

Two new species of *Afraflacilla* Berland et Millot, 1941 (Araneae: Salticidae: Chrysillini) from India

Два новых вида *Afraflacilla* Berland et Millot, 1941 (Araneae: Salticidae: Chrysillini) из Индии

Nishi Babu¹, Rishikesh Tripathi^{2*}, M. Sampathkumar³,
John T.D. Caleb⁴, G. Prasad^{1*}, A. Mohanasundaram⁵, G. Mahendiran³,
Ambalaparambil Vasu Sudhikumar²
Н. Бабу¹, Р. Трипати^{2*}, М. Сампаткумар³, Дж.Т.Д. Калей⁴,
Г. Прасад^{1*}, А. Моханасундарам⁵, Г. Махендиран³, А.В. Судхикумар²

¹ Department of Zoology, Kariavattom Campus, University of Kerala 695582, Kerala, India.

² Centre for Animal Taxonomy and Ecology, Department of Zoology, Christ College (Autonomous), Irinjalakuda 680125, Kerala, India.

³ ICAR-National Bureau of Agricultural Insect Resources, Bengaluru 560024, Karnataka, India.

⁴ Department of Anatomy, Saveetha Medical College & Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 602105, Tamil Nadu, India.

⁵ ICAR-National Research Centre for Banana, Tiruchirapalli 620102, Tamil Nadu, India.

*Correspondence: rishikesh.tripathi14@gmail.com; probios1@gmail.com

KEY WORDS: Aranei, Jumping spider, Kerala, species discovery, Tamil Nadu, taxonomy.

КЛЮЧЕВЫЕ СЛОВА: Aranei, паук-скакунчик, Керала, видове разнообразие, Тамилнад, таксономия.

ABSTRACT. Two new species of *Afraflacilla* Berland et Millot, 1941 are described from the states of Kerala and Tamil Nadu, India: *A. adavathurensis* sp.n. (♂) and *A. kerala* sp.n. (♂). Detailed descriptions, diagnostic features, and illustrations are given. A map showing the distribution of all the known Indian *Afraflacilla* species is also provided.

How to cite this paper: Babu N., Tripathi R., Sampathkumar M., Caleb J.T.D., Prasad G., Mohanasundaram A., Mahendiran G., Sudhikumar A.V. 2023. Two new species of *Afraflacilla* Berland et Millot, 1941 (Araneae: Salticidae: Chrysillini) from India // Arthropoda Selecta. Vol.32. No.4. P.459–465. doi: 10.15298/arthsel. 32.4.10

РЕЗЮМЕ. Два новых вида *Afraflacilla* Berland et Millot, 1941 описаны из штатов Керала и Тамилнад, Индия: *A. adavathurensis* sp.n. (♂) и *A. kerala* sp.n. (♂). Приводятся детальные описания, диагностические признаки и иллюстрации. Также дана карта распространения всех отмеченных в Индии видов *Afraflacilla*.

