Zoosyst. Evol. 99 (1) 2023, 209–216 | DOI 10.3897/zse.99.99285

PENSOFT

MUSEUM FÜR NATURKUNDE BERLIN

A new species of the genus *Siler* Simon, 1889 (Araneae, Salticidae, Chrysillini) from India

John T. D. Caleb[1], Ayush Parag[2], Aniruddha Datta-Roy[2]

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

2 *School of Biological Sciences, National Institute of Science Education and Research, An OCC of Homi Bhabha National Institute, Khordha, Jatni 752050, Odisha, India*

https://zoobank.org/E4E17325-0928-4FF9-83FD-67EAEB964128

Corresponding author: John T.D. Caleb (caleb87woodgate@gmail.com)

Academic editor: Danilo Harms ♦ **Received** 26 December 2022 ♦ **Accepted** 27 February 2023 ♦ **Published** 9 March 2023

Abstract

A new chrysilline jumping spider species belonging to the genus *Siler* Simon, 1889 is described from Odisha, India. Detailed morphological descriptions, illustrations of the male palp and female genitalia and phylogenetic relationships of the new *Siler* species are presented. Phylogenetic analysis reveals that the new species is sister to a clade of predominantly Southeast Asian *Siler* species. Furthermore, the results indicate the presence of multiple cryptic species masquerading as *S. semiglaucus sensu lato*. We also briefly discuss some unique behavioural observations on the newly-described species.

Key Words

Jumping spider, NISER, Odisha, phylogeny, species description, taxonomy

Introduction

The chrysilline jumping spider genus *Siler* Simon, 1889 presently includes 11 described species distributed from southern to eastern Asia (WSC 2023). Members of the genus are conspicuously coloured with iridescent scales (Hill 2009; Baba 2010; Kulkarni and Joseph 2015) and some species are reported to be myrmecophagous (Jackson et al. 1998; Nelson et al. 2004; Touyama et al. 2008). *Siler semiglaucus* (Simon, 1901) a widespread species distributed across tropical Asia is the only representative known from India until now (Kulkarni and Joseph 2015; Sen et al. 2015; Roy et al. 2016; Dhali et al. 2017; Tyagi et al. 2019; Caleb and Sankaran 2023). During recent surveys, we discovered a population of an undescribed species of the genus *Siler* from Odisha State, India. Members of the newly-discovered population had distinct morphological characters different from those of *S. semiglaucus*. Phylogenetic analysis using the Maximum Likelihood (ML) approach corroborates the morphological findings. In this paper, we describe this newly-discovered population as a new species.

Materials and methods

Specimens were hand collected and preserved in 70% ethanol. Images of live specimens were captured using a Nikon D500 camera with AF-S Micro Nikkor 60 mm macro lens. Morphological examination was carried out under a Leica SAPO stereomicroscope and photomicrographs were taken with a Leica MC190 HD camera and processed with the Leica Application Suite (**LAS**) version 4.13. The male left palp was detached and examined in detail and photographed. The temporary mount of the epigyne was studied under a Leica DM3000 LED compound microscope and photographed with a Leica MC190 HD camera. The line drawings were prepared using the GNU Image Manipulation Program (**GIMP**) (Montesanto 2015). The GPS coordinates of the collection localities were taken with the help of a Garmin GPSMAP 66S (Datum WGS 84). The map was prepared using QGIS (v.3.12.3) software. Body and eye measurements follow Żabka (1991). Leg measurements are given as follows: total (femur, patella, tibia, metatarsus, tarsus).

All measurements are in millimetres (mm). The studied specimens are deposited in the Southern Regional Centre, Zoological Survey of India (**ZSIC**), Chennai, Tamil Nadu, India.

For phylogenetic analysis, the total genomic DNA was extracted from a complete specimen (collected apart from the deposited type material), using a Qiagen™ Blood and Tissue kit. A region of the mitochondrial CO-I was PCR amplified (see Table 1 for primer details and thermocycler conditions). The PCR product was purified using a QIAGEN PCR purification kit and was sent for sequencing at Heredity Life Sciences Pvt. Ltd., Bhubaneswar.

The generated sequence was aligned with other *Siler* species (see Table 2 for details) in MEGA V.5.2 (Tamura et al. 2011) using MUSCLE (Edgar 2004). The alignment was uploaded on the IQ-Tree online portal (Trifinopoulos et al. 2016; http://iqtree.cibiv.univie.ac.at/) to estimate the best model of sequence evolution using a Bayesian Information Criterion (**BIC**) and subsequently generated a Maximum Likelihood tree. The branch support was estimated using 1000 ultrafast bootstrap replicates. Two species of the genus *Myrmarachne* were used as outgroups.

Abbreviations used in the text: **AER** – anterior eye row; **ALE** – anterior lateral eye; **AME** – anterior median eye; **EFL** – eye field length; **PER** – posterior eye row; **PLE** – posterior lateral eye; **PME** – posterior median eye; **RTA** – retrolateral tibial apophysis.

Species description

Genus *Siler* Simon, 1889

Type species. *Siler cupreus* Simon, 1889.

Siler niser sp. nov.

https://zoobank.org/08C8AFAD-A46F-4330-99E3-28336877D588

Figs 1A–F, 2A–L, 3A–D, 4A, B, 5

Type material. ***Holotype*** ♂ (ZSIC-I/SP 40) from India: Odisha, Bhubaneswar, Khordha, Jatani, NISER campus (20.16861°N, 85.68493°E), 46 m a.s.l., 06.v.2021, leg. A. Parag.

***Paratypes*:** 4 ♀♀ (ZSIC-I/SP 41 to 44), data same as holotype, 05.v.2021.

Etymology. The specific epithet is an acronym derived after the type locality, National Institute of Science Education and Research (NISER) campus from where the specimens were collected. The name is treated as a noun in apposition.

