

## A review of the pseudoscorpion genus *Metawithius* (Pseudoscorpiones: Withiidae) from the Indian subcontinent

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**Abstract.** A new species of the pseudoscorpion genus *Metawithius* Chamberlin, 1931 is described from Kerala, India. Detailed morphological descriptions, diagnostic features and illustrations of *Metawithius keralensis* Johnson, Mathew, Sebastian & Joseph, sp. nov. are provided. Detailed redescription and illustrations of *M. nepalensis* (Beier, 1974) are also provided. The current distribution of all the known *Metawithius* species is mapped. *Metawithius parvus* (Beier, 1930) from Travancore, India is recognised as a species of Chernetidae.

**Keywords:** Morphology; Nepal; taxonomy; Kerala

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The arachnid order Pseudoscorpiones is a cosmopolitan group of small arthropods found in a variety of terrestrial habitats (Harvey 2013). There are 26 families currently recognized, including over 3,600 species in more than 440 genera (Harvey 2013). Withiidae is a nearly cosmopolitan family of pseudoscorpions with the highest diversity in the tropical and sub-tropical biotopes (Harvey 2015), with 170 recognized species in 37 genera. Although the family seems to represent a robust monophyletic group (Harvey 1992), the subfamilial and tribal classification may represent an artificial system that is in need of further research (Harvey 2015).

The genus *Metawithius* Chamberlin, 1931 is endemic to south-eastern Asia, with its distribution ranging from India and Nepal to the Indonesian archipelago (Harvey 2015). Chamberlin (1931a) erected this genus for *Chelififer murrayi* Pocock, 1900, collected from Christmas Island, Australia (Pocock 1900). *Metawithius* was later partially revised by Harvey (2015), who redescribed and illustrated *M. murrayi* (Pocock, 1900), based on the type series and other material. The genus was primarily defined by the presence of a small patch of rugose cuticle on the internal surface of the maxilla of males and the sub-oral seta being borne on a small protuberance.

*Metawithius* currently includes seven nominal species and two subspecies: *M. annamensis* (Redikorzev, 1938), *M. dawydoffi* (Beier, 1951), *M. murrayi*, *M. nepalensis* (Beier, 1974), *M. philippinus* Beier, 1937, *M. spiniventer* Redikorzev, 1938, *M. spiniventer spiniventer* Redikorzev, 1938, *M. spiniventer pauper* Beier, 1953, and *M. tonkinensis* (Beier, 1951) (Harvey 2015).

Although the Indian pseudoscorpion fauna is diverse, comprising 19 families and 153 nominal species (Harvey 2013), there are only two Indian representatives of *Metawithius*: *M. murrayi*, recorded from Nankovry and Car Nikobar of the Nicobar Islands chain (Harvey 2015), and *M. parvus* (Beier, 1930) from Travancore, India (Beier 1930). In this

paper, we provide the description of a new *Metawithius* species collected from southern India, and provide a redescription and new illustrations of *M. nepalensis*, and recognise *M. parvus* as a species of Chernetidae.

### METHODS

The specimens used for this study are lodged in the following institutions: Senckenberg Museum, Frankfurt, Germany (SMF) and Division of Arachnology, Department of Zoology, Sacred Heart College, Thevara, Cochin, Kerala, India (ADSH). They were examined by preparing temporary slide mounts by immersing the specimens in 75% lactic acid at room temperature for several days and mounting them on microscope cavity slides with 18 mm coverslips. Small specimens were instead mounted in glycerol to avoid their being over-cleared. Permanent slide mounts were prepared, when necessary, by clearing the specimens in clove oil and mounting them using Canada balsam. After study, the specimens were rinsed with distilled water and returned to 75% ethanol. The dissected portions such as leg, pedipalp, chelicera etc., were kept in microvials containing 75% ethanol. Terminology and mensuration follow Chamberlin (1931b), Harvey (1992, 2015), Harvey & Edward (2007), Judson (2007) and Harvey et al. (2012).

The specimens were examined using a Leica S8AP0 stereomicroscope and a Labovision AXL compound microscope (Kerala) or a Leica DM2500 compound microscope (Perth). Measurements are in millimeters (mm) and were taken with the aid of Leica DFC 295 digital camera mounted on Leica M205C stereomicroscope (at the highest possible magnification) using the measurement module of the software package Leica Application Suite (LAS), version 4.3.0 (Kerala) or using an ocular graticule (Perth). Microphotographs were taken using Leica DMC 2900 digital camera mounted on a Leica M205A stereomicroscope with the software package

LAS, version 4.5.0. Scanning electron micrographs were taken using the Scanning Electron Microscope (JEOL Model JSM – 6390 LV) of the Sophisticated Test & Instrumentation Centre (STIC) facility of Cochin University of Science and Technology (CUSAT).

Abbreviations used: *b*—basal trichobothrium, *bs*—basal seta, *ca*—chitinized arch, *dd*—dorsal diverticulum, *eb*—exterior basal trichobothrium, *es*—exterior seta, *esb*—exterior sub-basal trichobothrium, *est*—exterior sub-terminal trichobothrium, *et*—exterior terminal trichobothrium, *ga*—genital atrium, *gls*—glandular setae, *gs*—galeal seta, *ib*—interior basal, *is*—interior seta, *isb*—interior sub-basal trichobothrium, *ist*—interior sub-terminal trichobothrium, *it*—interior terminal trichobothrium, *la*—lateral apodeme, *lcp*—lateral cribriform plate, *ls*—laminal seta, *mcp*—median cribriform plate, *md*—median diverticulum, *rc*—rugose cuticle, *sb*—sub-basal trichobothrium, *sbs*—sub-basal seta, *sos*—sub-oral seta, *sp*—spermatheca, *st*—sub-terminal trichobothrium, *t*—terminal trichobothrium, *ts*—tactile seta.

## SYSTEMATICS

**Family Withiidae** Chamberlin, 1931

**Subfamily Withiinae** Chamberlin, 1931

***Metawithius*** Chamberlin, 1931

*Metawithius* Chamberlin 1931a:293.

*Hyperwithius* Beier 1951:99–100. Synonymized by Harvey (2015).

**Type species.**—*Metawithius: Chelififer murrayi* Pocock, 1900, by original designation.

*Hyperwithius: Sundowithius annamensis* Redikorzev, 1938, by original designation.

**Diagnosis & description.**—See Harvey (2015).

**Remarks.**—With (1906) noted the occurrence of densely placed transverse lines/small patch of rugose cuticle in the internal surface of the male maxillae of *C. murrayi* (With 1906: plate III, fig. 8g). However, the significance of this was not noticed by subsequent authors (Beier 1930; Chamberlin 1931b). Later Harvey (2015) recognised its taxonomic importance and proposed it as a major feature for separating *Metawithius* from other withiid genera. The only pseudoscorpion genus with a similar feature is *Rugowithius* Harvey, 2015, where this patch is situated on the external surface of the male maxillae (Harvey 2015: figs. 16, 17). Another feature diagnostic for *Metawithius* is the excavated mesal margin of the male maxilla, where the sub-oral seta is born on a small protuberance (Harvey 2015: fig. 5; also this paper Figs. 5, 6).

*Metawithius parvus* (Beier, 1930) was described from a single female from Travancore, in the same region of southern India as *M. keralensis* (Beier 1930). The specimen is lodged in SMF and has been examined by CRO and MSH. It was found to belong to the family Chernetidae. A more detailed description will be presented in a forthcoming paper, (Romero-Ortiz & Harvey in press).

**Distribution.**—*Metawithius* species are currently known to occur throughout the Asian region, and have been recorded from Cambodia, China, Christmas Island, India, Indonesia, Malaysia, Myanmar, Nepal, Nicobar Islands, Philippines,

Thailand and Vietnam (Harvey 2015; present records) (Figs. 26, 42).

***Metawithius keralensis*** Johnson, Mathew, Sebastian & Joseph, sp. nov.

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(Figs. 1–26, 42)

**Type material.**—*Holotype male*. INDIA: Kerala: Alappuzha, Pathiramanal Island, 9°37'N, 76°23'E, 2 m, under bark of *Mangifera indica*, by hand, 30 January 2014, A. Joselipha (ADSH PS0001).

