Journal of Natural History

ISSN: 0022-2933 (Print) 1464-5262 (Online) Journal homepage: http://www.tandfonline.com/loi/tnah20

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To cite this article: Suresh P. Benjamin (2017): Distributional and taxonomic notes on the crab spider genus Epidius with descriptions of five new species (Araneae: Thomisidae), Journal of Natural History, DOI: 10.1080/00222933.2017.1302016

To link to this article: http://dx.doi.org/10.1080/00222933.2017.1302016

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JOURNAL OF NATURAL HISTORY, 2017
http://dx.doi.org/10.1080/00222933.2017.1302016

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Distributional and taxonomic notes on the crab spider genus *Epidius* with descriptions of five new species (Araneae: Thomisidae)

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ABSTRACT

Distributional and taxonomic data are provided for six species of crab spiders of the genus *Epidius* Thorell, 1877 of which five species, *E. coloratus* sp. nov., *E. elongatus* sp. nov. (male), *E. floreni* sp. nov. (male/female), *E. longimanus* sp. nov. (male/female) and *E. mahavira* sp. nov. (male/female), are newly described. Evidence is provided to demonstrate that *Pothaeus* Thorell, 1895 (type species *Pothaeus armatu* is a junior synonym of *Epidius. Epidius bazarus* is shown to be a junior synonym of *E. armatus* comb. nov.

http://zoobank.org/urn:lsid:zoobank.org:pub:15B56D3E-69FB-46CD-8AFE-34919B844D14

ARTICLE HISTORY
Received 27 October 2016
Accepted 27 February 2017

KEYWORDS
Taxonomy; South Asia; Southeast Asia; Burma; Ceylon; biodiversity

Introduction

Males of the crab spider genus *Epidius* Thorell, 1877 have a very characteristic palp first seen in an illustration of Simon (1897). His drawing shows a palp with an unusually elongated femur and tibia, which appear much longer than the cymbium. Further, the distal tip of the palpal tibia in his figure appears to be furnished with a number of thick elongated spines. These characters are still diagnostic for *Epidius* (Benjamin 2000, 2011) and enable constituent species of the genus to be easily recognised. However, the exact identity of the type species of *Epidius*, *E. longipalpis* Thorell, 1877, described over a century ago, remains a mystery. The type specimen, an adult male, from Kandari (Kendari), Southeast Sulawesi, has been misplaced (Dr. Maria Tavano (MCSN), in litt.).

In an effort to relocate and redescribe the type species, I examined collections of crab spiders in several museums. Although my search produced five new species, specimens that could be unambiguously identified as *E. longipalpis* were not discovered in the hundreds of vials examined. The aim of this paper is to describe the five new species found and to demonstrate that *Pothaeus* Thorell, 1895 is a junior synonym of *Epidius*. This is the fourth contribution of a series based partly on collections made by Christa Deeleman-Reinhold and coworkers, of spiders living in the forest canopy of Southeast Asia (Benjamin 2013, 2014, 2016).

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Material and methods

Methodology follows Benjamin (2011). Specimens used for habitus illustrations were placed in 70% ethanol and photographed with a Zeiss AxioCam HRc camera mounted on a dissecting microscope (Zeiss Discovery V20) with top illumination and a magnification of up to 150×. Images were edited using Zeiss ZEN Pro software package. Left male palp structures are depicted unless otherwise stated. Drawings were done as described in Benjamin (2011). Setae are usually not depicted in the final drawings. All measurements are given in millimetres. A Hitachi S-2460 SEM housed at ZFMK was used to study and photograph morphological features; relevant methodology is given in detail in Benjamin (2011). Coordinates are given only where known, in the format given in the labels.

Morphological abbreviations: AER, anterior row of eyes; ALE, anterior lateral eyes; AME, anterior median eyes; C, conductor; CD, copulatory duct; CO, copulatory opening; E, embolus; MA, median apophysis; MTr, macro-trichobothrium on palpal tibia; PER, posterior row of eyes; PLE, posterior lateral eyes; PME, posterior median eyes; RTA, retrolateral/apical tibial apophysis; S, spermatheca; SDT, sperm duct, connects to embolus.

Institutional abbreviations: BMNH, The Natural History Museum, London; MCSN, Museo Civico di Storia Naturale 'Giacomo Doria', Genova; MNHN, Muséum National d`Histoire Naturelle, Paris; SMF, Research Institute Senckenberg, Frankfurt am Main; RMNH, The National Museum of Natural History, Naturalis, Leiden; ZFMK, Zoological Research Museum Alexander Koenig, Bonn.

Taxonomy

Family Thomisidae
Genus ***Epidius*** Thorell, 1877

Epidius Thorell, 1877: 492 (type species by original designation *Epidius longipalpis* Thorell, 1877).

Pothaeus Thorell, 1895: 276 (type species by original designation *Pothaeus armatus* Thorell, 1895) New synonymy.

Synonymy

The type series of *P. armatus* are here considered typical members of the genus *Epidius* as they fulfill criteria given in the diagnosis of *Epidius* here and in Benjamin (2011). The type series in BMNH, examined by me, consists of 2 females (some legs missing/broken) and 1 juvenile (prosoma/opisthosoma separated) in a single vial. All specimens are in a bad condition (Figure 1(c, d)). The vial includes three labels: label 1: *Pothaeus armatus*, Thorell, type; label 2: 1971/213; label 3: *Pothaeus armatus* Thorell, Burma, Oates. One of the two adult females is a very large specimen (Figure 1(c)) and the other is much smaller (Figure 1(d)). Both adult specimens have a 'typical' *Epidius* epigynum with characteristic oval, dual-chambered spermatheca connected by a C-shaped, thick-walled CD (Figure 1(e, f)).

Diagnosis

Species of the genus *Epidius* can be separated by the following characters. Male palp with elongated femur and tibia (both are longer than the cymbium; Figure 2(f); Benjamin 2000, 2011, figs 33a–c, 35c). The distal tip of male palpal tibia with 4 to 6 thick long

