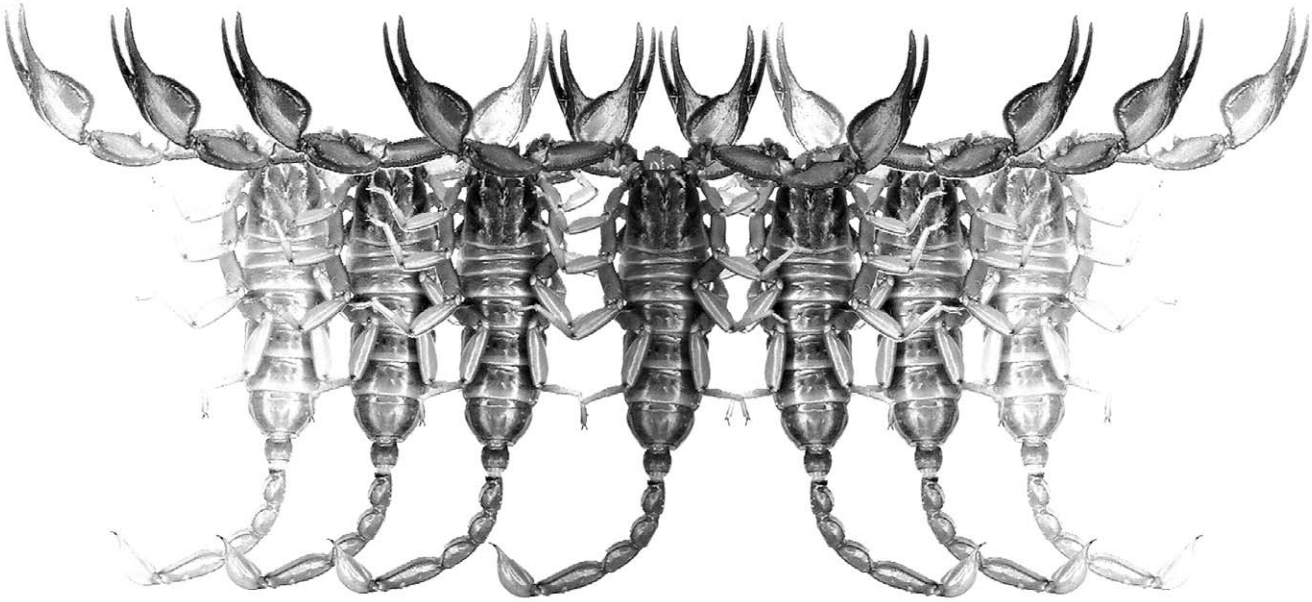
Euscorpius

Occasional Publications in Scorpiology



Scorpions of Sri Lanka (Arachnida, Scorpiones: Buthidae, Chaerilidae, Scorpionidae) with Description of Four New Species of the Genera *Charmus* Karsch, 1879 and *Reddyanus* Vachon, 1972, stat. n.

František Kovařík, Graeme Lowe, Kithsiri B. Ranawana, David Hoferek, V. A. Sanjeewa Jayarathne, Jana Plíšková & František Šťáhlavský

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Euscorpius

Occasional Publications in Scorpiology

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Derivatio Nominis

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Euscorpius — Occasional Publications in Scorpiology. 2016, No. 220

Scorpions of Sri Lanka (Scorpiones: Buthidae, Chaerilidae, Scorpionidae) with description of four new species of the genera *Charmus* Karsch, 1879 and *Reddyanus* Vachon, 1972, stat. n.

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http://www.zoobank.org/urn:lsid:zoobank.org:pub:DD0DF45D-F63A-4AA2-8EFF-03CF99E297EF

Summary

Data about all 18 known scorpion species of Sri Lanka are summarized. All previously known species were newly collected and four new species discovered during a scorpiological expedition in 2015. Information is provided about their taxonomy, distribution, ecology, and reproductive biology, fully complemented with color photos of live and preserved specimens, as well as their habitat. Subgenus *Isometrus* (*Reddyanus*) Vachon, 1972 is elevated to genus level, *Reddyanus* **stat. n.**, supported by new characters of setation on leg tarsomere II and hemispermatophore morphology. *Charmus saradieli* **sp. n.**, *Reddyanus ceylonensis* **sp. n.**, *R. jayarathnei* **sp. n.**, and *R. ranawanai* **sp. n.** are described, compared with other species and fully illustrated. *Heterometrus serratus* (Pocock, 1900) is restored and differentiated from *H. indus* (Geer, 1778). *Charmus minor* Lourenço, 2002 is synonymized with *Charmus laneus* Karsch, 1879; *Isometrus garyi* Lourenço et Huber, 2002 is synonymized with *Reddyanus loebli* (Vachon, 1982) **comb. n.**, and *Heterometrus spinifer solitarius* Couzijn, 1981 is synonymized with *Heterometrus indus* (Geer, 1778). A key and distribution maps for all 18 Sri Lankan scorpion species are presented. Hemispermatophores of *Buthoscorpio sarasinorum* (Karsch, 1892), *Charmus laneus* Karsch, 1879, *Isometrus thwaitesi* Pocock, 1897, *Lychas srilankensis* Lourenço, 1997, *Reddyanus basilicus* (Karsch, 1879) **comb. n.**, *R. ceylonensis* **sp. n.**, *R. loebli* **comb. n.** and *Heterometrus gravimanus* (Pocock, 1894) are illustrated and described for the first time. In additional to morphological analysis, we also describe the karyotype of *Buthoscorpio sarasinorum* (2n=14); *Charmus laneus* (2n=9); *Isometrus thwaitesi* (2n=8); *Lychas srilankensis* (2n=16); *Reddyanus basilicus* **comb. n.** (2n=15–16); *R. ceylonensis* **sp. n.** (2n=16); and *R. loebli* **comb. n.** (2n=17). The significance of cytogenetics and hemispermatophore morphology in buthid taxonomy are discussed.

Introduction

Early authors (1879–1913) cited scorpion records from Sri Lanka mostly in the course of broader works on Indian or worldwide scorpions, and these records were based on several often solitary specimens without exact localities. They described six Sri Lankan species, with type localities cited only as "Ceylon", of which five are still valid (i.e. *Charmus laneus* Karsch, 1879; *Isometrus thwaitesi* Pocock, 1897; *Reddyanus basilicus* (Karsch, 1879) **comb. n.**; *Heterometrus gravimanus* (Pocock, 1894); *Scorpio ceylonicus* Herbst, 1800 = *Heterometrus indus*; *Heterometrus serratus* (Pocock, 1900)). Two other described species, with type localities cited as "India or Ceylon" (*Heterocharmus cinctipes* Pocock, 1892 = *Charmus laneus* Karsch, 1879), and "India" (*Heterometrus indus* (De Geer, 1778)) are actually Sri Lankan endemics.

Until now, the most comprehensive study on Sri Lankan scorpions was authored by Vachon (1982) who analyzed material collected by entomologists Claude Besuchet and Ivan Löbl from MHNG. Vachon also cited older records and created the first distribution map and key for 11 species or subspecies (Vachon, 1982: 96, fig. 50, 102–110). Two of the subspecies that he listed are now placed in synonymy. A second paper on Sri Lankan

Figures 1–4: Figure 1. Sri Lankan scorpion expedition 2015 research team, the official photo. **Figure 2**. Collecting in the locality 15CA, within Peradeniya Univesity land. **Figure 3**. The main building of the Faculty of Science, Univesity of Peradeniya. **Figure 4**. F. Kovařík taking photo of *Heterometrus swammerdami* in the locality 15CB.

Figures 5–11: Figure 5. The reserarch team at a field station in the locality 15CB. **Figure 6**. Tea time in Girithale Wildlife Training Center close to the locality 15CD. From left P. Devasurendra, F. Kovařík and K. B. Ranawana. **Figure 7**. P. Rajkumar (Environmental Research, Jaffna), F. Kovařík and local people in the locality 15CK video recording *Hottentotta tamulus*. **Figure 8**. S. Jayarathne taking a picture of a dangerous snake *Hypnale hypnale* in the locality 15CD. **Figure 9**. Herpetologist S. Goonewardene and F. Kovařík in the locality 15CN. **Figure 10**. Meeting chief monk, in Monaragala "Sri Sambodhi Viharaya", who has helped to research scorpions in the locality 15CQ. **Figure 11**. Profesor K. B. Ranawana in his office at University of Peradeniya.

scorpions of more limited scope was published by Lourenço & Huber (2002). They listed 7 species or subspecies, based on specimens in MHNG collected in 1970–1979, a juvenile *Chaerilus ceylonensis* collected in 1992, and 7 specimens of *Reddyanus besucheti* **comb. n.** collected illegally in 2000. Two of their described taxa, *Isometrus* (*Reddyanus*) *garyi* (see below) and *Isometrus thwaitesi pallidus* (c.f. Kovařík & Ojanguren, 2013), and one that was elevated from a subspecies, *Heterometrus titanicus* (c.f. Kovařík, 2004), are now placed in synonymy. Lourenço (2002) also described *Charmus minor* based on specimens which are probably topotypes of *Charmus laneus* Karsch, 1879 (see below). In taxonomy, knowledge of the true distributions of species is of critical importance. Historically, wrong assumptions or incomplete data about distributions was a major factor causing the above documented errors in taxonomy of Sri Lankan scorpions. This indicates the need for comprehensive and rigorous field surveys of the Sri Lankan scorpion fauna. Recent works have begun to address this need. Ranawana et. al. (2013) and Veronika et. al. (2013) surveyed scorpions of the Jaffna Peninsula and accurately recorded distributions of 3 species: *Hottentotta tamulus*, *Isometrus maculatus* and *Heterometrus swammerdami*.

We have continued this important task by conducting a scorpiological expedition during the period of 19 April – 8 May 2015 to survey 20 carefully selected localities. Sri Lankan arachnologists from Peradenyia University also visited several other localities before and after our expedition. Our collection efforts yielded fresh material which, after analysis was found to represent a total of 18 valid species. We report here our results which provide the most complete and up-to-date account of the Sri Lankan scorpiofauna yet available, with precise locality data and detailed descriptions using modern methods.

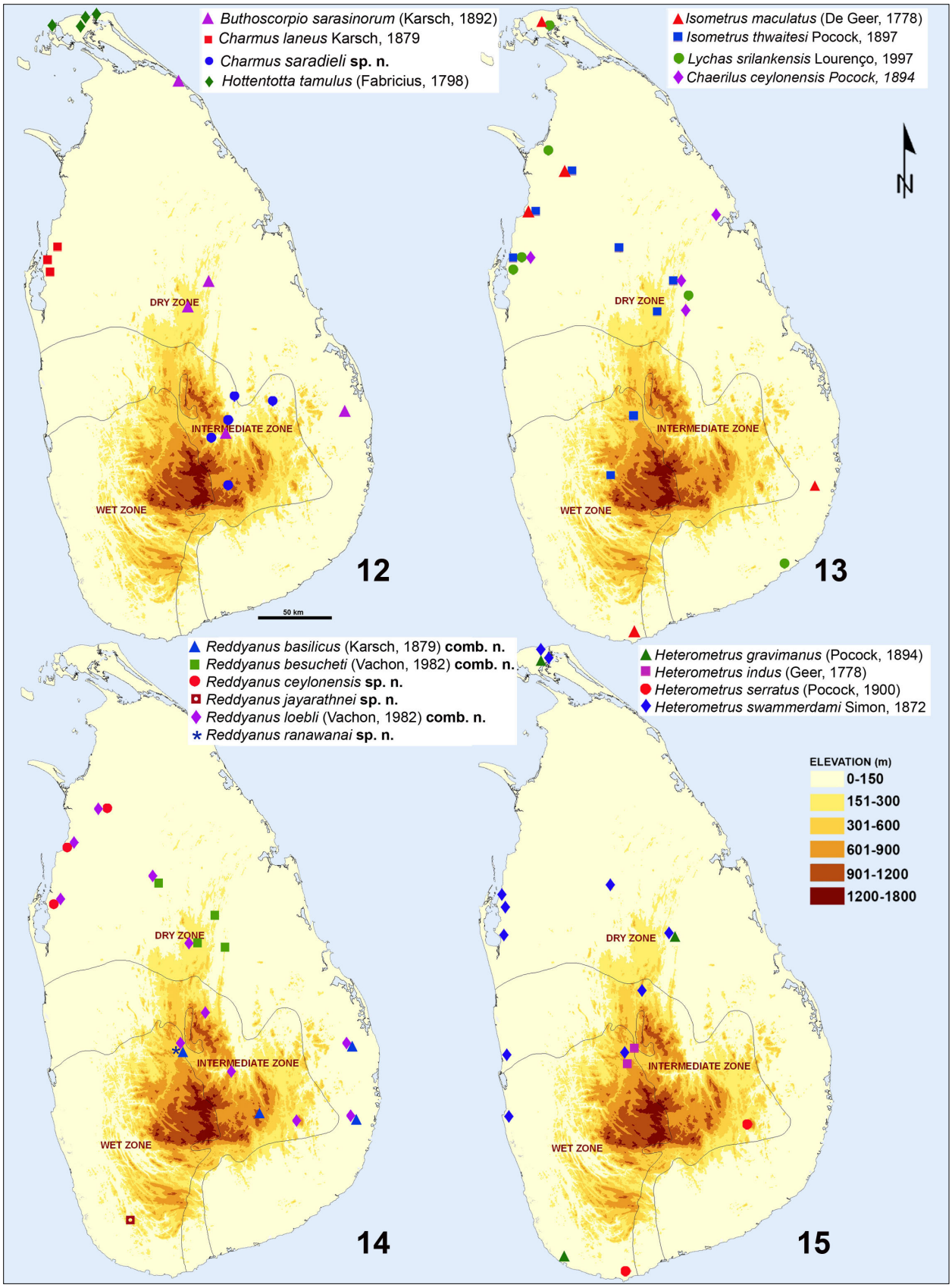
Geology and environment of Sri Lanka

Sri Lanka (05°54'–09°52'N and 79°39'–81°53'E) is an island lying off the south-eastern corner of the Indian subcontinent. The extent of the continental shelf and the nature of rock formations in both India and Sri Lanka provide evidence in support of the hypothesis that Sri Lanka was once a part of India and separated to become an island in the late Miocene. The islands south western part appears to have been the first to separate from India, with alternate shallow flooding and elevation at various times thereafter (Cruz, 1986). Sri Lanka was intermittently connected to mainland India during the last Pleistocene glaciations until sea level rise resulted in the present separation ca. 11,000 y BP (Vaz, 2000). The 65,610 km^2 island was, in the distant geological past, a part of Gondwana, which was never fully submerged by the sea. Nearly 90% of the island landmass comprises pre-Cambrian crystalline rocks, while sedimentary deposits of Miocene limestone are confined to the northwest, including the Jaffna Peninsula (Senanayake, 1990).

Parts of the island have, through subsidence, elevation, erosion and, faulting, produced three peneplains or erosion levels. They represent the lowlands, the uplands and the highlands of the country. The first peneplain represents the coasts and lowlands up to an elevation of 305 m a.s.l., with a few scattered inselbergs. The slope in the coastal belt ranges up to 15°. The first peneplain covers ca. 40,000 km^2 of land area (about 75% of the island). The lowlands are most extensive in the northern and eastern parts, and are very narrow in the southwestern, southern and southeastern regions, where their width is less than 4 km. The second peneplain is an upland belt encircling the third peneplain covering about 15,000 km^2. It is composed of ridge and valley topography with highly dissected plateaus. The mean slope ranges from 10° to 30° along the upland ridges. The upland belt is considerably narrower in the northern and south-eastern sectors than elsewhere. The third peneplain covers an area of ca. 10,000 km^2 of the south central mountains. It is a complex of well-defined high plains and plateaus rimmed with montane peaks and ridges. The highlands are not continuous, but separated from intervening dissected lower plateaus and uplands by steep escarpments and valleys.

Thus, the south central mountains are arranged in the shape of an anchor with two arms arching from the southernmost region of a central ridge. In addition to the south-central complex of major highlands, there are several isolated mountain highland massifs, the two most noteworthy of these being the Knuckles (Dumbara) and the Deniyaya-Rakwana ranges. The Knuckles massif has a maximum elevation of 2035 m a.s.l., is situated northeast of Kandy, and is separated from the central highland mass by deeply eroded valleys carved out by the Mahaweli River. The Deniyaya-Rakwana Massif reaches up to an elevation of 1488 m a.s.l., and is separated from the central highland proper by the valleys formed as a result of erosion caused by the head streams of the Kalu Ganga.

Sri Lanka receives 40–60% of its rain from the monsoons while the rest is inter-monsoonal. The spatial differences in the rain climate of Sri Lanka are a clear manifestation of an orographic effect of the south-central highlands. Although the Sri Lankan mountains have no great vertical extensions by global standards, their elevational range has a considerable influence on the climate, given the small land area involved (Pemadasa, 1996). The annual rainfall period of Sri Lanka extends from March to February. On the basis of the relative dominance of the causative factors, two general categories of rainy seasons can be recognized. These are regarded by climatologists as the monsoons and the



Figures 12–15: Maps showing the known geographical distribution of the Sri Lankan species.

inter-monsoons. The duration of inter-monsoons is less than those of the monsoons but their contribution to the total annual precipitation is remarkable and more outstanding than that of the monsoons. On the basis of the time of occurrence and the direction of the cloud movements, each of the two rainy seasons can be further subdivided into two periods, thus yielding four seasons:

First Inter-monsoon: March – Mid-May
Southwest monsoon: Mid-May – September
Second Inter-monsoon: October – November
Northeast monsoon: December – February

Rainfall and its seasonality is the main determinant of the distribution of natural vegetation in Sri Lanka. This climatic regime is the basis for dividing the island into three major climatic zones *viz*. wet, intermediate and dry (Figs. 12–15). Tropical lowland wet evergreen forests or lowland rain forests which are restricted to the wet southwest of the country up to an elevation of 900 m a.s.l. is the climax vegetation of the wet zone of the island (Gunatilleke et al, 2008). Wet evergreen montane forests are restricted to the uppermost elevations (> 1500 m a.s.l.) of the country while the lower montane forests are confined to middle elevations (900–1500 m a.s.l.) of the Peak Wilderness, Knuckles (Dumbara Hills), Namunukula, and the Rakwana-Deniyaya ranges. Tropical moist semi-evergreen forests are the characteristic vegetation type in the intermediate zone which includes seasonally dry northern and eastern plains. Tropical dry mixed evergreen forests are found in the dry zone. The tropical dry, mixed evergreen forests represent 54% of the island's natural forest cover and 16% of the total land area. The arid zones of the north-western and south-eastern extremities of the island are covered with tropical thorn forests.

Methods and Material

Specimens collected during the scorpiological expedition between 19 April and 8 May 2015 are cited as "leg. Kovařík et al." These scorpions were collected by a research team consisting of the following members: František Kovařík and David Hoferek (Czech Republic); Kithsiri B. Ranawana, Sanjeewa Jayarathne, Sanjaya Karunarathne, A. N. Thudugala, Sewwandi Wijesooriya, Dilan Chathuranga, Chamalka Halyala, and Ajith Hemachandra (University of Peradeniya, Sri Lanka) (Fig. 1). At localities 15CJ and 15CK, we were ably assisted by P. Rajkumar (Sri Lanka, Environmental Research, Jaffna) and local volunteers (Fig. 7). At locality 15CN (a private garden) we were assisted by herpetologist Suraj Goonewardene (Fig. 9).

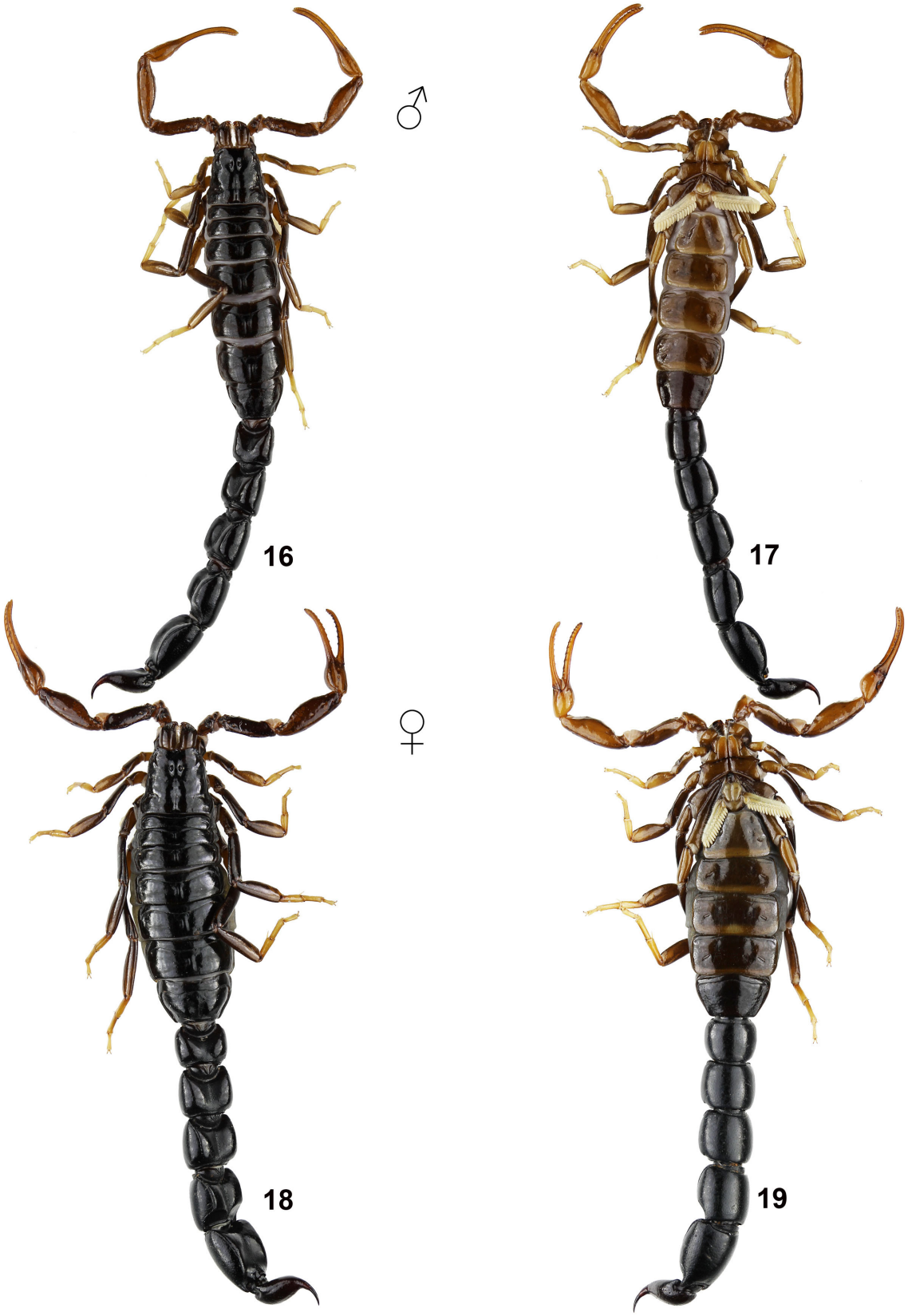
Specimens examined here were collected and exported legally, via permit No. WL/3/2/79/14 issued by the Department of Wildlife Conservation, Sri Lanka. We only collected samples needed for taxonomic revisions of each species. For conservation purposes, additional samples of species that were encountered at various sites were not taken, but were recorded photographically in the field.

Nomenclature and measurements herein follow Stahnke (1971), Kovařík (2009), and Kovařík & Ojanguren Affilastro (2013), except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), hemispermatophore (see below), and sternum (Soleglad & Fet, 2003). Unless otherwise noted, all diagnostic morphological characters mentioned in the text refer to adults of both sexes.

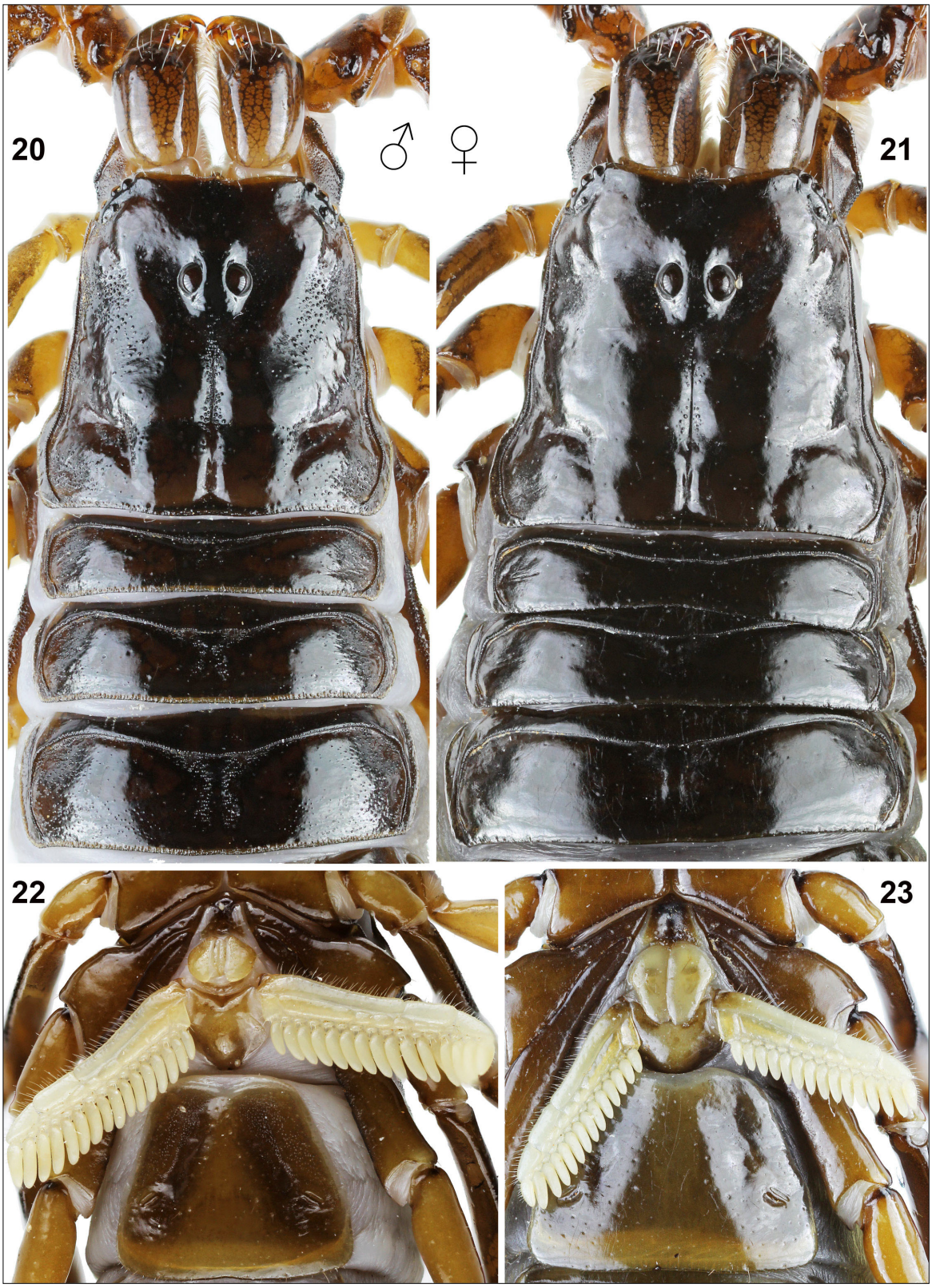
Hemispermatophore terminology. We use 'dorsal', 'internal', 'ventral' and 'external' to refer to axes of the scorpion mesosoma with hemispermatophores in situ. For flagelliform buthid hemispermatophore structures, we use the following terms: *f*, flagellum; *pr*, pars recta of flagellum; *prf,* pars reflecta of flagellum; *t*, trunk (c.f. Lamoral, 1979; Sissom, 1990; Vachon, 1952); *bl*, basal lobe (Maury, 1970; Ojanguren-Affilastro, 2005; Stockwell, 1989; Vachon, 1952); *ml*, median lobe (Vachon, 1952) with median lobe carina (*mlc*). For lamelliform scorpionid hemispermatophore structures, we use the folowing terms: *dl*, distal lamina; *h*, hook; *t*, trunk (Lamoral, 1979; Sissom, 1990); *bl*, basal lobe (Couzijn, 1981; Lamoral, 1979); *dtdl*, dorsal trough of distal lamina (Lamoral, 1979); *il*, inner lobe (Couzijn, 1981; Lamoral, 1979); *ml*, median lobe (Lamoral, 1979; Vachon, 1952); *mtt*, median transverse trough, (Lamoral, 1979); *pl*, proximal lobe (Koch, 1977); *tf*, truncal flexure (Bastawade, 1994; Stockwell, 1989). Note that the 'basal lobe' and 'median lobe' of lamelliform hemispermatophores are not necessarily homologous to structures bearing the same names in flagelliform hemispermatophores.

Specimens cited and/or studied herein are preserved in ethanol 80% and deposited in the following collections:

BMNH (The Natural History Museum, London, United Kingdom);
FKCP (František Kovařík, private collection, Prague, Czech Republic);
MHNG (Museum d`Histoire naturelle of Geneve, Geneva, Switzerland);
MNHN (Muséum National d´Histoire Naturelle, Paris, France);
NHRS (Naturhistoriska Riksmuseet, Stockholm, Sweden);
NMPC (National Museum of Natural History, Prague, Czech Republic);
UPSL (Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka);
ZMHB (Museum für Naturkunde der Humboldt-Universität, Berlin, Germany);



Figures 16–19: *Buthoscorpio sarasinorum*. **Figures 16–17**. Male from locality 15CF in dorsal (16) and ventral (17) views. **Figures 18–19**. Female from locality 15CG in dorsal (18) and ventral (19) views.



Figures 20–23: *Buthoscorpio sarasinorum*. **Figures 20, 22**. Male from locality 15CF, chelicerae, carapace and tergites I–III (20) and sternopectinal region and sternite III (22). **Figures 21, 23**. Female from locality 15CG, chelicerae, carapace and tergites I–III (21) and sternopectinal region and sternite III (23).

Figures 24–29: *Buthoscorpio sarasinorum*. **Figures 24–26**. Male from locality 15CF, metasoma and telson, lateral (24), ventral (25), and dorsal (26) views. **Figures 27–29**. Female from locality 15CG, metasoma and telson, lateral (27), ventral (28), and dorsal (29) views.

ZMUH (Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany).

For explanation of locality codes 15CA–15CT see legends of Figs. 575–598.

Checklist of Scorpions of Sri Lanka

Family **Buthidae** C. L. Koch, 1837

Buthoscorpio sarasinorum (Karsch, 1892) *

Charmus laneus Karsch, 1879 *

= *Heterocharmus cinctipes* Pocock, 1892

= *Charmus minor* Lourenço, 2002 **Syn**. **n**.

Charmus saradieli **sp**. **n**. *

Hottentotta tamulus (Fabricius, 1798)

Isometrus maculatus (De Geer, 1778)

Isometrus thwaitesi Pocock, 1897 *

= *Isometrus thwaitesi pallidus* Lourenço et Huber, 2002

Lychas srilankensis Lourenço, 1997 *

= *Lychas ceylonensis* Lourenço et Huber, 1999

Reddyanus basilicus (Karsch, 1879) **comb. n.** *

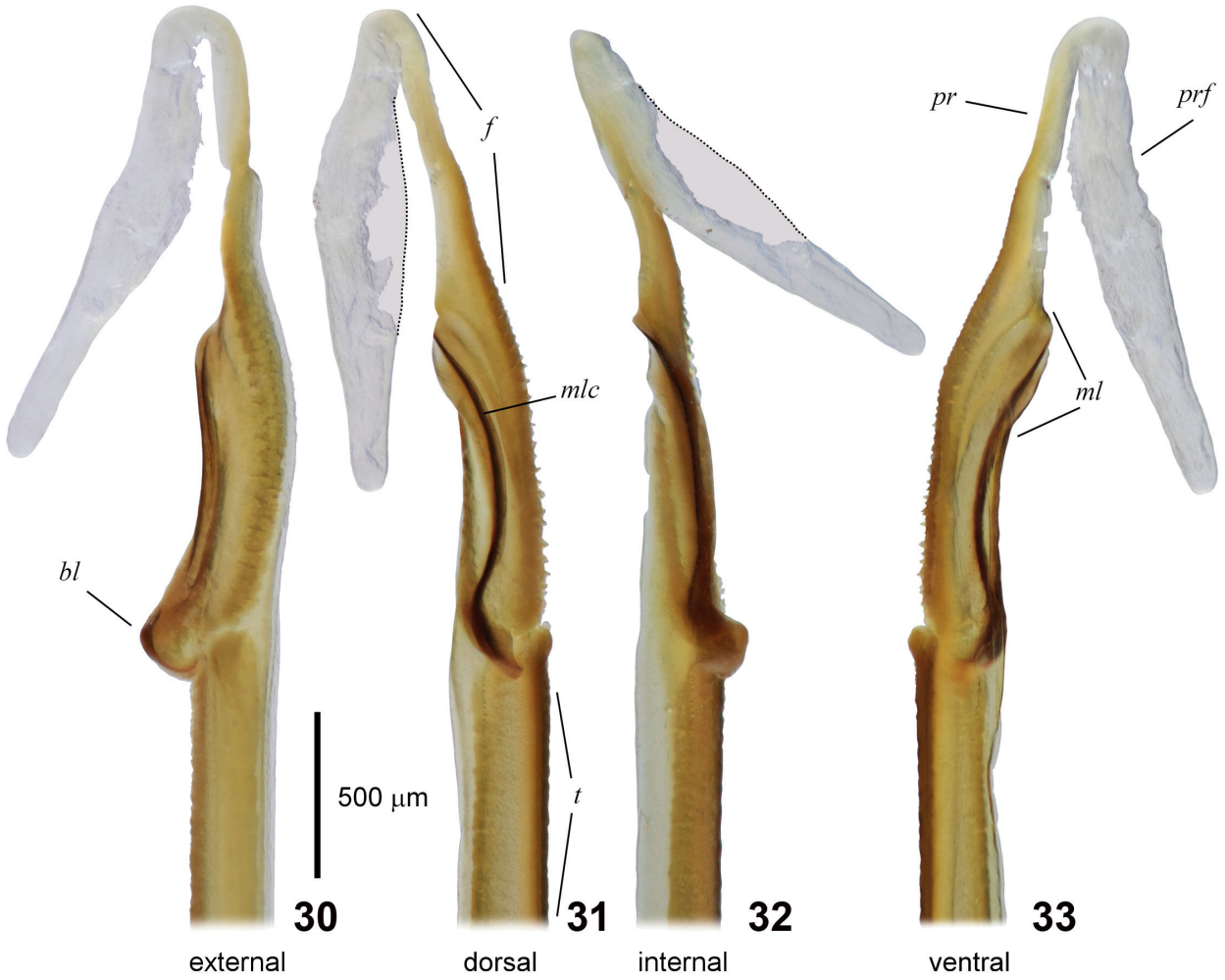
Reddyanus besucheti (Vachon, 1982) **comb. n.** *

Reddyanus ceylonensis **sp**. **n**. *

Reddyanus jayarathnei **sp**. **n**. *

Reddyanus loebli (Vachon, 1982) **comb. n.** *

= *Isometrus garyi* Lourenço et Huber, 2002 **Syn**. **n**.



Figures 30–33: Capsule region and flagellum of left hemispermatophore of *Buthoscorpio sarasinorum* from locality 15CF. External (30), dorsal (31), internal (32) and ventral (33) views. Note: damaged section of pars reflecta of flagellum is interpolated as a dotted outline. Scale bar: 500 µm. Abbreviations: *bl*, basal lobe; *f*, flagellum; *ml*, median lobe; *mlc*, median lobe carina; *pr*, pars recta of flagellum; *prf,* pars reflecta of flagellum; *t*, trunk.

***Reddyanus ranawanai* sp. n.** *

Family **Chaerilidae** Pocock, 1893

Chaerilus ceylonensis Pocock, 1894 *

Family **Scorpionidae** Latreille, 1802

Heterometrus gravimanus (Pocock, 1894)

Heterometrus indus (De Geer, 1778) *

= *Scorpio ceylonicus* Herbst, .1800

= *Heterometrus* (*Heterometrus*) *spinifer solitarius* Couzijn, 1981 **Syn. n.**

Heterometrus serratus (Pocock, 1900) *

Heterometrus swammerdami Simon, 1872

= *Heterometrus* (*Gigantometrus*) *swammerdami titanicus* Couzijn, 1981

* Sri Lankan endemics

Systematics

Family Buthidae C. L. Koch, 1837

Genus ***Buthoscorpio*** Werner, 1936

(Figs. 12, 16–40, 193, 421–422, 547)

= *Stenochirus* Karsch, 1892: 305–306, fig. 30, Pl. XXII; a junior homonym of *Stenochirus* Oppel, 1862 (Crustacea); Kraepelin, 1899: 39; Pocock, 1900: 32–33; Kraepelin, 1913: 131–132; Werner, 1934: 271; Vachon, 1982: 83–84, figs. 12–18, 84–85; Tikader & Bastawade, 1983: 152–153.

= *Pocockius* Francke, 1985: 13, 16 (syn. by Fet, 1997: 246).

Buthoscorpio Werner, 1936: 191; Fet, 1997: 246; Fet & Lowe, 2000: 90; Kovařík, 2009: 31; Javed et al.,

Figures 34–38: *Buthoscorpio sarasinorum*. **Figures 34**. Male at locality 15CF. **Figures 35**. Female at locality 15CS under UV. **Figures 36–38**. Female from locality 15CF (36) with newborns (37), and with juveniles after first ecdysis (38).

Figures 39–46: Chela of pedipalps (39–45) and movable finger of chela (46). **Figures 39–40**. *Buthoscorpio sarasinorum*, male from locality 15CF (39) and female from locality 15CG (40). **Figures 41–43**. *Charmus laneus*, male (41) and female (42) from locality 15CO, and female holotype (43). **Figure 44**. *Charmus saradieli*, **sp**. **n**., female holotype. **Figures 45–46**. *Hottentotta tamulus*, male from locality 15CK.

2010: 5–10, figs. 1–8; Aswathi et al., 2015: 213–218, figs. 1–5.

TYPE SPECIES. *Stenochirus sarasinorum* Karsch, 1892

DIAGNOSIS. Total length 30–52 mm. Sternum type 1, subpentagonal or subtriangular, roughly as wide as long, exhibiting horizontal compression. Pedipalps with trichobothrial pattern Aα; femur trichobothrium d_2 located dorsally, patella d_3 external to dorsomedian carina; chela with 3 *Eb* trichobothria on manus. Cheliceral fixed finger with two ventral accessory denticles. Movable finger of pedipalp chela longer than manus. Pectines with fulcra. Dentate margin of pedipalp chela movable finger with distinct granules divided into 10–11 linear rows, apical rows of 3–4 granules, and 3 terminal granules. Tergites I–VI smooth or finely granular, with one carina. Carapace smooth to finely granular without carinae, anterior edge with epistome present medially. Metasomal segments punctate, without stridulatory areas, without carinae except for dorsolateral carinae which may be developed. Telson vesicle punctate, subaculear tooth absent or weakly developed. Pedipalps, metasoma and telson glabrous. Legs III and IV with well developed, long tibial spurs; ventral aspect of tarsomere II with two rows of spiniform setae.

DISTRIBUTION. India, Sri Lanka.

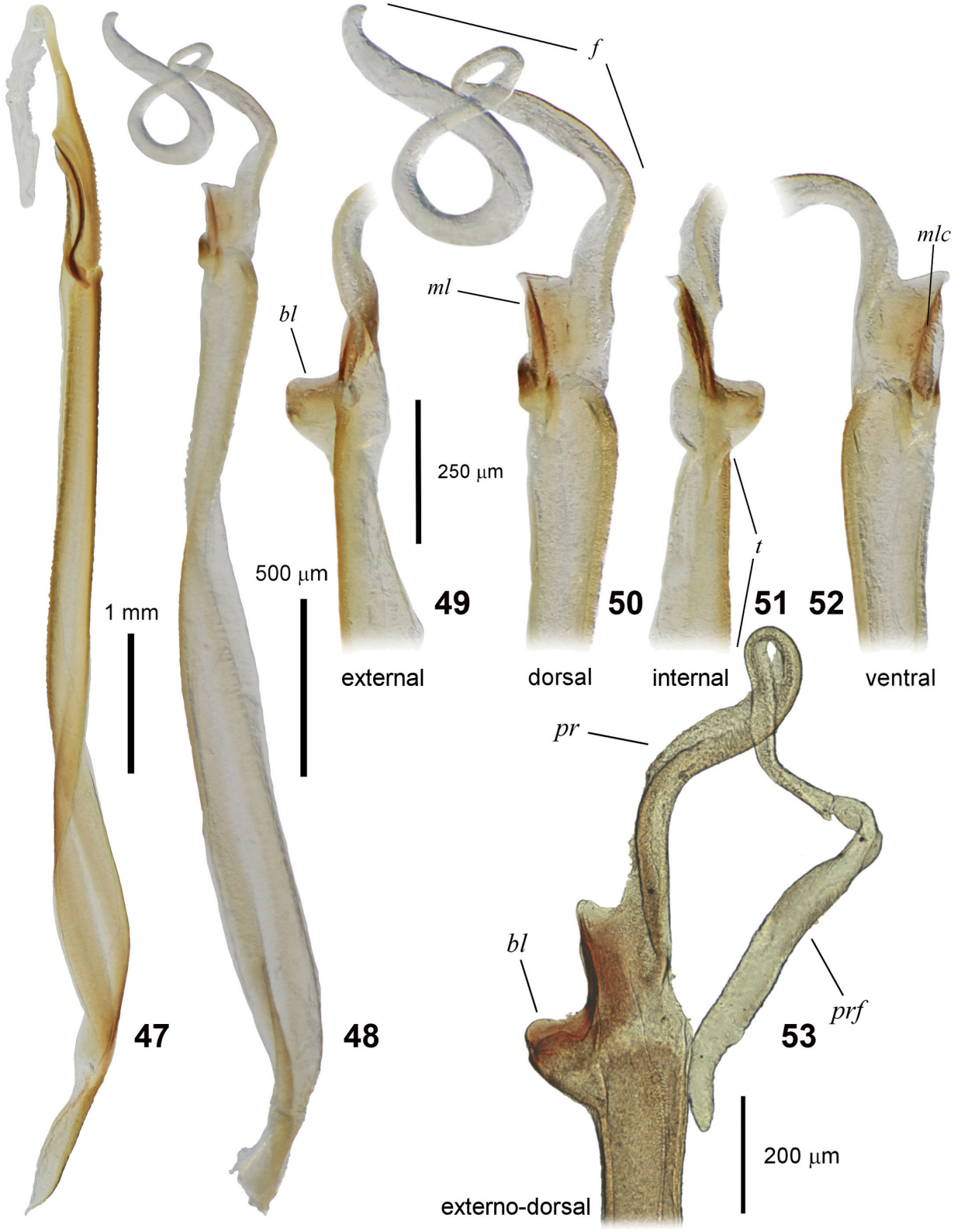
Buthoscorpio sarasinorum (Karsch, 1892)
(Figs. 12, 16–40, 47, 193, 421–422, 547)

Stenochirus sarasinorum Karsch, 1892: 305–306, fig. 30, Pl. XXII; Kraepelin, 1899: 39–40; Pocock, 1900: 33–34; Moritz & Fischer, 1980: 323; Vachon, 1982: 83–84, figs. 12–18, 84–85.

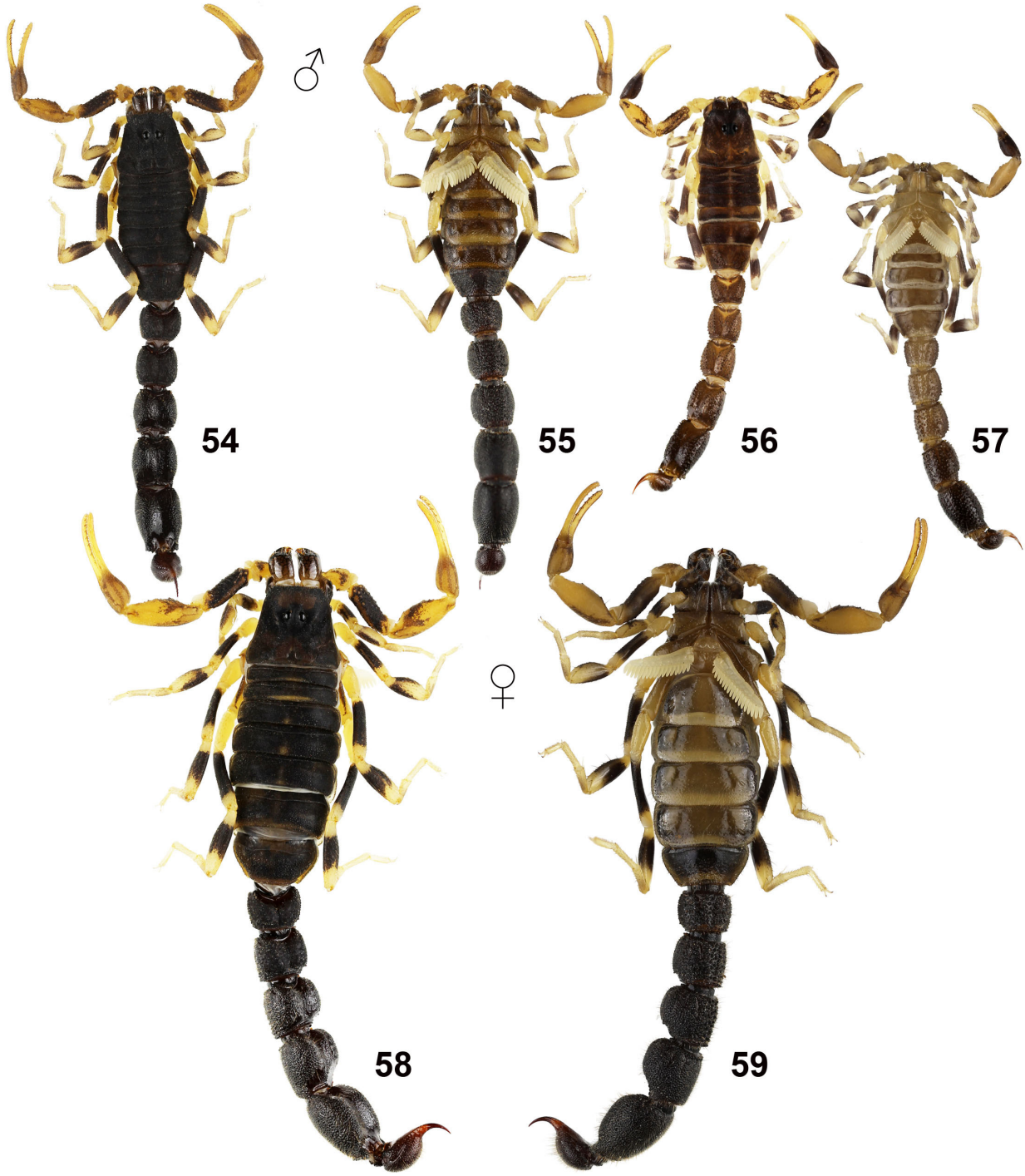
Buthoscorpio sarasinorum: Fet, 1997: 246; Fet & Lowe, 2000: 90 (? in part); Lourenço, 2012: 188–189, figs. 6–12.

TYPE LOCALITY AND TYPE REPOSITORY. Ceylon (now Sri Lanka), Peradeniya, ZMHB No. 6806.

MATERIAL EXAMINED. **Sri Lanka**, North Central Province, Polonnaruwa District, near Kaudulla National Park, 08°08'40.6"N 080°51'04"E, 101 m a.s.l. (Locality **15CF**, Fig. 581), 23.IV.2015, 1♂ (Figs. 16–17, 20, 22, 24–26, 30–34, 193, 421, 547), FKCP, 1♀ (Figs. 36–38) UPSL, leg. Kovařík et al.; Central Province, Matale District, Habarana, Wananiwahana Resort, 07°59'25.8"N 080°43'24.6"E, 280 m a.s.l. (Locality **15CG**, Fig. 584), 23. –24.IV.2015, 1♀ (Figs. 18–19, 21, 23, 27–29, 422), FKCP, leg. Kovařík et al.; Eastern Province, Ampara



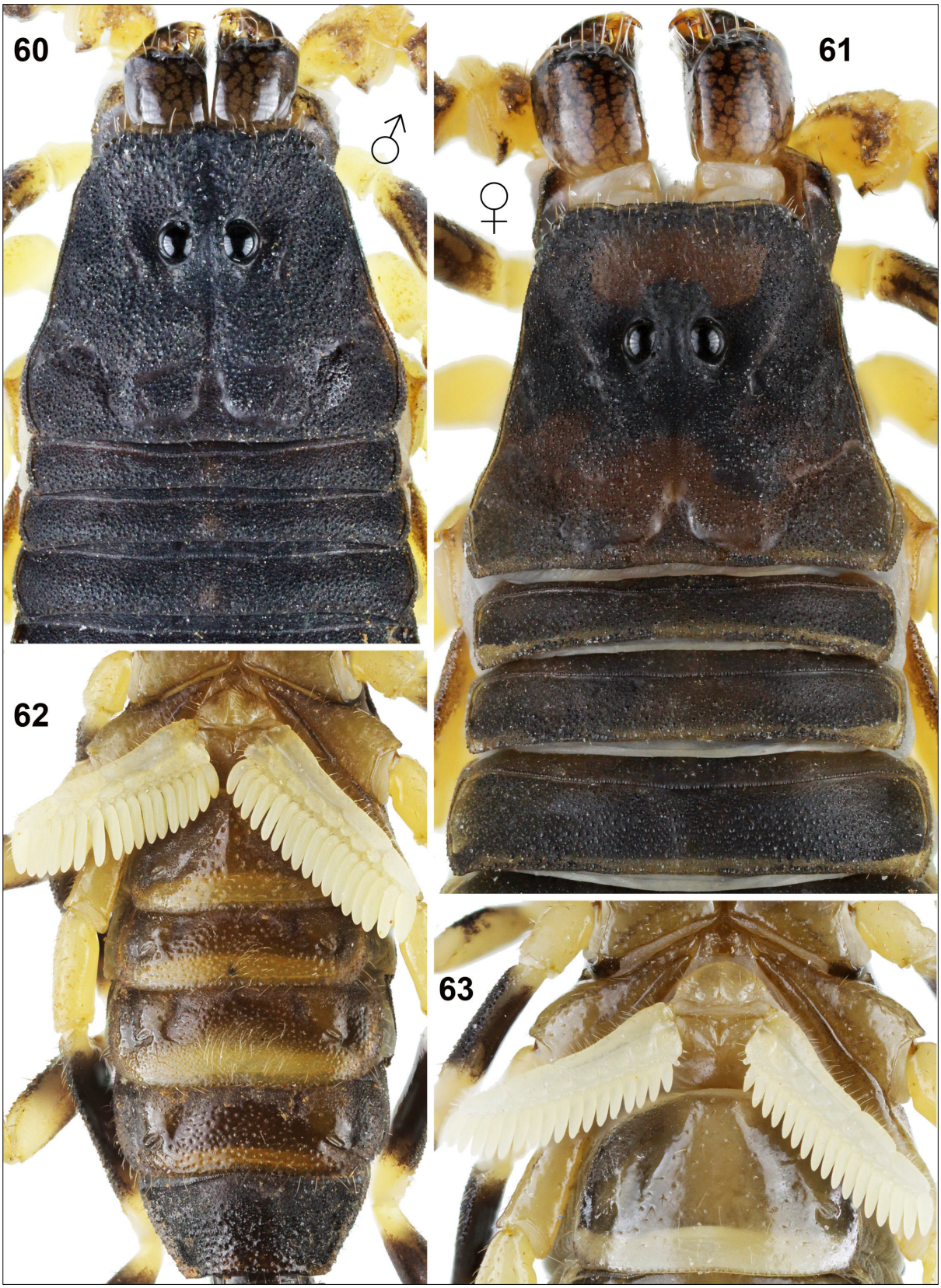
Figures 47–53: **Figure 47**. Left hemispermatophore of *Buthoscorpio sarasinorum* from locality 15CF. **Figures 48–53**. *Charmus laneus* from locality 15CO. **Figure 48**. Left hemispermatophore. **Figures 49–53**. Capsule region and flagellum. External (49), dorsal (50), internal (51) and ventral (52) views of left hemispermatophore, and externo-dorsal (53) view of right hemispermatophore presented as mirror image for comparison. Scale bars: 1 mm for 47, 500 µm for 48, 250 µm for 49–52, and 200 µm for 53. Abbreviations: *bl*, basal lobe; *f*, flagellum; *ml*, median lobe; *mlc*, median lobe carina; *pr*, pars recta of flagellum; *prf,* pars reflecta of flagellum; *t*, trunk.



