (Sudhikumar *et al.,* 2005).

The world-wide studies of carabid beetles in the rice agro-ecosystem is limited with a few studies from Italy, Africa, Iran, India, Sri Lanka and Korea. Studies on the Carabid fauna in the rice agro-ecosystems of India includes, studies from Maharashtra (Jadhao and Bhongade 2018) and Kerala (Divya 2022). The present study will provide detailed ecological aspects (abundance, richness, diversity and seasonality) of carabid beetles in the rice agro-ecosystems in Pattambi (Palakkad) and Ambalavayal (Wayanad) of the Kerala state.

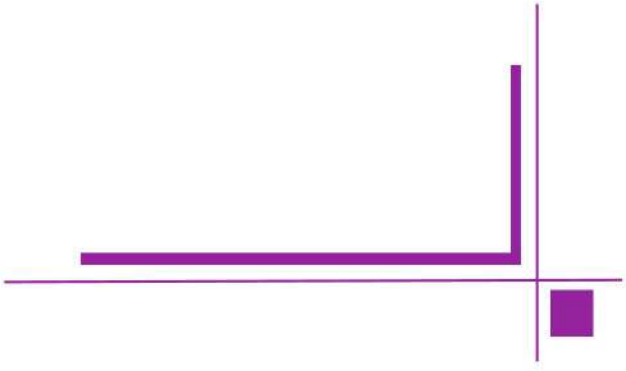
1. 3. Objectives

l. Taxonomic analysis and preparation of a faunal inventory of Carabidae.

2. Analysis of the diversity, abundance and seasonality (pre-harvest, harvest and post-harvest) of Carabidae in the selected rice agro-ecosystems.

Chapter 2

REVIEW OF LITERATURE



2. Review of Literature

2.1. Taxonomy of Carabidae from India

Linnaeus (1758) described a new carabid species, *Sphodrus leucophthalmus* from India. Linnaeus (1761) described two species, *Syntomus truncatellus* and *Bembidion quadrimaculatum* from India. Linnaeus (1771) described *Pheropsophus bimaculatus* from India. Fabricius (1775) described three species including *Anthia sexguttata* (*Carabus*) from India. Fabricius (1781, 1792, 1798 and 1801) described 19 species of Carabidae from India. Wiedemann (1819) described four species of Carabidae in his work '*Neue Kafer aus Bengalen und Java*'. Wiedemann (1821) described six species of Carabidae in his work '*Neue exotische Käfer*'. Wiedemann (1823) described 21 species in '*Zweihundert neue Kafer von Java, Bengalen undMac dem Vorgebirge der guten Hoffnung*'. MacLeay (1825) analysed the insect collections of Thomas Horsfield present in the East India Company's Museum and illustrated their natural affinities and analogies. Fifty four species of Carabidae were described from India in the five volumes of '*Species général des coléoptères, de la collection de M. le Comte Dejean'* by Dejean (1825, 1826, 1828, 1829 and 1831). Fourteen species of Carabidae were described from India by Hope (1831, 1833, 1838 and 1845). Chaudoir (1842, 1843, 1844, 1845, 1846a, 1846b, 1847, 1848, 1850a, 1850b, 1852, 1854, 1855, 1856, 1857, 1858, 1859a, 1859b, 1861a, 1861b, 1861c, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869a, 1869b, 1869c, 1869d, 1871a, 1871b, 1871c, 1871d, 1872a, 1872b, 1872c, 1873, 1874a, 1874b, 1875, 1876a, 1876b, 1876c, 1877, 1878a, 1878b, 1878c, 1879a, 1879b, 1880, 1882 and 1883) done a massive work on Indian Carabidae with 184 new

species and monographs on 14 genera (*Abacetus, Brachynides, Callidides, Chleniens, Lebiides, Masoreus, Nematotarsus, Oodides, Orthogonides, Panageides, Pogonoides, Scaritides, Siagonides, Tetragonoderus*). Fourty eight species were described by Schmidt-Goebel (1846) in his work '*Faunula coleopterorum Birmaniae, adjectis nonnulis Bengaliae indigenis'.* Putzeys (1846, 1861, 1866a, 1866b, 1867a, 1867b, 1873a, 1873b, 1873c, 1875a, 1875b, 1877a, 1877b and 1878) described 39 new species from India. Fairmaire (1849a, 1849b, 1882, 1883, 1889 and 1901) described five species of Carabidae from India. Laferte-Senectere (1851) described 12 species of the subfamily Panagaeinae and Licininae in his work '*Revision de la tribu des patellimanes de Dejean, coleopteres pentameres de la famille des carabiques*'. Lacordaire (1854) assembled various classifications of Carabidae hitherto known in his work '*Genera des Coleopteres*'. Nietner (1856, 1857a, 1857b, 1857c and 1858) described 21 new species belonging to the subfamilies Anthiinae, Dryptinae, Harpalinae, Lebiinae, Licininae, Pterostichinae, Scaritinae and Trechinae from India. Bates (1873, 1874, 1876, 1878, 1883, 1886a, 1886b, 1889a, 1889b, 1891a, 1891b, 1892a and 1892b) described 129 new carabid species from India. Tschitschérine (1894, 1897, 1898, 1899, 1900a, 1900b and 1903) described 12 species belonging to the subfamilies Harpalinae, Nebriinae and Pterostichinae. Maindron (1898, 1899, 1906a, 1906b, 1906c and 1909) described nine new species belonging to the subfamilies Licininae, Brachininae and Lebiinae.

Andrewes (1919–1946) described 485 carabid species belonging to 19 subfamilies from India, this accounts for about a quarter of Carabidae known from

India. Andrewes (1919b) synonymized *Anthia orientalis* Hope 1838 with *A. sexguttata* Fabricius 1775. Andrewes (1921b) listed 36 species of Carabidae from Barkuda Island, Odisha. Andrewes (1921c) studied the oriental species of the genus *Callistomimus* of the subfamily Licininae and provided taxonomic keys. Andrewes (1925) revised the oriental species of genus *Tachys* of the subfamily Trechinae and provided taxonomic keys. Andrewes (1929) provided a detailed account of the 10 tribes of the subfamily Carabinae along with taxonomic keys and descriptions to the species in the first volume of the '*Fauna of British India including Burma and Ceylon*'. Andrewes (1930a) catalogued all carabid species known from India till 1930 in '*Catalogue of Indian Insects'* along with their distribution and literature details. Andrewes (1930b) described 19 species of Anthiinae, 53 species of Brachininae and 17 species of Orthogoniinae from India. Andrewes (1932) provided species keys to the Indian genus *Cyminds*. Andrewes (1933b and 1933c) provided species keys to the genera *Dioryche* and *Phloeozeteus* respectively. Andrewes (1934) provided taxonomic keys to the genus *Calathus* in three volumes. Andrewes (1935a) provided a detailed account of the eight tribes of the subfamily Harpalinae along with taxonomic keys and descriptions to the species in the second volume of the '*Fauna of British India including Burma and Ceylon*'. Andrewes (1935b) provided species keys to the genera *Cymindoidea, Platytarus* and *Taridius* of the subfamily Lebiinae. Andrewes (1936b) provided species keys to the genera *Drypta* and *Desera* of the subfamily Dryptinae. Andrewes (1937a) provided keys to the genera and species of the Sphodrini group of subfamily Platyninae. Andrewes (1937b) provided species keys to the genera

Pericalus and *Catascopus* of Lebiinae. Andrewes (1940 and 1942) provided species keys to the genera *Oodes* and *Abacetus* respectively. Louwerens (1953) provided taxonomic keys to the oriental species of genus *Colpodes* and described 10 new species in his work '*The Oriental species of Colpodes*'. Habu (1955) described one new species, *Synuchus andrewesi* of the subfamily Platyninae from northwest India. Mateu (1959, 1960, 1971, 1978, 1979a, 1979b, 1984a, 1984b, 1986, 1991 and 1997) described 32 new species of the subfamily Lebiinae from India. Jedlička (1963a) described a single species, *Colpodes straneoi* from south India. Jedlička (1964a, 1964b and 1964c) added 14 new species to the Indian carabid fauna. Jedlička (1969) described nine new species from south India. Saha and Sengupta (1979) described three new species of *Chlaenius* (*C. besucheti, C. loebli* and *C. mussardi*) from South India. Morvan (1979, 1992, 1996, 1997, 1998, 1999, 2002, 2004 and 2007) described 36 new species of the subfamily Platyninae from India. Casale (1980, 1982 and 1988) described four new species of Platyninae from India. Deuve (1980a, 1980b, 2012, and 2015) described 14 new species from India. Mateu (1981) described two new species (*Paraleleupidia loebli* and *P. besucheti*) of the subfamily Dryptinae. Battoni (1982) described a new species, *Calathus kirschenhoferi* of the tribe Sphodrini from India. Saha (1984) described a new species, *Chlaenius puncticephalis* of the subfamily Licininae. Saha and Biswas (1985) recorded 22 carabid species belonging to two subfamilies from Arunachal Pradesh with a new species *Clivina arunachalensis*. Saha (1986) studied carabid beetles of Silent Valley and described a new species, *Oxylobus silenticus* of the subfamily Scaritinae. Baehr (1988, 1990, 1991, 1996a,

1996b and 1998) described six new species of the subfamily Dryptinae from India. Saha *et al.,* (1992) studied carabid collections of Zoological Survey of India, Kolkata and recorded 73 species belonging to 45 genera. Straneo (1994) did comprehensive work on the oriental species of the genus *Catascopus* and provided taxonomic keys. Schmidt (1998 and 2009) described three new species of Platyninae from India. Jeager (1998, 2012, 2013, 2016 and 2017) described seven species of Harpalinae from India. Kirschenhofer (1998, 2002 and 2013) described five species of *Chlaenius* from India.

Tian and Deuve (2000, 2005, 2006a, 2006b, 2016a and 2016b) described 31 new species of the subfamily Orthogoniinae from India by examining carabid collections present in the Paris museum. Kataev (2001, 2012, 2018 and 2020) described five new species of Harpalinae from India. Lorenz (2005) provided a catalogue of extant Carabidae of the world titled '*A systematic list of extant ground beetles of the World*'. Liang and Kavanaugh (2007) described a new species, *Dendrocellus inexpectus* from India. Abitha *et al.,* (2008) described a new species, *Helluodes devagiriensis* and studied the phylogenetic relationships of genera *Helluodes* and *Physocrotaphus* of the tribe Physocrotaphini. Abitha *et al.,* (2009) described a new species, *Orthogonius baconoides* from the Western Ghats. Abitha and Sabu (2009) described a new species, *Leleuporella devagiriensis* of the subfamily Scaritinae from south India. Baehr (2010) described two species, *Arhytinus indicus* and *A. lorenzi* of the subfamily Platyninae from South India. Shiju *et al.,* (2012a) described *Macrocheilus devagiriensis* from the Western Ghats. Shiju *et al.,* (2012b) described *Omphra drumonti* from the Western Ghats.

Anichtchenko (2012) described *Badister indicus* from India. Thakare *et al.*, (2013) identified 10 species of Carabidae belonging to six subfamilies from Melghat Tiger reserve. Hackel and Kirschenhofer (2014a and 2014b) described three new species of the subfamily Panagaeinae from India. Kushwaha *et al.*, (2015) provided a checklist of Carabidae from Chhattisgarh. Hegde and Kushwaha (2015) recorded 95 species of Carabidae from Uttar Pradesh with 22 first reports from the state. Kataev and Wrase (2001) described two new species of Harpalinae from India. Ito (1995, 1996, 1998 and 2003) described five new species of Harpalinae from India. Hegde and Manthen (2017) recorded 17 species of *Chlaenius* of the subfamily Licininae from the Western Ghats region of Maharashtra. Chanu and Swaminathan (2017) described two new species, *Chlaenius udaipurensis* and *Chlaenius pseudotristis* from Rajasthan. Hrdlicka (2017a) described a new species, *Styphlomerus bimaculatus* of the subfamily Brachininae from Rajasthan. Jithmon and Sabu (2018) synonymized *Eushcizomerus schuhi* Kirschenhofer 2000 with *Euschizomerus indicus* Jedlička 1955 and described a new species, *Euschizomerus devagiriensis* from India. Akhil *et al.* (2019) described *Macrocheilus chinnarensis* and *M. bandipurensis* of the subfamily Anthiinae from south Western Ghats. Akhil and Sabu (2019a) described *Pheropsophus devagiriensis* and *P. indicus* of the subfamily Brachininae from south India and provided taxonomic keys to Indian species of genus *Pheropsophus*. Akhil and Sabu (2019b) described *Styphlomerus devagiriensis* and *S. striatus* of the subfamily Brachininae from south India. Hrdlicka (2019) described a single species, *Brachinus geiseri* from central India. Shiju and Sabu (2019) provided an Indian checklist of subfamily Lebiinae.

Fedorenko (2020) described a new platynine species, *Tarsagonum indicum* from south India. Akhil *et al.,* (2020) described a new species, *Brachinus devagiriensis* and provided taxonomic keys to the Indian species of genus *Brachinus*. Divya and Sabu (2020) provided a checklist of Indian Pterostichinae with literature details and distribution patterns. Divya *et al.,* (2020) described a new species, *Brachinus paikadai* and synonymised *B. cinctellus* with *B. limbellus.* Jithmon and Sabu (2021) provided checklists of Dryptinae and Panagaeinae from the Indian subcontinent. Akhil and Sabu (2021) described two new species of *Omphra*, *O. balli* and *O. erwini* from Northwestern India. Ashly and Sabu (2022) provided a checklist of Indian Platyninae with literature details and distribution patterns. Sruthi and Sabu (2022) provided a checklist of carabid species in the Chinnar Wildlife Sanctuary of the south Western Ghats. Vasanthakumar and Kirschenhofer (2022) identified the carabid collections of Western Regional Centre of Zoological Survey of India and reported the new record of *Chlaenius cookei* Andrewes, 1933 and *Chlaenius puncticollis* Dejean, 1826 from the Western Ghats areas.

2.2. Ecology of Carabidae from India

Thiele (1977) provided a detailed account on ecology of Carabidae, this work serves as the base for the worldwide studies on carabid ecology. Studies on carabid ecology are limited in India. Mani (1968 and 1974) in his books '*Ecology and Biogeography of High Altitude Insects*' and '*Ecology and Biogeography of India*' states about the general ecology of Carabid beetles. Manjunath *et al.*, (1969) studied the use of *Pheropsophus sobrinus* Dejean 1826 as the bio-control agent of *Rhinoceros* beetle larvae. Rajagopal and Kumar (1992) studied the role of carabid

beetles in the predation of south Indian crop pests and identified six species of predatory carabid beetles. Chanu *et al.,* (2018) studied the plasticity in feeding behaviour of predatory carabid beetles in agro-ecosystems. Mili *et al.,* (2018a) provided comprehensive information of carabid beetles found in the horticultural orchards of Assam. Mili *et al.,* (2018b) studied the diversity, abundance and distribution pattern of carabid beetles in *Gladiolus* and *Gerbera* crops of Jorhat, Assam. Meena and Kumari (2022) studied the composition of carabid beetles in Jhunjhunu District, Rajasthan.

2.3. Carabid beetles in the rice agro-ecosystem

2.3.1. World-wide studies

Yahiro *et al.,* (1992) studied the seasonal abundance and species composition of carabid beetles in the rice agro-ecosystems of Japan. Kobayashi *et al.,* (1995) studied the distribution of larvae of the carabid beetle *Ophionea indica*, a predator of rice gall midge in the rice agro-ecosystems of Sri Lanka. Yamazaki *et al.,* (2003) studied the assemblage of carabid beetles and other predators in the arable and fallow rice and vegetable agro-ecosystems in central Japan. Woin *et al.,* (2005) studied the predatory carabid and staphylinid beetles in the upland rice agro-ecosystems of North Cameroon. Woin *et al.,* (2006) studied the diversity of epigeic beetles (Carabidae and Staphylinidae) in the rain-fed rice agro-ecosystems of North Cameroon. Ghahari *et al.,* (2008) studied the predator and pest fauna of Iranian rice agro-ecosystems and identified 16 predatory carabid beetles. Ghahari *et al.,* (2009) studied the carabid fauna in the rice agro-ecosystems of northern Iran and identified 27 species. Do *et al.,* (2012) studied the effect of abandonment of

cultivated paddy fields on the composition of ground beetles. Park *et al.,* (2013) studied the ground beetle fauna in the rice agro-ecosystems of Korea and identified 29 species under ten subfamilies. Pilon *et al.,* (2013) studied the carabid beetles in the rice field banks, buffer strips and in the restored habitats in an agricultural zone of Po Plain, Italy. Cardarelli and Bogliani (2014) studied the effect of rice field edge management practices on the carabid beetle assemblages in the rice agro-ecosystems of northern Italy. Do and Joo (2015) studied the response of ground beetles to the creation and restoration of wetlands from paddy fields, dry fields & abandoned paddy fields in South Korea. Ali *et al.,* (2018) evaluated the effect of surrounding landscape on the predator populations (carabid beetles, green mirid bugs, staphylinid beetles and spiders) in the rice agro-ecosystems of Bangladesh. Motevalli and Shayanmehr (2019) studied the carabid beetle diversity of a paddy field in Mazandaran Province of northern Iran.

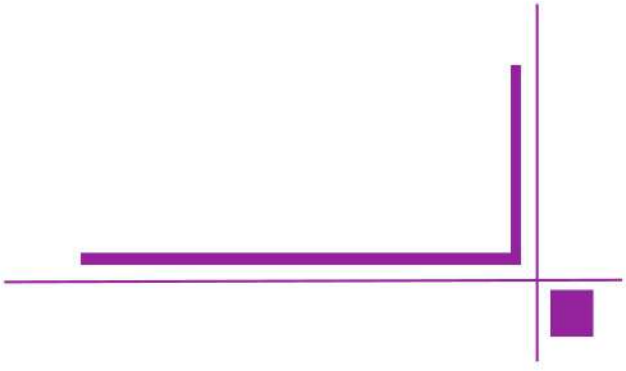
2.3.2. Indian studies

Bhattacharyya *et al.,* (2006) recorded the predators and parasitoids of rice insect pests of Jorhat districts of Assam and identified 26 predatory species including three carabid species (*Ophionea nigrofasciata, Casnoidea ishii ishii* and *Anoplogenius microgonus*). Kushwaha and Hegde (2015) recorded *Dyschirius hingstoni* from the rice agro-ecosystems of Bihar. Parasappa *et al.,* (2017) identified two predatory carabid beetles (*Pheropsophus sp.* and *Ophionea indica*) while analysing the pest and predator complex of rice agro-ecosystem in different locations of Mandya district, Karnataka. Jadhao and Bhongade (2018) studied the diversity and population dynamics of carabid beetles in the rice agro-ecosystems

of eastern Maharashtra during Kharif Season. Akhil and Sabu (2019a) described a new species (*Pheropsophus indicus*) and recorded two species (*P. bimaculatus* and *P. lissoderus*) from the rice agro-ecosystems while studying the genus *Pheropsophus* Solier 1833 from Indian subcontinent. Divya *et al.,* (2020) described a new species, *Brachinus paikadai* from the rice agro-ecosystems of Kerala. Divya (2022) recorded 66 species of Carabidae from the rice agro-ecosystem of Palakkad Gap in the Western Ghats.

Chapter 3

MATERIALS AND METHODS



3. Materials and Methods

3.1. Study area

Rice agro-ecosystems at Pattambi (63 m MSL) in Palakkad district and Ambalavayal (974 m MSL) in Wayanad district of the Kerala state (Figure 1) are selected for the present study. Kerala is a state with varying landforms and climatic factors, thus rice cultivation in the state is strongly influenced by these factors (Kumar & Kunhamu 2021). Palakkad district is located in the middle of Kerala state (10°46'27.84" N latitude & 76°39'22.50" E longitude). It is bordered by the Malappuram district and Thrissur district of the Kerala state on the northwest and southwest respectively, and by the Nilgiris district and Coimbatore district of the Tamil Nadu state on the northeast and east respectively. Palakkad is one among the districts having largest acreage under rice cultivation in the state, known as the "Rice bowl of Kerala" (Krishnankutty *et al.*, 2021). Palakkad has about 77121 hectares under paddy cultivation, accounting one-third of the state's total paddy area (Promodh 2018). Pattambi in the Palakkad district is located in the midland plains of Kerala and comes under Palakkad gap (30–40 km wide break in the Western Ghats located between the Nilgiri Hills and Anaimalai Hills) and is situated on the banks of Bharathapuzha. Palakkad gap influences the climate of the district, as it allows the north east winds, to blow spreading its wing throughout the range of the Ghats. As the district gets the advantage of south west and north east winds, rainfall is heavy in both seasons and subsequently Palakkad has got extensive paddy fields and it is known as the granary of the Kerala (Mukesh 2015).

Wayanad district is a mountainous terrain in the south Western Ghats with an altitude of above 700 m MSL, and between 11.6854° N latitude & 76.1320° E longitude (Prajeesh *et al.,* 2014, Dileep and Geetha 2015, Prajeesh and Kumar 2017). It is bordered on the north by Coorg districts of Karnataka, on the east by Nilgiris district of Tamil Nadu and Mysore district of Karnataka, on the west by Kannur and Kozhikode districts and on the south by Malappuram district of the Kerala state (Dileep and Geetha 2015). Wayanad is a high range agro climatic zone with several hills and valleys, and paddy is cultivated in the broad valley bottoms. Wayanad has a good climate with 2,322 mm mean rainfall & 18^{o}C to 29^{o}C mean temperature (Prajeesh *et al.,* 2014). Paddy is cultivated in two seasons in Wayanad, i.e., winter (Nancha cultivation) & summer (Puncha cultivation) (Gaetaniello *et al.,* 2014). A total of 7762 hectares of land is used for paddy cultivation in Wayanad.

3.2. Data Collection

3.2.1. Sampling of specimens

Sampling of specimens was done from the study sites for a period of two years from 2018 to 2019. Sampling was made from the pre-harvest (up to milk grain), harvest (dough & mature) and post-harvest stages (after harvesting) of each rice crop. Beetles were sampled using light trap, pitfall trap (Figure 2) and hand collection methods.

Pitfall trapping is the simplest & modest method, generally used for the sampling of epigeal arthropod communities (Joosse 1965, Spence and Niemela 1994, Schirmel *et al.,* 2010, Lasmar *et al.,* 2017, Nyundo and Yarro 2007). Pitfall

trap collects organisms that fall accidently into it (Porter 2005). For sampling of carabid beetles, transparent plastic cylinders of 8.5 cm diameter × 10 cm depth were used as pitfall traps. The one third of the trap was filled with a solution of salt and detergent powder (4:1 ratio), used as a preservative agent. Detergent reduces the surface tension of the liquid and makes sinking of insects easier (Woin *et al.,* 2006). Traps were installed at 10 meter intervals along the levees of the rice field with its upper edge in level of ground surface and were covered with a plastic roof in order to protect them from rainwater and daylight (Park *et al.,* 2013). Sample collection was done from three successive rice cultivation seasons (three crops) in each site (Ambalavayal & Pattambi). Samples were collected from the pre-harvesting, harvesting and post-harvesting stages of each rice crop. A total of 90 and 30 samples were collected from a single rice crop from Ambalavayal and Pattambi rice agro-ecosystem respectively. Traps were left open in the evening (18.00h) and emptied after 24 hours. Carabid beetles sampled in each trap were collected separately, washed in fresh water and transferred into separate vials containing 70% ethyl alcohol.

Light traps are commonly used sampling method in entomology for the collection of nocturnal arthropods since they are positively phototropic. Light traps can be used for carabid sampling since most of them are night active and attractive towards light (Thiele 1977, Abdullah *et al.,* 2008). It can be used as a simple and efficient method for the collection of carabid beetles (Liu *et al.,* 2007, Jocque *et al.*, 2016) especially from the regions like wetlands and marshes, where pitfall trap installation is more difficult (Jocque *et al.,* 2016). Light trap sampling data

provides information about diversity and abundance of carabid fauna (Jocque *et al.*, 2016). A low intensity portable Timer LED-UV Insect light trap having a collecting chamber and light source was used to collect samples from Ambalavayal. Preservative liquid (salt & detergent solution) is taken in the one third of the collecting chamber. The traps were placed in the levee of the rice field at 50 meter apart. Thirty samples were collected from each stages (pre-harvesting, harvesting and post-harvesting) of a single rice crop. A total of 90 samples were collected from a single rice crop. Samples were collected from three successive rice crops. Traps were left open in the evening (18.00h) and emptied after 12 hours. A single light trap which is permanently fixed in the field was used to take collections from Pattambi. Five samples were collected from the each stage (pre-harvesting, harvesting and post-harvesting) of a single rice crop. A total of 15 samples were collected from a single rice crop and 45 samples from three successive crops. Carabid beetles sampled from the study sites collected separately, washed in fresh water and transferred into separate vials containing 70% ethyl alcohol.

Hand collection method involves searching directly for the specimens in the margin of the rice field. It was carried out during the day time (between 9:00 am–10:00 am and 5:00 pm–6:00 pm) on each visit to the fields to conduct other sampling methods.

3.2.2. Taxonomic Identification and Preparation of Checklists and Keys

Taxonomic identification up to species level was done using Andrewes (1919 –1942), Abhitha and Sabu (2009), Akhil and Sabu (2019a), Akhil *et al.*,

(2019), Akhil *et al.*, (2020) and by newly prepared and modified keys. Images of specimens collected from Natural History Museum, Paris (MNHN) and British Museum of Natural History (BMNH) were also used for detailed taxonomic analysis. The specimens were examined under LEICA M205C stereo zoom microscope and images were taken by Leica MC 170 HD digital camera attached. Various measurements of the specimen were taken using Leica LAS (Leica Application Suite V4.12) microsystems and are given in millimetres. Specimens are labelled and deposited into the national insect collections of Zoological Survey of India, Kozhikode (ZSIK). Checklist of the identified species were prepared by referring Andrewes (1930a) and their literature works. Keys to the species identified from the study sites were prepared based on Abhita and Sabu (2009), Akhil and Sabu (2019a), Akhil *et al.*, (2020), Andrewes (1929, 1933, 1935a and 1942), Kataev (2002) and by referring the genus and species descriptions.

3.3. Data Analysis

3.3.1. Statistical Analysis

Ecological analysis of Carabidae from both of the study sites were conducted using PAST (PAST4.02) software and it includes analysis of diversity, relative abundance, seasonality, dominance, richness and evenness. All data were tested for normality with Anderson-Darling test. Data with sample size <30 and which are not normally distributed were tested with Kruskal-Wallis H tests (non-parametric) (Sachs 1992). Level of significance with a p-value <0.05 was compared using Mann-Whitney Test. Data with large sample size (>30) were taken for parametric tests (One Factor ANOVA) irrespective of normality tests. Level of

significance with a p-value <0.05 was compared using Tukey's tests. Rank-abundance plot was plotted to measure the relative abundance of species in the study sites (Whittaker 1965). Species with >0.5 percentage relative abundance were considered to create rank abundance plot. Species with >10.0 percentage relative abundance were treated as major species, 1.0–9.99 percentage as minor species and <1.0 percentage as rare species (Peterson *et al.,* 2021). Statistical graphs were created in MS-Excel 2013.

3.3.2. Diversity Analysis

Margalef's Index (d) is a species richness index (Clifford and Stephenson 1975, Magurran 2004).

Margalef's index (d) = S – 1 / ln (N)

S= total number of species,

N= total number of individuals,

In= natural logarithm.

Shannon-Wiener Diversity Index (H´) (Shannon and Weaver 1949) is a α-diversity (diversity of species within a community) index, take consideration of both species richness and evenness with mainly influenced by species richness (Kim *et al.,* 2017). Differences between two communities can be tested using a Shannon t-test/ANOVA (Cheng 1999, Magurran 2004).

Shannon-Wiener diversity index (H´) = - $\sum$ Pi ln Pi

Pi = is the proportion of individuals in the i^{th} species of the sample,

ln= is the natural logarithm.

Simpson's Index (1-D or 1/D) (Simpson 1949) measures the probability that two randomly selected individuals from a sample will be of the same species.

Simpson's Index (1-D) = ΣPi^2

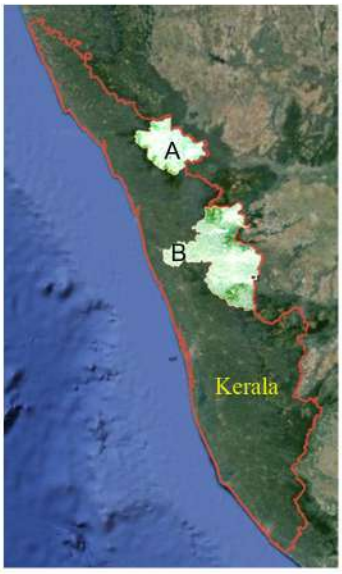
Pi = is the proportion of individuals in the i^{th} species of the sample.

Simpson's Evenness index ($E_{1/D}$), addresses equitability of the species (Simpson 1949).

Simpson's evenness index ($E_{1/D}$) = (1/D)/S

1/D= is the reciprocal form of the Simpson index (D),

S= is the number of species in the sample (Magurran 2004).



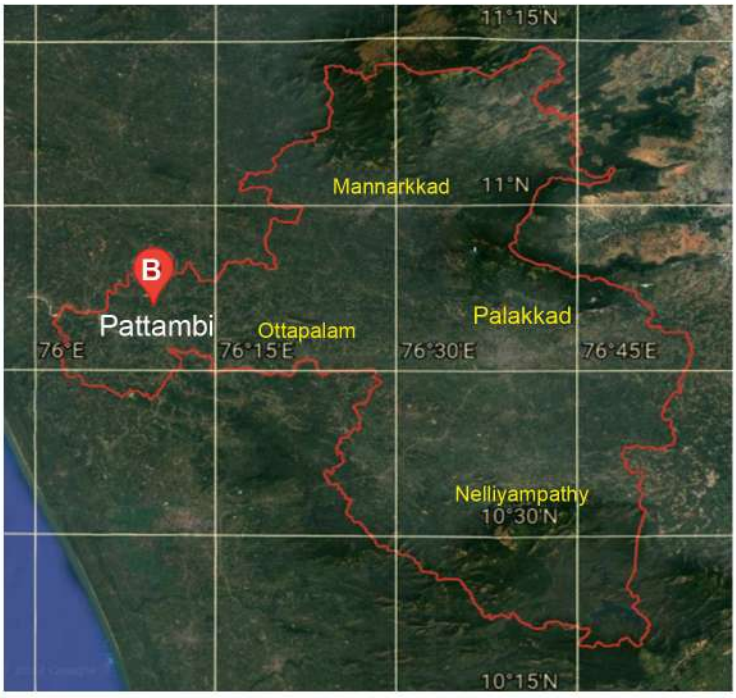


Figure 1. Map showing Ambalavayal and Pattambi rice agro-ecosystems of Kerala state- A). Ambalavayal rice agro-ecosystem in Wayanad district, B). Pattambi rice agro-ecosystem in Palakkad district.

A). 

B). 

C). 

Figure 2. Sampling methods used- A). Pitfall trap setup in the field, B). Portable Timer LED-UV light trap setup in the field, C). Permanent light trap fixed in the field.

Chapter 4

RESULTS

4. Results

4.1. Taxonomy

4.1.1. Carabidae of Ambalavayal and Pattambi rice agro-ecosystems

Eighty-one carabid species belonging to 13 subfamilies, 19 tribes and 48 genera were identified from the Ambalavayal and Pattambi rice agro-ecosystems during 2018–2019 period (Table 1).

Table 1. Carabid beetles of the Ambalavayal and Pattambi rice agro-ecosystems

Subfamily	Tribe	Genus	Species
1. Anthiinae Bonelli 1813	1. Helluonini Hope 1838	1. *Macrocheilus* Hope 1838	1. *Macrocheilus bensoni* Hope 1838
2. Apotominae LeConte 1853	1. Apotomini LeConte 1853	1. *Apotomus* Illiger 1807	2. *Apotomus hirsutulus* Bates 1892
3. Brachininae Bonelli 1810	1. Brachinini Bonelli 1810	1. *Brachinus* Weber 1801	3. *Brachinus devagiriensis* Akhil *et al.*, 2020
			4. *Brachinus limbellus* Chaudoir 1876
			5. * *Brachinus paikadai* Divya *et al.*, 2020
			6. # *Brachinus peltastes* Andrewes 1931
		2. *Pheropsophus* Solier 1833	7. *Pheropsophus indicus* Akhil and Sabu 2019
			8. *Pheropsophus lissoderus* Chaudoir 1850

			9. *Pheropsophus picicollis* Chaudoir 1876
4. Dryptinae Bonelli 1810	1. Dryptini Bonelli 1810	1. *Drypta* Latreille 1796	10. *Drypta lineola* MacLeay 1825
	2. Zuphiini Bonelli 1810	1. *Planetes* MacLeay 1825	11. *Planetes ruficeps* Schaum 1863
		2. *Zuphium* Latreille 1806	12. *Zuphium modestum* Schmidt-Goebel 1846
			13. *Zuphium olens* (Rossi 1790)
5. Harpalinae Bonelli 1810	1. Harpalini Bonelli 1810	1. *Amblystomus* Erichson 1837	14. *Amblystomus vulneratus* (Dejean 1831)
		2. *Anomostomus* Laferte-Senectere 1853	15. *Anomostomus orientalis* Andrewes 1923
		3. *Dioryche* W.S. MacLeay 1825	16. @ *Dioryche solida* Andrewes 1933
			17. *Dioryche torta* MacLeay 1825
		4. *Meroctenus* Gemminger and Harold 1868	18. *Meroctenus mediocris* (Andrewes 1936)
		5. *Ophoniscus* Bate 1892	19. *Ophoniscus puneensis* Kataev 2018
	2. Stenolophini Kirby 1837	1. *Acupalpus* Latreille 1829	20. *Acupalpus andrewesi* Jaeger 2013
			21. *Acupalpus rhombotus* Andrewes 1936
		2. *Batoscelis* Dejean 1836	22. *Batoscelis oblonga* (Dejean 1831)
		3. *Idiomelas* Tschitschérine 1900	23. *Idiomelas fulvipes* (Erichson 1843)
		4. *Loxoncus* Schmidt-Goebel 1846	24. *Loxoncus microgonus* (Bates 1886)
			25. *Loxoncus nagpurensis* (Bates 1891)
			26. # *Loxoncus schmidti* Kataev 2002

		5. *Stenolophus* Dejean 1821	27. *Stenolophus bajaurae* Andrewes 1924
			28. *Stenolophus lucidus* Dejean 1829
			29. *Stenolophus quinquepustulatus* (Wiedemann 1823)
			30. *Stenolophus smaragdulus* (Fabricius 1798)
6. Lebiinae Bonelli 1810	1. Cyclosomini Laporte 1834	1. *Anaulacus* MacLeay 1825	31. *Anaulacus rubidus* (Andrewes 1922)
		2. *Cyclicus* Jeannel 1949	32. *Cyclicus dilatatus* (Wiedemann 1823)
		3. *Tetragonoderus* Dejean 1829	33. *Tetragonoderus notaphioides* Motschulsky 1861
	2. Lebiini Bonelli 1810	1. *Anchista* Nietner 1856	34. *Anchista fenestrata* (Schmidt-Goebel 1846)
		2. *Anomotarus* Chaudoir 1875	35. *Anomotarus stigmula* (Chaudoir 1852)
		3. *Apristus* Chaudoir 1846	36. *Apristus subtransparens* Motschulsky 1861
		4. *Lebia* Latreille 1802	37. *Lebia campania* Andrewes 1933
	3. Odacanthini Laporte 1834	1. *Archicolliuris* Liebke 1931	38. *Archicolliuris bimaculata* (Redtenbacher 1844)
			39. @ *Archicolliuris immaculata* (Liebke 1938)
		2. *Eucolliuris* Liebke 1931	40. *Eucolliuris fuscipennis* (Chaudoir 1850)
		3. *Mimocolliuris* Liebke 1933	41. *Mimocolliuris indica* Baehr 2016
		4. *Ophionea* Klug 1821	42. *Ophionea indica* (Thunberg 1784)
		5. *Pentagonica* Schmidt-Goebel 1846	43. *Pentagonica pallipes* (Nietner 1856)
		6. *Selina* Motschulsky 1858	44. *Selina westermanni* Motschulsky 1858

7. Licininae Bonelli 1810	1. Chlaeniini Brulle 1834	1. *Callistomimus* Chaudoir 1872	45. *Callistomimus littoralis* Motschulsky 1859
		2. *Chlaenius* Bonelli 1810	46. *Chlaenius hamifer* Chaudoir 1856
			47. *Chlaenius malachinus* (Motschulsky 1865)
			48. *Chlaenius nigricans* Wiedemann 1821
			49. *Chlaenius posticus (*Fabricius 1798)
8. Panagaeinae Bonelli 1810	1. Panagaeini Bonelli 1810	1. *Adischissus* Fedorenko 2015	50. *Adischissus notulatus* (Fabricius 1801)
9. Platyninae Bonelli 1810	1. Platynini Bonelli 1810	1. *Dicranoncus* Chaudoir 1850	51. *Dicranoncus quadridens* (Motschulsky 1859)
10. Pterostichinae Bonelli 1810	1. Abacetini Chaudoir 1872	1. *Abacetus* Dejean 1828	52. *Abacetus dorsalis (*Motschulsky 1866)
			53. *Abacetus haplosternus* Chaudoir 1878
		2. *Chlaeminus* Motschulsky 1865	54. *Chlaeminus biguttatus* Motschulsky 1865
		3. *Cosmodiscus* Sloane 1907	55. *Cosmodiscus picturatus* Andrewes 1920
11. Scaritinae Bonelli 1810	1. Clivinini Rafinasque 1815	1. *Clivina* Latreille 1802	56. *Clivina attenuata* (Herbst 1806)
			57. *Clivina brevior* Putzeys 1867
			58. # *Clivina gamma* Andrewes 1929
			59. *Clivina helferi* Putzeys 1866
			60. *Clivina lobata* Bonelli 1813
			61. † *Clivina mustela* Andrewes 1923
			62. *Clivina tranquebarica* Bonelli 1813

			63. *Clivina westwoodi* Putzeys 1867
		2. *Leleuporella* Basilewsky 1956	64. *Leleuporella devagiriensis* Abhita & Sabu 2009
		3. *Pseudoclivina* Kult 1947	65. *Pseudoclivina arunachalensis* Saha & Biswas 1985
			66. *Pseudoclivina memnonia* (Dejean 1831)
	2. Dyschiriini Kolbe 1880	1. *Dyschirius* Bonelli 1810	67. *Dyschirius paucipunctus* Andrewes 1929
	3. Scaritini Bonelli 1810	1. *Distichus* Motschulsky 1858	68. *Distichus planus* (Bonelli 1813)
		2. *Scarites* Fabricius 1775	69. # *Scarites beesoni* Andrewes 1929
			70. *Scarites modestus* (Chaudoir 1880)
12. Siagoninae Bonelli 1813	1. Siagonini Bonelli 1813	1. *Siagona* Latreille 1804	71. *Siagona plana* (Fabricius 1801)
13. Trechinae Bonelli 1810	1. Bembidiini Stephens 1827	1. *Bembidion* Latreille 1802	72. *Bembidion niloticum* Dejean 1831
		2. *Elaphropus* Motschulsky 1839	73. *Elaphropus ceylanicus* (Nietner 1858)
			74. *Elaphropus decoratus* (Andrewes 1925)
			75. *Elaphropus klugi* (Nietner 1858)
			76. *Elaphropus nigellus* (Andrewes 1935)
			77. *Elaphropus nilgiricus* (Andrewes 1925)
			78. *Elaphropus politus* (Motschulsky 1851)
		3. *Polyderis* Motschulsky 1862	79. *Polyderis impressipennis* (Motschulsky 1859)
		4. *Paratachys* Casey 1918	80. *Paratachys impressus* (Motschulsky 1851)

			81. *Paratachys tropicus* (Nietner 1858)
***** *New species;* † *First report from India;* # *First report from South India;* @*First report from Kerala*			

4.1.2. Taxonomic keys to the Carabid species of the rice agro-ecosystems of Ambalavayal and Pattambi

Key to the Species of Carabidae

Tribe Helluonini Hope 1838

Genus *Macrocheilus* Hope 1838

- Elytra with two pairs of spots, front one covering intervals 3–7, hind one covering intervals 1–4; fourth maxillary palpomere not dilate----------*M. bensoni* Hope 1838

Tribe Apotomini LeConte 1853

Genus *Apotomus* Illiger 1807

- Body densely pubescent; punctures of the elytral striae conspicuous on both extremities----------*A. hirsutulus* Bates 1892

Tribe Brachinini Bonelli 1810

Genus *Brachinus* Weber 1801 (Modified from Akhil *et al.,* 2020)

1. Unicoloured elytra ---------- *B. devagiriensis* Akhil *et al.*, 2020

- Bicoloured elytra---------- 2

2. Elytra with reddish yellow lateral border----------*B. cinctellus* Chaudoir 1876

- Elytra without reddish yellow lateral border----------3

3. Elytral apical band narrow; first four antennomeres reddish yellow----------*B. peltastes* Andrewes 1931

- Elytral apical band broad; first two antennomeres reddish yellow----------*B. paikadai* Divya *et al.*, 2020 (*New species*)

Genus *Pheropsophus* Solier 1833 (Akhil and Sabu 2019a)

Tribe Dryptini Bonelli 1810

Genus *Drypta* MacLeay 1825

- Elytron with a red longitudinal linear band; femora reddish yellow with apical region black coloured ----------*D. lineola* MacLeay 1825

Tribe Zuphiini Bonelli 1810

Genus *Planetes* MacLeay 1825

- Elytron with a round yellow spot at the middle; prothorax dark brown----------
  ----------*P. ruficeps* Schaum 1863

Genus *Zuphium* Latreille 1806

1. Colour of the head black; large size, 8.8 mm----------*Z. olens* (Rossi 1790)

- Colour of the head brown; small size, 4.2 mm----------
  ---------- *Z. modestum* Schmidt-Goebel 1846

Tribe Harpalini Bonelli 1810

Genus *Amblystomus* Erichson, 1837

- Colour black, shiny; each elytron with a reddish yellow apical spot----------
  ----------*A. vulneratus* Dejean 1831

Genus *Anomostomus* Laferte-senectere 1853

- Humerus of elytra square, apex truncate, marginal series of pores widely interrupted----------*A. orientalis* Andrewes 1923

Genus *Dioryche* MacLeay 1825 (Modified key from Andrewes 1933)

1. Apical width of elytral intervals are almost same---------*D. torta* MacLeay 1825

- Apical width of elytral intervals 3 and 5 clearly wider than the adjoining ones--
  ----------*D. solida* Andrewes 1933

Genus *Meroctenus* Gemminger et Harold 1868

- Pronotum punctate at basal area; external intervals of elytra pubescent----------
  ----------*M. mediocris* Andrewes 1936

Genus *Ophoniscus* Bates 1892

- Body black, punctate, pubescent----------*O. puneensis* Kataev 2018

Tribe Stenolophini Kirby 1837

Genus *Acupalpus* Latreille 1829

1. Elytra with a more or less extended dark macula at middle ----------
   ----------*A. rhombotus* Andrewes 1936
- Elytra without macula----------*A. andrewesi* Jaeger 2013

Genus *Batoscelis* Dejean 1836

- Head black with two brown spots in the middle---------*B. oblonga* Dejean 1831

Genus *Idiomelas* Tschitschérine 1900

- Beads along the anterior margin of pronotum interrupted medially, posterior margin with fringe of hairs----------*I. fulvipes* Erichson 1843

Genus *Loxoncus* Schmidt-Goebel 1846 (Modified from Kataev 2002)

1. Basal angles of pronotum sharp, denticulate----------*L. microgonus* Bates 1886
- Basal angles of pronotum blunt, not denticulate----------2
2. Pronotum broad, lateral beads wide and not visible at basal angles ----------
   ----------*L. nagpurensis* (Bates 1891)
- Pronotum comparatively small, lateral beads narrow and visible at basal angles---------- *L. schmidti* Kataev 2002

Genus *Stenolophus* Dejean 1821

1. Elytra with spots----------2

- Elytra without spots----------3

2. Base of pronotum densely punctuate, apical angle slightly protrudent----------
   ----------*S. smaragdulus* Fabricius 1798

- Base of pronotum slightly punctuate, apical angle not protrudent----------
   ----------*S. quinquepustulatus* (Wiedemann 1823)

3. Basal transverse impression of pronotum conspicuous----------
   ----------*S. bajaurae* Andrewes 1924

- Basal transverse impression of pronotum inconspicuous-*S. lucidus* Dejean 1829

Tribe Cyclosomini Laporte 1834

Genus *Anaulacus* MacLeay 1825

- Elytra entirely black without spot or bands----------*A. rubidus* (Andrewes 1922)

Genus *Cyclicus* Jeannel 1949

- Elytron with two yellow irregular bands, basal band covering interval 1 to 9, apical band covering interval 1 to 8----------*C. dilatatus* Wiedemann 1823

Genus *Tetragonoderus* Dejean 1829

- Elytra with yellow subapical transverse band extending from interval 1 to 8, subbasal band extending from interval 2 to 7, and a lateral spot in the middle on the intervals 7 and 8; 3rd interval of elytra with more than two deep punctures---
   ----------*T. notaphioides* Motschulsky 1861

Tribe Lebiini Bonelli 1810

Genus *Anchista* Nietner 1856

- Elytra bicolored with brownish black and reddish yellow colourations; head and pronotum glabrous----------*A. fenestrata* (Schmidt-Goebel 1846)

Genus *Anomotarus* Chaudoir 1875

- Elytra with an elongated humeral spot and a transverse apical common spot reaching the third stria----------*A. stigmula* (Chaudoir 1852)

Genus *Apristus* Chaudoir 1846

- Pronotum cordiform, sub-transverse, dorsal side matte and black-bronze --------
  ----------*A. subtransparens* Motschulsky 1861

Genus *Lebia* Latreille 1802

- Elytra with a black band----------*L. Campania* Andrewes 1933

Tribe Odacanthini Laporte 1834

Genus *Archicolliuris* Liebke 1931

1. Elytron with a white spot at the apex -------*A. bimaculata* (Redtenbacher 1844)

- Elytron without white spot at the apex----------*A. immaculata* (Liebke 1938)

Genus *Eucolliuris* Liebke 1931

- Elytron with a reddish yellow spot at the apex extends from interval 2 to 4------
  ----------*E. fuscipennis* (Chaudoir 1850)

Genus *Mimocolliuris* Liebke 1933

- Each elytron with a brownish humeral patch and a reddish yellow spot at the apex---------- *M. indica* Baehr 2016

Genus *Ophionea* Klug 1821

- Elytra with two dark cross bands, one on the humerus, the other behind the middle, shoulder band interrupted at the suture-------*O. indica* (Thunberg 1784)

Genus *Pentagonica* Schmidt-Goebel 1846

- Pronotum orange; striae of elytra distinctly punctured----------*P. pallipes* (Nietner 1856)

Genus *Selina* Motschulsky 1858

- First three antennal segments reddish yellow, another four black and the last four pale yellow----------*S. westermanni* Motschulsky 1858

Tribe Chlaeniini Brulle 1834

Genus *Callistomimus* Chaudoir 1872

- Head greenish blue; elytra with red scutellary patch, frontal band of elytra at a fourth from base, extending from sutural line to lateral margin, hind band extending backwards to margin, constricted on stria 4---------- *C. littoralis* Motschulsky 1859

Genus *Chlaenius* Bonelli 1810 (Akhil 2020)

Tribe Panagaeini Bonelli 1810

Genus *Adischissus* Fedorenko 2015

- Elytron with orange-yellow macula at humerus and apex, humeral macula reaching from 4th interval to elytral margin---------*A. notulatus* (Fabricius 1801)

Tribe Platynini Bonelli 1810

Genus *Dicranoncus* Chaudoir 1850

- Elytra blue or violet colour; each elytron with two short spine at apex, making apex quadrispinose----------*D. quadridens* (Motschulsky 1859)

Tribe Abacetini Chaudoir 1872

Genus *Abacetus* Dejean 1828 (Modified from Andrewes 1942)

1. Base of pronotum little narrower than apex, elytra brown with a black patch on disk----------*A. dorsalis* (Motschulsky 1866)

- Base of pronotum as wide as apex, elytra entirely black----------
  ----------*A. haplosternus* Chaudoir 1878

Genus *Chlaeminus* Motschulsky 1865

- Body greenish bronze; pronotum cordiform; elytra with two spot at the three-quarter posterior ----------*C. biguttatus* Motschulsky 1865

Genus *Cosmodiscus* Sloane 1907

- Each elytron with a horse-shoe shaped patch at apex and a reddish brown longitudinal patch on humerus extends from interval 5 to 8 ----------
  ----------*C. picturatus* Andrewes 1920

Tribe Clivinini Rafinasque 1815

Genus *Clivina* Latreille 1802 (Modified from Andrewes 1929)

1. Mesotibiae without spur above apex----------2

- Mesotibiae with a spur above apex.----------3

2. Front margin of clypeus dentate, clypeus and wings fused; labrum with 6 setae at apex, ventral pores distant in the last segment----- *C. attenuata* (Herbst 1806)

- Front margin of clypeus truncate, clypeus and wings separated by a slight notch, labrum with 7 setae at apex, ventral pores close together in the last segment----------*C. tranquebarica* Bonelli 1813

3. Clypeal suture without distinct impression ----------4

- Clypeal suture with distinct impression----------6

4. Transverse groove in the pronotum reaching margin at extremities----------5

- Transverse groove in the pronotum not reaching margin----------
  ----------*C. gamma* Andrewes 1929

5. Median part of the clypeus fused with wings, front more or less punctate, mesotibial spur small and at apex----------*C. westwoodi* Putzeys 1867
- Median part of the clypeus separated from wings by a distinct notch, front smooth, mesotibial spurs long at apical third----------*C. helferi* Putzeys 1866

6. Front and vertex smooth or vaguely rugose, neck constriction shallow ---------7
- Front and vertex rugosely sculptured, neck constriction deep----------
  ----------*C. brevior* Putzeys 1867

7. Clypeus deeply emarginate, 3rd interval with moderate size pores adjoining stria 3, colour piceous ----------*C. lobata* Bonelli 1813
- Clypeus slightly emarginate, 3rd interval with large pores, occupying nearly the whole interval, colour dark red with piceous elytra ----------
  ----------*C. mustela* Andrewes 1923

Genus *Leleuporella* Basilewsky 1956 (Modified from Abhita and Sabu 2009)

- Frons smooth without longitudinal carina; genae inconspicuous; clypeus with distinct circular carina; outline of pronotum rounded curved laterally; sides of elytra smooth----------*L. devagiriensis* Abhita and Sabu 2009

Genus *Pseudoclivina* Kult 1947

1. Row of punctures across the neck more or less continuous ----------
   ----------*P. arunachalensis* Saha & Biswas 1985
- Row of punctures across the neck widely interrupted----------
  ----------*P. memnonia* (Dejean 1831)

Tribe Dyschiriini Kolbe 1880

Genus *Dyschirius* Bonelli 1810

- Pronotum globose; elytral interval 3 with three setiferous punctures and 5 without punctures; colour brassy----------*D. paucipunctus* Andrewes 1929

Tribe Scaritini Bonelli 1810

Genus *Distichus* Motschulsky 1858

- Neck punctated; metepisterna longer than wide---------*D. planus* (Bonelli 1813)

Genus *Scarites* Fabricius 1775 (Modified from Andrewes 1929)

1. Head with more striations; humeral dentation prominent----------
   ----------*S. beesoni* Andrewes 1929
- Head with fewer striations; humeral dentation less prominent----------
  ----------*S. modestus* (Chaudoir 1880)

Tribe Siagonini Bonelli 1813

Genus *Siagona* Latreille 1804

- Prothorax concolorous, slightly contracted in front; elytra red-brown with a piceous patch running down the middle----------*S. plana* (Fabricius 1801)

Tribe Bembidiini Stephens 1827

Genus *Elaphropus* Motschulsky 1839 (Modified from Andrewes 1935)

1. Elytra with at least four striae---------- *E. klugi* (Nietner 1858)
- Elytra with not more than three striae----------2
2. Elytra with three deep striae----------*E. ceylanicus* (Nietner 1858)
- Elytra with not more than two deep striae----------3
3. Basal groove of pronotum interrupted at middle----------4

- Basal groove of pronotum uninterrupted at middle----------5

4. Basal groove of pronotum not crenulate ----------*E. nilgiricus* (Andrewes 1925)

- Basal groove of pronotum distinctly crenulate----*E. politus* (Motschulsky 1851)

5. Colour black; legs infuscate; size 2–3 mm----------*E. nigellus* (Andrewes 1935)

- Colour brown-red; legs pale; size 2 mm----------*E. decoratus* Andrewes 1925

Genus *Bembidion* Latreille 1802

- Colour bronze, moderately shiny; each elytron with a pale spot at the apex; elytra striate, striae punctured----------*B. niloticum* Dejean 1831

Genus *Polyderis* Motschulsky 1862

- Elytral humerus angulate at outer border, apical dorsal pore just in front of the recurrent striole----------*P. impressipennis* (Motschulsky 1859)

Genus *Paratachys* Casey 1918

1. Elytra with basal pore on or adjoining stria 4; elytra entirely ferruginous; microsculpture absent----------*P. impressus* (Motschulsky 1851)

- Elytra with basal pore on interval 6; elytra ferruginous with a dark longitudinal cloud in the middle of the disk; microsculpture present in head between---------- ----------*P. tropicus* Nietner 1858

4.1.3. Checklist of the Carabidae of the rice agro-ecosystems of Ambalavayal and Pattambi

Family Carabidae Latreille 1802

Subfamily- Anthiinae Bonelli 1813

Tribe- Helluonini Hope 1838

Genus *Macrocheilus* Hope 1838

Type species. *Macrocheilus bensoni* Hope 1838

Macrocheilus Hope 1838: 166, Schmidt-Goebel 1846: 64, Lacordaire 1854: 93, Sloane 1914: 570.