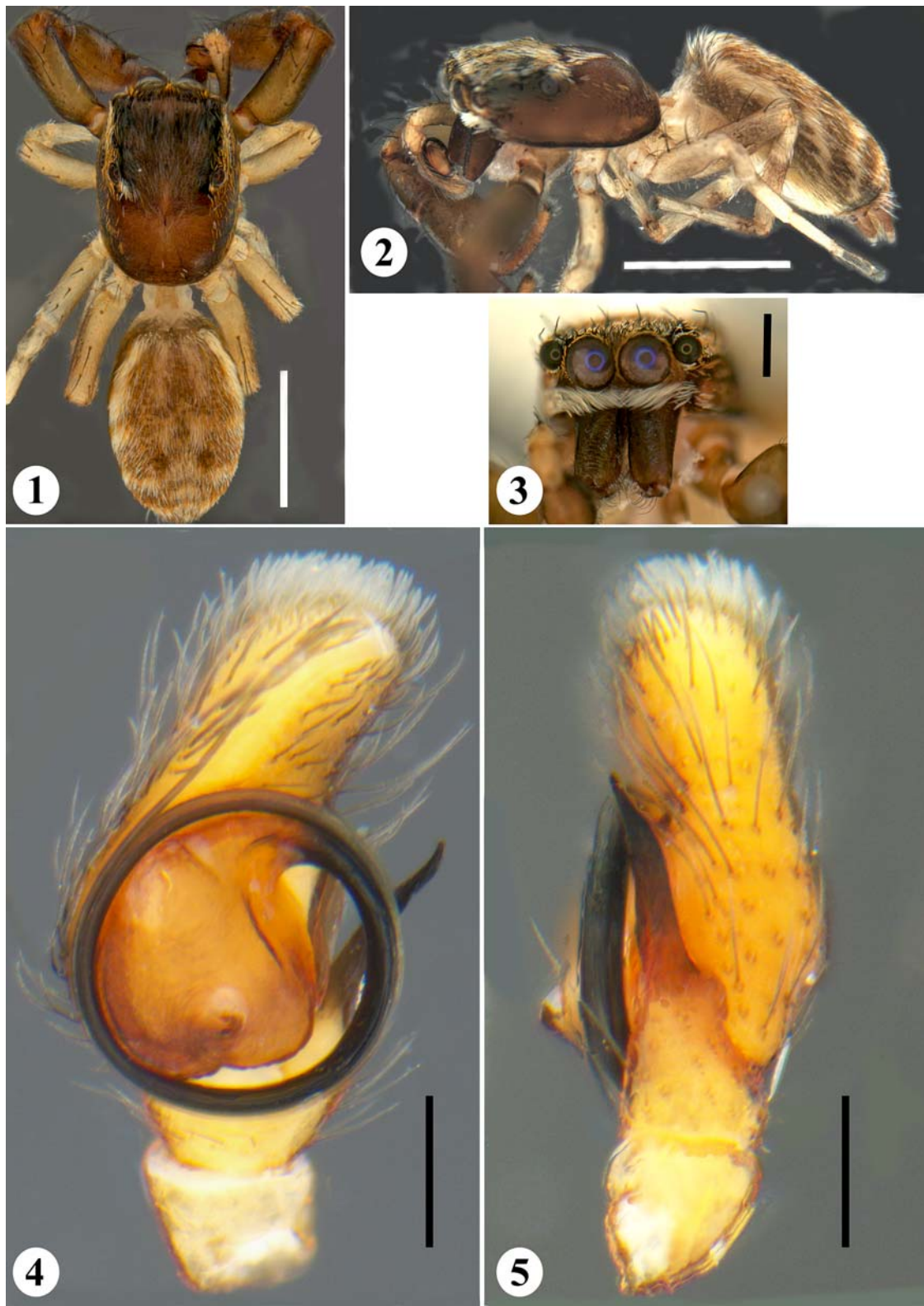
Introduction

The Chrysilline genus *Afraflacilla* Berland et Millot, 1941 was established by Berland & Millot [1941], with *Afraflacilla bamakoi* Berland et Millot, 1941 as the type species. Denis [1955] considered this genus a

senior synonym of *Flacilloides* Denis, 1954, but later Clark [1974] synonymised it with *Pseudicius* Simon, 1885. Since then, Žabka [1993] has revalidated the genus, which currently contains 45 valid species: 19 from Africa, 16 from Asia, six from Australia, one from Oceania, and three are widespread across the African and Asian continents [WSC, 2023]. The genus was recently recorded from India, being represented by three species: *Afraflacilla banni* Prajapati, Tatu et Kamboj, 2021, *A. miajlarensis* Tripathi, Jangid, Prajapati et Siliwal, 2022 and *A. kurichiadensis* Sudhin, Nafin et Sudhikumar, 2022 [Prajapati *et al.*, 2021; Sudhin *et al.*, 2022; Caleb, Sankaran, 2023]. In the present paper, two more new *Afraflacilla* species from Kerala and Tamil Nadu States in southern India are described.