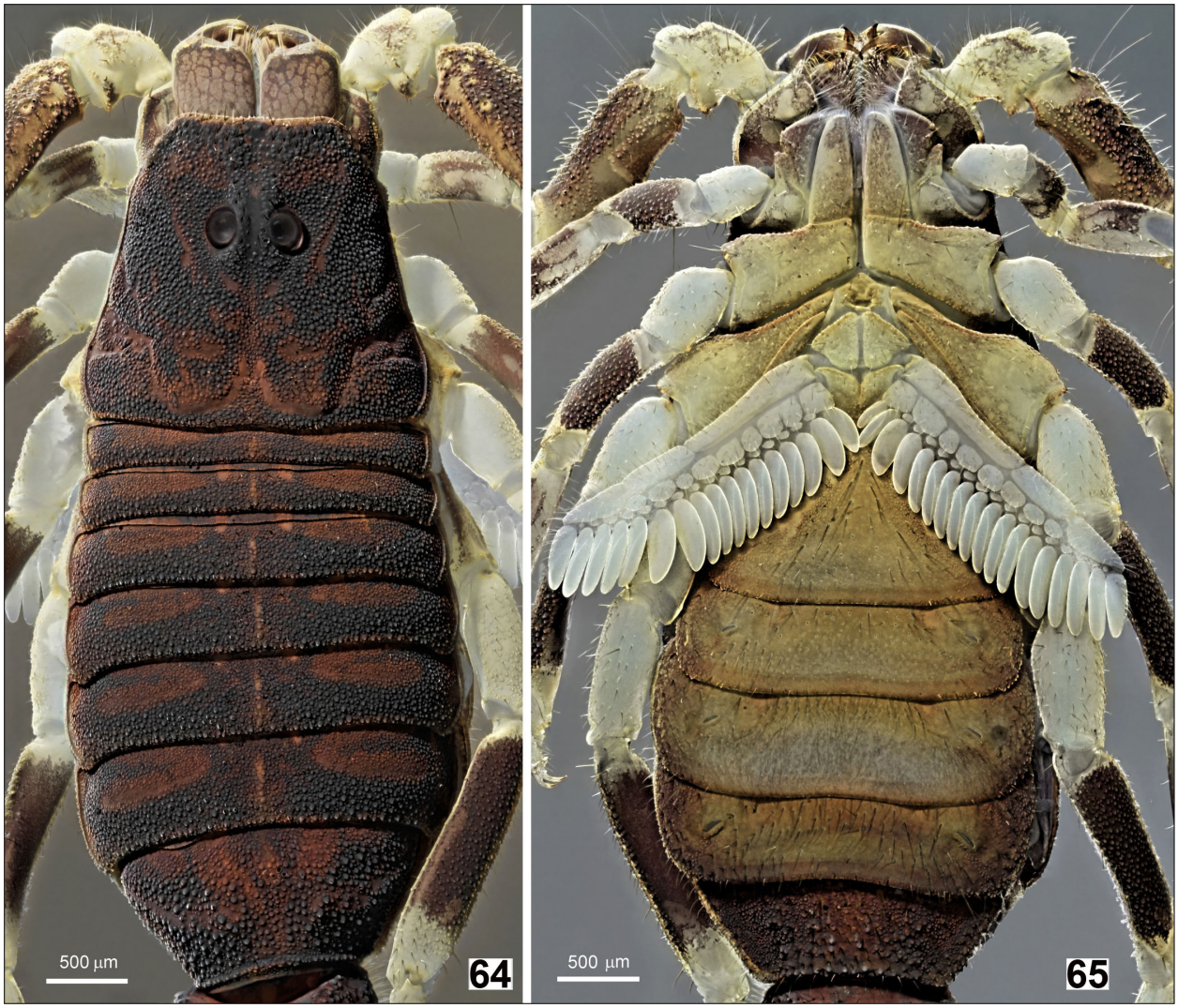
Figures 54–59: *Charmus laneus* from locality 15CO. **Figures 54–55**. Male 14.7 mm long in dorsal (54) and ventral (55) views. **Figures 56–57**. Juvenile male 7.5 mm long in dorsal (56) and ventral (57) views. **Figures 58–59**. Female 20.1 mm long in dorsal (58) and ventral (59) views.

District, Ampara env., 07°20'01.3"N 081°41'57.1"E, 56 m a.s.l. (Locality **15CS**, Fig. 597), 4.V.2015, 1♂, UPSL, 1♀ (Fig. 35), FKCP, leg. Kovařík et al.; Central Province, Kandy District, Tree Centre Wildlife Trust Sri Lanka "Rantambe", 07°12'22.1"N 080°57'20.7"E, 171 m a.s.l. (Locality **15CT**, Fig. 598), 5.V.2015, 1♂, FKCP, 1♂, UPSL leg. Kovařík et al.

DIAGNOSIS. Total length 25–52 mm. Dentate margin of pedipalp chela movable finger with distinct granules



Figures 60–63: *Charmus laneus* from locality 15CO. **Figures 60, 62**. Male, chelicerae, carapace and tergites I–III (60) and sternopectinal region and sternites III–VII (62). **Figures 61, 63**. Female, chelicerae, carapace and tergites I–III (61) and sternopectinal region and sternite III (63).

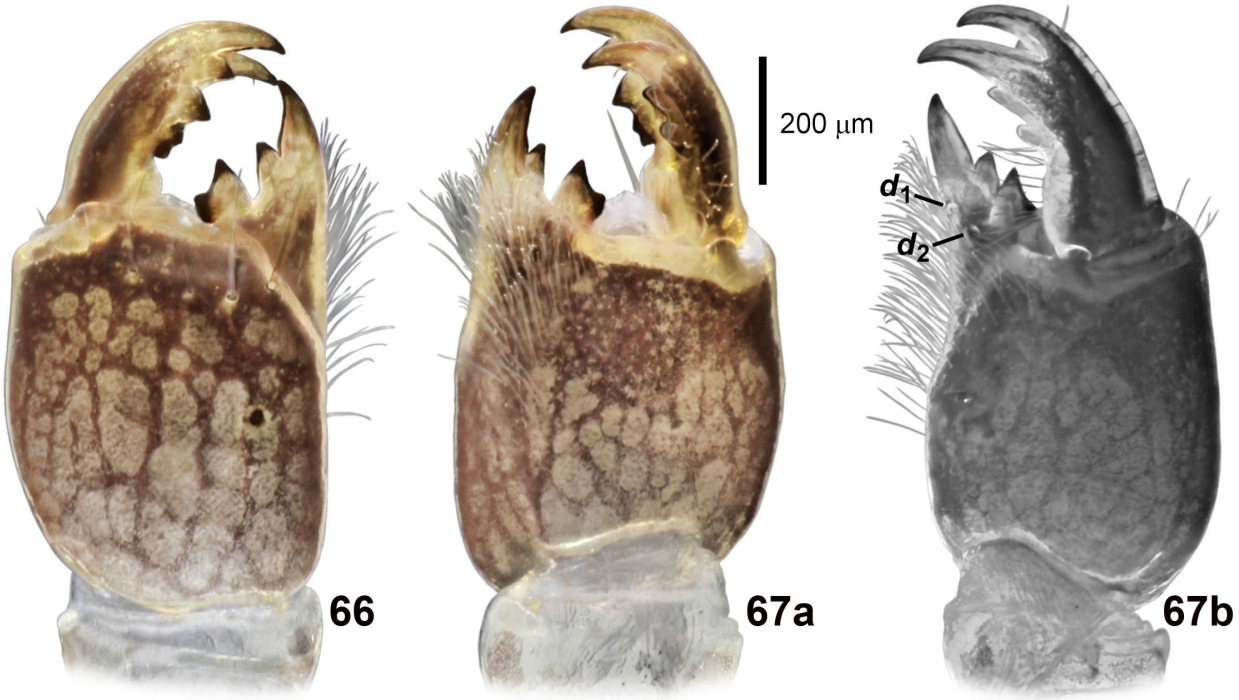


Figures 64–65: *Charmus laneus* from locality 15CO, showing granulation and color pattern of male. Chelicerae, carapace and tergites (64). Coxosternal region and sternites (65). Scale bar: 500 µm.

divided into 10 linear rows, apical rows of 3 granules, and 3 terminal granules. Tergites and carapace smooth to finely granular (more so in males). Median eyes located anteriorly in the ratio ca 1:2.5. Metasomal segments III–IV with well developed dorsolateral carinae. Dorsal surface of metasomal segments mesially granulated. Metasomal segments I–V granulated. Pectinal teeth number 14–17 in both sexes. Telson without subaculear tooth.

HEMISPERMATOPHORE (Figs. 30–33, 47). Trunk and capsule region very narrow, elongate (Fig. 47). Flagellum cylindriform, short, pars recta with broad base; pars reflecta thickened, about the same length as capsule region. Median lobe narrow with prominent, curved dorsal carina. Basal lobe strongly developed as a prominent, blunt, rounded scoop arising dorsally from base of median lobe carina. External surface of capsule region roughly sculptured with series of transverse corrugations.

COMMENTS. *Buthoscorpio sarasinorum* is probably endemic to Sri Lanka. Tikader & Bastawade (1983: 158–163, figs. 430–452) and Thulsi Rao et al. (2005: 7) cited *B. sarasinorum* from India but according to the characters they cited, their records probably represent a different species. Aswathi et al. (2015: 218) cited *B. sarasinorum* only from Sri Lanka (Aswathi et al., 2015: 217, fig. 1) but in their table (Aswathi et al., 2015: 218, tab. 2) they listed variable or incorrect diagnostic characters for *B. sarasinorum*.



Figures 66–67: Left chelicera of male *Charmus laneus* from locality 15CO. **Figures 66–67**. Dorsal (66) and ventral (67a) view (white light + UV), and ventroexternal (67b) aspect (UV) showing 2 denticles on ventral surface of fixed finger (d_1, d_2). Scale bar: 200 μm.

Genus ***Charmus*** Karsch, 1879
(Figs. 12, 41–43, 47–119, 194, 423–426, 548, Tables 1–2)

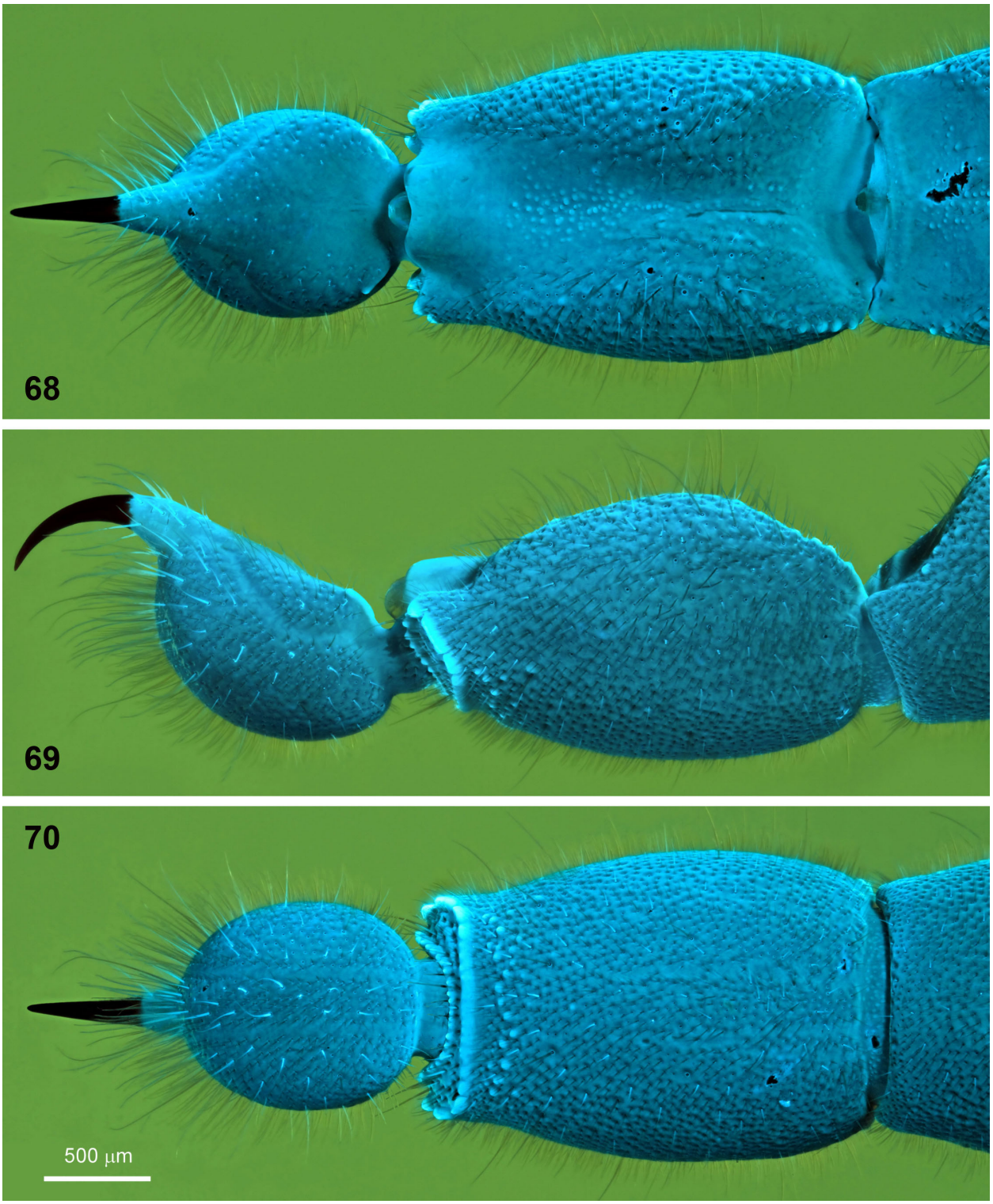
Charmus Karsch, 1879: 104; Kraepelin, 1899: 39; Pocock, 1900: 31–32; Kraepelin, 1913: 131; Vachon, 1982: 79, 81; Tikader & Bastawade, 1983: 140–152, figs. 382–416; Sissom, 1990: 101; Kovařík, 1998: 120; Lourenço, 2000: 295; Kovařík, Soleglad & Fet, 2007: 201; Kovařík, 2009: 31.

= *Heterocharmus* Pocock, 1892: 46–47, type species by monotypy *Heterocharmus cinctipes* Pocock, 1892 (= *Charmus laneus* Karsch, 1879) (syn. by Kraepelin, 1899: 39; Pocock, 1900: 31).

TYPE SPECIES. *Charmus laneus* Karsch, 1879

DIAGNOSIS. Small buthids, adults 12 mm (male) – 23.5 mm (female). Sternum type 1, subpentagonal, roughly as wide as long, exhibiting horizontal compression. Pedipalps trichobothrial pattern Aα; femur trichobothrium d_2 located dorsally, patella d_3 dorsal of dorsomedian carina; chela with 3 *Eb* trichobothria on manus. Movable finger of pedipalp longer than manus. Pectines with or without fulcra. Dentate margin of pedipalp chela movable finger with distinct granules divided into 8–9 linear rows, apical rows of 4–6 granules, and 3 terminal granules. Cheliceral fixed finger armed with two denticles on ventral surface (Fig. 67a). Tergites I–VI granular, with one clearly visible carina. Carapace granular without carinae, anterior edge with epistome present medially. Metasomal segments IV–V punctate without developed carinae. Telson vesicle punctate, without subaculear tooth. Pedipalps, metasoma and telson densely hirsute. Legs III and IV with well developed long tibial spurs, first and second tarsomeres with ventral setae.

NOTE. A remarkable feature of the metasoma and telson of *Charmus laneus* is the extremely dense pubescence (Figs. 71–73). All segments bear an abundance of fine setae of various lengths emerging from pits containing sockets or perforations in the thickened cuticle. These setae can be divided into at least two types: (1) straight or uniformly curved, non-fluorescent golden setae; and (2) terminally curved, brightly fluorescent, translucent setae with intense pinpoint fluorescence at the tip (Figs. 68–70). Comparing these setae to similar kinds of setae found in other scorpions, we suggest that type 1 setae may be mechanoreceptive and tactile, and type 2 setae may be chemoreceptive in function. Putative chemotactic microsetae in other scorpions are typically also fluorescent and exhibit a similar, apically curved shape, but are usually quite short compared to the long fluorescent setae seen here. A similar densely hirsute metasoma is also present in *C. saradieli* **sp**. **n**. and was also described in the other two known members of the genus, *C. indicus* Hirst, 1915 and *C. singhagadensis* Tikader et Bastawade, 1983 (Sreenivasa Reddy, 1966:



Figures 68–70: *Charmus laneus*, male from locality 15CO. Metasoma V and telson under UV fluorescence, showing granulation, punctuation and setation in dorsal (68), lateral (69) and ventral (70) views. Scale bar: 500 µm.

247–256; Tikader & Bastawade, 1983: 140–152). A similar, probably homologous development of dense setation is also observed in the closely related genus *Thaicharmus* (Kovařík, 1995, 2013; Mirza et. al., 2016). This massive concentration of multimodal sensory input indicates that *Charmus* is another example of the evolution of the metasoma into a specialized sensory organ. As noted previously, this has apparently occurred in-

Figures 71–73: Metasoma and telson of *Charmus laneus* male from locality 15CO, showing granulation, punctuation, setation and color pattern in dorsal (71), lateral (72) and ventral (73) views. Scale bar: 1 mm.

Figures 74–79: *Charmus laneus* from locality 15CO. **Figures 74–76**. Male, metasoma and telson, lateral (74), ventral (75), and dorsal (76) views. **Figures 77–79**. Female, metasoma and telson, lateral (77), ventral (78), and dorsal (79) views.

dependently in several different buthid lineages, e.g. *Butheoloides* Hirst, 1925; *Isometroides* Keyserling, 1885; *Karasbergia* Hewitt, 1914; *Microbuthus* Kraepelin, 1898; *Orthochirus* Karsch, 1892; etc. (E. Fet et al., 2003; Lourenço, 2001, 2003; Lowe, 2010; Prendini, 2004).

DISTRIBUTION. India, Sri Lanka.

Charmus laneus Karsch, 1879
(Figs. 12, 41–43, 47–83, 85–86, 96–98, 118–119, 194, 423–424, 548, Tables 1–2)

Charmus laneus Karsch, 1879: 104–105; Kraepelin, 1899: 39; Pocock, 1900: 32; Kraepelin, 1913: 131; Sreenivasa-Reddy, 1966: 253–254; Moritz & Fischer, 1980: 317; Kovařík, 1998: 108; Fet & Lowe, 2000: 123 (in part).

= *Heterocharmus cinctipes* Pocock, 1892: 47–48, pl. IIIB, fig. 2, 2a–b (TL: India or Sri Lanka; BMNH). Syn. by Kraepelin, 1899: 39.

= *Charmus minor* Lourenço, 2002: 19–24, figs. 1–14 (TL: Sri Lanka, Mannar District, Wilpattu National Park, 0.5 miles NE Cockmuttai; ZMUH). **Syn**. **n**.

TYPE LOCALITY AND TYPE REPOSITORY. Ceylon; ZMHB.

TYPE MATERIAL EXAMINED. Ceylon (now Sri Lanka), leg. Hoffmeister, 1♀ holotype (Figs. 43, 80–82, 96–98), ZMHB No. 3051.

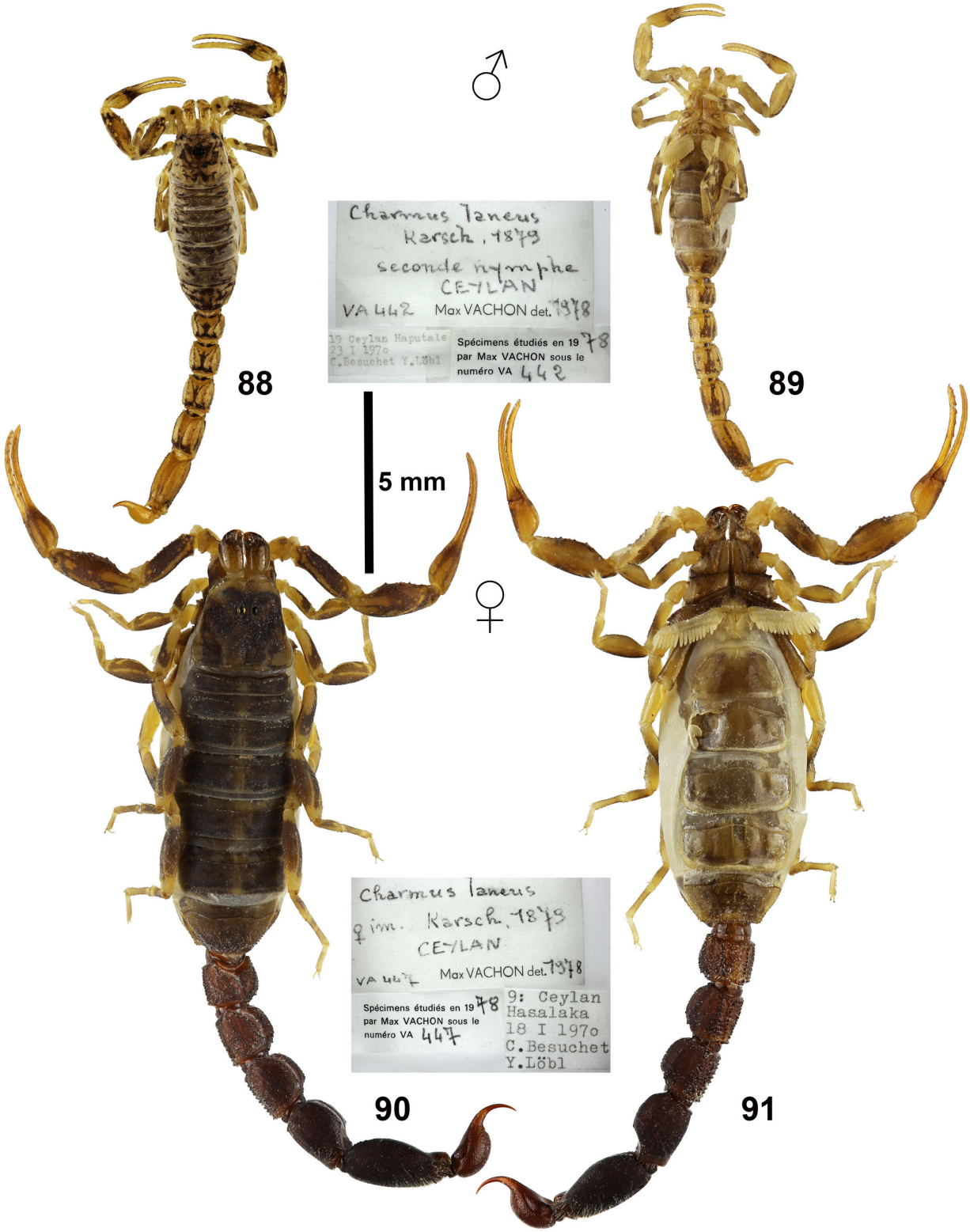
OTHER MATERIAL EXAMINED. Sri Lanka, North Central Province, Puttalam District, Eluwankulam, 08°12'35.1 "N 079°51'32"E, 52 m a.s.l. (Locality **15CN**, Fig. 591), 28.IV.2015, 1♂, FKCP, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°17'

Figures 80–84: Comparing Sri Lankan *Charmus* female metasomas. **Figures 80–82**. Female holotype of *Charmus laneus*, metasoma and telson, lateral (80), ventral (81), and dorsal (82) views. **Figures 83**. Female of *Charmus laneus* from locality 15CO, metasoma and telson dorsal. **Figures 84**. Female holotype of *Charmus saradieli* **sp**. **n**. (MHNG) metasoma and telson dorsal.

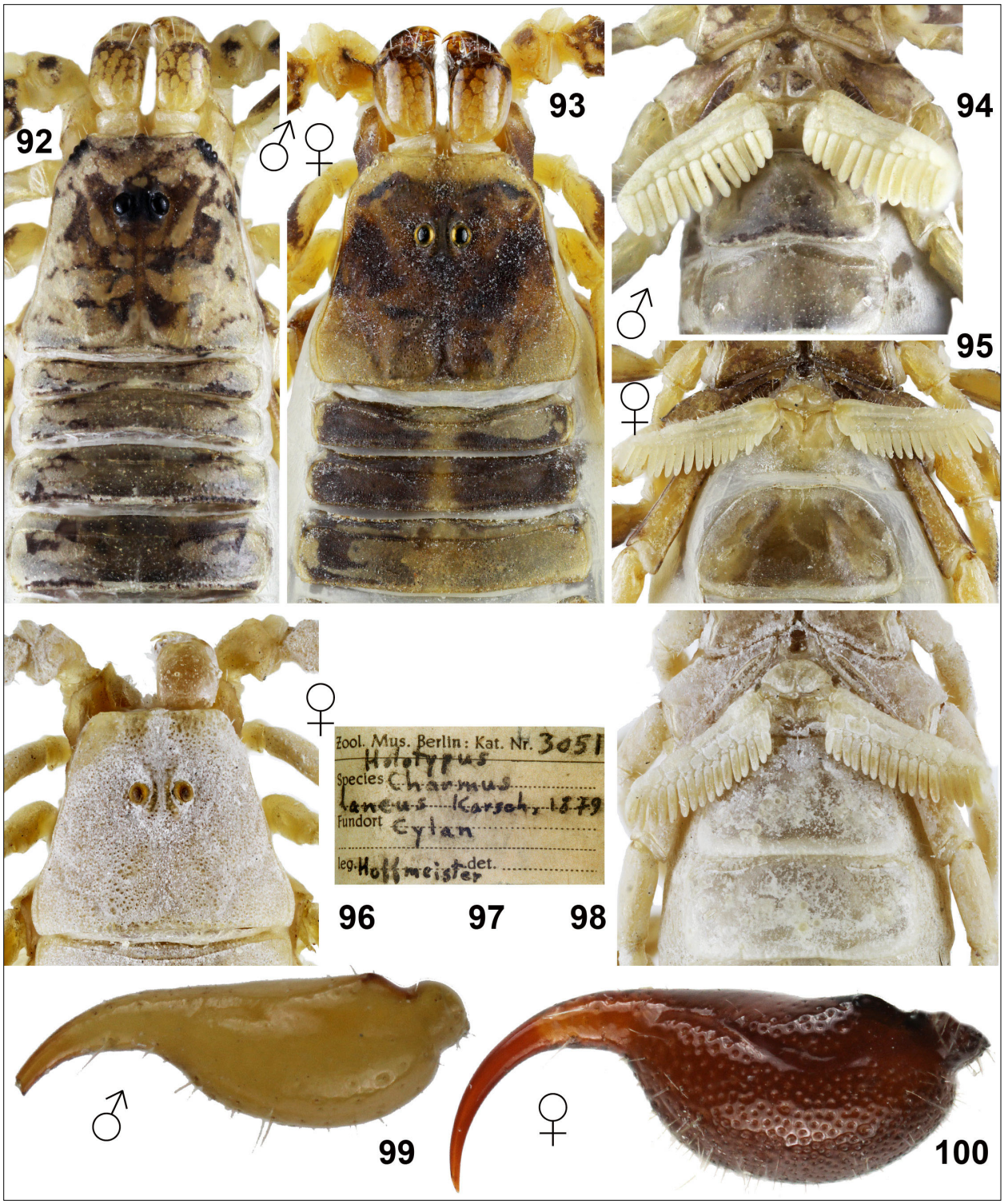
15"N 079°50'38.7"E, 38 m a.s.l. (Locality **15CO**, Fig. 592), 28.IV.2015, 1♂ (Figs. 41, 48–55, 60, 62, 74–76, 118, 194, 423, 548) 1♀ (Figs. 42, 58–59, 61, 63, 77–79, 83, 85, 119, 424) 1juv. (Figs. 56–57, 86), FKCP, 2♂ (Figs. 64–73) 1♀, UPSL, leg. Kovařík et al.

DIAGNOSIS. Total length 14 mm (male) – 21.3 mm (female). Mesosoma, carapace, metasoma and telson of adults black; pedipalp femur almost entirely black with several small yellow spots; pedipalp patella yellowish with several black spots; legs yellow with black spots; chelicerae brown, with black reticulation. Carapace granular without carinae, anterior edge with epistome present medially. Tergites I–VI granular, obviously with one carina. Sternites without carinae. Metasomal segments IV–V or III–V punctate without developed cari-

Figures 85–87: *Charmus*. **Figures 85–86**. Male (85) and female (86) of *Charmus laneus* from locality 15CO. **Figure 87**. Male paratype of *Charmus saradieli* **sp**. **n**. (UPSL).



Figures 88–91: *Charmus saradieli* **sp**. **n**. **Figures 88–89**. Male paratype (MHNG) in dorsal (88) and ventral (89) views, and original labels. **Figures 90–91**. Female holotype in dorsal (90) and ventral (91) views, and original labels. Scale bar: 5 mm.



Figures 92–100: *Charmus*. **Figures 92–95, 99–100**. *Charmus saradieli* **sp**. **n**., male paratype (MHNG), chelicerae, carapace and tergites I–IV (92), sternopectinal region and sternites III–IV (94), and telson lateral (99); female holotype, chelicerae, carapace and tergites I–III (93), sternopectinal region and sternite III (95), and telson lateral (100). **Figures 96–98**. *Charmus laneus*, female holotype, chelicera and carapace (96), original label (97), and sternopectinal region and sternites III–IV (98).

nae. Fifth metasomal segment length / width ratio 1.288–1.425 in female. Pectines with or without fulcra. Ratio of pedipalp chela length / fixed finger length in female 1.692–1.791. Movable and fixed fingers of pedipalps bearing 8 rows of granules, apical rows of 4–6 granules, and 3 terminal granules; each row of granules

Figures 101–106: *Charmus saradieli* **sp**. **n**. **Figures 101–103**. Male paratype (MHNG), metasoma and telson, lateral (101), ventral (102), and dorsal (103) views. **Figures 104–106**. Female holotype, metasoma and telson, lateral (104), ventral (105), and dorsal (106) views.

(except last) with one internal and two external accessory granules. Pectinal teeth number 16–18 in both sexes. Telson vesicle punctate, rather bulbous in male.

HEMISPERMATOPHORE (Figs. 48–53). Trunk very narrow, elongate, capsule region short (Fig. 48). Flagellum cylindriform, relatively short, robust, coiled. Median lobe broad, distally truncate, with straight dorsal carina near internal margin. Basal lobe well developed, a prominent, blunt, bilobate scoop arising dorsally near base of median lobe carina.

CHELICERA (Figs. 66–67). Manus with dark reticulated patterns on dorsal and ventral surfaces. Dorsal manus with 9 macrosetae near anterior margin. Movable finger with 2 dorsal macrosetae on anterior half. Ventrointernal aspect of manus and fixed finger with dense brush of microsetae, most if not all appearing fluorescent with intense terminal pinpoint fluorescence (i.e. putative chemoreceptive setae). Microsetae also present but sparse on ventral aspect of movable finger. Fingers with typical buthid dentition (Vachon, 1963). Fixed finger with distal and subdistal denticles, and 2 basal denticles fused into bicusp. Dorsal margin of movable finger with 5 denticles: 1 large distal and 1 large medial, 1 smaller subdistal, and 2 small partially fused basal denticles. Ventral margin of movable finger with 3 denticles: 1 large distal and 2 smaller medial denticles. Ventral surface of fixed finger armed medially and basally with 2 small denticles concealed by dense brush of microsetae (Fig. 67b).

Figures 107–119: *Charmus*. **Figures 107–114**. *Charmus saradieli* **sp**. **n**., female holotype. Pedipalp movable finger (107). Pedipalp chela, dorsal (108), external (109), and ventral (110) views. Pedipalp patella, dorsal (111) and external (112) views. Pedipalp femur and trochanter, internal (113) and dorsal (114) views. The trichobothrial pattern is indicated in Figures 108a–114a. **Figures 115–117**. *Charmus saradieli* **sp**. **n**., male paratype (MHNG), chelicerae (115), pedipalp dorsal (116), and fourth leg dorsal (117). **Figures 118–119**. *Charmus laneus* from locality 15CO. Pedipalp dorsal of male (118) and female (119).

Dimensions (mm)		*Charmus laneus* ♀ holotype	*Charmus laneus* ♀ 15CO	*Charmus saradieli* **sp. n.** ♀ holotype	*Charmus saradieli* **sp. n.** ♂ paratype
Carapace	L / W	2.125 / 2.425	2.250 / 2.900	2.625 / 2.900	1.450 / 1.575
Mesosoma	L	6.100	6.900	8.800	3.800
Tergite VII	L / W	1.250 / 2.050	1.550 / 2.600	1.600 / 3.000	0.825 / 1.375
Metasoma & telson	L	10.275	10.900	12.070	6.925
Segment I	L / W / D	1.175 / 1.475 / 1.260	1.150 / 1.625 / 1.425	1.375 / 1.700 / 1.500	0.800 / 0.900 / 0.825
Segment II	L / W / D	1.350 / 1.450 / 1.375	1.500 / 1.680 / 1.480	1.575 / 1.600 / 1.525	0.875 / 0.825 / 0.825
Segment III	L / W / D	1.600 / 1.550 / 1.425	1.625 / 1.825 / 1.600	1.600 / 1.650 / 1.610	0.925 / 0.850 / 0.825
Segment IV	L / W / D	1.750 / 1.600 / 1.425	1.875 / 1.875 / 1.675	2.100 / 1.580 / 1.630	1.250 / 0.825 / 0.775
Segment V	L / W / D	2.300 / 1.625 / 1.375	2.480 / 1.925 / 1.575	2.900 / 1.610 / 1.600	1.675 / 0.800 / 0.738
Telson	L / W / D	2.100 / 0.910 / 0.850	2.275 / 1.125 / 0.950	2.520 / 1.020 / 1.000	1.400 / 0.525 / 0.475
Pedipalp	L	7.050	7.520	9.200	5.200
Femur	L / W	1.800 / 0.530	1.900 / 0.630	2.050 / 0.700	1.275 / 0.425
Patela	L / W	2.150 / 0.750	2.325 / 0.900	2.900 / 0.980	1.625 / 0.525
Chela	L	3.000	3.300	4.250	2.300
Manus	L / W / D	1.050 / 0.600 / 0.575	1.025 / 0.725 / 0.710	1.300 / 0.800 / 0.790	0.625 / 0.475 / 0.475
Fixed finger	L	1.675	1.950	2.925	1.400
Movable finger	L	2.050	2.275	2.950	1.675
Total length		**18.50**	**20.10**	**23.50**	**12.18**

Table 1: Comparative measurements of adults of *Charmus laneus* and *C. saradieli* **sp. n.** Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

Ratios of adult females	***C. laneus*** **(n = 4)**	***C. saradieli*** **sp. n. (n = 1)**
Metasomal segment I (L/W)	0.707–0.796	0.808
Metasomal segment II (L/W)	0.892–0.931	0.984
Metasomal segment IV (L/W)	1.000–1.093	1.329
Metasomal segment IV (L/D)	1.119–1.228	1.288
Metasomal segment V (L/W)	1.288–1.425	1.801
Metasomal segment V (L/D)	1.574–1.672	1.812
Telson (L/D)	2.394–2.470	2.520
Pedipalp chela (L/W)	4.551–5.000	5.312
Pedipalp chela (L) / fixed finger (L)	1.692–1.791	1.452
Pedipalp chela (L) / movable finger (L)	1.450–1.512	1.440
Total (L)	**18.50–21.30**	**23.50**

Table 2: Comparison among Sri Lankan *Charmus* species (specimens), based upon selected morphometric ratios of adult females. Abbreviations: length (L), width (W), depth (D).

COMMENTS. Lourenço did not study any specimens of *C. laneus* in spite of the fact that he cited six characters for distinguishing *C. laneus* from *C. minor* (Lourenço, 2002: 23). Several of these 'character differences' lie within the range of intraspecific variation (e.g. fulcra of pectines), and others are not valid. Lourenço stated that the movable finger of *C. laneus* bears 7–8 rows of granules, while that of *C. minor* bears 9 rows of granules. However, his own figure (Lourenço, 2002: 18, fig. 1) shows that the male "paratype" of *C. minor* has only 8 rows of granules. Another problem is that according to the type material section (Lourenço, 2002: 19) there exist only two types of *C. minor* – the male holotype and a juvenile (second instar) female paratype. Neither a male paratype, nor an adult female paratype were listed. Thus, it is surprising that Lourenço claimed that the female of *C. minor* has a differently flattened sternum than the male (Lourenço, 2002: 23). If this was a reference to the second instar juvenile female paratype, the diagnostic character needs to specified for adult females. Under "Ecological observations" Lourenço (2002: 23) wrote that "The specimens of *C. laneus* studied by Vachon (1982) were all collected in the central-south region of Sri Lanka which is characterised by high altitudes reaching to more than 1000 m...". In fact, the three specimens studied by Vachon (1982: 81) were collected at altitudes of 250 m, 600 m, and 1350 m a.s.l. and according to Vachon's opinion they all belong

to the same species, '*C. laneus*'. Neither Vachon (1982) nor Lourenço (2002) studied the holotype of *C. laneus*, and as we show here, these three *Charmus* specimens from central Sri Lanka actually belong to a different species. These three specimens are herein designated as types of *C. saradieli* **sp**. **n**., and *C. minor* Lourenço, 2002 is synonymized with *C. laneus* Karsch, 1879 as there are no significant differences between them at the species level.

DISTRIBUTION. Sri Lanka.

Charmus saradieli Kovařík, Lowe, Ranawana, Hoferek et Jayarathne, **sp**. **n**.
(Figs. 12, 44, 84, 87–95, 99–117, 425–426, Tables 1–2)
http://www.zoobank.org/urn:lsid:zoobank.org:act:CCA71154-E551-49C4-B328-E84B86656252

Charmus laneus (misidentification): Vachon, 1982: 79–83, figs. 1–11, 82–83; Lourenço, 2000: 297, figs. 2–3; Lourenço, 2002: 24; Fet & Lowe, 2000: 123 (in part in references).

TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka, Hasalaka; MHNG.

TYPE MATERIAL EXAMINED. Sri Lanka, Hasalaka (Loc. No. 9), 250 m a.s.l., 18.I.1970, 1♀ (holotype, Figs. 44, 80–82, 90–91, 93, 95, 100, 104–114, 426), MHNG, leg. Y. Löbl et C. Besuchet; Haputale (Loc. No. 19), 1350 m a.s.l., 23.I.1970, 1♂ (paratype, Figs. 88–89, 92, 94, 99, 101–103, 115–117, 425), MHNG, leg. Y. Löbl, Kandy (Loc. No. 18), 600 m a.s.l., 22.I.1970, 1juv. (paratype), MHNG, leg. Y. Löbl et C. Besuchet; Eastern Province, Padiyatalawa (ca 7°25'N 81°15'E), IV.1994, 1♂ (paratype), FKCP, leg. P. Senft; Central Province, Kandy District, Gannoruwa village, 07°17'10" 080°35'35", 10. IX.2015, 1♂ (paratype, Fig. 87), UPSL, leg. S. Jayarathne.

ETYMOLOGY. Named after the popular Sri Lankan folk hero Deekirikevage Saradiel whose activities between Colombo and Kandy in the 1850s–1860s were comparable to the world famous legend of Robin Hood. His forest sanctuary was on the summit of Mt. Utuwankanda.

DIAGNOSIS. Total length 12.18 mm (male) – 23.5 mm (female). Sexual dimorphism manifested mainly in total length. Mesosoma and carapace yellow with black ornamentation, to almost entirely black; pedipalp femur and patella almost entirely black with several small yellow spots; telson yellow to reddish black; legs yellow with black spots; chelicerae yellow, with black reticulation. Carapace granular without carinae, anterior edge with epistome present medially. Tergites I–VI granular, with one clearly visible carina. Sternites without carinae. Metasomal segments IV–V punctate without developed carinae. Fifth metasomal segment length/ width ratio 1.8 in female. Pectines with or without fulcra. Movable and fixed finger of pedipalps long, ratio of pedipalp chela length/ fixed finger length in female 1.452. Movable and fixed fingers of pedipalps bear 8 rows of granules, apical rows of 4–6 granules, and 3 terminal granules; each row of granules (except most proximal) with one internal and two external accessory granules. Pectinal teeth number 12–17 in males, 16 in female. Telson vesicle punctate, rather elongate in male.

DESCRIPTION. The adult male paratypes are 12.18–18.42 mm long, the adult female holotype is 23.5 mm long. For habitus see Figs. 88–91. For position and distribution of trichobothria of pedipalps see Figs. 108–114. For measurements and ratios see Tables 1–2. Sexual dimorphism is manifested mainly in total length. Other sexual differences are noted below.

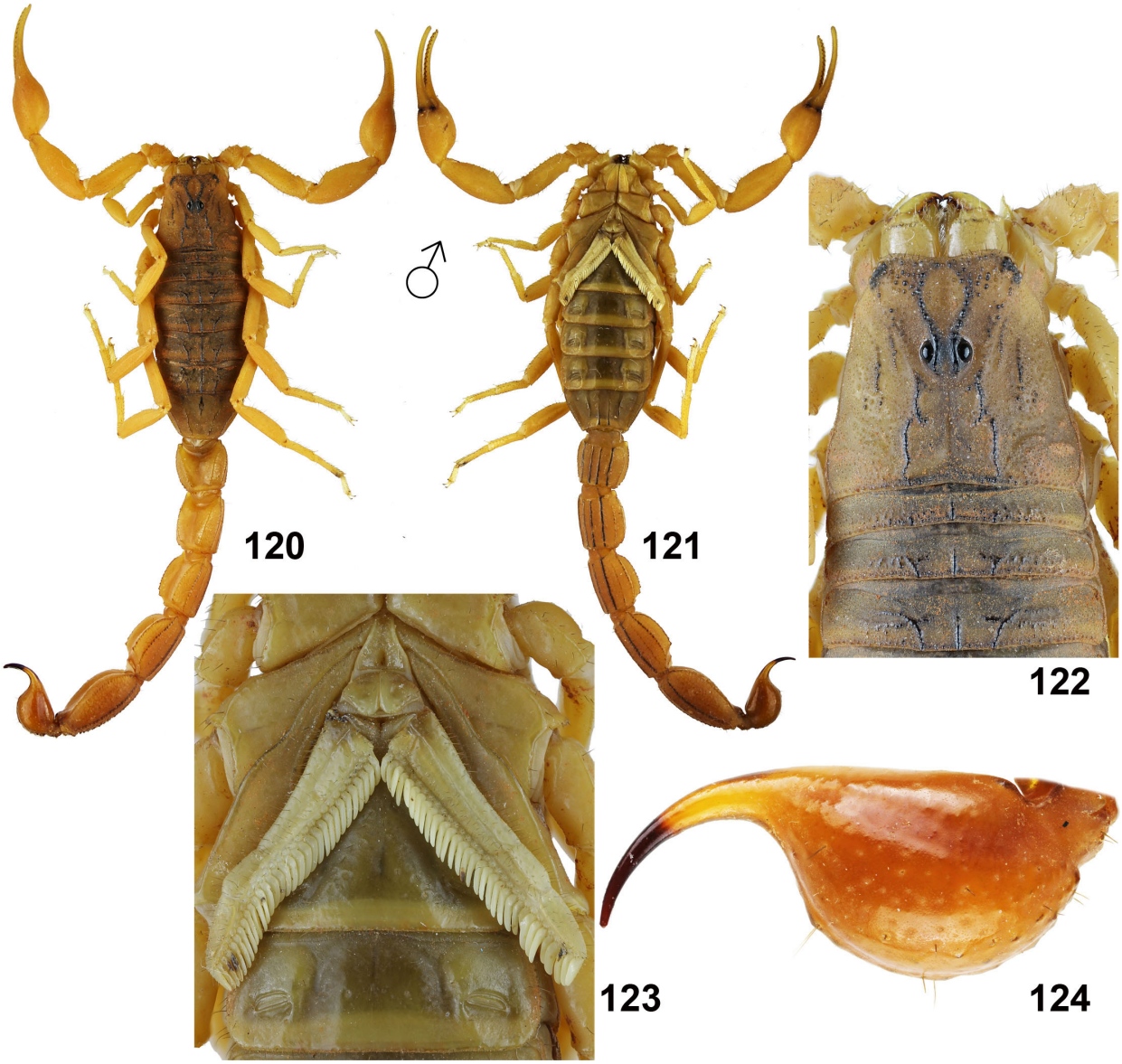
Coloration (Figs. 87–91). Mesosoma and the carapace yellow with black ornamentation, to almost entirely black, metasoma yellow to reddish black with black ornamentation, and pedipalp femur and patella mainly black with yellow spots, pedipalp chela yellow with black spots on manus, pedipalp fingers yellow without spots. Telson yellow to reddish black. Legs yellow with black spots. Chelicerae yellow, with black reticulation.

Carapace (Figs. 92–93). Granular without carinae, anterior edge straight with epistome present medially. Granulation stronger in female. Median furrow present, more distinct in male. Three well developed and two reduced or absent lateral eyes.

Mesosoma (Figs. 92–95). Tergites with one carina, densely granulate in the female. In the males granules are larger and sparse. Pectinal tooth count 16 in female, 12–17 in males. Marginal tips of pectines extending to 3/4 quarters of sternite III in female, to end of sternite III in the males. Pectines with 3 marginal lamellae and 7 middle lamellae, fulcra either present (female) or absent (male). Sternites III–VII smooth, without carinae. Stigmata short, ovoid.

Metasoma and telson (Figs. 101–106, 425–426). Metasoma relatively narrow, segment V length/ width ratio 1.8 in female. Segments I–III strongly granulated, more so in female, with 8–10 granulated carinae. Segments IV–V may have two smooth, poorly developed dorsal carinae; segments IV–V and telson punctate except for dorsal surface. Telson rather elongate, especially in smaller males. Entire metasoma and the telson densely hirsute. Vesicle of telson somewhat elongate with long, strongly curved aculeus.

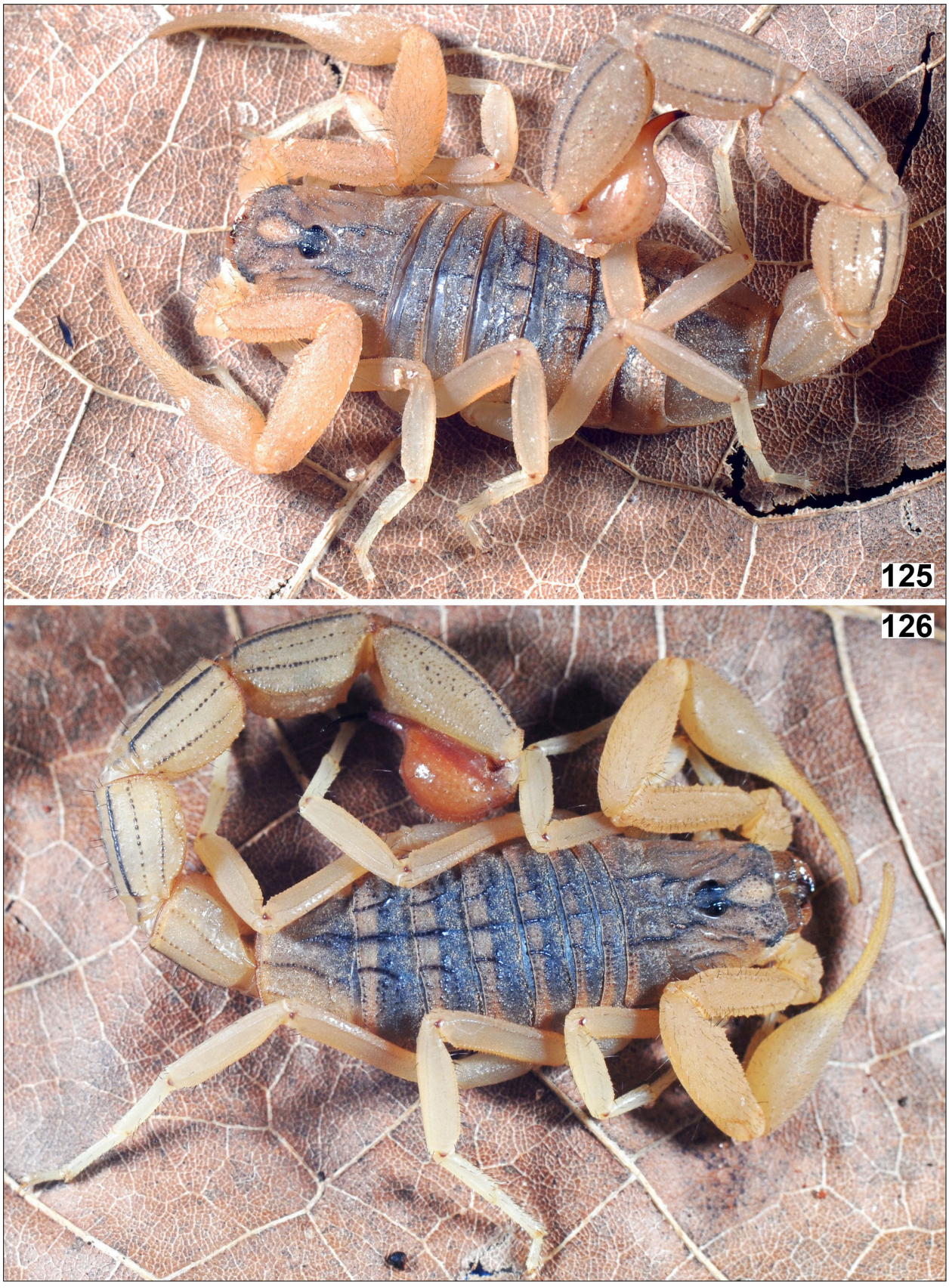
Legs (Figs. 117). Long tibial spur present on the third and fourth legs. Tarsus hirsute, more densely so on ventral surface. Tarsomeres bearing numerous setae on ventral surface, fewer on other surfaces; bristle combs absent.



Figures 120–124: *Hottentotta tamulus*, male from locality 15CK, dorsal (120) and ventral (121) views, chelicerae, carapace and tergites I–III (122), sternopectinal region and sternites III–IV (123), and telson lateral (124).

Pedipalps (Figs. 107–114, 116). Femur with 4 granulated carinae, surface finely granulated. patella smooth without developed carinae, only internal surface with several larger granules. Chela smooth, lacking carinae. Pedipalps hirsute on all segments. Movable and fixed fingers of pedipalp bear 8 rows of granules, each row (except most proximal) with one internal and two external accessory granules; fingers also with apical rows of 4–6 granules and 3 terminal granules.

