Revista Ibérica de Aracnología, nº **37** (31/12/2020): 159–164.
Grupo Ibérico de Aracnología (S.E.A.). ISSN: 1576 - 9518.

DESCRIPTION OF A NEW CAVE-DWELLING SPECIES OF *LIOCHELES* SUNDEVALL, 1833 (SCORPIONES: HORMURIDAE) FROM SUMATRA

Eric Ythier[1] & Thomas Richard[2]

[1] SynTech Research, 613 route du Bois de Loyse, 71570 La Chapelle de Guinchay, France, eythier@syntechresearch.com
[2] 7 rue Edmond Rostand, 13006 Marseille, France, thomas.richard1596@gmail.com

Abstract: A new scorpion species belonging to the genus *Liocheles* Sundevall, 1833 (family Hormuridae Laurie, 1896) is described on the basis of one adult male collected in a cave near Bukit Lawang, Sumatra, Indonesia. The specimen was collected approximately 200 m from the cave entrance, in complete darkness. This new scorpion represents the fifth known species of the genus *Liocheles* and the third reported from Sumatra.
Key words: Scorpiones, Hormuridae, taxonomy, morphology, biodiversity, Indonesia, Sumatra.

Descripción de una especie cavernícola nueva de *Liocheles* Sundevall, 1833 (Scorpiones: Hormuridae) de Sumatra
Resumen: Se describe una especie nueva de escorpión del género *Liocheles* Sundevall, 1833 (Hormuridae Laurie, 1896) a partir de un macho adulto recogido en una cueva situada cerca de Bukit Lawang, Sumatra, Indonesia. El ejemplar se recogió a unos 200 m de la entrada de la cueva, en total oscuridad. Este escorpión constituye la quinta especie conocida del género *Liocheles* y la tercera que se cita de Sumatra.
Palabras clave: Scorpiones, Hormuridae, taxonomía, morfología, biodiversidad, Indonesia, Sumatra.

Taxonomy / Taxonomía: *Liocheles oranghutan* **sp. n.**

Introduction

The family Hormuridae Laurie, 1896, previously included as a subfamily in Hemiscorpiidae Pocock, 1893, and recently elevated to the rank of family by Monod & Prendini (2014), has a long and complicated history (Lourenço, 1989, 1996; Stockwell, 1989; Fet *et al*., 2000; Prendini, 2000; Soleglad & Fet, 2003; Soleglad *et al*., 2005; Prendini & Wheeler, 2005; Monod, 2011; Monod & Prendini, 2014). The family currently includes 11 genera: *Cheloctonus* Pocock, 1892, *Chiromachetes* Pocock, 1899, *Chiromachus* Pocock, 1893, *Hadogenes* Kraepelin, 1894, *Hormiops* Fage, 1933, *Hormurus* Thorell, 1876, *Iomachus* Pocock, 1893, *Liocheles* Sundevall, 1833, *Opisthacanthus* Peter, 1861, *Palaeocheloctonus* Lourenço, 1996 and *Tibetiomachus* Lourenço & Qi, 2006.

The genus *Liocheles*, created as a subgenus (Sundevall, 1833) to accommodate the species *Liocheles australasiae* (Fabricius, 1775), originally described as *Scorpio australasiae* Fabricius, 1775, also has a complicated taxonomic history. It included 15 species until the reinstatement of the genera *Hormiops* and *Hormurus* (Monod *et al*., 2013; Monod & Prendini, 2014), previously synonymized with *Liocheles*. The genus *Liocheles* now includes four species (*Liocheles australasiae* (Fabricius, 1775), *Liocheles longimanus* (Werner, 1939), *Liocheles nigripes* (Pocock, 1897) and *Liocheles schalleri* Mirza, 2017) and is widely distributed in the Indo-Pacific region, from Réunion to French Polynesia.

In the present paper, a new species of the genus *Liocheles* is described from a cave located near Bukit Lawang, Sumatra, Indonesia, based on morphological traits. The material was collected approximately 200 m from the cave entrance, in complete darkness. The description of the new species raises to five the number of species belonging to the genus *Liocheles* and this is the third species of the genus reported from Sumatra.