Suggested common name. Glossy jumping spider.

Diagnosis. *Siler niser* sp. nov. resembles *Siler semiglaucus* (Simon, 1901) in general morphology and colour pattern (cf. Fig. 1A, B, D, E with images 1a, b in Kulkarni and Joseph (2015)), but can be easily distinguished by the morphology of the copulatory organs which are rather most similar to *S. cupreus* Simon, 1889 and *S. severus* (Simon, 1901): male palp with short beak-like embolus (slender and needle-like in *S. cupreus* and *S. severus*); relatively smaller RTA (smallest of all congeners, remaining below the small retrolateral tegular lobe); RTA directed anteriad in ventral view, with pointed tip and broad base in retrolateral view, ventral margin vertical, dorsal margin gradually sloping, gently curved (RTA directed retrolaterally in ventral view, thick, relatively long reaching beyond the retrolateral tegular lobe and curved in *S. cupreus* and *S. severus*) (cf. Figs 2E, F, 3A, B with illustrations on pg. 133, 135 in Prószyński (1984), figs 246, 247 in Bohdanowicz and Prószyński (1987) and figs 12, 13 in Prószyński (1985)); females can be recognised by the short and bent copulatory ducts and globular spermathecae separated by more than their radius (copulatory ducts relatively longer, almost straight and copulatory openings closely placed along the median in *S. cupreus*) (cf. Figs 2K, L, 3C, D with illustrations on pg. 134, 135 in Prószyński (1984) and figs 249, 251 in Bohdanowicz and Prószyński (1987)).

Description. ***Male*** (based on holotype ZSI-I/SP-40, colouration in alcohol) (Fig. 2A–F): total length 4.10; carapace 1.97 long, 1.50 wide; abdomen 2.13 long, 1.19 wide. Carapace greenish-brown; lateral sides with broad red patch; outer rim of carapace lined by blue scales (Fig. 2A). Anterior eyes surrounded by greyish-white orbital setae. Clypeus brown, 'cheeks' covered with bluish hairs (Fig. 2D). Eye measurements: AME 0.38, ALE 0.21, PME 0.07, PLE 0.19; AER 1.21; PER 1.34; EFL 0.95. Clypeus height 0.05. Sternum oval, yellowish-brown, covered with hairs; labium and maxillae brown (Fig. 2B). Chelicerae brown with two promarginal teeth and one fissident retromarginal tooth. Abdomen with an anchor-shaped red marking in the anterior three quarters; four grey spots composed of metallic

Table 1. Thermocycler condition and details of primer used for PCR reaction.

Primer name	Thermocycler conditions	Reference
LCO-1490 (forward primer)	Initial denaturation: 94 °C, 3 min Denaturation: 94 °C, 30 s Annealing: 45 °C, 30 s Extension: 72 °C, 90 s Final extension: 72 °C, 7 min	Bork RJ (2015) Primer efficacy in the DNA barcoding of spiders. Honours Program Theses. 169. https://scholarworks.uni.edu/hpt/169
HCO-700ME (reverse primer)	Initial denaturation: 94 °C, 3 min Denaturation: 94 °C, 30 s Annealing: 45 °C, 30 s Extension: 72 °C, 90 s Final extension: 72 °C, 7 min	Bork RJ (2015) Primer efficacy in the DNA barcoding of spiders. Honours Program Theses. 169. https://scholarworks.uni.edu/hpt/169

