ASIAN SOCIETY OF ARACHNOLOGY

SIXTH CONFERENCE AND MEETING

20-23 DECEMBER, 2021

JOINTLY ORGANIZED BY

SACRED HEART COLLEGE, KOCHI

AND

DEVA MATHA COLLEGE, KURAVILANGAD

ASA @ KOCHI

ORGANIZERS

Mathew M. Joseph

Sunil Jose K

Asian Society of Arachnology

Sixth Conference and Meeting

Kochi, 2021

Jointly organized by

Sacred Heart College, Thevera, Kochi & Deva Matha College, Kuravilangad

Organizers

Mathew M. Joseph

Sunil Jose K

Contents

Mathew M.Joseph Sunil Jose K

Welcome to 6th ASA 2020 at Kochi, India.

It is our great honour and pleasure to welcome each one of you to the sixth Asian Society of Arachnology (ASA) Conference and Meeting, which will be held in Kochi, the "Queen of the Arabian Sea."

The Asian Society of Arachnology's sixth Conference and Meeting is being jointly organized by Sacred Heart College and Deva Matha College, both of which are affiliated with Mahatma Gandhi University in Kottayam.

The ASA, founded in 2012, is the regional scientific society of Arachnology of Asia and provides the primary forum for arachnologists by hosting annual conferences. The sixth conference of ASA is the second ASA meeting held in India after the third ASA held at Amravati in 2015.

The ASA conferences bring together Asian and worldwide arachnologists who study Asian and other regional arachnids on a yearly basis.

The conference, which was initially scheduled to take place in November 2020, has been postponed. Even with an additional year's delay due to the covid 19 pandemic, the objective was partially achieved. As a result, the ASA meeting will be held in a dual-mode for the first time, with online and offline attendees.

We owe a debt of gratitude to President Prof. Li Daiqin for his invaluable assistance in organizing this conference. Additionally, we would like to express our appreciation to Dr.Peter Jagaer and all the council members for their constructive support throughout the process. We also wish to express our gratitude to Rev.Fr.Dr.Jose John CMI, principal of Sacred Heart College, and Dr.Sunil C.Mathew, principal of Deva Matha College, for their unwavering support and guidance.

This conference will have 40 offline and 40 online participants from the 93 registered participants. Eleven countries will be represented at the conference, including China, Singapore, Malaysia, Sri Lanka, Germany, Finland, the Netherlands, the Czech Republic, Thailand, Japan and India.

We would like to extend a warm welcome to all participants and wish you a productive four days at the conference.

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Peter Jaeger - Founding Ex-Officio (Germany)

VENUE

Sacred Heart College, Thevera, Kochi

Melesius Hall, Sacred Heart College, Thevera, Kochi

Hotel Harbour View Residency, Kochi

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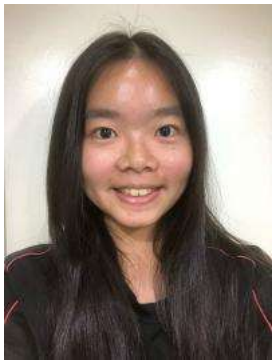

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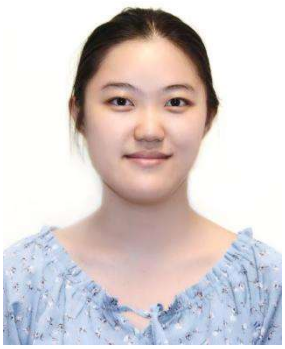

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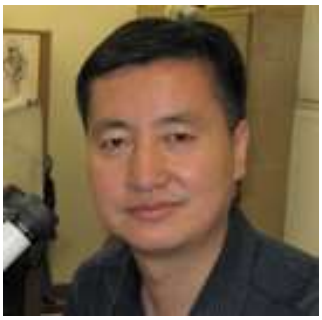

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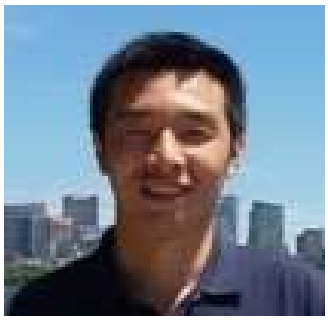

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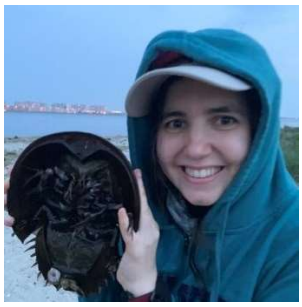

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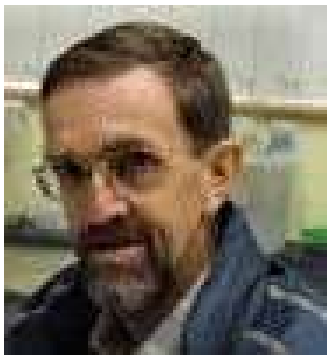

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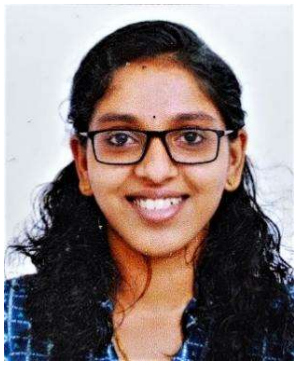

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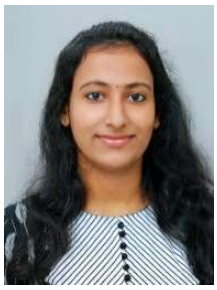

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Proceedings of the conference

The conference proceedings will be published as a special edition of 'ENTOMON' (Print ISSN: 0377-93350, indexed in Web of Science and UGC Care List) after the peer-review process.

ENTOMON is the official publication of the Association for Advancement of Entomology (AAE), a non-governmental organization of Entomologists in India and abroad, since 1975. It publishes original research articles in Entomology and related branches of science.

Outstanding articles, invited papers projecting novel ideas/ technology beneficial to the members of the AAE also may be considered for publication. Announcements of seminars/ symposia, book reviews and other items of entomological interest will also be considered for publication.

Research papers are to be covered in 4-10 printed pages and Short Communications in 1 - 3 pages.

The articles should be organized in the format seen in the latest issue of ENTOMON. Full papers consist of Title, Author's name/s and address, Abstract, Keywords, Introduction, Material and Methods, Results, Discussion, Acknowledgements, and References. Short Communication should be presented in the same format as full papers but without subheadings.

Submission of a manuscript to ENTOMON implies that the content has neither been published earlier nor will be sent to any other publisher without intimation to ENTOMON.

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At least one of the authors should be a member of AAE. However, authors need to register with the journal before submitting it.

Details regarding the nature of submission of papers for the proceedings will be intimated to the participants after the conference.

Program Schedule

Day	Time	Speaker	No	Subject
1	9.30			Inaugural session
1	10.30			Conference Photo
1	10.45			Tea break
1	10.55	Seah Wan Xin Rachel		Introducing the plenary speakers Sven Weber & Anja Melcher
1	11.00	Sven Weber & Anja Melcher		**Plenary talks:** Biodiversity assessments in the 21st century - and what spiders have to do with it.
1	11.57	Runbiao Wu		Introducing the session host Zhisheng Zhang
1	12.00	Li Fan	1	The complete mitochondrial genome of the intertidal spider (*Desis jiaxiangi*) provides novel insights into the adaptive evolution of the mitogenome and the evolution of spiders
1	12.15	Xi Yuan	2	Studying adaptive evolution to cave environment of cuticle in Chinese *Leptonetela* spiders based on transcriptomics
1	12.30	Mathura Tharmarajan	3	DNA barcoding, Molecular phylogeny and Taxonomy of selected genera of cobweb spiders (Araneae: Theridiidae) of Sri Lanka
1	12.45			Session Photo
1	12.50			Lunch
1	14.45	Rui Zhong		Introducing the session host Jie Liu
1	14.50	Li Daiqin	4	From crypsis to masquerade: ontogeny changes the colour defences of a crab spider hiding as bird droppings
1	15.00	Zheng Fan	5	The chromosome level genome of *Trichonephila antipodiana* revels its adaptive evolution of polyphagy
1	15.15	Amrita M. Shirbhate	6	Salticids of Patur region in Maharashtra
1	15.30	Zhou Wei	7	Sexual selection on jumping spider color pattern: investigation with a new quantitative approach
1	15.45			Session Photo
1	15.50			Tea break
1	15.57	Sheetal Laxman Zend		Introducing the session host Peter Jaeger
1	16.00	Milind Shirbhate	8	Araneids of Katepurna Sanctuary Akola

