ANIMAL TAXONOMY SUMMIT 2023

1-3 July, 2023

Book of Abstracts

ZOOLOGICAL SURVEY OF INDIA

Ministry of Environment, Forest and Climate Change
Government of India

सत्यमेव जयते

ANIMAL TAXONOMY SUMMIT 2023

1-3 July, 2023

Commemorating 108th Foundation Day of ZSI

BOOK OF ABSTRACTS

Zoological Survey of India

Book of Abstracts

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ANIMAL TAXONOMY SUMMIT 2023

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पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय

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FOREWORD

Since the past 267 years, about 1.25 million species are described as a result of taxonomic investigation. But there are still 86% of all plants and animals on terrestrial species and 91% of from Marine species seas have yet to be named, categorized and catalogued in publications. Taking an account based on the average rate of describing new species from past decades, some studies assumed that describing all remaining species on earth could require 13 centuries of work by more than 3,00,000 taxonomists required. Indian subcontinent situated north of the equator with diversified climatic conditions, represents Palearctic and Indo-Malayan Realms, five biomes such as Tropical Humid Forests, Tropical Dry or Deciduous Forests, Warm deserts and semi-deserts, Coniferous forests and Alpine meadow, 10 biogeographic zones viz. Trans-Himalayas, Himalayas, Desert, Semi-arid, Western Ghats, Deccan Peninsula, Gangetic plain, North-east India, Islands, and Coasts with 27 Biogeographic Provinces and Eastern Himalayas, Western Himalayas, Western Ghats, and Andaman and Nicobar Islands Biodiversity hotspots.

The Zoological Survey of India (ZSI) was established on 1st July, 1916 with 10 primary objectives and 7 secondary objectives and one of pioneer institutes in India to develop Taxonomy in the country. The institute mainly focus on exploration, survey, inventorying and monitoring of faunal diversity in various states, periodic review of the status of threatened and endemic species, ecosystems and protected areas of India, bio-ecological studies, and training, faunal identification, advisory services for forest department and maintenance and development of National Zoological Collection.

The overwhelming response received from both national and international Zoological fraternity gives me immense pleasure and confidence to achieve the purpose of 'Animal Taxonomy Summit' in commemoration with 108th foundation Day of Zoological Survey of India. More than 165 national and international delegates have registered for the symposium. There are about 12 eminent invited speakers who will be delivering talks on different aspects of animal taxonomy, biodiversity conservation and biogeography. I believe, the outcome of this three days' summit will establish progressive collaboration with all the stakeholders and policy makers to secure the holistic approach on documentation, conservation and sustainable use of faunal resources and update our knowledge on the current trends of research in animal taxonomy. I welcome all the participants in Kolkata, the City of Joy and convey my best wishes for their active participation in making the event a grand success.

Dr. Dhriti Banerjee
Director

Date : 16.06.2023

प्राणि विज्ञान भवन, 535, एम. ब्लॉक, न्यू अलीपुर, कोलकाता - 700053, दूरभाष: +91332400 6893, टेलीफैक्स: +913324008595
Prani Vigyan Bhawan, 535, M-Block, New Alipore, Kolkata-700 053, Phone: +91 33 2400 6893, Telefax: +91 33 2400 8595
E-mail: director@zsi.gov.in, dhritibanerjee@gmail.com, Website: zsi.gov.in

INVITED SPEAKERS

Contribution of a century old institute of taxonomy in progress of Zoology in India

Ashis Kumar Hazra

Zoological Survey of India, M block, New Alipore, Kolkata-700053, India

Abstract

Zoology is known since 1659 in India and Sri Lanka. The animal collections of the Asiatic Society of Bengal has an immense role on the development of the subject in India. The nineteenth century comprise the lasting contributions of outstanding workers in the field - the major land mark of Zoology in India. All the collections of animals of Asiatic Society were handed over to the Indian Museum in 1875. An untiring efforts of T. N. Annandale the Zoological section of the museum steadily expanded and the Government of India accepted the needs of Zoology in the country as a result on 1st July, 1916 the Zoological Survey of India was established. Basically an official recognition of practical value of pure zoology vis-a vis taxonomy. The 'Ology' courses like protozoology, entomology, ichthyology, parasitology are the traditional area of zoology expanded rapidly and introduced in the university curriculum. To know the Indian fauna from protozoa to Mammalia the survey created different scientific sections with specialist scientists for each group. Demand of identification of faunal resources from various state agriculture departments, medical institutes and universities were increased many folds. Sixteen regional centers throughout the country and twenty-nine scientific sections in Headquarters are now functioning. In the middle of the last century came the discovery of the structure of DNA, then the genetic code itself, the machinery of genetics transcription, translation etc. The present trends when everyone has become a molecular biologist, who is going to be able to tell them which species they are studying?! All these aspects have been discussed.

Enhancing Taxonomic Expertise and Explorations in India: Insights from Coleopteran Studies

Sabu K. Thomas
University of Calicut, Kerala, India
(Email: sabukthomas@gmail.com)

Abstract

Identifying faunal groups, especially insects, in natural habitats and agricultural lands is challenging and relies on taxonomic expertise. The introduction of new cultivars, high-yielding plant varieties, and imported crops brings along new faunal groups, including pests and beneficial organisms. Differentiating between diverse insect groups and identifying pests from beneficial species requires specialized knowledge from taxonomic specialists. It is crucial to acknowledge the importance of taxonomy and the need to prevent a decline in taxonomic professionals and a waning interest in taxonomy as a career among younger generations.

To illustrate the importance of taxonomy and its contribution to human welfare, three recent studies on Indian coleopteran taxonomy are cited. These studies provide valuable insights into the significance of taxonomy in understanding and addressing issues relevant to human well-being. Luprops tristis, a harmless detritivore beetle from the Tenebrionid family, has become a notorious pest due to its massive home invasions in regions with deciduous trees, especially in the rubber plantation belts of southern India. This beetle remained unidentified in India for many decades, without information on its taxonomy, distribution, or habitat preferences. Its population buildup in litter habitats went unnoticed and spread across the region. Recent studies on its taxonomy and geographical distribution patterns shed light on its ecology and biology, allowing the development of control measures. Monitoring its spread in new rubber plantation belts in northeastern India, necessitates the involvement of taxonomists.

Another example involves predatory Carabidae beetles, effective natural enemies of pests. Their diverse hunting strategies make them valuable in controlling pest populations in different habitats. However, due to the lack of taxonomic literature and expertise, their potential in integrated pest management programs remains untapped. Recent surveys and identification efforts have revealed the presence of numerous Carabidae species in local paddy ecosystems. Farmers can leverage their potential to balance pests and beneficial organisms in their fields by promoting the conservation and enhancement of Carabidae populations through sustainable farming practices.

Dung beetles, widely distributed and essential for soil health, play a crucial role as soil-dwelling insects that rely on mammalian dung. Their community structure and the essential ecosystem services they provide as soil bioturbators, seed dispersers, and dung mixers, have gained global recognition. Despite their well-established taxonomy, the economic importance and positive impacts of Indian dung beetles on human welfare are often overlooked due to limited taxonomic resources. Increasing the number of taxonomists will assist ecologists in identifying the extensive collections of dung beetles and raise awareness about their significance.

Biodiversity conservation strategies: A perspective from long-term research on the Indian macaques

Mewa Singh
University of Mysore, India

Abstract

India is a mega biodiversity country and harbours a large number of species of flora and fauna, many of them being endemic to the region. However, due to increasing demands on the natural resources and shrinking of habitats, many species of wild animals are threatened. There are generally two kinds of species: one that is usually a forest dweller, and the other that also shares habitats and sometimes resources with humans. Both need different conservation strategies. To illustrate this, I will talk about the lion-tailed macaque, a typical forest dweller, and the bonnet macaque, a species largely commensal with humans. The lion-tailed macaques are frugivorous and insectivorous. As a result, they are obligatory rainforest dwellers. Due to late reproductive onset, and long inter-birth intervals, the population turnover is low. These monkeys are now found primarily in fragmented habitats in the Western Ghats. Their conservation requires management at the behavioural, demographic, parasitic, physiological and genetic levels in these forest fragments. Identification of viable habitats, linking tree canopies to provide pathways for this arboreal species, and establishment of corridors linking the rainforest fragments are the primary management strategies. The bonnet macaques, a largely commensal species, are also facing threats due to several reasons. Their habitat in southern India is being invaded by the bigger and more aggressive rhesus macaques from the northern India shrinking the bonnet macaque habitats. They have disappeared from most temples and tourist places in the last four decades or so. One of their preferred habitats has been roadsides with abundant *Ficus* tress along crop lands. Our systematic records kept over a period of 30 years on large stretches of the roadside habitats have shown that the population has declined by 80% during this period. This seemingly a common macaque species is also actually facing survival threats. Their numbers have been observed to remain stable only in a few places with scrub forests and places of Hindu worship where these monkeys can be conserved for long periods of time. The strategy for such commensal species therefore is to identify these remaining habitats and declare them as monkey reserves. The two approaches may also be generalized with suitable modifications for the management of other such species which are forest dweller or commensal.

Parlance of Insect Systematics: From Classical to Molecular- The Journey has been long

Jagbir Singh Kirti

Department of Zoology & Environmental Sciences, Punjabi University, Patiala-147002, India

(Email: prjagbir2005@gmail.com)

Abstract

Taxonomy has its hey-days during the 17th, 18th, and 19th century, and then the downfall began and is still continuing. Nowdays, Scientists are opting for new and modern disciplines of biological sciences and in taxonomy everybody is interested in molecular aspects. Very few field biologists/taxonomists are left active in India. Taxonomy is time consuming and in the hands of few persons. Very few insect taxonomists are there working on Lepidoptera/Orthoptera/Odonata/Hymenoptera/Diptera and few other insect groups in India.

Aristotle (384-322 B.C.) made the beginning of taxonomy with his excellent studies on comparative anatomy, embryology, habit and ecology and emphasized that animals can be classified according to their way of living, habits and body parts. The identification keys used in taxonomy today is the reflection of the same. Later on, in the 18th century, Linnaeus and his followers brought taxonomy to the next level. The greatest contribution of Linnaeus was his publication "Systema Naturae" in 1758 in which he gave binomial (now binominal) nomenclature. Due to this contribution, he is called the "father of taxonomy".

The greatest development of modern taxonomy started around 1930s. It was Mayr in 1942 who considered species as "groups of interbreeding natural populations" and this become concept for polytypic species. The publication of a book entitled "New Systematics" became a landmark in the history of taxonomy. The taxonomists realized the importance of moving from museum to the field to add more to classical taxonomy of few characters and considered new taxonomic attributes like ecological, cyto-taxonomical, behavioural, ethological, embryological, physiological, and molecular ones. Thus, taxonomy got a new label "Biological Taxonomy" in its true sense. Morphological characteristics are still the best and can't be replaced by molecular and other modern taxonomic attributes in millions of species but at the same time we cannot depend only on morphological characteristics. The help of new taxonomic attributes is essential to solve the problems of species complexes/sibling or cryptic species, biotypes, etc.

Molecular taxonomy is one of the best tool to solve such cases of confusion where morphological characters alone are not sufficient identify various taxa. It has great potential to open up new vistas of taxonomic implications. A large number of molecular techniques have been introduced since early days of serology and electrophoresis. The researchers make use of proteins, nuclear DNA, protein, mitochondrial DNA, ribosomes, nucleic acids. Molecular methods that provide greatest information, are the sequencing of proteins and nucleic acids. Molecular technology permits the analysis wholly of new characters that are seemingly independent of more traditional characters. But the traditional taxonomic attributes can never be replaced as such by molecular characters. Thus, the journey of taxonomy from traditional to molecular has been very long.

The biology and history of Aphelinidae (Hymenoptera: Chalcidoidea) with special reference to India, and to the work of Prof. M. Hayat

Andrew Polaszek
Natural History Museum, London, United Kingdom
(Email: a.polaszek@nhm.ac.uk)

Abstract

The parasitoid wasp family Aphelinidae consists of 34 genera and 1,436 species classified into three subfamilies: Aphelininae (20 genera, 366 species); Coccophaginae (13 genera, 984 species); Eretmocerinae (1 genus, 86 species). Much of the species diversity in Aphelinidae belongs to the genus *Encarsia* Förster (486 species) ten percent of total species diversity estimate.

Aphelinidae primarily parasitize whiteflies, scale insects, mealybugs, and aphids (Hemiptera: Sternorrhyncha), with a few species having other life histories such as hyperparasitoidism, autoparasitoidism, or oophagy. Host-parasitoid relationships of some aphelinids are complicated by heteronomous development of males and females. In these cases, females are always primary endoparasitoids of scale insects or whiteflies, while males can be primary parasitoids of a different host species, ectoparasitoids on the same host, hyperparasitoids of a different species of parasitoid, or autoparasitoids of their conspecific females.

Because of their dependence on mainly sternorrhynchan hosts, Aphelinidae are among the most important taxa used in biological control. With over 90 examples of successful control programmes, they are rivalled only by Encyrtidae for their use in biological control.

The history of Aphelinidae in India is almost entirely the result of more than five decades of meticulous research and publication by Prof M. Hayat of Aligarh University. In this presentation I track the history of Aphelinidae with emphasis on India, and the work of Prof Hayat, to whom this presentation is dedicated. Recent major developments in Aphelinidae classification brought about by DNA-based taxonomy are presented and discussed in relation to traditional, morphology-based approaches.

A Retrospection of Selected Soil Fauna Inhabiting Indian Soil

Asok Kanti Sanyal

Abstract

The soil is the most essential natural component needed for survival of live-forms on this planet. The soil is also a complex living body that breaths, assimilates organic and organic elements, breakdown and mineralizes organic matters of biological origin and stores reserves as organic matter.

The soil ecosystem supports a complex of animal communities of which soil arthropods are of prime importance since they constitute the major component of soil fauna in all types of soil. The soil arthropods include a variety of mites, collembolans, pseudoscorpions, centipedes, millipedes, symphylans, diplurans, proturans, hymenopterans, coleopterans etc. They play an important role in releasing nutrients and improve productivity within an ecosystem by decomposition process. The present paper reviews the research work done in this field with reference to India. A detail account of update of soil fauna particularly acarina and collembola and their ecology was given.

Functional Diversity and Role of Nematodes in Soil Ecosystem

Wasim Ahmad
Department of Zoology, Aligarh Muslim University, Aligarh-202002, India
(Email: a.polaszek@nhm.ac.uk)

Abstract

Soil organisms are a crucial part of terrestrial biosphere. Despite their importance in ecosystem functioning, few quantitative, spatially explicit model of the active belowground community currently exists in particular on nematodes that are the most abundant animal on earth filling all trophic levels in the soil food web. They are classified at different taxonomic levels (order, family, genus, and species), exhibiting broad diversity both at higher and lower taxonomic levels. The vast biodiversity of soil nematodes is also reflected in their functional diversity, that generally concerns the range of functions that organisms do in communities and ecosystems, in which nematodes feature in all major trophic levels of the soil food web based on their feeding habits (i.e., bacterivores, fungivores, herbivores, omnivores and predators). In addition, another characteristic feature of soil nematodes which glorifies their functional aspect is their life history strategies, which are described by a colonizer-persister (cp) scale, with range from 1 (typical r-selected taxa) to 5 (typical K-selected taxa). Based on their familiar feeding types and inferred life history strategies or cp scales, soil nematodes can be grouped into 16 functional guilds (Ba1-4, Fu2-4, He2-5, Om4-5, and Pr3-5). They are considered as basal component (Fu2, Ba2), enrichment component (Ba1) and structure component (Ba3-4, Fu3-4, Om4-5 and Pr3-5) depending on what qualitative conditions in food web each guild indicates. Apart from this, the functional indices derived from these functional guilds indicate various complexities of soil ecosystem. Nematode functional diversity indicates soil biodiversity, soil resource diversity, and resource utilization diversity, hence it can serve as a useful indicator of the nutrient status of the ecosystem. They serve keystone function in connecting and shaping the structure of the soil food web. They also play pivotal roles in processing organic nutrients, control of soil micro-organism populations and play critical role in regulating carbon and nutrient dynamics.

Taxonomy, a fine tuning of structure and diversity

Neelima Gupta

Dr. Harisingh Gour Sagar University (A Central University) Sagar (MP), INDIA 470003

Abstract

Taxonomy, the science of classification comprises of the methodology and principles of systematic botany and zoology and sets up arrangements of the kinds of plants and animals in hierarchies of superior and subordinate groups. Biologists have attempted to view all living organisms with equal thoroughness and thus have devised a formal classification to provide the basis for a relatively uniform and internationally understood nomenclature, thereby simplifying cross-referencing and retrieval of information. Taxonomy is used for two totally different purposes, often in combination, namely, identifying and making natural groups. The specimen or a group of similar specimens must be compared with descriptions of what is already known. Basically, no special theory lies behind modern taxonomic methods. External and internal structure, along with the structure of cell, development process and ecological information of organisms are essential and form the basis of modern taxonomic studies. Broadly, taxonomic methods depend on: (1) obtaining a suitable specimen (collecting, preserving and, when necessary, making special preparations); (2) comparing the specimen with the known range of variation of living things; (3) correctly identifying the specimen if it has been described, or preparing a description showing similarities to and differences from known forms, or, if the specimen is new, naming it according to internationally recognized codes of nomenclature; (4) determining the best position for the specimen in existing classifications and determining what revision the classification may require as a consequence of the new discovery; and (5) using available evidence to suggest the course of the specimen's evolution. With the passage of time, taxonomical methods have gradually evolved from simply magnifying an organism to different phases of microscopy – simple microscopy, advanced microscopy, microscopy attached with photoautomat, measuring software aids and tuning the fine structure of an organism through scanning electron microscopy and transmission electron microscopy. In between, molecular taxonomy creeped in with genetic sequence database and molecular characterization. These methods have greatly enhanced the study of organisms thereby facilitating their classification. Evolution is the driving force behind biological diversity on Earth, therefore the taxonomic practice must adapt itself to the notion of change. In this context, the paper presents an overview of some unresolved problems in phylo- genetic taxonomy and gives a road map to appreciation, interpretation and proper use of the main taxonomic systems Evolution is the driving force behind biological diversity on Earth, therefore the taxonomic practice must adapt itself to the notion of change. In this context, the paper presents an overview of some unresolved problems in phylo- genetic taxonomy and gives a road map to appreciation, interpretation and proper use of the main taxonomic systems Evolution is the driving force behind biological diversity on Earth, therefore the taxonomic practice must adapt itself to the notion of change. In this context, the paper presents an overview of some unresolved problems in phylo- genetic taxonomy and gives a road map to appreciation, interpretation and proper use of the main taxonomic systems Evolution is the driving force behind biological diversity on

Earth, therefore the taxonomic practice must adapt itself to the notion of change. In this context, the paper presents an overview of some unresolved problems in phylo-genetic taxonomy and gives a road map to appreciation, interpretation and proper use of the main taxonomic systems Evolution is the driving force behind biological diversity on Earth, therefore the taxonomic practice must adapt itself to the notion of change. In this context, the paper presents an overview of some unresolved problems in phylo- genetic taxonomy and gives a road map to appreciation, interpretation and proper use of the main taxonomic systems. The present work depicts an overview of taxonomical studies on blood and helminth parasites based on microscopic taxonomy, molecular taxonomy and scanning electron microscopic taxonomy providing a road map to appreciation, interpretation and proper use of the main taxonomic systems and to correlate them to functional parasitology and evolution.

Integrated Management of Marine Biodiversity and Blue Economy in India

Prof. K. Sivakumar

Department of Ecology and Environmental Sciences, Pondicherry University

The sea around India is part of the great Indian Ocean, and India has a vast coastline of 7, 517 km, of which, 5, 423 km belong to Peninsular India and 2, 094 km to the Andaman, Nicobar, and Lakshadweep Islands, and with an EEZ of 2.02 million sq. km. This coastline supports a huge human population, which is dependent on the rich coastal and marine resources. It is estimated that nearly 250 million people live within the swath of 50 km from the coastline of India. Therefore, the ecological services of marine and coastal ecosystems of India play a vital role in India's economic growth.

Despite the tremendous ecological and economic importance, India's coastal and marine ecosystems are under threat. Numerous direct and indirect pressures arising from different types of economic development and associated activities are having adverse impacts on coastal and marine biodiversity across the country. Additionally, climate change is likely to have a growing impact on coastal and marine ecosystems, including a likely increase in extreme weather events as well as sea level rise, warming of the sea surface temperatures and ocean acidification.

Marine Protected Area Network in India has been used as a tool to manage natural marine resources for biodiversity conservation and for the well-being of people dependent on. There are 131 Coastal and Marine Protected Areas (CMPAs) in India. Of these, 25 Protected Areas are present in the Peninsular India, 103 PAs in Andaman & Nicobar Islands and four in Lakshadweep Islands. However, there is no policy in India to notify MPAs outside territorial waters but within EEZ.

Mainstreaming biodiversity is the process of embedding biodiversity considerations in fisheries policies, schemes, plans, programmes and projects is key to sustain the habitats, which serve as feeding, spawning, and nursery sites which are essential for increasing wealth of our country and human wellbeing. India as a UN member has committed itself to implement the 2030 sustainable development agenda. The Sustainable Development Goals are a big step forward for the environment. They recognise the importance of the planet's natural resources – its forests, rivers, oceans and land – for our social and economic wellbeing. Especially, the goal SDG 14 emphasise the importance of inclusive management of coastal and marine resources including fisheries and mainstreaming the biodiversity conservation into the Marine Fisheries Sector. These 131 CMPAs and 107 ICMBAs of India would help to achieve SDG 14. IMMA sites identified by IUCN can cover approximately 10% of EEZ of India that would fulfil the SDG 14 provided these IMMA sites are notified either by Indian Maritime Act or existing Wildlife (Protection) Act, 1972 may be amended so that India can notify MPAs in EEZ. Seascape level planning is necessary to secure the migratory routes of marine mammals, sea turtles and critical fish breeding grounds. India must consider marine biodiversity conservation as one of the developmental sector as part of 'Blue Economy Promotion' in India. In this context, having more MPAs in EEZ as some long-term investments to secure future livelihoods.

Newly launched 'Project Dolphins' of India by the Government of India, is envisioned at conserving the most threatened habitat in the sea, by not only addressing the well-being of all the stakeholders, but it also respects the equality of all life forms with humans, truly representing the philosophy of '*Vasudhaiva kutumbakam*'.

Taxonomy – how it has to be?
Lesson from the past and present for future

Vilayanoor V Ramamurthy

Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi 100012
vvr_ento@iari.res.in; vvrento@gmail.com

Abstract

The discipline of taxonomy is variously referred to as systematics and biosystematics. It encompasses recognition, description and arrangement of species for classification and is thus an integral component of biodiversity. There is considerable revival of interest in taxonomy due to the increasing demands on the biodiversity, especially on its utilitarian and bioinformatic components. With current estimate that ninety per cent of the world species remains undescribed, the framework of taxonomy is certain to be subjected to tremendous pressure. Such a pressure is expected to be not only towards the bedrock discipline of classical and traditional taxonomy, but also towards the ultimate evolutionary biology components, especially of the ecological aspects, intraspecific variations, population diversity, interspecific or intraspecific relationships, genetic variations etc., Further there will be dynamic and paradigm shifts in the demands on the knowledge associated with taxonomy, mainly due to the changed requirements to satisfy the requirements of the conservation and other utilitarian aspects of biodiversity. All these will demand that the taxonomy in future is to be essentially subjected to prioritization in its actions to make it relevant, objective and utilitarian thereby enhancing its applications and visibility. It is sure that the past and present taxonomy will teach lot of lessons for the future.

Taxonomy becomes systematics when it delves into the diversity and/or relationships among organisms at the population level or above. This includes biosystematics, which in essence is the study of origin and differentiation of living systems, encompassing speciation and phylogeny. All these empirically mean taxonomy, which is just the practical aspect of naming and classifying organisms. Progress in taxonomy is achieved through studies of aspects of holomorphology comprising structural features of adults, characters of immature forms, and developmental features. Ethological, physiological, cytological, genetic, and biochemical characters are the other aspects which must receive the desired attention. In fact, it would be impossible to understand interrelations of some taxa unless such attention is forthcoming. These also will augur well for the concepts of classification serving the objective that all taxa must be monophyletic, envisaging a holistic approach encompassing multiple character systems. The assessment of what was, in the past and what is in the present, going on in taxonomy, especially in India, reveals that there are only lopsided efforts. In many of the animal and also the plant groups this is quite apparent. In many a case, only few of the empirical aspects are given attention, and sans prioritization and objectivity to accomplish relevance.

It is imminent that taxonomy must take cognizance of these changes in the philosophical aspects of classical taxonomy, need for exploring interspecific and intraspecific population variations, character evaluation, assessment, computer simulation and other complexities, taxonomy's changing roles, and biodiversity management related requirements. It is also essential that recent developments namely DNA taxonomy and biodiversity informatics for placing taxonomy online are be considered. A concurrent analysis of these will reveal that in future the biodiversity research will be intertwined with taxonomy more than ever before. There will be a dire need for prioritization and accomplish relevance in every aspect of our taxonomy efforts. Needless to mention, taxonomy is at crossroads now as regards its methodology, constituents, expectations and outcome as could be learnt from its past and present.

ORAL PRESENTATIONS

Taxonomic study and redescription of the genus *Cepora* Billberg, 1820 including its different subspecies and polymorphic forms (Lepidoptera: Pieridae) from India

Manpreet Kaur[1], Jagbir Singh Kirti[2] and Avtar Kaur Sidhu[3]

[1,2]Punjabi University, Patiala
[3]High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan, Himachal Pradesh, India

(Email: preetpup@gmail.com)

Abstract

During this work, intensive samplings were conducted in various localities of India namely Northwest Himalayas (hilly areas of Himachal Pradesh), Western ghats (Evergreen forests of the nearby areas of Neyyar Dam, Lion safari park, surroundings of Periyar Tiger Reserve from the states of Kerala and dense forests of Karnataka), Eastern Himalayas (Tropical Semi Evergreen Forests and Tropical rain forests of Thenzawl and Serchipp, hilly dense forests of Lunglei and Reiek in Mizoram, Tropical rain forests of Nagaland and Sunderbans of West Bengal states) and various islands such as Long island, Havlok island, Neil island, Campbell bay and other localities of Andaman and Nicobar islands from 2016 to 2019 to study the diversity and taxonomic characters of the members belonging to genus Cepora Billberg, 1820 . The specimens of this genus under family Pieridae were also studied from the collections lying in the National Museum, Zoological Survey of India, Kolkata. The genus *Cepora* Billberg, comprises 20 species which are widely distributed in Pacific, Australian and Oriental regions (Vane-Wright and de Jong, 2003). This genus is represented by two species in India i.e. *Cepora nerissa* (Fabricius, 1775) and *Cepora nadina* (Lucas). A total count of 13 subspecies have been described under *Cepora nerissa* (Fabricius) and out of these, three subspecies i.e. *Cepora nerissa phryne* (Fabricius), *Cepora nerissa evagete* (Cramer) and *Cepora nerissa lichenosa* (Moore) have been found in India. *Cepora nadina* (Lucas, 1852) comprises of nine subspecies and out of these, three subspecies i.e. *Cepora nadina nadina* (Lucas), *Cepora nadina andamana* (Swinhoe) and *Cepora nadina remba* (Moore) have been found in India. In this work, the external features, genitalic characters and distribution of all these subspecies including their seasonal and polymorphic forms have been studied. The genitalic characters of all the seasonal and polymorphic forms have been discussed for the first time.

Keywords: *Cepora*, genitalia, genus, species, distribution

Indian Beetles: Diversity, Distribution and Dynamics at the Ecosystem and Biogeographic Zone Level

Devanshu Gupta and Kailash Chandra

Zoological Survey of India, M Block, New Alipore, Kolkata, 700053, West Bengal, India

(Email: devanshuguptagb4102@gmail.com)

Abstract

The beetle fauna of India is enumerated here for the first time based on an in-depth literature review and assessment of a compiled dataset. We report 22,664 valid species grouped in 114 families from India, accounting for one-third of country's known insect diversity and about 22% of India's fauna. Of the total Indian beetles, 766 species are found exclusively in freshwater ecosystems, 21898 in the terrestrial ecosystem, 340 in mangroves, and 359 in agroecosystems. The distribution of the beetles is not uniform across the country's biogeographical zones and compared to the area covered, the Himalayan region hosts almost half of the Indian beetles (10533 species), followed by Northeast (3521), Deccan Peninsula (3474), Gangetic Plains (3318), Western Ghats (1967), Semi-Arid (962), Islands (936), Desert (326), and Trans-Himalaya (93). Islands have only 0.25% of the country's total land area but represent 4.2% of the total beetle fauna of India. At the provincial level, the Central Himalayas are the richest with 5081 species, followed by West Himalayas (4075), North-west Himalayas (2903), Upper Gangetic Plains (2638), Deccan South (2580), North-Eastern Hills (2301), Brahmaputra Valley (1826), Western-Ghats Mountains (1811), and Malabar Plains (1683). Based on the observations of our data, we make the following observations: The Eastern Himalayas, Punjab Plains, Lower Gangetic Plains, the Indian Peninsula of Eastern Highlands, Central Highlands, and Central Plateau, Desert, and Trans-Himalayas are comparatively less explored and need to be documented over time and many species are still recorded only from their type localities, making it necessary to revisit and survey those localities for the taxonomic assessment of these species. The main challenge is taxonomic identification at the species level since the type materials for many species, described before independence are available in foreign museums. Taxonomic revisions of the various economically important beetles are required to solve the identification and classification problems.

Keywords: checklist, distribution, gap areas, museum collections, taxonomy

First record of *Acrida acuminata* Stål, 1873 (Orthoptera: Acrididae: Acridinae) from India with description of its female genitalia

Hirdesh Kumar[1], Mohd. Kamil Usmani[2] and D. Suresh Chand[3]

[1,3]Zoological Survey of India, Prani Vigyan Bhawan, Block M, New Alipore, Kolkata, West Bengal 700053, India
Department of Zoology, Aligarh Muslim University, Aligarh, Uttar Pradesh, India

(Email: entomologist1985@gmail.com)

Abstract

The genus *Acrida* Linnaeus, 1758 included 42 species worldwide (Cigliano *et al*., 2023) of which 7 species were reported from India (Gupta & Chandra, 2019). Stål (1873) described *Acrida acuminata* from South Africa. Later, Dirsh (1954) redescribed this species but no detailed study of the female genitalia has been carried out so far. The female specimen of Acrida acuminata Stål, 1873 was collected from Himachal Pradesh, which is recorded for the first time from India. An opportunity is taken to redescribe and illustrate the female including its genitalia.

Keywords: grasshoppers, Himachal Pradesh, short-horned, slant faced, Western Himalaya

Two new species of *Bryophaenocladius* (Diptera: Chironomidae: Orthocladiinae) from Darjeeling and Kolkata, West Bengal, India with a note on biology of montane species

Dipak Kumar Som, Tuhar Mukherjee, Torpita Das and Rima Chakraborty

Postgraduate Department of Zoology, Maulana Azad College, Kolkata- 700 013, India

(Email: dipaksom@gmail.com)

Abstract

The genus *Bryophaenocladius* Thienemann is one of the most speciose genera of the subfamily Orthocladiinae of the family Chironomidae (Order: Diptera). It is found in all the zoo-geographical realms except Australia. Prior to this study 13 species have been reported from the Oriental Region among which 3 species are described from Eastern Himalayan region of India. Objective: The objective of this study is to find the diversity and ecology of orthoclad midges in the montane as well as in tropical belt of West Bengal, India. Methodology: During this study male specimens from Kolkata were collected from pan trap whereas adults of Darjeeling specimens were procured through net sampling near its habitat. The specimens were mounted on glass slides following phenol-balsam technique. Individual insect samples were outsourced for DNA extraction, PCR amplification of COX1 genes using universal primers and subsequent Sanger sequencing of the amplified genes. Observations and outcome: *B. kolkataensis* sp. n. is described as male imagine and is the first orthoclad species found from Kolkata metropolis. *B. depilis* sp. n., whose immature are procured from humid rhizoid mat of bryophytes on rocks and tree bark habitats in the Darjeeling hills, a part of the Eastern Himalaya Biodiversity hotspot is described as adult male, pupa and larva. A key to Indian species is added. A brief biology of *B. depilis* sp. n. with special reference to its habitat preference, larval behaviour and adult swarming has been incorporated. This study also includes one of the few DNA barcodes of chironomid species in India.

Keywords: Orthocladiinae, *Bryophaenocladius*, new species, chironomid biology

Description of two new species of *Eulophus* Geoffroy (Hymenoptera: Chalcidoidea: Eulophidae) from India

Mohd Tanjeem Raza and Shahid Bin Zeya
Department of Zoology, Aligarh Muslim University, Aligarh, 202002
(Email: tanzeemraza3@gmail.com)

Abstract

Two new species of *Eulophus* Geoffroy (Eulophidae: Eulophinae), namely *Eulophus orientalis* Raza & Zeya, sp. nov. and *Eulophus almoriensis* Raza & Zeya sp. nov. are describe from India. An identification key of Indian species of *Eulophus* is also given.

Keywords: Hymenoptera, Chalcidoidea, Eulophidae, Eulophinae, New species.

Morphotaxonomy of Pyralidae (Lepidoptera) from North East India

Rahul Ranjan[1], Navneet Singh[2] and Jagbir Singh Kirti[3]
Zoological Survey of India, M Block, New Alipore, Kolkata, 700053,
West Bengal, India
[3]Punjabi University Patiala, Punjab, India
(Email: rranjan720@gmail.com)

Abstract

Family Pyralidae (Pyraloidea) comprises 6,197 described species in 1,099 genera globally (Nuss *et al.* 2003–2023, Singh *et al.*, 2022). Five subfamilies are currently recognized in the family: Epipaschiinae, Pyralinae, Phycitinae, Galleriinae, and Chrysauginae. All subfamilies except the latter are present in India. Pyralids are diagnosed by the closed bullae tympani (only open anteriorly), as opposed to the open type found in its sister family, Crambidae. In the forewing, R5 is stalked with R3 + R4 (Minet 1981, 1985). The male genitalia bear a pair of lateral processes arising from the base of the uncus (Solis & Mitter 1992). To study the morphotaxonomy of Pyralidae from North East India, we conducted surveys from 2017 to 2020 and more than one thousand examples have been collected using vertical sheet light traps. Collected specimens were euthanized with ethyl acetate vapours in killing jars. The specimens were pinned, set, processed as per standard techniques in lepidopterology (Holloway *et al.*, 2001) and identified using the help of relevant literatures. A total number of 105 species identified under different subfamilies, of which one species i.e. *Peucela acutativalva* Qi and Li, 2020 is reported for the first time from India. We report range extension of four species i.e., *Arippara vibicalis* (Lederer, 1863), *Hypanchyla fuscibasalis* Snellen, 1880, *Hypsopygia suffusalis* (Walker, 1866) and *Perisseretma endotrichalis* Warren, 1895, up to North East India. Herein, we describe one new species from Sikkim. The differential diagnosis of the new species and all the other studied Pyralid species will be discussed.

Keywords: Lepidoptera, Pyraloidea, New Species, New Record, Range Extension

New Records and New Combinations of Ladybird Beetles from India (Coleoptera: Coccinellidae)

Priyanka Das and Devanshu Gupta

Zoological Survey of India, M Block, New Alipore, Kolkata, 700053, West Bengal, India

(Email: priyankajan03@gmail.com)

Abstract

Ladybird beetles (Coleoptera: Coccinellidae) are recognised biological control agents predating aphids, mites and other minute insects. Some others are phytophagous, especially in the tribe Epilachnini. Their body design and tangible mandibular shape make them successful natural predators. Over 6000 species are established worldwide and nearly 550 species have been documented in India. Apart from the widely distributed species, the bulk of the species in this family are known by their narrow distributional ranges and not much has been documented. While investigating a collection of specimens from the Indian states of Arunachal Pradesh, Bihar, Gujarat, Jharkhand, Odisha and Telangana, we identified 11 species; interesting findings associated with these species are presented in the current communication. *Epilachna langpingensis* Zeng & Yang, 1996 and *E. sureilica* (Kapur, 1961) are transferred to the genus Afissa Dieke, 1947. Consequently, two new combinations are formed: *Afissa langpingensis* (Zeng & Yang, 1996), comb. n. and *Afissa sureilica* (Kapur, 1961), comb. n. *Afissa langpingensis* (Zeng & Yang, 1996) and *Jauravia albidula* Motschulsky, 1866 are reported for the first time from India, based on specimens examined from Arunachal Pradesh and Telangana respectively. The following eleven are reported for the first time from the states mentioned against their name: *Afissa langpingensis* (Zeng & Yang) (Arunachal Pradesh), *Illeis indica* Timberlake (Bihar), *I. bistigmosa* (Mulsant) (Telangana), *Propylea dissecta* (Mulsant) (Bihar, Jharkhand), *P. japonica* (Thunberg) (Bihar), *P. luteopustulata* (Mulsant) (Telangana), *Nephus tagiapatus* (Kamiya) (Gujarat), *Micraspis univittata* (Hope) (Odisha), *Phrynocaria circumusta* (Mulsant) (Odisha) and *Jauravia albidula* Motschulsky (Telangana). The photographs of these species are provided and their distribution is mapped.

Keywords: Epilachnini, diversity, morphology, taxonomy

First record of a Whitefly, *Asialeyrodes euphoriae* Takahashi, 1942 (Hemiptera: Aleyrodidae) from India

Anil Kumar Dubey and Lakshmi Kausalya

Zoological Survey of India, m Block, New Alipore, Kolkata, 700053, West Bengal, India

(Email: anil.2kd@gmail.com)

Abstract

Whiteflies are phloem sap-sucking insects belonging to the insect order Hemiptera. A few of them are pest and vectors of viruses causing diseases to plants. There are 1707 species in 197 genera known from the world and 497 species from India. Of these, the whitefly genus *Asialeyrodes* Corbett is mainly represented from the Oriental and Australian regions. It was first reported from the Andaman Islands through description of *Asialeyrodes nicobarica* Dubey in 2019. Recently, *Asialeyrodes euphoriae* Takahashi is found infesting an unidentified shrub in the South Andaman, and reported here for the first time from India. Puparia of the *A. euphoriae* are feeding on lower surface of leaves, broadly oval in shape, and have complete submarginal furrow. The species was originally described by Takahashi from Thailand in 1942, and remined unknown from elsewhere. This indicates that the Andaman and Nicobar Islands are harboring whitefly species sharing their geographical distribution with the Oriental countries.

Keywords: Aleyrodidae, Whitefly, Hemiptera, Andaman and Nicobar Islands

New species and records of Tribe Sericini from Manipur, India (Coleoptera: Scarabaeidae: Melolonthinae)

Debika Bhunia [1, 2], Devanshu Gupta [1], Subhankar Kumar Sarkar [2] and Dirk Ahrens[3]

[1]Zoological Survey of India, M Block, New Alipore, Kolkata, 700053, West Bengal, India.

[2]Entomology Laboratory, Department of Zoology, University of Kalyani, Kalyani, 741235, West Bengal, India

[3]Zoologisches Forschungsmuseum Alexander Koenig Bonn, Adenauerallee 127, 53113 Bonn, Germany

(Emails: dbhunia92@gmail.com, devanshuguptagb4102@gmail.com, sksarkarzoo18@klyuniv.ac.in, ahrens.dirk_col@gmx.de).

Abstract

Beetles of the tribe Sericini (Coleoptera: Scarabaeidae: Melolonthinae) are herbivores and are known by nearly 4,600 described species globally, of which over 682 species are known from India, accounting for 16% of the global diversity. Most of the Indian species are reported from the Himalayas and the southern areas of the country. However, in many regions, such as the Northeastern states, the tribe remain largely unexplored or represented only by old collection records which have too imprecise data to be geo- localized. While working on an unidentified collection of sericini beetles of Manipur state, we have found five interesting species, of which we describe one new species of the *Maladera thomsoni* group, *Maladera bezdeki* Bhunia, Gupta, Sarkar & Ahrens, **sp. nov.** Moreover, four species belonging to one genus are recorded from Manipur state for the first time: *Maladera drescheri* (Moser, 1913), *M. freyi* Ahrens & Fabrizi 2016, *M. rufotestacea* (Moser, 1915), and *M. satrapa* (Brenske, 1898). These new data show that there is continued urgent need to further explore the diversity of the species in the unexplored, white spots in India that will help to get insights on systematics, distribution, and biodiversity of Indian Sericini. The morphology of the new species is described and illustrated and the distribution data is mapped.

Keywords: Biodiversity hotspots, morphology, north-east region, taxonomy.

New record of *Bathytormus acuminatus* (Kobelt, 1885) [Mollusca, Bivalvia, Crassatellidae] from India

Md Hafiz, Sheikh Sajan and Tamal Mondal

Zoological Survey of India, Parni Vigyan Bhawan, M-Block, New Alipore, Kolkata 700053, West Bengal, India

(Email: hafizzsi12@gmail.com)

Abstract

Among the Phylum Mollusca, Bivalvia is the second most diverse class in terms of species diversity and is one of the most important contributors of marine and freshwater ecosystems. Bivalves are easily recognised by their two lateral halves, calcareous shells that are hinged dorsally and articulated with one another by an elastic or chitinous, external or internal ligament. Globally, about 7300 species of bivalves are reported, of which around 760 species have been reported from Indian water. The saltwater clam genus *Bathytormus* Stewart, 1930 is classified under the subfamily Crassatellinae with a total of five nominal species, which are distributed across the Indo-Pacific region. In India, only two nominal species *Bathytormus radiate* (Sowerby, 1825) and *B. jousseaumei* (Lamy, 1919) have been reported from different coastal regions. During the present study, *Bathytormus acuminatus* Kobelt, 1885 is reported as the new distributional record from Indian waters whereas the previous distributional ranges of this species were restricted to the coasts of Singapore and China. The specimen was collected at the depth of 30 m from off Gangavaram coast, Andhra Pradesh. The current study provides updates on the distribution and nomenclature of B. acuminatus in Indian waters along with global distribution.

Keywords: Taxonomy, Distribution, Heterodonta, Clams, New record

Moths of Valmiki Tiger Reserve (Bihar) with Fifteen New Records to India

Navneet Singh, Jalil Ahmad, Suresh Kr. Shah and Rahul Joshi
Zoological Survey of India, M Block, New Alipore, Kolkata, India
(Email: jalilahmad23046@gmail.com)

Abstract

The present study is based on two surveys conducted in Terai grasslands of Bihar (VTR), in the month of March and October, 2017. We identified 345 species under 242 genera and 60 subfamilies in 23 families and 12 superfamilies of Moths (Lepidoptera) from Valmiki Tiger Reserve, Bihar, India. This includes 15 species viz., *Adrapsa ablualis* Walker, [1859]; *Aiteta musculina* Walker, 1856; *Corgatha tornalis* Wileman, 1915; *Eugoa brunnea* Hampson, 1914; *Fossia melandra* (?erný, 2009); *Miltochrista roseogrisea* (Rothschild, 1913); *Oreta loochooana* Swinhoe, 1902; *Oruza crocodeta* (Turner, 1903); *Pingasa chloroides* Galsworthy, 1998; *Spaniocentra kuniyukii* Yazaki, 1994; *Spilosoma howqua* Moore, 1877; *Syllepta maculalis* Leech, 1889; *Theretra rhesus* (Boisduval, [1875]); *Xenochroa biviata* Hampson, 1905; *Xenochroa fulvescens* (Warren, 1912) as first record from India. Furthermore, the distributional range of 29 species is extended from North East India to Gangetic Plains (VTR, Bihar). Similarly, the distributional range of 13 species is extended from North India and of four species from South India to Bihar. Two species, which were reported from Andaman & Nicobar Islands are reported from VTR (Bihar). The images of the new records and the distribution of all the studied species are also provided.

Keywords: Lepidoptera, Moths, Terai grassland, New record, India

Centipede Diversity in Reserved Forests of Southern Kerala: A Preliminary Observation

Rahul Krishnan and G. Prasad
University of Kerala, India
(Email: rahulkrishnanrs@keralauniversity.ac.in)

Abstract

Centipedes are one of the apex invertebrate soil predators and play a significant role in the overall functioning of the soil ecosystem. Out of five orders globally, India houses four of them (except Craterostigmomorpha) The present study focuses on the southern districts of Kerala, viz., the reserved forests of Thiruvananthapuram, Kollam and Pathanamthitta for the period from May, 2021 to June, 2022. Active sampling strategies are employed for collecting the specimens, and identification is done by using available standard dichotomous keys. Representatives of three orders belong to three families, and six genera have been recorded. The dominant orders reported are Scolopendromorpha, followed by Geophilomorpha. Within Scolopendromorpha, the genera *Rhysida* and *Digitipes* are the most abundant and enjoy a rich distribution in these areas.

Keywords: Centipedes, Scolopendromorpha, Geophilomorpha, Southern Kerala, Scutigeromorpha

Mitogenome characterization and phylogenetic position of the giant form of Purpleback Flying Squid, *Sthenoteuthis oualaniensis* (Lesson, 1830) (Cephalopoda: Ommastrephidae) endemic to the Northern Arabian Sea

Jeena N. S., Wilson Sebastian, Summaya Rahuman and Sajeela K. A.
Central Marine Fisheries Research Institute, Cochin - 682 018, Kerala, India
(Email: jeenacmfri@gmail.com)

Abstract

Sthenoteuthis oualaniensis is an oceanic squid of the Indo-Pacific, renowned for having the most complex population structure of any Ommastrephid squid to date. Out of the five forms of identifiable sizes, it contains three primary morphotypes (middle-sized, giant, and dwarf forms) whose taxonomic position has long been debated. The species forms a target fishery in the Arabian Sea where it occurs at its highest density. Its giant form is endemic to the cool, deep waters of the Northern Arabian Sea which has a prominent oxygen minimum layer. This study provides the first report on the mitogenome of the giant form for better resolution of its evolutionary relationships. Using low-coverage Illumina sequencing, we assembled the complete mitogenome using the NOVOPlasty pipeline. The AT-rich mt- genome was 20318 bp in length. It contained 18 PCGs, 23 tRNAs, two rRNAs, and two non-coding regions with six genes and one non-coding region in duplicates. Its Heavy strand encoded 22 of the 43 genes while the others were by the Light strand. An examination of codon usage identified three main AT-rich codon families. Different lineages in various morphotypes of Sthenoteuthis appeared to share a compositional symmetry, according to skew statistics of the PCGs. Ka/Ks analyses of various lineages indicated purifying selection acting on PCGs. Phylogenetic analysis, despite the morphological similarities between the giant and middle-sized forms, recovered all forms into two sister clades, one of which had the giant form together with the dwarf form and the second containing all middle-sized forms. The major forms are in the grey zone of speciation and appear to have emerged through adaptive radiation. A taxonomy revision of *S. oualaniensis* is not possible at this point, due to the lack of consistent morphological distinctions between different forms.

Keywords: Sthenoteuthis, giant form, Arabian Sea, mitogenome, phylogeny

First report of *Trimorus* Förster (Hymenoptera: Scelionidae) from West Bengal, India, along with description of a new species

Rupam Debnath, Sunita Patra, Abitha and K. Rajmohana

Zoological Survey of India, M-Block, New Alipore, Kolakta-700053, West Bengal, India

(Email: rupam.zoology@gmail.com)

Abstract

Genus *Trimorus* Förster is one of the five genera recorded from India under the subfamily Teleasinae (Hymenoptera: Scelionidae). They are egg parasitoids of carabid beetles and are commonly encountered in both agricultural and cultivated landscapes. With 317 species known globally, Trimorus is moderately species rich. The genus is rather less explored in India, with only 31 species described till date. During our recent explorative surveys in West Bengal, we came across a couple of unusually robust and large females of Teleasinae, having a striking body coloration of yellowish-orange and black. Based on the morphological characters, the species was identified as an undescribed species of Trimorus. The lack of lateral mesoscutellar spines, distinguished it easily from Gryonoides Dodd. The present work describes the species as new to science, also documenting Genus *Trimorus* for the first time from West Bengal.

Keywords: Trimorus, Scelionidae, New species, India

Integrative Taxonomic Profile of the Genus *Mola* Koelreuter, 1766 (Tetraodontiformes: Molidae) from Indian waters

Subal Kumar Roul, N. S. Jeena and Ajay D. Nakhawa
ICAR-Central Marine Fisheries Research Institute, India
(Email: subalroul@gmail.com)

Abstract

Taxonomy of the ocean sunfishes (Molidae Bonaparte, 1832) has a long and complicated history due to their morphological similarity mostly during the juvenile and young stages. Currently, the genus *Mola* Kölreuter, 1766 (Tetraodontiformes: Molidae) is comprised of three valid species: the ocean sun fish *Mola mola* (Linnaeus 1758), the bump?head sunfish *M. alexandrini* (Ranzani, 1839) and the hoodwinker ocean sunfish *M. tecta* Nyegaard *et al*., 2017. About 23 occurrences of ocean sunfish for the genus *Mola* around the Indian coast, either under the name of *M. mola* or *M. ramsayi*, have been documented from the Arabian Sea and Bay of Bengal. However, recently *M. ramsayi* was synonymized with *M. alexandrini* by Sawai *et al*., (2017) based on a comprehensive revision of the genus, which confirmed that *M. alexandrini* is widely distributed in the world's oceans, whereas there are currently no records of *M. mola* from the Indian Ocean. In the absence of a detailed taxonomic study and reference sequences of the Indian Mola in the public databases, present study prompted to investigate the taxonomy of the Genus *Mola* by applying an integrative approach, based on the joint examination of genetic, morphological and anatomical traits. Based on a thorough review of the literature, morphological comparisons between the fresh specimens collected in the Bay of Bengal and Arabian Sea during 2022–2023 and the congeners, as well as molecular characterization using two mitochondrial regions – the D-loop and COI, our study concluded that the specimens from the Indian EEZ belong to *M. alexandrini* and cannot be attributed to previously misidentified to *M. mola* or *M. ramsayi*. This study also revealed complete absence of *M. mola* from Indian waters. Our findings further add the importance of an integrative taxonomic approach for studying such enigmatic species of Mola to better understand their zoogeographies.

Keywords: Ocean sunfish, Integrative taxonomy, Cytochrome c oxidase 1, D-loop, Indian Ocean

Taxonomical Investigation of Stingless Bees Midst South-Eastern Karnataka, India

Gopinatha Bachahalli Narasimhaiah and Basavarajappa Sekarappa
University of Mysore, India
(Email: apiraj09@gmail.com)

Abstract

Stingless bees (Hymenoptera: Apidae: Meliponinae) are small bodied insects live in cryptic nests under diversified agro-ecosystems. They show unique morphological features with special phenomenon of nesting behavior and difficult to distinguish their identity at species level unless with the help of body morphometrics and variation in male genitalia. Reports on taxonomical analysis of stingless bee population midst south-eastern Karnataka are diffuse. Therefore, morphological characters and male genitalia of stingless bee population were carried out systematically by following standard methods. Total 35 places were randomly selected, of which nine places were earmarked for the scientific collection, preservation and storage of dead or moribund stingless bees to assess their morphology during 2017 to 2019. Altogether, 62 and 68 morphological parameters were considered respectively in female and male stingless bees. Around 19 parameters in head region, 42 parameters in thorax that include wings and legs, two parameters in abdomen with six genitalia characters in male were analyzed using standard taxonomic procedures. Surprisingly, majority of the morphological parameters in head, thorax and abdomen revealed considerable variation. Although, certain morphological parameters didn't exhibit significant variation statistically, little variation in size and shape indicated the considerable difference among the morphometric characters in stingless bee population of South-Eastern Karnataka. Since, morphometric parameters are analyzed to identify and differentiate the species, if any exist amidst diversified agro-ecosystems. Every species has its own ecological niche, struggle to exist even under inclement climatic conditions. Identifying and inventorying such type of stingless bee species could help enrich the local biodiversity. In the present study attempts were made to reveal new species and details of such observations will be discussed at greater length during the presentation.