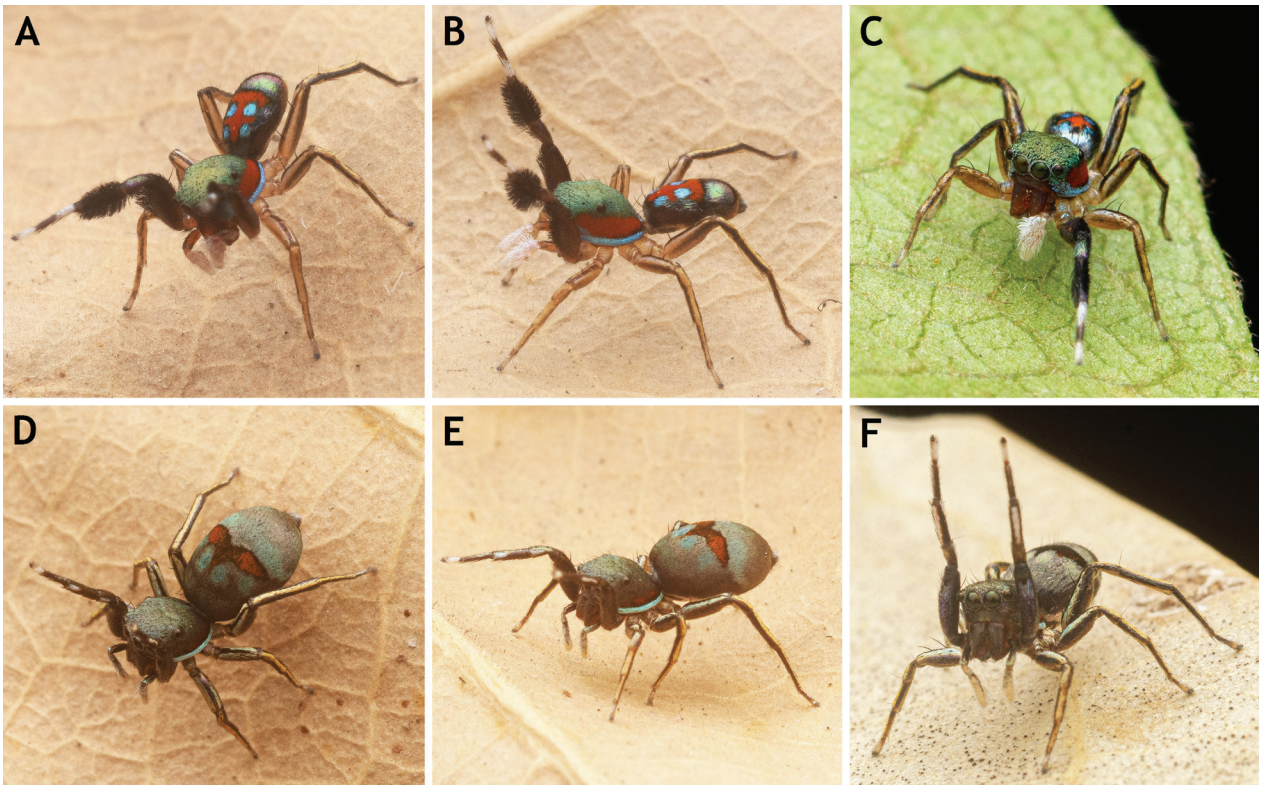

Figure 1. General habitus of *Siler niser* sp. nov. **A.** Male habitus, dorsal view; **B.** Same, lateral view; **C.** Same, front view; **D.** Female habitus, dorsal view; **E.** Same, lateral view; **F.** Same, front view.

scales present in the anterior portion; lateral and posterior half dark grey, composed of iridescent scales; venter brown, covered with iridescent scales; light brown below the epigastric region (Fig. 2A, B). Spinnerets yellowish-brown. Legs yellow with longitudinal brown streaks; leg I robust, brown, femur and patella with ventral fringe of dense black hairs, tibia with both ventral and dorsal fringe (Fig. 2A–C). Leg measurements: I 4.87 (1.64, 0.73, 1.08, 0.87, 0.55); II 3.45 (1.08, 0.54, 0.72, 0.68, 0.43); III 3.97 (1.20, 0.52, 0.80, 0.93, 0.52); IV 5.36 (1.63, 0.62, 1.18, 1.36, 0.57). Leg formula 4132. Palp as shown in Figs 2E, F, 3A, B.

Female (ZSI-I/SP-41, colouration in alcohol) (Fig. 2G–L). Total length 5.31; carapace 2.24 long, 1.69 wide; abdomen 3.07 long, 2.05 wide. Carapace brown; covered with black hairs; lateral margins covered with reddish hairs, outer rim lined by bluish-white hairs (Fig. 2G). Anterior eyes surrounded by greyish-white orbital setae. Clypeus brown, 'cheeks' covered with bluish hairs below ALEs (Fig. 2J). Eye measurements: AME 0.40, ALE 0.24, PME 0.09, PLE 0.23; AER 1.33; PER 1.50; EFL 1.04. Clypeus height 0.02. Sternum oval, yellow; labium and maxillae brown, maxillae apically paler (Fig. 2H). Chelicerae brown with two promarginal teeth and one fissident retromarginal tooth. Abdomen greyish-black with a median transverse black patch; venter yellow, lateral and posterior region brown (Fig. 2G–I). Spinnerets brown. Legs brownish-yellow with longitudinal black stripes (Fig. 2G, I). Leg measurements: I 4.30 (1.45, 0.77, 0.85, 0.76, 0.47); II 3.62 (1.18, 0.61, 0.69, 0.69, 0.45); III 4.13 (1.25, 0.62, 0.79, 0.99, 0.48); IV 5.59 (1.71, 0.72, 1.21, 1.40, 0.55). Leg formula 4132. Epigyne and vulva as shown in Fig. 2K, L, 3C, D.

Table 2. Accession numbers of samples used for the phylogenetic analysis.

Species name	Accession number
Siler semiglaucus	KY888770
Siler semiglaucus	MK392837
Siler collingwoodi	LC485246
Siler cupreus	LC485236
Siler ruber	LC485239
Siler niser sp. nov.	OQ553823
Myrmarachne formicaria	MZ626812
Myrmarachne robusta	MK154679

Variation. Total length of females ranges from 5.31 to 6.88 (n = 4).

Colour in life. ***Male.*** Carapace covered with a mixture of bluish and greenish scales; blue scales extending below the ALEs and running along the rim; lateral sides covered with a thick band of red scales (Fig. 1A–C). Legs yellow brown with a few interspersed iridescent scales and dark brown longitudinal stripes; leg I dark brown with white proximal half of metatarsi and white tarsi. Palps brown, cymbium, tibia and patella covered with white hairs. Abdomen covered with iridescent scales along anterior, lateral and posterior regions; anterior half with a distinct pattern composed of a reddish anchor-shaped mark and four bright blue spots (Fig. 1A–C).