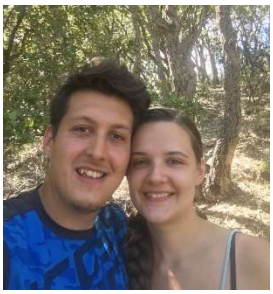
1	16.15	Elizabeth V Mathew	9	Taxonomy of *Cyrtophora* sp of Western Ghats
	16.30	Jithin Johnson	10	Diversity and evolution of the pseudoscorpion family Chthoniidae in the Western Ghats of India
	16.45	Reshmi Sekhar	11	Two species of genus *Argyrodes* Simon, 1864 (Araneae: Therididdae) from Kerala
	17.00	Session Photo		
2	09.30	Nishi Babu		Introducing the plenary speaker Nathan Morehouse
2	09.35	Nathan Morehouse		**Plenary talks:** Evolution of Looking and Seeing: New insights from Jumping Spiders
2	10.30	Aneesh Mathew Vergis		Introducing the session host Milind Shirbhate
2	10.35	Kun Yu	12	*Charippus* Thorell, 1895, a poorly studied genus of euophryine jumping spiders (Araneae, Salticidae)
2	10.50	Changhao Hu	13	Global Diversity of Pseudopoda Spiders (Araneae: Sparassidae)
2	11.05	Tan Min	14	Variation in visual responsiveness of motion in jumping spiders
2	11.20			Session Photo
2	11.25			Tea break
2	11.30	Anusmitha Domichan		Introducing the session host John Caleb
2	11.33	Rui Zhong	15	Safety becomes more and more important in cobweb spiders.
2	11.48	Nishi Babu	16	Species richness and vertical stratification of family Tetragnathidae (Araneae) in paddy fields of selected areas at Kuttanad.
2	12.05	Aswathy S.	17	Burrow morphology and microhabitat characteristics of an iridescent tarantula Haploclastus devamatha Prasanth & Jose, 2014 from Western Ghats, Kerala (Araneae: Theraphosidae)
2	12.20	Anitha Abraham	18	Spider silk-an alternative promising antibiotic.
2	12.35			Session Photo
2	12.40			Lunch
2	14.27	Linta Joseph		Introducing the session host Fr.Jobi Malamel CMI
2	14.30	Minu M	19	Diversity and Seasonal Variation in Spider Abundance from Salim Ali Bird sanctuary, Thattekkad, Kerala
2	14.45	Ashirwad Tripathy	20	New distributional record of Coenoptychus pulcher, Simon, 1885 (Araneae: Corinnidae) with notes on morphology from Eastern India.
2	15.00	Hemant Vijay Karkhanis	21	Spider Diversity at Godrej Mangroves, Vikhroli, Mumbai, Maharastra

2	15.15	Sheetal Laxman Zend	22	Faunistic diversity of spiders at Godrej Mangroves, Vikhroli, Mumbai, Maharastra
2	15.30			Session Photo
2	15.35			Tea break
2	15.42	Karthika K		Introducing the session host Stephanie Loria
2	15.45	Runbiao Wu	23	Inside the spider: gut microbial diversity and function in two closely related Pardosa spiders
2	16.00	Amelia Joyce Philip	24	Non-consumptive effects by spider and bird on herbivory rate
2	16.15	Caroline Fukushima	25	Who wants to buy a tarantula? Some results of a global survey about tarantula pet trade and conservation.
2	16.30	Peter Jaeger	26	A diverse lineage of ground-dwelling Ctenidae in Asia
2	16.50			Session Photo
2	17.00			ASA meeting
2	18.00			Concluding Meeting
3	09.30	Mathura Tharmarajan		Introducing the plenary speaker Suresh P. Benjamin
3	09.33	Suresh P. Benjamin		**Plenary talks:** Serendipity is the taxonomist's strongest ally: the discovery of spiders trapped on mountains trapped in a tropical island
3	10.27			Introducing the session host Booppa Petcharad
3	10.30	ASIMA A	27	Araneid Spiders of Shendurney Wildlife Sanctuary- A Short Term Study.
3	10.45	Anusmitha Domichan	28	First record of *Oedothorax rusticus* Tanasevitch, 2015 and Neriene birmanica
3	11.00	Irina Das Sarkar	29	Indian Arachnology in the 21st century
3	11.17			Session Photo
3	11.20			Tea break
3	11.27	Asima A		Introducing the session host Priyanka Hadole
3	11.30	Karthika K	30	New distributional record of *Annandaliella travancorica* Hirst 1909 from Western Ghats, Kerala
3	11.45	Namrata Kanjibhai Hun	31	A review and first geographic distribution record of *Chilobrachys fimbriatus* Pocock, 1899 (Araneae: Mygalomorphae: Theraphosidae) from Girnar Wildlife Sanctuary Junagadh Gujarat India.
3	12.00	Devi Priyadarshini	32	Comparative study on spider diversity of paddy fields and protected areas of Western Odisha
3	12.15	Linta Joseph	33	Preliminary Checklist of Spiders from Periyar Tiger Reserve (Vallakadavu Range), Western Ghats of Kerala

3	12.32			Session Photo
3	12.35			Lunch
3	14.25			Introducing the session host Elizabeth V. Mathew
3	14.30		34	Session 34: Cultural Programme
3	14.45		35	Session 35: Cultural Programme
3	15.00	Mogana Sundram a/l S. Arumugam	36	Preliminary Survey of Spiders (Arachnida: Araneae) In Kuala Selangor Nature Park, Kuala Selangor, Malaysia
3	15.15	Seah Wan Xin Rachel	37	Opsins variation and differential expression in jumping spiders
3	15.32			Session Photo
3	15.35			Tea break
3	15.42			Introducing the session host
3	15.45	Poster Li Daiqin	38	Masquerading predators deceive prey by aggressively mimicking bird droppings in a crab spider
3	16.00	Poster - Abira Satkunanathan	39	Diversity and conservation of Nannenini Jumping Spiders (Salticidae) in rapidly changing cloud forest of Sri Lanka
3	16.15	Poster	40	Session 40:
3	16.30	Poster	41	Session 41:
3	16.46			Session Photo
3	16.47			Valedictory Session
3	17.50			Concluding

PLENARY LECTURES

20 December, 2021



Sven Weber & Anja Melcher
University of Trier, Germany

Biodiversity assessments in the 21st century - and what spiders have to do with it

Anthropogenic stress significantly reduces biodiversity worldwide. Scientists are researching the insect decline to finally identify the main drivers of this observation. The biggest problem is, that we do not know much about the present biodiversity status, and considerably less for the last decades. Since time is of the essence, classical monitoring methods are the best solution to obtain fast biodiversity assessments. We developed a non-invasive method based on the leaf samples´ environmental DNA to analyse arthropod communities. As a result of our community analyses, we present novel and interesting insights of the canopy biocoenoses and changes over the last three decades in Germany. We think this method would be beneficial for conservationists all over the world, as this offers a noninvasive way to monitor arthropod biodiversity for future studies. Another novel and, compared to conventional methods minimally invasive approach, is to utilize predatory taxa such as spiders as collectors for arthropod communities and tools to assess biodiversity.

Spiders are top predators in temperate grassland biomes. Their diet is susceptible to any factors that change the abundance and biodiversity of their arthropod prey, as well as competition and araneophagic predators. Using molecular gut content analyses, we investigate spider diet composition in grassland ecosystems. By combining the findings with data of the taxonomic composition of spider- and arthropod communities, we can draw valuable information on the relationship between environmental conditions, prey availability and factual prey composition. Preliminary results show great success in enriching prey DNA using specialized primers, as well as a high diversity in spider diet composition.

The developed methods and the results of this study have the potential to be used in future monitoring projects around the world to help us to understand arthropod biodiversity better.

21 December, 2021

Nathan Morehouse
Associate Professor,
Department of Biological Sciences
Director, Institute for Research in Sensing
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Evolution of Looking and Seeing: New insights from Jumping Spiders

Abstract

Courtship displays are among nature's most exuberant expressions of biodiversity. Despite their diminutive size, jumping spiders engage in some of the world's most complex courtship displays, rivaling the flamboyance of other more well-known groups like birds of paradise or peacocks. But how do jumping spiders perceive these complex displays? In his plenary, Dr. Morehouse will share new insights from his research team that uncover how jumping spiders see color, pattern, and motion, and how such perceptual abilities have evolved across the group. In addition, he and his team, in collaboration with Dr. Beth Jakob, have begun exploring how females use the movable gaze of their principal eyes to focus their visual attention on specific elements of male displays during courtship. He will share brand new results from this work that not only shed light on how females manage where they look during courtship, but also on how male displays have evolved to capture and retain female visual attention.

22 December, 2021

Serendipity is the taxonomist's strongest ally: the discovery of spiders trapped on mountains trapped in a tropical island.

Suresh P. Benjamin

National Institute of Fundamental Studies, Hantana Road, 20000 Kandy, Sri Lanka and Zoologisches Forschungsmuseum A. Koenig, Adenauerallee 160, 53113 Bonn, Germany.