Methods

Illustrations and measurements were made using a Motic DM143 digital stereo-microscope together with a Canon EOS 7D camera and a Wacom Intuos drawing tablet. Map was made using Google Maps and Adobe Photoshop software. Measurements follow Stahnke (1970) and are given in mm. Morphological terminology mostly follows Hjelle (1990), trichobothrial notations follow Vachon (1974) and chelicerae dentition follows Vachon (1963). Specimens studied herein are deposited in the following collections: MNHN (Muséum national d'Histoire naturelle, Paris, France) and EYPC (Eric Ythier Private Collection, Romanèche-Thorins, France).

Taxonomic treatment

Family Hormuridae Laurie, 1896

Genus *Liocheles* Sundevall, 1833

COMPOSITION OF THE GENUS *LIOCHELES*
Liocheles australasiae (Fabricius, 1775) (Australia, Bangladesh, China, Federal States of Micronesia, Fiji, French Polynesia, India, Indonesia, Japan, Korea, Malaysia, Marianas, Marshall Islands, Myanmar, New Britain, New Caledonia, New Guinea, Palau, Philippines, Ponape, Réunion, Samoa, Solomon Islands, Thailand, Timor, Tonga, Tuvalu, Vanuatu, Vietnam).
Liocheles longimanus (Werner, 1939) (Indonesia: Sumatra).
Liocheles nigripes (Pocock, 1897) (India).
Liocheles schalleri Mirza, 2017 (India).

***Liocheles oranghutan* sp. n.**
Figs. 1-4, Table I

TYPE MATERIAL. Indonesia, Sumatra, Sumatera Utara Province, near Bukit Lawang, "Bat Cave", 3°32'07"N, 98°07'02"E, about 200 m from the cave entrance, in the second