1) *Macrocheilus bensoni* Hope 1838

Macrocheilus bensoni Hope 1838: 166, Schmidt-Goebel 1846: 65, Redtenbacher 1867: 4, Chaudoir 1872a: 212, Bates 1892b: 389, Andrewes 1919b: 129, 176, 202, Andrewes 1930a: 208, Csiki 1932: 1574, Lorenz 2005: 512, Zhao and Tian 2010: 10, Akhil 2020: 155, Sruthi and Sabu 2022: 21621, Divya 2022: 53.

= *Acanthogenius infuscatus* Bates 1892b.

= *Macrocheilus quadripustulatus* Schmidt-Goebel 1846.

= *Macrochilus trimaculatus* Andrewes 1919b.

Distribution: India- Kerala (Chinnar, Kozhikode: Thamarassery, Nilgiri Hills, Travancore; Palakkad: Walayar), Tamil Nadu (Anamalai Hills, Chennai, Coimbatore, Kodaikanal, Thiruchirapally), Pondicherry (Karaikal), Karnataka (Bengaluru, Mysore), Maharashtra (Mumbai), Rajasthan (Ajmer), Uttarakhand (Dehra Dun); Sri Lanka- Kandy; Myanmar; China- Guangdong, Zhongguo, Hong Kong, Macao S.A.R; Laos; Thailand- Loei, Na Haeo, Vietnam- Tonkin, Me Linh; Malaysia- Penang, Selangor; Indonesia- Sumatra; Philippine Island.

Specimens examined (n= 1): India- Kerala: Wayanad: Ambalavayal, 09.xi.2019, light trap, K. Ashly, 1 ex.

Subfamily- Apotominae LeConte 1853

Tribe- Apotomini LeConte 1853

Genus *Apotomus* Illiger 1807

Type species. *Scarites rufus* Rossi 1790

Apotomus Illeger 1807: 348, Dejean 1825: 449, Lacordaire 1854: 172, Reitter 1892: 137, Dupuis 1911: 1, Andrewes 1930a: 32.

2) *Apotomus hirsutulus* Bates 1892

Apotomus hirsutulus Bates 1892b: 287, Andrewes 1924c: 15, Andrewes 1930a: 32, Akhil, 2020: 79, Divya 2022: 56.

Distribution: India- Kerala (Palakkad; Wayanad: Tholpetty), Throughout India; Myanmar.

Specimens examined (n= 2): India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 1 ex.

Subfamily- Brachininae Bonelli, 1810

Tribe- Brachinini Bonelli 1810

Genus *Brachinus* Weber 1801

Type species. *Carabus crepitans* Linnaeus 1758

Brachinus Weber 1801: 22, Latreille and Dejean 1824: 104, Dejean 1825: 297, Schmidt-Goebel 1846: 71, Lacordaire 1854: 99, Wickham 1893: 330.

3) *Brachinus devagiriensis* Akhil *et al.*, 2020.

Brachinus devagiriensis Akhil, Divya and Sabu 2020: 595, Divya 2022: 56.

Distribution: India- Kerala (Palakkad: Chulanur, Pattambi, Peruvannamoozhi).

Specimens examined (n= 59): India- Kerala: Palakkad: Pattambi, 23.ii.2018, light trap, K. Ashly, 1 ex; 03.iv.2018, light trap, K. Ashly, 16 exs; 15.v.2018, light trap, K. Ashly, 3 exs; 16.v.2018, light trap, K. Ashly, 1 ex; 25.v.2018, light trap, K. Ashly, 2 exs; 19.vi.2018, light trap, K. Ashly, 1 ex; 17.xi.2018, light trap, K. Ashly, 4 exs; 11.xii.2018, light trap, K. Ashly, 17 exs; 04.iii.2019, light trap, K. Ashly, 5 exs; 02.v.2019, light trap, K. Ashly, 4 exs; 17.v.2019, light trap, K. Ashly, 4 exs; 19.v.2019, light trap, K. Ashly, 1 ex.

4) *Brachinus limbellus* Chaudoir 1876

Brachinus limbellus Chaudoir 1876c: 70, Andrewes 1923b: 42, Andrewes 1930a: 50, Hrdlicka 2003: 216, Hrdlicka 2017b: 477, Akhil *et al.*, 2020: 578, 584, Divya *et al.*, 2020: 6.

= *Brachinus cinctellus* Chaudoir 1876c.

Distribution: India- Kerala (Wayanad: Thrissilery; Palakkad: Malampuzha, Pattambi); Bangladesh- Dhaka; Myanmar- Yangon, Senmigion, Palon (Bego).

Specimens examined (n= 11): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 6 exs; 22.iii.2019, light trap, K. Ashly, 1 ex; 17.v.2019, light trap, K. Ashly, 1 ex; 18.v.2019, light trap, K. Ashly, 3 exs.

5) ****Brachinus paikadai* **Divya, Ashly and Sabu 2020

Brachinus paikadai Divya, Ashly and Sabu 2020: 2, Divya 2022: 56

Distribution: India- Kerala (Palakkad: Malampuzha, Chulanur, Pudussery, Pattambi).

Specimens examined (n=114): India- Kerala: Palakkad: Pattambi, 18.vi.2018, light trap, K. Ashly, 91 exs; 17.xii.2018, light trap, K. Ashly, 4 exs; 04.iii.2019, light trap, K. Ashly, 1 ex;05.iii.2019, light trap, K. Ashly, 11 exs; 01.v.2019, light trap, K. Ashly, 3 exs; 02.v.2019, light trap, K. Ashly, 4 exs.

6) #*Brachinus peltastes* Andrewes 1931

Brachinus peltastes Andrewes 1931: 518, Hrdlicka 2003: 216, Hrdlicka 2017b: 478, Akhil *et al.*, 2020, Divya, Ashly and Sabu, 2020: 7, Divya 2022: 57.

Distribution: India- Kerala (Palakkad: Chulanur, Pattambi), Uttarakhand (Dehradun: Dhobalwala).

Specimens examined (n= 60): India- Kerala: Palakkad: Pattambi, 23.ii.2018, light trap, K. Ashly, 1 ex; 14.v.2018, light trap, K. Ashly, 4 exs; 16.v.2018, light trap, K. Ashly, 51 exs; 17.xii.2018, light trap, K. Ashly, 4 exs.

Genus *Pheropsophus* Solier 1833

Type species. *Brachinus madagascariensis* Dejean 1831

Pheropsophus Solier 1833: 461, Lacordaire 1854: 99, Chaudoir 1876c: 16, Maindron 1906a: 15, Andrewes 1924c: 55, Andrewes 1930a: 270, Jeannel 1949: 1091, Jedlička 1963b: 524, Erwin 1970: 34.

= *Aptinomorphus* Jeannel 1949.

= *Stenaptinus* Maindron 1906a.

7) *Pheropsophus indicus* Akhil and Sabu 2019

Pheropsophus indicus Akhil and Sabu 2019a: 86, Divya 2022: 58.

Distribution: India- Kerala (Palakkad), Karnataka.

Specimens examined (n= 10): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 10.iii.2018, light trap, K. Ashly, 1 ex; 02.iv.2018, pitfall trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 17.vi.2018, light trap, K. Ashly, 1 ex; 12.xii.2018, pitfall trap, K. Ashly, 1 ex; 05.iii.2019, light trap, K. Ashly, 1 ex; 01.v.2019, light trap, K. Ashly, 1 ex; 28.x.2019, light trap, K. Ashly, 1 ex; 29.x.2019, light trap, K. Ashly, 1 ex; 18.xii.2019, light trap, K. Ashly, 1 ex.

8) *Pheropsophus lissoderus* Chaudoir 1850

Pheropsophus lissoderus Chaudoir 1850b: 79, Andrewes 1930a: 274, Hrdlicka 2017b: 480, Akhil and Sabu 2019: 86

Distribution: India- Kerala (Kalpetta), Tamil Nadu (Coimbatore), Gujrat (Kutch), Uttarakhand, Himachal Pradesh, Jammu & Kashmir, West Bengal (Darjiling), Arunachal Pradesh; Sri Lanka- Kandy, Peradeniya; Pakistan; Bhutan; China (Tibet).

Specimens examined (n= 3): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K Ashly, 1 ex; 24.ii.2018, pitfall trap, K. Ashly, 1 ex; 13.xii.2019, light trap, K. Ashly, 1 ex.

9*) Pheropsophus picicollis* Chaudoir 1876

Pheropsophus picicollis Chaudoir 1876c: 44, Bates 1892b: 392, Andrewes 1930a: 275, Hrdlicka 2017b: 480, Akhil and Sabu 2019: 79.

Distribution: India- Kerala (Thiruvananthapuram, Chelari, Koorachudu), Karnataka (Bengaluru), Goa (Mormugao), Arunachal Pradesh, Assam (Dafla Hills), Mizoram, Tripura (Lushai Hills); Sri Lanka; Andaman Island; Bhutan; Myanmar- Karen Hills, Shan Hills, Bhamo, Palon, Rangoon; Laos; Thailand- Siam; Malay Peninsula.

Specimens examined (n= 10): India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 1 ex; 26.i.2019, pitfall trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 12.xii.2019, pitfall trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 13.xii.2019, light trap, K. Ashly, 7 exs.

Subfamily- Dryptinae Bonelli 1810

Tribe- Dryptini Bonelli 1810

Genus *Drypta* Latreille 1796

Type species. *Carabus emarginatus* Gmelin 1790

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

10) *Drypta lineola* MacLeay 1825

Drypta lineola MacLeay 1825: 27, Dejean 1825: 184, Chaudoir 1877: 262, Bates 1883: 279, Bates 1891a: 336, Bates 1892b: 383, Bouchard 1903: 173, Andrewes 1919b: 167, Andrewes 1924a: 469, Andrewes 1924c: 52,

Andrewes 1930a: 158, Lorenz 2005: 503, Jithmon and Sabu 2021: 18562, Divya 2022: 62.

= *Drypta philippinensis* Chaudoir 1877.

Distribution: Throughout India; Myanmar; China; Indonesia- Java, Sumatra, Borneo; Philippines; Japan.

Specimens examined (n= 5): India- Kerala: Wayanad: Ambalavayal, 12.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 20.vi.2018, light trap, K. Ashly, 1 ex; 17.xii.2018, light trap, K. Ashly, 3 exs.

Tribe- Zuphiini Bonelli 1810

Genus *Planetes* MacLeay 1825

Type species. *Planetes bimaculatus* MacLeay 1825

Planetes MacLeay 1825: 28, Lacordaire 1854: 94, Bates 1873: 304, Andrewes 1924c: 52, Andrewes 1930a: 278, Lorenz 2005: 507, Löbl and Löbl 2017: 501, Jithmon and Sabu 2021: 18565.

11) *Planetes ruficeps* Schaum 1863

Planetes ruficeps Schaum 1863: 81, Chaudoir 1872e: 139, Andrewes 1924c: 53, Andrewes 1930a: 279, Lorenz 2005: 507, Jithmon and Sabu 2021: 18565, Divya 2022: 63.

= *Heteroglossa bimaculatus* Nietner 1857.

Distribution: India- Kerala (Wayanad: Tholpetty, Kozhikode: Koorachundu, Palakkad), Tamil Nadu (Chennai, Nilgiri Hills), Odisha

(Surada), Uttarakhand (Dehra Dun); Sri Lanka (Colombo, Hambegannuwa); Bangladesh (Dacca); Myanmar (Tharrawaddy).

Specimens examined (n= 2): India- Kerala: Palakkad: Pattambi, 16.v.2018, light trap, K. Ashly, 1 ex; 12.xii.2018, light trap, K. Ashly, 1 ex.

Genus *Zuphium* Latreille 1806

Type species. *Carabus olens* Rossi 1790

Zuphium Latreille 1806: 198, Dejean 1825: 192, Schmidt-Goebel 1846: 27, Lacordaire 1854: 85, Chaudoir 1862: 310, Andrewes 1930a: 358, Lorenz 2005: 506, Jithmon and Sabu 2021: 18564.

12) *Zuphium modestum* Schmidt-Goebel 1846

Zuphium modestum Schmidt-Goebel 1846: 29, Chaudoir 1862: 312, Bates 1892b 387, Andrewes 1930a: 359, Jithmon and Sabu 2021: 18564.

Distribution: India- Maharashtra (Nagpur, Yenna Valley, Satara), Kolkata; Myanmar- Tharrawaddy, Palon, Penang; Tailand- Siam; Vietnam- Cochin-China; Cambodia.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 17.xii.2018, light trap, K. Ashly, 1 ex.

13) *Zuphium olens* (Rossi 1790)

Zuphium olens Rossi 1790: 217 *(Carabus)*, Chaudoir 1862: 311, Bates 1889a: 280, Bates 1892b: 386, Andrewes 1921a: 155, Andrewes 1923b: 9, Andrewes 1927: 99, Andrewes 1930a: 359, Jithmon and Sabu 2021: 18564, Divya 2022: 65.

Distribution: India- Kerala (Palakkad), Odisha (Balugaon), west Bengal (Kolkata), Bihar (Chapra, Pusa); Sri Lanka; Myanamar- Tharrawaddy, Moulmein, Palon and Tikekee (pegu), Tenasserim, Langkawi; Thailand- Siam; Vietnam- Cochin-China; Indonesia- Java.

Specimens examined (n= 4): India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 2 exs; 16.v.2018, light trap, K. Ashly, 1 ex; 11.xii.2018, light trap, K. Ashly, 1 ex.

Subfamily- Harpalinae Bonelli 1810

Tribe- Harpalini Bonelli 1810

Genus *Amblystomus* Erichson 1837

Type species. *Acupalpus mauritanicus* Dejean 1829

Amblystomus Erichson 1837: 59, Lacordaire 1854: 301, Nietner 1858: 427, Wollaston 1867: 13, Reitter 1883: 139, Sloane 1898: 461, Tchitcherine 1900a: 348, Sloane 1900: 557, Sloane 1920: 131, Andrewes 1924c: 33, Andrewes 1930a: 17, Jeannel 1948: 729.

14) *Amblystomus vulneratus* (Dejean 1831)

Amblystomus vulneratus Dejean 1831: 852 (*Acupalpus*), Schaum 1847: 49, Motschulsky 1855: 43, Bates 1892b: 336, Andrewes 1924c: 34, Andrewes 1930a: 20, Lorenz 2005: 385, Divya 2022: 76.

= *Amblystomus tetrastigma* Bates 1892.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur), Tamil Nadu (Tharangambadi), Odisha (Ganjam, Surada); Sri Lanka; Myanmar; Laos.

Specimens examined (n= 269): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 16 exs; 23.ii.2018, light trap, K. Ashly, 51 exs; 22.iii.2018, light trap, K. Ashly, 16 exs; 03.iv.2018, light trap, K. Ashly, 14 exs; 16.v.2018, light trap, K. Ashly, 2 exs; 25.v.2018, light trap, K. Ashly, 1 ex; 20.vi.2018, light trap, K. Ashly, 2 exs; 12.xii.2018, light trap, K. Ashly, 36 exs; 17.xii.2018, light trap, K. Ashly, 43 exs; 04.iii.2019, light trap, K. Ashly, 5 exs; 01.v.2019, light trap, K. Ashly, 3 exs; 02.v.2019, light trap, K. Ashly, 56 exs; 17.v.2019, light trap, K. Ashly, 2 exs; 18.v.2019, light trap, K. Ashly, 1 ex; 20.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 1 ex; 28.x.2019, light trap, K. Ashly, 5 exs; 04.xi.2019, light trap, K. Ashly, 6 exs; 05.xi.2019, light trap, K. Ashly, 3 exs; 06.xi.2019, light trap, K. Ashly, 4 exs; 19.xii.2019, light trap, K. Ashly, 1 ex.

Genus *Anomostomus* Laferte-senectere 1853

Type species. *Anomostomus torridus* Laferte-senectere 1853

Anomostomus Laferte-senectere 1853: 376, Andrewes 1923a: 235, Andrewes 1930a: 27, Jeannel 1948: 725, Noonan 1976: 54, Lorenz 2005: 385.

15) *Anomostomus orientalis* Andrewes 1923

Anomostomus orientalis Andrewes 1923a: 237, Andrewes 1930a: 27, Lorenz 2005: 385, Azadbakhsh and Rafi 2017: 6, Divya 2022: 76.

Distribution: India- Kerala (Palakkad: Pudussery), Tamil Nadu (Chennai, Madura, Tiruchirappalli), Karnataka (Mysore, Chikkaballapur, Ramdurg), Odisha (Puri); Sri Lanka; Pakistan.

Specimens examined (n= 2): India- Kerala: Palakkad: Pattambi, 28.x.2019, light trap, K. Ashly, 2 exs.

Genus *Dioryche* MacLeay 1825

Type species. *Harpalus torta* MacLeay 1825

Dioryche MacLeay 1825: 21, Lacordaire 1854: 300, Gemminger and Harold 1868: 287, Bates 1873: 271, Andrewes 1919b: 156, Andrewes 1924c: 32, Andrewes 1930a: 146, Shauberger 1935: 93, Noonan 1976: 47 Saha 1995: 62, Lorenz 2005: 376, Kataev 2012: 112, Löbl and Löbl 2017: 518, Kataev and Wrase 2018: 359, Kataev and Wrase 2020: 837.

16) @*Dioryche solida* Andrewes 1933

Dioryche solida Andrewes 1933b: 32, Shauberger 1935: 93, Noonan 1985: 35, Lorenz 2005: 376.

Distribution: India- Karnataka (Kanara), Maharashtra (Mumbai).

Specimens examined (n= 7): India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 3 exs; 14.xii.2018, light trap, K. Ashly, 3 exs; 05.iii.2019, light trap, K. Ashly, 1 ex.

17) *Dioryche torta* MacLeay 1825

Dioryche torta MacLeay 1825: 21, Hope 1838: t. 2, Gemminger and Harold 1868: 287, Bates 1873: 271, Andrewes 1919b: 154, Andrewes 1926a: 68,

Andrewes 1930a: 148, Andrewes 1933c: 344, Noonan 1985: 35, Saha 1995: 63, Lorenz 2005: 376.

= *Platymetopus amoena* Dejean 1829.

= *Platymetopus laetula* Bates 1889.

Distribution: India- Tamil Nadu (Nilgiri Hills), West Bengal (Murshidabad), Uttarakhand (Gori Valley); Sri Lanka; Myanmar; Taiwan; Philippines; Indonesia.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 25.v.2018, light trap, K. Ashly, 1 ex.

Genus *Meroctenus* Gemminger and Harold 1868

Type species. *Ctenomerus crenulatus* Chaudoir 1843

Meroctenus Gemminger and Harold 1868: 262, Noonan 1976: 60, Lorenz 2005: 380, Kataev 2017: 511.

18) *Meroctenus mediocris* (Andrewes 1936)

Meroctenus mediocris Andrewes 1936a: 205 (*Xenodus*), Noonan 1985: 51 (*Xenodochus*), Lorenz 2005: 379 (*Xenodochus*), Kataev 2017: 518, Divya 2022: 79.

Distribution: India- Kerala (Palakkad: Pudussery), Maharashtra (Nagpur); Sri Lanka.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 28.x.2019, light trap, K. Ashly, 1 ex.

Genus *Ophoniscus* Bates 1892

Type species. *Ophoniscus iridulus* Bates 1892

Ophoniscus Bates 1892b: 337, Andrewes 1923c: 446, Andrewes 1930a: 242, Andrewes 1939: 136, Noonan 1985: 31, Ito 1994: 81, Saha 1995: 63, Kataev 2005: 269, Lorenz 2005: 376, Kataev and Wrase 2012: 215, Löbl and Löbl 2017: 546, Kataev 2018: 319, Kataev and Wrase 2018: 359.

19) *Ophoniscus puneensis* Kataev 2018

Ophoniscus puneensis Kataev 2018: 321, Sruthi and Sabu 2022: 21625, Divya 2022: 79.

Distribution: India- Kerala (Chinnar: Alampetty; Palakkad: Chulanur), Maharashtra (Mulshi environment, Pune).

Specimens examined (n= 4): India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; 15.xii.2018, light trap, K. Ashly, 1 ex; 04.xi.2019, light trap, K. Ashly, 2 exs.

Tribe- Stenolophini Kirby 1837

Genus *Acupalpus* Latreille 1829

Type species. *Carabus meridianus* Linnaeus 1760

Acupalpus Latreille 1829: 391, Dejean 1829: 435, Lacordaire 1854: 302, Motschulsky 1864: 205, Gemminger and Harold 1868: 287, Tschitschérine 1900a: 365, Tschitschérine 1901: 246, Andrewes 1930a: 9, Jeannel 1948: 714, Basilewsky 1956: 461, Habu 1973: 325, Noonan 1976: 23, Lorenz 2005: 359, Löbl and Löbl 2017: 562.

20) *Acupalpus andrewesi* Jaeger 2013

Acupalpus andrewesi Jaeger 2013: 315, Jaeger *et al.*, 2016: 1261, Divya 2022: 66.

Distribution: India- Kerala (Palakkad: Chulanur, Pudussery: Thekkady, Periyar), Karnataka (Kerwadi), Maharashtra (Savatvadi, Nagpur, Telinkheri), Madhya Pradesh (Khawasa, Seoni); Sri Lanka.

Specimens examined (n= 57): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K. Ashly, 1 ex; 11.iv.2018, light trap, K. Ashly, 1 ex; 30.v.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 20.vi.2018, light trap, K. Ashly, 1 exs; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, light trap, K. Ashly, 2 exs; 28.xi.2018, light trap, K. Ashly, 4 exs; 03.xii.2018, light trap, K. Ashly, 6 exs; India- Kerala: Palakkad: Pattambi, 11.xii.2018, light trap, K. Ashly, 1 ex; 12.xii.2018, light trap, K. Ashly, 1 ex; 17.xii.2018, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 25.i.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 18.v.2019, light trap, K. Ashly, 3 exs; 19.v.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 18 exs; India- Kerala: Palakkad: Pattambi, 05.xi.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 04.xii.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 19.xii.2019, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 12.xii.2019, light trap, K. Ashly, 2 exs.

21) *Acupalpus rhombotus* Andrewes 1936

Acupalpus rhombotus Andrews 1936c: 219, Lorenz 2005: 360, Jaeger 2013: 296, Jaeger *et al.*, 2016: 1261, Divya 2022: 66.

= *Acupalpus sinuellus sensu* Habu 1961.

Distribution: India- Kerala (Palakkad: Chulanur, Pudussery), Karnataka (Kerwadi), West Bengal (Sarda), Meghalaya (Khasi Hills, Mawsynram); Cambodia; Laos; Thailand; Vietnam; Indonesia; Philippines.

Specimens examined (n= 9): India- Kerala: Palakkad: Pattambi, 23.ii.2018, light trap, K. Ashly, 3 exs; India- Kerala: Wayanad: Ambalavayal, 23.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 20.vi.2018, light trap, K. Ashly, 1 ex; 01.v.2019, light trap, K. Ashly, 2 exs; 17.v.2019, light trap, K. Ashly, 1 ex; 20.v.2019, light trap, K. Ashly, 1 ex.

Genus *Batoscelis* Dejean 1836

Type species. *Agonoderus oblongus* Dejean 1831

Batoscelis Dejean 1836: 46, Lacordaire 1854: 261, Andrewes 1930a: 256, Jeannel 1948: 721, Noonan 1976: 25, Lorenz 2005: 361, Löbl and Löbl 2017: 566.

22) *Batoscelis oblonga* (Dejean 1831)

Batoscelis oblonga Dejean 1831: 813 (*Agonoderus oblongus*), Lorenz 2005: 361, Jaeger *et al.*, 2016: 1269, Baehr and Reid 2017: 438, Löbl and Löbl 2017: 566, Divya 2022: 67.

= *Batoscelis polita* Schmidt-Gobel 1846.

= *Batoscelis ceylonica* Motschulsky 1861.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur), Tamil Nadu (Chennai), Odisha (Ganjam, Surada), West Bengal (Kharagpur, Calcutta, Murshidabad, Maldah, Purulia, Medinipur); Nepal; China- Hong Kong,

Yunnan; Myanmar; Thailand; Malaysia; Philippines; Indonesia; Papua New Guinea; Australia.

Specimens examined (n= 553): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 35 exs; 23.ii.2018, light trap, K. Ashly, 89 exs; 22.iii.2018, light trap, K. Ashly, 16 exs; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 23 exs; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 32 exs; India- Kerala: Wayanad: Ambalavayal, 06.iv.2018, light trap, K. Ashly, 2 exs; 11.iv.2018, light trap, K. Ashly, 1 ex; 24.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 25.v.2018, light trap, K. Ashly, 5 exs; 26.v.2018, light trap, K. Ashly, 2 exs; 16.vi.2018, light trap, K. Ashly, 23 exs; 17.vi.2018, light trap, K. Ashly, 10 exs; 18.vi.2018, light trap, K. Ashly, 7 exs; 20.vi.2018, light trap, K. Ashly, 5 exs; 12.xii.2018, light trap, K. Ashly, 50 exs; 15.xii.2018, light trap, K. Ashly, 4 exs; 17.xii.2018, light trap, K. Ashly, 67 exs; India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 7 exs; 05.iii.2019, light trap, K. Ashly, 23 exs; 01.v.2019, light trap, K. Ashly, 12 exs; 02.v.2019, light trap, K. Ashly, 10 exs; 17.v.2019, light trap, K. Ashly, 3 exs; 18.v.2019, light trap, K. Ashly, 3 exs; 19.v.2019, light trap, K. Ashly, 3 exs; 20.v.2019, light trap, K. Ashly, 2 exs; 21.v.2019, light trap, K. Ashly, 3 exs; 28.x.2019, light trap, K. Ashly, 27 exs; 29.x.2019, light trap, K. Ashly, 20 exs; 04.xi.2019, light trap, K. Ashly, 5 exs; 05.xi.2019, light trap,

K. Ashly, 47 exs; 06.xi.2019, light trap, K. Ashly, 9 exs; India- Kerala: Wayanad: Ambalavayal, 12.xii.2019, light trap, K. Ashly, 1 ex; 14.xii.2019, light trap, K. Ashly, 3 exs.

Genus *Idiomelas* Tschitschérine 1900

Type species. *Stenolophus morio* Menetries 1832

Idiomelas Tschitschérine 1900a: 364, Noonan 1976: 23, Kataev 1997: 240, Lorenz 2005: 361, Löbl and Löbl 2017: 571.

23) *Idiomelas fulvipes* (Erichson 1843)

Idiomelas fulvipes Erichson 1843: 216 (*Stenolophus)*, Gemminger and Harold 1868: 291, Saha 1995: 70, Kataev 1997: 247, Lorenz 2005: 361, Divya 2022: 68.

= Anisodactylus basicollis Fairmaire 1892.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur, Walayar) Tamil Nadu (Chennai, Coimbatore, Kodaikanal, Tiruchirappalli), Odisha (Surada, Ganjam), Goa (Südgoa, Canacona Raj Baga Beach), Rajasthan (Jodhpur), New Delhi, Jammu & Kashmir (Sri Nagar); Myanmar; Nepal; Pakistan; Oman; Saudi Arabia; Yemen; Djibouti; Tanzania; Angola; Cape Verde Island; Mozambique; Sudan; Madagascar; Seychelles.

Specimens examined (n= 13): India- Kerala: Wayanad: Ambalavayal, 24.iv.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 25.v.2018, light trap, K. Ashly, 2 exs; 04.iii.2019, light trap, K. Ashly, 6 exs; 17.v.2019, light trap, K. Ashly, 1 ex; 19.v.2019, light trap, K. Ashly, 1 ex; 12.xii.2018, light trap, K. Ashly, 1 ex.

Genus *Loxoncus* Schmidt-Goebel 1846

Type species. *Loxoncus elevatus* Schmidt-Goebel 1846

Loxoncus Schmidt-Gobel 1846: Plate 3, Motschulsky 1864: 201, Andrewes 1930a: 28, Habu 1973: 395, Noonan 1976: 18, Kataev 2003: 352, Lorenz 2005: 355, Löbl and Löbl 2017: 572.

24) *Loxoncus microgonus* (Bates 1886)

Loxoncus microgonus Bates 1886a: 78 (*Anoplogenius*), Bates 1889a: 272, Bates 1891a: 333, Bates 1892b: 345; Andrewes 1930a: 29, Saha 1995: 70, Kataev 2002: 374, Jaeger and Ahmed 2017: 613, Akhil 2020: 89, Divya 2022: 70.

= *Anoplogenius andrewesi* Jedlička 1935.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur), Tamil Nadu (Nilgiri Biosphere Reseve), Maharashtra (Nagpur), Odisha, West Bengal (Calcutta, Sunderbans, Diamond Harbour, Surajabuggi, Sarda), Jharkhand (Chota Nagpur (Tetara)), Bihar, Himachal Pradesh (Shimla); Sri Lanka; Pakistan; Nepal; China; Bangladesh; Myanmar; Laos; Thailand; Vietnam; Malaysia; Indonesia; Philippines.

Specimens examined (n= 176): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 1 ex; 23.ii.2018, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 1 ex; 10.iii.2018, light trap, K. Ashly, 1 ex; 02.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 4 exs; India- Kerala: Wayanad: Ambalavayal, 11.iv.2018, light trap, K.

Ashly, 14 exs; 23.iv.2018, light trap, K. Ashly, 2 exs; 30.v.2018, light trap, K. Ashly, 10 exs; India- Kerala: Palakkad: Pattambi, 16.vi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 27.xi.2018, light trap, K. Ashly, 4 exs; 28.xi.2018, light trap, K. Ashly, 7 exs; 03.xii.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 11.xii.2018, light trap, K. Ashly, 4 exs; 12.xii.2018, light trap, K. Ashly, 5 exs; 14.xii.2018, light trap, K. Ashly, 12 exs; 15.xii.2018, light trap, K. Ashly, 1 ex; 17.xii.2018, light trap, K. Ashly, 42 exs; India- Kerala: Wayanad: Ambalavayal, 25.i.2019, light trap, K. Ashly, 12 exs; India- Kerala: Palakkad: Pattambi, 05.iii.2019, light trap, K. Ashly, 5 ex; 02.v.2019, light trap, K. Ashly, 3 exs; 17.v.2019, light trap, K. Ashly, 1 ex; 19.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 1 ex; 19.x.2019, light trap, K. Ashly, 5 exs; 28.x.2019, light trap, K. Ashly, 8 exs; 04.xi.2019, light trap, K. Ashly, 2 exs; 05.xi.2019, light trap, K. Ashly, 3 exs; 06.xi.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 09.xi.2019, light trap, K. Ashly, 5 exs; 04.xii.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 18.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 12.xii.2019, light trap, K. Ashly, 3 exs; 13.xii.2019, light trap, K. Ashly, 2 exs; 14.xii.2019, light trap, K. Ashly, 1 ex; 03.i.2020, light trap, K. Ashly, 1 ex; 04.i.2020, light trap, K. Ashly, 3 exs.

25) *Loxoncus nagpurensis* (Bates 1891)

Loxoncus nagpurensis Bates 1891a: 333 (*Anoplogenius*), Andrewes 1930a: 30; Kataev 2003: 356, Lorenz 2005: 356, Jaeger *et al.*, 2016: 1283, Löbl and Löbl 2017: 572, Divya 2022: 69.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur), Tamil Nadu (Chennai), Maharashtra (Nagpur), Jharkhand (Chota Nagpur: Tetara), Chhattisgarh (Bilaspur), West Bengal (Calcutta); Sri Lanka; Nepal; Thailand; Vietnam.

Specimens examined (n= 402): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 11 exs; 23.ii.2018, light trap, K. Ashly, 15 exs; India- Kerala: Wayanad: Ambalavayal, 10.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 7 exs; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 58 exs; India- Kerala: Wayanad: Ambalavayal, 06.iv.2018, light trap, K. Ashly, 1 ex; 11.iv.2018, light trap, K. Ashly, 12 exs; 24.iv.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 2 exs; 25.v.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 30.v.2018, light trap, K. Ashly, 4 exs; India- Kerala: Palakkad: Pattambi, 16.vi.2018, light trap, K. Ashly, 3 exs; 17.vi.2018, light trap, K. Ashly, 2 exs; 18.vi.2018, light trap, K. Ashly, 4 exs; India- Kerala: Wayanad: Ambalavayal, 27.xi.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 11.xii.2018, light trap, K. Ashly, 16 exs;

12.xii.2018, light trap, K. Ashly, 40 exs; 14.xii.2018, light trap, K. Ashly, 50 exs; 15.xii.2018, light trap, K. Ashly, 3 exs; 17.xii.2018, light trap, K. Ashly, 74 exs; India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 05.iii.2019, light trap, K. Ashly, 9 exs; 01.v.2019, light trap, K. Ashly, 5 exs; 02.v.2019, light trap, K. Ashly, 15 exs; 17.v.2019, light trap, K. Ashly, 2 exs; 18.v.2019, light trap, K. Ashly, 1 ex; 19.v.2019, light trap, K. Ashly, 10 exs; 20.v.2019, light trap, K. Ashly, 3 exs; 21.v.2019, light trap, K. Ashly, 17 exs; 19.x.2019, light trap, K. Ashly, 6 exs; 28.x.2019, light trap, K. Ashly, 4 exs; 04.xi.2019, light trap, K. Ashly, 2 exs; 05.xi.2019, light trap, K. Ashly, 8 exs; India- Kerala: Wayanad: Ambalavayal, 09.xi.2019, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 18.xii.2019, light trap, K. Ashly, 1 ex; 20.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 13.xii.2019, light trap, K. Ashly, 1 ex; 14.xii.2019, light trap, K. Ashly, 2 exs.

26) #*Loxoncus schmidti* Kataev 2003

Loxoncus schmidti Kataev 2003: 363, Lorenz 2005: 356, Jaeger *et al*., 2016: 1284, Jaeger & Ahmed 2017: 613, Löbl and Löbl 2017: 572.

Distribution: India- New Delhi; Sri Lanka; Nepal; Pakistan.

Specimens examined (n= 3): India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 1 ex; 05.iii.2019, light trap, K. Ashly, 2 exs.

Genus *Stenolophus* Dejean 1821

Type species. *Carabus vaporariorum* Linné sensu Fabricius 1787

Stenolophus Dejean 1821: 15, Dejean 1829: 405, Lacordaire 1854: 303, Gemminger and Harold 1868: 290, Tschitschérine 1900a: 364, Tschitschérine 1901: 246, Lesne 1904: 76, Andrewes 1930a: 316, Andrewes 1933d: 371, Habu 1973: 341, Noonan 1976: 17, Saha 1995: 67, Saha and Halder 2000: 15, Lorenz 2005: 353, Park *et al*., 2006: 96, Löbl and Löbl 2017: 573, Serrano *et al*., 2017: 218.

27) *Stenolophus bajaurae* Andrewes 1924

Stenolophus bajaurae Andrewes 1924c: 95, Andrewes 1926a: 69; Andrewes 1930a: 316, Lorenz 2005: 354, Wrase 2005: 852, Kushwaha and Hedge 2015: 401, Jaeger and Ahmed 2017: 613, Löbl and Löbl, 2017: 574, Sruthi and Sabu 2022: 21623, Divya 2022: 71.

Distribution: India- Kerala (Chinnar: Kootar; Palakkad: Pudussery), Jharkhand (Sarju Valley), Bihar, Uttar Pradesh (Fyzabad), Uttarakhand (Kumaon), Punjab, New Delhi, Himachal Pradesh (Bajaura, Kangra, Spiti, Manikaran), Jammu and Kashmir; Nepal; Pakistan; Afghanistan; Tajikistan; Turkmenistan; Uzbekistan.

Specimens examined (n= 41): India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, 1 ex, K. Ashly; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 7 exs; 25.v.2018, light trap, K. Ashly, 1 ex; 28.x.2019, light trap, K. Ashly, 3 exs; 05.xi.2019, light trap, K. Ashly, 1 ex; 06.xi.2019, light trap, K. Ashly, 1 ex; 11.xii.2018, light trap, K. Ashly, 2

exs; 12.xii.2018, light trap, K. Ashly, 13 exs; 17.xii.2018, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 05.iii.2019, light trap, K. Ashly, 1 ex; 01.v.2019, light trap, K. Ashly, 1 ex; 18.v.2019, light trap, K. Ashly, 1 ex; 19.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 1 ex; 19.xii.2019, light trap, K. Ashly, 1 ex.

28) *Stenolophus lucidus* Dejean 1829

Stenolophus lucidus Dejean 1829: 419, Andrewes 1930a: 317, Lorenz 2005: 355, Löbl and Löbl 2017: 574, Sruthi and Sabu 2022: 21623, Divya 2022: 71.

Distribution: India- Kerala (Chinnar; Palakkad: Chulanur, Pudussery); East Indies; Nepal; Bhutan; China- Fujian, Guangdong, Guangxi, Hainan, Yunnan; Taiwan; Japan.

Specimens examined (n= 28): India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, 3 ex, K. Ashly; 10.iii.2018, light trap, K. Ashly, 1 ex; 23.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 14.v.2018, light trap, K. Ashly, 1 ex; 16.v.2018, light trap, K. Ashly, 5 exs; 25.v.2018, light trap, K. Ashly, 3 exs; 14.xii.2018, light trap, K. Ashly, 4 exs; 04.iii.2019, light trap, K. Ashly, 1 ex; 02.v.2019, light trap, K. Ashly, 2 exs; 17.v.2019, light trap, K. Ashly, 2 exs; 19.v.2019, light trap, K. Ashly, 4 exs; 21.v.2019, light trap, K. Ashly, 1 ex.

29) *Stenolophus quinquepustulatus* (Wiedemann 1823)

Stenolophus quinquepustulatus Wiedemann 1823: 58 (*Badister*), Bates 1873: 270, Sloane 1920: 321, Dejean 1829: 414, Putzeys 1875b: 49, Bates 1889a: 272, Bates 1891a: 333, Bouchard 1903: 172, Lesne 1904: 76, Andrewes 1921a: 171, Andrewes 1924a: 469, Andrewes 1930a: 319, Habu 1973: 382, Saha 1995: 68, Lorenz 2005: 355, Park *et al*., 2006: 96, Jaeger and Ahmed 2017: 614, Löbl and Löbl 2017: 574, Sruthi and Sabu 2022: 21623, Divya 2022: 72.

Distribution: India- Kerala (Kootar; Palakkad: Pudussery, Chulanur), Rajasthan (Tetara), West Bengal (Singur, Hooghly); Sri Lanka; Pakistan; Nepal; China- Fujian (Fukien), Guizhou (Kweichow), Guangxi (Kwangsi), Hainan, Hong Kong, Hubei (Hupeh), Hunan, Jiangxi (Kiangsi), Macao, Sichuan (Szechwan), Shanghai; Myanmar; Indochina; Cambodia; Thailand; Vietnam; Malaysia; Indonesia; Philippines; Taiwan; Japan; Samoa; South Korea; Papua New Guinea; Australia.

Specimens examined (n= 728): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 4 exs; 23.ii.2018, light trap, K. Ashly, 17 exs; India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 6 exs; 12.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 13 exs; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 4 exs; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 112 exs; India- Kerala: Wayanad: Ambalavayal, 11.iv.2018, light trap, K. Ashly, 3 exs; 24.iv.2018, pitfall trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi,

15.v.2018, light trap, K. Ashly, 8 exs; 15.v.2018, pitfall trap, K. Ashly, 2 exs; 16.v.2018, light trap, K. Ashly, 10 exs; 25.v.2018, light trap, K. Ashly, 36 exs; 26.v.2018, light trap, K. Ashly, 12 exs; 26.v.2018, pitfall trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 30.v.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 16.vi.2018, light trap, K. Ashly, 7 exs; 17.vi.2018, light trap, K. Ashly, 11 exs; 17.vi.2018, hand picking, K. Ashly, 1 ex; 18.vi.2018, light trap, K. Ashly, 10 exs; 18.vi.2018, pitfall trap, K. Ashly, 1 ex; 19.vi.2018, light trap, K. Ashly, 3 exs; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, light trap, K. Ashly, 3 exs; 28.xi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 11.xii.2018, light trap, K. Ashly, 16 exs; 12.xii.2018, light trap, K. Ashly, 63 exs; 14.xii.2018, light trap, K. Ashly, 24 exs; 15.xii.2018, light trap, K. Ashly, 2 exs; 17.xii.2018, light trap, K. Ashly, 139 exs; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 1 ex; 08.x.2019, light trap, K. Ashly, 3 exs; 09.xi.2019, light trap, K. Ashly, 1 ex; 04.xii.2019, light trap, K. Ashly, 1 ex; 04.i.2019, light trap, K. Ashly, 2 exs; 05.i.2019, light trap, K. Ashly, 4 exs; 05.i.2019, pitfall trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 13 exs; 05.iii.2019, light trap, K. Ashly, 14 exs; 01.v.2019, light trap, K. Ashly, 3 exs; 02.v.2019, light trap, K. Ashly, 16 exs; 17.v.2019, light trap, K. Ashly, 30 exs;18.v.2019, light trap, K. Ashly, 12 exs; 19.v.2019, light trap, K. Ashly, 4 exs; 20.v.2019, light trap, K. Ashly, 8 exs; 21.v.2019, light trap, K. Ashly, 31 exs; 19.x.2019, light

trap, K. Ashly, 15 exs; 19.x.2019, hand picking, K. Ashly, 1 ex; 28.x.2019, light trap, K. Ashly, 5 exs; 04.xi.2019, light trap, K. Ashly, 14 exs; 05.xi.2019, light trap, K. Ashly, 18 exs; 06.xi.2019, light trap, K. Ashly, 5 exs; 18.xii.2019, light trap, K. Ashly, 1 ex; 19.xii.2019, light trap, K. Ashly, 3 exs; 20.xii.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 12.xii.2019, light trap, K. Ashly, 2 exs; 13.xii.2019, light trap, K. Ashly, 4 exs; 14.xii.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 30.xii.2019, pitfall trap, K. Ashly, 1 ex.