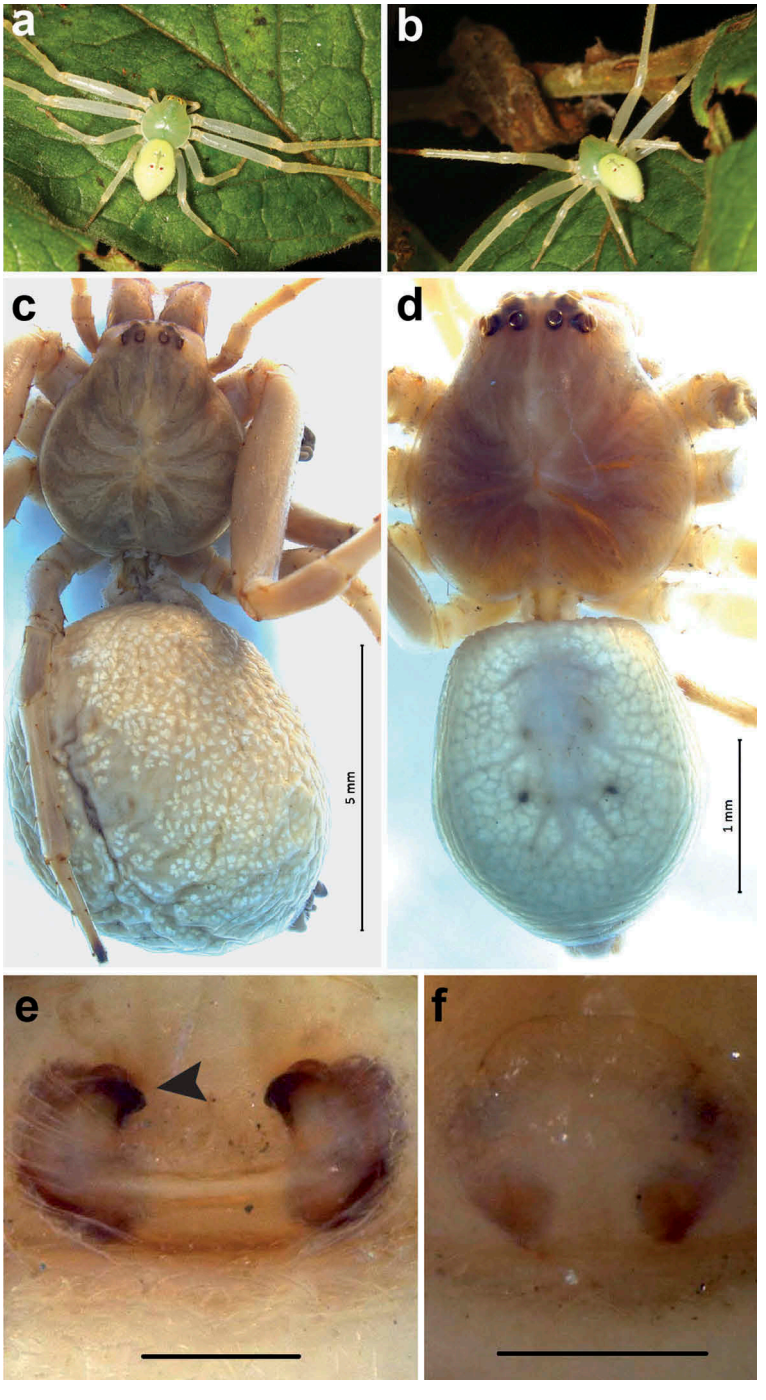

Figure 1. *Epidius armatus* (Thorell, 1895) comb. nov. (a–c, e), the smaller adult female of the type series (d, f). (a, b) Female from Laos, in life (image courtesy of Peter Jäger, SMF). (c) The larger adult female of the type series (1971/213). (d) Smaller adult female. (e) Epigynum of c. (f) Epigynum of d. (c, d) Dorsal view. (e, f) Ventral view. Arrow points to the lateral projections of the epigynum. Scale bars: e, f = 0.2 mm; d = 1.0 mm; c = 5.0 mm.

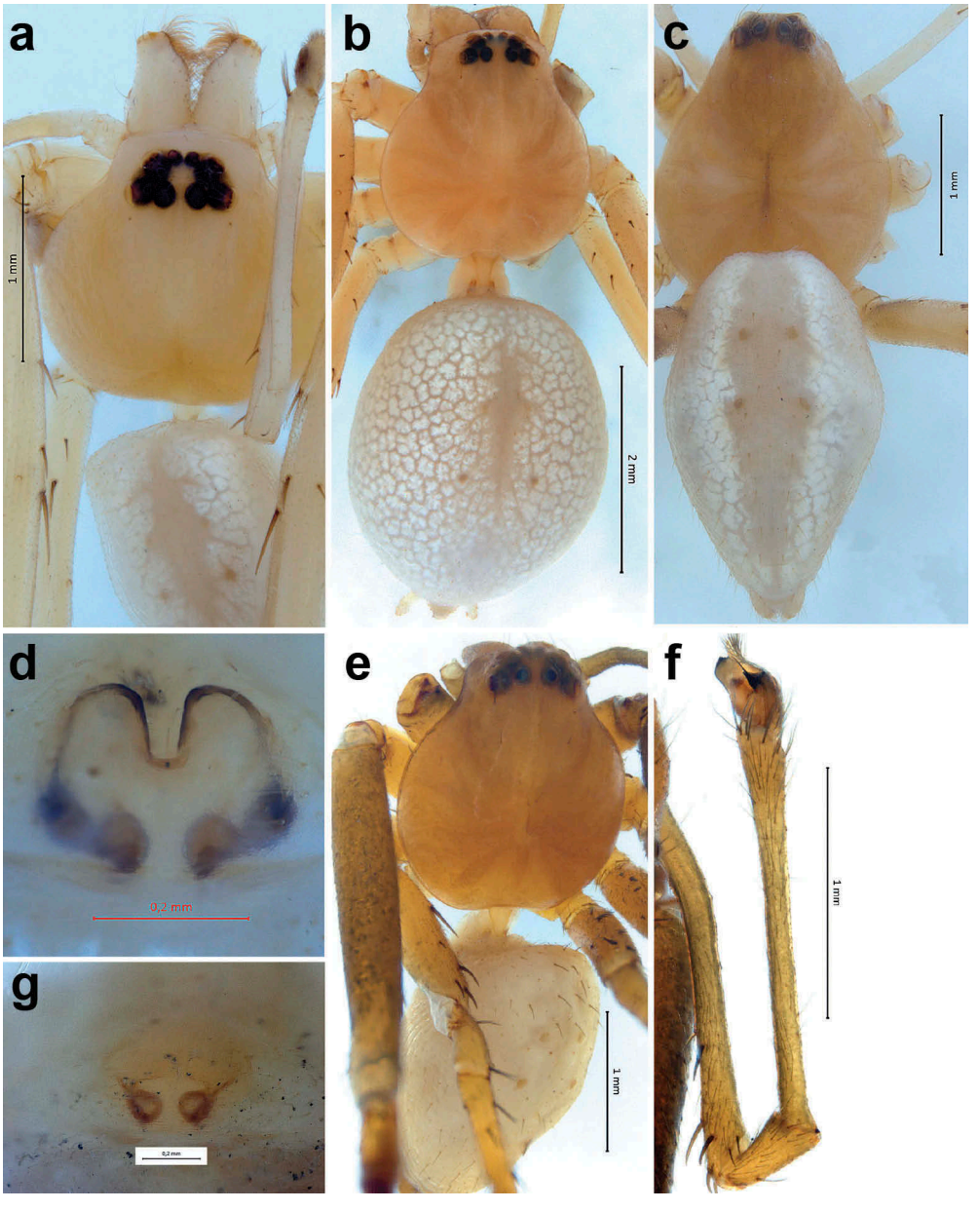

Figure 2. *Epidius floreni* sp. nov. RMNH 15,913 (a, b, d), *Epidius elongatus* sp. nov. RMNH 15,906 (c), *Epidius coloratus* sp. nov. RMNH 15,921 (e, f), and *Epidius longimanus* sp. nov. MNHN 9783 (g). (a, e) Male prosoma, dorsal view. (b) Female habitus, dorsal view. (d, g) Epigynum, ventral view. (f) Palp, prolateral view. Scale bars: d, g = 0.2 mm; a, c, e, f = 1.0 mm; b = 2.0 mm.

spines (Benjamin 2000, 2011, figs 33b, 35c, 36a–c; Tang et al. 2009); MA, if present, fixed (Benjamin 2011, figs 33b, 35c, 36a–c). Females can be separated by the presence of oval, dual-chambered spermatheca connected by C-shaped, thick-walled CD (Benjamin 2011, figs 34a–d, 35a, b, 38f).