AFFINITIES. *Charmus saradieli* **sp**. **n**. and *C. laneus* Karsch, 1879 are the only two members the genus known from Sri Lanka. Apart from their disjunct distributions (Fig. 12), these two species can be separated from each other by: **1**) the color of the patella of pedipalps, which is yellowish with several black spots in *C. laneus* (Figs. 118–119) and black with several little yellow spots in *C. saradieli* **sp**. **n**. (Figs. 111 and 116); **2**) the shape of the metasoma, as the metasomal segment V length/ width ratio is 1.288–1.425 in female of *C. laneus* (Figs. 80–83, Tables 1–2) and 1.800 in female of *C. saradieli* **sp**. **n**. (Fig. 84, Tables 1–2); and **3**) the shape of pedipalp chela, as the chela length/ fixed finger length ratio is 1.692–1.791 in female of *C. laneus* (Figs. 42–43, Tables 1–2) and 1.452 in female of *C. saradieli* **sp**. **n**. (Fig. 44, Tables 1–2).



Figures 125–126: *Hottentotta tamulus* from locality 15CK, female (125) and male (126).

Genus ***Hottentotta*** Birula, 1908
(Figs. 12, 45–46, 195, 427)

Buthus (*Hottentotta*) Birula, 1908: 141.
Hottentotta: Fet & Lowe, 2000: 133–145 (complete reference list until 1998); Kovařík & Ojanguren Affilastro, 2013: 159–180, figs. 942–1250 (reference list until 2013).
Mesobuthus (in part): Fet & Lowe, 2000: 169–180.

TYPE SPECIES. *Scorpio hottentotta* Fabricius, 1787.

DIAGNOSIS. Medium to large buthids, adults 30–130 mm. Sternum type 1, triangular in shape. Pedipalps orthobothriotaxic, type Aβ, femur trichobothrium d_2 dorsal, patella d_3 dorsal of dorsomedian carina. Chelal trichobothrium *db* usually located between *est* and *et*, but may be level with trichobothrium *est*, and rarely between *est* and *esb*. Trichobothrium *eb* clearly positioned on fixed finger of pedipalp. Pectines with fulcra. Dentate margin of pedipalp chela movable finger with distinct granules divided into 11–16 linear rows and (4) 5–7 terminal granules. Chelicerae with typical buthid dentition, fixed finger armed with two denticles on ventral surface. Tergites I–VI granular, with three carinae, tergite VII with 5 carinae. Carapace with distinct carinae, entire dorsal surface nearly planar. First sternite with two granulated lateral stridulatory areas, which may be reduced in some species. Metasoma elongate, segment I with 10 carinae, segments II-IV with 8–10 carinae. Ventrolateral carinae of fifth metasomal segment with all granules more or less equal in size, never lobate. Telson bulbous, lumpy and granulated, without subaculear tooth. Legs III and IV with well developed tibial spurs, first and second tarsomeres with paired ventral setae.

DISTRIBUTION. *Hottentotta* is one of the most widely distributed genera of the family Buthidae, with species present throughout Africa, the Arabian Peninsula, and in Asia to Pakistan and India.

Hottentotta tamulus (Fabricius, 1798)
(Figs. 12, 45–46, 120–126, 195, 427)

Scorpio tamulus Fabricius, 1798: 294.
Mesobuthus tamulus: Fet & Lowe, 2000: 179–180 (complete reference list until 1998).
Hottentotta tamulus: Kovařík & Ojanguren Affilastro, 2013: 176, figs. 1005–1008, 1173 (reference list until 2013); Ranawana et al., 2013: 3–7, figs.1–12; Veronika & al., 2013: 73–75, figs. 1, 9–14, tab. 1.
Hottentotta tumulus [sic]: Veronika & al., 2013: 70–71, fig. 1, 9–14, tab. 1.

TYPE LOCALITY AND TYPE REPOSITORY. "India orientalis"; original type lost. Neotype from India, Maharashtra State, Bombay env., designated by Kovařík, 2007: 76; NMPC.

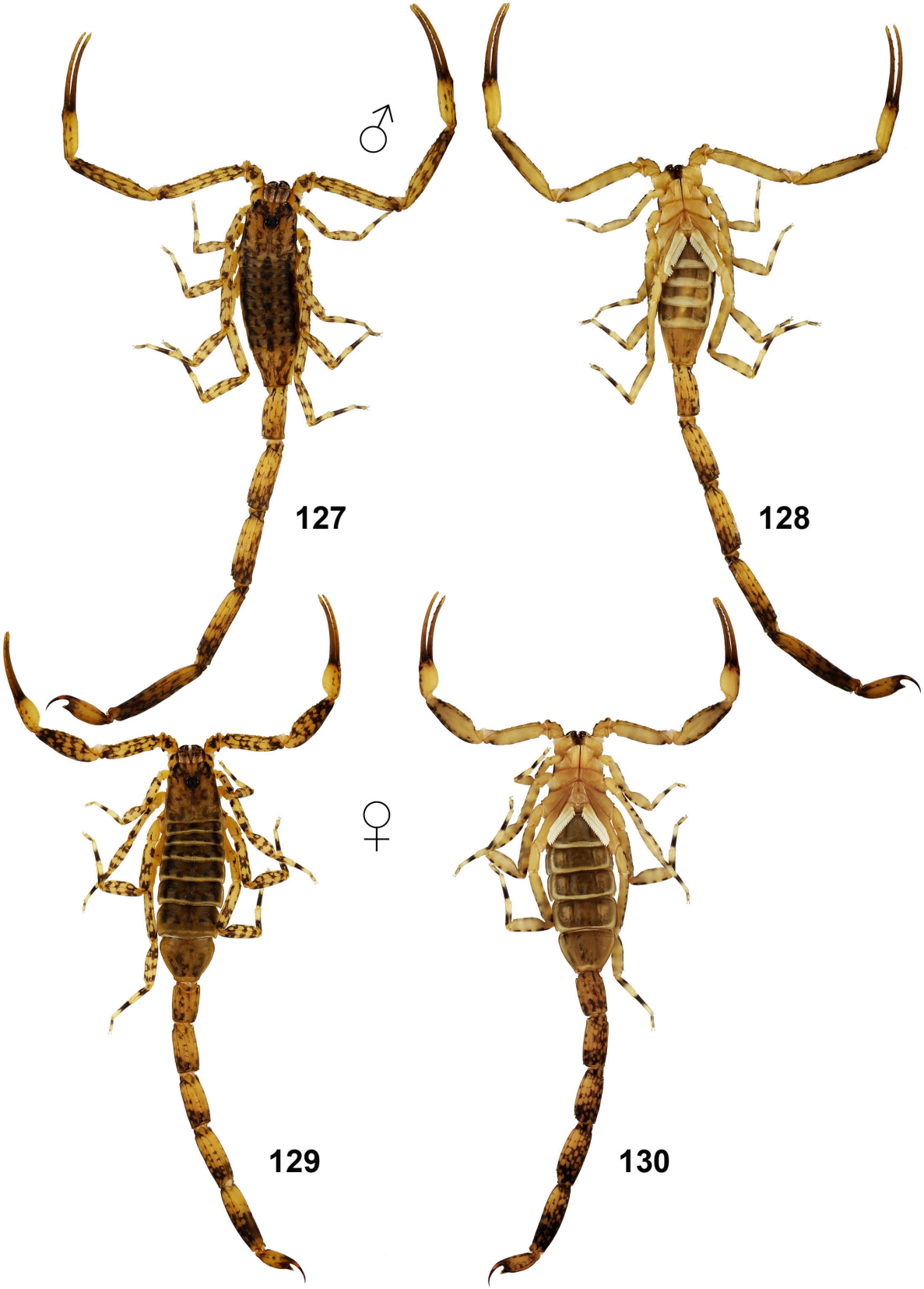
SRI LANKAN MATERIAL EXAMINED. Sri Lanka, Northern Province, Jaffna District, Palali, 09°44'16.83"N 080° 05'2.88"E, 2012, 1♂, FKCP, col. K. B. Ranawana; Northern Province, Jaffna District, 09°49'15.4"N 080° 08'41.6"E, 19 m a.s.l. (Locality **15CK**, Fig. 588), 27. IV.2015, 1♂ (45–46, 120–124, 126, 195, 427) 1♀im.1juv., FKCP, 1♀ (Fig. 125) 1juv., UPSL, leg. Kovařík et al.

DIAGNOSIS. Total length 50–90 mm. Trichobothrium *db* on fixed figer of pedipalp chela situated between trichobothria *et* and *est*, but may be level with *est*. Males with proximal margins of pedipalp fingers flexed, manus of pedipalps wider than female. Pectinal teeth number 30–39 in males, 27–34 in females. Chelicerae yellow, reticulated. Pedipalps densely hirsute, legs and metasoma sparsely hirsute. Setae on patella of pedipalps short. Color uniformly yellow to reddish, mesosoma dark. Ventral carinae on metasomal segments usually black. Pedipalp femur with 5 carinae, patella with two or 4 carinae on internal surface, no other carinae. Chela lacking carinae. Movable fingers of pedipalps with 13–15 rows of granules and 5 or 6 terminal granules. Seventh sternite with 4 well marked black carinae. First to third metasomal segments with 10 carinae; fourth with 10 or rarely 8 carinae; fifth with 5 or 7 carinae. Metasoma sparsely to densely granulated between carinae. Dorsal surface densely and very finely granulated, often bearing two short, inconspicuous marginal carinae. Telson granulated. Dorsal carinae of metasomal segments with posterior terminal granules of size approximately equal to preceding granules. First metasomal segments of adult female wider than long (in male usually as long as wide), second metasomal segment longer than wide in both sexes. Second to fourth metasomal segments width ratio about 1.1. Length to width ratio of fourth metasomal segment about 1.5. Telson bulbous, especially in large females.

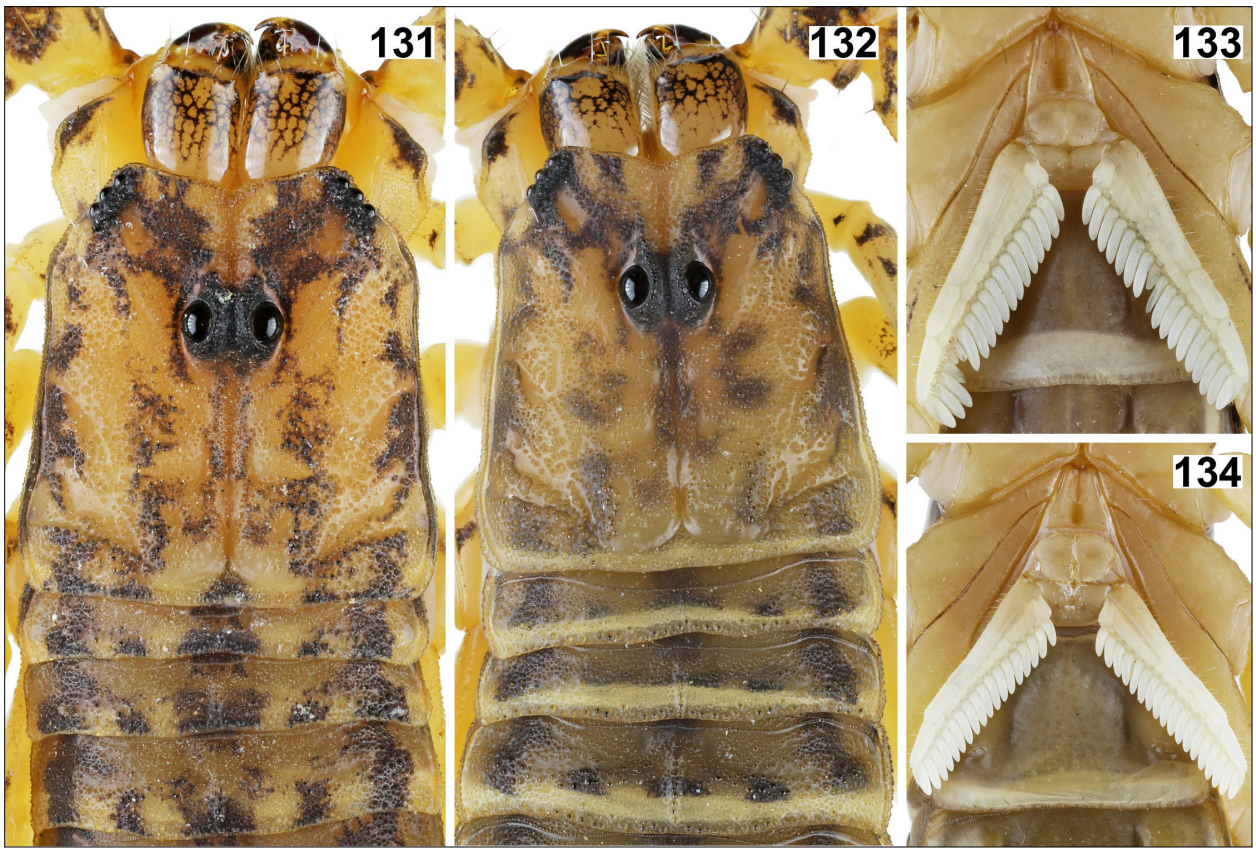
DISTRIBUTION. India (Andhra Pradesh, Bihar, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Pondicherry, Rajasthan, Tamil Nadu and West Bengal States), Pakistan, Sri Lanka.

Isometrus Ehrenberg, 1828
(Figs. 13, 127–151, 196–197, 221–224, 237–244, 252–253, 403–406, 549–555, 557–560)

Buthus (*Isometrus*) Ehrenberg in Hemprich & Ehrenberg, 1828: pl. 1, fig. 3; Hemprich & Ehrenberg, 1829: 351.



Figures 127–130: *Isometrus maculatus*. **Figures 127–128**. Male from locality 15CP in dorsal (127) and ventral (128) views. **Figures 129–130**. Female from locality 15CI in dorsal (129) and ventral (130) views.



Figures 131–134: *Isometrus maculatus*. **Figures 131, 133**. Male from locality 15CP, chelicerae, carapace and tergites I–III (131) and sternopectinal region and sternite III (133). **Figures 132, 134**. Female from locality 15CI, chelicerae, carapace and tergites I–III (132) and sternopectinal region and sternite III (134).

Isometrus (*Isometrus*): Vachon, 1972: 169–180, figs. 1–13, 15, 17, 19; Vachon, 1982: 86–90, 100–101, 108, figs. 28–39, 64–65; Fet & Lowe, 2000: 146–150 (complete reference list until 1998); Kovařík, 2003: 2; Kovařík & Ojanguren, 2013: 182–184, 347, 353, 355–357, figs. 1251–1264, 1354–1357, 1368–1375, 1376–1385.

Isometrus (*Raddyanus* [sic]): Tikader & Bastawade, 1983: 254–311 (in part), figs. 771–840.

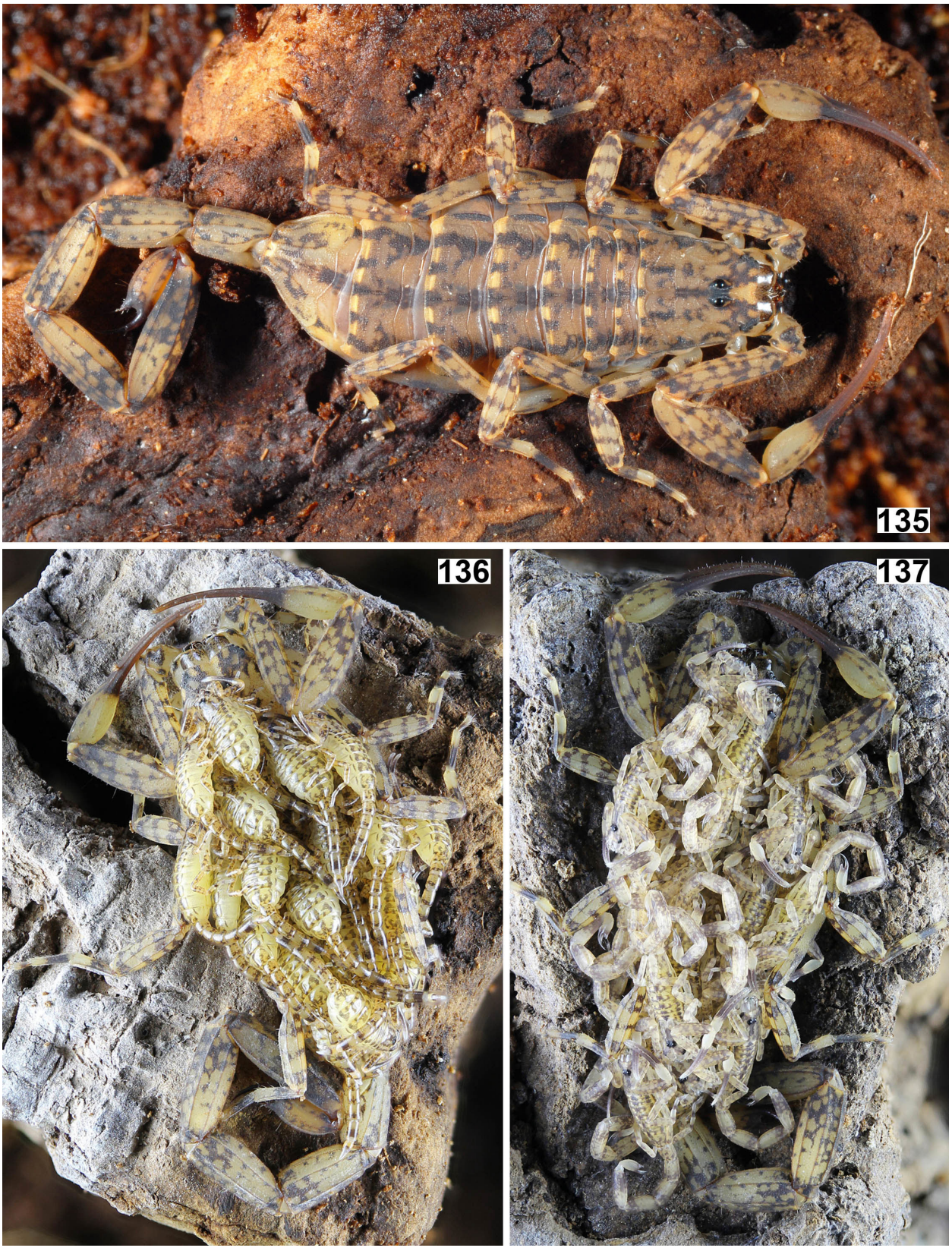
= *Isometrus* (*Closotrichus*) Tikader & Bastawade, 1983: 311–316, figs. 896–910 (syn. by Kovařík, 1994: 201).

TYPE SPECIES. *Scorpio maculatus* De Geer, 1778.

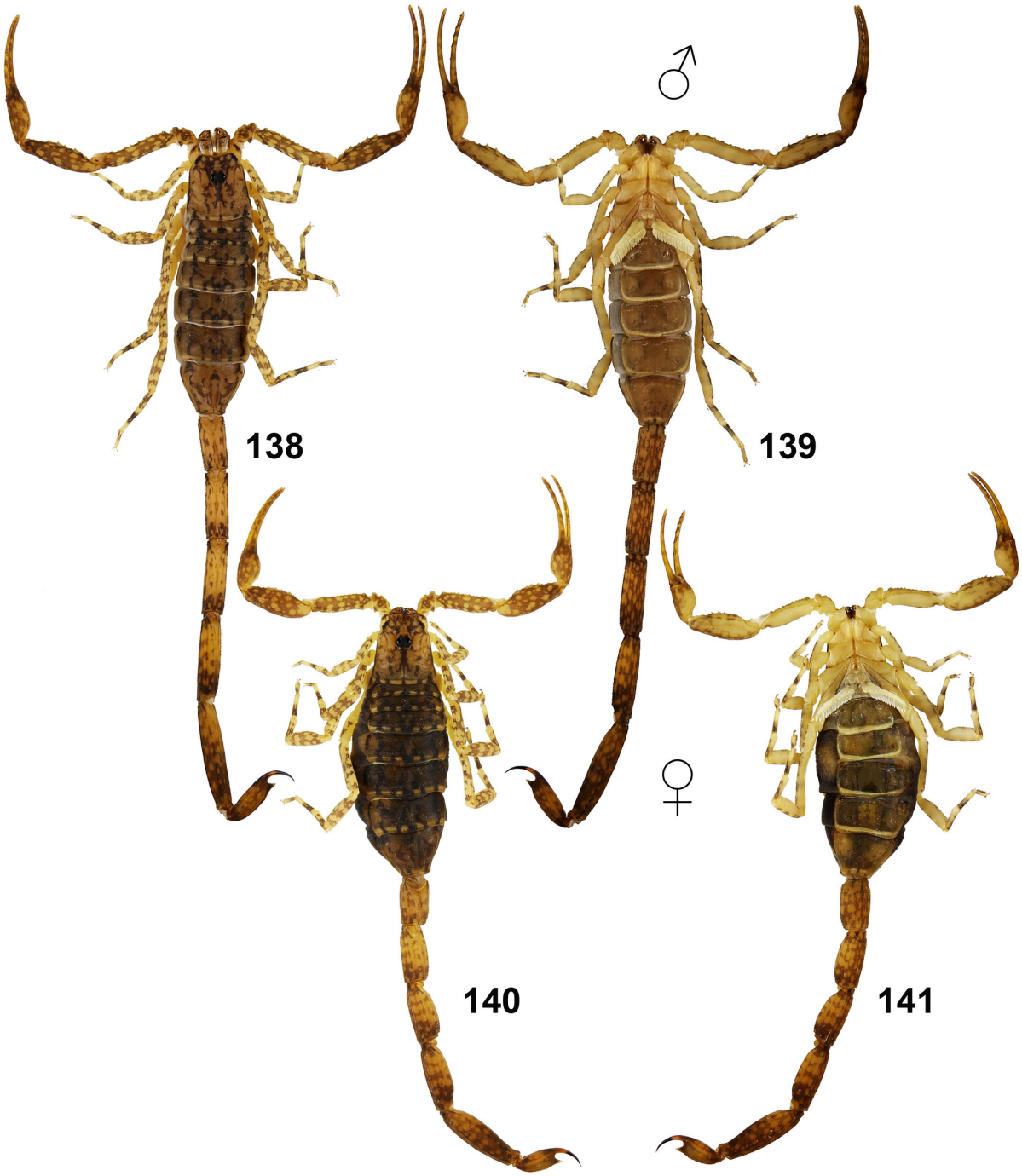
DIAGNOSIS. Medium sized buthids, adults 30–75 mm. Sternum type 1, triangular in shape. Pedipalps orthobothriotaxic, type Aβ. Chelal trichobothrium *db* located between *dt* and *et*. Three to five pairs of lateral eyes. Tibial spurs absent on all legs. Movable and fixed fingers of pedipalps with six rows of granules, several accessory granules and external and internal granules. Cheliceral fixed finger with a single ventral denticle. Third and fourth legs with tibial spurs. Tibia and tarsomeres of legs I–III with setae not arranged into bristle combs on dorsal surfaces. Tarsomeres II of leg IV with two rows of more than 30 dense setae. Mesosoma dorsally with one median carina. Telson with subaculear tooth pointed (except for *Isometrus formosus* Pocock, 1894). Pedipalp and metasomal segments longer in males than females.

COMMENTS. The taxonomic position of *Isometrus formosus* Pocock, 1894 from Indonesia is unclear. This species is probably not a member of the genus *Isometrus*, but comprises a separate genus. Two species of *Isometrus*, *I. maculatus* (De Geer, 1778) and *I. thwaitesi* Pocock, 1897 are known from Sri Lanka. Pocock, 1900: 48, in remarks on the Indian species *I. thurstoni* Pocock, 1893, wrote: "There are also two specimens in the British Museum labelled Ceylon". However, as no other specimen of *I. thurstoni* has ever been recorded from Sri Lanka, we believe that *I. thurstoni* probably does not occur there.

DISTRIBUTION. Oriental region from India to Melanesia (see comments for *I. maculatus*).



Figures 135–137: *Isometrus maculatus*, female from locality 15CH (135) with newborns before first ecdysis (136), and with juveniles after first ecdysis (137).

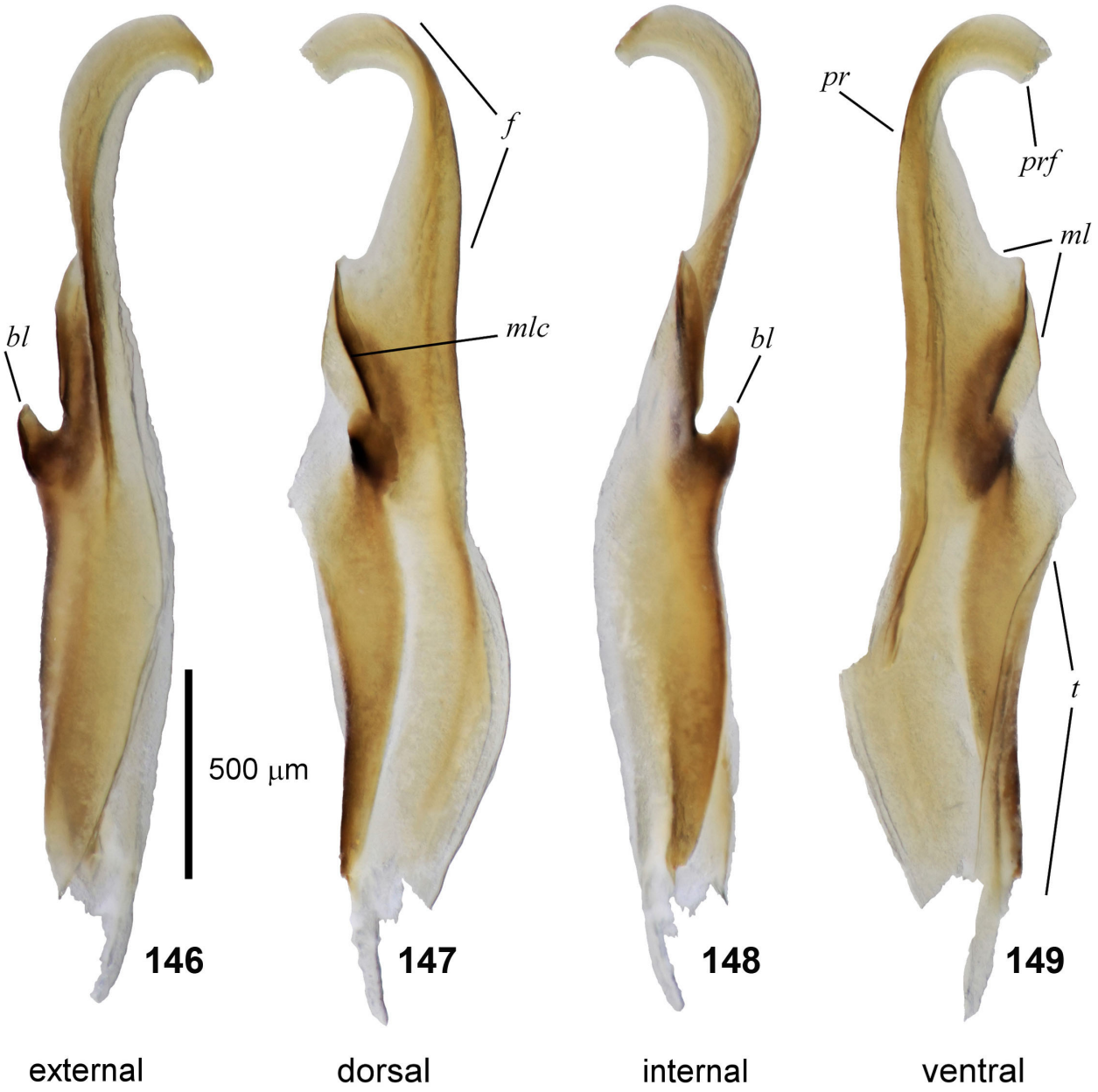


Figures 138–141: *Isometrus thwaitesi*. **Figures 138–139**. Male from locality 15CH in dorsal (138) and ventral (139) views. **Figures 140–141**. Female from locality 15CO in dorsal (140) and ventral (141) views.

Isometrus maculatus (De Geer, 1778)
(Figs. 13, 127–137, 196, 221–222, 237–238, 242, 252, 403–404, 555, 557, 559)

Scorpio maculatus De Geer, 1778: 346.
Isometrus maculatus: Kraepelin, 1899: 66.
Isometrus (*Isometrus*) *maculatus*: Vachon, 1972: 169–180, figs. 1–13, 15, 17, 19; Fet & Lowe, 2000: 147; Lourenço & Huber, 2002: 266; Teruel & Kovařík, 2012: 88–91, figs. 4, 27, 36–37, 46, 194–207, 566–569; Kovařík & Ojanguren, 2013: 182–184, 347, 355–356, figs. 1251–1255, 1264, 1368–1375, 1376–

Figures 142–145: *Isometrus thwaitesi*. **Figures 142, 144**. Male from locality 15CH, chelicerae, carapace and tergites I–III (142) and sternopectinal region and sternite III (144). **Figures 143, 145**. Female from locality 15CO, chelicerae, carapace and tergites I–III (143) and sternopectinal region and sternite III (145).



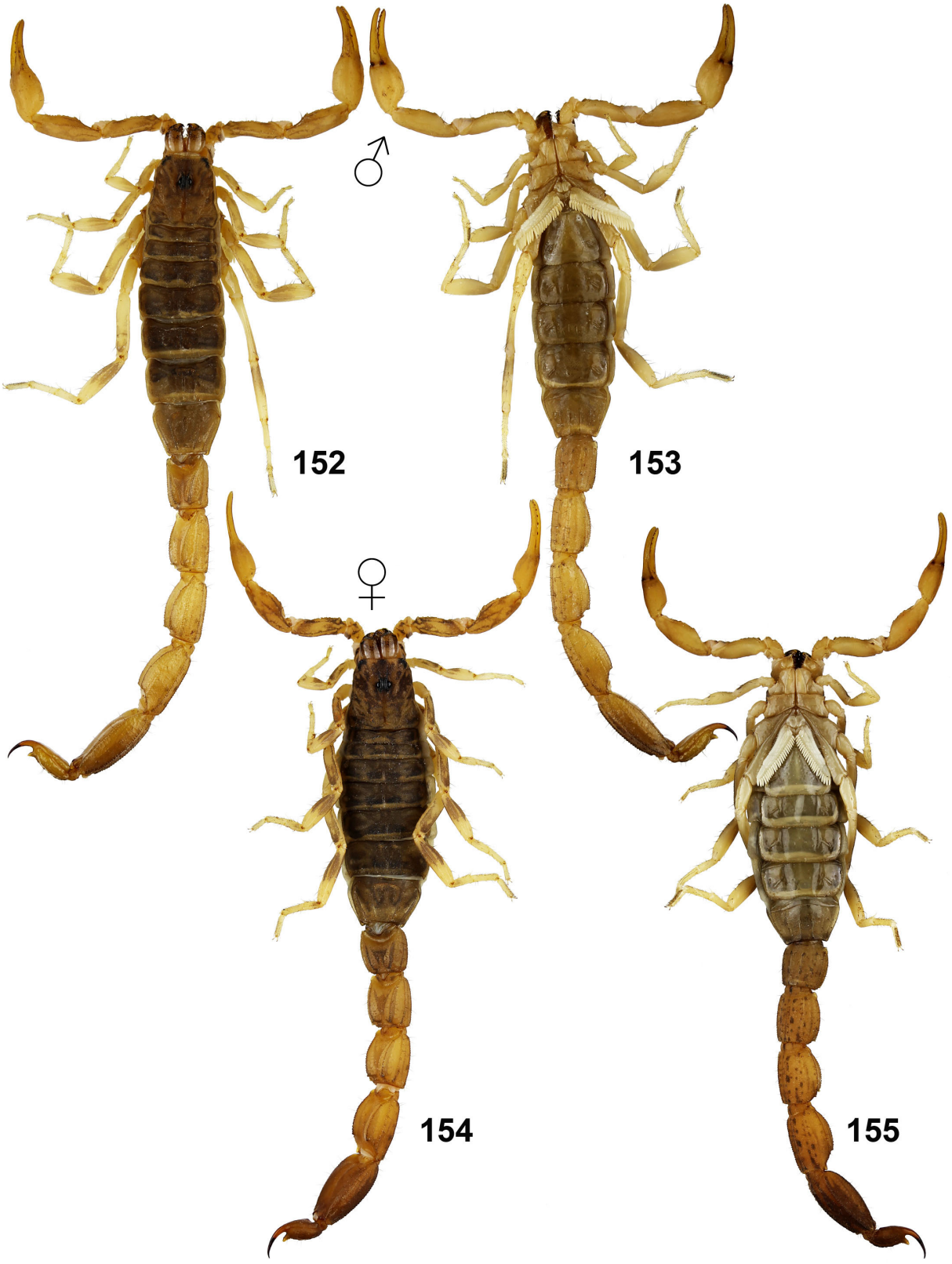
Figures 146–149: Left hemispermatophore of *Isometrus thwaitesi* from locality 15CH. External (146), dorsal (147), internal (148) and ventral (149) views. Note: distal part of flagellum and basal part of trunk (foot) were damaged during dissection. Scale bar: 500 μm. Abbreviations: *bl*, basal lobe; *f*, flagellum; *ml*, median lobe; *mlc*, median lobe carina; *pr*, pars recta of flagellum; *prf,* pars reflecta of flagellum; *t*, trunk.

1383 (reference and synonymes list until 2013); Veronika & al., 2013: 75, figs. 1, 15–20, tab. 1.

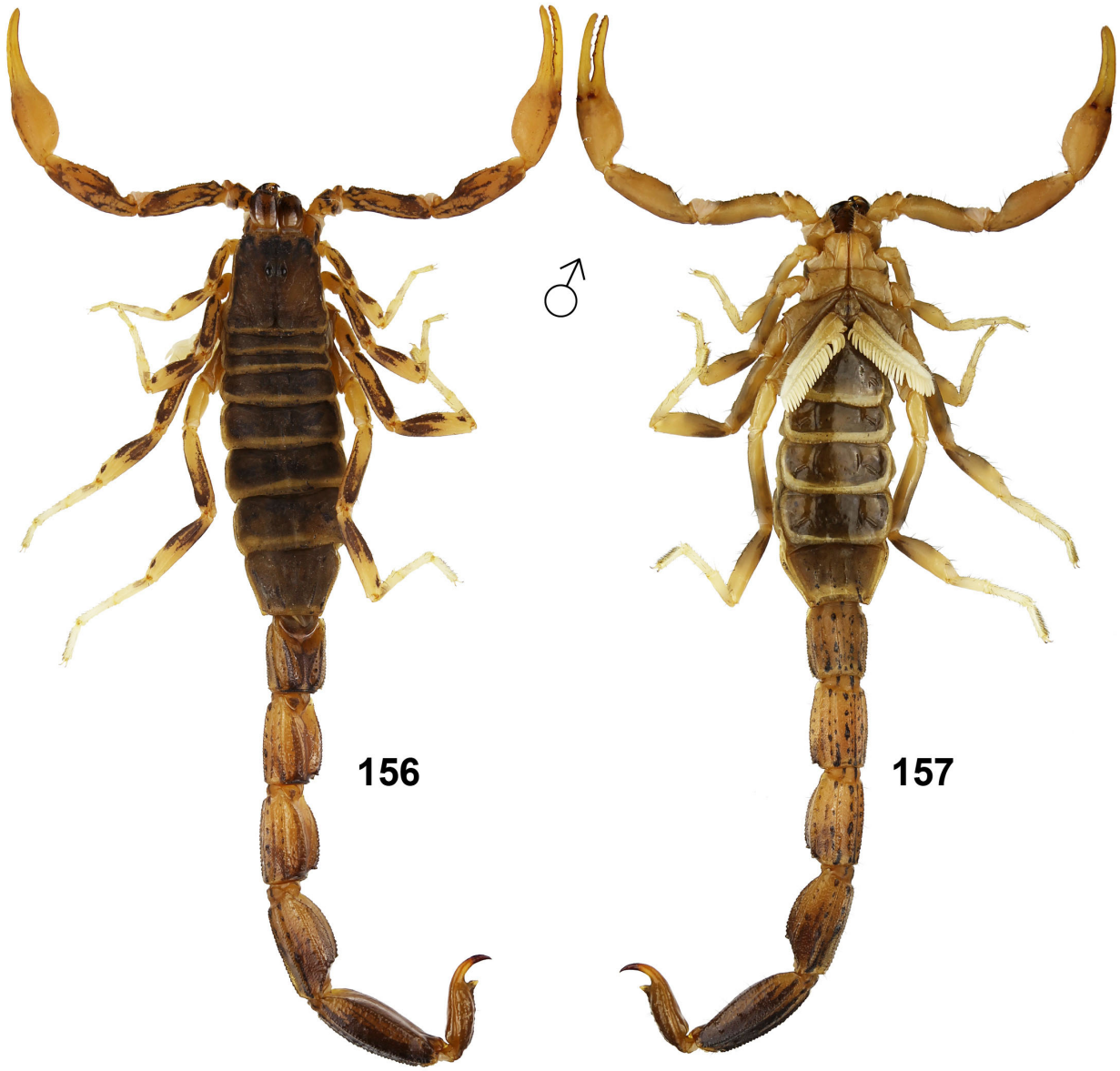
TYPE LOCALITY AND TYPE REPOSITORY. "Suriname and Pennsylvania"; NHRS.

SRI LANKAN MATERIAL EXAMINED. Sri Lanka, Northern Province, Mannar District, Madhu Road, 08°48'26.3"N 080°10'26"E, 90 m a.s.l. (Locality **15CH**, Fig. 584), 24. –25.IV.2015, 1♂1♀, FKCP, 1♀2juvs., UPSL, leg. Kovařík et al.; Northern Province, Mannar District, Marichchukkaddi env, border of Wilpattu National Park, 08°33'32.3"N 079°56'51"E, 7 m a.s.l. (Locality **15CI**, Fig. 585), 25. –26.IV.2015, 1♂1♀ (Figs. 129–130, 132, 134, 196, 222, 238, 404) 1 juv., FKCP, leg. Kovařík et al.; Southern Province, Matara District, Kekanadura village, 05°58'28.2"N 080°36'20.5"E, 40 m a.s.l. (Locality **15CP**, Figs. 593–594), 30.IV.2015, 1♂ (Figs. 127–128, 131, 133, 221, 237, 242, 252, 403, 555, 557, 559), FKCP, leg. Kovařík et al.; Eastern Province, Am-

Figures 150–151: *Isometrus thwaitesi* from locality 15CF, male (150) and female (151).



Figures 152–155: *Lychas srilankensis* from locality 15CJ. **Figures 152–153**. Male in dorsal (152) and ventral (153) views. **Figures 154–155**. Female in dorsal (154) and ventral (155) views.

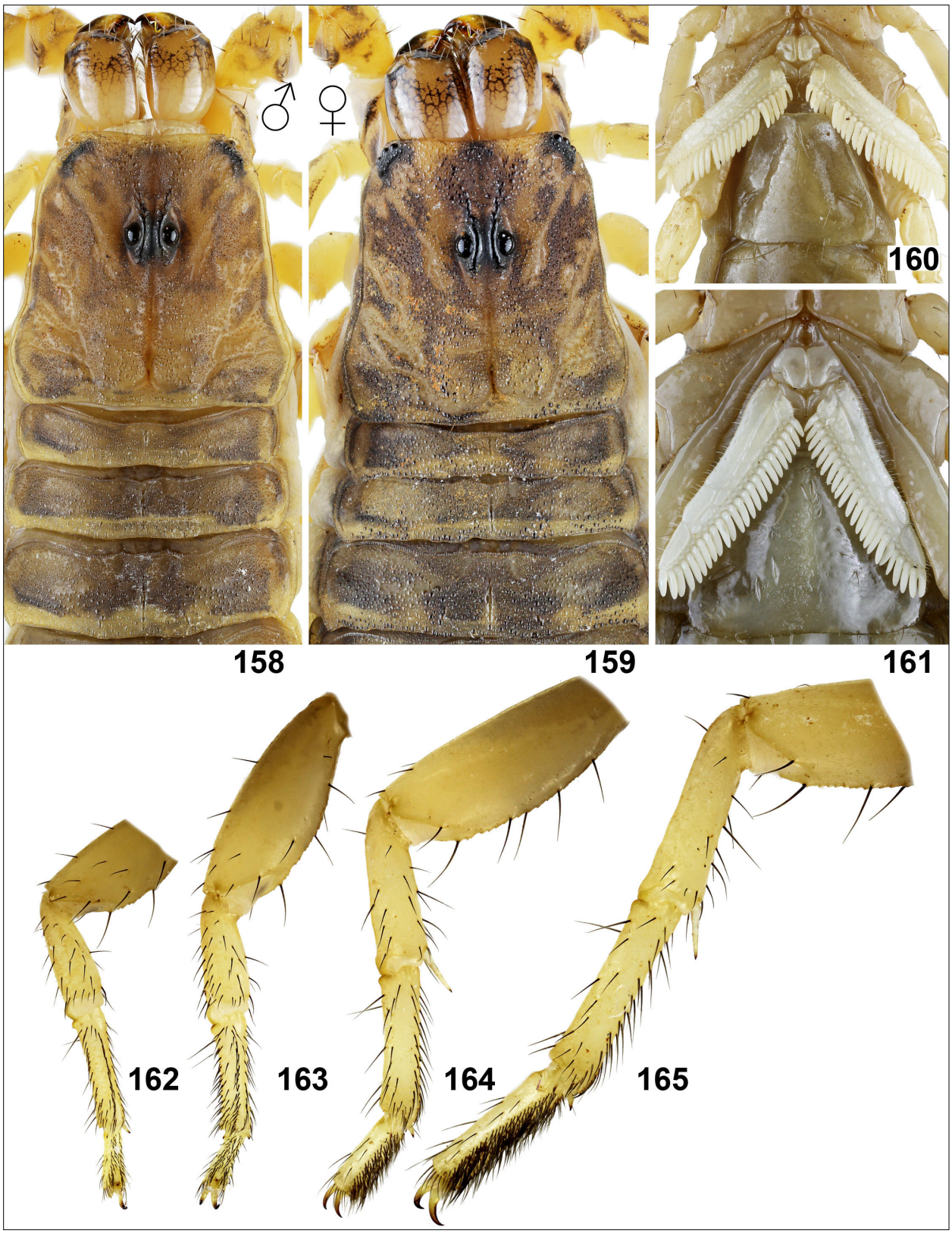


Figures 156–157: *Lychas srilankensis*, male from locality 15CO in dorsal (156) and ventral (157) views.

para District, Lahugala-Kitulana National Park, 06°52' 46"N 081°43'21.8"E, 40 m a.s.l. (Locality **15CR**, Fig. 596), 3.–4.V.2015, photos only, leg. Kovařík et al.

DIAGNOSIS. Total length 30–75 mm. Females usually reach ca. 45 mm. Manus of pedipalp very thin, in males its width equals that of patella and femur. Pedipalps and legs yellow, with spots. Manus of pedipalps yellow with several spots, fingers dark. Mesosomal segments light-colored. First (basal) middle lamella of female pecten quadrangular. Posterior margin of sternite V straight (females) to very slightly convex medially (males). Subaculear tooth spinoid. Pectinal teeth number 15–20 (17–20 in the examined Sri Lanka specimens).

COMMENTS ON DISTRIBUTION. *I. maculatus* has been regarded as cosmopolitan (see Fet & Lowe, 2000: 149) and records of this species are so numerous that a complete listing would be unreasonably long. A list of specimens which the first author examined until 2003 is published in Kovařík (2003: 3). Additonal records are given in Kovařík & Ojanguren (2013: 182–184). Records peaked in the earlier era of wooden sailing ships and harbors full of wooden barracks, both ideal niches for these scorpions. For that reason between 1758 and ca. 1940 this species was reported from many countries and large harbors including Hamburg in Europe. With the transition to modern building materials and modes of travel, reports of this species have greatly diminished,



Figures 158–165: *Lychas srilankensis* from locality 15CJ. **Figures 158, 160, 162–165**. Male, chelicerae, carapace and tergites I–III (158), sternopectinal region and sternite III (160), and distal segments of legs I–IV (162–165), retroventral view. **Figures 159, 161**. Female, chelicerae, carapace and tergites I–III (159) and sternopectinal region and sternite III (161).

Figures 166–171: *Lychas srilankensis* from locality 15CJ. **Figures 166–168**. Male, metasoma and telson, lateral (166), ventral (167), and dorsal (168) views. **Figures 169–171**. Female, metasoma and telson, lateral (169), ventral (170), and dorsal (171) views.

and in many places have ceased altogether. Apparently, relatively few of the old invasive populations were able to persist without being resupplied by a constant influx of new individuals via human transport. The distribution of *I. maculatus* in southeast Asia is not well documented, but it is possibly indigenous to India and/ or Sri Lanka because of the presence there of its most closely related species: *I. thurstoni* and *I. thwaitesi*. Lourenço & Huber (2002: 266) suggested that Sri Lanka was the original home of this species before cosmotropical dispersal by human activity, because Sri Lanka "is the only region in the world where *I. maculatus* is found in really wild conditions inland." This was pure speculation, unsupported by any data. Firstly, their assertion implies that the authors know all species of scorpions present in every "wild condition inland" everywhere else on the globe. Secondly, their logic is flawed because although certain exotic species may fail to penetrate endemic 'wild' ecosystems of host countries, this is by no means the rule. There are many counterexamples where invasive species have become established in endemic ecosystems and displaced native fauna or flora, causing

Figures 172–182: *Lychas srilankensis* from locality 15CJ. **Figures 174–180, 182**. Male. Pedipalp chela, dorsal (174), external (175), and ventral (176) views. Pedipalp patella, dorsal (177) and external (178) views. Pedipalp femur and trochanter dorsal (179) view. The trichobothrial pattern is indicated in Figures 175–179. Pedipalp movable finger (180). Complete pedipalp (182). **Figures 172–173, 181**. Female. Pedipalp chela, dorsal (172) and external (173) views. Complete pedipalp (181).

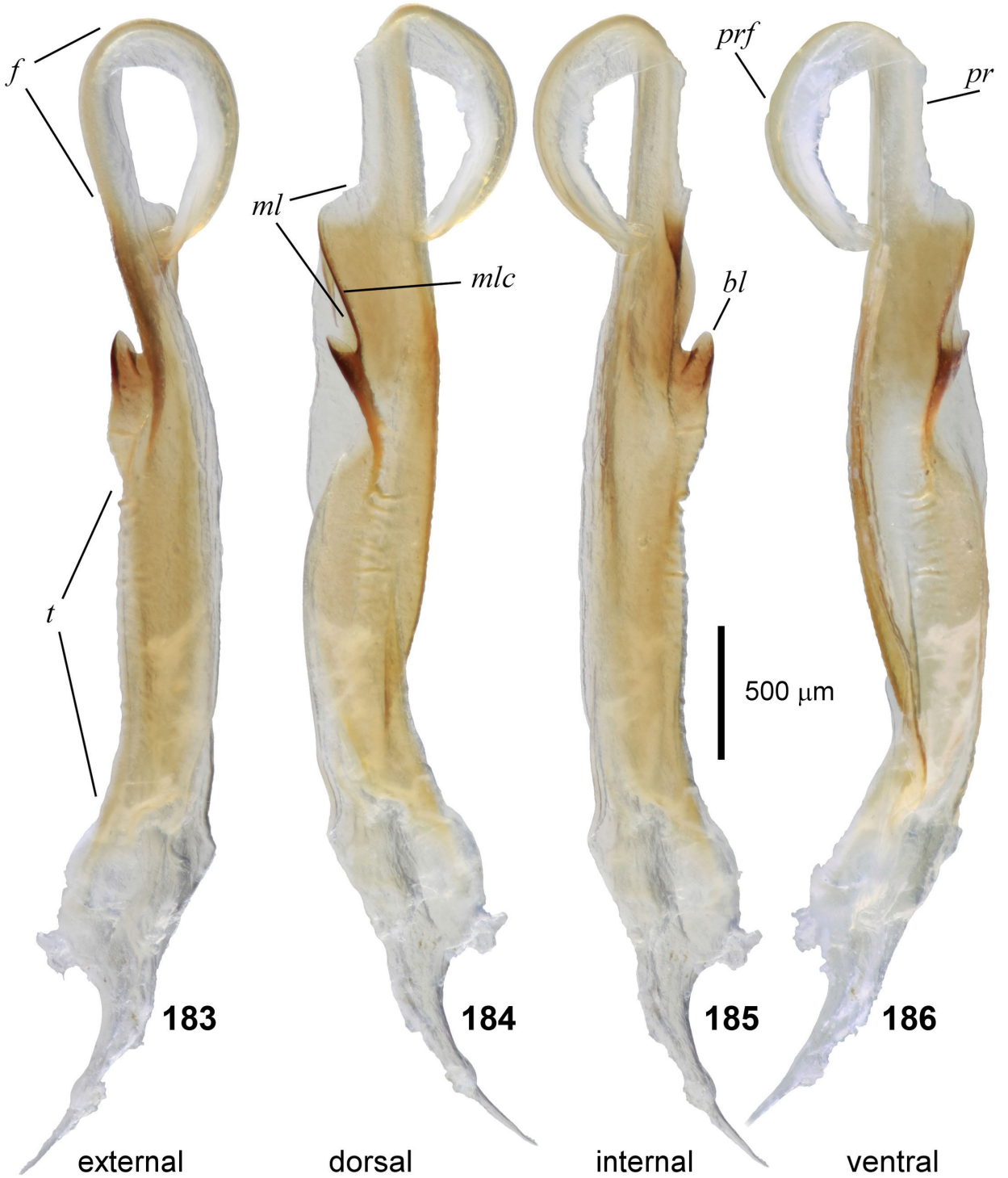
major negative impacts. However, Veronika et. al. (2013: 75) cited this speculation as fact, claimimg that *I. maculatus* is an "Endemic species in Sri Lanka". A proper test of this hypothesis may require comparative DNA studies of widespread *I. maculatus* populations.

Isometrus thwaitesi Pocock, 1897
(Figs. 13, 138–151, 197, 223–224, 239–241, 243–244, 253, 405–406, 549, 558–560)

Isometrus thwaitesii Pocock, 1897: 114.
Isometrus (*Isometrus*) *thwaitesi*: Vachon, 1982: 88–90, figs. 36–39; Fet & Lowe, 2000: 150 (complete reference list until 1998); Kovařík, 2003: 4; Kovařík & Ojanguren, 2013: 184, 347, figs. 1260–1263.
= *Isometrus* (*Isometrus*) *thwaitesi pallidus* Lourenço & Huber, 2002: 266, figs. 1–7 (syn. by Kovařík & Ojanguren, 2013: 184).

TYPE LOCALITY AND TYPE REPOSITORY. Ceylon, now Sri Lanka; BMNH.