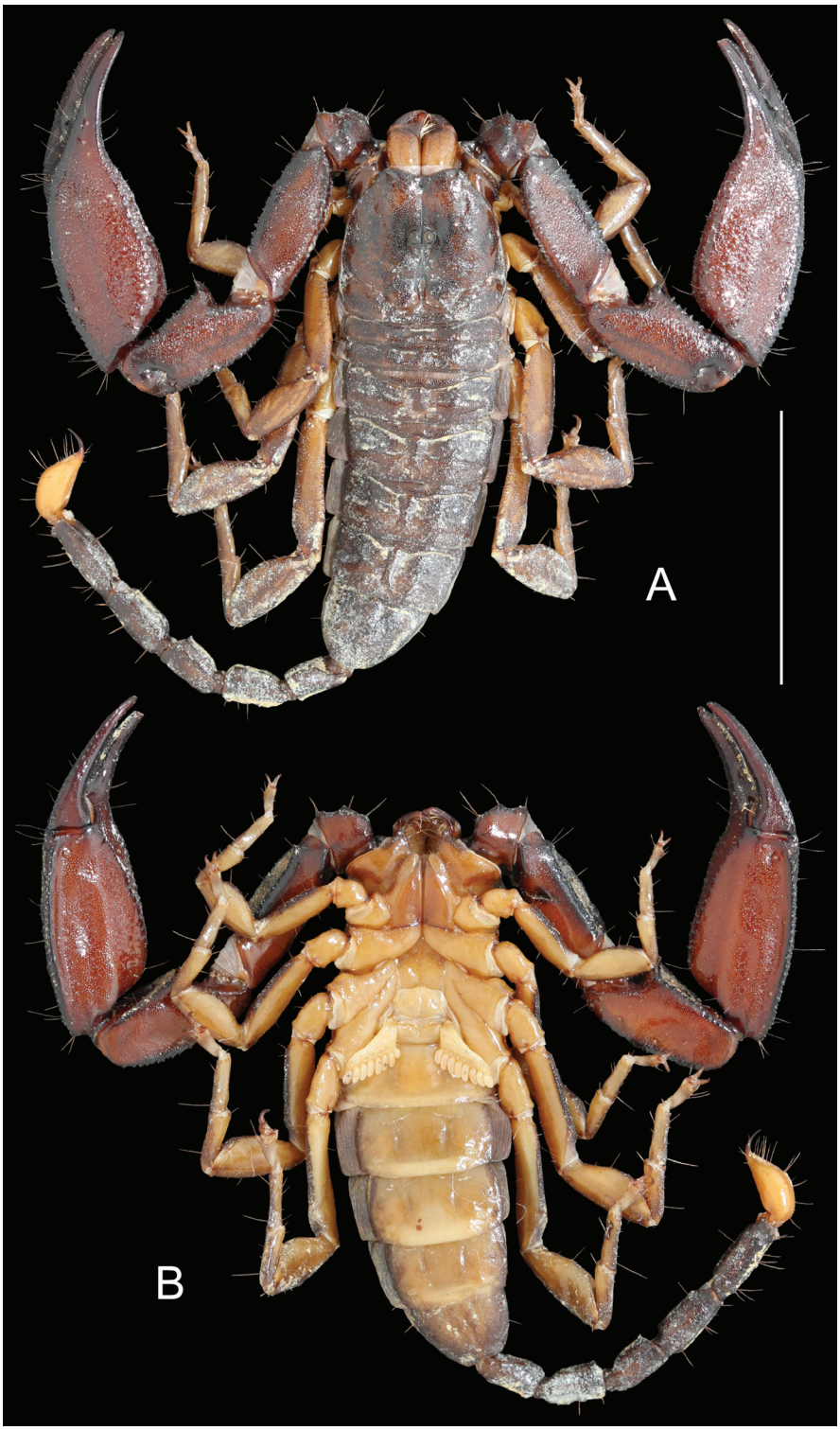


Fig. 1. *Liocheles oranghutan* sp. n., male holotype. Habitus, dorsal (**A**) and ventral (**B**) aspects. Scale bar = 1 cm.

chamber (complete darkness), on the ground, one adult male (holotype), deposited in the MNHN, T. Richard coll., IX/2019. Comparative material examined: *L. longimanus*, Indonesia, Sumatra, Sumatera Utara Province, near Bukit Lawang, edge of the village, under barks of oil palm trees, one adult male, one adult female, three juvenile females and two juvenile males, deposited in the EYPC (EY0145); *L. australasiae*, Philippines, one adult male, collected by local people, IX/1997, deposited in the EYPC (EY0001).

Etymology. The specific name is placed in apposition to the generic name and refers to the Sumatran orangutan (orang hutan in Malay language), living in the area where the new species was found. The reddish brown coloration and elongated pedipalps of the male also reminds the orangutan.

Distribution. The new species is only known from its type locality.

Diagnosis. Total length 34.8 mm for male holotype (see morphometric values in Table I); female unknown. General coloration reddish brown; carapace reddish brown marked with brownish variegated spots; tergites and metasomal segments yellowish brown with confluent reddish brown spots; pedipalps reddish brown with reddish black pigmentation on carinae; legs yellowish with brownish spots. Carapace smooth, with shallow median notch; ocular tubercle occupying