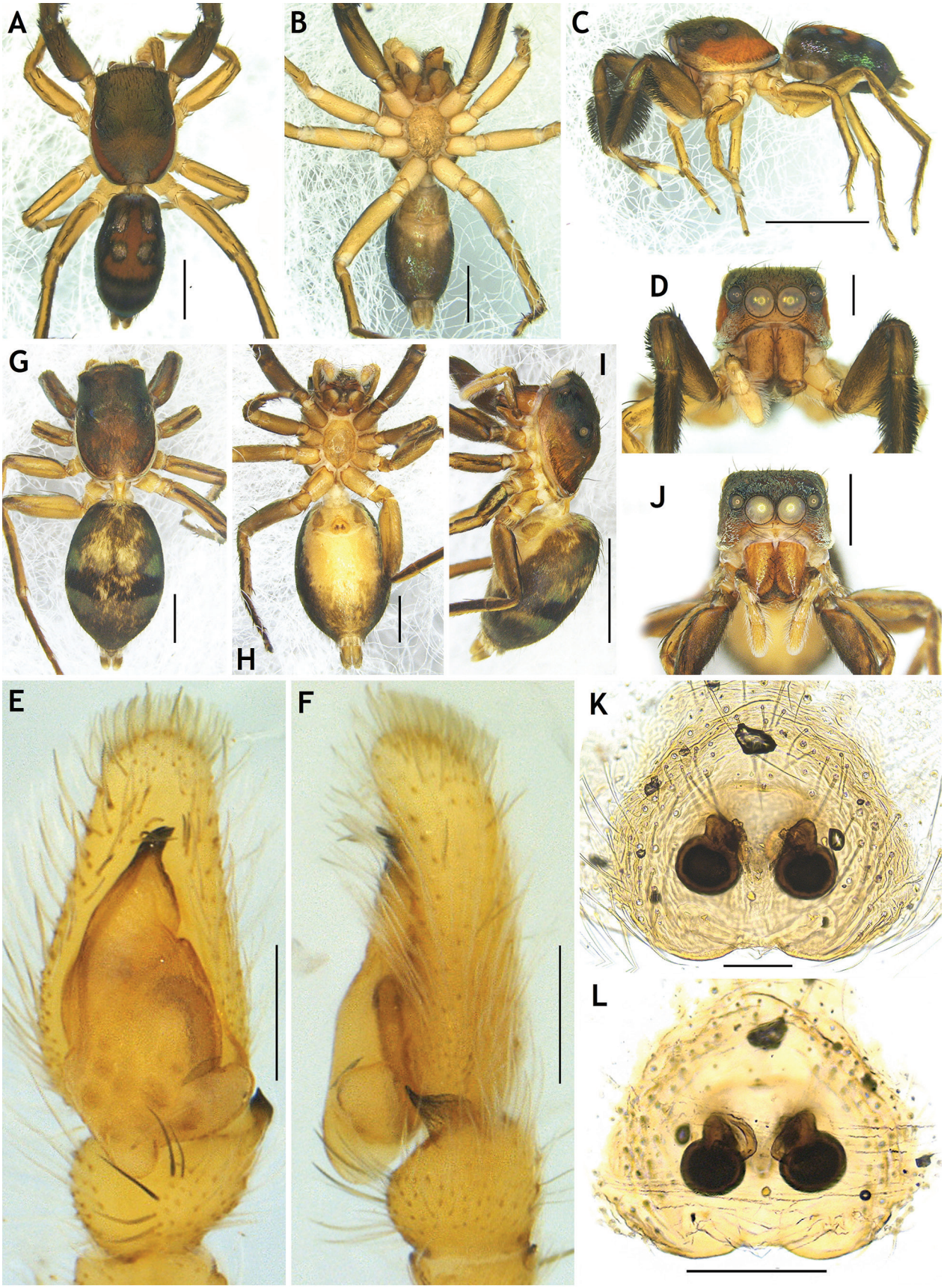

Figure 2. Somatic and genital morphology of *Siler niser* sp. nov. **A–F.** Holotype male (ZSI-I/SP 40) **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Front view; **E.** Left male palp, ventral view; **F.** Same, retrolateral view. **G–L.** Female paratype (ZSI-I/SP 41); **G.** Dorsal view; **H.** Ventral view; **I.** Lateral view; **J.** Front view; **K.** Epigyne, ventral view; **L.** Vulva, dorsal view. Scale bars: 2 mm (**C, I**); 1 mm (**A, B, G, H, J**); 0.5 mm (**D**); 0.2 mm (**E, F, L**); 0.1 mm (**K**).