Keywords: Meghalaya, Eriophyoidea, Biodiversity, Northeast India, Gall

Comparative morphometric studies on braconine species complexes, Habrobracon hebetor-brevicornis and Bracon lefroyi-greeni

Longjam Roni Kumar Singh[1], V. V. Ramamurthy[2] and Dulal Chandra Ray[3]

[1]Zoological Survey of India, M- Block, New Alipore, Kolkata 700053, India

[2]Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012, India

[3]Department of Ecology and Environmental Science, Assam University, Silchar, Assam 788801, India

(Email: lucicrohn@gmail.com)

Abstract

The accurate identification of parasitoids is of great significance to biological control. Despite their economic importance and commonly occurring, the taxonomy of *Habrobracon hebetor-brevicornis* and *Bracon lefroyi-greeni* species complexes is difficult and currently confused being cryptic and occurring as distinct populations as well as groups of populations. Thus, there exists confusion in species recognition and the diagnosis of the appropriate host can have a dramatic effect on the outcome of a biological control program. For instance, many biologists frequently used the name *Habrobracon brevicornis* (sometimes under the genera *Bracon* or *Microbracon*) ignoring the existence of complexity at the species level. Therefore, it is essential to provide a clear diagnosis through detailed study, especially of morphometrics. This study focuses on the morphometric variations in females of five biotypes each of two complexes associated with different hosts and localities. Although males and females are taxonomically equally important, females are most relied upon for authentic generic and species identification. Multivariate statistical analyses, such as Principal Component Analysis, Canonical Discriminant Analysis and Predictive Discriminant Analysis were used to analyse the complexes, and these enabled the identification of taxonomically important characters in differentiating the population and grouping. The quantitative characters were of two kinds: meristic and ratios. The evidence presented here rationalizes the confusion between the species complexes, and the additional morphological characters brought out here will help to resolve the taxonomic complexity.

Keywords: Braconidae, parasitoid, morphometrics, identification, biocontrol

Diversity of dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) in Shendurney region of Southern Western Ghats

Seena Narayanan Karimbumkara[1] and Priyadarsanan Dharma Rajan[2]

Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Srirampura, Jakkur Post, Bangalore 560064, India

(Email: seena.narayanan@atree.org)

Abstract

Dung beetles (Scarabaeidae: Scarabaeinae) play important roles in ecosystems as they help in nutrient cycling, bioturbation, parasite suppression, secondary seed dispersal and even pollination of some fetid smelling flowers. A study was conducted to assess the diversity and distribution of dung beetles in the Shendurney Wildlife Sanctuary and its surrounding areas within the Agasthyamala Biosphere Reserve. Dung beetle collections were carried out across nine different habitats in and around Shendurney Wildlife Sanctuary. Collection was done using open cow dung baits which were placed at the sampling sites for 24 hours. The study recorded a total of 62 species of Scarabaeinae belonging to 17 genera under nine tribes. Among these, four species of Onthophagus and one species of Paracopris are new to science. Agasthyamala Biosphere Reserve (ABS) is home to a diverse range of flora and fauna, including several endangered and endemic species. This study provides a comprehensive taxonomic overview of the dung beetle subfamily Scarabaeinae of Shendurney region in ABS. The results of this study also demonstrate high levels of endemism of dung beetles here. Given the discovery of new species, it is recommended that not only the Wildlife Sanctuary but also the surrounding plantations and grasslands also should be given conservation priority, as many of these species are threatened by habitat loss and fragmentation.

Keywords: Scarabaeinae, Dung Beetles, Conservation, Biosphere Reserve

From Paphia malabarica to *Marcia recens:* A Taxonomic Journey of the Short-Neck Clam

Summaya Rahuman[1] and Jeena N. S.[2]

[1]Research Scholar, ICAR-CMFRI, Kochi, India
[2]Scientist, ICAR-CMFRI, Kochi, India

(Email: summayarahuman@gmail.com)

Abstract

The short-neck clam is a significant fishery resource in Ashtamudi Lake, India, and holds Marine Stewardship Council (MSC) certification. While previous records referred this clam as *Paphia malabarica*, recent taxonomic research has classified it as Marcia recens. To facilitate molecular taxonomic studies, the next-generation sequencing (NGS) technology was used to characterize the entire mitogenome. With the low-coverage whole genome sequencing on Illumina NovaSeq platform (Illumina, USA) and assembling the short reads using the NOVOPlasty pipeline, we were able to generate the mitogenome profile for the species. The 17,991 base-pair(bp) length mitochondrial genome of the short-neck clam contained the typical metazoan gene components, consisting of 13 protein-coding genes (PCGs), 22 transfer RNAs (tRNAs), and 2 ribosomal RNAs (rRNAs). A sequence homology search of the characterized mt-genome by nBLAST against the nucleotide databases showed a sequence similarity of 90.47% with Marcia recens submitted from China (NC_068247.1). The mitochondrial gene arrangement was akin to the submitted mitogenome of Marcia recens. Phylogenetic trees based on the concatenated data set of 13 protein-coding genes (PCGs) were inferred using the Bayesian inference method. This study supported the polyphyletic status of the genus Marcia and validated the classification of the short-neck clam under the genus Marcia. Overall, this study characterized the entire mitogenome of the short-neck clam using NGS technology and reconstructed the phylogeny to understand the taxonomic status of the species. The results of our study may beneficial in managing and conserving this valuable fishery resource in Ashtamudi Lake, India, and provides insights into the evolution of this group of clams.

Keywords: Short-neck clam, Next-generation sequencing, Mitochondrial genome, Phylogeny

Revalidation of *Schizothorax chivae* from the Chindwin River basin, Northeastern India

Nilibo A. and Yumnam Lokeshwor

Department of Zoology, Assam Don Bosco University, Tapesia Campus, Kamarkuchi, Assam 782402, India

(Email: aloayehmi@gmail.com)

Abstract

Arunkumar & Moyon (2016) described *Schizothorax chivae*, a cold water cyprinid fish under family Cyprinidae, from Chiva River (Chindwin basin), Manipur. It needs taxonomic validation as the authors did not registered in Zoobank, a mandatory for online publication of journal as per ICZN electronic publication amendment (ICZN 2012: 17) in addition to articles 8.1.18.1.3 of ICZN (1999). The study on its type species for verification, the type species were un-catalogued though mentioned in the research paper and there have been a lot of ambiguities in terms of its meristic and morphometric features. With fresh collection of specimens and the re-examination of type species, *Schizothorax chivae* is redescribed here. The redescription is based on its morphological, meristic, anatomy and osteological features. A drastic difference in morphometric and meristic data of the type species comparing to data from its original publication have been observed. Thus erratic representation of data creates more puzzle at the time of identification. Thus proper taxonomic procedure should be maintained at the time of identification and description of a species.

Keywords: Schizothorax chivae, redescription, Cyprinidae, Zoobank, re-examination

Studies on the tylencholaimid nematodes (Nematoda, Dorylaimida, Tylencholaimoidea) from the Western Ghats, India

Md. Niraul Islam[1] and Wasim Ahmad[2]

[1]Agriculture and Ecological Research Unit, Indian Statistical institute, Giridih-815301, Jharkhand, India

[2]Nematode Biodiversity Research Lab, Department of Zoology, Aligarh Muslim University, Aligarh-202002, Uttar Pradesh, India

(Email: mnislam15@gmail.com)

Abstract

The western Ghats in India is one of the hottest biodiversity hotspots in the world. Its mountain range displays unique biophysical and biological processes as well as geomorphic features of enormous importance. Although the Western Ghats only make up about 6% of the total Indian land area, they still have a wide range of plants, animals, and fungi, and represents about 30% of India's biodiversity. Nematodes are the most versatile and diverse phylum among metazoans, and they can be found all over the globe in a variety of habitats. Nematodes of the Dorylaimida order are more prevalent in soil and outnumber all other soil organisms in terms of variety and abundance. During the nematofauna studies in the Western Ghats, a total of 225 soil samples were collected, brought to the lab, and processed by the standard lab procedure. A total of 160 genera were recorded belonging to eleven different orders from these samples, and 118 samples yielded tylencholaimid's nematodes. These populations are represented by sixty-six species, twenty genera, eleven subfamilies, and four families of the superfamily Tylencholaimoidea. Twenty species were described as new to science, and males were reported for the first time in *Chitwoodius musae*, *Proleptonchoides southindiae*, *Basirotyleptus caudatus*, and *Dorella papila*. A new genus *Oostenbrinkellus* gen. n. was proposed for *Oostenbrinkella ventrostylus* and three rare genera *Rostrulium*, *Lawtonema*, and *Tsukubanema*, and ten known species were reported for the first time from India. A total of eight genera and thirty-one species were reported for the first time from the Western Ghats. The current taxonomic status, description, and illustrations are given for the recently recorded species. With the addition of our research work, the hotspot is representing 75 valid tylencholaimid's species, and the existing data is demonstrating the geographical importance.

Keywords: Nematoda, Dorylaimida, Tylencholaimoidea, Taxonomy, Western Ghats

Taxonomy of some sponges (Porifera: Demospongiae) collected from the Gujarat coast and description of a new species

G. Sivaleela

Zoological Survey of India, MBRC, Chennai, India

(Email: sivaleelambrc9@gmail.com)

Abstract

Marine Sponges (Porifera) are the oldest still living multicellular animals within aquatic ecosystems, they have not been studied nearly as much compared to the recognized ecosystem in coral reefs & algae because of its difficulties in identification and this is the first survey of the sponge fauna of the Gujarat coast has been carried out from 17th to 26 December 2022. Sponge samples were collected using SCUBA diving, snorkeling, and reef-walk by hand picking method from subtidal to inter-tidal regions Gulf of Kachchh. The samples were preserved in 90% ethanol and brought to the laboratory in clean polythene bags: one sample per bag. Photographs of the reef area and the associated sponge fauna will also be taken. The specimens processed in carbol- xylol and mounted in glycerine. Spicules will be boiled in nitric acid, mounted in euparol and examined under Labomed microscope and photograph of spicules will be taken. Measurements will be made with the micrometer. A total of 17 species of sponges belonging to 13 families under the class Demospongiae were identified from coral reef and rocky shores which covers a broader geographical area of Gujarat. Some of the species found are boring species known among the corals. Out of seventeen species recorded, the species *Haliclona* (*Reneira*) *cinerea* (Grant, 1826) have been recorded for the first time from India. The order Clionida, Tetractinellida and Haplosclerida are dominant while the presence of the order Dictyoceratida and Poecilosclerida are noteworthy in providing contrast to the studies in the coast. In this paper, a description of the new species is presented along with the description of the first recorded species in the Gujarat coast. In addition to the taxonomic description of the species, a distribution pattern is also presented and has significant implications for the conservation and management of the Gujarat.

Keywords: Sponges, Porifera, Demospongiae, reef area, Gujarat

Exploring the Hyperdiverse yet Underexplored World of Darwin Wasps: New Discoveries and Challenges in Indian Biosystematics

A. P. Ranjith and Dharma Rajan Priyadarsanan

Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Srirampura, Jakkur Post, Bangalore 560064, India

(Email: ridhuranjith@gmail.com)

Abstract

Darwin wasps (Hymenoptera: Ichneumonidae) is a hyperdiverse, yet an underexplored taxon. So they are often considered as one of the dark taxa within the Hymenoptera. Though only 30,000 species are described so far, it is estimated that there could be half a million or more species exist globally. In India 1,456 species are reported from 25 subfamilies till 2016. Among this, subfamily Ichneumoninae is found speciose with 250 species. Our recent explorations to two important biodiversity hotspots, Western Ghats and Eastern Himalayas, has added one new genus and seven new species. Present study yielded new distribution records of subfamilies such as Adelognathinae, Ateleutinae, Lycorininae, Microleptinae and Oxytorinae including 10 new genera and nearly 100 new species. In addition to this around 20 genera are recorded new to India. Some genera including *Trieces*, *Hypambylis*, *Aperileptus*, *Neurateles*, *Plectiscus*, *Shortia* and *Stenomacrus* are reported from the Oriental region for the first time. One major gaps in Darwin wasp biosystematics is the lack of molecular data of Indian taxa. Of the 1,35,138 sequences in 13,688 Barcode Index Numbers [in BOLD] only 31 sequences of 13 species are of Indian origin. The paucity of molecular data has created a significant disparity between global and Indian taxa, and efforts are underway to bridge this gap. The phylogeny and biogeography of Indian Darwin wasps, particularly given recent discoveries of highly endemic genera like Shortia with two new species, which had previously only been reported in Australia but have now been found in South India with two new species. We are trying to bridging the gap and it is crucial for answering questions about the phylogeny and biogeography of Indian Darwin wasps.

Keywords: Ichneumonidae, new species, biodiversity hotspots, phylogeny, biogeography

Observation on a new septate gregarine, *Gregarina* sp. n. (Apicomplexa: Eugregarinida: Gregarinidae), parasitic in the alimentary canal of the lesser mealworm, *Alphitobius diaperinus* (Panzer, 1797) (Coleoptera: Tenebrionidae), from poultry houses

Susobhan Mondal and Biplob Kumar Modak

Sidho-Kanho-Birsha University, P.O. & Dist.- Purulia, Pin-723104, West Bengal, India

(Email: susobhan.sm@gmail.com)

Abstract

Poultry producers in the Western Plateau region of West Bengal often worry about the lesser mealworm, *Alphitobius diaperinus* (Panzer, 1797; Coleoptera: Tenebrionidae), since it consumes poultry feed, causes structural damage to chicken coops, and can be a reservoir for illness. An investigation for septate gregarine in *A. diaperinus*, inhabiting the poultry houses of the Western Plateau region of West Bengal, India, was conducted from January, 2021 to December, 2022. For permanent preparations of smear slides, Schaudinn's fixative was preferred, and staining with Heidenhain's hematoxylin. The septate gregarine observed in the alimentary canal of *A. diaperinus* (prevalence 23.07%) is characterised by a long, cylindrical, solitary gamont with a maximum length of 192 µm that remains inclined to one side. Protomerite is very shallowly luniform, and deutomerite is narrowly deltoid, covered by a thick pellicle. The association is caudo-frontal; primates retain the characteristics of gamont, but the satellite is linearly obdeltoid and, in certain circumstances, larger than the primate. Orbicular gametocysts range in size from 89 to 110 micrometres and dehisce through 8-12 sporoducts. Oocysts, which are typically dolioform, are extruded in long, linked chains. The above characteristics validate its inclusion under the genus *Gregarina* Dufour, 1828 (Apicomplexa: Eugregarinida: Gregarinidae), but it is distinctive by the shape of the body, WP: WD ratio (1: 1.12), number of sporoducts and other measurements as well as hosts. Present communication considers it as a new species of septate gregarine, *Gregarina* sp. n. sp.

Keywords: Apicomplexa, septate gregarine, Gregarina, lesser mealworm, Alphitobius diaperinus

Redescription of *Neoeucirrhichthys maydelli* (Teleostei: Cobitidae) from Brahmaputra drainage, Assam, Northeastern India

Bidangshri Basumatary and Yumnam Lokeshwor Singh

Assam Don Bosco University, India

(Email: bidangshribasu@gmail.com)

Abstract

Banarescu & Nalbant (1968) described a cobitid genus *Neoeucirrhichthys*, a monotypic loach under family cobitidae, based on a single specimen *N. maydelli* from Janali River (Brahmaputra River system) at Raimona, Goalpara district, Assam. It is characterized by having an elongated, slightly compressed body, highly placed eye with very narrow interorbital space, strong suborbital bifid spine with low processus dorso-caudalis branch, no trace of rostral or maxillary barbel and presence of very minute maxillo-mandibular rudimentary barbel at the corner of the mouth. Edds & Ng (2007) attempted to redescribe *Neoeucirrhichthys maydelli* from Mechi River, Nepal without mentioning the information of minute maxillo-mandibular rudimentary barbels at the corner of mouth. Some of the informations are not conformed to original characters, thus, need verification and confirmation of its taxonomic status with specimens collected in and around the habitat of its type locality. In view of this, recently populations of *Neoeucirrhichthys maydelli* have been collected from Khujia River flowing to the Champabati River (vicinity of type locality of type species), the northern tributary of Brahmaputra drainage, Assam. It is redescribed here based on the additional information of its morphology, anatomy and osteology. The present study revealed the presence of a lateral extension of air bladder capsule on each side which is not shown in the figure of original description. Important osteological features of *Neoeucirrhichthys maydelli* includes neurocranium with reduce (almost absent) anterior frontal region, posterior portion well developed triangular shape, no anterior preepiphysial fontanelle, posterior fontanelle well form triangular shape with wide base towards posterior; total vertebrae 34–35 (16 abdominal vertebrae; 18–19 caudal vertebrae), dorsal fin insertion between 12–13 vertebrae, anal fin insertion between 21–22 and 22–23 vertebrae; caudal complex with 5 hypural, parahypural and hypural 1 fused, gap between epural and neural arch of compound centrum.

Keywords: Monotypic loach, Neoeucirrhichthys maydelli, redescription, Khujia River, osteology

A new species of genus *Carbula* Stål, 1865 (Hemiptera: Pentatomidae) from West Bengal, India, with a key to Indian species

Amartya Pal, Swetapadma Dash and Devanshu Gupta

Zoological Survey of India, Kolkata, India

(Email: amartyapal08@gmail.com)

Abstract

The genus *Carbula* Stål, 1865 is represented by 76 species from the world with 10 species from India. Genus *Carbula* is characterized by broadly ovate body; head rounded or somewhat truncated at apex with lobes of equal length; first segment of antennae not reaching the apex of the head and having pronotum with anterolateral margin generally obtuse, terminated by a rarely crenulated levigate margins. A new species of the genus *Carbula* Stål, 1865 (Hemiptera: Pentatomidae) is described from West Bengal, India. The diagnostic characters of the newly described species are illustrated and compared to the allied species. The new species can be distinguished by its blunt humeral angles of pronotum and paramere lobes, angulate at the apex. A key to the Indian species of Carbula is prepared and a checklist with distributional records is provided.

Keywords: Taxonomy, Stink bugs, Identification key, Oriental region, Palearctic region

Integrative Taxonomy of a New Species of the Genus *Coriophagus* Kinzelbach from Jharkhand, India with tentative phylogeny to known males (Strepsiptera: Halictophagidae)

Poulami Hui, Bindarika Mukherjee and Niladri Hazra
RESEARCH SCHOLAR
(Email: moupou1997@gmail.com)

Abstract

Objectives: Taxonomic enumeration of a new species of *Coriophagus*. Hypothesise possible phylogeny among the known males of the genus. Methodology: Two adult males were captured in Jamtara, Jharkhand with the aid of an open light trap and were preserved in absolute ethanol for DNA analysis. One of the specimens was carefully dissected and a little bit of tissues was taken from the thorax and outsourced for sequencing of COX I gene following Harrup, 2014. Specimens were mounted in slides after Wirth and Marston, 1968. Cladistic analysis using TnT version 1.5 software of the 15 species (ingroup) of the genus *Coriophagus* is made while *Halictophagus prominens* and *Tridactylophagus sufflatus* are considered as outgroup. Observations: The proposed new species, *Coriophagus connexus* differs from other allied species by the following characters: detached vein R3 touching basally at distal 3/4th of vein R4 and flattened, oval-shaped tarsomere I of forelegs. The cladogram represents two clades including all the species with sinuate posterior margin of postlumbium. Clade A comprises two species, *C. adebratti* and *C. medleri*. Clade B consists of two subclades — subclade B1 comprising *C. calcaneus*, *C. rieki*, and *C. hansoni*. Subclade B2 is further subdivided into two groups; the first one comprises *C. monteithi* and *C. latimanus* whilst another one consists of *C. lockerbiensis*, *C. connexus* and *C. casui*. Outcomes: Before the study, only one species, *Coriophagus calcaneus* was described from India. GenBank Accession number, OQ282516 for the new species is obtained. At present this is the only COI sequence under the Coriophagus at NCBI. Molecular phylogeny can be made later when COI sequences will be uploaded by others. In cladistic analysis the genus has been recovered as a monophyletic group.

Keywords: *Coriophagus*, new species, DNA barcoding, Phylogeny, India

Comparative analysis on Sclerite Morphometry: A useful tool in the soft corals *Lobophytum* sp. (Sarcophytidae: Octocorallia: Anthozoa) identification from Andaman and Nicobar Islands, India

S. Rajendra and C. Raghunathan

Zoological Survey of India, Prani Vigyan Bhawan, M-Block, New Alipore, Kolkata 700 053, West Bengal, India

(Email: rajenzsi1992@gmail.com)

Abstract

Soft corals are sessile, marine benthic organisms that play an important role in the coral reef ecosystem. The identification of soft coral species is challenging due to their morphological deviations. Octocorals are one of least studied groups in Indian waters due to a lack of expertise. In the world's oceans, a total of 60 Lobophytum species have been identified while India shares 21 species including 18 species from the Andaman and Nicobar Islands. During the study, Lobophytum specimens were collected from coral reef regions of the Andaman and Nicobar Islands employing SCUBA-diving and hand-picking methods. Specimens were distinguished with lobate, plate-like, or capitate with a prominent stalk and dimorphic, fully retractile polyps into thick coenenchyme. Species were identified by extracting sclerites from various regions of the colony with 5% sodium-hypochlorite (capitulum surface and interior, base surface, and interior) under a stereo-zoom microscope. Sclerite structure and measurements, as well as type composition, have been examined in ten *Lobophytum* species in this study. In different regions of the same colony, the structural composition of each species' sclerites varies. Sclerites of various shapes were observed in ten *Lobophytum* species, including club-shaped, rod-shaped, spindle-shaped, shuttles, capstans, dumbbells, cylindrical, barrel-shaped, irregular-shaped, and cross-shaped sclerites. The colony morphology also plays a role in taxonomy and species arrangement in systematics. Aside from colony morphology, zooid arrangement in the colony is also important for species identification. The colour of the colonies does not have a proper role in species identification because they show a variety of colours due to their symbiosis with zooxanthellate microalgae. The colony colours are determined by zooxanthellate concentration, temperature, depth, and other environmental factors. However, after preservation, most colonies turn white, beige white, or cream in colour. Hence, Sclerite morphometric is a very useful characteristic for species identification in the *Lobophytum* species.

Keywords: Andaman and Nicobar Islands, Finger leather coral, Lobes, Sclerites, Taxonomy

Polymorphic Forms in Cobitid Loach under Genus *Lepidocephalichthys* Bleeker, 1863 of Northeast India

Kangjam Velentina and Yumnam Lokeshwor

Department of Zoology, Assam Don Bosco University, Tapesia Gardens, Sonapur, Assam 782402, India

(Email: k.velentinad@gmail.com)

Abstract

The spined loaches under the genus *Lepidocephalichthys* Bleeker, 1863 under family Cobitidae are colourful freshwater fishes with both ornamental and food values and are characterized by the presence of a sub-orbital spine and pectoral rod formed by the fused last two pectoral-fin rays in males. A total of 20 valid species are under this genus all over the world, out of which the inland freshwater bodies of Northeastern India harbours 9 valid species viz. *Lepidocephalichthys alkaia*, *L. annandalei*, *L. arunachalensis*, *L. berdmorei*, *L. goalparensis*, *L. guntea*, *L. irrorata*, *L. longipinnis* and *L. micropogon*. They show a great diversity and polymorphism in body morphology, number and size of barbels, colour pattern on the body and the size of ocellus on caudal-fin base. Species under this genus are facing taxonomic ambiguities due to lack of evidence of the representative species and polymorphic forms. In view of this, the current study has been taken up to contribute in solving the existing taxonomic ambiguities by studying the various polymorphic forms observed in Lepidocephalichthys of the Northeastern India. Multiple comparisons through morphometry, meristic, anatomy and osteology of the specimens collected from different river systems from different parts of the Northeast India has been employed. The present study has revealed the observance of a great polymorphism in three species viz. *Lepidocephalichthys berdmorei*, *L. guntea* and *L. irrorata* collected from different rivers of the Northeastern India and documented here with relevant data and photographs.

Keywords: Northeastern India, Lepidocephalichthys, Cobitidae, sub-orbital spine, polymorphism

Description of a new plant-parasitic nematode of the genus *Pratylenchoides indicus* sp. nov. (Tylenchida: Pratylenchidae) associated with banana from West Bengal, India

Subhankar Dey[1], Viswa Venkat Gantait[2] and Biplob Kumar Modak[1]

[1,3]Sidho-Kanho-Birsha University, Ranchi Road, P.O.-Purulia Sainik School, Purulia, West Bengal- 723104, India

[2]Zoological Survey of India, Prani Vigyan Bhawan, Block M, New Alipore, Kolkata, West Bengal- 700053, India

(Email: subhankar048@gmail.com)

Abstract

A survey was conducted in Hooghly district of West Bengal, India during 2019 to 2021 to investigate soil free-living and plant-parasitic nematodes (PPNs) associated with banana. Nematodes were extracted from soil and root samples by Cobb's sieving technique (Cobb, 1918). The decanting and dehydration was performed by Modified Baermann's funnel technique (Chirstie and Perry, 1951) and Seinhorst's slow dehydration method (Seinhorst, 1959) respectively. Permanent slides have been prepared for microscopic studies and taxonomic identification is done by following the identification key of Siddiqi (2000). Photo micrographs, camera lucida drawings and morphometric measurements of the specimens were taken by using research microscope. The detailed taxonomic insight has revealed a PPN species of the genus *Pratylenchoides* belonging to the family Pratylenchidae, subfamily Radopholinae under the order Tylenchida, having prominently annulated cuticle, ventro-laterally overlapping oesophageal gland, pore-like phasmid and presence of deirids. The present species shows some unique characteristics in having typical 'hook' or 'interrogation' shaped small body (0.6 mm in length); round, unannulated lip region with non-sclerotized labial framework; oesophageal gland with two nuclei opposite to oesophago-intestinal junction; lateral field with 6 incisures; absence of epiptygma; and clavated conico-cylindrical tail in female with unannulated terminus (40µm long). At present, 31 species are known under the genus *Pratylenchoides*, however the differential diagnosis distinctly separates the present species from the other with close resemblance to 7 species viz. *P. crenicauda*, *P. leiocauda*, *P. laticauda*, *P. variabilis*, *P. camachoi*, *P. maritimus* and *P. erzurumensis*. Thus, the observed species Pratylenchoides indicus sp. nov. is considered as a new to science.

Keywords: Banana, India, new species, plant-parasitic nematode, taxonomy

Myxobolus murakamii: A rare myxozoa (Myxozoa: Bivalvulida) showing host plasticity, tissue tropism and wide geographical distribution

Prabir Banerjee[1], Saugata Basu[2] and Biplob Kumar Modak[3]

[1]Jarura Sikshaniketan, P.O. Jarura, P.S. Polba, Dist. Hooghly, Pin 712138, West Bengal, India

[2]Department of Biology, Uttarpara Govt. High School, Uttarpara, Hooghly, West Bengal, India

[3]Department of Zoology, Sidho-Kanho-Birsha University, Purulia, West Bengal, India

(Email: banerjee.prabir@gmail.com)

Abstract

A myxozoan species has been obtained from the caudal fin of a cyprinid host, *Puntius sophore* Hamilton, 1822 from Bardhaman Town, Purba Bardhaman, West Bengal, India. It shows very close morphological similarities with *Myxobolus murakamii* Urawa *et al*., 2009 which originally had been reported from salmonidae fish, *Oncorhynchus masou ishikawae* at the lateral line nerve from the Oze River, Hiroshima, Japan. Molecular phylogenetic study has been done using small subunit ribosomal DNA (SSU rDNA) sequencing. The sequence of the present species (MF582545) shows 99.84% and 100% sequence identity with *Myxobolus murakamii* Urawa *et al*., 2009 from the hosts *Oncorhynchus masou ishikawae* (AB469984) and *Oncorhynchus masou masou* (AB469985) respectively, reported from Japan. The pairwise evolutionary divergence value between the studied species (MF582545) and two species of *M. murakamii* (AB469984 and AB469985) reported from two different countries is 0.00.The SSU rDNA sequence of the present species along with 14 closely related sequenced data obtained from GenBank are used to construct the phylogenetic tree. Present species (MF582545) and two species of *M. murakamii* (AB469984 and AB469985) from distant geographical regions have been placed in the same clade. Considering all these features, present communication considers the studied species as conspecific with *Myxobolus murakamii* Urawa *et al*., 2009. In this communication, *M. murakamii* Urawa *et al*., 2009 is regarded as a rare one as it exhibits host plasticity, tissue tropism and wide geographical distribution.

Keywords: Cyprinid, Salmonidae, Myxozoa, Myxobolus murakamii, SSU rDNA

Studies on the Genus *Talanema* Andrassy, 1991 with description of a New Species *Talanema* Dhritae from West Bengal, India

Viswa Venkat Gantait and Olivia Das

Zoological Survey of India, M- Block, New Alipore, Kolkata -700053, West Bengal, India

(Email: oliviadas12@gmail.com)

Abstract

The genus *Talanema* was erected by Andrassy (1991) under subfamily Qudsianematinae, family Qudsianematidae and order Dorylaimida by differentiating it from Labronema Thorne 1939 in having transverse vulva (vs longitudinal), digitate tail (vs rounded) and non-contiguous supplements (vs contiguous). He transferred four species viz. *Labronema digitatum* Sukul *et al*., 1975, *L. mauritiense* Williams 1959, *L. pararapax* Ahmad and Jairajpuri, 1982 and *L. pygmaeum* Heyns, 1963 and proposed the genus. Vinciguerra and Clausi described *T. avolai* and *T. salinae* in 1995. Shaheen and Ahmad (2005) added *T. nicaraguaense* as a new species. Andrassy (2011) transferred *Labronema ibarakiense* Khan and Araki, 2002 to the genus. Imran *et al*., (2021) combined *Labronema baqrii* Khan *et al*., 1989, *L. malagari* Furstenberg *et al*., 1993 and *L. sphinctum* Mohilal and Dhanachand, 2001 to Talanema. *T. saccatum* was described by Jabberi *et al*., (2021). *Talanema dhritae* sp. n., collected from vine-yard field in Bankura district of West Bengal, India is characterized by having shorter body (L= 0.71-0.97 mm; a= 15.5-20.5; b= 3.4-4.6; c= 28.4-35.4; c'= 0.96-1.13); transverse vulva (V= 44.6-48.2); small rounded cardia and digitate tail, bend dorsally. It differs from all the species of the genus except *T. avolai* (L= 0.85-0.99 mm) and *T. salinae* (L= 0.7-0.8 mm) having shorter body length and absence of male. But differs from them in odontostylet length (15.7 -17?m in *T. avolai* and 12-14 ?m in *T. salinae*); width of lip (11-14 ?m in *T. avolai* and 12-14 ?m in *T. salinae*); oesophageal length (251-263 ?m in *T. avolai* and 210-243 ?m in *T. salinae*) and position of vulva (V = 55.3-61.3 in *T. avolai* and 56.8-58.4 in *T. salinae*). *T. dhritae* sp. n. differs from all the species having small spherical cardia. It is claimed as a new species to the genus. A compendium and species key of the genus are also provided.

Keywords: *Talanema, T. dhritae* sp. n., compendium, species key, West Bengal, India

New record of Collembola (Hexapoda) from West Bengal with notes on their taxonomy

Pritha Mandal, G. P. Mandal, K. K. Bhattacharya, K. K. Suman and Dhriti Banerjee

Zoological Survey of India, M- Block, New Alipore, Kolkata -700053, West Bengal, India

(Email: prithamandal1995@gmail.com)

Abstract

Collembolas are minute, wingless, and highly abundant soil organisms that contribute to soil structure formation and nutrient cycling through litter decomposition and fungal foraging. Pioneering work on Indian Collembola was undertaken by Imms (1912), later many researchers like Mitra (1966, 1974), Hazra & Chowdhari (1981), and Mandal (2011) contributed to this field. Mandal (2018) reported a total of 342 species of collembola from India, out of which only 78 collembolan species were studied from the state of West Bengal. The state exhibits a wide range of landforms, ecosystems, climatic variations, and soil types, starting from the Himalayan terai in the north, dry deciduous forest in the east, and the mangroves at the coast of the Bay of Bengal. Such diverse eco-geographic regions favor the occurrence of a large number of discriminative collembolan species therefore, more exploration and extensive study is required from the state to enrich the knowledge of the collembolan taxonomy and diversity. For the present study, several surveys and expeditions of various habitats were taken using different collection methods (aspirator, pan-trap, soil extraction, bush beating, etc.). The collected specimens were preserved in 70% alcohol and carried to the laboratory for later studies. Specimens were sorted and mounted on slides for microscopic identification as per standardized protocols. During examination following microscopic observation of the sorted specimens, we found 22 species under 17 genera, and 9 families are new for the state of West Bengal. Some species of genera such as *Lepidocyrtus*, *Salina*, *Callyntrura*, *Dicranocentroides*, *Cyphoderus*, *Homidia*, etc. are ubiquitous in distribution, unlike Tomocerus which are found only in high altitudes, and Spheredia, Xenylla are prevalent on lowlands. A descriptive note on their taxonomy with proper illustrations is provided in the present paper with an approach to improve the faunistic understanding of collembolans from the state.

Keywords: New record, Entomobryomorpha, Springtails, Soil invertebrates, Taxonomy

Redescription of a labeonid fish *Garra nasuta* (McClelland, 1838) from Meghalaya

Ibansiewdor Marngar and Yumnam Lokeshwor

Department of Zoology, Assam Don Bosco University, Tapesia Gardens, Kamarkuchi, Assam – 782402, India

(Email: bankingfisher@gmail.com)

Abstract

McClelland (1838) described *Platycara nasuta* (now Garra) from Kasya mountains, Assam (now Khasi Hills, Meghalaya). The type species does not exist. Neither McClelland's (1838) text nor the accompanying illustration provides significant information to diagnose the species only mentioning the presence of a pit between the nares. Menon (1964) attempted to redescribe this stenotopic species based on the specimens from Assam, India; Sittang drainage in southern Shan State Myanmar and from parts of China and had mentioned the presence of a prominent trilobed proboscis which is not mentioned in McClelland (1838). Thus, identity of *Garra nasuta* is not yet clear. In view of this taxonomic ambiguity, the present study attempts to redescribe of Garra nasuta collected from Khasi Hills, the original collection site of McClelland (1838). The study has been based on morphological, anatomical, and osteological characteristics. To solve the existing taxonomic ambiguities on the taxonomic status of *Garra nasuta*, a neotype has been designated and the same has been deposited in the Assam Don Bosco University Museum of Fish (ADBU-MF). It is distinguished from other congeners in having a trilobed proboscis, the presence of a pit-like crease between nares, 33-34 lateral line scales, and 9-10 pre-dorsal scales with 16 circumpeduncular scales. Samples have been collected from two main river basins in the Khasi Hills, Meghalaya viz. the Brahmaputra and the Barak-Surma-Meghna River basins.

Keywords: *Platycara nasuta, Garra*, Khasi Hills, redescription, neotype

First report on Egg parasitism of *Spodoptera frugiperda* (J. E. Smith, 1797) (Lepidoptera: Noctuoidea: Noctuidae) by *Telonomus* sp. (Platygastridae: Telenominae) from Kerala, India

Aiswarya N.[1] and Abhilash Peter[2]
[1]Research Scholar
[2]Assistant Professor
(Email: aiswaryavmspp@gmail.com)

Abstract

Spodoptera frugiperda (J. E. Smith), also known as the fall armyworm (FAW), is a member of the Noctuidae family and is indigenous to the Americas. It was discovered in Africa in 2016 and is an invasive pest there (Prasanna, B. M. *et al*., 2018). It was reported to have severely reduced corn productivity in America and Africa. In India, Karnataka received a report on it in 2018 (Sharanabasappa *et al*., 2018). The migratory nature of FAW resulted in significant reductions in maize yield in a number of areas. Despite eating maize, it can eat 80 different types of crop plants (Prasanna, B. M. *et al*., 2018). High FAW egg parasitism by *Telenomus remus*, *Trichogramma* sp. and *Chelonus* sp. was recorded by ICAR-NBAIR (Patil, Jagadeesh *et al*., 2020). We are reporting Spodoptera frugiperda egg parasitism by *Telenomus* sp. on okra hostplant from Kerala for the first time. Eggs were collected from the okra field at Karumalloor, Ernakulam, Kerala, India (N10º08′33.1″ E076º16′40.7″) on 30th March, 2022 by handpicking method. Some of the eggs hatched on 31st March, 2022 and were raised in the Entomo Taxonomy Lab, Christ College, Irinjalakuda, Thrissur, Kerala. A muslin cloth cover was placed over each of the six bottles (10cm height × 5cm diameter) containing six larvae. Okra was used to feed the larvae in the containers. The bottles were cleaned daily using tissue paper to prevent fungus infections. Egg parasitoids emerged from the remaining eggs on 6th and 7th April, 2022. The emerged male and female moths were kept in the same bottle after the first generation of the moth was finished to collect information about the second generation. The life cycle of the *Spodoptera frugiperda* (J. E. Smith) was completed in 22.6 ± 0.47days.

Keywords: Egg parasitism, *Spodoptera frugiperda*, *Telenomus* sp., Kerala

Review of Genus *Hydrophilus* Leach, 1815 (Coleoptera: Hydrophilidae: Hydrophilinae) of India

Shipra Sonali, Sujit Kumar Ghosh and Devanshu Gupta

Zoological Survey of India, Prani Vigyan Bhawan, Block M, New Alipore, Kolkata, West Bengal 700053, India

(Email: shipra.aquaticbeetles@gmail.com)

Abstract

Hydrophilus Leach, 1815 is a large genus of family Hydrophilidae, with about 48 described species globally. This genus comprises of 3 subgenera: *Temnopterus* Solier 1834, *Dibolocelus* Bedel 1891 and *Hydrophilus* Geoffroy, 1762 and only subgenus *Hydrophilus* Geoffroy is reported from India. Genus *Hydrophilus* in India is represented by 10 species i.e *Hydrophilus bilineatus caschmirensis* Redtenbacher, 1884; *Hydrophilus dauricus* Mannerheim, 1852; *Hydrophilus hastatus* (Herbst, 1779); *Hydrophilus indicus* (Bedel, 1891); *Hydrophilus Olivaceus* Fabricius, 1781; *Hydr ophilus piceus* (Linnaeus, 1758); *Hydrophilus rufocinctus* (Bedel, 1891); *Hydrophilus temnoptreoides* (Orchymont, 1913); *Hydrophilus unguicularis* (Régimbart, 1901) and *Hydrophilus senegalensis* (Percheron, 1835). Maximum number of species are reported from Himalyan region (7 species) and Gangetic plains (7 species), followed by Deccan Peninsula (4 species), Desert (3 species) and Semi-Arid zone (3 species) and 1 species from Islands. No comprehensive work has been done on this genus so far and only world revision was done by Régimbart, 1913 in which he included 39 species of genus Hydrophilus from world fauna. In this paper, a review of the genus *Hydrophilus* is presented from India with male genitalia photographs and key identification characters.

Keywords: Aquatic Coleoptera, Taxonomy, Checklist, Hydrophilidae, review

Divulging the veracious diversity of *Congrid eels* (Anguilliformes: Congridae) along the Indian waters

Paramasivam Kodeeswaran[1], Anil Mohapatra[2], T. T. Ajith Kumar[3] and Uttam Kumar Sarkar[4]

[1,3,4]ICAR - National Bureau of Fish Genetic Resources, Lucknow, Uttar Pradesh - 226 002, India

[2]Estuarine Biology Regional Centre, Zoological Survey of India, Gopalpur-on-Sea, Ganjam, Odisha - 761 002, India

(Email: kodyvenkat1995@gmail.com)

Abstract

Conger eels (Congridae Kaup, 1856) are known to be small to large-sized animals that dwell throughout temperate and tropical waters, particularly from the continental shelf or slope to the deep sea, along the world's oceans. At present, 226 valid species belong to 32 genera under three subfamilies, and very little is known about their taxonomy, biology, ecology, and precise distribution. The present study aims to document the diversity of Congridae eel distributed along Indian waters. Sampling has been done at various major landing centres along the Indian coast during 2020-2022 and further literature survey has been done to perceive true diversity. In this present study, 36 species belonging to 16 genera have been documented. Amongst this, 9 new species and 4 new records have been described and documented in the last 3 years. The genus *Ariosoma* dominates the species diversity with 8 species, followed by Rhynchoconger (5 species), Bathycongrus and Heteroconger with 3 species each. The genus *Macrocephenchelys* was recorded for the first time from Indian water based on a specimen from the Arabian Sea. Further, molecular analyses revealed that few more species of congrid eels have been distributed along the Indian water. Even though there were 32 genera in the family Congridae, only a few genera such as Conger and Ariosoma possess minor commercial fishery, but distinct statistical data is not available. Hence, the recent new species discovered from the genus *Ariosoma*, *Conger* and *Rhynchoconger* have fleshy body, that can be used for commercial purposes, after proximate analyses as value-added products such as fish balls, crackers, burgers and Congrid grills, which are already delicious seafood in Western Pacific countries, which will make a better way towards consumption of these groups among the commodities.

Keywords: Congridae, New species, Integrated Taxonomy, Human use

A description of four new species of *Hymenolepis* Weinland (Platyhelminthes: Cestoidea) from north eastern states of India

Suranjana Banerjee and A.K. Sanyal

Zoological Survey of India, M-Block, New Alipore, Kolkata- 700053, India

(Email: serenebanerjee@gmail.com)

Abstract

The objective of the present study was the collection, identification and documentation of cestode parasites from vertebrate hosts of Tripura, Sikkim and Arunachal Pradesh in India. The cestode parasites were isolated from the host intestine and then fixed, stained, observed and identified following the protocol of Ghosh and Kundu (1999). The present paper deals with four new species of *Hymenolepis* Weinland, 1858 from three north eastern states of India. It was observed that all the four described species were new to science. *Hymenolepis tripurensis* n. sp. obtained from *Rattus rattus* from Kanchonpur in Tripura is characterized by a length of 95.46-95.64 and breadth of 0.57; scolex continuous with main body, measuring 0.15 in length and 0.24 in breadth; suckers 0.07-0.08 long and 0.09-0.1 broad and cirrus sac measuring 0.04-0.075 in length and 0.01-0.015 in breadth that differentiates it from the rest of the described species in the genus. *Hymenolepis subhankari* n. sp. obtained from the intestine of *Suncus murinus* (common shrew) from Teliamura in Tripura is characterized by a squarish scolex measuring 0.17-0.2 in length and 0.22-0.34 in breadth; unarmed rostellum measuring 0.04-0.08 in length and 0.05-0.09 in breadth; ovary fan-shaped, that differentiates it from the rest of the described species in the genus. *Hymenolepis sikkimensis* n. sp. obtained from the intestine of *Corvus splendens* (common house crow) from Rhenok in Sikkim, India is characterized by a small, cauliflower-shaped scolex 0.18 in length and 0.14 in width; unarmed rostellum; rostellar pouch measuring 0.12 in length; testes forming a triangle around the ovary, pear-shaped cirrus sac, and a fan-shaped ovary consisting of several elongated lobes that differentiates it from the rest of the described species in the genus. *Hymenolepis subhendui* n. sp. obtained from the intestine of a bird *Heterophasia capistrata* (*Sibia* sp.) from Zemithung in Itanagar district of Arunachal Pradesh, India is characterized by scolex slightly set off from the neck, almost round, unarmed, measures 0.175 in length and 0.165 in breadth; rostellum absent; that differentiates it from the rest of the described species in the genus. The study led to the discovery of four new species of *Hymenolepis* Weinland, 1858 from these three north eastern states of India.

Keywords: *Hymenolepis tripurensis* n. sp., *Hymenolepis subhankari* n. sp., *Hymenolepis sikkimensis* n. sp., *Hymenolepis subhendui* n. sp., north east.

Systematic Status and Life Cycle of Pod Borer, *Mangina argus* (Kollar) (Lepidoptera: Erebidae) From India

Adarsh P. K.[1] and Abhilash Peter[2]

[1]Research scholar, Department of Zoology, Christ College, Irinjalakuda, Thrissur, Kerala 680125, India

[2]Assistant Professor, Department of Zoology, Christ College, Irinjalakuda, Thrissur, Kerala 680125, India

(Email: adarshpkjanardhanan@gmail.com)

Abstract

Mangina argus (Kollar) was placed earlier under the Genus *Argina* Hubner. Later, genitalia study revealed that the species in the genus *Argina* are non-congeneric, which led to the erection of a new genus *Mangina* Kaleka and Kirti with *A. argus* as the type species. *M. argus* is a major pest of the Crotalaria plants, commonly known as pod borer. Objective of the work is to study the complete life cycle of *M. argus* and to give the new systematic status of the species. The larvae of *M. argus* were collected from the Crotalaria plant at Irinjalakuda, Kerala, India. It was reared in the Entomo Taxonomy Lab of Christ College Irinjalakuda, Kerala. The larvae were kept separately in 10 different plastic jars (10 cm height x 25 cm diameter) with muslin cloth as lid. Larva was supplied with fresh crotalaria leaves every day and the excreta of larvae were removed daily. 3 generation of the species was completed reared in the laboratory. A detailed life cycle of *Mangina argus* (Kollar) is reported for the first time from India. *Mangina argus* completes its life cycle in 35-37 days. Longest life stage of *M. argus* is the larval stage with 17.7±1.2 days. A total of 7 larval instars observed. Pupal period extends 7.57±0.65 days. Adult moths lay eggs in 5 to 7 days after emerging and the eggs hatch in 5.6±0.4 days. According to Reichenbach, Norman G., and Gordon R. Stairs 1984 Temperature fluctuation and high temperature affects the embryo development significantly. Our study also showed the change in temperature due to commencement of summer season and rearing in lab conditions affected the body size as well as hatching capacity of eggs.

Keywords: *Mangina argus*, Lifecycle, Erebidae, Immature stages, Temperature

A new species of the genus *Acaropsella* (Acari: Trombidiformes) from Kerala, India

Neeraj Martin[1] and Sachin P. James[2]

[1]First Author
[2]Second Author

(Email: neeraj.martin@gmail.com)

Abstract

A new species of Acaropsella mite *Acaropsella strioreticulata* sp. nov has been collected from wheat semolina from Kerala state, South India, which is described and illustrated. The genus *Acaropsella* comprises of only eight species. No species of *Acaropsella* genus known from India till date. Descriptions are based on the morphology of adult females.

Keywords: *Acaropsella*, New species, Trombidiformes, Acari, Kerala.

Two new records of soil-inhabiting nematodes (Nematoda: Plectidae and Cephalobidae) from India

Priyanka Kashyap[1], Anjum Nasreen Rizvi[2] and Virendra Prasad Uniyal[3]

[1,3]Wildlife Institute of India, Chandrabani, Dehradun, Uttarakhand-248001, India

[2]Zoological Survey of India, New Alipore, Kolkata, West Bengal-700053, India

(Email: 11priyankakashyap@gmail.com)

Abstract

Objective: To study the diversity of soil-inhabiting nematodes from subalpine and alpine regions of Gangotri valley in Gangotri National Park, Uttarakhand and reporting new nematode species records from India viz. *Plectus parietinus* Bastian, 1865 and *Stegelletina devimucronata* (Sumenkova, 1964) Bostromand De Ley, 1996. Methodology: Soil samples were collected from subalpine and alpine regions of Gangotri valley in Gangotri National Park, Uttarakhand. Stratified random sampling technique was used for soil sampling. The soil samples were processed by sieving and decantation technique. The Nematodes extracted from processed samples were fixed in hot Formalin: Acetic Acid fixative. Fixed nematodes were transferred to the mixture of a Glycerin-Alcohol for dehydration in desiccator. The wax ring method of De Maeseneer and D' Herde (1963) were used for mounting and sealing of the nematodes. The mounted nematodes were studied under compound microscope BX 51 DIC Olympus microscope and photographed with DP20 digital camera. Observation: Upon processing and examination, two first records of nematodes from India were found namely, *Plectus parietinus* Bastian, 1865 and *Stegelletina devimucronata* (Sumenkova, 1964) Bostrom and De Ley, 1996. Data on their morphometrics and distribution are provided. Both species were found at high altitude areas of the valley above 3800 m. elevation. There are 76 Plectus species records across the world and eleven species records from India. Currently nine valid species of genus *Stegelletina* and no available species record of *Stegellitina* from India Outcome: Data on their morphometrics and distribution are provided. The present population of *Plectus* and *Stegelletina* species, forms first records from India, *Plectus parietinus* shows conformity to most morphometric characteristics expect the body length which is slightly longer than the earlier descriptions. Morphometric data of *Stegelletina devimucronata* population is same as described by earlier workers.

Keywords: Gangotri National park, Morphology, Distribution, Nematodes, Indian Himalayan Region

Taxonomy of Cephalopods Using Fine-Grained Lightweight Transfer Learning Techniques

P. Anantha Prabha[1], R. Sugunadevi[2], G. Suchitra[3] and R. Saravanan[4]

[1]Department of Computer Science & Engineering, Sri Krishna College of Technology, Coimbatore, 641042, Tamil Nadu, India

[2]Research Scholar, Department of Electronics and Communication Engineering, Government College of Technology, Coimbatore, 641013, Tamil Nadu, India

[3]Department of Electronics and Communication Engineering, Government College of Technology, Coimbatore, 641013, Tamil Nadu, India

[4]Faculty of Allied Health Sciences, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam-603 103, Chengalpattu Dist, Tamil Nadu, India

(Email: saran_prp@yahoo.com)

Abstract

Cephalopod classification is a challenging method that requires a Malacologist to investigate the animals by hand while also maintaining constant approach. Manual investigation and classification require patience and are seldom done without the guidance of experts. To address this issue, a system that automatically classifies cephalopods using transfer learning methods is proposed. Only such Lightweight Pre-trained Networks are used in the Proposed Method to Enable IoT in the Task of Identifying Cephalopods. The efficiency of the model variables is first determined by assessing their output and evaluating the results. Finally, the models are adjusted to increase classification accuracy by introducing dense layers and adjusting model parameters. To optimize test accuracy, the programs installed use a fine-tuned Rectified Adam optimizer. Third, RAdamGC, a technique for Adam with Gradient Centralization, is suggested and implemented in improved models to reduce training schedules. By implementing a suitable, lightweight pre-trained network, the framework enables an Internet of Things (IoT) or embedded device to perform out the classification tasks. MobileNetV2, InceptionV3, and NASNet Mobile, three fine-tuned models, have each obtained a classification accuracy of 89.74%, 87.12%, and 89.74%. The results indicate that the refined models are competent of classifying distinct cephalopod taxa. The findings have also shown that using RAdamGC effectively helps to cut down on training time.

Keywords: Cephalopod, taxonomy, RAdamGC, MobileNetV2, NASNet.

A Study on Butterfly and use of their Larval Host Plants in a Tropical Urban Context: Diversity and Associations

Sneha Thakur Chakraborty[1], Sourish Bhattacharjee[2], Sayan Panja[3], Supritam Pandey[4], Rudra Prasad Das[5] and Soumyajit Banerjee[6]

[1,2,3,4,6]Department of Zoology for UG and PG Studies, Serampore College, Serampore, Hooghly, West Bengal 712201, India
[5]Department of Zoology, Kishore Bharati Bhagini Nivedita College (Co-ed.), Behala, Kolkata, West Bengal 700060, India

(Email: snehathakurch@gmail.com)

Abstract

In the present study, an attempt was made at the basic level to analyze the relationship between abundance of butterflies with the niche breadth with respect to host and nectar plants to portray resource sharing, if any. The study was conducted at four selected spots adjacent to Serampore College, Serampore, Hooghly. Bi-weekly sampling of the study site was done in between July, 2020 – June, 2022 following 'Pollard Walk' method with necessary modifications. 2860 individuals of butterflies belonging to 27 species categorized under 5 families were recorded. The variation in niche breadth suggested that species with higher values of Levins' measure of niche breadth have wider utilization of resource sharing and indicate the 'generalist' pattern of the particular species. Same holds true for Levins' standardized niche breadth where species with values less than 1 (<1) are specialists. Results of three way factorial ANOVA on abundance of butterfly species taking sampling spots, months and plant species as explanatory variables yielded significant variation. Post hoc Tukey test reflected significant variation across the sampling sites and plant species in terms of butterfly abundances. The results are expected to highlight the harmonization between abundance of butterflies with its respective host plants at tropical urban town, similar to the present study area thereby emphasizing the need for their conservation. The information on the spatial scale distribution of the butterflies against the host plants is crucial for the purpose of management and conservation of butterflies in order to maintain a healthy and pollution free ecosystem. The present study thus calls for a restriction in various anthropogenic activities including construction of buildings at the cost of habitat loss of responsive species.