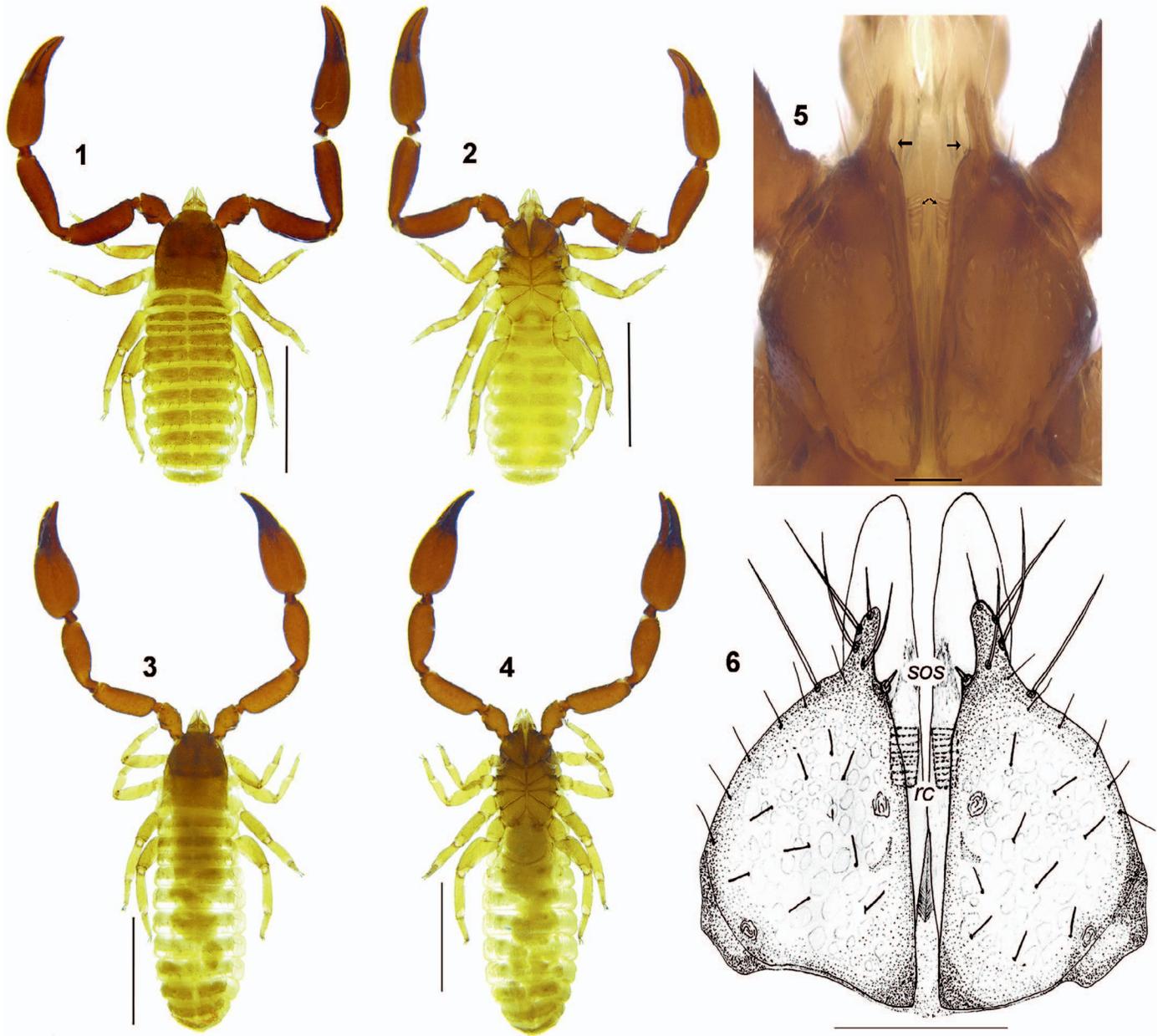
*Paratypes*. INDIA: Kerala: 3 males, 1 female, same data as holotype (ADSH PS0002), except 23 January 2014 (1 male) and 30 January 2014 (2 males, 1 female).

**Other material examined.**—INDIA: Kerala: 2 males, 1 female, Kottayam, Changanassery, Paippad, 9°25'34"N, 76°35'22"E, 20 m, under bark of *Hevea brasiliensis*, by hand, 22 September 2017, M.V. Aneesh (ADSH PS0003); 1 male, Pathanamthitta, Thiruvalla, Mundiyyappally, 9°25'40"N, 76°37'16"E, 59 m, under bark of *Hevea brasiliensis*, by hand, 22 September 2017, M.V. Aneesh (ADSH PS0009); 1 male, Thiruvalla, Kunnathanam, 9°25'36"N, 76°35'44"E, 49 m, under bark of *Hevea brasiliensis*, by hand, 16 February 2017, M.V. Aneesh (ADSH PS0005); 4 males, 1 female, Alappuzha, Pathiramanal Island, 9°37'N, 76°23'E, 2 m, under bark of *Anacardium occidentale*, by hand, 17 January 2018, J. Johnson (ADSH PS0006); 2 males, 1 female, Ernakulam, Thrippunithura, Hill Palace area, 9°57'09"N, 76°21'49"E, 30 m, under bark of *Garcinia gummi-gutta*, by hand, 17 January 2018, J. Johnson (ADSH PS0007); 1 male, Thrissur, Irinjalakuda, Thumboor, 10°18'35"N, 76°15'42"E, 20 m, under bark of *Artocarpus heterophyllus*, by hand, 10 March 2018, J. Johnson (ADSH PS0008).

**Diagnosis.**—*Metawithius keralensis* sp. nov. appears to be most similar to *M. nepalensis* but differs in the reduced number of glandular setae on the male sternites (ca. 32: 39: 44: 46: 40 vs ca. 50: 71: 74: 64: 40 in *M. nepalensis*). The pedipalpal chela of *M. keralensis* is less slender than that of *M. nepalensis* [chela (with pedicel) 3.23–3.69 (♂), 2.83 (♀) and chela (without pedicel) 2.8–3.43 (♂), 2.73 (♀) x longer than broad, respectively], whereas in *M. nepalensis*, it is slender [chela (with pedicel) 3.75 (♂), 3.28 (♀) and chela (without pedicel) 3.51 (♂), 3.07 (♀) x times longer than broad, respectively]. The pedipalpal chela of *M. keralensis* has ca. 33 (♂), 32 (♀) teeth on the fixed finger and ca. 38 (♂), 34 (♀) teeth on the movable finger [whereas, it is ca. 32 (♂), 27 (♀) on the fixed and ca. 34 (♂), 28 (♀) on the movable finger of *M. nepalensis*]. Furthermore, the presence of only 16 (♂), 14 (♀) blades in the serrula exterior of *M. nepalensis* also distinguishes it from the new species [18 (♂), 19–20 (♀)].

**Description.**—Adults (Figs. 1–4) with sclerotized portions generally dark reddish-brown in colour; dorsal setae mostly denticulate; setae on sternites acicular (Fig. 12).