Remarks

The type specimen of *E. longipalpis*, which was from Kendari, Southeast Sulawesi, Indonesia, was deposited in the MCSN. However, it cannot be located there (Maria Tavano in litt.). Thorell's (1877) description was not illustrated. The first illustration of the unique male palp of the type species *E. longipalpis* is by Simon (1897), which shows a palp with an elongated tibia and femur (femur and tibia longer than the cymbium). Further, the distal tip of the male palpal tibia in the figure appears to be furnished with some thick elongated spines. Both characters are diagnostic for *Epidius*.

Epidius armatus (Thorell, 1895) comb. nov.

Figure 1(a–c, e)

Type material

Pothaeus armatus Thorell, 1895: 276. Type material (BMNH): 2 females, 1 juvenile from Burma (Thorell 1895). See above for details. The largest female in the type series is designated as the lectotype to define the species. The identity of the smaller female (Figure 1(d, f)) and juvenile specimen is unclear.

Platythomisus bazarus Tikader, 1970: 48, figs 27a–c. Transferred by Tang et al. (2009) from *Platythomisus* to *Epidius*; types not available for study. New synonymy.

Epidius bazarus (Tikader, 1970): Tang et al. (2009, p. 42, fig. 2A–F); Tang and Li (2010, p. 8–11, figs 1–3). Transfer from *Platythomisus* and description of male. New synonymy.

Remarks

The illustrations of *Platythomisus bazarus* (Tikader 1970, fig. 27a, b) match the lectotype and other material listed herein. The markings, the lines and the two round muscle spots are found in the female specimen shown in Figure 1(a). The outline of the epigynum shown in Tikader's fig. 27b matches the outline of the epigynum of the lectotype (Figure 1(e)).

Diagnosis

Distinguished from known congeners by the short MA and RTA. Females are distinguished by the large pointed medial projections (pointed towards the median line) of the epigynum (arrow in Figure 1(e)) and by larger size (Tikader 1970; Tang et al. 2009; Tang and Li 2010). Tang and Li (2010, p. 8) also note the large body size and the 'medially shrunken' cymbium.

Description

See Tikader (1970), Tang et al. (2009) and Tang and Li (2010).

Other material examined

1 female, Laos, Champasak Province, Muang Bachieng, Ban Lak 35, That Etu, N 15°11´37,7´´ E 106°06´06,3´´, 810 m, secondary forest, vegetation, under stones, stairway to waterfall, by night, by hand. P. Jäger leg. 22 November 2012, SMF. 1 male, 1 female, same locality and label data, leaf litter near waterfall, by hand, at night, P. Jäger & S.

Muennch leg, 1-2 August 2016. Material not seen, but drawings of the male and female genitalia were made available to me by Peter Jäger (SMF).

Distribution

Burma, China, India, Laos (new record).

Epidius coloratus sp. nov.
(Figures 2(e, f) and 3(a, b))

Type material

Holotype, male, Malaysia, Sabah, Crocker Range. Ulu Senagang, 5.36° N, 11.03° E, Dendrocnidae sp. 1 15, leg. A. Floren, 18 August 2009, RMNH.ARA.15921.

Diagnosis

Distinguished from known congeners by distinctive filiform E (Figure 3(a, b)), C (ovoid, curved tip, Figure 3(a, b)), presence of a filiform MA and oval, curved RTA (Figure 3(a)).

Etymology

Refers to the intense golden colour of the holotype.

Description

Male. Total length: 3.6; prosoma length: 1.8, width: 1.5. Leg I: femur 2.5, patella 0.9, tibia 2.4, metatarsus 2.1, tarsus 0.9. Prosoma dark yellow, eye regions darker, without prominent markings or conspicuous setae. Opisthosoma without spots or markings, folium absent. Leg formula 1243, ALE > PLE > PME > AME. AER, PER recurved, eyes on brown-coloured mounds, but not touching. Palps as in Figure 3(a, b), femur and tibia characteristically elongated, femur as long as tibia, furnished with 6 thick spines and MTr. RTA present, ovoid, curved. Bulbus ovoid. C ovate, curved tip surrounds E. MA present in between C and tegulum. Embolus broad based, filiform (Figure 3(a, b)).

Female. Unknown.

Distribution

Malaysia, Sabha, Crocker Range and Brunei.

Remarks: during the production process of this paper I received images of the *Epidius* species from Brunei illustrated on p. 307 of Koh and Tzi Ming (2014). They are a perfect match to the holotype.

Epidius elongatus sp. nov.
(Figures 2(c) and 4(b))

Type material

Holotype. Male from Thailand, Nakhon Ratchasima Province, Khao Yai National Park [14° 26'29N, 101°22'11E], 800 m, 26 December 1988, leg. C. L. and P. R. Deeleman (RMNH. ARA.15906).

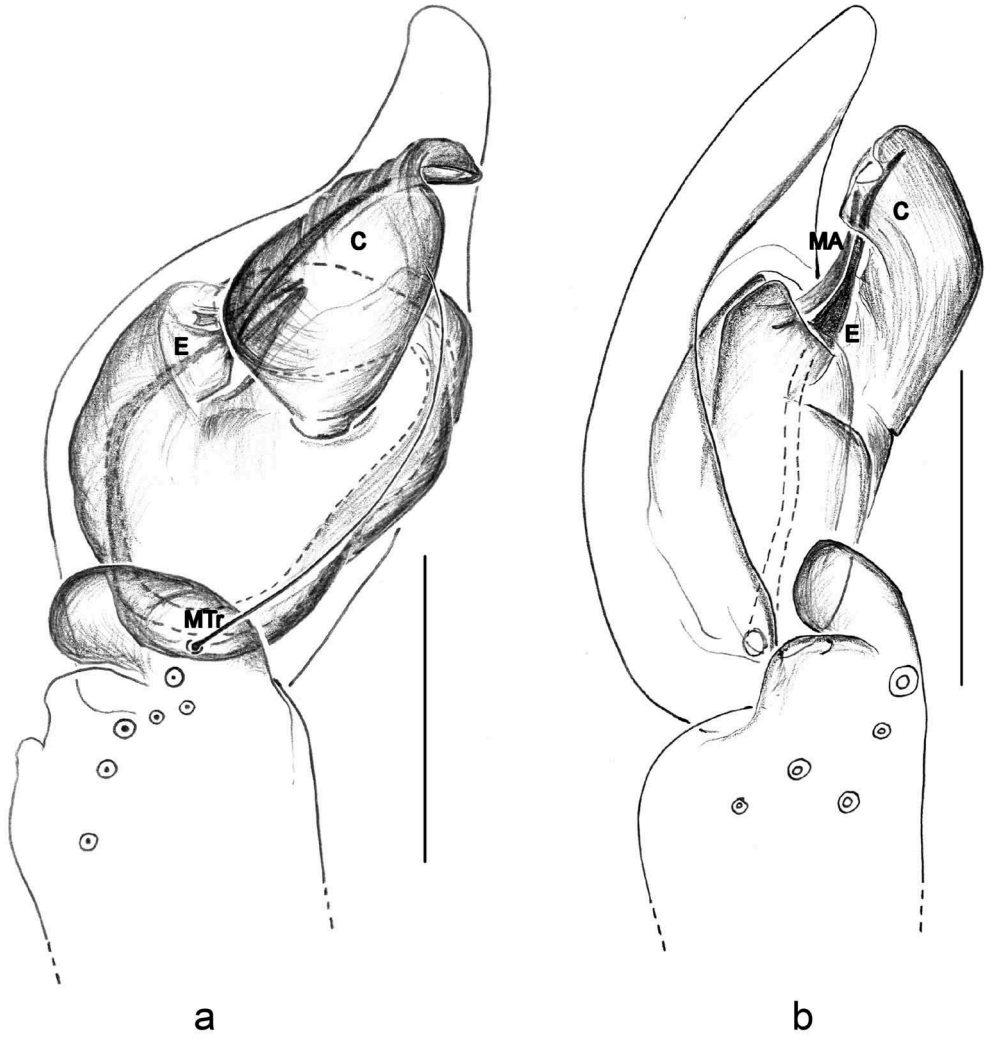

Figure 3. *Epidius coloratus* sp. nov. RMNH 15921. (a) Male palp, ventral view. (b) Same, retrolateral view. Scale bars = 0.2 mm.