30) *Stenolophus smaragdulus* (Fabricius 1798)

Stenolophus smaragdulus Fabricius 1798: 60 (*Carabus*), Fabricius 1801: 209, Dejean 1829: 418, Hope 1838: 93, Schaum 1847: 49, Motschulsky 1855: 43, Gemminger and Harold 1868: 292, Bates 1886a: 80, Bates 1891a: 333, Bates 1892b: 349, Bouchard 1903: 172, Sloane 1920: 321, Andrewes 1921a: 160, Andrewes 1924c: 40, Andrewes 1930a: 318, Habu 1973: 377, Saha 1995: 69, Saha and Halder 2000: 16, Lorenz 2005: 355, Park *et al.*, 2006: 96, Jaeger and Ahmed 2017: 614, Löbl and Löbl 2017: 575, Sruthi and Sabu 2022: 21623, Divya 2022: 73.

= *Egadroma apicalis* Motschulsky 1864.

= *Stenolophus transmutans* Bates 1886a.

Distribution: India- Kerala (Palakkad: Pudussery, Walayar, Chulanur, Kootar), Tamil Nadu (Tharangambadi), Rajasthan (Tetara), Punjab, Haryana (Kalka), Himachal Pradesh (Bajaura, Kangara), Jharkhand (Konbir), West Bengal (Calcutta, Darjeeling, Siliguri, Midnapur,

Kharagpur, Purulia), Meghalaya (Khasi Hills, Jayantia Hills); Sri Lanka; Pakistan; China; Myanmar; Indochina; Thailand; Vietnam; Malaysia; Philippines; Indonesia; Japan; Papua New Guinea; Australia; Denmark.

Specimens examined (n= 63): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 3 exs; India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 4 exs; 10.iii.2018, light trap, K. Ashly, 2 exs; 12.iii.2018, light trap, K. Ashly, 2 exs; 02.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 12.iv.2018, light trap, K. Ashly, 1 ex; 24.iv.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 14.v.2018, light trap, K. Ashly, 1 ex; 16.v.2018, light trap, K. Ashly, 1 ex; 25.v.2018, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 30.v.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 17.vi.2018, light trap, K. Ashly, 2 exs; 20.vi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 28.xi.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 11.xii.2018, light trap, K. Ashly, 1 ex; 12.xii.2018, light trap, K. Ashly, 3 exs; 14.xii.2018, light trap, K. Ashly, 2 exs; 17.xii.2018, light trap, K. Ashly, 8 exs; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 1 ex; 05.i.2019, light trap, K. Ashly, 2 exs; 25.i.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 1 ex; 05.iii.2019, light trap, K. Ashly, 1 ex; 01.v.2019, light trap, K. Ashly, 1 ex; 17.v.2019, light

trap, K. Ashly, 4 exs; 19.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 1 ex; 09.xi.2019, light trap, K. Ashly, 1 ex; 12.xii.2019, light trap, K. Ashly, 1 ex.

Subfamily- Lebiinae Bonelli 1810

Tribe- Cyclosomini Laporte 1834

Genus *Anaulacus* MacLeay 1825

Type species. *Anaulacus sericipennis* MacLeay 1825

Anaulacus MacLeay 1825: 22, Lacordaire 1854: 309, Schaum 1863: 76, Chaudoir 1876b: 25, Andrewes 1926b: 346, Andrewes 1930a: 21, Jedlička 1951: 60, Jedlička 1963b: 286, Lorenz 2005: 451, Park *et al.*, 2006: 98, Löbl and Löbl 2017: 631, Shiju and Sabu 2019: 9.

31) *Anaulacus rubidus* (Andrewes 1922)

Anaulacus rubidus Andrewes 1922: 169 (*Aephnidius*), Andrewes 1930a: 12, Lorenz 2005: 451, Shiju and Sabu 2019: 9, Divya 2022: 82.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur, Walayar), Tamil Nadu (Madura), Karnataka (Belgaum), Maharashtra (Mumbai-Khandesh, Nagpur).

Specimens examined (n= 23): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 1 ex; 25.v.2018, light trap, K. Ashly, 1 ex; 26.v.2018, light trap, K. Ashly, 2 exs; 12.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 17.xii.2018, light trap, K. Ashly, 1 ex; 04.iii.2019, light trap, K. Ashly, 4 exs; 05.iii.2019, light trap, K. Ashly,

4 exs; 01.v.2019, light trap, K. Ashly, 3 exs; 17.v.2019, light trap, K. Ashly, 4 exs; 20.v.2019, light trap, K. Ashly, 1 ex; 29.x.2019, light trap, K. Ashly, 1 ex.

Genus *Cyclicus* Jeannel 1949

Type species. *Tetragonoderus perrieri* Fairmaire 1900

Cyclicus Jeannel 1949: 865 and 870, Basilewsky 1953: 117, Basilewsky 1956: 464, Lorenz 2005: 452, Shiju and Sabu 2019: 11.

32) *Cyclicus dilatatus* (Wiedemann 1823)

Cyclicus dilatatus Wiedemann 1823: 61 (*Bembidium*), Lorenz 2005: 452, Shiju and Sabu 2019: 11.

= *Tetragonoderus dilatatus* Dejean 1829.

Distribution: India- Kerala (Nilgiri Hills- Bhawani Valley), Tamil Nadu (Chennai, Palur- Arcot), Karnataka (Belgaum), Maharashtra (North Kanara), Andhra Pradesh (Waltair), Odisha (Puri), West Bengal (Kurseong), Uttarakhand (Almora).

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 1 ex.

Genus *Tetragonoderus* Dejean 1829

Type species. *Carabus quadrum* Fabricius 1792

Tetragonoderus Dejean 1829: 485, Schmidt-Goebel 1846: 92, Lacordaire 1854: 132, Chaudoir 1876b: 33, Horn 1882: 127, Andrewes 1924c: 60, Andrewes 1930a: 343, Jeannel 1949: 865, Basilewsky 1956: 463, Jedlička

1963b: 291, Saha *et al.,* 1992: 49, Lorenz 2005: 453, Löbl and Löbl 2017: 498, Shiju and Sabu 2019: 12.

33) *Tetragonoderus notaphioides* Motschulsky 1861

Tetragonoderus notaphioides Motschulsky 1861: 99, Chaudoir 1876b: 54, Bates 1886a: 201, Andrewes 1928: 24; Andrewes 1930a: 345, Lorenz 2005: 453, Shiju and Sabu 2019: 12, Sruthi and Sabu 2022: 21626, Divya 2022: 84.

Distribution: India- Kerala (Ambalavayal, Kozhikode; Chinnar: Kootar; Palakkad: Chulanur, Walayar), Tamil Nadu (Chennai, Palni Hills, Tharangambadi, Thiruchirapalli), Maharashtra (Bhandara, North Kanara), Odisha (Barkuda Island- Chilka Lake, Berhampur, Puri, Rambha- Ganjam); Sri Lanka- Colombo, Dikoya, Murunkam.

Specimens examined (n= 3): India- Kerala: Wayanad: Ambalavayal, 28.xi.2018, light trap, K. Ashly, 1 ex; 08.x.2019, light trap, K. Ashly, 1 ex; 27.i.2019, pitfall trap, K. Ashly, 1 ex.

Tribe- Lebiini Bonelli 1810

Genus *Anchista* Nietner 1857

Type species *Anchista modesta* Nietner 1856

Anchista Nietner 1856: 523, Nietner 1857b: 374, Chaudoir 1877: 236, Andrewes 1926b: 346, Andrewes 1930a: 22, Csiki 1932: 1455, Jedlička 1963b: 449, Darlington 1968: 139, Darlington 1970: 45, Habu 1982: 102, Kirschenhofer 1994: 1006, Lorenz 2005: 491, Löbl and Löbl 2017: 623, Shiju and Sabu 2019: 40

34) *Anchista fenestrata* (Schmidt-Goebel 1846)

Anchista fenestrata Schmidt-Goebel, 1846: 42 (*Plochionus*); Andrewes 1923b: 20; Andrewes 1930a: 23; Csiki 1932: 1456; Jedlička 1963b: 449; Lorenz 2005: 491; Löbl and Löbl 2017: 623, Shiju and Sabu 2019: 40, Sruthi and Sabu 2022: 21626, Divya 2022: 84.

= *Anchista nepalensis* Kirschenhofer 1994.

= *Anchista subpubescens* Chaudoir 1877.

Distribution: India- Kerala (Palakkad: Chulanur, Walayar; Charalmedu, Chinnar-Karimutty, Koorachundu, Nedumkayam, Thamarassery), Tamil Nadu (Alwarkurichi, Srivilliputhur, Thambaram), Pondicherry, Karnataka (Gundelpet), Rajasthan, Bihar, Uttarakhand (Dehra Dun), West Bengal (Singbhum); Sri Lanka- Horowupotana; Myanmar; Nepal; Pakistan.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 05.iii.2019, light trap, K. Ashly, 1 ex.

Genus *Anomotarus* Chaudoir 1875

Type species *Anomotarus olivaceus* Chaudoir 1875

Anomotarus Chaudoir 1875: 48, Sloane 1917: 435, Sloane 1920: 170, Andrewes 1930a: 27, Jedlička 1963b: 450, Lorenz 2005: 497, Löbl and Löbl 2017: 580, Shiju and Sabu 2019: 42.

35) *Anomotarus stigmula* (Chaudoir 1852)

Anomotarus stigmula Chaudoir 1852: 57 (*Cymindis*); Andrewes 1930a: 28, Jedlička 1963b: 451, Lorenz 2005: 497, Löbl and Löbl 2017: 580, Shiju and Sabu 2019: 42, Sruthi and Sabu 2022: 21626, Divya 2022: 86.

= *Uvea stigmula* Fauvel 1882.

Distribution: India- Kerala (Chinnar; Palakkad: Pudussery, Chulanur; Charalmedu, Eravikulam National Park, Koorachundu, Nedumkayam, Thamarassery, Vazhachal, Vettiozhinjathottam), Tamil Nadu (Chennai, Srivilliputhur), Karnataka (Belgaum, Gundelpet, Mysore-Nandidurg), Maharashtra (Mumbai- Khandesh, Nagpur), Uttarakhand (Dehra Dun), Himachal Pradesh (Shimla), Assam (Gauhati); Sri Lanka; Pakistan; Nepal; Myanmar (Tharrawady); Indonesia- Celebes, Timor; Taiwan; Japan; Papua New Guinea; New Caledonia.

Specimens examined (n= 6): India- Kerala: Palakkad: Pattambi, 23.ii.2018, light trap, K. Ashly, 2 exs; 03.iv.2018, light trap, K. Ashly, 1 ex; 16.vi.2018, light trap, K. Ashly, 1 ex; 05.iii.2019, light trap, K. Ashly, 1 ex; 01.v.2019, light trap, K. Ashly, 1 ex.

Genus *Apristus* Chaudoir 1846

Type species. *Apristus subaeneus* Chaudoir 1846

Apristus Chaudoir 1846a: 62, Lacordaire 1854: 123, Horn 1882: 133, Andrewes 1930a: 33, Ganglbauer 1892: 397 and 401, Blackwelder 1944: 59, Jedlička 1963b: 427, Kryzhanovskij *et al.*, 1995: 165, Lorenz 2005: 472, Park *et al.*, 2006: 100, Löbl and Löbl 2017: 595, Shiju and Sabu 2019: 26.

36) *Apristus subtransparens* Motschulsky 1861

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

Distribution: Throughout India- Kerala (Chinnar, Koottar, Nedumkayam, Thamarassery); Sri Lanka; Nepal; Pakistan.

Specimens examined (n= 10): India- Kerala: Wayanad: Ambalavayal, 24.iv.2018, pitfall trap, K. Ashly, 1 ex; 27.i.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 12.xii.2018, hand picking, K. Ashly, 1 ex; 04.iii.2019, pitfall trap, K. Ashly, 2 exs; 18.v.2019, hand picking, K. Ashly, 1 ex; 11.vi.2019, pitfall trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 13.xii.2019, pitfall trap, K. Ashly, 1 ex; 04.i.2020, pitfall trap, K. Ashly, 1 ex.

Genus *Lebia* Latreille 1802

Type species. *Carabus haemorrhoidalis* Fabricius 1792

Lebia Latreille 1802: 85, Dejean 1825: 253, Schmidt-Goebel 1846: 43, Lacordaire 1854: 127, Horn 1882: 130, Fowler 1887: 136, Ganglbauer 1892: 397, Andrewes 1930a: 191, Jedlička 1933: 144, Alluaud 1936: 8, Jeannel 1942: 1028, Blackwelder 1944: 52, Jeannel 1949: 882 and 902, Jedlička 1963b: 314, Mateu 1984a: 398, Kryzhanovskij *et al.,* 1995: 161, Hurka 1996: 468 and 470, Lorenz 2005: 481, Park *et al.,* 2006: 102, Löbl and Löbl 2017: 611, Shiju and Sabu 2019: 36.

37) *Lebia campania* Andrewes 1933

Lebia campania Andrewes 1933a: 20; Lorenz 2005: 482, Shiju and Sabu 2019: 36, Divya 2022: 89.

Distribution: India- Kerala (Palakkad: Chulanur, Walayar; Nilgiri Hills), Tamil Nadu (North Salem, Palni Hills), Maharashtra (Mumbai- Khandesh), Madhya Pradesh (Hoshangabad, Rahatgaon), Bihar (Chapra).

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 12.xii.2018, light trap, K. Ashly, 1 ex.

Tribe- Odacanthini Laporte 1834

Genus *Archicolliuris* Liebke 1931

Type species. *Casnonia bimaculata* Redtenbacher 1844

Archicolliuris Liebke 1931: 284, Liebke 1938: 61, Csiki 1932: 1525, Basilewsky 1956: 462, Jedlička 1963b: 497, Lorenz 1998: 418, Lorenz 2005: 442, Baehr 2005: 136, 137, 190 and 192, Baehr 2006: 70, Löbl and Löbl 2017: 632, Shiju and Sabu 2019: 6.

= *Anacasnonia* Liebke 1938.

= *Anacolliuris* Liebke 1938.

= *Archicasnonia* Liebke 1938.

= *Eucasnonia* Liebke 1938.

38) *Archicolliuris bimaculata* (Redtenbacher 1844)

Archicolliuris bimaculata Redtenbacher 1844: 498 (*Casnonia*), Lorenz 2005: 442 (*Archicolluris*), Terada and Wu 2014: 15 and 16, Löbl and Löbl 2017: 632, Shiju and Sabu 2019: 6.

= *Colliuris jaechi* Kirschenhofer 1994.

Distribution: India- Jammu and Kashmir; Sri Lanka, Myanmar; Nepal; Pakistan.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 27.xii.2019, light trap, K. Ashly, 1 ex.

39) @*Archicolliuris immaculata* (Liebke 1938)

Archicolliuris immaculata Liebke 1938: 61 (*Colliuris*), Lorenz 2005: 442, Shiju and Sabu 2019: 7.

Distribution: India- Karnataka (Belgaum); Sri Lanka- Colombo.

Specimens examined (n= 2): India- Kerala: Palakkad: Pattambi, 25.v.2018, light trap, K. Ashly, 1 ex; 27.xii.2019, light trap, K. Ashly, 1 ex.

Genus *Eucolliuris* Liebke 1931

Type species. *Casnonia natalensis* Chaudoir 1862

Eucolliuris Liebke 1931: 284, Liebke 1938: 64, Jeannel 1948: 748 and 750, Jedlička 1963b: 494, Baehr 2005: 192, Lorenz 2005: 441, Baehr 2006: 71, Park *et al.*, 2006: 98, Terada and Wu 2014: 16, Löbl and Löbl 2017: 633, Shiju and Sabu 2019: 5.

40) *Eucolliuris fuscipennis* (Chaudoir 1850)

Eucolliuris fuscipennis Chaudoir 1850a: 26 (*Casnonia*); Habu 1961a: 294, Habu 1961b: 96, Habu 1967: 17, Habu 1982: 88, Bousquet and Ito 2003: 443, Lorenz 2005: 441, Baehr 2005: 192, Baehr 2006: 71, Park *et al.*, 2006: 98, Terada and Wu 2014: 16 and 36, Löbl and Löbl 2017: 633, Shiju and Sabu 2019: 5, Divya 2022: 90.

= *Casnonia flavicauda* Bates 1873.

= *Casnonia haemorrhoidalis* Motschulsky 1864.

= *Casnonia litura*: Bouchard 1903.

= *Casnonia punctata* Nietner 1858.

Distribution: India- Kerala (Palakkad: Pudussery), Assam (Noa Dehing, Sadiya); Sri Lanka; Myanmar- Rangoon; China- Foochow; Thailand; Vietnam- Thai Nguyen, Ninh Binh, Thai Binh; Malaysia- Malacca; Indonesia- Sumatra, Celebes; Japan- Osaka; Taiwan.

Specimens examined (n= 177): India- Kerala: Palakkad: Pattambi, 14.v.2018, light trap, K. Ashly, 1 ex; 25.v.2018, light trap, K. Ashly, 1 ex; 14.xii.2018, light trap, K. Ashly, 7 exs; 15.xii.2018, light trap, K. Ashly, 1 ex; 17.xii.2018, light trap, K. Ashly, 1 ex; 11.vi.2019, light trap, K. Ashly, 1 ex; 05.xi.2019, light trap, K. Ashly, 1 ex; 21.xii.2019, light trap, K. Ashly, 1 ex; 27.xii.2019, light trap, K. Ashly, 3 exs.

Genus *Mimocolliuris* Liebke 1933

Type species. *Ophionea chaudoiri* Boheman 1858

Mimocolliuris Liebke 1933: 207, Jedlička 1963b: 492, Lorenz 2005: 442, Park *et al.*, 2006: 98, Terada and Wu 2014: 16, Löbl and Löbl 2017: 633, Shiju and Sabu 2019: 7.

41) *Mimocolliuris indica* Baehr 2016

Mimocolliuris indica Baehr 2016: 35.

Distribution: India- Kerala (Munnar, Kallar Valley), Maharashtra (Pune).

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 11.vi.2019, light trap, K. Ashly, 1 ex;

Genus *Ophionea* Klug 1821

Type species. *Cicindela cyanocephala* Fabricius 1798

Ophionea Klug 1821: 298, Eschscholtz 1829: 5, Schmidt-Goebel 1846: 20, Chaudoir 1848: 31 and 43, Lacordaire 1854: 73, Sloane 1917: 415, Andrewes 1919c: 475, Andrewes 1926b: 353, Andrewes 1930a: 240, Csiki 1932: 1534, Liebke 1938: 79, Jedlička 1963b: 490, Darlington 1968: 207, Saha *et al.*, 1992: 48, Lorenz 2005: 441, Baehr 2005: 135, 180, 191 and 192, Baehr 2006: 71, Park *et al.*, 2006: 98, Terada and Wu 2014: 16, Löbl and Löbl 2017: 634, Shiju and Sabu 2019: 5.

42) *Ophionea indica* (Thunberg 1784)

Ophionea indica Thunberg 1784: 68 (*Attelabus*), Andrewes 1919c: 476, Andrewes 1921b: 345, Andrewes 1924c: 116, Andrewes 1930a: 241, Habu 1961a: 296, Habu 1961b: 113, Habu 1967: 31, Habu 1982: 96, Saha *et al.*, 1992: 48, Bousquet and Ito 2003: 444, Lorenz 2005: 442, Baehr 2005: 180, 191 and 192, Park *et al.*, 2006: 98, Terada and Wu 2014: 16 and 25, Löbl and Löbl 2017: 634, Shiju and Sabu 2019: 6, Akhil 2020: 109, Divya 2022: 91.

= *Cicindela cyanocephala* Fabricius 1798.

= *Casnonia cyanocephala* Latreille and Dejean 1824.

= *Odacantha cyanocephala* Fabricius 1801.

= *Ophionea cyanocephala* Schmidt-Goebel 1846.

Distribution: India- Kerala (Malabar; Palakkad: Pudussery, Chulanur), West Bengal (Kolkata); Throughout southeastern Asia; Sri Lanka; Nepal;

China- Fujian, Yunnan; Vietnam; Taiwan; Malay archipelago from Japan to Papua New Guinea.

Specimens examined (n= 467): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 6 exs; 23.ii.2018, light trap, K. Ashly, 11 exs; 22.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 62 exs; India- Kerala: Wayanad: Ambalavayal, 11.iv.2018, light trap, K. Ashly, 6 exs; 23.iv.2018, light trap, K. Ashly, 3 exs; 24.iv.2018, light trap, K. Ashly, 6 exs; India- Kerala: Palakkad: Pattambi, 14.v.2018, light trap, K. Ashly, 3 exs; 15.v.2018, light trap, K. Ashly, 5 exs; 16.v.2018, light trap, K. Ashly, 55 exs; 25.v.2018, light trap, K. Ashly, 46 exs; 26.v.2018, light trap, K. Ashly, 1 ex; 18.vi.2018, light trap, K. Ashly, 1 ex; 19.vi.2018, light trap, K. Ashly, 1 ex; 20.vi.2018, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, light trap, K. Ashly, 2 exs; 28.xi.2018, light trap, K. Ashly, 1 ex; 03.xii.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 11.xii.2018, light trap, K. Ashly, 22 exs; 12.xii.2018, light trap, K. Ashly, 7 exs; 14.xii.2018, light trap, K. Ashly, 9 exs; 17.xii.2018, light trap, K. Ashly, 13 exs; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 2 exs; 26.i.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 14 exs; 05.iii.2019, light trap, K. Ashly, 27 exs; 01.v.2019, light

trap, K. Ashly, 10 exs; 02.v.2019, light trap, K. Ashly, 3 exs; 17.v.2019, light trap, K. Ashly, 18 exs; 18.v.2019, light trap, K. Ashly, 22 exs; 20.v.2019, light trap, K. Ashly, 12 exs; 21.v.2019, light trap, K. Ashly, 16 ex; 11.vi.2019, light trap, K. Ashly, 11 exs; 12.vi.2019, light trap, K. Ashly, 10 exs; 19.x.2019, light trap, K. Ashly, 2 exs; 28.x.2019, light trap, K. Ashly, 2 exs; 04.xi.2019, light trap, K. Ashly, 2 exs; 05.xi.2019, light trap, K. Ashly, 1 ex; 06.xi.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 04.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 19.xii.2019, light trap, K. Ashly, 1 ex; 20.xii.2019, light trap, K. Ashly, 3 exs21.xii.2019, light trap, K. Ashly, 7 exs; India- Kerala: Wayanad: Ambalavayal, 14.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 27.xii.2019, light trap, K. Ashly, 24 exs; 28.xii.2019, light trap, K. Ashly, 1 ex; 30.xii.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 1 ex; 03.i.2020, light trap, K. Ashly, 1 ex; 04.i.2020, light trap, K. Ashly, 2 exs.

Genus *Pentagonica* Schmidt-Goebel 1846

Type species. *Pentagonica ruficollis* Schmidt-Gobel 1846

Pentagonica Schmidt-Goebel 1846: 47, Lacordaire 1854: 133, Schaum 1863: 74, Bates 1873: 321, Chaudoir 1877: 212, Seidlitz 1903: 157, Andrewes 1926b: 353, Andrewes 1930a: 259, Jeannel 1942: 1017, Blackwelder 1944: 63, Jeannel 1949: 768, Basilewsky 1956: 472, Jedlička

1963b: 505, Darlington 1968: 192, Darlington 1970: 46, Lorenz 2005: 445, Park *et al.*, 2006: 103, Löbl and Löbl 2017: 640, Shiju and Sabu 2019: 8.

43) *Pentagonica pallipes* (Nietner 1856)

Pentagonica pallipes Nietner 1856: 525 (*Elliota*), Lorenz 2005: 446, Aston 2018: 8, Divya 2022: 92.

= *Pentagonica transparipes* Motschulsky 1859

Distribution: India- Kerala (Palakkad: Pudussery); Australia; Sri Lanka; China; Singapore; Philippines; Indonesia; Papua New Guinea; Solomon Islands; Micronesia.

Specimens examined (n= 2): India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 12.xii.2018, light trap, K. Ashly, 1 ex.

Genus *Selina* Motschulsky 1858

Type species. *Selina westermanni* Motschulsky 1858

Selina Motschulsky 1858: 110, Schaum 1860: 172, Bates 1871: 31, Alluaud 1918: 222, Andrewes 1924c: 51, Andrewes 1930a: 306, Jeannel 1942: 578, Jeannel 1948: 744, Basilewsky 1956: 462, Jedlička 1963b: 504, Lorenz 2005: 441, Park *et al.*, 2006: 98, Löbl and Löbl 2017: 579, Shiju and Sabu 2019: 4.

44) *Selina westermanni* Motschulsky 1858

Selina westermanni Motschulsky 1858: 110, Schaum 1863: 74, Reitter 1883: 96, Bates 1886a: 199, Fowler 1912: 58, Andrewes 1924c: 51, Andrewes and Scott 1924: 466 and 469, Andrewes 1928: 23, Andrewes

1930a: 307, Jeannel 1948: 745, Jedlička 1963b: 504, Lorenz 2005: 441, Park *et al.,* 2006: 98, Löbl and Löbl 2017: 579, Shiju and Sabu 2019: 5.

= *Ega natalensis* Peringuey 1896.

= *Pselaphanax natalensis* Peringuey 1898.

= *Selina ritsemae* Oberthur 1883.

Distribution: India- Kerala (Malabar), Tamil Nadu (Chennai, Coimbatore, Tharangambadi), Karnataka (Mysore), Maharashtra (Natal, Nagpur, North Kanara), Madhya Pradesh (Seoni, Mandla), West Bengal (Kolkata, Midnapur), Siwalik Hills, Uttarakhand (Dehra Dun, Haldwani); Sri Lanka; Bangladesh (Dacca, Sardah); China- Hong Kong; Vietnam; Indonesia- Sumatra; Kenya- Nairobi; Madagascar; Zimbabwe- Rhodesien.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 16.v.2018, light trap, K. Ashly, 1 ex.

Subfamily- Licininae Bonelli 1810

Tribe- Chlaeniini Brulle 1834

Genus *Callistomimus* Chaudoir 1872

Type species. *Callistus quadripustulatus* Gory 1833

Callistomimus Chaudoir 1872d: 382, Bates 1873: 323, Bates 1892b: 304, Chaudoir 1878b: 85, Andrewes 1921c: 233, Andrewes 1924c: 23, Andrewes 1930a: 60; Akhil 2020: 113, Divya 2022: 94.

45) *Callistomimus littoralis* Motschulsky 1859

Callistomimus littoralis Motschulsky 1859: 33, Schaum 1863: 85, Chaudoir 1872d: 383, Bates 1891a: 327, Dupius 1913: 6, Andrewes 1921c: 237, 245, Andrewes 1928: 22; Andrewes 1930a: 62.

= *Callistus westwoodi* Schaum 1863.

= *Callistomimus coarctatus* Chaudoir 1872.

Distribution: India- Kerala (Malabar; Palakkad: Pudussery), Tamil Nadu (Tharangambadi, Madurai, Ginjee, Thiruchirapalli), Karnataka (Belgavi, Mysore), Maharashtra (Nagpur, Bhandara), Madhya Pradesh (Barway, Bhopal, Jabalpur, Hoshangabad, Mandla), Jharkhand (Chota Nagpur, Tetara), Chhattisgarh (Raipur); Sri Lanka- Anuradhapura.

Specimens examined (n= 2): India- Kerala: Wayanad: Ambalavayal, 05.i.2019, pitfall trap, K. Ashly, 1 ex; 26.i.2019, light trap, K. Ashly, 1 ex.

Genus *Chlaenius* Bonelli 1810

Type species. *Carabus festivus* Panzer 1796

Chlaenius MacLeay 1825: 13, Dejean 1826: 297, 368, Schmidt-Goebel 1846: Cover page, Chaudoir 1850a: 407, Laferecte-Senectere 1851: 212, 233, 238, 263, 293, Lacordaire 1854: 213, 217, 219-221, 223-235, Chaudoir 1856: 192, Motschulsky 1864: 334, 347, Chaudoir 1876d: 10-12, 16, Bates 1892b: 309, Sloane 1910: 437, Andrewes 1919a: 91, Andrewes 1923b: 58, Andrewes 1924c: 24, Andrewes 1930a: 82.

46) *Chlaenius hamifer* Chaudoir 1856

Chlaenius hamifer Chaudoir 1856: 209, 210, Chaudoir 1876d: 62, Bates 1889a: 265, Bates 1892a: 230, Bates 1892b: 311, Bouchard 1903: 171,

Lesne 1904: 69, Sloane 1910: 439, Sloane 1920: 322, Andrewes 1919b: 140, Andrewes 1924c: 24, Andrewes 1930a: 94, Akhil 2020: 115, Sruthi and Sabu 2022: 21628, Divya 2022: 95.

= *Chlaenius bihamatus* Chaudoir 1856.

= *Chlaenius queenslandicus* Sloane 1910.

Distribution: India- Kerala (Tholpetty; Chinnar; Palakkad: Pudussery, Walayar); Sri Lanka; Myanmar; China- Hong Kong; Indochina; Thailand; Singapore; Indonesia- Java, Sumatara; Borneo; Taiwan.

Specimens examined (n= 10): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, 1 ex, K. Ashly; 24.ii.2018, light trap, 1 ex, K. Ashly; India- Kerala: Wayanad: Ambalavayal, 11.iv.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 25.v.2018, light trap, K. Ashly, 1 ex; 18.vi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, pitfall trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 1 ex; 27.i.2019, hand picking, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 12.vi.2019, light trap, K. Ashly, 1 ex.

47) *Chlaenius malachinus* (Motschulsky 1865)

Chlaenius malachinus Motschulsky 1865: 335 (*Callistoides*), Chaudoir 1876d: 280, Andrewes 1928: 12, Andrewes 1930a: 96, Akhil 2020: 116, Divya 2022: 95.

= *Chlaenius pudicus* Chaudoir 1876.

Distribution: India- Kerala (Palakkad: Walayar, Chulanur, Pudussery; Muthanga), Karnataka (Gundelpet); Sri Lanka.

Specimens examined (n= 1): India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 1 ex.

48) *Chlaenius nigricans* Wiedemann 1821

Chlaenius nigricans Wiedemann 1821: 110, Dejean 1826: 371, Laferte-Senectere 1851: 253, Chaudoir 1856: 238, Chaudoir 1876d: 126, Redtenbacher 1867: 9, Bates 1873: 251, Bates 1883: 208, Bates 1892b: 314, Bouchard 1903: 171, Andrewes 1921a: 166, Andrewes 1924b: 462, Andrewes 1930a: 98, Akhil 2020: 116, Divya 2022: 96.

= *Chlaenius culminatus* Bates 1873.

= *Epomis rugicollis* Laferte-Senectere 1851.

= *Chlaenius duvauceli* Redtenbacher 1867.

Distribution: India- Kerala (Palakkad: Pudussery; Vellarimala); Sri Lanka; Myanmar; China- Yunnan; Indonesia- Java, Nias Islands, Sumatra, Borneo; Indochina; Japan; Taiwan.

Specimens examined (n= 3): India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 1 ex; 27.i.2019, pitfall trap, K. Ashly, 1 ex.

49) *Chlaenius posticus* (Fabricius 1798)

Chlaenius posticus Fabricius 1798: 57 (*Carabus*), Hope 1838: 82, Guerin-Meneville 1840: 38, Guerin-Meneville 1843: 36, Schaum 1847: 46, Laferte-Senectere 1851: 242, Motschulsky 1855: 61, Chaudoir 1856: 206, Motschulsky 1864: 341, Nietner 1857a: 148, Nietner 1857c: 371, Chaudoir 1876d: 54, 55, Bates 1892a: 230, Andrewes 1921a: 159, Andrewes 1924c:

24, Andrewes 1927: 104, Andrewes 1928: 12, Andrewes 1930a: 101; Akhil 2020: 117, Divya 2022: 96.

= *Chlaenius bilunatus* Guerin-Meneville 1843.

= *Chlaenius binotulatus* Motschulsky 1864.

= *Chlaenius formosus* Chaudoir 1856.

= *Chlaenius maleolens* Nietner 1857.

Distribution: India- Kerala (Palakkad: Pudussery; Tholpetty, Muthanga, Silent Valley, Nilambur), Karnataka (Gundelpet), Maharashtra (Bhandara), Odisha (Puri), West Bengal (Kolkata), Assam (Brahmaputra river above Jorhat), Bihar (Pusa), Uttarakhand (Dehra Dun, Kalsi); Myanmar- Rangoon, Teinzo; Bangladesh- Dhaka; Pakistan- Jhelum; China; Vietnam- Annam; Indonesia- Java, Sumatra; Japan.

Specimens examined (n= 2): India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 1 ex; 11.vi.2019, light trap, K. Ashly, 1 ex.

Subfamily- Panagaeinae Bonelli 1810

Tribe- Panagaeini Bonelli 1810

Genus *Adischissus* Fedorenko 2015

Type species. *Carabus notulatus* Fabricius 1801

Adischissus Fedorenko 2015: 273, Jithmon and Sabu 2021: 18568.

50) *Adischissus notulatus* (Fabricius 1801)

Adischissus notulatus Fabricius 1801: 201 (*Carabus*), Hope 1838: 90, Schaum 1847: 48, Schaum 1854: 432, Motschulsky 1855: 70, Fedorenko 2015: 277, Jithmon and Sabu 2021: 18569.

= *Craspedophorus longicornis* Schaum 1863.

= *Dischissus phuongensis* Kirschenhofer 1994.

= *Panagaeus sumatranus* Dohrn 1891.

Distribution: India- Kerala, Tamil Nadu, Nilgiri hills, Karnataka, Andhra Pradesh, Odisha, Madhya Pradesh, Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, West Bengal (Kolkata, Almora), Sikkim (Namsoo), Meghalaya, Assam, Arunachal Pradesh, Manipur, Mizoram, Nagaland, Tripura; Sri Lanka; Bangladesh; Myanmar- Insein, Taungoo, Rangoon, Kawkareik; China- Shanghai, Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Xizang, Zhejiang provinces; Hongkong; Nepal; Cambodia; Vietnam; Laos; Malaysia- Kuala Lumpur; Singapore; Thailand; Taiwan.

Specimens examined (n= 3): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 1 ex; 25.v.2018, light trap, K. Ashly, 1 ex; 20.v.2019, light trap, K. Ashly, 1 ex.

Subfamily- Platyninae Bonelli 1810

Tribe- Platynini Bonelli 1810

Genus *Dicranoncus* Chaudoir 1850

Type species. *Dicranoncus femoralis* Chaudoir 1850

Dicranoncus Chaudoir 1850a: 392, Lacordaire 1854: 358, Sloane 1910: 456, Andrewes 1930a: 144, Darlington 1971: 274, Lorenz 2005: 419, Löbl and Löbl 2017: 657, Ashly and Sabu 2022: 188.

***51) Dicranoncus quadridens* (Motschulsky 1859)**

Dicranoncus quadridens Motschulsky 1859: 32 (*Menera*), Andrewes 1928: 17, Andrewes 1930a: 145, Lorenz 2005: 419, Löbl and Löbl 2017: 657, Ashly and Sabu 2022: 188.

= *Colpodes ruficeps* Bates 1883.

= *Loxocrepis amabilis* Chaudoir 1859b.

Distribution: India- Kerala (Thiruvananthapuram), Anamalai Hills, Nilgiri Hills, Karnataka (Mudigere, Coorg), West Bengal (Mungpoo, Gopaldhara), Uttarakhand (Almora, Bhimtal, Mussoorie), Assam (Rotung), Meghalaya (Shillong), Andaman Island; Nepal; Myanmar; Indochina, Indonesia; Malaysia; Malay Peninsula and Archipelago; Philippines.

Specimens examined (n= 1): India- Kerala: Wayanad: Ambalavayal, 13.xii.2019, light trap, K. Ashly, 1 ex.

Subfamily- Pterostichinae Bonelli 1810

Tribe- Abacetini Chaudoir 1873

Genus *Abacetus* Dejean, 1828

Type species. *Abacetus gagates* Dejean 1828

Abacetus Dejean 1828: 195, Lacordaire 1854: 315, Chaudoir 1859a: 126, Chaudoir 1869b: 355, Tschitschérine 1898: 519, 531, 538, Andrewes 1924c: 44, Andrewes 1930a: 1, Andrewes 1938: 129, Andrewes 1942: 21, Jeannel 1948: 420, Lorenz 2005: 255, Löbl and Löbl 2017: 480; Divya and Sabu 2020: 4.

52) *Abacetus dorsalis* (Motschulsky 1866)

Abacetus dorsalis Motschulsky 1866: 229 (*Astygis*), Chaudoir 1869b: 397, Andrewes 1928: 21, Andrewes 1930a: 3, Andrewes 1938: 189, Andrewes 1942: 27, Lorenz 2005: 258, Divya and Sabu 2020: 6, Divya 2022: 102.

Distribution: India- Kerala (Palakkad: Pudussery, Walayar), Tamil Nadu (Madura, Madras, Tranquebar), Karnataka (Belgaum), Maharashtra (Nagpur), Odisha (Barkuda Island: Lake Chilka); Myanmar.

Specimens examined (n= 6): India- Kerala: Palakkad: Pattambi, 23.ii.2018, light trap, K. Ashly, 2 exs; 18.vi.2018, light trap, K. Ashly, 1 ex; 04.iii.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 1 ex; 28.x.2019, light trap, K. Ashly, 1 ex.

53) *Abacetus haplosternus* Chaudoir 1878

Abacetus haplosternus Chaudoir 1878a: 25, Andrewes 1930a: 4, Andrewes 1942: 25, Lorenz 2005: 258, Divya and Sabu 2020: 9, Sruthi and Sabu 2022: 21630, Divya 2022: 103.

Distribution: India- Kerala (Palakkad: Pudussery, Walayar), Maharashtra (Nagpur), Madhya Pradesh (Hoshangabad), Uttarakhand (Almora, Ranikhet, Haldwani), Himachal Pradesh (Katrain); Indonesia: Thailand.

Specimens examined (n= 21): India- Kerala: Palakkad: Pattambi, 16.v.2018, light trap, K. Ashly, 1 ex; 25.v.2018, light trap, K. Ashly, 1 ex; 26.v.2018, light trap, K. Ashly, 2 exs; 17.vi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 28.xi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 12.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 1

ex; 25.i.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 01.v.2019, light trap, K. Ashly, 1 ex; 17.v.2019, light trap, K. Ashly, 3 exs; 18.v.2019, light trap, K. Ashly, 1 ex; 19.v.2019, light trap, K. Ashly, 1 ex; 20.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 5 exs.

Genus *Chlaeminus* Motschulsky 1865

Type species. *Chlaeminus biguttatus* Motschulsky 1865

Chlaeminus Motschulsky 1865 (1864): 350, Chaudoir 1869b: 401, Andrewes 1930a: 82, Lorenz 2005: 259, Löbl and Löbl 2017: 481, Divya and Sabu 2020: 10.

54) *Chlaeminus biguttatus* Motschulsky 1865

Chlaeminus biguttatus Motschulsky 1865 (1864): 351, Chaudoir 1869b: 401, Bates 1889a: 277, Bates 1892b: 363, Andrewes 1928: 14, Andrewes 1930a: 82, Lorenz 2005: 259, Divya and Sabu 2020: 10, Divya 2022: 103.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur), Tamil Nadu (Tranquebar, Nilgiris); Sri Lanka; Bangladesh; Myanmar; Cambodia; Indonesia; Thailand.

Specimens examined (n= 141): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 13 exs; 23.ii.2018, light trap, K. Ashly, 8 exs; 22.iii.2018, light trap, K. Ashly, 5 exs; 03.iv.2018, light trap, K. Ashly, 6 exs; 14.v.2018, light trap, K. Ashly, 7 exs; 16.v.2018, light trap, K. Ashly, 13 exs; 19.vi.2018, light trap, K. Ashly, 1 ex; 20.vi.2018, light trap, K. Ashly, 1 ex; 11.xii.2018, light trap, K. Ashly, 15 exs; 12.xii.2018, light trap, K. Ashly, 5 exs; 14.xii.2018, light trap, K. Ashly, 2 exs; 17.xii.2018, light

trap, K. Ashly, 3 exs; 04.iii.2019, light trap, K. Ashly, 2 exs; 02.v.2019, light trap, K. Ashly, 16 exs; 17.v.2019, light trap, K. Ashly, 30 exs; 19.v.2019, light trap, K. Ashly, 1 ex; 12.vi.2019, light trap, K. Ashly, 1 ex; 19.x.2019, light trap, K. Ashly, 2 exs; 28.x.2019, light trap, K. Ashly, 1 ex; 04.xi.2019, light trap, K. Ashly, 6 exs; 05.xi.2019, light trap, K. Ashly, 1 ex; 06.xi.2019, light trap, K. Ashly, 1 ex; 27.xii.2019, light trap, K. Ashly, 1 ex.

Genus *Cosmodiscus* Sloane 1907

Type species. *Cosmodiscus rubripictus* Sloane 1907

Cosmodiscus Sloane 1907: 371, Andrewes 1920: 445, Andrewes 1930a: 131, Lorenz 2005: 260, Hegde and Kushwaha 2015: 396, 401, Löbl and Löbl 2017: 481.

55) *Cosmodiscus picturatus* Andrewes 1920

Cosmodiscus picturatus Andrewes 1920: 447, Andrewes 1921b: 345, Andrewes 1930a: 131, Lorenz 2005: 260, Hegde and Kushwaha 2015: 396, 401, Sruthi and Sabu 2022: 21630, Divya 2022: 104.

Distribution: India- Kerala (Kozhikode; Palakkad: Chulanur; Chinnar), Maharashtra (Nagpur), Andhra Pradesh (Jammelamadugu), Odisha (Rambha: Ganjam, Barkuda and Gopkuda Island: Lake Chilka), Uttar Pradesh (Fyzabad).

Specimens examined (n= 1): India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 1 ex.

Subfamily- Scaritinae Bonelli 1810

Tribe- Clivinini Rafinesque 1815

Genus *Clivina* Latreille 1802

Type species. *Scarites arenarius* Fabricius 1775.

Clivina Latreille 1802: 96, Bonelli 1813: 480, Dejean 1825: 411, Putzeys 1846, 523, 577, Lacordaire 1854: 204, Andrewes 1924c: 11, Andrewes 1926b: 372, Andrewes 1929: 344, 351, Andrewes 1930a: 110.

56) *Clivina attenuata* (Herbst 1806)

Clivina attenuata Herbst 1806: 264 (*Eoclivina*), Bates 1889a: 262, Bates 1891a: 325, Andrewes 1921b: 340, Andrewes 1924c: 11, Andrewes 1926b: 374, Andrewes 1927: 98, Andrewes 1929: 353, 355, Andrewes 1930a: 111, Lorenz 2005: 145, Hegde and Kushwaha 2015: 399, Divya 2022: 105.

= *Clivina picipes* Bonelli 1813.

= *Scarites attenuatus* Herbst 1806.

Distribution: India- Kerala (Palakkad: Pudussery), Uttar Pradesh; Myanmar; Cambodia; Laos; Vietnam; Malaysia; Indochina; Indonesia; Iran.

Specimens examined (n= 1): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, 1 ex, K. Ashly.

57) *Clivina brevior* Putzeys 1867

Clivina brevior Putzeys 1867a: 126, Bates 1892b: 277, Andrewes 1926b: 375, Andrewes 1929: 355, 378, Andrewes 1930a: 112, Sruthi and Sabu 2022: 21631, Divya 2022: 103.

Distribution: India- Kerala (Kozhikode: Kuttikattoor, Medical College, Thamarassery; Wayanad: Muthanga, Tholpetty; Nilambur; Chinnar; Palakkad: Pudussery, Walayar, Chulanur), Bihar (Pusa); Myanmar; Malaysia; Indonesia.

Specimens examined (n= 835): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 23.ii.2018, light trap, K. Ashly, 77 exs; India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 9 exs; 03.iv.2018, light trap, K. Ashly, 64 exs; India- Kerala: Wayanad: Ambalavayal, 11.iv.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 11 exs; 16.v.2018, light trap, K. Ashly, 20 exs; 25.v.2018, light trap, K. Ashly, 32 exs; 16.vi.2018, light trap, K. Ashly, 19 exs; 17.vi.2018, light trap, K. Ashly, 25 exs; 18.vi.2018, light trap, K. Ashly, 21 exs; 19.vi.2018, light trap, K. Ashly, 2 exs; 20.vi.2018, light trap, K. Ashly, 27 exs; India- Kerala: Wayanad: Ambalavayal, 27.xi.2018, light trap, K. Ashly, 12 exs; 28.xi.2018, light trap, K. Ashly, 9 exs; 03.xii.2018, light trap, K. Ashly, 5 exs; India- Kerala: Palakkad: Pattambi, 11.xii.2018, light trap, K. Ashly, 21 exs; 12.xii.2018, light trap, K. Ashly, 25 exs; 15.xii.2018, light trap, K. Ashly, 28 exs; 17.xii.2018, light trap, K. Ashly, 9 exs; India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 57 exs; 01.v.2019, light trap, K. Ashly, 143 exs; 02.v.2019, light trap, K.

Ashly, 22 exs; 17.v.2019, light trap, K. Ashly, 18 exs; 19.v.2019, light trap, K. Ashly, 11 exs; 20.v.2019, light trap, K. Ashly, 7 exs; 21.v.2019, light trap, K. Ashly, 25 exs; 11.vi.2019, light trap, K. Ashly, 2 exs; 12.vi.2019, light trap, K. Ashly, 21 exs; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 7 exs; India- Kerala: Palakkad: Pattambi, 04.xi.2019, light trap, K. Ashly, 25 exs; 05.xi.2019, light trap, K. Ashly, 8 exs; 06.xi.2019, light trap, K. Ashly, 10 exs; India- Kerala: Wayanad: Ambalavayal, 09.xi.2019, light trap, K. Ashly, 3 exs;04.xii.2019, light trap, K. Ashly, 7 exs; India- Kerala: Palakkad: Pattambi, 18.xii.2019, light trap, K. Ashly, 3 exs; 20.xii.2019, light trap, K. Ashly, 4 exs; 21.xii.2019, light trap, K. Ashly, 40 exs; 30.xii.2019, light trap, K. Ashly, 7 exs.

58) #*Clivina gamma* Andrewes 1929

Clivina gamma Andrewes 1929: 354, 368, Andrewes 1930a: 114.

Distribution: India- Uttar Pradesh (Siddharth Nagar), Uttarakhand.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 1 ex.

59) *Clivina helferi* Putzeys 1867

Clivina helferi Putzeys 1867a: 126; Andrewes 1926b: 375; Andrewes 1927: 109, Andrewes 1929: 354, 367, Andrewes 1930a: 111.

= *Clivina debilis* Bates 1892b.

= *Clivina grammica* Putzeys 1877b.

Distribution: India- Tamil Nadu (Madras), Odisha (Balugaon), West Bengal (Kolkata, Kharagpur, Parbatipur, Sunderbans), Bihar (Pusa, Dinapur); Myanmar - Tharrawaddy, Prome, Rangoon, Mandalay.

Specimens examined (n= 18): India- Kerala: Palakkad: Pattambi, 17.vi.2018, light trap, K. Ashly, 4 exs; 19.vi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 21.xii.2019, light trap, K. Ashly, 1 ex; 31.xii.2019, light trap, K. Ashly, 11 exs.

60) *Clivina lobata* Bonelli 1813

Clivina lobata Bonelli 1813: 481, Dejean 1825: 414, Putzeys 1861: 599, Andrewes 1919b: 209, Andrewes 1921b: 340; Andrewes 1924b: 462 Andrewes 1924c: 11, Andrewes 1926b: 375, Andrewes 1929: 355, 375, Andrewes 1930a: 115, Lorenz, 2005: 143; Hegde and Kushwaha 2015: 399, Sruthi and Sabu 2022: 21631, Divya 2022: 107.

Distribution: India- Kerala (Kozhikode: Thamarassery; Wayanad: Thirunelli; Chinnar, Palakkad: Chulanur, Pudussery), Odisha (Ganjam district: Surada), Gujarat, Haryana (Kalka), Uttar Pradesh, Bihar (Pusa), Chhattisgarh (Raipur), West Bengal (Sundarban, Gosaba: Pakhirala), Assam (Jorhat); Myanmar; China; Thailand; Japan.