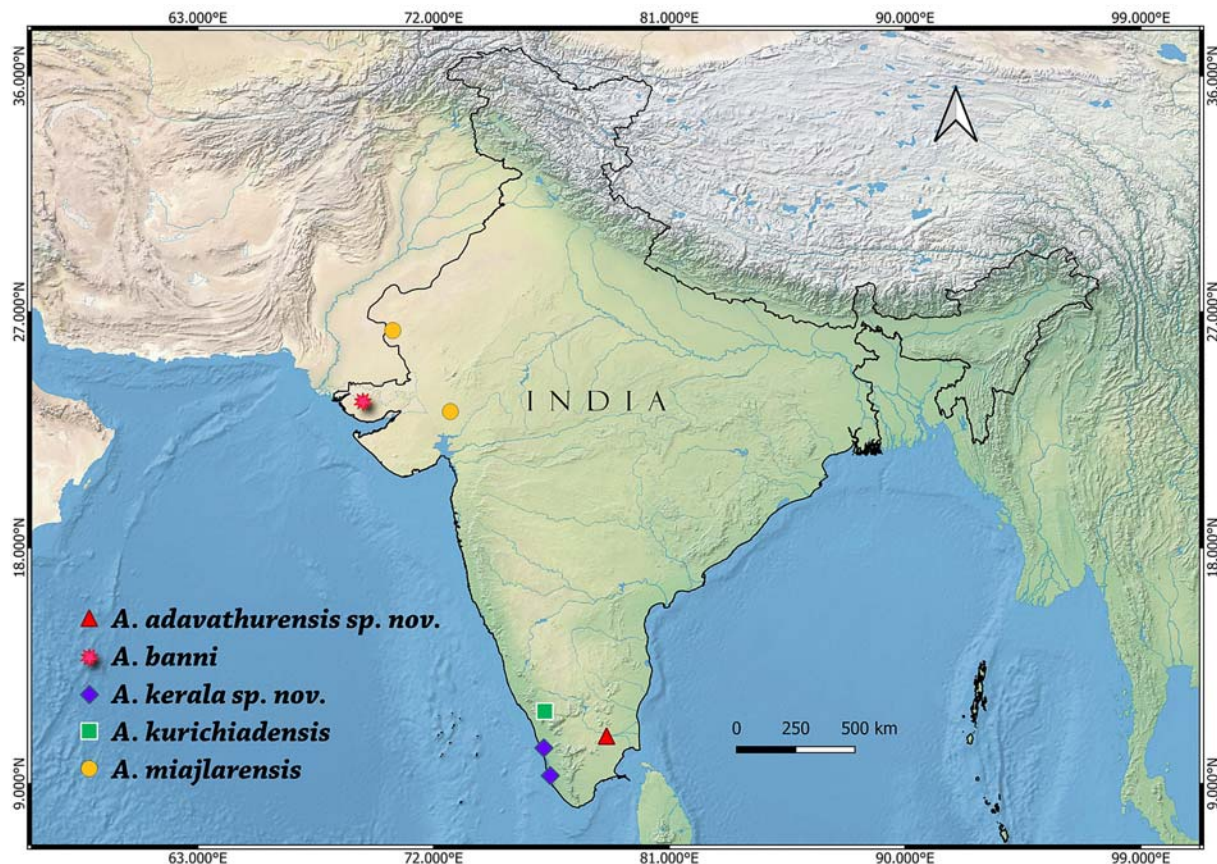
Materials and methods

Specimens were hand-collected, preserved in 70% alcohol and then examined in detail. They were photographed by means of a Leica DFC295 camera attached to the Leica S8APO (for *A. adavathurensis* sp.n.) and a Leica DMC4500 digital camera attached to a Leica M205C stereomicroscope (for *A. kerala* sp.n.) with the software package Leica Application Suite (LAS, version 4.3.0). All images were then processed with the aid of LAS version 4.2 software. Zeiss EVO 18 Scanning Electron Microscope was used to image the palp of *A. kerala* sp.n. A distributional map was generated using the online mapping software QGIS (version 3.16.3). Description format follows Sudhin *et al.* [2022]. Leg and



Figs 1–5. *Afraflacilla adavathurensis* Sampathkumar et Caleb sp.n., holotype male (NIM/NBAIR/SAL/AFRA/H-211123): 1 — habitus, dorsal view; 2 — same, lateral view; 3 — same, frontal view; 4 — left palp, ventral view; 5 — same, retrolateral view. Scale bars: (1–2) 1 mm, (3) 0.5 mm, (4–5) 0.2 mm.

Рис. 1–5. *Afraflacilla adavathurensis* Sampathkumar et Caleb sp.n., голотип самец (NIM/NBAIR/SAL/AFRA/H-211123): 1 — габитус, сверху; 2 — то же, сбоку; 3 — то же, спереди; 4 — левая пальпа, снизу; 5 — то же, сбоку-сзади. Масштаб: (1–2) 1 мм, (3) 0,5 мм, (4–5) 0,2 мм.



Map. Distributional records of *Afraflacilla* species in India.

Карта. Точки находок видов *Afraflacilla* в Индии.

palp measurements are given as follows: total length [femur, patella, tibia, metatarsus (except palp), tarsus]. The type specimens have been deposited in research collections of the National Centre for Biological Sciences (NRC), Bengaluru, India, the museum of the Department of Zoology, University of Kerala, Kariavattom, India (KUDZ), and the National Insect Museum, Indian Council of Agricultural Research – National Bureau of Agricultural Insect Resources, Bengaluru, India (NIM).