Keywords: Environmental indicator, niche breadth, resource sharing, species richness

Assesment of aquatic insects' diversity in selected wetlands of Hooghly: A progessive tool towards Conservation Biological Control

Rima Sadhukhan[1], Himadri Chakraborty[2], Subhayan Adhikary[3], Meghma Ghosh[4], Asif Hossain[5] and Soumyajit Banerjee[6]

[1,2,3,6]Department of Zoology for UG and PG Studies, Serampore College, Serampore, Hooghly, West Bengal 712201, Kolkata, India
[4]IISER Kolkata, West Bengal 741246, Kolkata, India
[5]Department of Zoology, The University of Burdwan, Burdwan 713104, India

(Email: chakrabortyhimadri2019@gmail.com)

Abstract

The assessment of aquatic insect diversity of the temporary pools and allied wetlands 271 will help to understand their role in maintenance of biological integrity of the wetlands. The correlation between the productivity and diversity of the aquatic insects will be emphasized to substantiate the abundance at the spatial and temporal scale. In the present study 4 different ponds and 4 different rice field, located in Hooghly district were selected for study. The specimens were collected by monthly sampling between 6am to 10am. The samples were collected from four corners of each study site. The sampling was done between November, 2020 to October, 2022. An "O" frame insect net was taken for the collection of sample from the sampling sites. Limnological parameters were also measured. The values of diversity indices varied significantly across different sampling spots justifying the usage of those wetlands. Among the insects Hemiptera dominated over Coleoptera, Odonata, Diptera. Individuals order Hemiptera found to be highest. The measure of biotic index, calculated also revealed the characteristic feature of the wetlands based on the pollution present and subsequent response by the corresponding species. Variation of different aquatic insects varied distinctly across the seasons irrespective of the classes and orders the representative individuals were observed in high numbers during the post monsoon and winter months. The diversity of these aquatic insects and their prey in the temporary pools are on record that prompts for evaluation of their ecology in the wetlands for the purpose of classical or conservation biological control with the aim of preserving the natural environment. In Indian as well as global perspective such information is wanting. Therefore, under this background the present study was conducted at two types of wetlands in the rural areas of Hooghly district.

Keywords: Aquatic insects, Wetlands Diversity, Conservation, Biological control

Study on The Abundance and Status of Jungle Cat (*Felis chaus* Schreber, 1777) in Hooghly And Purba Bardhhaman: An Approach Towards Mitigation Of Human Wildlife Conflict

Sumana Pathak[1], Arun Jana[2], Tapajit Bhattacharya[3] and Soumyajit Banerjee[4]

[1,2,4]Department of Zoology for UG and PG Studies, Serampore College, Serampore, Hooghly, West Bengal 712201, India

[3]PG Department of Conservation Biology, Durgapur Government College, Durgapur, West Bengal 713214, India

(Email: sumanapathak6@gmail.com)

Abstract

The Jungle cat is one of the least known carnivores in the world. They play an important role as pest controllers, prey for many animals, seed dispersers and pollinators. The status of jungle cats in India remains poorly known due to a lack of rigorous assessments of their respective populations. This study was conducted in the selected spots of the Hooghly and Purba Bardhhaman districts of West Bengal. In this study, trail sampling for direct and indirect evidence was conducted along with a camera trap, questionnaire survey, and scat analysis for the dietary analysis of the study species. The encounter rates of the two sites have high level of difference. In Purba Bardhhaman, the abundance of jungle cats is higher than in Hooghly. The questionnaire survey indicates that there is a constant conflict between humans and jungle cats over livelihoods (mainly poultry birds). The status of this wild cat is threatened and on both the sites and in Hooghly it is facing more stress and has very low population density. In the near future, the population of this exotic wild cat will go to local extinction if any conservation measures are not taken. Carnivores naturally occur at low densities owing to their apex position in the food web. Concomitantly, they continue to encounter severe declines, mostly because of their range shortening caused by habitat fragmentation, which in turn requires a deep understanding of the different parts of the ecosystem. The current study makes an attempt to study the abundance and status of jungle cats in West Bengal, the eastern part of India, along with identification of their mitigation of human wildlife conflict and potential threats to survival.

Keywords: Jungle Cat, Conflict, Local extinction

Seasonal variations in Nymphalid butterflies (Lepidoptera: Nymphalidae): effect on community dynamics and assemblages

C. Sivaperuman

Zoological Survey of India, Andaman Nicobar Regional Center, India

(Email: c_sivaperuman1@rediffmail.com)

Abstract

Butterfly species frequently synchronise their life cycles to seasonality, as rising temperatures and precipitation serve as indicators of resource availability. Nonetheless, deforestation and logging in the islands cause significant changes in microclimatic conditions. Nymphalid distribution pattern was studied over a year in three different habitats (forest interior, edge and agricultural fields). The current study was conducted in the Andaman and Nicobar Islands. A total of 1987 butterflies from 90 different species were studied. Butterfly abundance varied by habitat, with greater abundance, richness, and species diversity during the wet season. Understanding how species turnover rates change over time in different habitats can help explain species' vulnerability to environmental changes, allowing for comparison of assemblages over time. Species diversity and high community similarity over time are maintained by unidentified processes that are most active during the dry season. Monitoring and analysing changes in community composition over time scales can be used to refine community dynamics models by incorporating environmental factors needed to foresee the ecological impact of future climate change.

Keywords: Lepidoptera, Butterfly, Seasonal Variation , Ecosystem, Andaman and Nicobar Island

Biosystematics and Biogeography of Indian Mantodea (Insecta)

P. M. Sureshan and A. P. Kamila
Zoological Survey of India, WGRC, India
(Email: pmsuresh43@gmail.com)

Abstract

The order Mantodea (Insecta) includes large predatory insects popularly known as praying mantis, distributed in tropical and subtropical habitats of the world. Mantids are exclusively carnivorous feeding mainly on other arthropods as well as small vertebrates, thus having a very important ecological role in the suppression of herbivorous insect populations including major agricultural pests. Though ecologically important, the studies on praying mantids have been largely ignored and in the Indian context, the situation is also not encouraging. Contribution towards the enrichment of Indian fauna is only 2 genera and 19 species since the late nineties till date. There are more than 2500 species of mantids belonging to 438 genera in 31 families known worldwide, out of which 168 species under 70 genera in 13 families are known from the country (Ehrmann (2002), Schwarz & Roy (2019). The biogeography of the world Mantodea has not been much studied. Mantid fauna of the Oriental region shows close affinity with that of Afro-tropical and Australasian regions. Neotropical and Nearctic elements are very rarely reported from the region .Among the 70 genera reported from the country 58 are distributed only in the oriental region and out of which 8 genera are endemic to India. Due to the incompleteness of field studies and poor documentation of diversity, it is not possible to predict a pattern of distribution for Indian Mantodea. Being a less studied group of insects, taxonomic research in the group has to be promoted to understand the mantid biodiversity of the country and to utilize them for biological control programmes against agricultural pests. Detailed studies on the life history, ecology, ethology, phylogeny or any other facet of mantid life will be highly rewarding in entomological science.

Keywords: Praying mantis, Biogeography, Biosystematics, India

Untangling a Pheretimoids riddle: Integrated taxonomy acquaint three novel species of genus *Metaphire* Sims and Easton, 1972 from Manipur, India

Nalini Tiwari and Shweta Yadav

Department of Zoology, Dr. Harisingh Gour Vishwavidyalaya (A Central University) Sagar, Madhya Pradesh, India

(Email: n.tiwari2987@gmail.com)

Abstract

Pheretimoids systematics have been riddled by the small number of taxonomically important morpho-anatomical traits and high levels of homoplasy in this group. However, in recent years, pheretimoid taxonomy has significantly improved as a result of molecular phylogenetic methods. We applied the integrative taxonomy approach using morpho-anatomical traits and a mitochondrial COI dataset to reveal species delineation and phylogenetic relationships among the pheretimoid species in India. Results of our morpho-anatomical observation presented fourteen species which include five species of Amynthas (*A. alexandri alexandri*, *A. andersoni choprai*, *A. corticis*, *A. gracilis* and *A. morrisi*), four species of Metaphire (*M. anomala*, *M. birmanica*, *M. houlleti* and *M. posthuma*), Polypheretima elongata, Pheretima vungtauensis and three novel species of genus Metaphire (*M. manipurensis* sp. nov., *M. thabiensis* sp. nov. and *M. churachandpurensis* sp. nov. from Manipur, North-eastern Region, India). Out of the fourteen species A. andersoni choprai was first record for India, while *A. alexandri alexandri*, *M. posthuma* and *Polypheretima elongata* was the first record from Manipur, India. Similarly, A. corticis was the first record from Madhya Pradesh, India. Also, the analysed COI dataset provided strong support for each finding and showed that the species appeared distinct on the phylogenetic trees with full statistical support. Additionally, the species validation was confirmed by species delineation methods applying both tree-based and distance-based approach, in which the congruence among OTUs was observed for the studied samples. Despite the fact that these results are crucial for understanding the phylogenetics and development of the group, more comprehensive COI datasets are needed to draw firm conclusions.

Keywords: COI, Earthworms, Novel species, Pheretimoids, Phylogenetics.

Landscape ecology of the Pampa Riverine Ecosystem

Biji Abraham and Susan Abraham

Department of Economics Christian College Chengannur Alappuzha (Dist) Kerala, India

(Email: bijiab17@gmail.com)

Abstract

Failure to account for the importance of the landscape ecology and economic uses of river ecosystems has led to patterns of economic use with many detrimental environmental consequences. River channels comprise only a small part of the total landscape, yet their significance far outweighs their areal extent. In spite of the environmental, ecological, cultural, social and religious importance of this river system, it faces degradation and deterioration. It is one of the most congested and polluted rivers in south India. This study aims at a non-market valuation of the total economic value generated by the Pampa river system. People's stated preference gives an indication of the immense value of the system to users and non-user who are willing to pay for its conservation. The study makes use of a non-market valuation methodology called the Contingent valuation methodology to estimate values for the indirect benefits provided by the Pampa river system. Both primary and secondary data was used for the study. This analysis demonstrated the feasibility of extending the use of contingent valuation methods to local populations in developing countries like India. Certain issues emerge from these applications. Income is strongly related to willingness to pay to conserve river ecosystems, yet income levels are often low. Secondly, education is not an important factor that influences willingness to pay. Rather, relation of individual occupation to any river systems based activity very much influenced their willingness to pay. The study revealed that people very much valued the indirect function performed by river system, in fact as much as they valued the direct benefits provided by the system. There still exist differences of opinions among experts when undertaking such valuation studies. However, in the absence of a better technique for valuing environmental services that have no markets, this is definitely a first step.

Keywords: Landscape, Pampa Riverine Ecosystem, Ecology

Investigating the pollen transport network between moths (Lepidoptera) and the economically important plants in Central and Eastern Himalaya

Avishek Talukdar[1], Rajesh Lenka[2], Dipayan Mitra[3], Pallab Chatterjee[4] and Navneet Singh[5]

[1,2,3,4,5]Zoological survey of India, New Alipore, M-Block, Kolkata-700053, West Bengal, India

[1,2,4]Department of Zoology, University of Calcutta, Kolkata- 700019, West Bengal, India

[3]Department of Botany, University of North Bengal, West Bengal, India

(Email: askdar94@gmail.com)

Abstract

Around 87.5% of all angiosperms are mainly pollinated by both vertebrates and invertebrate pollinators. The scientific studies on pollination ecology largely ignored the nocturnal pollinators and mainly focused on diurnal pollinators. However, some recent research investigations revealed that the moths, majorly the nocturnal lepidopterans, form a major component of the pollen transport network during night time. A recent study in the Himalayan ecosystem of North-East India revealed that 65% of the moths are potential pollinators. The present study was designed to investigate the role of moths in pollen transportation of economically important plants in Central and Eastern Himalaya. A total of 14 sites of Arunachal Pradesh, Sikkim and North Bengal were surveyed from September, 2018 to August, 2019. We identified 37 species of six moth families as the pollen transporter of 12 species of economically important plants under nine angiosperm families. The analysis is based on quantifying parameters like pollen carrying capacity, pollen frequency, pollen abundancy, selectivity, connectance, Shannon's diversity, linkage diversity, and link per species by performing bipartite model between the identified moths and identified plant taxa. We also analysed generalized and specialised moth species. In conclusion, the present study provides a preliminary and fundamental understanding about the ecological role of moths in pollen transportation of economically important plants in Central and Eastern Himalaya and thus, will open up a new gateway in pollination ecology.

Keywords: Angiosperms, Bipartite network, Pollen transport network, Economically Important plants, Central and Eastern Himalaya.

Anthropogenic Intervention and its Impact on the Landscape Ecology of the Cochin Wetlands

Dr. Susan Abraham

Department of Economics Christian College Chengannur, Alappuzha (dist) Kerala, India

(Email: susanabraham@christiancollege.ac.in)

Abstract

Tropical wetlands are known for their biological diversity and in their diverse forms deliver a variety of direct and indirect benefits to society. These not only include the direct benefits derived by various sections of the ecosystem communities through fishing, aquaculture, wetland paddy cultivation, etc., but also an array of ecological services. The diversity and extend of benefits provided by wetlands is determined by its spatial attributes and landscape ecology. Characterizing the landscape ecology of the Cochin wetlands relies on a multidisciplinary approach as it has been affected both by natural and socio economic forces. Therefore, two sets of primary and secondary data have been used in the study. The first set of data deals with its natural processes and diversity while the second set falls under the economic and social domain. The study attempts to trace changes in the hydro-biological setting of the study area by means of secondary studies. It then traces changes in the taxonomic listing of different species of flora and fauna identified from the ecosystem to generate an idea of the change in biological diversity. It then proceeds to understand anthropogenic interventions in the ecosystem as part of resource appropriation and how this has affected species diversity, homogeneity, and ecological processes. Anthropogenic intervention has indeed impacted the landscape ecology of the Cochin wetlands. Analysis revealed changes in hydro-chemical properties indicating environmental degradation particularly in areas with higher anthropogenic influence. Fish and shell fish diversity was highly uneven across space and time and lower in areas with deteriorating water quality. The study also throws light on how human intervention in the Cochin wetland for resource appropriation has led to biodiversity degradation. It identifies factors such as lack of well-defined and enforceable property rights and the public good nature of biodiversity as responsible for the worsened.

Keywords: Iandscape ecology, taxonomy, biodiversity, resource use, anthropogenic

Overview of Eocene Arthropods in Amber, Gujarat: Systematics, Ecology and Geological Implications

Priya Agnihotri and Hukam Singh
Birbal Sahni Institute of Palaeosciences, Lucknow, India
(Email: shilpaagnihotri1989@gmail.com)

Abstract

Thirty eight taxa of fossil arthropods preserved in amber nodules, ranging in age from 54 to 40 million years have been reported from the open-cast lignite mines of the Kutch and Cambay basins in Gujarat. Conventional imaging including state of art 3D Synchrotron X-Ray tomography, Confocal Laser and electron microscopy. The amber assemblage is dominated by 55% of canopy, 32% xylophagous and terrestrial, 3% litter-dwelling and sub-soil, and 10% of aquatic biota. Amongst the arthropod assemblage, the most dominant group of insects are eleven taxa of true flies including non-biting and biting midges (Families Chironomidae, Cecidomyiidae and Ceratopogonidae) that makeup the major proportion of flying biota. True flies are indicators of water habitats near the vicinity of resinous trees and biting midges suggest the mutual relationship between parasitic arthropods and diversifying mammalian hosts. The arboreal taxa of social insects comprises of nine taxa of ants (Family Formicidae) and some unidentified groups of wasps and termites. Arachnid fossils include eight spider taxa and a new pseudoscorpion taxon Geogaranya valiyaensis in amber. Spider genus Rugathodes exhibits traits of parental care with evidences of unidentified egg sacs. The egg sacs are multilayered and complex structures. Spider webs and web-building taxa Araniella, Rugathodes and Baalzebub show great diversity. Baalzebub in amber resin represents the oldest representative of Family Theridiosomatidae and is unique due to the exceptionally round and globose palpal bulbs. *Geogaranya valiyaensis* (Family Geogarypidae) is the first ever phoretic taxa recorded from Indian amber from a warm-temperate biome. Of special significance is the occurrence of cetoniid beetles and oribatid mites as representatives of the litter-dwelling sub-soil biota. The beetles are phytophagous. Plant remains in amber are vital in understanding the symbiotic relationship or otherwise between plants and insects. The mite family thrives in humid, semi-aquatic habitats and is a well-known parasite of mammals. Freshwater ostracod families comprising over eight genera are uniquely preserved, varying in size with soft parts intact. These include anterior appendages and adductor muscles. The arthropod assemblage is an indicator of dispersal in and out of India with affinities to Europe, Asia and Gondwana. India lay as an island subcontinent at the equator at a time when the earth was experiencing episodic thermal heating. The Eocene saw an intense biotic radiation with many of the lineages surviving upto the present day.

Keywords: Amber, Biodiversity, Eocene, Arthropods, Gujarat

Conservation and Management of Ganges River Dolphin (*Platanista gangetica* Roxburgh, 1801) in India

Gopal Sharma and Jyoti Mehta
GPRC, Zoological Survey of India, Patna, India
(Email: gopal_dolphinboy@rediffmail.com)

Abstract

The *Platanista gangetica* the freshwater dolphin locally called Soon is one of the three obligatory freshwater dolphins in the world. The species is distributed in the Ganges–Brahmaputra-Meghna and Sangu-Karnaphuli River systems in India, Nepal, and Bangladesh. Due to many threats to the animal, the population has decreased from 5000 in the early 1980s to 3850 in 2022 in the entire distribution range. Many efforts have been made by the Govt. and scientific organizations for the protection and developing of strategies for the conservation of this endangered and endemic mega-charismatic fauna of India. The decrease in the number of dolphins is mainly due to anthropogenic activities and multiple threats, including direct or incidental catch; construction of dams, barrages, and embankments; strikes by vessels; effluent of industry, mining, and noise pollution due to cruise and vessels and heavy siltation and competing demands of freshwater for irrigation. The freshwater dolphin has declined drastically in numbers and reduced the distributional range in the Asian country. The Yangtze River dolphin (Baijee) is already officially declared extinct in 2006. The baiji's extinction clearly demonstrates that, without appropriate and timely actions, the future of the remaining other dolphin species is in danger. The first and foremost step has been taken in the conservation of the Gangetic Dolphin by the Government of India providing legal protection to the Ganges River dolphin by including it in Schedule I of the Wildlife (Protection) Act, 1972. Since the Act was enacted in 1972, the killing and poaching of any animal included in Schedule I of the Act are cognizable offenses, and the offender may be fined up to Rs. 25000 and/or receive 7-year imprisonment. During the recent conservation efforts, the help rendered by the mass media, both print and electronic, was valuable in educating people of different social strata.

Keywords: Ganges River dolphin, Conservation, Population, Endangered species, microcosm

Impact of climate change implies the habitat shifting of the micro snails Vallonia in India (Mollusca, Stylommatophora, Valloniidae)

S.K. Sajan[1], Basudev Tripathy[2], Kuppusamy Sivakumar[3], Krishnendu Mondal[4], Paromit Chatterjee[5] and Tamal Mondal[6]

[1,4,5,6]Zoological Survey of India, Prani Vigyan Bhawan, M Block, New Alipore, Kolkata-700 073, West Bengal, India

[2]Western Regional Centre, Zoological Survey of India, Pune-411 044, Maharashtra, India

[1,3]Wildlife Institute of India, Chandrabani Road, Post Box #18, Dehradun- 248171, Uttarakhand, India

[3]Department of Ecology and Environmental Sciences, Pondicherry University, R Venkat Raman Nagar, Kalapet, Pondicherry -605 014, India

(Email: sksajan.sajan@gmail.com)

Abstract

The knowledge on accurate species distribution is preliminary stage towards conservation in the current scenario of climate and land-use change. It gives an apparent idea on habitat and climate suitability of the species, rather than that in the modern scientific world, we can compare several environmental, climatic, and anthropogenic data on current species distribution to known the exact suitable habitats of distribution as well as occurrence. However, because of inadequate biological data and cryptic habitat sharing, the lesser-known invertebrates have gained little attention on conservation (especially land snails) in comparison with vertebrates. The distribution of terrestrial molluscs especially minute snails like Vallonia, Alycaeus, Diplomatina, etc. are still inadequately known, because of size and insufficiency on ecological data. In this study, the possibility of habitat sharing of three species viz. *Vallonia pulchella*, *V. ladacancis*, and *V. costata* are performed in relation with the climatic variable, human occurrence and anthropogenic activities by using MaxEnt. The results of the species distribution model indicate the clear scenario of climate dependency of these species in relation to the other anthropogenic factors. However, the endemic species *V. ladacensis* is mostly dependent on the mean diurnal range. This communication presents new information about species distributional range and climatic requirement of these species which can contribute the future climate research and can formulate a suitable management plan before it gets vermin.

Keywords: Mollusca (Gastropoda), Topography, Habitat, Climate change, Western Himalaya

Development and speciation pattern of Carcharolaimids, with first report of *Carcharolaimus ramirezi* Thorne, 1967 male from Costa Rica, and some comments on their biogeography

Zarrin Imran and Wasim Ahmad

Nematode Biodiversity Research Lab, Department of Zoology, Aligarh Muslim University, Aligarh, 202002, India

(Email: zarrin.imran@gmail.com)

Abstract

Family Carcharolaimidae comprises of three valid genera and twenty eight species exhibiting variable degree of labial sclerotization. It is a characteristic group of Southern Hemisphere, all three genera are reported from South and Central America. In the present study we sought to clarify the speciation pattern and evolutionary relationship of the taxa occurring in the South and Central America. The analysis were based on morphological characters of adults and observed changes in developmental stages of juveniles because specimen suitable for molecular studies are not available for most of the taxa. The analysis resulted in the recognition of monophyletic origin of charcharolaimids and allopatric and parapatric speciation pattern is strongly supported by their structural development and biogeographic distribution. One known and a new species of the genus *Carcharolaimus* Thorne, 1939 and one new species of *Carribenema* Thorne, 1967 are also described and illustrated. *Carcharolaimus ramirezi* Thorne 1967 described here with the first report of its male. Morphological differences in developmental stages were observed in the three juvenile stages of *C. ramirezi.*

Keywords: Monophyletic evolution, biogeographic distribution, morphological characters, Central America, Carcharolaimids

Spatial and temporal patterns of threatened waterbirds assemblages in Chilika Lagoon, Odisha: Implication for conservation

Tuhinansu Kar, Lipika Patnaik and R. N. Samal

Environmental Science Lab, Department of Zoology, Ravenshaw University, Cuttack Chilika Development Authority, Bhubaneswar, India

(Email: kartuhinansu@gmail.com)

Abstract

Deliberate drainage, habitat conversion, and several other impacts of climate change made wetlands one of the most threatened ecosystems in the world, which ultimately had a negative impact on their biodiversity, including waterbirds. As waterbirds have high mobility and the ability to respond quickly to habitat changes, they are regarded as strong 'bio indicators' of the habitat quality of wetland ecosystems. The tropical coastal lagoon Chilika, one of India's oldest Ramsar sites, was monitored using the total species count method (Bibby *et al*., 2000) from November, 2018 to February, 2023. A total of 19 species of threatened waterbirds were found, belonging to 6 orders, 10 families, and 16 genera. As per the IUCN Red List, out of a total 19 species, two are listed as Endangered, including Indian Skimmer *Rynchops albicollis* and Great Knot *Calidris tenuirostris*. Four species: Common Pochard *Aythya ferina*, Woolly-necked Stork *Ciconia episcopus* and River Tern *Sterna aurantia* are Vulnerable and the other fourteen species belong to Near-threatened category. Central Sector of the lagoon had the highest number of species (n=14), followed by the Northern Sector with 13 species and the Outer Channel Sector with 11 species, while the Southern Sector had the lowest number of species (n=10). The majority of threatened waterbirds reported (57.89%, n=11) were winter migrants, and two species were breeding in the lagoon. However, the wetland is a crucial habitat for five threatened waterbird species, which occur more than their 1% biogeographical population; those are the Black-tailed Godwit, Common Pochard, Ferruginous Duck, Black-headed Ibis and Curlew Sandpiper. During study period, Black-tailed Godwit population was observed 60,000-80,000 every year, accounting for 54% of total Biogeographic population. Hence, Chilika wetland is an important wintering habitat for the conservation of this threatened shorebird in the Central Asian Flyway (CAF).

Keywords: Threatened waterbirds, Chilika, Waterbird diversity, Population, Central Asian Flyway

Ichthyofauna of Desert Ecosystem of Rajasthan, India

Indu Sharma
Zoological Survey of India, India
(Email: indudrc@gmail.com)

Abstract

The Thar Desert of Rajasthan (Western Rajasthan) comprises thirteen districts partially or fully occupied, out of total 33 districts of the State and has good potential for fishery due to water of Indira Gandhi Nahar Pariyojana (IGNP) and River Ghaggar besides many other seasonal, fresh, saline water Rivers, ponds, reservoirs, canals in the area. It comprises fishes of four origins viz. Western Himalayas, Aravallis, Peninsular India and the Middle East. During studies, an attempt has been made to work out the fish fauna of the region, collection of fishes was undertaken with the help of cast, gill, mosquito & hand net, and subsequently fishes were preserved in 10% formalin followed by 70% alcohol for further studies. Total 122 species belonging to 64 genera 27 families and six orders have been recorded from the Thar Desert of Rajasthan. Order Cypriniformes (70 spp.) and Family Cyprinidae (81spp.) is the largest among all orders and families. Ten exotic fishes have been also reported in various water bodies of area. Distribution and IUCN status of fishes has also been discussed. It has been found that area is facing various anthropogenic stresses such as habitat alteration, water pollution, mining, human activities, deforestation along the riverbeds is disturbing the ecology of the streams.

Keywords: Thar, Exotic, Desert, Anthropogenic, Ecology

Apterygota faunal diversity from Andaman and Nicobar Islands

G. P. Mandal, K. K. Suman, K. K. Bhattacharya, K. K. Roy, Simran Kumari and Rahul Adhikary

Zoological Survey of India, India

(Email: simran1994.ara@gmail.com)

Abstract

Andaman and Nicobar islands with its very distinctive geographical location harbors highly diversified ecosystem. Andaman and Nicobar islands in Bay of Bengal becomes endemic for many floral & faunal species. The Andaman and Nicobar Islands having a tropical rain forest canopy consists of 572 islands, out of which 37 islands are habitable. The present forest coverage in the Andaman and Nicobar Islands claimed to be 86.2 % of the total land area. Apterygotes are primitive wingless insects distinct from the Pterygotes or Winged insect. The term Apterygote commonly includes the primitive insects of groups: Protura, Diplura, Collembola and order Zygentoma, Archaeognatha (formerly the Thysanura). The taxonomical status of Apterygote is wingless and has six legs. Objective: To study the Apterygota taxonomic and faunal diversity in Andaman and Nicobar Islands. Methodologies: To collect Apterygota fauna from diverse habitat from Andaman and Nicobar Islands through different methods are used such as aspirators, pan trap, soil extraction and bush beating. The collected specimen is sorted and mounted on glass slide in Hoyer's medium and studied under Leica DM2500 microscope. Observation: The study of Apterygota fauna in the Andaman and Nicobar Islands is very poor. Mandal and Hazra (2012) reported first time collembolan fauna consisting of 18 species, 11 genera and 5 families and also in Thysanura 3 species, 2 genera and 2 families. From Andaman and Nicobar Islands, *Isotomurus balteatus* (Reuter, 1876) of family Isotomidae is abundant in South Andaman whereas North and Middle Andaman is enriched with *Callyntrura* (*Handschinphysa*) *lineata* (Parona, 1892) of family Paronellidae. In our study, collembolan fauna added from the Andaman and Nicobar Islands; 6 species, 5 genera and 3 families. Diplura and Protura fauna were not reported due to non-availability of collections.

Keywords: Apterygota, Diversity, Andaman and Nicobar Islands, Collembola, Thysanura

Assessing the factors influencing Sloth Bear presence during winter in Jambughoda Wildlife Sanctuary, Gujarat

V. Shah[1], S. Pandya[2] and G. Padate[3]

[1]Department of Environmental Studies, Faculty of Science, The Maharaja Sayajirao University of Baroda, India

[2]Department of Statistics, Faculty of Science, The Maharaja Sayajirao University of Baroda, India

[3]Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, India

(Email: vaidehishah202@gmail.com)

Abstract

Jambughoda Wildlife Sanctuary (JWLS) in central Gujarat has dry deciduous forest which provides a habitat for Sloth Bears. In the study conducted to assess the factors influencing presence of sloth bear, forest trails were walked from November to January to collect indirect evidences. Also, habitat surveys with 10m radius plots at every 500m distance on forest trails were assessed for vegetation type, number of termite/ ant hills, presence of sloth bear preferred trees and water sources. Sloth bear presence signs (n=48) were marked with GPS coordinates. Their scats (n=15) were examined to understand their dietary preference by assessing the undigested food items in-situ. These food items were broadly classified into ants, termites, fruits and others. Seeds of different fruits in the scat were preliminarily identified by the locals, and their photographic evidences were used to verify in the lab. On the basis of the scat analysis, ants were found in 61% of scats followed by termites (19%) and fruits (19%). Along with this, digging sites by sloth bears were considered as its food preference for ants or termite (n=21). Out of these, 5 incidences were found on termite/ant hills and 16 were noted as subterranean. Further, water points and vegetation types were also considered. To predict, the presence of Sloth Bear in the area, logistic regression and naive bayse classification models were built using R. Logistic model and naïve bayse classification showed that number of termite/ant hills was found to be the most influencing factor followed by water points and vegetation type. Logistic regression was found to have an accuracy of 78% and that of naïve basye was 82%. Hence, we could conclude that number of termite/ant hills influence sloth bear presence in winter; followed by the vegetation type and feeding trees.

Keywords: Sloth bear, Habitat suitability, Naive bayse, Logistic regression

A Sacred River of Pune: Boon or Bane on Diversity of Aquatic Beetles *W.R.T* Water Parameters

Rita Deb[1] and Pallavi Takawane[2]

[1]Zoological Survey of India, Western Regional Centre, Akurdi, Pune- 411044, Maharashtra, India

[2]Prof. Ramakrishna More Arts, Commerce and Science College, Akurdi, Pune-411044, Maharashtra, India

(Email: rita.deb24@zsi.gov.in)

Abstract

Aquatic beetles are a potential indicator of freshwater ecosystem and play an important role in food web and nutrient cycling. Physicochemical factors like pH, temperature, conductivity, total dissolved solids, salinity, and dissolved oxygen, are important water quality parameters. The present study is focused on the diversity of aquatic beetles and assessing physicochemical parameter from the Indrayani River. The River is considered as sacred as it is associated to religious names like Sant Tukaram and Sant Dhyaneswar. It originates from Western Ghats of India (18.731°N & 73.382°E) and flows east to meet Bhima River, a tributary of Krishna River. Despite being an attraction for a lot of pilgrims and source of irrigation, Indrayani River is under threat due to anthropogenic interference like inorganic pollution, constructions and various recreational activities. Recently there was report (23rd February, 2023) on formation of toxic foam on the banks of the River in Alandi from factories and sewage according to Indrayani Foundation. Water samples for physio-chemical analysis and aquatic beetles were collected from different locations of the rain fed Indrayani River monthly throughout 2022. The water parameters was recorded with the help of multi parameter Eutech PCS Tester35 and DO was recorded with the help of Digital Bench top DO meter (Aquasol AB-DO-01). The obtained data subjected to statistical analysis. Result showed that out of 7 sampling locations, 4 locations namely Moshigaon, Alandi, Dhanori and Tulapur showed poor water quality according to WHO and Indian standard values and less/no beetle collection. The findings revealed a total of 75 examples belonging to 28 species under 19 genera and 4 families. The family Dytiscidae is the most abundant followed by Hydrophilidae, Gyrinidae, and Noteridae. Above mentioned 4 localities showed lowest diversity of aquatic beetles, indicating the quality of physicochemical variables, food, and vegetation that serve as breeding sites.

Keywords: physicochemical parameters, dissolved oxygen, aquatic beetles, diversity, River

Diversity and distribution of Trichoptera (Insecta) in India

Manpreet Singh Pandher[1] and Simarjit Kaur[2]

[1]High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan, Himachal Pradesh, India

[2]Department of Zoology, Post Graduate Govt. College for Girls, Sector-11, Chandigarh, India

(Email: mpandher.iari@gmail.com)

Abstract

The present paper represents the compiled information on Indian Trichoptera w.r.t. their distribution in various states/ union territories (UTs) along with diversity in different biogeographic zones of India. The order is distributed across the country except states like Andhra Pradesh, Gujarat, Goa, Haryana and Tripura; UTs like Chandigarh and, Dadra Nagar Haveli and, Daman & Diu and, Puducherry. The two states with the highest biodiversity are Meghalaya and Arunachal Pradesh with 254 and 227 species respectively. Among the different biogeographic zones, Himalaya is the most diverse with 652 species followed by North East with 471 species. Our work suggests that the data on diversity and distribution of Trichoptera is underrepresented and gaps areas need more attention to update the status of this ecologically important insect order.

Keywords: Caddisfly, Biogeographic zones, diversity

Substratum preferences of Ascidians in Natural and Artificial Reef Environment, Andaman and Nicobar Islands

Jhimli Mondal and C. Raghunathan

Zoological Survey of India, Prani Vigyan Bhawan, M – Block, New Alipore, Kolkata – 700053, West Bengal, India

(Email: jmjhimli@gmail.com)

Abstract

Ascidians are one of the significant bio-fouling organisms causes great economic loss, as they grow on offshore shellfish and finfish culture system, ship hulls, pontoons, jetties, buoys etc. This study carried out to estimate the fouling preferences of ascidians in variation with depth, season, and substrate at Pongibalu (natural reef) (Lat: 11°30.958'N; Long: 92°39.201'E) and North Bay (artificial reef) (Lat: 11°43.006'N; Long: 92°45.465'E) of Andaman and Nicobar Islands. Panels (concrete, glass, ceramic and metal) of 30X20 cm^2 were placed at the depth of 10 m. and 20 m. from December, 2014 to November, 2015 by SCUBA diving. The data collection was made in every four months interval. Altogether 35 species of ascidians belonging to five families were settled on the panels including 12 species under Didemnidae family. A total of 29 species of ascidians were recorded from Pongibalu whereas, only nine species were recorded from the North Bay during the period of study. It is interesting to note that, *Pyura lanka* was found on the settlement panels only, instead of reef areas of Pongibalu; similarly, *Symplegma brakenhielmi* and *Symplegma rubra* were observed on the panels at North Bay although they were not observed in the reef areas of North Bay during the study period. Both *P. lanka* and *S. brakenhielmi* is considered as cryptogenic in nature and status of *S. rubra* is yet to be established. Among four types of settlement panels, concrete and ceramic panels showed significant coverage of ascidian settlement at both experimental stations. It was observed during the study that the panels of natural reef area showed the higher diversity, species richness, lesser dominance, and lesser coverage. Whereas panels of artificial reef areas showed lesser diversity and species richness and higher dominance (90.20%) of three species coverage which indicates an early sign of species invasion.

Keywords: Artificial reef, Ascidians, Bio-fouling, Natural reef, Substrate specificity

The Extant Fauna of Neuroptera from India: Diversity and Distribution

Simarjit Kaur[1] and Manpreet Singh Pandher[2]

[1]Department of Zoology, Post Graduate Govt. College for Girls, Sector-11, Chandigarh, India

[2]High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan, Himachal Pradesh, India

(Email: simarjit485@gmail.com)

Abstract

The present paper represents an overall view of the order Neuroptera from India. A total of 337 species of Neuroptera divided into 11 families are recorded from the country. Among the Indian fauna, 162 species are endemic (48.07%). The family Myrmeleontidae is the most diverse with 155 species followed by Chrysopidae with 79 species. The order is distributed across the country except Chandigarh and Dadra & Nagar Haveli and Daman & Diu. The two states with the highest neuropteran biodiversity are West Bengal and Maharashtra with 92 and 72 species respectively. Among the different biogeographic zones, Himalaya is the most diverse with 16 species followed by coasts with 67 species.

Keywords: Diversity, Neuroptera, distribution

Ecological interactions based on shell selection in Hermit Crabs: A case study from Kerala Coast

Reshmi R.[1], Preetha Karnaver[2] and A. Bijukumar[3]

[1]Dept. of Zoology NSS College, Pandalam Pathanamthitta (Dist), Kerala, India

[2]Dept. of Zoology Christian College Chengannur Alappuzha (Dist), Kerala, India

[3]Professor and Head Department of Aquatic Biology and Fisheries University of Kerala, Karyavattom, Thiruvananthapuram, Kerala, India

(Email: preethakarnaver@christiancollege.ac.in)

Abstract

Hermit crabs coming under the superfamily Paguroidea (Phylum Arthropoda) represent an important portion of the intertidal, sublittoral and moderately deep benthic marine community worldwide. They inhabit empty shells of gastropods in order to protect their soft, vulnerable and uncalcified abdomens from predators, physical stress, desiccation and extreme salinity. This kind of mobile habitat selection is very important for their survival as they depend on these shells throughout their lifespan. Hermit crabs often engage in shell fights and choose suitable shells after a lengthy process of shell investigation which assures perfect new shelter and also is an excellent example of decision making during habitat selection. Hermit crabs also exhibit mutualism with sea anemone, carry them on shells which provide additional protection and are mutually benefited by their food gathering activity. Main objective of the study is to understand the shell selection behavior of hermit crabs under natural conditions. Specimens were collected from trawlbycatch and intertidal zones of Kerala coast. Hermit crabs and shells were identified using taxonomic keys. Thirty-five species of hermit crabs and their shell selection parameters were studied. Diogenes alias was the most common hermit species found occupying diverse shells. The semi-terrestrial genus *Coenobita* specifically found to occupy shells belonging to the gastropod genus *Nerita*. Hermit crabs belonging to genus *Ciliopagurus* occupied shells of conus and Diogenes miles were found to occupy only *Agaronia gibbosa* because of their much flattened carapaces. *C. morgani* and *C. laevimanus* occupied shells of *Turbo* sp. This study emphasizes an intrinsic relationship between hermit crab and gastropod shells, their shell use pattern and shell preferences. Hermit crabs are good example of 'ecosystem engineers' as they influence the abundance and distribution of diverse variety of invertebrates through use of gastropod shells and by this they are bringing dead gastropod shells back to life that would have been otherwise degraded.

Keywords: Paguroidea, Hermit crab, Gastropod, shell selection, Ecological interaction

Assessment of diversity of fishes in the Ganges along the stretch flowing through Hooghly District: A preliminary approach towards Biodiversity Conservation

Sanghati Sau, Debolina Basu and Soumyajit Banerjee

Department of Zoology for UG and PG Studies, Serampore College, Serampore, Hooghly, West Bengal 712201, India

(Email: sanghatisau14@gmail.com)

Abstract

The present study aims for a detailed account of the fish community structure, endemism and species richness in the freshwater zone of the Hooghly estuary of Hooghly district of West Bengal by studying gear wise fish catch diversity which in turn will also be used to assess the present fish status as well as the health of the riverine ecosystem. Fish samples were surveyed from September, 2020 to May, 2022 by different gears used by local fishermen through a stretch from Bally (Howrah District) to Bandel (Hooghly District) during full moon and new moon period. To investigate the seasonal variation of fish communities this study period was categorized into Summer, Post Monsoon and Winter. Catches were dominated by *Setipinna phasa*, *Mystus cavasius*, *Glossogobius giuris* in rivers throughout all seasons but they varied in their abundance season to season. *Glossogobius giuris*, *Pseudapocryptes lanceolatus*, *Tenualosa ilisha*, *Setipinna phasa*, *Mystus cavasius* were found in large numbers and form a major portion of the catch. Post monsoonal catch represents highest species richness and summer catch represents highest species diversity. This is due to presence of most species rich community in post monsoon because of heavy raining and flood which causes the mixing of water from different water bodies. Besides during monsoon heavy rainfall causes entry of marine water with some typically marine species into the estuarine water system and they utilize this habitat for their breeding and spawning purpose. Shannon-Wiener diversity index was noted to be highest in the summer (1.799) followed by the post-monsoon (1.644); Simpson's Diversity and Berger-Parker index was highest in the post monsoon. The study can be seen as an opportunity to bridge some of the gaps in information on inland fisheries and to contribute, albeit in a small way, to a better understanding of the diversity of fishes.

Keywords: Hooghly river, Fish diversity, fish species

Spider richness in Kuttanad, a major low-lying rice agroecosystem in Central Kerala, India

Nishi Babu[1] and G. Prasad[2]

[1]Research Scholar, Department of Zoology, University of Kerala, India

[2]Professor and Head, Department of Zoology, University of Kerala, India

(Email: nishibabu510@gmail.com)

Abstract

This study focused on the spider fauna of rice agroecosystem around Kuttanad's paddy fields and proximate areas. The spider richness, abundance, and species composition between the rice agroecosystem and nearby surroundings were assessed from July, 2021 to April, 2022. This work also intends to propagate the knowledge that spiders are a common and influential group of natural predators that are thought to be effective in the biocontrol of significant paddy pests in agroecosystems. Pitfall trap and sweeping net were used to conduct monthly collection in six sites: Edthuva, Champakulam, Veeyapuram, Kainakary, Moncompu, and Karuvatta. We collected only adult spiders for identification. Edthuva represented the highest number of specimens, followed by Champakulam, Moncompu, Karuvatta, Kainakary, and Veeyapuram. Representatives from 16 families were obtained, with Salticidae, Araniedae, and Tetragnathidae families being the most prevalent. Also, it was noted that the spider species in rice fields were typical, and statistical analysis revealed a substantial variation in species composition between paddy fields and their nearby areas. In addition to the species diversity, a closer look at the vertical distribution pattern of orb-web weavers belonging to Tetragnathidae and Araneidae in paddy fields was also observed. The diversity indices indicate that the Edthuva and Champakulam rice agroecosystems spider communities are more diversified than those in other locations.

Keywords: Spider fauna, paddy fields, Kuttanad, biocontrol, paddy pest

Biodiversity profile of Phytotelmata of the Southern Western Ghats, and the use of Tree Crab *Kani maranjandu* Kumar, Raj and Ng 2017, as an indicator of ecosystem health

Soumya K. R. and A. Bijukumar

Department of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram, Kerala – 695581, India

(Email: soumyamrayyar314@gmail.com)

Abstract

Kani maranjandu (family Gecarcinucidae) is India's first tree-climbing crab reported from Agasthyamalai Biosphere Reserve, Southern Western Ghats (Bijukumar *et al*., 2017). This unique arboreal species uses phytotelmata or water-filled tree holes as their habitat. The species has been reported from the phytotelmata of trees of evergreen and adjacent semi-evergreen forest covers across Agasthyamalai Biosphere Reserve. Phytotelmata being an aquatic microcosm, serves as a discrete ecosystem. It harbours a diverse range of taxa, dominated by insect larvae, crustacean communities and amphibians which interact and interrelate as small ecosystems. The highly selective habitat requirements of the Kani crab eventually highlight their importance as indicator species, which can showcase the health and productivity of the ecosystem. Kani crab, as indicator species, serves as an effective management tool in assessing climate change, monitoring pollution, and tracking environmental conditions and the biodiversity of other communities within their respective ecosystem. Any notable alterations in the population size, distribution, reproductive patterns and behavioural responses of the Kani crab signal unusual changes in the abiotic factors prevalent in the region, which evokes urgent investigation to interpret the overall health and quality of the ecosystem. Addressing the issue at the earliest will generate data on the whole Agasthayamalai Biosphere Reserve, which gives a complete picture of the forest and the ongoing threats in the ecosystem. Removing the novel cause aids in the successful conservation and sustainable management of the ecosystem's biodiversity. The study further suggest conservation of larger trees in the degraded forests through ecorestoration efforts, besides considering this ubiquitous species as indicators of ecosystem health.

Keywords: Kani maranjandu, Phytotelmata, Biodiversity, Indicator species, Ecorestoration

Status, Distribution and Diversity of Endemic Butterflies (Lepidoptera: Rhopaclocera) of the Western Ghats - An overview

Muhamed Jafer Palot

Zoological Survey of India Western Regional Centre, Pune, India

(Email: palot.zsi@gmail.com)

Abstract

The Western Ghats, also known as the Sahyadri hills, is well known for their rich and unique assemblage of flora and fauna. The rich floral diversity is evidenced by the richness of butterfly diversity in the region. Altogether 335 species of butterflies under 168 genera belong to 6 families are so far known from the Western Ghats. The family Nymphalidae dominated with 100 species followed by Lycaenidae (98), Hesperiidae (82), Pieridae (34) and Papilionidae (19) and two species from the family Riodinidae. Of these, 42 species (13%) are endemic to the area. This includes four papilionids, three pierids, 18 nymphalids, five lycaenids, and 12 hesperiids. Taxonomic uniqueness is not very high, only two genera are endemic to the area, namely Parantirrhoea and Zesius. A state-wise analysis of the distribution of butterflies of the Western Ghats suggests that three southern states contain the majority of the species including endemics. Kerala part of the Western Ghat leading with 326 species with 42 endemics. The second area of maximum diversity is found on the Ghats in Tamil Nadu (323 species with 40 endemics). The diversity of species decreases further from Karnataka (315 species with 35 endemics) to Goa (267 species with 23 endemics), Maharashtra (258 species with 12 endemics) and Gujarat, is least with 170 species with only one endemic species. Similarly, the butterfly diversity showed a decreasing gradient from south to north, with the Southern Western Ghats having 323 species (with 38 endemics), Central Western Ghats 322 species (with 37 endemics) and Northern Ghats having only 255 species (with 15 endemics). Six species are endemic and restricted strictly to Southern Ghats, five species are endemic to the Central WG, while no species are endemic to Northern Western Ghats alone. A complete analysis of endemic butterflies of Western Ghats with their status, distribution.

Keywords: Migration, Western Ghats, Butterflies, Endemics, Distribution

Araneae of Oclandra Reed Brakes of Shendurney Wildlife Sanctuary in the Southern Western Ghats, Kerala, India

Asima. A. and G. Prasad

Department of Zoology, University of Kerala, Kariavattom Campus, Thiruvananthapuram, India

(Email: asimaashrafkh15@gmail.com)

Abstract

Reeds are a tall, thin, shrubby, highly productive grass of the Poaceae family and have a worldwide distribution except in Antarctica. Tropical reeds include the bamboo genus *Ochlandra* and are endemic to the Western Ghats of India and Sri Lanka. They are an essential component of the forest ecosystem, providing numerous ecosystem services that help maintain forest stability. They are a keystone species that are crucial food sources for many animals. The spider fauna of reed breaks was largely unknown, and few studies are available. The present study was conducted in the Ochlandra reed breaks of Kallar, located in the northern part of the Agasthyamalai Hills of the southern Western Ghats, in Shendurney Wildlife Sanctuary, Kollam district, Kerala, India. Data on the spiders were collected throughout four seasons, and spiders were collected using the standard protocols. They were identified based on literature and available keys using the World Spider Catalogue. We recorded 42 species of spiders belonging to 31 genera and ten families. A checklist of spiders in the reed breaks is also provided.

Keywords: Araneae, Ochlandra reed brakes, Western Ghats, Kerala, checklist

Ichthyofaunal diversity of West Bengal, India

Arya Sen[1] and Chemmencheri Ramakrishnan Sreeraj[2]

[1]Zoological Survey of India, Sunderban Regional Centre, West Bengal 743329, India

[2]Zoological Survey of India, Western Ghats Regional Centre, Kozhikode, Kerala 673006, India

(Email: crsreeraj@gmail.com)

Abstract

West Bengal is bestowed with various aquatic ecosystems such as coastal and marine ecosystem, mangroves ecosystem, wetland ecosystem, rivers, streams and ponds. Hence the fish diversity of the state is also rich considering the numerous freshwater as well as brackish water ecosystem. An updated systematic inventory of the fish fauna from the state of West Bengal, comprising 894 species represented by 36 orders and 152 families, has been provided in this work along with an extensive review of the ichthyofaunal research. Diversity-wise, order Acanthuriformes, has 19 families and 120 species, and is the top order of both freshwater and marine fishes. Cypriniformes, which has 7 families and 117 species, is the second most diverse order and the most diverse order in freshwater. Cyprinidae, makes up 6% of the entire fish population in West Bengal, is the fish family with the most diversity. Marine fishes showed the highest diversity in Gobiidae and Carangiidae with 5.6% and 4.8% respectively. 221 species are fully freshwater species, whereas 297 species are marine. The rest of the species are associated with fresh water, brackish and marine habitats. According to the IUCN red list status, 8 species belong to the critically endangered category, 18 belong to the endangered category, 30 species belong to the vulnerable category and 37 species belong to the near threatened category. The conservation status of 239 fish species found in West Bengal has not yet been determined by IUCN. The present study provides a comprehensive data of fish faunal diversity occurring from all the habitats present in West Bengal, which will ultimately help in the management of the future prospects of fisheries resources from West Bengal as well as provide support for the effective conservational planning process.

Keywords: Checklist, Diversity, Fish, Fresh water, Marine

Unusual abundance of invasive *Tilapia* sp. in coastal waters of Devipattinam, Palk Bay

Swarnendu Bera, Soumili Paul, Kannan Rangesh and Muthusamy Anand

Department of Marine and Coastal Studies, School of Energy, Environment and Natural Resource, Madurai Kamaraj University, Madurai 625021, India

(Email: iamgarjan@gmail.com)

Abstract

Worldwide, Tilapia fish has gained a reputation as a highly sought-after, culturable species in the aquaculture industry for its higher growth rate, excellent adaptive nature, low disease rate, and prolific breeding. Aquaculture is the only means to satisfy the dietary demand for fish protein in India, which has the highest population in the world. The first Tilapia species used for extensive aquaculture was *Oreochromis mossambicus*, which was introduced in India in the early 1950s under government patronage. Since then, aquaculture farms have been developed to culture Tilapia all over India, from the warmer tropical brackish waterbodies of Tamil Nadu to the cooler Himalayan regions. The past few decades have witnessed a huge surge of Tilapia abundance in various natural water bodies, posing a serious threat to indigenous fish species. These highly adaptive fishes have now been observed surviving in fully marine environment in Palk Bay. Local fishermen are pretty aware of the presence of these invasive species and regularly harvest them from the inshore waters. Several specimens of different age groups have been found and recorded during a survey in coastal areas near Devipattinam, Tamil Nadu. These exotic species are believed to have made their way from nearby aquaculture farms to nearby canals, eventually ending up in the ocean. In a recent survey in January, adult specimens with fertile gonads were recorded. But most of the specimens were juveniles and sexually immature, indicating that the inshore water of the Palk Bay region serves as a breeding and nursery ground for young ones. Surveys have shown that they are more abundantly found in coastal waters with an average depth of 2–5 meters, dominated by several sea grass species. Survival success is influenced by their ability to withstand oceanographic conditions and their interactive credibility with native indigenous species.

Keywords: *Tilapia* sp, Fish abundance, invasive, Seagrass ecosystem, Palk Bay

Species diversity of Zooplankton in organic based paddy-cum-fish cultivation system in Ziro, Arunachal Pradesh

Rajashree Saikia[1], Tapati Das[2] and D. N. Das[3]

[1]Dept. of Environmental Science, Gauhati University, India
[2]Dept. of Ecology & Environmental Science, Assam University, Silchar, India
[3]Dept. of Zoology, Rajiv Gandhi University, India

(Email: kripashree@gauhati.ac.in)

Abstract

Zooplanktons in paddy fields play an important role for the holistic development of fisheries and aquaculture sector, promoting livelihoods, food and nutritional security. To know the species diversity of Zooplanktons, samples were collected with plankton nets (60 µm) by filtering 25L of water collected from paddy fields and the sediments were preserved immediately in 4% formalin. The observed zooplankton species was identified by standard keys and monographs. Five major communities of zooplankton namely Cladocera, Copepoda, Rotifera, Protozoa, and Ostracoda were found in the study area where 34 species under Cladocera, 7 species under Copepoda along with some nauplii, 17 species under Rotifera and 5 species under Protozoa, and 1 species under Ostracoda were recorded. Simpson dominance index revealed that Bosmina, Chydorus, Cyclops, Diaptomus, Brachionus, Keratella, Arcella were found as the most dominant zooplankton species. Shannon diversity index and Margelef richness index showed dominant hierarchy as follows: Cladocera (2.45)> Copepoda (1.44)> Rotifera (1.30)> Protozoa (1.27). Margelef richness index showed that Cladocera (5.64)> Copepoda (1.65)> Rotifera (1.10)> Protozoa (1.33).

Keywords: Diversity, mountainous paddy field, zooplankton, SDG

Importance of Taxonomy for Achieving Sustainable Development Goals

Priyadarsanan Dharma Rajan
Ashoka Trust for Research in Ecology and the Environment (ATREE), India
(Email: priyan@atree.org)

Abstract

Taxonomy, as a scientific discipline, is important for achieving sustainable development goals (SDGs) for several reasons. It is directly relevant to five of the SDGs, namely eradicating hunger, promoting good health, conserving life on earth and underwater, and addressing climate change. Taxonomy is deeply embedded in local cultural and social systems and serves a variety of social functions. It provides a foundation for understanding the diversity of life on Earth, including the identification and classification of species. This knowledge is essential for conservation. Local taxonomic knowledge is present in every language and dialect, providing essential information on survival, such as the fruiting patterns of trees, ecology of disease vectors, habits of pests and wild animals, and more. This paper explores how taxonomy can actively engage in global decision-making and contribute to achieving the United Nations' sustainability goals.