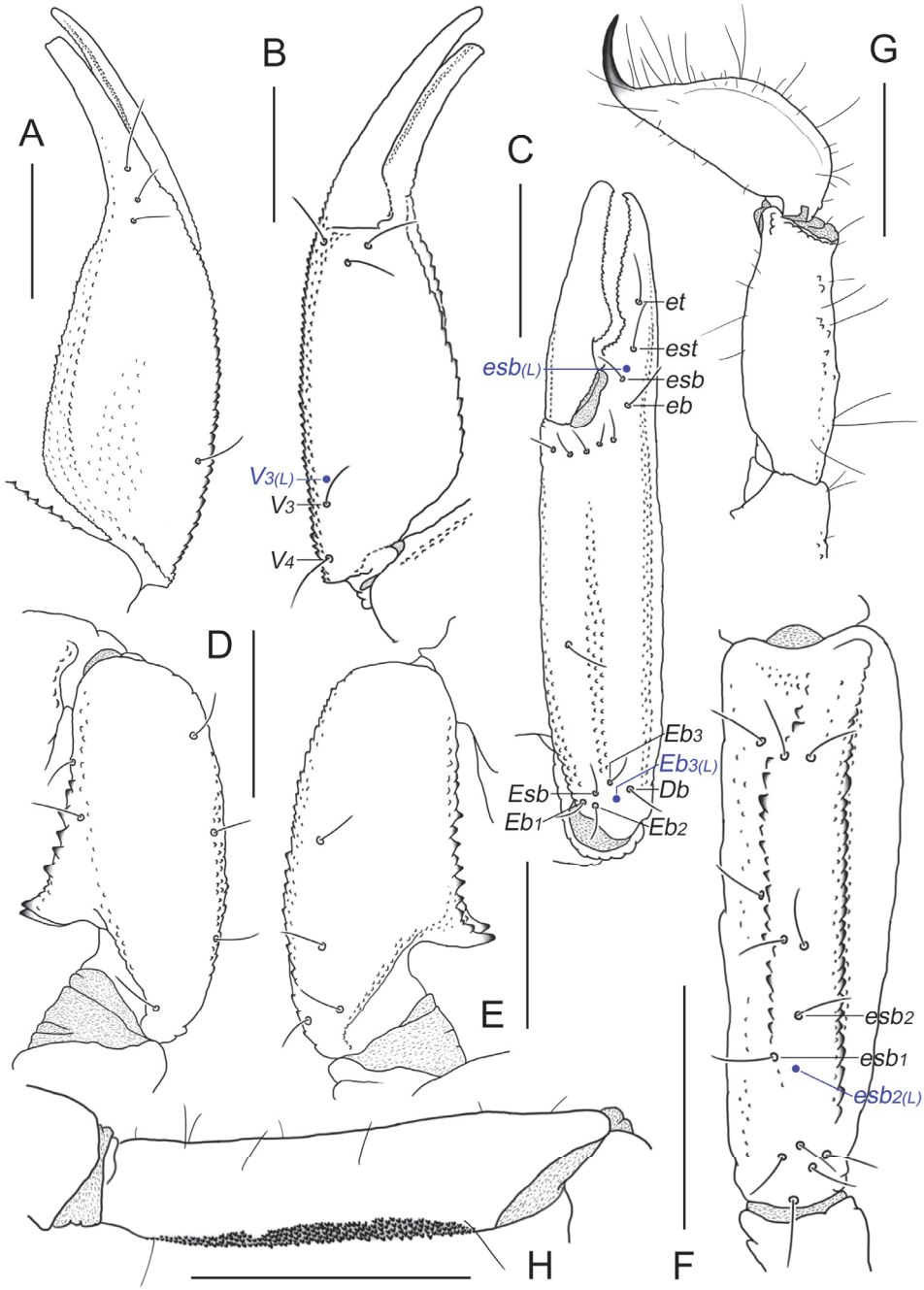


Fig. 2. *Liocheles oranghutan* sp. n., male holotype, showing comparison with trichobothrial pattern of *Liocheles longimanus* male (blue dots). **A-C**. Right chela, dorsal (**A**), ventral (**B**) and external (**C**) aspects. **D-F**. Right patella, dorsal (**D**), ventral (**E**) and external (**F**) aspects. **G**. Metasomal segment V and telson, lateral aspect. **H**. Leg femur IV, internal aspect. Scale bars = 3 mm.

about 1/6 of carapace width. Tergites with most of surface smooth, with only some minute granulation on lateral edges, posteriorly. Pectines of male holotype with 8-8 teeth; female unknown. Ventrosubmedian carinae of metasomal segments I-II with moderate to strong spiniform granules, smooth or with only few reduced spiniform granules on segments III-V; segment V depth/width ratio 1.56. Pedipalps elongated with femur longer than carapace; femur length/width ratio 2.19; patella with prolateral process strongly developed, forming a single large spine; chela with external secondary carinae present. Leg femora with ventromedian surfaces bicarinate, well developed on all legs including on femur IV. Trichobothrial pattern on external side of patella with esb_2 situated distal to esb_1; ventral side of chela with V_3 and V_4 close together, in proximal part of manus; external side of chela with Eb_3 situated distal to *Esb-Db* axis and with *esb* closer to *eb* than to *est*.

DESCRIPTION BASED ON MALE HOLOTYPE.

Coloration. General coloration reddish brown. Carapace reddish brown, marked with brownish variegated spots around the median ocular tubercle, lateral ocelli and on the posterior and lateral edges of the carapace. Tergites yellowish brown with confluent reddish brown spots, on the sides and middle of tergites. Venter and sternites yellowish, with brownish pigmentation on lateral edges of sternites III-VI and on entire surface of sternite VII; sternum yellowish with brownish pigmentation on anterior half; genital operculum pale yellow; pectines pale yellow. Metasomal segments yellowish brown with confluent reddish brown spots along and between carinae on ventral, lateral and dorsal sides of segments. Vesicle yellowish with basis of aculeus yellowish and tip of aculeus reddish. Chelicerae yellowish with variegated dark brown spots over the entire surface, more marked at the base of fingers; fingers reddish yellow; teeth reddish.