MATERIAL EXAMINED. Sri Lanka, Ratnapura District, 2 km S Hayes, 30.XI.1995, 1♀, FKCP, leg. S. Bečvář & Košťál; North Central Province, Polonnaruwa District, near Kaudulla National Park, 08°08'40.6"N 080°51' 04"E, 101 m a.s.l. (Locality **15CF**, Fig. 581), 23.IV. 2015, 1♂ (Fig. 150, 549) 1♀ (Fig. 151), FKCP, leg. Kovařík et al.; Northern Province, Mannar District, Madhu Road, 08°48'26.3"N 080°10'26"E, 90 m a.s.l. (Locality **15CH**, Fig. 584), 24. –25.IV.2015, 1♂ (Figures 138–139, 142, 144, 146–149, 223, 239, 243, 405, 558–560) 1juv., FKCP, leg. Kovařík et al.; Northern Province, Mannar District, Marichchukkaddi env, border of Wilpattu National Park, 08°33'32.3"N 079°56'51"E, 7 m a.s.l. (Locality **15CI**, Fig. 585), 25. –26.IV.2015, 1♀, FKCP, leg. Kovařík et al.; North Central Province, Anuradhapura District, Mihintale, 08°20'51.8"N 080°30' 27.7"E, 156 m a.s.l. (Locality **15CL**, Fig. 589), 27. – 28.IV.2015, 1♂, FKCP, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°17' 15"N 079°50'38.7"E, 38 m a.s.l. (Locality **15CO**, Fig. 592), 28.IV.2015, 1♂1♀ (Figures 140–141, 143, 145, 197, 224, 240–241, 244, 253, 406) 1juv., FKCP, leg.



Figures 183–186: Right hemispermatophore of *Lychas srilankensis* from locality 15CN (presented as mirror image for comparison to other species). External (183), dorsal (184), internal (185) and ventral (186) views. Extracted after 3rd ecdysis. Hemispermatophores examined from a second male after 4th ecdysis were similar. Scale bar: 500 µm. Abbreviations: *bl*, basal lobe; *f*, flagellum; *ml*, median lobe; *mlc*, median lobe carina; *pr*, pars recta of flagellum; *prf,* pars reflecta of flagellum; *t*, trunk.

Kovařík et al.; North Central Province, Sigiriya, 7°58'25.6"N 80°44'59.7"E, 1♀, UPSL, leg. S. Jayarathne.

DIAGNOSIS. Total length 30–50 mm. Manus of pedipalp very thin, width in male equal to that that of patella and femur. Pedipalps and legs yellow, with spots. Fingers

Figures 187–190: *Lychas srilankensis*. **Figures 187**. Male after 5th ecdysis at locality 15CJ. **Figures 188**. Female after 5th ecdysis at locality 15CO. **Figures 189**. Male after 3rd ecdysis at locality 15CN. **Figures 190**. Female after 5th ecdysis at locality 15CJ.

Figures 191–192: *Lychas srilankensis*, female from locality 15CN with newborns before first ecdysis (191), and with juveniles after first ecdysis (192).

Figures 193–200: Distal segments of leg IV, retroventral view of Sri Lankan Buthidae and Chaerilidae genera. *Buthoscorpio sarasinorum*, male from locality 15CF (193), *Charmus laneus*, male from locality 15CO (194), *Hottentotta tamulus*, male from locality 15CK (195), *Isometrus maculatus*, female from locality 15CI (196), *Isometrus thwaitesi*, female from locality 15CO (197), *Lychas srilankensis*, male from locality 15CJ (198), *Reddyanus basilicus*, male from locality 15CS (199), and *Chaerilus ceylonensis*, male from locality 15CD (200).

and manus of pedipalps of the same color, spotted. Mesosomal segments light-colored. First (basal) middle lamella of both sexes pecten rounded. Posterior margin of sternite V strongly convex medially. Subaculear tooth spinoid. Pectinal teeth number 13–16.

HEMISPERMATOPHORE (Figs. 146–149). Trunk broad, short, only slightly longer than capsule region. Capsule region broad. Flagellum laminiform, short, basally broadened and fused with median lobe. Median lobe rather narrow, distally truncate, with strong, curved dorsal carina. Basal lobe well developed, a broad hook-like process arising dorsally at base of median lobe.

DISTRIBUTION. Sri Lanka.

Lychas C. L. Koch, 1845
(Figs. 13, 152–192, 198, 251, 407–408, 550)

Lychas C. L. Koch, 1845: 3 (in part), fig. 962, Tab. CCCXCVIII; Tikader & Bastawade, 1983: 40–107, figs. 99–285; Kovařík, 1997: 311–371, figs. 1–116, 122–123; Fet & Lowe, 2000: 158–169 (complete reference list until 1998); Kovařík & Ojanguren, 2013: 194–211, 361–378, figs. 1410–1600 (reference and synonymy list until 2013).

= *Archisometrus* Kraepelin, 1891: 75 (in part); type species by subsequent designation (L. E. Koch, 1977: 123) *Tityus marmoreus* C. L. Koch, 1845 (syn. by Pocock, 1900: 35).

= *Lychas* (*Distotrichus*) Tikader & Bastawade, 1983: 41–51, figs. 99–129 (syn. by Vachon, 1986: 848).

= *Lychas* (*Alterotrichus*) Tikader & Bastawade, 1983: 52–71, figs. 130–184) (syn. by Kovařík, 1995: 188).

= *Lychas* (*Endotrichus*) Tikader & Bastawade, 1983: 71–107, figs. 185–285 (syn. by Kovařík, 1995: 188).

TYPE SPECIES. *Lychas scutilus* C. L. Koch, 1845.

DIAGNOSIS. Total length 21.8–90 mm. Sternum type 1, subpentagonal or subtriangular. Pedipalps orthobothriotaxic, type Aβ; patella trichobothrium d_3 external to dorsomedian carina; chela with 3 *Eb* trichobothria on

Figures 201–208: Distal segments of legs, retroventral view of Sri Lankan *Reddyanus*. **Figures 201–204**. *R. ceylonensis* **sp**. **n**., male holotype from locality 15CI, legs I–IV. **Figures 205–208**. Leg IV. *R. besucheti*, male from locality 15CD (205), *R. jayarathnei* **sp**. **n**., male paratype (206), *R. loebli*, male from locality 15CG (207), and *R. ranawanai* **sp**. **n**., male holotype (208).

manus. Cheliceral fixed finger with a single ventral denticle. Third and fourth legs with tibial spurs. Pectines with conspicuous or inconspicuous fulcra, rarely without fulcra. Pectinal teeth number 8–26. Movable fingers of pedipalps with six rows of granules and external and internal granules and apical row represented by 3 or 4 accessory granules. Total number of terminal granules 6 or 7. Carapace in lateral view with entire dorsal surface horizontal, or nearly so. Telson with distinct subaculear tooth. Fifth metasomal segment with carinae.

DISTRIBUTION. *Lychas* is one of the most widely distributed genera of the family Buthidae, with species present in Africa and Seychelles, and in the Oriental region from India to Melanesia.

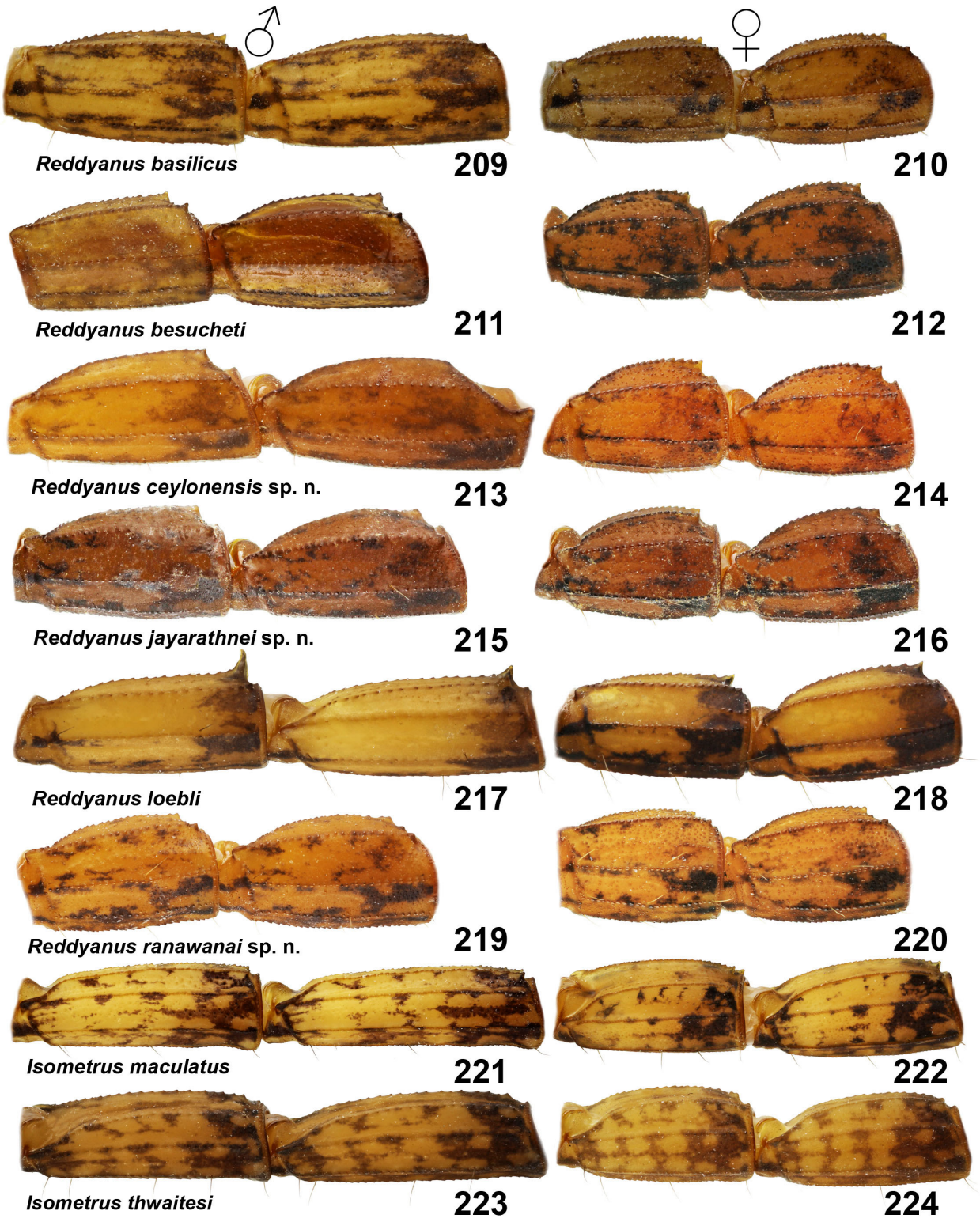
Lychas srilankensis Lourenço, 1997
(Figs. 13, 152–192, 198, 251, 407–408, 550)

Lychas srilankensis Lourenço, 1997: 831–836, figs. 1–9; Lourenço & Huber, 1999: 26; Fet & Lowe, 2000: 168; Kovařík & Ojanguren, 2013: 209, 364, figs. 1462–1470.

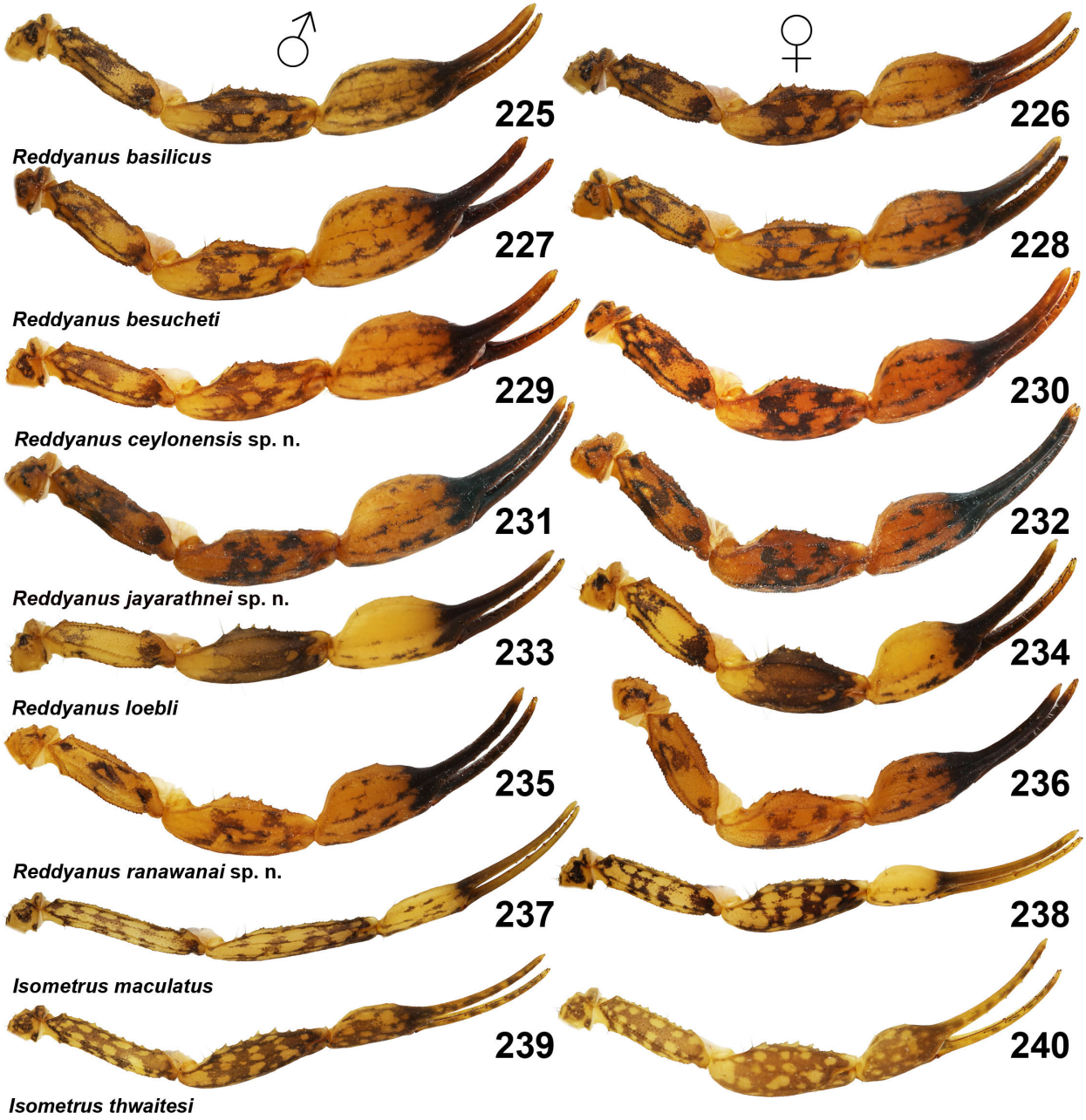
= *Lychas ceylonensis* Lourenço & Huber, 1999: 23–26, figs. 1–7 (syn. by Kovařík & Ojanguren, 2013: 209).

TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka, Northern Province, Mannar District, Occapu Kallu, Wilpattu; MHNG.

MATERIAL EXAMINED. Sri Lanka, Northern Province, Jaffna District, 09°42'51.6"N 080°04'44.8"E, 19 m a.s.l. (Locality **15CJ**, Fig. 586), 26. –27.IV.2015, 1♂ after 5th ecdysis (Figs. 152–153, 158, 160, 162–168, 174–180, 182, 198, 407) 1♀ (Figs. 154–155, 159, 161, 169–173, 181, 408) 1im.♂, FKCP, 1♂, UPSL, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°12'35.1"N 079°51'32"E, 52 m a.s.l. (Locality **15CN**, Fig. 591), 28.IV.2015, 1♂ after 3rd ecdysis (Figs. 183–186, 189, 550) 1♂ after 4th ecdysis 1♀ (Figs. 191–192), FKCP, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°17'15"N 079°50'38.7"E, 38 m a.s.l. (Locality **15CO**, Fig. 592), 28.IV.2015, 2♂ (Figs. 156–157, 251) 1♀, FKCP, 1♀1juv, UPSL, leg. Kovařík et al.



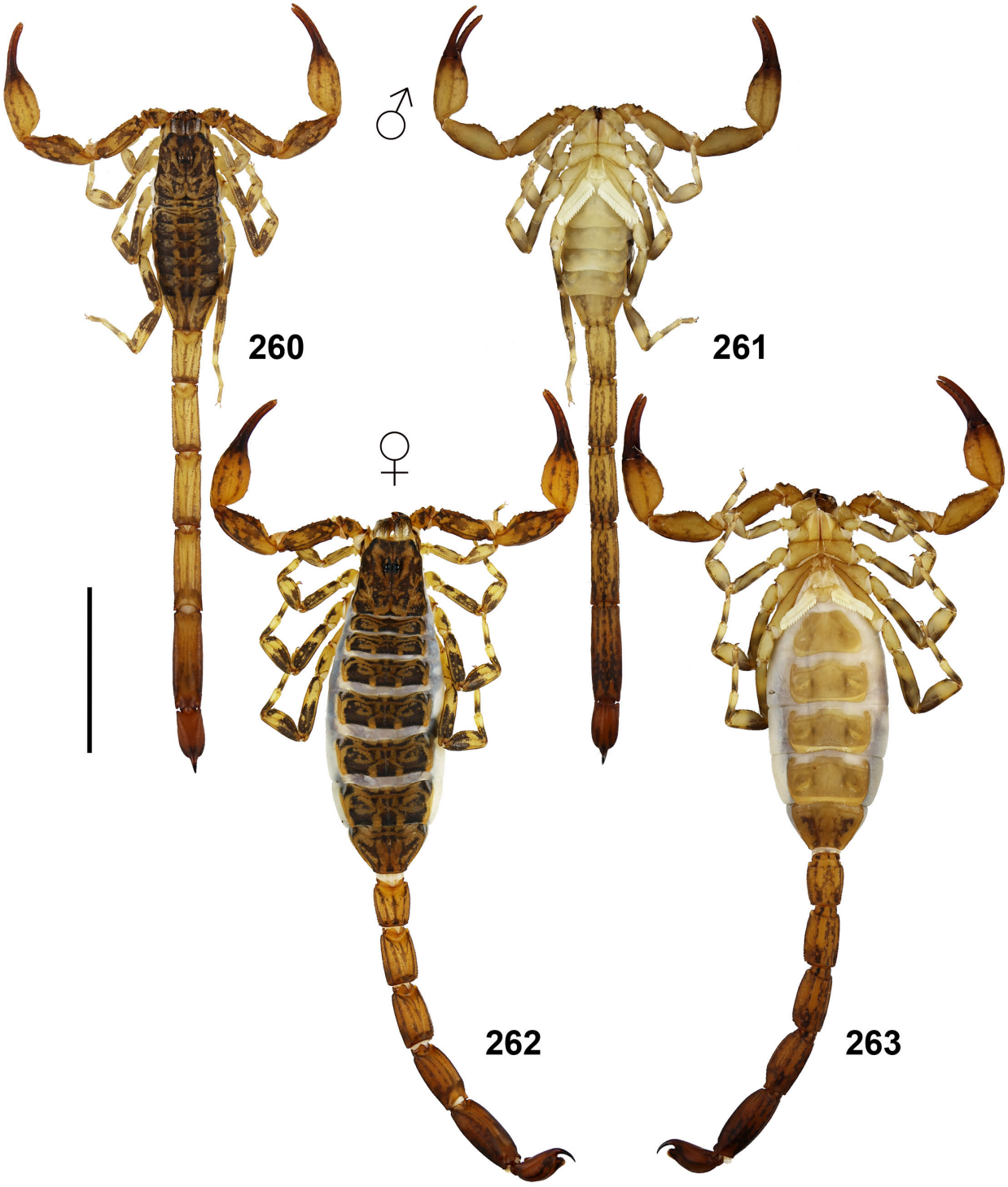
Figures 209–224: Metasomal segments II–III, lateral view of Sri Lankan *Reddyanus* and *Isometrus* species. **Figures 209–210**. *Reddyanus basilicus*, male (209) and female (210) from locality 15CR. **Figures 211–212**. *R. besucheti*, male holotype (211) and female from locality 15CG (212). **Figures 213–214**. *R. ceylonensis* **sp**. **n**., male holotype (213) and female paratype from locality 15CI (214). **Figures 215–216**. *R. jayarathnei* **sp**. **n.,** male (215) and female (216) paratypes. **Figures 217–218**. *R. loebli*, male (217) and female (218) from locality 15CG. **Figures 219–220**. *R. ranawanai* **sp**. **n**., male holotype (219) and female paratype (220). **Figures 221–222**. *Isometrus maculatus*, male from locality 15CP (221) and female from locality 15CI (222). **Figures 223–224**. *I. thwaitesi*, male from locality 15CH (223) and female from locality 15CO (224).



Figures 225–240: Pedipalp, dorsal view of Sri Lankan *Reddyanus* and *Isometrus* species. **Figures 225–226**. *Reddyanus basilicus*, male (225) and female (226) from locality 15CR. **Figures 227–228**. *R. besucheti*, male from locality 15CD (227) and female from locality 15CG (228). **Figures 229–230**. *R. ceylonensis* **sp. n.**, male holotype (229) and female paratype from locality 15CI (230). **Figures 231–232**. *R. jayarathnei* **sp. n.,** male (231) and female (232) paratypes. **Figures 233–234**. *R. loebli*, male (233) and female (234) from locality 15CG. **Figures 235–236**. *R. ranawanai* **sp. n.**, male holotype (235) and female paratype (236). **Figures 237–238**. *Isometrus maculatus*, male from locality 15CP (237) and female from locality 15CI (238). **Figures 239–240**. *I. thwaitesi*, male from locality 15CH (239) and female from locality 15CO (240).

DIAGNOSIS. Total length 38–65 mm. Sternum type 1, subpentagonal, exhibiting horizontal compression. Metasoma approximately the same length in both sexes, or male with slightly longer metasoma. Sixth row of granules on both movable and fixed fingers of pedipalps with out external and internal granules. First through third metasomal segments with 10 carinae, fourth with eight carinae. Lateral inframedian carinae of second and third metasomal segments may be incomplete. Fingers and manus of pedipalps identically colored, light and spot-

Figures 241–259: Pedipalp chela dorsal (241), movable finger (242–250), and fixed finger (251–259) of Sri Lankan *Isometrus*, *Lychas*, and *Reddyanus* species. **Figures 241–242**, **252**. *Isometrus maculatus*, female from locality 15CO (241) and male from locality 15CP (242, 252). **Figures 243–244, 253**. *I. thwaitesi*, male from locality 15CH (243) and female from locality 15CO (244, 253). **Figures 245, 254**. *Reddyanus basilicus*, male from locality 15CS. **Figures 246, 255**. *R. besucheti*, male from locality 15CD. **Figures 247, 256**. *R. ceylonensis* **sp**. **n**., male holotype. **Figures 248, 257**. *R. jayarathnei* **sp**. **n.,** male paratype. **Figures 249, 258**. *R. loebli*, male from locality 15CG. **Figures 250, 259**. *R. ranawanai* **sp**. **n**., male holotype. **Figure 251**. *Lychas srilankensis*, male from locality 15CO.



Figures 260–263: *Reddyanus basilicus* from locality 15CS. **Figures 260–261**. Male in dorsal (260) and ventral (261) views. **Figures 262–263**. Female in dorsal (262) and ventral (263) views. Scale bar: 10 mm.

ted. Manus of pedipalps smooth without granules in females and usually finely granulated in males. Pectinal teeth number 21–25.

HEMISPERMATOPHORE (Figs. 183–186). Trunk broad, short, only slightly longer than capsule region. Capsule region broad. Flagellum short, laminiform, with broad hyaline fin along internal margin of cylindrical core. Median lobe broad, with thin dorsal carina near internal margin. Basal lobe strongly developed, a broad, blunt hook-like process arising dorsally at base of median lobe carina.

COMMENTS. The taxonomic position of this species is not clear. *L. srilankensis* is very similar to *L. tricarinatus* (Simon, 1884) and there is a real possibility that further study of *L. tricarinatus* (type locality India, Pondichéry) could reveal that these two species are synonyms. Lourenço did not compare these two species and only compared *L. srilankensis* with *L. shoplandi* (Oates, 1888) and *L. feae* (Thorell, 1889) (= *L. shoplandi*) from Myanmar in the original description (Lourenço, 1997: 831–836, figs. 1–9). The description is superficial with several errors (e.g. compare Fig. 179 with fig. 6 in Lourenço 1997: 833, which depicts a spurious additional trichobothrium between d_4 and d_5; and the shape and densely hirsute setation of tarsomere II of leg IV in Fig. 165 with fig. 8 in Lourenço 1997: 833, which depicts same setation for tarsomeres I and II). Kovařík et Ojanguren (2013: 196) cited a difference in the length of the metasoma in males, but our study of new Sri Lankan specimens shows that there is little or no significant difference. Both species *L. srilankensis* and *L. tricarinatus* have the metasoma approximately the same length in both sexes, or the male has a slightly longer metasoma.

In the original description, *L. ceylonensis* was characterized as having the terminal accessory granules on the movable finger of the pedipalp modified into another (seventh) row of granules (see fig. 7 in Lourenço & Huber, 1999: 24). The authors (p. 26) distinguished *L. ceylonensis* from *L. srilankensis* as follows: "... the presence of 7 oblique rows of granules on the movable finger of pedipalp, instead of 6 as in *L. srilankensis*. The row of granules on the extremity of the finger is normal, and not represented merely by 3 or 4 accessory granules as it is in *L. srilankensis*". This is incorrect. The male holotype of *L. ceylonensis* only has a right movable finger (the left is missing), and this finger only bears six rows of granules and three external accessory granules on its distal extremity (see Fig. 1465 in Kovařík & Ojanguren, 2013: 364), which is the normal condition for the genus *Lychas* (see genus diagnosis), including *L. srilankensis*.

DISTRIBUTION. Sri Lanka.

Genus ***Reddyanus*** Vachon, 1972 **stat**. **n**.
(Figs. 14, 199, 201–220, 225–236, 245–250, 254–402, 409–420, 551–554, 561–570, Tables 3–5)

Isometrus (*Reddyanus*): Vachon, 1972: 176–177, figs. 14, 16, 18, 20; Vachon, 1982: 90–101, 108–110, figs. 47–67, 88–91; Fet & Lowe, 2000: 150–154; Kovařík, 2003: 5–14, figs. 1–8; Kovařík & Ojanguren, 2013: 184–193, 347–354, 357–360, figs. 1265–1367, 1384–1409.

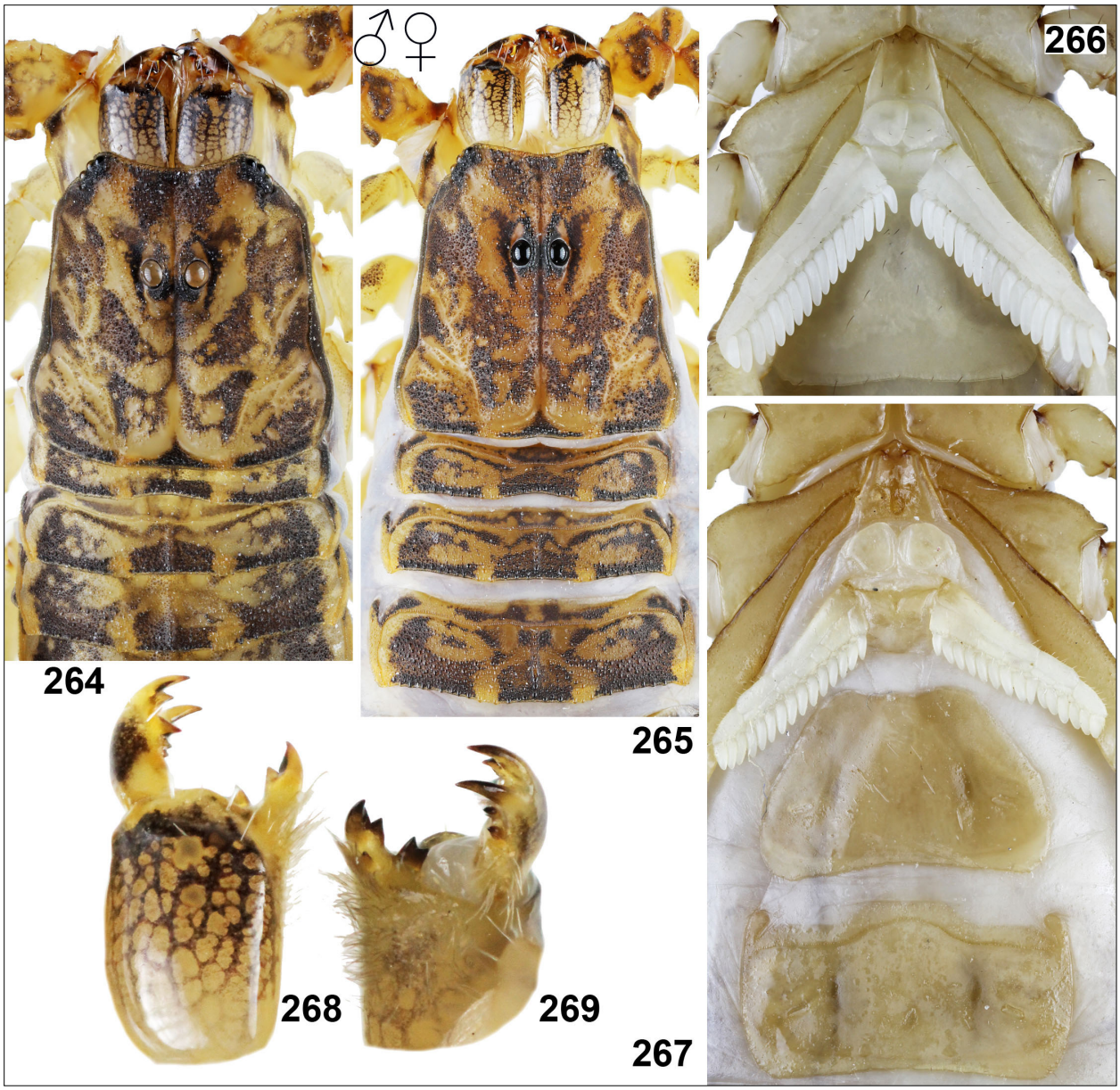
Isometrus (*Raddyanus* [sic]): Tikader & Bastawade, 1983: 254–311 (in part), figs. 727–770, 841–895.

TYPE SPECIES. *Isometrus acanthurus* Pocock, 1899.

DIAGNOSIS. Medium sized buthids, adults 19–75 mm. Sternum type 1, triangular in shape. Pedipalps orthobothriotaxic, type Aβ. Chelal trichobothrium *db* located between *et* and *est*. Three to five pairs of lateral eyes. Tibial spurs absent on all legs. Pedipalp movable finger with six rows of granules, several accessory granules and external and internal accessory granules. Pedipalp fixed finger with seven rows of granules and six external and seven internal accessory granules. Cheliceral fixed finger with a single ventral denticle. Third and fourth legs with tibial spurs. Tibia and tarsomeres of legs I–III with setae not arranged into bristle combs on dorsal surfaces. Tarsomere II of leg IV with two sparse rows of < 20 spiniform setae on ventral surface. Mesosoma dorsally with one median carina. Telson with subaculear tooth pointed or more often rounded. Males of most species have longer metasomal segments and often also a wider pedipalp chela manus than females.

SUBORDINATE TAXA. Currently, 27 species are formally included under the genus (cf. Kovařík & Ojanguren (2013) for information about species not treated here): *Reddyanus acanthurus* (Pocock, 1899) **comb. n.**, *Reddyanus assamensis* (Oates, 1888) **comb. n.**, *Reddyanus basilicus* (Karsch, 1879) **comb. n.**, *Reddyanus besucheti* (Vachon, 1982) **comb. n.**, *Reddyanus bilyi* (Kovařík, 2003) **comb. n.**, *Reddyanus brachycentrus* (Pocock, 1899) **comb. n.**, *Reddyanus ceylonensis* Kovařík, Lowe, Ranawana, Hoferek, Jayarathne, Plíšková et Šťáhlavský, **sp. n.**, *Reddyanus corbeti* (Tikader et Bastawade, 1983) **comb. n.**, *Reddyanus deharvengi* (Lourenço et Duhem, 2010) **comb. n.**, *Reddyanus feti* (Kovařík, 2013) **comb. n.**, *Reddyanus heimi* (Vachon, 1976) **comb. n.**, *Reddyanus jayarathnei* Kovařík, **sp. n.**, *Reddyanus jendeki* (Kovařík, 2013) **comb. n.**, *Reddyanus khammamensis* (Kovařík, 2003) **comb. n.**, *Reddyanus krasenskyi* (Kovařík, 1998) **comb. n.**, *Reddyanus kurkai* (Kovařík, 1997) **comb. n.**, *Reddyanus loebli* (Vachon, 1982) **comb. n.**, *Reddyanus melanodactylus* (L. Koch, 1867) **comb. n.**, *Reddyanus navaiae* (Kovařík, 1998) **comb. n.**, *Reddyanus neradi* (Kovařík, 2013) **comb. n.**, *Reddyanus petrzelkai* (Kovařík, 2003) **comb. n.**, *Reddyanus problematicus* (Kovařík, 2003) **comb. n.**, *Reddyanus ranawanai* Kovařík, **sp. n.**, *Reddyanus rigidulus* (Pocock, 1897) **comb. n.**, *Reddyanus tibetanus* (Lourenço et Zhu, 2008) **comb. n.**, *Reddyanus vittatus* (Pocock, 1900) **comb. n.** and *Reddyanus zideki* (Kovařík, 1994) **comb. n.**.

COMMENTS. Vachon (1972: 177) described the subgenus *Reddyanus* and distinguished it from the nominotypic subgenus *Isometrus* Ehrenberg, 1828 by the position of chelal fixed finger trichobothria (trichobothrium *db* located between *dt* and *et* in *Isometrus*, between *et* and *est*



Figures 264–269: *Reddyanus basilicus*. **Figures 264, 266**. Male from locality 15CS, chelicerae, carapace and tergites I–III (264), and sternopectinal region and sternite III (266). **Figures 265, 267**. Female from locality 15CS, chelicerae, carapace and tergites I–III (265) and sternopectinal region and sternites III–IV (267). **Figures 268–269**. Male from locality 15CR, chelicera dorsal (268) and ventral (269) aspects.

in *Reddyanus*). Vachon also cited the different positions of the e_2 trichobothria on the femur (see figs 15, 16 in Vachon, 1972: 176). Subsequently, Vachon (1982) added another character for distinguishing the two subgenera: *Isometrus* has pedipalp fixed fingers with six rows of granules and six external and internal accessory granules (Figs. 252–253 and figs. 64, 65 in Vachon, 1982: 100), and *Reddyanus* has pedipalp fixed fingers with seven rows of granules and six external and seven internal granules (Figs. 254–259 and figs. 66 and 67 in Vachon, 1982: 100). Here we propose two additional characters for distinguishing these taxa: (i) ventral aspect of tarsomere II of leg IV with two dense rows of > 30 longer, more filamentous setae in *Isometrus* (Figs. 196–197), vs. two sparse rows of < 20 shorter, thicker, more spiniform setae in *Reddyanus* (Figs. 199, 205–208); (ii) hemispermatophore with a relatively short, broad trunk, a short, broad, uncoiled flagellum, and a smaller, blunt basal lobe in *Isometrus* (Figs. 146–149), vs. a narrow trunk, a long, thin, coiled flagellum and a much enlarged, pointed basal lobe in *Reddyanus* (Figs. 283–286). The form of the hemispermatophore of *Isometrus*

Figures 270–275: *Reddyanus basilicus* from locality 15CS. **Figures 270–272**. Male, metasoma and telson, lateral (270), ventral (271), and dorsal (272) views. **Figures 273–275**. Female, metasoma and telson, lateral (273), ventral (274), and dorsal (275) views. Scale bar: 10 mm.

Figures 276–282: *Reddyanus basilicus* from locality 15CS. **Figures 276–277**. Female. Pedipalp chela, dorsal (276) and external (277) views. **Figures 278–282**. Male. Pedipalp chela, dorsal (278) and external (279) views. Pedipalp patella, dorsal (280) and external (281) views. Pedipalp femur and trochanter dorsal view (282). The trichobothrial pattern is indicated in Figures 279–282.

appears more similar to that of *Lychas* (Figs. 183–186), than to *Reddyanus*. Differences in trichobothriotaxy, pedipalp finger dentition, tarsal setation and hemispermatophore structure provide characters that are useful for higher level classification of buthid scorpions (Kovařík, 2009; Lamoral, 1979; Sissom, 1990; Stahnke, 1972; Stockwell, 198; Vachon, 1952). Taken together, these differences support our taxonomic decision to elevate *Reddyanus* to a genus distinct from *Isometrus*.

DISTRIBUTION. Oriental region from India, China (Tibet) to Melanesia.

Reddyanus basilicus (Karsch, 1879) **comb. n.**
(Figs. 14, 199, 209–210, 225–226, 245, 254, 260–290, 409–410, 551–552, 565, Tables 3, 5)

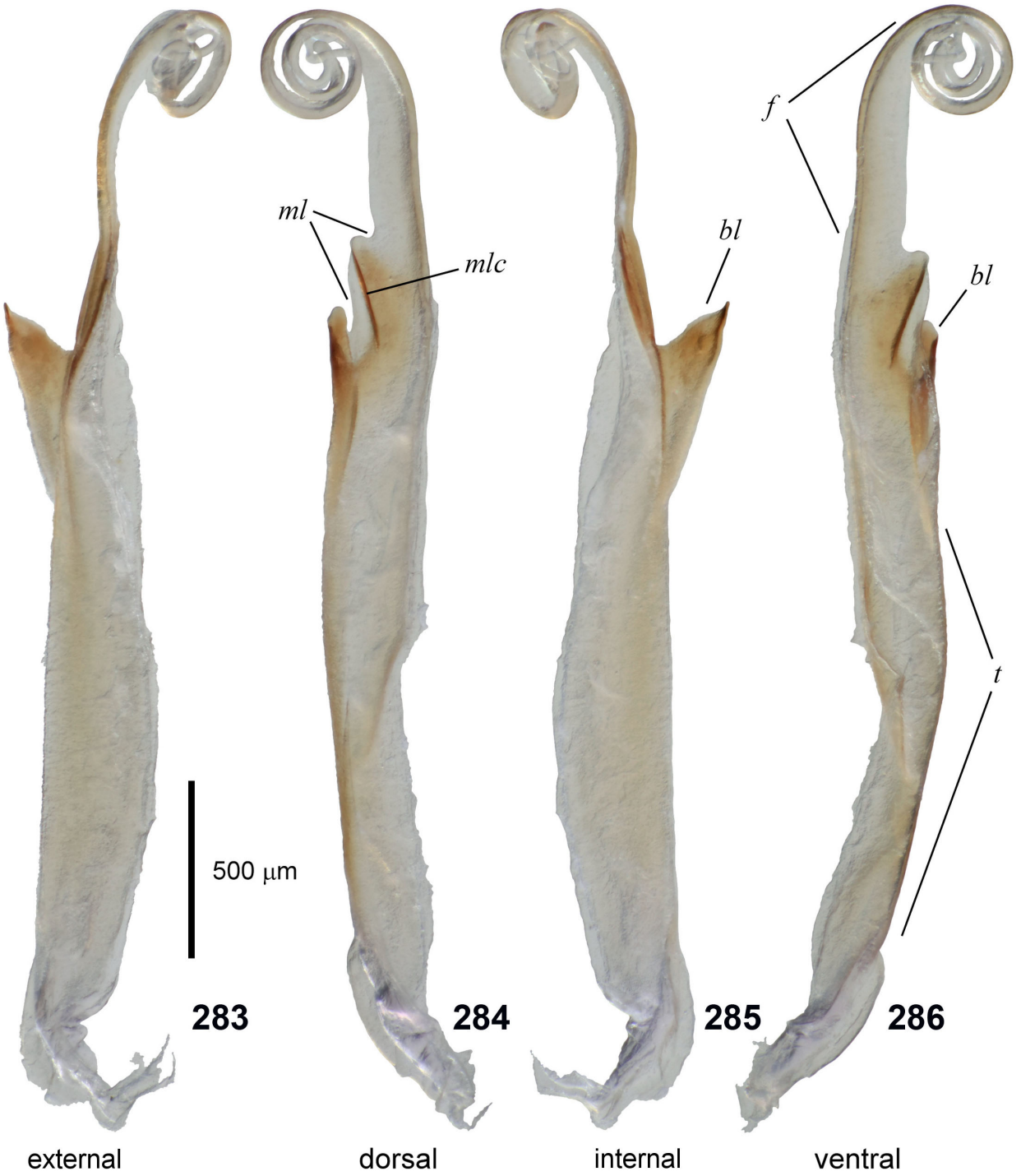
Isometrus basilicus Karsch, 1879: 113.
Isometrus (*Reddyanus*) *basilicus*: Vachon, 1982: 91–92, figs. 40–46, 49?, 66, 88–89; Fet & Lowe, 2000: 151; Kovařík, 2003: 5 (in part); Kovařík & Ojanguren, 2013: 185, 350, 358, figs. 1296–1303, 1386–1392 (reference list until 2013).

TYPE LOCALITY AND TYPE REPOSITORY. Ceylon, now Sri Lanka; ZMHB No. 113.

TYPE MATERIAL EXAMINED. Ceylon (now Sri Lanka), 1♂ (holotype, Fig. 565, Table 3), leg. Nietner, ZMHB No. 113.

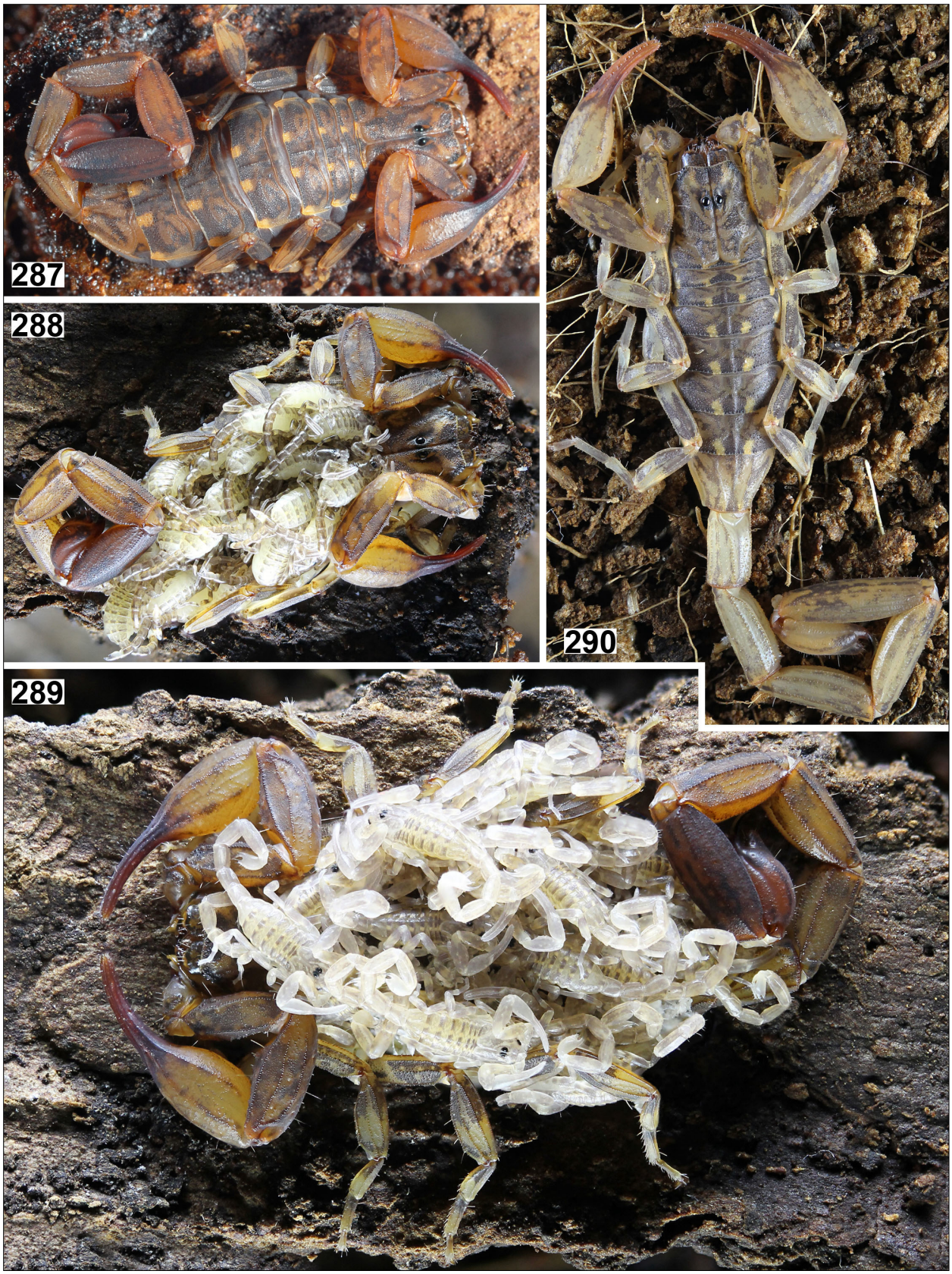
OTHER MATERIAL EXAMINED. Sri Lanka, Uva Province, Uva Hills, Badula District, Namunukula, 1970, 1♂A, FKCP; Kandy, 1♂ after 4th ecdysis 2♂ after 5th ecdysis 2♀, FKCP; Eastern Province, Ampara District, Lahugala Kitulana National Park, 06°52'46"N 081°43'21.8"E, 40 m a.s.l. (Locality **15CR**, Fig. 596), 3.–4.V.2015, 1♂ (Figs. 209, 225, 268–269, 409, 552) 1♀ (Figs. 210, 226, 410) 1juv., FKCP, 1♂, UPSL, leg. Kovařík et al.; Eastern Province, Ampara District, Ampara env., 07°20' 01.3"N 081°41'57.1"E, 56 m a.s.l. (Locality **15CS**, Fig. 597), 4.V.2015, 1♂ (Figs. 199, 245, 254, 260–261, 264, 266, 270–272, 278–286, 290, 551) 2♀ (Figs. 262–263, 265, 267, 273–275, 276–277, 287–289), FKCP, leg. Kovařík et al.

DIAGNOSIS. Total length 27–46 mm. Male with longer metasomal segments and telson than female. Segments of pedipalps approximately the same length and width in both sexes. Ratio of pedipalp chela length/ width 3.41–3.79 in male. Pedipalp movable finger clearly longer than chela manus in both sexes, but in largest male specimens could be shorter than manus. Base coloration

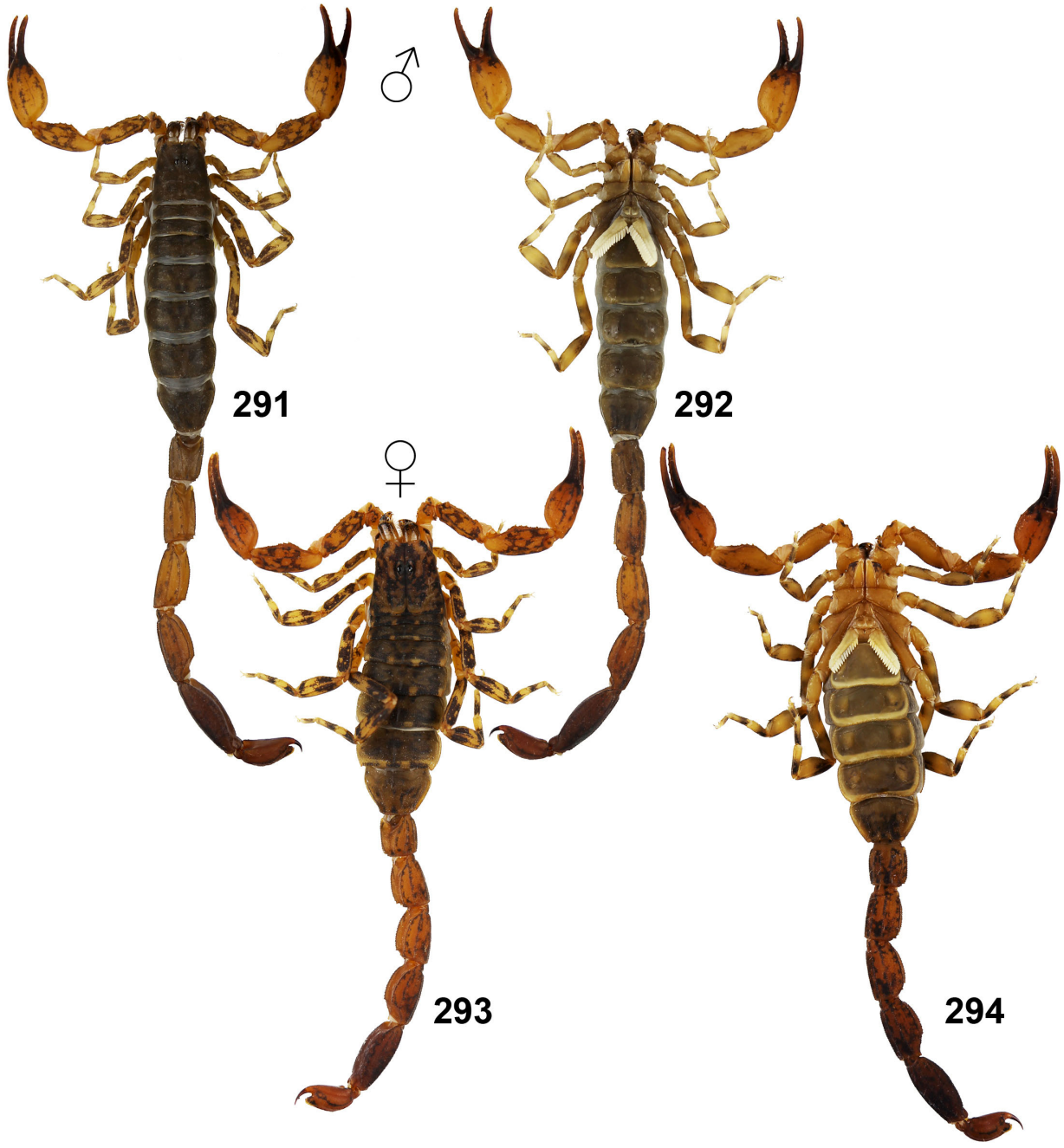


Figures 283–286: Left hemispermatophore of *Reddyanus basilicus* from locality 15CR. External (283), dorsal (284), internal (285) and ventral (286) views. Scale bar: 500 µm. Abbreviations: *bl*, basal lobe; *f*, flagellum; *ml*, median lobe; *mlc*, median lobe carina; *t*, trunk.

reddish. Pedipalps and legs with brown maculation, identical on femur and patella. First metasomal segment bears 10 carinae, second through fourth segments bear eight carinae, fifth segment bears five carinae in female and three to five in male. Terminal tubercle of each dorsal carina on metasomal segments of both sexes scarcely larger than preceding tubercles. Subaculear tooth wide and rounded, dorsally with granules in three or four rows; four or six symmetrical granules and one or two granules on tip. Glabrous zone along posterior margin of fifth sternite absent. Pectinal teeth number 13–18 in both sexes.



Figures 287–290: *Reddyanus basilicus* from locality 15CS, female (287), female with newborns before first ecdysis (288), female with juveniles after first ecdysis (289), and male (290).



Figures 291–294: *Reddyanus besucheti*. **Figures 291–292**. Male from locality 15CD in dorsal (291) and ventral (292) views. **Figures 293–294**. Female from locality 15CG in dorsal (293) and ventral (294) views.

HEMISPERMATOPHORE (Figs. 283–286). Trunk moderately narrow, elongate, more than twice as long as capsule region. Flagellum long, slender, laminiform, with broad hyaline fin along internal margin of cylindrical core, distally coiled. Median lobe narrow, distally truncate, with thin dorsal lamina near internal margin. Basal lobe greatly enlarged, a narrow, angular, pointed hook-like process arising dorsally, separated from base of median lobe.

VARIABILITY. There is high variability in morphometric characters between small males 27–32 mm long after the fourth ecdysis, and males 40–46 mm long after the fifth ecdysis.