Abbreviations used in the text are as follows: ALE — anterior lateral eye, AME — anterior median eye, PLE — posterior lateral eye, PME — posterior median eye, RTA — retrolateral tibial apophysis, NCBS — National Centre for Biological Sciences, Bengaluru, India, KUDZ — University of Kerala, Kariavattom, India, NIM — National Insect Museum, Indian Council of Agricultural Research National Bureau of Agricultural Insect Resources, Bengaluru, India.

Taxonomy

Genus *Afraflacilla* Berland et Millot, 1941

Type species: *Afraflacilla bamakoi* Berland et Millot, 1941

Afraflacilla adavathurensis Sampathkumar
et Caleb **sp.n.**
Figs 1–5, Map.

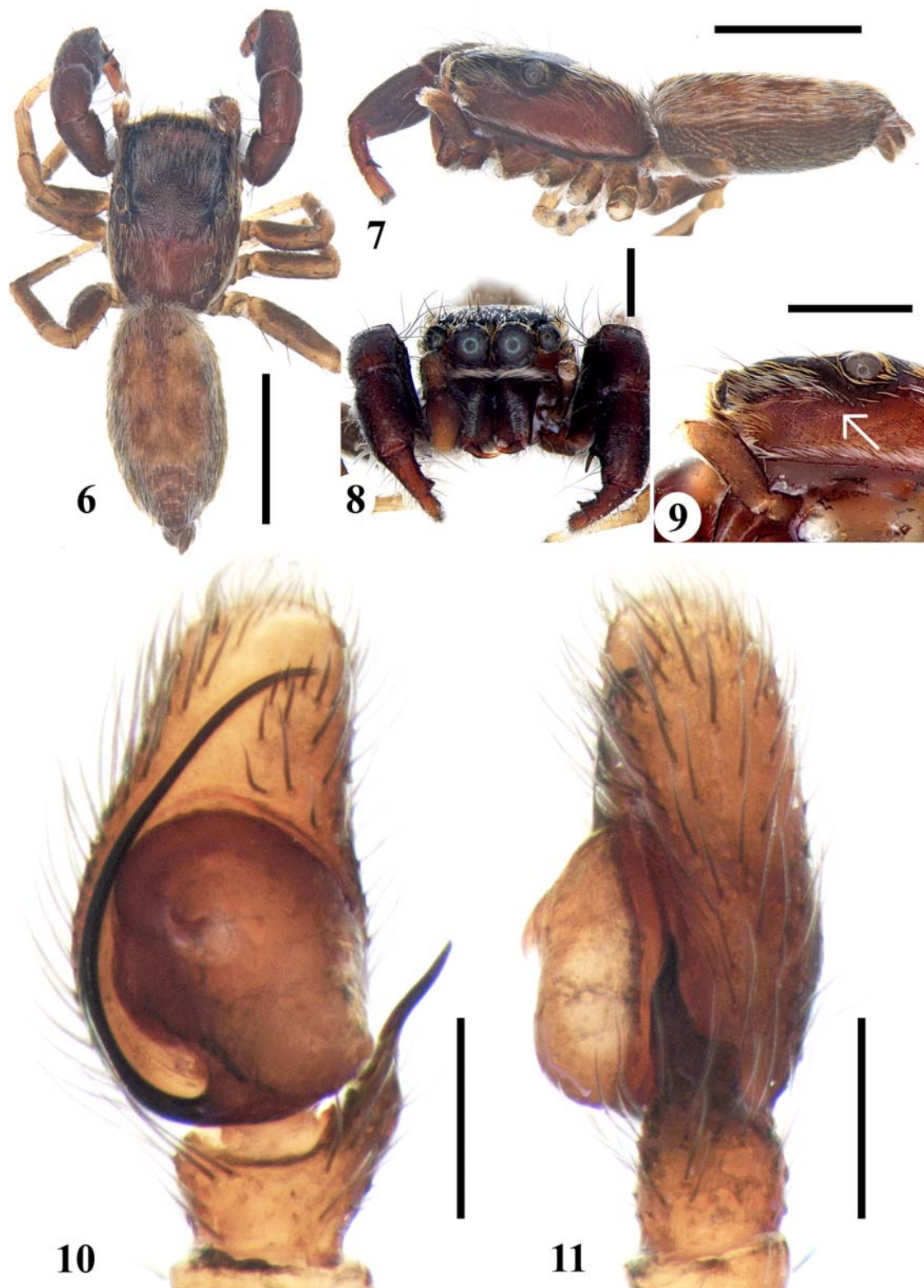
TYPE. HOLOTYPE ♂ (NIM/NBAIR/SAL/AFRA/H–211123), India, Tamil Nadu, Tiruchirappalli, Adavathur (10°82'28.2"N, 78°

61'22.9"E), by hand from banana plantations, 21.11.2022, A. Mo-hanasundaram.