*Chelicera:* movable finger with rasp-like ornamentation (Figs. 10, 25). Hand with 5 setae, *sbs* slightly denticulate (with serrated edge), *bs*, *es*, *ls* and *is* smooth and acuminate; movable finger with 1 sub-distal seta (*gs*); galea of ♂ with 2–3 small terminal rami and 2–4 sub-terminal rami, ♀ with 2–3



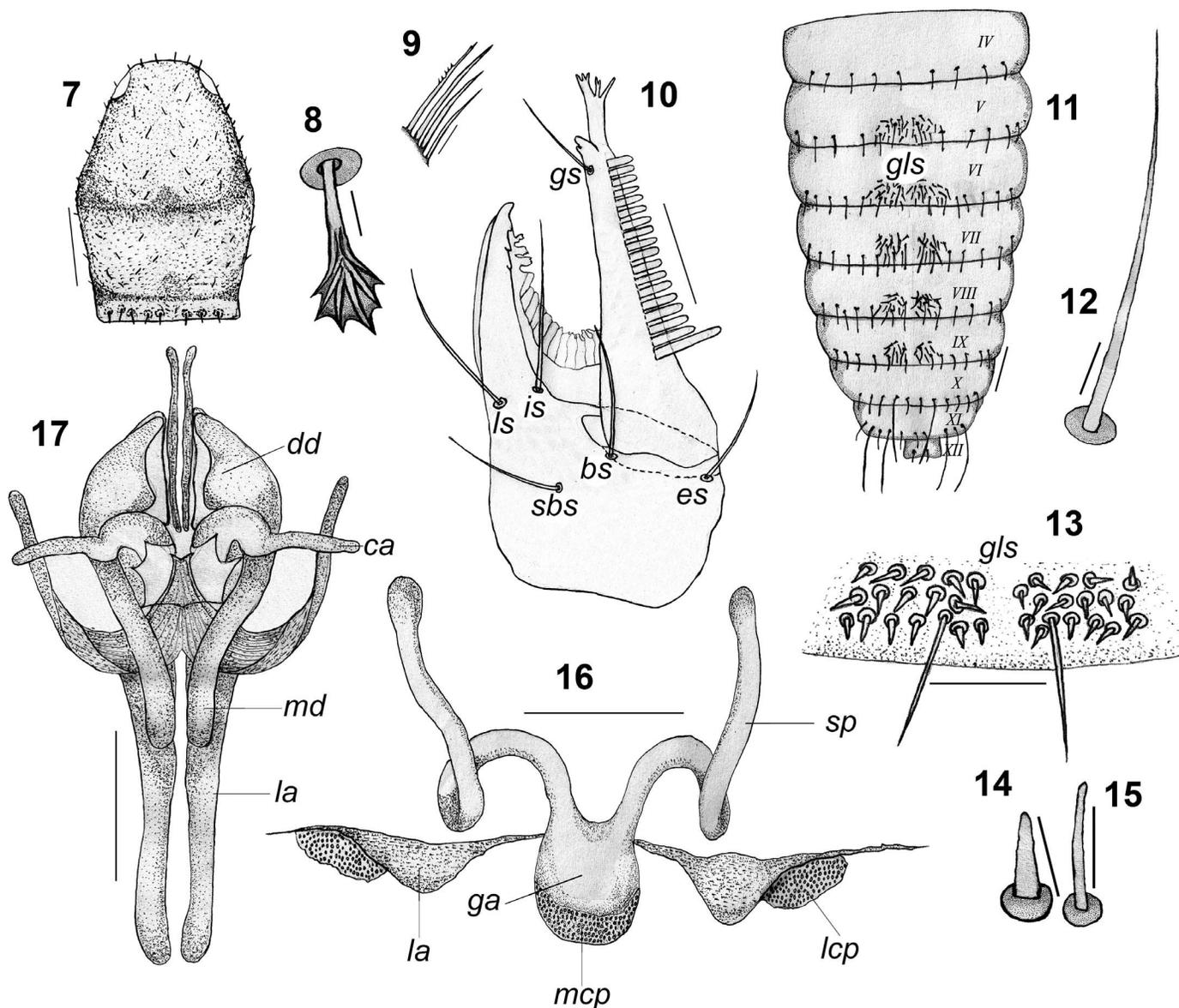
Figures 1–6.—*Metawithius keralensis* sp. nov., holotype male (ADSH PS0001), unless otherwise stated: 1. Habitus, dorsal; 2. Habitus, ventral; 3. Female habitus, dorsal (ADSH PS0002); 4. Female habitus, ventral (ADSH PS0002); 5. Maxillae, ventral; 6. Maxillae, ventral view, illustrating rugose cuticle and sub-oral setae, ventral view. Scale bars: 1 mm (Figs. 1–4); 0.1 mm (Figs. 5, 6).

terminal and 3–4 sub-terminal rami; rallum of 4 blades, the most distal blade with a few serrations on anterior edge, other blades smooth and acuminate (Fig. 9); serrula exterior with 18 ( $\delta$ ), 19–20 ( $\text{♀}$ ) blades; lamina exterior present.

**Pedipalp:** trochanter, femur and patella granulate, chela smooth; dorsal setae denticulate; trochanter with dorsal tubercle, 1.39–1.61 ( $\delta$ ), 1.71 ( $\text{♀}$ ), femur 2.79–3.10 ( $\delta$ ), 2.79 ( $\text{♀}$ ), patella 3.22–3.64 ( $\delta$ ), 2.80 ( $\text{♀}$ ), chela (with pedicel) 3.23–3.69 ( $\delta$ ), 2.83 ( $\text{♀}$ ), chela (without pedicel) 2.8–3.43 ( $\delta$ ), 2.73 ( $\text{♀}$ ), hand 1.65–1.95 ( $\delta$ ), 1.72 ( $\text{♀}$ ) x longer than broad, movable finger 0.75–0.83 ( $\delta$ ), 0.65 ( $\text{♀}$ ) x longer than hand. Male femur with unexpanded basal region (Fig. 20). Fixed chelal finger with 8 trichobothria, movable chelal finger with 4

trichobothria (Fig. 21); trichobothria *ib*, *ist*, *isb* and *it* grouped in basal half of finger; *b* and *sb* situated near one another; *st* slightly closer to *sb* than to *t*. Venom apparatus present in both chelal fingers, venom ducts long, nodus ramosus slightly basal to *et* in fixed finger, proximal to *t* in movable finger. External margin of fixed finger with 3–6 sense-spots situated midway between *esb* and *est*; external margin of movable finger with 2–3 sense-spots situated between *sb* and *st* (Fig. 21). Chelal teeth rounded; fixed finger with ca. 33 ( $\delta$ ), 32 ( $\text{♀}$ ) teeth; movable finger with 38 ( $\delta$ ), 34 ( $\text{♀}$ ) teeth; accessory teeth absent.

**Carapace:** 1.13–1.19 ( $\delta$ ), 1.43 ( $\text{♀}$ ) x longer than broad; lateral margins convex, not posteriorly widened, with 2 non-



Figures 7–17.—*Metawithius keralensis* sp. nov., holotype male (ADSH PS0001), unless otherwise stated: 7. Carapace, dorsal; 8. Foliate seta; 9. Rallum, paratype male (ADSH PS0005); 10. Right chelicera, dorsal, paratype male (ADSH PS0005); 11. Sternites IV–XII; 12. Acicular seta; 13. Glandular setae on sternite V; 14. Glandular seta, paratype female (ADSH PS0005); 15. Glandular seta, paratype female (ADSH PS0005); 16. Female genitalia, ventral (ADSH PS0002); 17. Genitalia, ventral, paratype male (ADSH PS0005). Scale bars: 0.2 mm (Figs. 7, 11); 0.1 mm (Figs. 16, 17); 0.05 mm (Figs. 10, 13); 0.01 mm (Figs. 8, 9, 12, 14, 15).