Specimens examined (n= 482): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K. Ashly, 2 exs; 10.iii.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 11.iv.2018, light trap, K.

Ashly, 1 ex; 23.iv.2018, light trap, K. Ashly, 1 ex; 24.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 14.v.2018, light trap, K. Ashly, 19 exs; 15.v.2018, light trap, K. Ashly, 18 exs; 16.v.2018, light trap, K. Ashly, 9 exs; 26.v.2018, light trap, K. Ashly, 7 exs; India- Kerala: Wayanad: Ambalavayal, 30.v.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 17.vi.2018, light trap, K. Ashly, 1 ex; 19.vi.2018, light trap, K. Ashly, 16 exs; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, light trap, K. Ashly, 9 exs; 27.xi.2018, light trap, K. Ashly, 5 exs; 28.xi.2018, light trap, K. Ashly, 2 exs; 03.xii.2018, light trap, K. Ashly, 4 exs; India- Kerala: Palakkad: Pattambi, 12.xii.2018, light trap, K. Ashly, 8 exs; 14.xii.2018, light trap, K. Ashly, 15 exs; 15.xii.2018, light trap, K. Ashly, 29 exs; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 2 exs; 03.i.2020, light trap, K. Ashly, 3 exs; 04.i.2020, light trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 10 exs; 26.i.2019, light trap, K. Ashly, 2 exs; 27.i.2019, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 02.v.2019, light trap, K. Ashly, 2 exs; 19.v.2019, light trap, K. Ashly, 3 exs; 20.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 27 exs; 12.vi.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 18 exs; India- Kerala: Palakkad: Pattambi, 19.x.2019, light trap, K. Ashly, 12 exs; 28.x.2019, light trap, K. Ashly, 5 exs; 04.xi.2019, light trap, K. Ashly, 4 exs; 05.xi.2019, light trap, K. Ashly, 7 exs; 06.xi.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 09.xi.2019,

light trap, K. Ashly, 7 exs; 04.xii.2019, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 19.xii.2019, light trap, K. Ashly, 3 exs; 21.xii.2019, light trap, K. Ashly, 171 exs; India- Kerala: Wayanad: Ambalavayal, 12.xii.2019, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 22.xii.2019, light trap, K. Ashly, 12 exs; 29.xii.2019, light trap, K. Ashly, 12 exs; 30.xii.2019, light trap, K. Ashly, 2 exs; 31.xii.2019, light trap, K. Ashly, 10 exs;

61) †*Clivina mustela* Andrewes 1923

Clivina mustela Andrewes 1923a: 226, Andrewes 1929: 3, 5, 377.

Distribution: Sri Lanka (Anuradhapura); China; Cambodia.

Specimens examined (n= 55): India- Kerala: Palakkad: Pattambi, 16.v.2018, light trap, K. Ashly, 11 exs; 18.vi.2018, light trap, K. Ashly, 6 exs; 19.v.2019, light trap, K. Ashly, 24 exs; 11.vi.2019, light trap, K. Ashly, 5 exs; 12.vi.2019, light trap, K. Ashly, 6 exs; 19.x.2019, light trap, K. Ashly, 2 exs; 06.xi.2019, light trap, K. Ashly, 1 ex.

62) *Clivina tranquebarica* Bonelli 1813

Clivina tranquebarica Bonelli 1813: 484, Andrewes 1926b: 377, Andrewes 1929: 353, 359, Andrewes 1930a: 117, Hegde and Kushwaha 2015: 399, Löbl and Löbl 2017: 257, Akhil, 2020: 132, Divya 2022: 107.

= *Clivina convexicollis* Putzeys 1861

= *Eupalamus brunnescens* Motschulsky 1861

= *Clivina foveicollis* Putzeys 1861

= *Clivina obesicollis* Putzeys 1861

= *Eupalamus fulvaster* Motschulsky 1861

= *Eupalamus cordicollis* Motschulsky 1861

= *Eupalamus rufipes* Motschulsky 1861

Distribution: India- Kerala (Kozhikode: Kuttikatoor, Thondayad, Chelannur, Thamarassery; Wayanad: Tholpetty; Malappuram: Nilambur; Palakkad: Chulanur,Pudussery, Walayar), Bihar (Pusa), Uttar Pradesh, Uttarakhand (Rishikesh), South East India; Sri Lanka; Myanmar; Nepal; China; Indo- china; Thailand; Vietnam; Malaysia; Indonesia.

Specimens examined (n= 499): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K. Ashly, 3 ex; India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 1 ex; 23.ii.2018, light trap, K. Ashly, 12 exs; India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 8 ex; 10.iii.2018, light trap, K. Ashly, 9 exs; 12.iii.2018, light trap, K. Ashly, 5 exs; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 16 exs; 02.iv.2018, pitfall trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 03.iv.2018, light trap, K. Ashly, 8 exs; India- Kerala: Wayanad: Ambalavayal, 06.iv.2018, light trap, K. Ashly, 12 exs; 11.iv.2018, light trap, K. Ashly, 11 exs; 12.iv.2018, light trap, K. Ashly, 5 exs; 23.iv.2018, light trap, K. Ashly, 9 exs; 24.iv.2018, light trap, K. Ashly, 15 exs; India- Kerala: Palakkad: Pattambi, 14.v.2018, light trap, K. Ashly, 4 exs; 16.v.2018, light trap, K. Ashly, 8 exs; India- Kerala: Wayanad: Ambalavayal, 30.v.2018, light trap, K. Ashly, 18 exs; India- Kerala:

Palakkad: Pattambi, 16.vi.2018, light trap, K. Ashly, 4 exs; 17.vi.2018, light trap, K. Ashly, 5 exs; 18.vi.2018, light trap, K. Ashly, 3 exs; 19.vi.2018, light trap, K. Ashly, 3 exs;20.vi.2018, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, light trap, K. Ashly, 8 exs; 27.xi.2018, light trap, K. Ashly, 12 exs; 03.xii.2018, light trap, K. Ashly, 9 exs; India- Kerala: Palakkad: Pattambi, 12.xii.2018, light trap, K. Ashly, 35 exs; 14.xii.2018, light trap, K. Ashly, 10 exs; 15.xii.2018, light trap, K. Ashly, 8 exs; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 5 exs; 04.i.2019, light trap, K. Ashly, 5 exs; 05.i.2019, light trap, K. Ashly, 3 exs; 25.i.2019, light trap, K. Ashly, 24 exs; 26.i.2019, light trap, K. Ashly, 4 exs; 27.i.2019, light trap, K. Ashly, 4 exs; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 8 exs; 05.iii.2019, light trap, K. Ashly, 3 exs; 01.v.2019, light trap, K. Ashly, 12 exs; 02.v.2019, light trap, K. Ashly, 9 exs; 19.v.2019, light trap, K. Ashly, 16 exs; 20.v.2019, light trap, K. Ashly, 5 exs; 21.v.2019, light trap, K. Ashly, 10 exs; 11.vi.2019, light trap, K. Ashly, 4 exs; 12.vi.2019, light trap, K. Ashly, 22 exs; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 8 exs; India- Kerala: Palakkad: Pattambi, 28.x.2019, light trap, K. Ashly, 5 exs; 05.xi.2019, light trap, K. Ashly, 9 exs; 06.xi.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 09.xi.2019, light trap, K. Ashly, 8 exs; 09.xi.2019, pitfall trap, K. Ashly, 1 ex;04.xii.2019, light trap, K. Ashly, 9 exs; 12.xii.2019, light trap, K. Ashly, 6 exs; 13.xii.2019, light trap, K. Ashly, 2 exs; 14.xii.2019, light trap, K. Ashly, 6

exs; 14.xii.2019, pitfall trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 18.xii.2019, light trap, K. Ashly, 16 exs; 19.xii.2019, light trap, K. Ashly, 2 exs; 21.xii.2019, light trap, K. Ashly, 7 exs; 22.xii.2019, light trap, K. Ashly, 8 exs; 29.xii.2019, light trap, K. Ashly, 1 ex; 30.xii.2019, light trap, K. Ashly, 9 exs; 31.xii.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 7 exs; 03.i.2020, light trap, K. Ashly, 3 exs; 04.i.2020, light trap, K. Ashly, 4 exs.

63) *Clivina westwoodi* Putzeys 1867

Clivina westwoodi Putzeys 1867a: 109, Andrewes 1926b: 373, Andrewes 1929: 351, 365, Andrewes 1930a: 119, Lorenz 2005: 145, Löbl and Löbl 2017: 256, Divya 2022: 109.

= *Clivina castanea* Putzeys 1861.

Distribution: India- Kerala (Kozhikode: Kuttikatoor, Cherukulam, Chelannur, Thamarassery; Palakkad: Pudussery), Karnataka (Belgaum), Maharashtra (Mumbai, Nagpur), Uttarakhand (Dehradun), Arunachal Pradesh; Sri Lanka; Japan; Taiwan; New Guinea.

Specimens examined (n= 28): India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 2 exs; 17.vi.2018, light trap, K. Ashly, 1 ex; 18.vi.2018, light trap, K. Ashly, 1 ex; 19.vi.2018, light trap, K. Ashly, 1 ex; 15.xii.2018, light trap, K. Ashly, 2 exs; 04.iii.2019, light trap, K. Ashly, 3 exs; 05.iii.2019, light trap, K. Ashly, 4 exs; 01.v.2019, light trap, K. Ashly, 3 exs; 02.v.2019, light trap, K. Ashly, 2 exs; 19.v.2019, light trap, K. Ashly, 2 exs; 12.vi.2019, light trap, K. Ashly, 1 ex; 18.xii.2019, light trap,

K. Ashly, 1 ex; 21.xii.2019, light trap, K. Ashly, 1 ex; 27.xii.2019, light trap, K. Ashly, 3 exs; 31.xii.2019, light trap, K. Ashly, 1 ex;

Genus *Leleuporella* Basilewsky 1956

Type species. *Leleuporella caeca* Basilewsky 1956

Leleuporella Basilewsky 1956: 426, Bulirsch and Magrini 2019: 300

64) *Leleuporella devagiriensis* Abhita and Sabu 2009

Leleuporella devagiriensis Abhita and Sabu 2009: 61.

Distribution: India- Kerala (Kozhikode: Kunnamangalam).

Specimens examined (n= 12): India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 11 exs; 21.v.2019, light trap, K. Ashly, 1 ex.

Genus *Pseudoclivina* Kult 1947

Type species. *Clivina grandis* Dejean 1826

Pseudoclivina Kult 1947: 30

= *Afroclivina* Kult 1959

65) *Pseudoclivina arunachalensis* Saha and Biswas 1985

Pseudoclivina arunachalensis Saha and Biswas 1985: 118.

Distribution: India- Kerala (Kozhikode: Kuttikatoor, Poonoor, Thamarassery; Wayanad: Tholpetty, Muthanga, Ambalavayal), Arunachal Pradesh (Tirap, Namdhapa).

Specimens examined (n= 2): India- Kerala: Wayanad: Ambalavayal, 25.i.2019, light trap, K. Ashly, 1 ex; 14.xii.2019, light trap, K. Ashly, 1 ex.

66) *Pseudoclivina memnonia* (Dejean 1831)

Pseudoclivina memnonia Dejean, 1831 (*Clivina*): 503, Putzeys 1846: 588, Bouchard 1903: 169, Andrewes 1929: 354, Andrewes 1930a: 115.

= *Clivina indica* Putzeys 1846.

= *Clivina rugosifrons* Nietner 1856.

Distribution: India- Kerala (Idukki: Chinnar; Kozhikode; Wayanad: Sulthan Bathery, Panamaram, Thirunelli, Muthanga, Tholpetty, Ambalavayal; Kasargod: Periya), Rajasthan (Tetara), Jharkhand (Konbir), West Bengal (Konbir), Assam (Jorhat); Sri Lanka; Myanmar; Indochina; Vietnam; Cambodia; Singapore; Indonesia.

Specimens examined (n= 1): India- Kerala: Wayanad: Ambalavayal, 25.i.2019, light trap, K. Ashly, 1 ex.

Tribe- Dyschiriini Kolbe 1880

Genus *Dyschirius* Bonelli 1810

Type species. *Scarites thoracicus* Rossi 1790

Dyschirius Bonelli, 1810: Tabula synoptica, Löbl and Löbl 2017: 263.

= *Dyschiridius* Jeannel, 1941: 263

67) *Dyschirius paucipunctus* Andrewes 1929

Dyschirius paucipunctus Andrewes 1929: 392, 397, Andrewes 1930a: 160, Sruthi and Sabu 2022: 21631, Divya 2022: 110.

Distribution: India- Kerala (Pudussery; Chinnar), Karnataka (Belgaum), Maharashtra (Pune, Mumbai), Uttar Pradesh (Hardoi, Dudhwa National Park, Salukapur, Lakhimpur: Salukapur); Sri Lanka.

Specimens examined (n= 2): India- Kerala: Wayanad: Ambalavayal, 28.xi.2018, light trap, K. Ashly, 1 ex; 08.x.2019, light trap, K. Ashly, 1 ex.

Tribe- Scaritini Bonelli 1810

Genus *Distichus* Motschulsky 1858

Type species. *Scarites planus* Bonelli 1813

Distichus Motschulsky 1858: 96, Tschitschérine 1904: 258, 265, Andrewes 1924c: 9, Andrewes 1930a: 295, Löbl and Löbl 2017: 309.

68) *Distichus planus* (Bonelli 1813)

Distichus planus Bonelli 1813: 470 (*Scarites*), Dejean 1825: 395, Chaudoir 1855: 46, Tchitcherine 1904: 265, Andrewes 1919c: 470, Andrewes 1919b: 99, Andrewes 1921a: 146, Andrewes 1929: 233, 279, Andrewes 1930a: 301, Divya 2022: 111.

= *Scarites biskrensis* Puel 1938.

= *Scarites nitidus* Dejean 1831.

Distribution: India- Kerala (Palakkad: Pudussery), Uttar Pradesh (Chitrakoot, Pahari); Pakistan; Kazakhstan; Tajikistan; Turkmenistan; Uzbekistan; Yemen; Saudi Arabia; Iran; Iraq; Azerbaijan; Ethiopia; Sudan; Egypt; Morocco; Tunisia; Azores; Cyprus; France; Germany; Georgia; Greece; Ireland; Israel; Italy; Jordan; Malta; Portugal; Spain; Syria; Turkey; Russia.

Specimens examined (n= 46): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 1 ex; 23.ii.2018, light trap, K. Ashly, 3 exs; 16.v.2018, light trap, K. Ashly, 3 exs; 26.v.2018, light trap, K. Ashly, 1 ex;

Kerala: Palakkad: Pattambi, 16.vi.2018, light trap, K. Ashly, 1 ex; 22.iii.2018, light trap, K. Ashly, 10 exs; 15.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 02.v.2019, light trap, K. Ashly, 6 exs; 19.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 3 exs; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 29.x.2019, light trap, K. Ashly, 4 exs; 05.xi.2019, light trap, K. Ashly, 3 exs; India- Kerala: Wayanad: Ambalavayal, 04.xii.2019, light trap, K. Ashly, 1 ex; India- India- Kerala: Palakkad: Pattambi, 29.xii.2019, light trap, K. Ashly, 2 exs; 31.xii.2019, light trap, K. Ashly, 2 exs.

Genus *Scarites* Fabricius 1775

Type species. *Scarites subterraneus* Fabricius 1775

Scarites Fabricius 1775: 249, Bonelli 1813: 463, Dejean 1825: 364, Schmidt-Goebel 1846: 93, Putzeys 1846: 521, Lacordaire 1854: 194, Chaudoir 1855: 51, Chaudoir 1880: 63, Reitter 1899: 4, Andrewes 1929: 210, 225, Andrewes 1930a: 294.

69) #*Scarites beesoni* Andrewes 1929

Scarites beesoni Andrewes 1929: 290, Andrewes 1930a: 295.

Distribution: India- West Bengal (Buxa, Rajabhatkhawa); Bangladesh.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 28.x.2019, light trap, K. Ashly, 1 ex.

70) *Scarites modestus* (Chaudoir 1880)

Scarites modestus Chaudoir 1880: 57 (*Distichus*), Andrewes 1929: 234, 289, Andrewes 1930a: 300.

Distribution: East Indies.

Specimens examined (n= 23): India- Kerala: Palakkad: Pattambi, 15.xii.2018, light trap, K. Ashly, 1 ex; 21.xii.2019, light trap, K. Ashly, 2 exs; 30.xii.2019, light trap, K. Ashly, 20 exs.

Subfamily- Siagoninae Bonelli 1813

Tribe- Siagonini Bonelli 1813

Genus *Siagona* Latreille 1804

Type species. *Cucujus rufipes* Fabricius 1792

Siagona Latreille 1804: 141, Latreille 1806: 208, Bonelli 1813: 457, Dejean 1825: 357, Lacordaire 1854: 162, Chaudoir 1850a: 439, Peringuey 1896: 414, Horn 1907: 428, Andrewes 1924c: 13, Andrewes 1929: 174, Andrewes 1930a: 308.

71) *Siagona plana* (Fabricius 1801)

Siagona plana Fabricius 1801: 216 (*Galerita*), Hope 1838: 99, Andrewes 1921a: 163, Andrewes 1929: 180, 198, Andrewes 1930a: 312, Divya 2022: 114.

= *Siagona plagiata* Chaudoir 1876.

Distribution: India- Kerala (Palakkad: Pudussery, Walayar), Tamil Nadu (Madras: Tiruchirappalli; Shembaganur), Odisha (Satpara, Lake Chilka); Sri Lanka- Hambegamuwa, Murunkan, Wirawila; Bangladesh- Dacca.

Specimens examined (n= 1): India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 1 ex.

Subfamily- Trechinae Bonelli 1810

Tribe- Bembidiini Stephens 1827

Genus *Bembidion* Latreile 1802

Type species. *Carabus quadriguttatus* Fabricius 1775

Bembidion Latreile 1802: 82, Andrewes 1924c: 16, Andrewes 1930a: 38, Andrewes 1930b: 10, Andrewes 1935a: 92, Lorenz 2005: 246, Toledano and Rébl 2006: 7, Toledano 2009: 579, Löbl and Löbl 2017: 297,

72) *Bembidion niloticum* Dejean 1831

Bembidion niloticum Dejean 1831:73, Bates 1873: 301, Bates 1886a: 156, Bates 1889a: 269, Andrewes 1919b: 100; Andrewes 1919c: 472, Andrewes 1924c: 18, Andrewes 1930a: 42, Andrewes 1935a: 199, Lorenz 2005: 246, Kuswaha *et al.*, 2017: 335, Löbl and Löbl 2017: 319, Divya 2022: 115.

= *Bembidion niloticum* Netolitzky 1914.

= *Bembidion terminans* Gemminger and Harold 1868

= *Notaphus batesi* Putzeys 1875.

Distribution: India- Kerala (Palakkad: Pudussery), Haryana, Uttarakhand (Upper Jhelum, Almora, Ranikhet, Mussoorie, Lyallpur), Uttar Pradesh, West Bengal (Dhappa), Nagaland; Sri Lanka; Myanmar; Nepal; China; Pakistan; Afghanistan; Kazakhstan; Kyrgyzstan; Turkmenistan; Uzbekistan; Iran; Iraq; Israel; United Arab Emirates; Azerbaijan; Armenia; Bulgaria;

Cyprus; Egypt; Georgia; Greece; Turkey; Cambodia; Vietnam; Philippines; Japan; Russia; Taiwan.

Specimens examined (n= 27): India- Kerala: Wayanad: Ambalavayal, 10.iii.2018, light trap, K. Ashly, 2 ex; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 5 exs; 11.iv.2018, light trap, K. Ashly, 1 ex; 23.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 25.v.2018, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 30.v.2018, light trap, K. Ashly, 1 ex; 03.xii.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 15.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 17.v.2019, light trap, K. Ashly, 2 exs; 21.v.2019, light trap, K. Ashly, 1 ex; 28.x.2019, light trap, K. Ashly, 2 exs.

Genus *Elaphropus* Motschulsky 1839

Type species. *Elaphropus caraboides* Motschulsky 1839.

Elaphropus Motschulsky 1839: 73, Erwin 1975: 1, Kopecky 2003: 63, Lorenz 2005: 230, Löbl and Löbl 2017: 342.

73) *Elaphropus ceylanicus* (Nietner 1858)

Elaphropus ceylanicus Nietner 1858: 423 (*Tachys*), Andrewes 1925: 436, Andrewes 1929: 307, Andrewes 1930a: 326, Andrewes 1935a: 257, Lorenz 2005: 246, Divya 2022: 116.

= *Bembidium ceylanicum* Nietner 1858.

= *Tachys flaviculus* Motchulsky 1859.

= *Tachys flaveolus* Gemminger and Harold 1868.

Distribution: India- Kerala (Chambad; Palakkad: Pudussery), Andra Pradesh (Teppukadu), Uttarakhand (Almora, Dehradun), West Bengal (Gopaldhara, Gielle Khola, Tista Valley, Eastern Duars, Kolkata); Sri Lanka; Myanmar; China; Vietnam; Malaysia; Indonesia; Philippines; Papua New Guinea.

Specimens examined (n= 8): India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; 26.v.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 28.xi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 15.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 04.i.2019, light trap, K. Ashly, 1 ex; ; India- Kerala: Palakkad: Pattambi, 28.x.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 1 ex

74) *Elaphropus decoratus* (Andrewes 1925)

Elaphropus decoratus Andrewes 1925: 424 (*Tachys*), Andrewes 1930a: 328, Andrewes 1935a: 278, Divya 2022: 116.

= *Bembidium ornatum* Nietner 1858

= *Tachys ornatus* (Nietner 1858)

Distribution: India- Kerala (Palakkad: Pudussery); Sri Lanka- Nalanda, Colombo, Kandy.

Specimens examined (n= 17): India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 6 exs; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 2 exs; 28.xii.2018, light trap, K. Ashly, 1 ex; 04.i.2019, light trap, K. Ashly, 3 exs; 25.i.2019, light trap, K. Ashly, 1 ex; 09.xi.2019, light trap, K. Ashly, 2 exs; 04.xii.2019, light trap, K. Ashly, 1 ex.

75) *Elaphropus klugi* (Nietner 1858)

Elaphropus klugi (Nietner 1858): 423 (*Tachys*), Bates: 1886a: 155, Bates 1892b: 291, Andrewes 1925: 414, Andrewes 1930a: 332, Andrewes 1935a: 252, Lorenz 2005: 256, Hegde and Kushwaha 2015: 395, Löbl and Löbl 2017: 350, Divya 2022: 116.

= *Tachys euglyptus* Bates 1883.

= *Tachys sulculatus* Putzeys 1875.

= *Tachys sulcatopunctatus* Putzeys 1875.

Distribution: India- Kerala (Palakkad: Pudussery), Uttar Pradesh (Mathura, Kishori Kunj, Jalaun, Orai), Himachal Pradesh, Sikkim; Sri Lanka; Myanmar; China; Thailand; Malaysia; Taiwan; Indonesia; Philippines; Japan; New Guinea; South East Asia.

Specimens examined (n= 13): India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; 15.v.2018, light trap, K. Ashly, 2 exs; 16.v.2018, light trap, K. Ashly, 2 exs; 16.vi.2018, light trap, K. Ashly, 1 ex; 18.vi.2018, light trap, K. Ashly, 1 ex; 15.xii.2018, light trap, K. Ashly, 1 ex;

05.iii.2019, light trap, K. Ashly, 1 ex; 17.v.2019, light trap, K. Ashly, 1 ex; 20.v.2019, light trap, K. Ashly, 1 ex; 28.x.2019, light trap, K. Ashly, 2 exs.

76) *Elaphropus nigellus* (Andrewes 1935)

Elaphropus nigellus (Andrewes 1935a): 277 (*Tachys*), Sruthi and Sabu 2022: 21632, Divya 2022: 117.

= *Tachys nigella* (Andrewes 1935a): 277.

Distribution: India- Kerala (Palakkad: Chulanur, Pudussery, Walayar; Aralam Wildlife sanctuary, Odakkad, Chambad), Tamil Nadu (Madras, Nilgiri hills).

Specimens examined (n= 28): India- Kerala: Wayanad: Ambalavayal, 10.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; 15.v.2018, light trap, K. Ashly, 2 exs; 16.v.2018, light trap, K. Ashly, 1 ex; 25.v.2018, light trap, K. Ashly, 1 ex; 26.v.2018, light trap, K. Ashly, 3 exs; 20.vi.2018, light trap, K. Ashly, 1 ex; 15.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 05.i.2019, light trap, K. Ashly, 1 ex; 05.i.2019, pitfall trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 17.v.2019, light trap, K. Ashly, 3 exs; 19.v.2019, light trap, K. Ashly, 3 ex; 27.x.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 13.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 18.xii.2019, light trap, K. Ashly, 1 ex; 19.xii.2019, light trap, K. Ashly, 2 exs; 22.xii.2019, light trap, K. Ashly, 2 exs; 28.xii.2019, light trap, K. Ashly, 1 ex.

77) *Elaphropus nilgiricus* (Andrewes 1925)

Elaphropus nilgiricus (Andrewes, 1925): 446 (*Tachys*), Andrewes 1930a: 334, Andrewes 1935a: 265, Lorenz 2005: 258, Sruthi and Sabu 2022: 21632, Divya 2022: 118.

= *Tachyura nilgirica* (Andrewes 1925)

= *Elaphropus unisculptus* (Andrewes 1925)

Distribution: India- Kerala (Palakkad: Chulanur, Pudussery, Walayar; Chinnar; Aralam wildlife sanctuary, Odakkad), Tamil Nadu (Nilgiri Hills), Karnataka (Mysore); Sri Lanka.

Specimens examined (n= 88): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K. Ashly, 1 ex; 24.ii.2018, light trap, K. Ashly, 11 exs; 10.iii.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 1 ex; 11.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 8 exs; 26.v.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 30.v.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 18.vi.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, light trap, K. Ashly, 3 exs; 27.xi.2018, light trap, K. Ashly, 1 ex; 03.xii.2018, light trap, K. Ashly, 15 exs; India- Kerala: Palakkad: Pattambi, 15.xii.2018, light trap, K. Ashly, 4 exs; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 17.v.2019, light trap, K. Ashly, 2 exs; 21.v.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad:

Ambalavayal, 08.x.2019, light trap, K. Ashly, 5 exs; India- Kerala: Palakkad: Pattambi, 27.x.2019, light trap, K. Ashly, 11 exs; India- Kerala: Wayanad: Ambalavayal, 09.xi.2019, light trap, K. Ashly, 2 exs; 04.xii.2019, light trap, K. Ashly, 2 exs; 12.xii.2019, light trap, K. Ashly, 2 exs; 13.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 28.xii.2019, light trap, K. Ashly, 6 exs; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 1 ex.

78) *Elaphropus politus* (Motschulsky 1851)

Elaphropus politus Motschulsky 1851: 509 (*Tachys*), Putzeys 1875a: 743, Bouchard 1903: 170, Andrewes 1919b: 199, Andrewes 1921a: 146, Andrewes 1925: 448, Andrewes 1930a: 338, Andrewes 1935a: 269, Lorenz 2005: 258, Hegde and Kushwaha 2015: 395, Sruthi and Sabu 2022: 21632, Divya 2022: 119.

= *Bembidium ebeninum* Nietner l858.

= *Tachys bioculatus* Putzeys 1875.

Distribution: India- Kerala (Palakkad: Chulanur, Pudussery, Walayar; Chinnar, Aralam Wildlife Sanctuary, Chambad, Odakkad), Uttar Pradesh (Auraiya, Fatehpur, Muradganj, Mathura, Kishori Kunj, Jhansi, Shahjahanpur).

Specimens examined (n= 156): India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, 6 exs, K. Ashly; 12.iii.2018, light trap, K. Ashly, 4 exs; India- Kerala: Palakkad: Pattambi, 22.iii.2018, light trap, K. Ashly, 8 exs; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K.

Ashly, 2 exs; 06.iv.2018, light trap, K. Ashly, 1 ex; 06.iv.2018, pitfall trap, K. Ashly, 2 exs; 11.iv.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 14.v.2018, light trap, K. Ashly, 1 ex; 15.v.2018, light trap, K. Ashly, 2 exs; 25.v.2018, light trap, K. Ashly, 7 exs; 26.v.2018, light trap, K. Ashly, 5 exs; 26.v.2018, pitfall trap, K. Ashly, 1 ex; 17.vi.2018, light trap, K. Ashly, 10 exs; 20.vi.2018, light trap, K. Ashly, 17 exs; India- Kerala: Wayanad: Ambalavayal, 28.xi.2018, light trap, K. Ashly, 1 ex; 03.xii.2018, light trap, K. Ashly, 2 exs; India- Kerala: Palakkad: Pattambi, 15.xii.2018, light trap, K. Ashly, 4 exs; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 1 ex; 04.i.2019, light trap, K. Ashly, 7 exs; 05.i.2019, light trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 11 exs; 25.i.2019, pitfall trap, K. Ashly, 1 ex; 26.i.2019, light trap, K. Ashly, 1 ex; 27.i.2019, light trap, K. Ashly, 3 exs; 27.i.2019, pitfall trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 3 exs; 17.v.2019, light trap, K. Ashly, 5 exs; 21.v.2019, light trap, K. Ashly, 8 exs; 11.vi.2019, light trap, K. Ashly, 8 exs; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 4 exs; India- Kerala: Palakkad: Pattambi, 27.x.2019, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 04.xii.2019, light trap, K. Ashly, 2 exs; 12.xii.2019, light trap, K. Ashly, 1 ex; 12.xii.2019, pitfall trap, K. Ashly, 1 ex; 14.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 18.xii.2019, light trap, K. Ashly, 5 exs; 19.xii.2019, light trap, K. Ashly, 9 exs; 21.xii.2019, pitfall trap, K. Ashly, 2 exs; 28.xii.2019, light

trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 1 ex; 03.i.2020, light trap, K. Ashly, 1 ex.

Genus *Polyderis* Motschulsky 1862

Type species. *Tachys brevicornis* Chaudoir 1846

Polyderis Motschulsky 1862: 27, Löbl and Löbl, 2017: 344.

= *Brachytachys* Basilewsky 1953.

= *Limnastinus* Schatzmayr 1936.

= *Microtachys* Casey 1918.

= *Neotachys* Kult 1961.

79) *Polyderis impressipennis* (Motschulsky 1859)

Polyderis impressipennis Motschulsky 1859: 39 (*Tachys*), Andrewes 1930a: 331, Andrewes 1935a: 215, Lorenz 2005: 220, Löbl and Löbl 2017: 10, 344, Divya 2022: 122.

= *Tachys dohertyi* Jordan 1894.

= *Tachys sinuaticollis* Sloane 1903.

= *Tachys schoutedeni* Burgeon 1935.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur, Walayar); Iran; Yemen; Sri Lanka; Thailand; Vietnam; Cambodia; Indonesia- Java, Lesser Sunda Ils, Sumatra, Timor; Japan; Philippines; Reunion Island; Australia.

Specimens examined (n= 3): India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, 1 ex, K. Ashly; 28.xi.2018, light trap, K. Ashly, 1 ex; 08.x.2019, light trap, K. Ashly, 1 ex.

Genus *Paratachys* Casey 1918

Type species. *Paratachys austinicus* Casey 1918

Paratachys Casey 1918: 174.

= *Eotachys* Jeannel 1941.

= *Macrotachys* Kult 1961.

80) *Paratachys impressus* (Motschulsky 1851)

Paratachys impressus Motschulsky 1851: 508 (*Tachys*), Andrewes 1925: 342, 353, Andrewes 1928: 4, Andrewes 1930a: 331, Andrewes 1935a: 220, Lorenz 2005: 220, Divya 2022: 121.

Distribution: India- Kerala (Palakkad: Pudussery, Chulanur; Chambad); West Bengal (Kolkata); Myanmar; Indonesia.

Specimens examined (n= 291): India- Kerala: Wayanad: Ambalavayal, 03.ii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 24.ii.2018, light trap, K. Ashly, 3 exs; 10.iii.2018, light trap, K. Ashly, 2 exs; 02.iv.2018, light trap, K. Ashly, 20 exs; 06.iv.2018, light trap, K. Ashly, 3 exs; 11.iv.2018, light trap, K. Ashly, 1 ex; 24.iv.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 15.v.2018, light trap, K. Ashly, 3 exs; 25.v.2018, light trap, K. Ashly, 11 exs; 26.v.2018, light trap, K. Ashly, 9 exs; India- Kerala: Wayanad:

Ambalavayal, 30.v.2018, light trap, K. Ashly, 18 exs; India- Kerala: Palakkad: Pattambi, 16.vi.2018, light trap, K. Ashly, 1 ex; 17.vi.2018, light trap, K. Ashly, 31 exs; 18.vi.2018, light trap, K. Ashly, 15 exs; 20.vi.2018, light trap, K. Ashly, 18 exs; India- Kerala: Wayanad: Ambalavayal, 15.x.2018, light trap, K. Ashly, 4 exs; 27.xi.2018, light trap, K. Ashly, 1 ex; 28.xi.2018, light trap, K. Ashly, 12 exs; 03.xii.2018, light trap, K. Ashly, 17 exs; India- Kerala: Palakkad: Pattambi, 12.xii.2018, light trap, K. Ashly, 6 exs; 14.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 4 exs; 04.i.2019, light trap, K. Ashly, 2 exs; 05.i.2019, light trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 21 exs; 27.i.2019, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 04.iii.2019, light trap, K. Ashly, 2 exs; 05.iii.2019, light trap, K. Ashly, 11 exs; 01.v.2019, light trap, K. Ashly, 8 exs; 02.v.2019, light trap, K. Ashly, 1 ex; 21.v.2019, light trap, K. Ashly, 18 exs; 11.vi.2019, light trap, K. Ashly, 20 exs; India- Kerala: Wayanad: Ambalavayal, 08.x.2019, light trap, K. Ashly, 29 exs; 09.xi.2019, light trap, K. Ashly, 22 exs; 04.xii.2019, light trap, K. Ashly, 10 exs; 12.xii.2019, light trap, K. Ashly, 3 exs; 13.xii.2019, light trap, K. Ashly, 1 ex; 14.xii.2019, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 28.xii.2019, light trap, K. Ashly, 8 exs; 30.xii.2019, light trap, K. Ashly, 23 exs; 31.xii.2019, light trap, K. Ashly, 15 exs; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 4 exs; 03.i.2020, light trap, K. Ashly, 1 ex; 04.i.2020, light trap, K. Ashly, 2 exs.

81) *Paratachys tropicus* (Nietner 1858)

Paratachys tropicus Nietner 1858: 421 (*Bembidium*), Putzeys 1875a: 746, Andrewes 1929: 16, Andrewes 1930a: 341, Andrewes 1935a: 227, Divya 2022: 121.

= *Tachys cinctipennis* Motschulsky 1861.

= *Tachys subvittatus* Bates 1886.

Distribution: India- Kerala (Palakkad: Pudussery, Walayar, Chulanur); Sri Lanka- Colombo, Kandy (Uzel), Dikoya, Trincomali, Bandarawella, Kanthalay.

Specimens examined (n= 61): India- Kerala: Palakkad: Pattambi, 22.ii.2018, light trap, K. Ashly, 14 exs; India- Kerala: Wayanad: Ambalavayal, 02.iv.2018, light trap, K. Ashly, 1 ex; 23.iv.2018, light trap, K. Ashly, 1 ex; 24.iv.2018, light trap, K. Ashly, 1 ex; 30.v.2018, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 16.vi.2018, light trap, K. Ashly, 1 ex; 17.vi.2018, light trap, K. Ashly, 1 ex; 19.vi.2018, light trap, K. Ashly, 2 exs; India- Kerala: Wayanad: Ambalavayal, 28.xi.2018, light trap, K. Ashly, 3 exs; India- Kerala: Palakkad: Pattambi, 14.xii.2018, light trap, K. Ashly, 2 exs; 17.xii.2018, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 28.xii.2018, light trap, K. Ashly, 5 exs; 04.i.2019, light trap, K. Ashly, 9 exs; 05.i.2019, light trap, K. Ashly, 1 ex; 25.i.2019, light trap, K. Ashly, 4 exs; 27.i.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 02.v.2019, light trap, K. Ashly, 1 ex; 17.v.2019, light trap, K. Ashly, 2 exs; 21.v.2019, light trap, K. Ashly, 2 exs;

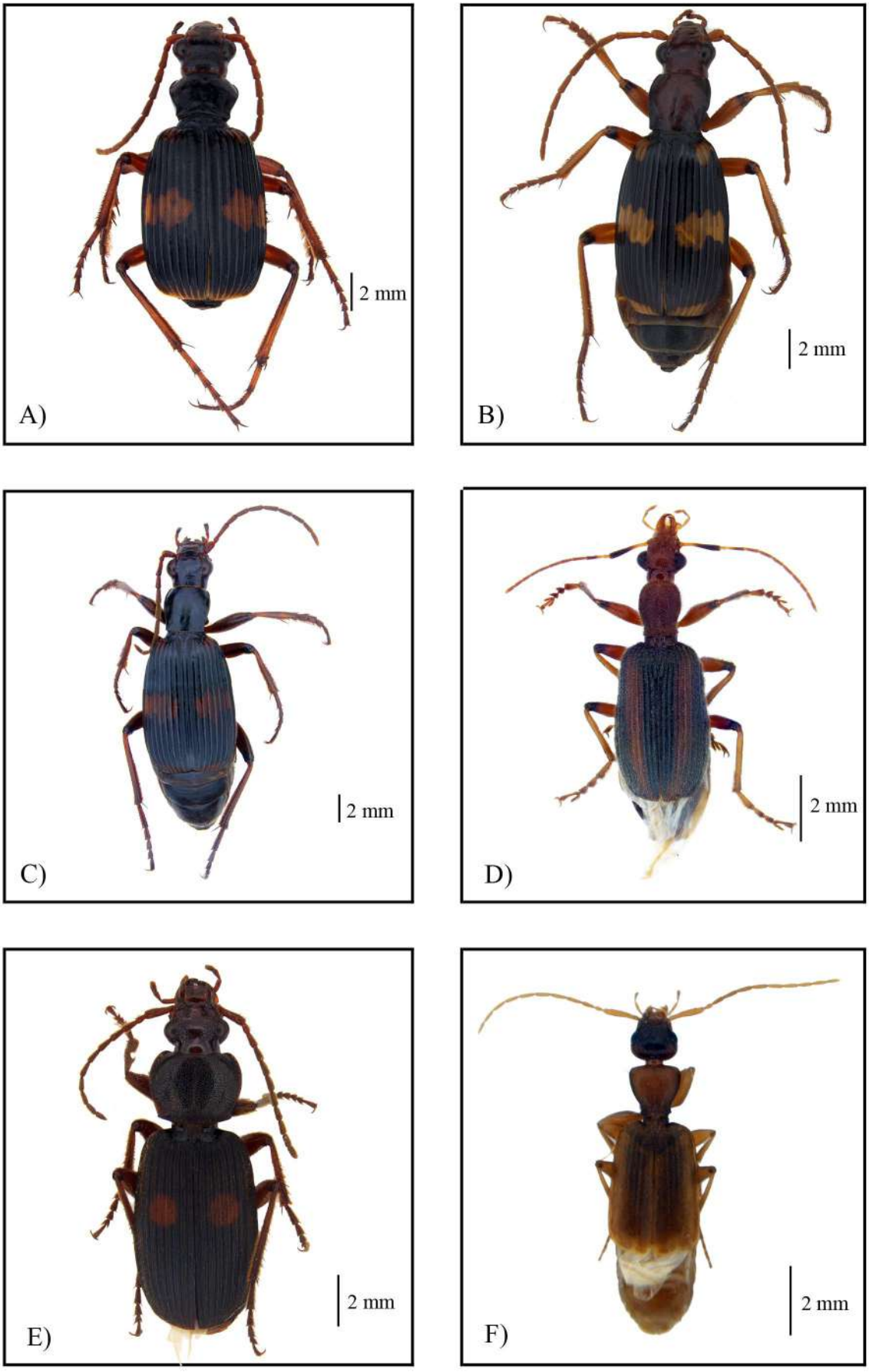


Plate 2. A). *Pheropsophus indicus* Akhil and Sabu 2019, B) *P. lissoderus* Chaudoir 1850, C). *P. picicollis* Chaudoir 1876, D). *Drypta lineola* MacLeay 1825, E). *Planetes ruficeps* Schaum 1863, F). *Zuphium modestum* Schmidt-Goebel 1846.

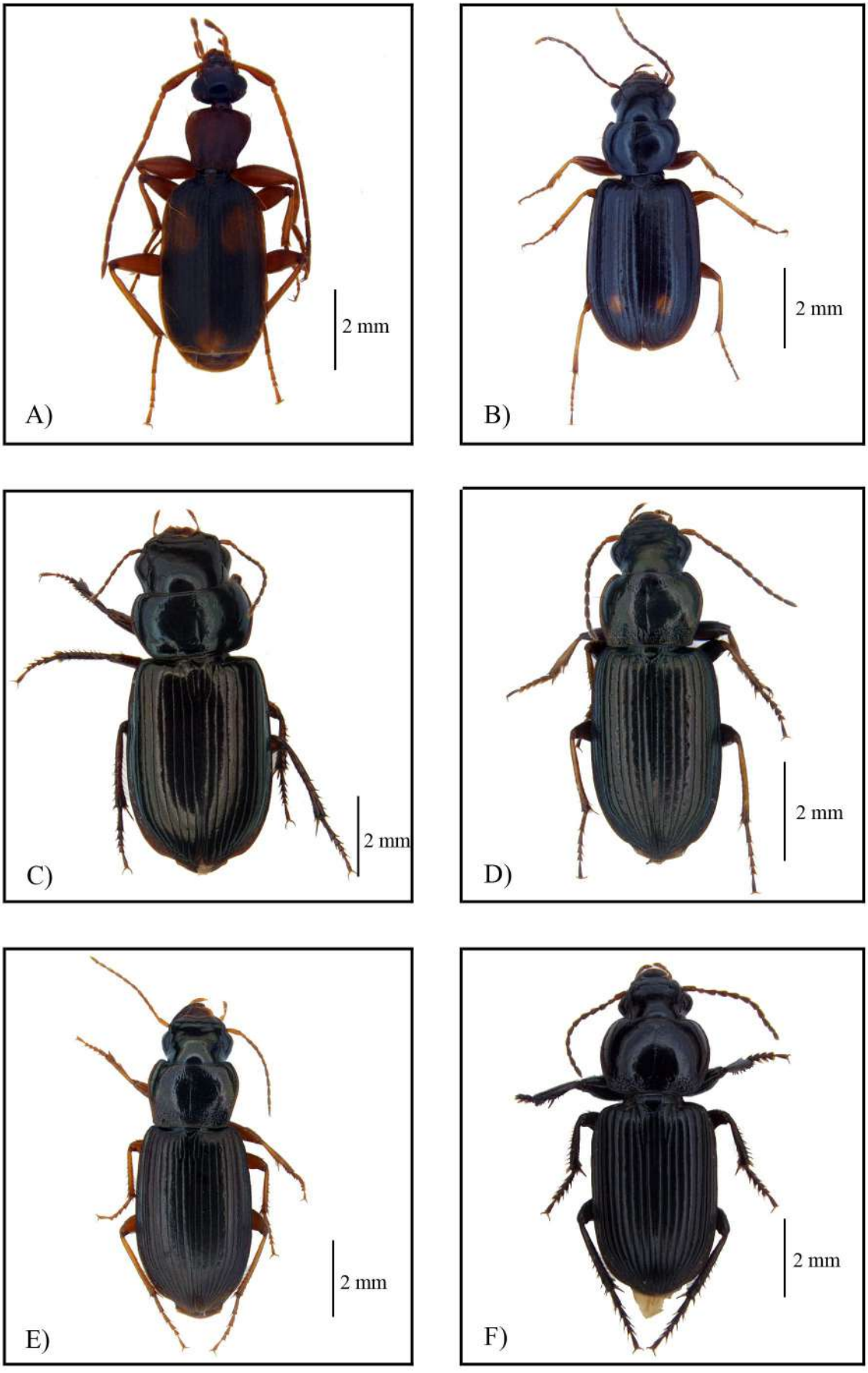


Plate 3. A). *Zuphium olens* (Rossi 1790), B). *Amblystomus vulneratus* (Dejean 1831), C). *Anomostomus orientalis* Andrewes 1923, D). *Dioryche solida* Andrewes 1933, E). *D. torta* MacLeay 1825, F). *Meroctenus mediocris* (Andrewes 1936).

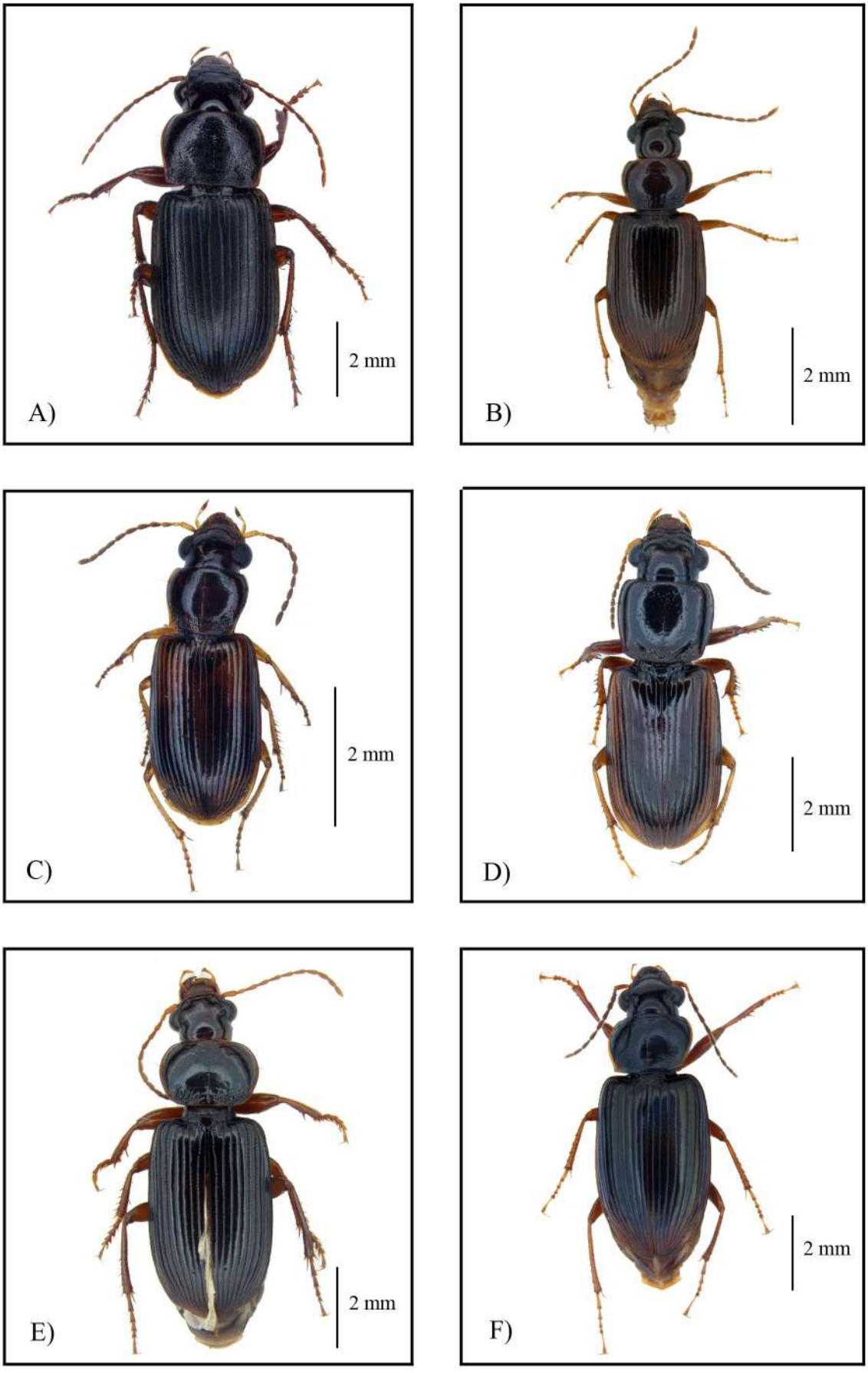


Plate 4. A). *Ophoniscus puneensis* Kataev 2018, B). *Acupalpus andrewesi* Jaeger 2013, C). *A. rhombotus* Andrewes 1936, D). *Batoscelis oblonga* (Dejean 1831), E). *Idiomelas fulvipes* (Erichson 1843), F). *Loxoncus microgonus* (Bates 1886).