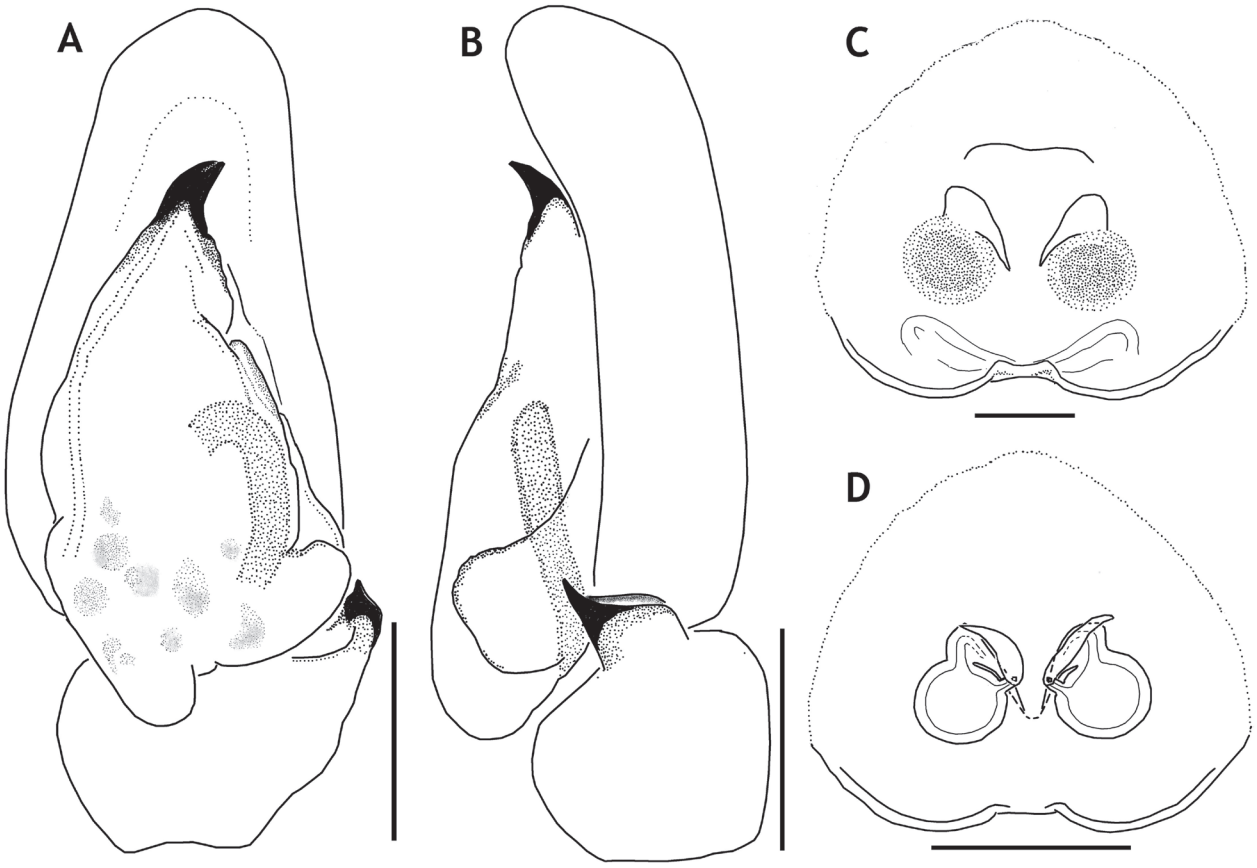

Figure 3. Genital morphology of *Siler niser* sp. nov. **A.** Left male palp of holotype (ZSI-I/SP 40), ventral view; **B.** Same, retrolateral view; **C.** Epigyne of paratype (ZSI-I/SP 41), ventral view; **D.** Vulva, dorsal view. Scale bars: 0.2 mm (**A, B, D**); 0.1 mm (**C**).

Female. Carapace covered with white and grey scales; lateral margins covered with reddish scales; outer rim covered with bluish-white scales. Legs yellow-brown with longitudinal dark brown and white stripes. Abdomen greyish with a similar, but incomplete pattern as seen in male; a median transverse red band sandwiched between two blue bands; anterior blue band discontinuous medially, posterior band broad and continuous (Fig. 1D, E). In darker females, the red band is completely black, this perhaps occurring in older females when the scales are lost (Fig. 1F).

Natural history. Specimens were found in acute vicinity of the ant *Camponotus compressus*. Individuals were myrmecophagic like *Siler semiglaucus* (confirmed through visual observations). Both sexes waved the first pair of legs in the air, perhaps mimicking the antennae of the ants (Fig. 1B, F). This behaviour was observed both in the presence as well as in the absence of ants. Individuals were extremely agile and moved to the underside of leaves as soon as they detected any external movement. Specimens were collected from *Hyptis suaveolens* and *Lannea coromandelica* seedling foliage, both about 2 feet (ca. 60 cm) above the ground, during the month of May. The average humidity during the collection period was 63% (range: 62% to 64%).

Threat status. The individuals of *Siler niser* sp. nov. were collected from a grassland-shrubland type habitat (Fig. 4A, B). These biomes are under threat as they are often labelled as unproductive and the biodiversity they harbour remains poorly documented (Nerlekar et al. 2022). Since *Siler niser* sp. nov. is known only from its type locality (Odisha, India), other possible locations of its occurrence are yet unknown. Due to lack of distributional data especially in grasslands where surveys are most often ignored, we categorise *Siler niser* sp. nov. as data deficient.

Distribution. Known only from the type locality (Odisha, India) (Fig. 5).

Phylogeny. The best model of sequence evolution according to BIC was TRN+I+G. The obtained ML tree (Fig. 6) was rooted using the branch leading to the two outgroup taxa. The new species was sister to a clade consisting of *S. collingwoodi*, *S. cupreus* and *S. ruber*, albeit with low bootstrap support. The uncorrected p-distance within *Siler* species ranged from 1.3% to 7.4%.

The new species was also morphologically different from all other congeners with a suite of morphological characters as described above. The members of the population we collected from Odisha State, India share characters like the body covered with iridescent scales, abdomen with transverse banding pattern and spots, tibia I in males with typical dense bottle brush-like setae, male palp with elongated bulbus and flattened, spatulate RTA, female with simple rounded epigyne and short copulatory ducts

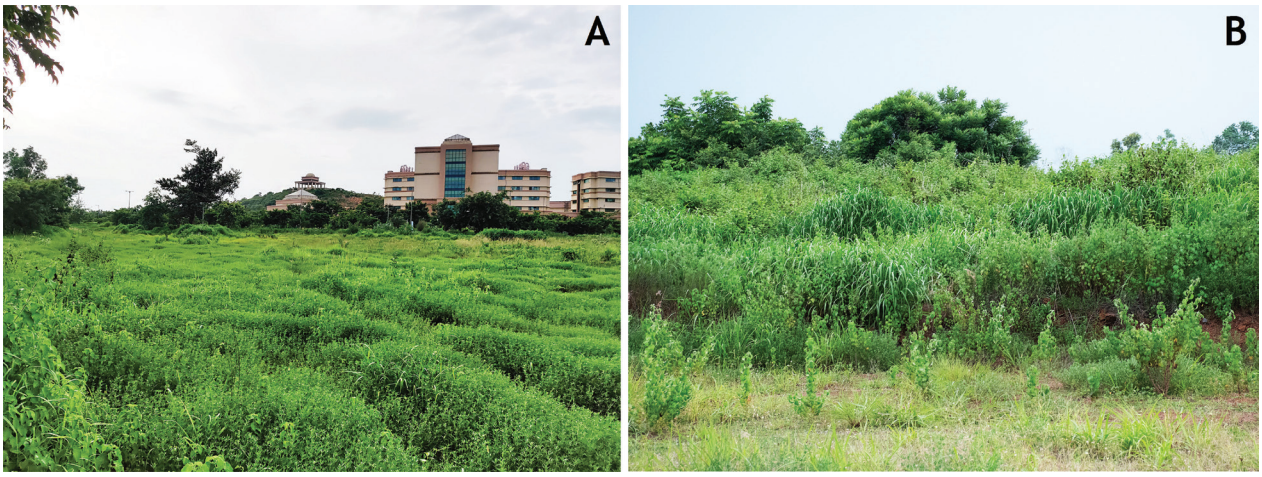

Figure 4. Habitat photographs and type locality of *Siler niser* sp. nov. in NISER campus, Khordha, Odisha.