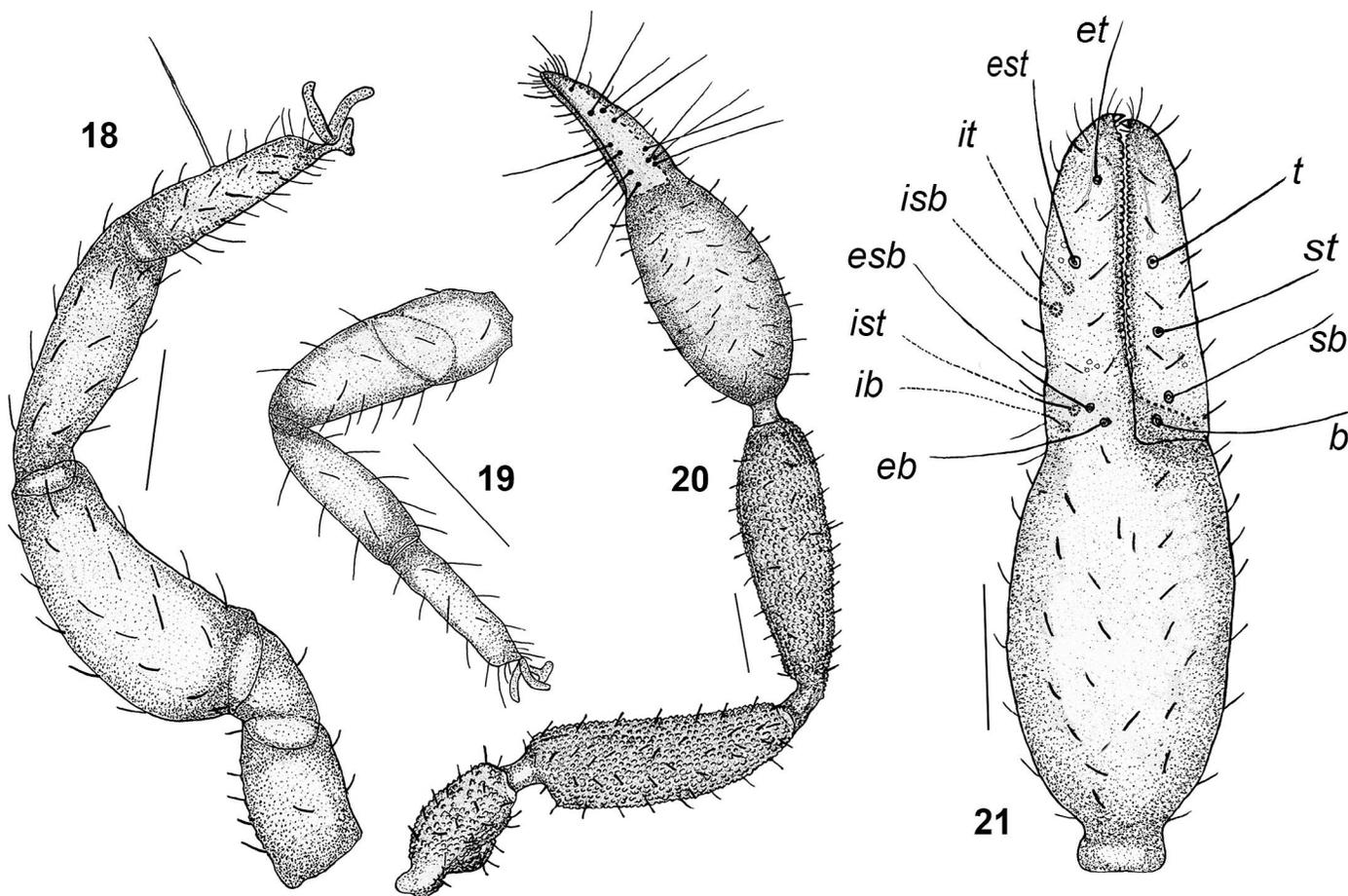
corneate eyes, with ca. 37–41 ( $\delta$ ), 45–60 ( $\text{♀}$ ) number of setae, including 6 ( $\delta$ ,  $\text{♀}$ ) near anterior margin and 6–8 ( $\delta$ ), 8 ( $\text{♀}$ ) near posterior margin; with 2 furrows, distinct anterior and indistinct posterior (Fig. 7), posterior furrow slightly closer to posterior carapaceal margin than anterior furrow; carapaceal metazone without any paired pale spots.

**Coxal region:** maxilla with 2 apical setae and 1 very small internal, sub-oral seta; patch of rugose cuticle/parallel ridges (ca. 6–7 in number) anterior to median maxillary lyrifissure of males (Figs. 5, 6); sub-oral seta of male maxilla on a ‘hooked’ mound (Figs. 5, 6). Coxal chaetotaxy:  $\delta$ , 9–13: 9–14: 8–16: 14–31;  $\text{♀}$ , 9–17: 9–18: 10–15: 22–35.

**Legs:** yellowish; monotarsate; junction between femora and patellae I and II only slightly oblique (Fig. 19); femur + patella

of leg IV 2.69–2.91 ( $\delta$ ), 3.19 ( $\text{♀}$ ) x longer than deep; tarsal tactile seta of leg IV situated medially or sub-medially; 0.68–0.78 ( $\delta$ ), 0.63–0.83 ( $\text{♀}$ ) of tarsus length (Fig. 18); sub-terminal tarsal setae arcuate and acute; arolium slightly shorter than claws.

**Abdomen:** tergites and sternites with faint medial suture. Tergal chaetotaxy:  $\delta$ , 8: 8–9: 10: 11–12: 10–13: 12–13: 11–14: 13: 10–11: 10: 10 (including two tactile setae): 2,  $\text{♀}$ , 8–10: 8–9: 10–12: 10–12: 10–13: 12–13: 10–12: 11–13: 11: 10: 10 (including two tactile setae): 2; setae uniseriate with a few setae placed anteriorly; all setae foliate (Fig. 8) (except tergites XI–XII with denticulate). Sternal chaetotaxy:  $\delta$ , 9: 8–9: 9: 12–15 + ca. 16/16 *gls*: 15 + ca. 22/17 *gls*: 15 + ca. 25/19 *gls*: 13–15 + ca. 23/23 *gls*: 13–15 + ca. 22/18 *gls*: 11 (including two tactile



Figures 18–21.—*Metawithius keralensis* sp. nov., holotype male (ADSH PS0001), unless otherwise stated: 18. Right leg IV (paratype male); 19. Right leg I (trochanter omitted; paratype male); 20. Right pedipalp, dorsal; 21. Right chela, retrolateral. Scale bars 0.2 mm (Figs. 18–21).

setae): 11–12 (including four tactile setae): 2, ♀, 8–17: (3) 8–10 (3): (3) 10 (3): 15–19: 19–20: 19–21: 16–19 + 2 *gls*: 18–19 + 2 *gls*: 12 (including two tactile setae): 11–14 (including four tactile setae): 2; sternal setae mostly uniseriate and acicular (Fig. 12), becoming progressively denticulate on posterior sternites X–XII (except for the tactile setae); sternites V–IX of male with patches of glandular setae (Figs. 11, 22); sternites VIII–IX of female with 1 pair of glandular setae; glandular setae ca. 0.02 (♂), 0.03 (♀) in length, stout and conical in males (♂) (Fig. 14, 23–24), slender in female (♀) (Fig. 15); male without paired invaginations on anterior margins of sternites.