Etymology

Refers to the rather elongated body and legs of the holotype.

Diagnosis

Distinguished from other known congeners by distinctive shape of E (large, stout, hook-like, tapered fine tip; Figure 4(b)), C (triangular, blunt tip; Figure 4(b)), lack of a MA and the leaf-shaped RTA (Figure 4(b)).

Description

Male. Total length: 4.5; prosoma length: 2.1, width: 1.5. Leg I: femur 3.9, patella 0.9, tibia 3.9, metatarsus 2.8. tarsus 1.2, Prosoma light brown/yellow, eye regions darker, without prominent markings or conspicuous setae. Opisthosoma with white spots, dorsally with

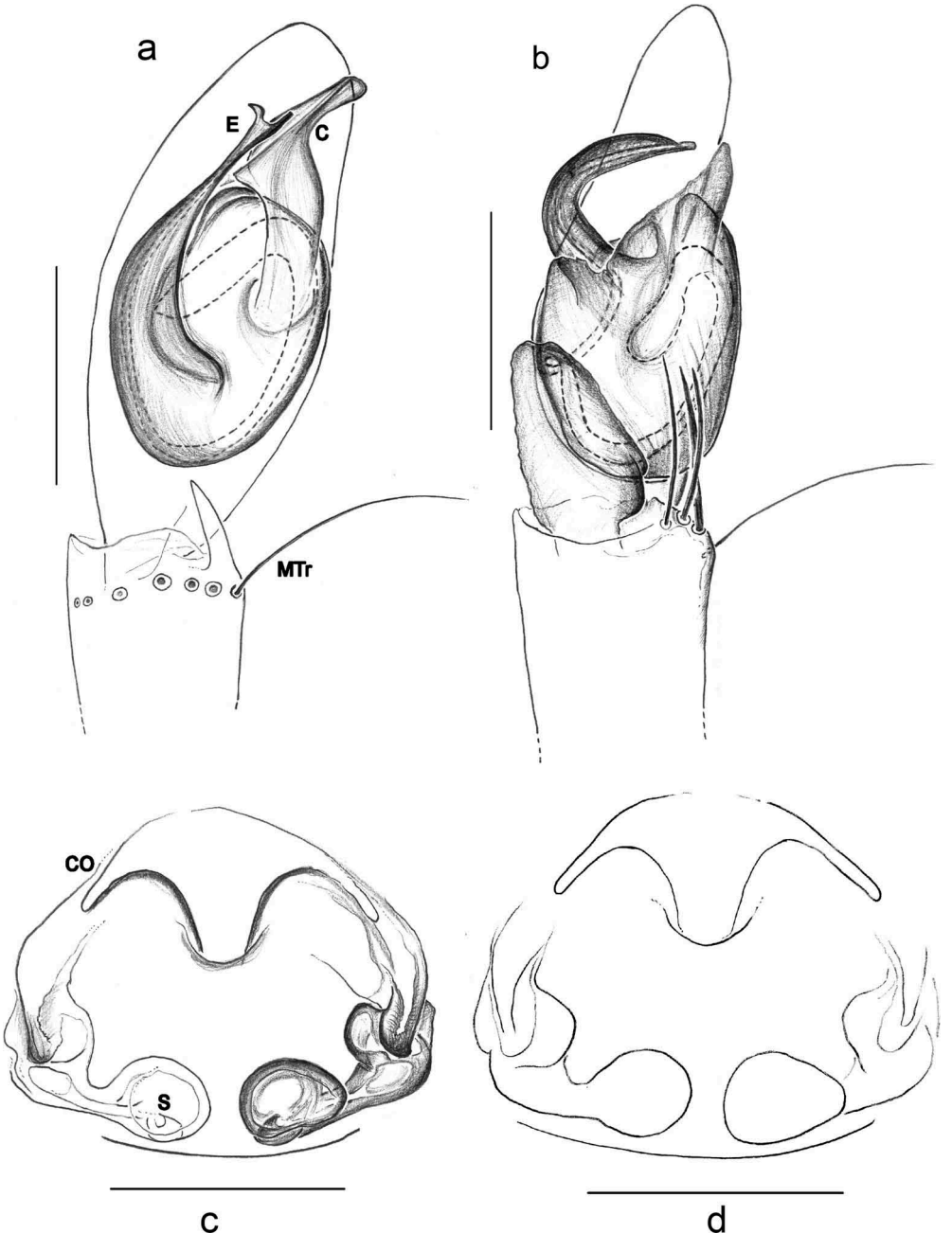

Figure 4. *Epidius floreni* sp. nov. RMNH 15,913 (a), same RMNH 15,916 (c, d) and *Epidius elongatus* sp. nov. RMNH 15,906 (b). (a, b) Male palp, ventral view. (c) Epigynum, ventral view. (d) Vulva, ventral view. Scale bars = 0.2 mm.

a dark brown folium and spots. ALE > PLE > PME > AME. AER, PER recurved, eyes on brown-coloured mounds, but not touching. Leg formula 1243. Palps as in Figure 4(b), femur and tibia characteristically elongated, femur as long as tibia, furnished with 3 thick

spines and MTr. RTA present, leaf-shaped. Bulbus ovoid. C triangular, stout tip without serration. MA absent. Embolus large, stout, C-shaped, tapered tip (Figure 4(b)). SDT with an inward turn just below the embolic base (Figure 4(b)).

Female. Unknown.

Natural History

Extracted from label: 'in dead Pending leaf in dense extended cocoon'.

Distribution

Known only from the type locality.

Epidius floreni sp. nov.
(Figures 2(a, b, d) and 4(a, c, d))

Type material

Holotype, male, (RMNH.ARA.15913), Malaysia, Borneo, west Sabah, Mt. Kinabalu National Park; 6.15°N, 116.50°E; 5 year old secondary forest, 500–700 m, fogging canopy tree 1 *Melochia umbellata*, 16 February 1997, leg. A. Floren, loc 19.

Etymology

This species is named after the collector Andreas Floren.

Diagnosis

Distinguished from known congeners by the distinctive E (broad base, tapering towards tip, bifurcate tip; Figure 4(a)), C (prolateral margin grooved to accommodate E, enlarged tip; Figure 4(a)) and RTA (tapered, fine tip; Figure 4(a)). Females are distinguished by the globular S, relatively longer CD and except for *E. longimanus* by the deeply indented anterior margins of the epigynum (Figure 4(c, d)).