DISTRIBUTION. Sri Lanka.

Figures 295–300: *Reddyanus besucheti*. **Figures 295–297**. Male from locality 15CD, metasoma and telson, lateral (295), ventral (296), and dorsal (297) views. **Figures 298–300**. Female from locality 15CG, metasoma and telson, lateral (298), ventral (299), and dorsal (300) views.

Figures 301–302: *Reddyanus besucheti*, male at locality 15CF (301) and female at locality 15CG (302).

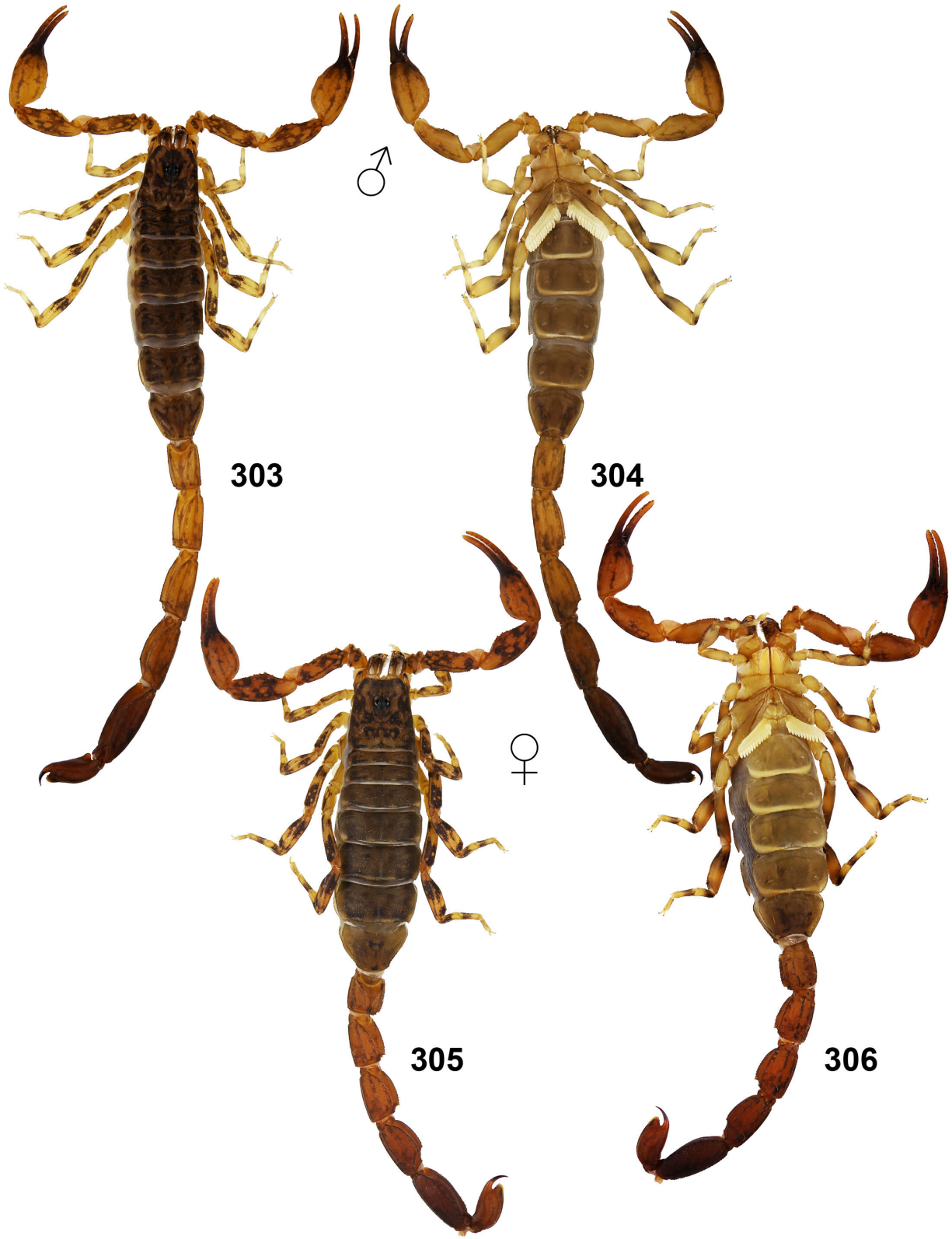
Reddyanus besucheti (Vachon, 1982) **comb. n.**
(Figs. 14, 205, 211–212, 227–228, 246, 255, 291–302, 411–412, 562, 564, 566–567, Tables 3, 5)

Isometrus (*Reddyanus*) *besucheti* Vachon, 1982: 93–97, figs. 47, 51–57, 90–91; Fet & Lowe, 2000: 151; Lourenço & Huber, 2002: 267; Kovařík, 2003: 5–6; Kovařík & Ojanguren, 2013: 186 (in part).

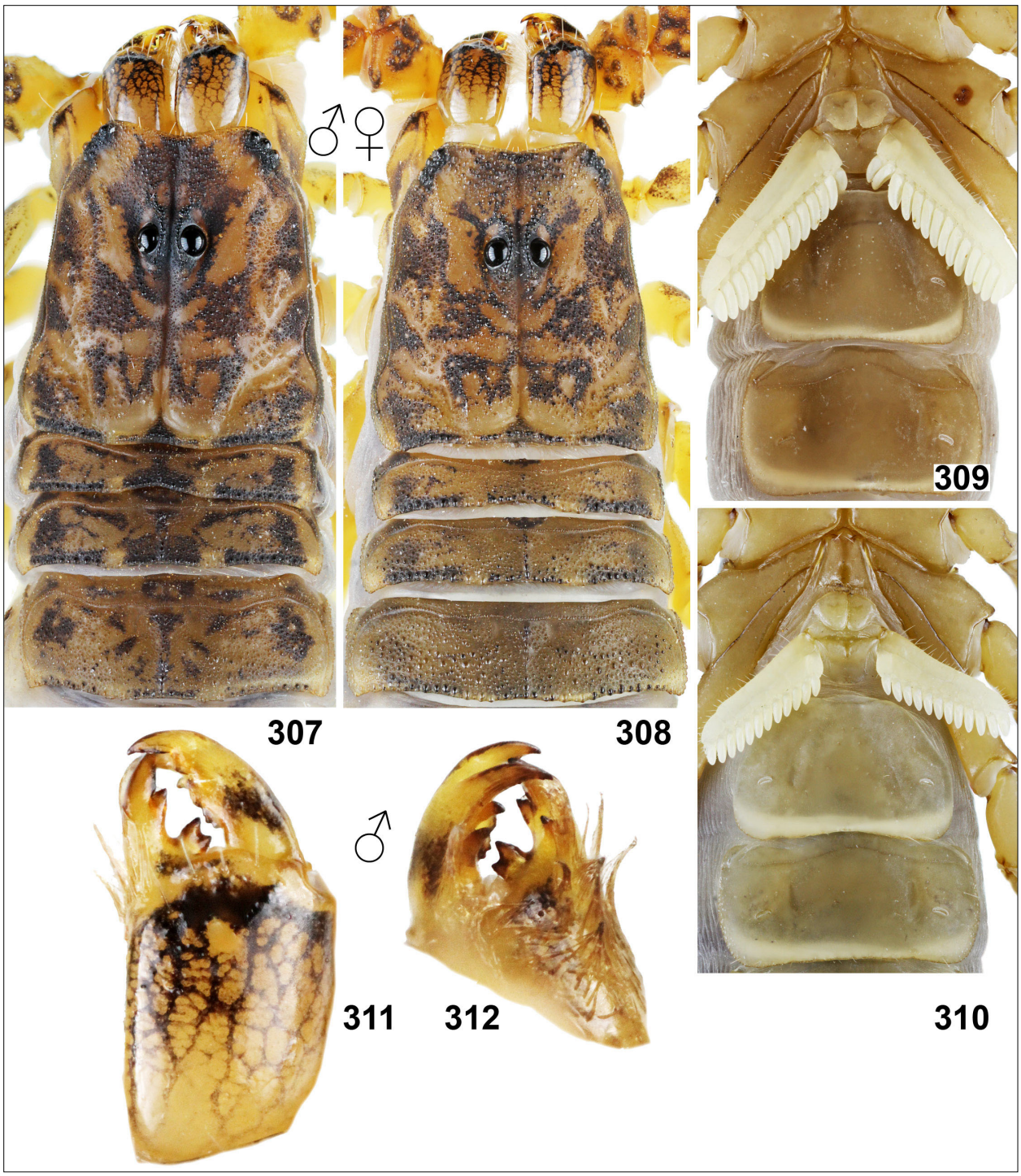
TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka, Ambagaswewa; MHNG.

TYPE MATERIAL EXAMINED. Sri Lanka, Ambagaswewa, Locality 44, 3.II.1970, leg. C. Besuchet et Y. Löbl, 1♂ (holotype, Figs. 211, 411, 566, Table 3), MHNG.

OTHER MATERIAL EXAMINED. Sri Lanka, North Central Province, Polonnaruwa District, ca 35 km from Dambula, 07°57'15.1"N 080°54'45,4"E, 132 m a.s.l. (Locality **15CD**, Fig. 578), 22.IV.2015, 2♂ (topotypes, Figs. 205, 227, 246, 255, 291–292, 295–297), FKCP, leg. Kovařík et al.; North Central Province, Polonnaruwa District, near Kaudulla National Park, 08°08'40.6"N 080°51'



Figures 303–306: *Reddyanus ceylonensis* **sp**. **n**. from locality 15CI. **Figures 303–304**. Male holotype in dorsal (303) and ventral (304) views. **Figures 305–306**. Female paratype in dorsal (305) and ventral (306) views.



Figures 307–312: *Reddyanus ceylonensis* **sp**. **n**. from locality 15CI. **Figures 307, 309, 311–312**. Male holotype, chelicerae, carapace and tergites I–III (307), sternopectinal region and sternites III–IV (309), and chelicera in dorsal (311) and ventral (312) views. **Figures 308, 310**. Female paratype, chelicerae, carapace and tergites I–III (308), and sternopectinal region and sternites III–IV (310).

04"E, 101 m a.s.l. (Locality **15CF**, Fig. 581), 23.IV. 2015, 1♂ (Fig. 562, 564, 567), FKCP, leg. Kovařík et al.; Central Province, Matale District, Habarana, Wananiwahana Resort, 07°59'25.8"N 080°43'24.6"E, 280 m a.s.l. (Locality **15CG**, Fig. 582), 23. –24.IV.2015, 1♀ (Figs. 212, 228, 293–294, 298–300, 302, 412), FKCP, leg. Kovařík et al.; North Central Province, Anuradhapura District, Mihintale, 08°20'51.8"N 080°30'27.7"E,

156 m a.s.l. (Locality **15CL**, Fig. 589), 27. –28.IV.2015, 1♀1juv.♂, FKCP, leg. Kovařík et al.

DIAGNOSIS. Total length 30–45 mm. Male with slightly longer metasomal segments and telson than female. Segments of pedipalps approximately the same length in both sexes, pedipalp chela wider in male. Pedipalps and legs with brown maculation, identical on femur and patella. First metasomal segment with 10 carinae, second through fourth segments with eight carinae, fifth segment with five carinae in female and three to five in male. Posterior terminal tubercle of each dorsal carina on metasomal segments of both sexes scarcely larger than preceding tubercles. Subaculear tooth wide and rounded, dorsally with granules in three rows, four symmetrical granules and one or two granules on tip. Glabrous zone along posterior margin of fifth sternite either absent or present. Pectinal teeth number 12–18 in both sexes.

DISTRIBUTION. Sri Lanka

Reddyanus ceylonensis Kovařík, Lowe, Ranawana, Hoferek, Jayarathne, Plíšková et Šťáhlavský, **sp**. **n**.
(Figs. 14, 201–204, 213–214, 229–230, 247, 256, 303–333, 413–414, 553, 567, Tables 3, 5)
http://www.zoobank.org/urn:lsid:zoobank.org:act:EE798511-D2D8-4D5A-9094-BE5551EC1CCB

TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka, Northern Province, Mannar District, Marichchukkaddi env, border of Wilpattu National Park, 08°33'32.3"N 079° 56'51"E, 7 m a.s.l., Locality 15CI; UPSL.

TYPE MATERIAL. Sri Lanka, Northern Province, Mannar District, Madhu Road, 08°48'26.3"N 080°10'26"E, 90 m a.s.l. (Locality **15CH**, Fig. 584), 24. –25.IV.2015, 1♀ (paratype, Fig. 331), FKCP, leg. Kovařík et al.; Northern Province, Mannar District, Marichchukkaddi env, border of Wilpattu National Park, 08°33'32.3"N 079°56'51"E, 7 m a.s.l. (Locality **15CI**, Fig. 585), 25. –26.IV.2015, 1♂ (holotype, Figs. 201–204, 213, 229, 247, 256, 303–304, 307, 309, 311–315, 320–326, 413, 567) 3♂ (paratypes, Figs. 327–330, 333, 553) 3♀ (paratypes, Figs. 214, 230, 305–306, 308, 310, 316–319, 332, 414), 2juvs. (paratypes), FKCP, 1♂1♀ (paratypes), UPSL, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°12'35.1"N 079°51'32"E, 52 m a.s.l. (Locality **15CN**, Fig. 591), 28.IV.2015, 2♀1juv.♂ (paratypes), FKCP, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°17'15"N 079°50'38.7"E, 38 m a.s.l. (Locality **15CO**, Fig. 592), 28.IV.2015, 4♀4juvs, UPSL, leg. Kovařík et al.

ETYMOLOGY. Named after country of occurrence. Ceylon is the older name for Sri Lanka.

DIAGNOSIS. Total length 27–39 mm. Male has slightly longer metasomal segments and telson than female. Pedipalp segments approximately the same length in both sexes, pedipalp chela wider in male. Ratio of pedipalp chela length/ width 2.97–3.17 in male (Fig. 213, Tab. 5). Pedipalp movable finger shorter than manus of chela in male. Pedipalps and legs with brown maculation, identical on femur and patella. First metasomal segment with 10 carinae, second through fourth segments with eight carinae, fifth segment with five carinae in female and three to five in male. Terminal tubercle of each dorsal carina on metasomal segments of both sexes scarcely larger than preceding tubercles. Subaculear tooth wide and rounded, dorsally with granules in three rows, four symmetrical granules and one or two granules on tip. Ratio of metasomal segment II length/ width 1.85–1.97 in male. Glabrous zone along posterior margin of fifth sternite absent. Pectinal teeth number 11–15 in both sexes.

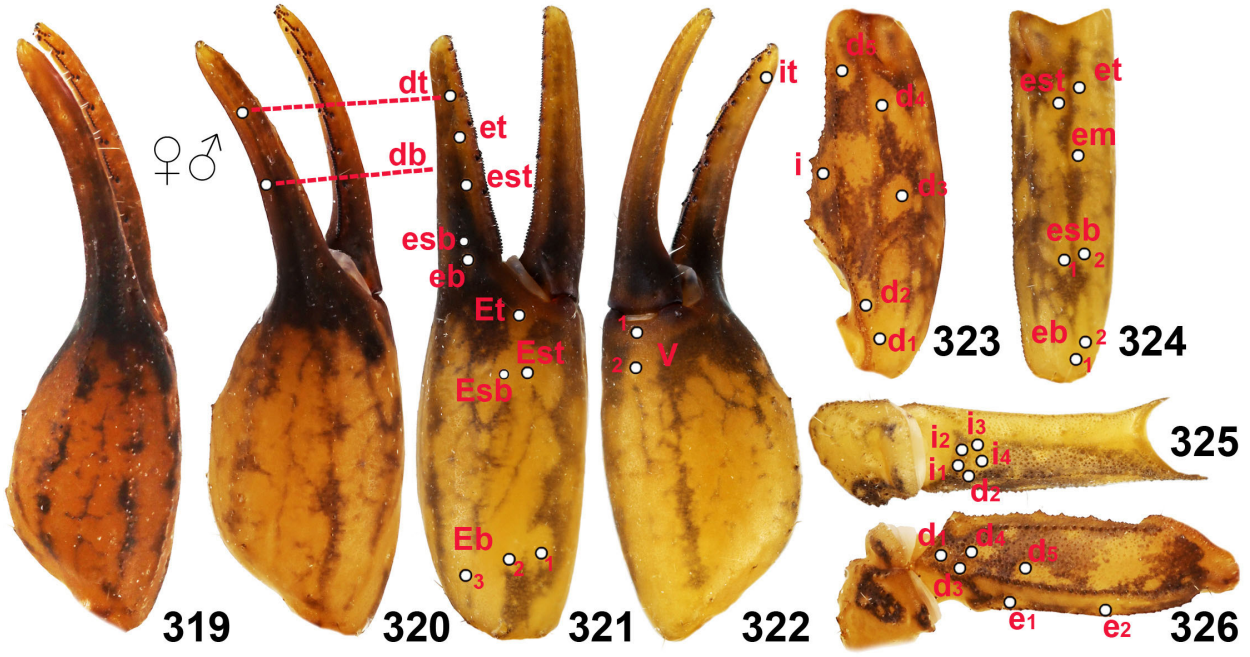
DESCRIPTION. Total length 27–39 mm. The habitus is shown in Figs. 313–306. For measurements and morphometric ratios see Tables 3 and 5. For position and distribution of trichobothria of pedipalps see Figs. 320–326. The male has slightly longer metasomal segments and telson (Figs. 331–318) and wider pedipalp chela than the female (Figs. 319–320).

Coloration (Figs. 303–306). Base color yellowish to reddish, with brown to black spots. Chelicera strongly reticulated, mainly anteriorly, with spotted fingers. Ventral surface of mesosoma and pedipalps yellowish brown with a pair of black spots on seventh sternite. Carapace and pedipalps dorsally and laterally yellowish to reddish, with brown to black spots, identical on femur, patella and manus of pedipalps. Pedipalp fingers reddish black. Legs with same color and pattern as pedipalp femur and patella. Metasomal segments yellowish to reddish with the spots. Older specimens have fourth and fifth metasomal segments reddish brown to black, both darker than the first to third segments. Telson reddish brown with spots but in older specimens could be black.

Mesosoma and carapace (Figs. 307–310). Carapace without carinae but with large granules. Mesosoma with one granulated median carina. Tergite VII pentacarinate. Seventh sternite with four incomplete carinae, sparsely granulate. The pectinal tooth count 11–15 in the females, 14–15 in the males. Pectines with three marginal lamellae, six or seven middle lamellae. Lamellae with numerous pale or reddish setae

Metasoma and telson (Figs. 213–214, 313–318, 413–414). First metasomal segment with 10 carinae, second to the fourth segments with eight carinae, fifth segment with five carinae well developed in the female, only indicated or absent in the male. Ventral carina present on telson. Intercarinal surfaces of metasoma granulated, in-

Figures 313–318: *Reddyanus ceylonensis* **sp**. **n**. from locality 15CI. **Figures 313–315**. Male holotype, metasoma and telson, lateral (313), ventral (314), and dorsal (315) views. **Figures 316–318**. Female paratype, metasoma and telson, lateral (316), ventral (317), and dorsal (318) views.



Figures 319–326: *Reddyanus ceylonensis* **sp**. **n**. from locality 15CI. **Figures 319**. Female partatype, pedipalp chela, dorsal view. **Figures 320–326**. Male holotype. Pedipalp chela, dorsal (320), external (321) and ventral (322) views. Pedipalp patella, dorsal (323) and external (324) views. Pedipalp femur and trochanter internal (325) and dorsal (326) views. The trichobothrial pattern is indicated in Figures 320–326.

cluding dorsal surface mainly in the female. In both sexes, posterior terminal tubercle of each dorsal carina on metasomal segments is not enlarged but only very slightly larger on second and third segments. Telson elongate, with subaculear tooth wide and rounded, dorsally with granules in three rows, four symmetrical granules and one or two granules on the tip.

Pedipalps (Figs. 229–230, 319–326). Femur and patella only very sparsely hirsute, with complete carinae, granulated. Dorsal carinae indicated on the chela manus in female, absent in male. Sixth row of granules on movable finger with one external granule. Seventh row of granules on fixed finger without additional granules.

Legs (Figs. 201–204). Femur and patella with complete carinae, granulated. Legs hirsute, without bristle combs.

Hemispermatophore (Figs. 327–330). Trunk moderately narrow, elongate, more than twice as long as capsule region. Flagellum long, slender, laminiform, with broad hyaline fin along internal margin of cylindrical core, distally coiled. Median lobe narrow, distally truncate, with thin dorsal lamina near internal margin. Basal lobe greatly enlarged, a narrow, angular, pointed hook-like process arising dorsally, separated from base of median lobe.

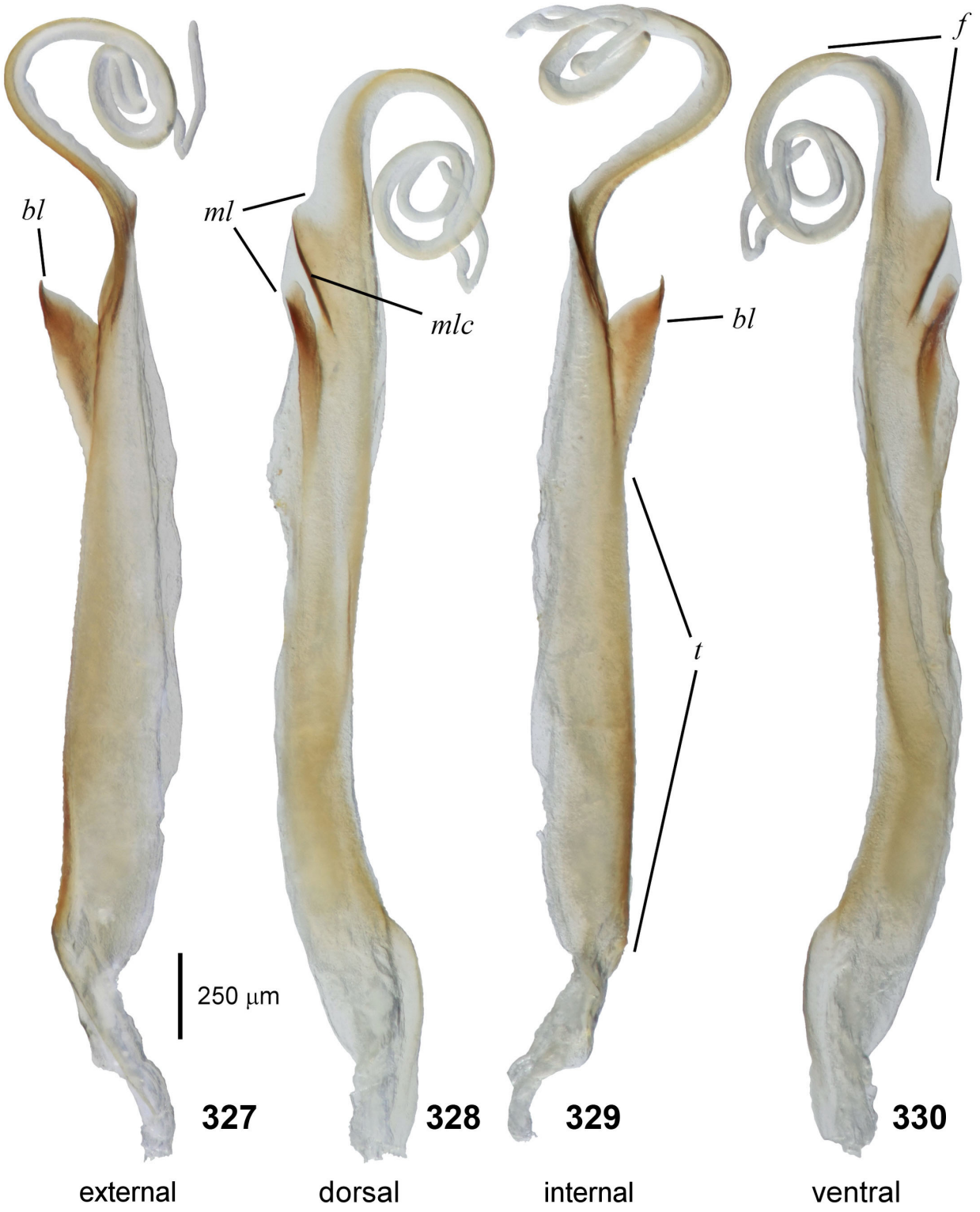
VARIABILITY. Males of Sri Lankan *Reddyanus* species could be adults after the third to fifth ecdysis. Small males after the third ecdysis may not exhibit some diagnositic characters such as fully developed shape of chela or telson.

AFFINITIES. The described features distinguish *R. ceylonensis* **sp**. **n**. from all other species of the genus, and are recounted in the key. The morphologically closest species is *R. besucheti*, from which *R. ceylonensis* **sp**. **n**. differs mainly by the longer and narrower metasoma in males, and other measurements compared in Tab. 5. *R. besucheti* and *R. ceylonensis* **sp**. **n**. are the only two Sri Lankan *Reddyanus* species with the movable finger shorter than the manus of the pedipalp chela in the male, and with sexual dimorphism in the width of the chela.

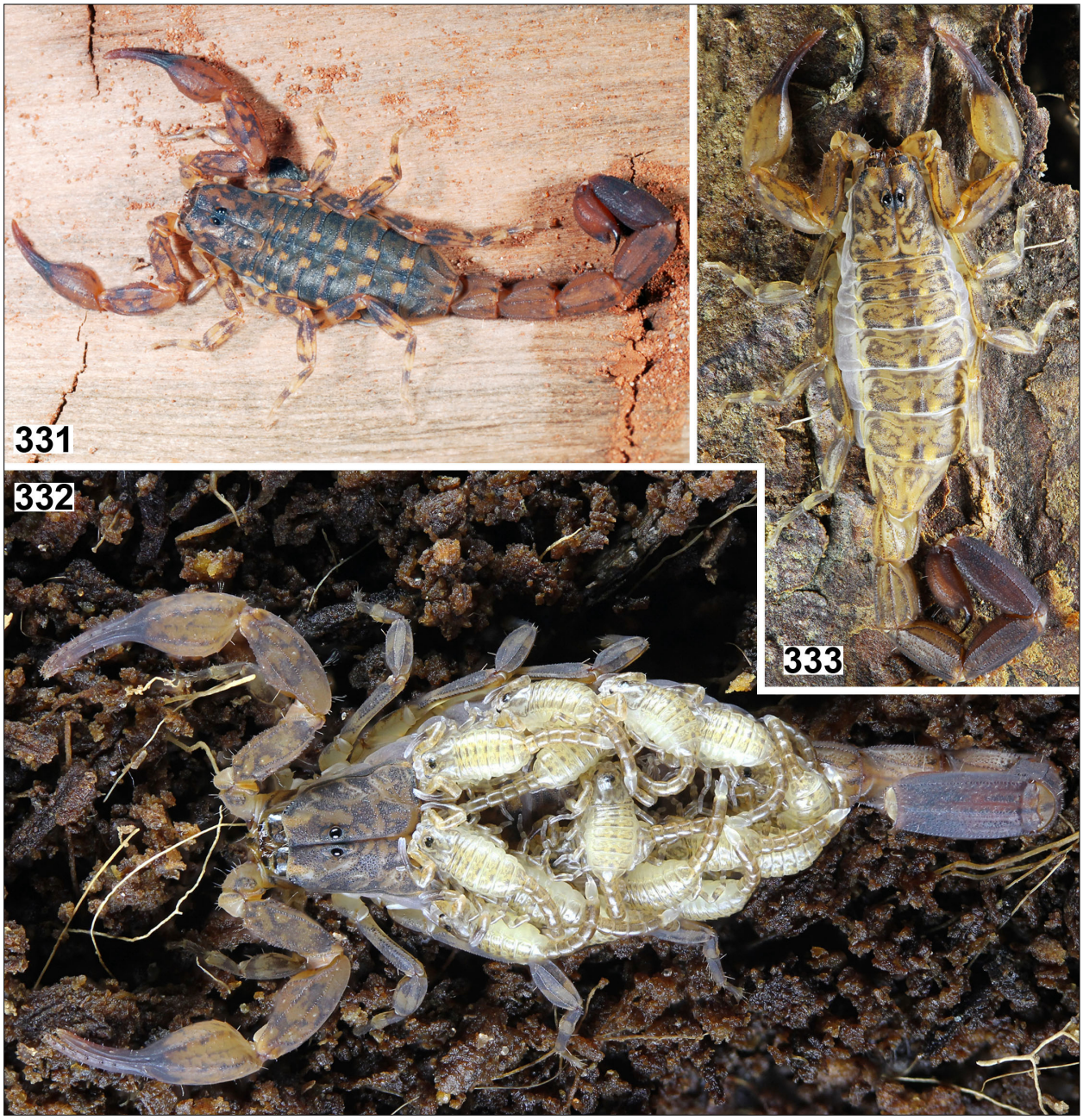
Reddyanus jayarathnei Kovařík, **sp**. **n**.
(Figs. 14, 206, 215–216, 231–232, 248, 257, 334–357, 415–416, 569, Tables 4–5)
http://www.zoobank.org/urn:lsid:zoobank.org:act:FE1515A9-8302-46D4-8298-11BFB4555882

TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka, Galle district, Kanneliya Rain Forest, 06°15'04" N 80°20'18" E; UPSL.

TYPE MATERIAL. Sri Lanka, Galle District, Kanneliya Rain Forest, 06°15'04" N 80°20'18" E (Fig. 357), 1♂ (holotype, Fig. 356) 1♀ (paratype, Fig. 355), UPSL, 1♂ (paratype, Figs. 206, 215, 231, 248, 257, 334–335, 338,



Figures 327–330: Left hemispermatophore of *Reddyanus ceylonensis* **sp**. **n**. male paratype from locality 15CI. External (327), dorsal (328), internal (329) and ventral (330) views. Extracted after 4th ecdysis. A second hemispermatophore examined from a second male after 5th ecdysis was similar. Scale bar: 250 µm. Abbreviations: *bl*, basal lobe; *f*, flagellum; *ml*, median lobe; *mlc*, median lobe carina; *t*, trunk.

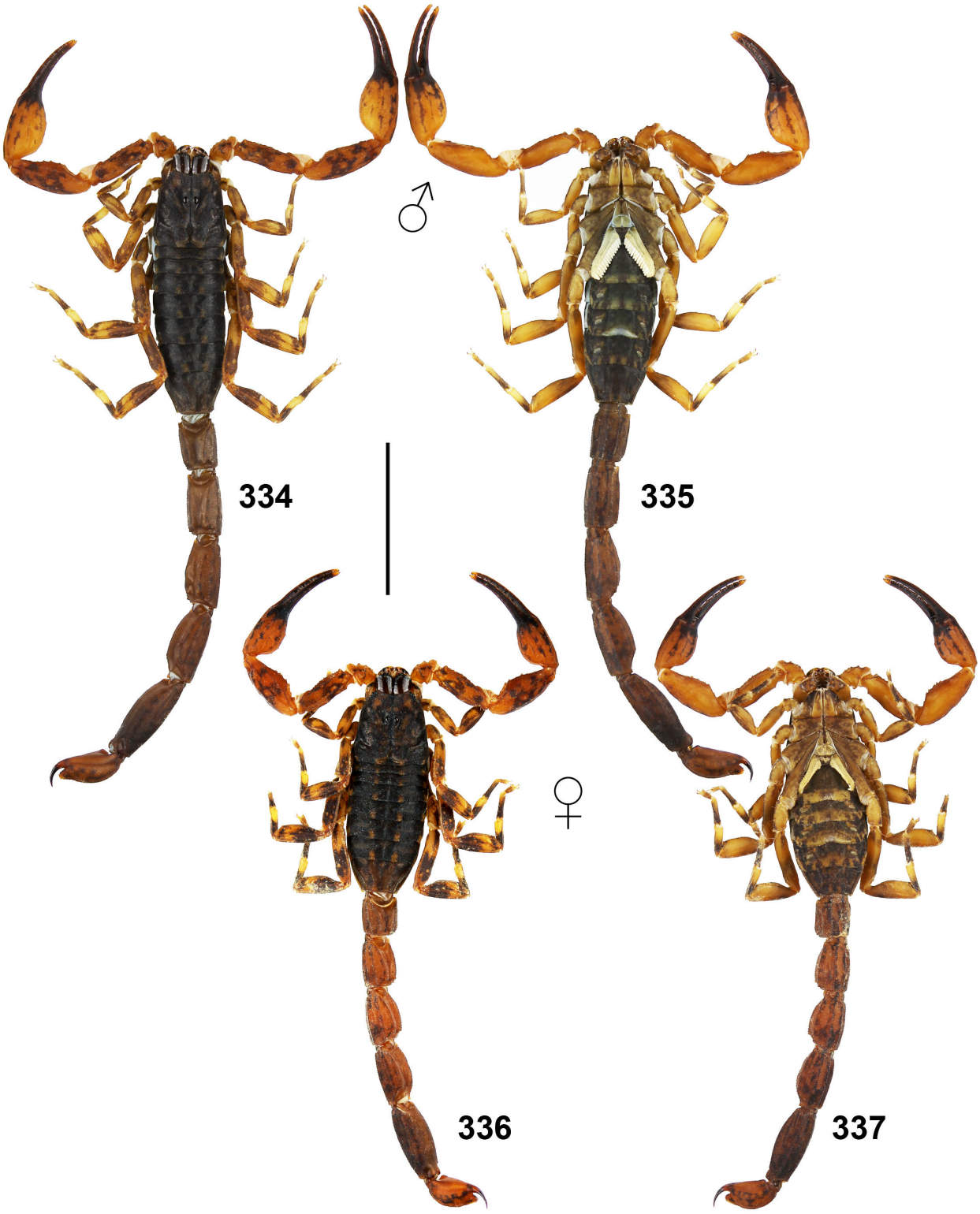


Figures 331–333: *Reddyanus ceylonensis* **sp**. **n**., female from locality 15CH (331), female from locality 15CI with newborns before first ecdysis (332), and male from locality 15CI (333).

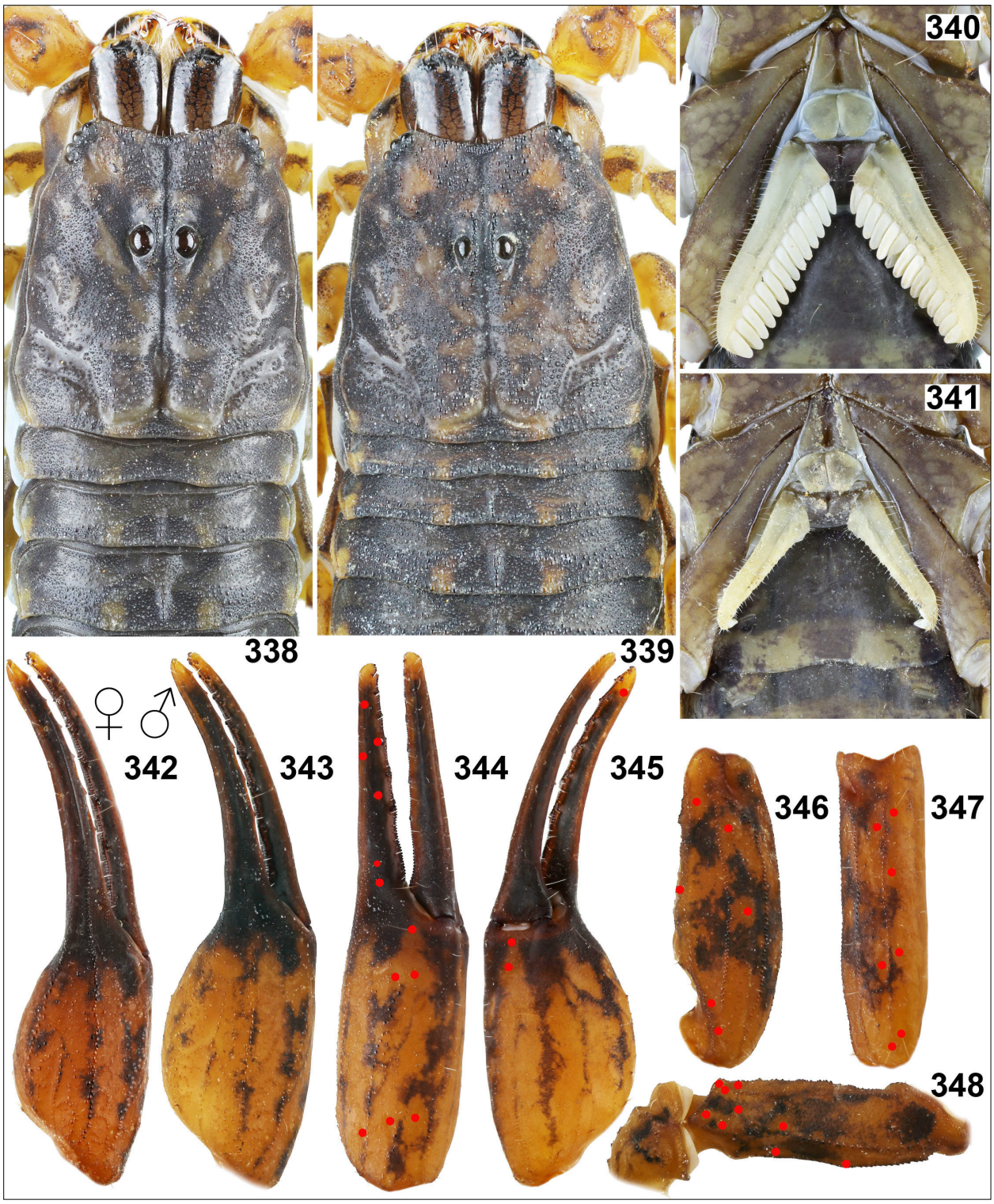
340, 343–351, 415, 569) 1♀ (paratype, Figs. 216, 232, 336–337, 339, 341–342, 352–354, 416), FKCP, V.–XI.2015, leg. S. Jayarathne.

ETYMOLOGY. Named after V. A. Sanjeewa Jayarathne who collected the types.

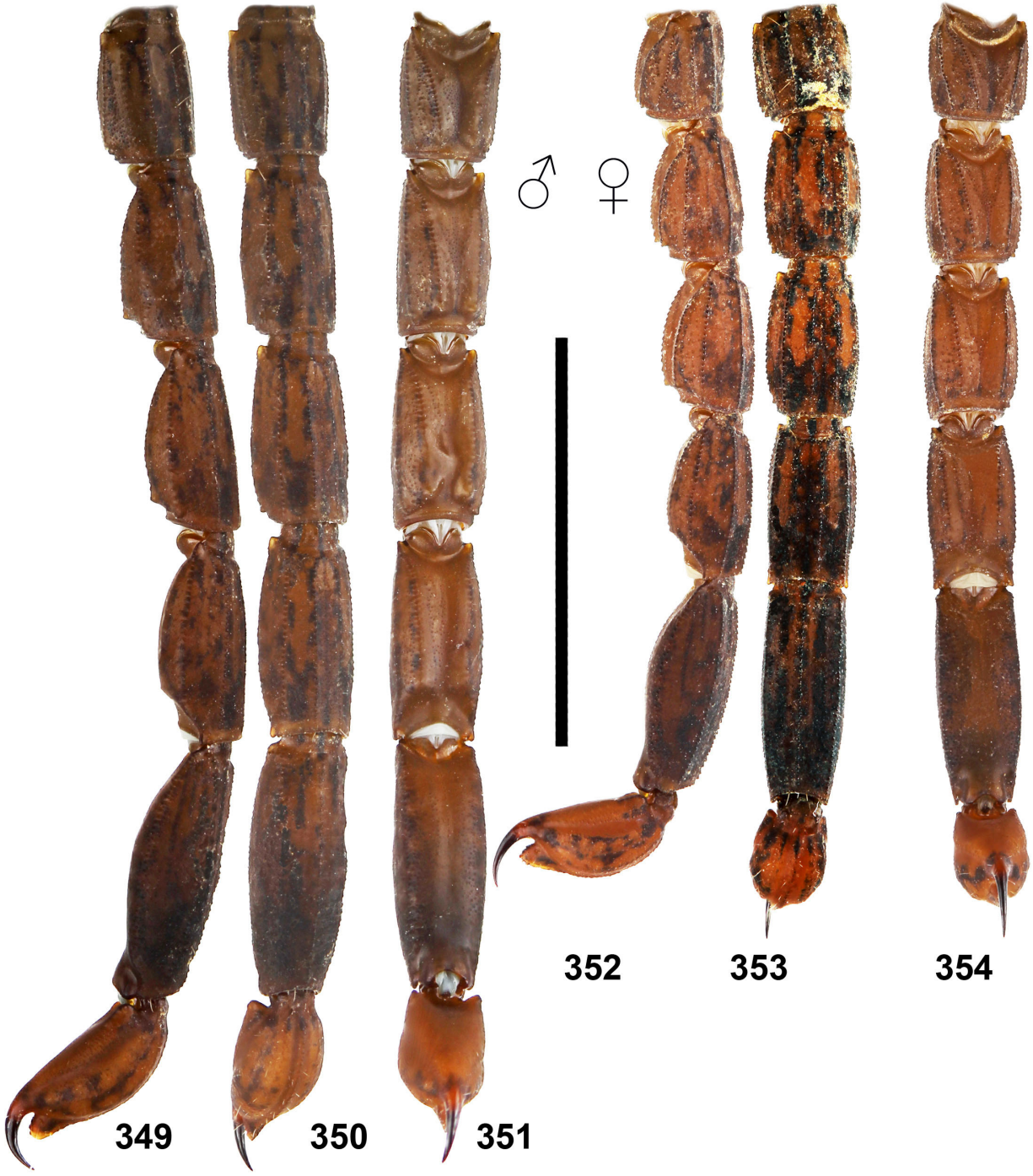
DIAGNOSIS. Total length 37.1 mm (female) – 45.5 mm (male). Male with slightly longer metasomal segments and telson than female. Pedipalp segments approximately the same length and width in both sexes. Pedipalp movable finger longer than manus of chela in both sexes. Pedipalps and legs with brown maculation, identical on femur and patella. First metasomal segment bears 10 carinae, second through fourth segments bear eight carinae, fifth segment bears five carinae in female and three to five in male. Posterior terminal tubercle of each dorsal carina on metasomal segments of both sexes scarcely larger than preceding tubercles. Subaculear tooth wide and rounded, dorsally with granules in four



Figures 334–337: *Reddyanus jayarathnei* **sp**. **n**., paratypes. **Figures 334–335**. Male in dorsal (334) and ventral (335) views. **Figures 336–337**. Female in dorsal (336) and ventral (337) views. Scale bar: 10 mm.



Figures 338–348: *Reddyanus jayarathnei* **sp**. **n**., paratypes. **Figures 338, 340, 343–348**. Male, chelicerae, carapace and tergites I–III (338), sternopectinal region (340). Pedipalp chela, dorsal (343), external (344) and ventral (345) views. Pedipalp patella, dorsal (346) and external (347) views. Pedipalp femur and trochanter dorsal (348) view. The trichobothrial pattern is indicated in Figures 344–348. **Figures 339, 341–342**. Female, chelicerae, carapace and tergites I–III (339), sternopectinal region and sternite III (341), and pedipalp chela dorsal view (342).

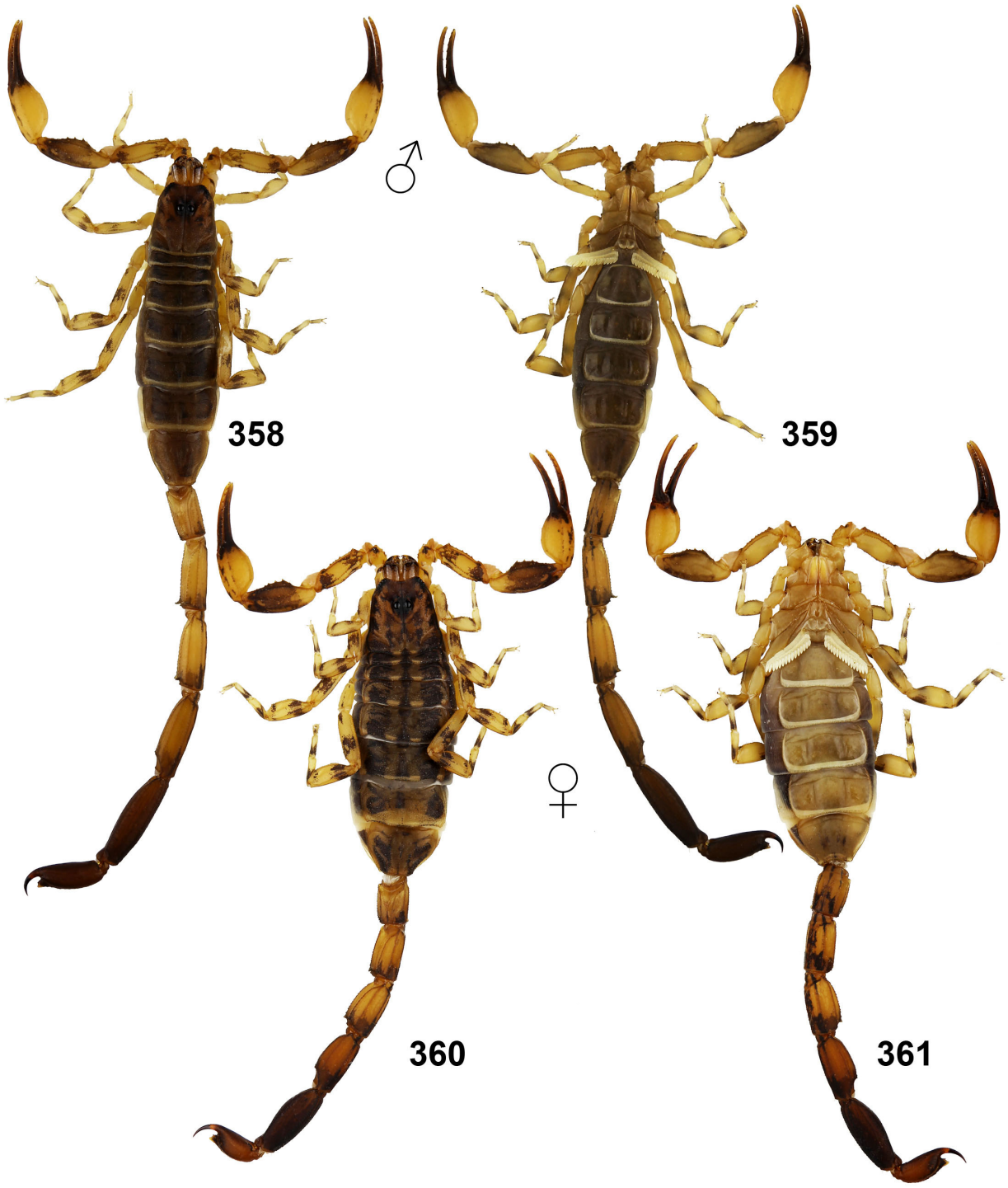


Figures 349–354: *Reddyanus jayarathnei* **sp**. **n**., paratypes. **Figures 349–351**. Male, metasoma and telson, lateral (349), ventral (350), and dorsal (351) views. **Figures 352–354**. Female, metasoma and telson, lateral (352), ventral (353), and dorsal (354) views. Scale bar: 10 mm.

rows; six symmetrical granules in three rows and one or two granules on tip. Ratio of metasomal segment II length/ width 1.81 in male. Glabrous zone on posterior part of fifth sternite present medially in male. Pectinal teeth number 12 in female, 14 in male.

DESCRIPTION. Total length 37.1 mm (female paratype) – 45.5 mm (male holotype). The habitus is shown in Figs. 334–337. For measurements and ratios see Tables 4–5. For position and distribution of trichobothria of pedipalps see Figs. 344–348. The male has slightly longer meta-

Figures 355–357: *Reddyanus jayarathnei* **sp**. **n**., female paratype (355) and male holotype (356) at the type locality (357), Galle district, Kanneliya Rain Forest, 06°15'04" N 80°20'18" E.

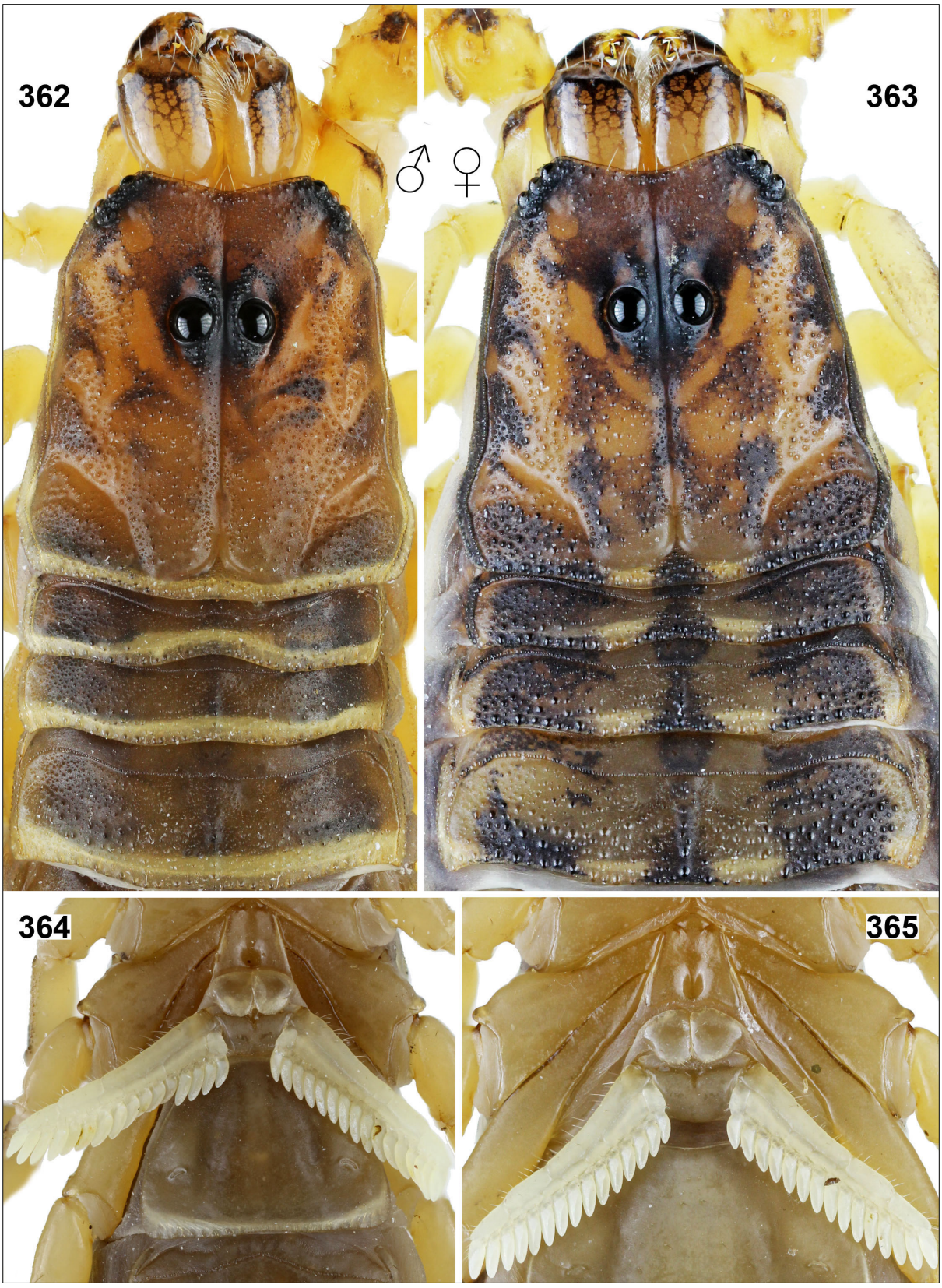


Figures 358–361: *Reddyanus loebli* from locality 15CG. **Figures 358–359**. Male in dorsal (358) and ventral (359) views. **Figures 360–361**. Female in dorsal (360) and ventral (361) views.

somal segments and telson than the female (Figs. 349–354).