Keywords: Eradicating hunger, climate change, conservation, taxonomy, sustainable development goals.

A new Sisorid Catfish of the Genus *Glyptothorax* Blyth (Teleostei: Sisoridae) from Kasom Khullen of Manipur, India

Kongbrailatpam Babyrani Devi, Kh. Rajmani Singh and I. Linthoingambi
Dhanamanjuri University, Thangmeiband, Manipur, India
(Email: kbabyrani1995@gmail.com)

Abstract

Glyptothorax lairamkhulensis a new species is described from Taretlok river of Kasom Khullen, Manipur, India. River Kasom Khullen drains into the Chindwin river basin in Myanmar. Fish specimens were collected and preserved in 10% formalin and stored for further analyses. The new Sisorid catfish is very similar to *Glyptothorax ventrolineatus* however former is distinguished from later by having pleated pectoral and pelvic fins at under surface vs not pleated or smooth. Dorsal spine not serrated on tips vs finely serrated at tips. The adhesive apparatus width at 91.19% of its length, U-shaped open caudally supraoccipital process width 52.45% of its length with claspers at anus. Glyptothorax species so far reported from Chindwin basin of Manipur has under surface of paired smooth fins. The present species is the only one having pleated skin on paired fins.

Keywords: Sisorid, new species, *Glyptothorax lairamkhulensis*, Taretlok river, Chindwin basin

A New Fish Species of the Genus *Garra* from Chalou River, Manipur, India (Teleostei:Cyprinidae)

Thonbamliu. Abonmai, I. Linthoingambi and Kh. Rajmani Singh
Dhanamanjuri University, Thangmeiband, Manipur, India
(Email: thonabonmai7@gmail.com)

Abstract

Garra chingailensis, a new labeonine cyprinid fish, is described from the Chalou River, Manipur, India. Fish specimens were collected from the Chalou River in Chingai Village, Ukhrul district and preserved in 5% formalin. Taxonomic identification of the specimens followed Nebeshwar and Vishwanath, 2013. The new species belongs to "proboscis with a transverse lobe species group" and can be distinguished from the congeners in having a combination of the following characters: a prominent 3-4 unicuspid tubercles on the proboscis, a transverse lobe with an irregular 11-13 unicuspid tubercles, lateral surface of the snout with 2-3 minute tubercles; a narrow black 5 stripes, laterally more distinct towards caudal peduncle, 3 stripes below lateral line and 2 stripes above lateral line; longitudinal black band in the middle of the caudal fin; ventral profiled scale;12 circumpeduncular scales; 34-35 lateral scales; 8 ½ branched dorsal fin rays; and 5 ½ branched anal fin rays.

Keywords: Labeoninae, *Garra,* Taxonomy, new species, Chalou River

Preliminary Study of Fish Diversity of the East Siang and Lohit River of Arunachal Pradesh, North East India

Kalpana Thoidingjam, I. Linthoingambi and Kh. Rajamani Singh
Dhanamanjuri University, Thangmeiband, Imphal, Manipur, India
(Email: abethoi.thoi@gmail.com)

Abstract

A short survey was conducted in February, 2023 to study the fish diversity of the two major rivers of Arunachal Pradesh i.e., Siang and Lohit river of Pasighat and Tezu District, respectively. The collected specimens were kept in 10% formalin for preservation. The taxonomic identification of the specimen was done referring Darshan (2019) and Vishwanath (2013). During the survey, a total of 14 species belonging to 5 families of Cyprinidae, Siluridae, Sisoridae, Belonidae and Bagridae were collected. Among them, Barilus, Garra, Tariqilabeo, Glyptothorax were commonly found in both the rivers. While in Lohit river of Tezu district more number of species of the genera Raiamas, Xenentodon, Pterocryptis, Pseudocheneis, Schizothorax, Batasio, Puntuis, Wallago were collected. A new species of garra is also reported belonging to "proboscis with transverse lobe group", exhibiting the following characters: prominent, regular scales on abdomen, large gular dics, its width 54.0-55.0% HL, anus fully covered by the pelvic fin, distance between pelvic fin base- anus and pelvic fin base- anal fin base is 65-66 %, lateral line scales 34-35, branched dorsal fin ray 9½, branched anal fin ray 5½. As of now, very few studies have been conducted on the Siang and Lohit rivers hence, further in-depth study of the fish diversity will help us in highlighting a bigger picture of the fish biodiversity of this biodiversity hotspot in Arunachal Pradesh.

Keywords: Fish Diversity, East Siang, Lohit, *Garra,* Arunachal Pradesh

Garra jalukiensis, a new fish species of the family (Teleostei: Cyprinidae) from Nagaland, India

Catherine Ngangbam and I. Linthoingambi
Dhanamanjuri University, Thangmeiband, Imphal-795001, Manipur, India
(Email: pipingangbam@gmail.com)

Abstract

Garra jalukiensis, a new species is described from Intanki River, Jalukie Village, Nagaland. The collected specimens were preserved in 10% formalin. Counts and measurements for identification and terminology for oromandibular structures follow Nebeshwar & Viswanath, 2013 and Kottelat, 2020 respectively. The specimens in study belong to the member of "proboscis with transverse lobe" group. It differs from its member in having the following combined characteristics: prominent unilobed, short, and thick proboscis which occupies 51.90% of internarial space with 10 uni- to bi-cuspid acanthoid tubercles; transverse lobe with 15 uni- to bi-cuspid small- to medium-sized acanthoid tubercles; gular disc posteriorly positioned; rostral cap highly fimbriated, partly covering the torus; lateral line 32+1; lateral transverse scale 4/1/3; circumpeduncular scales 16; pre-dorsal scales 10. Among its members of "proboscis with transverse lobe" group, it closely resembles *G. simbalbaraensis* and *G. jaldhakaensis* in having a prominent unilobed proboscis smaller than internarial space but differs in gular disc position i.e., posteriorly positioned vs. anteriorly positioned vs. medially positioned respectively. The detailed morphometric and meristic comparisons among its members are also studied. Thus, this study helps to identify and describe a new *Garra* sp. from Intanki River of Nagaland.

Keywords: Brahmaputra basin , North-East India, Peren district, new species, Nagaland

Assessment of human–leopard conflict in Human dominated landscape of Surat district, Gujarat, India- A people's perception

Keyur Naria, Hiren Patel, Narendra Chetule, Chandni Valodkar and Geeta Padate

Division of Wildlife Biology, Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara-390002, Gujarat, India

(Email: keyurnariah@gmail.com)

Abstract

An increase in leopard populations outside forest areas and conflicts humans have increased recently. This increase has been attributed to the decline in natural habitats and wild prey species. Leopard, an opportunistic hunter, has found easy prey in the form of livestock and stray animals outside forested areas. The depredation on livestock has become one of the major conservation issues in landscapes with limited natural resources. The present study was conducted to assess livestock depredation by leopards in human-dominated landscapes of Surat district, Gujarat from July, 2021 to June, 2022. The Surat district is a human dominated landscape, with urban and rural landscapes on western side and hills and forested patches on the eastern side. To find out peoples' view regarding conflict with leopards, a structured survey was carried out in the form of an interview-based questionnaire. We interviewed 575 randomly selected households with an intention to quantify livestock losses resulting from depredation by leopards in the study area. The extent of losses varied from month to month. Other than poultry, small-bodied livestock such as goats and calves (83.8%) were more vulnerable to predation than large-bodied adult cattle. Livestock was killed more frequently at night time (68.8%). Local's attitudes toward leopards were largely negative. Majority of participants of survey were found to be illiterate. An awareness campaigns are required to educate people on the role of leopard in their ecosystem and how to save their livestock from predation by leopards.

Keywords: Indian Leopard, Livestock depredation, People's perception, Surat

Systematic inventorization and utilization of edible hymenopterans of Nagaland

Ezhuthupallickal Benny Femi[1] and Dharma Rajan Priyadarsanan[2]

[1]Academy of Conservation Sciences and Sustainability Studies, ATREE, Bangalore (Main), Bangalore, Karnataka, India;
[1]Manipal Academy of Higher Education, Manipal, Karnataka, India
[2]Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Srirampura, Jakkur Post, Bangalore - 560 064, India

(Email: femi.benny@atree.org)

Abstract

As the human population and conventional livestock rearing result in larger carbon footprints, insects are considered as a potential alternative to alleviate the impending protein crisis. In India, several indigenous communities use insects as food, feed and as medicine. Among the people of the Nagaland, insects are their staple food, with the Order Hymenoptera being one of the most preferred delicacies and a dietary supplement. The present study was carried out to document the importance of hymenopterans in the diet, culture and socioeconomic status of the ethnic communities of Nagaland. Market surveys, direct interviews and field collections were used to document ethnozoological knowledge among the indigenous communities. Around 28 species of hymenopterans are consumed as food or used in traditional medicine. Also, several species like hornets are successfully domesticated here. The ethnographic surveys carried out here reveal that chemicals generated by Hymenopterans like ants, bees, hornets and other wasps for self-defence are being used in entomotherapeutics for the treatment of a variety of ailments like rheumatoid arthritis, stomach disorders, skin diseases, pain and infections, cancer, tissue repair and so on. Promoting the consumption of insects can help in increasing awareness and recognition, leading to increased livelihood options. In comparison to conventional livestock keeping, farming of edible insects can be a more environmentally-friendly and sustainable option, thus mitigating pressure on ecosystems.

Keywords: Entomophagy, Insects, Entomotherapeutics, Sustainable management, Insect farming

Studies on Nematodes and Mycorrhiza Association at Rhizospheric Zone of Paddy in South 24 Parganas District of West Bengal, India

Mahasweta Guha[1], Viswa Venkat Gantait[2] and Narayan Ghorai[3]

[1,2]Zoological Survey of India, M-Block, New Alipore, Kolkata-700053, India
[3]West Bengal State University, Berunanpukuria, Barasat, North 24 Parganas, Pin- 700126, India

(Email: mahaswetaguha1986@gmail.com)

Abstract

Rice is the most important staple food of India. Nematode is considered as serious pest of paddy and cause up to 80% yield losses. Diversity of nematodes along with mycorrhiza associations at rhizospheric zone of paddy in all the 29 blocks of South 24 Parganas district of West Bengal, India was studied. The edaphic factors i.e. soil pH, temperature, salinity, organic carbon content, potassium, phosphate, nitrogen etc. were also measured during the study. The study explored 22 species under 46 genera of nematodes belonging to 5 orders. It was observed that the saline and sandy soils with basic pH, least quantity of organic matter and high quantity of potassium, mycorrhizas are generally absent there. But other soil varieties like loamy, clay and alluvial etc. with pH level 5-7 with high organic matter and nitrogen had extensive nematode-mycorrhiza. Mycorrhiza culture is very cheap and it can be used as bio-control agent against plant parasitic nematodes in paddy fields. It may help to enhance rice production and to achieve Sustainable Development Goal 2 i.e., "Zero Hunger" and Goal 3 i.e., "Good Health and Well-Being" with new source of employments.

Keywords: Nematode, Mycorrhiza, Nematophagous fungi, Paddy, West Bengal

Bycatch of the Deep Sea Shrimp Fishery along the Kerala Coast

Poonam Pal and Bineesh K. K.
Zoological Survey of India, India
(Email: zoo.s.p.9095@gmail.com)

Abstract

The present study aims to analyze the bycatch composition of deep-sea shrimp trawlers operating along the Kerala coast. Regular observations were made in the major fish-landing centers such as Sakthikulangara, Kollam, Cochin Fisheries Harbor during 2019 to 2022. Sub-samples of bycatch were collected to identify the species in the deep-sea trawl fisheries. The trawlers operating from Kollam and Cochin have an OAL of 13-16m with an engine power of > 140 hp and fitted with echosounders, GPS etc. The shrimp trawls have mesh sizes ranging from 40 mm in the front part down to 28 mm in the cod end. The trawlers specifically targeted deep sea shrimp species such as *Aristeus alcockii*, *Heterocarpus woodmasoni*, *Heterocarpus gibbosus*, *Plesionika spinipes* and *Metapenaeopsis andamanensis*. Trawling operations are mainly carried out at a depth ranging from 200 to 500m during early morning and late evening hours and the catches were predominantly deep sea shrimps. The trawling operations extend from 4 to 6 h at 2 knots towing speed. Normally in each operation bycatch contributes to about 20 to 40% along with targeted species. Sometimes the bycatch exceeds more than 80% and the entire haul is discarded without being taken on board the vessel. So far, there is no mechanism to make a reasonable estimate of these discards. A total of 162 fish species of 38 families, 18 crustacean species of 12 families and 5 molluscs from 4 families were identified. Myctophids are the dominant group of fishes in the bycatch composition. There are some deep sea nonconventional fishes suitable for human consumption that are discarded in the sea due to less demand and low price in the market.

Keywords: Bycatch, Species composition, Diversity, Indian EEZ, Conservation

Human-wildlife conflict and sustainable development in India: insights from a systematic literature review

Nandakumar M. K. and C.C. Harilal

Division of Environmental Science, Department of Botany, University of Calicut, Kerala-673635, India

(Email: nandakumarmk.mk@gmail.com)

Abstract

Incidents of human-wildlife conflict have been on the rise in India, especially over the past decade. It is a well-accepted fact that developmental activities have a stake in increasing conflict. Most of the sustainable development goals have a strong link to wildlife conflict (UNEP, 2021). In this context, a quantitative analysis of the human-wildlife conflict was carried out to understand how development and conflict related. Drivers of conflict and conflict-inducing animals mentioned in the articles were identified and scored based on the number of citations. A total of 170 articles were considered for the study. The south Indian states of Kerala, Tamil Nadu, and Karnataka contributed to 43.5% of the total studies. Thirty-nine species in seven species groups are involved in the conflict. Large herbivores (?=0.68), large carnivores (?=0.46) and primates (?=0.43) were responsible for most of the damages. There is a positive correlation observed between conflict and the SDG score published by NITI Ayog (r=0.48, p=0.01). That is, an increase in developmental activities will be a driving force for conflict. There are 24 key conflict drivers identified. Habitat fragmentation (?=0.46) and land use land cover change (?=0.42) have the highest effect on increasing wildlife conflict. The combination of habitat degradation, development-related factors, and availability of food turns out to be the best model (AIC= 174.56, AIC.wt=0.53, Log.liklihood= -80.13) to predict the conflict incidents. The results of the study show that there is a visible relationship between developmental activities and conflict incidents. Increasing urbanisation and population ultimately leads to land use and land cover changes, habitat fragmentation, encroachment, and degradation of habitats. An integrated holistic approach with community participation is required to transform conflict into coexistence to achieve SDG goals.

Keywords: Human-wildlife conflict, Sustainable development, Habitat degradation, SDG

Genetic diversity and phylogenetic analysis of Indian Rhesus macaque using Mitochondrial Dloop

Ranjana Bhaskar and E. Agnita Sharon

Molecular Systematics laboratory, Zoological Survey of India, Southern Regional Center, 130 Santhome High Road, Chennai-600028, India

(Email: agnitajohnson02@gmail.com)

Abstract

Rhesus macaques are the primary animal model used for research. Most of the rhesus macaques were transported from India and China, but after 1978, India ceased to supply macaques, and China became the main supplier of rhesus macaques to biomedical research centers in the United States. However, phenotypic and significant genetic differences between Chinese and Indian rhesus macaques have been understood. It is necessary to understand the distribution and patterns of genetic diversity at the intraspecies level for planning effective conservation management of Indian rhesus macaque populations. The control region (CR) or the dloop was selected as it evolves at a magnitude more rapidly than nuclear DNA. Faecal samples were collected from various Indian states using non-invasive techniques. A phylogenetic tree was constructed to understand the genetic relationships among various Indian rhesus macaque populations. Higher number of haplotypes and the haplotype diversity was observed in rhesus macaque populations. Numerous primate habitats have been destroyed due to increasing human population pressure, industrialization, and urbanization, and many rhesus macaque populations have been confined to human settlements. This study will provide a baseline for the effective conservation and management of wild rhesus populations.

Keywords: Macaques, Populations, habitats, India, conservation

Diversity of Moth Fauna in Jammu and Kashmir Union Territory, India: An Overview

Taslima Sheikh[1] and P. C. Pathania[2]

[1]Department of Zoology, Sunrise University, Alwar-301028, Rajasthan, India

[2]High Altitude Regional Centre, Zoological Survey of India,Saproon, Solan-173211, Himachal Pradesh, India

(Email: sheikhtass@gmail.com)

Abstract

Moths, butterflies and skippers (scaly winged insects) belonging to order Lepidoptera under the class Insecta is the third largest order after the orders Coleoptera and Diptera. Lepidoptera having 1,58,570 species on global basis which is approximately 9% of total Animalia amongst them 88% are moths and 12% are butterfly. Around 15,000 species under 84 families fall under this order, of which the major part, i.e., 13,359 species under 78 families are moths and rest are butterflies from India. Moths act as pollinators, indicators of climate change, primary consumers though they have a negative impact as pests in agricultural fields. There is no proper checklist of moths is currently available from Jammu and Kashmir, India till date. But it is estimated that there are about more than 500 species of moths found in this region, which is one of the biodiversity rich regions. In the present study, 105 species of moths were recorded from Jammu and Kashmir, India that was carried out from 2020 to 2022. One moth species was found to be new records to India and five moths species are new records from Jammu and Kashmir.

Keywords: Moth, noctuidae, pyralidae, macromoths, Jammu and Kashmir, India

Herpatofaunal Assemblage and Needs of Conservation in Solapur District, Maharashtra (India)

Abhijit B. Mane[1] and Vijaykumar S. Gadekar[2]

[1]School of Life Science, Punyashlok Ahilyadevi Holkar Solapur University, Solapur, India and Dr. Patangrao Kadam Mahavidhyalaya, Ramanandnagar (Burli), Sangli, (M.S), India

[2]Sangola College Sangola, Dist: Solapur (M.S), India

(Email: abhijitbmane@gmail.com)

Abstract

The purpose of the study was to investigate the assemblage of the amphibians and reptiles in western parts of Solapur district, Maharashtra, India. Solapur district is situated on the south east fringe of Maharashtra and lies entirely in the Bhima and Seena basins. Whole of the district is drained either by Bhima river or by its tributaries. The survey methods involved careful visual estimation of amphibians and reptiles in all possible microhabitat identified in the study region. The different microhabitat selected were leaf litters, water pools, fallen wooden logs, grasses and shrubs. We observed the spatial and temporal patterns of herpatofauna species richness in four tehsils of Solapur. We identified fourteen amphibian species and thirty-five reptilian species. The studies showed significant difference amongst the reptilian species acquiring different microhabitat. Species diversity was determined by Shannon-Wiener's index. The herpatofauna face an enormous challenge for coexistence in the semi urbanized district and habitat degradation is one of the primary causes of decline of both these groups.

Keywords: Herpatofauna, Microhabitat, Species richness, Spatial-Temporal patterns, Conservation

POSTER PRESENTATIONS

Biodiversity of Molluscan Fauna of Lakshadweep Atol, India

Ravinesh, R.[1,] and Biju Kumar A.[2]

[1,2]Department of Aquatic Biology & Fisheries, University of Kerala, Thiruvananthapuram, 695 581, Kerala, India

[1]Centre for Marine Living Resources and Ecology, Ministry of Earth Sciences, Atal Bhavan, Kochi, 682 508, Kerala, India.

(Email: ravineshr08@gmail.com)

Abstract

The Union Territory of Lakshadweep in the Arabian Sea, a group of coral islands in the Laccadive Sea, represents the only atoll coral island chain in India and forms the northernmost of the Chagos-Maldives-Lakshadweep-group of islands. A total of 504 species of molluscs were collected from 10 Lakshadweep islands, which comprises two species of Polyplacophora, 424 species of Gastropoda, 100 species of Bivalvia and 6 species of Cephalopoda, classified under 9 subclasses, 62 superfamilies, 116 families and 270 genera. Of this, 102 species were recorded for the first time from the Indian coast, while 69 species were recorded for the first time from Lakshadweep. The molluscan fauna of the islands was dominated by Gastropoda (80.16%), followed by Bivalvia (18.45%), Cephalopoda (1%) and Polyplacophora (0.4%). Habitat-wise variations in molluscan diversity in 10 Lakshadweep islands showed that diversity was maximum in rocky intertidal areas (273 species), followed by lagoons (228 species), subtidal environment (183 species), sandy shore (140 species), seagrass (75) and other ecosystems (47 species). The overall results showed that the number of species recorded was maximum on Minicoy Island (373 species), followed by that in Kavaratti (331 species), and the least diversity was recorded in Androth island (227 species). In general, other diversity indices also recorded higher values in Minicoy Island and lower values in Androth island. The high and unique feature of molluscan diversity of Minicoy Island could be due to the increased fine-scale habitat heterogeneity, including large lagoons, intertidal rocky shores, sandy shores, seagrass beds and mangroves. This study also documented 17 species of molluscs protected under various schedules (schedules I and IV) of the Wildlife (Protection) Act of India. This research provides a checklist of the molluscan fauna of Lakshadweep, which will provide benchmark data for further research.

Keywords: Lakshadweep, Union Territory, New Records, Checklist, Conservation

Stranding records of *Sousa plumbea* and *Neophocaena phocaenoides* from the southwestern coast of Kerala, India

Kuberan Ganesan, Sendhil Kumar R., Sherine Sonia Cubelio, Chandrasekhar K. and Madhu Magesh Ku

Centre for Marine Living Resources & Ecology, Ministry of Earth Sciences, Government of India, Atal Bhavan, LNG Terminus Road, Puthuvype, Kochi, 682508, India.

(Email: gkuber006@gmail.com)

Abstract

Marine mammals are a charismatic and diverse group of marine vertebrates. Among them, cetaceans, including whales, dolphins and porpoises, are the most commonly distributed groups. Here, we provide taxonomic description of two species of cetaceans stranded in regular time interval off the Kerala, Southwest coast of India. In addition, the study also examines the cause of death which may aid to deliver inferences on proportional links with both natural and anthropogenic disturbances/ stressors induced mortality based on necropsies. Overall, six individuals were found stranded at two districts, Ernakulam and Allepey of Kerala during June, 2022 and March, 2023. The stranded carcasses were taxonomically identified as Indian humpback dolphin (Sousa plumbea - 5) and In do-Pacific finless porpoise (*Neophocaena phocaenoides* - 1) using the morphometric features and were photo-documented. According to the results from necropsy, the cause of death was natural – two (*S. plumbea*); boat strike – three (*S. plumbea* & *N. phocaenoides*); and carcass was decomposed (necropsies not undergone) – 2 (*S. plumbea*). The work contributes to the information on potential threats to these apex predators of trophic level. It also emphasizes on importance of conservation and sustainable management policies of these resources of the Wildlife Protection Act, 1972 and IUCN Red List of Species.

Keywords: Cetaceans, Morphometric, Southwest coast, Necropsy, Mortality.

Inventorization of Moth of Subfamily Ennominae (Lepidoptera) from North India

Rachita Sood, P.C. Pathania and H.S. Rose

[1]Guru Nanak Girls (PG) College, Model Town, Ludhiana, Punjab, India
[2]High Altitude Regional Centre, Zoological Survey of India,Saproon, Solan, Himachal Pradesh, India
[3]Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India

(Email: pathaniapc-ent@pau.edu)

Abstract

Phylum Arthropoda which contain about 70-80% of total living animal species is one of the most diverse groups in the class Insecta. Insects not only outnumber other groups but are also successful in all habitat/ecosystems. Lepidoptera having scaly winged insects (moth, butterfly and skipper) is the third largest orders in the class Insecta. In the present study, 24 different localities were surveyed for the collection of moths of subfamily Ennominae belonging to family Geometridae of the order Lepidoptera from the area under reference. Adults of the same subfamily were collected during the night time by installing portable light traps fitted with Mercury Vapour Lamp. This family is mainly characterised by slender body, medium to large in size, male with antennae simple or bipectinate, female with simple, forewing with fovea present, vein R1 usually anastomoses with Sc, hindwing with vein M2 lacking or weakly represented, tibiae bearing hairpencil on mesothoracic leg. From these surveys, 112 specimens belonging to 15 species of 10 genera of subfamily Ennominae were collected and identified. Genera such as *Abraxas* Leach, *Chiasmia* Hübner, *Heterostegane* Hampson, Hyperythra Guenée, *Hyposidra* Guenée, *Luxiaria* Walker, *Petelia* Herrich-Schäffer, Zamarada Moore, *Tephrina* Guenée and *Zeheba* Moore are represented in the collected material. The details on their distribution, morphological characters and significance of their male and female genitalia along with phylogenetic analysis will be discussed at the time of presentation.

Keywords: Ennominae, Inventorization, Moths, Lepidoptera, Phylogenetic

Study of Fish diversity by applying Molecular tools from the riverine systems of the Amravati area, Maharashtra

Vaishnavi S. Kuralkar, Gajanan A. Wagh and Pratik S. Chaudhari

Biodiversity Research Laboratory, Department Of Zoology, Shri Shivaji Science College, Amravati, Maharashtra, India- 444603

(Email: pratikchaudhary260@gmail.com)

Abstract

India is a hotspot for the diversity of freshwater fish, which contributes to the world's biological resources possessing a high level of endemism. Understanding species and communities reveals underlying information required for managing ecosystems and habitats. It is important to understand the current status of various biota in the era of the worldwide reduction of aquatic biodiversity, that is why this endeavor was done. The present study was carried out on fish diversity at a molecular level from the major rivers and their tributaries in the Amravati area including the Melghat landscape in Maharashtra. The study was conducted from November, 2022 to January, 2023. Fishes were sampled with the help of locals and fishermen. Muscle tissues of fishes were used for molecular study. Photographic evidences of fishes, ecological parameters of the habitat, and coordinates of sites were recorded stationwise. 29 species were recorded from the study sites, of which 7, 3, 3, and 7 species were found endemic to the Wardha river, the Purna river, the Chandrabhaga river, and the Tapi river respectively. Out of 29 species, 20 species have been successfully barcoded from which 3 species were not included in the NCBI databases. The obtained data showed that the Tapi river and its tributaries flowing through the Melghat landscape showed more endemism than the Wardha river. A keen observation of species endemism reveals their preference for the particular rivers due to supporting ecological elements present there. This was only a brief study of the riverine fishes in the Amravati area.

Keywords: Fishes diversity, DNA barcoding, Endemism, Major rivers, Melghat, Amravati

Morphological discrepancies of three *Garra* (Teleostei: Cyprinidae) in Arunachal Pradesh, India- A possible evolutionary process

Shibananda Rath, Bungdon Shangningam, Asha Kiran Tudu and Laishram Kosygin

Freshwater Fish Section, Zoological Survey of India, 27 JL Nehru Road, Kolkata, India

(Email: bdshangningam@gmail.com)

Abstract

The present study appraises the discrepancies patterns of morphometry for the first time on the three species of *Garra*. *Garra arunachalensis*, *G. birostris*, and *G. quadratirostris* were collected from various locations of the Siang River in Arunachal Pradesh, India. The results of the morphological analysis revealed that *G. arunachalensis*, *G. birostris*, and *G. quadratirostris* hold many similar characteristics compared to the type species, which confirms its speciation. However, they parade distinct variations in morphological and meristic characters which indicate genetic variation as time lapsed. Certain morphometric characters overlapped. Hence the variations in many morphometric characters point towards a possible continuous evolutionary process. Details of the morphological discrepancies of the three species and possible hypotheses of climatic, geographical, and habitat changes are discussed. MATERIAL AND METHODS The specimens were collected from the Siang River, a tributary of the Brahmaputra drainage, Arunachal Pradesh, India. Specimens were fixed in 10 % formalin and subsequently transferred to 70 % ethanol for storage. GPS coordinates and elevations of the sampling sites were recorded using a Garmin Oregon 750 GPS. Measurements were taken point-to-point, with digital calipers, on the left side of the specimens, and recorded to the nearest 0.1 mm. Counts, measurements, and terminology follow Nebeshwar & Vishwanath (2013). Gular disc terminology follows Kottelat (2020). Counts for dorsal and anal-fin rays follow Kottelat (2001). Fin rays and the number of scales were counted using a Leica stereo-zoom microscope. Head length and measurements of the body are expressed as percent of standard length (% SL); subunits of the head as percent of head length (% HL). Numbers in parentheses after a count indicate the frequency of that value. Specimens are deposited in the Zoological Survey of India, Freshwater Fish Section, Kolkata, India.

Keywords: Taxonomy, Variation, Labeoninae, Brahmaputra, Pisces

Altitudinal gradient dependent deviation in elytral and mandibular size of the saproxylic Lucanus Stag beetle (Coleoptera) from India

Priyanka Ghosh, Devanshu Gupta, Irtiza Wani and Priyanka Das

Zoological Survey of India, Prani Vigyan Bhawan, M-Block, New Alipore, Kolkata- 700053, India

(Email: priyankaghosh8559@gmail.com)

Abstract

The stag beetles (Insecta: Coleoptera) are associated with the destruction of woods including forests and timber depots. The male beetles have remarkable external mandibular features. The stag beetles under the genus Lucanus Scopoli?, 1763? belonging to the family Lucanidae is known for its variation in the size of the mandible. In this study, 225 male specimens were analyzed using geometric morphometric approaches to investigate the variation in external dimensions of 10 species of Lucanus males, focusing on the mandible and elytra size as well as the pronotum width. Allometric relationships were calculated, revealing that the length of the mandible and elytra are interrelated. The analysis of altitude gradients showed that there are three different morphs of Lucanus males based on the eigenvalues: "Alpha" with large and long mandibles that were found at lower latitudinal gradients, "Beta" with neither very long nor small mandibles found at the transitional zone, and "Gamma" with very small mandible length which were ranged at the highest altitudes. Among the ten species being examined, 9 species express alpha morphs, 6 species express beta morphs and 4 species express gamma morphs. The shape variation of mandible length and elytra length suggests that they can be considered as a functional unit evolved under the influence of the same selective pressures, while the pronotum width showed less variation. These differences in the mandible size may be related to alternative mating tactics and behaviors in smaller and larger males. Moreover, the Alpha and Beta morphs have interaction in contests over mating possibilities, and the differing shapes of the enlarged mandibles could play an important role in both inter- and intrasexual interactions. The findings of this study provide insights into the morphological diversity and potential adaptations of Lucanus males, highlighting the importance of considering size and shape relationships in evolutionary studies.

Keywords: Polymorphism, Allometric relationship, Geometric morphometric, Morphology, Altitude gradient

First record of albatross turrid *Gemmula diomedea* Powell, 1964 (Mollusca: Gastropoda: Turridae) from Indian waters

Md Hafiz, Aritra Ghosh, Tamal Mondal and Sheikh Sajan

Zoological Survey of India, Prani Vigyan Bhawan, M Block, New Alipore, Kolkata 700053, West Bengal, India

(Email: aritra.zsi14@gmail.com)

Abstract

Turrids are the largest marine predatory sea snails group inhibiting mainly on muddy substratum, coral reefs, and rocky shores. The group comprises around 2990 species classified into the family Turridae and one of the largest groups of marine Caenogastropods. The species under this family are minute to very large and have a worldwide distribution in every sea and ocean. In India, 110 species have been reported under 36 genera and 9 families. The Albatross turrid i.e. *Gemmula diomedea*, previously reported from Philippines and South China Sea is recorded for the first time from Indian water. The present paper reports the new distribution record of the *Albatross turrid* and also provides a complete checklist of Turrid species found in India.

Keywords: Distribution, Neogastropoda, New Record, Conoidea, India.

First record of *Tabanus dorsiger* Wiedemann, 1821 (Insecta: Diptera: Tabanidae) from Andaman and Nicobar Islands, India

Koustav Mukherjee*, Atanu Naskar** and Dhriti Banerjee

Diptera Section

Zoological Survey of India

M-Block, New Alipore, Kolkata-700053

***Presenting author mail id:* koustav.mukherjee107@gmail.com**

****Corresponding author mail id:* atanu.diptera@gmail.com**

Abstract

The fly *Tabanus dorsig*er Wiedemann, 1821 belongs to the family Tabanidae, under the infraorder Tabanomorpha and order Diptera, and act as a mechanical vector of various diseases (Maity et al., 2019). While sucking blood from hosts, they transfer numerous pathogens causing vesicular stomatitis, bovine leukosis, anaemia, swine fever, and various species of trypanosomes (Foil, 1989; Krinsky, 1976). "Surra disease" or trypanosomiasis, caused by *Trypanosoma evansi* (Steel) is one of the most important diseases affecting the health and survival of a number of domestic and wild animals worldwide (Veer et al., 2002). The disease has been categorized under list B diseases by the Office International des Epizooties (OIE, 2014). *Tabanus dorsiger* has been suspected as a vector of Surra disease from the Indian states of Punjab, Haryana, Rajasthan, and Himachal Pradesh. Maity *et al*., 2019 recorded this species from Assam, Bihar, Maharashtra, Odisha, and West Bengal. However, the studies are relatively restricted, and comprehensive surveys and collections are required to determine the presence and abundance of the species in other states. As per best of our knowledge, this species has not been recorded from the Island ecosystem of the Andaman & Nicobars. During a survey in 2022 by the Diptera section in the Andaman and Nicobar Islands, 7 males and 16 females specimens of this species were documented and collected. The first report of this species from this island ecosystem is alarming for the livestock. A detailed study is essential to know the distribution pattern and seasonal abundance of *Tabanus dorsiger* which has been first time recorded from the Andaman and Nicobar Islands, India.

Keywords: Horse fly, Surra disease, Livestock, Island Ecosystem, Taxonomic study

A pilot inventory on the diversity of freshwater molluscan fauna of the river Daya, Odisha, India

Sheikh Sajan, Indrani Ganguly, Aritra Ghosh and Tamal Mondal

Mollusca Section, Zoological Survey of India, Prani Vigyan Bhawan, M Block, New Alipore, Kolkata 700053, West Bengal, India

(Email: indrani942@gmail.com)

Abstract

As per Article 7(a) of Convention on Biological Diversity (CBD), identifying components of biological diversity important for its conservation and sustainable use is the first step for in-situ conservation of the species. On the other hand, there is probably more than 1,00,000 plant species and more than 3,00,000 animal species yet to be discovered and documented, particular in country like India. The taxonomic inventory is the primary concern to understand the current status, distribution, and conservation of the species. However, lack of taxonomic data may mislead to bias understanding in the knowledge of ecological importance at the species or community level conservation, which may lead the scientists, park manager, and policy maker to build an inadequate plan for long term conservation and management of the species. In order to understand the status and distribution pattern of the freshwater molluscs, sampling of malacofauna of river Daya, Khordha district of Odisha was made during recent time. The river Daya starts as a branch of the Kuakhai River at Saradeipur in Odisha, which is one of the major tributaries of the river Mahanadi and emptying into the northeastern corner of Chilika Lake. The river is one of the major sources of water for irrigation and livelihood in this region. A total of olny 15 species of molluscs including 10 species of aquatic gastropods and five species of freshwater bivalves belonging to 13 genera and nine families were documented. The Thiaridae is the most dominant family among gastropods. The invasive alien species (IAS) Acute bladder snail (*Physella acuta*) is recorded for the first time from the state which is required to study intensively to safeguard native species. The preliminary results and checklist of freshwater molluscs are presented herein.

Keywords: Taxonomy, Invasive, Threats, Gastropoda, Bivalvia.

Morphological and genital studies on litchi shoot and fruit borer, *Conopomorpha sinensis* Bradley (Lepidoptera: Gracillariidae) from Nagaland, India

P. Maheswara Reddy[1], Imti Naro L.[2], M. Shankara Murthy[3] and C. S. Maiti[4]

[1,2]Department of Entomology, School of Agricultural Sciences and Rural Development, Medziphema campus, Nagaland University - 797106, Nagaland, India

[3]Department of Agricultural Entomology, College of Agriculture, Raichur, University of Agricultural Sciences, Raichur - 584104, Karnataka, India

[4]Department of Horticulture, School of Agricultural Sciences and Rural Development, Medziphema campus, Nagaland University - 797106, Nagaland, India

(Email: pasammaheswarareddy@gmail.com)

Abstract

Litchi is an important subtropical fruit crop, widely spread in Eastern India. The growth of litchi is hindered by several factors. Among these, insect pests are the major constraint in the successful and profitable cultivation of this fruit crop. Of these insect pests, litchi fruit and shoot borer, *Conopomorpha sinensis* pose a serious threat to litchi growers in India. The larvae are initially found feeding on shoots and in later stages, they cause severe damage to both immature and ripen fruits causing significant economic losses. In India, the litchi shoot and fruit borer damage was estimated at 48-74%. In the current paper, damaged litchi fruits were collected and reared to an adult stage on their respective hosts. A total of 55 adults emerged and these were utilized to study the morphological and genital characters. The study revealed that *C. sinensis* is the only species of the genus *Conopomorpha* affecting the litchi fruits from Nagaland. Further, the adult habitus, damage symptoms, distribution, and morphological and genital characteristics are described with photographs.

Keywords: *Conopomorpha sinensis*, Gracillariidae, Nagaland, Damage symptoms, Morphological and genital characteristics.

A Study of Ichthyofaunal Diveristy of Yerla River, Western Maharashtra, Southern India

Suresh M. Kumbar and Angha V. Bhoi - Kamble
Arts, Commerce and Science College, Palus
(Email: anghabhoi@gmail.com)

Abstract

The freshwater fish fauna of Yerla River, Sangli district was studied from 2021 to 2022. The main aim of the present study is to make comprehensive checklist and to find out real anthropogenic threats on freshwater fishes of Yerla River. We have regularly visited to 12 locations for observation and collection of fishes by using cast net, gill nets, hand nets, hooks and line. Data obtained were analyzed using standard taxonomic keys based on morphometric characters. A total of 58 species belonging to 5 orders, 18 families and 38 genera were recorded. Order Cypriniformes were the most dominant one and represents 32 species followed by Siluriformes (13 species), Perciformes (8 species), Synbranchiformes (3 species), Beloniformes (2 species). Among these, 19 species are endemic to the Western Ghats and 3 species endemic to the Krishna river system. As per IUCN Red list criteria 40 species are least concern, 4 species Mystus malabaricus, Clarias dussumieri, Ompok bimaculatus and Oreochromis mossambicus are near threatened, 4 species Cirrhinus mrigala, Cyprinus carpio, Wallago attu and Gagata itchkeea are vulnerable, 4 species Botia striata, Hypselobarbus curmuca, Puntius fraseri and Schismatorhynchos nukta are endangered, another 4 species Neotropius khavalchor, Puntius amphibius, Osteobrama peninsularis and Hypselobarbus dobsoni are Data Deficient and 2 species Ctenophryngodon idella and Pethia sanjaymoluri are not evaluated. Anabas testudineus, a climbing perch of amphibious species was recorded first time from Yerla River, Maharashtra. The fish fauna of the river is threatened due to alien exotic species and some anthropogenic activities like releasing of agricultural effluents, domestic organic wastes and non-degradable plastic materials owing to tourism activities. Since, this small study area hosts 19 endemic and 16 threatened species, therefore, Yerla River will be the most suitable habitation for conservation of endemic and threatened species.

Keywords: Fish diversity, Endemics, Threats, Conservation, Yerla River

Species Diversity of Phytophagous Scarab Fauna (Coleoptera: Scarabaeidae) In Western Ghats of Kerala, India

Judith Corolin Correya[1] and K. Sreedevi[2]

[1]Research Scholar ICAR-NBAIR Bellary Road, Hebbal Bengaluru, India

[2]NF & Principal Scientist Germplasm Collection and Characterisation ICAR-NBAIR Bellary road, Hebbal Bengaluru, India

(Email: judithcorolin@gmail.com)

Abstract

The phytophagous scarab group mainly includes white grubs, also known as June beetles or chafer beetles that belong to the family Scarabaeidae of Coleoptera. They are economically important as they are the serious pests of several agricultural crops like Sugarcane, groundnut, potato, arecanut, etc. in which the larvae of white grubs feed on the roots, rootlets and underground stems and adult feeds on the aerial parts of the plants which results in huge economic losses. These in particular belong to subfamilies Melolonthinae, Rutelinae and partly Dynastinae of Scarabaeidae. A survey has been taken up to document the species diversity of phytophagous scarabs in selected locations of four districts of Kerala viz., Wayanad, Malappuram, Palakkad and Idukki which are rich biodiversity hotspots in Western Ghats. The adult beetles were collected through light trap and manual scouting from March to August during 2021 and 2022. The collected scarabs were brought to the laboratory, sorted, cleaned, mounted, labeled and identified up to species level with the available literature and idenitfication keys. A collection of 1953 beetle specimens resulted in 60 species belonging to 18 genera of subfamilies Melolonthinae Rutelinae and Dynastinae. Melolonthinae represented by 11 genera is speciose over Rutelinae and Dynastinae which is represented by four and three genera, respectively. The preliminary survey data subjected to various diversity indices revealed variations in species diversity in terms of species richness and evenness among the surveyed locations. The species, Anomalachela bicolor, Sophrops karschi, Apogonia proxima, Apogonia sp.1, Maladera rufocuprea and Anomala communis were present in all the four surveyed districts. Ten species each were observed to be specific to Palakkad and Idukki districts. The species distribution and dynamics across the districts are discussed. KEY WORDS: Scarabaeidae, Species diversity, Wayanad, Malappuram, Palakkad, Idukki, Kerala.

Keywords: Scarabaeidae, Species diversity, Wayanad, Idukki, Kerala

Systematic studies on the ant genus *Lepisiota* Santschi, 1926 in India

Anand Harshana and Debjani Dey

National Pusa Collection, Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi-110012, India

(Email: anandharshana@gmail.com)

Abstract

The genus *Lepisiota* Santschi is a species-rich taxon of the subfamily Formicinae (Hymenoptera: Formicidae), with 147 species/subspecies described worldwide. However, only thirteen species/subspecies have been reported in India and many parts of the country remain poorly explored. In the present study, systematic work was carried out on the genus Lepisiota and four new species, *L. binghami* Harshana & Dey 2022, *L. pusaensis* Harshana & Dey 2022, *L. satpuraensis* Harshana & Dey 2022, and *L. wilsoni* Harshana & Dey 2022 were described from India based on the worker caste. Further, five known species, *L. annandalei* (Mukerjee 1930), *L. bipartita* (Smith 1861), *L. integra* (Forel 1894), *L. layla* Wachkoo, Bharti & Akbar 2021, and *L. pulchella* (Forel 1892), were redescribed and their new state distribution records reported. The taxonomic confusion around *L. opaca* (Forel, 1892) was solved by studying its type specimens images and original description. An identification key for all seventeen Indian species of Lepisiota is presented. The male genitalia of L. bipartita has been described in detail with illustration of different parts. Moreover, the DNA barcodes of *L. annandalei*, *L. bipartita*, L. mayri, *L. pulchella*, and *L. pusaensis* have been generated based on sequences of mtCOI region and submitted to NCBI and BOLD. A phylogenetic tree for six Indian species of the genus *Lepisiota* was prepared by using the Neighbor-Joining method based on the sequences of mtCOI region.

Keywords: Lepisiota, Taxonomy, New Species, Male Genitalia, DNA Barcoding

Gobiiformes fish from East coast of India: Integrative taxonomy and species diversity

Moumita D., Akhila T., Ida E. G., Sweta B., Agnita Sharon., Ranjana and K.K. Bineesh

Zoological Survey of India, India

(Email: moumitadas310@gmail.com)

Abstract

The fish order Gobiiformes distributed among all of the three habitat and one of the most specious fishes in the world. The present research work is an attempt to provide a taxonomic data, exploration of species diversity of Gobiids along East coast of India. Fishes were collected by trawl survey, caste net, gill net, hand picking from freshwater, brackish and marine habitat. About 1250 goby specimens were collected from east coast (Tamil Nadu, West Bengal, Pondicherry) during 2020-2022 and identified 20 genus under 60 species. Major genus identified were *Parachaeturichthys*, *Favonigobius*, *Obliquogobius*, *Acentrogobius*, *Oxyurichthys*, *Trypauchen*, *Teanoides*, *Valenciennea*, *Amblyeleotris* from Tamil Nadu. Among which dominant genus *Parachaeturichys*, *Oxyurichthys*, *Acentrobius* were recorded. *Acentrogobius*, *Trypauchen*, *Oxyurichthys* also reported from Gulf of Mannar with 10 species. Survey in Pondicherry shows the presence of genus *Oligolepis*, *Taenoides* and *Trypauchen* covering 16 species. Molecular studies and DNA barcoding sequence carried out for the collected specimens and generated COI barcodes were deposited in NCBI database with accession number. Sequence information generated will be helpful for the separation of cryptic species and also help to discover new species of gobiids.

Keywords: Gobiiformes, East coast, Cryptic species, DNA barcoding, Species diversity.

Taxonomic diversity and Distribution of the family Gobiidae in Kerala with Conservation implication

Akhila T, Moumita D., Ida E.G., Sweta B., Poonam P., E. Agnita Sharon, Ranjana and K.K. Bineesh

Zoological Survey of India, India

(Email: akhilabdev@gmail.com)

Abstract

The order Gobiiformes is one of the largest fish families comprising more than 2,000 species in more than 200 genera. The present study aims to provide updated information on species diversity and distribution and utilization of gobioid fishes of Kerala, west coast of India using morphometric and molecular identification. Present study based on the field surveys conducted during 2021 to 2022 in the fresh water, estuarine and marine habitat using cast nets, bottom trawls, traps conducted of Kerala. About 600 specimens were collected from coast of Kerala and 18 genus and 26 species were identified. Major genus identified are *Glossogobius*, *Auloperia*, *Psammogobius*, *Butis*, *Arcygobius*, *Istigobius*, *Obliquogobius*, *Oxyurichthys*, *Trypauchen*, *Teanoides*, from Kerala. Species under genus *Glossogobius*, *Butis*, *Taenoides*, *Psammogobius* and *Oxyuricthys* are predominant among collected specimens. A deep water gobioid fish species of *Vanderhorista* collected from west coast of India is confirmed as new species. *Oxyurichthys tentacularis* is one of the most demanding gobioid fish in Ashtamudi Lake of Kollam, known by its vernacular name "Koozhali" which contribute economic importance and sustenance fishery to the people of rural areas of the lake. Molecular studies on collected specimen of fishes were done with generation of DNA sequence with COI genes. High genetic separation observed within the *Glossogobius giuris* and *Obliquogobius cometus* warranted further taxonomical analysis. They possess a unique haplotype that is substantially divergent from other species. The sequence of O. tentacularis shows 5.5% genetic divergence with sequences of *Oxyurichthys* sp. A from Kochi, Kerala. The study suggests that molecular markers can be used for accurate species identification of the family Gobiidae.

Keywords: Gobiiformes, West coast of India, Molecular Taxonomy, Species diversity, Conservation.

An insight into the taxonomy and diversity of pollinating Hoverflies (Insecta: Diptera: Syrphidae) from dry deciduous landscape of West Bengal

Jayita Sengupta, Arka Mukherjee, Atanu Naskar and Dhriti Banerjee

Diptera Section, Zoological Survey of India, M-Block, New Alipore, Kolkata-700053, India

(Email: mukherjee.arka03@gmail.com)

Abstract

Differential uses of land use pattern have causes declination of pollinator globally. The current pollinator catastrophe anomaly affects food scarcity, magnifies problems with hidden hunger, erodes ecological resilience and threatens ecosystems. Despite of visiting at least 72% of global food crops, dipteran pollinators always have received much less research attention than hymenopterans. Hoverflies (Insecta: Diptera: Syrphidae) being one of the largest pollinator group from Dipteran lineage is worthy of more research priorities. The study on this group of flies represents a huge research gap particularly from the plain land ecosystems of West Bengal. According to the report ISHI score (India State Hunger Index) is 20.97 which is in alarming level. Current study includes a detailed systematics & diversity analysis of this pollinator from the dry deciduous landscape (Sonamukhi Forest) from the state. For the current study purpose, pollinators have been collected by net sweeping & by using different traps over a span of 3 years. Detailed study includes 20 species under 16 genera over two subfamilies where Syrphinae (53%) are more prevalent than Eristalinae (47%). The most prevalent species is found to be *Episyrphus* (*Episyrphus*) *balteatus* (De Geer, 1776) whereas *Sphaerophoria indiana* Bigot, 1884 is rarely present in all the season. On the other hand, the results of the diversity analysis study show species diversity to be at its highest during the Pre-Monsoon season (H= 4.261) and its lowest during the Monsoon season (H= 1.12). Further detailed studies at periodic interval is necessary for more accurate database development and for ecosystem monitoring.

Keywords: Pollinator, Hoverfly, Food security, Diversity, Ecosystem

Descriptions of poorly known marine sponges (Phylum Porifera) from the Andaman Islands, India with notes on their ecology

Preeti Antonetta Pereira[1] and Chelladurai Raghunathan[2]

[1]Zoology Discipline, School of Biological Sciences and Biotechnology, Goa University, Taleigao, Goa, India

[2]Zoological Survey of India, M-Block, New Alipore-700 053, Kolkata, West Bengal, India. E-mail: raghuksc@rediffmail.com; https://orcid.org/0000-0003-1417-5496

(Email: preetipereira@unigoa.ac.in)

Abstract

Marine sponges (Phylum Porifera) of the Andaman and Nicobar Islands are probably one of the most diverse in India, yet have poorly represented apart the species names being included in a few checklists. Although a large number of studies on marine sponges of the Islands have been carried out in the recent years, most of them have dealt with species checklists, providing no scope for ascertaining the validity of the listed species. This report is part of sponge taxonomy and diversity studies conducted at several localities using SCUBA (up to 20m) and rocky shore explorations during the low tides in the Andaman Islands during 2015–2018. Taxonomic descriptions of 20 species of sponges distributed among 18 genera, 14 families and 10 orders are provided along with a note on their geographic distribution and ecology. A total of 10 growth forms were observed of which, thin sheets were the most dominant growth form (25%) followed by massive globose (15%); massive lobose (15%) and massive flanged (10%). Seven growth forms were found to be rare, represented only by one species each. Most sponge species preferred a rocky substrate followed by dead coral and live coral. Sponges exhibiting thin sheet type of growth form were found to colonise on all hard substrates such as rocky substrates, dead and live corals. Only one species, *Oceanapia sagittaria*, exhibiting cylindrical growth form, was found in sandy bottom. *Stylissa massa* and *Phyllospongia foliascens* were found to be present invariably in all depths. *Spheciospongia vagabunda*, and two subspecies viz., *Spheciospongia inconstans* var. *meandrina* and *S. inconstans* var. *digitata* were found in the shallow waters (0 – 1 m). Species-specific information on taxonomy, zoogeography and bathymetric distribution of the sponges of the Andaman Islands provided herein would be valuable for future biomonitoring programs for their conservation and management.

Keywords: Demospongiae, Distribution, Diversity, Taxonomy, Zoogeography.

An updated Checklist of Thrips (Insecta: Thysanoptera) of Sikkim

Th. D. Songomsing Chiru[1], Thang Johnson[2], R.R. Rachana[3] and R. Varatharajan[4]
[1,2,4]Department of Zoology, Manipur University-795003, India
[3]ICAR-National Bureau of Agricultural Insect Resources, Bengaluru 560024, India
(Email: songomsing@manipuruniv.ac.in)

Abstract

Systematic survey of thrips was undertaken during 2019-2022 with specific reference to Khangchendzonga National Park in order to understand the species richness of this World heritage habitat. The study revealed the presence of 56 species which culminated in the preparation of the checklist "The Thysanoptera (Insecta) fauna of Sikkim". The details of the species composition are as follows. The suborder Tubulifera is represented by 24 species which can be grouped into 14 genera under the two subfamilies Phlaeothripinae and Idolothripinae in Phlaeothripidae. Similarly, the collection records have indicated as many as 32 species of terebrantians under Thripidae. All the above said 32 thripids belong to 20 genera which are grouped within four subfamilies, with the lion's share of 25 species in Thripinae, followed by 5 Panchaetothripines, and one each of Dendrothripinae and Sericothripinae. Analysis of the species composition in terms of their feeding habit and habitat reflected that 83% of the thrips are phytophagous, 13% mycophagous and 4% obligate predators. From amongst the phytophagous forms, 27 are phyllophilous, 17 flower dwelling anthophilous species, and 4 poephilous. A close scrutiny also revealed the presence of pests, of which Sciothrips cardamomi, Thrips palmi, and Ceratothripoides claratris are notable pests with appreciable economic importance.