Description

Male. Total length: 3.7; prosoma length: 1.8, width: 1.5. Leg I: femur 3.0, patella 0.6, tibia 3.6, metatarsus 3.0, tarsus 1.4. Prosoma light brown/yellow, eye regions darker, without prominent markings or conspicuous setae. Opisthosoma with white spots, dorsally with a dark brown folium and spots. ALE = PLE > PME > AME. AER, PER recurved, eyes on brown-coloured mounds, but not touching. Chelicerae with 3 and 2 teeth on pro- and retromargin of fang furrow, respectively. Leg formula 1243. Palps as in Figure 4(a), femur and tibia characteristically elongated, femur as long as tibia, furnished with around 6 thick long spines and MTr. RTA present, tapered, fine tip. Bulbus ovoid, conductor prolateral margin grooved to accommodate E. E stout tip, not serrated. MA absent. Embolus stout, enlarged, bifurcate tip (Figure 4(a)).

Female. Total length: 5.4; prosoma length: 2.2, width: 1.9. Leg I: femur 3.0, patella 0.9, tibia 3.1, metatarsus 2.1. tarsus 1.2. In general similar to male (Figure 2(b)). Epigynum

without hood, anterior margin deeply indented, dual-chambered S connected by a C-shaped, thick-walled CD (Figure 4(c, d)).

Distribution

Mount Kinabalu National Park, Sabah, Malaysia.

Other material examined

3 males, 5 females, 7 juveniles, same data as the holotype, RMNH.ARA.15913. 1 female, Malaysia, Borneo, west Sabah, Mt. Kinabalu National Park; 6.15°N, 116.50°E; 40 year old secondary forest, 500–700 m, fogging canopy tree 6 *Vinex pinnata*, 16 March 1997, leg. A. Floren, loc 57, RMNH.ARA.15916. 2 males, 1 female, same locality, 5 year old secondary forest, 500–700 m, fogging canopy tree 5, *Melochia umbellata*, refog after 17 days, 10 March 1997, leg. A. Floren, loc 29, RMNH.ARA.15919. 3 males, 1 juvenile, same data as above, RMNH. ARA.17160. 1 male, 1 female, 1 juvenile, same data as above, 16 March 1997, loc 24, RMNH. ARA.17161. 1 female, 2 juveniles, same data as above, fogging canopy tree 1, *Melochia umbellata*, 18 February 1997, refog 1 after 2 days, loc 20, RMNH.ARA. 17,162. 2 males, same locality and data as above, fogging canopy tree 5, *Melochia umbellata*, 22 February 1997, refog 1 after 1 day, loc 26, RMNH.ARA. 17,163. 1 female, same data as above, fogging canopy tree 10, *Melochia umbellata*, refog after 1 day, 10 March 1997, loc 34, RMNH.ARA. 17,164.

Epidius longimanus sp. nov.

(Figures 5(a–d), 6(a–c), and 8(c))

Type material

Holotype, Male (MNHN 9783), India, Tamil Nadu State, Kodaikanal (10.23°N, 77.48°E), no more data, E. Simon collection.

Etymology

Latin, 'longimanus' refers to the relatively longer male palp.

Diagnosis

Distinguished from known congeners by the distinctive shape of E (thick, stout tip), C (tapering, screw-like tip; Figures 5(d), 6(a), and 8(c)) and absence of RTA (Figures 5(d) and 6(a)). Females are distinguished by the globular S, and except for *E. floreni* sp. nov. by the deeply indented anterior margin of the epigynum (Figure 6(b, c)).

Description

Male. Total length: 4.0; prosoma length: 2.1, width: 1.6. Leg I: femur 3.6, patella 0.9, tibia 3.4, metatarsus 3.3. tarsus 1.7. Prosoma yellow, without prominent markings or conspicuous setae. Opisthosoma light yellow, dorsally with inconspicuous brown spots. ALE = PLE > PME > AME. AER, PER recurved, eyes on brown-coloured pro-tuberances. Chelicerae with 3 and 2 teeth on pro- and retromargin of fang furrow, respectively. Leg formula 1243. Palps as in Figures 5(d), 6(a), and 8(c), femur and tibia characteristically elongated, femur as long as tibia, furnished with 2 thick long spines