ETYMOLOGY. The specific epithet is an adjective derived from the name of the village Adavathur from where the holotype was collected.

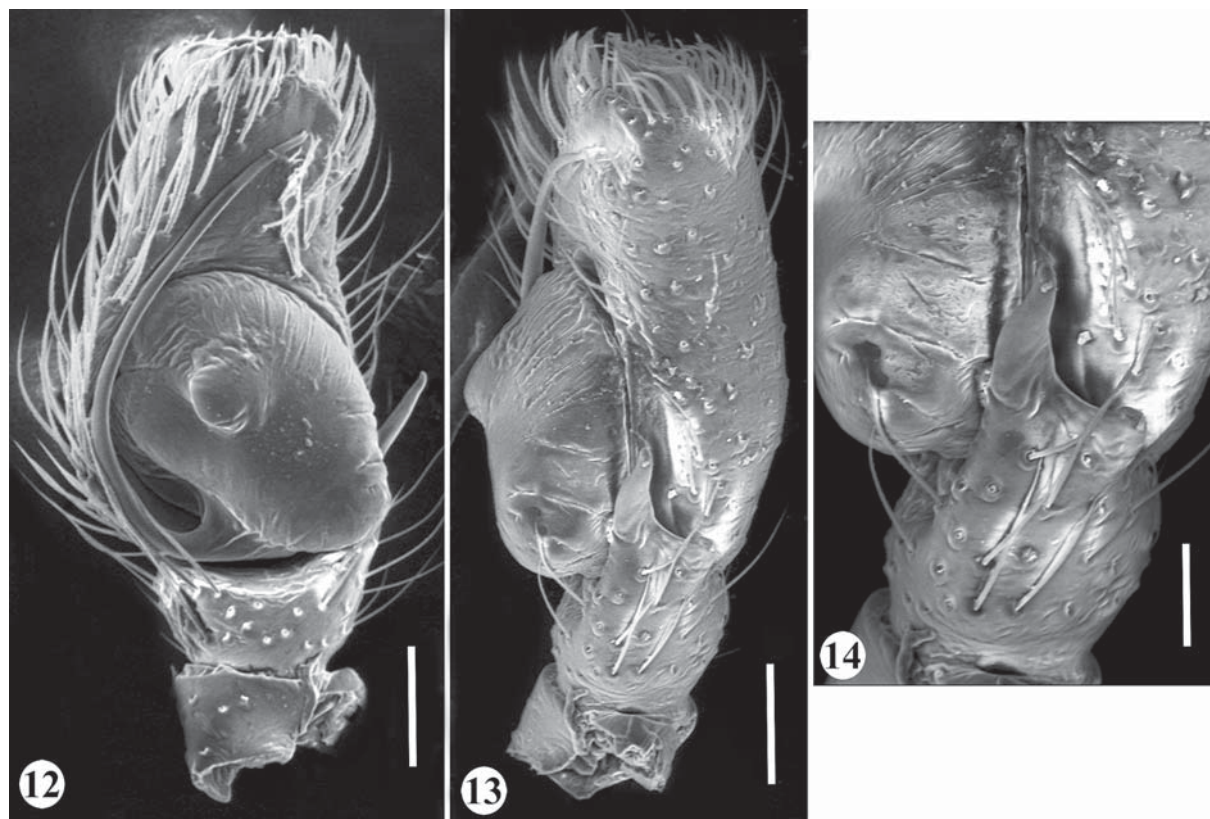
DIAGNOSIS. In a similar point of origin of the embolus (1 o'clock position), the male palp of *A. adavathurensis* sp.n. is most similar to that of the Indian *A. kurichiadensis* Sudhin, Nafin et Sudhikumar, 2022, from which it can be distinguished by the bulb lacking the prolateral process (present in *A. kurichiadensis*) and RTA singular, long and tapering toward its tip, with a simple dorsal bump at its bottom half (RTA broad, with a distinct bifurcation in *A. kurichiadensis*) (cf. Figs 4–5 with figs 33, 34, 39, 40 in Sudhin *et al.* [2022]).