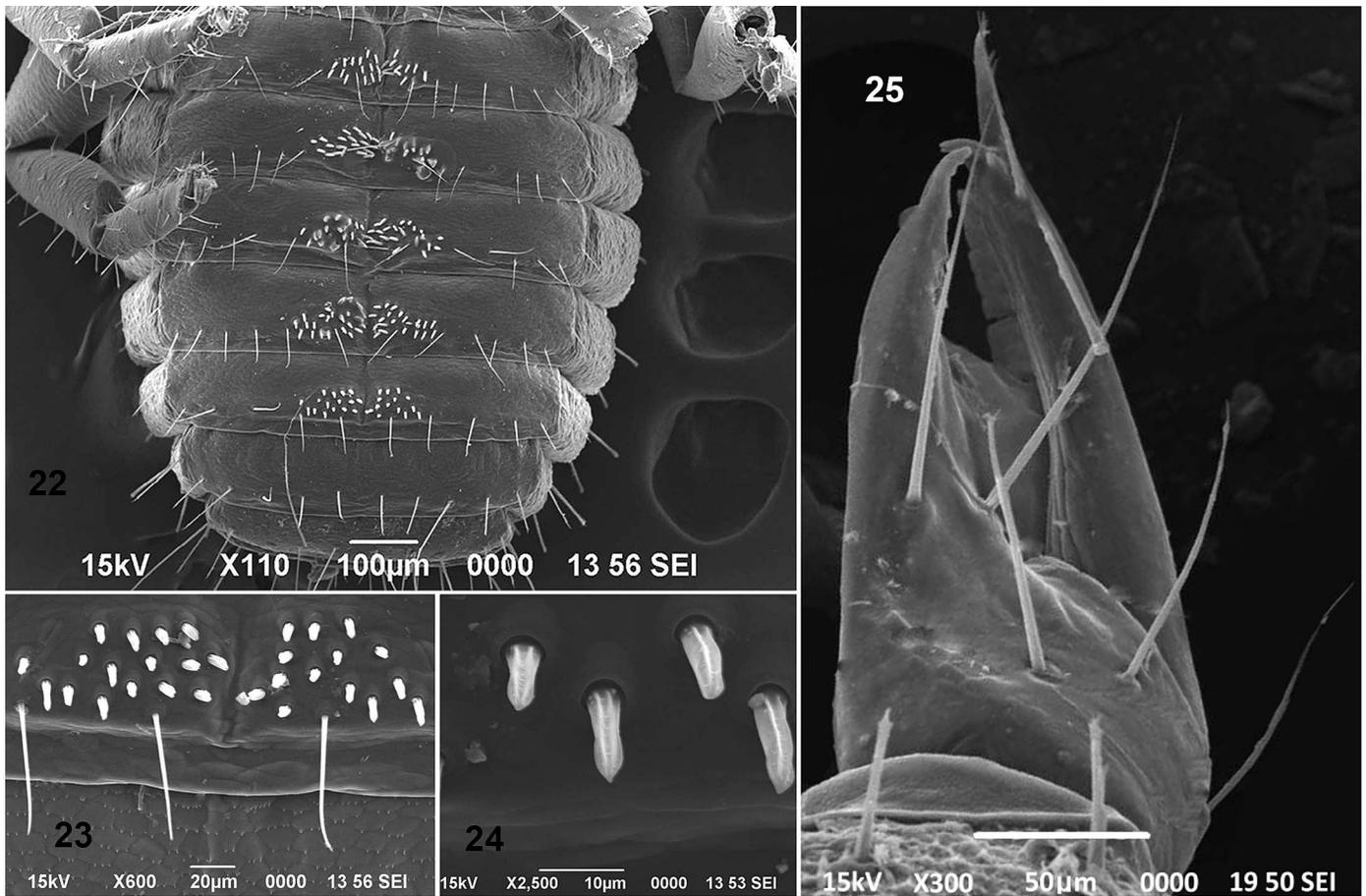
**Genitalia:** males with elongated and posteriorly tapering lateral apodemes (Fig. 17). Females with a circular genital atrium and 2 long, tubular, slightly coiled spermathecae (Fig. 16), with sclerotized lateral apodemes, with a single median and paired lateral cribriform plates.

**Dimensions:** Males: holotype followed by 3 paratypes (where applicable): body length 2.19 (2.30–2.56). Pedipalps: trochanter 0.33/0.21 (0.28–0.36/0.21–0.22), femur 0.64/0.20 (0.61–0.66/0.20–0.22), patella 0.73/0.20 (0.67–0.74/0.18–0.22), chela (with pedicel) 1/0.33 (1.13/0.39), chela (without pedicel) 0.92 (0.87–0.95), hand length 0.55 (0.50–0.58), movable finger length 0.45 (0.39–0.46). Chelicera 0.20/0.10 (0.19/0.23), movable finger length 0.17 (0.16–0.19). Carapace 0.67/0.56

(0.65–0.72/0.56–0.64); eye diameter 0.07 (0.06–0.08). Leg I: femur 0.12/0.11 (0.11–0.16/0.11–0.13), patella 0.29/0.11 (0.28–0.30/0.11–0.13), tibia 0.26/0.07 (0.25–0.27/0.07–0.12), tarsus 0.19/0.04 (0.17–0.25/0.04–0.05). Leg IV: femur + patella 0.51/0.17 (0.45–0.57/0.17–0.20), tibia 0.40/0.10 (0.37–0.42/0.09–0.11), tarsus 0.25/0.06 (0.24–0.32/0.06–0.06), TS 0.44 (0.44–0.49).

**Females:** Paratype (ADSH PS0002) followed by 1 other paratype (where applicable): body length 2.93 (2.52). Pedipalps: trochanter 0.37/0.22 (0.28/0.17), femur 0.64/0.23 (0.42/0.19), patella 0.69/0.24 (0.42/0.11), chela (with pedicel) 1.13/0.39, chela (without pedicel) 1.06, hand length 0.68, movable finger length 0.44. Chelicera 0.22/0.14, movable finger length 0.20. Carapace 0.81/0.57; eye diameter 0.07. Leg I: femur 0.56/0.14, patella 0.30/0.13, tibia 0.27/0.08, tarsus 0.23/0.05. Leg IV: femur + patella 0.59/0.18, tibia 0.33/0.11, tarsus 0.23/0.06 (0.32/0.08), TS 0.49 (0.44–0.51).

**Remarks.**—The new species can be differentiated from all other *Metawithius* species by the following combination of characters: morphometry, shape of the chela, chelal dentition and glandular setae on the sternites. *Metawithius keralensis* resembles *M. nepalensis* in having glandular setae on the male sternites V–IX, but differs in the reduced number of glandular setae (ca. 32: 39: 44: 46: 40 in the new species vs ca. 50: 71: 74: 64: 40 in *M. nepalensis*). The males of *M. keralensis* also differs



Figures 22–25.—*Metawithius keralensis* sp. nov., paratype male (ADSH PS0003), scanning electron micrographs: 22. Sternites V–IX with glandular setae, ventral; 23. Glandular setae on sternite IX; 24. Glandular setae; 25. Right chelicera, dorsal.

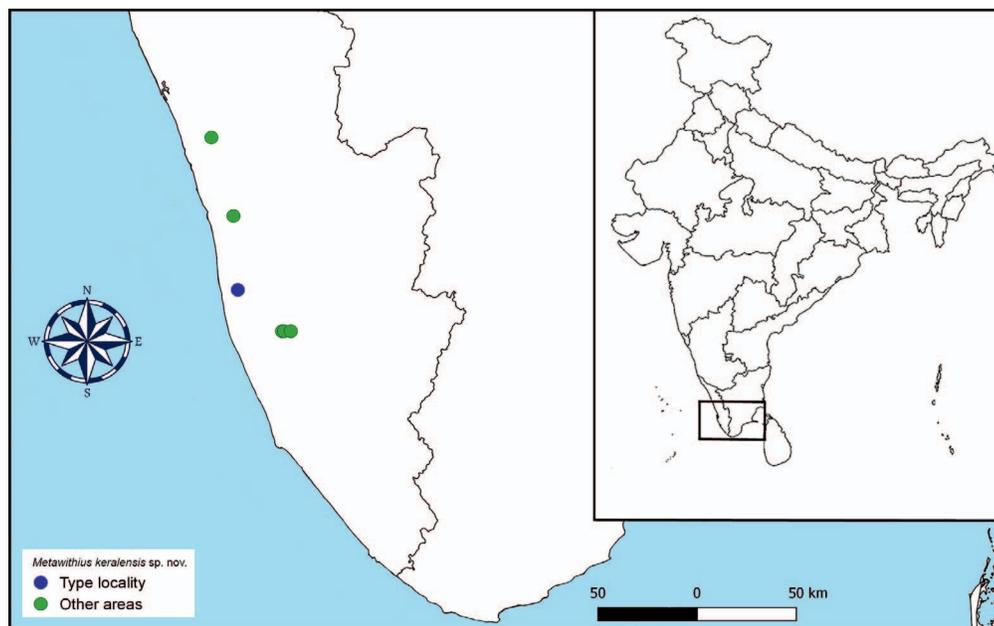
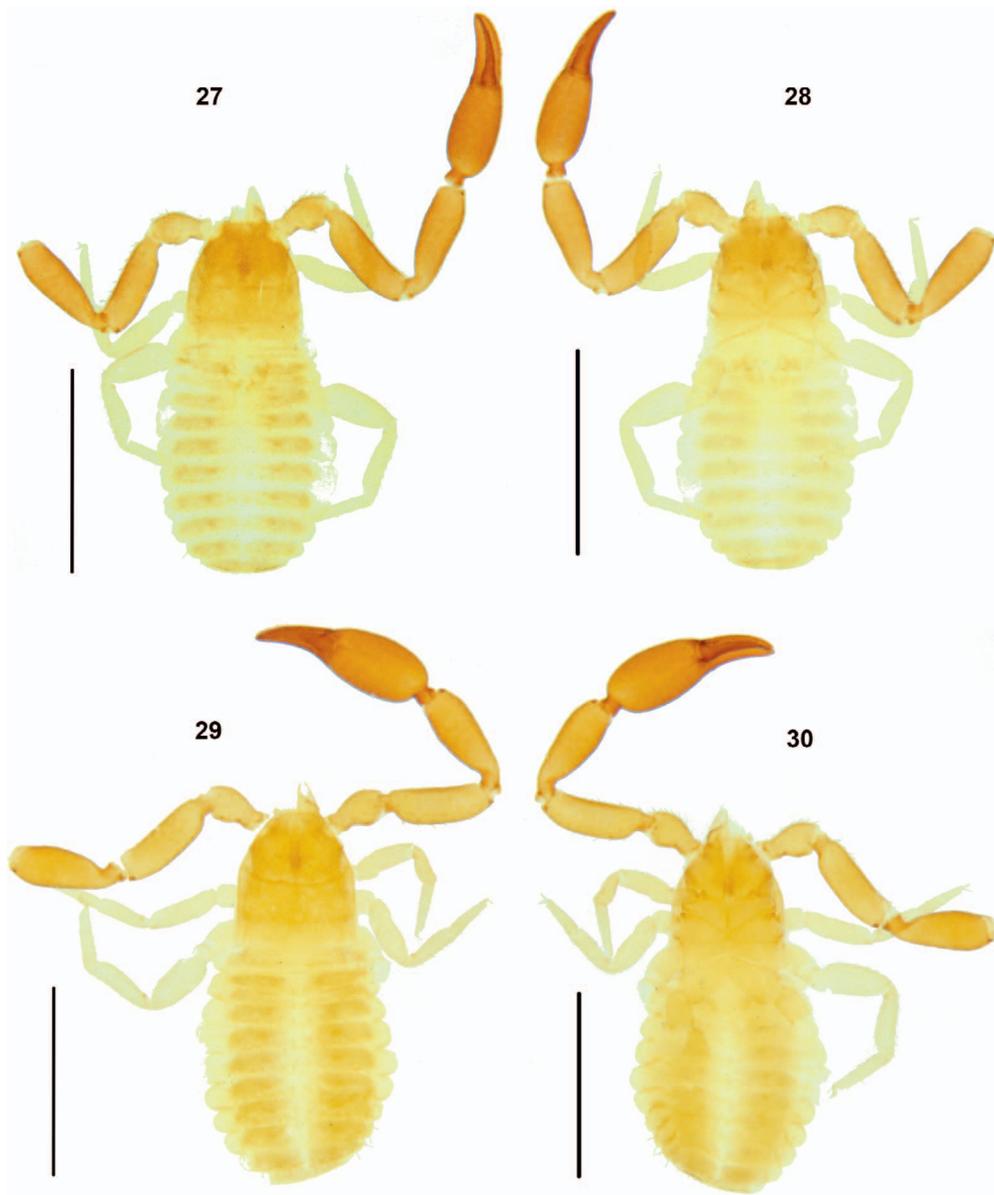