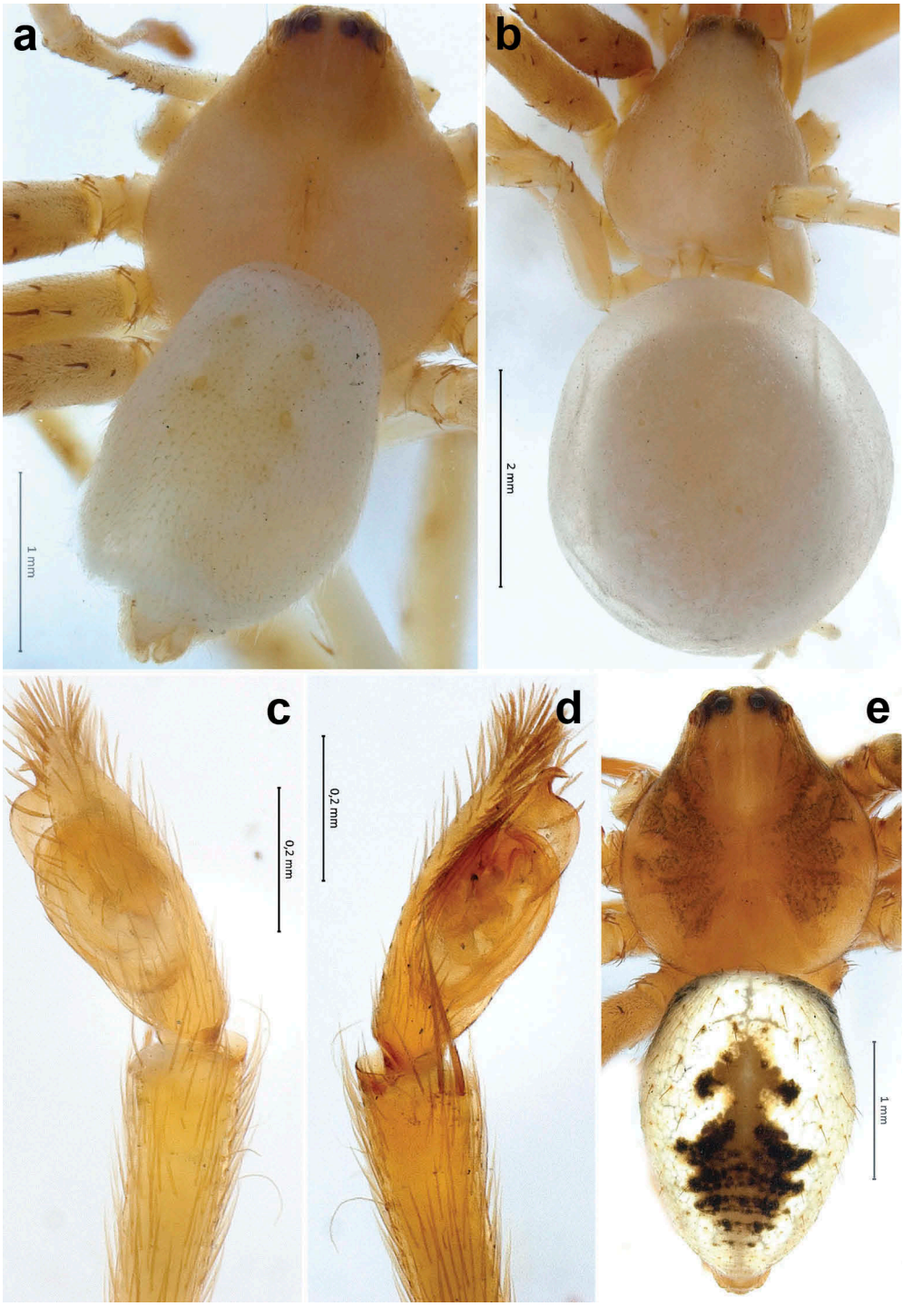

Figure 5. *Epidius longimanus* sp. nov. MNHN 9783 (a–d) and *Epidius mahavira* sp. nov. MNHN 14,996 (e). (a, e) Male dorsal view. (b) Female, dorsal view. (c) Male palp, proloateral/ventral view. (d) Same, retrolateral view. Scale bars: c, d = 0.2 mm; a, e = 1.0 mm; b = 2.0 mm.

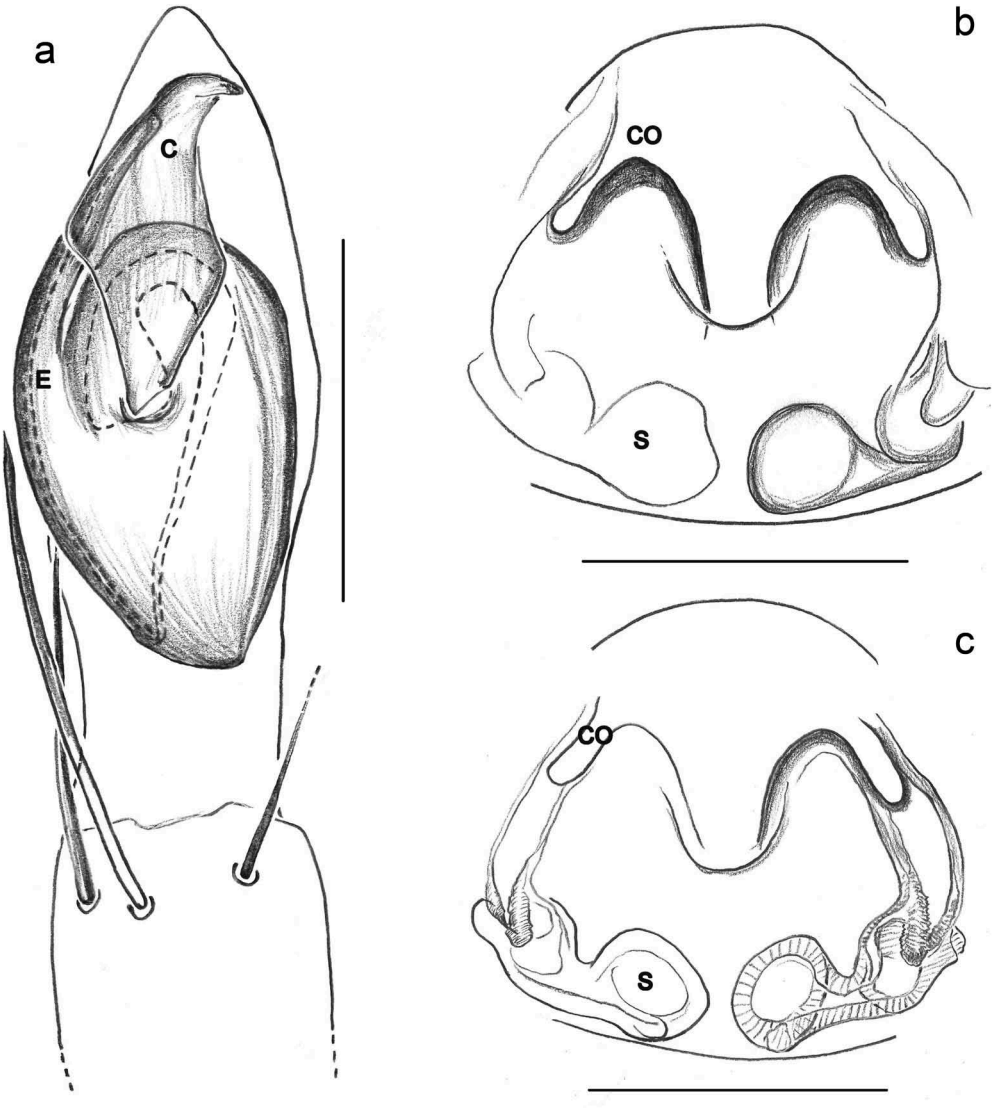

Figure 6. *Epidius longimanus* sp. nov. MNHN 9783. (a) Male palp, ventral view. (b) Epigynum, ventral view. (d) vulva, ventral view. Scale bars = 0.2 mm.

and MTr, RTA absent. Bulbus ovoid, conductor with a screw-like tip, MA absent. Embolus stout, tapering.

Female. Total length: 6.0; prosoma length: 2.4, width: 2.1. Leg I: femur 3.6, patella 0.9, tibia 3.2, metatarsus 2.4, tarsus 1.2. In general similar to male. Epigynum without hood, anterior margin deeply indented, dual-chambered S connected by a C-shaped, thick-walled CD (Figure 6(b, c)).

Distribution

Known only from Kodaikanal and Trichanophilai in India. This species and the next, *Epidius mahavira* sp. nov., appear to occur in the same two localities. This might be due to mislabeling.

Other material examined

1 male, 1 female, same data as the holotype (MNHN 9783). 2 males, India, Tamil Nadu State, Trichanophilai (also known as Tiruchirappalli [10°48′18″N, 78°41′08″E]), no more data, E. Simon collection (MNHN 16498).

Epidius mahavira sp. nov.

(Figures 5(e), 7(a–e), 8(a, b, d, e,), and 9(a–e))

Type material

Holotype, male, India, Tamil Nadu State, Trichanophilai (also known as Tiruchirappalli; 10° 48′ 18″N 78° 41′ 08″E), E. Simon collection, (MNHN14,996; separated from an original vial that contained 1 male, 3 females and 2 juveniles; rest listed below.).

Other material examined

1 female, 4 juveniles, India, Tamil Nadu state, Kodaikanal, E. Simon collection, MNHN 9822. 3 females, 2 juveniles, same data has the haplotype, MNHN 14996.

Etymology

Mahavira is widely regarded as the founder of Jainism. Used as a noun in apposition.

Diagnosis

Distinguished from known congeners by the distinctive shape of E (filiform, reaches up to the tip of C), C (cylindrical, enlarged at the centre, tapered towards tip, tip blunted; Figures 8(a, b) and 9(a–d)) and RTA (stout, tooth-shaped; Figure 9(e)). Females may be distinguished by the oval S, and short CD (Figure 8(d, e)).