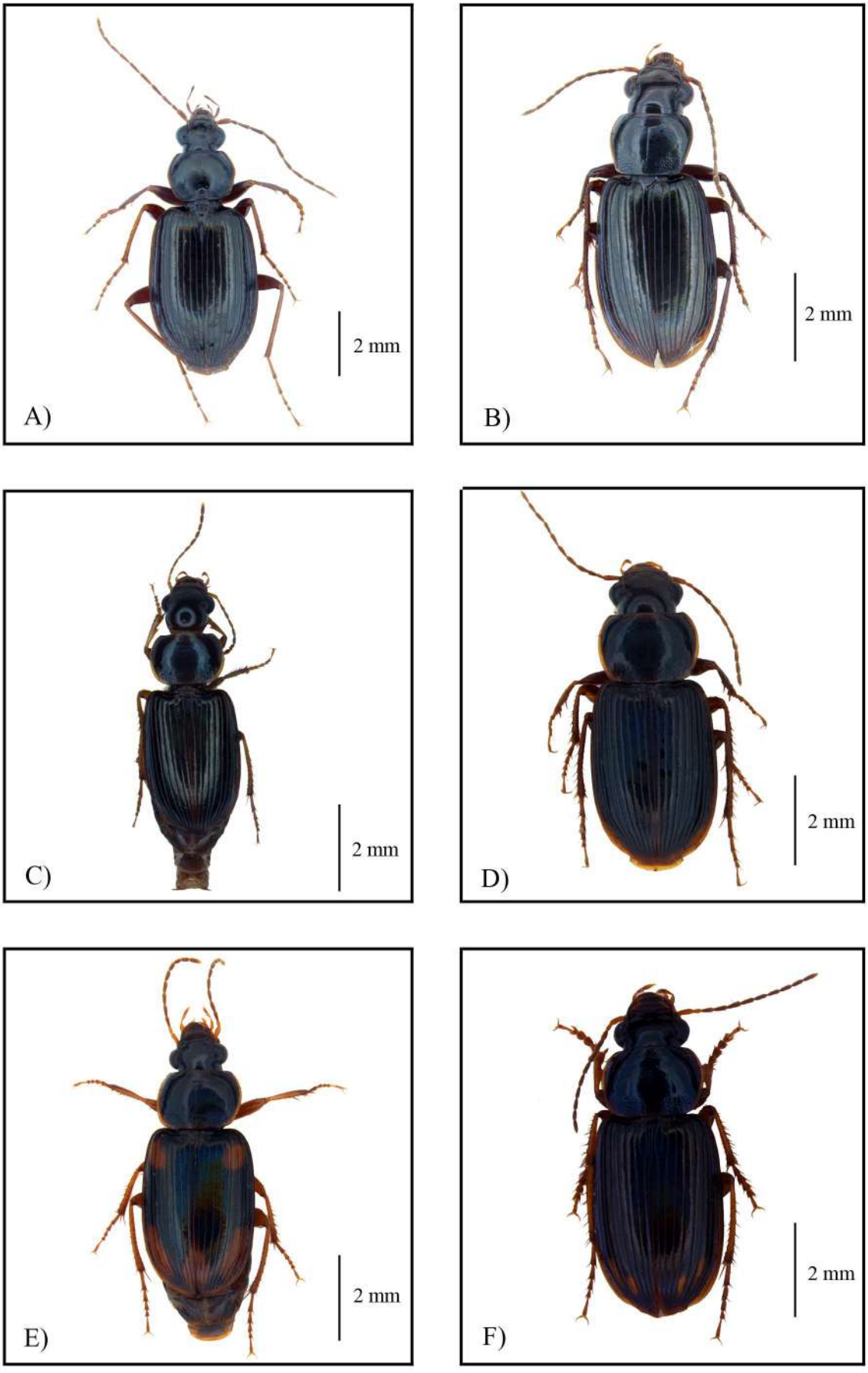


Plate 5. A). *Loxoncus nagpurensis* (Bates 1891), B). *L. schmidti* Kataev 2002, C). *Stenolophus bajaurae* Andrewes 1924, D). *S. lucidus* Dejean 1829, E). *S. quinquepustulatus* (Wiedemann 1823), F). *S. smaragdulus* (Fabricius 1798).

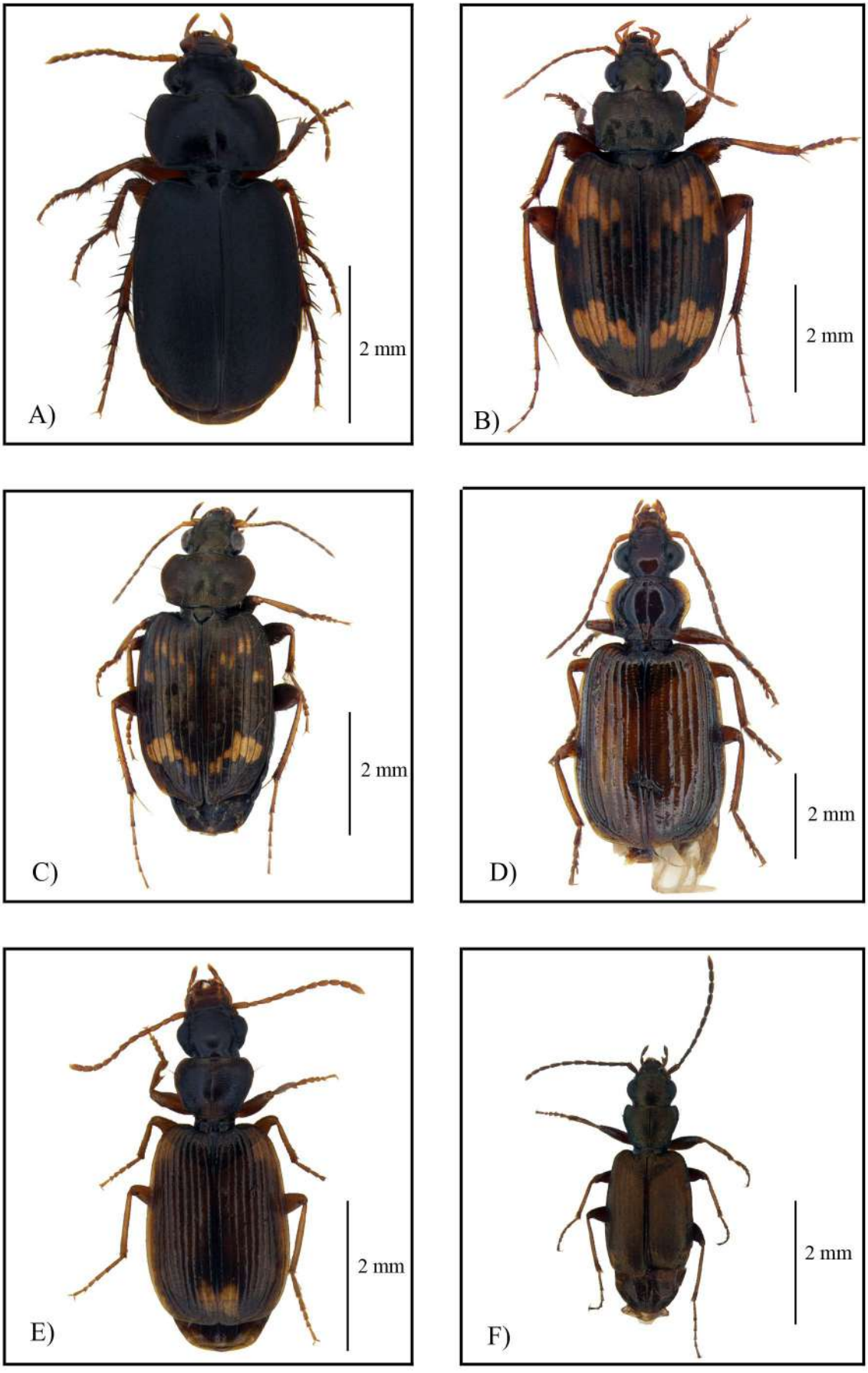


Plate 6. A). *Anaulacus rubidus* (Andrewes 1922), B). *Cyclicus dilatatus* (Wiedemann 1823), C). *Tetragonoderus notaphioides* Motschulsky 1861, D). *Anchista fenestrata* (Schmidt-Goebel 1846), E). *Anomotarus stigmula* (Chaudoir 1852), F). *Apristus subtransparens* Motschulsky 1861

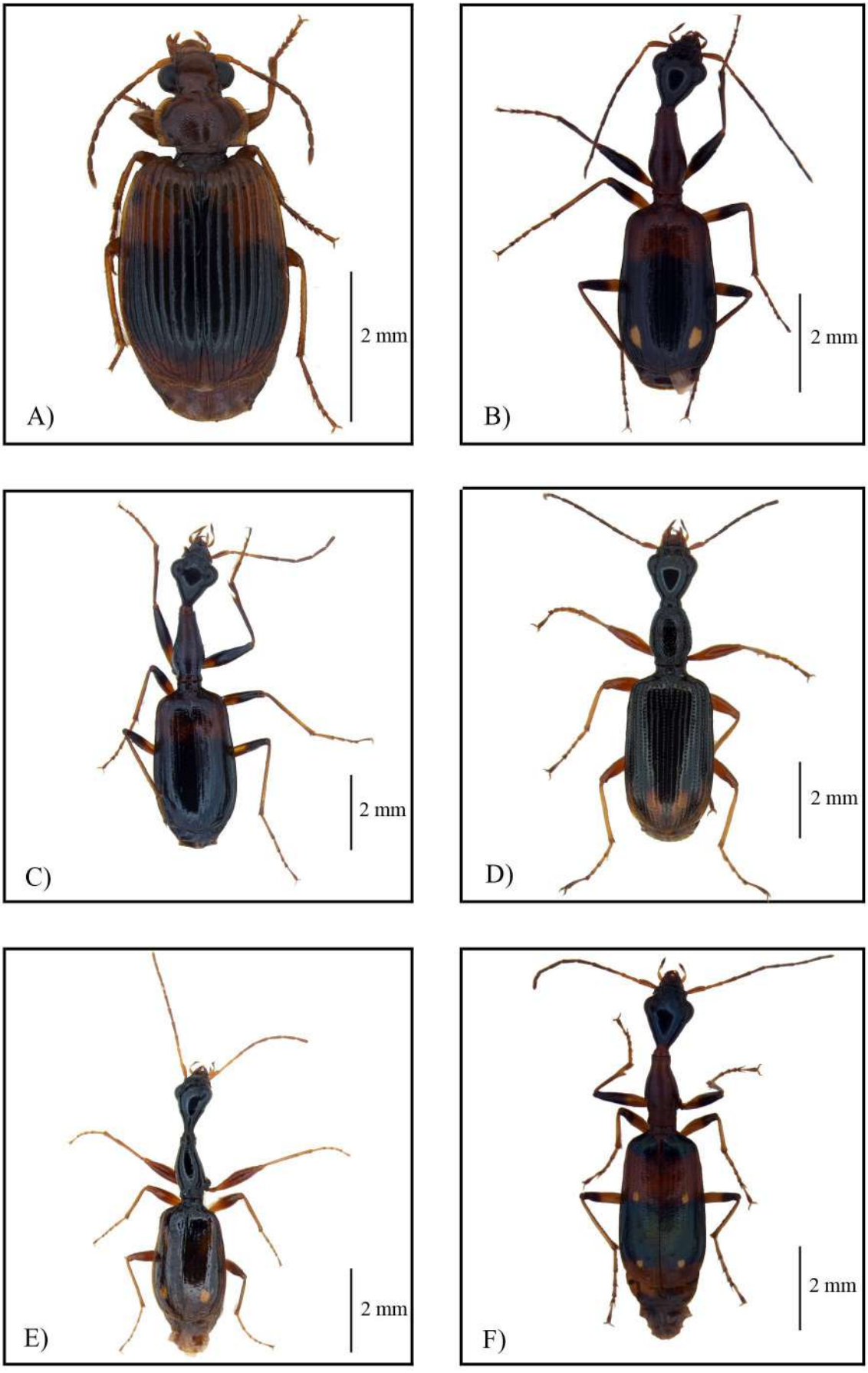


Plate 7. A). *Lebia campania* Andrewes 1933, B). *Archicolliuris bimaculata* (Redtenbacher 1844), C). *A. immaculata* (Liebke 1938), D). *Eucolliuris fuscipennis* (Chaudoir 1850), E). *Mimocolliuris indica* (Nietner 1858), F). *Ophionea indica* (Thunberg 1784).

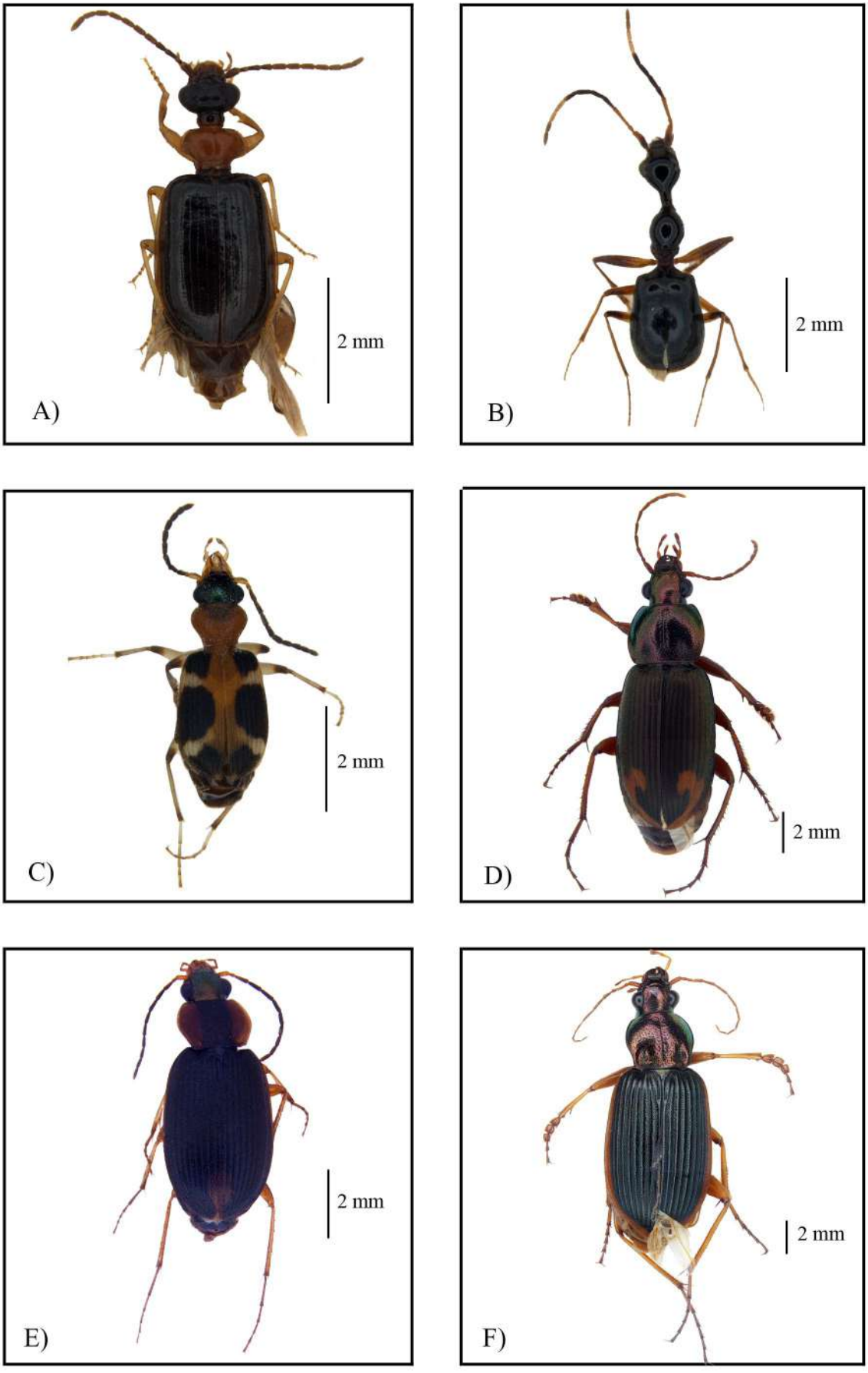


Plate 8. A) *Pentagonica pallipes* (Nietner 1856), B). *Selina westermanni* Motschulsky 1858, C). *Callistomimus littoralis* Motschulsky 1859, D). *Chlaenius hamifer* Chaudoir 1856, E). *C. malachinus* (Motschulsky 1865), F). *C. nigricans* Wiedemann 1821.

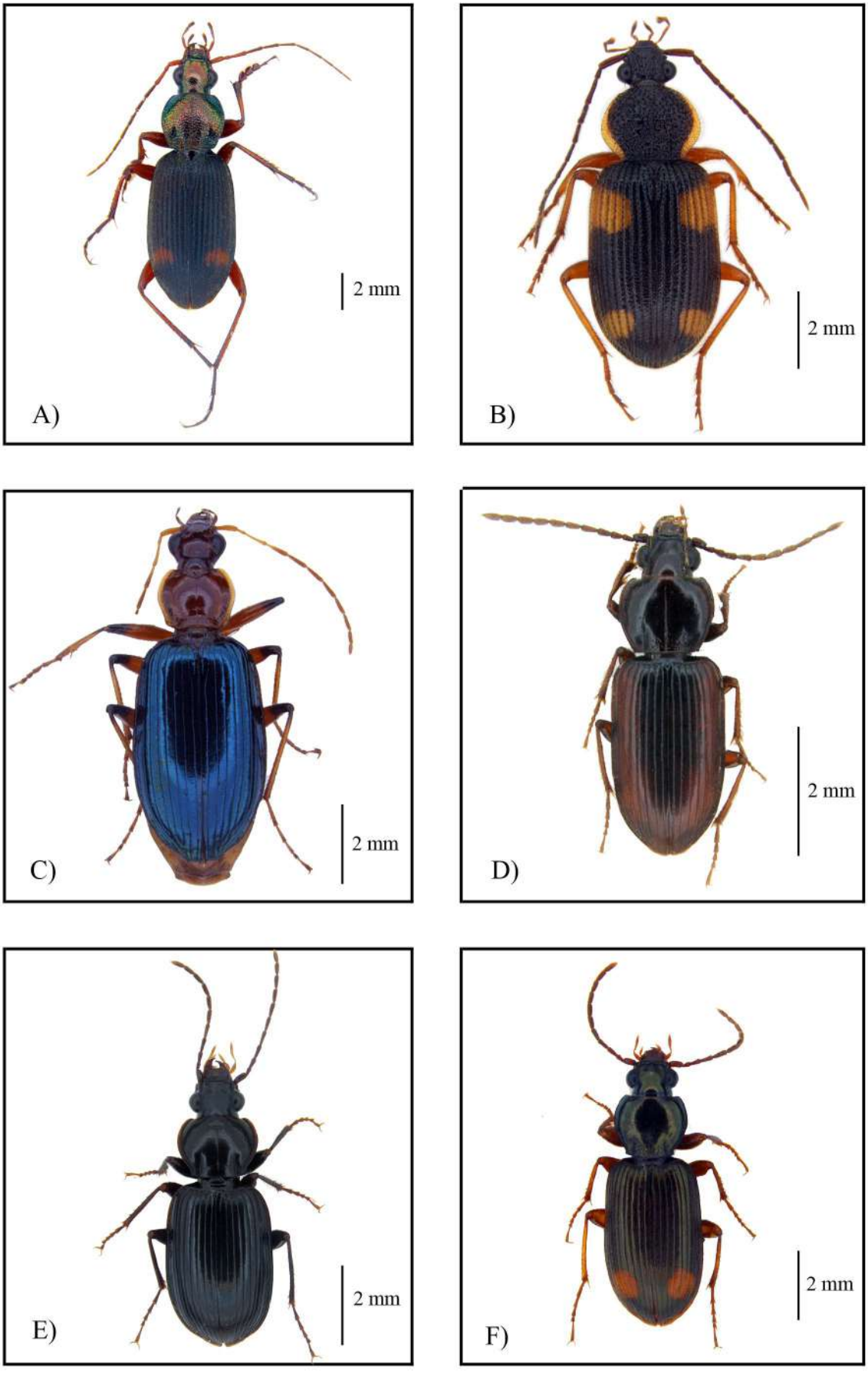


Plate 9. A). *Chlaenius posticus* (Fabricius 1798), B). *Adischissus notulatus* (Fabricius 1801), C). *Dicranoncus quadridens* (Motschulsky 1859), D). *Abacetus dorsalis* (Motschulsky 1866), E). *A. haplosternus* Chaudoir 1878, F). *Chlaeminus biguttatus* Motschulsky 1865.

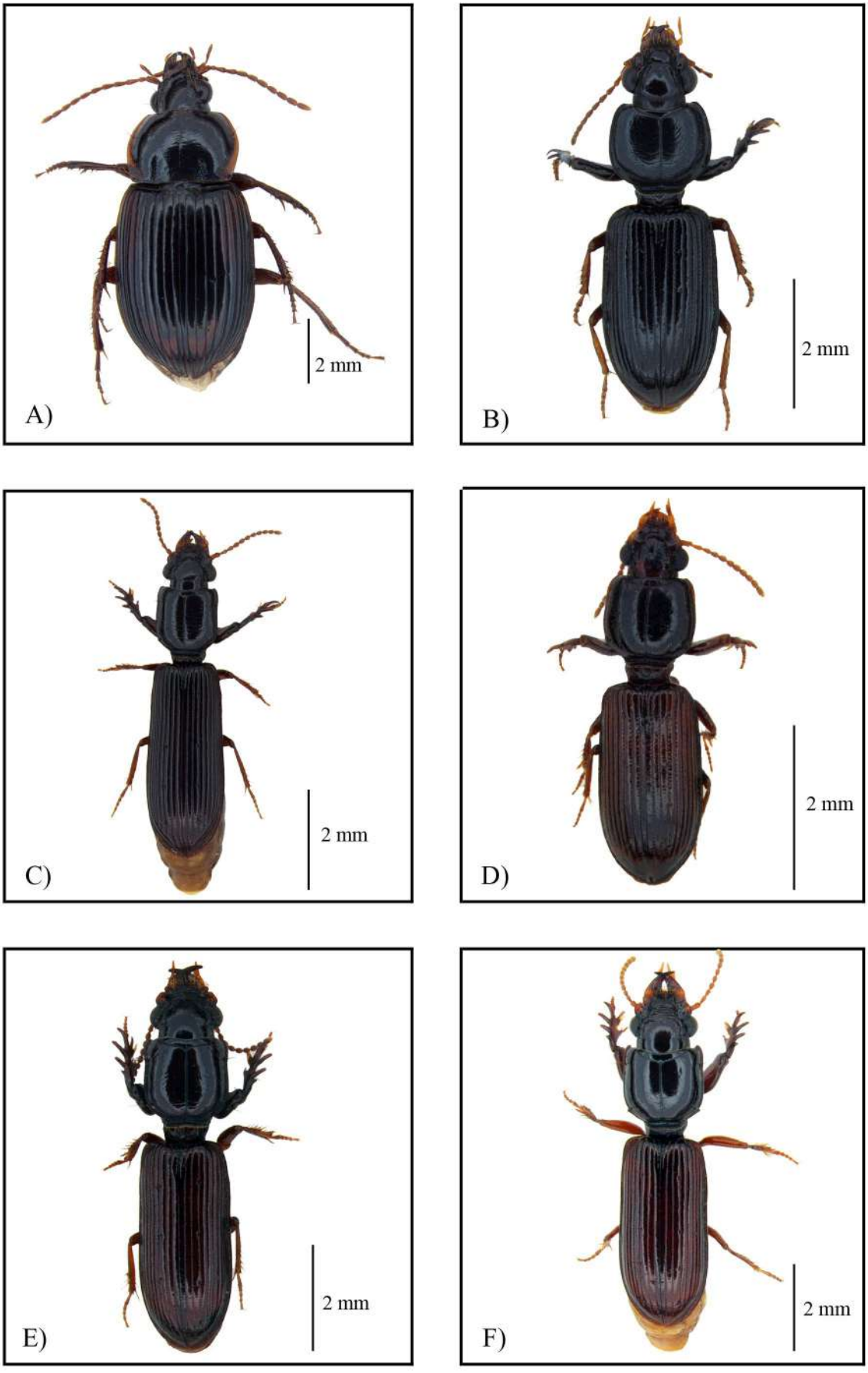


Plate 10. A). *Cosmodiscus picturatus* Andrewes 1920, B). *Clivina attenuata* (Herbst 1806), C). *C. brevior* Putzeys 1867, D). *C. gamma* Andrewes 1929, E). *C. helferi* Putzeys 1866, F). *C. lobata* Bonelli 1813.

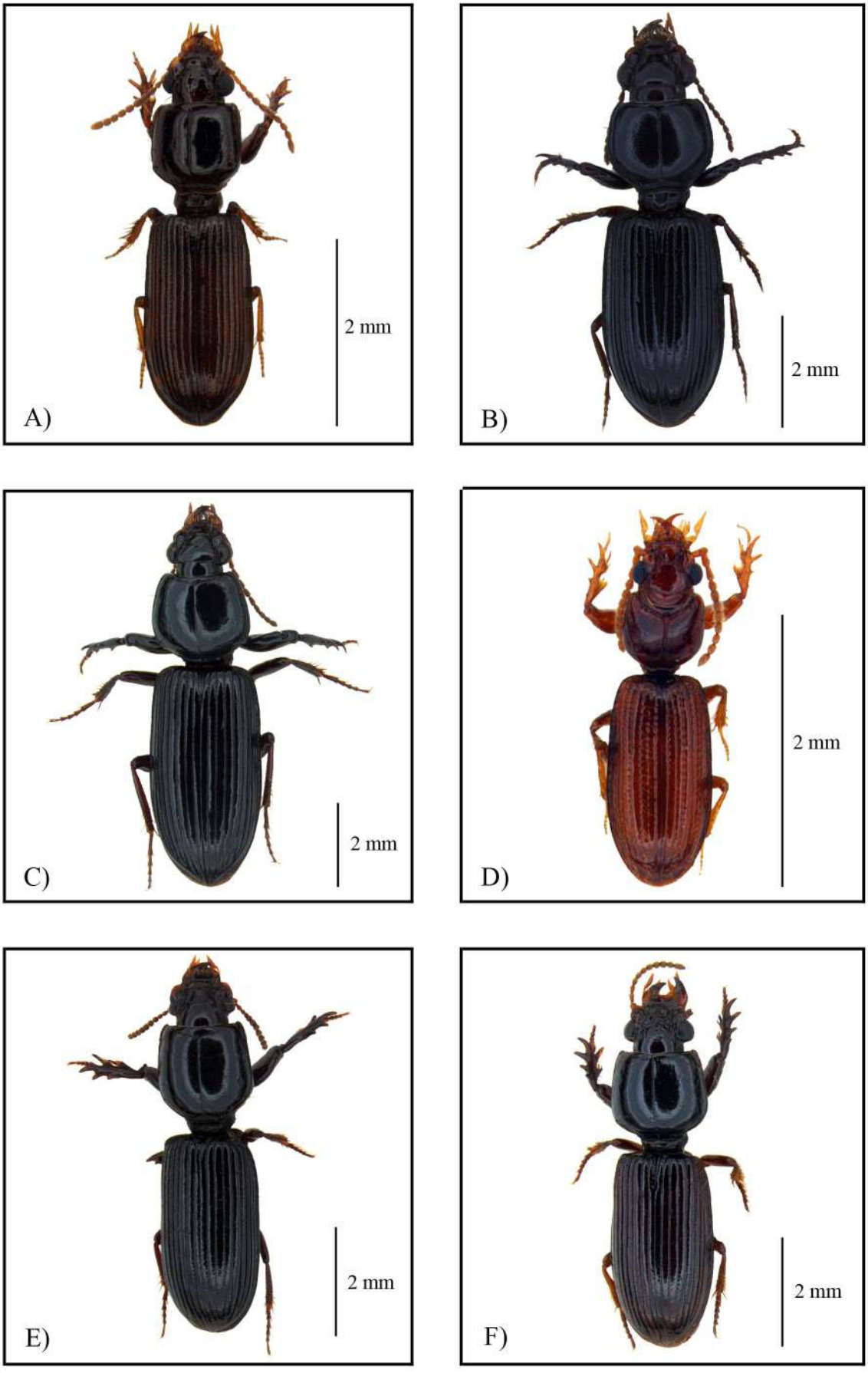


Plate 11. A). *Clivina mustela* Andrewes 1923, B). *C. tranquebarica* Bonelli 1813, C). *C. westwoodi* Putzeys 1867, D). *Leleuporella devagiriensis* Abhita & Sabu 2009, E). *Pseudoclivina arunachalensis* Saha & Biswas 1985, F). *P. memnonia* (Dejean 1831).

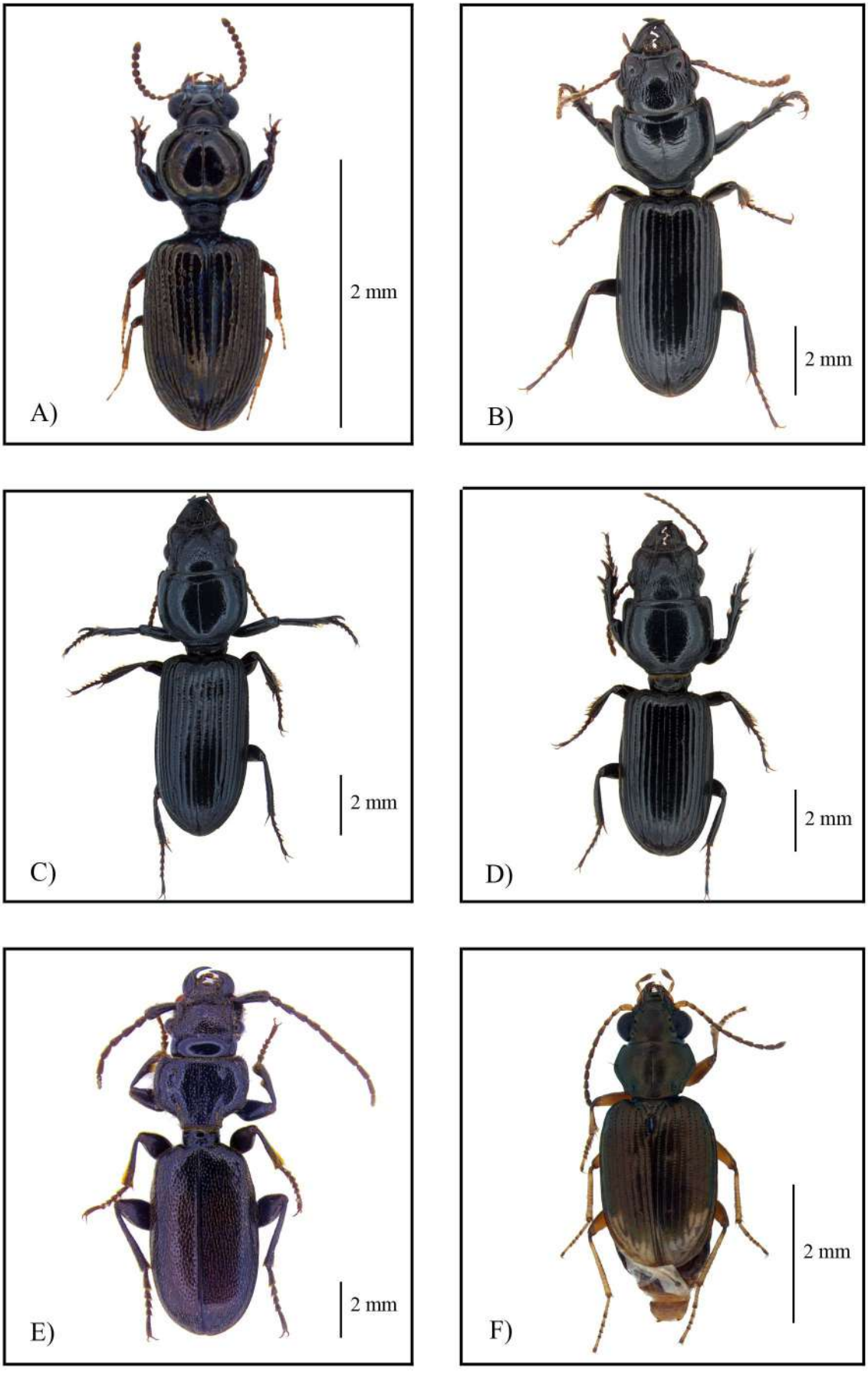


Plate 12. A). *Dyschirius paucipunctus* Andrewes 1929, B). *Distichus planus* (Bonelli 1813), C). *Scarites beesoni* Andrewes 1929, D). *S. modestus* (Chaudoir 1880), E). *Siagona plana* (Fabricius 1801), F). *Bembidion niloticum* Dejean 1831.

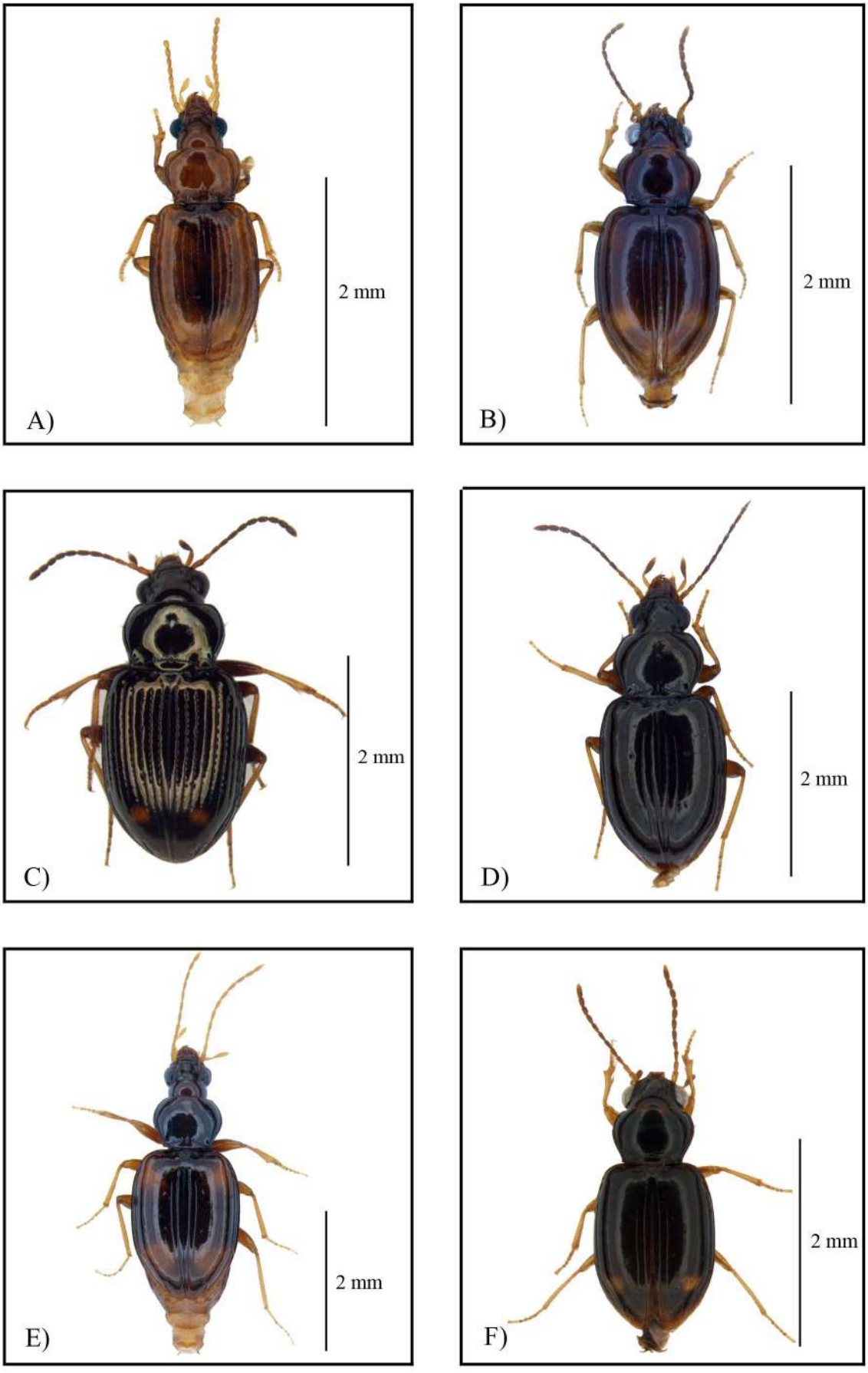


Plate 13. A). *Elaphropus ceylanicus* (Nietner 1858), B). *E. decoratus* (Andrewes 1925), C). *E. klugi* (Nietner 1858), D). *E. nigellus* (Andrewes 1935), E). *E. nilgiricus* (Andrewes 1925), F). *E. politus* (Motschulsky 1851)

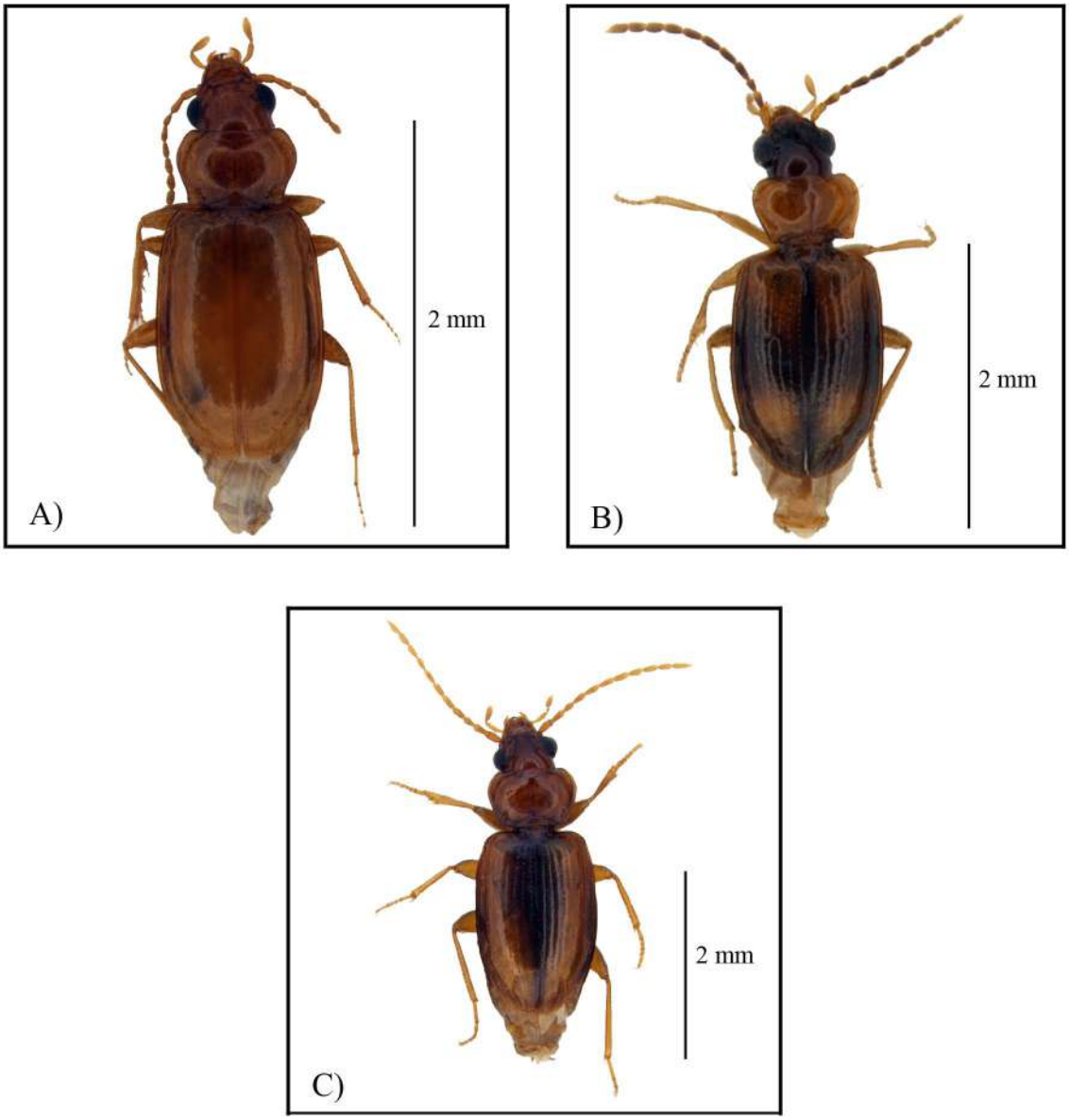


Plate 14. A). *Polyderis impressipennis* (Motschulsky 1859), B). *Paratachys impressus* (Motschulsky 1851), C). *P. tropicus* (Nietner 1858).

28.x.2019, light trap, K. Ashly, 5 exs; India- Kerala: Wayanad: Ambalavayal, 12.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Palakkad: Pattambi, 29.xii.2019, light trap, K. Ashly, 1 ex; India- Kerala: Wayanad: Ambalavayal, 02.i.2020, light trap, K. Ashly, 1 ex.

4.2. Ecology

4.2.1. Ambalavayal rice agro-ecosystem

Diversity and abundance

Forty-four carabid species belonging to eleven subfamilies, fifteen tribes and twenty-five genera were recorded from the Ambalavayal rice agro-ecosystem in light trap collections. List of species and their abundance are given in Table 4. Among the forty-four species, two species (*Clivina tranquebarica* and *Paratachys impressus*) were major species, fourteen species (*Acupalpus andrewesi, Batoscelis oblonga, Bembidion niloticum, Clivina brevior, C. lobata, Elaphropus decoratus, E. nilgiricus, E. politus, Loxoncus microgonus, L. nagpurensis, Ophionea indica, Paratachys tropicus, Stenolophus quinquepustulatus* and *S. smaragdulus*) were minor species and twenty-eight species (*Abacetus haplosternus, Acupalpus rhombotus, Apotomus hirsutulus, Apristus subtransparens, Callistomimus littoralis, Chlaenius hamifer, C. malachinus, C. nigricans, Clivina attenuata, C. helferi, Cosmodiscus picturatus, Dicranoncus quadridens, Distichus planus, Dyschirius paucipunctus, Drypta lineola, Elaphropus ceylanicus, E. nigellus, Idiomelas fulvipes, Macrocheilus bensoni, Paratachys impressipennis, Pheropsophus indicus, P. lissoderus, P. picicollis, Pseudoclivina arunachalensis, P. memnonia, Stenolophus bajaurae, S. lucidus* and *Tetragonoderus notaphioides*) were rare

species. *Clivina tranquebarica* (0.88±1.61, 22.18%) was the most dominant species followed by *Paratachys impressus* (0.7±1.77, 17.61%). Rank abundance plot of light-trapped species were represented in Figure 3. Subfamily wise abundance was in the order of Scaritinae (35.79%)> Trechinae (34.11%)> Harpalinae (24.24%)> Lebiinae (3.36%)> Brachininae (1.03%)> Licininae (0.74%)> Pterostichinae (0.37%)> Anthiinae (0.09%)= Apotominae (0.09%)= Dryptinae (0.09%)= Platyninae (0.09%) (Table 4).

The Shannon-Weaver diversity (H') of light-trapped species in the Ambalavayal rice agro-ecosystem was 2.69, Margalef's richness (d) was 6.16 and Simpson's evenness ($E_{1/D}$) was 0.89 (Table 2).

The pitfall trap method recorded, twelve species belonging to six subfamilies, seven tribes and eight genera. List of species and their abundance are given in Table 7. Four major species (*Elaphropus politus*, *Clivina tranquebarica*, *Apristus subtransparens* and *Stenolophus quinquepustulatus*) and eight minor species (*Callistomimus littoralis, Chlaenius hamifer, C. nigricans, Elaphropus nigellus, Pheropsophus indicus, P. lissoderus, P. picicollis* and *Tetragonoderus notaphioides*) were recorded. *Elaphropus politus* (0.11±0.59, 21.73%) was the dominant species followed by *Clivina tranquebarica* (0.04±0.26, 17.39%). Rank abundance plot of pitfall-trapped species were represented in Figure 4. Subfamily wise abundance was in the order of Trechinae (26.08%)> Lebiinae (17.39%) = Scaritinae (17.39%)> Brachininae (13.05%)= Licininae (13.05%)> Harpalinae (13.04%) (Table 7).

The Shannon-Weaver diversity (H') of pitfall-trapped Carabidae was 2.26, Margalef's richness (d) was 3.51 and Simpson's evenness ($E_{1/D}$) was 0.87 (Table 3).

Seasonality

Overall abundance of Carabidae with light trap method showed no significant variation with seasons (pre-harvest, harvest and post-harvest) (Table 6). Among the forty-four light-trapped carabid species, six species namely, *Acupalpus andrewesi, Batoscelis oblonga, Clivina brevior, C. lobata, Elaphropus nilgiricus* and *Stenolophus quinquepustulatus* were seasonal species and the remaining thirty-eight species were aseasonal (Table 5). Among these six seaonal species, *Batoscelis oblonga* was present in harvest and post-harvest stages and the other five species were present in all three stages (pre-harvest, harvest and post-harvest) of paddy cultivation with abundance of four species namely, *Acupalpus andrewesi, Clivina brevior, C. lobata* and *Elaphropus nilgiricus* peaked in pre-harvest stage and *Stenolophus quinquepustulatus* peaked in harvest stage. Dominant species in the pre-harvest stage was *Paratachys impressus* (1.12±2.43, 20.70%), harvest stage was *Clivina tranquebarica* (0.79±1.39, 23.20%) and post-harvest stage was *Clivina tranquebarica* (0.98±1.78, 31.54%). Season wise rank abundance of species are represented in Figures 5, 6 and 7.

Overall abundance of Carabidae with the pitfall trap method showed no significant seasonal variation (Table 9). All the pitfall-trapped species were aseasonal (Table 8). All the species in the pre-harvest stage [(*Pheropsophus lissoderus* (0.01±0.11, 16.67%) = *Chlaenius hamifer* (0.01±0.11, 16.67%) =

Clivina tranquebarica (0.01±0.11, 16.67%)] are with same percentage abundance, two species [*Clivina tranquebarica* (0.03±0.23, 27.27%) = *Elaphropus politus* (0.03±0.23, 27.27%)] were dominant in the harvest stage and three species [*Stenolophus quinquepustulatus* (0.02±0.21, 22.22%) = *Apristus subtransparens* (0.02±0.21, 22.22%) = *Elaphropus politus* (0.02±0.21, 22.22%)] were dominant in the post-harvest stage. Season wise rank abundance of species are represented in Figures 8, 9 and 10.