Keywords: Thrips, checklist, Sikkim, survey, pest

Morpho-taxonomy and seasonal effect on the ecology of Culicoides Latreille, 1809 (Diptera: Ceratopogonidae) in Sonamukhi protected forest, Bankura, West Bengal

Emon Mukhopadhyay, Supradipta Dutta, Moubanti Das, Suman Kumar Saha, Sudip Mondal and Dhriti Banerjee

Diptera Section, Zoological Survey of India, M-Block, New Alipore, Kolkata 700053, India

(Email: supradutta96@gmail.com)

Abstract

Culicoides (Diptera: Ceratopogonidae), popularly known as 'biting midges' play a significant role as vectors in the transmission of pathogens to vertebrate animals-particularly livestock animals, other mammals (including humans) and birds, causing severe diseases like Bluetongue (BT), Epizootic haemorrhagic disease (EHD), African horse sickness (AHS), Equine encephalitis (EE), etc. The present research focuses on morpho-taxonomy, ecological diversity, seasonal prevalence, and species abundance of Culicoides in different cattle farms and pastoral regions of Sonamukhi Protected area, Bankura, West Bengal for three seasons (pre-monsoon, monsoon, and post-monsoon) from 2013 to 2015 in sixteen sampling sites. Taxonomic studies show- four species under three subgenera- Avaritia: *Culicoides actoni*, *C. imicola*, Remmia: *C. oxystoma*, Hoffmania: *C. peregrinus* of genus *Culicoides* for the first time from Sonamukhi area. Ecological analysis shows the highest species diversity in the postmonsoon (H=0.881), species dominance maximum in post-monsoon (D=0.5179), and species richness-maximum in monsoon (Dmg=0.6). Species relative abundance (pi=0.664), rank abundance curve and seasonal prevalence pattern shows-*C. oxystoma* as the most dominant species. This study provides a brief idea of the taxonomy, ecology, and seasonal prevalence of Culicoides species in the Sonamukhi Protected area, Bankura. From the seasonal effect studies, it is established that moderate rainfall and moist weather play an essential role in the development of this vector fly. Despite the area showing extreme weather conditions, the preand post-monsoon seasons are the ideal time and the species abundance to reach its highest seasonal peak. This research is a preliminary step which delivers insights into the taxonomy, ecological role, species diversity, seasonal abundance, and factors affecting the growth and survival of Culicoides, for its scientific direction in vector control strategies as well as conservation and management of livestock via proper monitoring and surveillance programs.

Keywords: Culicoides, Vector, Ecology, Prevalence, Post-monsoon.

Morphological characterization of Discomedusae jellyfish (Scyphozoan) of Andhra Pradesh coast, Western Bay of Bengal, India

Pralaya Ranjan Behera[1], Shubhadeep Ghosh[2] and Raju Saravanan[3]

[1,2]ICAR-Central Marine Fisheries Research Institute, Visakhapatnam, Andhra Pradesh – 530003, India

[3]ICAR-Central Marine Fisheries Research Institute, Mandapam, Tamil Nadu-623520, India

(Email: beherapralaya213@gmail.com)

Abstract

Species identification is the first step in forecasting and managing jellyfish impacts. The significant identification constraints are attributed to the high degree of morphological variations among and within species. Research on jellyfish has increased in recent years from Indian waters, but knowledge of accurate taxonomic identification of Scyphozoans, mostly Discomedusae groups still lacking. We identified and described ten Discomedusae species (*Crambionella annandalei* Rao, 1931, *Catostylus* sp.; *Rhopilema hispidum* (Vanhoffen, 1888); *Cyanea nozakii* Kishinouye, 1891; *Chrysaora chinensis* Vanhoffen, 1888, *Chrysaora* sp.; *Netrostoma coerulescens* Maas, 1903, *Acromitus flagellatus* (Maas, 1903), *Lychnorhiza malayensis* Stiasny, 1920 and *Lobonemoides robustus* Stiasny, 1920) by using the morphological taxonomic approach from coastal and estuarine waters between January 2019 to December 2022 along the West coast of the Bay of Bengal. This study documents the first records of eight species of Discomedusae from the coast and provides additional taxonomic features along with color photographs of the reported species. These results deliver the basics for covering the taxonomic research in the area; the account of the species diversity will increase the understanding of the population dynamics and their consequences in the fisheries.

Keywords: Bay of Bengal, Scyphozoan, Taxonomy, Rhizostomeae, Semaeostomeae

A study on diversity and relative abundance pattern of Tabanidae (Insects: Diptera) from dry deciduous protected forest habitat of Bankura district of West Bengal, India

Aniruddha Maity, Ankush Mitra*, Pubali Mitra, Siddharth Singh, Mousumi Chowdhury, Jayita Sengupta, Atanu Naskar**, Dhriti Banerjee

Diptera Section, Zoological Survey of India, M-Block, New Alipore, Kolkata 700053

*Presenting author mail id: mailto:ankush2408mitra@gmail.com
**Corresponding author email: atanu.diptera@gmail.com

Abstract

The family Tabanidae (Insects: Diptera), also known as daans-makkhi or dansmachi are widely known for their habit of fierce biting, sucking blood meal and disease causing capabilities in domesticated and wild animals and even in humans. Current study was aimed to find out the diversity and relative abundance pattern of Tabanid flies in Sonamukhi dry deciduous protected forest habitat of Bankura district of West Bengal. Female Tabanids were collected from cattles and males from tree trunks or on vegetation by sweeping insect net in warm sunny weather from 2020-2022 in Sonamukhi dry deciduous protected forest. After collection, samples were prepared by standard protocol, for further examination. Structural associations i.e. percentage abundance were calculated and analysed from the pooled data and finally enumerating Tabanidae diversity by biodiversity indices, like Shannon-weaver index, Species richness index, Evenness index and dominance diversity index. Present study enumerated a total of 72 specimens of eleven Tabanid species under five genera and two subfamilies namely Chrysopsinae and Tabaninae. The Tabanid species are namely *Chrysops dispar* (Fabricius, 1798); *Atylotus virgo* (Wiedemann, 1824); *Atylotus agrestis (Wiedemann, 1828); Tabanus dorsiger* Wiedemann, 1821; *Tabanus (Tabanus) rubidus* Wiedemann, 1821; *Tabanus (Tabanus) striatus* Fabricius, 1787; *Tabanus (Tabanus) tenens* Walker, 1850; *Tabanus (Tabanus) diversifrons* Ricardo, 1911; *Haematopota javana* Wiedemann, 1821; *Haematopota marginata* Ricardo, 1911 and *Hippocentrodes desmotes* Philip, 1961. Comparative diversity analyses of Tabanid species throughout the three season revealed that mostly the diversity and evenness indices yielded maximum value during post monsoon. Dominance indices showed maximum value during pre-monsoon and post monsoon. Among all the Tabanid fauna recorded from Sonamukhi protected forest and adjacent area representing arid zone of the state, *Tabanus (Tabanus) striatus* Fabricius, 1787 is most widespread and almost found to be cosmopolitan in distribution.

Keywords: Tabanidae; Diversity; Abundance; Dry deciduous protected forest.

First record of haematophagous Muscid fly *Haematobia exigua* Meijere, 1903 (Diptera: Muscidae) from the Lower Ganga Delta of West Bengal

Debjani Ghosh[1*], Atanu Naskar[1**] and Dhriti Banerjee

[1] Zoological Survey of India, M Block, New Alipore, Kolkata

[*] Presenting author email: debjanighosh0009@gmail.com

**Corresponding author email: atanudiptera@gmail.com

Abstract

The Muscid flies belonging to the order Diptera, family Muscidae, commonly known as houseflies are infamous for their ability to transmit disease-causing organisms to humans and livestock alike. The flies in this group are predatory, hematophagous, and saprophagous and they frequently consume exudates from plants and animals as evidenced by their distinctive mouthparts. The buffalo flies or *Haematobia exigua* Meijere, 1903 under subfamily Musciinae and tribe Stomoxyini are infamous for their incessant biting and are responsible for losses over billions of dollars worldwide. Although their population had previously been well-documented from Southern India, this was the first time it had been recorded from the lower Ganga delta of West Bengal. The flies were captured from two separate cattle farms in the semi-urban settlements of South 24 parganas district of West Bengal in the month of September, 2021. There is a confusion among taxonomists worldwide, regarding the species level identification of the buffalo flies. It was observed that another congeneric species, share complete morphological similarity with the buffalo flies, except some geographical variants. So, after the morphological identification of the specimen up to the genus, DNA Barcoding was performed for the species level identification. This area is well known for its dairy based industry for decades. The discovery of these flies from this area can be crucial in identifying the role of the haematophagous Muscid flies on the economic situation of the dairy based industries.

Keywords: Haematophagous fly, Buffalo fly, DNA barcoding, Muscidae, Dairy economy

First state record of family Diapriidae (Hymenoptera: Diaprioidea) from Odisha with generic level distribution in rice ecosystems

P. V. Theertha, K. Rajmohana and Sunita Patra

Zoological Survey of India, Kolkata, India (Sister Institute of University of Calcutta, West Bengal, India)

(Email: theerthapvg@gmail.com)

Abstract

Rice is one of the important staple crops in Odisha, India. The rice fields are dominated by arthropod communities which comprise pests, predators, and parasitoids. Among them, parasitic hymenopterans play an important role in the regulation of insects and arthropods. The diapriids are a family of parasitic wasps, a less studied group. They are pupal or larval-pupal endoparasitoids, mainly of dipterans either at the primary or secondary level; a few parasitize ant larvae or beetle pupae. By regulating the population of their host insect groups they contribute to the food web dynamics, thereby maintaining ecosystem balance and stability. Thus, in the rice fields, they influence the population of several dipteran families like Ephydridae, Ceratopogonidae, Syrphidae, and Tabanidae, which are vital components of the food webs and energy transfer. The present work aimed to investigate the presence and distribution of diapriids in the rice fields of Odisha. Through field surveys, nearly 750 diapriid specimens were collected across 10 rice fields falling under the 10 agroclimatic zones. The study could document nine out of the 14 genera of the subfamily Diapriinae found in India, the genera being- Aneuropria Kieffer, Basalys Westwood, Calogalesus Kieffer, Coptera Say, Entomacis Foerster, Monelata Foerster, Odontopria Kieffer, Spilomicrus Westwood, and Trichopria Ashmead. Their distribution across the agroclimatic zones is presented through GIS mapping. Comments on their abundance and morphological specializations are also included. Diapriids are documented for the first time in Odisha, and our findings imply that they are abundant and widespread in Odisha's rice ecosystems.

Keywords: Diapriidae, rice field, Diptera, Odisha, parasitoids

Distribution, Diversity and Taxonomical Identification of Marine and Coastal Polychaete from Digha Coastal Waters, West Bengal

Aniket Ghosh, K. Anbarasu and S. Balakrishnana
Bharathidasan University, Tiruchirappalli, Tamil Nadu 6200024, India
(Email: aniketghosh883@gmail.com)

Abstract

Polychaetes are one of the most important coastal and marine macro benthic communities having high ecological and economical consequence. The scientific information on this group in Indian waters is scanty particularly with reference to coastal and marine region of Digha, West Bengal. The coastline of West Bengal is quite quick i.e. 158.2 kms, however it constitutes a huge variety of meiofaunal biota. Polychaetes (Chaetopod) are the amplest macro meiofauna taxa beneath the Phylum Annelida of marine and coastal sediments. The sampling was done by gently sieving and samples collected by forceps and brought into laboratory in icebox. Samples were identified up to species level by following standard identification keys and identified specimens were preserved in 70% alcohol for further studies. In this present study, the distribution, diversity and taxonomical identification of marine and coastal polychaete are collected from the Digha adjacent coastal area (21.6222?N; 087.5066?E), West Bengal, India. Hence, a taxonomic systematic classification of all the valid polychaete species along with diversity and distribution is provided in this paper. Worldwide around 10,000 species and in India 883 species of the catalogue of the polychaetes annelids. A total of 10 species under 08 genus, 05 orders 04 different family i.e. Goniadiae, Sigalionidae, Glyceridae and Orbinidae have been recorded so far from Digha adjacent waters. Digha coast are very rich in biodiversity. Coastal soil pollution can be analysed by the indication of abundance of polychaetes as they cannot live in inorganic polluted sediments. The fauna inhabiting the coastal waters of Digha are a treasured resource both in terms of utility as food and as material for scientific study.

Keywords: Polychaete, Taxonomy, Diversity, Coastal, Digha, West Bengal

An account of fungus feeding darkling beetles (Coleoptera: Tenebrionidae)

T. K. Viswanath and V. D. Hegde
Zoological Survey of India, WGRC, Kozhikode, Kerala, India
(Email: vivekvishvanath@gmail.com)

Abstract

Darkling beetles belongs to the family Tenebrionidae under order Coleoptera. This is a widely distributed family showing variety of adaptations namely litter feeding, surface grazing on lichens and mosses, Myrmecophily, Termitophily, Cavernicoly, Xerophily etc. Some species of darkling beetles are well adapted to feed and live on fungi. This habit of feeding fungi is called "Mycophagy". Feeding of fruiting bodies, mycelia or fungal spores can be considered as mycophagy. Dead trees form habitats for variety of fungi like slime molds, bracket fungi and other major groups. These fungi growing in dead trees in turn provides shelter, breeding places or food source for their inhabitants both directly and indirectly. The five tribes under the family Tenebrionidae namely Bolitophagini, Diaperini, Toxicini, Scaphidemini and Rhipidandrini are known to be obligatory inhabitants of longevous and woody bracket fungi. Both adults and larvae of fungivorous tenebrionid beetles spent their whole life in fruiting bodies of bracket fungi. Adults are known to be surface feeders while larvae tunnels inside and feed. Here we discuss about some of the fungus feeding species of darkling beetles coming under the genera like Byrsax, Boletoxenus, Bradymerus, Catapiestus, Ceropria, Crypaheus and Toxicum. This paper is based on the examination of earlier collections as well as recent collections of ZSI and also with data from literature study. Identification is mainly based on the morphological characters and sometimes by the dissection of male genitalia. The details of some of the fungus feeding darkling beetles along with the images are given in this paper. The images were taken with the help of Leica binocular microscope fitted with DFC 500 digital camera.

Keywords: Darkling Beetles, Mycophagy, Fungivorous, Coleoptera, Bracket fungi

Larval and adult taxonomy of kodomillet shoot fly, *Atherigona simplex* (Thomson) (Diptera: Muscidae)

Prabhu Ganiger[1], Muddasar[2], Yamanappa R. Madigar[3] and Aswini R.[4]

[1]Entomologist and PI, PC unit, ICAR-AICRP on Small millets, UAS, GKVK, Bangalore, Karnataka, India

[2,4]Senior Research Fellow, DST-Project on Systematics of Shoot flies of India, AICRP on Small millets, UAS, Bangalore, Karnataka, India

[3]M. Sc, Department of Entomology, UAS, GKVK, Bangalore

(Email: prabhuganiger@gmail.com)

Abstract

Objectives: To know the identification of larval and adult kodomillet shoot fly, *Atherigona simplex* (Thomson) (Diptera: Muscidae) Methodology: Larvae, adult and male genetalia were prepared based on the methods described by Frías *et al*., (2006), Steck *et al*. (1990), Mc Alpine *et al*., (1981), Pont (1973), 1986 and Pont & Magpayo (1995) was followed. Observations: Maggot characters, adult and male genetalia features were observed and described. Outcomes: The maggot of A. simplex is described for the first time with different instars. Abstract: The muscid shoot-fly *Atherigona simplex* (Thomson) (Diptera: Muscidae) is major pest in kodomillet grown in different parts of India. Adult with dark palpi, sometime partly or mainly yellow. The interfrontalia are shining black and the male has the fore femur partly darkened, the wing usually with a dark smudge at the tip of the sub-costa, and the fore tarsus without erect hairs. The fore tibia and tarsus are mainly brown, the tibia being yellow on basal third or less. The hypopygial prominence with a deep notch. Male adult trifoliate process with long stalk and median basally slender with apex triangular with few prominent setae. The lateral plates and median piece are yellow on the basal half and dark brown on the apical half. First instar with distinct mouth hook, suprabuccal teeth and dorsal process, Pharyngeal sclerite narrow and elongated. Anterior Spiracle with five digitations. Posterior spiracle with two spiracular openings surrounded by papillae. Whereas in second instar with three pair of mouth hooks and dorsal process, dorsal and ventral cornua are of equal length. Anterior spiracle with 9 digitations in each arm. Posterior spiracle with three C-shaped spiracular openings, peritreme slightly sclerotized. In third instar cephalopharyngeal skeleton with a distinct mandible, suprabuccal teeth and dental sclerite. Anterior spiracle with nine digitations. Posterior spiracle with three C- shaped Spiracular slits and heavily sclerotized peritreme.

Keywords: Shoot fly, Atherigona simplex, kodomillet, maggot, Muscidae

A Synoptic Review of Ephemerellidae (Insecta: Ephemeroptera) of India

Vasanth, M.[1], Subramanian, K. A.[2], Kubendran, T.[3], Selvakumar, C.[4] and Sivaramakrishnan, K. G.[5]

[1]Research Biologist (LTEO), Zoological Survey of India, Southern Regional Centre, Santhome High Road, Chennai, Tamil Nadu, India

[2]Scientist E, Zoological Survey of India, Southern Regional Centre, Santhome High Road, Chennai, Tamil Nadu, India

[3]Scientist D, Zoological Survey of India, Prani Vigyan Bhawan, M-Block, New Alipore, Kolkata, West Bengal, India

[4]Assistant Professor, Department of Zoology, The Madura College (Autonomous), Madurai, Tamil Nadu, India

[5]Emeritus Scientist, Flat 3, Door No.7, Gokulam Colony, West Mambalam, Chennai, Tamil Nadu, India

(Email: vasan071994@gmail.com)

Abstract

The family Ephemerellidae (spiny crawler mayflies) contains some of the most striking larvae among extant mayflies and is widely distributed in torrential and high-gradient streams. The inventory of the family Ephemerellidae has been revised to include biogeographic differentiation and the external morphology of each species. The higher classification is represented by two subfamilies, of which only Ephemerellinae s.s. which is recognized by two tribes viz., Ephemerellini: Drunella, Notacanthella, Spinorea, Ephacerella and Cincticostella. Hyrtanellini: Teloganopsis, Serratella, Torleya and Hyrtanella are presently found in India. The Western Ghats and the Western Himalayas are reasonably well explored with regard to ephemerellid species. In this context, spiny crawler mayflies of three different groups were studied and in India, most of the species are described from the eastern Himalayas and two species are from the Western Ghats. Presently, 19 species belonging to 7 genera are recorded from the Eastern Himalayas. The Western Ghats have only a genus Torleya which belongs to two species viz., *T. lacuna* and *T. nepalica* these species are also distributed in Eastern Himalaya. The present study documents and reviews the diversity, distribution, and generic concepts of the spiny crawler species from the Eastern Himalayas.

Keywords: Systematics, Ephemerellidae, Ephemerellinae, Biogeography, India

Updated Status: Eriophyoid Mites (Acari: Eriophyoidea) from Meghalaya State of North-East India

Surajit Sur

State Aided College Teacher-1 and Head, Department of Zoology, Muralidhar Girls' College, P-411/14, Gariahat Road, Kolkata-700029, India

(Email: surajitsur.1990@gmail.com)

Abstract

Eriophyoid mites are the second largest group among all phytophagous mites and have immense economic importance as pest of a large variety of Agri-horticultural crops throughout the world. They are very much morphologically and biologically specialized as they have only two pairs of legs, lots of body setations absent and they are extremely host-specific. Many eriophyoid mites can produced erinea, rusting, different kinds of galls, witches' broom etc. Northeast India (NEI) is a highly biodiversified place with different floral and faunal compositions. This present study deals with the faunal composition of eriophyoid mites only from Meghalaya state (out of 7 states of NEI). Till now, from NEI as a whole 27 eriophyoid mites under 2 families: Eriophyidae and Diptilomiopidae, 4 subfamilies viz., Ashieldophyinae, Eriophyinae, Nothopodinae and Phyllocoptinae and under 4 tribes viz., Acaricalini, Calacarini, Phyllocoptini and Anthocoptini have been collected. Out of which, from Meghalaya, a total of 16 eriophyoid mites have been described so far under 11 genera (8 genera under family Eriophyidae and 3 genera under family Diptilomiopidae) where most species (4) found under genera of Tetra under the subfamily-Phyllocoptinae and tribe-Anthocoptini. So, lots of survey works need to be done from such above mentioned state of NEI to explore such tiny, phytophagous and very interesting group of mite for better understanding and biodiversity exploration and to describe new taxa as much as possible.

Keywords: Meghalaya, Eriophyoidea, Biodiversity, Northeast India, Gall

Integrative Taxonomy of Tetraodontiform Fishes from Southern West Coast of India with a New Record on Mola Alexandrini (Ranzani 1839)

Suvarna S. Devi, Vishnuraj R. S., Nishanth H. P., Shabina N. A. and Biju Kumar A.
Dept. of Aquatic Biology & Fisheries, India
(Email: suvarnaraja.abf@keralauniversity.ac.in)

Abstract

The taxonomy of the order Tetraodontiformes are not well studied from the Indian coast, hence an integrated approach was attempted in this paper to check the identification of the fishes. A total of 42 species of Tetraodontiform fishes classified under 8 families in 25 genera were obtained from southern west coast of India. Family Tetraodontidae was the most speciose family with fourteen species, followed by Balistidae and Monacanthidae with seven species; families Ostraciidae, Diodontidae, Triacanthodidae and Tricanthidae harboured three species each and Molidae represented by two species. *Mola alexandrini* (Ranzani 1839), recorded from Sakthikulangara harbour is a new record to India. *Sphoeroides pachygaster* Muller & Troschel, 1848, (Family: Tetraodontidae) encountered during the present study from Sakthikulangara harbour, is a new record to Kerala coast. DNA barcoding using mitochondrial CO1 gene confirmed thirteen species of Tetraodontiform fishes. Low pairwise genetic distances (Kimura 2-Parameter) between the species of the samples and those from the gen bank were noticed based on COI sequences. The study advocates integrated approach in identifying tetraodontiform fishes considering the fact that there are cryptic species and some of them are commercially valuable in aquarium industry and human consumption.

Keywords: Tetraodontiformes, taxonomy, molecular studies, South India, Mola alexandrini

First report of demospongiae *Chondrilla mixta* from Kavaratti, Lakshadweep Islands, India

Sree Vishnu R.[1], Limna Mol V. P.[2] and S. Sureshkumar[3]

[1,2]Marine Biology Laboratory, Department of Marine Biosciences, Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, Panangad, Kochi, India

[3]Biodiversity Laboratory, Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, Kochi, Kerala, India

(Email: sreevishnuptpm7434@gmail.com)

Abstract

The members of the phylum Porifera, with primitive evolutionary lineage, plays a very important role in the reef stabilization process. The marine environment of the Lakshadweep archipelago is one of the unique coral reef ecosystems with enormous and unexplored biotic assemblage. The marine archipelago of Lakshadweep receives more research attention due to the scarcity of taxonomic studies. The present study focuses on the morphological and phylogenetic identification of *Chondrilla mixta* Schulze, 1877, collected from Kavaratti Island, Lakshadweep archipelago. The species exhibited dark grey colour with lighter spotted region and firm and compact texture which are the identified features of the genus *Chondrilla*. Microscopic analysis of the spicules indicated the presence of oxeas and triactine (Upright Zeiss Primostar 3 microscope) supporting the features of *C. mixta*. Further studying its molecular taxonomic analysis using the modified CTAB method for DNA extraction, amplification of mitochondrial COI gene and sequence analysis resulted in 573bp of DNA which was subjected to phylogenetic variability analysis and it yielded 99% similarity in BLAST result. The phenotypic character is related to *Chondrilla mixta* collected from Kaneohe bay, Hawaii. From the specified characters it can be concluded that the present study is the first report of demospongiae *Chondrilla mixta* from the Lakshadweep Islands.

Keywords: Sponges, *Chondrilla mixta*, COI gene, DNA barcoding, Spicules

Status of Chrysidid Taxonomy in India and its Significance

Aswathi P. G. and Bijoy C.
Christ College (Autonomous), Irinjalakuda Calicut University, India
(Email: achuzdgr8@gmail.com)

Abstract

Chrysididae, popularly known as cuckoo wasps, mainly consists of solitary wasps with brilliant metallic colouration. Cuckoo wasps are parasitoids or kleptoparasites of stick insects, moths, wasps, bees and sawflies. Chrysididae is a cosmopolitan family with approximately 2500 species under five subfamilies- Cleptinae, Amiseginae, Loboscelidiinae, Chrysidinae and Parnopinae. Knowledge on the diversity and distribution of Chrysididae in the ecosystems of India is sparse as compared to other countries. Earlier works on Indian Chrysididae was a monograph by Bingham in 1903, in which he recorded 78 species under 9 genera from 3 Subfamilies. Some other scattered works on Indian Chrysididae until 1988 recorded 92 species from India. However, recent studies on Chrysidid taxonomy by Aswathi and Bijoy (2019 onwards) in Western ghats (2021, ….) in collaboration with Rosa (2020) have increased the known number of Indian Chrysididae to 126 species under 20genera and four subfamilies. Western Ghats is one of the "hottest hotspots" of biological diversity in the world because of its high level of biological diversity and endemism. Western Ghats is facing severe threats to its ecosystem such as habitat destruction and fragmentation and as a result, its biodiversity is being declined at an alarming rate Therefore, documentation of Chrysidids is a matter of grave concern in the Western Ghats. Recent works conducted by Kimsey, Dewhurst and Nyaure (2013) have revealed the scope of chrysidid wasps in pest control. They documented two species of Chrysidids, *Cladobethylus insularis* Kimsey & Dewhurst, 2013 and *Exova tunana* Kimsey & Dewhurst, 2013 that can control outbreaks of the oil palm stick insect, *Eurycantha insularis* Lucas, 1869 in oil palm plantations in the Northern Province of Papua New Guinea. Another study by Kevin M. O' Neill (2001), recorded *Praestochrysis shanghaiensis* Smith, 1874 parasitising Limacodidae (lepidoptera). Further in-depth studies on the biology of Chrysididae are needed to validate.

Keywords: Chrysididae, taxonomy, biodiversity, rare, Kerala

Ants (Hymenoptera: Formicidae) of Siang, Arunachal Pradesh

Sahanashree R. and Priyadarsanan Dharma Rajan
Ashoka Trust for Research in Ecology and the Environment (ATREE), India
(Email: sahanashree228@gmail.com)

Abstract

Eastern Himalayas, one of the 36 global biodiversity hotspots, is home to two thirds of India's unique and vast biodiversity. The state of Arunachal Pradesh is the most diverse among the eight states in this region, through which Brahmaputra, one of Asia's largest rivers flows. The Siang and Dibang Valleys through which the river flows include diverse habitats and very rich biodiversity. In 1911, an expedition was conducted by the British government to explore the geology and biodiversity of Siang Valley and findings were published in Vol. VIII, 1912-1922. Recently, a team of researchers from ATREE, supported by an NGS grant, conducted an expedition to the Siang Valley to explore biodiversity and compare it with what was reported by the previous expedition. Ants play a critical role in maintaining biodiversity and ecosystem functioning – as predators, pollinators, scavengers, and soil turnovers. But they have been poorly studied in this important region of the Eastern Himalaya Biodiversity Hotspot. The earlier expedition had reported 28 species from the Siang valley. During our expeditions we have conducted extensive collections using Winkler extraction method, pitfall traps, and hand collection. In total 257 species from 70 genera were recorded from Arunachal Pradesh. As a result of our research, 74 species of ants from the Siang region belong to the Myrmicinae, Ponerinae, Formicinae, Dolichoderinae, and Proceratiinae subfamilies. Nineteen ant species are new report to India, whereas eight genera and eleven species of ants are new report to Arunachal Pradesh.

Keywords: Myrmecology, Ant Taxonomy, Siang, Northeast India, Diversity

Ichthyofaunal diversity of Ñiangdai River in Ri-bhoi district, Meghalaya

Batngenlang Mawlong and Yumnam Lokeshwor Singh
Assam Don Bosco University, India
(Email: batngenlangmawlong55@gmail.com)

Abstract

The present research work on ichthyofauna diversity of the Ñiangdai River in Ri-bhoi district, Meghalaya carried out from the month of October, 2021 to May, 2022 on three collection sites, have revealed 11 species belonging to Cypriniformes order, Siluriformes order and Perciformes order. Cypriniformes show a major percentage of species with 73%, followed by Siluriformes with 18% and Perciformes with 9% the species found in this river include *Neolissocheilus hexagonolepis*, *Pethia shalynius*, *Garra nasuta*, *Garra lissorhynchus*, *Garra* sp., *Devario aequipinnatus*, *Schistura* sp, *Schistura reticulofasciata*, *Glyptothorax striatus*, *Channa stewartii*, *Channa* sp. Habitat inventory and physico-chemical parameters are also studied in the river Ñiangdai revealing that the habitat area is productive for the species to survive. This study will provide authentic information on the species present in the river Ñiangdai and act as a reference for future initiative studies and conservation and sustainable exploitation of habitat. Detailed research is still needed to explore the indigenous species present in this river.

Keywords: Diversity, Habitat inventory & physico- chemical, Cypriniformes, Siluriformes, Perciformes.

Partial characterization of Lipase from Gram pod borer male and female moth *(Helicoverpa armigera)*

Aishwarya S. Pawar[1] and R. M. Gejage[2]

[1]Shri. Vijaysinha Yadav College, Peth Vadgaon, Dist- Kolhapur. Pin- 416112 (MS), India

[2]Assistant Professor in Zoology, Department of Zoology, Smt. Kusumtai Rajarambapu Patil, Kanya Mahavidyalaya, Islampur Tal. Walwa, Dist. Sangli-415 409. (M.S). India

(Email: saishwaryapawar@yahoo.in)

Abstract

Lipases play an important role in the physiology of insects, particularly at the non larval life stages. Lipase activity of Gram pod borer male and female moth, *Helicoverpa armigera* was studied by the spectrophotometric method using crude homogenate of male and female moth as the enzyme source and olive oil as substrate. The lipolytic activity at pH 8.3 and Km 0.221×10-2 mM suggests male adult lipase is active at an alkaline pH with more affinity of substrate. Decreased activity was detected after incubation at pH above and below 8.3. The enzyme was stable at 370C. On the other hand, the female adult lipase was maximum at pH 8.1 and Km 0.246×10-2 mM. The lipolytic activity was observed to be more in male than female moth.

Keywords: Lipases, *Helicoverpa armigera*, Lipase activity, spectrophotometer

Diversity of the diminutive sisorid catfish of the genus *Pseudolaguvia* (Teleostei: Siluriformes) in the Northeastern India

Yumnam Lokeshwor Singh
Assam Don Bosco University, India
(Email: lokeyum24@gmail.com)

Abstract

Northeastern India, a part of the Indo-Burma mega biodiversity hotspot of the world, is blessed with five different drainage systems viz. the Brahmaputra, the Barak-Surma-Meghana, the Chindwin, the Kaladan, and the Karnaphuli. The colourful diminutive catfishes of the genus *Pseudolaguvia* are one of the representative freshwater fish fauna of the region. The routine studies on the collected fishes from various rivers of northeastern India since 2017 to till date, have revealed the distribution of 15 species under the genus *Pseudolaguvia*. It has been found that *Pseudolaguvia* species can be characterized into two groups based on the presence or absence of serrations on the anterior edge of the dorsal spine. Of the 15 species of *Pseudolaguvia* in the region, 11 species are categorized under the group of fish with a smooth face on the anterior edge of the dorsal spine whereas the remaining four species are under the second category of fish with a serrated edge on the anterior dorsal spine. The Brahmaputra River has the maximum diversity of *Pseudolaguvia* with 10 species. The Barak-Surma-Meghna River harbours three species while the Karnaphuli and the Kaladan Rivers are with one species each. Applications of modern integrated taxonomic tools are much needed for a proper understanding of the species' identity.

Keywords: Diminutive catfish, Pseudolagiuvia, freshwater, megabiodiversity hotspot, Northeastern India

Collecting and preserving freshwater crabs: some advanced techniques

Sameer Kumar Pati

Zoological Survey of India, Western Regional Centre, Vidyanagar, Sector 29, P.C.N.T. Post, Akurdi, Pune- 411 044, Maharashtra, India

(Email: sameerkumarpati@gmail.com)

Abstract

Globally, some 1700 species of freshwater crabs are known, which need not to return the sea for completing their life cycles. Considering their ecological and economical importance, surveys and explorations have started accelerating. It is foremost important for the researchers to know the methods involved in the collection and preservation of freshwater crabs. The present paper briefly discusses most of the previously described methods for collecting and preserving freshwater crabs. The methods for storing and transporting crab specimens, as crucial as their collection and preservation, are particularly emphasized. Some advanced techniques are also provided, which assure the best preservation of crabs and the time-saving mode of writing labels. Moreover, all or some of the methods (collection, preservation, storage, labelling and transportation) discussed here are also applicable to other zoological specimens, including marine crabs and decapod crustaceans.

Keywords: Zoological specimens, methods, storage, labelling, transportation

Diversity of Gastropods (Mollusca: Gastropoda) Along Intertidal Rocky Shores of Thiruvananthapuram District; Kerala Coast

Preetha Karnaver[1], Reshmi R.[2], A. Bijukumar[3], Ravinesh R.[4] and B. Harikumar[5]

[1]Dept. of Zoology, Christian College, Chengannur, Alappuzha (dist), Kerala, India

[2]Department of Zoology, NSS College, Pandalam, Pathnamthitta (dist) Kerala, India

[3]Professor and Head, Department of Aquatic Biology and Fisheries, University of Kerala, Karyavattam, Thiruvananthapuram, Kerala, India

[4]Project Scientist II (Deep Ocean Mission) Centre for Marine Living Resources and Ecology, Ministry of Earth Sciences, Atal Bhavan, LNG Road, Puthyuvypu, Ochanthuruthu P.O, Kochi- 682508, India

[5]NSS Ayurveda Hospital, Vallamkulam, India

(Email: karnaver1@gmail.com)

Abstract

Biodiversity, the variation that exists among various life forms within an ecosystem indicates the health of biological systems. The intertidal zone lying at the junction of the land and the sea is subject to variations in tides, waves, changing temperature and salinity, associated with cyclic change of exposure and immersion. The solid rocks and boulders in intertidal areas and associated tidepools forms an ideal microhabitat for settlement of many marine organisms such as seaweeds, barnacles, mussels and limpets. Rocky shores are highly productive ecosystems that provide ecosystem services such as provision of providing fresh air, cleaning and recycling water, etc. Rocky shores are threatened by pollution, high recreational pressure and rising sea level and are a source of detrital material for coastal food webs. Class Gastropoda form the most species rich and diverse class in phylum Mollusca with respect to the number of species. The present study assesses the gastropod diversity associated with intertidal rocky shores along Thriuvananthapurm district, Kerala Coast. Regular collections were taken from rocky intertidal patches of Muloor, Vizhinjam, and Kovalam during 2021-2022 by handpicking and snorkelling with the help of professional divers, preserved in formalin and identified upto species level using standard Keys. The study revealed the presence of a total of 112 species of gastropods belonging to 32 families and 61 genera. Out of these, 5 species are considered new to Indian coast. The most abundant species among the recorded specimens were *Cellana radiata*; *Cellana testudinaria*, *Clypidina notata*, *Trochus radiatus*; *Euchelus asper*; *Turbo bruneus*; *Nerita albicilla*; *Nerita plicata*; *Nerita polita*; *Littoraria undulata*; *Planaxis sulcatus*; *Lotoria perryi*; *Gyrineum natator*; *Anachis Terpsichore*; *Monetaria annulus*; *Mauritia arabica*; *Erosaria ocellata*; *Purpura bufo*; *Agaronia gibbosa*; *Oliva oliva*; *Conus inscriptus*; *Turricula javana* and *Turricula tornata*. The natural rocky shore was found to be rich in biodiversity.

Keywords: Gastropoda, mollusca, intertidal, diversity, ecotone

On the record of the dwarf snakehead *Channa kelaartii* (Günther, 1861) from India

Nallathambi Moulitharan, Jayakumar Natarajan, Uma Arumugam and Praveenraj Jayasimhan

Dr. MGR Fisheries College and Research Institute, Tamil Nadu, India and Dr. J Jayalalithaa Fisheries University, Ponneri, India

(Email: moulitharan769677@gmail.com)

Abstract

The present study reports the first record of the dwarf snakehead fish *Channa kelaartii* from the Indian freshwater ecosystems based on the integrative taxonomic approach with a series of specimens collected over the entire South-eastern peninsular India. *Channa kelaartii*, a recently validated fish species of dwarf snakehead group from Sri Lanka is found to have a distribution in the East flowing rivers, streams and other waters including stagnant water bodies in South-eastern peninsular India. Multiple series of specimens were collected from the Southern Andhra Pradesh and Tamil Nadu which reveals its identity as *C. kelaartii* on both morphological and genetic analysis. It is evident that most dwarf snakeheads so far reported as *C. gachua/ C.orientalis* from the Eastern peninsular India are *C. kelaartii*. Hamilton (1822) described *C. gachua* from the waters of the river Ganges in Bengal and reported to have a distribution from Iran to Taiwan. Later Günther (1861) described *C. kelaartii* from Sri Lanka. Day (1878) synonymized *C. kelaartii* with *C. gachua* but Deraniyagala (1945) identified *C. kelaartii* as a subspecies of *C. gachua*. Recently Sudasinghe *et al*., (2020) revalidated *C. kelaartii*. The findings of this study document the confirmed distribution of *C. kelaartii* in South-eastern peninsular India thereby adding an additional species to Indian snakehead diversity.

Keywords: Dwarf snakehead, taxonomy, Sri Lanka, eastern peninsular India, Channa kelaarti

Osteology of incomplete lateral lined schisturid loaches of Meghalaya: A comparative account

Wimarithy K. Marak and Yumnam Lokeshwor Singh

Department of Zoology, Assam Don Bosco University, Tapesia Garden, Kamarkuchi, Assam 782402, India

(Email: wimmarak@gmail.com)

Abstract

Fishes of the genus *Schistura* McClelland, are colourful small nemacheiline fishes found in the hill streams and rivers. They are characterized by moderately arched mouth, medially interrupted lower lip without forming two lateral triangular pads, median notch in lower jaw present or absent and processus dentiformes well developed to feebly developed (absent in some). Comparative osteology is one of the important taxonomic tool in systematic study of species or group of species within a genus or family. The present study is based on the comparative osteology among schisturid fishes with incomplete lateral line found in Meghalaya. Meghalaya is blessed with eight Schistura species with incomplete lateral line are found, out of which six species have been studied for osteology viz., *Schistura fasciata*, *S. larketensis*, *S. papulifera*, *S. reticulofasciata*, *S. savona*, and *S. syngkai*. Two unkown species of *Schistura* in the same group differ from the hitherto known species are also included in this paper. The clearing and staining of the bones of these species groups in their neurocranium, structure of air bladder capsule, vertebrae, fin insertion and caudal-fin complexes show variation and similarity. The study have revealed with *Schistura fasciata* with a total of 35 vertebrae, *S. reticulofasciata* with 33-34, *S. savona* with 30, *S. syngkai* with 31-32, *Schistura* sp1. with 32 and *Schistura* sp 2. with 35 vertebrae. There is variation in neurocranium, structure of air bladder capsule, fin insertion and caudal-fin complexes in all cases. Thus, osteology is one of the useful taxonomic tools to discriminate species and their phylogenetic relationship.

Keywords: Schistura, Nemacheiline fish, comparative osteology, Meghalaya

Comparative morphological notes on *Cletomorpha benita* Kirby, 1891with a checklist of Indian species of *Cletomorpha* Mayr, 1866 (Hemiptera: Coreidae)

Susmita Khanra, Swetapadma Dash, Amartya Pal and Devanshu Gupta

Zoological Survey of India, Kolkata, India

(Email: susmitakhanra.7258@gmail.com)

Abstract

The global distribution of genus *Cletomorpha* Mayr, 1866 (Hemiptera: Coreidae) includes 22 species; out of them, four are distributed in India, *C. raja* Distant, 1901; *C. hastate* (Fabricius, 1787); *C. Benita* Kirby, 1891; and *C. walkeri* Kirby, 1891. This genus is widely distributed in the Ethiopian and Indo-Malayan regions. It is characterized by the head which is indistinctly produced before antenniferous tubules and presence of acutely and exteriorly produced connexival segment. The morphological characters of *Cletomorpha benita* Kirby, 1891 (Hemiptera: Heteroptera) have been studied and compared with allied species, along with the illustration of male genitalia for the first time. Comparison of male genitalia of different Indian species of Genus *Cletomorpha* Mayr, 1866 have been studied and a key to Indian species of this Genus is provided in the present study.

Keywords: Taxonomy, Coreidae, *Cletomorpha benita*, Genitalia, Morphometry

Moth Diversity of Desert Ecosystem of Rajasthan

Preeti Choudhary and Indu Sharma
Zoological Survey of India, India
(Email: alliswell.0356@gmail.com)

Abstract

Lepidoptera is one of the most diverse groups represented by 1,57,424 species all over the world. Moths are insects that come under the order Lepidoptera, which means scaly-winged. They are mostly characterized by bright-colored scales, epiphysis on the foreleg, phytophagous and nocturnal in nature. They play a vital role in ecological, economic services and are good pollinators. Besides this, they are the pest of crop plants and thus are a primary food source for insectivores. They are sensitive to climate change and therefore one of the important groups for monitoring habitat alteration/ climate change studies. Western Rajasthan is also termed as Thar Desert, which comprises thirteen districts viz. Barmer, Bikner, Churu, Sriganganagr, Hanumangarh, Jaisalmer, Jodhpur, Nagour, Jhunjhunu, Sikar, Jalore, Pali and Ajmer. Moths were collected by using light traps at several study areas of the desert ecosystem. Total 161 species of moths belonging to 129 genera under 25 families have been recorded during the studies. Erebidae was the most dominant family followed by, Noctuidae, Crambidae, Pyralidae, Geometridae, and Sphingidae.

Keywords: Moth, Diversity, Desert, Rajasthan, Ecosystem

New records of Murchisonellidae and Pyramidellidae (Mollusca: Gastropoda) from Gulf of Mannar, Tamil Nadu, India

R. Rajendra Kumar

Zoological Survey of India, Marine Biology Regional Centre, Chennai, India

(Email: rrajendarkumarzsi@gmail.com)

Abstract

In this paper, we report three species of micro gastropods *Murchisonella columna* (Hedley, 1907), *Syrnola karachiensis* Melvill, 1897 and *Turbonilla pachypleura* Melvill, 1910 have been collected from the fringing reef at Vedalai Island, Gulf of Mannar, south-east coast of India. These 3 taxa are new record to the Indian Waters. This study will help in the contribution to the knowledge of the Indian marine malacofauna. Studies of micro molluscs are very few in India now it is very essential for Indian malacology.

Keywords: Micro mollusc, India, Gulf of Mannar, Pyramidellidae, Murchisonellidae

Importance and the present status of phytoseiid mites (Acari: Mesostigmata) in India

Shubhadeep Biswas and Krishna Karmakar

Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal, India

(Email: shubhadeep81096@gmail.com)

Abstract

Phytoseiid mites are widely recognized as potential predators of small soft-bodied arthropods, nematodes and destructive mite pests on account of their high searching capability, good adaptability to a wide range of climatic regimes from arctic to tropics, short life span, high multiplication capacity with voracious feeding potential. Phytoseiid mites are now exploited as efficient biocontrol agents playing crucial role in managing pest population below economic injury level, ensuring a safe and sustainable pattern of food production without using dangerous chemicals. Right now, the group of acarologists are deeply involved with this group of mites and the number of valid phytoseiid species has increased from 34 in 1950 to more than 2500 in 2022. Some of them are extensively mass-reared and commercially utilized for biological control programs in high valued crop production likely, *Neoseiulus longispinosus* (Evans), *Neoseiulus barkeri* Hughes, *Amblyseius swirskii* Athias-Henriot, that are predaceous on two-spotted spider mite, *Tetranychus urticae* (Koch). Faunistic studies on phytoseiid mites have been started in India since 1960s with the publication of Narayanan *et al*., (1960). The first systematic compilation on Indian Phytoseiidae was done by Gupta (1986) with 139 nominal species. Currently, the total number has been raised to 285 under 8 tribes, 24 genera, belonging to 3 subfamilies. Among them 110 species have been known from West Bengal, 36 from Uttar Pradesh, 17 from Tripura, 35 from Tamil Nadu, 26 from Punjab, 30 from Karnataka, 23 from Andaman & Nicobar Islands and others. An exhaustive inscription on the taxonomic identification, distribution, feeding behaviour and scope of utilization of phytoseiid mites occurring in this vast landmass of India have been dealt in the present paper.

Keywords: Biological control, Phytoseiidae, Systematics, Potential predators, Economic injury level

Present status of Laelapidae mites (Acari: Mesostigmata) in India

Pritha Bandyopadhyay[1] and Krishna Karmakar[2]

[1]Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal, India, https://orcid.org/0000–0002–2450–7880

[2]Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal, India. E-mail: kkbckv64@gmail.com; karmakar.krishna@bckv.edu.in; ORCID: https://orcid.org/0000–0002–5582–3560

(Email: pritha.bandyopadhyay31@gmail.com)

Abstract

One of the largest and diversified families in the Order Mesostigmata is *Laelapidae Canestrini*, 1891 (Acari: Parasitiformes). Members of this family differ greatly in terms of their morphology, habitat, distribution and feeding habits. They include both free-living predatory species as well as associated with arthropods, mammals or birds. Some free-living forms spend at least some of their lives in the soil those are commercially produced as predatory biocontrol agents and many play a crucial role in soil nutrient recycling. They have a worldwide distribution and comprise obligate and facultative vertebrate parasites and free-living predators of small arthropods, nematodes in soil-litter as well as vertebrate and arthropod nests. Apart from a few research on soil-associated laelapid mites, there are very little information on rodent-associated and arthropod-associated (mostly bee-parasitic) Laelapidae available from India. Recent study reveals 66 Laelapidae species belonging to 21 genera those have been documented along with a summary of the available information on the distribution and biology of each species from India. Information presented in the study includes the current valid name of each species with a bibliographic reference to its original description, a reference explaining the current taxonomic placement of the species, references to atleast one paper that records the species in India and ambiguity about placement of species in taxonomic hierarchy, if any. Considering the vastness of Indian zoogeographic sphere which consist of four hotspots of biodiversity, encompasses only a few species of the family Laelapidae, documented and described till date. Hence, there is immense scope to explore laelapid mites highlighting their importance and their role in the ecosystem with proper description, urgently needed from India.

Keywords: Soil mesofauna, Mesostigmata, Laelapidae, Predatory, Biocontrol

Status, Prospects and Role of Tarsonemid Mites in India

Sandipan Kayal[1] and Krishna Karmakar[2]

[1]Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal, India.

[2]Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal, India.
E-mail: kkbckv64@gmail.com; karmakar.krishna@bckv.edu.in; ORCID: https://orcid.org/0000–0002–5582–3560

(Email: sandirection07@gmail.com)

Abstract

Tarsonemidae Canestrini and Fanzago, 1877 is a diverse family of heterostigmatid mites which include phytophagous, fungivorous, detriphagous, algivorous and insect parasitic species living in terrestrial, arboreal, subcortical or nidicolous habitats. Although being hugely diverse in nature, it is very less explored in India. Many of these mites pose a serious threat to global agriculture due to their direct feeding on crop plants or indirect transmission of disease-causing microbes to healthy plants. Polyphagotarsonemus latus may reproduce year-round in all tropical and subtropical areas and have hundreds of dicot hosts. Steneotarsonemus species, such as *S. spinki* and *S. subfurcatus*, attack rice and can significantly reduce the harvest; *S. ananas* attacks pineapple, and *S. laticeps* targets lilies. Several Tarsonemus species phoretic on several insects, while some other species are pest of cultivated mushrooms and stored products. The study of tarsonemid mites in India has intensified in the latter half of present decade, and the description of various new species and their host associations has led to a realistic overview of the diversity of tarsonemids in India as well as their potential to disrupt Indian agriculture and forests. A total of 36 species of tarsonemid mite species are described or reported from India of which 23 are recorded from West Bengal accounting for 64% of Indian tarsonemid mites. New species of *Bongotarsonemus*, *Ceratotarsonemus*, *Daidalotarsonemus*, *Floridotarsonemus*, *Fungitarsonemus*, *Metatarsonemus*, *Steneotarsonemus*, *Tarsonemus* and *Xenotarsonemus* are discovered recently from West Bengal, India and further studies on host plant association established the presence of *S. spinki* and *S. subfurcatus* in rice under West Bengal conditions, but *S. furcatus* was only found to infest weed hosts but not in rice. Tarsonemids also show diverse ecological interaction like phytophagy, fungivory, algivory, detriphagy, phoresy, microbe association, soil dwelling nature and storage inhabitants.

Keywords: Taxonomy, Diversity, Tarsonemidae, Ecological role, Status

Diversity of threadfin breams (family Nemipteridae) in the Andaman Islands: An integrated approach

Lakshmi Devi[1], Deepmala[2] and K. K. Bineesh[3]

[1]Dept. of Marine Science, JAIN (Deemed to be Univeristy), Bangalore, India

[2]University of Lucknow, Uttar Pradesh, India

[3]Marine Biology Regional Centre, Zoological Survey of India, Chennai, Tamil Nadu, India

(Email: d.lakshmi@jainuniversity.ac.in)

Abstract

The threadfin breams (family Nemipteridae) of the genus *Nemipterus* Swainson, 1839 are small to medium-sized fishes that are widespread throughout the tropical and subtropical Indo-West Pacific region. They are valued table food fishes throughout Asia where they are mainly taken by hook-and-line and bottom trawl fishery. Accurate identification and description of species is essential for these economically important groups with a view to documenting their diversity and abundance thus enabling managing their stocks. The key characters used for their identification show great plasticity and the overlapping characters of species make these small demersal fishes as taxonomically challenging group. The present study was conducted to review the genus Nemipterus and resolve the taxonomic ambiguities among the threadfin breams in the Andaman Islands and update the taxonomic key using integrative approach, incorporating traditional morphology based taxonomy with COI marker. We examined 12 species belonging to the genus *Nemipterus* sampled from south and north Andaman Islands. The study revealed two species of them to be new to science that provisionally labeled as *Nemipterus* sp. A and *Nemipterus* sp. B An updated morphological key for the species of the genus *Nemipterus* from the Indian waters was also provided for the accurate species identification. The genetic variations within and between the species were calculated. High genetic separation observed within Nemiperus japonicas and *Nemipterus peronii* warranted further taxonomical analysis. They possess a unique haplotype that is substantially divergent from all other *Nemipterus* species. The sequence of *Nemipterus marginatus* shows 8.5% genetic divergence with our sequences of *Nemipterus* sp. A from South Andaman Islands. The study suggests that molecular markers can be used as complementary tool for accurate species identification, which in turn would help fishery management plans for small scale threadfin fisheries.

Keywords: Threadfin breams, Diversity, Andaman Islands, Taxonomy

Taxonomic review of the genus *Nala* Zacher, 1910 (Dermaptera: Labiduridae) from India

Shruti Lekha Dey and K. G. Emiliyamma

Zoological Survey of India, Prani Vigyan Bhawan, M- Block, New Alipore Kolkata – 700053, India

(Email: shrutilekha1995@gmail.com)

Abstract

The genus *Nala* Zacher, 1910 (Dermaptera: Labiduridae) is reviewed from India. Three species of the genus, viz., *Nala lividipes* (Dufour, 1829), *Nala nepalensis* (Burr, 1907) and Nala basalis Bey-Bienko, 1970 are known from India, which are redescribed and illustrated. The redescription and illustration were made based on detailed morphological characters, the unique male forceps structure of every *Nala* species and the structures of male genitalia. New, additional diagnostic characters, which are more specific to each species are proposed for the identity of these species of Dermaptera. The family Labiduridae is distributed worldwide and is subdivided into three subfamilies including, Nalinae which includes only one genus *Nala* Zacher, 1910, with seven species distributed throughout South-East Asia, out of these, three species are known from India. The genus *Nala* was erected by Zacher (1910) with *Forficula lividipes* Dufour, 1829 as the type species. *Nala lividipes* (Dufour, 1829) is the most abundant species of the genus in the Indian fauna. A key to the Indian species of the genus *Nala* is provided, along with systematic list, geographical distributions, type localities, taxonomic remarks, digital images and point distribution map of every Indian *Nala* species. This study will be useful for accurate identification of the species in the future researchers.

Keywords: Dermaptera, Genus, India, Nala, Redescription.