Sri Lanka is one of the smallest but biologically diverse countries in Asia. The Western Ghats and Sri Lanka together are considered as one of the world's biological hotspots. However, many invertebrates, including spiders, have not received much scientific attention until recently. Since recently, students of my lab at NIFS have been working to understand how Sri Lankas spider biodiversity is moulded through processes like speciation and adaptive radiation as well as describing the newly discovered taxa using morphology and molecules. In this talk, I will explore the advances made in understanding the spider biodiversity of Sri Lanka. There is a certain serendipity in the convergence of morphology, molecules, phylogenetics, and Taxonomy!

ORAL PRESENTATIONS

The evolution of jumping spider colour pattern: investigation with a new quantitative approach.

Wei Zhou[a], Long Yu[a,b], Bernetta Z. W. Kwek[a], Ge Jin[c], Hua Zeng[a,d] and Daiqin Li[a]


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Abstract

How animals assess information encoded in individual colour patches, have been extensively studied, yet the role of both individual colour patches and gross colour pattern (i.e., the combination of multiple colour patches) in sexual selection remains understudied. We investigated the variation in both individual colour patches and gross colour patterns between the sexes and between populations and explored if sexual selection drives the evolution of colour patterns in the jumping spider *Siler semiglaucus*. We first quantified sexual dimorphism in *S. semiglaucus* in both individual patches and gross colour patterns using the newly developed quantitative colour pattern analysis (QCPA) framework and also compared the colour pattern between two different populations (China and Singapore). After detecting sexual and populational differences in colour coverage and pattern contrast, we manipulated the abdomen colour pattern of Singapore males and had them engage in both female mate choice and male contest trials. Our results showed that females from Singapore spent more time watching males with lower pattern contrast and greater red coverage during mate assessment, suggesting that they evaluate information from both individual patches and the gross color pattern of males. However, the male colour pattern had no significant effect on the outcomes of male contests. Thus, we concluded that the observed sexual dimorphism in colour patterns may have evolved primarily through female mate choice in Singapore *S. semiglaucus*, although there may be variation in the relative strength of sexual and natural selection between populations. Our study suggests the potential of QCPA framework for quantifying sexual dimorphism and population variation in within-pattern conspicuousness from an intraspecific perspective in invertebrates and highlights the importance of both individual colour patches and gross colour pattern in sexual selection.

Key words: Gross colour pattern, salticid, sexual dimorphism, sexual selection, visual signaling, *Siler semiglaucus*.

From crypsis to masquerade: ontogeny changes the colour defences of a crab spider hiding as bird droppings

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Abstract.

Selection imposed by visually-hunting predators has driven the evolution of colour-based antipredator defence strategies such as crypsis, masquerading, mimicry and aposematism. Individuals of many animals are generally considered to rely on a single type of defence strategy, but individuals of some species use multiple colour-based defences. Many animals switch between colour-based defences against visually-hunting predators during ontogeny. However, why this occurs remains poorly understood. The crab spider *Phrynarachne ceylonica* is an often-cited example of a bird dropping masquerade. It has recently been demonstrated that *P. ceylonica* crab spiders gain protection from their predators by being misidentified as bird droppings by their predators. *P. ceylonica* females show an ontogenetic shift in colour defences: early instars possess a dark and cryptic form, while at later instars and as adults, the spiders resemble bird droppings. We hypothesised that such a change might be driven by differential changes in predation risk of two defence strategies with increasing body size due to ontogeny. We tested this hypothesis by presenting naïve domestic chicks with 3D printed artificial spiders of two different sizes (small, large) and two colours (dark, bird dropping-like), and determined if larger bird dropping-like spiders are more readily found and attacked than cryptic forms by chicks. We found that small cryptic spiders were more difficult to detect than small bird dropping masquerading spiders, but large cryptic spiders were attacked much more quickly and more frequently than large bird dropping masquerading spiders. Increasing predation pressure on larger, cryptic spiders during ontogeny suggests that switching to bird dropping masquerading may be a more effective defence as spiders increase in size. We thus conclude that the ontogenetic shift from crypsis to masquerading is adaptive. Our study will shed light on our understanding of the initial evolution of bird dropping masquerade.

Keywords: Camouflage, colour, antipredator, masquerade, ontogeny, visual modelling

Global Diversity of *Pseudopoda* Spiders (Araneae: Sparassidae)

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Abstract.

The huntsman spider genus *Pseudopoda* Jäger, 2000 contains 142 species worldwide, which are exclusively distributed in the southern, eastern and north-western parts of southeast Asia. However, the diversity of this genus is significantly higher than the known species. In the past ten years, the colleagues of faculty of resources and environmental sciences carried out a series of field trips in China and borrowed lots of specimens worldwide, yield more than 100 new species. In the current study, we carried out systematic research of taxonomy for this genus, with reporting 104 new species (*P.daiyunschana* sp. nov., *P. huangschana* sp. nov., *P. yunfengschana* sp. nov. and so on), two supplemental descriptions of single gender (*P. exigua* (Fox, 1938), *P. gexiao* (Zhao& Li, 2018)), and 50 known species. We provided detailed morphological descriptions, illustrations and photos. For the known species, we provided the detailed photos for the first time. In addition, we took an ecological analysis to model the potential environmental factors affecting the distribution of *Pseudopoda* species. More than 600 collection events belonging to 246 species are collected from all previously published *Pseudopoda* distribution data and novel data obtained from fieldwork of our laboratory. Our research indicated that the Precipitation of Warmest Quarter, Min Temperature of Coldest Month, Mean Diurnal Range and Elevation exerted a vital part in the distribution of *Pseudopoda* spiders. Therefore, *Pseudopoda* spiders is highly diverse, sensitive to the global climate change, and also a good model to analyse evolution and biogeography in Asia.

Keywords: *Pseudopoda*, distribution, taxonomy, diversity, ecology.

The complete mitochondrial genome of the intertidal spider (*Desis jiaxiangi*) provides novel insights into the adaptive evolution of the mitogenome and the evolution of spiders.

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Abstract

Although almost all extant spider species live in terrestrial environments, a few species live fully submerged in freshwater or seawater. The intertidal spiders (genus Desis) built silk nests within coral crevices can survive submerged in high tides. The diving bell spider, *Argyroneta aquatica*, resides in a similar dynamic environment but exclusively in freshwater. Given the pivotal role played by mitochondria in supplying most energy for physiological activity via oxidative phosphorylation and the environment, herein we sequenced the complete mitogenome of Desis jiaxiangi to investigate the adaptive evolution of the aquatic spider mitogenomes and the evolution of spiders.

We assembled a complete mitogenome of the intertidal spider Desis jiaxiangi and performed comparative mitochondrial analyses of data set comprising of Desis jiaxiangi and other 45 previously published spider mitogenome sequences, including that of *Argyroneta aquatica.* We found a unique transposition of trnL2 and trnN genes in *Desis jiaxiangi.* Our robust phylogenetic topology clearly deciphered the evolutionary relationships between *Desis jiaxiangi* and Argyroneta aquatica as well as other spiders. We dated the divergence of *Desis jiaxiangi* and *Argyroneta aquatica* to the late Cretaceous at ~ 98 Ma. Our selection analyses detected a positive selection signal in the nd4 gene of the aquatic branch comprising both Desis jiaxiangi and *Argyroneta aquatica*. Surprisingly, *Pirata subpiraticus, Hypochilus thorelli,* and *Argyroneta aquatica* each had a higher Ka/Ks value in the 13 PCGs dataset among 46 taxa with complete mitogenomes, and these three species also showed positive selection signal in the nd6 gene.

Our finding of the unique transposition of trnL2 and trnN genes indicates that these genes may have experienced rearrangements in the history of intertidal spider evolution. The positive selection signals in the nd4 and nd6 genes might enable a better understanding of the spider metabolic adaptations in relation to different environments. Our construction of a novel mitogenome for the intertidal spider thus sheds light on the evolutionary history of spiders and their mitogenomes.