4.2.2. Pattambi rice agro-ecosystem

Diversity and abundance

Sixty-six carabid species belonging to eleven subfamilies, sixteen tribes and thirty-nine genera were recorded from the Pattambi rice agro-ecosystem by light trap method. List of species and their abundance are given in Table 10. Among the sixty-six species, three were major species (*Batoscelis oblonga*, *Clivina brevior* and *Stenolophus quinquepustulatus*), thirteen were minor species (*Amblystomus vulneratus*, *Brachinus devagiriensis*, *B. paikadai*, *B. peltastes*, *Chlaeminus biguttatus*, *Clivina lobata*, *C. mustela*, *C. tranquebarica*, *Elaphropus politus*, *Loxoncus microgonus*, *L. nagpurensis*, *Ophionea indica* and *Paratachys impressus*) and the remaining fifty species were rare species. *Clivina brevior* (17.62±26.10, 15.54%) was the dominant species followed by *Stenolophus quinquepustulatus* (15.13±27.07, 13.34%) and *Batoscelis oblonga* (12.16±19.43, 10.72%). Rank abundance plot of light-attracted species are represented in Figure 11. Subfamily wise abundance was in the order of Harpalinae (25.76%)> Lebiinae (18.18%)> Scaritinae (16.67%)> Trechinae (13.64%)> Brachininae (7.58%)>

Dryptinae (6.06%)> Pterostichinae (4.55%)> Licininae (3.03%)> Apotominae (1.52%)= Panagaeinae (1.52%)= Siagoninae (1.52%) (Table 10).

The Shannon-Weaver diversity (H') of the light trapped Carabidae in the Pattambi rice agro-ecosystem was 2.89, Margalef's richness (d) was 7.61 and Simpson's evenness ($E_{1/D}$) was 0.92 (Table 2).

The pitfall trap method recorded five species belonging to four subfamilies, four tribes, and four genera from the Pattambi rice agro-ecosystem. List of species and their abundance are given in Table 13. *Stenolophus quinquepustulatus, Apristus subtransparens* and *Elaphropus politus* were major and the remaining two species, *Pheropsophus indicus* and *P. picicollis* were minor species. *Stenolophus quinquepustulatus* (0.17±0.59, 35.71%) was the dominant species followed by *Apristus subtransparens* (0.13±0.43, 28.57%) and *Elaphropus politus* (0.1±0.40, 21.43%). Rank abundance plot of pitfall trapped species are represented in Figure 12. Subfamily wise abundance was in the order of Harpalinae (35.71%)> Lebiinae (28.57%)> Trechinae (21.43%)> Brachininae (14.29%) (Table 13).

The Shannon-Weaver diversity (H') of the pitfall trapped Carabidae in the Pattambi rice agro-ecosystem was 1.43, Margalef's richness (d) was 1.52 and Simpson's evenness ($E_{1/D}$) was 0.73 (Table 3).

Seasonality

Overall abundance of Carabidae with light trap method showed no significant variation with seasons (pre-harvest, harvest and post-harvest) (Table 12). Among the sixty-six light-trapped carabid species seven species namely, *Amblystomus vulneratus, Batoscelis oblonga, Chlaeminus biguttatus, Loxoncus*

microgonus, L. nagpurensis, Paratachys impressus and *Stenolophus quinquepustulatus* were seasonal species and the remaining fifty-nine species were aseasonal (Table 11). Among the seasonal species, abundance of five species namely, *Amblystomus vulneratus, Batoscelis oblonga, Loxoncus microgonus, L. nagpurensis* and *Stenolophus quinquepustulatus* peaked in pre-harvest stage, *Chlaeminus biguttatus* peaked in harvest stage and *Paratachys impressus* peaked in post-harvest stage. Dominant species in the pre-harvest stage was *Stenolophus quinquepustulatus* (30.87±41.32, 18.05%), harvest stage was *Clivina lobata* (18±43.17, 20.13%) and post-harvest stage was *Clivina brevior* (21.6±37.18, 27.05%). Season wise rank abundance of species are represented in Figures 13, 14 and 15.

Overall abundance of Carabidae with the pitfall trap method showed no significant seasonal variation (Table 15). All the pitfall-trapped species were aseasonal (Table 14). Only one species, *Pheropsophus indicus* (0.03±0.18, 100%) was recorded in the pre-harvest harvest stage. Two species [*Stenolophus quinquepustulatus* (0.1±0.40, 42.86%) = *Elaphropus politus* (0.1±0.40, 42.86%)] were dominated in the harvest stage and *Apristus subtransparens* (0.13±0.43, 66.67%) dominated in the post-harvest stage. Rank abundance of species in the harvest and post-harvest stages are represented in Figures 16 and 17 and that of pre-harvest stage with single species is not plotted.

4.2.3. Comparative analysis of Carabidae assemblages in the Ambalavayal and Pattambi rice agro-ecosystem

A total of eighty-one species belonging to thirteen subfamilies, nineteen tribes and forty-eight genera were collected by light trap method from both rice agro-ecosystems. Subfamily wise abundance in the Ambalavayal rice agro-ecosystem was in the order of Scaritinae (35.79%, 9 species)> Trechinae (34.11%, 9 species)> Harpalinae (24.24%, 10 species)> Lebiinae (3.36%, 3 species)> Brachininae (1.03%, 3 species)> Licininae (0.74%, 4 species)> Pterostichinae (0.37%, 2 species)> Anthiinae (0.09%, 1 species)= Apotominae (0.09%, 1 species)= Dryptinae (0.09%, 1 species)= Platyninae (0.09%, 1 species). Subfamily wise abundance in the Pattambi rice agro-ecosystem was in the order of Harpalinae (25.76%, 17 species)> Lebiinae (18.18%, 12 species)> Scaritinae (16.67%, 11 species)> Trechinae (13.64%, 9 species)> Brachininae (7.58%, 5 species)> Dryptinae (6.06%, 4 species)> Pterostichinae (4.55%, 3 species)> Licininae (3.03%, 2 species)> Apotominae (1.52%, 1 species)= Panagaeinae (1.52%, 1 species)= Siagoninae (1.52%, 1 species). Harpalinae was the most speciose subfamily in both rice agro-ecosystems- Ambalavayal (10 species) and Pattambi (17 species) (Tables 4 and 10).

Twelve species belonging to six subfamilies, seven tribes and eight genera were collected by pitfall trap method from both rice agro-ecosystems. Subfamily wise abundance in the Ambalavayal rice agro-ecosystem was in the order of Trechinae (26.08%, 2 species)> Lebiinae (17.39%, 2 species) = Scaritinae (17.39%, 1 species)> Brachininae (13.05%, 3 species)= Licininae (13.05%, 3 species)> Harpalinae (13.04%, 1 species). Subfamily wise abundance in the Pattambi rice agro-ecosystem was in the order of Harpalinae (35.71%, 1 species)>

Lebiinae (28.57%, 1 species)> Trechinae (21.43%, 1 species)> Brachininae (14.29%, 2 species). Brachininae and Licininae were the most speciose subfamilies in Ambalavayal rice agro-ecosystem (3 species each) and Brachininae was the most speciose subfamily in Pattambi rice agro-ecosystem (2 species) (Tables 7 and 13).

In Ambalavayal rice agro-ecosystem, *Clivina tranquebarica* (0.88±1.61, 22.18%) dominated the assemblage followed by *Paratachys impressus* (0.7±1.77, 17.61%) in light trap collections (Figure 3). In Pattambi rice agro-ecosystem, *Clivina brevior* (17.62±26.10, 15.54%) dominated followed by *Stenolophus quinquepustulatus* (15.13±27.07, 13.34%) and *Batoscelis oblonga* (12.16±19.43, 10.72%) (Figure 11) in light trap collections. In Ambalavayal rice agro-ecosystem, *Elaphropus politus* (0.11±0.59, 21.73%) dominated the assemblage followed by *Clivina tranquebarica* (0.04±0.26, 17.39%) in pitfall trap collections. In Pattambi rice agro-ecosystem *Stenolophus quinquepustulatus* (0.17±0.59, 35.71%) dominated followed by *Apristus subtransparens* (0.13±0.43, 28.57%) and *Elaphropus politus* (0.1±0.40, 21.43%) in pitfall trap collections.

Seasonal dominant species in Ambalavayal rice agro-ecosystem using light trap was *Paratachys impressus* (1.12±2.43, 20.70%) in pre-harvest stage, *Clivina tranquebarica* (0.79±1.39, 23.20%) in harvest stage and *Clivina tranquebarica* (0.98±1.78, 31.54%) in post-harvest stage. Seasonal dominant species in Pattambi rice agro-ecosystem was *Stenolophus quinquepustulatus* (30.87±41.32, 18.05%) in pre-harvest stage, *Clivina lobata* (18±43.17, 20.13%) in harvest stage and *Clivina brevior* (21.6±37.18, 27.05%) in post-harvest stage (Figure 5, 6, 7, 13, 14 and 15).

Seasonal dominant speceis in Ambalavayal rice agro-ecosystem using pitfall trap was *Pheropsophus lissoderus* (0.01±0.11, 16.67%), *Chlaenius hamifer* (0.01±0.11, 16.67%) and *Clivina tranquebarica* (0.01±0.11, 16.67%) in pre-harvest stage, *Clivina tranquebarica* (0.03±0.23, 27.27%) and *Elaphropus politus* (0.03±0.23, 27.27%) in harvest stage and *Stenolophus quinquepustulatus* (0.02±0.21, 22.22%), *Apristus subtransparens* (0.02±0.21, 22.22%) and *Elaphropus politus* (0.02±0.21, 22.22%) in post-harvest stage. *Pheropsophus indicus* (0.03±0.18, 100%) in pre-harvest harvest stage, *Stenolophus quinquepustulatus* (0.1±0.40, 42.86%) and *Elaphropus politus* (0.1±0.40, 42.86%) in harvest stage and *Apristus subtransparens* (0.13±0.43, 66.67%) in post-harvest stage (Figures 8, 9, 10, 16 and 17) dominated the Pattambi rice agro-ecosystem.

Table 2. Diversity, richness and evenness of Carabidae collected from the Ambalavayal and Pattambi rice agrecosystems with light trap during 2018–2019 period

Region	Shannon-Weaver diversity index (H')	Margalef's richness index (d)	Simpson's evenness index ($E_{1/D}$)
Ambalavayal	2.69	6.16	0.89
Pattambi	2.89	7.61	0.92

Table 3. Diversity, richness and evenness of Carabidae collected from the Ambalavayal and Pattambi rice agro-ecosystems with pitfall trap during 2018–2019 period

Region	Shannon-Weaver diversity index (H')	Margalef's richness index (d)	Simpson's evenness index ($E_{1/D}$)
Ambalavayal	2.26	3.51	0.87
Pattambi	1.43	1.52	0.73

Table 4. Abundance (Mean±SD, percentage) of Carabidae collected from the Ambalavayal rice agro-ecosystem with light trap during 2018–2019 period

Sl No.	Name of Species	Mean±SD	Percentage
1.	*Abacetus haplosternus*	0.01±0.11	0.28
2.	*Acupalpus andrewesi*	0.14±0.77	3.63
3.	*Acupalpus rhombotus*	0.00±0.06	0.09
4.	*Apotomus hirsutulus*	0.00±0.06	0.09
5.	*Apristus subtransparens*	0.00±0.06	0.09
6.	*Batoscelis oblonga*	0.13±0.69	3.17
7.	*Bembidion niloticum*	0.06±0.32	1.40
8.	*Callistomimus littoralis*	0.00±0.06	0.09
9.	*Chlaenius hamifer*	0.02±0.14	0.47
10.	*Chlaenius malachinus*	0.00±0.06	0.09
11.	*Chlaenius nigricans*	0.00±0.06	0.09
12.	*Clivina attenuata*	0.00±0.06	0.09
13.	*Clivina brevior*	0.20±0.99	4.94
14.	*Clivina helferi*	0.00±0.06	0.09
15.	*Clivina lobata*	0.30±1.11	7.55
16.	*Clivina tranquebarica*	0.88±1.61	22.18
17.	*Cosmodiscus picturatus*	0.00±0.06	0.09
18.	*Dicranoncus quadridens*	0.00±0.06	0.09
19.	*Distichus planus*	0.02±0.18	0.47
20.	*Drypta lineola*	0.00±0.06	0.09
21.	*Dyschirius paucipunctus*	0.01±0.09	0.19
22.	*Elaphropus ceylanicus*	0.01±0.11	0.28
23.	*Elaphropus decoratus*	0.06±0.36	1.49
24.	*Elaphropus nigellus*	0.01±0.09	0.19
25.	*Elaphropus nilgiricus*	0.21±0.81	5.31
26.	*Elaphropus politus*	0.19±0.60	4.66

27.	*Idiomelas fulvipes*	0.01±0.09	0.19
28.	*Loxoncus microgonus*	0.27±0.85	6.71
29.	*Loxoncus nagpurensis*	0.14±0.53	3.54
30.	*Macrocheilus bensoni*	0.00±0.06	0.09
31.	*Ophionea indica*	0.12±0.42	3.08
32.	*Paratachys impressus*	0.7±1.77	17.61
33.	*Paratachys tropicus*	0.11±0.57	2.89
34.	*Pheropsophus indicus*	0.00±0.06	0.09
35.	*Pheropsophus lissoderus*	0.01±0.09	0.19
36.	*Pheropsophus picicollis*	0.03±0.37	0.75
37.	*Polyderis impressipennis*	0.01±0.11	0.28
38.	*Pseudoclivina arunachalensis*	0.01±0.09	0.19
39.	*Pseudoclivina memnonia*	0.00±0.06	0.09
40.	*Stenolophus bajaurae*	0.01±0.09	0.19
41.	*Stenolophus lucidus*	0.02±0.14	0.47
42.	*Stenolophus quinquepustulatus*	0.16±047	4.01
43.	*Stenolophus smaragdulus*	0.09±0.34	2.24
44.	*Tetragonoderus notaphioides*	0.01±0.09	0.19

Table 5. Abundance (Mean±SD, percentage) of Carabidae collected from the Ambalavayal rice agro-ecosystem in different seasons (P- pre-harvest, H- harvest, PH- post-harvest) with light trap during 2018–2019 period

No.	Species	Pre-harvest (P)	Harvest (H)	Post-harvest (PH)	Mann-Whitney U test (*P value*)		
		Mean± SD	Mean± SD	Mean± SD	P-H	H-PH	P-PH
1.	*Acupalpus andrewesi*	0.37±1.29	0.03±0.18	0.03±0.18	<0.05	>0.05	<0.05
2.	*Batoscelis oblonga*	0.00 ± 0.00	0.34±1.15	0.03±0.18	<0.05	<0.05	>0.05
3.	*Clivina brevior*	0.53±1.64	0.04±0.33	0.01±0.11	<0.05	>0.05	<0.05
4.	*Clivina lobata*	0.58±1.47	0.04±0.26	0.28±1.16	<0.05	<0.05	>0.05
5.	*Elaphropus nilgiricus*	0.47±1.29	0.07±0.29	0.10±0.37	<0.05	>0.05	<0.05
6.	*Stenolophus quinquepustulatus*	0.18±0.46	0.24±0.62	0.06±0.23	>0.05	<0.05	<0.05
7.	*Abacetus haplosternus*	0.01±0.11	0.01±0.11	0.01±0.11			
8.	*Acupalpus rhombotus*	0.00±0.00	0.00±0.00	0.01±0.11			
9.	*Apotomus hirsutulus*	0.01±0.11	0.09±0.65	0.00±0.00			
10.	*Apristus subtransparens*	0.00±0.00	0.00±0.00	0.01±0.11			
11.	*Bembidion niloticum*	0.06±0.38	0.09±0.39	0.02±0.15			

12.	*Callistomimus littoralis*	0.00±0.00	0.00±0.00	0.01±0.11			
13.	*Chlaenius hamifer*	0.02±0.15	0.02±0.15	0.01±0.11			
14.	*Chlaenius malachinus*	0.00±0.00	0.01±0.11	0.00±0.00			
15.	*Chlaenius nigricans*	0.00±0.00	0.00±0.00	0.01±0.11			
16.	*Clivina attenuata*	0.01±0.11	0.00±0.00	0.00±0.00			
17.	*Clivina helferi*	0.01±0.11	0.00±0.00	0.00±0.00			
18.	*Clivina tranquebarica*	0.88±1.64	0.79±1.39	0.98±1.78			
19.	*Cosmodiscus picturatus*	0.00±0.00	0.01±0.11	0.00±0.00			
20.	*Dicranoncus quadridens*	0.00±0.00	0.01±0.11	0.00±0.00			
21.	*Distichus planus*	0.03±0.23	0.02±0.21	0.00±0.00			
22.	*Drypta lineola*	0.01±0.11	0.00±0.00	0.00±0.00			
23.	*Dyschirius paucipunctus*	0.02±0.15	0.00±0.00	0.00±0.00			
24.	*Elaphropus ceylanicus*	0.01±0.11	0.01±0.11	0.01±0.11			
25.	*Elaphropus decoratus*	0.10±0.52	0.07±0.33	0.01±0.11			
26.	*Elaphropus nigellus*	0.01±0.11	0.01±0.11	0.00±0.00			

27.	*Elaphropus politus*	0.21±0.71	0.16±0.47	0.19±0.60			
28.	*Idiomelas fulvipes*	0.00±0.00	0.00±0.00	0.02±0.15			
29.	*Loxoncus microgonus*	0.26±0.80	0.23±0.77	0.31±0.97			
30.	*Loxoncus nagpurensis*	0.08±0.37	0.27±0.76	0.08±0.31			
31.	*Macrocheilus bensoni*	0.01±0.11	0.00±0.00	0.00±0.00			
32.	*Ophionea indica*	0.10±0.37	0.11±0.38	0.16±0.50			
33.	*Paratachys impressus*	1.12±2.43	0.42±1.27	0.56±1.28			
34.	*Paratachys tropicus*	0.06±0.38	0.19±0.78	0.1±0.48			
35.	*Pheropsophus indicus*	0.01±0.11	0.00±0.00	0.00±0.00			
36.	*Pheropsophus lissoderus*	0.01±0.11	0.00±0.00	0.00±0.00			
37.	*Pheropsophus picicollis*	0.00±0.00	0.09±0.65	0.00±0.00			
38.	*Polyderis impressipennis*	0.03±0.18	0.00±0.00	0.00±0.00			
39.	*Pseudoclivina arunachalensis*	0.00 ±0.00	0.01±0.11	0.01±0.11			
40.	*Pseudoclivina memnonia*	0.00±0.00	0.00±0.00	0.01±0.11			
41.	*Stenolophus bajaurae*	0.01±0.11	0.01±0.11	0.00±0.00			

42.	*Stenolophus lucidus*	0.04±0.21	0.00±0.00	0.01±0.11			
43.	*Stenolophus smaragdulus*	0.14±0.44	0.07±0.25	0.06±0.23			
44.	*Tetragonoderus notaphioides*	0.02±0.15	0.00±0.00	0.00±0.00			

Table 6. Statistical analysis of the seasonal variation in the overall abundance of Carabidae collected from the Ambalavayal rice agro-ecosystem with light trap during 2018–2019 period (P- pre-harvest, H- harvest, PH- post-harvest; '-' denotes no significant variation)

	One-Way ANOVA			**Tukey's HSD test (*P* value)**		
	F	**DF**	***P***	**P-H**	**H-PH**	**P-PH**
Overall abundance	0.74	2	>0.05	-	-	-

Table 7. Abundance (Mean±SD, percentage) of Carabidae collected from the Ambalavayal rice agro-ecosystem with pitfall trap during 2018–2019 period

Sl No.	**Species**	**Mean±SD**	**Percentage**
1.	*Apristus subtransparens*	0.03±0.23	13.04
2.	*Callistomimus littoralis*	0.01±0.11	4.35
3.	*Chlaenius hamifer*	0.01±0.11	4.35
4.	*Chlaenius nigricans*	0.01±0.11	4.35
5.	*Clivina tranquebarica*	0.04±0.26	17.39
6.	*Elaphropus nigellus*	0.01±0.11	4.35
7.	*Elaphropus politus*	0.05±0.27	21.73
8.	*Pheropsophus indicus*	0.01±0.11	4.35
9.	*Pheropsophus lissoderus*	0.01±0.11	4.35
10.	*Pheropsophus picicollis*	0.01±0.11	4.35
11.	*Stenolophus quinquepustulatus*	0.03±0.23	13.04
12.	*Tetragonoderus notaphioides*	0.01±0.11	4.35

Table 8. Abundance (Mean±SD, percentage) of Carabidae collected from the Ambalavayal rice agro-ecosystem in different seasons (P- pre-harvest, H- harvest, PH- post-harvest) with pitfall trap during 2018–2019 period

No.	Species	Pre-harvest (P)	Harvest (H)	Post-harvest (PH)	Mann-Whitney U test (*P value*)		
		Mean±SD	Mean± SD	Mean± SD	P-H	H-PH	P-PH
1.	*Apristus subtransparens*	0.00±0.00	0.01±0.11	0.02±0.15			
2.	*Callistomimus littoralis*	0.00±0.00	0.01±0.11	0.00±0.00			
3.	*Chlaenius hamifer*	0.01±0.11	0.00±0.00	0.00±0.00			
4.	*Chlaenius nigricans*	0.00±0.00	0.00±0.00	0.01±0.11			
5.	*Clivina tranquebarica*	0.01±0.11	0.03±0.23	0.00±0.00			
6.	*Elaphropus nigellus*	0.00±0.00	0.01±0.11	0.00±0.00			
7.	*Elaphropus politus*	0.00±0.00	0.03±0.23	0.02±0.15			
8.	*Pheropsophus indicus*	0.00±0.00	0.01±0.11	0.00±0.00			
9.	*Pheropsophus lissoderus*	0.01±0.11	0.00±0.00	0.00±0.00			
10.	*Pheropsophus picicollis*	0.00±0.00	0.00±0.00	0.01±0.11			
11.	*Stenolophus quinquepustulatus*	0.00±0.00	0.01±0.11	0.02±0.21			
12.	*Tetragonoderus notaphioides*	0.00±0.00	0.00±0.00	0.01±0.11			

Table 9. Statistical analysis of the seasonal variation in the overall abundance of Carabidae collected from the Ambalavayal rice agro-ecosystem with pitfall trap during 2018–2019 period (P- pre-harvest, H- harvest, PH- post-harvest; '-' denotes no significant variation)

	One-Way ANOVA			**Tukey's HSD test (*P* value)**		
	H	**DF**	***P***	**P-H**	**H-PH**	**P-PH**
Overall abundance	2.88	2	>0.05	-	-	-

Table 10. Abundance (Mean±SD, percentage) of Carabidae collected from the Pattambi rice agro-ecosystem with light trap during 2018–2019 period

Sl No.	**Name of Species**	**Mean±SD**	**Percentage**
1.	*Abacetus dorsalis*	0.13±0.40	0.12
2.	*Abacetus haplosternus*	0.40±0.94	0.35
3.	*Acupalpus andrewesi*	0.40±1.14	0.35
4.	*Acupalpus rhombotus*	0.18±0.58	0.16
5.	*Adischissus quadrinotatus*	0.07±0.25	0.06
6.	*Amblystomus vulneratus*	5.98±13.58	5.27
7.	*Anaulacus rubidus*	0.51±1.12	0.45
8.	*Anchista fenestrata*	0.02±0.15	0.02
9.	*Anomostomus orientalis*	0.04±0.30	0.04
10.	*Anomotarus stigmula*	0.13±0.40	0.12
11.	*Apotomus hirsutulus*	0.02±0.15	0.02
12.	*Archicolliuris bimaculata*	0.02±0.15	0.02
13.	*Archicolliuris immaculata*	0.04±0.21	0.04
14.	*Batoscelis oblonga*	12.16±19.43	10.72
15.	*Bembidion niloticum*	0.27±0.86	0.24

16.	*Brachinus devagiriensis*	1.31±3.56	1.16
17.	*Brachinus limbellus*	0.18±0.65	0.16
18.	*Brachinus paikadai*	2.53±15.19	2.23
19.	*Brachinus peltastes*	1.33±7.62	1.18
20.	*Chlaeminus biguttatus*	3.13±5.92	2.76
21.	*Chlaenius hamifer*	0.07±0.25	0.06
22.	*Chlaenius posticus*	0.04±0.21	0.04
23.	*Clivina brevior*	17.62±26.10	15.54
24.	*Clivina gamma*	0.02±0.15	0.02
25.	*Clivina helferi*	0.38±1.74	0.33
26.	*Clivina lobata*	8.91±25.80	7.86
27.	*Clivina mustela*	1.22±4.4.08	1.08
28.	*Clivina tranquebarica*	5.71±6.81	5.04
29.	*Clivina westwoodi*	0.62±1.05	0.55
30.	*Cyclicus dilatatus*	0.02±0.15	0.02
31.	*Dioryche solida*	0.16±0.64	0.14
32.	*Dioryche torta*	0.02±0.15	0.02
33.	*Distichus planus*	0.91±1.93	0.80
34.	*Drypta lineola*	0.09±0.47	0.08
35.	*Elaphropus ceylanicus*	0.11±0.38	0.09
36.	*Elaphropus decoratus*	0.09±0.36	0.08
37.	*Elaphropus klugi*	0.29±0.59	0.25
38.	*Elaphropus nigellus*	0.53±0.92	0.47
39.	*Elaphropus nilgiricus*	0.8±2.23	0.71
40.	*Elaphropus politus*	2.18±3.74	1.92
41.	*Eucolliuris fuscipennis*	0.38±1.15	0.33
42.	*Idiomelas fulvipes*	0.24±0.96	0.23
43.	*Lebia compania*	0.02±0.15	0.02
44.	*Leleuporella deavagiriensis*	0.27±1.64	0.24
45.	*Loxoncus microgonus*	2.31±6.53	2.04

46.	*Loxoncus nagpurensis*	8.09±16.17	7.13
47.	*Loxoncus schmidti*	0.07±0.33	0.06
48.	*Meroctenus mediocris*	0.02±0.15	0.02
49.	*Mimocolliuris indica*	0.02±0.15	0.02
50.	*Ophionea indica*	9.93±14.27	8.56
51.	*Ophioniscus puneensis*	0.09±0.36	0.08
52.	*Paratachys impressus*	4.8±7.76	4.23
53.	*Paratachys tropicus*	0.42±0.94	0.37
54.	*Pentagonica pallipes*	0.04±0.21	0.04
55.	*Pheropsophus indicus*	0.16±0.37	0.14
56.	*Planetes ruficeps*	0.04±0.21	0.04
57.	*Scarites beesoni*	0.02±0.15	0.02
58.	*Scarites modestus*	0.51±2.99	0.45
59.	*Selina westermanni*	0.02±0.15	0.02
60.	*Siagona plana*	0.02±0.15	0.02
61.	*Stenolophus bajaurae*	0.87±2.29	0.76
62.	*Stenolophus lucidus*	0.51±1.22	0.45
63.	*Stenolophus quinquepustulatus*	15.13±27.07	13.34
64.	*Stenolopus smaragdulus*	0.87±1.60	0.76
65.	*Zuphium modestusm*	0.02±0.15	0.02
66.	*Zuphium olens*	0.09±0.36	0.08

Table 11. Abundance (Mean±SD, percentage) of Carabidae collected from the Pattambi rice agro-ecosystem in different seasons (pre-harvest, harvest, post-harvest) with light trap during 2018–2019 period

No.	Species	Pre-harvest (P)	Harvest (H)	Post-harvest (PH)	Mann-Whitney U test (*P value*)		
		Mean± SD	Mean± SD	Mean± SD	P-H	H-PH	P-PH
1.	*Amblystomus vulneratus*	16.67±19.84	0.60±0.74	0.67±1.50	<0.05	>0.05	<0.05
2.	*Batoscelis oblonga*	29.27±25.23	1.4±1.68	5.80±8.11	<0.05	>0.05	<0.05
3.	*Chlaeminus biguttatus*	5.60±5.25	3.40±8.22	0.40±0.63	<0.05	>0.05	<0.05
4.	*Loxoncus microgonus*	6.27±10.34	0.27±0.46	0.40±1.30	<0.05	>0.05	<0.05
5.	*Loxoncus nagpurensis*	20.2±23.57	2.53±4.73	1.53±2.67	<0.05	>0.05	<0.05
6.	*Paratachys impressus*	1.53±3.78	2.73±5.50	10.13±9.92	>0.05	<0.05	<0.05
7.	*Stenolophus quinquepustulatus*	30.87±41.32	10.47±12.13	4.07±5.38	<0.05	>0.05	<0.05
8.	*Abacetus dorsalis*	0.20±0.56	0.07±0.26	0.13±0.35			
9.	*Abacetus haplosternus*	0.07±0.26	1.00±1.41	0.13±0.35			
10.	*Acupalpus andrewesi*	0.53±1.30	0.60±1.45	0.07±0.26			
11.	*Acupalpus rhombotus*	0.20±0.77	0.13±0.35	0.20±0.56			

12.	*Adischissus quadrinotatus*	0.07±0.26	0.13±0.35	0.00±0.00			
13.	*Anaulacus rubidus*	0.27±0.46	0.53±1.13	0.73±1.53			
14.	*Anchista fenestrata*	0.00±0.00	0.00±0.00	0.07±0.26			
15.	*Anomostomus orientalis*	0.13±0.52	0.00±0.00	0.00±0.00			
16.	*Anomotarus stigmula*	0.20±0.56	0.00±0.00	0.20±0.41			
17.	*Apotomus hirsutulus*	0.07±0.26	0.00±0.00	0.00±0.00			
18.	*Archicolliuris bimaculata*	0.00±0.00	0.00±0.00	0.07±0.26			
19.	*Archicolliuris immaculata*	0.00±0.00	0.07±0.26	0.07±0.26			
20.	*Bembidion niloticum*	0.27±0.59	0.53±1.36	0.00±0.00			
21.	*Brachinus devagiriensis*	2.80±5.73	0.73±1.28	0.40±1.30			
22.	*Brachinus limbellus*	0.27±0.80	0.27±0.80	0.00±0.00			
23.	*Brachinus paikadai*	0.53±1.41	0.00±0.00	7.00±26.27			
24.	*Brachinus peltastes*	0.33±1.05	3.67±13.13	0.00±0.00			
25.	*Chlaenius hamifer*	0.00±0.00	0.07±0.26	0.13±0.35			
26.	*Chlaenius posticus*	0.00±0.00	0.00±0.00	0.13±0.35			

27.	*Clivina brevior*	19.87±22.97	11.4±12.93	21.6±37.18			
28.	*Clivina gamma*	0.00±0.00	0.07±0.26	0.00±0.00			
29.	*Clivina helferi*	0.00±0.00	0.07±0.26	1.07±2.94			
30.	*Clivina lobata*	5.87±7.92	18±43.17	2.87±5.25			
31.	*Clivina mustela*	0.20±0.56	2.33±6.63	1.13±2.36			
32.	*Clivina tranquebarica*	6.87±8.88	5.07±5.66	5.20±5.73			
33.	*Clivina westwoodi*	0.40±0.83	0.27±0.59	1.20±1.37			
34.	*Cyclicus dilatatus*	0.00±0.00	0.00±0.00	0.07±0.26			
35.	*Dioryche solida*	0.40±1.06	0.00±0.00	0.07±0.26			
36.	*Dioryche torta*	0.00±0.00	0.07±0.26	0.00±0.00			
37.	*Distichus planus*	1.87±2.92	0.53±1.06	0.33±0.72			
38.	*Drypta lineola*	0.20±0.77	0.00±0.00	0.07±0.26			
39.	*Elaphropus ceylanicus*	0.27±0.59	0.07±0.26	0.00 ±0.00			
40.	*Elaphropus decoratus*	0.27±0.59	0.00±0.00	0.00±0.00			
41.	*Elaphropus klugi*	0.27±0.59	0.40±0.74	0.20±0.41			

42.	*Elaphropus nigellus*	0.27±0.59	1.20±1.21	0.13±0.35			
43.	*Elaphropus nilgiricus*	1.07±2.94	0.87±2.10	0.47±1.55			
44.	*Elaphropus politus*	1.07±2.25	2.80±3.34	2.67±5.07			
45.	*Eucolliuris fuscipennis*	0.67±1.80	0.20±0.41	0.27±0.80			
46.	*Idiomelas fulvipes*	0.07±0.26	0.27±0.59	0.40±1.55			
47.	*Lebia compania*	0.07±0.26	0.00±0.00	0.00 ± 0.00			
48.	*Leleuporella deavagiriensis*	0.00±0.00	0.80±2.83	0.00±0.00			
49.	*Loxoncus schmidti*	0.07±0.26	0.00±0.00	0.13±0.52			
50.	*Meroctenus mediocris*	0.07±0.26	0.00±0.00	0.00±0.00			
51.	*Mimocolliuris indica*	0.00±0.00	0.00±0.00	0.07±0.26			
52.	*Ophionea indica*	9.47±15.73	12.6±17.03	7.07±8.84			
53.	*Ophioniscus puneensis*	0.27±0.59	0.00±0.00	0.00±0.00			
54.	*Paratachys tropicus*	0.67±1.35	0.27±0.70	0.33±0.62			
55.	*Pentagonica pallipes*	0.13±0.35	0.00±0.00	0.00±0.00			
56.	*Pheropsophus indicus*	0.20±0.41	0.07±0.26	0.20±0.41			

57.	*Planetes ruficeps*	0.07±0.26	0.07±0.26	0.00±0.00			
58.	*Scarites beesoni*	0.07±0.26	0.00±0.00	0.00±0.00			
59.	*Scarites modestus*	0.07±0.26	0.13±0.52	1.33±5.16			
60.	*Selina westermanni*	0.00±0.00	0.07±0.26	0.00±0.00			
61.	*Siagona plana*	0.00±0.00	0.07±0.26	0.00±0.00			
62.	*Stenolophus bajaurae*	2.13±3.68	0.33±0.49	0.13±0.35			
63.	*Stenolophus lucidus*	0.40±1.12	1.07±1.67	0.07±0.26			
64.	*Stenolopus smaragdulus*	1.27±2.19	0.93±1.58	0.40±0.63			
65.	*Zuphium modestusm*	0.07±0.26	0.00±0.00	0.00±0.00			
66.	*Zuphium olens*	0.07±0.27	0.20±0.56	0.00±0.00			

Table 12. Statistical analysis of the seasonal variation in the overall abundance of Carabidae collected from the Pattambi rice agro-ecosystem with light trap during 2018–2019 period (P- pre-harvest, H- harvest, PH- post-harvest; '-' denotes no significant variation)

	Kruskal-Wallis			**Mann-Whitney U test (*P* value)**		
	H	**DF**	***P***	**P-H**	**H-PH**	**P-PH**
Overall abundance	1.92	2	>0.05	-	-	-

Table 13. Abundance (Mean±SD, percentage) of Carabidae collected from the Pattambi rice agro-ecosystem with pitfall trap during 2018–2019 period

Sl No.	**Species**	**Mean±SD**	**Percentage**
1.	*Apristus subtransparens*	0.13±0.43	28.57
2.	*Elaphropus politus*	0.1±0.40	21.43
3.	*Pheropsophus indicus*	0.03±0.18	7.14
4.	*Pheropsophus picicollis*	0.03±0.18	7.14
5.	*Stenolophus quinquepustulatus*	0.17±0.59	35.71

Table 14. Abundance (Mean±SD, percentage) of Carabidae collected from the Pattambi rice agro-ecosystem in different seasons (P- pre-harvest, H- harvest, PH- post-harvest) with pitfall trap during 2018–2019 period

No.	Species	Pre-harvest (P)	Harvest (H)	Post-harvest (PH)	Mann-Whitney U test (*P value*)		
		Mean± SD	Mean± SD	Mean± SD	P-H	H-PH	P-PH
1.	*Apristus subtransparens*	0.00±0.00	0.00±0.00	0.13±0.43			
2.	*Elaphropus politus*	0.00±0.00	0.1±0.40	0.00±0.00			
3.	*Pheropsophus indicus*	0.03±0.18	0.00±0.00	0.00±0.00			
4.	*Pheropsophus picicollis*	0.00±0.00	0.03±0.18	0.00±0.00			
5.	*Stenolophus quinquepustulatus*	0.00±0.00	0.1±0.40	0.07±0.25			

Table 15. Statistical analysis of the seasonal variation in the overall abundance of Carabidae collected from the Pattambi rice agro-ecosystem with pitfall trap during 2018–2019 period (P- pre-harvest, H- harvest, PH- post-harvest; '-' denotes no significant variation)

	One-Way ANOVA			Tukey's HSD test (*P* value)		
	F	DF	*P*	P-H	H-PH	P-PH
Overall abundance	1.84	2	>0.05	-	-	-

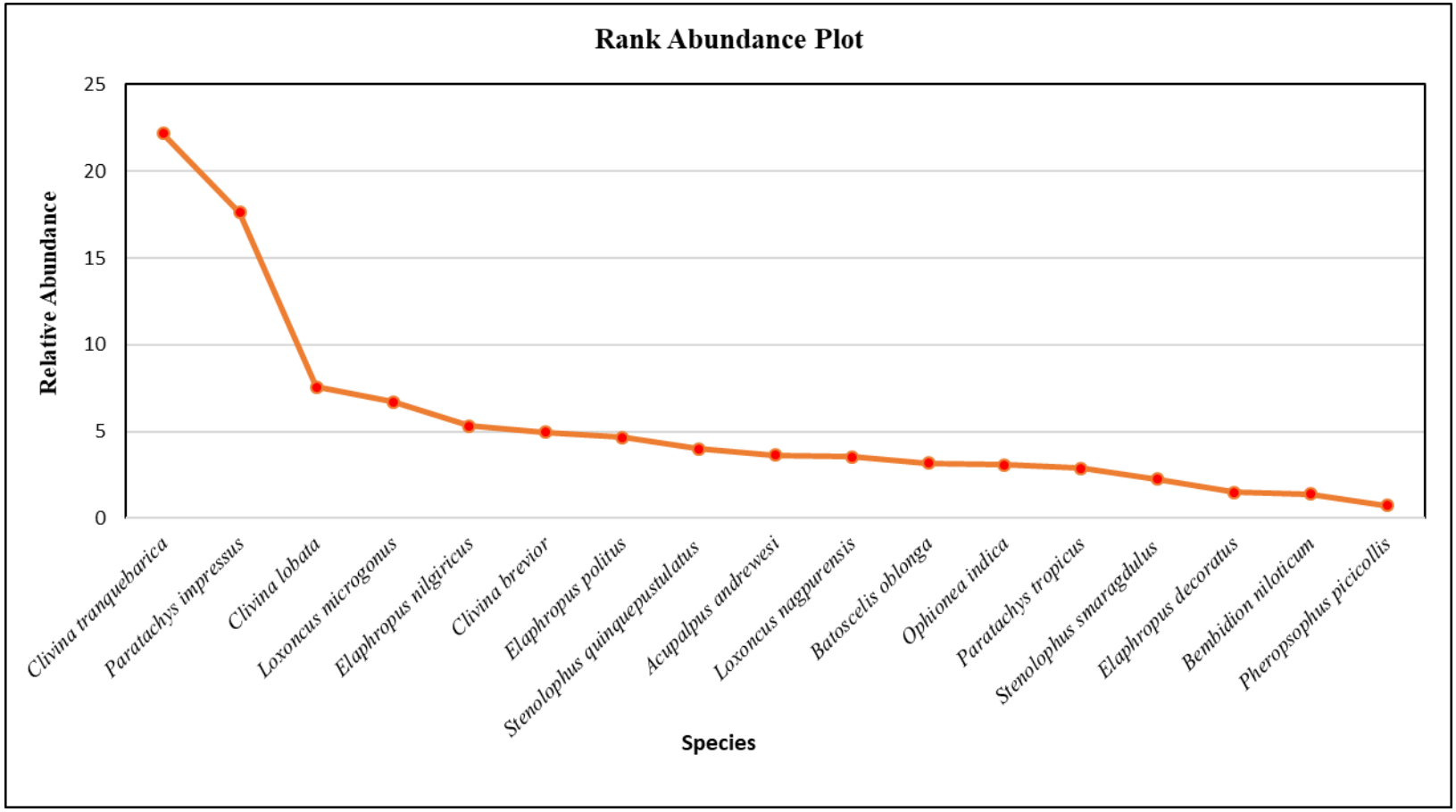


Figure 3. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with light trap

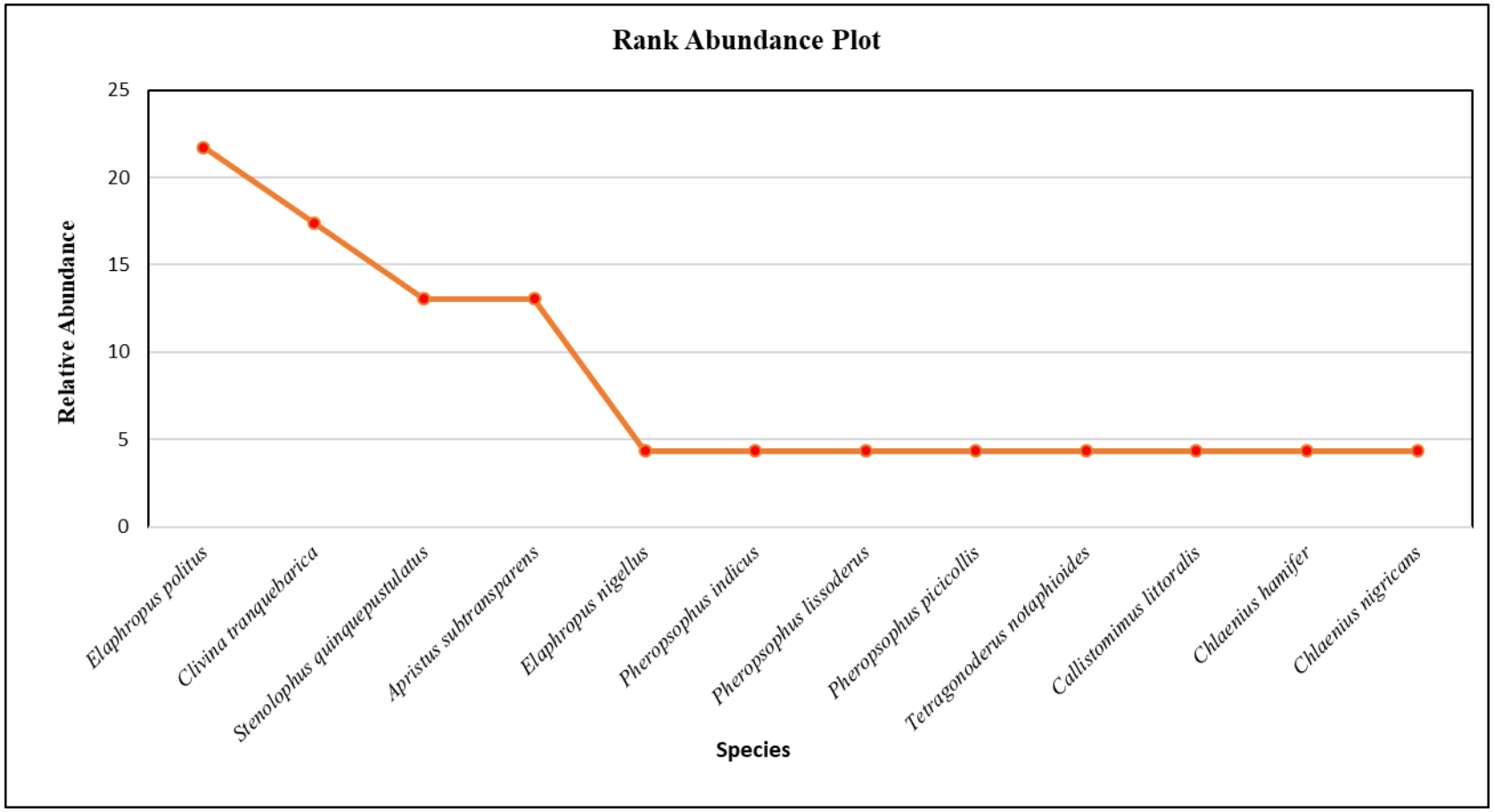


Figure 4. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with pitfall trap

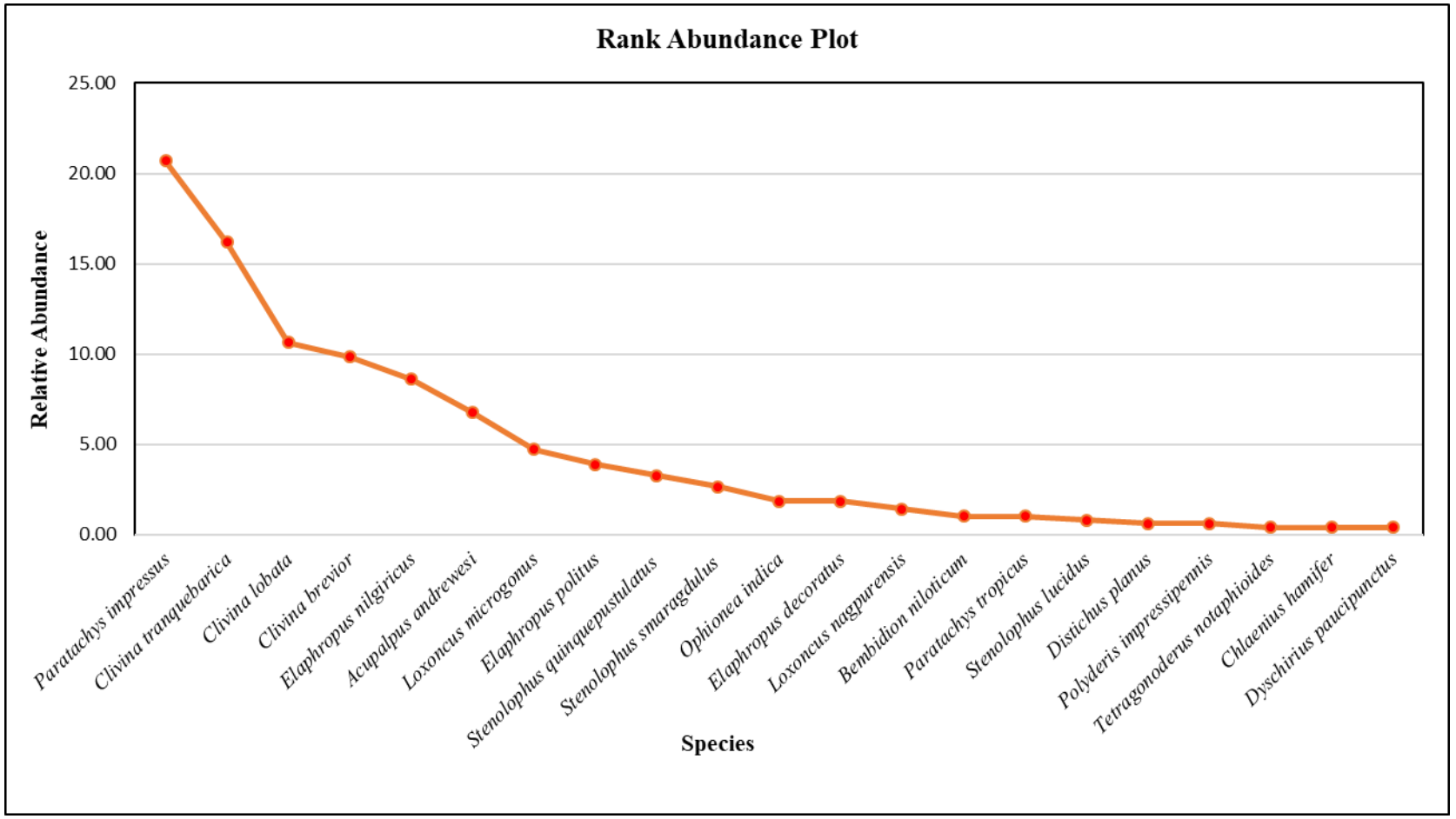


Figure 5. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with light trap during pre-harvest stage