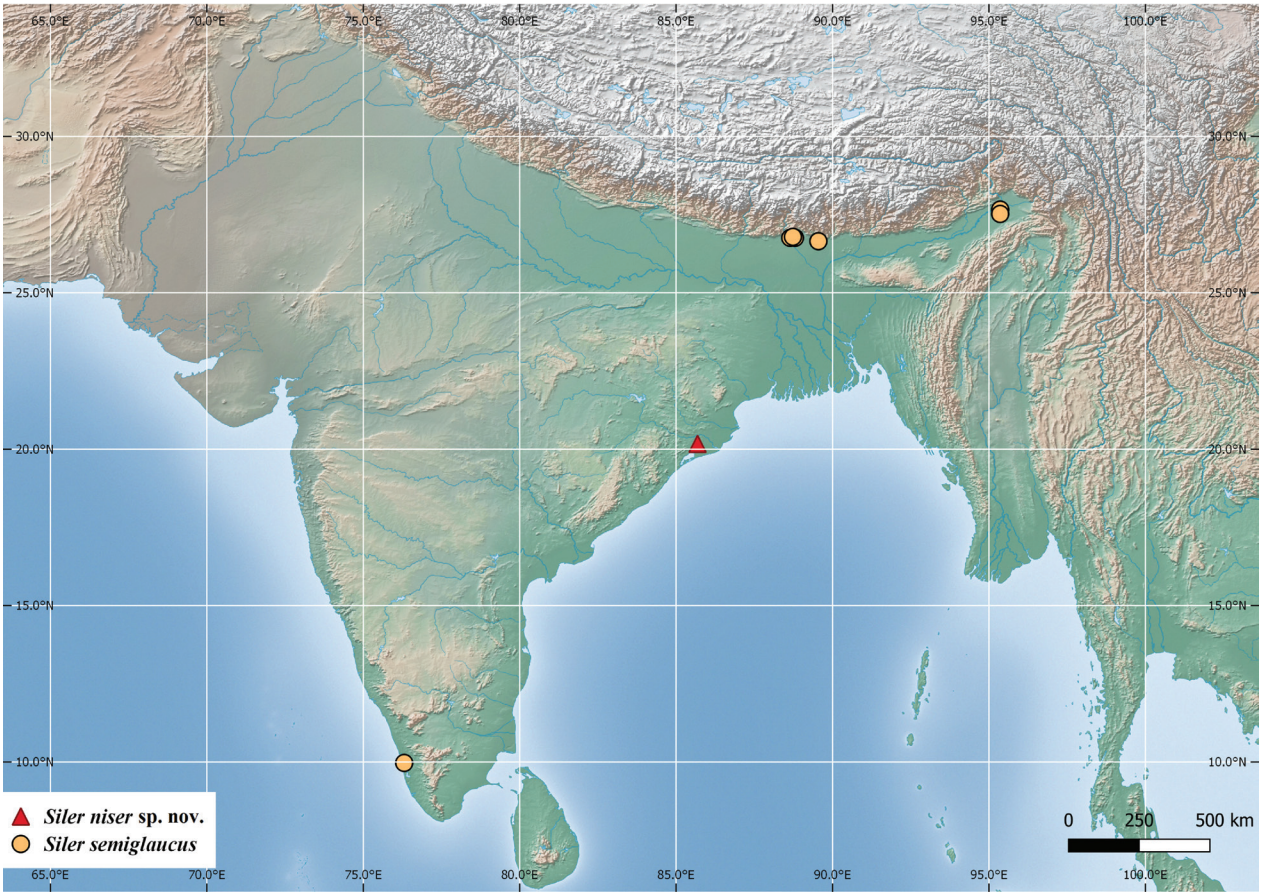

Figure 5. Map showing the current distribution of the genus *Siler* in India.

(Prószyński 1985; Żabka 1985) with congeners, but are distinct both morphologically and phylogenetically. Therefore, we use the general lineage concept in order to delineate this population as a new species (de Quiroz 1998).

Discussion

We used multiple lines of evidence to establish the newly-found population as a new species. The morphological diagnosis provides clear evidence for the distinction of this new population of *Siler* species. Given the known distribution of jumping spiders of the genus *Siler*, we expected a sister relationship between our new species and the only known congener from India – *Siler semiglaucus*. Surprisingly, our phylogenetic analysis retrieved *S. niser* sp. nov. as sister to a clade containing the Southeast Asian lineages namely – *S. collingwoodi*, *S. cupreus* and *S. ruber*. We included two published sequences of *S. semiglaucus* (Specimen KY888770 from Sri Lanka, Specimen 392837 from India) (Kanesharatnam and Benjamin 2019; Tyagi et al. 2019). These specimens, however, were retrieved as