Table I. Morphometric values (in mm) of adult males of *L. longimanus* (Werner, 1939) (1): one male from Bukit Lawang and (2) range of three males from Monod (2011) and *L. oranghutan* sp. n. (male holotype).

	L. longimanus		*L. oranghutan* sp. n.
	(1) ♂	(2) ♂	Holotype ♂
Total length	44.0	42.0 - 46.0	34.8
Carapace:			
- length	6.7	6.4 - 6.8	5.5
- anterior width	4.4	4.3 - 4.6	3.8
- posterior width	7.4	7.2 - 7.5	6.0
Metasomal segment I:			
- length	2.6	2.6 - 2.7	2.2
- width	1.5	1.6 - 1.7	1.3
Metasomal segment V:			
- length	4.0	4.1 - 4.2	3.3
- width	1.1	1.2 - 1.3	0.9
- depth	1.4	1.5 - 1.5	1.4
Telson vesicle:			
- width	1.5	1.3 - 1.5	1.3
- depth	1.5	1.4 - 1.6	1.3
Pedipalp:			
- femur length	7.2	7.4 - 8.3	5.7
- femur width	2.7	2.6 - 2.9	2.6
- patella length	7.5	7.6 - 8.0	6.9
- patella width	3.0	3.0 - 3.1	2.9
- chela length	14.5	13.6 - 15.1	12.8
- chela width	4.7	4.2 - 4.6	3.9
- chela depth	2.7	2.7 - 2.8	2.5
- movable finger length	5.9	5.4 - 6.6	5.8
Ratios:			
- carapace length / posterior width	0.91	0.89 - 0.91	0.92
- metasomal segment I length / width	1.73	1.59 - 1.69	1.69
- metasomal segment V length / width	3.64	3.15 - 3.50	3.67
- metasomal segment V depth / width	1.27	1.15 - 1.25	1.56
- telson vesicle depth / width	1.00	1.00 - 1.07	1.00
- femur length / width	2.67	2.55 - 3.19	2.19
- patella length / width	2.50	2.45 - 2.67	2.38
- chela length / width	3.09	2.96 - 3.57	3.28
- chela depth / width	0.57	0.59 - 0.67	0.64
- chela length / movable finger length	2.46	2.29 - 2.52	2.21

Pedipalps reddish brown with reddish black pigmentation on carinae; fingers reddish black. Legs yellowish marked with brownish spots, darker on posterior legs.