Keywords: Mitogenome, Phylogeny, Evolution, Positive selection, *Desis jiaxiangi, Argyroneta aquatica.*

DNA barcoding, Molecular phylogeny and Taxonomy of selected genera of cobweb spiders (Araneae: Theridiidae) of Sri Lanka

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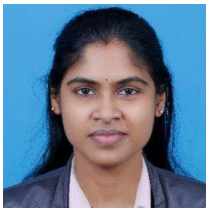


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Abstract

Patterns of present-day faunal diversity may provide insights into their origin. Historically older islands such as Sri Lanka may have been accumulating species for an extended period. Nevertheless, Sri Lanka contains a rich assemblage of endemic spider lineages. A recent study stated that in Sri Lanka, over 500 species of spiders are known, and they are under 45 families. Endemic spider fauna is limited to South-West and central highlands, and they are mostly related to the Western Ghats of India. Family Theridiidae is one of the seventh largest and diverse families in the Araneae represented by 124 genera with over 2500 species. Cobweb spiders of Sri Lanka are insufficiently explored. So far, only 31 species have been recorded and described. An ongoing survey of spider diversity in Sri Lanka revealed the presence of 4 new species of *Rhomphaea*, two new species of *Neospintharus*, four new species of *Meotipa* and a new species of *Argyrodes*. Taxonomic revision and multi-locus molecular phylogeny of these new taxa with other Asian and American species were constructed to investigate the evolutionary origin, divergent times, and their biogeographical origins. Sampling was done by beating vegetation and hand collection all around the country, and species distribution was mapped in QGIS v 3.14. Collected specimens were catalogued and preserved in 70% and 100% ethanol. Species were identified with an Olympus SZX7 stereomicroscope using available literature. DNA was extracted from two legs of each specimen using the Qiagen DNeasy Tissue kit. PCR was done with previously successfully tested primers of three genes: *16S*, *COI* and *28S*. Before likelihood and Bayesian analysis, Partition finder software v 2.1.1 was run to find the best fit model for each partition. The lengths of targeted fragments: *16S* ~536bp, *28S* ~544bp and *CO1* ~1067bp. Likelihood and Bayesian topologies agree on the fundamental classification of subfamily Argyrodinae and support the monophyly of *Rhomphaea* and *Ariamnes* with polyphyletic *Neospintharus* and *Argyrodes*. Within the multiple supported clades, each type of lineage shows the geographic distribution of species between North America + South America and South East Asia + East Asia. Dated phylogeny suggests speciation occurred around 19.6 Mya between the late Paleogene and early Neogene. The results showed that most of the Sri Lankan species are closely related with South East Asian countries than American species and appear to be evolved very recently less than 2Mya. Five species of *Argyrodes*, two species of *Coleosoma*, one species of *Cephalobares*, three species of *Meotipa*, and one species of *Chikunia* were redescribed and recorded after a century. This study represents a milestone towards the understanding of biodiversity and conservation of Sri Lankan cobweb spiders.

Keywords: Sri Lanka, Taxonomy, Theridiidae, Phylogeny.

Seasonal variation and species diversity of spider population in rice agroecosystem of Bargarh District, Odisha, India

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Abstract:

The present study was taken up at Bargarh district of the East Indian state of Odisha, India, to compare the spider diversity in the two different cropping seasons with different climatic conditions in irrigated rice lands. This study attempts to understand the diversity and abundance of spider populations and the difference in their distribution pattern related to cropping season across different blocks of Bargarh District, which is one of the largest rice-producing districts of Odisha. The observations were made across two cropping seasons from 2018 to 2019 during two Rabi (summer crop season; January to June) and two Kharif cropping seasons (Winter crop; July to December). Spiders were collected from the paddy field during the flowering period, from 75 to 110 days after transplantation (DAT) of paddy saplings as this period was found to have the highest pest and prey-predator activity in the entire season. Seventeen families of spiders were recorded comprising of 62 genera and 92 species in the said tenure. Various diversity indices were used, which showed that species diversity of spiders was more in the Rabi season. The Chao 1 estimator was used to find out the effect of cropping season on the species richness, and results showed that the season in the present landscape did have a considerable effect on the species richness of spiders in paddy fields as it was found higher in the rabi cropping season. There were five major dominant families reported commonly from both cropping seasons. However, the Tetragnathidae family remained dominantly abundant in both seasons, followed by Araneidae; but in terms of diversity, the family, Araneidae was found much more diverse than all other families in both seasons. All the species were categorized into six different feeding guilds, and the orb weavers were dominant in both cropping seasons.

Key words: Spiders, cropping season, diversity, rice agro-ecosystem, Odisha, India.

Indian Arachnology in the 21st Century

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Abstract

Formal Arachnological research (Araneae) in India can be traced back to the pioneering works of John Blackwall in the late 19th century, which led to several taxonomic descriptions, including new discoveries. Since then, the focus on Araneae has progressed from mere descriptions and inventories to fundamental (ecological and evolutionary) and applied (medicinal and conservation) research. Studies over the last 20-years have provided novel insights into our understanding of spatial and temporal patterns in spider diversity across the country. However, we lack a systematic synthesis of this work, which creates a knowledge blind spot for answering more pressing questions of ecology and conservation of the taxon. Here, we present the first comprehensive review of the status of arachnological research in India spanning the 21st century by collating information from over 400 published literature. We assess Spatio-temporal trends in research and identify key geographic gaps requiring urgent research focus. We find a systematic bias in research (> 80% of all studies) towards inventories and taxonomic descriptions, with very little work on other aspects such as ecology, biogeography and phylogeny, thereby impairing conservation efforts. Compared to global research advancements, much of Indian data seems to be limited to qualitative checklists, with under-documentation from several important ecozones of the country, highlighting an urgent need to initiate systematic research to achieve a more comprehensive understanding of Araneae fauna of the country for inclusion in conservation and policy making.

Species richness and vertical stratification of family Tetragnathidae (Araneae) in paddy fields of selected areas at Kuttanad.

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Abstract:

A study was conducted in the rice agroecosystems of Kuttanad to understand the species composition and habitat preferences of the family Tetragnathidae. The survey was carried out during the period of 5 months from July 2020 to November 2020. The investigations were conducted to analyze the differences in species richness in paddy fields practising different farming techniques and to observe the vertical stratification of spiders belonging to the family Tetragnathidae in the field. The results in the present study showed that a total of eleven species of Tetragnathidae were collected from paddy fields and their nearby areas utilizing organic fertilizers and a total of six species from rice fields with its surroundings using chemical fertilizers. Also, it was observed that the ecological guild structure of Tetragnathids was based on foraging behaviour related to the height of the rice plant.

Key Words: Rice ecosystem, Kuttanad, Tetragnathidae, species richness, paddy fields.

Opsins variation and differential expression in jumping spiders

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Abstract

Visual systems in animals allow them to see and make sense of the world based on light and colours. Opsins, the main visual pigments found in the retinas, determine the light sensitivity of the organism. It is known that opsins abundance can be influenced by variations in lighting conditions. Among the invertebrates family, jumping spiders have excellent vision and are able to detect ultraviolet (UV) wavelengths as they possess the opsin, rh3. Using whole-genome sequencing of 5 different salticids spiders, Cosmophasis umbratica, Menemerus bivittatus, Phintella vittata, Siler semiglaucus and Telamonia festiva, we determine the types of opsins genes that are present in these spiders, and by extension, their light sensitivity. Next, we focused on quantifying the expression of rh3 gene using real-time polymerase chain reaction. Our results indicate that different species have significant differential rh3 expression between most of them, with C. umbratica possessing the highest amount of rh3. This is congruent with previous studies that demonstrate C. umbratica's heavy reliance on UV signals for sexual selection and behaviour. Lastly, we conducted behavioural experiments on C. umbratica to determine if short term UV deprivation will result in changes in sexual selection. In males, I found that UV deprivation significantly decreases the initiation and attacking time while increasing female preference for UV-unblocked males over UV-blocked males. In conclusion, these preliminary findings offer insights into the genetic basis of the opsins diversification, highlight the plasticity of the UV visual systems and the role of UV in influencing sexual behaviour.

A newly discovered lineage of ground-dwelling Ctenidae Keyserling 1877 from Asia

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Abstract

The genus Ctenus Walckenaer 1805 was used for a long time as a dumping ground for species described from around the world. Although it was clear that it is actually endemic to South America, Asian species have been assigned still to that genus. One reason was the poor morphological distinguishability of those representatives. The hunt for good diagnostic characters proved to be difficult…as in other newly described genera from Africa or South America.

Within the new Asian genus, a total of 55 species was recognised as new to science; 48 species have to be transferred to the new genus, resulting in more than 100 species. Most of them are small range endemics between the Himalayas and Papua New Guinea; only a few have a wider distribution. This Asian lineage is now the second largest after the name-giving genus Ctenus.

Two species of genus Argyrodes Simon, 1864 (Araneae: Therididdae) from Kerala

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Abstract

Theridiidae is one of the largest families of spiders in the world with about 2472 species in 124 genera (World spider catalogue, 2020). These incorporate 58 Indian species belonging to 19 genera (Sebastian & Peter, 2009). Despite rich diversity, studies about Indian Theridiids are exceptionally ignored, probably because of their small size and absence of relevant literature (Siliwal, 2009). Around 98 species of genus *Argyrodes* Simon, 1864 have been accounted for from various parts of the world; however, there is no report of genus Argyrodes Simon, 1864 from Kerala. In this paper, we depict two species of the genus *Argyrodes*, *Argyrodes bonadea* Karsch, 1881 and *Argyrodes nephilae* Taczanowski, 1873, collected from Kerala. Photographs, distribution, and morphology of the specimens will be discussed.

Keywords: First report, India, Theridiidae, Argyrodes.