Figure 26.—Collecting localities of *Metawithius keralensis* sp. nov.



Figures 27–30.—*Metawithius nepalensis* (Beier, 1974), holotype male (SMF 28969): 27. Habitus, dorsal; 28. Habitus, ventral; 29. Female habitus, dorsal; 30. Female habitus, ventral. Scale bars: 1 mm (Figs. 27–30).

from *M. murrayi*, *M. annamensis* and *M. spiniventer* in the presence of glandular setae on the sternites V–IX (whereas, it is on the sternites V–X, IV–XI and IV–X in the above-mentioned three species respectively). It further differs from *M. murrayi* in the number of coils in the female genital atria (2 coils each in *M. keralensis* vs 1 in *M. murrayi*) and the shape of the male genitalia. The new species differs from *M. annamensis*, *M. dawydoffi* and *M. tonkinensis* in the shape of the pedipalpal femur, which have a slightly expanded basal region, which is lacking in *M. keralensis*. It differs from *M. philippinus* in the shape of the chelal hand, which is more slender in *M. keralensis*, and the pedipalpal tibia is longer in *M. keralensis*.

**Distribution.**—*Metawithius keralensis* has been collected from a variety of localities in the southern Indian state of

Kerala: Alappuzha, Ernakulam, Kottayam, Pathanamthitta and Thrissur districts (Figs. 26, 42).

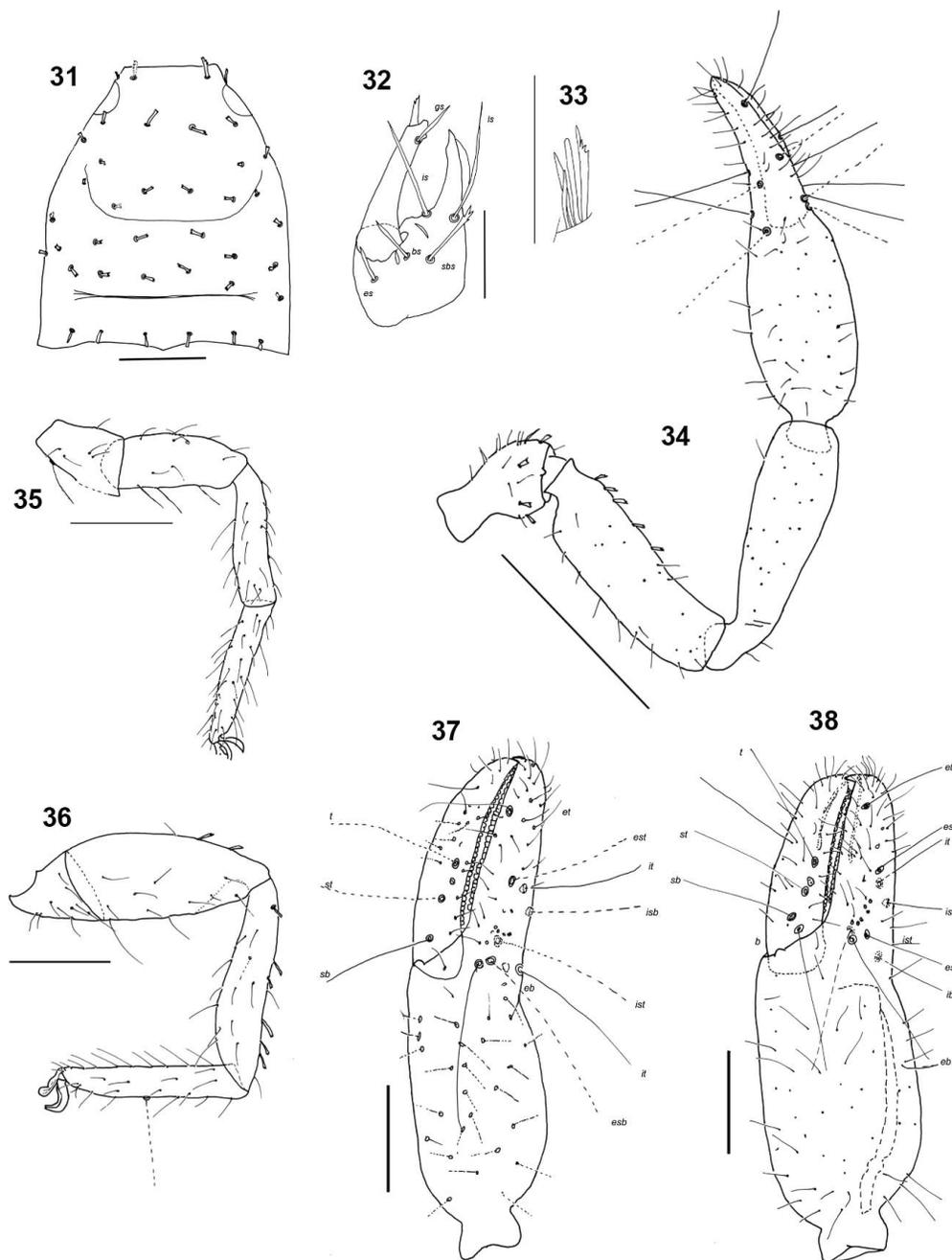
**Etymology.**—This species is named after the Indian state of Kerala, from where the species has so far been reported.