Morphology. Carapace entirely smooth, without granulations; anterior margin with shallow median notch; median ocular tubercle situated anteromedially, occupying about 1/6 of carapace width; median ocelli about half diameter apart; three pairs of lateral ocelli. Tergites with most of surface smooth, with only some minute granulation on lateral edges, posteriorly; posterior margin of all tergites nearly straight. Sternum subpentagonal, as long as wide. Pectines with fulcrae and three marginal lamellae; pectinal tooth count 8-8 in male holotype, teeth entirely covered with sensory papillae. Sternites smooth and shiny, sternite VII acarinate; spiracles oval in shape. Metasomal segments with intercarinal surfaces smooth or nearly so; median furrow shallow; dorsolateral and dorsosubmedian carinae absent or obsolete; ventrolateral and ventrosubmedian carinae present; ventrosubmedian carinae of segments I-II with moderate to strong spiniform granules, smooth or with only few reduced spiniform granules on segments III-V; ventrolateral carinae of segment V with anterior half smooth, posterior half with strong conical tooth, segment V depth/width ratio 1.56; anal arch crenulate. Telson with vesicle smooth, without granules; aculeus moderately long, well curved. Pedipalps elongated with femur longer than carapace; pedipalp femur with dorsoexternal and dorsointernal carina present, internomedian dorsal carina absent, internomedian ventral carina vestigial, ventromedian carina absent, ventrointernal carina present, femur length/width ratio 2.19; pedipalp patella with prolateral process strongly developed, forming a single large spine, internodorsal and dorsomedian carinae present, dorsoexternal carina absent, externomedian carinae present, ventroexternal carina present; pedipalp chela with dorsal secondary carina vestigial, digital carina present, external secondary carinae present, ventroexternal carina present, ventromedian and ventrointernal carinae absent, internomedian carina present; chela fingers with double row of primary denticles with inner accessory denticles, suprabasal lobe and suprabasal notch well developed. Leg femora with ventromedian surfaces bicarinate, well developed on all legs including on femur IV; telotarsi prolateral/ retrolateral rows with 4/4 spiniform macrosetae on all legs. Chelicerae with medial and basal teeth of fixed finger fused; dorsal margin of movable finger with four teeth. Trichobothriotaxy of type C, orthobothriotaxic (Vachon, 1974). Pedipalp patella with d_2 trichobothria distal to prolateral process; *et* series with three trichobothria; *est* series with one trichobothrium; *em* series with two trichobothria; *esb* series with two trichobothria with esb_2 situated distal to esb_1; *eb* series with five trichobothria in two groups eb_1 and $eb_{2\text{-}5}$; three *V* trichobothria. Pedipalp chela manus without accessory trichobothria; *Dt* trichobothrium in proximal part of manus; four *V* trichobothria, V_3 and V_4 close together, in proximal part of manus; *Esb* trichobothrium situated basally, close to *Eb* group; Eb_3 trichobothrium situated distal to *Esb*-*Db* axis; *Est* trichobothrium midpalm. Pedipalp chela fixed finger with *db* trichobothrium on dorsal surface; *esb* closer to *eb* than to *est*; *eb* and *esb* trichobothria at base of finger, behind point of articulation between fixed and movable fingers; eb trichobothrium above *esb*-*et* axis; *esb* trichobothrium below *est*-*et* axis; two *i* trichobothria.

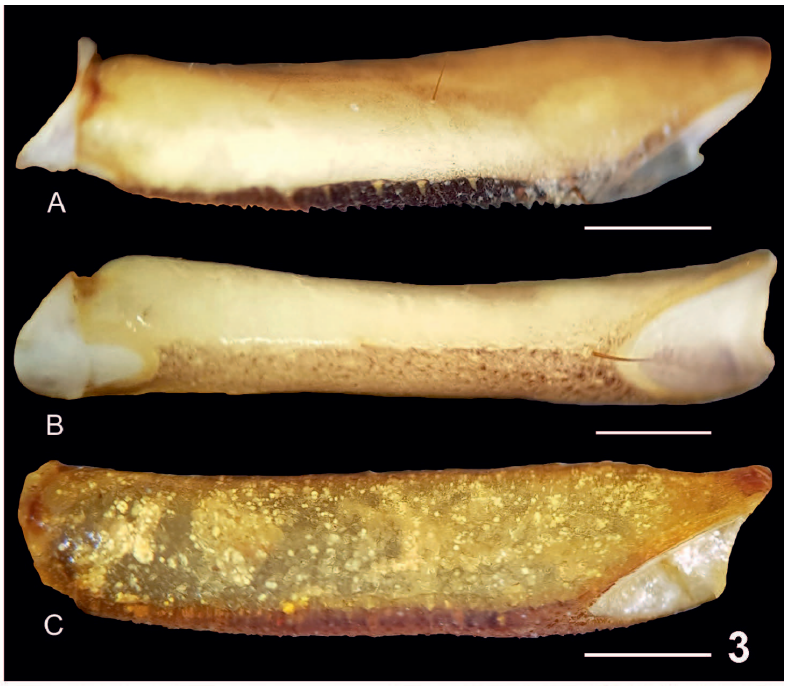


Fig. 3. Leg femur IV, internal aspect of *Liocheles oranghutan* sp. n., male holotype (**A**), *Liocheles longimanus* male (**B**) and *Liocheles australasiae* male (**C**). Scale bars = 1 mm.



Fig. 4. Natural habitat of *Liocheles oranghutan* sp. n. showing the cave (**A-C**) near Bukit Lawang where the type material was collected (**A**. Cave entrance. **B**, **C**. Second chamber, about 200 m from the entrance) and the male holotype, alive in its habitat (**D**).