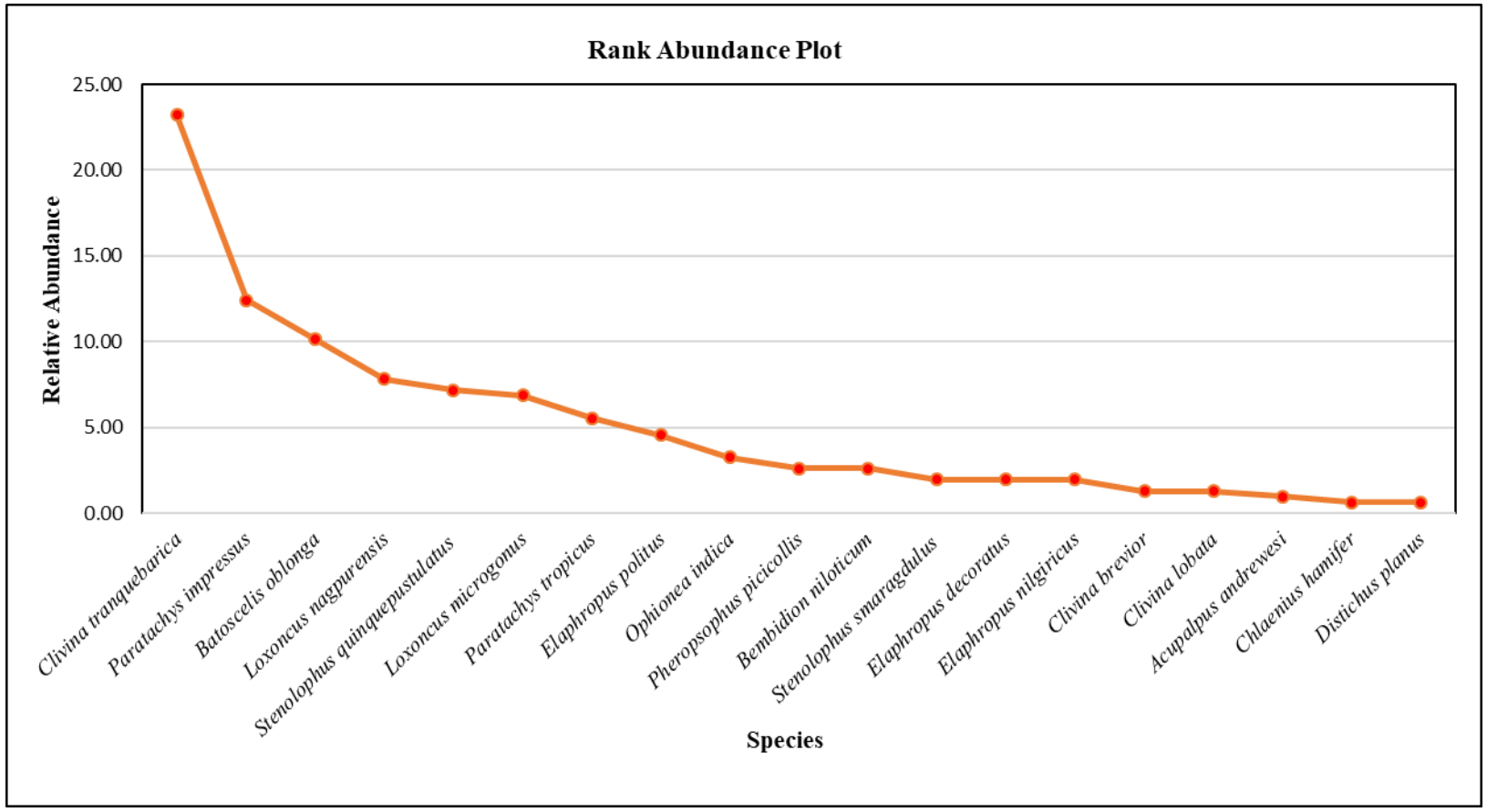


Figure 6. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with light trap during harvest stage

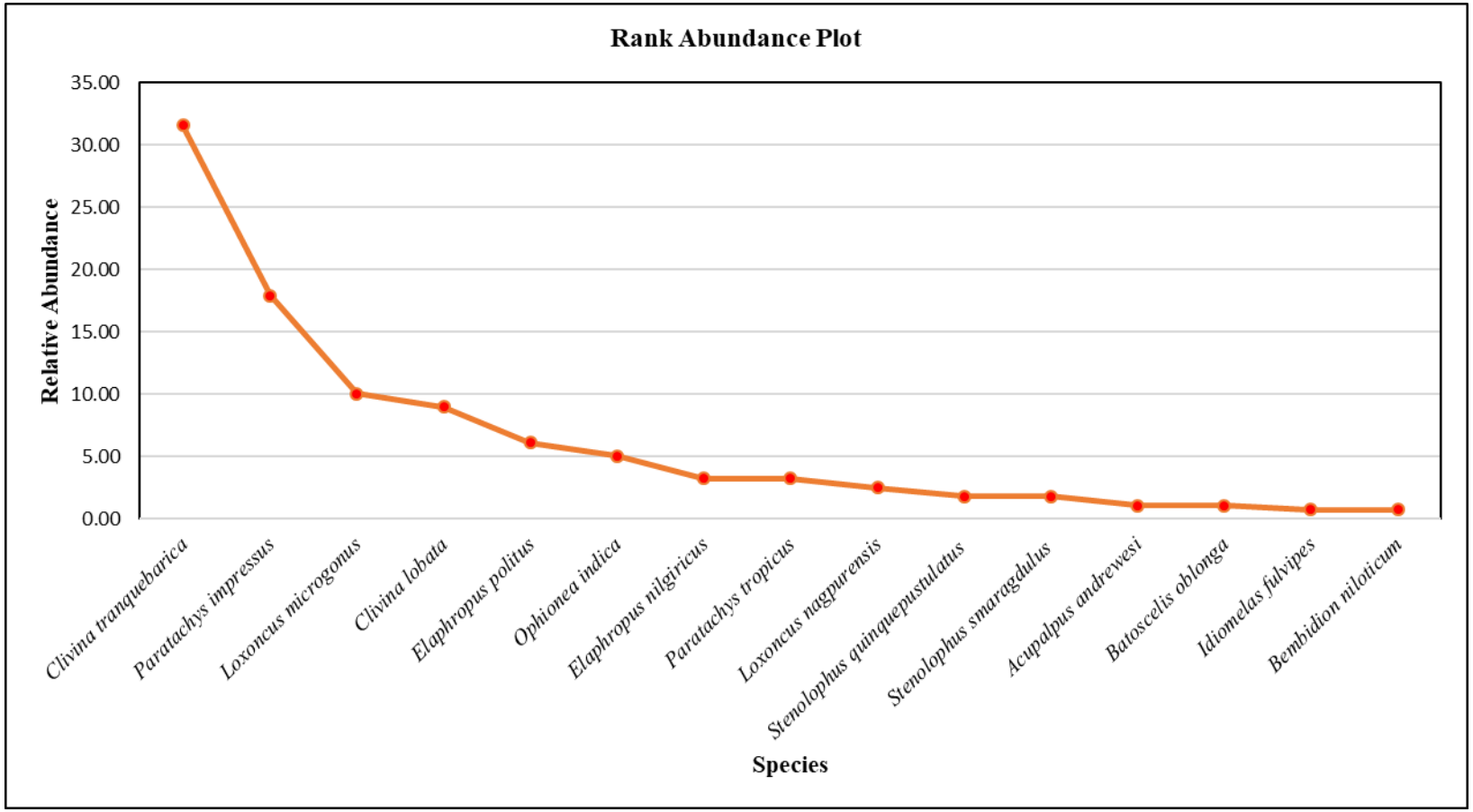


Figure 7. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with light trap during post-harvest stage

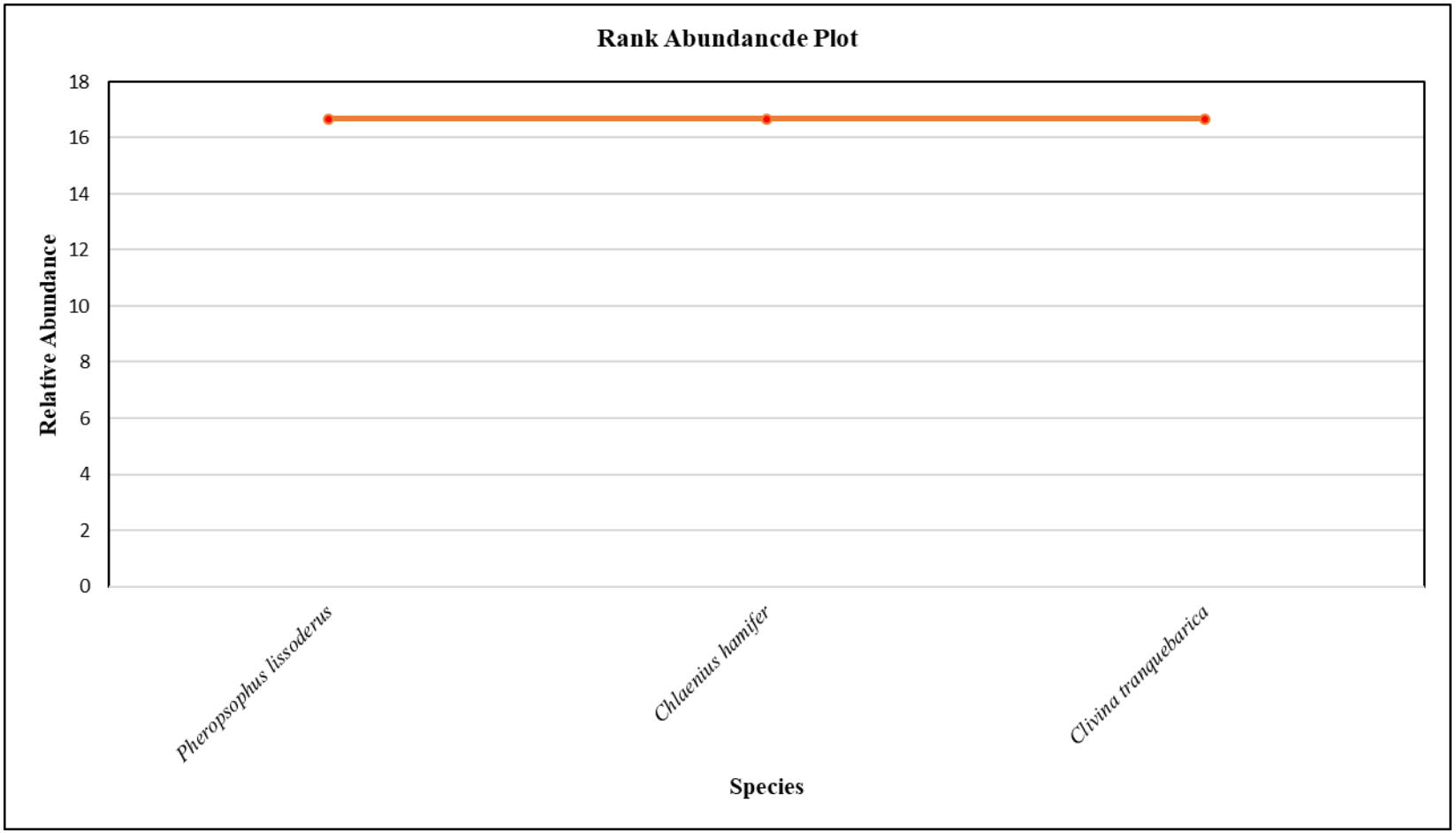


Figure 8. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with pitfall trap during pre-harvest stage

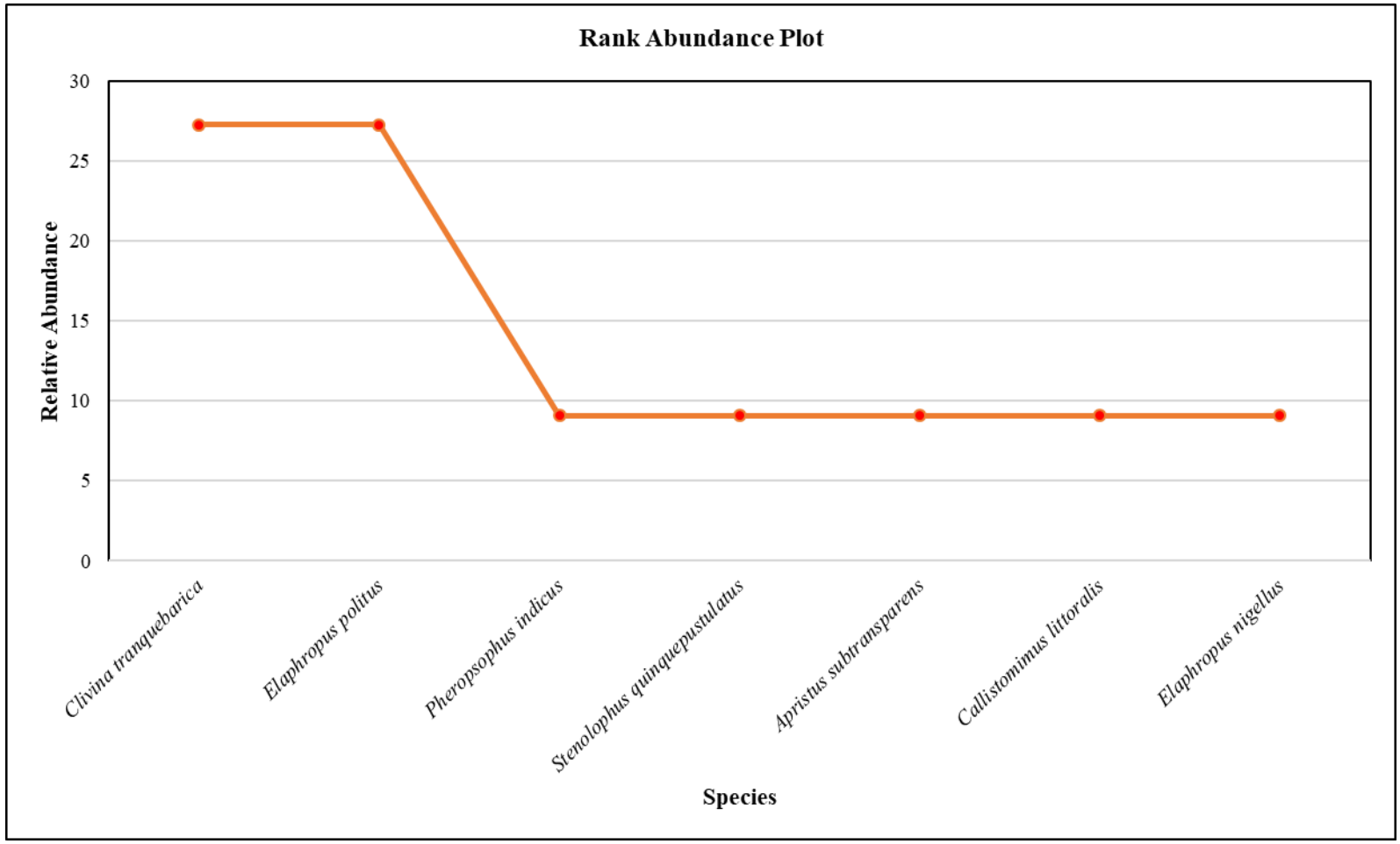


Figure 9. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with pitfall trap during harvest stage

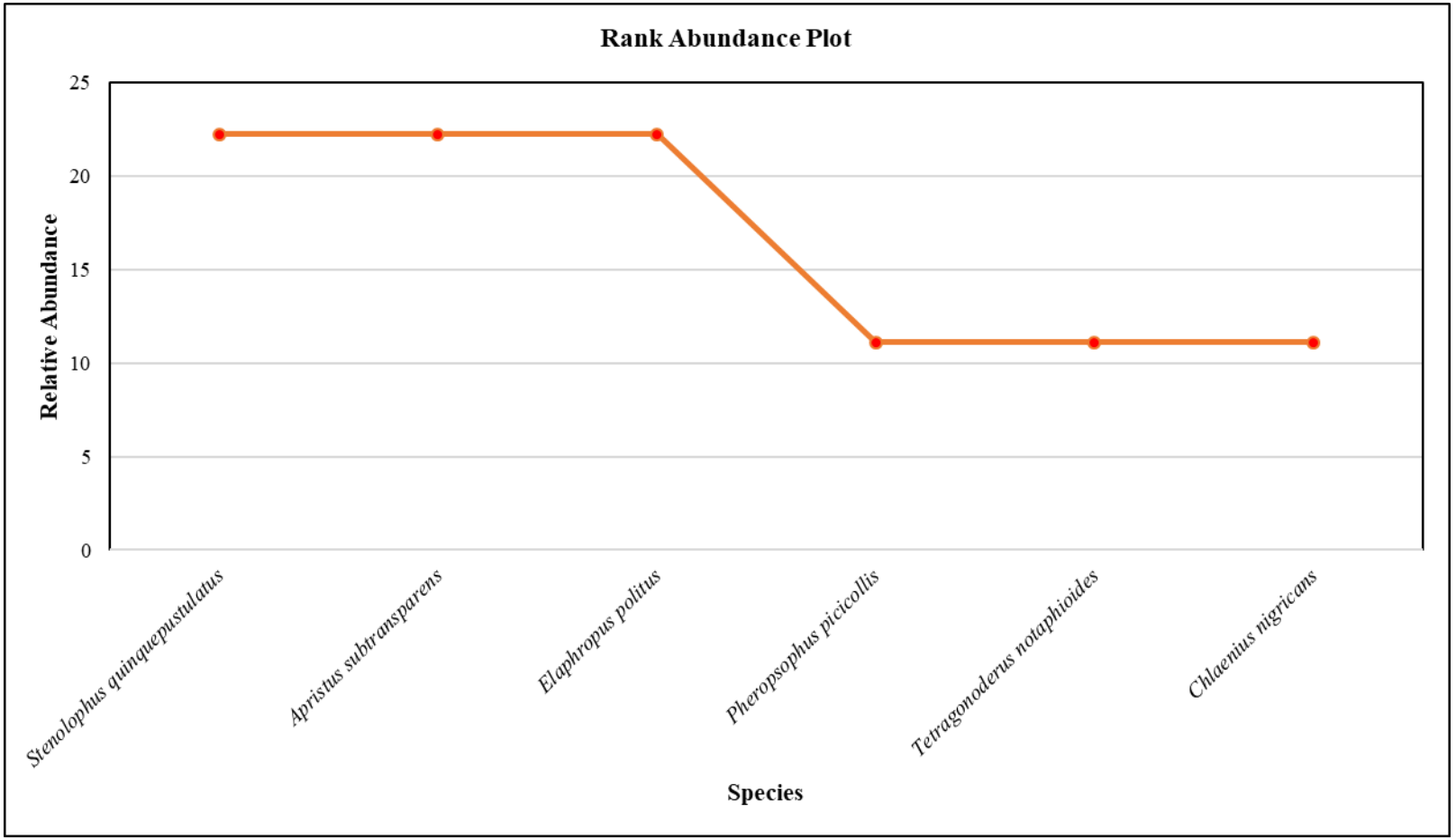


Figure 10. Rank abundance plot for the Carabidae collected from the Ambalavayal rice agro-ecosystem with pitfall trap during post-harvest stage

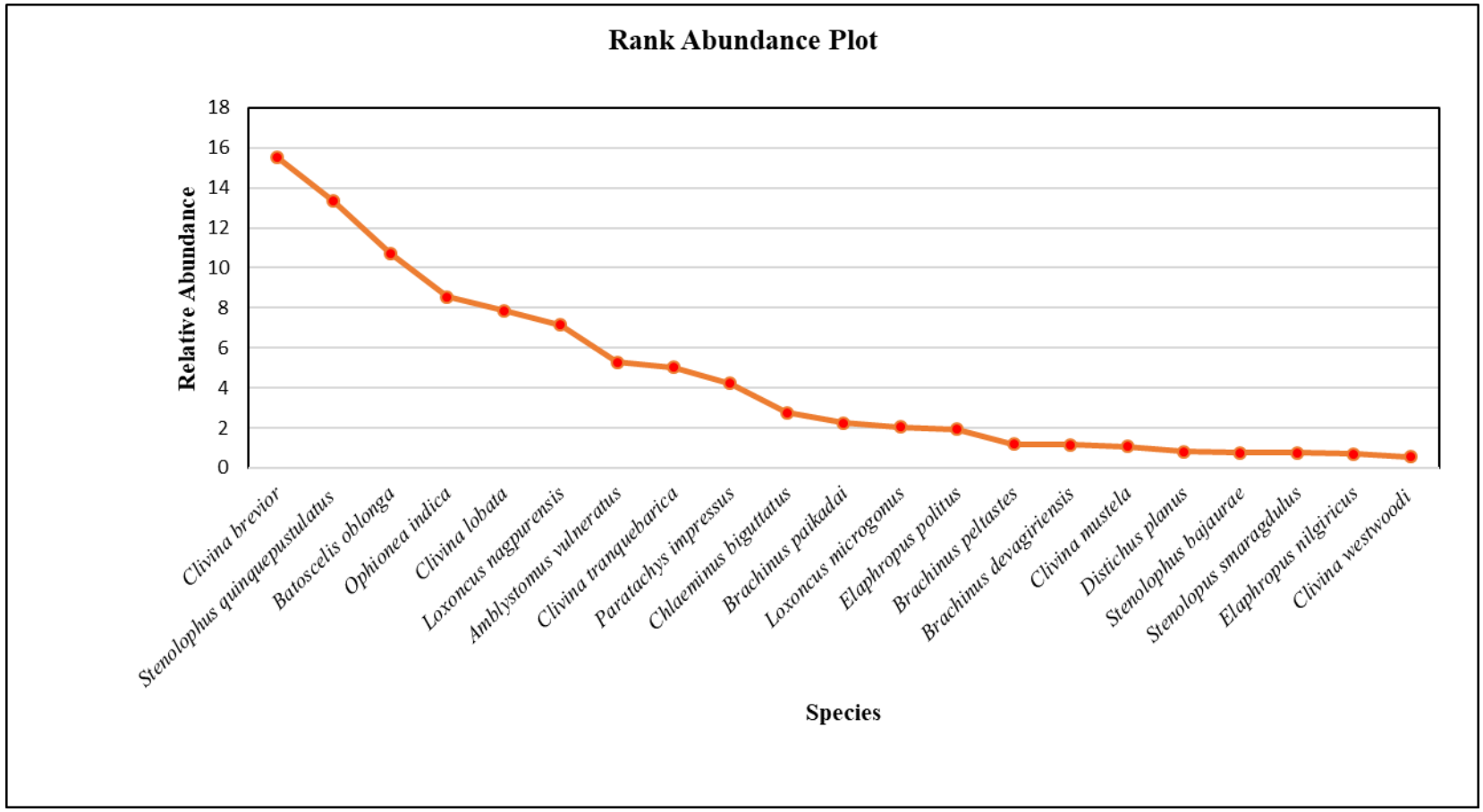


Figure 11. Rank abundance plot for the Carabidae collected from the Pattambi rice agro-ecosystem with light trap

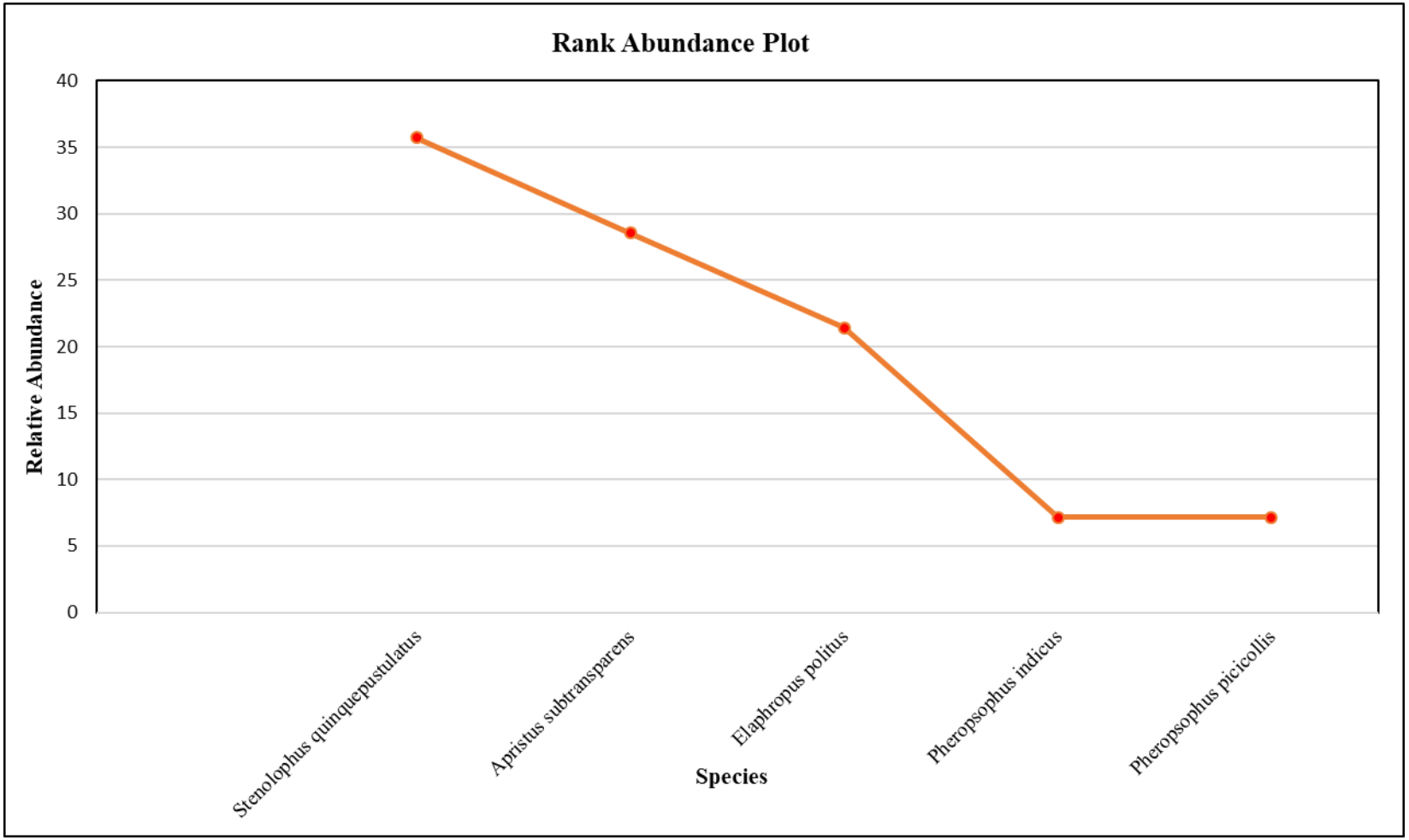


Figure 12. Rank abundance plot for the Carabidae collected from the Pattambi rice agro-ecosystem with pitfall trap

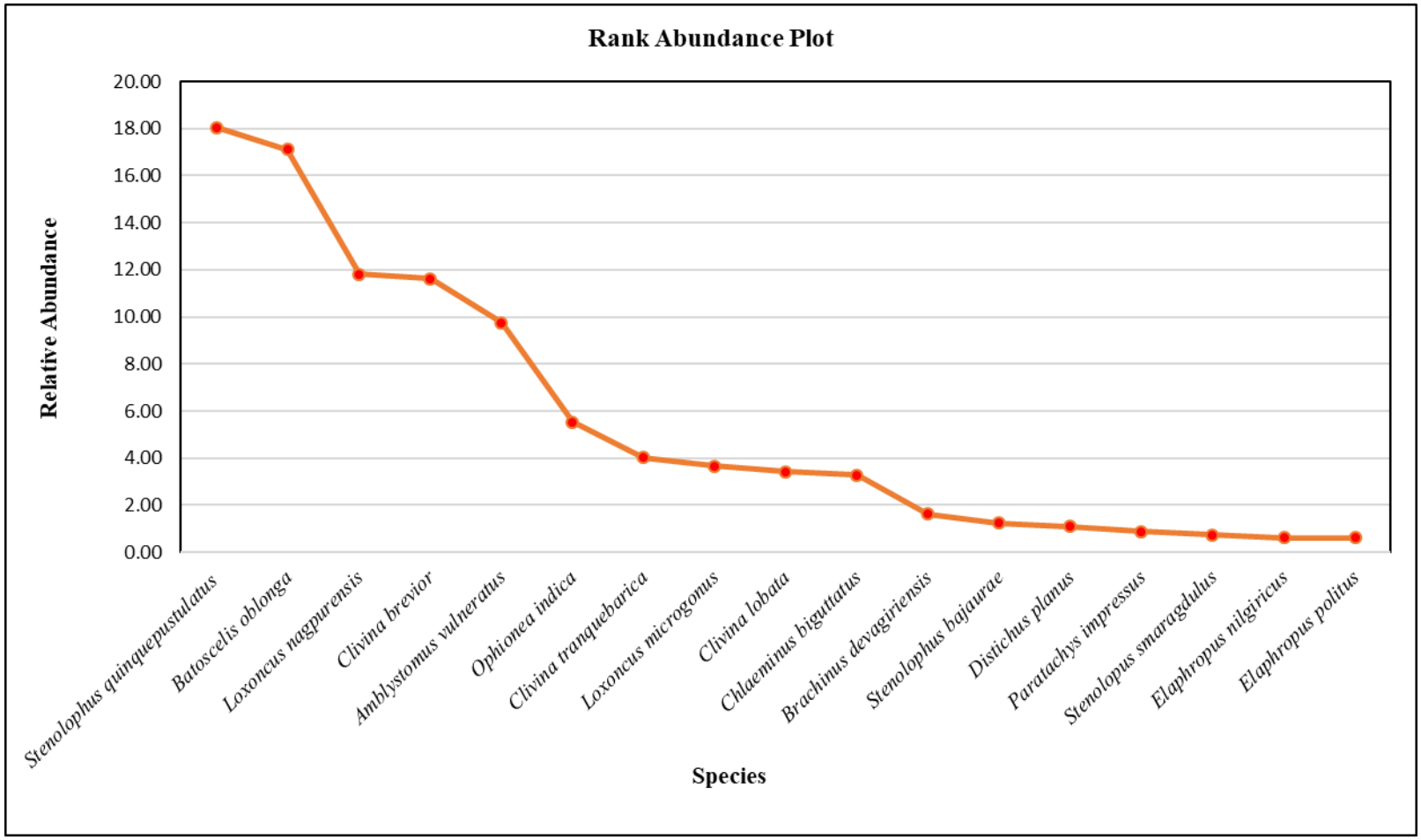


Figure 13. Rank abundance plot for the Carabidae collected from the Pattambi rice agro-ecosystem with light trap during pre-harvest stage

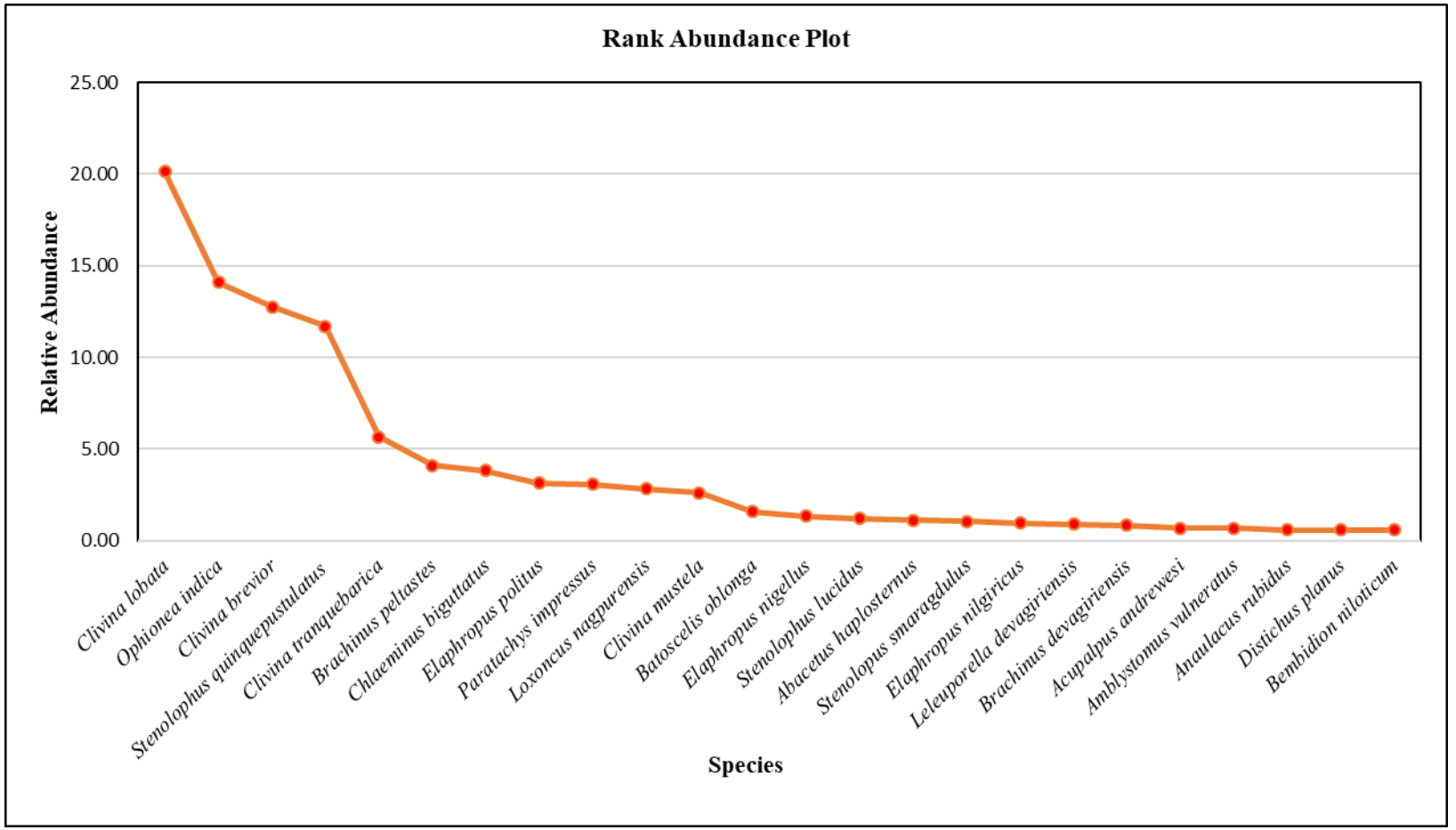


Figure 14. Rank abundance plot for the Carabidae collected from the Pattambi rice agro-ecosystem with light trap during harvest stage

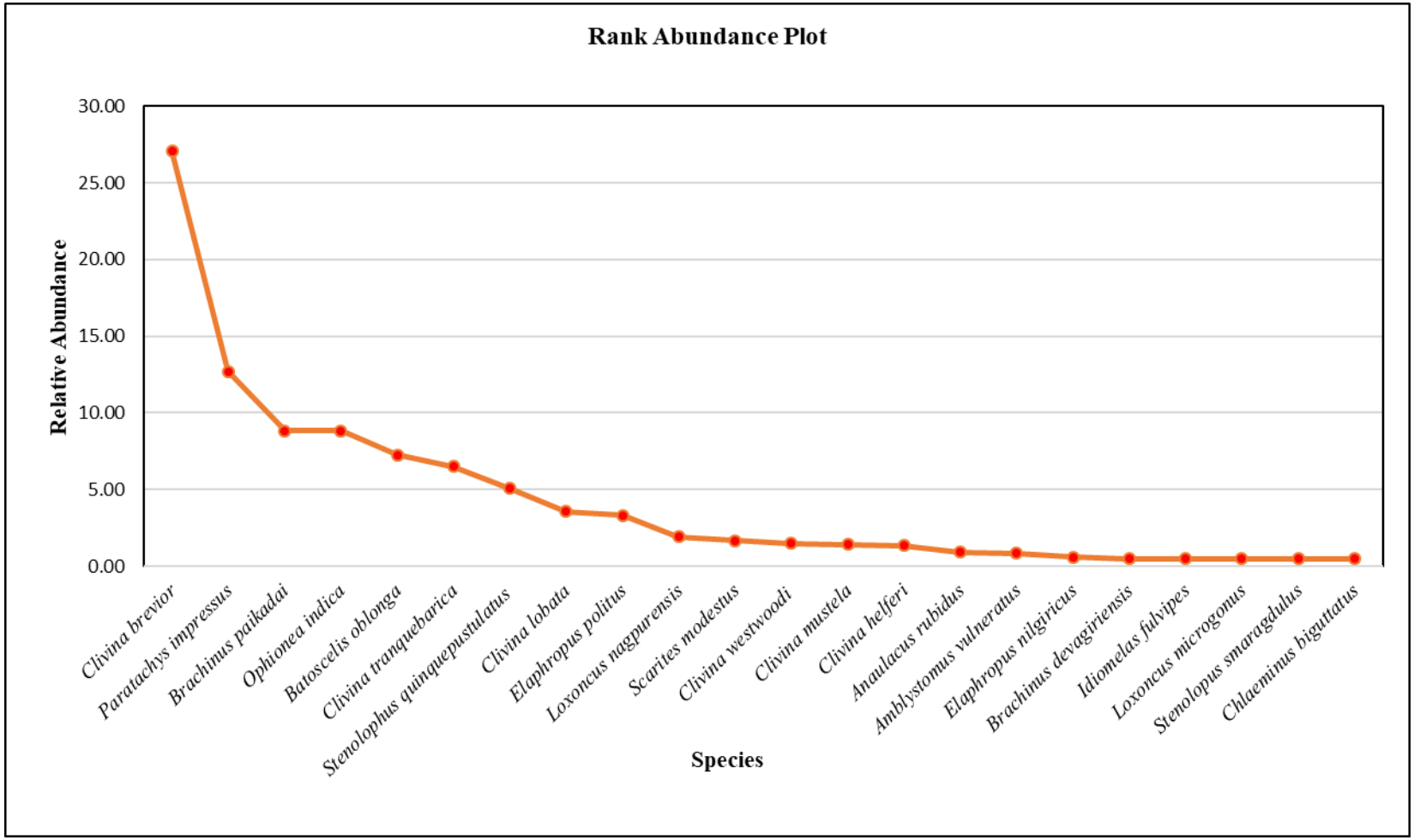


Figure 15. Rank abundance plot for the Carabidae collected from the Pattambi rice agro-ecosystem with light trap during post-harvest stage

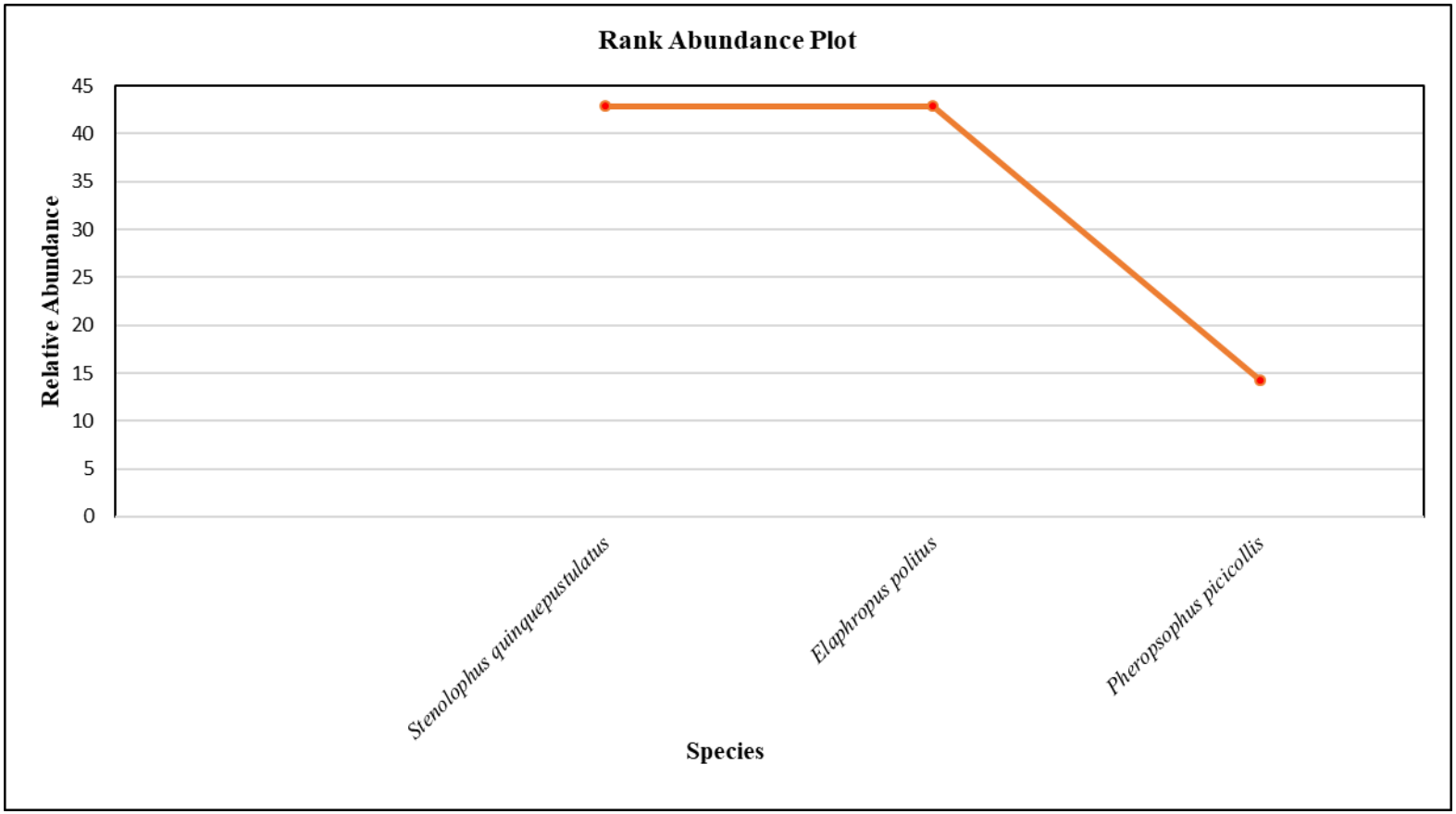


Figure 16. Rank abundance plot for the Carabidae collected from the Pattambi rice agro-ecosystem with pitfall trap during harvest stage

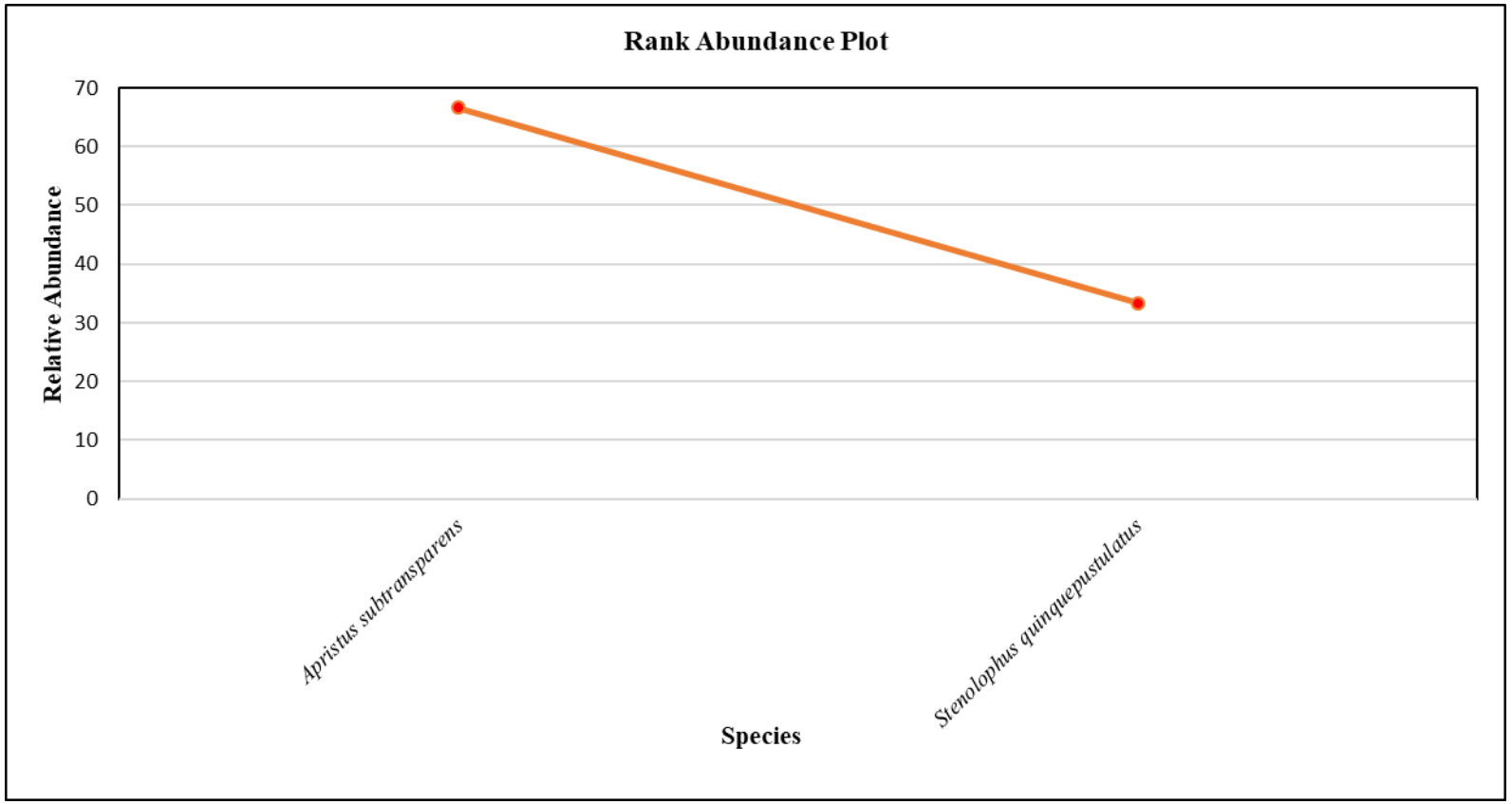
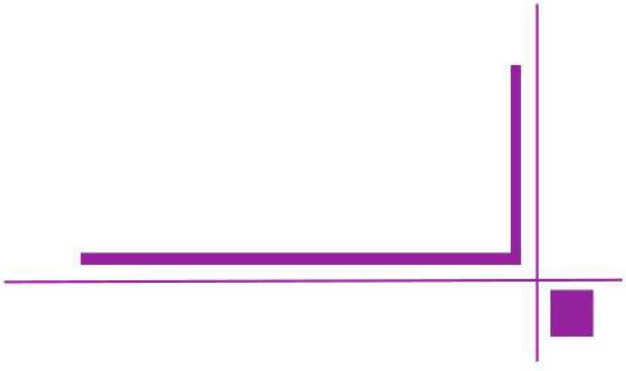


Figure 17. Rank abundance plot for the Carabidae collected from the Pattambi rice agro-ecosystem with pitfall trap during post-harvest stage

Chapter 5

DISCUSSION



5. Discussion

5.1. Taxonomy

Carabid beetle composition of two rice agro-ecosystems, Ambalavayal in Wayanad district (974 m MSL, highland) and Pattambi in Palakkad district (63 m MSL, midland) of the Kerala state is provided along with the checklist of the species, taxonomic keys and images. Taxonomy of carabid beetles in the rice agro-ecosystems of India is limited with only few studies, i.e. diversity and population dynamics of carabid beetles in the rice agro-ecosystems of eastern Maharashtra during Kharif Season (Jadhao and Bhongade 2018) and composition of Carabid beetles from a rice agro-ecosystem in the Palakkad Gap of the Western Ghats in Kerala State (Divya 2022). The present study provides detailed account of Carabid beetles in the two rice agro-ecosystems located at different altitudes of Kerala state, India.