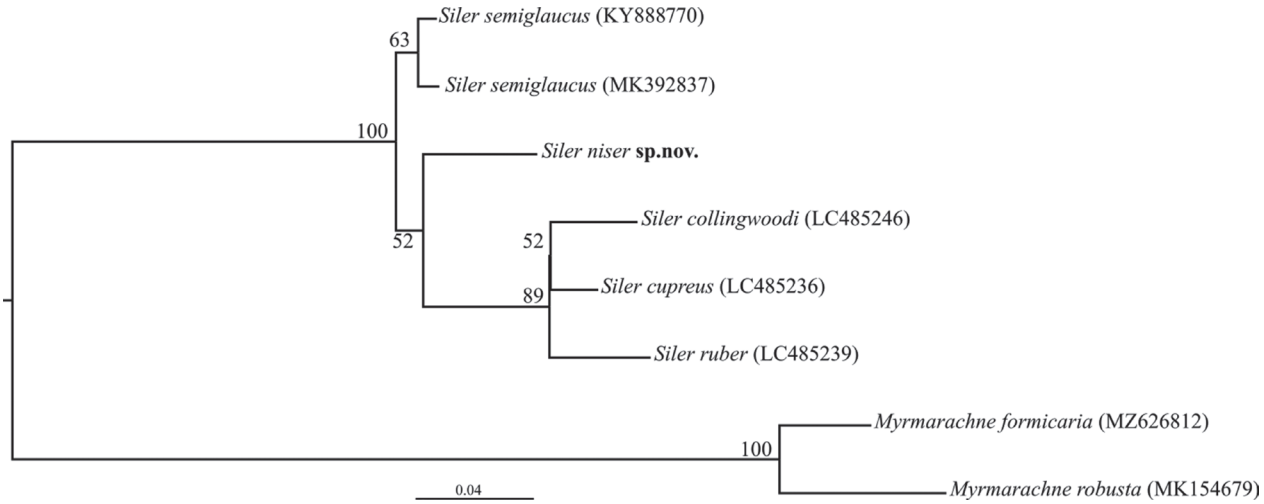

Figure 6. Maximum Likelihood tree of the genus *Siler* using an unpartitioned partial CO-1 gene. The numbers near the nodes represent branch support values.

sister lineages, albeit with low bootstrap support. Although *S. semiglaucus* is considered a widespread species, such low bootstrap support indicates a species complex encompassing multiple independently evolving lineages that require further investigation. In addition, our findings suggest that the low number of species observed in the genus *Siler* may be an artefact of inadequate sampling. A taxonomic revision of jumping spiders of the genus *Siler* is thus warranted.

The behaviour of individuals of *S. niser* sp. nov. is especially intriguing. Both sexes bob their abdomens and wave their front pair of legs to produce a type of behaviour termed as "antennal illusion". This type of behaviour is commonly observed in various species of ant-mimicking spiders (Ceccarelli 2008; Shamble et al. 2017). Although *S. niser* sp. nov. bears no visual resemblance to an ant, it may utilise such behavioural adaptations to infiltrate ant colonies, as ants are their preferred prey (pers. obs. AP). Moreover, they may bear a chemical resemblance to the ants, which may also enable them to stay in close vicinity with the ants despite bearing no morphological resemblance (Uma et al. 2013). These traits may also grant protection from predators, which is the most commonly cited explanation for the evolution of such processes (Ceccarelli 2008; Uma et al. 2013; Shamble et al. 2017). Since such types of behaviour have been documented in *S. semiglaucus* (Grob 2015), we suspect that the presence of the same mymercophagy is prevalent in other *Siler* species (Jackson et al. 1998; Nelson et al. 2004; Touyama et al. 2008; Grob 2015). We recommend that the evolution and functional ecology of such behaviour in the brilliantly coloured spiders of the genus *Siler* are investigated in the future.

Acknowledgements

We are grateful to Dr K.A. Subramanian, Officer-in-Charge, SRC, ZSI for kindly allowing JC to use the microscope facility. Thanks to Mr. Shubhang Srikanth Acharya (NISER Bhubaneswar) for the help and support during the fieldwork. ADR and AP thank the Department of Atomic Energy and NISER Bhubaneswar for their facilities and support. We thank the subject editor Dr Danilo Harms (Germany) and the reviewers Dr Dmitri V. Logunov (UK), Dr Galina N. Azarkina (Russia) and Dr Suresh P. Benjamin (Sri Lanka) for their constructive comments and suggestions which improved the manuscript.

References

Baba YG (2010) A new record of *Siler collingwoodi* (Araneae: Salticidae) from Japan. Acta Arachnologica 59(1): 17–19. https://doi.org/10.2476/asjaa.59.17

Bohdanowicz A, Prószyński J (1987) Systematic studies on East Palaearctic Salticidae (Araneae), IV. Salticidae of Japan. Annales Zoologici, Warszawa 41(2): 43–151.

Bork RJ (2015) Primer efficacy in the DNA barcoding of spiders. Honors Program Theses, 169 pp. https://scholarworks.uni.edu/hpt/169

Caleb JTD, Sankaran PM (2023) Araneae of India. Version 2023. http://www.indianspiders.in [Accessed on 25.02.2023]

Ceccarelli FS (2008) Behavioral mimicry in Myrmarachne species (Araneae, Salticidae) from North Queensland, Australia. The Journal of Arachnology 36(2): 344–351. https://doi.org/10.1636/CSt07-114.1

de Quiroz K (1998) The general lineage concept of species, species criteria and the process of speciation: a conceptual unification and terminological recommendations. In: Howard DJ, Berlocher SH (Eds) Endless forms: Species and speciation, Oxford University Press, New York, 57–75.

Dhali DC, Saha S, Raychaudhuri D (2017) Litter and ground dwelling spiders (Araneae: Arachnida) of reserve forests of Dooars, West Bengal. World Scientific News 63: 1–242.