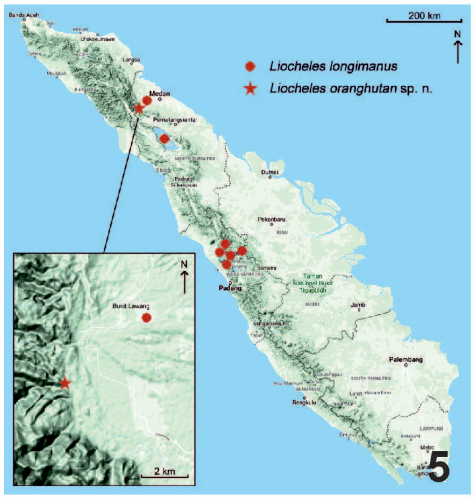


Fig. 5. Topographic map of Sumatra showing the known distribution of *Liocheles longimanus* (circles) and *Liocheles oranghutan* sp. n. (star).

RELATIONSHIPS. *Liocheles oranghutan* sp. n. is related to *Liocheles longimanus* (Werner, 1939), also distributed in Sumatra (Fig. 5), but the new species can be readily distinguished from *L. longimanus* by a number of features: (i) overall coloration more reddish (ii) smaller size with 34.8 mm for male holotype (42 to 46 mm for males *L. longimanus*), (iii) median ocular tubercle occupying 1/6 of carapace width (1/9 in *L. longimanus*), (iv) metasomal segment V depth/width ratio 1.56 (1.15 to 1.27 in males *L. longimanus*), (v) pedipalp femur length/width ratio 2.19 (2.55 to 3.19 in males *L. longimanus*) (Table I), (vi) pedipalp chela with external secondary carinae well developed (absent or obsoleted in *L. longi-*

manus), (vii) leg femur IV with ventromedian carinae well developed (vestigial in *L. longimanus*) (Figs 2H, 3), (viii) trichobothrial pattern on external side of patella with esb_2 situated distal to esb_1 (esb_2 proximal to esb_1 in *L. longimanus*) (Fig. 2F), (ix) trichobothrial pattern on ventral side of chela with V_3 situated closer to V_4 (Fig. 2B) and (x) trichobothrial pattern on external side of chela with Eb_3 situated distal to *Esb-Db* axis (Eb_3 close to Eb_{1-2}, situated proximal to *Esb-Db* axis in *L. longimanus*) and *esb* closer to *eb* than to *est* (distance *esb-est* similar to *esb-eb*, or *esb* closer to *est* in *L. longimanus*) (Fig. 2C).

Liocheles oranghutan sp. n. can also be distinguished from the widely distributed *Liocheles australasiae* (Fabricius, 1775), also occurring in Sumatra, by the following main features: (i) pedipalps elongated with femur longer than carapace (not elongated in male *L. australasiae*), (ii) pectinal tooth count 8-8 in male holotype (6 to 7 in males *L. australasiae*), (iii) leg femur IV with ventromedian carinae well developed (reduced in *L. australasiae*) (Figs 2H, 3) and (iv) trichobothrial pattern on ventral side of chela manus with V_3 and V_4 close together, in proximal part of manus (V_3 and V_4 distant from each other in *L. australasiae*) (Fig. 2B).

Ecological notes. The holotype specimen was found during a biodiversity exploration of the so-called "Bat Cave", near Bukit Lawang, northern Sumatra. The specimen was found in the second chamber of the cave (three chambers in total) in complete darkness, and it has been estimated that the specimen was found approximately 200 m from the cave entrance. No other specimens were found during this exploration, neither in the cave, nor outside the cave in its immediate vicinity. Several *Liocheles* specimens were found in oil palm trees (under trees' bark) on the edge of the village of Bukit Lawang, approximately 5 km from the cave, all corresponding to *Liocheles longimanus*.

True troglobitic scorpions (*i.e.* species which complete their entire life cycle within caves) are rare (Lourenço & Pham, 2013, 2014) and further exploration of the cave where the new species was found as well as its immediate vicinity would be needed in order to define whether the new species is a true troglobiotic species, or only a trogloxene species (or subtroglophile, *i.e.* periodically living into the cave, but completing part of its life cycle outside). However, the presence of *L. longimanus* in the surrounding area (5 km from the cave) and the morphological differences between *L. longimanus* and *L. oranghutan* sp. n. may suggest that both species originated from a common surface ancestor and that the new species has evolved within the confines of the cave environment and now probably presenting a permanent subterranean way of life (although many morphological characteristics do not show major regressions; *e.g.* it is interesting to note that the new species has a larger ocular tubercle than *L. longimanus*). This hypothesis could also be supported by the significant distance (200 m) between the cave entrance and the place where the new species was found.