Eighty-one carabid species belonging to thirteen subfamilies (Anthiinae, Apotominae, Brachininae, Dryptinae, Harpalinae, Lebiinae, Licininae, Panagaeinae, Platyninae, Pterostichinae, Scaritinae, Siagoninae and Trechinae), nineteen tribes and forty-eight genera were recorded from the Ambalavayal and Pattambi rice agro-ecosystems. Forty-four species belonging to eleven subfamilies, fifteen tribes and twenty-five genera were recorded from Ambalavayal rice agro-ecosystem, and sixty-six species belonging to eleven subfamilies, sixteen tribes and thirty-nine genera were recorded from Pattambi rice agro-ecosystem. Fifteen species (*Apristus subtransparens, Callistomimus littoralis, Chlaenius malachinus, C. nigricans, Clivina attenuata, Cosmodiscus picturatus, Dicranoncus quadridens, Dyschirius paucipunctus, Macrocheilus bensoni, Pheropsophus lissoderus, P.*

picicollis, Polyderis impressipennis, Pseudoclivina arunachalensis, P. memnonia, and *Tetragonoderus notaphioides*), nine genera (*Apristus, Callistomimus, Cosmodiscus, Dicranoncus, Dyschirius, Macrocheilus, Polyderis, Pseudoclivina* and *Tetragonoderus*) and two subfamilies (Anthiinae and Platyninae) were recorded only from the Ambalavayal rice agro-ecosystem and thirty-seven species (*Abacetus dorsalis*, *Adischissus notulatus*, *Amblystomus vulneratus*, *Anaulacus rubidus, Anchista fenestrata, Anomostomus orientalis, Anomotarus stigmula, Archicolliuris bimaculata, A. immaculata, Brachinus devagiriensis, B. limbellus, B. paikadai, B. peltastes, Chlaeminus biguttatus, Chlaenius posticus, Clivina gamma, C. mustela, C. westwoodi, Cyclicus dilatatus, Dioryche solida, D. torta, Elaphropus klugi, Eucolliuris fuscipennis*, *Lebia campania, Leleuporella devagiriensis, Loxoncus schmidti, Meroctenus mediocris, Mimocolliuris indica, Ophoniscus puneensis, Planetes ruficeps, Pentagonica pallipes*, *Scarites beesoni*, *S. modestus, Selina westermanni, Siagona plana*, *Zuphium modestum* and *Z. olens*), twenty three genera (*Amblystomus, Anaulacus, Anchista, Adischissus, Anomostomus, Anomotarus, Archicolliuris, Brachinus, Chlaeminus, Cyclicus, Dioryche, Eucolliuris, Lebia, Leleuporella, Meroctenus, Mimocolliuris, Ophoniscus, Pentagonica, Planetes, Scarites, Selina, Siagona* and *Zuphium*) and two subfamilies (Panagaeinae and Siagoninae) were recorded only from the Pattambi rice agro-ecosystem.

Twenty nine species (*Abacetus haplosternus, Acupalpus andrewesi, A. rhombotus, Apotomus hirsutulus, Batoscelis oblonga, Bembidion niloticum, Chlaenius hamifer, Clivina brevior, C. helferi, C. lobata, C. tranquebarica, Distichus planus, Drypta lineola, Elaphropus ceylanicus, E. decoratus, E. nigellus,*

E. nilgiricus, E. politus, Idiomelas fulvipes, Loxoncus microgonus, L. nagpurensis, Ophionea indica, Paratachys impressus, P. tropicus, Pheropsophus indicus, Stenolophus bajaurae, S. lucidus, S. quinquepustulatus and *S. smaragdulus*), sixteen genera (*Abacetus, Acupalpus, Apotomus, Batoscelis, Bembidion, Chlaenius, Clivina, Distichus, Drypta, Elaphropus, Idiomelas, Loxoncus, Ophionea*, *Paratachys*, *Pheropsophus* and *Stenolophus*) and nine subfamilies (Apotominae, Brachininae, Dryptinae, Harpalinae, Lebiinae, Licininae, Pterostichinae, Scaritinae and Trechinae) were recorded from both rice agro-ecosystems.

One new species, *Brachinus paikadai* was reported from the rice agro-ecosystem of Pattambi and which differs from the closely related species *Brachinus peltastes* Andrewes 1931, in having a broad, yellow elytral apical band and first two antennomeres pale reddish yellow instead of four (Divya *et al.*, 2020). *Brachinus limbellus* Chaudoir 1876c recorded from the rice agro-ecosystem of Pattambi was synonymized with *Brachinus cinctellus* Chaudoir 1876c due to their close similarities in the external morphology irrespective of the variation in size and colour of the abdomen and the absence of spots on the antennae (Chaudoir 1876c, Divya *et al.,* 2020). Variations in size and colour of abdomen are slight variations, and spots on the antennae of *B. cinctellus* are not detectible which may be due to the decolouration over the years (Akhil *et al.,* 2020). One species, *Clivina mustela* Andrewes 1923a was recorded first time from the Indian mainland with earlier reports from Sri Lanka, China and Cambodia (Andrewes 1923a and 1929). Four species namely, *Brachinus peltastes, Clivina gamma, Loxoncus schmidti,* and *Scarites beesoni* were first reported from South India. Of these, two

species *Brachinus peltastes* and *Clivina gamma* were endemic to Indian mainland with *B. peltastes* recorded earlier from Palearctic region (Uttarakhand) (Andrewes 1931) and *C. gamma* from both Palearctic & Oriental (Uttar Pradesh and Uttarakhand) (Andrewes 1929) regions. Two species, *Archicolliuris immaculata* and *Dioryche solida* were new reports from Kerala and are endemic to Oriental region. Nine species namely, *Archicolliuris immaculata, Brachinus devagiriensis, B. paikadai, Ophoniscus puneensis, Chlaenius malachinus, Elaphropus decoratus, E. nigellus, E. nilgiricus* and *Paratachys tropicus* are endemic to the Western Ghats and Sri Lankan hotspot of biodiversity.

5.2. Ecology

5.2.1. Ambalavayal rice agro-ecosystem

Diversity and abundance of carabid beetles in the rice agro-ecosystem in Ambalavayal of Wayanad district are analyzed. Carabid species *Clivina tranquebarica* and *Paratachys impressus* dominated the light trap collections and *Elaphropus politus, Clivina tranquebarica, Apristus subtransparens* and *Stenolophus quinquepustulatus* dominated the pitfall trap collections. Subfamilies Scaritinae, Trechinae and Harpalinae dominated the light trap collections and Trechinae, Lebiinae and Scaritinae dominated the pitfall trap collections. The presence of Scaritinae and Trechinae beetles in the rice agro-ecosystem and their dominance in both light and pitfall trap collections attributed to their moisture-loving nature (specialized to survive in wet habitats) (Darlington 1971, Larochelle and Larivière 2005) and burrowing behaviour (Scaritinae) (Hogan 2012). Scaritinae beetles have several adaptations like large mandibles for crushing arthropod prey (Forsythe 1991, Geeraert 2014) and distinct body shape (head, legs

and mandibles) for burrowing (Hogan 2012, Geeraert 2014), which increase their survival ability. Trechinae species have several adaptations to survive in moist/aquatic habitats, which include air pocket on the ventral side of the elytra (for swimming) and adhesive laminae on tarsi (give adhesion on moist surfaces) (May and Kermode 1972). All the Trechinae species recorded from the Ambalavayal rice agro-ecosystem (nine species) belong to a single tribe Bembidiini. Species of the tribe Bembidiini are moisture loving, preferring to live in riparian and marsh habitats, and most of them are predators (Ortuno and Arillo 2010). Dominance of the genus *Clivina* (Scaritinae) in both the light trap and the pitfall trap is attributed to its size, aggregation, fossorial behaviour, and frequent active flight (Esau 1968, Thiele 1977, Hogan 2012, Akhil 2020, Divya 2022). Harpalinae species are moisture-loving (hygrophilous) and they normally live on the soil surface rather than on plants (Darlington 1971, Larochelle and Larivière 2005), which could be the reason for their dominance in rice agro-ecosystem that have wet (aquatic and semi-aquatic phase) conditions and very poor canopy. Subfamilies Harpalinae and Scaritinae dominated (in both species and numbers) in the present study, and similar dominance were recorded in the upland rice agro-ecosystems of North Cameroon (Woin *et al.,* 2005). Harpalinae was the most speciose (10 species) subfamily in the Ambalavayal rice agro-ecosystem, and similar results were recorded from the rice agro-ecosystems of Northern Iran (Ghahari *et al.,* 2009) and Korea (Park *et al.,* 2013).

Subfamily Brachininae was represented by three species of a single genus *Pheropsophus* (*P. indicus*, *P. lissoderus* and *P. picicollis*) in both light and pitfall traps. *Pheropsophus* beetles prefer moist areas near water bodies, wetlands and

cultivated lands due to their ectoparasitoid life stage on water beetle pupae (Wickham 1893, King 1919, Erwin 1970, Akhil 2020, Divya 2022) and their long legs (enables fast running through water) (Divya 2022), and explosive defensive mechanism (give protection from predators) (Akhil and Sabu 2019a, Divya 2022) allows them to survive in rice agro-ecosystems. In the rice agro-ecosystem, *Pheropsophus* species predate on slugs, snails and caterpillars (Kumar 1997). Among the four Licininae species recorded, three belong to the genera *Chlaenius*. *Chlaenius* species are wet and marshy loving (Meng 2011), hence they are well-adapted to survive in rice agro-ecosystem, and their capture in both light trap (three species) and pitfall trap (two species) may be associated with their fast running nature and well developed hind wings (Wrase 2012, Chanu and Swaminathan 2017).

In light trap collections, of the forty-four species recorded, two species were major, fourteen species were minor and twenty-eight species were rare. In pitfall trap collections, of the twelve species recorded, four were major and eight were minor. Single species, *Clivina tranquebarica* was found major in both light and pitfall trap collections, indicating high survival ability of Scaritinae species due to their frequent active flight, aggregation and fossorial behaviour (Thiele 1977, Hogan 2012, Akhil 2020). All the minor species in the pitfall trap collections were found as rare species in light trap collections. This result indicates that the minor species recorded in the pitfall collections have characteristics like, reduced wings or wingless, fast and active movement on soil surface and fossorial behaviour, this might lead to their capture in pitfall traps and rareness in light trap collections.

All the pitfall trapped subfamilies (Trechinae, Lebiinae, Scaritinae, Brachininae, Licininae and Harpalinae) were found as the abundant subfamilies in the light trap collections, and the least abundant subfamilies in the light trap collections (Pterostichinae, Anthiinae, Apotominae, Dryptinae and Platyninae) were not included in pitfall trap collections. This indicates that the species of the least abundant subfamilies are not well adapted to the conditions (ecological and biological) of the rice agro-ecosystem, which resulted in their least abundance (in terms of species and individuals) in light trap collections and absence in pitfall trap collections.

Rank abundance curve of carabid species in the Ambalavayal rice agro-ecosystem with light trap method showed an initial steep slope with two dominant species namely, *Clivina tranquebarica* and *Paratachys impressus*, signifies low evenness, as the dominant species have much higher abundance than the low-ranking species. Rank abundance curve of carabid species in pitfall trap collections showed an initial steep gradient with four dominant species namely, *Elaphropus politus*, *Clivina tranquebarica*, *Apristus subtransparens* and *Stenolophus quinquepustulatus,* followed by singletons, signifies low evenness, as the dominant species have much higher abundances than singletons.

Seasonality

Overall abundance of Carabidae in light trap collections showed no significant variation with seasons (pre-harvest, harvest and post-harvest stages of rice cultivation). Among the forty-four light-trapped carabid species, six species namely, *Acupalpus andrewesi, Batoscelis oblonga, Clivina brevior, C. lobata, Elaphropus nilgiricus* and *Stenolophus quinquepustulatus* were seasonal species

and the remaining thirty-eight species were aseasonal. Among the seasonal species, *Batoscelis oblonga* was present in the harvest and post-harvest stages of rice cultivation and the other five species were present in all three stages (pre-harvest, harvest and post-harvest) of rice cultivation with abundance of four species namely, *Acupalpus andrewesi, Clivina brevior, C. lobata* and *Elaphropus nilgiricus* peaked in pre-harvest stage and *Stenolophus quinquepustulatus* peaked in harvest stage. This indicates that *B. oblonga* is not adapted to the prey resources and habitat conditions available in the pre-harvest stage, whereas the four species (*Acupalpus andrewesi, Clivina brevior, C. lobata* and *Elaphropus nilgiricus*) are better adapted to the habitat conditions (wet phase) and prey resources available in the pre-harvest stage of rice cultivation and *Stenolophus quinquepustulatus* is adapted to the habitat conditions and prey resources of harvest stage. Composition in the arthropod community (pests and predators) of the rice fields depends on the different growth stages of rice crop (Heong *et al.,* 1991, Bambaradeniya and Edirisinghe 2008) and ecological phases (aquatic, semi-aquatic and dry land) of the rice field (Bambaradeniya *et al.,* 2004). Carabid beetles are the predators of many rice insect pests like aphids, fly maggots, grubs, and slugs (Bambaradeniya *et al.,* 2004) and seeds of weeds (Adhikari and Menalled 2018). Insect pest composition of rice agro-ecosystem varies according to the rice growth stages. Hence the variation in the insect pest populations may have influenced the carabid beetle composition. The dominant species in the pre-harvest stage was *Paratachys impressus* (Trechinae). Trechinae beetles are specialized to live in moist/aquatic habitats (May and Kermode 1972). Hence, the dominance of *P. impressus* in the pre-harvest stage is attributed to the favourable ecological phases (aquatic/semi-

aquatic nature) and food availability in the pre-harvest stage. Dominance of *Clivina tranquebarica* in both harvest and post-harvest stages attributed to their aggregation and fossorial behaviour (Esau 1968, Thiele 1977, Hogan 2012) and availability of food resources. *Paratachys impressus* and *Clivina tranquebarica* were the common dominant species in all three seasons, indicating their high resilience, availability of food resources and chance for r-selection strategies. Most paddy field organisms are typical r-strategists (they have a high reproductive allocation, recolonization ability, earlier maturation and adaptations to face dry conditions) (Bambaradeniya *et al.*, 2004).

Overall abundance of Carabidae in pitfall trap collections showed no significant variation with seasons (pre-harvest, harvest and post-harvest stages of rice cultivation). All the pitfall-trapped species were aseasonal. In pitfall trap collections, the least number of species were observed in pre-harvest stage (three species) while compared to harvest (seven species) and post-harvest (six species) stages. Among the three species present in the pre-harvest stage (*Pheropsophus lissoderus*, *Chlaenius hamifer* and *Clivina tranquebarica*), *P. lissoderus* and *C. hamifer* are adapted to survive in aquatic conditions. *Pheropsophus* species has long legs for fast running through water (Divya 2022), and prefer moist areas (Wickham 1893, King 1919, Erwin 1970, Akhil 2020, Divya 2022) and *Chlaenius* species are wet and marshy loving (Meng 2011). This indicates that species that have adaptations to survive on wet surfaces have a high chance of occurrence in the pre-harvest stage, where the ecological phase remains aquatic/wet.

5.2.2. Pattambi rice agro-ecosystem

Diversity and abundance of carabid beetles in the Pattambi rice agro-ecosystem of Palakkad district are analyzed. Carabid species *Clivina brevior, Stenolophus quinquepustulatus* and *Batoscelis oblonga* dominated the light trap collections and *Stenolophus quinquepustulatus, Apristus subtransparens* and *Elaphropus politus* dominated the pitfall trap collections. Subfamilies Harpalinae, Lebiinae, Scaritinae and Trechinae dominated the light trap collections and Harpalinae, Lebiinae and Trechinae dominated the pitfall trap collections. Dominant light trapped species belong to the subfamilies Harpalinae and Scaritinae. Harpalinae and Scaritinae species are moist loving (Darlington 1971, Larochelle and Larivière 2005) and are adapted to survive in wet conditions. Besides survival ability in wet conditions, species specific dominance depends on factors like feeding habits, life cycle traits and availability of food resources. Hence, a detailed study on these factors is essential to understand the dominance of individual species in the rice agro-ecosystem. Subfamily Lebiinae dominated in both light and pitfall trap collections indicates that the Lebiinae species are well adapted to survive in rice agro-ecosystems and the pitfall trapped species (*Apristus subtransparens*) are more active hence trapped in pitfall collections. Torres and Ruberson (2007) and Geeraert (2014) recorded *Apristus* species from the agricultural ecosystems and found them as seed feeders. Hence the dominance of *Apristus subtransparens* in pitfall collections of the present study may be attributed to their weed seed predatory nature, which involves active searching in rice fields that leads to their capture in pitfall traps. Lebiinae beetles have diverse biology. There are arboreal species, ground dwellers, grass climbers and xerophiles (Darlington 1971, Tamutis and Barsevskis 2014). Among the twelve

Lebiinae species recorded, seven species belongs to the tribe Odacanthini. Species of the tribe Odacanthini are wet loving, live near water bodies and also in the rice agro-ecosystem (Terada and Wu 2014). Genus *mimocolliuris* of the tribe Odacanthini was represented by a single species, *Mimocolliuris indica* in present study. *Mimocolliuris* species are adapted to survive in rice agro-ecosystems (Zhao and Tian 2010). *Ophionea indica* (Odacanthini) predate on the major rice insect pests, brown planthopper (*Nilaparvata lugens*) (Ullah and Jahan 2004) and rice gall midge (*Orseolia oryzae*) (Kobayashi *et al.,* 1995). *Ophionea* species also predate on the stem borer larvae of rice and control their population (Millsap 2017).

In light trap collections, among the sixty-six species recorded, three species were major, thirteen species were minor and fifty species were rare species. In pitfall collections, three species were major, and two were minor. Single species, *Stenolophus quinquepustulatus* (Harpalinae) was found prominent in both light and pitfall trap collections, and their dominance in both collections was attributed to their wet-loving (hygrophilous) nature (Chang-Seop and Paik 2006), which increase their survival ability in rice agro-ecosystems.

The rank abundance curve of carabid species in light trap method showed an initial steep slope with three dominant species namely, *Clivina brevior, Stenolophus quinquepustulatus* and *Batoscelis oblonga* signifies their higher abundance than the low-ranking species. Steep gradient indicates low evenness, as the dominant species have much higher abundance than the low-ranking species. Rank abundance plots of carabid species in pitfall trap collections showed an initial steep gradient with three dominant species, *Stenolophus quinquepustulatus,*

Apristus subtransparens and *Elaphropus politus* followed by singletons, indicating higher abundance of dominant species than the low-ranking species.

Seasonality

Overall abundance of Carabidae in light trap and pitfall trap collections showed no significant variation with seasons (pre-harvest, harvest and post-harvest stages of rice cultivation). Among the sixty-six light-trapped carabid species seven species namely, *Amblystomus vulneratus, Batoscelis oblonga, Chlaeminus biguttatus, Loxoncus microgonus, L. nagpurensis, Paratachys impressus* and *Stenolophus quinquepustulatus* were seasonal species and the remaining fifty-nine species were aseasonal species. Among the seasonal species, abundance of five species namely, *Amblystomus vulneratus, Batoscelis oblonga, Loxoncus microgonus, L. nagpurensis* and *Stenolophus quinquepustulatus* peaked in pre-harvest stage indicating that these species are better adapted to the habitat conditions (wet phase) and prey resources available in the pre-harvest stage of rice cultivation. High abundance of *Chlaeminus biguttatus* in the harvest stage may be attributed to the prey availability and that of *Paratachys impressus* in the post-harvest stage indicating that the species is well adapted to the dry ecological phase and prey resources available in the post-harvest stage of rice cultivation. Abundance of aseasonal species showed no significant variation with seasons. Dominant species in the pre-harvest stage was *Stenolophus quinquepustulatus.* Dominance of *S. quinquepustulatus* in pre-harvest stage may be attributed to the hygrophilous nature of Harpalinae species (Darlington 1971, Larochelle and Larivière 2005) and prey availability. *Clivina lobata* and *Clivina brevior* are the dominant species in the harvest and post-harvest stages respectively. Dominance

of the *Clivina* species is attributed to its size, aggregation and fossorial behaviour (Esau 1968, Thiele 1977, Hogan 2012, Akhil 2020, Divya 2022). *Clivina brevior* is the common dominant species in all three seasons, indicating their high resilience and availability of prey resources. *Ophionea indica* present in all three stages of rice growth with more than 5% abundance in each stage (pre-harvest- 5.54%, harvest- 14.09% and post-harvest- 8.85%) indicating the availability of their prey population in rice agro-ecosystem. *Ophionea indica* (Lebiinae) predate on major rice insect pests, brown planthopper (*Nilaparvata lugens*) (Ullah and Jahan 2004) and rice gall midge (*Orseolia oryzae*) (Kobayashi *et al.,* 1995). Hence, rice agro-ecosystem can be considered a preferred habitat for *O. indica* species.

All the pitfall trapped species are aseasonal. In pitfall traps, *Pheropsophus indicus* dominated in pre-harvest harvest stage, *Stenolophus quinquepustulatus* and *Elaphropus politus* were dominated in harvest stage and *Apristus subtransparens* dominated in post-harvest stage. *Pheropsophus* species are hygrophilous (Wickham, 1893, King 1919, Erwin 1970) and they predate on slugs, snails and caterpillars in rice agro-ecosystem (Kumar 1997).

5.2.3. Comparative analysis of Carabidae assemblages in the Ambalavayal and Pattambi rice agro-ecosystem

Eighty one species of Carabidae belonging to thirteen subfamilies, nineteen tribes and forty-eight genera were recorded from both rice agro-ecosystems. This result indicates that rice agro-ecosystems harbour a rich fauna of Carabid beetles. Similarly, Ghahari *et al.,* (2009) recorded twenty-seven carabid species from the rice agro-ecosystems of Northern Iran, Park *et al.,* (2013) recorded twenty-nine

species from the rice agro-ecosystems of Korea, Jadhao and Bhongade (2018) recorded seventeen species from the rice fields of Maharashtra during Kharif seasons and Divya (2022) recorded sixty-six species from the rice agro-ecosystems of Palakkad Gap. Factors affecting the composition of Carabid beetles in agro-ecosystem are, abiotic environmental factors (pH, humidity, organic matter content) (Lövei and Sunderland, 1996, Do *et al.*, 2012, Gasparic *et al.*, 2016, Rocca *et al.*, 2021), agricultural practices (tillage, crop type, crop rotation harvest) (Lemic *et al.*, 2017, Adhikari and Menalled 2018), agrochemicals (insecticides, herbicides, fungicides and synthetic fertilizers) (Heij and Willenborg 2020, Kolarik *et al.*, 2014), vegetative community, prey availability (Rondon *et al.*, 2013), weed and weed seed abundance (Heij and Willenborg 2020, Honek *et al.*, 2003, Kulkarni *et al.*, 2015), boundary habitats and adjacent environments (Jowett *et al.*, 2019), width and hedgerows of rice field margins (Ghahari *et al.*, 2009, Cardarelli and Bogliani 2014, Rocca *et al.*, 2021), vegetation cover (Do *et al.*, 2012), soil texture (Goulet 2003, Boivin and Hance 2003), soil moisture (Descender *et al.*, 1984, Amri *et al.*, 2019), geographic location, altitude (Avgin and Luff 2009) and landscape features (Ghahari *et al.*, 2009, Lemic *et al.*, 2017). Composition of arthropod community in the rice fields varies according to the growth stages of rice crop (Heong *et al.*, 1991, Bambaradeniya and Edirisinghe 2008) and ecological phases (aquatic, semi-aquatic and dry land) of the rice field (Bambaradeniya *et al.*, 2004).

In light trap collections subfamilies Scaritinae, Trechinae and Harpalinae dominated in Ambalavayal rice agro-ecosystem and Harpalinae, Lebiinae, Scaritinae and Trechinae dominated in Pattambi rice agro-ecosystem. The

dominance of Scaritinae, Trechinae and Harpalinae in both rice agro-ecosystems could be attributed to their moisture-loving nature and specialization to survive in wet habitats (Darlington 1971, May and Kermode 1972, Larochelle and Larivière 2005) along with prey availability. Hence the dominance of these subfamilies throughout the rice growth stages amidst changing conditions of the rice agro-ecosystem (ecological phases, plant growth and pest population) reflects their specialized adaptations for rapid colonization and utilization of available niches. Harpalinae was the most speciose subfamily in both rice agro-ecosystems [Ambalavayal (10 species) and Pattambi (17 species)] with representatives of two tribes, Harpalini and Stenolophini- and similar species richness was observed in the rice agro-ecosystems of Northern Iran (Ghahari *et al.,* 2009) and Korea (Park *et al.,* 2013), indicates that rice agro-ecosystem provide suitable ecological and biological conditions for Harpalinae species which leads to their dominance in rice agro-ecosystems. Harpalini species normally live on the ground in open habitat and some smaller species inhabit especially in wet places (Darlington 1971). Subfamilies Apotominae, Dryptinae and Platyninae in Ambalavayal rice agro-ecosystem, and Apotominae, Panagaeinae and Siagoninae in Pattambi rice agro-ecosystem were found as least dominant subfamilies in terms of species number and individuals (each subfamilies with one species), indicates that the rice agro-ecosystem does not provide suitable conditions for the survival of these subfamilies.

In pitfall trap collections, Brachininae and Licininae were the most speciose subfamilies in Ambalavayal rice agro-ecosystem (three species each) and Brachininae was the most speciose subfamily in Pattambi rice agro-ecosystem

(two species). Subfamily Brachininae was represented by *Pheropsophus* species and *Licininae* was represented by *Chlaenius* species. *Pheropsophus* beetles prefer moist areas near water bodies, wetlands and cultivated lands (Wickham 1893, King 1919, Erwin 1970, Akhil 2020, Divya 2022) and their long legs (enables fast running through water) (Divya 2022), and explosive defensive mechanism (give protection from predators) (Akhil and Sabu, 2019a, Divya 2022) allows them to survive in rice agro-ecosystems. In the rice agro-ecosystem, *Pheropsophus* species predate on slugs, snails and caterpillars (Kumar 1997). *Chlaenius* species are wet and marshy loving (Meng 2011). Hence they are well-adapted to survive in rice agro-ecosystem, and their capture in pitfall trap may be associated with their fast running nature (Wrase 2012, Chanu and Swaminathan 2017).

In light-trapped species, *Clivina tranquebarica* and *Paratachys impressus* dominated in Ambalavayal rice agro-ecosystem and *Clivina brevior*, *Stenolophus quinquepustulatus* and *Batoscelis oblonga* dominated in Pattambi rice agro-ecosystem. Dominant species in both rice agro-ecosystems are different, but they belong to the dominant subfamilies Scaritinae, Trechinae and Harpalinae, which are adapted to survive in the rice agro-ecosystem due to their moisture-loving nature. Variation in the dominant species in both rice agro-ecosystems mainly attributed to landscape characteristics since both the rice agro-ecosystems have different landscape features. Landscape features can influence agro-ecosystem's pest and predator populations (Ali *et al.,* 2020) and have a major effect on the carabid population (Ghahari *et al.,* 2009, Lemic *et al.,* 2017). Besides these, the factors which influence the carabid beetle compositions are abiotic environmental factors (pH, humidity, organic matter content) (Rocca *et al.,* 2021, Do *et al.,* 2012,

Lövei and Sunderland, 1996, Gašparić *et al.,* 2016), agrochemicals (insecticides, herbicides, fungicides and synthetic fertilizers) (Heij and Willenborg 2020, Kolarik *et al.,* 2014), vegetative community, prey availability (Rondon *et al.,* 2013), weed and weed seed abundance (Heij and Willenborg 2020, Honek *et al.,* 2003, Kulkarni *et al.,* 2015), boundary habitats and adjacent environments (Jowett *et al.,* 2019), width and hedgerows of rice field margins (Ghahari *et al.,* 2008, Rocca *et al.,* 2021, Cardarelli and Bogliani 2014), vegetation cover (Do *et al.,* 2012), soil texture (Goulet 2003, Boivin and Hance 2003), soil moisture (Descender *et al.,* 1984, Amri *et al.,* 2019), geographic location, altitude (Avgin and Luff 2009). Hence it is clear that the above mentioned factors influence the carabid beetle composition, which resulted in the variation of species composition between two rice agro-ecosystems.

In Ambalavayal rice agro-ecosystem, *Elaphropus politus* and *Clivina tranquebarica* dominated in pitfall trap collections. In Pattambi rice agro-ecosystem *Stenolophus quinquepustulatus*, *Apristus subtransparens* and *Elaphropus politus* dominated in pitfall trap collections. *Elaphropus politus* were common dominant pitfall trapped species in both rice agro-ecosystems, and the reasons could be their smaller size (Andrewes 1929, Darlington, 1971, Divya 2022), availability of prey resources and favourable habitat conditions. In both rice agro-ecosystems, the least number of species were observed in pre-harvest stage while compared to harvest and post-harvest stages in pitfall trap collections, indicating that only the species that have adaptations to survive in wet surfaces have a high chance for occurrence in the pre-harvest stage, where the ecological phase remains aquatic/wet.

Overall abundance of Carabidae in the light trap and pitfall trap collections showed no significant variation with seasons (pre-harvest, harvest and post-harvest stages of rice cultivation) in both rice agro-ecosystems. Seasonal variation in species specific abundance depends on ecological phases of rice agro-ecosystem, life cycle traits of species, feeding behaviour, prey availability, competition and resilience. In both rice agro-ecosystems dominant species in each season are shown to be different irrespective of their subfamilies (because in both agro-ecosystems dominant species belongs to the subfamilies Scaritinae Trechinae and Harpalinae), indicates that variability in the dominant species could be due to the species-specific food availability and habitat conditions of the rice agro-ecosystem. Detailed study on the biology of dominant species is essential to find out the exact reason for their dominance.

Chapter 6

CONCLUSIONS

6. Conclusion

6.1. Taxonomy

- Eighty-one carabid species were listed out from the rice agro-ecosystems of Ambalavayal (forty-four species) and Pattambi (sixty-six species) and were added to the national insect collections of Zoological Survey of India, Kozhikode (ZSIK).
- A checklist and taxonomic keys to the carabid species recorded from the rice agro-ecosystems of Ambalavayal and Pattambi are provided.
- One new species, *Brachinus paikadai* Divya, Ashly and Sabu 2020 was described from the Pattambi rice agro-ecosystem.
- *Brachinus limbellus* Chaudoir 1876 was synonymized with *Brachinus cinctellus* Chaudoir 1876.
- *Clivina mustela* Andrewes 1923 was recorded for the first time from the Indian mainland.
- Four species namely, *Brachinus peltastes, Clivina gamma, Loxoncus schmidti* and *Scarites beesoni* were first reported from South India.
- Two species, *Archicolliuris immaculata* and *Dioryche solida* were new reports from Kerala.
- Nine species namely, *Archicolliuris immaculata, Brachinus devagiriensis, B. paikadai, Ophoniscus puneensis, Chlaenius malachinus, Elaphropus decoratus, E. nigellus, E. nilgiricus* and *Paratachys tropicus* are endemic to the Western Ghats and Sri Lankan hotspot of biodiversity.

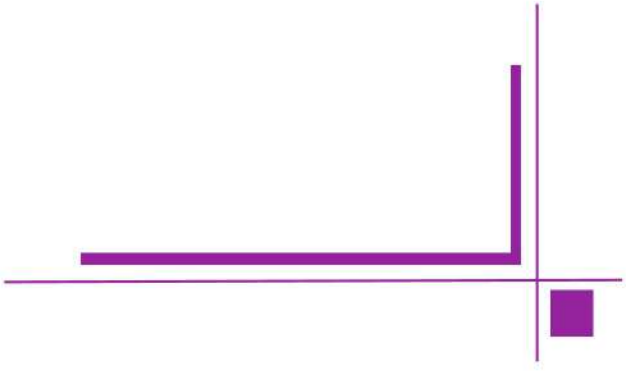
6.2. Ecology

- Eighty-one species of Carabidae were recorded from both rice agro-ecosystems, indicating rich fauna of Carabid beetles in rice agro-ecosystems.
- *Clivina tranquebarica* and *Paratachys impressus* were the dominant light-trapped species in Ambalavayal rice agro-ecosystem and *Clivina brevior*, *Stenolophus quinquepustulatus* and *Batoscelis oblonga* were the dominant light-trapped species in Pattambi rice agro-ecosystem.
- *Elaphropus politus* and *Clivina tranquebarica* were the dominant pitfall-trapped species in Ambalavayal rice agro-ecosystem and *Stenolophus quinquepustulatus*, *Apristus subtransparens* and *Elaphropus politus* were the dominant pitfall-trapped species in Pattambi rice agro-ecosystem.
- Subfamily wise abundance of Carabidae with light trap method in Ambalavayal rice agro-ecosystem was in the order of Scaritinae (35.79%)> Trechinae (34.11%)> Harpalinae (24.24%)> Lebiinae (3.36%)> Brachininae (1.03%)> Licininae (0.74%)> Pterostichinae (0.37%)> Anthiinae (0.09%)= Apotominae (0.09%)= Dryptinae (0.09%)= Platyninae (0.09%), and that of Pattambi rice agro-ecosystem was Harpalinae (25.76%)> Lebiinae (18.18%)> Scaritinae (16.67%)> Trechinae (13.64%)> Brachininae (7.58%)> Dryptinae (6.06%)> Pterostichinae (4.55%)> Licininae (3.03%)> Apotominae (1.52%)= Panagaeinae (1.52%)= Siagoninae (1.52%).

- Subfamily wise abundance of Carabidae with pitfall trap method in Ambalavayal rice agro-ecosystem was in the order of Trechinae (26.08%)> Lebiinae (17.39%) = Scaritinae (17.39%)> Brachininae (13.05%)= Licininae (13.05%)> Harpalinae (13.04%), and that of Pattambi rice agro-ecosystem was Harpalinae (35.71%)> Lebiinae (28.57%)> Trechinae (21.43%)> Brachininae (14.29%).
- Dominance of same subfamilies, Scaritinae, Trechinae and Harpalinae in both rice agro-ecosystems could be attributed to their moisture-loving nature, specialization to survive in wet habitats, prey availability, adaptations for rapid colonization and utilisation of available niches.
- Subfamilies Apotominae, Dryptinae, Platyninae, Panagaeinae and Siagoninae found as least dominant subfamilies (in terms of species number and individuals), indicating that they are not adapted to the habitat conditions of rice agro-ecosystem.
- Overall abundance of Carabidae in light trap and pitfall trap collections showed no significant variation with seasons (pre-harvest, harvest and post-harvest stages of rice cultivation) in both the rice agro-ecosystems.
- Variation in the dominant species in the rice agro-ecosystems with different landscape features indicates that landscape features influence the composition of ground beetles.

Chapter 7

RECOMMENDATIONS



7. Recommendations

- Present study recorded eighty one species of Carabidae from the rice agro-ecosystems, indicating the presence of rich fauna of Carabid beetles in rice agro-ecosystems.
- Since carabid beetles act as insect and weed seed predators in the rice agro-ecosystem, more studies have to be concentrated on predatory behaviour of carabid beetles (prey resources, prey specificity, prey-searching method, competition, categorization in to stem borers, leaf folders, root borers etc.) to implement biological control of pests (Integrated Pest Management) using Carabidae.
- Detailed studies on the biology of prominent carabid beetle species (reproduction, larval development, feeding behaviour, longevity) in the rice agro-ecosystem is needed.
- Present study is conducted in the conventional rice agro-ecosystems. Further comparative studies on the diversity of carabid beetles between organic and conventional rice agro-ecosystems is suggested to analyze the effect of pesticides and herbicides on carabid beetle composition.
- Present study analyzes the carabid beetle fauna of rice agro-ecosystems. Study on the carabid beetle fauna of different agricultural ecosystems is suggested which will help to implement IPM using Carabidae in different crop fields.
- Present study analyzes variations of carabid beetle composition at different growth stages of rice plants (pre-harvest, harvest and post-harvest). Further

studies on carabid beetle composition at different climatic seasons (summer, pre-monsoon and monsoon) in the rice agro-ecosystem must be analyzed and more studies have to be conducted to analyze the effect of other factors like temperature, pH, humidity, rainfall, soil moisture and percentage of vegetation cover on carabid beetle assemblage.

- Effect on agricultural practices (tillage, fragmentation, crop rotation, rearrangement of field margins) on carabid beetle composition should be analyzed.
- Present study is conducted in cultivated rice fields. Comparative study on carabid beetle composition of cultivated and abandoned rice fields is suggested since abandoned rice fields have more vegetative structure compared to cultivated rice fields.
- Some carabid beetles act as weed seed predators in agro-ecosystems, hence along with controlling weed seeds, studies have to be carried out to check whether they are causing any damage to the rice.
- As ground beetles are predators of insect pests, practices for increasing the population densities of predatory carabid beetles in the agro-ecosystems must be found and implemented.

Chapter 8

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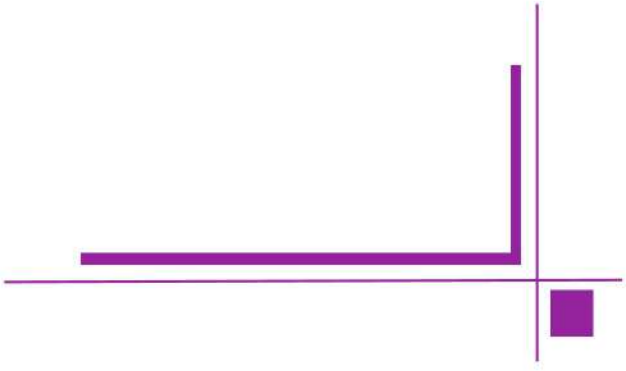

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THE INDIAN PLATYNINAE - A CHECKLIST (COLEOPTERA: CARABIDAE)#

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ABSTRACT

An updated checklist of 188 species of the Platyninae (with 139 species under Platynini and 49 species under Sphodrini) known in the Indian subcontinent, along with details of the revisions, literature, and distribution patterns is provided. One hundred twenty-five species of these occur only in the Indian landmass, with 89 in the Platynini and 36 in the Sphodrini. Of the 125 Indian species, 94 occur within the Palaearctic region in India, 22 in the Oriental, and five in both Oriental and Palaearctic regions. Among the 125 Indian species, 111 are endemic to three global hotspots of biodiversity in the Indian subcontinent: (i) 96 endemic to the Himalaya, (ii) eight to the Western Ghats and Sri Lanka, and (iii) seven to the Indo-Burma hotspot of biodiversity. Five genera are endemic to the Indian mainland, and 10 genera to the Himalaya hotspot of biodiversity.

Key words: Carabidae, Platynini, Sphodrini, India, checklist, Atranopsina, Calathina, Dolichina, Pristosiina, Synuchina, distribution endemism, Himalaya, Western Ghats, Indo-Burma hotspot, Oriental, Palaearctic

The Carabidae (ground beetles) is one of the most speciose of beetle families that includes 39,358 extant taxa. The Platyninae is speciose that includes more than 3,900 species under the Omphreini, Platynini, and Sphodrini (Lorenz 2005, 2021). The Platyninae in India and Sri Lanka are represented by 188 species belonging to Platynini and Sphodrini. The Platynini is more diverse in tropical than in temperate regions (Bousquet 2012, Fedorenko 2011, 2015) and less understood due to limited revisionary works (Fedorenko 2015). The Sphodrini is principally distributed in temperate regions (Casale 1988, Ruiz et al., 2009). Of the 188 Platyninae species known from India, 68 were reported by Andrewes (1930-1937) with 49 from the Palaearctic Himalaya, 14 from the non-Himalayan Oriental, and five from both Himalayan and non-Himalayan regions. The present checklist updates the Indian taxa of the Platyninae with all the nomenclatural changes and revisions after 1929, supplemented with details of distribution patterns and pertienent references.

Distribution data for each species were collected by verifying records and descriptions of the Indian taxa determined between 1758 and 1929 from the *Catalogue of Indian Carabidae* (Andrewes 1930). Subsequent species additions and revisions were collected by tracing the references of species in Lorenz (2005), Löbl & Löbl (2017), Lorenz (2021) and from the *Carabidae of the World* website (Anichtchenko et al., 2021). In this article, we treat *Colpodes* following Liebherr (1998) as a taxon that includes three Javanese species and the non-Javanese species as species of *Platynus* and not as two genera, *sensu* Lorenz (2005, 2021). Data for the four Platynini taxa were collected by examining insect collections available at St. Joseph's College, Kozhikode (11°25'N, 75°77'E) and at various museums of the Zoological Survey of India. Specimens collected and verified by the authors (marked *) are deposited in the national insect collections of Zoological Survey of India Western Ghats Regional Centre, Kozhikode (ZSIK). Locality details of 184 species of Indian landmass from the descriptions and records are supplied. Species from the upper Himalaya (500 amsl and above) are recognized as the Palaearctic species of the Indian subcontinent (PAR - India), and the others as the Oriental species of the Indian subcontinent (ORR - India). Species from ORR and PAR in the upper ranges of the Himalaya of the Indian subcontinent have been categorized as ORR - India/PAR - India. Four species with no locality details in the descriptions are indicated 'India'.

The following are the symbols and abbreviations used: = Synonym; † Untraceable references and full paper not in hand; # Reference which led to the synonymy; AUR Australian Region; NAR Nearctic Region; ORR Oriental Region; PAR Palaearctic Region; ssp. Subspecies

#Invited Review: Courtesy Review Editor– Dr. A. Anantanaryanan Raman, CSIRO, Australia.

Checklist of species

A. Platynini Bonelli 1810

Platynina (*sensu stricto*)

1. *Agonidium* Jeannel 1948

Type species. *Megalonychus madagascariensis* Chaudoir 1843.

Agonidium Jeannel 1948: 523, Liebherr & Schmidt 2004: 151, 153.

***Agonidium birmanicum* (Bates 1892)**

Megalonychus birmanicus Bates 1892: 369, Andrewes, 1930a: 211.

Agonidium birmanicum (Bates 1892), Liebherr & Schmidt 2004: 151, Lorenz 2005: 407.

ORR - India. Assam (26°20'N, 92°937'E): Noa Dehing, Naga Hills; Meghalaya (25°57'N, 91°36'E): Khasi Hills; New Delhi (28°36'N, 77°12'E): Pusa; Uttar Pradesh (26°84'N, 80°94'E): Saharanpur; West Bengal (22°98'N, 87°85'E): Gopaldhara; PAR - India. Uttarakhand (30°06'N, 79°01'E): Dehra Dun. Also known in the Lao People's Democratic Republic, Myanmar and North Korea.

***Agonidium cyanipenne* (Bates 1892)**

Megalonychus cyanipennis Bates 1892: 370, Andrewes 1930a: 211.

Agonidium cyanipenne (Bates 1892): Liebherr & Schmidt 2004: 151, Lorenz 2005: 407.

ORR - India. Assam: Noa Dehing; Meghalaya: Khasi Hills: PAR - India. Sikkim (27°53'N, 88°51'E): Tista Bridge.

2. *Agonum* Bonelli 1810

Type species. *Carabus marginatus* Linnaeus 1758.

Agonum Bonelli 1810: Tabula synoptica, Casey 1920: 98, Liebherr 1994: 2, Liebherr & Schmidt 2004: 151, Lorenz 2005: 407, Löbl & Löbl 2017: 642.

=*Agonops* Bousquet 2002: 5, #Liebherr & Schmidt 2004: 151, =*Amolyntus* Gistel 1848: viii [Homonym], =*Megalonychus* Chaudoir 1843: 418, Liebherr & Schmidt 2004: 151#.

***Agonum (incertae) abnormale* Jedlička 1960**

Agonum abnormale Jedlička 1960: 593, Lorenz 2005: 412, Löbl & Löbl 2017: 649.

PAR - India. Jammu & Kashmir (33°27'N, 75°34'E): Pahalgam.

Remarks: Endemic to the Himalaya hotspot of biodiversity.

***Agonum (Agonum) chinense* (Boheman 1858)**

Anchomenus chinensis Boheman 1858: 15, Bates 1891b: 335, Andrewes 1924a: 49, Andrewes 1930a: 24.

Agonum chinense (Boheman 1858): Liebherr & Schmidt 2004: 202, Lorenz 2005: 409, Schmidt 2008: 200, Löbl & Löbl 2017: 643.

=*Agonocyrtes orbicollis* Motschulsky 1865: 323 [Homonym], =*Agonum javanense* Louwerens 1955: 54, =*Agonum sinensis* Csiki 1931: 868 [Replaced Name], =*Anchomenus indicus* Andrewes 1922a: 165, =*Anchomenus irideus* Bates 1873b: 329, Bates 1891b: 335, =*Platynus hasegawai* Habu 1975: 65.

ORR - India. Karnataka (15°31'N, 75°71'E): Belgaum; Madhya Pradesh (22°97'N, 78°65'E): South Mandla, Motinala, Khawasa, Mhow, Seoni; Chota Nagpur (Tetara); Maharashtra (19°75'N, 75°71'E): Bhiwapur; Sri Lanka. Also known in Indonesia, Singapore, Vietnam; PAR - China, Japan and Taiwan.

Remarks: Only species of *Agonum* reported in south India.

***Agonum (incertae) comatum* (Andrewes 1923)**

Anchomenus comatus Andrewes 1923b: 219, Andrewes 1930a: 24.

Agonum comatum (Andrewes 1923): Löbl & Smetana 2003: 454, Lorenz 2005: 412, Löbl & Löbl 2017: 649.

ORR - India. Assam: Kobo; Bank of Dihong below Pasighat; Eastern Duars. Also known in Vietnam; PAR - India. Uttarakhand: Kumaon, Almora, Tanakpur, Ranikhet, Dehra Dun.

***Agonum euroum* (Andrewes 1924)**

Anchomenus eurous Andrewes 1924a: 105, Andrewes 1926a: 69, Andrewes 1930a: 24.

Agonum euroum (Andrewes 1924): Lorenz 2005: 412.

=*Colpodes eurous* Löbl & Löbl 2017: 654.

PAR - India. Himachal Pradesh (31°10'N, 77°17'E): Spiti, Kulu; Uttarakhand: Kumaon, West Almora, Dehra Dun, Mundali, Gori Valley and Gorge, Girgaon path to Munsyari, Sunderdhunga Valley, Kali Valley.

Remarks: Endemic to the Himalaya hotspot of biodiversity.

***Agonum (Agonum) illocatum* (Walker 1858)**

Argutor degener Walker 1858: 204, Bates 1886: 146, Andrewes 1919b: 189 (*Anchomenus*), Andrewes 1930a: 24.

Agonum illocatum (Walker 1858): Andrewes 1930a: 24.

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A new bombardier beetle species of the genus *Brachinus* (Coleoptera: Carabidae: Brachininae) from the Western Ghats in south west India with a new synonymy

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ABSTRACT

Description of a new bombardier beetle species, *Brachinus paikadai* **sp. nov**., first report of *B. peltastes* Andrewes, 1931 from south India and outside the type locality in Himalaya and synonymisation of *B. cinctellus* Chaudoir, 1876 with *B. limbellus* Chaudoir, 1876 are provided.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:93B7754A-8088-4631-AACD-AA55D48DFED9

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Introduction

Subfamily Brachininae (Bombardier beetles) is represented by sixty-three species belonging to five genera, *Brachinus* Weber, 1801; *Crepidogaster* Boheman, 1848; *Mastax* Fischer von Waldheim, 1828; *Pheropsophus* Solier, 1833 and *Styphlomerus* Chaudoir, 1876 under two tribes, Crepidogastrini Jeannel, 1949 and Brachinini Bonelli, 1810 in India. Twenty-six species of genus *Brachinus* are known from India (Akhil et al. 2020). Present study reports a new species, *Brachinus paikadai* **sp. nov**., first report from south India and outside the type locality in Himalaya with additional information on *B. peltastes* Andrewes, 1931 from the Palakkad Gap of the Western Ghats and Sri Lanka hotspot of Biodiversity in south west India and synonymisation of *B. cinctellus* Chaudoir, 1876 with *B. limbellus* Chaudoir, 1876.

Material and methods

Specimens were collected with light trap from different sites in the Palakkad Gap of the Western Ghats (Chulanur, 10° 48′ 0.36″ N 76° 38′ 20.76″ E; Malampuzha, 10° 49′ 6.96″ N 76° 39′ 53.244″ E; Pattambi, 10° 48′ 17.424″ N 76° 11′ 12.444″ E and Pudussery, 10° 48′ 0.36″ N 76° 38′ 20.76″ E) in south west India (Fig. 1). Identification up to species level was done using Akhil et al.

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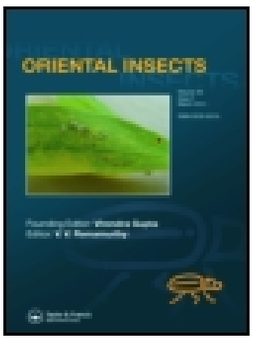

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