*Metawithius nepalensis* (Beier, 1974)  
(Figs. 27–42)

*Withius nepalensis* Beier 1974:277–278, fig. 11.

*Metawithius nepalensis* (Beier): Harvey 2015:358–359.

**Type material.**—*Holotype male*. NEPAL: *Central*: Daman, Mahabarat region [27°41'N, 85°07'E], 2500 m, under bark of *Rhododendron arboreum*, February 1970, J. Martens (SMF 28969).



Figures 31–38.—*Metawithius nepalensis* (Beier, 1974): 31–37. Holotype male (SMF 28969): 31. Carapace; 32. Chelicera; 33. Rallum; 34. Left pedipalp; 35. Left leg I; 36. Left leg IV; 37. Right chela; 38. Allotype female (SMF 28969): Right chela. Scale bars: 0.5 mm (Fig. 34); 0.2 mm (Figs. 31, 35–38); 0.1 mm (Figs. 32, 33).

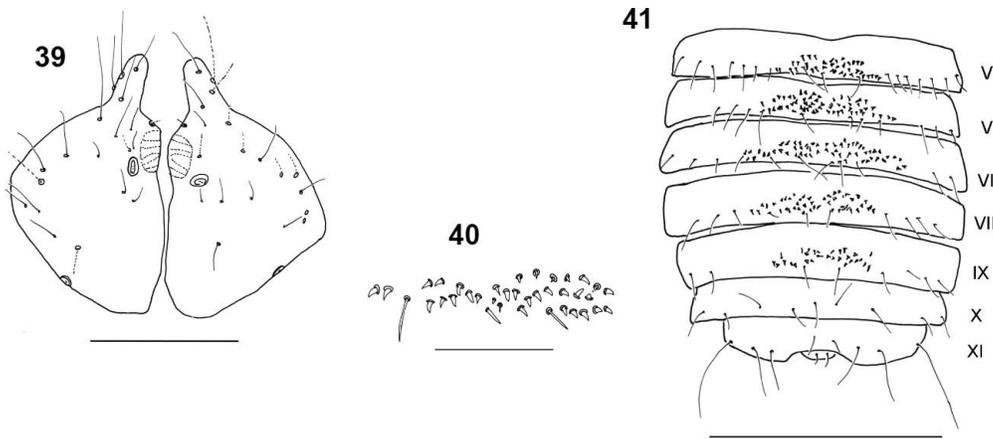
*Allotype*. NEPAL: *Central*: female, collected with holotype (SMF 28969).

**Description.**—Adults (Figs. 27–30): *Colour*: with sclerotized portions generally light yellow-brown; carapaceal metazone without paired pale spots.

*Chelicera* (Fig. 32): with 5 setae on hand, *sbs* denticulate, all others including *bs* acuminate; movable finger with 1 subdistal seta; galea of male with 3 very small terminal rami, of female with 2 sub-terminal and 3 terminal rami; rallum of 4 blades, the most distal blade with several serrations on leading edge,

other blades smooth (Fig. 33); serrula exterior with 16 ( $\delta$ ), 14 ( $\text{♀}$ ) blades; lamina exterior present; 2 lyrifissures on dorsal and 1 on ventral side.

*Pedipalp* (Fig. 34): trochanter, femur and patella granulate, chela smooth; dorsal setae clavate and denticulate; trochanter 2.00 ( $\delta$ ), 1.79 ( $\text{♀}$ ), femur 3.06 ( $\delta$ ), 3.15 ( $\text{♀}$ ), patella 3.26 ( $\delta$ ), 2.92 ( $\text{♀}$ ), chela (with pedicel) 3.75 ( $\delta$ ), 3.28 ( $\text{♀}$ ), chela (without pedicel) 3.51 ( $\delta$ ), 3.07 ( $\text{♀}$ ), hand 2.11 ( $\delta$ ), 1.81 ( $\text{♀}$ ) x longer than broad, movable finger 0.74 ( $\delta$ ), 0.76 ( $\text{♀}$ ) x longer than hand. Fixed chelal finger with 8 trichobothria, movable chelal



Figures 39–41.—*Metawithius nepalensis* (Beier, 1974), holotype male (SMF 28969): 39. Maxillae; 40. Glandular setae, sternite VII, left hemisternite; 41. Abdominal segments V–XII, ventral. Scale bars: 0.5 mm (Fig. 41); 0.2 mm (Fig. 39); 0.1 mm (Fig. 40).

finger with 4 trichobothria, although only 3 in the left chela of ♂ (Figs. 37, 38): *eb* and *esb* situated basally; *ib*, *ist*, *isb* and *it* grouped in basal half of finger; *b* and *sb* situated near one another; *st* slightly closer to *sb* than to *t*. Venom apparatus

present in both chelal fingers, venom ducts not visible in ♂; nodus ramosus distal to *t* on movable finger, distal to *est* on fixed finger in ♀. External margin of fixed finger with 6 sense-spots situated midway between *esb* and *est*. Chelal teeth

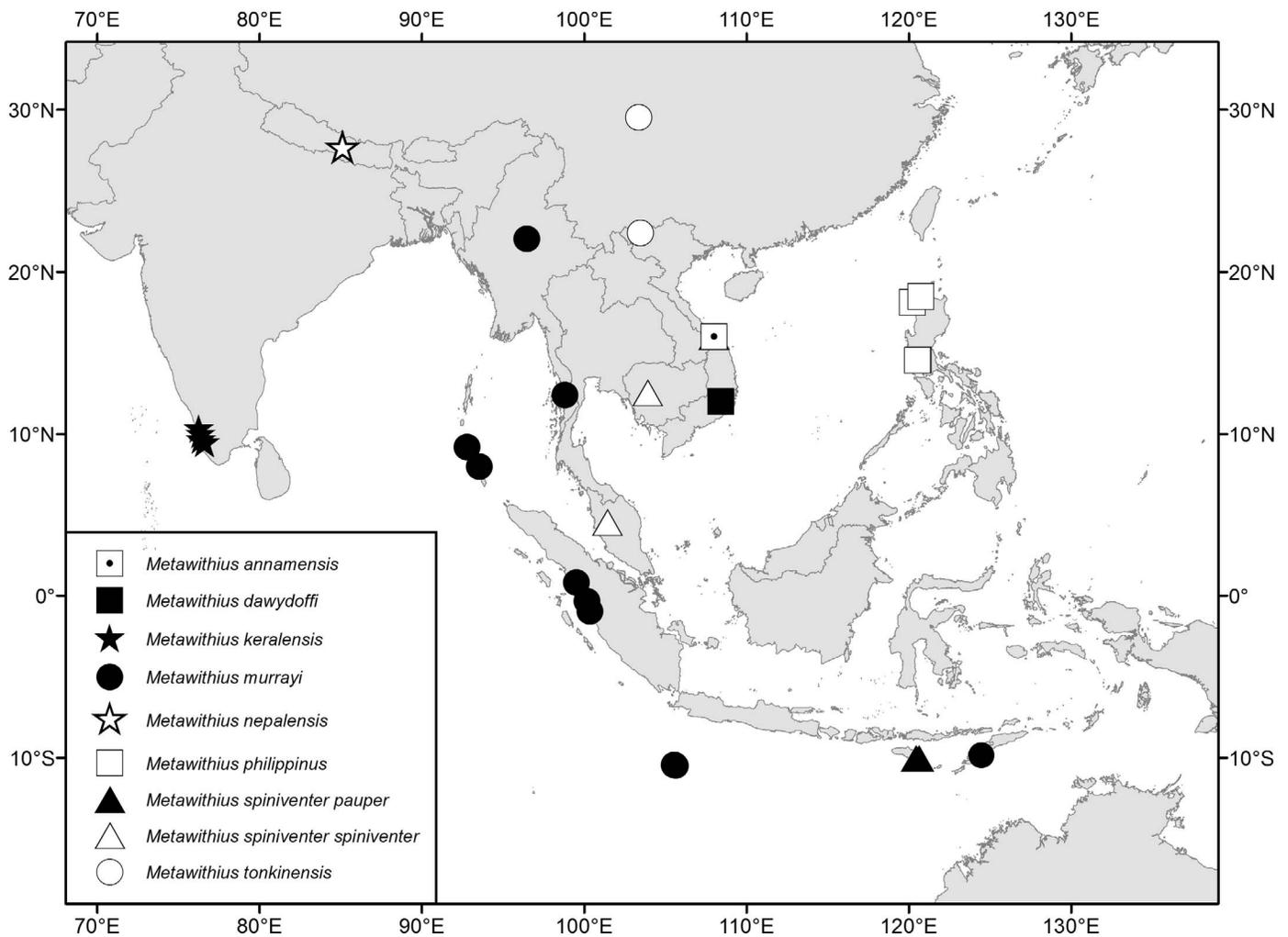


Figure 42.—Geographic distribution of known *Metawithius* spp.

rounded; fixed finger with 32 (♂), 27 (♀) teeth; movable finger with 34 (♂), 28 (♀) teeth; accessory teeth absent.