Description

Male. Total length: 3.6; prosoma length: 2.1, width: 1.8. Leg I: femur 3.6, patella 0.8, tibia 3.3, metatarsus 3.2. tarsus 1.6. Prosoma brown/yellow, mid and eye regions darker, without prominent markings or conspicuous setae. Opisthosoma with white spots, dorsally with a dark brown folium. ALE = PLE > PME > AME. AER, PER recurved, eyes on brown-coloured mounds, but not touching. Chelicerae with 3 and 2 teeth on pro- and retromargin of fang furrow, respectively. Leg formula 1243. Palps as in Figures 7(c), 8(a, b), and 9(a–e), femur and tibia characteristically elongated, femur as long as tibia, furnished with around 6 thick long spines and MTr. RTA present, stout, not well developed. Bulbus ovoid, conductor with a stout tip, not serrated, MA absent. Embolus stout, tapering.

Female. Total length: 5.7–4.5; prosoma length: 2.1, width: 1.8. Leg I: femur 2.4, patella 0.9, tibia 2.4, metatarsus 1.7, tarsus 1.0. In general similar to male. Epigynum without

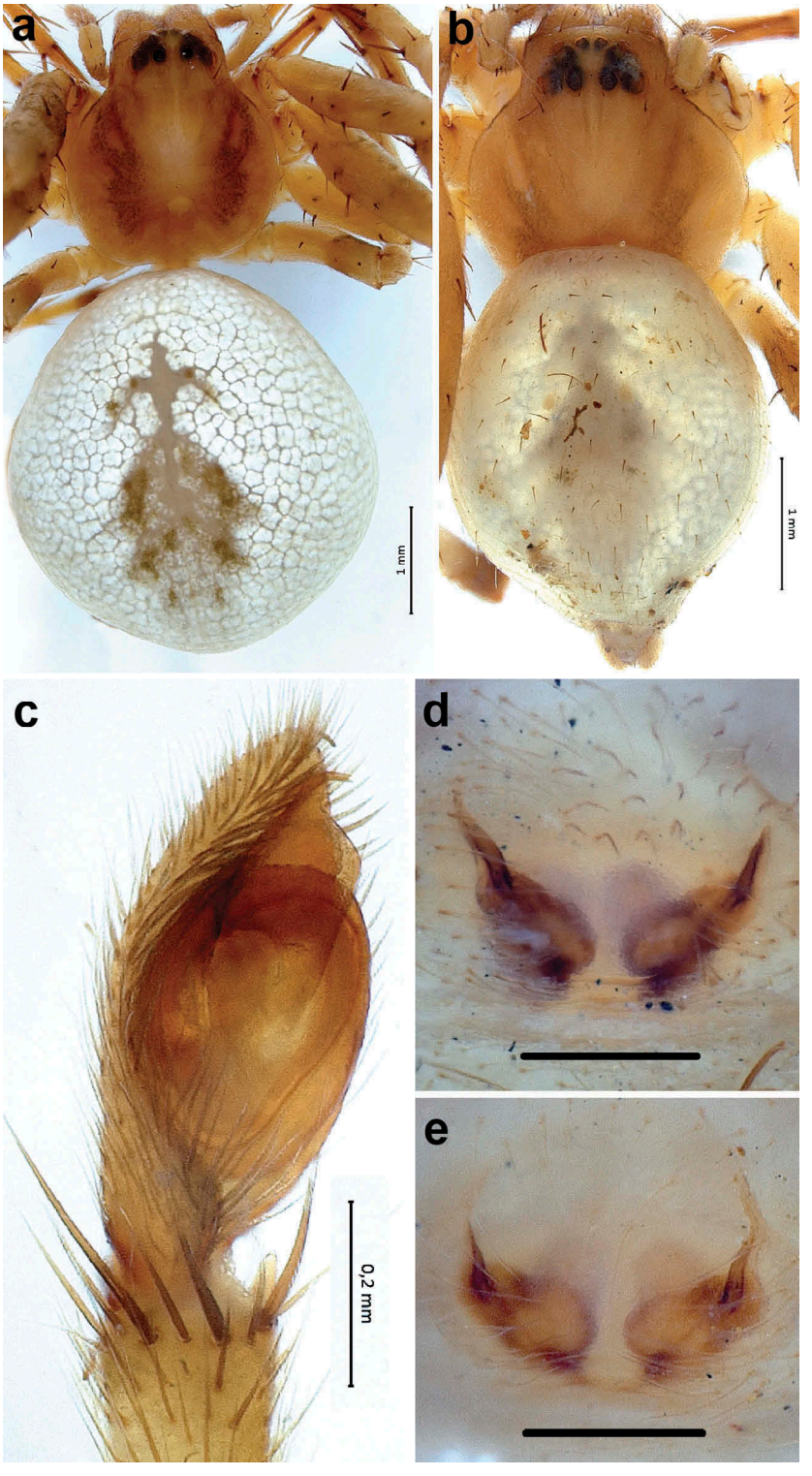

Figure 7. *Epidius mahavira* sp. nov. MNHN 14,996. (a, b) Female habitus, dorsal view. (c) Male palp, prolateral view. (d, e) Epigynum, ventral view. Scale bars: c–e = 0.2 mm; a, b = 1.0 mm.