DESCRIPTION. MALE (holotype, Figs 1–3, colouration in alcohol). Carapace brown, covered with white and brown setae (Figs 1–2). Ocular region dark brown, covered with numerous white and black setae (Fig. 2). Clypeus covered with a dense fringe of white setae (Fig. 3). Chelicerae brownish, promargin with one tooth, retromargin with one tooth. Maxillae pale white. Sternum oval, pale brown. Leg I robust, brown, leg II–IV slender, yellow. Abdomen oval, brown with white markings dorsally and antero-laterally, chevron-shaped marking present mid-dorsally (Fig. 1). Venter pale white. Spinnerets light brown (Fig. 1). Measurements: body length 3.40. Carapace length 1.54, width 1.00, height at PLE 0.52. Abdomen length 1.74, width 0.96. Ocular area length 0.80, width 0.83. Eye diameters: AME 0.26,



Figs 6–11. *Afraflacilla kerala* Babu, Tripathi et Caleb sp.n., holotype male (NRC-AA-4016): 6 — habitus, dorsal view; 7 — same, lateral view; 8 — same, frontal view; 9 — carapace, lateral view; 10 — left palp, ventral view; 11 — same, retrolateral view. Arrow shows stridulatory tubercles. Scale bars: (6–7) 1 mm, (8–9) 0.5 mm, (10–11) 0.2 mm.

Рис. 6–11. *Afraflacilla kerala* Babu, Tripathi et Caleb sp.n., голотип самец (NRC-AA-4016): 6 — габитус, сверху; 7 — то же, сбоку; 8 — то же, спереди; 9 — головогрудь, сбоку; 10 — левая пальпа, снизу; 11 — то же, сбоку-сзади. Стрелка указывает на стридуляционные бугорки. Масштаб: (6–7) 1 мм, (8–9) 0,5 мм, (10–11) 0,2 мм.



Figs 12–14. *Afraflacilla kerala* Babu, Tripathi et Caleb sp.n., paratype male (KUDZEN2022.XII.22b), SEM images: 12 — left palp, ventral view; 13 — same, retrolateral view; 14 — same, RTA close-up. Scale bars: (12–13) 100 μ m, (14) 50 μ m.

Рис. 12–14. *Afraflacilla kerala* Babu, Tripathi et Caleb sp.n., паратип самец (KUDZEN2022.XII.22b), СЕМ изображения: 12 — левая пальпа, снизу; 13 — то же, сзади-сбоку; 14 — то же, увеличенный RTA. Масштаб: (12–13) 100 μ m, (14) 50 μ m.

ALE 0.13, PME 0.04, PLE 0.15. Eye interdistances: AME–ALE 0.02, PME–PME 0.73, ALE–ALE 0.57, PME–PLE 0.15, PLE–PLE 0.70, ALE–PME 0.22. Length of chelicera 0.47. Palp and leg lengths: palp 1.03 [0.40, 0.13, 0.10, 0.40], leg I 2.10 [0.77, 0.19, 0.67 0.25, 0.22], II 2.07 [0.77, 0.22, 0.45, 0.33, 0.30], III 2.19 [0.70, 0.26, 0.46, 0.42, 0.35], IV 2.03 [0.85, 0.19, 0.31, 0.38, 0.30]. Leg formula: 3124. Pedipalp (Figs 4–5): segments brown; RTA long, broad basally and tapering toward tip, dorsal margin with a small bump basally (Fig. 4); embolus originates at 1 o'clock position, coiled, tip needle-like (Fig. 5).

FEMALE. Unknown

DISTRIBUTION. Known only from the type locality in Tamil Nadu, India (Map).

Afraflacilla kerala Babu, Tripathi et Caleb sp.n.
Figs 6–14, Map.

TYPE. HOLOTYPE ♂ (NRC-AA-4016), India, Kerala, Thrissur, Irinjalakuda, Christ college campus (10°21'27.8"N, 76°12'48.3"E), by hand from a tree branch, 22.06.2022, R. Tripathi. — PARATYPE: 1 ♂ (KUDZEN2022.XII.22b), India, Kerala, Alappuzha, Veeyapuram (9.30°N, 76.46°E), by hand from a tree, 18.12.2021, N. Babu.

ETYMOLOGY. The specific epithet is a noun in apposition referring to the name of the Indian State, Kerala from where the types were collected.

DIAGNOSIS. In the ventral origin of the embolus and the long, thin RTA, the male palp of *A. kerala* sp.n. is most similar to *A. gunbar* Żabka et Gray, 2002 from Australia

which and *A. asorotica* Simon, 1890 from Yemen, but can be separated from both by the RTA directed retrolaterally (as seen in ventral view; apically in *A. gunbar* and *A. asorotica*), RTA with broad base and a short blunt dorsal process (seen in retrolateral view; RTA ventral branch narrow, dorsal margin crescent-shaped with a pointed dorsal process in *A. gunbar*; RTA unbranched and long in *A. asorotica*), an the bulb with a retrolateral process (median in *A. gunbar*) (cf. Figs 10–14 with figs 3A–B in Żabka & Gray [2002] and figs 41, 42 in Prószyński [1993]).