Safety becomes more and more important in cobweb spiders

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Abstract:

Conflicts exist between foraging and defence, which are the principal components of the fitness of most animals. Foraging decisions may reflect trade-offs between food intake and safety and may be influenced by an animal's age, life stage, or internal state. Web-building spiders are ideal models for studying foraging-defence trade-offs in complex environments, especially the cobwebs have well-defined structures for foraging (gumfooted lines), and defence (structural lines) functions. However, how to trade-off between foraging and defence in the whole life history and the long evolutional history is never reported in any group. We used cobwebs with detritus-based bell-shaped retreats to research the plasticity of cobwebs. Field survey and phylogenetic analyses were used In our study to elucidate the tradeoffs between defense and foraging during the different developmental sates and test the life history theory in cobweb spiders and to elucidate the evolutional pattern of web decorations in the family Theridiidae and ask whether there is a similar trend of tradeoffs between defence and foraging in both the life history of *C.campanulata* and the whole cobweb spiders.

Key words: Foraging and defense, tradeoffs, web, life history, evolution.

Faunistic diversity of spiders (Arachnida: Araneae) at Godrej Mangroves, Vikhroli, Mumbai, Maharashtra.

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Abstract:

Mangrove Forest being one of the most dynamic ecosystems; supports a rich bio- network; having a varied aquatic and terrestrial invertebrates and vertebrates. Among them, spiders are considered to be an important bio-indicator of ecological health. In the corporate world, spider diversity research on its organizational campus forest has never been conducted in the past. Keeping this in view, the study of diversity of spiders from the mangroves of Godrej & Boyce (19006'37.47"N 72056'32.16"E to 19003'53.39"N 7205'.33.66"E) at Vikhroli, Mumbai, Maharashtra, was conducted, which resulted in the documentation of a total of 38 spider species belonging to the 33 genera and 12 families. Salticidae was found to be the dominant with ten species from 10 genera, followed by Araneidae (9 species and 7 genera). However, in terms of abundance, Araneidae ranked first, whereas Salticidae, Oxyopidae, Thomisidae were on second, third and fourth positions, respectively. The survey was done in three mangrove zones; classified on the basis of density of mangrove flora as Dense, Moderate and sparse Mangroves. Out of which, zone II showed the highest diversity (H=0.89) of spiders. Guild structure analysis revealed six different guilds. Stalkers (Salticidae and Oxyopidae) were the predominant feeding guild (26.31%). Seasonal (pre-monsoon, monsoon and post-monsoon) analysis revealed more species diversity in the month of June to September. Being one of the key components of a biotic community, spider diversity study plays a significant role in the conservation of their respective ecosystem.

Keywords: Mangroves, spiders, biodiversity, Mumbai, bio-indicators, Godrej

Spider Diversity at Godrej Mangroves, Vikhroli, Mumbai, Maharastra

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Abstract:

One of the most dynamic ecosystems, the mangrove forest supports a vast bio-network that includes insects, arachnids, reptiles, birds, and a variety of aquatic and terrestrial invertebrates and vertebrates. Spiders are one of them, and they're thought to be a significant bio-indicator of ecological health. Spider biodiversity research on an organization's campus forest has never been done before in the corporate world. With this in mind, researchers performed a study of spider diversity in the Godrej & Boyce mangroves (19006'37.47"N 72056'32.16"E to 19003'53.39"N 7205'.33.66"E) in Vikhroli, Mumbai, Maharashtra, which resulted in the recording of 37 spider species belonging to 32 genera and 12 families.

Salticidae, followed by Araneidae, were determined to be the most dominating of all the families. The survey was conducted in three mangrove zones: dense, moderate, and sparse mangroves, which were categorised based on the density of mangrove flora. The highest diversity of spiders was found in Zone II, which has moderate mangrove vegetation. The guild structure research identified a total of 6 guilds, with stalkers (Salticidae and OXYOPIDAE) dominating. Seasonal analysis (pre-monsoon, monsoon, and post-monsoon) revealed species diversity and abundance. The presence of spiders on specific mangrove vegetation has been linked to the availability of prey and the appropriate site for web-building. Being an environment indicator group, spider biodiversity study plays an immense role in the conservation of their respective ecosystem.

Keywords: Mangroves, spiders, biodiversity, Mumbai, bio-indicators, Godrej

Research on adaptive evolution to cave environment of cuticle in Chinese Leptonetela spiders based on transcriptomics

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Abstract

Living in a stable environment with high humidity for a long time, terrestrial arthropods in caves were always under less selective pressure from water loss due to evaporation; the structure and function of their cuticles to limit water loss are correspondingly weakened. Therefore, cave-dwelling terrestrial arthropods are ideal materials for studying the development and water-proofing property of arthropod cuticles. To date, the related researches mainly focus on a few kinds of arthropod species, most of which were based on behavioral, morphological or physiological studies.

Cave-dwelling Leptonetela spiders are highly diverse. Compared with the non-troglobiont spiders, the troglobiont spiders living in caves appear to show obvious cave-adapted characteristics. For example, morphological observation showed that the cuticles of the troglobiont spiders were obviously albino compared with the non troglobiont spiders. In addition, behavioral test of our pre-analysis showed a significantly weaker ability of water holding and drought resistance of the cuticles in cave-dwelling spiders. Cuticle is an important protective barrier against water loss in terrestrial arthropods, and cuticular lipids are one of the main contributors determining their survival in dry and high temperatures and other stresses. The related genes and functional analysis are mainly concentrated in Drosophila and other model organisms, most of which was focused on specific single or a few genes. So systematic researches were appealed, and the research on Araneae is basically blank. Then we employed comparative transcriptome analysis to systematically explore the genetic mechanism underlying adaptive evolution to cave environment of the cuticles in Lepidoptera spiders. The main results are as follows

Transcriptome sequencing of the abdomen was performed for two non troglobiont spiders III (Leptonetela sp. and Leptonetela palmata) and two troglobiont spiders (Leptonetela reticulopecta and Leptonetela tetracantha), with 3 biological repeats for each species. A total of more than 80 gigabases (Gb) of clean data were obtained. Subsequently, 41591, 39405, 40681 and 29354 unigenes were obtained for the four species, respectively. After pairwise comparison, 5586 single-copy orthologous genes were obtained. A phylogenetic tree was constructed based on concatenated single-copy orthologous genes. The results showed that L. reticulopecta and L. sp. were sister groups to each other, L. tetracantha and L. palmata were sister groups to each other. So we divided them into two groups to analyze differential gene expression.

The results of differential gene expression analysis showed that 126 genes were up-regulated and 87 genes were down-regulated in the group of L. reticulopecta vs. L. sp., while 707 genes were up-regulated and 515

genes were down-regulated in the group of *L. tetracantha* vs. *L. palmata*. Among them, APMAP, Cyp49a1, CYP3A28 and acat1 may be involved in cuticular lipid synthesis. The differentially expressed genes of L. reticulopecta vs. L. sp. group were enriched in acetyl CoA biosynthesis and thioester biosynthesis GO terms, as well as two KEGG pathways of fatty acid biosynthesis and cutin, amber and wax biosynthesis; the KEGG pathway of steroid biosynthesis was enriched in *L.tetracantha* vs. *L. palmata* group, and these five biological processes or metabolic pathways are involved in the synthesis of lipid, the main water-proofing component in the cuticle. The results of annotation and enrichment showed that acat1, Pdhx, MPC1, ACSS2, ACSL1, HSD17B8, cdo1, aldh9a1a, Cyp49a1, emb-9, APMAPand CYP3A28 may be candidate genes to regulate the synthesis of cuticular lipids. ACSS2 has been proved to play a key role in the process of adipogenesis, Cyp49a1 affects the amount of hydrocarbons in the cuticles, APMAP is an essential adipogenesis enhancer, and other genes need to be further functional verified. Through comparative transcriptome analysis of 12 Leptonetela spider samples, candidate genes related to lipid synthesis in spider cuticles were mined, which not only provided new data for studying the development and water conservation of terrestrial arthropod cuticles, but also provided a new system for related research.

Key words: cave; adaptive evolution; Leptonetela; cuticular lipids; transcriptome.

Preliminary Checklist of Spiders from Periyar Tiger Reserve (Vallakadavu range), Western Ghats of Kerala

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Abstract

A preliminary study was conducted to document the spider fauna in Periyar Tiger Reserve (Vallakadavu range), Idukki district, Kerala. This was a brief study of one week. Opportunistic observations were mainly employed for the study. A total of 33 species of spiders belonging to 29 genera from 12 families has been recorded from the Periyar Tiger Reserve. Among the 12 families recorded, Araneidae Clerck,1757 was the most predominant with orb-web weavers. The web pattern differs for each family. From the guild analysis, the recorded families were categorized into seven major types of web patterns.

Keywords: Preliminary study, spiders, guild, Periyar Tiger Reserve.