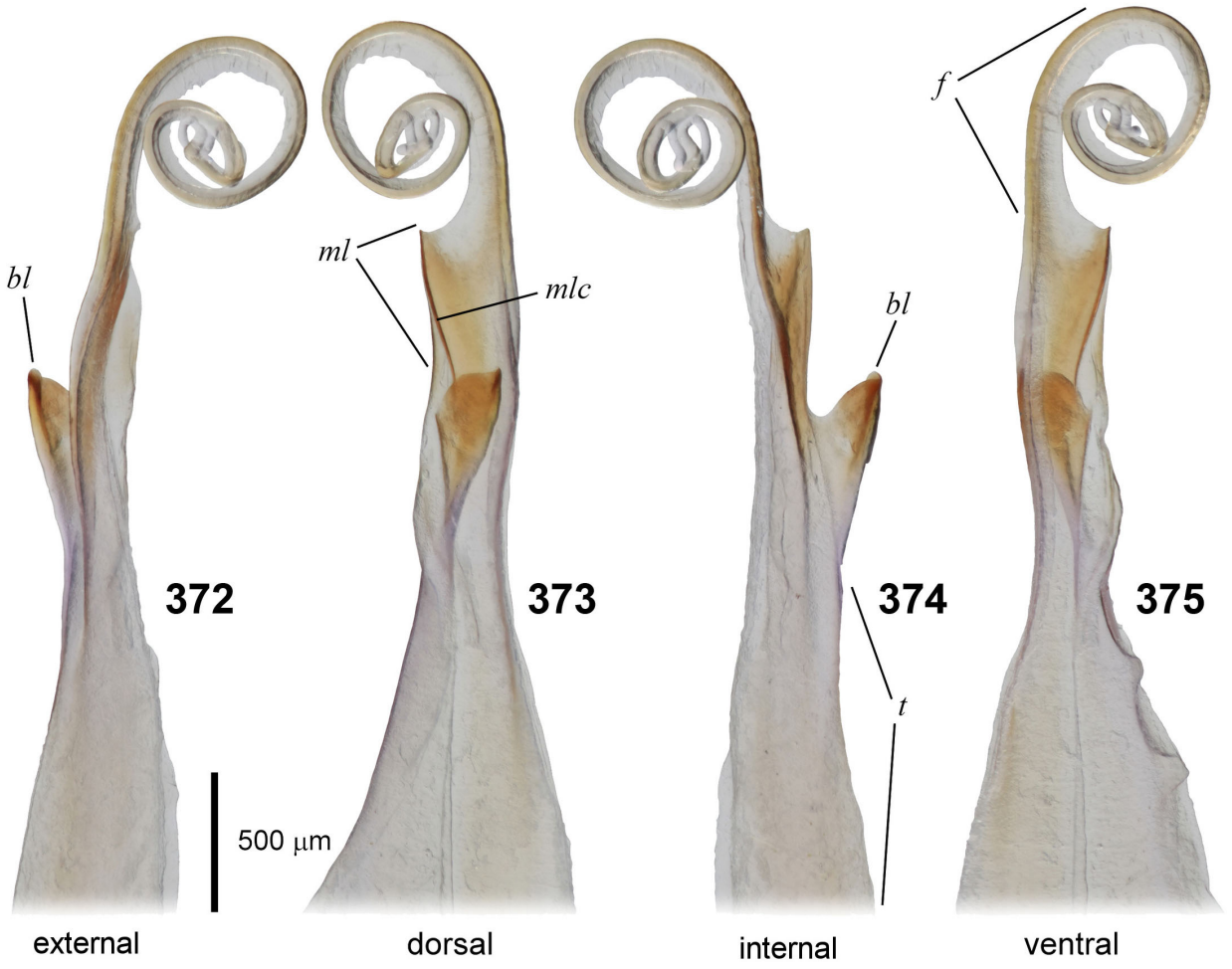
Coloration (Figs. 334–337). Entire mesosoma and carapace dark, almost black with yellow to reddish spots. Chelicera strongly reticulated, with spotted fingers. Pedipalps dorsally and laterally reddish, with brown to black spots, identical on femur and patella. Pedipalp chela fingers reddish black. Legs with same color and pattern as pedipalp femur and patella. Metasomal segments reddish brown with the spots. Telson reddish brown with spots.

Mesosoma and carapace (Figs. 338–341). Carapace without carinae but with large granules. Mesosoma with one granulated median carina. Tergite VII pentacarinate.



Figures 362–365: *Reddyanus loebli* from locality 15CG. **Figures 362, 364**. Male, chelicerae, carapace and tergites I–III (362), sternopectinal region and sternite III (364). **Figures 363, 365**. Female, chelicerae, carapace and tergites I–III (363), and sternopectinal region (365).

Figures 366–371: *Reddyanus loebli* from locality 15CG. **Figures 366–368**. Male, metasoma and telson, lateral (366), ventral (367), and dorsal (368) views. **Figures 369–371**. Female, metasoma and telson, lateral (369), ventral (370), and dorsal (371) views.



Figures 372–375: Distal trunk, capsule region and flagellum of left hemispermatophore of *Reddyanus loebli* from locality 15CH. External (372), dorsal (373), internal (374) and ventral (375) views. Extracted after 5th ecdysis. Note: this hemispermatopore was folded along a dorsal line and flattened; dorsal and ventral views show it as unfolded and flat, hence the broad appearance of the trunk. Compare with Figs. 283–286 and 327–330 which show typical *Reddyanus* hemispermatophores with trunk in natural curved conformation. Scale bar: 500 μm. Abbreviations: *bl*, basal lobe; *f*, flagellum; *ml*, median lobe; *mlc*, median lobe carina; *t*, trunk.

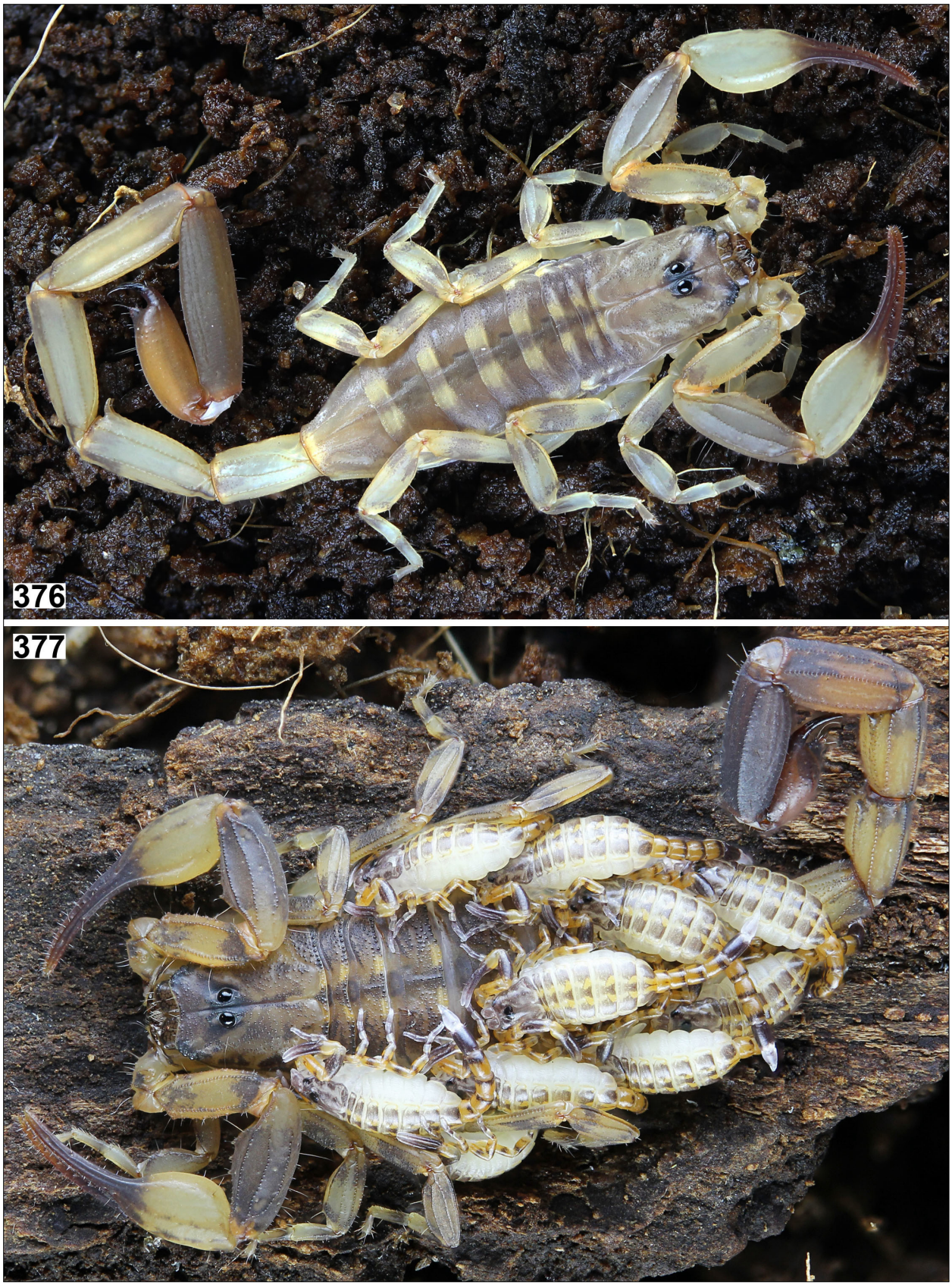
Fifth sternite with glabrous zone on posterior medial part in the male. Seventh sternite with four incomplete carinae, sparsely granulate. Pectinal tooth count is 12 in the female, 14 in the male. Pectines with three marginal lamellae and seven middle lamellae. The lamellae bear numerous pale setae.

Metasoma and telson (Figs. 215–216, 349–354, 415–416). The first metasomal segment bears 10 carinae and the second to the fourth segments bear eight carinae, the fifth segment bears five carinae well developed in the female and only indicated or absent in the male. Lateral inframedian carinae may be indicated on second metasomal segment. Ventral carina present on telson. Intercarinal surfaces of metasoma granulated including dorsal surface mainly in the female. In both sexes, posterior terminal tubercle of each dorsal carina on metasomal segments not enlarged. Telson elongate, with subaculear tooth wide and rounded, dorsally with granules in four rows; six symmetrical granules in three rows and one or two granules on the tip.

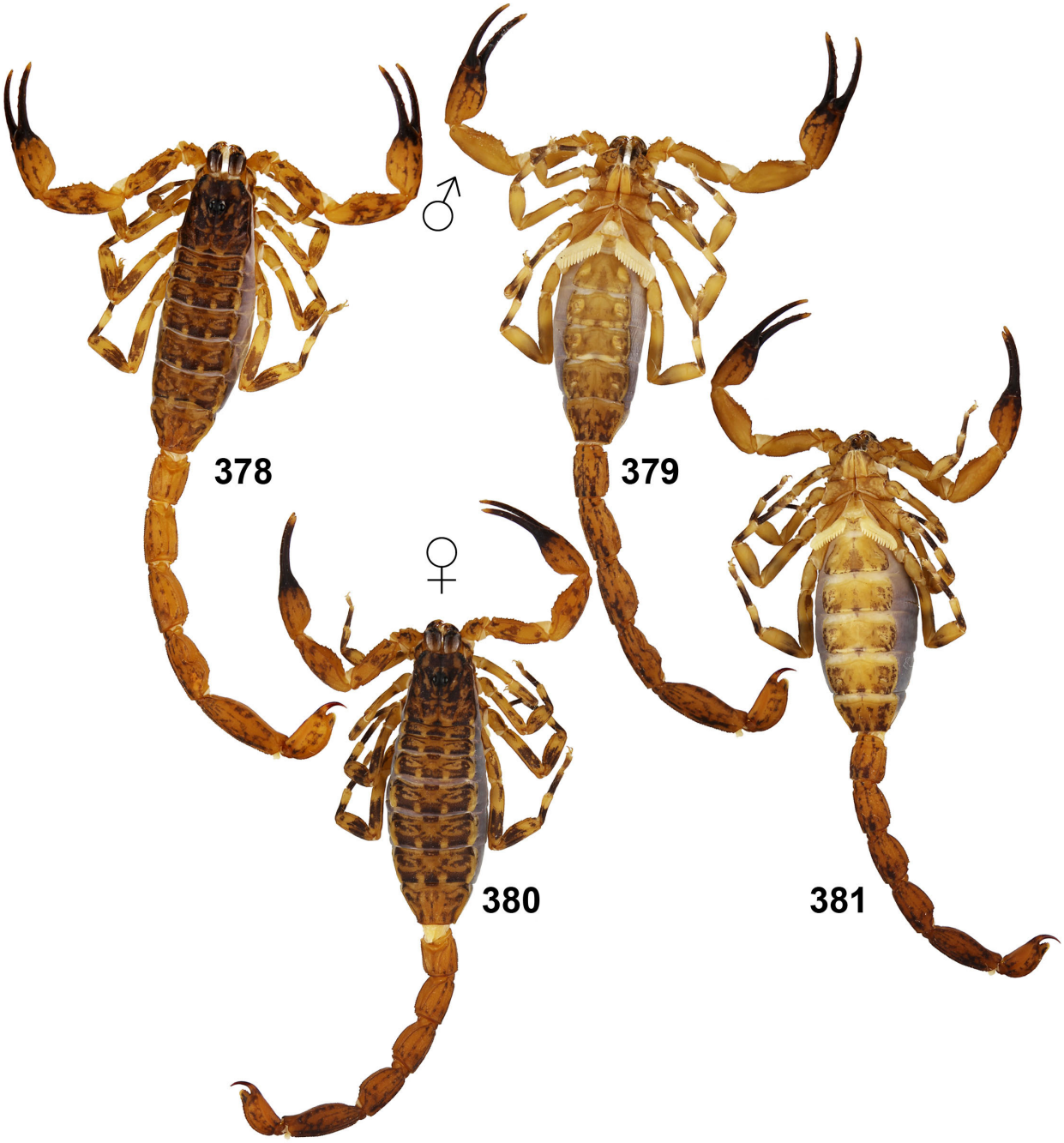
Pedipalps (Figs. 231–232, 342–348). Femur and patella only very sparsely hirsute, with complete carinae, granulated. Dorsal carinae indicated on chela manus in both sexes. Sixth row of granules on movable finger with one external granule. The seventh row of granules on the fixed finger without additional granules.

Legs (Fig. 206). Femur and patella bear complete carinae and are granulated. Legs hirsute without bristle combs.

AFFINITIES. The described features distinguish *R. jayarathnei* **sp. n.** from all other species of the genus. *R. jayarathnei* sp. n. is well characterized by the glabrous zone on the posterior medial part of the fifth sternite in the male, which is not as extensive in *R. ranawanai* **sp. n.** (Fig. 570 versus Fig. 569) and is absent in other Sri Lankan *Reddyanus* species (Figs. 567–568).



Figures 376–377: *Reddyanus loebli* from locality 15CH, male (376) and female with newborns (377).



Figures 378–381: *Reddyanus ranawanai* **sp**. **n**. **Figures 378–379**. Male holotype in dorsal (378) and ventral (379) views. **Figures 380–381**. Female paratype in dorsal (380) and ventral (381) views.

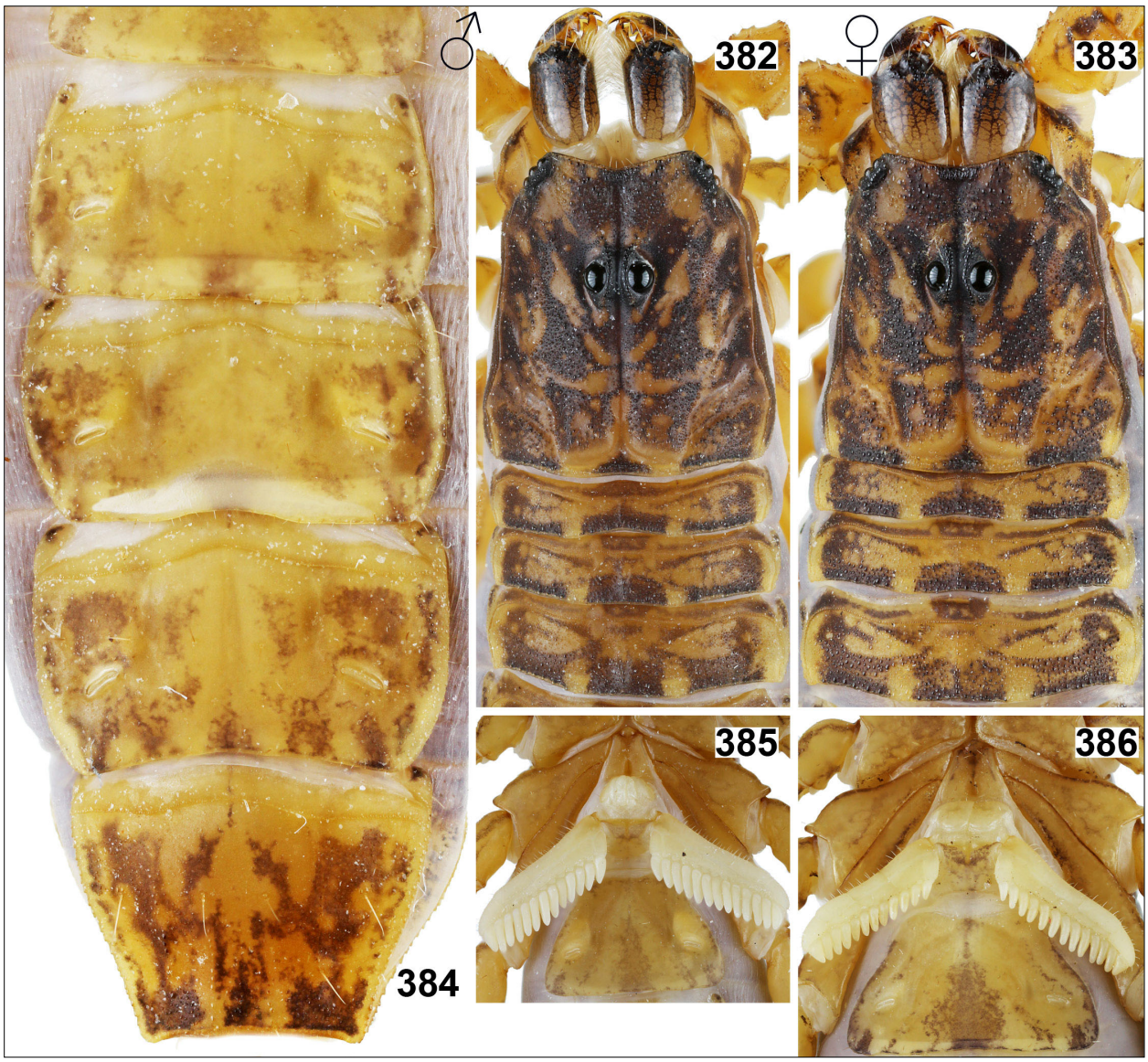
Reddyanus loebli (Vachon, 1982) **comb. n.**
(Figs. 14, 207, 217–218, 233–234, 249, 258, 358–377, 417–418, 554, 561, 563, Table 5)

Isometrus (*Reddyanus*) *acanthurus loebli* Vachon, 1982: 98–99, figs 48, 58–63, 92–93; Fet & Lowe, 2000: 151.

Isometrus (*Reddyanus*) *loebli*: Lourenço & Huber, 2002: 267; Kovařík, 2003: 10; Kovařík & Ojanguren, 2013: 190, 348, figs. 1279–1280 (reference list until 2013).

= *Isometrus* (*Reddyanus*) *garyi* Lourenço & Huber, 2002: 270–273, figs. 13–18; Kovařík & Ojanguren, 2013: 187–188, 347, 350, figs. 1266, 1304–1307 (reference list until 2013). **Syn**. **n**.

TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka, Kandy; MNHN RS 1164.



Figures 382–386: *Reddyanus ranawanai* **sp**. **n**. **Figures 382, 384–385**. Male holotype, chelicerae, carapace and tergites I–III (382), sternites IV–VII (384), and sternopectinal region (385). **Figures 383, 386**. Female paratype, chelicerae, carapace and tergites I–III (383), and sternopectinal region with sternite III (386).

TYPE MATERIAL EXAMINED. Sri Lanka, Mannar District, beside an irrigation canal, Madhu Road, 50 ft., 23.III. 1970, leg. Davis et Rowe, 1♀juv., holotype of *Isometrus* (*Reddyanus*) *garyi* (figs. 1266, 1304–1307 in Kovařík & Ojanguren, 2013: 187–188, 347, 350), MHNG.

OTHER MATERIAL EXAMINED. Sri Lanka, Central Province, Matale District, Habarana, Wananiwahana Resort, 07°59'25.8"N 080°43'24.6"E, 280 m a.s.l. (Locality **15CG**, Figs. 582–583), 23. –24.IV.2015, 1♂ (Figs. 207, 217, 233, 249, 258, 358–359, 362, 364, 366–368, 417, 561, 563) 1♀ (Figs. 218, 234, 360–361, 363, 365, 369–371, 418) 1juv, FKCP, leg. Kovařík et al.; Northern Province, Mannar District, Madhu Road, 08°48'26.3"N 080°10'26"E, 90 m a.s.l. (Locality **15CH**, Fig. 584), 24. –25.IV.2015, 2♂ (Figs. 372–375, 376, 554) 1♀ (Fig. 377), FKCP, leg. Kovařík et al.; Northern Province, Mannar District, Marichchukkaddi env, border of Wilpattu National Park, 08°33'32.3"N 079°56'51"E, 7 m a.s.l. (Locality **15CI**, Fig. 585), 25. –26.IV.2015, 1♂ 1♀1juv., FKCP, leg. Kovařík et al.; North Central Province, Anuradhapura District, Mihintale, 08°20'51.8"N 080°30'27.7"E, 156 m a.s.l. (Locality **15CL**, Fig. 589), 27. –28.IV.2015, 1♂1♀1juv.♀, FKCP, 2♀, UPSL, leg. Kovařík et al.; Central Province, Matale District, Pallegama, 07°32'49.5"N 080°47'50"E, 434 m a.s.l. (Locality **15CM**, Fig. 590), 28.IV.2015, 1♀, FKCP, leg. Kovařík et al.; North Central Province, Puttalam Dis-

Figures 387–392: *Reddyanus ranawanai* **sp**. **n**. **Figures 387–389**. Male holotype, metasoma and telson, lateral (387), ventral (388), and dorsal (389) views. **Figures 390–392**. Female paratype, metasoma and telson, lateral (390), ventral (391), and dorsal (392) views. Scale bar: 10 mm.

trict, Eluwankulam, 08°12'35.1"N 079°51'32"E, 52 m a.s.l. (Locality **15CN**, Fig. 591), 28.IV.2015, 1juv., FKCP, leg. Kovařík et al.; Uva Province, Monaragala District, Monaragala, 06°52'30.7"N 081°21'17"E, 288 m a.s.l. (Locality **15CQ**, Fig. 595), 2.–3.V.2015, 1♂1♀, FKCP, 1♂4♀, UPSL, leg. Kovařík et al.; Eastern Province, Ampara District, Lahugala Kitulana National Park, 06°52'46"N 081°43'21.8"E, 40 m a.s.l. (Locality **15CR**, Fig. 596), 3.–4.V.2015, 1♂1♀1juv., FKCP, 1♂4♀2juvs, UPSL, leg. Kovařík et al.; Eastern Province, Ampara District, Ampara env., 07°20'01.3"N 081°41'57.1"E, 56 m a.s.l. (Locality **15CS**, Fig. 597),

Figures 393–400: *Reddyanus ranawanai* **sp**. **n**. **Figure 393**. Female paratype, pedipalp chela dorsal. **Figures 394–400**. Male holotype. Pedipalp chela, dorsal (394), external (395) and ventral (396) views. Pedipalp patella, dorsal (397) and external (398) views. Pedipalp femur internal (399) and trochanter and femur dorsal (400) views. The trichobothrial pattern is indicated in Figures 395–400.

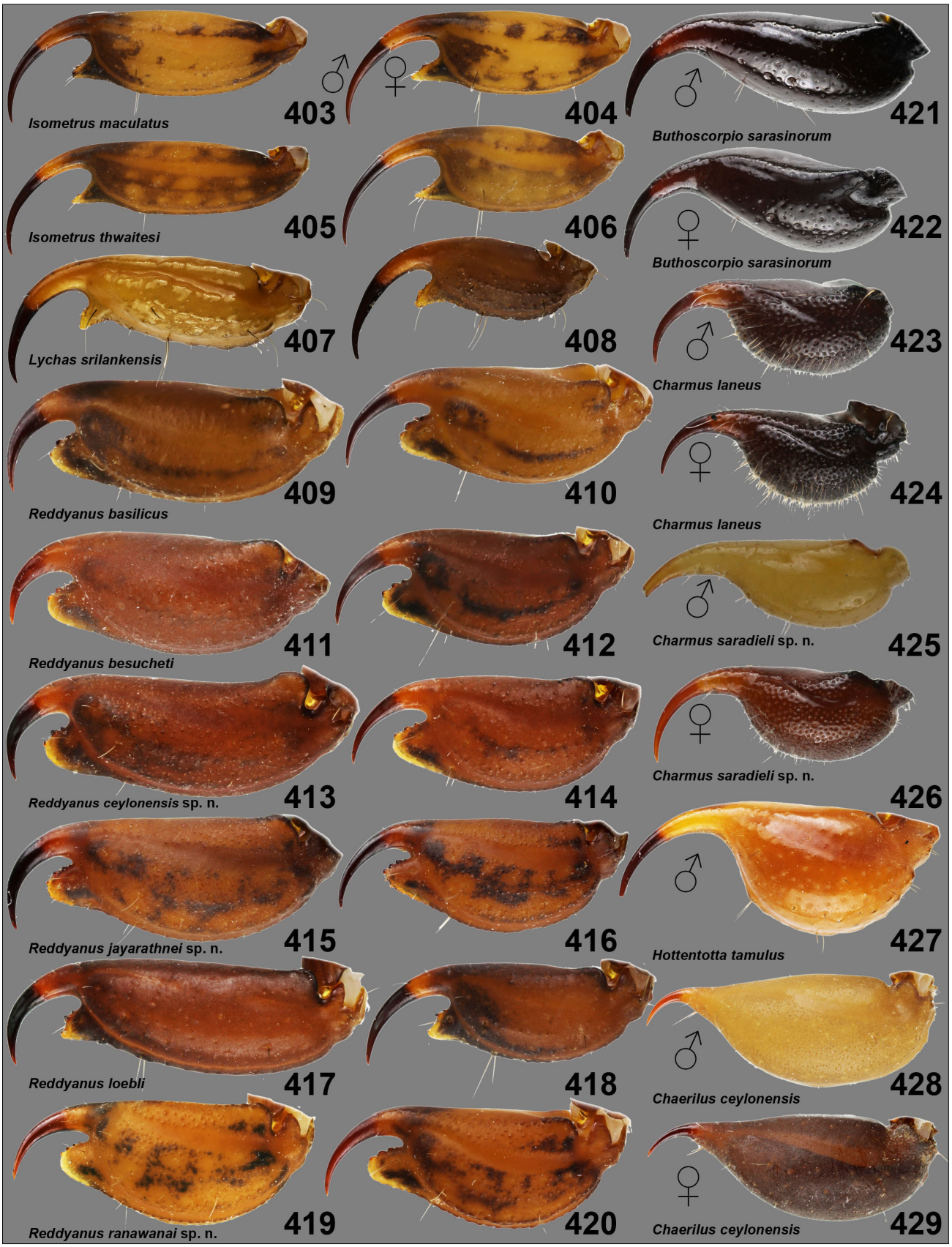
4.V.2015, 1♂1♀, FKCP, 2♀1juv., UPSL, leg. Kovařík et al.; Central Province, Kandy District, Tree Centre, Wildlife Trust Sri Lanka "Rantambe", 07°12'22.1"N 080°57'20.7"E, 171 m a.s.l. (Locality **15CT**, Fig. 598), 5.V.2015, 2♀, FKCP, leg. Kovařík et al.

DIAGNOSIS. Total length 26–45 mm. Male with longer metasomal segments and telson. Pedipalp segments approximately the same length and width in both sexes. Pedipalps and legs yellow with several small brown spots. Base color yellow with black spots. Pedipalp femur and patella spotted, patella mostly black, femur mostly yellow. Posterior terminal tubercle of dorsal carina on second metasomal segment of male markedly enlarged; on third metasomal segment of male partly enlarged; terminal tubercle of dorsal carina on other metasomal segments of male scarcely larger than preceding granules. Subaculear tooth more or less pointed, termination not rounded, dorsally with two pairs of granules and one or two terminal granules. Pectinal teeth number 14–17 in both sexes.

HEMISPERMATOPHORE (Figs. 372–375). Trunk moderately narrow, at least twice as long as capsule region. Capsule region narrow. Flagellum long, slender, laminiform, with broad hyaline fin along internal margin of cylindrical core, distally coiled. Median lobe broad, distally truncate, with thin dorsal lamina near internal margin terminating in distal cusp. Basal lobe enlarged, a narrow, angular, pointed hook-like process arising dorsally, separated from base of median lobe. Translucent structures with a light violet tint.

COMPARISONS. The hemispermatophore of *R. loebli* **comb. n.** differs from those of *R. basilicus* **comb. n.** and *R. ceylonensis* **sp**. **n**. by having a median lobe terminating distally in a pointed cusp (vs. a rounded margin), and a smaller basal lobe with apex blunt (vs. sharp) in lateral view. *R. loebli* also differs from all other Sri Lankan *Reddyanus* species in external characters (c.f. Figs. 217, 561, showing the enlarged terminal tubercle of dorsal carina on the second metasomal segment of the male; and Figs. 417–418, showing the pointed subaculear tooth in both sexes) and in behavior (all other Sri Lankan *Reddyanus* species forage at ground level among leaf litter, whereas *R. loebli* usually sits under the scales of bark of standing tree trunks, c.f. Fig. 583). Also, first instar juveniles *R. loebli* are different colored than those of other Sri Lankan *Reddyanus* species (c.f. Fig. 377 versus Figs. 288 and 332).

Figures 401–402: *Reddyanus ranawanai* **sp**. **n**., female paratype (401) and male holotype (402).


403 ♂
Isometrus maculatus
404 ♀
405
Isometrus thwaitesi
406
407
Lychas srilankensis
408
409
Reddyanus basilicus
410
411
Reddyanus besucheti
412
413
Reddyanus ceylonensis sp. n.
414
415
Reddyanus jayarathnei sp. n.
416
417
Reddyanus loebli
418
419
Reddyanus ranawanai sp. n.
420
421 ♂
Buthoscorpio sarasinorum
422 ♀
Buthoscorpio sarasinorum
423 ♂
Charmus laneus
424 ♀
Charmus laneus
425 ♂
Charmus saradieli sp. n.
426 ♀
Charmus saradieli sp. n.
427 ♂
Hottentotta tamulus
428 ♂
Chaerilus ceylonensis
429 ♀
Chaerilus ceylonensis

COMMENTS. *Isometrus* (*Reddyanus*) *garyi* Lourenço et Huber, 2002 was based on two juveniles (the holotype is 28 mm long, the second juvenile is smaller), which the authors compared only to *I.*(*R.*) *besucheti*. They ignored *R. loebli*, the only species of Sri Lankan *Reddyanus* with a pointed (spinoid) subaculear tooth (Figs. 417–418) in juveniles. Although *R. loebli* is characterized by a markedly enlarged terminal tubercle of the dorsal carina on the second metasomal segment of the male (Fig. 217), this character is missing in females (Fig. 218) and juveniles. Thus, we consider *Isometrus* (*Reddyanus*) *garyi* to be a junior synonym of *Reddyanus loebli*.

DISTRIBUTION. Sri Lanka.

Figures 403–429: Telson, lateral view of Sri Lankan Buthidae and Chaerilidae species. **Figures 403–404**. *Isometrus maculatus*, male from locality 15CP (403) and female from locality 15CI (404). **Figures 405–406**. *I. thwaitesi*, male from locality 15CH (405) and female from locality 15CO (406). **Figures 407–408**. *Lychas srilankensis*, male (407) and female (408) from locality 15CJ. **Figures 409–410**. *Reddyanus basilicus*, male (409) and female (410) from locality 15CR. **Figures 411–412**. *R. besucheti*, male holotype (411) and female from locality 15CG (412). **Figures 413–414**. *R. ceylonensis* **sp**. **n**., male holotype (413) and female paratype (414) from locality 15CI. **Figures 415–416**. *R. jayarathnei* **sp**. **n.,** male (415) and female (416) paratypes. **Figures 417–418**. *R. loebli*, male (417) and female (418) from locality 15CG. **Figures 419–420**. *R. ranawanai* **sp**. **n**., male holotype (419) and female paratype (420). **Figures 421–422**: *Buthoscorpio sarasinorum*, male from locality 15CF (421) and female from locality 15CG (422). **Figures 423–424**. *Charmus laneus*, male (423) and female (424) from locality 15CO. **Figures 425–426**. *Charmus saradieli* **sp**. **n**. male paratype (425) (MHNG) and female holotype (426). **Figurs 427**. *Hottentotta tamulus*, male from locality 15CK (427). **Figures 428–429**. *Chaerilus ceylonensis*, male (428) and female (429) from locality 15CD.

Reddyanus ranawanai Kovařík, **sp**. **n**.
(Figs. 14, 208, 219–220, 235–236, 250, 259, 378–401, 419–420, 570, Tables 4–5)
http://www.zoobank.org/urn:lsid:zoobank.org:act:D6B4D355-F67F-4D3C-94A5-6782DD9E1986

Isometrus (*Reddyanus*) *basilicus*: Kovařík, 2003: 5 (in part); Kovařík & Ojanguren, 2013: 186 (in part), 347, 350, 359, figs. 1267, 1308–1311, 1393–1395.

TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka, Kandy; FKCP.

TYPE MATERIAL. Sri Lanka, Kandy, IV.2001, 1♂ after fifth ecdysis (holotype, Figs. 208, 219, 235, 250, 259, 378–379, 382, 384–385, 387–389, 394–400, 402, 419), 1♂3♀ (paratypes, Figs. 220, 236, 380–381, 383, 386, 390–393, 401, 420, 570), FKCP, leg. V. Fura.

ETYMOLOGY. Named after Prof. Kithsiri B. Ranawana who organized our Sri Lankan expedition.

DIAGNOSIS. Total length 35–43 mm. Male with very slightly longer metasomal segments than female. Pedipalp segments and telson approximately the same length and width in both sexes. Pedipalp movable finger longer than manus of chela in both sexes. Pedipalps and legs with brown maculation, identical on femur and patella. First metasomal segment with 10 carinae, second through fourth segments with eight carinae, fifth segment with five carinae in female and three to five in male. Posterior terminal tubercle of each dorsal carina on metasomal segments of both sexes scarcely larger than preceding tubercles. Subaculear tooth wide and rounded, dorsally with granules in four rows; six symmetrical granules in three rows and one or two granules on tip. Ratio metasomal segment II length/ width 1.78–1.80 in male. Glabrous zone stretching over almost whole posterior margin of fifth sternite. Pectinal teeth number 12–14 in both sexes.

DESCRIPTION. Total length 35–43 mm. The habitus is shown in Figs. 378–381. For measurements and ratios see Tables 4–5. For positions and distribution of trichobothria see Figs. 395–400. The male has very slightly longer metasomal segments than the female. Length and width of the telson is approximately the same in both sexes (Figs. 419–420).

Coloration (Figs. 378–381). Base color reddish, with brown to black spots. Chelicera strongly reticulated mainly anteriorly, with spotted fingers. Ventral surface of mesosoma and pedipalps yellowish brown with a pair of black spots mainly on the sixth and seventh sternites. The carapace and pedipalps dorsally and laterally yellowish to reddish, with brown to black spots, identical on pedipalp femur, patella and manus. Pedipalp fingers reddish black. Legs with the same color and pattern as the pedipalp femur and patella. Metasomal segments and telson are yellowish to reddish with spots.

Mesosoma and carapace (Figs. 382–386). Carapace without carinae but with large granules. Tergites I–VI with one granulated median carina, tergite VII pentacarinate. Fifth sternite with glabrous zone stretching over almost the whole posterior margin. Seventh sternite with four incomplete carinae, sparsely granulate. Pectinal tooth count 12–14 in females, 13–14 in males. Pectines with three marginal lamellae and six to seven middle lamellae. The lamellae bear numerous pale setae.

Metasoma and telson (Figs. 219–220, 387–392, 419–420). The first metasomal segment bears 10 carinae and the second to the fourth segments bear eight carinae, the fifth segment bears five carinae developed in both sexes.

		R. basilicus	*R. besucheti*	*R.ceylonensis* **sp. n.**	
Dimensions (mm)		♂ **holotype**	♂ **holotype**	♂ **holotype**	♀ **paratype**
Carapace	L / W	4.10 / 3.70	4.50 / 3.90	3.65 / 3.55	3.30 / 3.30
Mesosoma	L	9.00	10.1	12.65	10.5
Tergite VII	L / W	2.30 / 3.30	2.80 / 3.45	2.75 / 3.10	2.30 / 3.20
Metasoma & telson	L	26.75	24.78	22.7	16.35
Segment I	L / W / D	3.25 / 1.80 / 1.80	2.65 / 2.20 / 1.95	2.75 / 1.80 / 1.60	1.95 / 1.80 / 1.65
Segment II	L / W / D	4.00 / 1.75 / 1.70	3.45 / 2.20 / 2.10	3.35 / 1.70 / 1.63	2.30 / 1.65 / 1.70
Segment III	L / W / D	4.35 / 1.70 / 1.75	4.55 / 2.20 / 2.05	3.80 / 1.80 / 1.75	2.55 / 1.70/ 1.70
Segment IV	L / W / D	4.80 / 1.75 / 1.75	4.23 / 2.25 / 1.88	4.10 / 1.75 / 1.73	2.90 / 1.68 / 2.10
Segment V	L / W / D	5.85 / 1.85 / 1.75	5.30 / 2.30 / 2.07	4.80 / 1.90 / 1.70	3.60 / 1.70 / 1.55
Telson	L / W / D	4.50 / 1.80 / 1.57	4.60 / 1.90 / 1.65	3.90 / 1.70 / 1.35	3.05 / 1.35 / 1.30
Pedipalp	L	15.35	15.35	12.8	11.25
Femur	L / W	3.85 / 1.25	3.75 / 1.23	3.40 / 1.05	2.90 / 1.05
Patela	L / W	4.45 / 1.55	4.35 / 1.65	3.80 / 1.45	2.80 / 1.40
Chela	L	7.05	7.25	6.50	5.55
Manus	L / W / D	3.30 / 1.90 / 1.60	3.70 / 2.30 / 2.15	3.30 / 2.05 / 1.73	2.40 / 1.65 / 1.40
Movable finger	L	3.75	3.55	3.20	3.15
Total	**L**	**39.85**	**39.38**	**39.0**	**30.2**

Table 3: Comparative measurements of adults of *Reddyanus basilicus*, *R. besucheti* and *R. ceylonensis* **sp. n.** Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

		R. ranawanai **sp. n.**		*R. jayarathnei* **sp. n.**	
Dimensions (mm)		♂ **holotype**	♀ **paratype**	♂ **holotype**	♀ **paratype**
Carapace	L / W	4.55 / 4.40	4.20 / 4.35	5.10 / 5.35	4.97 / 5.15
Mesosoma	L	13.00	11.7	11.4	8.80
Tergite VII	L / W	3.00 / 3.90	2.60 / 4.10	3.05 / 4.15	2.20 / 4.25
Metasoma & telson	L	25.35	20.6	29.0	23.33
Segment I	L / W / D	2.90 / 2.20 / 2.05	2.40 / 2.20 / 2.05	3.35 / 2.60 / 2.50	2.58 / 2.45 / 2.35
Segment II	L / W / D	3.65 / 2.05 / 2.05	2.95 / 2.15 / 1.95	4.35 / 2.40 / 2.50	3.15 / 2.45 / 2.35
Segment III	L / W / D	3.95 / 2.00 / 2.10	3.25 / 2.00 / 1.90	4.70 / 2.45 / 2.50	3.60 / 2.42 / 2.35
Segment IV	L / W / D	4.35 / 2.00 / 2.10	3.55 / 1.95 / 1.85	5.10 / 2.40 / 2.45	4.05 / 2.30 / 2.25
Segment V	L / W / D	5.75 / 2.05 / 2.10	4.50 / 1.95 / 1.80	6.40 / 2.40 / 2.35	5.30 / 2.22 / 2.20
Telson	L / W / D	4.75 / 1.85 / 1.95	3.95 / 1.70 / 1.65	5.10 / 2.15 / 2.20	4.65 / 1.85 / 1.95
Pedipalp	L	17.35	15.50	20.02	18.12
Femur	L / W	4.25 / 1.40	3.40 / 1.35	4.97 / 1.52	4.32 / 1.50
Patela	L / W	5.05 / 1.85	4.60 / 1.80	5.60 / 1.97	5.15 / 2.03
Chela	L	8.05	7.50	9.45	8.65
Manus	L / W / D	3.20 / 2.25 / 2.00	3.05 / 1.90 / 1.56	4.20 / 2.70 / 2.25	3.25 / 2.27 / 1.95
Movable finger	L	4.85	4.45	5.25	5.40
Total	**L**	**42.9**	**36.5**	**45.5**	**37.1**

Table 4: Comparative measurements of adults of *Reddyanus ranawanai* **sp. n.** and *R. jayarathnei* **sp. n.** Abbreviations: length (L), width (W, in carapace it corresponds to posterior width), depth (D).

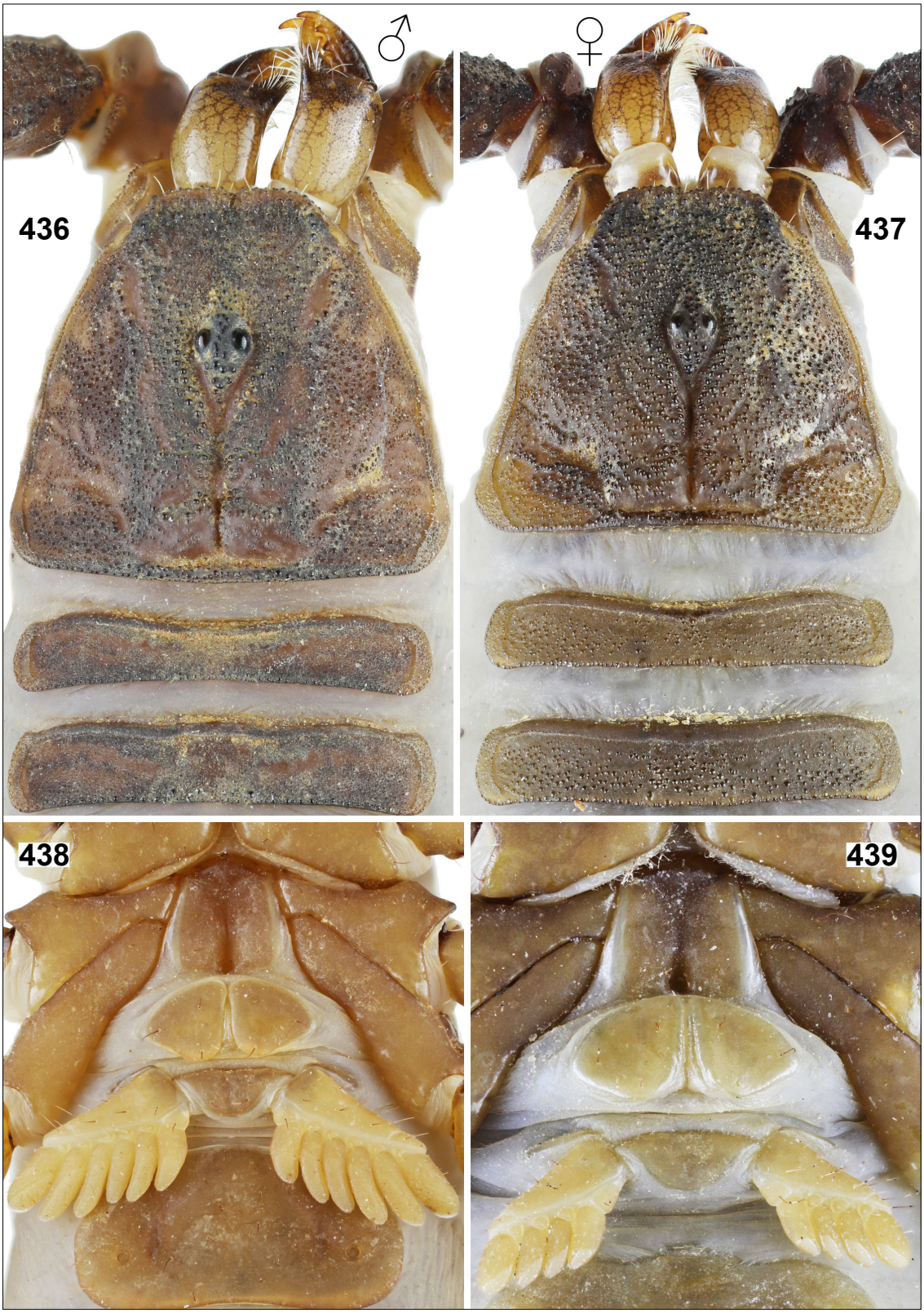
Ratios of adult males	*R. basilicus* (n = 6)	*R. besucheti* (n = 4)	*R. ceylonensis* sp. n. (n = 2)	*R. jayarathnei* sp. n. (n = 1)	*R. loebli* (n = 9)	*R. ranawanai* sp. n. (n = 2)
Metasomal segment I (L/W)	1.50–1.80	1.20–1.35	1.40–1.52	1.29	1.58–2.03	1.30–1.31
Metasomal segment II (L/W)	2.04–2.32	1.56–1.79	1.85–1.97	1.81	2.08–2.60	1.78–1.80
Metasomal segment IV (L/W)	2.47–2.75	1.88–2.09	2.24–2.34	2.12	2.69–3.35	2.16–2.18
Metasomal segment IV (L/D)	2.57–2.79	2.25–2.28	2.29–2.36	2.08	2.45–3.46	2.07–2.15
Metasomal segment V (L/W)	2.85–3.16	2.30–2.31	2.45–2.53	2.66	2.90–3.82	2.79–2.80
Metasomal segment V (L/D)	3.04–3.34	2.56–2.72	2.81–2.82	2.72	3.11–3.74	2.73–2.80
Telson (L/D)	2.57–3.05	2.42–2.36	2.29–2.40	2.32	2.76–3.35	2.43
Pedipalp chela (L/W)	3.41–3.79	2.94–3.15	2.97–3.17	3.50	3.35–3.66	3.57–3.61
Pedipalp chela (L)/Mov. Fing.(L)	1.98–1.88	2.04–2.44	2.03–2.10	1.80	1.70–2.03	1.66–1.69
Total (L)	**28.3–45.85**	**34–46**	**36–39.1**	**45.5**	**28–45**	**40–42.9**

Table 5: Comparison among Sri Lankan *Reddyanus* species (specimens), based upon selected morphometric ratios of adult males. Abbreviations: length (L), width (W), depth (D).

Figures 430–435: *Chaerilus ceylonensis* from locality 15CD. **Figures 430–431**. Male in dorsal (430) and ventral (431) views. **Figures 432–435**. Female, dorsal (432) and ventral (433) views, and chelicera ventral (434) and dorsal (435) views.

Ventral carina present on telson. Intercarinal surfaces of metasoma granulated, including dorsal surface. In both sexes, posterior terminal tubercle of each dorsal carina on metasomal segments not enlarged. Telson elongate, with subaculear tooth wide and rounded, dorsally with granules in four rows; six symmetrical granules in three rows and one or two granules on the tip.

Pedipalps (Figs. 235–236, 393–400). Femur and patella only very sparsely hirsute, with complete carinae, granulated. Chela manus in both sexes granulated, with dor-



Figures 436–439: *Chaerilus ceylonensis* from locality 15CD. **Figures 436, 438**. Male, chelicerae, carapace and tergites I–II (436), and sternopectinal region with sternite III (438). **Figures 437, 439**. Female, chelicerae, carapace and tergites I–II (437), and sternopectinal region (439).

Figures 440–445: *Chaerilus ceylonensis* from locality 15CD. **Figures 440–442**. Male, metasoma and telson, lateral (440), ventral (441), and dorsal (442) views. **Figures 443–445**. Female, metasoma and telson, lateral (443), ventral (444), and dorsal (445) views.

sal carinae indicated. Sixth row of granules on movable finger with one external granule. Seventh row of granules on the fixed finger without additional granules.
Legs (Fig. 208). Femur and patella with complete carinae, granulated. Legs hirsute, without bristle combs.

AFFINITIES. The described features distinguish *R. ranawanai* sp. n. from all other species of the genus. All other Sri Lankan *Reddyanus* species exhibit sexual dimorphism in the length of the telson, which is absent in *R. ranawanai* sp. n. (c.f. Figs. 419–420 versus Figs. 409–418).

Family **Chaerilidae** Pocock, 1893
Chaerilus Simon, 1877
(Figs. 13, 200, 428–457)

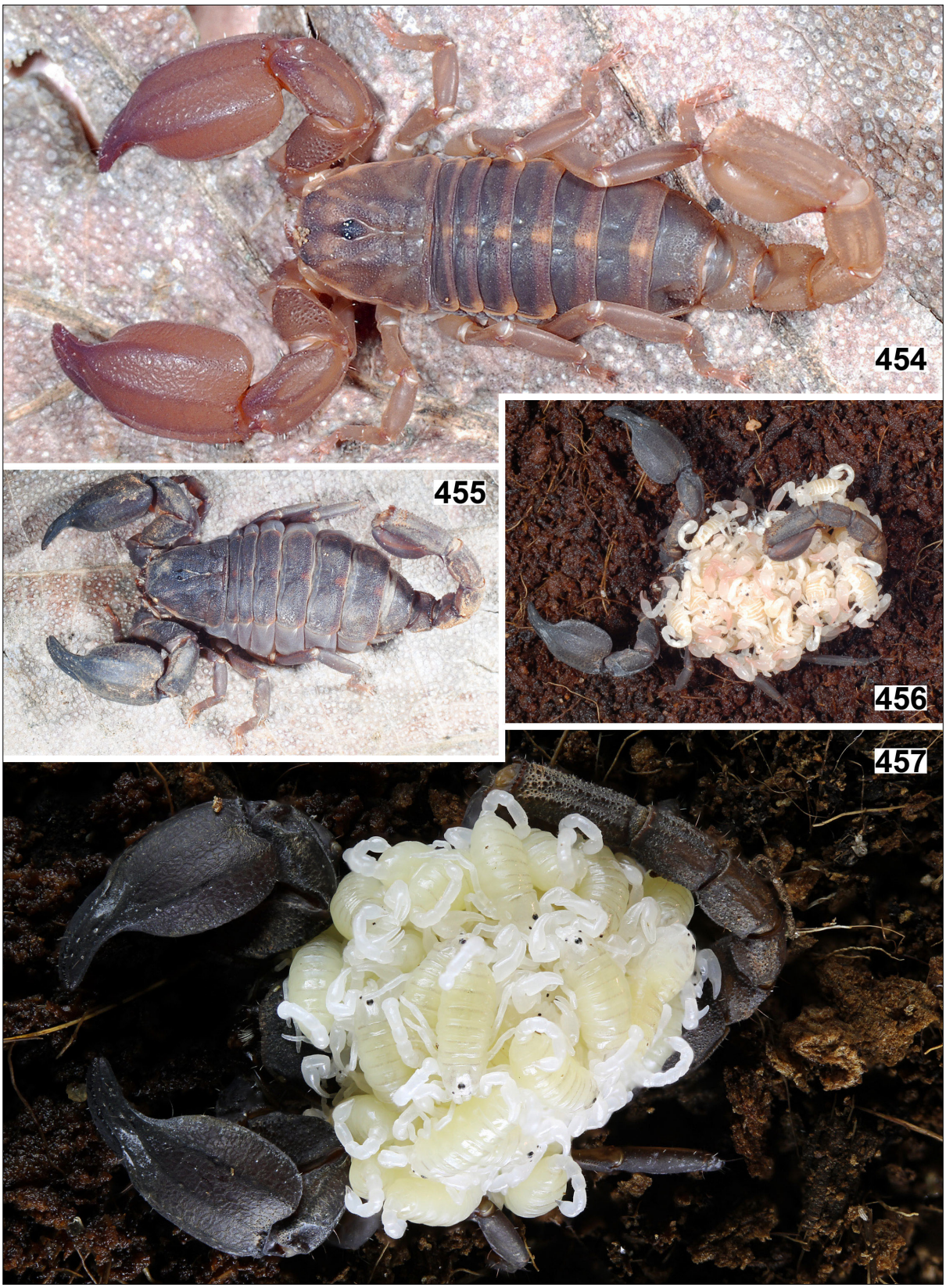
Chaerilus Simon, 1877: 238; Fet, 2000: 323–328 (complete reference list until 1998); Kovařík & Ojanguren, 2013: 131–145, figs. ZN.1–7, 617–776 (reference list until 2013); Kovařík et al., 2015: 1–21, figs. 1–91.
= *Chelomachus* Thorell, 1889: 583 (syn. by Kraepelin, 1899: 157).
= *Uromachus* Pocock, 1890: 250 (syn. by Kraepelin, 1899: 157).