DESCRIPTION. MALE (holotype, NRC-AA-4016, Figs 6–9, colouration in alcohol). Carapace oval, rather flattened, dark brown, covered with white and golden-brown hairs (Figs 6–7, 9), laterally provided with a fine band of white setae (Figs 7, 9); ocular region black, slightly wider than long, with scarce black thin spines, rim of eyes with golden brown setae, with a row of eleven long black curved bristles behind anterior eyes. Clypeus very low, brown, densely covered with white setae (Figs 8–9). Chelicerae blackish brown, prolaterally with black longitudinal streaks (Fig. 8); promarginal teeth slightly separated from each other, one large and other tiny; retromargin with one large tooth. Endites dark brown, longer than wide, broad distally, with grey hairs on inner margins. Labium brown, with scarce black setae. Sternum oval, brown, without setae. Leg I strong, robust, reddish brown; legs II–IV light yellowish brown, with black markings on all femora, patellae, tibiae and metatarsi IV (Fig. 6). Abdomen oval, light brown, indistinct median longitudinal greyish black stripe anteriorly on dor-

sum, laterally with a longitudinal white band formed of white hairs, and posterior half with fine blotches forming chevron pattern (Figs 6–7). Venter light greyish brown, with sigillae arranged in a V-shape. Spinnerets brown. Measurements: body length 3.33. Carapace length 1.44, width (at the middle) 1.01. Abdomen length 1.89, width (at the middle) 0.90. Ocular area length 0.78, width 0.83. Eye diameters: AME 0.28, ALE 0.17, PME 0.05, PLE 0.15. Eye interdistances: AME–ALE 0.01, PME–PME 0.76, ALE–ALE 0.56, PME–PLE 0.12, PLE–PLE 0.68, ALE–PME 0.23. Length of chelicera 0.45. Palp and leg lengths: palp 1.11 [0.39, 0.11, 0.09, 0.52], leg I 2.42 [0.78, 0.43, 0.65, 0.34, 0.22], II 1.76 [0.58, 0.25, 0.39, 0.31, 0.23], III 1.92 [0.60, 0.26, 0.36, 0.42, 0.28], IV 2.55 [0.83, 0.31, 0.62, 0.51, 0.28]. Leg formula: 4132. Pedipalp (Figs 10–14): segments brownish. RTA long, thin, broad base, with blunt dorsal process (Figs 11, 13–14); embolus elongate, originating at 6 o'clock position (in ventral view) with broad embolic base, tip pointed (Figs 10 & 12).

FEMALE. Unknown

DISTRIBUTION. Known from Thrissur and Alappuzha Districts of Kerala, India (Map).

Discussion

Jumping spiders of the genus *Afraflacilla* are widespread from Africa to Australia, including the Middle East, South and Southeast Asia, Central, Eastern and Western Europe, numerous African countries, and Australia [WSC, 2023]. Recent findings in India have also revealed the presence of the genus in states like Rajasthan, Kerala and Tamil Nadu (Map). This study has introduced two more new species, raising the total number of known *Afraflacilla* species to 47.

An overall comparison of Indian species with Asian/Near East and Oriental/Austro-Asian relatives is here presented to understand possible affinities of the Indian fauna. Since the majority of the Indian species are known only from the male sex, only the palpal organs have been compared. The Indian species displays affinities to other representatives of the genus found across a vast geographic range. *A. banni* shows a close resemblance to *A. reiskindi* (Prószyński, 1992) from Borneo. Similarly, *A. kurichiadensis* exhibits similarities to *A. ballarini* Cao et Li, 2016 from China, and also the newly described species, *A. adavathurensis* sp.n. The second new species, *A. kerala* sp.n., shares similarities with both *A. gunbar* from Australia and *A. asorotica* found in Libya, Yemen, Saudi Arabia, and Israel. *A. maijlaensis* from western India displays resemblance to *A. arabica* Wesolowska et van Harten, 1994 known from Egypt, Yemen, Israel, Afghanistan and to *A. braunsi* (Peckham et Peckham, 1903) distributed in South Africa, the UAE, Saudi Arabia, and Turkmenistan. Thus, the Indian *Afraflacilla* fauna appear to be of a mixed composition reflecting both the Near East and Oriental/Australasian connections, which is hardly surprising as India lies in between these regions.