Variation in visual responsiveness of motion in jumping spiders

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Abstract

An animal's motion processing capability is a vital factor in influencing its survivability. This is especially so as animals are often faced with the need to move. However, there remains, to date, limited comparative studies of the motion processing capabilities among jumping spider species. Comparative studies are important as closely related species with similar eye morphology, and visual systems may differ greatly in visual acuity. Here, I investigated if there were differences in responsiveness of moving stimuli across six species of jumping spiders (*Cosmophasis umbractica, Menemerus bivittatus*, *Portia labiata, Phintella vittata, Siler semiglaucus* and *Thiania bhamoensis*) by presenting them with computer-generated stimuli of two sizes moving at six speeds and recording their responses. My results showed a significant effect of moving speed and size of stimuli as well as species on responsiveness. Spider responses were negatively correlated with the moving speed of the stimuli. Large stimuli elicited more responses than small ones. Menemerus bivittatus were generally more responsive than the rest of the species, whereas *P.labiata* were the least responsive. *Thiania bhamoensis* showed higher and stronger responses at slow speeds, yet, as stimulus speed increased, its response decreased more sharply than other species. Therefore, my results suggest the differences in motion processing abilities among jumping spider species. I discussed this variation in the context of the salticids' evolutionary history and phylogenetic constraints.

New distributional record of velvet ant-mimicking spider Coenoptychus pulcher, Simon, 1885 (Araneae: Corinnidae) with notes on morphology from eastern India.

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Abstract:

A new distributional record is reported here for the monotypic spider Cynoptychus pulcher Simon, 1885 from the Corinnidae family. The record registers the presence of the species from the Chhota Nagpur plateau region from Jharkhand past of Eastern India against its previously described range from different states of the Deccan peninsula in India and Sri Lanka.

Keyword: Distributional record, Jharkhand, mutilid wasp mimicking spider, corinnidae.

Inside the spider: gut microbial diversity and function in two closely related *Pardosa* spiders

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Abstract

Wolf spiders (Lycosidae) are crucial component of integrated pest management programs, and their characteristic gut microbiota are known to play important roles in improving the fitness and survival of the host. However, there are only a few studies of the gut microbiota among closely related species of wolf spider. Whether wolf spiders gut microbiota varies with habitats remains unknown. Here, we used shotgun metagenomic sequencing to compare the gut microbiota of two wolf spider species, *Pardosa agraria* and *P. laura* from farmland and woodland ecosystems, respectively. The results show that the gut microbiota of *Pardosa* spiders is similar in richness and abundance. Approximately 27.3% of the gut microbiota of *P. agraria* comprises Proteobacteria, and approximately 34.5% of the gut microbiota of *P. laura* comprises Firmicutes. We assembled microbial genomes and found that the gut microbiota of *P. laura* are enriched in genes for carbohydrate metabolism.

In contrast, those of *P. agraria* showed a higher proportion of genes encoding acetyltransferase, an enzyme involved in resistance to antibiotics. We reconstructed three high-quality and species-level microbial genomes: *Vulcaniibacterium thermophilum*, *Anoxybacillus flavithermus* and an unknown bacterium belonging to the family Simkaniaceae. Our results contribute to an understanding of the diversity and function of gut microbiota in closely related spiders.

Keywords: Shotgun metagenomic sequencing, spiders, host-bacterial interaction, symbiosis, microbiome

Non-consumptive effects on insect herbivory by spiders and birds

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Abstract

Non-consumptive effects have a complex interaction, as it can be either negative or positive effects on the prey, the prey host plant or from the prey to the predator. Previous studies showed that the presence of spiders as predators reduced herbivory damage significantly. Since most of the current studies of insect non-consumptive effects were largely focused on short time scales in laboratory settings, this experiment was carried out in the field, allowing a more natural interaction between herbivores and plants. In this study, we tested whether there are any differences in herbivory rate in two local species of plants in Czech Republic (*Rubus ideaus* and *Urtica dioica*) after being exposed with predators-birds (varied) and spiders (*Pisaura mirabilis*) for 72 hours via an enclosure experiment. We found that the herbivory damage was significantly higher in *Rubus ideaus*, though no significant differences in the percentage of herbivory damage with the presence of predators' cues on both plant species. Feeding guilds analysis showed that leaf chewer and leaf sucker were more abundant in *Rubus ideaus*. We conclude that the specificity of predator-herbivore-plants plays an important role in determining the effects of herbivory damage.

Keywords: Feeding guilds, trophic cascade, prey-predator relationship

Taxonomy of *Cyrtophora citricola* (Forsskal, 1775) from the Western Ghats

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Abstract

The study focuses on the taxonomy of *Cyrtophora citricola* of the Western Ghats. The spider genus *Cyrtophora* Simon, 1864 belongs to the family Araneidae Clerck, 1757 and subfamily Cyrtophorinae Simon, 1895. C. citricola (Forsskal, 1775) is the type species and is the only representative of *Cyrtophora* in the New World. Specimens were collected from different sites spanning the length and breadth of the Western Ghats. Taxonomic description and illustration of the species is done. Stereomicroscope Leica M205C with advanced automontage software is used for detailed description and documentation. *Cyrtophora citricola* has more than one pair of abdominal tubercles, is colonial and abundantly found in urban landscapes. DNA barcoding with Cytochrome oxidase 1 (Cox1) marker is carried out. DNA isolation was done with Qiagen DNeasy® kit. Data analyses were conducted on TCoffee, BioEdit and MEGA5. Two extreme colour variants of *C.citricola* were sequenced to know if they were two individual species, but were confirmed to be only colour morphs. The combination of traditional taxonomy and molecular data is a good model to adopt. When species identification is complicated, the potential of DNA barcoding can be utilized. An integrated approach in taxonomy is the need of the hour.

Keywords: Taxonomy, *Cyrtophora*, Western Ghats, DNA barcoding, Cytochrome oxidase1

Charippus Thorell, 1895, a poorly studied genus of euophryine jumping spiders (Araneae, Salticidae)

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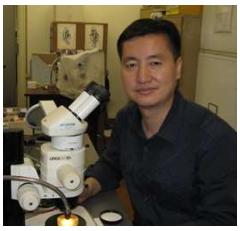
Abstract

Charippus Thorell, 1895, a poorly studied genus of jumping spiders, currently contains only two species: the type species *C.errans* Thorell 1895 from Myanmar and *C.yinae* Wang & Li, 2020 from China. However, our recent study on jumping spider specimens from Southeast Asia and China showed that the diversity of this genus is far beyond that, and at least eight new species have been discovered so far. Previous studies suggested that *Charippus* belonged to Euophryini and probably fell into the Cytaea-Euryattus Clade. However, our molecular phylogenetic analyses based on four genes (28S, 16S, ND1 and Actin5C) reveal that *Charippus* falls within the Laufeia Clade of Euophryini. In addition, somatic and genitalic characters were explored for potential synapomorphies of *Charippus* and its close relatives.

The chromosome level genome of *Trichonephila antipodiana* revels its adaptive evolution of polyphagy

Zheng Fan, Zhisheng Zhang*



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Abstract

Spiders are ancient animals that have been evolving on earth for about 400 million years and provide a basis for studying adaptive evolution. Spiders are cosmopolitan in distribution except for Antarctica and can be found in almost all terrestrial living environments e.g. from coastal to inland, from plain to plateau, from underground to tree canopy, from leaf litter to rock crevices, and even under fresh water. In order to adapt to different environments, spiders have evolved different body shapes, colors, even different tissue and organ structures. Some are good at spinning webs, while others are good at hunting. Some are good at roaming on the surface, some are good at climbing, some are good at living in underground caves, and some are good at living underwater. The cause of such behavioral changes is due to the differential expression of different genes. With the advances in genome sequencing technology, more and more spider species genome has been sequenced, and due to the continuous progress of bioinformatics and genomics has opened a new era of adaptive evolution research.

1. We present a chromosome-level genome of T.antipodiana constructed based on PacBio and Hi-C sequencing. Survey analysis based on illumina predicted a genome assembly size of 2.15 Gb. The assembled genome is 2.29 Gb in size with a scaffold N50 of 172.89 Mb. Hi-C scaffolding assigned 98.5% of the bases to 13 pseudo-chromosomes, and BUSCO completeness analysis revealed that the assembly included 97.8% of the complete arthropod universal single-copy orthologs. We predicted 19,001 protein-coding genes with a mean number of 7.24 exons and 6.12 introns per gene, and mean exon and intron lengths of 247.46 bp and 3.73 kb, respectively. Furthermore, we found that a total of 18,303 (96.33%) genes had at least one record in the SwissProt or TrEMBL databases. InterProScan and EggOG analyses identified the protein domains for 14,705 (77.39%) genes, 12,226 GO terms, 9,465 KEGG ko terms, 5,788 KEGG pathways, 14,325 COG categories, and 3,183 Enzyme Codes.