TYPE SPECIES. *Chaerilus variegatus* Simon, 1877.

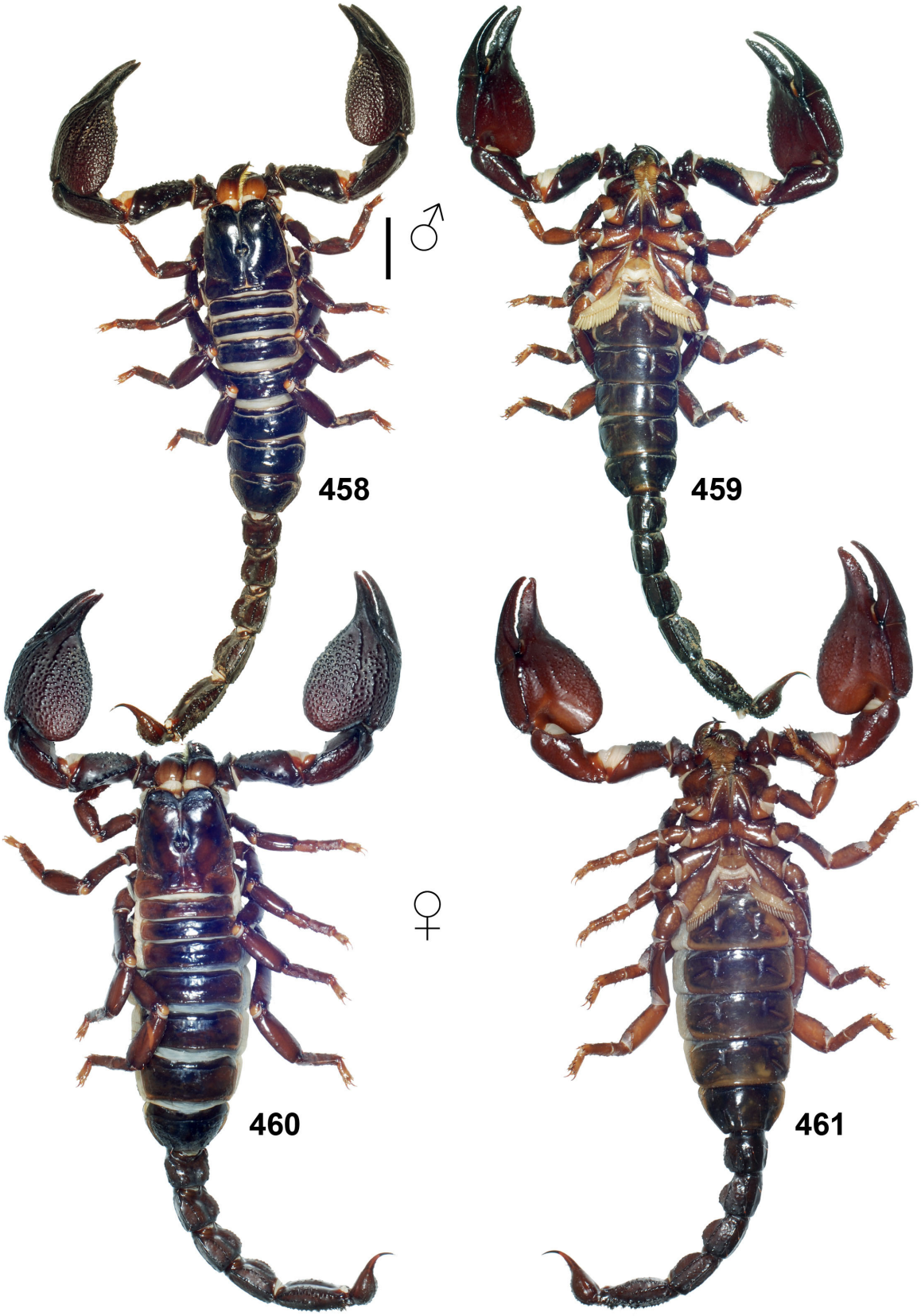
DIAGNOSIS. Total length 15–75.4 mm. Orthobothriotaxy type B; pedipalp femoral d_3–d_4 trichobothria configuration points toward dorsoexternal carina; pedipalp patella with 3 ventral trichobothria and pedipalp femur with 9 trichobothria, 4 of them dorsal. Cheliceral fixed finger with median and basal denticles flush on surface, not conjoined on common trunk; ventral edge of cheliceral movable finger crenulated; dorsal edge of cheliceral movable finger with a single subdistal den-

Figures 446–453: *Chaerilus ceylonensis* from locality 15CD. **Figures 446–449**. Male. Pedipalp chela, dorsal (446), external (447) and ventral (448) views. Movable finger (449). **Figures 450–453**. Female. Pedipalp chela, dorsal (450), external (451) and ventral (452) views. Movable finger (453).

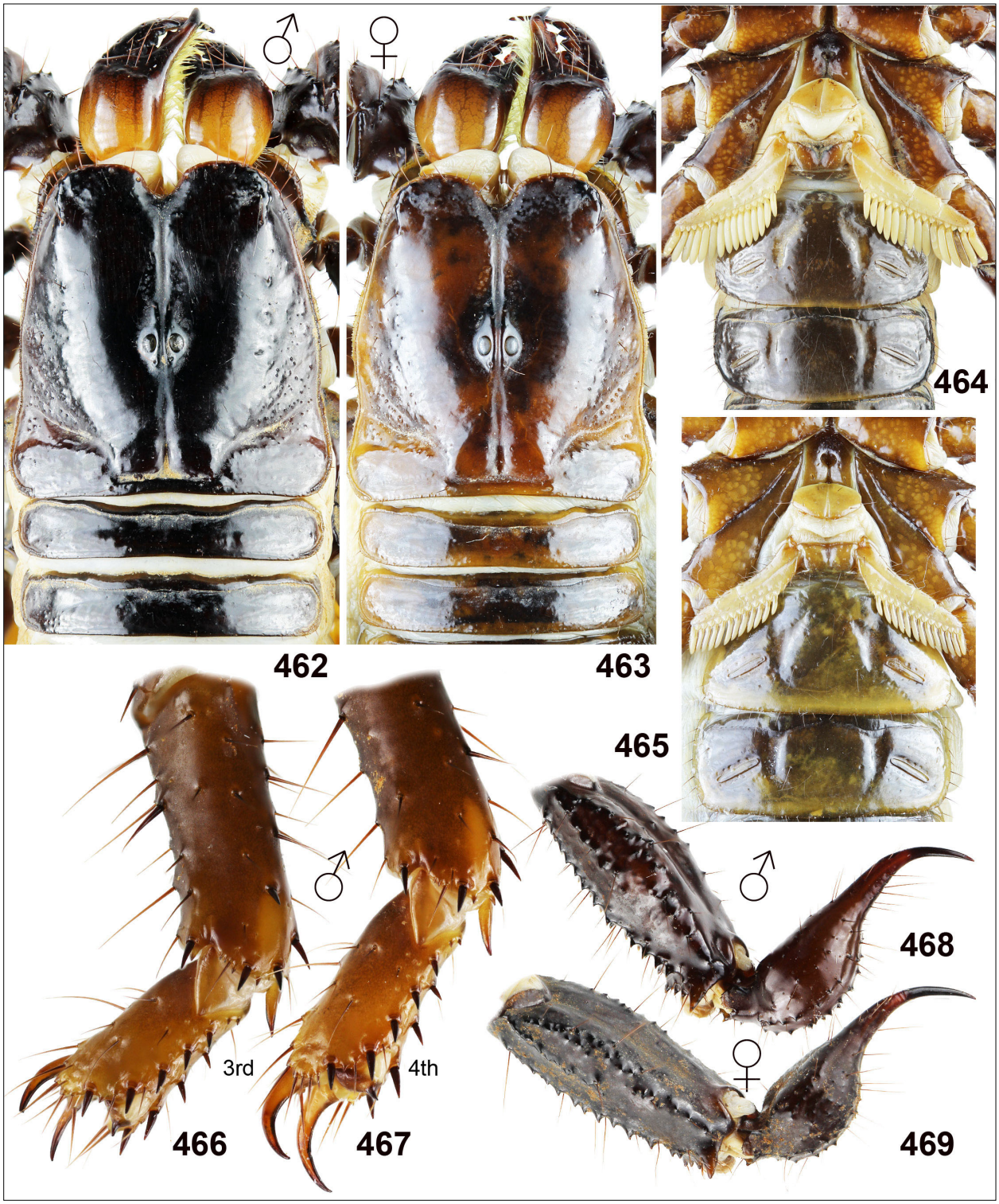
ticles; ventral surface of cheliceral fixed finger with denticle. Sternum, *type 1*, exhibits subtle wide horizontal compression; maxillary lobes I spatulate. Hemispermatophore *fusiform*. Pedipalp patella with "6-carinae" configuration. Median denticle row of pedipalp chelal finger arranged in *oblique* groups; pedipalp chela exhibits "8-carinae" configuration. Fifth metasomal segment with single ventral carina. Legs without tibial



Figures 454–457: *Chaerilus ceylonensis* from locality 15CD, male (454), female (455), female with juveniles after first ecdysis (456), and female with newborns (457).

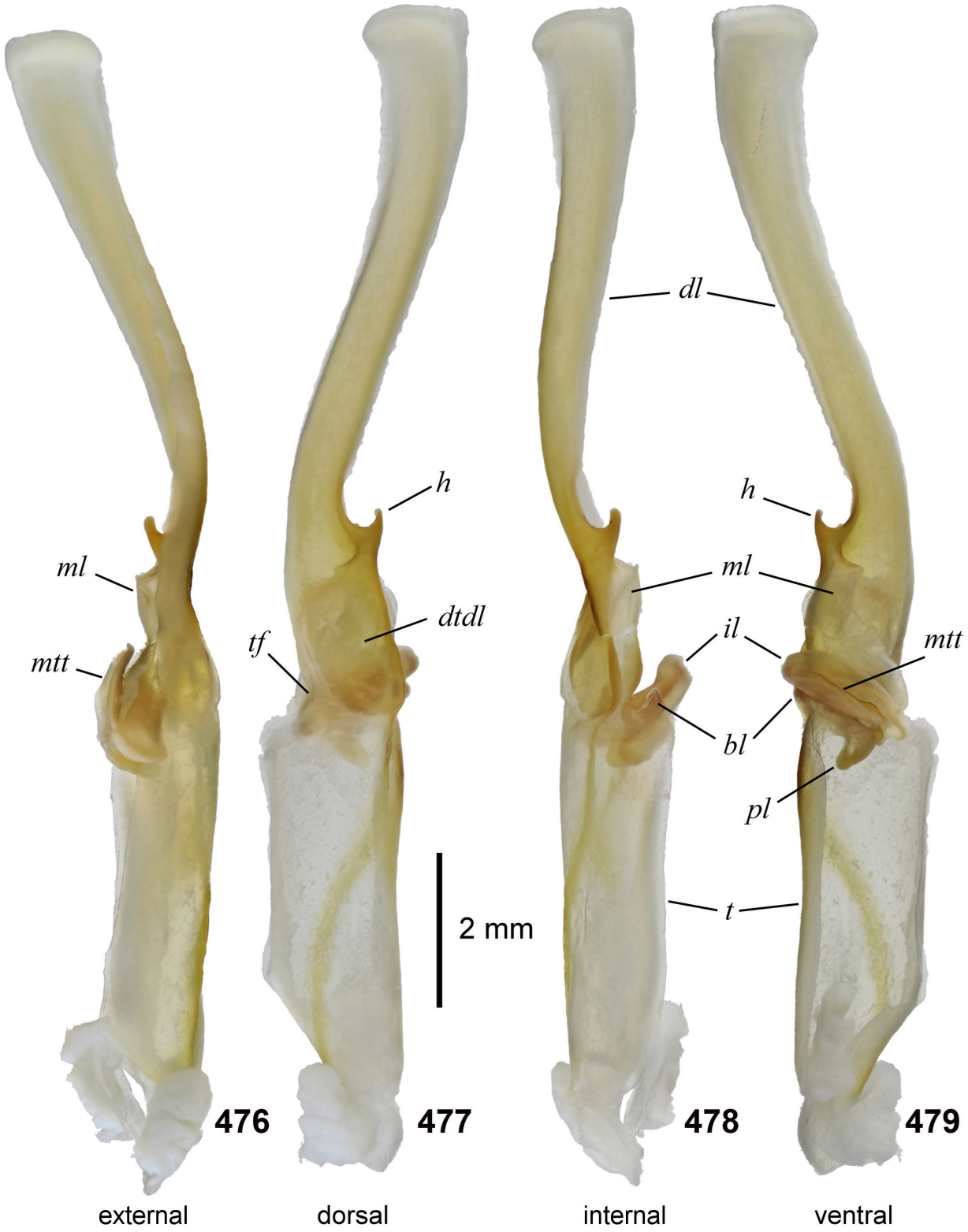


Figures 458–461: *Heterometrus gravimanus* from locality 15CE. **Figures 458–459**. Male in dorsal (458) and ventral (459) views. **Figures 460–461**. Female, dorsal (460) and ventral (461) views. Scale bar: 10 mm.



Figures 462–469: *Heterometrus gravimanus*. **Figures 462, 464**. Male from locality 15CE, chelicerae, carapace and tergites I–II (462), and sternopectinal region with sternites III–IV (464). **Figures 463, 465**. Female from locality 15CJ, chelicerae, carapace and tergites I–II (463), and sternopectinal region with sternites III–IV (465). **466–468**. Male from locality 15CJ, tarsomeres of third (466) and fourth (467) legs retroventral views, and telson with metasomal segment V in lateral view (468). **Figure 469**. Female from locality 15CJ, telson with metasomal segment V in lateral view.

Figures 470–475: *Heterometrus gravimanus*. **Figures 470–472**. Male 105 mm long from locality 15CE, pedipalp chela in dorsal (470), external (471) and ventral (472) views. **Figure 473**. Female from locality 15CE, pedipalp chela in dorsal view. **Figures 474**. Male 106 mm long from locality 15CJ, pedipalp chela in dorsal view. **Figures 475**. Male 77 mm long from locality 15CE, pedipalp chela in dorsal view.



Figures 476–479: Right hemispermatophore of *Heterometrus gravimanus* from locality 15CE. External (476), dorsal (477), internal (478) and ventral (479) views. Scale bar: 2 mm. Abbreviations: *bl*, basal lobe; *dl*, distal lamina; *dtdl*, dorsal trough of distal lamina; *h*, hook; *ml*, median lobe; *mtt*, median transverse trough; *pl*, proximal lobe; *t*, trunk.

Figures 480–481: *Heterometrus gravimanus*, male (480) and female (481) at locality 15CE.

spurs, but with prolateral and retrolateral pedal spurs. Tarsi of legs bear two rows of ventral setae and median row of spinules. Telson without subaculear tubercle.

DISTRIBUTION. Oriental region from India to Melanesia.

Chaerilus ceylonensis Pocock, 1894
(Figs. 13, 200, 428–457)

Chaerilus ceylonensis Pocock, 1894: 83–84; Vachon, 1982: 102, figs. 94–95; Tikader & Bastawade, 1983: 326–332, figs. 925–939; Fet, 2000: 325 (complete reference list until 1998); Kovařík, 2000: 44–45, fig. 14; Lourenço & Huber, 2002: 273; Kovařík & Ojanguren, 2013: 135, 284, figs. 732–733.

TYPE LOCALITY AND TYPE REPOSITORY. Sri Lanka (Ceylon), Trincomalee; BMNH.

TYPE MATERIAL EXAMINED. Sri Lanka, Trincomalee, 1♂ (holotype, figs. 732–733 in Kovařík & Ojanguren, 2013: 284), BMNH No. 1893.10.20.4.

OTHER MATERIAL EXAMINED. Sri Lanka, North Central Province, Polonnaruwa District, ca 35 km from Dambula, 07°57'15.1"N 080°54'45,4"E, 132 m a.s.l. (Locality **15CD**, Fig. 578), 22.IV.2015, 2♂ (Figs. 200, 428, 430–431, 436, 438, 440–442, 446–449, 454) 1♀ (Figs. 429, 432–435, 437, 439, 443–445, 450–453, 455), FKCP, 1♂1♀1juv., UPSL, leg. Kovařík et al.; North Central Province, Polonnaruwa District, near Kaudulla National Park, 08°08'40.6"N 080°51'04"E, 101 m a.s.l. (Locality **15CF**, Fig. 581), 23.IV.2015, 1♂1♀1juv., FKCP, 1♂1juv., UPSL, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°17'15"N 079°50'38.7"E, 38 m a.s.l. (Locality **15CO**, Fig. 592), 28.IV.2015, 2♂, FKCP, 3juvs., UPSL, leg. Kovařík et al.

DIAGNOSIS. Total length 27–45 mm. Two pairs of lateral eyes and one pair of median eyes. Movable fingers of pedipalps with 11–12 rows of granules. Fingers straight and short. Trichobothrium d_2 of pedipalp patella located on dorsal surface, trichobothrium *id* on internal surface. Pedipalp chela with 9 carinae. Pectinal teeth number 4–6. Entire carapace evenly covered by granules. Ratio of median eye distance from anterior and posterior margins of carapace = 1 : 1.55–1.60. Mesosoma without carinae. Sternites smooth. First and second metasomal segments with 10 carinae, third and fourth segments with 8 carinae, fifth segment with 7 carinae. All carinae consist of large, denticulate granules.

DISTRIBUTION. Sri Lanka.

Family **Scorpionidae** Latreille, 1802
Heterometrus Ehrenberg, 1828
(Figs. 15, 458–546, 571–574)

Buthus (*Heterometrus*) Ehrenberg in Hemprich & Ehrenberg, 1828: pl. 1, figs 1–2 (part, only fig. 2); Hemprich & Ehrenberg, 1829: 351.
Heterometrus: Kovařík, 2004: 1–60, figs. 1–32 (complete reference and synonymy list until 2004); Kovařík, 2009: 34–49, 73–113, figs. 1–283.

TYPE SPECIES. *Buthus* (*Heterometrus*) *spinifer* Ehrenberg, 1828, by subsequent designation (Karsch, 1879: 20).

DIAGNOSIS: Total length 60–176 mm. Orthobothriotaxy type C. Pedipalp femur with three trichobothria, only one of which resides on internal surface. Pedipalp patella with 19 trichobothria, 3 ventral, and 13 external. Chela of pedipalp with 26 trichobothria. Retrolateral pedal spurs absent. Lateroapical margins of tarsi produced into rounded lobes. Metasomal segments I–IV with paired ventral submedian carinae. Stridulatory organ located on opposing surfaces of pedipalp coxa and first leg.

DISTRIBUTION. Oriental region from India to Indonesia.

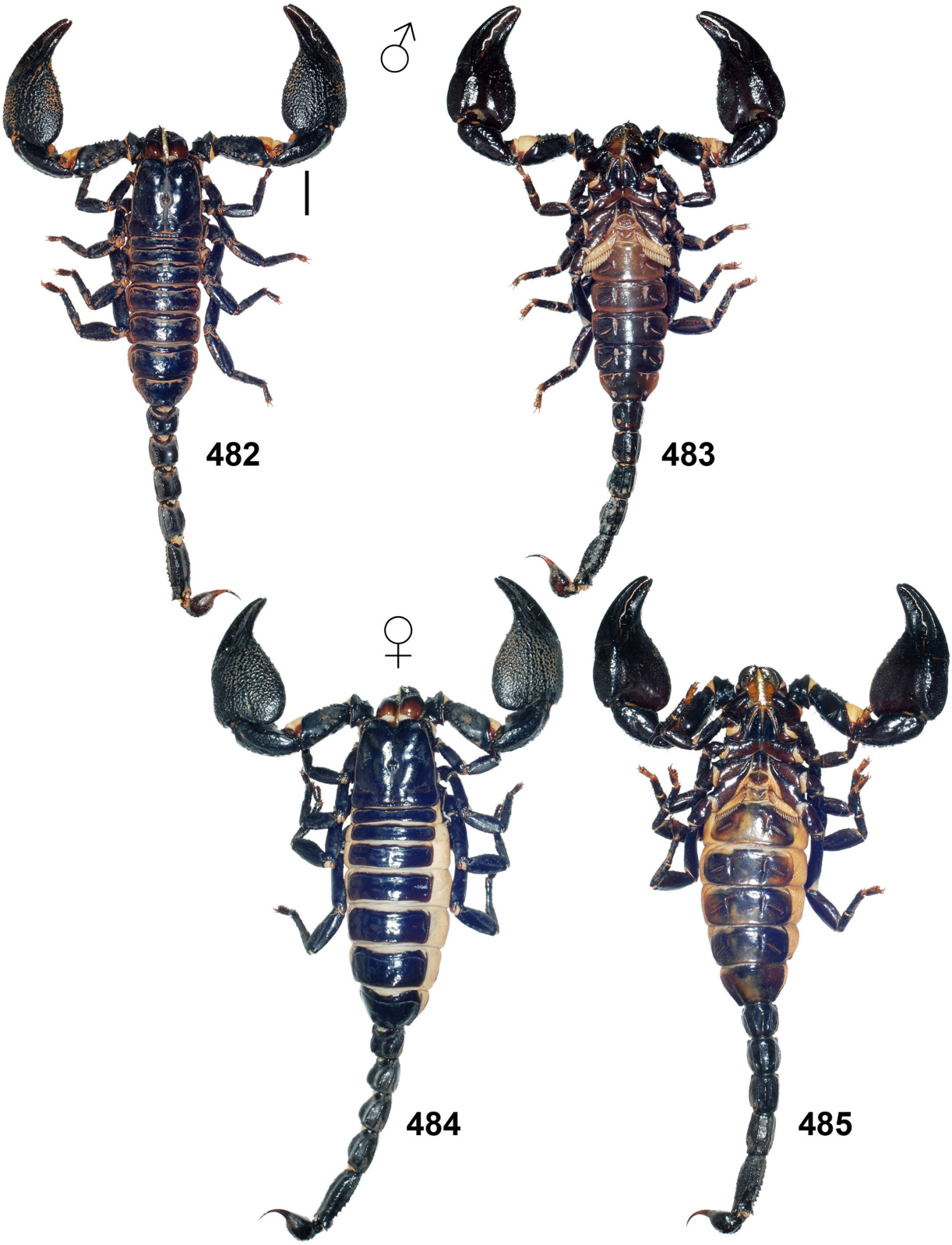
Heterometrus gravimanus (Pocock, 1894)
(Figs. 15, 458–481, 572)

Scorpio gravimanus Pocock, 1894: 75–76.
Heterometrus (*Srilankametrus*) *gravimanus*: Tikader & Bastawade, 1983: 550–555, figs. 1469–1482; Fet, 2000: 446;
Heterometrus gravimanus: Kovařík, 2004: 15, 17, fig. 15; Kovařík, 2009: 38, 79, figs. 40–42.

TYPE LOCALITY AND TYPE REPOSITORY. Ceylon, now Sri Lanka; BMNH.

SRI LANKAN MATERIAL EXAMINED. Sri Lanka, Southern Province, Galle, 1♂, FKCP, IV.1994, leg. P. Senft; North Central Province, Polonnaruwa District, Giritale, 08°01'26.0"N 080°54'37.2"E, 233 m a.s.l. (Locality **15CE**, Fig. 579), 22. –23.IV.2015, 2♂ (Figs. 458–459, 462, 464, 470–472, 475–479, 480, 572) 1♀ (Figs. 460–461, 463, 465, 473), FKCP, 1♀7juvs., UPSL, leg. Kovařík et al.; Northern Province, Jaffna District, 09° 42'51.6"N 080°04'44.8"E, 19 m a.s.l. (Locality **15CJ**, Figs. 586–587), 26. –27.IV.2015, 2♂ (Figs. 466–468, 474), 1♀ (Fig. 469), FKCP, leg. Kovařík et al.

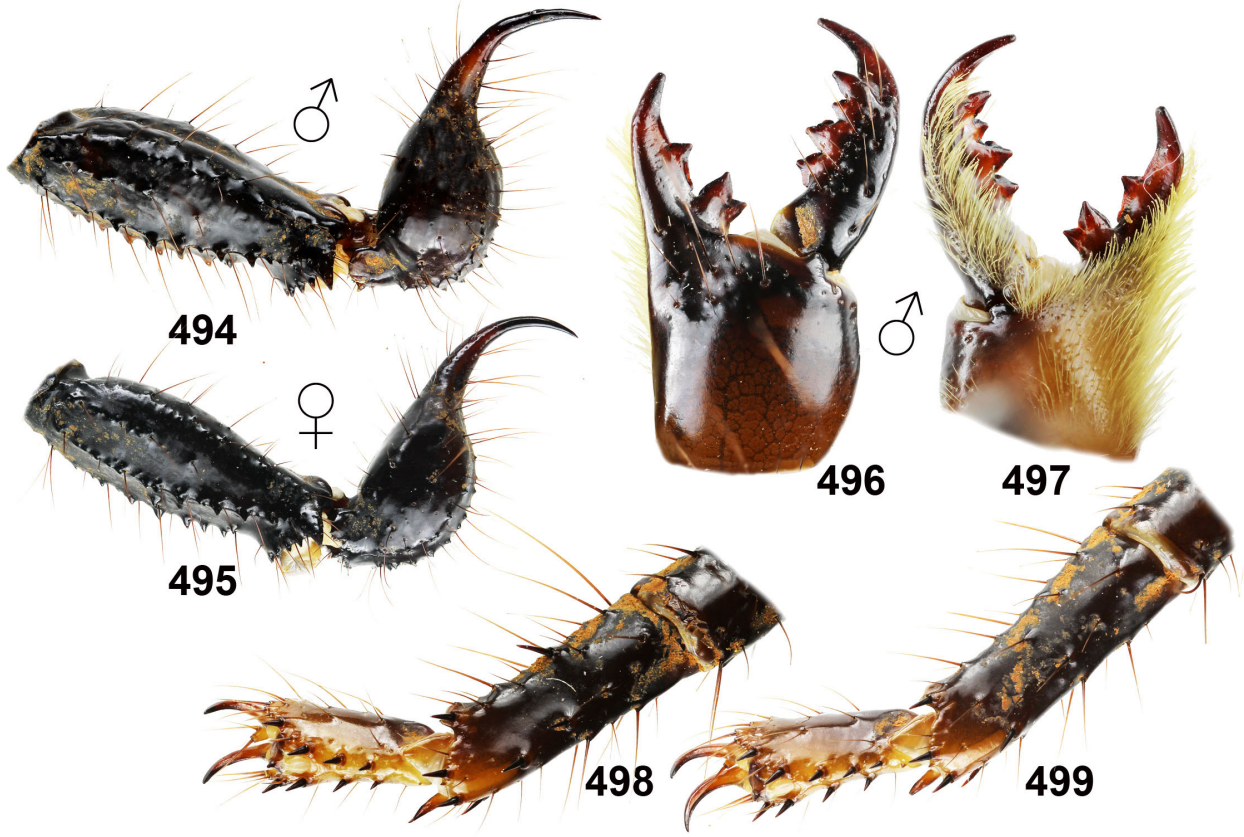
DIAGNOSIS. Total length 75–110 mm long. Color of adults uniformly reddish brown. Pectinal teeth number 13–16 in males and 11–13 in females. Male with slightly



Figures 482–485: *Heterometrus indus* from locality 15CA. **Figures 482–483**. Male in dorsal (482) and ventral (483) views. **Figures 484–485**. Female, dorsal (484) and ventral (485) views. Scale bar: 10 mm.

Figures 486–489: *Heterometrus indus* from locality 15CA. **Figures 486, 488**. Male, chelicerae, carapace and tergites I–III (486), and sternopectinal region (488). **Figures 487, 489**. Female, chelicerae, carapace and tergites I–II (487), and sternopectinal region (489).

Figures 490–493: *Heterometrus indus* from locality 15CA. **Figure 490**. Male, metasoma and telson, lateral view. **Figures 491–493**. Female, metasoma and telson, lateral (491), ventral (492), and dorsal (493) views. Scale bar: 10 mm.



Figures 494–499: *Heterometrus indus* from locality 15CA. **Figures 494, 496–499**. Male, telson with metasomal segment V in lateral view (494), chelicera dorsal (496) and ventral (497) views, and tarsomeres of third (498) and fourth (499) legs retroventral views. **Figure 495**. Female, telson with metasomal segment V in lateral view.

longer pedipalp femur and patella. Chela lobiform, narrower in male than female; chela length/ width ratio 1.79–2.05 in males, 1.65–1.75 in females. Entire manus covered by rounded granules, with five carinae mainly in anterolateral part. Pedipalp patella smooth, without pronounced internal tubercle. Carapace smooth, glossy. Spination formula of tarsomeres II of legs: 4/4-5 : 4/5 : 4/5-6 : 4/5-6. Telson elongate, vesicle shorter than aculeus.

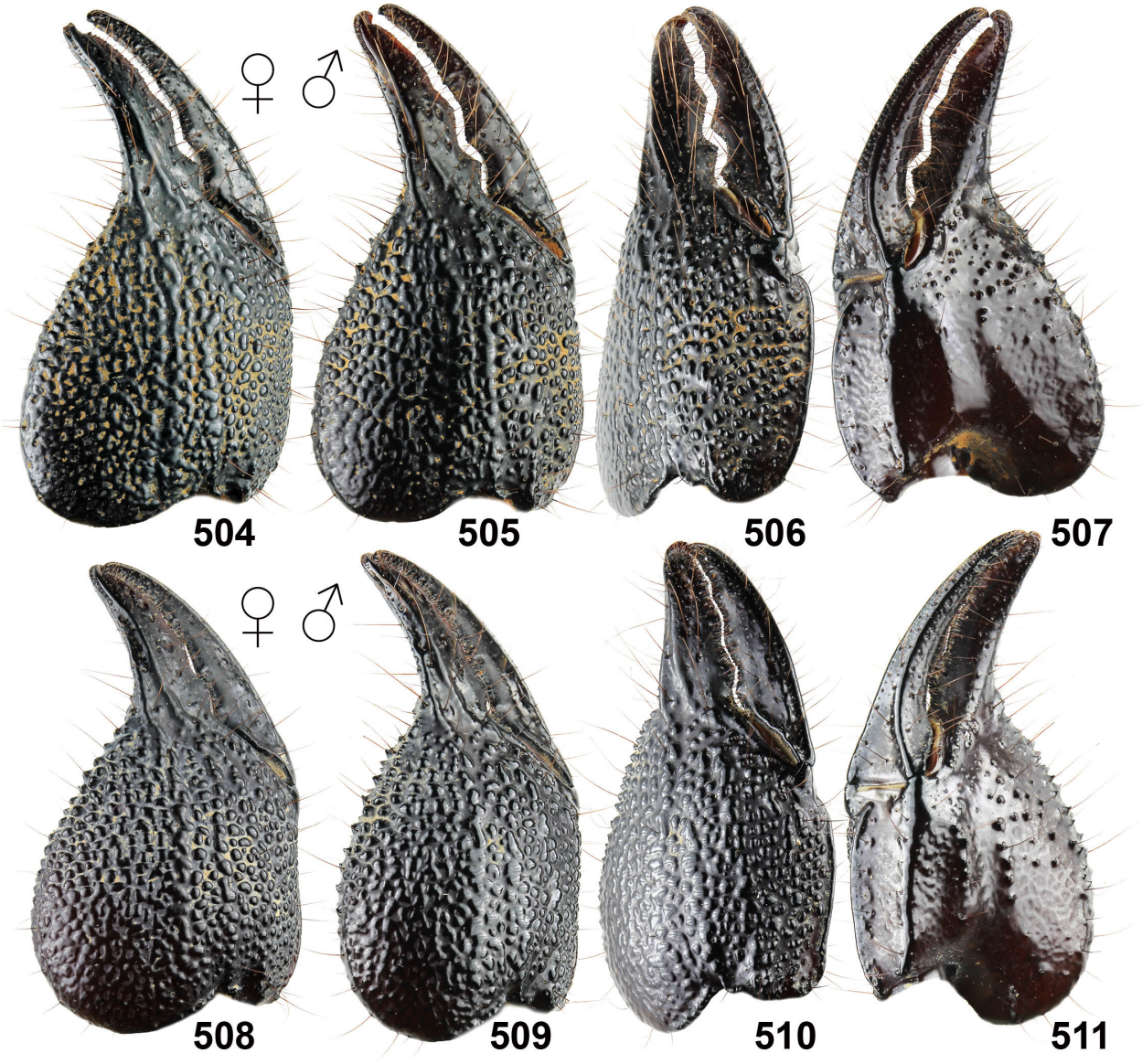
HEMISPERMATOPHORE (Figs. 476–479). Lamelliform. Distal lamina long, slender, basal capsular portion one fifth of total lamina length, wider, dorsal trough nearly flat with slightly elevated transverse strip, bordered internally by strong carina; portion of lamina just distal to hook constricted, curved, deflected internally; distal terminus of lamina dilated, truncated and spatulate. Hook prominent, with narrowed tip and wide triangular base, lacking dorsal trough. Median lobe elongate, extending from base of hook to truncal flexure, with fine longitudinal carina and trough along internal side. Inner lobe and median transverse trough large, prominent. Basal and proximal lobes smaller but well developed, blunt, rounded. All lobes of capsule region smooth, without barbs or spicules. Trunk broader than both capsule and distal lamina, parallel-sided, with moderately sclerotized diagonal axial rib.

The hemispermatophore is quite similar to those of several other species of *Heterometrus* previously illustrated as line drawings: *H. longimanus* (Herbst, 1800), *H. cyaneus* (C.L. Koch, 1836) and *H. spinifer* (Ehrenberg, 1828) (Couzijn, 1981; Stockwell, 1989). The relative proportions of the distal lamina and trunk are comparable and the same capsular structures or lobes are present. Some differences can be seen: (i) in *H. cyaneus* and *H. spinifer*, the distal lamina is straight, not internally deflected; (ii) the hook is smaller in *H. longimanus* and *H. cyaneus*, and has a shorter tip in *H. spinifer*; (iii) the distal lamina is not terminally dilated in *H. longimanus* and *H. cyaneus*. However, the extent of intraspecific morphological variation in *Heterometrus* hemispermatophores is unknown, so it is unclear if these differences have diagnostic value.

VARIABILITY. The figures 470–475 show variability in the shape of the chela in adult males. The greatest difference is between the 77 mm long male (Fig. 475) and the 105 mm long male (Fig. 470) from the same locality 15CE.

Figures 500–501: *Heterometrus indus*, female (500) and male (501) at locality 15CA.

Figures 502–503: *Heterometrus indus*, female from Peradeniya with newborns (502) and with juveniles after first ecdysis (503).



Figures 504–511: Pedipalp chela. **Figures 504–507**: *Heterometrus indus* from locality 15CA, pedipalp chela dorsal (504) view of female, and pedipalp chela dorsal (505), external (506) and ventral (507) views of male. **Figures 508–511**: *Heterometrus serratus* from locality 15CP, pedipalp chela dorsal (508) view of female, and pedipalp chela dorsal (509), external (510) and ventral (511) views of male.

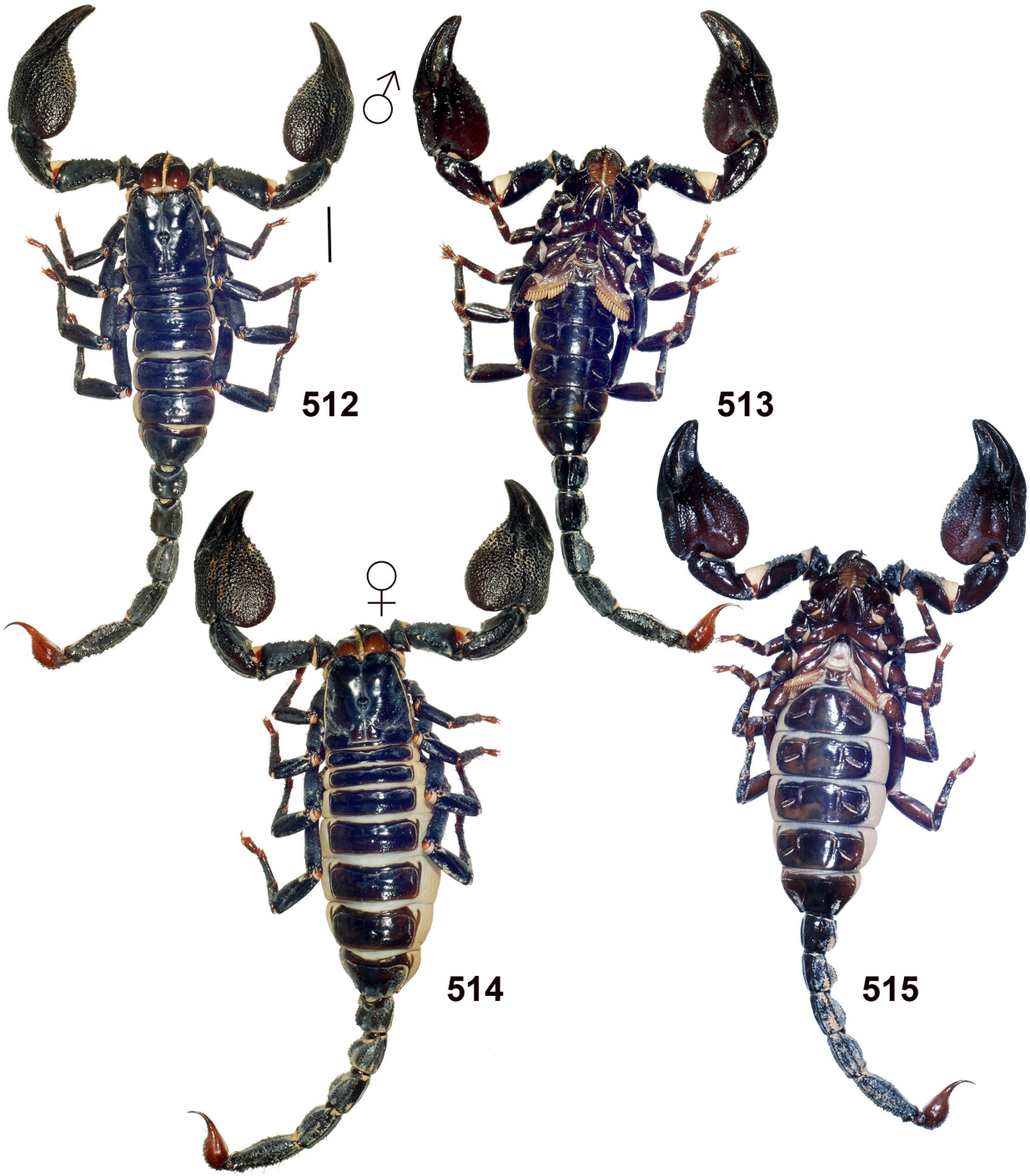
DISTRIBUTION. India and Sri Lanka.

Heterometrus indus (De Geer, 1778)
(Figs. 15, 482–507, 573)

Scorpio indus De Geer, 1778: 341–343.
Heterometrus indus indus: Couzijn, 1981: 121–123, fig. 35 (in part).
Heterometrus indus: Fet, 2000: 446–448 (complete reference and synonymy list until 1998); Kovařík, 2004: 17–20 (in part) (complete reference and synonymy list until 2004); Kovařík, 2009: 38, 80, 105, figs. 50–56, 249–252.
= *Scorpio ceylonicus* Herbst, 1800: 83–84, fig. 1, Tab. V (syn. by Kraepelin, 1899: 113).
= *Heterometrus* (*Heterometrus*) *spinifer solitarius* Couzijn, 1981: 93–94, fig. 23. **Syn. n.**

TYPE LOCALITY AND TYPE REPOSITORY. "India" (incorrect type locality; see Kovařík, 2004: 20); NHRS.

MATERIAL EXAMINED. Sri Lanka, Kandy, 30.III.1902, 1♂, FKCP; Peradeniya, 3♂2♀ (Figs. 502–503) 6juvs., IV.1994, FKCP; leg. P. Senft; Central Province, Kandy District, Hantana (Peradeniya), University land, 07° 14'54.7"N 080°36'54"E, 760 m a.s.l. (Locality **15CA**,



Figures 512–515: *Heterometrus serratus* from locality 15CP. **Figures 512–513**. Male in dorsal (512) and ventral (513) views. **Figures 514–515**. Female, dorsal (514) and ventral (515) views. Scale bar: 10 mm.

Fig. 575), 19. –21.IV.2015, 1♂ (Figs. 482–483, 486, 488, 490, 494, 496–499, 505–507) 1♀ (Figs. 484–485, 487, 489, 491–493, 495, 504, 573), FKCP, 4♀1juv., UPSL, leg. Kovařík et al.; Central Province, Kandy District, 20 km S Kandy, Meegammana, Wattegama, 07° 20'41.9"N 080°39'30.6"E, 534 m a.s.l. (Locality **15CC**, Fig. 577), 21.IV.2015, 1♀, FKCP, leg. Kovařík et al.

DIAGNOSIS. Total length 90–130 mm long. Color of adults uniformly reddish black to greenish black. Pec-

Figures 516–519: *Heterometrus serratus* from locality 15CP. **Figures 516, 518**. Male, chelicerae, carapace and tergites I–II (516), and sternopectinal region (518). **Figures 517, 519**. Female, chelicerae, carapace and tergites I–II (517), and sternopectinal region (519).

Figures 520–525: *Heterometrus serratus* from locality 15CP. **Figures 520–522**. Male, metasoma and telson, lateral (520), ventral (521), and dorsal (522) views. **Figures 523–525**. Female, metasoma and telson, lateral (523), ventral (524), and dorsal (525) views. Scale bar: 10 mm.

tinal teeth number 10–15 in both sexes. Sexual dimorphism in proportions of pedipalps not noticeable. Pedipalp chela hirsute, lobiform, without carinae on dorso-external surface, but may bear rows of granules. Chela length/ width ratio 1.8–2.0 in adults. Entire manus covered by rounded granules that may merge and appear as rows. Pedipalp patella without pronounced internal tubercle. Carapace smooth, glossy, occasionally with granules at margins. Second metasomal segment approximately as long as wide. Fifth segment of metasoma approximately as long as pedipalp femur, fourth segment of metasoma shorter than pedipalp femur. Dorsal and dorsolateral carinae of metasomal segments smooth. Vesicle of telson usually longer than aculeus. Spination formula of tarsomeres II of legs: 3/4 : 2-4/3-4 : 4/4-5 : 4/5.

COMMENTS. *Heterometrus* (*Heterometrus*) *spinifer solitarius* Couzijn, 1981 was described from a female (109 mm long) from Sri Lanka, Peradeniya, where *H. indus* is very common and *H. swammerdami* is not very common. The original description of *H. spinifer soli-*

Figures 526–529: *Heterometrus serratus*, female from locality 15CP, tarsomeres of legs I–IV, ventral view.

tarius lacks clear diagnostic characters and any connection to *H. spinifer* (Ehrenberg, 1828). The type locality of *H. spinifer* (Ehrenberg, 1828) 'India' must be regarded as erroneous. The species is known from Malaysia and Thailand, and probably also from Cambodia and Vietnam (Kovařík, 2009: 35, 44).

DISTRIBUTION. Sri Lanka.

Heterometrus serratus (Pocock, 1900)
(Figs. 15, 508–534, 571, 574)

Palamnaeus serratus Pocock, 1900: 86, 97.
Heterometrus serratus: Takashima, 1945: 94.
Heterometrus (*Srilankametrus*) *serratus*: Tikader & Bastawade, 1983: 555–561, figs. 1483–1496; Fet, 2000: 448.
Heterometrus indus indus (in part): Couzijn, 1981: 121–123, fig. 35 (in part).
Heterometrus indus (in part): Kovařík, 2004: 17–20, fig. 16; Kovařík, 2009: 38.

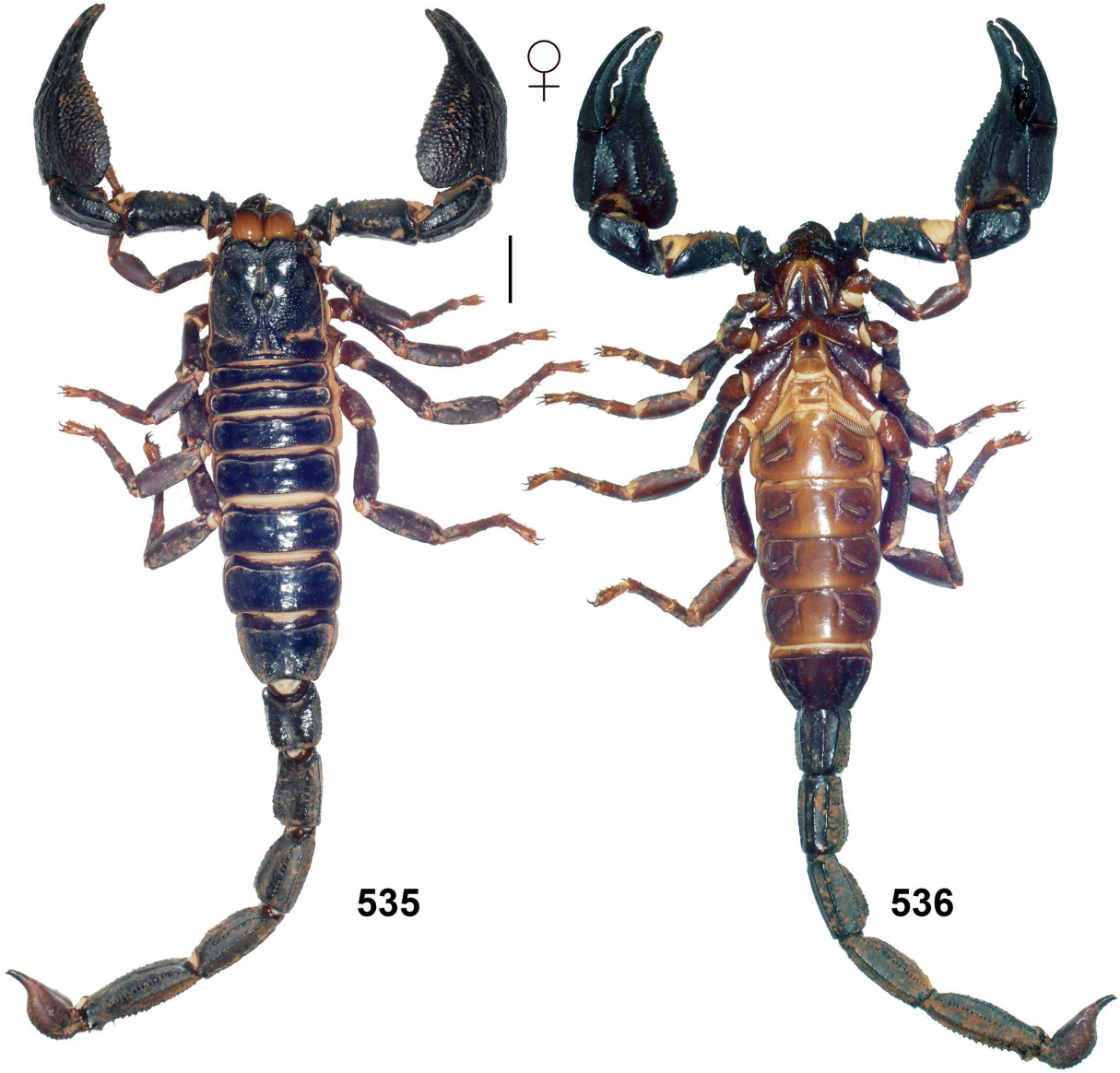
TYPE LOCALITY AND TYPE REPOSITORY. Ceylon, now Sri Lanka; BMNH.

TYPE MATERIAL EXAMINED. Sri Lanka, Ceylon, 1♂ (holotype, fig. 16 in Kovařík, 2004: 19), leg. Dr. Ondaatje, BMNH No. 1888.55.

OTHER MATERIAL EXAMINED. Sri Lanka, Southern Province, Matara District, Kekanadura village, 05° 58'28.2"N 080°36'20.5"E, 40 m a.s.l. (Locality **15CP**, Fig. 594), 30.IV.2015, 1♂ (Figs. 509–513, 516, 518, 520–522, 571) 1♀ (Figs. 508, 514–515, 517, 519, 523–529, 574), FKCP, 1♀im., UPSL, leg. Kovařík et al.; Uva Province, Monaragala District, Monaragala, 06°52' 30.7"N 081°21'17"E, 288 m a.s.l. (Locality **15CQ**, Fig. 595), 2.–3.V.2015, 2♀, FKCP, leg. Kovařík et al.