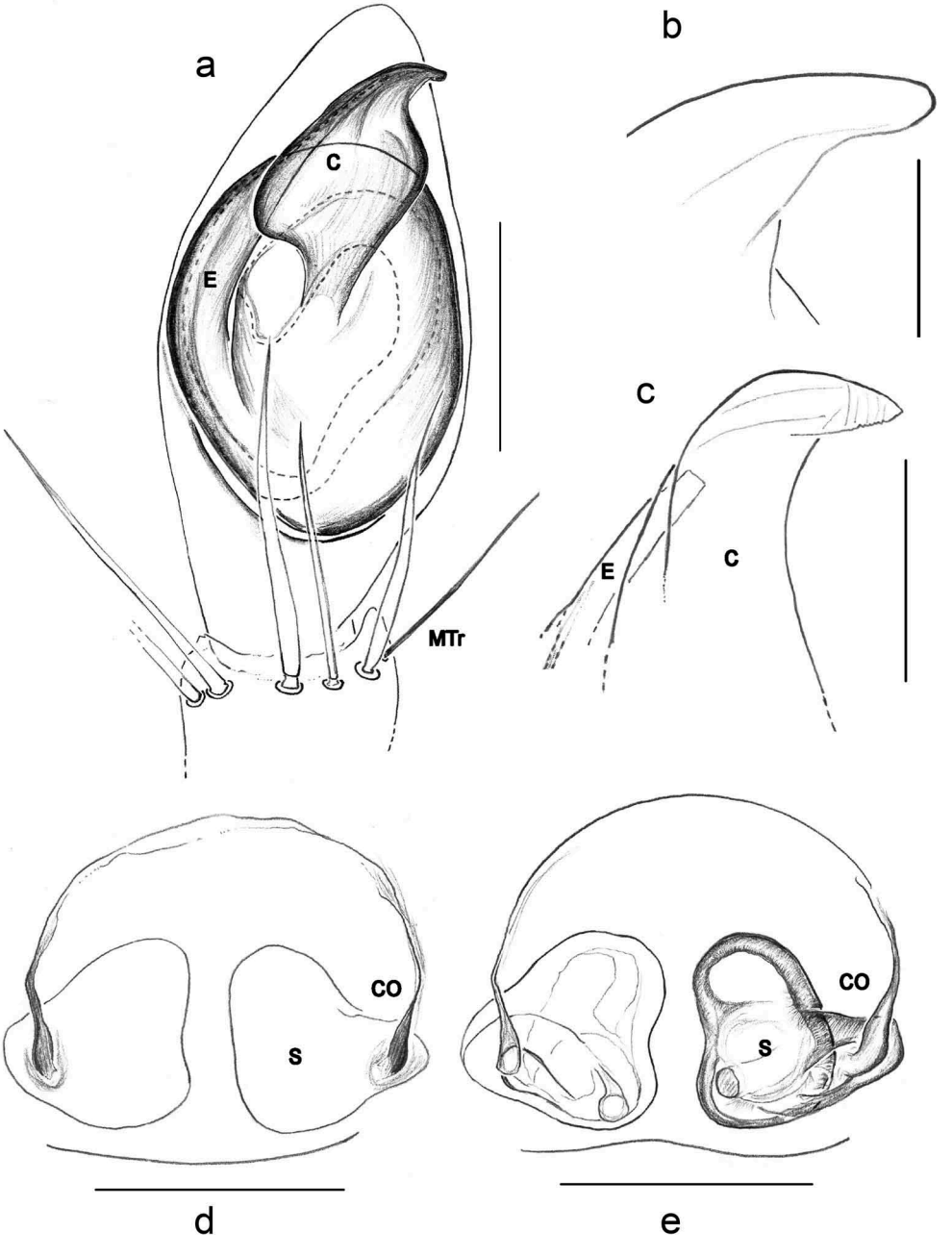

Figure 8. *Epidius mahavira* sp. nov. MNHN 14,996 (a, b, d, e) and *Epidius longimanus* sp. nov. MNHN 9783 (c). (a) Male palp, ventral view. (b) Tip of embolus/conductor complex, *Epidius mahavira* sp. nov. (c) Tip of embolus/conductor complex, *Epidius longimanus* sp. nov. (d) Epigynum, ventral view. (e) Vulva, ventral view. Scale bars: b, c = 0.1 mm; a, d, e = 0.2 mm.

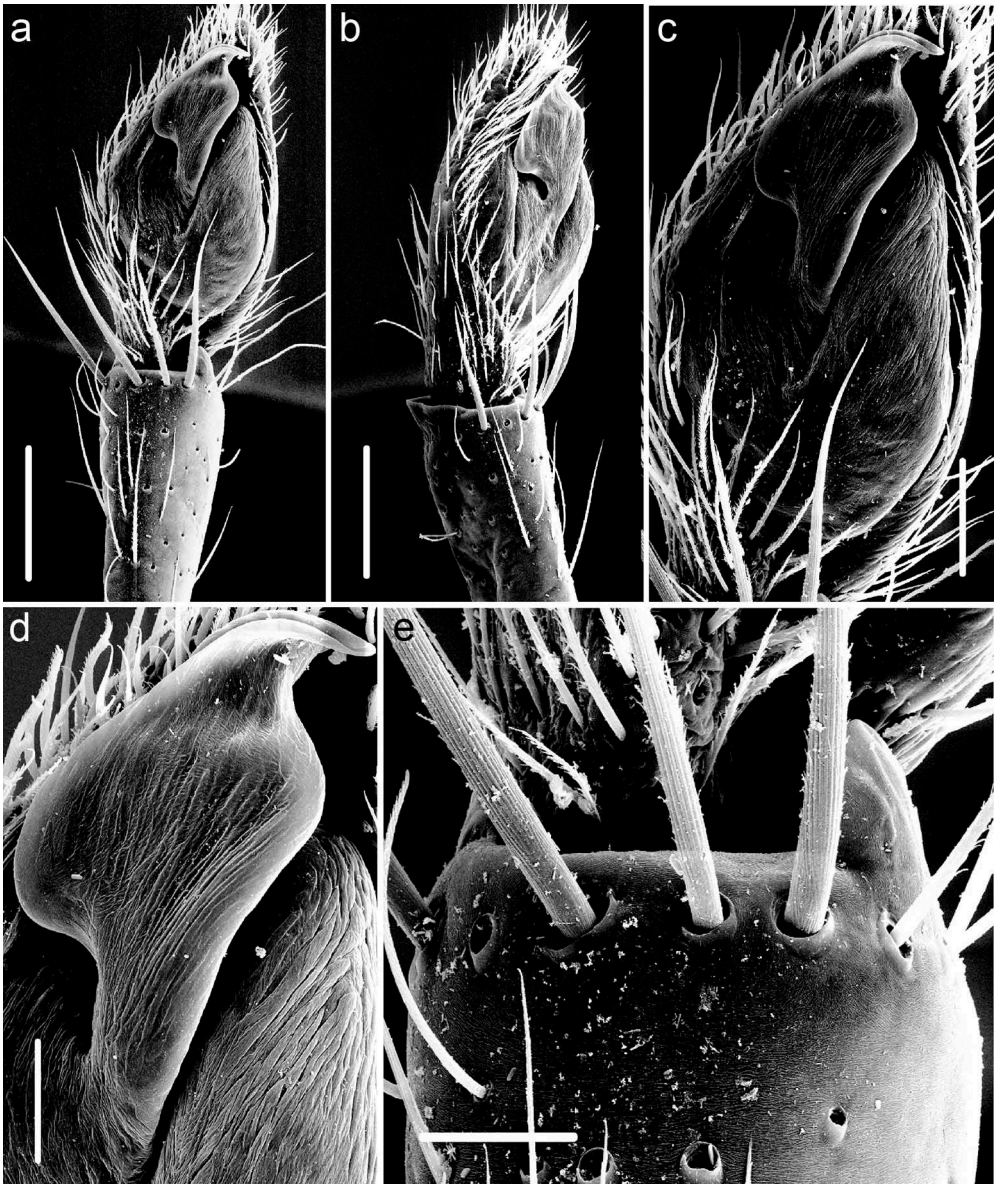

Figure 9. Scanning electron micrographs of *Epidius mahavira* sp. nov. MNHN 14,996. (a) Male palp with bulb and tibia, ventral view. (b) Same, prolateral view. (c) Bulb, ventral view. (d) Conductor, ventral view. (e) RTA and palpal macrosetae, ventral view. Scale bars: d, e = 50 µm; c = 90 µm; a, b = 200 µm.

hood, anterior margins not clearer, lateral margins sclerotised. Dual-chambered S connected by a short, thick-walled CD), second chamber enlarged, positioned posterior to first chamber (Figures 7(d, e) and 8(d, e)).

Distribution

Known only from Kodaikanal and Trichanophilai in India.

Acknowledgements

Thanks to Christa L. Deeleman-Reinhold for letting me study her collection of canopy spiders. Thanks to the following curators for granting access to collections under their care: Janet Beccaloni (BMNH), Karen van Dorp (RMNH), Peter Jäger (SMF), Christine Rollard and Elise-Anne Leguin (MNHN), Maria Tavano (MCSN). The SEMs were taken at the ZFMK, Bonn, with assistance from Karin Ulmen. Bernhard Huber (ZFMK) was of great assistance to me during my time in Bonn. Thanks to Joseph Koh and David Court of Singapore who commented on and provided invaluable inputs at various stages of this study. Thanks to two anonymous reviewers for helpful comments.

Disclosure statement

No potential conflict of interest was reported by the author.

Funding

This study was mainly funded by a fellowship from the Alexander von Humboldt Foundation. Additional funding came from the National Institute of Fundamental Studies and the ZFMK.

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