2. Polyphagy of T. antipodiana is highly related to the expansion of P450 gene family. For further analysis of the detoxification ability of T. antipodiana, we manually annotated the genes of detoxification-related enzymes (P450s, CCEs, GSTs, and ABCs). In the genome of T. antipodiana, we identified 167 CYP genes, comprising four major classes: CYP2 (57 genes), mitochondrial P450 (19), CYP3 (43), and CYP4 (48). The results indicate the remarkable expansion of CYP2 and CYP3 clade genes of T. antipodiana. We identified 48 CCE genes, among which the overwhelming majority (47) belongs to neuro/developmental class, and the remaining single gene belongs to the hormone/semiochemical class. We identified 22 GST genes, and phylogenetic analyses of the cytosolic revealed the five different classes of these genes named as, Delta/Epsilon (2 genes), Mu (15), Theta (1), Sigma (2), and Zeta (2), among which the Mu class is the largest and shows considerable expansion in T. antipodiana. And 47 ABC genes was found belonging to seven different classes: ABCA (10 genes), ABCB (12), ABCC (11), ABCD (3), ABCE (1), ABCF (3), and ABCG (7).

We also analyzed the P450 genes expression in the *T. antipodiana* by RNA-Seq. Further analysis of the *T. antipodiana* genome architecture reveals an ancient whole-genome duplication event, based on 2 lines of evidence: (i) large-scale duplications from inter-chromosome synteny analysis and (ii) duplicated clusters of Hox genes located on chromosomes 8 and 12, respectively.

Keywords: *Trichonephila antipodiana*, chromosomes-level genome, polyphagy, P450

Salticids of Patur Region in Maharashtra

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Abstract:

Jumping spiders (Salticidae) are easily distinguished from other spiders by their four big eyes on the face and four smaller eyes on top of the head. Around the world, there are probably more than 5000 species of jumping spiders. The adults not making snare-webs; actively pursuing their prey on foliage, ground vegetation and walls, leaping onto their prey in a characteristic fashion. A detailed survey of spiders from the Salticidae family was carried out in the Patur region near Akola (Maharashtra). We have reported 20 species from 07 different genera includes *Marpissa* Sp., *Rhene* Sp., *Euophrys* Sp., *Myrmarachne* Sp., *Phidippus* Sp., *Telomonia* Sp. and *Plexippus*. The maximum species diversity was noted from August to November 2021.

Spider silk – An Alternative Promising Antibiotic.

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Abstract

As a result of the unfavourable effects of chemically identified antimicrobials resulting in antimicrobial resistance and the harmful disposition of antimicrobial residues in mammalian cells, natural alternatives are extensively studied nowadays. Considering the stability, bioavailability and internalization profile of natural antibacterial agents, spider silk with its unique mechanical properties and complex genetic constitution deserves devoted focus. The present investigation deals with assessing the antibacterial activity of spider silk of three species against five bacterial strains (two gram-positive and three-gram negative strains). Egg case silk of *Pardosa sumatrana* showed the highest range of activity against the gram-negative Escherichia coli. Bacillus cereus was the only bacterial strain that was not inhibited by any of the silk types. The idea of antibacterial activity screening in spider silk can a have long term effect in treating bacterial diseases with auxiliary research.

Keywords: Antibiotic resistance, antimicrobial residues, antimicrobial agents, spider silk

First record of *Oedothorax rusticus* Tanasevitch, 2015 and *Neriene birmanica* Thorell, 1887 from Kerala, India

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Abstract

Linyphiidae Blackwall, 1859 is the second largest family of spiders with a worldwide report of 4719 species under 621 genera (World spider catalog, 2021). In this paper, two linyphiid species, Oedothorax rusticus Tanasevitch, 2015 and Neriene birmanica Thorell, 1887 are reported for the first time from Kerala. Tanasevitch described O. rusticus Tanasevitch, 2015, from Tamil Nadu, an Indian state, in 2015. In India, Neriene birmanica has been reported from Jammu & Kashmir, Karnataka and Uttarakhand. More studies into the linyphiid diversity of Kerala would bring many undiscovered species to light.

Keywords: Kanjoor, Kerala, palp , rusticus, tegulum

Araneid Spiders of Shendurney Wildlife Sanctuary- A Short Term Study.

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Abstract:

A study of spiders belonging to the family Araneidae was conducted for a period of two seasons (dry summer and south-west monsoon) revealed a total of 38 species. *Nephila pilipes, Cyclosa hexatuberculata* and *Cyclosa bifida* were found as the most common species. A checklist of Araneid spiders is also given.

Keywords: Araneidae, Shendurney Wildlife sanctuary, checklist.

Burrow morphology and microhabitat characteristics of an iridescent tarantula *Haploclastus devamatha* Prasanth & Jose, 2014 from the Western Ghats, Kerala (Araneae: Theraphosidae).

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Abstract

Tarantula spiders from the genus Haploclastus are considered endemic to Western Ghats of India. *Haploclastus devamatha* Prasanth & Sunil Jose, 2014 is a ground burrowing tarantula described from Kerala state, India has a metallic blue lustre all over its body, putting it at risk of being illegally traded by pet dealers. The study offers the first description of the burrow and microhabitat variables of the little known theraphosid *H.devamatha*. The species constructs burrows on roadside mud embankments along the forest roads additionally on leaf litter which are dominated by moist deciduous and semi-evergreen forest. Adult of *H.devamatha* constructs deep vertical burrows on forest floors while juveniles and sub-adults build short horizontal burrows on mud embankments. Burrows are mostly constructed on deep clay soils, with sandy soils or soils with a high density of roots and stones being avoided. The presence of H.devamatha may be determined mainly through soil properties. Each species constructed burrows by excavating sediment using their chelicerae and pedipalps. Burrow density was found to have a marginally positive relationship with soil and substrate type. The structure of the burrow and the soil parameters are closely linked. Burrow sites were not significantly related to the pH of the soil in which they were discovered. These findings may be crucial to determine the true distribution of this iridescent theraphosid within its geographic range, as well as in effectively managing the species for conservation and reintroduction.

Keywords: *Haploclastus devamatha,* burrow and its morphology, microhabitat, soil characteristics, conservation.

New distributional report of *Annandaliella travancorica* Hirst 1909, From Western Ghats of Kerala.

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Abstract

Only three species of *Annandaliella* Hirst, 1909 are known from the Western Ghats of Kerala: *Annandaliella travancorica* Hirst 1909, *Annandaliella ernakulamensis* Jose and Sebastian 2018, *Annandaliella pectinifera* Gravely 1935. This species is distinguished by its primary apophysis on the first leg, which has a horn-like projection with a pointed black spine at the tibial end. The presence of a Tibial apophysis with a thick black spine distinguishes it from *A.ernakulamensis* and *A.pectinifera*. *A.travancorica* has previously been reported in the Travancore, Kozhikode, and Thrissur districts of Kerala. As far as we know, this is the first time it has been reported from Peechi Wildlife Sanctuary.

Keywords: Tarantula, Mygalomorph, Range extension, Theraphosid.

Diversity and evolution of the pseudoscorpion family Chthoniidae in the Western Ghats of India

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Abstract

The Western Ghats (WG) of India is a 1600 km long mountain chain running parallel to the western coast of India. Being part of peninsular India, the WG have a complex climatic and geological history and harbour high biodiversity and endemism across a heterogeneous landscape. This region is also threatened by habitat destruction, thus making it one of the 'hottest' biodiversity hotspots in the world. The pseudoscorpion family Chthoniidae is one of the basal-most pseudoscorpion lineages. These pseudoscorpions are found primarily in leaf-litter habitats across the globe, including the WG, although most species have restricted distributions. We investigated the diversity and distributional patterns of Chthoniidae in the WG. A phylogenetic tree was constructed using one mitochondrial and two nuclear loci for a total of 1947 aligned sites from 46 chthoniid samples from the WG and 38 outgroup terminals. Divergence time and biogeographical analyses were also performed to understand the pattern and timing of diversification of this family in the WG. Preliminary results indicate that Chthoniidae is an ancient lineage with high species diversity. Our study also sheds light on the historical biogeography of relictual taxa in the WG and highlights the importance of integrating invertebrates, particularly soil-arthropods, in planning conservation strategies in this hyper-diverse region.

Keywords: Diversity, Chthoniidae, evolution, Western Ghats.

Diversity and conservation of Nannenini Jumping Spiders (Salticidae) in rapidly changing cloud forest of Sri Lanka

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Abstract

The jumping spider family Salticidae includes more than 6359 species in 659 genera. This study is being done to determine how habitat quality and diversity affect the species composition of Nannenini Jumping spiders of the island. Further, this study aims to establish the diversity of Nannenini through an island-wide sampling regime and DNA barcodes. The collection of spiders was by beating and hand collection in 31 selected sites covering all of Sri Lanka. Using a multilocus molecular data set (18S, 28S, CO1 and H3) and 61 morphological characters (coded for 17 taxa), we provide the first hypothesis on the internal phylogenetic structure of the Epidelaxia and its placement within tribe Nannenini. We used TNT 1.1 for the parsimony analysis of the morphological data matrix and RAxML for the maximum-likelihood (ML) analysis of the molecular data set. The resulting cladistics analysis, based on 63 morphological characters from 17 taxa supports the monophyly of the genus. All analysis strongly supports the monophyly of Epidelaxia and validates its placement within the tribe Nannenini. The Nannenini Jumping spiders are restricted to the undisturbed cloud forests of the central highlands and lowland secondary rainforests of Sri Lanka. To conserve them in their natural habitat, we have to avoid habitat fragmentation and deforestation of such forests.