**Carapace** (Fig. 31): 1.15 (♂), 1.27 (♀) x longer than broad; lateral margins convex, not posteriorly widened; with 2 non-corneate eyes; with ca. 40 (♂), 44 (♀) setae, including 4 (♂), 6 (♀) near anterior margin and 6 (♂, ♀) near posterior margin; with 2 distinct furrows; posterior furrow slightly closer to posterior carapaceal margin than to median furrow (Fig. 31).

**Coxal region:** coxal chaetotaxy: ♂, 9: 7: 9: 18, ♀, 7: 9: 8: 19; maxilla with 4 apical setae and 1 very small internal, sub-oral seta (Fig. 39); interno-median region of male maxilla with rugose area located anterior to the median maxillary lyrifissure; sub-oral seta of male maxilla on 'hooked' mound (Fig. 39).

**Legs:** junction between femora and patellae I and II only slightly oblique; femur + patella of leg IV 3.06 (♂), ? (♀) x longer than deep; tarsal tactile seta of leg IV situated medially, 0.54 (♂), 0.51 (♀) of tarsus length (Fig. 35–36); subterminal tarsal setae arcuate and acute; arolium slightly shorter than claws.

**Abdomen:** tergites and sternites with faint medial suture. Tergal chaetotaxy: ♂, 6: 10: 8: 10: 10: 12: 10: 12: 10: 10: 8 (including 2 tactile setae): 2; ♀, 10: 10: 12: 11: 12: 14: 12: 14: 14: 11: 10 (including 2 tactile setae): 2; mostly uniseriate but some tergites with a few setae placed anteriorly; all setae foliate. Sternal chaetotaxy: ♂, 10: (0) 6 (0): (1) 10 (1): 17 + 26/24 gls: 13 + 35/36 gls: 12 + 40/34 gls: 14 + 32/32 gls: 9 + 23/17 gls: 10 : 10 (including 4 tactile setae): 2; ♀, 16: (0) 12 (0): (1) 12 (1): 19: 19: 17: 16 + 1/1 gls: 14 + 1/1 gls: 14: 10: 2; sternites V–IX of ♂ with patches of glandular setae (Fig. 41); glandular setae ca. 21 µm in length, stout and conical (Fig. 40); sternites VIII–IX of female with 1 pair of glandular setae; setae uniseriate and acuminate; ♂ without paired invaginations on anterior margins of sternites.

**Genitalia:** male with elongated lateral apodemes, although other structures not visible; female genitalia not visible.

**Dimensions:** Male: holotype: body length 1.64. Pedipalps: trochanter 0.290/0.145, femur 0.505/0.165, patella 0.570/0.175, chela (with pedicel) 0.880/0.235, chela (without pedicel) 0.825, hand length 0.370, movable finger length 0.495. Chelicera 0.195/0.120, movable finger length 0.165. Carapace 0.625/0.545 (width at medial area); eye diameter 0.075. Leg I: femur 0.135/0.105, patella 0.255/0.120, tibia 0.285/0.075, tarsus 0.295/0.050. Leg IV: femur + patella 0.505/0.165, tibia 0.410/0.085, tarsus 0.360/0.060, TS 0.195.

**Female:** Allotype: body length 1.78. Pedipalps: trochanter 0.295/0.165, femur 0.535/0.170, patella 0.570/0.195, chela (with pedicel) 0.935/0.285, chela (without pedicel) 0.875, hand length 0.515, movable finger length 0.390. Chelicera 0.275/0.130, movable finger length 0.175. Carapace 0.695/0.545 (width at medial area); eye diameter 0.095. Leg I: femur 0.130/0.120, patella 0.270/0.110, tibia 0.285/0.075, tarsus 0.350/0.055. Leg IV: femur + patella ?/0.165, tibia 0.425/0.085, tarsus 0.365/0.065, TS 0.185.

**Distribution.**—*Metawithius nepalensis* is currently known only from the type locality in Nepal (Fig. 42).

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#### LITERATURE CITED

- Beier, M. 1930. Die Pseudoscorpione der Sammlung Roewer. Zoologischer Anzeiger 91:284–300.
- Beier, M. 1951. Die Pseudoscorpione Indochinas. Mémoires du Muséum National d'Histoire Naturelle, Paris, nouvelle série 1:47–123.
- Beier, M. 1974. Pseudoscorpione aus Nepal. Senckenbergiana Biologica 55:261–280.
- Chamberlin, J.C. 1931a. A synoptic revision of the generic classification of the chelonethid family Cheliferidae Simon (Arachnida). Canadian Entomologist 63:289–294.
- Chamberlin, J.C. 1931b. The arachnid order Chelonethida. Stanford University Publications, Biological Sciences 7(1):1–284.
- Harvey, M.S. 1992. The phylogeny and classification of the Pseudoscorpionida (Chelicerata: Arachnida). Invertebrate Taxonomy 6:1373–1435.
- Harvey, M.S. 2013. Pseudoscorpions of the World, version 3.0. Western Australian Museum, Perth. Available online at <http://museum.wa.gov.au/catalogues-beta/pseudoscorpions>. Accessed on 16 April 2018.
- Harvey, M.S. 2015. Revised diagnoses for the pseudoscorpion genera *Metawithius* and *Microwithius*, with the description of a new Australian genus, and notes on *Withius* (Pseudoscorpiones, Withiidae). Journal of Arachnology 43:353–370.
- Harvey, M.S. & K.L. Edward. 2007. A review of the pseudoscorpion genus *Ideoblothrus* (Pseudoscorpiones, Syarinidae) from western and northern Australia. Journal of Natural History 41:445–472.
- Harvey, M.S., P.B. Ratnaweera, P.V. Udagamaand & M.R. Wijesinghe. 2012. A new species of the pseudoscorpion genus *Megachernes* (Pseudoscorpiones: Chernetidae) associated with a threatened Sri Lankan rainforest rodent, with a review of host associations of *Megachernes*. Journal of Natural History 46:2519–2535.
- Judson, M.L.I. 2007. A new and endangered species of the pseudoscorpion genus *Lagynochthonius* from a cave in Vietnam, with notes on chelal morphology and the composition of the

- Tyrannochthoniini (Arachnida, Chelonethi, Chthoniidae). *Zootaxa* 1627:53–68.
- Pocock, R.I. 1900. Chilopoda, Diplopoda, and Arachnida. Pp. 153–162, pl. 16. *In* A Monograph of Christmas Island (Indian Ocean). (C.W. Andrews, ed.) British Museum (Natural History), London.
- Redikorzev, V. 1938. Les pseudoscorpions de l'Indochine française recueillis par M. C. Dawydoff. *Mémoires du Muséum national d'Histoire naturelle*, Paris 10:69–116.
- Romero-Ortiz, C. and Harvey, M.S. (in press). The pseudoscorpion genus *Verrucachernes* (Pseudoscorpiones: Chernetidae) in the Indian region. *Zootaxa*.
- With, C.J. 1906. The Danish expedition to Siam 1899–1900. III. Chelonethi. An account of the Indian false-scorpions together with studies on the anatomy and classification of the order. *Oversigt over det Kongelige Danske Videnskabernes Selskabs Forhandling*, 3:1–214.

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