Batoids in Indian Fisheries: Prevalence and conservation concerns

K. K. Bineesh, Ida E. G., Sweta B., Moumita D., Akhila T. and Poonam P. A.

Marine Biology Regional Centre, Zoological Survey of India, Chennai, Tamil Nadu, India

(Email: kkbineesh@gmail.com)

Abstract

India is one of the leading chondrichthyan fishing nations. Batoids are one of the most threatened groups of elasmobranchs in India. The present paper is an attempt to provide new information on catch, taxonomy, current distribution, fleet size, trade and usage of of Batoids in India. This study based on the landing site surveys conducted during the years 2017-2022 at major fish landing centres along coast of India. The present findings revealed a total of 64 species caught in commercial and artisanal fisheries. *Torpedo panthera* was regularly caught in the commercial trawler and discarded. Among the deepwater batoids, Dipturus spp, *Torpedo* sp. and *Benthobatis moresbyi* were identified in the trawl bycatch. Trawl survey show that *Acroteriobatus variegates* distribution restricted to southern cost of India. *Rhinobatos lionotus* also restricted to north east coast of India from West Bengal to Tamil Nadu coast. Our survey found that *Glaucostegus typus* and *Rhina ancylostoma* contribute average of 7% of total batoids catch in the ray fisheries in the Tamil Nadu. Trawlers targeting shrimp contribute 94% of the catch and remaining catch by gillnets. Our data suggest that population of all Guitarfishes and Wedgefishes in Indian waters declined drastically pointing out immediate management actions to protect Guitarfishes and Wedgefishes.

Keywords: Rhinopristiformes, Diversity, Species composition, Indian EEZ, Conservation

Comparative Cranial Osteology of *Hydrophis schistosa* Daudin, 1803 and Hydrophis platurus (Linnaeus, 1799) (Elapidae: Hydrophiinae) in Indian subcontinent.

Sonia Mondal, Souradeepa Kundu, Pratyush P. Mohapatra and C. Raghunathan

Zoological Survey of India, Kolkata, India

(Email: researchwild.ophidia@gmail.com)

Abstract

The viviparous sea snakes under the subfamily Hydrophiinae are morphologically and ecologically diverse young clade distributed throughout the Indo-Pacific. Earlier work on the cranial morphology of the species under this subfamily was restricted with schematic diagram of skull in the monograph of sea snakes by Smith 1926. The present study aims to provide with detailed description of cranium and mandibular structure of two commonly found species of sea snakes in India, *Hydrophis schistosa* and *Hydrophis platurus* and also analyze the variations in the cranial morphology between the species using allometric properties. The study reveals that altogether various components of the skull vary in shape compared to their terrestrial Elapid cousins. On comparison among these two species, it was found that considerable morphological variation in length in major bone structure like, ectopterygoid, frontal, mandible, maxilla, nasal, parietal, premaxilla, pterygoid and quadrate. In addition, structural variation in the frontal, parietal, premaxillary, basisphenoid bones along with variation in all the teeth bearing structures including maxilla, palatine, pterygoid and dentine have also been noticed. Further it is observed that the presence of basisphenoid process in cranial structure of *H. schistosa*, which is absent in *H. platurus*. The presence of basisphenoid process in *H. schistose* is possibly associated with crushing of skull bone of Cat fish which constitute majority its diet. The present findings provide first detailed cranial morphology of two common species of Hydrophiinae in Indian coasts and a preliminary overview on cranial structure variation in both Piscivorous species.

Keywords: Hydrophiinae, Cranial, Piscivorous, Hydrophis, Basisphenoid process.

Distribution, Diversity and Taxonomical Identification of Marine Zooplankton from Digha Adjacent Coastal Waters

Purbita Bhattacharyya, K. Anbarasu and S. Balakrishnan
Bharathidasan University, India
(Email: purbita.rimpi@gmail.com)

Abstract

Zooplanktons are the micro or macroscopic group of aquatic organisms that float in the water at different zones by the mercy of wind and water flow. Zooplanktons are the predator of phytoplankton, the photosynthetic oxygen producing aquatic plant, thus they control the ecosystem and eutrophication. Zooplankton are diversified and widely distributed throughout the lotic and lentic water bodies. The marine zooplankton community includes many different species of animals, ranging in size from microscopic protozoans to animals of several meters in dimension with buoyancy capacity. In this present study, the distribution, diversity and taxonomic identification of marine zooplankton are collected from the Digha adjacent coastal area (21.6222?N, 87.5066?E), West Bengal, India. Generally almost all zooplankton species have their specific depth range but some of those also exhibit nocturnal migration and helps in conserving energy, as well as beneficial for themselves, to prevent mortality by visual predators. Zooplankton, as the intermediate link between producer (phytoplankton) and consumer (secondary and tertiary) level in the trophic chain, plays pivotal roles in the energy and matter transport processes, cycling of elements and their vertical flux in marine environment. This community is highly diverse in terms of their size, taxonomy, trophic structure, geographical distribution, tolerance to different environmental variables, etc. These are also considered as one of the most important linkages in shaping the extent and pace of climate change. During the survey, local small plankton net was used to collect zooplanktons. Totally 15 number of genera under 6 different species such as *Euterpina* sp., *Corycaceus* sp., *Oithona brevicoides*, *Harpacticus* sp., *Paracalanus parvus*, *Johnius dussumeiri*, *Portunus* sp. *Porpita porpita* and *Physalia physalis* have been identified. The survey a clear data has been obtained how the diversity and distribution variance has indicated the water quality difference from one to another region of the coastal areas.

Keywords: Zooplanktons, Diversity, Taxonomy, Digha, West Bengal

Identification and Phylogenetic Classification of Marine Ornamental By-Catch Fauna from Digha Mohana fish Landing Centre, West Bengal

Sayan Maity, S. Rajakumar and S. Balakrishnan
Bharathidasan University, India
(Email: msayan073@gmail.com)

Abstract

Fishing is one of the major factors contributing to the livelihood and income of the vast coastal populations. Fishing practices are done collectively from the sea, and as a result, the yield contains all kinds of organisms present in a specific area, which includes targeted and non-targeted organisms. Mostly non-food fishes are considered trash or by-catches, including internationally accepted ornamental varieties. To estimate the same, indigenous marine ornamental by-catch fauna (fishes and invertebrates) were collected from the Digha Mohana fish landing centre, West Bengal. The collected specimens were identified and classified taxonomically based on physical characteristics. To learn more about ornamental fish as bycatch, a serious concern about ecological impacts such as population declines has been raised. The accidental fishing of non-targeted organisms can lead to reduced ornamental fish stock and slow down the process of re-establishment of the same, including endangered fish species, as they do not serve as income for the fishermen communities. Thus, accidental fishing of non-targeted fish species creates economic and ecological imbalances. To assess the aforementioned issue, a survey of the total population of bycatch fauna from the fish landing centre was conducted using taxonomic classification. The phyla Chordata, Mollusca, Arthropoda, Cnidaria, and Echinodermata contain the vast majority of trash organisms. Emphasising marine ornamental species (fishes and invertebrates), DNA barcoding as a useful tool for the classification and identification of species that are more vulnerable to population decline is the objective of the current study. The current study also includes the construction and analysis of phylogenetic trees using specific sequences from databases of previously barcoded species, as well as the barcoding of sequences from collected species that are not in the database and contributing new sequences.

Keywords: By-catch, Fish landing centre, Taxonomy, DNA Barcoding, Phylogenetic

Diversity in Belondiroidea, a group of soil inhabiting nematodes from Western Ghats, India

Sumit Kumar[1] and Wasim Ahmad[2]

[1]Department of Life Sciences, Jaypee University, Anoopshahr, Bulandshahr (U.P.) – 203 390, India

[2]Department of Zoology, Aligarh Muslim University, Aligarh- 202 002, India

(Email: sumitchandra.20@gmail.com)

Abstract

The Western Ghats of India, one of the 36 biodiversity hotspots of the world, supports an enormous biodiversity of flora and fauna. But this region has remained largely unexplored with regards to soil-inhabiting nematode fauna. Nematodes belonging to the superfamily Belondiroidea Thorne, 1939 (Order Dorylaimida) constitute an important group of soil-inhabiting nematodes which represent an important part of soil food webs and play important roles in regulating decomposition and recycling of nutrients in soil ecosystem. Belondirid nematodes are a diverse and successful group mostly found in undisturbed habitats, with most of its species restricted to tropical rain forests, and have in recent years been used in soil health assessments. Although, the Western Ghats are rich biodiversity hotspots, only 21 species representing this group have so far been recorded from this region (Ahmad & Jairajpuri 1982; Dhanam & Jairajpuri 1998). Hence an extensive survey was conducted to investigate the diversity of belondirid nematodes from Western Ghats. Four survey trips were conducted during 2016 to 2018 for isolation of soil-inhabiting nematodes, around 300 soil samples were collected from different habitats. These samples yielded several species of belondirids fauna. On detailed study they were found to represent 56 species, Out of these, nineteen were new to science, nine were reported for the first time from India, and forty nine are reported for the first time from Western Ghats. We also recorded two new genera *Qudsialemellus* and *Timmiella*. A total 280 species of Belondiroidea have so far been described from the world. Among these, 102 species (36% of total described species), has earlier been recorded from India. As the results of this survey, Western Ghats fauna is now represented by 70 species (making a total of 130 species from India) which constitutes about 54% of Indian's belondirids and 23% of world's belondirids fauna.

Keywords: Biodiversity, Nematode, Western Ghats, Belondirids, Taxonomy.

Brachyuran crab diversity from Digha, West Bengal, Northern East Coast of India with Special Reference to DNA Molecular Phylogentic Analysis

Diptadyuti Das, M. Muthuselvam and S. Balakrishnan
Bharathidasan University, India
(Email: diptadyutidas07@gmail.com)

Abstract

A variety of marine and estuarine crab species can thrive in the northern east coastal zone. In the present study, totally 35 species of marine crabs under 12 genera and 10 families were identified. All of the species' systematic taxonomic accounts were given, together with information on their precise distribution and synonymies. Observations were also made that just 5 portunid crabs out of all these species are being used as food by the coastal inhabitants in the area; as a result, a significant regulation is required for the sustainable management of fisheries. The present study was conducted to verify the divergence between two different families or two different genus of crabs DNA sequences. We are going to measure the divergence of the sequences with the help of molecular phylogenetic analysis commonly known as DNA Barcoding. DNA Barcoding is the derivation of short DNA sequences that enables species identification. The tissue samples collected from the pereopods or the walking legs and, extracted the DNA samples from Cytochrome C Oxidase Subunit I. The barcode region is located at the 5 prime end of the gene. It is usually 648 base pair long. DNA Barcoding technique is based on the amplification, sequencing and comparison of a mitochondrial gene that identifies the organism. After the Barcoding was done, then we construct the Phylogenetic tree. This phylogenetic tree helps to get the information about the ansestral relationship between the species.

Keywords: Northern east coast, Brachyuran, Crab, DNA Barcoding, Phylogenetic Analysis

Checklist of the family Megachilidae Latreille, 1802 (Hymenoptera: Insecta) of India

P. M. Osman Javid[1], Rifat H. Raina[2], P. C. Pathania[3] and Sajad H. Paray[4]

[1,4]Department of Zoology, BGSB University Rajouri (J&K)-185234, India

[2]Desert Regional centre, Zoological Survey of India, Jodhpur, Rajasthan, 342005, India

[3]High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan, 173211, India

(Email: osmanjavid750@gmail.com)

Abstract

Objectives: 1 To collect & identify the Megachilidae species. 2 To describe new species based on Morphological & Molecular approach. 3 To design Checklist. Methodology: Bees were collected from J & K and Ladakh from 2019-2022 with the help of insect sweep net. They were killed with ethyl acetate and were identified upto species level with the help of relevant literature. Checklist have been designed based on previous literature & new collection data. Observations: Family Megachilidae include leafcutter, mason, resin, and carder bees. In India it is the largest Bee family with a total of 172 species under 23 Genera & 36 Subgenera in 3 tribes. This checklist is compiled based on the previous published literature. Some additional new distribution data of different species is given based on the work carried out from 2019 to 2022. In India the North West Himalayas contains rich diversity of these bees and is represented by around 100 species. About 20,500 species of bees have been described over the globe (Ascher & Pickering, 2021). Superfamily Apoidea have been subdivided under 07 families namely Apidae Linnaeus, Colletidae Lepeletier, Andrenidae Laterille, Halictidae Thomson, Melittidae Schenck, Megachilidae Laterille, Stenotritidae Cockerell. Among them Stenotritidae, Colletidae, Andrenidae, Halictidae, and Melittidae are short tongued bees, and Megachilidae and Apidae are long tongued bees. At present, about 4000 species under 70 subgenera are described worldwide, whereas, more than 150 species of Genus *Megachile* belonging to a dozen subgenera are recognized as valid from Southeast Asia. Family.The family Megachilidae has been subdivided under two subfamilies. i.e Lithurginae and Megachilinae. Subfamily Megachilinae further branches into 3 tribes namely Anthidini, Osmiini and Megachilini. The Megachilini tribe is worldwide in distribution more particularly genera like Coelioxys, Megachile and Chalicodoma are almost cosmopolitan. Outcome: 1. 12 survey cum collection tours were done across J & K and Ladakh.

Keywords: Taxonomy, DNA barcoding, Bees, Megachilidae, India

Characterization and Morphologically Identification of scavenger Syrphid (Insecta; Diptera) pupae using Scanning Electron Microscopy study

Bristi Roy, Jayita Sengupta, Atanu Naskar, G. P. Mandal and Dhriti Banerjee
Zoological Survey of India, Kolkata, India
(Email: roybristi19@gmail.com)

Abstract

Syrphidae commonly known as hoverflies, an established pollinator is one of the largest and most diverse groups of the insect order Diptera. Their larvae play a crucial role in the biocontrol of aphids in vegetable crops and the scavenging of organic matter (Ghahari *et al*., 2008). Even though their immature stages are economically important, studies have been carried out only for a few Palaearctic Eristalis species (Perez-Banon *et al*., 2013). India itself has 355 reported species of hoverflies (Sengupta *et al*., 2016), but unfortunately, their developmental stages have not received any research attention so far. The present study of scavenger syrphid pupal stages, collected from various habitats of Gangetic plains by using Scanning Electron Microscopy to provide a detailed elucidation and characterization of pupae is the first attempt from the country. For the present study, pupae were collected from cracks, crevices, and hardened mud on the wall of the drainage systems with the help of forceps, brush, and strainer, and then carried to the laboratory for further studies. Dissected and processed pupal appendages (mainly spiracles) were subjected to SEM observation following standard protocols. The observation reveals that the sub-cylindrical shape of the pupal spiracles is covered dorsally and laterally with protrusions bearing alveolar openings. Circular microtrichial bands are present in the entire length of the spiracle except on the basal part. The basal part ornamentation consists of small irregular bulges with hair-like structures on them. The length of the spiracle measures 1.882±0.118 mm, and the average diameter of alveolar openings (4-8) measures 21.49 µm. After examination of the different morphological characters following the SEM study, it is found that the studied pupae are of *Eristalinus* (*Eristalinus*) *arvorum* Fabricius, 1787 species, which are predatory and scavenger of organic matter. Further detailed studies are required at regular intervals for a better understanding of the pupal taxonomy.

Keywords: Hoverflies, Immature stage, Taxonomic study, Scavenger flies, Ecosystem Services

Advances in the Taxonomy of Indian Salticidae (Araneae)

John Caleb T. D.

Department of Anatomy, Saveetha Medical College & Hospital, Saveetha Institute of Medical and Technical Sciences, Chennai 602503, Tamil Nadu, India

(Email: caleb87woodgate@gmail.com)

Abstract

This work aims to summarize the recent advances in Indian salticid taxonomy. The family Salticidae (jumping spiders) is the most speciose among all spider families. It is represented by about 6500 species, under 671 genera and the Indian diversity is represented by 300 species under 104 genera. Taxonomic work on the family Salticidae remained practically untouched with the exception of a few sporadic descriptions through the past century. A study of spiders within a small patch of Tropical Dry Evergreen Scrub provides an example of how less the diversity of India's jumping spider species have been studied. The present study was based on original literature survey and analysing databases like the World Spider Catalog and Salticidae of the World. The results show the trends in progress of Indian Salticidae. The last decade of the 20th century saw the description of over 40 species which was the highest through the century. But the highest number (65 species) was seen during the second decade of the 21st century. It is apparent that recent work in the past four decades shows a greater number of newly added species either in terms of species new to science or new records to India. Data suggests that much of the Indian landscape especially the bio-diverse regions need to be surveyed systematically. In comparison with the diversity from countries with biodiversity hotspots like Brazil, Australia and China (over 500 species each) we are just over the half way mark (300 species) and many species are yet to be discovered. India has been put up on the global taxonomic map with efforts from both native and foreign taxonomists giving a modern treatment supported by good quality illustrations and taxonomic revisions. The future of Indian Salticidae is promising but it is still a work in progress.

Keywords: Distribution, Diversity, Jumping spider, Species, Systematics

Bio-systematically explored family Drosophilidae in North Chotanagpur, Jharkhand, India

Shakti Pada Mahato and Kishore Kumar Gupta

Cytogenetic laboratory, University Department of Zoology, VBU, Hazaribag, Jharkhand, India

(Email: shakti.eco@gmail.com)

Abstract

Family Drosophilidae is biosystematically and cytogenetically most exploited animal group but its distribution status in Jharkhand is not yet explored. Jharkhand being rich in ecological heritage with variety of natural resources covered by approximately 30% of forests provides shelter to many wildlife fauna and flora including species of Drosophila. In the current study, our intensive field surveys conducted by three traditional methods (Trap- bait method, Net- sweeping method and Direct Collections with the help of aspirator) during 2017-18 in the wild areas of North Chotanagpur division of Jharkhand revealed altogether 20 different species distributed in four genera and six sub genera of family Drosophilidae. Among these, the subgenus Sophophora of genus *Drosophila* was dominant, consisting of 10 taxonomically recognized species while other recognized five subgenera were poorly explored. To the best of our knowledge, it is first biosystematics report on family Drosophilidae in Jharkhand and further extensive survey is needed to present the great taxonomic panorama of family Drosophilidae in this state. The present study deals with the taxonomical analysis based on the established scientific parameters of identified species, phallic and periphallic organs, body indices of their various parts, respective morphometric measurement and taxonomic keys of identified species.

Keywords: Biosystematics, Drosophilidae, Phallic & Periphallic organs, Taxonomic key, Jharkhand

In-Silico structural characterisation of cytochrome c oxidase transmembrane protein and its role in regenerative aspect of *Dugesia japonica*

Mithila M. Chinchalkar and Ravindra Kshirsagar

Research Center of Modern College Arts Science Commerce Ganeshkhind, India

(Email: mithu.182feb@gmail.com)

Abstract

Planaria (Phylum Platyhelminthes) shows epimorphic and morphollactic regenerative potential due to presence of neoblasts. The present study focuses on various computational techniques like molecular docking, molecular dynamic simulation and homology modelling to explore structural features and binding mechanism of cytochrome c oxidase subunit (COX1) with known inhibitor in planarians. MODELLER software was used for 3D Model building of COX1. Modelled protein was analysed and validated using GROMACS and web servers. Molecular docking was done using Auto Dock tools for Carbon Monoxide and nitric oxide. The three-dimensional structure of mitochondrial transmembrane protein COX1 was built using homology modelling based on high-resolution crystal structures of *Dugesia* sp. Molecular dynamics simulation was performed on the modelled protein structure. The modelled protein was validated using qualitative structural indices. Known inhibitors such as carbon monoxide (CO) and nitric oxide (NO) inhibit their active binding sites of mitochondrial COX1 and the inhibitors were docked into the active site of attained model and their regenerative effect was studied. A structure-based virtual screening was performed on the basis of the active site inhibition with best scoring hits. Structural characterization and active site identification can be further used as target for the planning of regenerative studies, thereby assisting the information in the field of regenerative medicine and stem cell research.

Keywords: Cytochrome c oxidase subunit I (COX1), Gremlin, Homology modelling, Molecular docking studies, Regenerative medicine

Shining leaf chafers (Rutelinae: Scarabaeidae: Coleoptera) of Jammu and Kashmir, India

Irtiza Wani[1], Joyjit Ghosh[2] and Devanshu Gupta[3]

[1]Ph.D Scholar, Zoological Survey of India, Prani Vigyan Bhawan, Block M, New Alipore, Kolkata, West Bengal 700053, India

[2]Visiting faculty, Department of Zoology, Prabhu Jagatbandhu College, Andul, Howrah, West Bengal, India

[3]Scientist-D, O/C Coleoptera Section, Zoological Survey of India, Prani Vigyan Bhawan, Block M, New Alipore, Kolkata, West Bengal 700053, India

(Email: irtiza.wani.9@gmail.com)

Abstract

Shining leaf chafers are group of scarab beetles under the family Scarabaeidae belonging to superfamily Scarabaeoidea of the insect Order Coleoptera. This subfamily reports over 4,100 species globally, with around 370 species known from India. The family includes subfamilies, like Scarabaeinae, Aphodinae, Melolonthinae, Orphininae, Rutelinae, Dynastinae and Cetoniinae. Of these, Subfamily Rutelinae is identified by the presence of two apical spurs in middle tibiae, exposed pygidium, not completely covered by elytra. The Rutelinae scarabs feed on foliage, fruit and flowers of the plants, thus acting as pests. The union territory of Jammu & Kashmir, situated in the Himalaya biogeographic zone of India, has been less explored and less information is published on scarab beetles, especially Rutelinea. The union territory has a lack of baseline data of the diversity of Rutelinae subfamily of the scarab beetles. The study reports a total of 20 species belonging to 7 genera of subfamily Rutelinae of family Scarabaeidae from Jammu & Kashmir union territory, India, as reported in different available literatures. Adoretus is the genus with most number of species (6), followed by Popillia (5), Callistethus (3), Anomala and Mimela (2 each), and Rhinyptia and Tropiorhynchus (1 each). Anomala dimidiata is a prevalent species in the Himalayas, acting as a pest that causes severe crop damage in Jammu & Kashmir. Larvae feed on soil humus, live in decayed woods and debris in hollow parts of the trees. This paper deals the study of the species of the Shining leaf chafers reported from Jammu & Kashmir, from recent surveys and the specimens present in Coleoptera Section of Zoological Survey of India to provide an account of Subfamily Rutelinae from this area.

Keywords: Himalayas, Diversity, Pest, Species, Scarab beetles

Moths fauna (Lepidoptera: Heterocera) in the forest ecosystem of Doon Valley, Uttarakhand

Sanjay Paunikar and Gaurav Sharma

Zoological Survey of India, Central Zone Regional Centre, Jabalpur and ZSI, NRC, Dehradun, India

(Email: sanjaypaunikar@gmail.com)

Abstract

Moths are a diverse group of insects under the order Lepidoptera and suborder Heterocera. They are phytophagous, cosmopolitan, forestry and agricultural pests, night pollinators, chiefly nocturnal, food resources for birds and small mammals and potential bio-indicators. The Doon valley situated in the Indian state of Uttarakhand is a mountain valley bounded in the south-west by the Siwalik Range, in the north-east by the Mussoorie Range of the Lesser Himalaya, in the north-west by the Yamuna River, and in the south-east by the Ganga River. The habitats include blossoming and fruiting trees, wetlands, Terai, Bhabar ecosystems and several perennial rivers/ many hill streams moving through Doon Valley, and moist deciduous types of forest areas providing ideal habitats for flourish entomofauna and other fauna. The present study was carried out to investigate on the diversity of moth in the different forest ecosystem of Doon valley, Uttarakhand. The moths were observed and collected in the different localities of the Doon Valley from 2019 to 2021. During the study period observed and recorded a total 127 species belonging to 102 genera in 14 families viz., Brameidae, Crambidae, Erebidae, Eupterotidae, Geometridae, Hybaleidae, Limacodidae, Lasiocampidae, Noctuidae, Nolidae, Notodontidae, Sphingidae, Thyrididae and Uriindae. The highest species diversity of moths were observed in the family Erebidae followed by the Crambidae, Geometidae, Sphingidae, Noctuidae, and least Brameidae, Hybaleidae, Nolidae, Notodontidae, Thyradidae, and Uraniidae with one species each.

Keywords: Heterocera, Moths, Species diversity, Doon valley, Uttarakhand

Occurrence of Soil-inhabiting Nematoda (Dorylaimida and Tylenchida) from Some Protected Areas and Tea Estates of Assam with Four New Record of Dorylaimid Nematodes from India

Debabrata Sen and Samprit Deb Roy

Zoological Survey of India, M-Block, New Alipore, Kolkata- 700056

Corresponding author: debabrata.zsi@gmail.com

Abstract

During a survey in 2018, a good number of soil samples were collected to explore the occurrence and diversity of soil-inhabiting nematode fauna in some of the districts of Assam state, India including several protected areas and Tea Estates/gardens which have immense economic importance. Soil samples were collected from Pobitora Wildlife Sanctuary, Morigaon district; Nameri forest range of Nameri National Park and Bhomoraguri Reserve Forest, Shonitpur district; Jeypore Forest Range of Dehing-Patkai Wildlife Sanctuary and Mariani Forest Range of Hollongapar Gibbon Wildlife Sanctuary, Jorhat district along with Panbari Tea Estate, Golaghat district; Experimental garden of Tocklai Tea Research Institute and Holangooree Tea Estate, Jorhat district; Burrapahar Tea Estate, Nawgaon district. The soil samples were processed by Cobb's Sieving and Decantation method and the extraction of nematodes was done by modified Baerman Funnel Technique. Twenty-five soil-inhabiting Nematoda have been reported from the above mentioned conservation areas and Tea gardens. Among these twenty-five soil nematodes, twenty-one belong to the order Dorylaimida and four to the order Tylenchida. Out of these nematodes, fifteen species are reported as new distributional record from Assam. Four species, *Mesodorylaimus bastiani* (Butschli, 1873) Andrassy, 1959, *Aporcelaimellus taylori* Yeates, 1967, *Makatinus punctatus* Heyns, 1965 and *Nygolaimus macrobrachyurus* (Heyns, 1967) Thorne, 1974 have been recorded for the first time from India. The trophic groups of the nematodes were noted due to their enormous importance in soil ecosystem as well as for their agricultural significance. It was observed that they belong to omnivorous, herbivorous or plant feeding, Predatory and predatory-omnivorous feeding habits.

Key words: Soil inhabiting Nematoda, Protected areas, Tea gardens, Assam, New records.

Rediscovery and Range Extention of *Paracopium lewisi* Distant, 1903 (Hemiptera: Heteroptera: Tingidae) from India after a century from Oriental Region

Sandeep Kushwaha

Zoological Survey of India, Central Zone Regional Center, Jabalpur- 482002, Madhya Pradesh, India

(Email: sandeepkushwaha_17@yahoo.com)

Abstract

Family Tingidae is distributed from tropical to temperate zones. Because of the honeycomb-like surface on wings so-called lace bugs. The Genus *Paracopium* has some economic importance such as playing an important role in gall formation and acting as a pest also. *Paracopium lewisi* Distant, 1903 (Hemiptera: Heteroptera: Tingidae) was reported only from Sri Lanka and Indonesia (Oriental region), in 1902. For the first time after 118 years, it has been reported from the North-Eastern region, of India. The new distribution record from Sri Lanka and Indonesia to Mizoram, India shows the long dispersal of the species. An updated checklist of the genus *Paracopium* Distant, 1902 from the world has been provided along with their distributions.

Keywords: *Paracopium lewisi*, dispersal, Oriental region, Range Extention, economic importance

Tortoise Beetles (Cassidinae: Chrysomelidae): Their diversity, abundance & host preference in the forests of Dooars, West Bengal

Pratik Halder, Soumik Chowdhury, Sumana Saha and Dinendra Raychaudhuri

Post Graduate Department of Zoology, Barasat Government College, 10, K.N.C. Road, Barasat, Kolkata – 700124, India

(Email: halderpratik2000@gmail.com)

Abstract

Tortoise beetle with more than 6000 species compose the second most diverse subfamily Cassidinae of family Chrysomelidae that resemble a tortoise because of the forward and sideways extensions of the body. Many Cassidoids are plant-genus or -family specific in their food choice, and many have become agricultural pests, while others are remnant-dependent species found only on rare occasions. The diversity of such beetles in an area or region should be related to the diversity of its plant community. To better understand, appreciate, document and conserve the fauna, an inventory of the leaf beetles was initiated through various projects during 1992-2009. Present study is an attempt to assess the faunal diversity of tortoise beetles of forests of Dooars, West Bengal. A total of 23 species under 7 genera distributed over 2 tribes under subfamily Cassidinae are recorded so far from the study area. These include *Aspidomorpha orientalis* Boheman, *Cassida stupa* Maulik and *Cassida subtilis* Weise endemic to India, *Basiprionata maculipennis* (Boheman), *Cassida horni* Weise, *Cassida subtilis* Weise, *Cassida timefacta* Boheman and *Laccoptera* nr. *discreta* Boheman recorded first time from the state, 73.91% of the reported species new for the district. Genus *Aspidomorpha* has maximum number of species followed by Cassida. Analysis of their zoogeographical distribution reveals that the fauna apart from being Oriental (100%) also includes Nearctic and Australian (4.35?ch) and Palaearctic (39.13%) elements. Buxa Tiger Reserve is highest in species richness and abundance. Most of the species and individuals are encountered during premonsoon (February to May) period. It appears that plants of Convolvulaceae are the most preferred choice of the cassidines within the reserve. It is to be noted that the modes of feeding of tortoise beetles and the corresponding damage patterns are quite diverse and in many cases species specific. Further studies of these aspects, together with obtaining.

Keywords: Tortoise beetles, diversity, abundance, host plant specificity, forests.

Two New Records of free-living Marine Nematodes (Nematoda: Enoplida: Ironidae and Plectida: Leptolaimidae) from Coastal India

Ritika Datta[1], Anjum N. Rizvi[2] and C. Raghunathan[3]

[1]Zoological Survey of India, New Alipore, Kolkata-700053, West Bengal, India
University of Calcutta, 87/1, College Street, Kolkata-700 073, India

[2,3]Zoological Survey of India, New Alipore, Kolkata-700053,
West Bengal, India

(Email: dattaritika1@gmail.com)

Abstract

Objective: To study the diversity of free-living marine nematodes and reporting two new records to India from the East Coast. viz. *Trissonchulus provulvatus* Orselli and Vinciguerra, 1997 and *Antomicron quindecimpapillatus* Holovachov, 2012. Methodology: Sediment samples were collected from Coastal regions of Puducherry. Sediment samples were fixed with 4% formalin. The samples were then sieved through 2 mm coarse sieve followed by 53 µm mesh sieve. Fixed nematodes were transferred to the mixture of a Glycerin- Alcohol for dehydration in desiccator and permanent slides were prepared by the wax ring method. Identification was done under BX-53 DIC Olympus research microscope and photomicrographed with DP27 camera. Observation: After processing and examination, two first records of free-living marine nematodes species were identified, namely *Trissonchulus provulvatus* Orselli and Vinciguerra, 1997 and *Antomicron quindecimpapillatus* Holovachov, 2012. Morphological data along with description and distribution for both the species are documented here. Outcome: *Trissonchulus provulvatus* reported here conforms well with the earlier descriptions except in having slightly smaller body and longer tail. Morphometric data of *Antomicron quindecimpapillatus* recorded has a smaller pharynx and body length than descriptions given by earlier workers. A total of sixteen species of genus *Trissonchulus* and ten species of genus *Antomicron* are considered valid throughout the world. Both the species reported here have been recorded previously only from their type localities: *T. provulvatus* Orselli and Vinciguerra, 1997 from the Mouth of River Simeto, Catania, Italy, while, *A. quindecimpapillatus* Holovachov, 2012 from Gullmarn Fjord near Fiskebackskil, Sweden.

Keywords: *Trissonchulus provulvatus, Antomicron quindecimpapillatus*, distribution, morphology.

Study of Physico-Chemical Parameters and Zooplankton diversity of Bhima River from Solapur District (M.S) India

Mr. Pankaj Vilas Pawar[1] and Prof. Sudha Bansode[2]

[1]School of Life Sciences P.A.H Solapur University, Solapur, Maharashtra, India

[2]Research Guide School of Life Sciences P.A.H. Solapur University, Solapur, Maharashtra, India

(Email: pawar2925@gmail.com)

Abstract

The present study is on "Physico-chemical parameters of Bhima river of Solapur District (Maharashtra)".The Study was carried on from Jan'2022 to Des'2022 at Three selected sampling stations. Monthly variation of Physico-chemical Characteristics of water of Bhima River were studied and it revealed that the water quality is fairly homogeneous and suitable for drinking. India is best owed with plenty of diverse aquatic resources both natural and man-made, supporting huge and diverse biodiversity, including the fish therby supporting the livelihood concerns of millions of people. Among the in land opens waters the rivers which came into being due to damming of various rivers are unique ecosystems offering tremendous scope for increasing inland fish production. Solapur District is a district in Maharashtra state of India. The city of Solapur is the district headquarters. It is located on the south east edge of the state and lies entirely in the Bhima and Seena basins. The entire district is drained by the Bhima River. Chandani, Kamini, Moshi, Bori, Sina, Man, Bhogavati River and Nira are the major tributaries of the river in Solapur District. Bhima River, major tributary of the Krishna River, flowing through Maharashtra and Karnataka states, western India. It rises in the Bhimashankar heights of the Western Ghats and flows southeastward for 450 miles (725 km.) in Maharashtra to join the Krishna in Karnataka. Major tributaries are the Sina and Nira rivers. Study of Zooplanktone showed 90 species of Zooplanktone belonging to 4 different classes. Key Words:- Bhima River, Physico-chemical Parameters, Zooplanktons.

Keywords: Aquatic Diversity, Bhima River, Physico-chemical Parameters, Zooplankton, Health Hazard

Freshwater Crabs of Indian Himalaya- Diversity, Habitat Choice, Economic Evaluation and Its Conservation

Santanu Mitra

Zoological Survey of India, Fire Proof Spirit Building 27, Jawaharlal Nehru Road Kolkata-700016, West Bengal, India

(Email: santanuzsi@gmail.com)

Abstract

Freshwater crabs are considered as potential ecosystem service provider, maintain nutrient cycle in freshwater ecosystem, used as food, ethno-medicine, bio-pesticide and as bio-indicator in environmental monitoring. Some species of freshwater crab act as a vector of paragonimiasis a serious disease caused by the Lung-fluke, reported from Manipur and Arunachal Pradesh. Globally true freshwater crab constitutes about 1400 species in relation to 6700 species of brachyuran crabs diversity of the world. In India true freshwater crabs constitutes only 140 species (Potamidae 42 species and Gecarcinucidae 98 species) in comparison to 944 species of brachyuran crabs. The diversity of freshwater crabs in India has not yet studied elaborately and there is a lot of scope in taxonomic, ecological, biochemical as well as aqua cultural perspectives. There are no any comprehensive studies to know the actual species diversity and biosystematics of this group in the entire Himalaya in respect of spatial distribution and microhabitat. Although some species of this group occur in abundance and have highly in demand in local communities for their delicacy, but the nutritional value of those species till not evaluated. Aquaculture sustains the wild population in one hand and in other hand it provides the market demand of biological samples but there is no initiation taken so far to culture any freshwater crab species in India. In the present paper a brief account of Freshwater crabs of Himalaya of Indian territory will be discussed in the light of their habitat choice, economic evaluation will be analysed, and some conservation measure would be proposed according to species.

Keywords: Diversity, Economic evaluation, Habitat choice, Spatial Distribution, Conservation

A note on the migration of *Catopsilia pyranthe* Linnaeus, 1758 (Insecta: Lepidoptera) in the Jodhpur region of the Thar Desert of Rajasthan

Jitendra Kumar and Indu Sharma
Zoological Survey of India, Desert Regional Centre, Jodhpur, India
(Email: jitendra.84@zsi.gov.in)

Abstract

The migration of *Catopsilia pyranthe* (Linnaeus, 1758) the Mottled Emigrant of the family Pieridae of Order Lepidoptera was recorded in the month of September, 2020 post-monsoon season on the campus of the Zoological Survey of India, Desert Regional Centre, Jodhpur in the Thar Desert of Rajasthan, India. The orientation of flight was from northwest (NW) to southeast (SE) unidirectional migration occurred in the year 2020 and the group comprised about 82.94% of males and 17.05% of females of *Catopsilia pyranthe* (Linnaeus, 1758) of the family Pieridae. The observation revealed that the most abundant migratory species was *Catopsilia pyranthe* (93.48%). Followed by other species like *Junonia hierta* (Fabricius, 1798), *Junonia orithya* (Linnaeus, 1758) of the family Nymphalidae, *Papilio demoleus* Linnaeus, 1758 of family Papilionidae and *Colotis amata* (Fabricius, 1775) of Pieridae. The peak hours of flight was between 1200 hrs and 0100 hrs when as many as 430 individual/ minute were recorded on September 25, 2020. In various locations in the vicinity of Jodhpur, butterflies were seen migrating from the northwest to the southeast. It was also observed that butterflies stopped moving as soon as clouds appeared in the sky, but they would start moving again as immediately as the clouds disappeared.

Keywords: Catopsilia, Pieridae, Lepidoptera, Butterfly migration, Jodhpur

Disclosing the Secrets behind Geophagy in Non-human Primates: A Suggestive Evidence

Ayushi Bandyopadhyay, Priyanka Jena and B. Anjan Kumar Prusty
Berhampur University, India
(Email: ayushi.b145@gmail.com)

Abstract

Intentional consumption of earth is commonly observed in animal-taxa from invertebrates to vertebrates. Worldwide research on geophagy has been carried out in several species to discover the reason for soil consumption. From all articles reviewed regarding geophagy (n=374), ~29% publications were compiled based on behavior, ecology, habitat, nutrition and chemical aspects of non-human primates (monkeys) and considered in the present analysis, wherein geophagy was known to be common in all age groups spread across climatic zones leading to a quest on primate geophagy, objected to infer the cause of the behavior based on scientific studies. Several hypotheses linking with nutritional/supplement hypothesis, detoxification/protection hypothesis, pharmacological/medication hypothesis have been put forward. Investigating empirical analyses on simulated physiological digestion combined with soil mineralogical assays that technically depict the bioavailable fraction of the soil consumed and thus disclose the reason for geophagy, support the element of detoxification. Herein, plant secondary metabolites (PSM), alkaloids/ phenolic components derived from plant-based diet were potential toxic agents those needed gut elimination; and clay based diet adsorbs the former. The results are in agreement when analyzed to diagnose the adsorptive ability of PSM using liquid chromatography, gas chromatography, colorimetry, radial diffusion and spectrophotometry in vitro. Evidence was more skewed towards protection hypothesis i.e. gastrointestinal distress due to the effect of PSM. Furthermore, research states a direct link of elevated levels of CO2 in atmosphere and global warming with increased PSMs level attributing to decreased nutrition in leaves and potent inhibitors of iron bio-availability in the gut in non-human primates of herbivory diet. Nutritional supplementation though in favour of the behavior differ across primates and studies are yet to validate the reason behind supplementation of minerals via soil fraction. Research on geophagy could enhance the knowhow of this enigmatic behaviour, strategizing the management thereof for protected species which practice geophagy.

Keywords: Detoxification, Geophagy, Metabolites, Primates, Soil

Communal heterogeneity of Tick Fauna in three ecological community of Western Ghat -Trivandrum -India

K. M. Samitha

K. Prakasan, India

(Email: samithakm19@gmail.com)

Abstract

In recent timeline, the deadly effects of tick-borne zoonoses have been manifested in Southern India. Despite tick epidemics, Kerala, particularly Southern Kerala, has seen few studies on ticks and the threats they pose. As the area of tick occurrence spread, the current study attempted to investigate the tick flora in the Ponmudi Hills of the Western Ghat in the Trivandrum district of Kerala. Given that the research location is both a well-known tourist destination and a place where people live, there is a wild life-human interaction there. The effort was intended to outline the hazards that officials and villagers have identified as well as basic facts regarding species abundance in the research area. The objectives of the study are: to calculate diversity of tick species in the study area. And to compare the diversity over three communities, present in the study area. The study area was divided into three ecological community area viz., shola forest area (Comminity 1), human residence area (Community 2), and rolling grass land (Community 3). Tick samples were collected by flagging and dragging method. Collected samples were preserved and identified. And alpha, beta diversity indices were calculated using formula. Total 335 individuals were obtained out of which, two genera of the family Ixodidae, Haemaphysalis and Amblyomma, were identified from total 9 sample locations, with an occurance ratio of about 3: 1. The following species has been documented with relative abundance: *H. intermedia* (0.60%), *H. pappuana kinnari* (0.90%), *H. Cuspidate* (0.60%), *H. cornigera shimoga* (1.49%), *H. leachii* (8.06%), *H. Turturis* (7.76%), *H. spinigera* (53.13%) and *Amblyomma integrum* (27.46%) (Graph1). Shannon Weiner (H') and Simpson indices (D) of the three communities shows that Community 2 (H'=1.45; D=0.28) is the most diversified, followed by Community 1 and Community 3. In comparison community 3 has a more evenly distributed population of the species (Peilou evenness index J- 0.81) than other two.

Keywords: Tick fauna, Trivandrum, Tick diversity, Ponmudi Hils, Western Ghat

A Study on Butterfly and use of their Larval Host Plants in a Tropical Urban Context: Diversity and Associations

Sneha Thakur Chakraborty[1], Sourish Bhattacharjee[2], Sayan Panja[3], Supritam Pandey[4], Rudra Prasad Das[5] and Soumyajit Banerjee[6]

[1,2,3,4,6]Department of Zoology for UG and PG Studies, Serampore College, Serampore, Hooghly, West Bengal 712201, India
[5]Department of Zoology, Kishore Bharati Bhagini Nivedita College (Co-ed.), Behala, Kolkata, West Bengal 700060, India

(Email: snehathakurch@gmail.com)

Abstract

In the present study, an attempt was made at the basic level to analyze the relationship between abundance of butterflies with the niche breadth with respect to host and nectar plants to portray resource sharing, if any. The study was conducted at four selected spots adjacent to Serampore College, Serampore, Hooghly. Bi-weekly sampling of the study site was done in between July, 2020 – June, 2022 following 'Pollard Walk' method with necessary modifications. 2860 individuals of butterflies belonging to 27 species categorized under 5 families were recorded. The variation in niche breadth suggested that species with higher values of Levins' measure of niche breadth have wider utilization of resource sharing and indicate the 'generalist' pattern of the particular species. Same holds true for Levins' standardized niche breadth where species with values less than 1 (<1) are specialists. Results of three way factorial ANOVA on abundance of butterfly species taking sampling spots, months and plant species as explanatory variables yielded significant variation. Post hoc Tukey test reflected significant variation across the sampling sites and plant species in terms of butterfly abundances. The results are expected to highlight the harmonization between abundance of butterflies with its respective host plants at tropical urban town, similar to the present study area thereby emphasizing the need for their conservation. The information on the spatial scale distribution of the butterflies against the host plants is crucial for the purpose of management and conservation of butterflies in order to maintain a healthy and pollution free ecosystem. The present study thus calls for a restriction in various anthropogenic activities including construction of buildings at the cost of habitat loss of responsive species.

Keywords: Environmental indicator, niche breadth, resource sharing, species richness

Effect of an Intermittent and Degraded Stream on the Avifaunal Abundance: An Example from Rural Area

Swati Saha[1], Tapajit Bhattacharya[2], Rudra Prasad Das[3] and Soumyajit Banerjee[4]

[1,4]Department of Zoology for UG and PG Studies, Serampore College, Serampore, Hooghly, West Bengal 712201, India

[2]PG Department of Conservation Biology, Durgapur Government College, Durgapur, West Bengal 713214, India

[3]Department of Zoology, Kishore Bharati Bhagini Nivedita College (Co-ed.), Behala, Kolkata, West Bengal 700060, India

(Email: swatisaha527@gmail.com)

Abstract

The present study was carried out to assess the avian diversity in a rural area (Howrah) having a degraded stream (Saraswati) to compare the abundance of birds in the river catchment with rest of the town. The present study aimed to explore which functional groups were associated with the river; whether and how the bird community of the river's catchment reflected the ecological functions present in the broader avian community of the rural area. The birds were observed and counted in the sampling sites using fixed-radius (50m) point count method and maintaining constant transect length from Sep 2020 – June 2022 between 5.30am-8.00am depending on the sunlight when the birds were found to be more active. A total number of 77 species of terrestrial and water birds belonging to 16 orders and 36 families were observed. In the study area Passeriformes order was maximum represented by 16 families. Family Ardeidae represented the highest number of species, 42 species were widespread resident, 19 species were resident, 5 species were widespread winter visitor, 4 species were winter visitor, 1 species was summer visitor, 1 species was fairly widespread resident, 1 species was passage migrant. Seasonal analysis revealed that relative abundances of omnivores were higher in all seasons and that of nectarivores and frugivores were comparatively less throughout the year. Species richness (taxa S) indicated maximum richness during monsoon. The bird diversity encountered in the present study can strengthen local perceptions of the river as an ecologically functional unit and highlight its potential conservation value, with both the birds and the river itself providing valuable ecosystem services. These findings can be extended to river catchments in other cities, which face a variety of major challenges such as storm water management, development pressure, pollution, in stream heterogeneity, riparian health and invertebrate and fish diversity.

Keywords: Avifaunal diversity, intermittent stream, anthropogenic activity

Comparing Butterfly Abundance between a Riparian and Terrestrial Habitat: Paving way towards Conservation

Mainak Mitra[1], Rudra Prasad Das[2] and Soumyajit Banerjee[3]

[1,3]Department of Zoology for UG and PG Studies, Serampore College, Serampore, Hooghly, West Bengal 712201, India

[2]Department of Zoology, Kishore Bharati Bhagini Nivedita College (Co-ed.), Behala, Kolkata, West Bengal 700060

(Email: infomainakmitra@gmail.com)

Abstract

Assessment of the environmental quality of revegetated areas relative to that of the historic riparian ecosystem is difficult because baseline data on the structure and dynamics of desert riparian assemblages maintained by a highly irregular flow regime are either limited or lacking. Owing to habitat destruction and fragmentation much of our native butterflies are fast disappearing and at present, their survival is under threat. Despite these limitations, butterfly assemblages may be useful for investigating these riparian ecosystems. The objective of the present survey is focused on the assessment of the diversity and seasonal abundance of butterflies at a riparian and terrestrial habitat with distinct vegetation composition and conservation requirement located along the suburban-rural landscape gradient. Weekly sampling of both the study sites was done between December, 2021 and November, 2022 and the butterflies were recorded directly in the field following 'Pollard Walk' method with necessary modifications. Each of the individual transects within the study sites were visited every month between 07:00 AM to 11:00 AM on mostly sunny days with no rainfall. Observation revealed that 31 species belonging to five families were present taking both the habitats into consideration. Family Pieridae was dominant in abundance averaging both the spots (almost 44%) except the month May where Family Lycaenidae was on top, Family Hesperidae was lowest in all the seasons. Thus, butterfly diversity indirectly reflected overall plant diversity, especially that of herbs and shrubs. Information on species richness, diversity and abundance pattern of butterflies across the three seasons and two different landscape elements (LSE) would help to set conservation priorities across the suburban (riparian) and rural (terrestrial) landscape.

Keywords: Butterfly, riparian and terrestrial, diversity, Jamuna river, conservation

Description of *Limax mayae* Godwin-Austen, 1914; First confirmed report from Pir Panjal Range of Jammu and Kashmir, India

Hilal Ahmed[1], Imtiaz Ahmed[2] and N. A. Aravind[3]

[1,2]Fish Nutrition Lab., Department of Zoology, University of Kashmir, Srinagar 190006, India

[3]SMS Foundation Centre for Biodiversity and Conservation, ATREE, Royal Enclave, Srirampura, Jakkur PO, Bangalore 560064, India

(Email: Hilalahmed1991@gmail.com)

Abstract

The terrestrial slug *Limax mayae* Godwin Austin 1914 is described from morphological and molecular characters based on 131 specimens from 10 localities of Pir Panjal range of Jammu and Kashmir. Detailed descriptions of morphology, reproduction anatomy, ecology and distribution are provided. The new species differs from all other sympatric congeners by a diagnostic combination of characters: yellowish-grey or cinereous ground colour, variously banded or maculated with black, but sometimes unicolour coloration of body of average length of 123 mm with uni-coloured anterior mantle or shield with clear demarcation, the elongated, subcylindrical body, noticeable dorsal keel, most pronounced at the caudal end, respiratory aperture on the right side behind the middle of the mantle margin, sole longitudinally tripartite, mid-area locomotory; penis dimension in preserved specimen about one third to half of body length; penis interior with small transverse riblets, one longitudinal interior crest and one longitudinal interior cord. It is restricted to north-western Himalayas and adjoining regions and found in wild, prevalent in woody forest with abundant old litters as well as in anthropogenous areas. Phylogenetic analysis of Limacidae using cytochrome c oxidase subunit I gene supports the recognition of *L. mayae*. The integrative approach of morphological and molecular characters concordant with ecological behaviour of the species.

Keywords: *Limax mayae*, Terrestrial slug, Himalayas, Endemic species, Kasperia

New Distributional Record of Bumblebees (Hymenoptera: Apoidea) from Nanda Devi Biosphere Reserve, Western Himalaya, India

Rifat H. Raina, Trilok Jangid, Purnima Pathak, Keshav Kumar and Indu Sharma
Zoological Survey of India, India
(Email: trilokjangid09@gmail.com)

Abstract

The present work incorporates new distributional records of genus *Bombus* (Hymenoptera: Apoidea) from Nanda Devi Biosphere Reserve of western Himalaya covering some major habitats/ localities. The sample collection was made in the buffer zone (Joshimath, Auli, Niti valley) of Nanda Devi Biosphere Reserve (NDBR) in Chamoli district, Uttarakhand by using insect collection nets and collection of bees were made in the different habitats having congregation of flowering plants stratified through random and opportunistic sampling methods, simultaneously the Geo-coordinates of the sampling area were also recorded through GPS. A total of 418 specimens of bumblebees were collected during the survey period from June-July, 2022. The study was first of its kind in the area and has resulted the distributional records of nine bumblebee species from protected area of NDBR viz. *B. albopleuralis*, *B. asiaticus*, *B. festivus*, *B. jacobsoni*, *B. keriensis*, *B. melanurus*, *B. rufofasciatus*, *B. simillimus* and *B. tunicatus* distributed over five subgenera with elevation ranging from 2500m-3500m AMSL. Out of nine species *B. tunicatus* was already recorded from the study area (Gupta, 1997). The remaining eight species were recorded for the first time from the study area. *B. tunicatus* was observed to be the most predominant species with respect to number of individuals of worker caste in the study area. The identified bumblebee species comprise individuals from all castes- queens, workers, and males. The specimens were later identified with the help of literature (Williams, 1991, 2022; Saini *et al*., 2015). The pictorial key for the identification of the bees has been prepared. In addition, some foraging plants of these bees were also recorded for the first time from the study area.

Keywords: Distribution, Bumblebees, Hymenoptera, Nanda Devi Biosphere Reserve, western Himalaya

A brief account of the Superfamily Pyraloidea (Insecta: Lepidoptera) from Andaman and Nicobar Islands

C. Sivaperuman and B. Sumit Kumar Rao

Zoological Survey of India, Andaman Nicobar Regional Center, India

(Email: c_sivaperuman1@rediffmail.com)

Abstract

Among insects, the order Lepidoptera (moths and butterflies) is one of the four largest groups with more than 157,000 described species. The superfamily Pyraloidea is preceded only by two other large families: Noctuoidea and Geometroidea and is again categorised into two families— Pyralidae and Crambidae. This group of taxa are a vast community comprising more than sixteen thousand species, which show maximum richness near the equator and southeast Asian tropical forests. The morphological features of the superfamily are definite basally scaled proboscis and the presence of tympanal organs on the second abdominal segment. Most of the members of this superfamily Pyraloidea are economically important pests. We studied the specimens sharing close affinities with their Indo-Burmese and Indo-Malayan neighbours during our investigation period from 2022- 2023 in the Andaman and Nicobar Islands. The Andaman and Nicobar Islands are a component of the Indo-Malayan global biodiversity hotspot. A total of ninety species were dealt with in this present study species diagnosis, habitat, and the new distributional data from these islands are provided. Out of these, twenty species were recorded for the first time from this archipelago, microphotographs of adult genitalia along with genitalia structures of seven species are depicted for the very first time namely *Tatobotys varanesalis* Walker, 1859, *Ravanoa xiphialis* (Walker, 1859), *Dausara marginalis* (Moore, 1877), *Nosophora conjunctalis* Walker, 1866 and *Omiodes maculicostalis* (Hampson, 1893). This study also reconfirms the presence of *Dausara marginalis* (Moore, 1877), *Tetridia vinacealis* (Moore, 1877), *Tyspanodes linealis* (Moore, 1867), *Talanga sexpunctalis* (Moore, 1877), *Bacotoma cuprealis* (Moore, 1877), after their original description of 145 years and after 159 years of *Spinosuncus aureolalis* (Lederer, 1863) from their TYPE location (Andaman Islands).