Keywords: endemic, Nannenini, Sri Lanka, synapomorphies, systematics

A review and first geographic distribution record of *Chilobrachys fimbriatus* Pocock, 1899 (Araneae: Mygalomorphae: Theraphosidae) from Girnar Wildlife Sanctuary Junagadh Gujarat India

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Abstract

Girnar Wildlife Sanctuary is situated in Junagadh district, which is well known for Mount Girnar and occurrence of Asiatic lions. The present study is based on the existence of tarantula spider Chilobrachys fimbriatus Pocock 1899. Mygalomorphae are poorly studied in India. Since only a few records have been reported so far about this beautiful tarantula species, this study is a little step toward documentation of C. fimbriatus Pocock 1899 from Junagadh district, Gujarat state, India. During a random walk on a trail in Girnar forest, this species is observed. Previously it was reported from Maharashtra, Goa, Western Ghats and other states of India. As no strong evidence or literature is made on the existence of it from this area, in the present study, we had the first record along with review literature.

Key words: *Chilobrachys fimbriatus*, Girnar Wildlife Sanctuary, First record, Junagadh, Gujarat, Tarantula.

Who wants to buy a tarantula? Some results of a global survey about tarantula pet trade and conservation.

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Abstract

Although often neglected and poorly documented, arthropod trade represents a significant business, and their illegal trade is considered to be a serious but many times overlooked threat to their populations. The demand for tarantulas (Araneae, Theraphosidae) as pets at global level is high and increasing. Currently, CITES lists 36 tarantula species of 6 different genera; however, this is just a gross underestimation of what is really traded. Even though their trafficking is an important driver of biodiversity loss, tarantulas have low priority for enforcement authorities. Thus, it is necessary to create alternatives to the traditional way of dealing with wildlife trafficking - focused on regulation and enforcement – and tackle the problem from the demand-side. In order to find out some traits and trends of the tarantula pet market and who are the people involved in it, and what they think about pet trade and conservation, we created a query containing 30 questions (http://biodiversityresearch.org/query-on-global-tarantula-trade/) in 12 different languages that were sent to researchers, arachnological societies, and tarantula hobbyist societies across the world, as well as disseminated in several Facebook groups and forums related to spiders. The survey contained 30 questions classified in demographic and profile questions (n=7), tarantula owner questions (n=6, answered only if the respondent had a tarantula pet), trade questions (n=13) and conservation questions (n=4). There were different types of questions: multiple-choice, open-ended and rating questions.

Respondents in the English version (n=290) of the survey were mainly males (58,97%), between 30-49 years old (46,21%), mostly living in the Nearctic region (56,9%). Around 70% of them considered themselves mainly as pet owners; just 12% of the respondents were researchers. Apart from the profile of tarantula owners, we could find out their motivation to start the hobby, the most used channels for buying tarantulas, and other trade chain characteristics. In addition, we could detect important points to be addressed when tackling the illegal or unsustainable trade from the pet owner's perspective. The survey made clear the necessity of connecting biological and trade information and to improve the cooperation among stakeholders involved in the trade chain. The engagement of all parties involved in tarantula trade is essential to the success of any conservation actions.

Keywords: tarantula, pet trade, conservation, survey.

Financial support: Kone Foundation (Finland)

Spider (Araneae) Diversity and their community structure In Thattekkad Bird Sanctuary, Kerala

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Abstract

Tropical rain forests are diverse with rich flora and fauna. The stability of this diverse ecosystem is distressed by deforestation, over-exploitation, invasive species and climate change. Spiders form one of the most diverse groups of organisms and ecosystem engineers and have a notable share in arthropod diversity. The aim of the present study was to analyze community structures, species richness and relative abundances of spiders across the various parts of Salim Ali Bird Sanctuary, Thattekkad, Kerala, a tropical semi-evergreen low-land forest located between the branches of the Periyar river. A Survey of Spider fauna was carried out from February 2018 to January 2019. Sampling was conducted across and along with the nearby human settlement areas, transition and buffer zones. In total, 3286 individuals were collected from the sanctuary, which consists of 59 genera in 20 families. 89 taxa have been identified to the species level. Relative abundances of spider communities strongly differed in sampling seasons. The most abundant species were Hippasa agelenoides (402 individuals). Diversity indices of Pielou's evenness index, Shannon-Wiener, Simpson and Margalef were, respectively: 0.751, 2.46, 0.860 and 4.78.

Keywords: Thattekkad, Spider, Diversity, Abundance

An insight to the type localities of Pseudoscorpiones of India

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Abstract

The study of Pseudoscorpions in independent India was started by Indian arachnologist Murthy (1960). Sivaraman (1980) contributed a lot to the field along with other arachnologists. The type specimens of both these researchers are lost from V.A.M collections and Fr. Charles Leigh SJ Museum Loyola College, Chennai. The collection of topotypes were a tough task as they lacked GPS coordinates. The Indo-china Expedition (1938-1939) by Dawydoffi and Afghanistan Expedition (1952-1953) by J. Klapperich is also studied to verify the type localities of specimens identified by Beier (1951, 1959). This study is based on the visit of type localities, field catalogues, historical records and maps. We clarify the geographic location, provide current names and restrict these types localities.

Keywords: type specimens, taxonomy, geographic distribution.

Spider fauna (Family:Araneidae) in and around Karanja Sohol Wildlife Sanctuary, India

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Abstract:

A study on the diversity and distribution of spider fauna (Family- Araneidae) in and around the Karanja Sohol Wildlife Sanctuary, India, was conducted from February 2018 to November 2020. A total of 11 genus and 23 species of family Araenidae (Arachnida: Araneae) were recorded. The generic diversity is in the order of Neoscona (6), Cyclosa (3), Larinia (2), Cyrtophora (2), Eriovixia (2), Poltys (2), Araneus (1), Argiope (1), Chorizopes (1), Gasteracantha (1), Zygiella (1). The present investigation and checklist will help the forest officials regarding fauna and flora records of the sanctuary in future.

Keywords: Spider, Araneidae, Diversity and distribution, Karanja Sohol Widlife Sanctuary.

Preliminary Survey of Spiders (Arachnida: Araneae) In Kuala Selangor Nature Park, Kuala Selangor, Malaysia

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Abstract

A preliminary study of the spider diversity of Kuala Selangor Nature Park (KSNP), a wetland conservation and education center in Kuala Selangor, Malaysia, was conducted during 21-24 September 2019. by employing the manual search method. Spiders were surveyed by non-detrimental sampling by exploring leaf litter, logs, rocks, tree trunks, leaves and branches. Images of live spiders were taken with Canon EOS 600D digital SLR camera with EF 100mm f/2.8L IS USM Macro Lens. The survey yielded a total of 37 species of spiders belonging to 30 genera and 11 families. Family Salticidae was the most diverse family with 11 species, followed by families Araneidae and Thomisidae (five species each). Other major families included Oxyopidae, Lycosidae and Theridiidae. Two species viz. , Eriovixia sakiedaorum Tanikawa, 1999 and Steatoda cingulata (Thorell, 1890) are being reported for the first time from Malaysia. The study also documented one wetland specialist, Tetragnatha josephi Okuma, 1988. Guild classification of the spiders KSNP revealed six functional guilds namely orb weavers, stalkers, ground runners, space web builders, ambushers and foliage runners. Stalkers constituted the dominant guild (40.54% of the total sample) followed by orb weavers (16.22%). The preliminary results indicate that KSNP has a rich and varied spider diversity and could be home to many more species of spiders as it provides a heterogenous spectrum of habitats ranging from secondary forests to mangrove forests, estuary, mudflats, as well as brackish water lake system providing a greater array of microhabitats, microclimatic features, alternative food sources, retreat sites and web attachment sites. In order to unravel the true araneid diversity of this ecosystem, a detailed and comprehensive study involving routine seasonal samplings, taking into account the seasonality of different species, their diurnal and/or nocturnal activity, special and temporal distribution, microhabitat preferences etc. is warranted. Sighting wetland specialist spiders indicate the necessity for conserving this wetland ecosystem as wetlands are facing the serious threat of extinction worldwide due to urbanization and industrialization, as well as natural processes, including siltation and drainage. The presence of these wetland specialist spiders would further strengthen the claims of KSNP for becoming a Ramsar site.

Key words: Checklist, KSNP, Mangrove, Ramsar Site, Spiders, Wetland

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