DIAGNOSIS. Total length 100–130 mm long. Color of adults uniformly reddish black to greenish black. Pectinal teeth number 12–15 in both sexes. Male with slightly narrower chela than female; chela length/ width ratio 1.79–1.94 in males, 1.69 in female. Chela hirsute, lobiform, without carinae on dorsoexternal surface, but may bear rows of granules. Chela length/ width ratio 1.8–2.0 in adults. Entire manus covered by rounded granules that may merge and appear as rows. Pedipalp patella without pronounced internal tubercle. Carapace smooth, glossy medially, with granules at margins. Se-

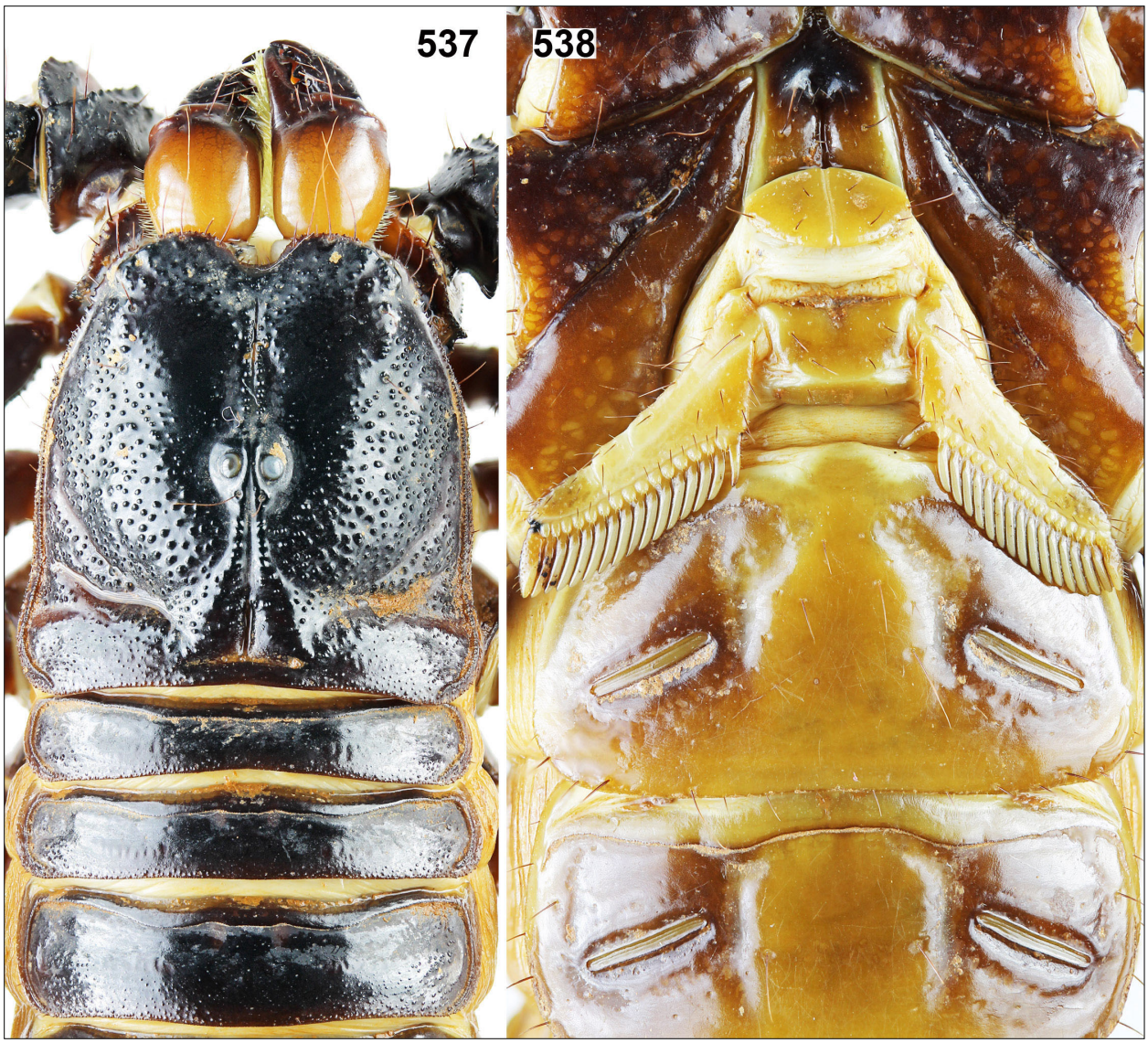
Figures 530–534: *Heterometrus serratus*. **Figures 530–533**. Juvenile from locality 15CQ in phases of ecdysis. **Figures 534**. Female at locality 15CP.



Figures 535–536: *Heterometrus swammerdami* from locality 15CB, female in dorsal (535) and ventral (536) views. Scale bar: 10 mm.

Species	2n	Relative Size of Chromosomes	Locality
Buthoscorpio sarasinorum	14	2x 11.2 + 7.4 – 5.7	15CF
Charmus laneus	9	19.2 + 12.9 – 6.7	15CO
Isometrus thwaitesi	8	16.4 – 13.0 + 2x 6.3	15CF
Lychas srilankensis	16	2x 9.2 + 7.0 – 4.2	15CN
Reddyanus basilicus	16	8.0 – 4.6	15CS
Reddyanus basilicus	15	11.5 + 8.0 – 4.6	15CR
Reddyanus ceylonensis **sp. n.**	16	8.9 – 4.2	15CI
Reddyanus loebli	17	7.7 – 5.0 + 3.5	15CH

Table 6: The diploid numbers and the relative size of the diploid set (in %) of chromosomes of Sri Lankan buthid scorpions.



Figures 537–538: *Heterometrus swammerdami* from locality 15CB, female, chelicerae, carapace and tergites I–III (537), and sternopectinal region with sternites III–IV (538).

cond metasomal segment approximately as long as wide. Fifth segment of metasoma about as long pedipalp femur, fourth segment of metasoma shorter than pedipalp femur. Dorsal and dorsolateral carinae of metasomal segments granulated. Vesicle of telson usually longer than aculeus. Spination formula of tarsomeres II of legs: 3-4/4-6 : 4/4-5 : 4/5-6 : 4/5-7.

COMMENTS. *Palamnaeus serratus* Pocock, 1900 was synonymized with *H. indus* by Couzijn (1981: 121). The first author (Kovařík, 2004: 17 and Kovařík, 2009: 38) accepted the synonymy, whereas Tikader & Bastawade (1983: 555) considered *H. serratus* a valid species. Examination of additional specimens collected during the Sri Lankan expedition of 2015 convinced us that *H. serratus* is in fact a valid species. Pocock (1900: 86) differentiated *H. serratus* and *H. indus* as follows: **1)** dorsal and dorsolateral carinae of metasomal segments granulated in *H. serratus* (Fig. 574), smooth in *H. indus* (Fig. 573). We found other minor differences: **2)** sexual dimorphism in proportions of pedipalps not noticeable in *H. indus*, male with slightly narrower chela than female in *H. serratus* (chela length to width ratio 1.79–1.94 in males, 1.69 in the females); **3)** carapace smooth and glossy, only occasionally with granules at margins in *H. indus* (Figs. 486–487); carapace smooth and glossy medially, always with more granules at margins in *H. serratus* (Figs. 516–517); **4)** spination formula of tar-

Figures 539–543: *Heterometrus swammerdami* from locality 15CB, female, pedipalp chela dorsal (539), external (540) and ventral (541) views, tarsomeres of third (542) and fourth (543) legs retroventral views.

someres II of legs: 3/4 : 2-4/3-4 : 4/4-5 : 4/5 in *H. indus*; 3-4/4-6 : 4/4-5 : 4/5-6 : 4/5-7 in *H. serratus*.

The distribution of *H. serratus* was previously unknown, as the type locality was imprecise and the holotype male was the only known specimen. We collected additional specimens at localities cited here as 15CP (Fig. 594) and 15CQ (Fig. 595). Our data suggest that *H. serratus* is distributed in the southern part, and *H. indus* in the central part of Sri Lanka (Fig. 15).

DISTRIBUTION. Sri Lanka.

Heterometrus swammerdami Simon, 1872
(Figs. 15, 535–546)

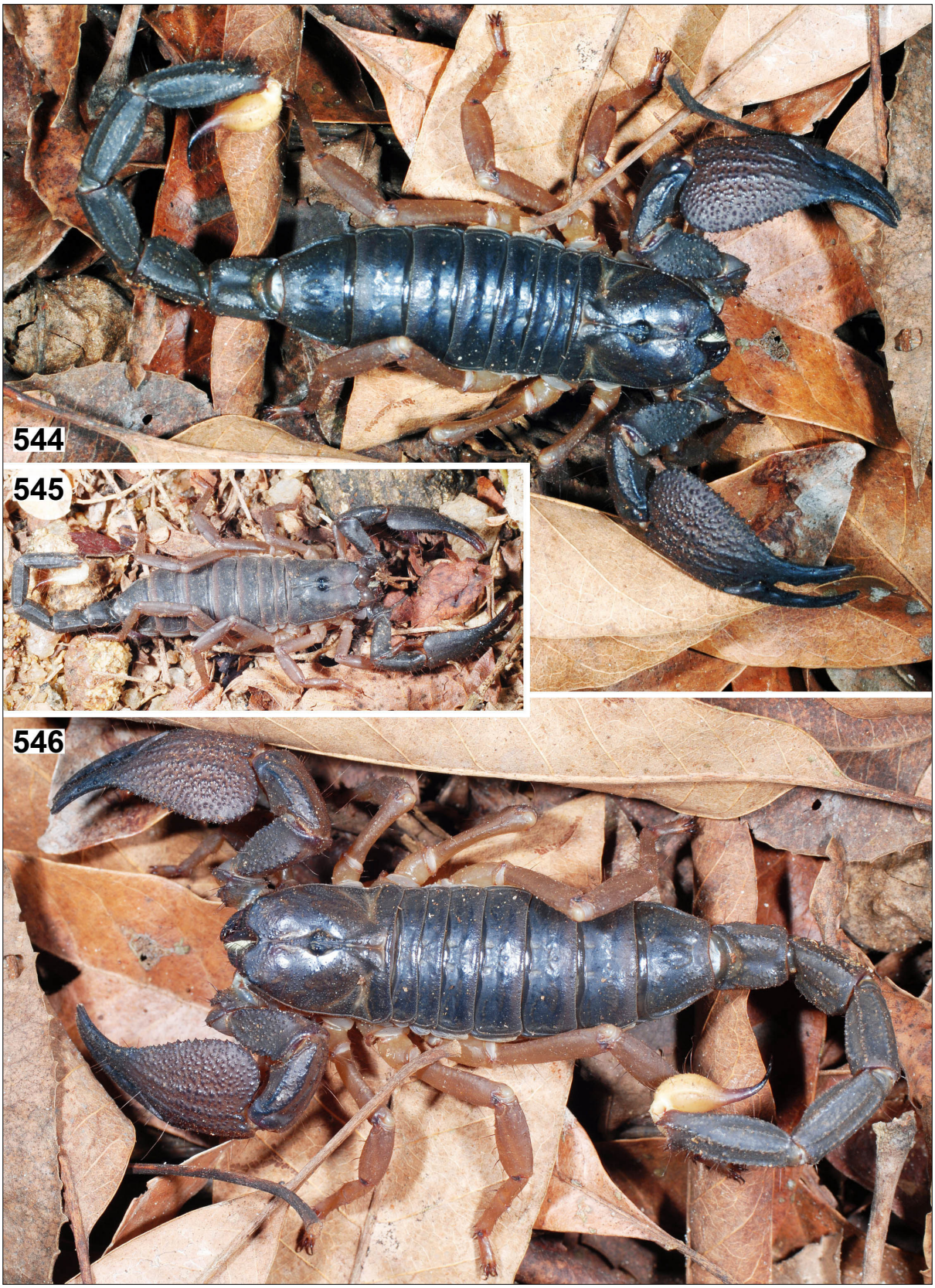
Heterometrus swammerdami Simon, 1872: 56–59; Fet, 2000: 443–444 (complete reference list until 1998); Kovařík, 2004: 42–44, fig. 28 (complete reference list until 2004); Kovařík, 2009: 44, 93, 113, figs. 139–145, 275–283; Veronika & al., 2013: 72–73, figs. 1, 3–8, tab. 1.

Heterometrus (*Gigantometrus*) *swammerdami*: Tikader & Bastawade, 1983: 562–567, figs. 1497–1510;

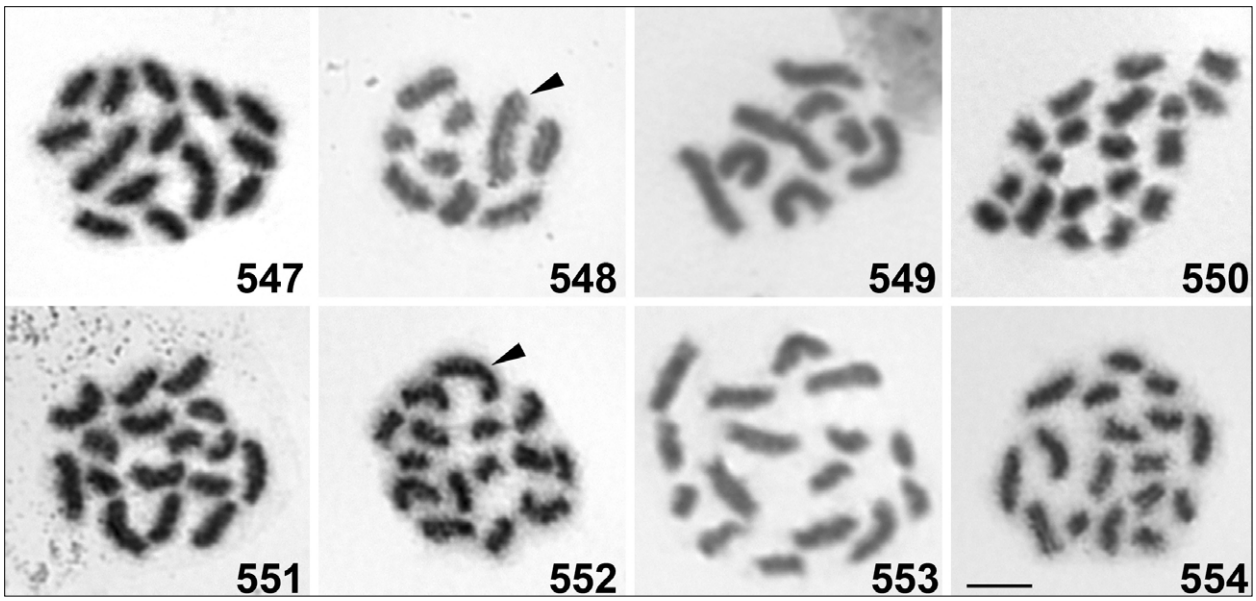
= *Heterometrus* (*Gigantometrus*) *swammerdami titanicus* Couzijn, 1981: 165–167, figs. 4f, 55, 56 (syn. by Kovařík, 2004: 42).

TYPE LOCALITY AND TYPE REPOSITORY. East Indies; MNHN.

SRI LANKAN MATERIAL EXAMINED. Sri Lanka, North Western Province, Puttalam, IV.1994, 1♂1♀1juv., FKCP, leg. P. Senft; Central Province, Kandy District, Hantana (Peradeniya), University land, 07°14'54.7"N 080°36'54"E, 760 m a.s.l. (Locality **15CA**, Fig. 575), 19.



Figures 544–546: *Heterometrus swammerdami*, two differently colored females (544, 546) at locality 15CJ and juvenile (545) at locality 15CE.



Figures 547–554: The mitotic metaphases of buthid males from Sri Lanka. *Buthoscorpio sarasinorum* from locality 15CF (2n=14) (547), *Charmus laneus* from locality 15CO (2n=9) (548), *Isometrus thwaitesi* from locality 15CF (2n=8) (549), *Lychas srilankensis* from locality 15CN (2n=16) (550), *Reddyanus basilicus* from locality 15CS (2n=16) (551), *Reddyanus basilicus* from locality 15CR (2n=15) (552), *Reddyanus ceylonensis* from locality 15CI (2n=16) (553), *Reddyanus loebli* from locality 15CH (2n=17) (554). Arrowheads indicate extra large odd chromosomes. Scale bar = 5 μm for 547–554.

–21.IV.2015, 1♀, UPSL, leg. Kovařík et al.; Central Province, Matale District, Maragamuwa/Kumaragala, 07°41'58.5"N 080°42'26.7"E, 662 m a.s.l. (Locality **15CB**, Fig. 576), 21.IV.2015, 1♀ (Figs. 535–543), FKCP, leg. Kovařík et al.; North Central Province, Polonnaruwa District, Giritale, 08°01'26.0"N 080°54' 37.2"E, 233 m a.s.l. (Locality **15CE**, Figs. 579–580), 22. –23.IV.2015, 1juv. (Fig. 545), FKCP, 3juvs., UPSL, leg. Kovařík et al.; Northern Province, Jaffna District, 09°42'51.6"N 080°04'44.8"E, 19 m a.s.l. (Locality **15CJ**, Fig. 587), 26. –27.IV.2015, 1♀, FKCP, leg. Kovařík et al.; North Central Province, Anuradhapura District, Mihintale, 08°20'51.8"N 080°30'27.7"E, 156 m a.s.l. (Locality **15CL**, Fig. 589), 27. –28.IV.2015, photos only, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°12'35.1"N 079°51'32"E, 52 m a.s.l. (Locality **15CN**, Fig. 591), 28.IV.2015, photos only, leg. Kovařík et al.; North Central Province, Puttalam District, Eluwankulam, 08°17'15"N 079°50' 38.7"E, 38 m a.s.l. (Locality **15CO**, Fig. 592), 28. IV.2015, 1juv., UPSL, leg. Kovařík et al.

DIAGNOSIS. Total length 128–176 mm long. Base color uniformly reddish brown to reddish black. Juveniles may be red with yellow telson. Pectinal teeth number 16–20. Sexual dimorphism in proportions of pedipalps not noticeable. Chela strongly lobiform, length/ width ratio 1.6–1.8 in both sexes. Entire manus covered by large, rounded granulae that do not form true carinae. Pedipalp patella without pronounced internal tubercle. Carapace with disc smooth, margins and posterior portion granulate, anterior portion granulate and tuberculate; occasionally entire surface sparsely granulate. Fifth segment of metasoma longer than pedipalp femur, fourth segment of metasoma approximately as long as pedipalp femur. Telson bulbous, vesicle as long as or longer than aculeus.

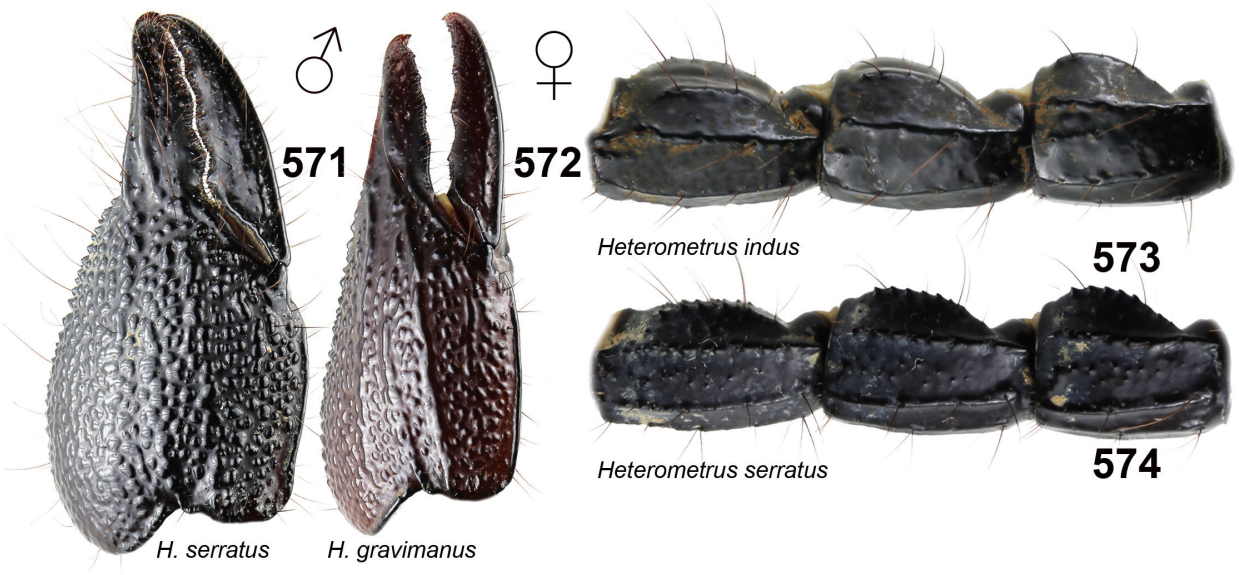
NOTE. For photos of the male see figs. 139–142 and 275 in Kovařík, 2009: 93 and 113.

DISTRIBUTION. India and Sri Lanka.

Hemispermatophores of the Buthids

We obtained new data on hemispermatophore morphologies of a variety of Old World buthids from Sri Lanka, that have not previously been described. Our findings may be significant in the context of the larger problem of defining monophyletic genera in the family and understanding relationships of major lineages of buthids. A preliminary buthid phylogeny was derived by Fet et. al. (2005) from the cladistic analysis of certain trichobothrial characters. They proposed a major family subdivision based on whether patella trichobothrium d_3 is positioned internal to the dorsomedian carina, which defined the '*Buthus*' group, or external to it, which is the character state for the remaining five 'non-*Buthus*' groups. Hemispermatophores of '*Buthus*' group genera have been relatively well described, including for the

Figures 555–570: Key characters for distinguishing males of Sri Lankan *Isometrus* and *Reddyanus*. **Figures 555–556, 565–566**. Pedipalp chela dorsal view, *I. maculatus* from locality 15CP (555), *I. thwaitesi* from locality 15CH (556), *R. basilicus*, holotype (565), and *R. besucheti*, holotype (566). **Figures 557–558**. Sternopectinal area, *I. maculatus* from locality 15CP (557), and *I. thwaitesi* from locality 15CH (558). **Figures 559–560, 567–570**. Sternite V, *I. maculatus* from locality 15CP (559), *I. thwaitesi* from locality 15CH (560), *R. besucheti*, from locality 15CF (567), *R. ceylonensis* **sp. n.**, holotype (568), *R. jayarathnei* **sp. n.,** paratype (569), and *R. ranawanai* **sp. n.**, paratype (570). **Figures 561–564**. Metasomal segment II lateral (561–562) and pedipalp patella dorsal (563–564), *R. loebli* from locality 15CG (561, 563) and *R. besucheti*, from locality 15CF (562, 564).



Figures 571–574: Key characters for distinguishing Sri Lankan *Heterometrus*. **Figures 571–572**. Pedipalp chela dorsal view of male, *Heterometrus serratus* from locality 15CP (571) and *Heterometrus gravimanus* from locality 15CE (572). **Figures 573–574**. Metasomal segments IV-II lateral view of female, *Heterometrus indus* from locality 15CA (573) and *Heterometrus serratus* from locality 15CP (574).

genera *Androctonus*, *Apistobuthus*, *Buthacus*, *Buthiscus*, *Buthus*, *Cicileus*, *Compsobuthus*, *Femtobuthus*, *Gint*, *Hottentotta*, *Leiurus*, *Lissothus*, *Mesobuthus*, *Microbuthus*, *Neobuthus*, *Odontobuthus*, *Orthochirus*, *Picobuthus* and *Vachoniolus* (Kovařík & Lowe, 2012; Kovařík, Lowe et. al., 2013; Levy & Amitai, 1980; Lowe, 2009, 2010a, 2010b, 2010c; Lowe et. al., 2014; Navidpour & Lowe, 2009; Vachon, 1952a, 1952b, 1958; Vachon & Stockmann, 1968). Their capsule region has a stereotypic 4-lobed configuration, in which the sperm hemi-duct is composed of 3 lobes (i.e. *external lobe*, carinated *median lobe*, and *internal lobe*), and a single *basal lobe* arises dorsally near the base of the median lobe carina. The flagellum is well separated from these lobes. So far, this '3+1' configuration has been found in all *Buthus* group members, suggesting that it is a synapomorphy for the group.

Hemispermatophores of non-*Buthus* group genera, including most of the Sri Lankan buthids (except *Hottentotta tamulus*), are more heterogeneous. In the majority of genera, the base of the flagellum is broadly fused to a large carinated lobe, and there may be one or more additional distinct lobes on the internal side. A basal lobe is usually present, and its size and shape varies considerably. This configuration has been described in the genera *Ananteris*, *Australobuthus*, *Butheoloides*, *Centruroides*, *Chaneke*, *Hemilychas*, *Isometroides*, *Isometrus*, *Parabuthus*, *Rhopalurus*, *Tityus* and *Zabius* (Botero-Trujillo & Florez-Daza, 2011; Francke & Stockwell, 1987; Gysin & Le Coroller, 1968; Koch, 1977; Kovařík, Teruel, et al., 2015; Kovařík, Teruel & Lowe, 2016; Lamoral, 1979; Lenarducci et. al., 2005; Locket, 1990; Lourenço et. al., 2006; Maury, 1969, 1970, 1974; Ojanguren-Affilastro, 2005; Prendini et. al., 2009; Probst, 1972; Stockwell, 1989; Teruel & Armas, 2012). Here we document this lobe configuration also in the non-*Buthus* group genera, *Buthoscorpio*, *Charmus*, *Lychas* and *Reddyanus* **stat. n.**

Following Stockwell (1989), we have proposed that the carinated lobe of buthids is homologous to and derived from the carinated lobe of the chaerilid hemispermatophore (Kovařík, Teruel & Lowe, 2016). In the '*Buthus*' group, this lobe sits between two other lobes with more external and more internal positions, and hence was termed the 'median lobe' (Vachon, 1952). Taking the carina as a conserved landmark, we hypothesize that the median lobe is homologous to the carinated lobe in non-*Buthus* group genera that is fused to the base of the flagellum. We further hypothesize that the fused state is plesiomorphic because it approximates the chaerilid condition in which the carinated lobe is joined continuously to the distal lamina. Some exceptions to the fused configuration are seen in the genera *Ananteris*, *Babycurus*, *Grosphus* and *Uroplectes* (Lamoral, 1979; Lowe, 2000; Kovařík, Lowe et. al., 2015, 2016; Ojanguren-Affilastro, 2005;Vachon, 1950, 1969), in which the flagellum appears well separated from the carinated median lobe. However, in contrast to the *Buthus* group, a non-carinated external lobe is not interpolated between the flagellum and the median lobe. This arrangement could represent a precursor to the *Buthus* group configuration.

All Sri Lankan representatives of non-*Buthus* group genera so far examined (*Buthoscorpio*, *Charmus*, *Iso-*

metrus, *Lychas* and *Reddyanus* **stat. n.**) exhibit a basic 1+1 lobe configuration (fused median lobe + basal lobe), without additional internal lobes developed. This configuration is shared with a number of other non-*Buthus* group genera that have been reported, i.e. some species of *Ananteris* (Botero-Trujillo & Florez-Daza, 2011; Ojanguren-Affilastro, 2005) and *Tityus* (Kovařík, Teruel, et. al., 2015; Ojanguren-Affilastro, 2005); and *Australobuthus*, *Hemilychas*, *Isometroides* and *Isometrus* (Gysin & Le Coroller, 1968; Locket, 1990; Probst, 1972). This may be a plesiomorphic state from which additional internal or external lobes have arisen independently in different lineages. Even under a basic 1+1 configuration, we observe hemispermatophore differences that are diagnostic at the generic level, e.g. enabling us to differentiate *Reddyanus* from *Isometrus* by the size of the basal lobe, and the length and shape of the flagellum. Two novel, unique hemispermatophore morphologies that we found are: (i) a highly elongated capsule in *Buthoscorpio*, with a long narrow median lobe fused to the base of the flagellum, and a round, blunt basal lobe; and (ii) a short capsule in *Charmus*, with a truncated median lobe, and a bulging, bilobate basal lobe. These findings reveal an unexplored diversity in buthid hemispermatophores, that could provide new characters for analyzing phylogenetic relationships in this large and ancient family.

Cytogenetic Data on Sri Lankan Buthid Scorpions

Altogether we analyzed seven buthid species (Figs. 547–554, Table 6) using standard cytogenetic methods (e.g. Kovařík et al., 2009; Šťáhlavský et al., 2014). The karyotype characteristics of all analyzed species correspond to the cytogenetic attributes typical for the family Buthidae. Chromosomes do not have visible centromere regions which is a typical feature for holocentric chromosomes. This type of organization is only known in the family Buthidae within scorpions (e.g. Mattos et al., 2013). This family is also characterized by low numbers of chromosomes. Half of the cytogenetically investigated species show diploid numbers from 14 to 24 (Schneider et al., 2016). In view of this fact, *Charmus laneus* (2n=9) (Fig. 548) and *Isometrus thwaitesi* (2n=8) (Fig. 549) represent exceptions with very low number of chromosomes. Only three known species from the genus *Tityus* C. L. Koch, 1836 have diploid numbers of chromosomes lower than 10 (see Schneider et al., 2016). This phenomenon has been documented in *T. bahiensis* (Perty, 1834) and was explained as an effect of intensive fusion of holocentric chromosomes (Schneider et al., 2009). This type of chromosomal rearrangement may also explain the differences in chromosome size within *Buthoscorpio sarasinorum* (Fig. 547), *Lychas srilankensis* (Fig. 550) (both with one extra larger pair of chromosomes) and *Isometrus thwaitesi* (Fig. 549) (with one extra shorter pair of chromosomes). Moreover, heterozygous chromosomal rearrangements may also explain odd diploid numbers of chromosomes in karyotypes of *Isometrus thwaitesi* (Fig. 549), *Reddyanus loebli* (Fig. 554) and one male of *Reddyanus basilicus* (Fig. 552). In *Reddyanus basilicus* we found 2n=16 in a male from locality 15CS. In this case the chromosomes gradually decrease in size (Fig. 551, Table 6). However, the male of *R. basilicus* from locality 15CR has 2n=15, including one extra large chromosome (Fig. 552, Table 6). The intraspecific variability has also been documented in another 8 species from different genera in the family Buthidae (see Schneider et al., 2016). Due to the intraspecific variability and high similarity of basic cytogenetic characteristics (such as number and size of chromosomes) it seems difficult to apply standard cytogenetic techniques to the taxonomy of buthid scorpions. In the future, application of more refined molecular cytogenetic techniques should lead to a better understanding of the organization of genome, which may be the key to detecting specific differences between closely related species.

Key to Scorpions of Sri Lanka

1. Pedipalp patella without ventral trichobothria. ..... **Buthidae** C. L. Koch, 1837 ..……..... 3
– Pedipalp patella with three ventral trichobothria. 2

2. Adults 27–45 mm long. Pedipalp femur with 9 trichobothria, of which 4 are dorsal. …….... **Chaerilidae** Pocock, 1893, …... ***Chaerilus ceylonensis*** Pocock, 1894
– Adults 75–176 mm long. Pedipalp femur with 3 or 4 trichobothria, of which only one is dorsal ..... **Scorpionidae** Latreille, 1802 ....……..... 15

3. Legs III and IV with well developed long tibial spurs (Figs. 193–195, 198) ....……..... 4
– Legs III and IV without tibial spurs (Figs. 196–197, 199) .....……..... 8

4. Telson with a distinct subaculear tooth (Figs. 407–408). .....…..... ***Lychas srilankensis*** Lourenço, 1997
– Telson without subaculear tooth (Fig. 421–427). 5

5. Metasomal segments IV–V punctate without developed carinae (Figs. 24–29). Dentate margin of pedipalp chela movable finger with distinct granules divided into 8–11 linear rows, apical rows of 3–6 granules, and 3 terminal granules (Figs. 39–44). ...……..... 6
– Metasomal segments IV–V not punctate with well developed carinae (Figs. 120–121). Dentate margin of pedipalp chela movable finger with distinct granules

divided into 13–15 linear rows and 5–6 terminal granules (Fig. 46). ..... ***Hottentotta tamulus*** (Fabricius, 1798)

6. Adults 25–52 mm long. Pedipalps, metasoma and telson glabrous (Figs. 24–29). ..……..... ……..……. ***Buthoscorpio sarasinorum*** (Karsch, 1892)
– Adults 12–25 mm long. Pedipalps, metasoma and telson densely hirsute (Figs. 71–73). ……..... 7

7. Pedipalp patella yellowish with several black spots (Figs. 118–119); metasomal segment V length/ width ratio is 1.28–1.43 in female (Fig. 83); pedipalp chela length/ fixed finger length ratio is 1.69–1.79 in female (Figs. 42–43). ……..... ***Charmus laneus*** Karsch, 1879
– Pedipalp patella black with several little yellow spots (Figs. 111, 116); metasomal segment length/ width ratio is 1.80 in female (Fig. 84); pedipalp chela length/ fixed finger length ratio is 1.45 in female (Fig. 44). ..... ……..... ***Charmus saradieli*** **sp**. **n**.

8. Chelal trichobothrium *db* located between *dt* and *et*. Fixed fingers of pedipalps with six rows of granules and six external and internal granules (Figs. 252–253). Tarsomeres II of leg IV with two rows of dense setae (Figs. 196–197). ..... ***Isometrus*** Ehrenberg, 1828 ….. 9
– Chelal trichobothrium *db* located between *et* and *est* (Fig. 321). Fixed fingers of pedipalps with seven rows of granules and six external and seven internal granules (Figs. 254–259). Tarsomeres II of leg IV with two rows of no more than 20 spiniform setae (Figs. 199, 201–208). ..... ***Reddyanus*** Vachon, 1972 **stat**. **n**. ….... 10

9. First (basal) middle lamella of pectine in both sexes rounded (Fig. 558). Fingers and manus of pedipalp chela the same color, spotted (Fig. 556). Posterior margin of sternite V strongly convex medially (Fig. 560) …….. …..……..……. ***I. thwaitesi*** Pocock, 1897
– First (basal) middle lamella of pectine in both sexes quadrangular (Fig. 557). Manus of pedipalp yellow with several spots, fingers dark (Fig. 555). Posterior margin of sternite V almost straight to very slightly convex medially (Fig. 559). …..... ***I. maculatus*** (De Geer, 1778)

10. Terminal tubercle of dorsal carina on second and third metasomal segment of male markedly enlarged (Fig. 561). Pedipalp femur and patella spotted, patella mostly black (Fig. 563), femur mostly yellow. Subaculear tooth spinoid (Figs. 417–418). ..……..... …….. ***R. loebli*** (Vachon, 1982) **comb. n.**
– Terminal tubercle of dorsal carina on metasomal segments of male are not enlarged (Fig. 562). Pedipalps with brown spots, identical on femur and patella (Fig. 564). Subaculear tooth wide and rounded (Figs. 409–416, 419–420). ….....……..... 11

11. Glabrous zone on posterior part of fifth sternite present medially in male (Figs. 569–570). …….. 12
– Glabrous zone along posterior margin of fifth sternite absent or indicated (*R. besucheti*) (Figs. 567–568). 13

12. Whole mesosoma dark, almost black (Figs. 338–339). Glabrous zone present in middle part of fifth sternite only (Fig. 569). ....……..... ***R. jayarathnei*** **sp**. **n**.
– Mesosoma lighter, yellowish brown (Figs. 382–383). Glabrous zone stretches almost over whole posterior margin of fifth sternite (Fig. 570).... ***R. ranawanai*** **sp**. **n**.

13. Manus of pedipalp chela wide in male. Ratio pedipalp chela length/width 2.94–3.28 (Fig. 566, Table 5). Chela wider in male than in female. .....…..... 14
– Manus of pedipalp chela narrow in male. Ratio pedipalp chela length/width 3.41–3.79 (Fig. 565, Table 5). Chela the same width in both sexes. ..... ……....…… ***R. basilicus*** (Karsch, 1879) **comb. n.**

14. Ratio metasomal segment II length/width 1.56–1.79 in male (Fig. 211, Table 5). .....…..... ……..……. ***R. besucheti*** (Vachon, 1982) **comb. n.**
– Ratio metasomal segment II length/width 1.85–1.97 in male (Fig. 213, Table 5). ……..... ***R. ceylonensis*** **sp**. **n**.

15. Adults 128–176 mm long. Pectinal teeth number 16–20. Fifth segment of metasoma longer than pedipalp femur, fourth segment of metasoma about as long as pedipalp femur ..…..... ***H. swammerdami*** Simon, 1872
– Adults 75–130 mm long. Pectinal teeth number 10–16. Fifth segment of metasoma about as long as pedipalp femur, fourth segment of metasoma shorter than pedipalp femur. .....…….....16

16. Pedipalp chela with carinae on dorsoexternal surface (Fig. 572). ……..... ***H. gravimanus*** (Pocock, 1894)
– Pedipalp chela without carinae on dorsoexternal surface (Fig. 571). .....……..... 17

17. Dorsal and dorsolateral carinae of metasomal segments smooth (Fig. 573). ….. ***H. indus*** (De Geer, 1778)
– Dorsal and dorsolateral carinae of metasomal segments granulated (Fig. 574). ..…..... ***H. serratus*** (Pocock, 1900)

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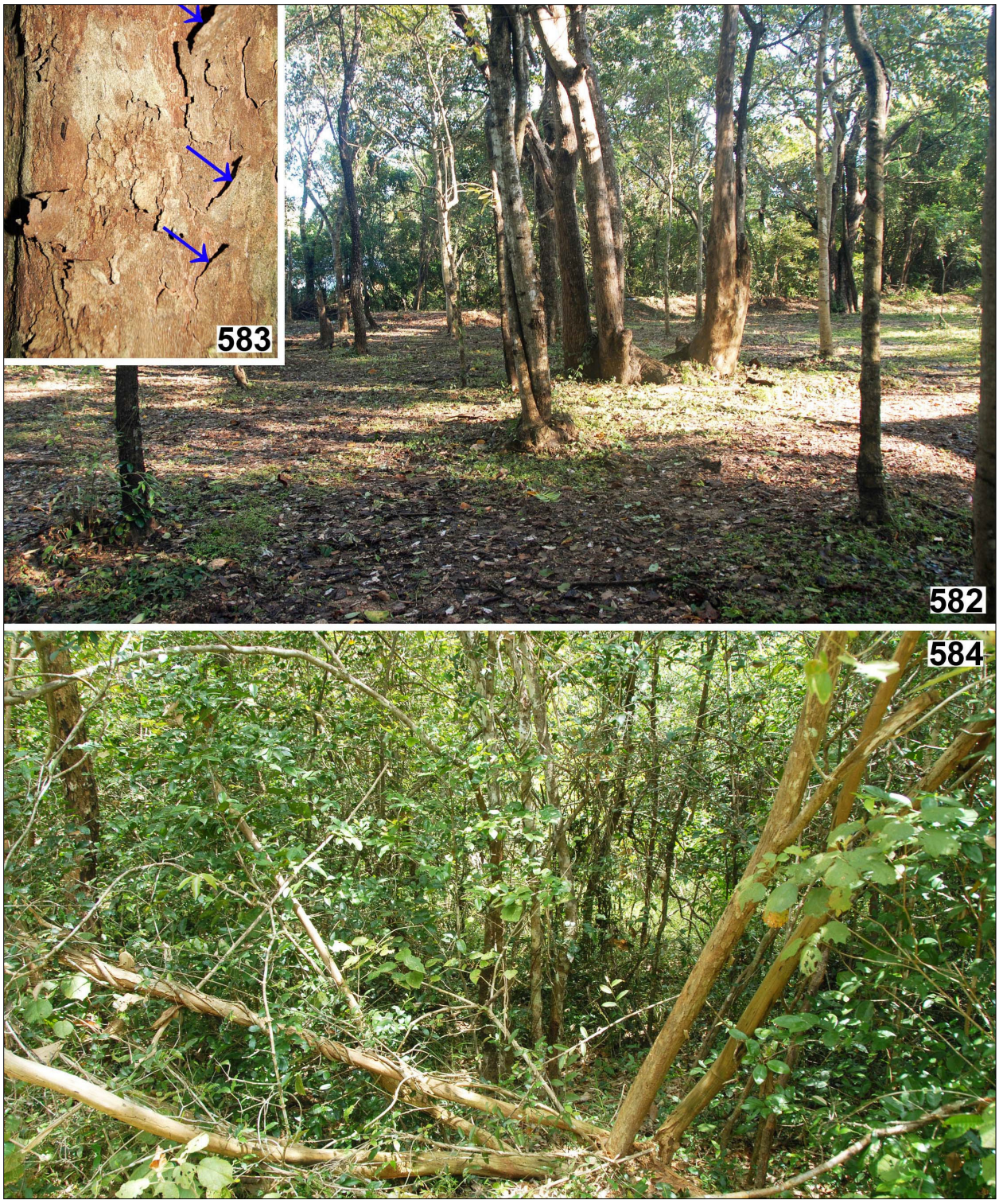
Figures 575–576: Figure 575. Locality **15CA**, Sri Lanka, Central Province, Kandy District, Hantana (Peradeniya), University land, 07°14'54.7"N 080°36'54"E, 760 m a.s.l. Specimens of *Heterometrus indus* were collected along a road during a day under stones and under bark on the photo. A male was collected also in a kitchen inside a house. During night collecting on 19.–21.IV.2015 (UV detection), we recorded a lot of specimens around their burrows. On the locality we recorded night temperature 25.6 ºC– 21.4 ºC (minimum temperature) and night humidity varied between 72% (evening) and 87% (morning). There also lives *Heterometrus swammerdami* and *Buthoscorpio sarasinorum* (type locality). **Figure 576**. Locality **15CB**, Sri Lanka, Central Province, Matale District, Maragamuwa/Kumaragala, 07°41'58.5"N 080°42'26.7"E, 662 m a.s.l. During a day (21.IV.2015, temperature 26.1 ºC– 33.2 ºC, humidity 63%–88%) we recorded *Heterometrus swammerdami* inside termite constructions. There also lives *Isometrus thwaitesi*.

Figures 577–578: Figure 577. Locality **15CC**, Sri Lanka, Central Province, Kandy District, 20 km S Kandy, Meegammana, Wattegama, 07°20'41.9"N 080°39'30.6"E, 534 m a.s.l.. We collected a female of *Heterometrus indus* close to a house on 21.IV.2015 evening. There also lives *Isometrus* sp. **Figure 578**. Locality **15CD**, Sri Lanka, North Central Province, Polonnaruwa District, ca 35 km from Dambula, 07°57'15.1"N 080°54'45,4"E, 132 m a.s.l. During the day 22.IV.2015 under stones we recorded *Reddyanus besucheti* (close to the type locality) and *Chaerilus ceylonensis*.

Figures 579–581: **Figures 579–580**. Locality **15CE**, Sri Lanka, North Central Province, Polonnaruwa District, Giritale, 08°01'26.0"N 080°54'37.2"E, 233 m a.s.l. During night collecting on 22.–23.IV.2015 in the hotel garden (UV detection) we recorded *Heterometrus swammerdami* (inside the termite constructions, Fig. 580) and *Heterometrus gravimanus* inside burrows in open terrain. The mothers had 30 to 60 cm long oblique burrows usually once curved from which several narrow burrows created by their juveniles separated under surface. Every burrow of juveniles has a proper exit 15 to 90 cm from the main exit of the mother´s burrow. On the locality we recorded night temperature 32.8 ºC– 26.5 ºC (minimum temperature) and night humidity varied between 51% and 79%. **Figure 581**. Locality **15CF**, Sri Lanka, North Central Province, Polonnaruwa District, near Kaudulla National Park, 08°08'40.6"N 080°51'04"E, 101 m a.s.l. During a day 23.IV.2015 we recorded *Buthoscorpio sarasinorum* (under stones or woods), *Isometrus thwaitesi* (under dry bark of standing trees), *Reddyanus besucheti* (under stones), and *Chaerilus ceylonensis* (under stones).



Figures 582–584: **Figures 582–583**. Locality **15CG**, Sri Lanka, Central Province, Matale District, Habarana, Wananiwahana Resort, 07°59'25.8"N 080°43'24.6"E, 280 m a.s.l. During night collecting on 23.–24.IV.2015 in Wananiwahana resort garden (UV detection) we recorded *Buthoscorpio sarasinorum* (running on the land among leaves), *Reddyanus besucheti* (on the land among leaves) and *Reddyanus loebli* (hidden under scales of barks of standing tree trunks, see the blue arrows on the Fig. 583). On the locality we recorded night temperature 28.4 ºC– 24 ºC (minimum temperature) and night humidity varied between 55% and 87%. **Figure 584**. Locality **15CH**, Sri Lanka, Northern Province, Mannar District, Madhu Road, 08°48'26.3"N 080°10'26"E, 90 m a.s.l. During night collecting on 24.–25.IV.2015 (UV detection) we recorded *Isometrus maculatus* and *Isometrus thwaitesii* sympatrically (running on branches and trunks of trees, also siting on leaves one to four metres high), *Reddyanus ceylonensis* **sp. n**. (on the land among leaves), *Reddyanus loebli* (hidden under scales of barks of standing tree trunks).

Figures 585–587: Figure 585. Locality **15CI**, Sri Lanka, Northern Province, Mannar District, Marichchukkaddi env, border of Wilpattu National Park, 08°33'32.3"N 079°56'51"E, 7 m a.s.l. During night collecting on 25.–26.IV.2015 (UV detection) we recorded *Isometrus maculatus* and *Isometrus thwaitesii* sympatrically (running on branches and trunks of trees, also sitting on leaves one to four metres high), *Reddyanus ceylonensis* **sp**. **n**. (on the land among leaves; the type locality), *Reddyanus loebli* (hidden under scales of bark of standing tree trunks). Near to the locality we recorded temperature between 37.6 ºC (maximum daytime temperature and 26.2 ºC (minimum nighttime temperature) shortly before sunrise. Humidity varied between 67% and 81%. **Figures 586–587**. Locality **15CJ**, Sri Lanka, Northern Province, Jaffna District, 09°42'51.6"N 080°04'44.8"E, 19 m a.s.l. During night collecting on 26.–27.IV.2015 (UV detection) we recorded *Lychas srilankensis* (on the land usually under branches, leaves or in their vicinity), *Heterometrus swammerdami* (inside the termite constructions or inside heaps of garden "waste") and *Heterometrus gravimanus* inside burrows in open terrain (Fig. 587). The females had 30 to 60 cm long oblique burrows once or twice curved. A female shortly after maturity ecdysis was in the burrow together with a male; another female was in the burrow together with three juveniles which had their own narrow burrows separated under surface from the mother´s burrow; a juvenile after the third ecdysis had a proper burrow 30 cm long oblique and once curved. There also lives *Isometrus maculatus*. On the locality we recorded night temperature 31.6 ºC– 27.2 ºC (minimum temperature) and night humidity varied between 60% and 87%.

Figures 588–589: Figure 588. Locality **15CK**, Sri Lanka, Northern Province, Jaffna District, 09°49'15.4"N 080°08'41.6"E, 19 m a.s.l. During day 27.IV.2015 we recorded *Hottentotta tamulus* under stones or woods and also in vicinity of houses. **Figure 589**. Locality **15CL**, Sri Lanka, North Central Province, Anuradhapura District, Mihintale, 08°20'51.8"N 080°30'27.7"E, 156 m a.s.l. During night collecting on 27.–28.IV.2015 (UV detection) we recorded *Isometrus thwaitesii* (running on branches and trunks of trees, also sitting on leaves), *Reddyanus besucheti* (on the ground among leaves), *Reddyanus loebli* (hidden under scales of bark of standing tree trunks) and *Heterometrus swammerdami* (inside burrows). On the locality we recorded night temperature 27.4 ºC– 24.5 ºC (minimum temperature) and night humidity varied between 64% and 87%.

Figures 590–591: **Figure 590**. Locality **15CM**, Sri Lanka, Central Province, Matale District, Pallegama, 07°32'49.5"N 080°47'50"E, 434 m a.s.l. During a day 28.IV.2015 we recorded *Reddyanus loebli* (under bark). **Figure 591**. Locality **15CN**, Sri Lanka, North Central Province, Puttalam District, Eluwankulam, 08°12'35.1"N 079°51'32"E, 52 m a.s.l. During night collecting on 28.IV.2015 (UV detection) between 9.00 and 10.00 p.m. we recorded *Charmus laneus* (running on the ground among leaves), *Lychas srilankensis* (on the ground under branches or leaves or in their vicinity), *Reddyanus ceylonensis* **sp**. **n**. (on the ground and inside old moulder stump), *Reddyanus loebli* (hidden under scales of bark of standing tree trunks) and *Heterometrus swammerdami* (inside burrows). On the locality we recorded between 9.00 and 10.00 p.m. temperature 28.5 ºC– 25.9 ºC and humidity between 61% and 78%.

Figures 592–594: **Figure 592**. Locality **15CO**, Sri Lanka, North Central Province, Puttalam District, Eluwankulam, 08°17'15"N 079°50'38.7"E, 38 m a.s.l. During night collecting from 10.30 p.m. on 28.IV.2015 to 4.00 a.m. on 29.IV.2015 (UV detection) we recorded *Charmus laneus* (running on the ground among leaves), *Isometrus thwaitesii* (running on branches of bushes, also sitting on leaves), *Lychas srilankensis* (on the ground under branches, leaves or in their vicinity), *Reddyanus ceylonensis* **sp**. **n**. (on the ground), *Chaerilus ceylonensis* (inside oblique usually not curved burrows 15 to 30 cm long) and *Heterometrus swammerdami* (inside long burrows). On the locality we recorded between 10.00 p.m. and 4.00 a.m. temperature 25.9 ºC and humidity between 58% and 70%. On the locality we recorded 6 scorpion species and genera of all three Sri Lankan families. **Figures 593–594**. Locality **15CP**, Sri Lanka, Southern Province, Matara District, Kekanadura village, 05°58'28.2"N 080°36'20.5"E, 40 m a.s.l. During night collecting on 30.IV.2015 (UV detection) we recorded *Isometrus maculatus* (inside a house, the species occupy the roof of the house, Fig. 593) and *Heterometrus serratus* (inside almost straight burrows in a ground wall). On the locality we recorded night temperature 28.4 ºC– 25.2 ºC (minimum temperature) and night humidity varied between 63% and 89%.

Figures 595–596: Figure 595. Locality **15CQ**, Sri Lanka, Uva Province, Monaragala District, Monaragala, 06°52'30.7"N 081°21'17"E, 288 m a.s.l. During night collecting on 2.–3.V.2015 (UV detection) we recorded *Reddyanus loebli* (under scales of bark and under bark) and *Heterometrus serratus* (females with juveniles inside oblique burrows). On the locality we recorded a temperature of 33.1 ºC at 5.00 p.m., which gradually dropped to 24.6 ºC (minimum temperature) before sunrise. Humidity during the night varied between 61% and 84%. **Figure 596**. Locality **15CR**, Sri Lanka, Eastern Province, Ampara District, Lahugala Kitulana National Park, 06°52'46"N 081°43'21.8"E, 40 m a.s.l. During night collecting on 3.–4.V.2015 (10.00 p.m. to 01.00 a.m.) we recorded *Isometrus maculatus* (running on branches, also sitting on leaves on trees), *Reddyanus basilicus* (on the ground among leaves) and *Reddyanus loebli* (hidden under scales of bark of standing tree trunks). On the locality we recorded between 10.00 p.m. on 3.V. and 01.00 a.m. on 4.V.2015 temperature 28 ºC, which gradually dropped to 26.9 ºC and humidity 73%.

Figures 597–598: Figure 597. Locality **15CS**, Sri Lanka, Eastern Province, Ampara District, Ampara env., 07°20'01.3"N 081°41'57.1"E, 56 m a.s.l. During night collecting on 4.V.2015 (between 10.00 and 11.30 p.m.) we recorded *Buthoscorpio sarasinorum* (running on the ground among leaves and escaping to borrows), *Reddyanus basilicus* (on the ground among leaves), and *Reddyanus loebli* (hidden under scales of bark of standing tree trunks). Near to the locality we recorded maximum day temperature 39 ºC and 27 ºC night temperature at 10.00 p.m.; humidity 68%. **Figure 598**. Locality **15CT**, Sri Lanka, Central Province, Kandy District, Tree centre Wildlif Trust Sri Lanka "Rantambe", 07°12'22.1"N 080°57'20.7"E, 171 m a.s.l. During night collecting on 5.V.2015 (between 11.00 and 12.00 p.m.) during rain we recorded *Buthoscorpio sarasinorum* (running during rain on the ground among leaves) and *Reddyanus loebli* (hidden under scales of bark of standing tree trunks). On the locality we recorded night temperature 28.4 ºC– 24.8 ºC (minimum temperature) and night humidity varied between 61% and 83%.

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