Keywords: Pyraloidea, Crambidae, Distribution, Morphology, Andaman and Nicobar Island

Habitat selection in Orb weaving spider *Nephila pilipes* Fabricius, 1793 (Aranea: Araneidae): niche complexity determines site selection and distribution of kleptoparasites

Minakshi Dash and C. Sivaperuman
Zoological Survey of India, Andaman and Nicobar Regional Centre, India
(Email: minakshidash97@gmail.com)

Abstract

It is hypothesized that small changes in the physical parameters inside the microhabitat will result in drastic differences in the abundance of both the host and parasite. The golden orb weaver spider *Nephila pilipes* Fabricius, 1793 hosts a variety of kleptoparasites in its web. In the current paper, we have discussed the abundance of Argyrodinae spiders and their occupancy rates in the web in relation to the placement of the web on the roadside vegetation of Kamorta, Nancowry group of Islands, Andaman and Nicobar Islands, India. We have analysed the species abundance through presence or absence data. To calculate the niche overlap we have used NMDS and PCoA. The total number of specimens collected is analysed through individual rare fractions.

Keywords: Spider, Orb-weaver, Kleptoparasitism, Andaman and Nicobar Islands, Ecology

Taxonomic Composition, Distribution and Diversity of Benthic Foraminiferans along the Svalbard Archipelago

Jima M.[1], Jayachandran P.R.[2] and S. Bijoy Nandan[3]

[1]Department of Marine Biology, Microbiology and Biochemistry School of Marine Sciences Cochin University of Science and Technology (CUSAT) Fine Arts Avenue, Pallimukku, Kochi 16, Kerala, India

[2]The Applied Research Center for Environment and Marine Studies (ARC-EMS), King Fahd University of Petroleum and Minerals, P.B. No. 1995, Dhahran 31261, Saudi Arabia

[3]Department of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science & Technology, Kochi, Kerala, India

(Email: pinkblossomjima@gmail.com)

Abstract

Foraminifera are eukaryotic unicellular microorganisms inhabiting all marine environments. The study of these protists has huge potential implications and benefits. They are good indicators of global change and are also promising indicators of the environmental health of marine ecosystems. This work is based on samples collected during the Indian Arctic Expedition, Summer phase 2017 and 2018. The diversity of benthic foraminifera in the High Arctic Fjords of the Svalbard archipelago and adjacent ridges in the Fram Strait has been evaluated by reviewing all the available literature published since 1984. Field based studies conducted from the Arctic fjords during 2017, 2018 also forms a significant aspect of this contribution. In the western part of Svalbard archipelago, the documentation of foraminiferal species is relatively good, when compared with the eastern side. In total, 322 modern foraminiferal species belonging to 141 genera and 68 families have been reported from the fjords of Svalbard. Among them, 110 species are agglutinated, 198 are calcareous and 15 have p roteinaceous tests. In addition, 116 species belonging to 76 genera and 45 families are documented from the ridges of Fram Strait with 39 exclusive species. The Kulczynski-2 similarity and ?w diversity indices also confirms the uniqueness of western Svalbard fjord. This could be mainly due to the influence of the warm Atlantic water mass on this region. The objective of this work is to review the distribution and diversity of benthic foraminiferal species in the Svalbard archipelago and form the baseline for understanding the foraminiferal diversity and assemblage composition around the Svalbard Archipelago on a single stretch and could contribute to understand the foraminiferal diversity variation since 1984-to till date of this region in the context of global climate changes.

Keywords: Foraminiferan, diversity, fjord, Svalbard, Arctic

Diversity and Distribution of Indian Psocoptera (Insecta: Psocodea)

Ramesh, G., Babu, R. and Subramanian, K.A.

Zoological Survey of India, Southern Regional Centre, 130, Santhome High Road Chennai- 200 028, India

(Email: beetles2007@gmail.com)

Abstract

The order Psocodea includes parasitic lice of birds and mammals (Phthiraptera), free-living booklice and bark lice (Psocoptera). It is one of the lesser-known orders of paraneopteran insects, distributed worldwide in a wide range of terrestrial environments. Worldwide, 485 genera and 5941 species have been reported, of which 134 species under 66 genera and 22 families are known from India. Among this, 58 species are endemic to India. West Bengal has recorded maximum number of species (45), followed by Maharashtra (28), Kerala (22), Tamil Nadu (21), Meghalaya (18), Assam (13), Uttarakhand (8), Manipur and Tripura (7 each), Jammu and Kashmir (5), Arunachal Pradesh (4), Jharkhand (2), Odisha and Andaman & Nicobar Islands (1 each), and there are no records from the remaining states. Across the biogeographic zones, the Western Ghats has reported 53 species followed by the Himalayas and north eastern India (40 species each.). In India, the Psocoptera fauna is poorly studied, and information about their diversity and distribution is scanty. Since 1980, no work on the diversity of psocids were carried out in India. This is evidenced by the absence of any records of this group from more than 15 states and extensive surveys are needed to estimate diversity and cover geographic gap areas.

Keywords: Psocoptera, Diversity, India, Western Ghats

Diversity of sharks in the commercial fishery at Chennai, East coast of India

Sweta B., Ida E. G., Moumita D., Akhila T., Poonam P. and K. K. Bineesh
Zoological Survey of India, India
(Email: bsweta492@gmail.com)

Abstract

Sharks, of class chondrichthyes, comprises 9 orders and 34 families. Globally there are about 536 species of sharks known till date and about 160 species are reported from Indian EEZ. The present study was based on the field observations carried out during the months during 2021 to 2023 at Kasimedu fisheries harbor, Chennai and data on the catch were monitored. Maximum catches are recorded from multi day trawlers. The shark fishery in Chennai constituted 15 species belonging to 3 orders and 5 families. The members of the family Carcharhinidae were predominant among the shark fishery. Nine genera of sharks namely, Carcharhinus, Sphyrna, Chiloscyllium, Rhizoprionodon, Alopias, Iago, Scoliodon, Galeocerdo, and Pseudocarcharias were observed. The crocodile shark, *Pseudocarcharias kamoharai*, a rare and endangered species that was observed only once caught by gillnet fishery targeting tuna. The peak time of catches is observed during the months of June-July and less catch occurs during the month of April-May. Increase in the catch of Milkshark, *Rhizoprionodon acutus* and Spadenose shark, *Scoliodon laticaudus* and decrease in the catch of Thresher shark, *Alopias vulpinus* and Bull shark, *Carcharhinus leucas* were also recorded. Target catching of sharks are the main threat to shark populations in India due to high demand for the meat, fin and oil in the local and international markets.

Keywords: Shark fishery, catch, diversity, Indian EEZ, Chennai

Guitarfishes of India: Distribution and species diversity for Conservation and Management

Ida E. G., Sweta B., Moumita D., Akhila T., Poonam P. and K. K. Bineesh
Zoological Survey of India, India
(Email: idaageorge@gmail.com)

Abstract

India is one of the leading chondrichthyan fishing nations for the past several years after Indonesia. Sharks and rays are fished historically and are supported both as a source of food and livelihood for the coastal population in the country. Guitarfishes are the most threatened species of elasmobranchs in India due to habitat loss and intensive fishing in their distribution range. However, there is no information on catches, biology, population size, and current distribution. The present paper aims to provide new information on their catch, current distribution, and trade in India. A total of 8 species under two families were recorded in the commercial catch. Smoothback guitarfish *Rhinobatos lionotus* is restricted to the northeast coast of India between West Bengal and Chennai. Landing centre surveys were conducted during the years 2019-2022 along the east coast of India. The present findings revealed Smoothback guitarfish caught in commercial shrimp trawl fisheries operated at depth ranges of 10-30 m. Survey found that Smoothback guitarfish contribute an average of 3% of total batoids catch in the batoid fisheries. Shrimp trawlers contribute 97% of the total catch. Market surveys reveal very low local demand for Smoothback guitarfish. Trawlers contribute about 74% of Rhinorays followed by bottom-set gillnets. There is an urgent need for this information for initiating the conservation and management and this vulnerable species.

Keywords: Smoothback guitarfish, Rhinopristiformes, Distribution, Indian EEZ, Conservation

Diversity and Distribution of Lepidoptera from Tropical Dry Deciduous Forest of West Bengal

Suresh Kr. Shah, Purnendu Mishra and Jalil Ahmad

Lepidoptera section, Zoological Survey of India, H.Q. Office, New Alipore, Kolkata- 700053, India

(Email: skshah082@gmail.com)

Abstract

In the present study, a comprehensive data on the diversity and distribution of Lepidoptera from Tropical dry deciduous forest of Bankura, West Bengal is provided. The present research work is based on a faunal survey tour conducted in July 2022 and the available secondary data from the study area. From voucher specimens, we identified 57 species under 49 genera in 11 families of moths and 29 species under 21 genera in 05 families of butterflies. This raised the total number of Lepidoptera from Tropical dry deciduous forest of Bankura to 264 species. It is close to 16% of estimated Lepidopteran species known from West Bengal. The moths constitute about 52% of species with 137 species under 117 genera in 16 families. The butterflies comprise about 48% of species with 127 species under 83 genera in 06 families. The study area is located at the transitional position of Chhota-Nagpur Plateau of peninsular India and Gangetic Plain. So, the distributional patterns of recorded Lepidopteran species were compared with the species occurring in above two provinces. Of the recorded moth species, about 80% are commonly distributed in both the provinces, which is more than 90% in case of butterflies. Distributional range extension is reported for 20 species of moths, of which 07 species are recorded for the first time from Gangetic plain.

Keywords: Lepidoptera, Diversity, Distribution, Tropical dry deciduous forestm, West Bengal

Spider diversity of Chhattisgarh based on field study and review

Sudhir Ranjan Choudhury and Yash Nirmalkar

Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas University, Bilaspur, Chhattisgarh, India

(Email: sudhirranjanchoudhury@gmail.com)

Abstract

The current study is based on fieldwork and an extensive review of published literature from Chhattisgarh. There are 155 species from 21 families listed from Chhattisgarh. The species which are identified up to genus level are not included in the final checklist. The family Araneidae having the highest number of species i.e. 31 species followed by family Gnaphosidae and Salticidae representing 25 and 20 species respectively. The spider distribution and diversity are poorly documented in Chhattisgarh. Various families of spiders still now not documented from Chhattisgarh. There is no representative of infraorder mygalomorphae are reported from the state. Various spider species found in the neighboring state still those are not been reported from Chhattisgarh. There is an extensive study on spiders required because majority of Protected areas, agricultural fields and other habitats in Chhattisgarh and nearby areas still require major surveys in order to document a comprehensive spider fauna.

Keywords: Araneomorphae, Mygalomorphae, Distribution of spider

Nesting site characteristics of Stingless Bee, *Tetragonula ruficornis* (Hymenoptera: Apidae: Meliponini) in Delhi, India

Basavaraj N. Hadimani and Dr. Debjani Dey
IACR-Indian Agricultural Research Institute, New Delhi, India
(Email: hadimanibasavaraj6@gmail.com)

Abstract

The stingless bees are highly evolved eusocial bees acting as pollinators and honey yielders, showing tropical and southern subtropical distribution. Stingless bees display species-specific characteristics when it comes to nest location and nest design. The goal of the current study was to assess as preferences shown by stingless bees for factors as such nesting location, nest orientation, nesting height from ground and shape of entrance. The study was based on data records of 47 feral colonies located inside the campus of ICAR- Indian Agricultural Research Institute, New Delhi. Analysis of the recorded data indicated that cement and brick walls were the most popular nesting sites (31.91%), followed by stem cavities of Syzygium cumini (25.53%) and Cassia fistula (19.15%) while Morus alba (2.13%) was least favoured. Moreover, stingless bees favoured nesting heights of 1 to 2 metres (40.43%) from ground i.e. at medium elevation range. The purpose appears to ensure the availability of flora and predator protection for better and safer survival at its nesting locations. Regarding nest opening, the majority of nests (25.53%) faced South-East, followed by South-West (19.15%) and East (14.89%). Although some oriented their nests to provide the lowest possible exposure to incident solar radiation during mid day, some chose to have their nests warmed by sun radiation in the morning. The entrance, i.e., opening of the nest, varied in size and shapes such as circular, oval, slit like, and irregular. Overall, geographic convenience, ecological variety, and seasonal cycles all influence bees' nesting preferences.

Keywords: *Tetragonula ruficornis*, Nesting preference, Pollinators, Nest orientation, Geographic convenience

Do earthworms truly always assist farmers, or is there another fact?

Pooja Tiwari and Shweta Yadav

Department of Zoology, Dr. Harisingh Gour Vishwavidyalaya (A Central University), Sagar 470003, Madhya Pradesh, India

(Email: tiwari06puja@gmail.com)

Abstract

Among all the soil creatures, earthworms are regarded as the most crucial. They are found in areas where the soil contains enough water and the temperature. They also exhibit a variety of environmental adaptations to the various environments. Earthworms may live in local microsites, even in unsuitable areas, when the conditions are favourable (such as urban gardens, desert oasis etc), especially if well-adapted species have been introduced. Despite the fact that earthworms have many positive effects on the soil ecology, certain of their activities are deemed undesirable. The destructive behaviours of earthworms include removing and burying surface residues that would otherwise protect soil surfaces from erosion, producing fresh casts that promote erosion and surface sealing, increasing soil compaction on the surface, leaving castings on lawns and golf courses where they are an annoyance, dispersing weed seeds in gardens and agricultural fields, transmitting plant or animal pathogens, and riddling irrigation canals that reduce their ability to function. Although being little understood, there is a surge in exotic earthworm invasions as a result of worldwide commerce in agriculture, waste management, and bioremediation. Exotic earthworm invasions are spreading globally and having a significant impact on plant populations and soil processes, according to mounting biological data. It has been documented that at least 100 different species of earthworms are found outside of their natural habitats. Non-native earthworms can potentially colonise new places despite disturbance and interference. The study discusses the biogeographical distribution of invasive earthworms, their effects on the agroecosystem, and an analysis to review the importance of earthworms in all soil ecosystems.

Keywords: Exotic earthworms, Earthworm invasion, Non-native earthworms, Biological invasion, Below ground invasion.

Seasonal variation of the species complex of Necrophagous fly communities from a dry deciduous forest landscape

Garima Hore, Oishik Kar, Atanu Naskar, Jayita Sengupta and Dhriti Banerjee

Diptera Section, Zoological Survey of India, M-Block, New Alipore, Kolkata 700053, India

(Email: oishikkar10@gmail.com)

Abstract

A plethora of necrophagous insect species exist on or around a cadaver, and a certain chronological sequence of colonization is expected to occur based on their preference, enabling microbial decomposition and aiding in maintaining ecosystem balance. Necrophagous flies comprise the foremost and often the most significant carrion entomofauna, playing crucial ecological roles in the decomposition process. They are therefore significant from both forensic entomological and ecological standpoints. Calliphorids, sarcophagids, and muscids constitute the predominant families of necrophagous flies to colonize carcasses. In the present study, a total of 24 species of necrophagous flies belonging to six dipteran families from three sites of Sonamukhi Protected Forest, Bankura have been documented seasonally. The dipteran families documented in the present study are Calliphoridae, Sarcophagidae, Muscidae, Phoridae, Stratiomyidae, and Sepsidae. The present research, a comprehensive account of the seasonal variations of necrophagous fly communities from a dry, deciduous forest landscape, the first of its kind conducted from this region displayed a diverse necrophagous species composition, consisting of 24 species under 12 genera from 6 families. Notably, out of the 24 species recorded in the present study, a total of 5 species were recorded for the first time from this state. Taxa richness tends to decline as environmental quality, favourable climatic conditions decline. The current study reveals that, on a seasonal note, pre-monsoon > monsoon > post-monsoon is favourable for necrophagous community growth and development. Thus, the relevance of the present study is not only limited to the medico-legal forensic entomological context but is also focused on assessing the risk status of the study sites in and around the Sonamukhi forest area with the help of ecological indices and biomonitoring of the study area. Consequently, the presence or absence of the indicator species or indicator community reflects the prevailing environmental conditions.

Keywords: Forensic entomology, Decomposition, Species composition, Biomonitoring, Seasonality

Checklist and Distribution of Endemic Stoneflies (Order: Plecoptera) in India

Dej Vignesh, K., Subramanian, K. A. and Babu, R.

Research Biologist, Scientist - E and Scientist - E (Southern Regional Centre - Zoological Survey of India, Chennai- 600028, India)

(Email: dejvignesh4896@gmail.com)

Abstract

The Stoneflies are a group of freshwater insects distributed in all the biogeographic realms except Antarctica. It is an ancient lineage of aquatic neopterans restricted to cold, fast flowing, well oxygenated hill streams. The nymphs are completely freshwater inhabitant and present primarily under the pebbles, cobbles, decaying leaf litters and wood materials. Adults are weak fliers and found commonly close to the larval habitat in the riparian zone. Globally it is considered to be one of the excellent bio indicators to monitor the water quality, due to its sensitive nature to the alteration in the local environment. More than 3700 species belonging to 16 families reported globally and 146 species belonging to 27 genera and 8 families have been reported from India. Among them 91 species are endemic which is reported from 14 states and out of which 28 species are reported from more than two states and remaining species are restricted in distribution. Arunachal Pradesh (24) harbors the maximum number of endemic species, followed by Assam (14), Himachal Pradesh (14), Manipur (13), Meghalaya (13), Tamil Nadu (10), West Bengal (9), Karnataka (8), Uttarakhand (8), Kerala (7), Sikkim (5), Maharashtra (2), Odisha (2) and Madhya Pradesh (1). About 75% of the species are restricted to Indian Himalayan region. For most of the species, there are no new records after the discovery. We strongly recommend carrying out the exploratory survey to confirm the present status of this indicator taxa in the type locality and unexplored hill streams to design the bio monitoring protocol along with other aquatic macroinvertebrates which will be useful to monitor the hill stream ecosystem and particularly in assessing the effects of climate change.

Keywords: Endemic, Distribution, Stoneflies, Bio monitoring, India

Bombus haemorrhoidalis Smith, 1852 (Apoidea: Hymenoptera) is a significant Pollinator of the Lower Shiwalik ranges in the Western Himalayan States of India

Shivani Sharma[1], Gaurav Sharma[2] and Namita Joshi[3]

[1]Department of Environmental Sciences, Kanya Gurukula Campus, Gurukula Kangri Vishwavidyalaya, Haridwar-249404, Uttarakhand, India

[1,2]Zoological Survey of India (MoEFCC), Northern Regional Centre, Dehradun-248195, Uttarakhand, India.

[3]Gurukula Kangri Vishwavidyalaya, Haridwar-249404, Uttarakhand, India

(Email: shiva.skt.03@gmail.com)

Abstract

Objective: This study has been carried out to find out the role of bumble bee, *Bombus haemorrhoidalis* as significant pollinator and bio-indicator species in the sustainability of the ecosystems of the lower Shiwalik ranges in the Western Himalayan states of India. Methodology: The present study was conducted in the selected 20 sites of the Lower Shiwalik ranges in the Western Himalayan States of India (i.e. 10 selected sites each in Himachal Pradesh and Uttarakhand). In the field, collection has been done by sweep net sampling and the yellow trap methods between the altitudes of 565m-1224m during different seasons of 2019-22. Observations and outcomes About 250 species of Bumble bees are reported from the world, including 48 species from India. The Bumble bee, *Bombus haemorrhoidalis* was the only dominant species of the genus *Bombus* ranging in the selected study area. This species was recorded as very active and pollinate in the winter period during harsh environmental conditions. This species observed as most significant pollinator to maintain the germplasm of many floral species in the study area, due to the presence of very limited pollinators of other faunal groups. The *B. haemorrhoidalis* was observed foraging and pollinating the flowers of *Gossypium arboreum*, *Solanum melongena*, *Mesosphaerum suaveolens*, *Vitex negundo*, *Ocimum tenuiflorum*, *Eremostachys superba*, *Justicia adhatoda*, *Cajanus cajan*, *Impatiens glandulifera*, *Helianthus annus*, *Tecoma stans*, *Cucurbita maxima* and *Lantana camara* etc. in the study area. The population of bumble bees declining worldwide due to integrated-agricultural practices such as hybrid plants, use of pesticides and herbicides, habitat degradation and fragmentation, forest fires, outbreak of invasive species and climate changes. The conservation of bumble bees will help us in the sustaining of natural resources, ecosystem functioning and food security. Therefore, more earnest efforts are required for the conservation of this species, their habitats and floral resources.

Keywords: *Bombus haemorrhoidal*, Bumble bee, Western-Himalaya, Apoidea, Hymenoptera, Shiwalik foot-hills, Pollinator

Distribution and zoogeographical analysis of Amphicrossinae (Coleoptera: Nitidulidae)

Jhikmik Dasgupta[1] and Tarun Kumar Pal[2]

[1]Zoological Survey of India, M- Block, New Alipore, Kolkata- 700053, India

[2]Social Environmental and Biological Association, O/143-E, Mudiali Road, Kolkata- 700024, India

(Email: indianaspoonbill@gmail.com)

Abstract

Amphicrossinae, a small subfamily of Nitidulidae is represented by a single genus *Amphicrossus* Erichson, 1843. These beetles primarily feed on plant sap and occasionally become predacious on minute dipteran larvae. They are characterized by their oblong-ovate shape, brownish colour, with a row of setae on lateral margins of pronotum and elytra and a tuft of long and erect setae on each elytron in males. This subfamily exhibits a wide distribution range and its representatives are found in all the major zoogeographical realms of the world. The global distribution of the species of Amphicrossus drew our attention while working with the Indian fauna in recent past. The current distributional profile which had happened in the past can be traced from the circumstantial pointers. The (dis)similarity and turnover among the sites (here zoogeographical realms) are the recognized tools in the analysis of the biodiversity metrics. Species turnover measurements differ in the species compositions of two or more sites. The dissimilarity index is a population measure of the evenness with which two species assemblages are distributed across two component geographic areas. The dissimilarity index is also considered as a measure of segregation. The current distributional data of *Amphicrossus* spp. was plotted under six zoogeographical realms, which showed differential dominance of the species, plasticity of the species, sharing of fauna of one realm with others, degree of uniqueness (endemicity) and commonness. The high degree of endemicity indicate towards the centre of origin of the group, and degree of dominance and sharing of species point out to the segregation of species and dispersal of lineages in larger geographical areas in course of time. Plate tectonic events of Earth, sea level changes and climate fluctuations had obviously influenced their distributional course in geologic past. Historical zoogeography and current distributional pattern of Amphicrossus have been presented here.

Keywords: Sap beetle, Amphicrossus, Dispersal, Plate tectonics, Zoogeographical realms

Taxonomic explorations in the Laccadive archipelago for the molecular and digital documentation of the reef-associated biotaxonomy?

Sureshkumar S.[1] and Idreesbabu K. K.[2]

[1]Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, Kochi, Kerala, India

[2]Department of Science and Technology, Kavaratti-682555, Union Territory of Lakshadweep, India, Email: idreesbabu@gmail.com

(Email: suresh@kufos.ac.in)

Abstract

We explored various islands in the Laccadive archipelago as a part of the long-term coral monitoring programme for biodiversity documentation. The study aimed to develop a comprehensive account of the biodiversity of a region as baseline information for an environmental impact assessment. We adopted visual documentation, collection and identification from all the geomorphological zones of the atoll, submerged pars and associated regions to document the biota. An exploration of butterflyfishes revealed that even after four decades of scientific exploration, many of the regions of the Lakshsdeep remain untouched as far as taxonomy is concerned. We could report nine species of butterflyfishes with valid vouchers for all seventeen species. Presently, we have developed a checklist of 851 species of fish with 26 new records and five new species. We identified 60 hard corals and 53 soft corals from the region in the surveys. The checklists of most of the organisms like Crustaceans (248 species), molluscs (778), echinoderms (119), sponges (103) and zooplanktons (155) were prepared and documented. Among the flora, mangroves (8), mangrove-associated plants (9), macroalgae (153), microalgae (180), and seagrass (7) were also documented. We could document four species of marine turtles and two sea snakes. Photographic documentation of 16 marine mammals is also carried out. We conducted molecular barcoding to delineate cryptic species and species confirmation when ambiguity in the taxonomy, if any. Specific genes were sequenced for phylogenetic attempts of the species that occurred, and we submitted 245 CO1 gene sequences of fishes to the NCBI.

Keywords: Lakshadweep, Arabian Sea, Biodiversity documentation, Indian Ocean, Coral reef

First Record of *Spilomutilla eltola* (Cameron, 1898) (Hymenoptera: Mutillidae) From India

Terine Joshua Benjamin and Girish Kumar P.

Western Ghat Regional Centre, Zoological Survey of India, Kozhikode, Kerala-673006, India

(Email: suresh@kufos.ac.in)

Abstract

Background: In this study, we report the first record of the velvet ant species *Spilomutilla eltola* (Cameron, 1898) (Hymenoptera: Mutillidae) from India. Our analysis revealed that the species *S. eltola* (Cameron, 1898), was previously known from Sri Lanka only. Our finding represents a significant range extension for the species, highlighting the need for continued exploration and documentation of the mutillid fauna of India. Methods: The studied specimen was collected using yellow pan trap, then pinned using 0-sized entomological pin and examined under CZM6 Labomed stereo zoom microscope. Photographs were taken with a Leica DFC 450 camera and images were stacked using Leica V3.80. The images were post-processed only to improve contrast and brightness using Adobe® Photoshop® CS6 software. Results: The species *Spilomutilla eltola* (Cameron, 1898) earlier recorded from Sri Lanka, is now newly recorded from India (Ukkonam of Tenkasi district of Tamil Nadu state, a part of (Agasthyamalai Biosphere Reserve). Keywords: Mutillid wasp, Tamil Nadu, New record.

Keywords: Mutillid wasp, New record , Tamil Nadu, Sri Lanka, Agasthyamalai

First report of *Cypris decaryi* Gauthier, 1933 (Crustacea: Ostracoda) from Maharashtra with comment on Zoogeographical distribution

Renuka R. Khairnar and Yugandhar S. Shinde

Modern College of Arts, Science and Commerce (Autonomous) Shivajinagar, Pune – 411005, India

(Email: khairnarrenu1998@gmail.com)

Abstract

Ostracoda is a group of micro-crustaceans with about 0.2 to 3mm body size. Ostracods are found in different types of aquatic habitats. Globally around 2330 ostracod species are documented from freshwater habitats (Meisch *et al*., 2019). Whereas 152 subjective species of freshwater ostracods are known from India (Karuthapandi *et al*., 2014). Baird (1859) described first species of freshwater ostracod from Maharashtra; but freshwater ostracod fauna of Maharashtra is not well explored. The present study is an attempt to explore ostracods from Maharashtra state, especially from the northern part. Ongoing studies on Freshwater ostracods from northern part of Maharashtra led to the finding of species *Cypris decaryi* Gauthier, 1933, a first report from Maharashtra state or only report after Uttar Pradesh, India (Victor and Fernando, 1979). *C. decaryi* collected from different parts of Maharashtra. In present study description of species with comments on zoogeography distribution at global scenario are discussed.

Keywords: Ostracoda, *C. decaryi,* Maharashtra, First report, Distribution

Biological monitoring of major water bodies of city Kolkata

Subhadip Ghosh, Shaheen Akhter and Kanchan Kumari
CSIR- NEERI, India
(Email: subhadipghosh225@gmail.com)

Abstract

Benthic invertebrates monitoring or Biological monitoring is use of biological responses of populations and communities of certain indicator organisms to evaluate environmental changes. Biomonitoring is a special way of assessing water quality using macro invertebrates to find Saprobic score and Diversity score to indicate level of pollution as well as biological quality of water. It involves the use of indicator species, communities' generally benthic macro invertebrates/ fish and algae. Certain aquatic plants species are also used. It has been studied that, among all the biotic components benthic macro-invertebrate communities have been considered as the most suitable and cost-effective biological parameter to measure the quality of surface water bodies. The mapping based on bio-monitoring have easily proved as a powerful tool; for preparation of action plan for control of pollution and for improvement of water quality of large waterbodies. Four sampling sites were selected in the city, Kolkata, West Bengal. The benthos samples were collected from sediment, sieved, washed, and transferred into a large tray for identification purpose. All the benthic macro invertebrates collected were classified according to their taxa. Most of the sampling sites were marked as moderately polluted. Gastropods, annelids, crustacea and insects made up the majority of the benthic macro-invertebrate species that were collected. In this paper, authors have also highlighted the various opportunities and lesson learned from past experience of monitoring of different water bodies.

Keywords: Biomonitoring, Benthos, Water Quality, Pollution, Diversity

Preliminary Study of Butterfly Diversity on the Campus of the University of North Bengal, West Bengal, India

Abhirup Saha, Subhajit Das, Prapti Das, Debayan Raha and Dhiraj Saha

Insect Biochemistry and Molecular Biology Laboratory, Department of Zoology, University of North Bengal, Raja Rammohunpur, P.O. NBU, District: Darjeeling, West Bengal, Pin: 734013, India

(Email: rs_abhirup@nbu.ac.in)

Abstract

Butterflies are considered as one of the potential bio-indicators and they should be conserved to protect both the environment and biodiversity. The northern part of West Bengal, a state in eastern India, is well known for its rich butterfly diversity. The campus of the University of North Bengal (26°42?34.03?N; 88°21?14.96?E) spans 315.99 acres at the Eastern Himalayan foothills, housing various flora and fauna. Its surrounding region offers diverse habitats like forests, grasslands, tea gardens, and wetlands that support various animal species. The current study was conducted to understand the butterfly diversity from three geographically different study sites namely the Tea garden area (grasslands predominated by tea and rubber plants), Sal kunja (forest area with semi-perennial stream mainly dominated by Sal trees), and Magurmari (semi-perennial stream, ponds, ephemeral waterbodies, paddy fields, and grasslands) of the University campus. The butterfly observation was conducted from December, 2021 to January, 2023 and each study site was visited once a month. A total of 54 species of butterflies belonging to six families namely Hesperiidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae, and Riodinidae were recorded during the study. Among all the recorded families Nymphalidae was the most dominant one, whereas Riodinidae was the least available. Moreover, the most variety of butterflies was recorded from the Magurmari area, which is an ecotone. Among all the recorded species, four species were found to be protected under the Wildlife (Protection) Act (WPA), 1972. This study aims to analyze the diversity of butterflies with their habitats and conservation needs from the campus. This study will also assist in creating a concise checklist from this district that will aid in conservation. It is clear from the study that this campus has a wide variety of butterflies, thus efforts should be made to ensure their proper conservation.

Keywords: Butterfly diversity, Nymphalidae, Lycaenidae, West Bengal, University of North Bengal

A new entomophytophagous wasp associated with Ficus galls

B. Niveditha, S. V. Ayiswarya, A. P. Ranjith and Dharma Rajan Priyadarsanan

Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Srirampura, Jakkur Post, Bangalore 560064, India

(Email: niveditha.balachandran@atree.org)

Abstract

Among the hyperdiverse braconid wasps a few exhibit different foraging patterns, such as pure predation and entomophytophagy, where larvae of parasitoid wasp consume insect as well as plant materials. Entomophytophagy has previously observed in, Bracon garugaphagae Ranjith & Quicke a braconid species associated with leaf galls of Garuga pinnata Roxb. (Bursaraceae). This study reports a second case of entomophytophagy exhibited by a new species of Bracon associated with leaf galls of Ficus racemosa L. (Moraceae) induced by Pauropsylla depressa Crawford. We dissected more than 100 galls and found that early instars of the braconid wasp attack nymphal stages of the gall inducer and kills them and feed on the plant materials at the later instar to complete the development. Until now entomophytophagy is mostly associated with galls having psylloid (Hemiptera: Psylloidae) as inducer species in the plant family Bursaraceae. This is the first report of phytophagous behaviour of Bracon species apart from the plant family Bursaraceae. This suggests the behavioural plasticity among Bracon species may be larger than what is previously known. This discovery could shed lights to the studies assessing morphological adaptations for the changes in the foraging behaviour within parasitic Hymenoptera.

Keywords: Host parasitoid interactions, new species, plant galls, foraging behaviour, gall inducer

Gall midges (Diptera: Cecidomyiidae) of Northern Western Ghats, India

Vasanthakumar D.

Zoological Survey of India, Western Regional Centre, Pune, India

(Email: duraivasanthakumar@gmail.com)

Abstract

Cecidomyiidae is one of the largest families in the order Diptera, with some 6,650 known species globally, and many more species are yet to be described. Members of Cecidomyiidae are small inconspicuous flies, often go unnoticed except by the specialists, but the wide diversity of host plants they attack, and their role in forest and agroecosystems, make them much more important than their appearance might suggest. Currently Cecidomyiidae consists of six subfamilies viz. Catotrichinae (not reported from India), Lestremiinae, Micromyinae, Winnertziinae, Porricondylinae and Cecidomyiinae. The Indian fauna of gall midges is so far represented by 398 species. A large number of studies on various insect fauna of the Northern Western Ghats of India notwithstanding, only a little attention has been paid on the gall making insects especially midges. The present study report on the diversity of the gall midges from Northern-Western Ghats areas. A total of 35 species in 18 genera of two subfamilies of gall midges are reorganised herein from the Northern Western Ghats. Of these, *Asphondylia singanallurensis* Vasanthakumar & Sharma, 2020 and *Mycodiplosis coimbatorensis* (Agarwal, 1956) are reported here for the first time from the Northern Western Ghats, which have so far been known only from the Southern Western Ghats. The actual species richness of gall midges is much higher than the currently known diversity, which suggests for their extensive survey and exploration.

Keywords: Cecidomyiidae, Gall midges, Northern Western Ghats, *Asphondylia singanallurensis, Mycodiplosis coimbatorensis*

Butterfly Diversity of Maharashtra State: An overview

Gayatri Pawar, Shweta Sutar, Md Jafer Palot and Sunil Bhoite
Zoological Survey of India, Western Regional Centre, Pune, India
(Email: gayatripawar805@gmail.com)

Abstract

Lepidoptera is one the most widespread insect order in the world comprising butterflies and moths. Although they are extremely sensitive to environmental change, butterflies serve as Ecological indicators and are beneficial pollinators of forest and agricultural ecosystems, popularly known to be "Flagship Taxa" in biodiversity inventories. The aim of this paper is to provide an overview of the diversity of butterflies in Maharashtra. It is located in India's western peninsular area and features a considerable part of the Deccan plateau along with 640 km. long Western Ghats (Sahyadri ranges) and a coastline that stretches for 720 km. Besides presence of evergreen, semi evergreen, mixed deciduous, littoral and swamp type forest with great diversity and endemism of larval food plants. However, there is no comprehensive documentation on the butterflies of Maharashtra has been attempted. In the present communication we made an attempt to compile checklist from various sources. A total 283 species of butterflies belonging to 155 genera under 21 subfamilies in 6 families were recorded from the Maharashtra State. The family Lycaenidae dominated with (87 species in 51 genera) followed by Nymphalidae (81 speceis in 46 genera), Hesperiidae (66 speceis in 41 genera), Pieridae (32 speceis in 12 genera) Papilionidae (16 species in 4 genera) and a single species from the family Riodinidae. Out of the 283 species, 9 species are endemic to the Western Ghats and 3 species are listed in schedule I of the Wildlife Protection Act of 1972, whereas 52 species are included in schedule II.

Keywords: Western Ghats, Lepidoptera, Flagship Taxa, Diversity, Ecological Indicator

Guild structure of spiders in the Narayan Sarovar Wildlife Sanctuary, Gujarat, India

Neisseril Anirudhan Kashmeera, Preeti Choudhary and Indu Sharma

Desert Regional Centre, Zoological Survey of India, Jodhpur-342005, Rajasthan, India

(Email: kashmeera.n.a@gmail.com)

Abstract

Narayan Sarovar Wildlife Sanctuary is located in desert district of Kachchh, Gujarat in the westernmost part of India. To date, there are no substantial studies on the ecology of invertebrate fauna, especially spider fauna of the Narayan Sarovar Wildlife Sanctuary. Spiders are one of the most important predators of insects in the world. Considering the environmental importance of spiders, this paper attempts to reveal the guild structure of spiders reported from Narayan Sarovar Wildlife Sanctuary. Characters of spider families like circadian activity, method of foraging, phenology, size of the body, etc. were considered for the guild structure analysis. The presence of five ecological guild categories was revealed through this study. This includes Orb web weavers, Other hunters, Ground hunters, Space web weavers, and Ambush hunters. Results of this study indicate relatively low functional diversity of spiders in Narayan Sarovar Wildlife Sanctuary.

Keywords: Araneae, Guild composition, Ecology, Gujarat, Protected area

Different habitat and it's diversity of Dermaptera of West Bengal, India

Tanusri Das and K. G. Emilyamma

Zoological Survey of India, India

(Email: tanusridas1071994@gmail.com)

Abstract

Dermaptera fauna is well explored as almost 85 species of Dermaptera reported under 40 genera and 7 families from West Bengal, India based on literature studies. Some specimens of Dermaptera were collected from various parts of West Bengal during local field surveys. These specimens were later on identified as four species under four genera and three families viz., *Euborellia annulata* (Fabricius, 1793), *Nala lividipes* (Dufour, 1829), *Labidura riparia* (Pallas, 1773) and *Circolabia curvicauda* (Motschulsky, 1863). Recent studies reported the taxonomy and habitat of earwigs of West Bengal, India. The species like *Euborellia annulata* (Fabricius, 1793), *Labidura riparia* (Pallas, 1773) and *Nala lividipes* (Dufour, 1829) frequently collected from inside the moist dam soil and gathering old decaying debris from Khardah and Baruipur. *Circolabia curvicauda* (Motschulsky, 1863) collected from inside the banana sheath from Mohanpur and Madhyamgram. *Nala lividipes* (Dufour, 1829) were also collected from decaying fallen mango from Khardah. It was also noticed that it shares its habitat with some maggots along with the species of Dermaptera under the Genus *Euborellia* Burr, 1910 collected from inside the onion bulb from Hooghly district, West Bengal. Among all the species collected from West Bengal, two species are most dominant, which can be easily collected from anywhere are *Nala lividipes* (Dufour, 1829) and *Labidura riparia* (Pallas, 1773), whereas some other species of Dermaptera are restricted to certain parts of West Bengal. This observation has revealed that some species of Dermaptera share its habitat with other Dermaptera species, whereas others prefer to live alone.

Keywords: Dermaptera, Earwig, Habitat, Taxonomy, West Bengal

First report and diversity of Collembola (Apterygota) from Todgarh-Raoli Wildlife Sanctuary, Rajasthan

Ruquaeya Bano and Indu Sharma
Zoological Survey of India, Desert Regional Centre, Jodhpur (Rajasthan), India
(Email: rbano.zsi@rediffmail.com)

Abstract

The diversity of soil collembolans were investigated for the first time from Todgarh-Raoli Wildlife Sanctuary, Rajasthan. This sanctuary located in the Aravalli Hills of Central Rajasthan spread over the three districts viz. Ajmer, Pali and Rajsamand of Rajasthan State and occupies about 495 km² of tropical deciduous forests and grasslands. The collembolans are very minute, wingless, soft-bodied hexapods found on soil surface, usually associated with decaying vegetable matter, in rotten logs, under rocks and the bark of trees. They play an important role in plant litter decomposition and recycle the organic waste by participating in the nutrient cycle. To determine the diversity of soil Collembolans, soil samples were collected from different localities of the sanctuary and then taken to laboratory for processing. Extraction was made in modified Berlese-Tullgren funnels. The identification of specimens was done by Leica DM 2000 compound microscope. In this study a total of one hundred ten individual collembolans were collected and eight species were recorded belong to six families viz. Entomobryidae, Brachystomellidae, Isotomidae, Cyphoderidae, Neelidae and Sminthurididae for the first time from the said protected area.

Keywords: Collembola, Apterygota, Todgarh-Raoli, Berlese-Tullgren, Decomposer.

Study of wading birds diversity from foraging sites of Indian Sarus Crane *(Grus antigone)* in Unnao district, U.P., India

Varsha Rani and Amita Kannaujia
University of Lucknow, Lucknow. Uttar Pradesh, India
(Email: varshharaj@gmail.com)

Abstract

The Indian Sarus Crane (*Grus Antigone*) belongs to group of wading birds, which are described as group of small to medium sized birds living at the edge of water bodies. The agricultural fields and water bodies (ponds, canal sides, wetlands) of Unnao are supporting rich sites for sarus cranes along with other wading birds diversity, providing immense source of food and water availability to support their life cycles. The present study provides diversity of wading birds which share same foraging grounds with Indian Sarus Crane from surveys which were conducted in different foraging sites selected in unprotected areas of Unnao district, located at geographical co-ordinates 26°.33'0" N and 80°.28'48" E, from February, 2020 to March, 2023 .Total of 7 species of wading birds were reported representing 5 orders and 6 families in five foraging sites. Among them maximum number of species were of Ardeidae family order ciconiformes, succeeded by order charadiformes family charadriidae, occasional visitors included order gruiformes family rallidae and ciconiformes order, jacanidea family species were all recorded from these sites. The purpose of study is to provide information of diversity of wading birds to recognize these sites as habitat sites for their conservation and setting up and monitoring actions strategies towards their habitats protection.

Keywords: Sarus, wading birds, foraging sites, Unnao, conservation

Pesticide has differential effect on natural predators causing pest build up: A case study in brinjal

Manobrata Das and Parthiba Basu

Ecology Research Unit, Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road, Ballygunge, Kolkata: 700019, India

(Email: zoomanobrata@gmail.com)

Abstract

Pesticide application aimed at pest regulation in agricultural field can have unintended differential and negative impact on non-target species. Its continuous and uncontrolled usage can disturb the balance of agricultural ecosystem. Objective of the present study was to assess relative impacts of pesticide on pest and predator populations in an agricultural ecosystem. We chose brinjal farm as our focal system as it is an economically important crop which also suffers from various crop pests and require pest control for marketable yield. Whitefly is a major pest of brinjal. On the other hand, spiders are important natural predators that can control pest population by active predation. We explored the relationship between pesticide, whitefly, and spider populations in brinjal farming system. Thirty farms were selected in Coastal Agro-climatic Zone in Southern West Bengal. Whitefly abundance increased significantly with increasing pesticide usage intensity. Spider abundance decreased with pesticide intensity. Whitefly population was negatively related with spider abundance. The study revealed that pesticides actually cannot control whitefly population rather it harms friendly natural predators e.g., spiders. As a result the pest population goes unchecked. Ecological intensification of agriculture that augments ecosystem system delivery is the remedy for sustainable crop production.

Keywords: Pesticide, Natural predator, Pest, Spider, Whitefly

Role of Mesostigmatid Mites in Agriculture

Payel Kar[1] and Krishna Karmakar[2]

[1]Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, 741252, Nadia, West Bengal, India, ORCID: https://orcid.org/0009-0003-6102-1219

[2]Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal, India. E-mail: kkbckv64@gmail.com; karmakar.krishna@bckv.edu.in; ORCID: https://orcid.org/0000–0002–5582–3560

(Email: karpayel78@gmail.com)

Abstract

Mesostigmata is a diverse order group of parasitiform mites (Subclass: Acari). The members of this order show a high level of heterogeneity in terms of habit and habitat, from soil-dwelling Laelapidae, Rhodacaridae, to the plant-dwelling Phytoseiidae, and the parasitic and phoretic mites of families Varroidae, Dermanyssidae, Macronyssidae, this order is truly an all-encompassing one. Phytoseiids are one of the most studied mesotigmatic mites and their predatory habit makes them very useful biocontrol agents against pest mites, and soft-bodied insects. The soil-dwelling Laelapids, Ascids, and Rhodoacarids also predate on crop pests, nematodes, and other pest mites as well. Other non-predatory mesostigmata like Ameroseiidae, Blattisociidae, play an important role in the decomposition of organic matter, which contributes to the nutrient cycling of soil. Furthermore, they act as soil engineers, i.e., they help to build and maintain a healthy soil structure and profile. Also, they act as bioindicators of the overall health of the ecosystem. Mites of families Varroridae, Dermanyssidae are parasitic on beneficial and domesticated animals. There are also phoretic mites that live in close association with insects, birds, snakes, mammals, etc., which are still largely unexplored. Despite their potential benefits, mesostigmatid mites are often overlooked in agricultural systems. They are small and difficult to detect, and their biology and ecology are not well understood. Furthermore, habitat destruction, pesticide use, and other anthropogenic activities can negatively affect their population. Therefore, extensive research is needed to fully understand their role in agriculture and to develop effective strategies for their conservation and use in pest management.

Keywords: Mesostigmatidae, Predator , Parasite, Pest Management, Soil health

Diversity and spatial distribution of Molluscs along the Salinity Gradient in Ashtamudi Lake Ramsar Site, Kerala, India

Chinnu Vishwanathan and Biju Kumar A.
Department of Aquatic Biology and Fisheries, University of Kerala, India
(Email: chinnu@keralauniversity.ac.in)

Abstract

Ashtamudi Lake in the Kollam district of Kerala, India is the deepest and the second largest backwater system in Kerala. The estuary is basin-shaped or palm-shaped, with eight prominent arms and the lake was designated as a Ramsar site in November, 2002. For the present study, six sampling sites were selected randomly on the basis of increasing salinity from Koivila, where Kallada River joins the Ashtamudi estuary to Neendakara Barmouth, where the estuary discharges into the Arabian Sea. A total of 83 molluscan species, with 1 Polyplacophora, 41 Gastropods, 37 Bivalves and 4 Cephalopods were recorded in the study. Neendakara Barmouth (salinity 25 ppt-34 ppt) recorded the highest diversity of species (65), classified under 4 molluscan classes. The species diversity recorded a minimum of 9 in the freshwater zone Koivila (salinity of 5 ppt-14 ppt). The species diversity in various salinity zones was in the order: Saline zone- 65 species > Estuarine zone- 20 species > Freshwater zone- 9 species. Gastropods like *Clithon oualaniense* (Lesson, 1831) (Family: Neritidae), *Neripteron violaceum* (Gmelin, 1791) (Family: Neritidae), *Pirenella cingulata* (Gmelin, 1791) (Family: Potamididae), *Indothais blanfordi* (Melvill, 1893) (Family: Muricidae), and the bivalve *Martesia nairi* (Turner & Santhakumaran, 1989) (Family: Pholadidae), were observed in all the three zones. The alien mussel, *Mytella strigata* (Hanley, 1843) has established successfully in all the salinity zones. The paper analyses the spatial variation and alpha and beta diversity of molluscs in the Ashtamudi Lake, Kerala.

Keywords: Ashtamudi Lake, Molluscs, Salinity Zones, Salinity Gradient, Ramsar site

The Diversity and Distribution of the Order Charadriiforms along the Kerala Coast and Lakshadweep Islands, India

Nisanth H.P. and Biju Kumar A.
Department of Aquatic Biology and Fisheries, University of Kerala, India
(Email: nisanthphd@gmail.com)

Abstract

The birds belonging to the Order Charadriiformes are widely distributed along the coastal regions and coastal waters of Kerala and Lakshadweep. Most of the species found in this region are migratory and use the coastal habitats and coastal waters as their feeding grounds or stopover sites. In this study, we documented the diversity and distribution of Order Charadriiforms along the Kerala coast and Lakshadweep and we recorded 49 species of birds in this order. In this, 24 species representing 3 families are considered as seabirds and 25 species belongs to 6 families represent shorebirds. The distribution of these birds was mapped and the study evaluated the aggregation and occurrence of these birds along the mainland and islands. The patterns obtained from the studies shows that, the distribution of charadriiforms varies in mainland and islands and also within the coastal regions of the mainland. During the study the breeding of Brown Noddy (*Anous stolidus*), Sooty Tern (*Onychoprion fuscatus*) and Greater crested terns (*Thalasseus bergii*) were observed in the Pashi Pitti While considering the fact that the distribution and diversity of birds will be used to measure the health of the ecosystem, the results obtained from the current study will provide an insight into coastal management and conservation of the avian fauna.

Keywords: Charadriiforms, Seabirds, Shorebirds, Lakshadweep, Charadriidae

Seasonal incidence of peach fruit fly in Hamirpur district of Himachal Pradesh

Anupama Kalotra, Dr. V. K. Rana and Vijay Singh Chandel
Dr. Y.S.P University of Horticulture and Forestry, India
(Email: anukalotra45@gmail.com)

Abstract

Peach (*Prunus persica* L.) belongs to the family Rosaceae, the most delicious stone fruit, temperate and sub-tropical in nature. It is native to China and an important fruit crop grown in mid hills of Himalaya extending from warm temperate to sub-tropical parts of Himachal Pradesh, Jammu & Kashmir, Punjab, Haryana, Uttarakhand and parts of Uttar Pradesh. Peach is attacked by various insect pests. Fruit flies belonging to the genus, *Bactrocera Macquart* are among the major pest of this fruit. Among various species of fruit flies, *Bactrocera zonata* Macquart is a serious pest of fruits causing severe losses to quality and the fruit production. In the present study, the population of *B. zonata* was monitored by using methyl eugenol traps. During the investigation, incidence of this pest was observed from fruit initiation till harvest.

Keywords: Sub-tropical, Fruit fly, Peach, Pest

Ecology and Diversity of Intertidal Polychaetes (Annelida: Polychaeta) of the Northern part of East Coast of India

Jyoshna Pradhan, Cukoo Mahapatra and S. Balakrishnan

Zoological Survey of India, Marine Aquarium and Regional Centre, Digha – 721 428, West Bengal, India. Deparment of Zoology, Maharaja Sriram Chandra Bhanja Deo University– 757 003, Baripda, Odisha, India

(Email: pjyoshna78@gmail.com)

Abstract

The phylum Annelida is one of the most and diverse invertebrates groups that inhibit the marine, brackish, freshwater, terrestrial and coastal zones. Both morphologically and ecologically, diversity in annelids is extraordinary. This group evolved and spread over the globe during the Cambrian epoch (490 to 500 million years ago), diversifying into 21,000 species. Around 7-8% of all species known on our planet come from the incredibly diverse Indian subcontinent, which also exhibits prevalence of endemism. The samples were brought to the laboratory in icebox and identified up to species level by following standard identification keys and identified specimens were preserved in 70% alcohol for further studies. The diversity of species of polychaetes 179 species reported along the northern part of the east coast of India which belongs from eight orders i.e. Phyllodocida, Euncida, Spionida, Sabellida, Terebellida, Capetillida, Amphinomida and Scoleisida. Maximum numbers of polychaetes species are represented from Nereididae (33) followed by Spionidae (18), Eunicidae (9), Glyceridae (8), Polynoidae (7), Capitellidae (7), Sabellidae (7), Lumbrineridae (7), Amphinomidae (6), Phyllodocidae (6), Syllidae (6), Hesionidae (6), Orbiniidae(6), Onuphidae (5), Nephthyidae (5), Serpulidae (5), Sabellaridae (4), Terebellidae (4), Maldanidae (3), Sigalionidae (3), Goniadidae (3), Pilargidae (3), Ampharetidae (3), Flabelligeridae (3), Oweniidae (2), Aphroditidae, Trochochaetidae, Paranoidae, Pilargidae, Ampharetidae, Trichobranchidae, Sternaspidae, Cirratulidae, Scalibregmatidae and Magelonidae. During the survey, observed polychaetes indicated that the environment in the area was in good condition. Coastal areas provide invaluable service to people and marine organisms, making their protection critical. The present study indicated that the species diversity could be varied depending on the habitat. The present study therefore aims to provide further information on the taxonomy critical overview of Indian polychaetes.

Keywords: Benthos, Intertidal, Annelida, Ecology, Bay of Bengal

First confirm report of Threaded fig shell, *Ficus filosa* (G. B. Sowerby III, 1892) (Gastropoda: Ficidae) from Indian coast

Prasad Chandra Tudu, Jyoshna Pradhan and Sukanta Ghosh

Marine Aquarium and Regional Centre, Zoological Survey of India, Digha, West Bengal, 721428, India

(Email: tuduprasad@gmail.com)

Abstract

There are only five species of fig shells of the genus *Ficus* are reported so far from Indian water. The present paper deals with the first ever confirm report of *Ficus filosa* (G. B. Sowerby III, 1892) from Indian water and added the list of number species to six. The identification of the species was confirmed by examining the morphological characters of shell. The one specimen with animal was collected from Fishing harbour, Kakinada, and another empty shell was collected from Bandaruvanipeta, Andhra Pradesh coast. A distributional checklist for Indian water of this genus was presented in the article.