Edgar RC (2004) MUSCLE: multiple sequence alignment with high accuracy and high throughput. Nucleic Acids Research 32(5): 1792–1797. https://doi.org/10.1093/nar/gkh340

Grob P (2015) Notes on the jumping spider *Siler semiglaucus* (Simon, 1901) in Thailand (Araneae: Salticidae: Heliophaninae). Peckhamia 126(1): 1–5.

Hill DE (2009) Bottle brush of a male *Siler* from Hong Kong, with notes on some related spiders (Araneae: Salticidae). Peckhamia 73(1): 1–3.

Jackson RR, Li D, Barrion AT, Edwards GB (1998) Prey-capture techniques and prey preferences of nine species of ant eating jumping spiders (Araneae: Salticidae) from the Philippines. New Zealand Journal of Zoology 25(3): 249–272. https://doi.org/10.1080/03014223.1998.9518155

Kanesharatnam N, Benjamin SP (2019) Multilocus genetic and morphological phylogenetic analysis reveals a radiation of shiny South Asian jumping spiders (Araneae, Salticidae). ZooKeys 839: 1–81. https://doi.org/10.3897/zookeys.839.28312

Kulkarni S, Joseph S (2015) First record of genus *Siler* Simon, 1889 (Araneae: Salticidae) from India. Journal of Threatened Taxa 7(10): 7701–7703. https://doi.org/10.11609/JoTT.o4266.7701-3

Montesanto G (2015) A fast GNU method to draw accurate scientific illustrations for taxonomy. In: Taiti S, Hornung E, Štrus J, Bouchon D (Eds) Trends in Terrestrial Isopod Biology. ZooKeys 515: 191–206. https://doi.org/10.3897/zookeys.515.9459

Nelson XJ, Jackson RR, Pollard SD, Edwards GB, Barrion AT (2004) Predation by ants on jumping spiders (Araneae: Salticidae) in the Philippines. New Zealand Journal of Zoology 31(1): 45–56. https://doi.org/10.1080/03014223.2004.9518358

Nerlekar AN, Chorghe AR, Dalavi JV, Kusom RK, Karuppusamy S, Kamath V, Pokar R, Rengaian G, Sardesai MM, Kambale SS (2022) Exponential rise in the discovery of endemic plants underscores the need to conserve the Indian savannas. Biotropica 54(2): 405–417. https://doi.org/10.1111/btp.13062

Prószyński J (1984) Atlas rysunków diagnostycznych mniej znanych Salticidae (Araneae). Zeszyty Naukowe Wyższej Szkoły Rolniczo-Pedagogicznej w Siedlcach 2: 1–177.

Prószyński J (1985) On *Siler*, *Silerella*, *Cyllobelus* and *Natta* (Araneae, Salticidae). Annales Zoologici, Warszawa 39: 69–85.

Roy TK, Saha S, Raychaudhuri D (2016) A treatise on the jumping spiders (Araneae: Salticidae) of tea ecosystem of Dooars, West Bengal, India. World Scientific News 53(1): 1–66.

Sen S, Dhali DC, Saha S, Raychaudhuri D (2015) Spiders (Araneae: Arachnida) of reserve forests of Dooars: Gorumara National Park, Chapramari Wildlife Sanctuary and Mahananda Wildlife Sanctuary. World Scientific News 20: 1–339.

Shamble PS, Hoy RR, Cohen I, Beatus T (2017) Walking like an ant: A quantitative and experimental approach to understanding locomotor mimicry in the jumping spider *Myrmarachne formicaria*. Proceedings of the Royal Society B, Biological Sciences 284(1858): 20170308. https://doi.org/10.1098/rspb.2017.0308

Simon E (1889) Etudes arachnologiques. 21e Mémoire. XXXIII. Descriptions de quelques espèces receillies au Japon, par A. Mellotée. Annales de la Société Entomologique de France 8(6): 248–252.

Tamura K, Peterson D, Peterson N, Stecher G, Nei M, Kumar S (2011) MEGA5: Molecular Evolutionary Genetics Analysis using Maximum Likelihood, Evolutionary Distance, and Maximum Parsimony Methods. Molecular Biology and Evolution 28: 2731–2739. https://doi.org/10.1093/molbev/msr121

Touyama Y, Ihara Y, Ito F (2008) Argentine ant infestation affects the abundance of the native myrmecophagic jumping spider *Siler cupreus* Simon in Japan. Insectes Sociaux 55(2): 144–146. https://doi.org/10.1007/s00040-008-0983-8

Trifinopoulos J, Nguyen LT, von Haeseler A, Minh BQ (2016) W-IQ-TREE: A fast online phylogenetic tool for maximum likelihood analysis. Nucleic Acids Research 44(W1): W232–W235. https://doi.org/10.1093/nar/gkw256

Tyagi K, Kumar V, Kundu S, Pakrashi A, Prasad P, Caleb JTD, Chandra K (2019) Identification of Indian spiders through DNA barcoding: Cryptic species and species complex. Scientific Reports 9(14033): 1–13. https://doi.org/10.1038/s41598-019-50510-8

Uma D, Durkee C, Herzner G, Weiss M (2013) Double deception: Ant-mimicking spiders elude both visually- and chemically-oriented predators. PLoS ONE 8(11): e79660. https://doi.org/10.1371/journal.pone.0079660

WSC (2023) World Spider Catalog. Version 24. Natural History Museum Bern. http://wsc.nmbe.ch [Accessed on 25.02.2023]

Żabka M (1985) Systematic and zoogeographic study on the family Salticidae (Araneae) from Viet-Nam. Annales Zoologici, Warszawa 39: 197–485.

Żabka M (1991) Salticidae (Arachnida: Araneae) of Oriental, Australian and Pacific Regions, VI. *Mopsolodes*, *Abracadabrella* and *Pseudosynagelides*—new genera from Australia. Memoirs of the Queensland Museum 30: 621–644.