References

Fet, V., W.D. Sissom, G. Lowe & M.E. Braunwalder 2000. *Catalog of the Scorpions of the World (1758-1998).* New York Entomological Society, New York, NY. 690 pp.

Hjelle, J.T. 1990. Anatomy and morphology. In: Polis GA (Ed.) *The Biology of Scorpions*. Stanford University Press, Stanford, pp 9-63.

Lourenço, W.R. 1989. Rétablissement de la famille des Ischnuridae, distincte des Scorpionidae Pocock, 1893, à partir de la sous-famille des Ischnurinae Pocock, 1893. *Revue Arachnologique*, **8**: 159-177.

Lourenço, W.R. 1996. Faune de Madagascar. 87. *Scorpiones (Chelicerata, Scorpiones).* Museum National d'Histoire Naturelle, Paris. 202 pp.

Lourenço, W.R. & D.-S. Pham 2013. First record of a cave species of *Euscorpiops* Vachon from Vietnam (Scorpiones, Euscorpiidae, Scorpiopinae). *Comptes Rendus Biologies,* **336**: 370-374, http://dx.doi.org/10.1016/j.crvi.2013.06.005

Lourenço, W.R. & D.-S. Pham 2014. A second species of *Euscorpiops* Vachon from caves in Vietnam (Scorpiones, Euscorpiidae, Scorpiopinae). *Comptes Rendus Biologies,* **337**: 535-544, https://doi.org/10.1016/j.crvi.2014.07.006

Monod, L. 2011. Taxonomic emendations in the genus *Liocheles* Sundevall, 1833 (Scorpiones, Liochelidae). *Revue Suisse de Zoologie*, **118**: 723-758.

Monod, L., M.S. Harvey, & L. Prendini 2013. Stenotopic *Hormurus* Thorell, 1876 scorpions from the monsoon ecosystems of northern Australia, with a discussion on the evolution of burrowing behaviour in Hormuridae Laurie, 1896. *Revue Suisse de Zoologie*, **120**, nº 2 : 281-346.

Monod, L. & L. Prendini 2014. Evidence for Eurogondwana: the roles of dispersal, extinction and vicariance in the evolution and biogeography of Indo-Pacific Hormuridae (Scorpiones: Scorpionoidea). *Cladistics*, **1876**: 1-41. https://doi.org/10.1111/cla.12067.

Prendini, L. 2000. Phylogeny and classification of the superfamily Scorpionoidea Latreille, 1802 (Chelicerata, Scorpiones): an exemplar approach. *Cladistics,* **16**: 1-78.

Prendini, L. & W.C. Wheeler 2005. Scorpion higher phylogeny and classification, taxonomic anarchy, and standards for peer review in online publishing. *Cladistics,* **21**: 446-494.

Soleglad, M.A. & V. Fet 2003. High-level systematics and phylogeny of the extant scorpions (Scorpiones: Orthosterni). *Euscorpius,* **11**: 1-175.

Soleglad, M.A., V. Fet & F. Kovarik 2005. The systematic position of the scorpion genera Heteroscorpion Birula, 1903 and Urodacus Peters, 1861 (Scorpiones: Scorpionoidea). *Euscorpius,* **20**: 1-38.

Stahnke, H.L. 1970. Scorpion nomenclature and mensuration. *Entomological News*, **81**: 297-316.

Stockwell, S.A. 1989. *Revision of the phylogeny and higher classification of scorpions (Chelicerata).* PhD thesis, University of California, Berkeley, CA. 413 pp.

Sundevall, C.J. 1833. *Conspectus Arachnidum.* Londini Gothorum: 1-39.

Vachon, M. 1963. De l'utilité, en systématique, d'une nomenclature des dents des chélicères chez les scorpions. *Bulletin du Muséum national de Histoire naturelle*, Paris 2è sér., **35**(2): 161-166.

Vachon, M. 1974. Etude des caractères utilisés pour classer les familles et les genres de scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum national de Histoire naturelle*, Paris, 3è sér., n° **140**, Zool. 104: 857-958.