Keywords: East coast, fishing bycatch, range extension, Andhra Pradesh, Bay of Bengal

Study of Ant (Family: Formicidae) Diversity in urban localities of Kolkata

Priyanka Das[1], Dr. Arijit Chatterjee[2] and Dr. Sheela S.[3]

[1,3]Zoological Survey of India, Kolkata, India
[2]Asutosh College

(Email: priyankazsi10@gmail.com)

Abstract

Ants are one of most abundant organisms of terrestrial ecosystem. Their rich diversity, biomass, responsive nature to environmental changes makes them suitable for studies related to biodiversity and conservation. This study was carried out between September, 2020-August, 2021 in two urban localities of Kolkata; Subhas Sarovar (SS), a manmade lake and Salt-Lake (SL), busy roadside area beside a canal; SS consists more diverse habitats, exposing less pollution in comparison to SL. This study aims to understand how diversity and distribution of ant species vary in different habitat types in an urban set up. Ants were collected along a transect followed by hand picking throughout the year. During the study total 45 ant species (6-subfamilies) were collected which is approximately 11.7% ant species of West Bengal, among them subfamily Myrmicinae consists maximum species. SS consists 36 ant species while SL having 33 species. Diversity indices for SS and SL are 2.415 and 2.299 (Shannon_H), 0.872 and 0.846 (Simpson_1-D), 0.128 and 0.154 (Dominance_D) respectively. SS is more species rich and diverse and species dominance is less in this area than SL. It could be as SS consists a huge water body, having diverse vegetation including plenty of trees and is well maintained in comparison to SL where dominance is more and diversity is less. Dominance of Camponotus compressus, presence of Tapinoma Melanocephalum, Paratrechina longicornis indicate human interference, disturbance in study areas. Presence of terrestrial and arboreal ants reveals, though areas exposed to human activities, still provide sufficient microhabitats for ants. This study has shown ants can adapt themselves in disturbed habitats and survive and flourish in urban localities. Rapid urbanization, climatic change put enormous challenge on the ecosystem's functioning and human wellbeing. This kind of diversity studies help making strategies for maintaining balance between human needs and ecological stability in urban areas.

Keywords: Ant, Urban areas, diversity, Indicator species, Subhas Sarovar

Observation of Floral-Faunal Interaction of selected species of Impatiens from Nilgiris, Western Ghats

Nithya Basith and P. Selva Singh Richard
Madras Christian College, Chennai, India
(Email: nithyabasith1994@gmail.com)

Abstract

The plant-animal interaction in 13 species of Impatiens including some narrow endemics such as Impatiens clavicornu, *I. cuspidata*, *I. fasciculata*, *I. fruticosa*, *I. latifolia*, *I. leschenaultiana*, *I. levinjii*, *I. modesta*, *I. munroii*, *I. pendula*, *I. pseudoacaulis*, *I. orchioides*, *I. nilgirica* were attempted from Nilgiris, Western Ghats of India. Most of these taxa are in flowering during south west monsoon which is from June to September. During the field surveys, the floral-visitor interaction was visually and photographically recorded, floral visitor behavior on blossom, frequency of visitation were also recorded. Details of each specimen including its scientific name, family, habit, habitat, date and place of collection and phenological status were documented. The floral - faunal interactions can be categorized as Pollinators, nectar or pollen thief, nectar robber or just visitor. During the present investigation, a significant record was made i.e. fungus gnat an important pollinator of the Orchid mimicking Balsam (*Impatiens orchioides*), like-wise species of wasp, ant, flies and bugs were observed to be the major groups of pollinator of *I. pendula*; *I. munroii* and *I. levinjii* visiting the blossoms even in heavy rains for floral rewards; nectar stealing and robbery was also recorded in *I. fasciculata* by *Xylocopa* sp. and Syrphid flies. Most of the plant species were offering nectar, pollen and shelter.

Keywords: Impatiens, Endemic to Nilgiris, Fungus Gnat, Western Ghats

Genetic population structure and historical demography of the largehead hairtail *Trichiurus lepturus* Linnaeus, 1758 (Perciformes: Trichiuridae) from Indian waters

Lakshmi P. Mukundan, Sandhya Sukumaran, Subal Kumar Roul, Shubhadeep Ghosh, Anulekshmi Chellappan, Abdul Azeez P., Remya .L, Prathibha Rohit and A. Gopalakrishnan

ICAR-Central Marine Fisheries Research Institute, Kochi, Kerala-682018, India

(Email: lakshmipm14@gmail.com)

Abstract

The genetic population structure and historical demography of one of the most commercially important cosmopolitan species, the large head hairtail *Trichiurus lepturus*, was investigated using two mitochondrial markers; Cytochrome C oxidase I (COI) and control region by collecting samples from Peninsular Indian Waters. We sequenced and analyzed a 730 bp region of the control region from 117 individuals and a 634 bp region of COI from 123 individuals. The AMOVA results indicated significant genetic differentiation (?ST, 0.23 for the control region and 0.16 for COI) between populations in the Arabian Sea and Bay of Bengal. The genetic subdivision between the populations can be attributed to a combination of factors including environmental and oceanographic parameters, larval retention, migratory and spawning behavior of the species. Neutrality tests, mismatch analyses, and Bayesian skyline plots revealed a history of population expansion dating back to the late Pleistocene epoch due to sea-level fluctuations. Conservation and management of this species can be undertaken regionally (east and west coasts of India) so that genetic variation and biological complexity can be effectively conserved. Comparisons of Indian Ocean COI sequences to Southwest Atlantic and East China Sea indicated the possible presence of 2 more putative species in this group as indicated by genetic distance values. High genetic differentiation can be attributed to the presence of several biogeographical barriers in the open ocean which can shape the distribution of species by restricting/ limiting the success of dispersal due to the vast distance among the habitats. Therefore, a comprehensive morphological and genetic analysis is proposed to elucidate and confirm the species status of Trichiurus worldwide so that the implementation of efficient management protocols can be done precisely.

Keywords: Indian Ocean, Mitochondrial markers, Cryptic speciation, Biogeographical barriers, Population genetics

Understanding behavior and microhabitat preference of Dragonfly larvae could help to control Insect Vectors in urban landscapes

Iptishamun Nesha[1] and Prosenjit Dawn[2]

[1]Department of Zoology, Vidyasagar University, Rangamati, Midnapore-721102, India

[2]Department of Zoology, Shyampur Siddheswari Mahavidyalaya, Ajodhya, Howrah – 711312, India

(Email: iptisham96@gmail.com)

Abstract

Odonata larvae are voracious predators and play an important role as bio-control agents for mosquitoes and flies; thus, can be used to combat vector-borne diseases. Hence it is important to understand the larval behavior and know the microhabitat preferences for species of interest under laboratory conditions. Different dragonfly larvae occupy different microhabitats and are known to be classified as claspers, burrowers, sprawlers and hiders according to their concealment behavior. The odonata species composition of any waterbody depends on the number of microhabitats present in it. This study was designed to identify the preferred microhabitats by common dragonfly species and to find out the generalist species that can exploit maximum available niches and can be used to control mosquito populations in urban lakes or water-tanks if needed. Larvae of three species of family Libellulidae, *Crocothemis servilia*, *Brachythemis contaminata* and *Urothemis signata* was studied under laboratory conditions, in aquariums replicating different possible microhabitats of an urban pond ecosystem. Larvae of both species showed a combination of Clasping and Sprawling behavior. They usually spent time securing themselves attached against substrate like submerged vegetation; stayed immobile when disturbed or kept hiding between leaflitter or submerged leaves. Occasionally the larvae foraged around and grabbed prey actively.

Keywords: Odonata larva, Biological indicator, Microhabitat, Dragonfly, Insect vector

Diversity of *Eimeria* Schneider, 1875 in broiler chickens of Purulia District, West Bengal, India

Azmal Baidya and Prof. Biplob Kumar Modak
Sidho kanho Birsha University, Purulia, India
(Email: Azmalbaidya1234@gmail.com)

Abstract

Eimeria is one of the most important pathogenic parasites in broiler chickens that causes huge economic loss in poultry birds throughout the world including the Purulia district of West Bengal. To study the prevalence of cocciodiosis in the broiler chickens of the district, coprological studies were carried out from February, 2022 to January, 2023. Faecal samples were collected from different poultry farms of the district and examined by Floatation method (sheather's solution) followed by microscopic examination of coccidian oocyst and sporocyst. Species were identified by morphometric analysis and standard literature. Out of 254 samples examined, 169 samples were found positive with coccidian species, i.e. the prevalence of coccidiosis in broiler chickens of the Purulia district was 66.53%. Altogether six species of *Eimeria* were recorded of which *Eimeria tenella* was the most prevalent species (57.08%, 145/254), followed by *Eimeria necatrix* (48.42%, 123/254), *Eimeria maxima* (40.55%, 103/254), *Eimeria mitis* (37.78%, 96/254), *Eimeria acervulina* (22.44%, 57/254) and *Eimeria brunetti* (6.29%, 16/254). The most common type of mixed infection found in combination with *E. tenella*, *E. mxima* and *E. necatrix* (33.85%, 86/254), followed by *E. tenella*, *E. maxima* (25.19%, 64/254) and *E. tenella*, *E. necatrix* (15.35%, 39/254). Interestingly, in most cases, *E. tenella*, *E. mxima* and *E. necatrix* were coexisting in various combinations. *E. tenella*, *E. mxima* and *E. necatrix* were coexist in 33.85%, (86/254) cases, *E. tenella* and *E. maxima* in 25.19?ses (64/254) and *E. tenella* and *E. necatrix* in 15.35?ses (39/254). The present study also revealed that the infection was more prevalent in the rainy season (62.68%) and less in the summer (11.42%). The present communication intends to conclude that coccidiosis is still a major threat to poor poultry bird keepers of the district.

Keywords: *Eimeria*, Prevalent, Coccidiosis

Studies on the prevalence of endoparasitic protozoans of Oligochaetes in the Bankura district of West Bengal

Moumita Sinha and Biplob Kumar Modak
Sidho Kanho Birsha University, Purulia, India
(Email: sinhamoumita11@gmail.com)

Abstract

Endoparasitic aseptate gregarines are commonly found in Annelida, particularly in seminal vesicles of earthworms. An extensive survey has been carried out for aseptate gregarine in earthworms in the Bankura district during the period of January, 2022-December, 2022. Different genera of host earthworms were studied for occurrence of aseptate gregarines throughout the year. To study the morphology, prevalence and life cycle of these parasites, earthworms were dissected and a thin film of seminal fluid was drawn out on the slide. Then they are fixed in Schaudin's fixative, stained in Heidenhain's hematoxylin and studied under the light microscope. During the survey four genera viz. *Monocystis* Stein, 1848, *Nematocystis* Hesse, 1909; *Stomatophora* Drzhevetskii, 1907; *Apolocystis Cognetti* de Martiis, 1923 are recorded but the prevalence of *Monocystis* Stein, 1848 and *Stomatophora* Drzhevetskii, are much higher than the others. These endoparasites reproduce sexually and exhibit mainly three distinct stages viz. trophozoite, gametocyst and oocyst in their lifecycle.

Keywords: Endoparasite, Monocystis, Earthworm, Oligochaeta, Bankura

Community structure and parameters of Oribatid Mites associated with Acacia Litter in North Kerala

Arun, A. and Ramani, N.

Research Scholar, Division of Acarology, Department of Zoology, University of Calicut, Kerala, PO 673635, India

(Email: arunaugust93@gmail.com)

Abstract

A. auriculiformis represents an invasive plant. Like all other invasive flora, it also exerts several adverse effects on the environment, by interfering with the distribution and diversity of the native flora and fauna, particularly the mesofaunal components in many ways. The study aims to understand the alpha and beta diversity parameters of oribatid mites in five districts of North Kerala, in order to find out the community structure and diversity of these mites in the various districts, changes in their community structure between different districts, species richness, species evenness, similarities in the community structure etc. of these mites. Litter samples were collected using a square transect from the collection sites and extracted under modified open brass funnel apparatus. Extracted mites were sorted, processed and identified up to species level. The data were tabulated and analysed for alpha index, beta index and other population parameters using PAST4 software. The faunal diversity of oribatid mites associated with the degrading litter of Acacia was found to comprise 57 species belonging to 42 genera, 29 families and 21 superfamilies. *Galumna* (*G.*) *flabellifera*, *Scheloribates* (*S.*) *decarinatus*, *Oppia* (*Lasiobelba*) *kuehnelti* and *Rostrozetes ovulum* showed a uniform distribution. The numerical density of oribatids was found high in the Malappuram district followed by the Kozhikode district. Lower density was observed in the collection sites of Wayanad. The majority of oribatid species collected were members of the superfamily Oripodoidea, followed by Lohmannioidea and Galumnoidea. The genus *Scheloribates* showed the maximum species diversity, comprising four species. Kozhikode district showed higher species diversity followed by Malappuram and Kannur. Evenness was also found high in Kozhikode, indicating an even distribution of species in the sampling localities. Kozhikode and Malappuram revealed the occurrence of 17 common species and this was followed by the Malappuram and Kannur districts, by sharing 13 species each.

Keywords: Oribatid, Mites, Diversity, Litter, Acacia

Ant Diversity in Forested and Human Disturbed varying elevational habitats of Shendurney Wildlife Sanctuary, Western Ghats, India with Landscape Analysis using QGIS

Merin Elizabeth George[1] and G Prasad[2]

[1]Ph.D Scholar, Department of Zoology, University of Kerala, Kariavattom, Trivandrum, Kerala, India

[2]Professor, Department of Zoology, University of Kerala, Kariavattom, Trivandrum, Kerala, India

(Email: megkattimattom@gmail.com)

Abstract

Shendurney Wildlife Sanctuary is located at Agasthyamalai Hills of Southern Western Ghats, Southern India. Despite being in a biodiversity hotspot, there has been no study of ants from this region to date which makes it difficult to monitor any need for conservation efforts. The present study aims to make a comparison between the Forested and Disturbed Habitats of the Sanctuary. The study was done from March, 2021 to February, 2022 spanning four seasons. Two Forested and two disturbed habitats were selected in two elevations (500m and 1100 m). Three 20x20 m. quadrats were selected in each habitat. The ants were collected using standard protocol. The diversity of the sites was analysed and compared to understand the impact of disturbance on ant assemblages. From all sites, soil samples were collected. The samples were analysed for pH, Organic Carbon, Moisture, and Temperature. The soil parameters were compared with diversity indices to understand their effect on diversity. It was noticed that forested regions had a better diversity and lesser dominance compared to Disturbed Habitats. In addition, landscape usage was analysed for multiple years using QGIS to understand the change in landscape pattern and disturbance throughout the years.

Keywords: Ants, Shendurney Wildlife Sanctuary, Landscape Analysis, GIS, Habitat Disturbance

A preliminary approach on the Zoogeographic affinities of Silverfish fauna (Zygentoma: Lepismatidae) from India

Debanjan Jana[1] and Ashis Kumar Hazra[2]

[1]Junior Research Fellow, AICOPTAX Project, Zoological Survey of India, Kolkata, India

[2]Emeritus Scientist & Former Additional Director, AICOPTAX Project, PI, Zoological Survey of India, Kolkata, India

(Email: debanjanjana4@gmail.com)

Abstract

The poorly known Indian fauna of Zygentoma of the family Lepismatidae is presently represented by seventeen species. All these species are known to occur from fourteen States and two Union Territories of India. Available data indicates that absence of records of the family Lepismatidae in almost half of the states. Data concerning the species like *Acrotelsa collaris*, *Ctenolepisma* (*Ctenolepisma*) *longicaudatum*, *Lepisma saccharina*, *Thermobia domestica* are referred only to cosmopolitan synanthropes, therefore without any zoogeographic interest. The Lepismatidae, excluding those species which are distributed from one country to other due to anthropogenic activities have lost all their zoogeographical weight. The genus *Lepidospora* with two species and *Ctenolepisma alticola* these are only known to occur from north western states. However, the genus *Ctenolepisma* presents along Africa, Palearctic and Oriental Asia, Mediterranean Europe Australia and Central northern South America. Afrolepisma and Xenolepisma show a clear Afro-Indian distribution. The genus *Xenolpisma* being exclusive from Cape province of South Africa and from India are discussed.

Keywords: Zygentoma, Ctenolepisma, Zoogeographic affinities, Cosmopolitan, Synanthropes

COMPARISON OF THE POPULATION OF SOIL-INHABITING NEMATODA IN THE CONTEXT OF PESTICIDE APPLICATION WITH AN OBSERVATION ON THEIR TROPHIC GROUPS

Debabrata Sen and Samprit Deb Roy

Zoological Survey of India, M-Block, New Alipore, Kolkata- 700053

Corresponding author: debabrata.zsi@gmail.com

Abstract

Soil-inhabiting Nematodes are agriculturally important for significant loss of crop production as well as for their beneficial role in soil ecosystem. During a visit to Bali Island of Indian Sundarbans, West Bengal, India, few soil samples were collected from agricultural fields. As reported by the villagers, some fields were applied with pesticides like Furadon (carbofuran 3% g) and Phorate (Phorate 10% g organophosphate) and some were without any pesticide. Both of these pesticides have nematicidal effects besides being contact and systemic insecticide. The collected soil samples were processed by Cobb's Sieving and Decantation method followed by modified Baermann Funnel Technique to extract the nematodes. The populations of nematodes were counted with the help of a counting dish and a hand tally counting machine under a stereo zoom microscope following standard method. The soils applied with pesticides, collected from cauliflower and tomato fields, showed a lesser population count of 26 and 98 nematodes respectively in 250 gm. of soil for each of the samples, whereas the population count for the soils without pesticides from vegetable and paddy fields were 293 and 625 nematodes respectively in the same quantity of soils. The nematodes were identified up to the generic level and presence of twelve genera was observed which indicates an idea about their trophic groups in the soil micro-habitat of agro-ecosystem being associated with the mangrove ecosystem ('ecotone' of terrestrial and marine ecosystem) of Sundarbans. So this observation can be considered as various trophic levels of nematodes in an 'ecotone'. Soils with the pesticides showed only two trophic groups (omnivorous and predatory-omnivore), whereas soil without pesticides revealed four trophic groups (plant and hyphal feeder, omnivorous, bacterial feeder and predatory) of nematodes. The difference in population in different soils was statistically analyzed to show the relation between the nematode population in the soil applied with pesticides and without pesticides.

Key words: Soil-inhabiting Nematoda, Sundarbans, Population, Pesticide, Trophic groups

Diversity of Zooplankton in the Wetlands of Nagaland, North-East India

Kensibo Pamai[1] and B. K. Sharma[2]

[1]Department of Zoology Patkai Christian College (Autonomous) Chümoukedima-Seithekema Chümoukedima, Pin- 797103 Nagaland, India

[2]Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Permanent campus, Shillong-793022 Meghalaya, India

(Email: kensibo971@gmail.com)

Abstract

The study aims to assess the diversity of zooplankton in wetlands located in Nagaland, a state in North-East India. The plankton samples observed from three wetlands viz., Bolfangdisa wetland, Madladijam wetland and Noune wetland of Dimapur district, Nagaland recorded a total (S) of 181 species spread over 79 genera and 34 families, and belonging to five groups of zooplankton. Rotifera (110 species) > Cladocera (44 species) mainly contributed to zooplankton richness with limited species of Rhizopoda (14 species) > Copepoda (8 species) > Ostracoda (5 species). Of these, Rhizopoda and Ostracoda comprised facultative zooplankton. In all, 84 species of zooplankton are new records; these included 82 new records from Nagaland state and 2 species are new records from northeast India (NEI). Total zooplankton richness ranged between 109-160 (138±22) species. Percentage similarity between wetlands shows high similarities, Noune and Madladijam is 71.1%; Noune and Bolfangdisa is 73.6% and similarity between Madladijam and Bolfangdisa wetland is 83.4%. This study recorded one of the richest zooplankton diversity known till date from small lentic environs of any state of NEI and from India, respectively and thus asserted biodiversity importance of the present study vis-à-vis ecosystem diversity of the small lentic ecosystems of Nagaland.

Keywords: Zooplankton, Diversity, Wetlands, Nagaland, North-East India

Preliminary assessment of the faunal diversity of the rock cut caves in Satara, Maharashtra, India

Pooja Kumar Misal[1] and Aparna Sureshchandra Kalawate[2]

[1]Shivaji University, Kolhapur, India

[2]Zoological Survey of India, WRC, Pune, India

(Email: pkmspider@gmail.com)

Abstract

Lohare Palpeshwar caves are situated 5 km north of Wai and 39 km from Satara. Wai was an important village in ancient India, also known as Dakshin Kashi as it is situated next to the banks of Krishna River. Lohare Palpeshwar caves are the oldest caves situated in the Lohare village of Wai, Satara district of Maharashtra, India. These caves are important for local people due to the presence of Shiva Lingam. Thousands of devotees from the surrounding villages visit this cave particularly in Shravan, an auspicious month for the Shiva devotees, thus facing anthropogenic pressure. These caves are the true example of marvelous rock engineering of ancient India. Unfortunately, these caves have never been explored for its assessment of biodiversity particularly for arthropod fauna. Today, the need of the hour is to document the fauna before its extinction. Hence, an attempt has been made to document the preliminary arthropod diversity from the Lohare Palpeshwar cave. From the two month exploration studies it was observed that a total six different orders representing 20 species of phylum arthropoda such as 10 species from order Lepidoptera, 6 species from order Araneae, 1 species of order Hemiptera, 1 species of order Coleoptera, 1 species of order Orthoptera and 1 from order Phasmatodea in different micro habitat of rock cut cave. Among these orders Lepidoptera shows its dominance over other species of Arthropod fauna. The present study is based on two surveys undertaken in January, 2023 to February, 2023. For proper assessment of the diversity of the cave more extensive surveys will be undertaken seasonal wise.

Keywords: Arthropod fauna, Moths, Spiders, Satara, Caves

Faunal diversity of Pulicat lake, Southeast Coast of India

Pranjal Sharma, C. Venkatraman and S. Prabakaran
Marine Biology Regional Centre, Zoological Survey of India, Chennai-28, India
(Email: pranjalsharma2912@gmail.com)

Abstract

Pulicat lake is a brackish water lagoon is sharing two states (Andhra Pradesh and Tamil Nadu) and situated along the East coast of India. It is very productive ecosystem in terms of faunal composition and density. Pulicat lake provides an excellent breeding ground for crustaceans, finfish, and migratory birds that are valuable to society and the economy. Faunal diversity of Pulicat lake (Tamil Nadu part) has been compiled based on the field survey conducted by Marine Biology Regional Centre, Zoological Survey of India, Chennai during 2005-2007 & May to Dec, 2022 and from the published literature. Sampling was done in different locations of the lake. Standard methods were followed for collecting every group. Altogether a total of 354 species belongs to six phyla, of which, 65 species are microfauna (phytoplankton, zooplankton and meiofauna) and 289 species are macrofauna (Mollusca, Arthropoda, Echinodermata, Cnidaria, Pisces and birds) has been reported so far from the lake. During the field survey, it has been observed that the biodiversity of the lake has been badly affected due to increasing rate of siltation and developmental activities. Agriculture pollution, domestic sewage and industrial effluent pollution together make a significant threat to this Lake. A risk is always posed by the automated boats' oil spills. The Ennore thermal power plant had created significant change in the biogeography of this lake, since it was shut down in 2017, restorative methods have not been aplenty to reintroduce the lost or dwindling biota. It is critical to implement effective measures for the preservation of the fauna of the lake in order to preserve biodiversity and the equilibrium of this aquatic environment. To restore the habitat to its original form, management strategies such as removing silt deposition, opening of closed river mouths, preventing soil erosion, and maintaining freshwater flow should be adopted.

Keywords: Pulicat lake, lagoon, Southeast Coast, birds, Planktons

New Distributional Records of Three Species of Water Bugs (Insecta: Hemiptera: Heteroptera) From Kerala, India

Jyothylakshmi K. and S. Nandakumar

P. G and Research department of Zoology, N.S.S College, Pandalam, Kerala - 689501, India (Affiliated to the University of Kerala)

(Email: jyothylakshmik@gmail.com)

Abstract

Water bugs are the major group of insects successfully utilize enormous array of aquatic habitats. The present study reports new distributional records of three species of water bugs *Ranata varipes varipes* Stal, 1861; *Mesovelia horvathi Lundblad*, 1934, and *Nychia sappho Kirkaldy*, 1901 belonging to the families of Nepidae, Mesoveliidae and Notonectidae respectively from Kerala. The current study shall contributes three species of water bugs to the checklist of aquatic Heteropterans of the State, thereby strengthens information on the geographic distribution. Concise comments on their general characteristics and bionomics have been integrated.

Keywords: New record, Water bugs, Distribution, Heteroptera, Kerala

Biogeography and Habitat Ecology of the Chestnut-Capped Babbler in Southern West Bengal

Sekhar Pramanik and Kaushik Deuti

Zoological Survey of India, FPS Building, 27 JL Nehru Road, Kolkata – 700016, India

(Email: sekhar.bubun@gmail.com)

Abstract

The habitat specialist grassland bird, Chestnut-capped Babbler (*Timaliapileata bengalensis*) was known from only a small population in Kolbass village of Amta Block II in Howrah district of southern West Bengal adjoining the Damodar River. We conducted extensive surveys and found the species to be breeding in the grasslands formed by the Rupnarayan River in Deulti and Bagnan areas of Howrah district of southern West Bengal. These grasslands have been recently formed in the last six years when the Rupnarayan River changed its course for the second time in the last twenty years and exposed about 8 kms of silted land on its left bank. Presently, the bird was found to breed by constructing cup-shaped nests made up of a ball of coarse grass low down at the base of Kash (*Saccharum spontaneum*) grass and Hogla (*Typha angustifolia*) reeds at a height of only one meter from the ground. It stays in small flocks of 6-8, hunting among the grass stems, picking up insects off the grass leaves and twigs, threading its way through the tangles of tall grass, seldom exposing itself to view. However, at Kolbass village (where it was earlier known) it lives only among Khori (*Saccharum fiescum*) grass, although its secretive habits of feeding and breeding are the same in both areas. Destruction of grasslands by cutting and burning for extensive flower cultivation, development of silted land along the Rupnarayan river banks for hotel construction and the lack of any extended stretch of grasslands in the districts of southern West Bengal, seem to be the reasons for the restricted distribution of this grassland habitat specialist bird in southern West Bengal.

Keywords: Chestnut capped Babbler, Grassland ecology, Breeding, Nesting, Habitat loss

Spiders (Arachnida: Araneae) of Shendurney Wildlife Sanctuary, Kerala, India

Puthoor Pattammal Sudhin and Souvik Sen

Zoological Survey of India, M-Block, New Alipore, Kolkata- 700053, India

(Email: sudhinpp@gmail.com)

Abstract

Spiders are abundant in the forest ecosystem, and their population status is a key factor in future conservation and management. The present study was carried out in Shendurney Wildlife Sanctuary, which is in the core area of Agasthyamalai Biosphere Reserve, Kollam district, Kerala. The sanctuary is one of the richest areas of biodiversity in the Western Ghats. The sampling of spiders was undertaken for a period of three years from April, 2019 to March, 2022, and the standard spider collection methods such as hand searching, vegetation beating, and sweep netting were used. The collected spiders were identified using standard taxonomic keys and related literature available in the World Spider Catalog (2023). A total of 79 species of spiders belonging to 53 genera and 16 families were recorded from the study area. Among them, 24 species are endemic to India, and two species, *Clubiona melanosticta* Thorell, 1890, and *Oxyopes mirabilis* Zhang, Yang & Zhu, 2005, are new records to India. Majority of the species belong to the families Araneidae and Salticidae. Analysis of the Guild structure of spiders revealed six feeding guilds, in which the most dominant was orb-web weavers, followed by stalkers and ambushers. The present study provides a comprehensive list of spiders of Shendurney Wildlife Sanctuary, which will help to increase our knowledge about the diversity and distribution of spiders in our country and can be used as baseline data for future conservation and management in the Western Ghats of India.

Keywords: Araneae, checklist, new record, Western Ghats, biodiversity hot spot

Flower visiting flies (Insecta: Diptera) and their interaction with the flowering plants in a tropical island ecosystem

Debdeep Pramanik, Koustav Mukherjee, Debjani Ghosh, Saikat Sarkar, Atanu Naskar and Dhriti Banerjee

Zoological Survey of India, Kolkata, India

(Email: mailtodebdeep.005@gmail.com)

Abstract

Pollen transportation and pollination is an essential ecological function. Flies of order Diptera perform a significant role in transfer of pollen and pollination to some extent (Raguso, 2020). In tropical island ecosystems the flower visiting dipteran flies may function simultaneously with the bees to maintain a healthy ecosystem service. However, the study of flower visiting Dipteran flies in India has received less attention from the entomologists and even lesser in island ecosystems. In tropical areas the Hymenopterans can be outnumbered by the Dipterans in terms of biodiversity (Inouye, 2001). So, the main objective of this study is to identify and make an inventory of flower visiting Dipteran flies of a tropical island along with their visited plant species. The study was conducted across the Sagar Island, West Bengal. The collection of flies and observation of the plants visited by them was done through line transect method in 10 chosen study sites containing both the crop and non-crop flowering plants. Throughout the study, a total of 41 species of flies belonging to 34 genera under 13 families have been observed to visit flowers of 32 species in our studied landscape. *Paragus serratus* of family Syrphidae has been found to be the most interactive fly visiting 27 different flowering plant species and *Mangifera indica* appears to be the most visited plant with 17 dipteran species visiting its flowers. We have also observed the variation in seasonal occurrence of the flower visiting flies and prepared a simple bipartite network representing the links between the dipteran flower visitors and their visited flowering plants. The outcomes illustrate a clear scenario of flower visiting Dipteran flies occurring in a tropical island that interact with the plants. This can also lead to future studies about pollination by Diptera in an island ecosystem.

Keywords: insect-plant interaction, bipartite network, island diptera, syrphidae, island flowering plants

Climatic impact and habitat efficiency on species diversity of plant mites in an Agri-Climatic Zone of Southern West Bengal

Subhasree Mitra[1], Shelley Acharya[2] and Sujay Ghosh[3]

[1,3]Department of Zoology, University of Calcutta, India

[2]Zoological Survey of India, Kolkata, India

(Email: subhasreezoology@gmail.com)

Abstract

The paper deals with the climatic impact and habitat efficiency on species diversity of plant mites and their abundance, species richness and species composition in different agri-horticultural crops of four phytogeographic regions in southern part of West Bengal. Observational data demonstrate how simultaneously acting climatic factors can affect the structure of plant mite communities in four phytogeographic regions. The study reported acaro-faunistic diversity, their phytogeographic distribution, abundance and potential impact on environment. The seasonal occurrence of mites, influence of climatic factors on four selected natural habitats of given ecosystem (Habitat 1, Habitat 2, Habitat 3 and Habitat 4) and randomly chosen natural habitats of four phytogeographic regions (Forest region, Coastal plain region, Rarh region and Gangetic-Delta region) were recorded. The study found the highest species diversity of plant mites in Gangetic Delta region. The Canonical Correspondence Analysis (CCA) was applied to study the relationship between species assemblages and the distribution of associated environmental factors. A total of 1236 individuals belonging to 122 species, 43 genera and 16 families were registered. CCA analysis showed that Forest region, Coastal Plain region, Rarh region and Gangetic Delta region are accounted for 94.99% (axis 1?=?50.1% and axis 2?=?44.89%) patterns of species variability across different phytogeographic sites. The interrelationship between climatic variables, species distribution, their occurrence, abundance and the nature of the plant mites in an agri-horticultural ecosystem from the tropical standpoint were analysed.

Keywords: Abundance, Climatic factor, Plant mite, Species diversity, Habitat

Inventorization on Microlepidoptera diversity (Lepidoptera) from Tehsil Dharampur (District Mandi) of Himachal Pradesh, India

Viveka Nand Sharma[1] and P.C. Pathania[2]

[1]Sardar Patel University Mandi Himachal Pradesh (Dr. Radhakrishnan Govt. Degree College, Dharampur, Dist.Mandi -175040, Himachal Pradesh, India)

[2]Zoological Survey of India, High Altitude Regional Centre, Solan - 173 212, Himachal Pradesh, India

(Email: skaku02@gmail.com)

Abstract

Under Kingdom Animalia, a total of 1,552,319 species belonging to 40 phyla have been described as per new evolutionary classification. One of the phylum Arthropoda (Class Insecta) having 1,242,040 species, which is about 80% of the total diversity. Lepidoptera is the third largest order after Coleoptera and Diptera (Zhang, 2011) in the class Insecta includes moths, butterflies and skippers. Economically they are very important as they are associated with various host plants and are rich in diversity in different climatically areas. On world basis, 1,58,570 species of Lepidoptera are present (Zhang, 2013), of which 1,38,656 species are moths and the rest are butterflies (Zhang, 2011). In India, 15,000 species under 84 families are present. Only 13,359 species belonging to 79 families are of moths (88%) and remaining are butterflies (12%) (Chandra, 2011). Small primitive moths belonging to order Lepidoptera have been artificially divided as Microlepidoptera. Very less work has been done on the biosystematic studies of Indian Microlepidoptera due to their small size, poor flight capacity, difficulty in study and lack of literatures. As per literature Microlepidoptera has been represented by a total of 45,735 species belonging to 4,626 genera of 73 families under 19 superfamilies globally (Nieukerken *et al*., 2011). Eight superfamilies i.e., Gelechioidea, Tortricoidea, Tineoidea, Zygaenoidea, Cossoidea, Gracillarioidea, Yponomeutoidea and Pterophoroidea are more represented while the eleven i.e., Schreckensteinioidea, Epermenioidea, Urodoidea, Immoidea, Simaethistoidea, Alucitoidea, Carposinoidea, Choreutoidea, Galacticoidea and two unassigned are less reported on global basis (Hampson, 1892; Meyrick, 1912-1936). The present paper deal with the 37 species of microlepidoptera from tehsil Dharampur, dist.

Keywords: Himachal Pradesh, Moths, Micro-Lepidoptera, diversity

Pallas's cat and Tibetan fox Standoff in Ladakh, India

Dr. Aishwarya Maheshwari and Stuart Champman
Independent Scientist
(Email: aishwaryamahehswari@gmail.com)

Abstract

The Pallas's cat (*Otocolobus manul*) and Tibetan fox (*Vulpes ferrilata*) are two mesocarnivores co-occurring across a vast landscape in Tibetan Plateau and Trans-Himalaya. Our understanding of this species' basic ecology and interactions are limited in this region, any noteworthy observation is valuable in improving our understanding of these species' ecology and behaviour. Here, we report an interaction incident between the Pallas's cat and Tibetan fox in Ladakh, India. We also discuss the distribution overlap between the Pallas's cat and Tibetan fox. Our preliminary observations suggest that the Pallas's cat and Tibetan fox potentially share their habitat and compete for prey resources in the Indian Trans-Himalaya and Tibetan Plateau.

Keywords: Pallas's cat, Tibetan fox, interspecific interaction, Ladakh, Tibetan Plateau

Fish diversity, fishery and conservation of less explored small estuarine habitat in Kerala - through the Perceptive of fisherman community, Western Ghats, India

Sreebin, P., V. Ramasubhramanian and T. V. Jayakrishnan

Research scholar, Bharathiar University, India

(Email: sreebinp2018@gmail.com)

Abstract

Coastal wetlands are one of the most disappearing habitats among all the wetland types. Landfilling, construction of buildings, urban development projects, aquaculture farming are some of the major threats to these wetlands. The study focused on the least studied and unexplored coastal wetland system in northern Kerala, India. Kavvayi, Azheekkal, Dharmadam, Ezhimala, Valapattanam are the selected estuaries for this study. Azheekkal, Madakkara, Ezhimala, Dharmadam, valapattanam are the major estuaries in Kannur and Kasargod districts, Kerala, India. The area is part of Western Ghats. All these estuaries ultimately join with Arabian Sea. As a part of the research fish diversity in each coastal wetland was studied from monsoon to summer season. The fishes were collected from the fish landing centers. Surveys were systematically conducted to know the fishery resource of each estuary. Accordingly 158 fish species were recorded. There were 28 elasmobranches fishes found throughout the study area. Fish diversity was abundant in Dharmadam, Azheekkal and valapattanam. Through open interactive forums 580 fisherman community in each estuarine zone were interviewed to know the perception of fish and fishery in these estuarine habitats. The unsustainable fishing or juvenile catch was highest during monsoon. Our study focused only on finfishes and elasmobranches (Rays & sharks). During our study interviews, local survey, focal group discussions, estuary wise vulnerability assessment were also conducted.

Keywords: Coastal wetlands, Estuary, Conservation, Live and livelihood

Avian Diversity in the Riverine Habitat of Melghat Landscape, Amravati, Maharashtra: A GIS-based Approach

Chaudhari Pratik, Gajanan Wagh and Vaishnavi Kuralkar
Shri Shivaji Science College, Amravati, Maharashtra, India
(E-mail: pratik.chaudhary15@yahoo.in)

Abstract

This study was carried out to determine the diversity and abundance of riverine avian fauna in the selected areas of the Melghat landscape. This study focuses on the assessment of the status, distribution, and diversity using the Geographic Information System (GIS). The study used globally consistent and comprehensive geospatial data sets generated using other sources, and the application of QGIS layering methods. The study was carried out from November, 2022 to February, 2023 in the rivers of the Melghat Landscape. Line transects and the point count methods were used in the study stations. Two stations were selected from the Tapi River, i.e., Rangubeli and Katunga, and two stations from the Sipna River, i.e., Semadoh and Harisaal. In all, 68 species of riverine birds were recorded at the study site. A total of 30 families of riverine birds was observed in the course of the study. The majority of the species were of Ardeidae family, followed by the Charadriidae family. According to the IUCN Red List (2022), 06 species were Near Threatened (NT) and the remaining were of Least Concern (LC). The sightings of River Lapwings (*Vanellus duvaucelii*) and Stork-billed Kingfisher (*Pelagopsis capensis*) from the Tapi River were found to be significant records for the Melghat landscape.

Keywords: GIS based study, Riverine birds, Diversity, Melghat Landscape, Amravati, Maharashtra

Utilization and processing of biodiversity of insects as food to secure malnutrition: Sustainable development

Rishi Richa[1] and Devanshu Gupta[2]

[1]College of Agricultural Engineering and Technology, Sher-e- Kashmir University of Agricultural Sciences and Technology, 190025, Shalimar, Srinagar, India

[2]Zoological Survey of India, M Block, New Alipore, 700053, Kolkata, India

(Email: rishi.richa24@gmail.com)

Abstract

Hunger and malnutrition are serious threats to humanity especially in a over populated country. Alternate food supply and nutrition is essential due to continuous loss of soil nutrition and subsequent less food production. Insects are the most abundant and most diverse multicellular organisms account for about 80% of all species on earth. They belong to different groups such as Coleoptera (beetles, often larvae) (659), Lepidoptera (caterpillars) (362), Hymenoptera (wasps, bees, and ants) (321), Orthoptera (crickets, grasshoppers, and locusts) (278), Hemiptera (true bugs) (237), Odonata (dragonflies) (61), Isoptera (termites) (59), Diptera (flies) (37), cockroaches (37), and others (9%). Worldwide, there are more than 2111 edible insect species. In India, Coleopterans (34%) are the most preferred edible insects followed by Orthoptera (24%), Hemiptera (17%), Hymenoptera (10%), Odonata (8%), Lepidoptera (4%), Isoptera (2%), and Ephemeroptera (1%). Edible insects are consumed as boiled, cooked, fried, roasted/ toasted; some insects such as *Cossus* sp., larvae and pupae of ants, bees, wasps, and hornets as well as honey bee comb, bee wax are consumed raw. Certain edible insects are either fully domesticated (e.g., *Antheraea assamensis*, *Apis cerana indica*, and *Samia cynthia ricini*) or semi-domesticated in their natural habitats (e.g., *Vespa mandarinia*, *Vespa soror*, *Vespa tropica tropica*, and *Vespula orbata*), and have vast potentials to commercialize these insects. Insects have protein, fat, calcium, iron, and zinc as nutrients. In contrast to animal protein they (insects) are cost effective. Though it has high nutritional and medicinal value and help to secure malnutrition but has less consumer acceptability due to emotional factors. Hence, there is need of processing of edible insects and development of different value added products to secure the malnutrition and consumer acceptance. There are different high temperature processing methods such as blanching, pasteurization, and commercial sterilization, dehydration, low-temperature processing refrigeration and freezing and fermentation technology through which produced for common masses.

Keywords: edible insect, processing, food security, malnutrition

The role of citizen science in studying hemiptera biology and conservation in India

Purnima Kumari

Zoological Survey of India, Western Regional Center, Pune, India

(Email: purnimadtg@gmail.com)

Abstract

The landscape of big data on ecology, biodiversity and conservation has been transformed by Citizen Science. In India, new data on the biology and distribution of hemipteran's namely cicadas, aphids, planthoppers, leafhoppers, assassin bugs, shield bugs, and bed bugs are being generated through the 'Bugs Of India' and 'Hemiptera of India' websites with contributions from a large network of amateur naturalists. The new species descriptions, species rediscoveries, and range extensions into India have been led by these efforts. These citizen science platforms are increasing our knowledge of hemipteran insects' distributions, larval host plants, early stages, and other natural history information, including that of many rare, endangered, and endemic species. In India, there has been no large scale rigorous documentation or long-term monitoring of insect populations of insect biodiversity. This article explains role of citizen science in studying Hemiptera biology and conservation in India.

Keywords: Citizen Science, Bugs Of India, species descriptions, species rediscoveries, biodiversity and conservation

A Study on Mangrove Associated Avian Fauna in Vembanad Kole Wetlands, Kerala

Sethu M. R. and V. P. Limna Mol

Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, India

(Email: sethumadhavn7@gmail.com)

Abstract

Mangrove ecosystems provide important habitats for a variety of avian fauna, including migratory birds and resident species that depend on these habitats for nesting, foraging, and roosting. The Kole Wetlands of Central Vembanad Lake is one such complex wetland ecosystem in Kerala, India, that includes extensive mangrove forests and supports a diverse array of bird species. The mangrove-associated avian fauna of the Kole Wetlands includes several species of birds such as the White-bellied Sea Eagle (*Haliaeetus leucogaster*), Osprey (*Pandion haliaetus*), Brahminy Kite (*Haliastur indus*), Western Reef Heron (*Egretta gularis*), Little Heron (*Butorides striata*), and the Common Kingfisher (*Alcedo atthis*). Remote sensing (RS) and geographic information system (GIS) can be used to map and analyze the distribution of these bird species within the Kole Wetlands. RS data can be used to identify and map the extent of the mangrove ecosystems within the wetlands, which are the primary habitat for these bird species. GIS can then be used to overlay the distribution maps of these bird species onto the mangrove maps, to identify the areas of the wetlands where these birds are most commonly found. This information can be used to develop conservation strategies to protect these birds within the Kole Wetlands.

Keywords: Remote sensing, GIS, Avian fauna, wetlands, Lake ecosystems

Cheetah reintroduction in relation to SDGs

P. S. Bhatnagar
ZSI, CZRC, Jabalpur, India
(Email: zsiczrcjabalpur@gmail.com)

Abstract

There have been several studies on Cheetah reintroduction perse and recently African Cheetahs have been reintroduced at Kuno National Park, Sheopur district of Madhya Pradesh, India and there are plans to reintroduce at elsewhere in India. Asiatic Cheetah's original range included vast areas in India as well as other parts of Asia. SDG is an important concept so it is worthwhile to relate Cheetah reintroduction to SDGs so that local community support and other benefits are ensured and efforts are sustainable. SDG goal 15 (Life on land) is directly related to this and within this SDG, 15.5 deals with combating species extinction. As SDGs rest on three pillars; social, economic and environmental, it is needed to incorporate these aspects in a well integrated manner. Furthermore, SDG 15 should relate to SDG 1 (no poverty, SDG 3 (good health and well being), SDG 5 (gender equality), SDG 6 (clean water and sanitization) and SDG 13 (climate action). These are some of the SDGs to which SDG 15 can relate while doing Cheetah reintroduction in in India.

Keywords: Reintroduction, SDG, Cheetah, Asia, Kuno National Park

Sustainable Development Goals to Conserve the marine fish Ecosystem: An Overview

Sandeep Kumar and Aparna S. Kalawate
Zoological Survey of India, Western Regional Center, Pune, India
(Email: sandyrock707@gmail.com)

Abstract

Sustainable utilization of oceans, seas and coastal areas, is recently becoming one of the primary goals for conservation of aquatic ecosystem. Due to climate change, ocean warming, acidification, unlimited extraction of marine resources various morphological alterations have occurred in marine and coastal areas. For instance, the ongoing industrialization and unethical intensive agriculture activities in the coastal areas of country are contributing to marine pollution (plastic and metallic). It has been observed that eating such contaminated fishes (Pampus, Salmon, Trout, Tuna etc.) can expose people to hazardous metals (As, Hg, Pd, and Cd) and microplastics. These heavy metals from natural and anthropogenic sources continuously enter the aquatic ecosystem where they pose serious threat due to toxicity, long persistence, bioaccumulation and biomagnification. Besides, unsustainable extraction of marine resources and overfishing also causing imbalance in marine ecosystems (dramatic population decline in many fish species) and putting food security and regional stability at risk. Rise of ocean temperature and loss of oxygen act concurrently with ocean acidification which constitute the "deadly trio" of climate change pressures on the marine ecosystem. Therefore, it is mandatory to keep a check on these effects on marine ecosystem. Considering the aforementioned aspects, this overview article is based on factors that can be recorded to identify these adverse effects and to achieve sustainable development goals to conserve the marine fish ecosystem. These factors include sustainable land-based and marine-based industrial activities, besides taking adequate sustainable measures to reduce the negative anthropogenic impacts on the marine environment.

Keywords: Marine fish, heavy metals, bioaccumulation, biomagnification, overfishing

Genetic diversity, population structure and gene flow pattern among populations of Blackbuck *(Antilope cervicapra)*

Ranjana Bhaskar and Praveen Kanaparthi

Molecular Systematics laboratory, Zoological Survey of India, Southern Regional Center, 130 Santhome High Road, Chennai-600028, India

(Email: ranjana.bhaskar@gmail.com)

Abstract

Blackbuck (*Antilope cervicapra*) is a threatened species and distributed only in the Indian subcontinent. Populations of blackbuck are declined in many places for various reasons, such as hunting, stress, habitat loss, diseases, poaching, road accidents, habitat fragmentation, predation pressure etc. Their range decreased sharply during the 20th century. There is limited information on blackbuck populations and their genetic diversity in India. For the phylogenetic and genetic diversity analyses of blackbuck, we collected faecal pellets from distribution ranges across India, and extracted mtDNA sequences of cytochrome b (Cyt b) and the control region (CR) from 350 faecal pellets from its distribution ranges. We analyzed the genetic structure of two mitochondrial markers, the CR and Cyt b, separately and in a combined manner. The haplotype diversity and nucleotide diversities of CR were 0.97 and 0.047, respectively, and were higher than those of Cyt b. A Bayesian phylogeny and haplotype network based on the CR and combined dataset signified several distinct haplotype clusters within blackbuck populations. The analysis of molecular variance of the combined data set revealed genetic variations within a population. Mismatch distribution analysis revealed that blackbuck populations underwent complex changes with analysis of the combined dataset in the overall population. The results provide evidences that blackbucks in different geographic locations have distinct population structure.

Keywords: Blackbuck, Bayesian phylogeny, Haplotype, Conservation Status, Distribution Range

Diversity of Butterflies in Jammu and Kashmir Union Territory, India: Overview

Taslima Sheikh[1] and P. C. Pathania[2]

[1]Department of Zoology, Sunrise University, Alwar-301028, Rajasthan, India

[2]High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan -173211, Himachal Pradesh, India. Email: sheikhtass@gmail.com

(Email: sheikhtitlii@gmail.com)

Abstract

A checklist of all known butterfly species recorded in the Union Territory of Jammu & Kashmir (UT J&K) has been compiled. In all, the checklist covers 308 species belonging to 154 genera under 14 subfamilies of 6 families of order Lepidoptera. Eighteen species of butterflies are being reported for the first time from Jammu and Kashmir after surveying the whole Jammu and Kashmir region. Beside this, important nectar plants are also being recorded from the different region/localities of the said area which shall sustain are sufficient population of butterfly over the years. The detailed aspects on their distribution, host plants, habitat and new records are highlighted herein.

Keywords: Butterfly, diversity, Jammu and Kashmir, India

Kerala BioBlitz- A citizen science initiative to learn and monitor backyard biodiversity

Maneeja Murali and Priyadarsanan Dharma Rajan

Ashoka Trust for Research in Ecology and the Environment, Community Environmental Resource Centre (ATREE CERC), India

(Email: maneeja.murali@atree.org)

Abstract

Kerala Bioblitz (KB) is a unique biodiversity documentation program initiated by ATREE-CERC in association with the India Biodiversity Portal (IBP). It provides a platform for students to enhance their senses to observe the biodiversity around them, appreciates the values and services they provide, and cater for better conservation and management. The main objective of the program is to identify and document the backyard biodiversity and provide the students an opportunity to learn about the life around their homes and premises. This online platform having entire program was started during the COVID pandemic period. A mobile application named "Kerala Bioblitz" was developed and made available in the Play Store. The observations collected by participants were uploaded to IBP for expert identification. We created taxonomist groups by including the researchers, retired professors, naturalists, etc., for local biodiversity identification in addition to IBP. As part of KB, we have conducted a webinar series for students and teachers on topics related to photography, taxonomy, biodiversity documentation, and data analyses. To motivate the observation skills of students, we have provided star ratings according to the number of observations and distributed a VIBGYOR certificate to students who had uploaded 1000 or more observations. A total of 65 colleges from different parts of Kerala are part of this program. KB recorded 16,220 biodiversity observations until February 2023, and the program is still going on. A total of 27,933 taxa has been identified so far. Plants and arthropods are the most observed groups. KB has 483 active users in Kerala and resulted in two university projects derived out of KB initiative. According to teachers and students, the Kerala Bioblitz helped them generate curiosity about nature and biodiversity and to some extend reduced the mental stress during COVID.

Keywords: Backyard biodiversity, Kerala, India Biodiversity Portal, Webinars, Covid pandemic.

First Successful Conservation breeding programme of Gharial *(Gavialis gangeticus)* from West Bengal

Sanjit Kumar Saha[1], Dabir Hossain[2], Dipankar Sarkar[3], Mukesh Sarkar[4], Saurabh Chaudhuri[5]

[1]West Bengal Forest Service, Deputy Conservator of Forests, Personnel, Directorate of Forests, Government of West Bengal,

[2]Assistant Veterinarian, [3]Zoo Keeper, [4]Zoo Supervisor of Rasikbeel Mini Zoo, Coochbehar; [5]Indian Forest Service, Member Secretary, West Bengal Zoo Authority, West Bengal

Email: dcfp-wb@nic.in

Abstract

As per the IUCN Red lists of Threatened Taxa (2019), present population of Gharial (*Gavialis gangeticus*) in the world is 300-900, with the decreasing status of 'Endangered' to 'Critically Endangered' from 1982 to 2007 and till date. With this significance and learning from the failure of 2021, Rasikbeel Mini Zoo of Coochbehar under the West Bengal Zoo Authority, have tried first time for Conservation breeding of Gharial, a fish eating crocodile in captivity in 2022 by Assisted Breeding Technologies from the routine maintenance of water depth to facilitate under water mating, enrichment with contiguous near natural sand bad for nesting, egg laying, non invasive mode of CCTV monitoring, egg collection, artificial incubation; controlling of temperature (29°C to 34 °C) and relative humidity (74 to 75% at incubation, 84 to 90% at hatching); x-ray imaging of the zygote development, assisted hatching to post birth care, with the objective to increase the dwindling number of population. Founder stock of 11 parent Gharials including 2 males and 9 females, involved in reproduction were rescued from different parts of West Bengal at different times and also procured from a Zoo. This hereditary difference gave the background to maintain genetic diversity in the offspring, with the future objective of reintroduction of genetically viable population in the wild. From 3 clutches 66 eggs were collected out of total laid eggs of 90, with the specific marking of number, layer, clutches and arrangement pattern on egg shell. 7 eggs were found cracked. Effectively (66-7) =59 intact eggs were incubated in controlled condition. With the assisted hatching 44 offspring took birth during 27/5/22 to 8/6/22, with the success rate of (44/59x100) =74.57%. Finally, 42 are survived, with survival rate of (42/44 x 100) = 95.45%.

Keywords: Gharial, Reproduction, Conservation, Assisted Breeding, Captivity, Offspring

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भारतीय प्राणि सर्वेक्षण
ZOOLOGICAL SURVEY OF INDIA
Director's Phone : 033-2400-6820
E-mail : director@zsi.gov.in

पर्यायवरण, वन एवं जलवायु परिवर्तन मंत्रालय
Ministry of Environment, Forest and Climate Change
भारत सरकार
Government of India

प्राणि विज्ञान भवन
Prani Vigyan Bhawan
'एम ब्लॉक' न्यु अलीपुर
'M' Block, New Alipore
कोलकाता/Kolkata - 700 053

Telefax : 033-2400-8595
E-mail : hoo@zsi.gov.in
Website : www.zsi.gov.in