The distribution of similar/related species raises intriguing questions about the historical biogeographic events that might have shaped the dispersal and diver-

sification of these jumping spider species. The broad distribution of *Afraflacilla* across diverse continents and regions points to complex biogeographic history. Integrated molecular and biogeographic analyses would help to decipher historical biogeographic processes that might have influenced their global dispersal and diversification.

Although India currently harbours five *Afraflacilla* species (including those described herein) reported from the western and southern parts of the country, it is important to note that only one of them is known by both sexes; the females of others remain unknown. The relatively limited sampling across India suggests the possibility of discovering not only these four unknown females, but also other as yet undescribed species in further studies.

Compliance with ethical standards

CONFLICT OF INTEREST: The authors declare that they have no conflict of interest.

Ethical approval: No ethical issues were raised during our research.

Acknowledgments. We extend our heartfelt thanks to Dmitri Logunov (Zoological Institute, Saint-Petersburg, Russia) for his constructive comments on the manuscript. We are grateful to Rev. Fr. Jolly Andrews CMI, Principal, Christ College, Irinjalakuda, Thrissur for providing facilities for completing this work and to the Curator, National Centre for Biological Sciences, Bengaluru, India for the deposition of voucher specimen. Nishi Babu (NB) is thankful to the University Grants Commission (UGC), New Delhi and the University of Kerala for financial support. Mrs. Soumya from the Central Laboratory for Instrumentation, University of Kerala, Kariavattom is acknowledged for help with SEM images. NB would like to extend gratitude to Mr. Akhil G Nair and Ms. Kripa Mariam Mammen for their assistance and continual support throughout the field collections. ICAR Scientists of NBAIR & NRCB are thankful to their respective Directors for their facilities and encouragement. JC thanks the authorities of Saveetha Institute of Medical and Technical Sciences for their kind support during this work.

References

- Berland L., Millot J. 1941. Les araignées de l'Afrique Occidentale Française I. — Les salticidés // Mémoires du Muséum National d'Histoire Naturelle de Paris (N.S.). Vol.12. P.297–423.
- Caleb J.T.D., Sankaran P.M. 2023. Araneae of India. Version 2023. Available from: <http://www.indian.spiders.in> (accessed 23 July 2023).
- Clark D.J. 1974. Notes on Simon's types of African Salticidae // Bulletin of the British Arachnological Society. Vol.3. P.11–27.
- Denis J. 1954. Araignées recueillies par P. Remy du Sud-Algérien au Hoggar // Bulletin de la Société Zoologique de France. Vol.78. No.5–6. P.311–324.
- Denis J. 1955. Contribution à l'étude de l'Air (Mission L. Chopard et A. Villiers). Araignées // Bulletin de l'Institut Fondamental d'Afrique Noire. Vol.17(A). No.1. P.99–146.
- Prajapati D.A., Tatu K., Kamboj R.D. 2021. First records of *Afraflacilla* Berland & Millot, 1941 from India, with description of a new species (Araneae: Salticidae) // Arachnology. Vol.18. Pt.9. P.990–992.

- Prószyński J. 1993. Salticidae (Araneae) of Saudi Arabia II // Fauna Saudi Arabia. Vol.13. P.27–54.
- QGIS Development Team 2020. QGIS Geographic Information System. Ver. 3.16. Open Source Geospatial Foundation. Available from <https://qgis.org> [accessed on 30 Jun. 2023].
- Sudhin P.P., Nafin K.S., Tripathi R., Jangid A.K., Prajapati D.A., Siliwal M., Sudhikumar A.V. 2022. Description of two new species of the genus *Afraflacilla* Berland et Millot, 1941 (Araneae: Salticidae) from India // Arthropoda Selecta. Vol.31. No.3. P.326–334.
- WSC 2023. World Spider Catalog. Version 24 Natural History Museum Bern, online at: <http://wsc.nmbc.ch> (accessed on 23 June 2023). doi: 10.24436/2.
- Žabka M. 1993. Salticidae (Arachnida: Araneae) of the Oriental, Australian and Pacific regions. IX. Genera *Afraflacilla* Berland & Millot 1941 and *Evarcha* Simon 1902 // Invertebrate Taxonomy. Vol.7. P.279–295.
- Žabka M., Gray M.R. 2002. Salticidae (Arachnida: Araneae) from Oriental, Australian and Pacific regions, XVI. New species of *Grayenuilla* and *Afraflacilla* // Records of the Australian Museum. Vol.54. P.269–274.

Responsible editor D.V. Logunov