



## A new species of *Linothele* (Araneae: Dipluridae) from Peru


## Новый вид пауков рода *Linothele* (Araneae: Dipluridae) из Перу


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**Abstract.** A new species of *Linothele* Karsch, 1879 from southern Peru is described and illustrated, *L. mubii* sp. nov. The new species can be distinguished from other species of the genus by scopulation in combination with the morphology of copulatory organs.

**Резюме.** Приведено иллюстрированное описание нового вида из рода *Linothele* Karsch, 1879, *L. mubii* sp. nov. с юга Перу. Новый вид отличается от других представителей рода скопулой и морфологией копулятивных органов.

**Keywords:** taxonomy, South America, sheet-web spider, Mygalomorphae, Dipluridae, *Linothele*, new species

**Ключевые слова:** таксономия, Южная Америка, паук-пологопряд, Mygalomorphae, Dipluridae, *Linothele*, новый вид

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## Introduction

*Linothele* Karsch, 1879 is a relatively large genus of diplurine spiders (Araneae: Dipluridae), with 21 named species distributed in the Bahamas and South America. It was recently revised by Drolshagen & Bäckstam (2021), who provided the first list of *Linothele* species, together with a di-

agnostic key to the species and a distribution map. Of the 21 known *Linothele* species, only five are known from both males and females, one species is known only from a male and 15 species are known from females. Four species of *Linothele* are cited for Peru, *L. monticolens* (Chamberlin, 1916) and *L. uniformis* Drolshagen et Bäckstam, 2021 known only from females, *L. jelskii* (F.O. Pickard-Cambridge, 1896) known only from the male holotype and

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*L. spinosa* Drolshagen et Bäckstam, 2021 described from both sexes (World spider catalog ..., 2022).

When studying the material deposited in the collection of Museo de Biodiversidad del Perú, Lima (MUBI), we found specimens belonging to *Linothele* that do not fit in with any of the known species. Therefore, in the present study we diagnose, describe and illustrate a new species of *Linothele* from Peru based on an adult male and female.

## Material and methods

The studied material is stored in 70% ethanol and deposited at Museo de Biodiversidad del Perú, Lima (MUBI; curator José A. Ochoa). The collection numbers are indicated in the list of material.

Specimens were examined in 70% ethanol under a Leica S APO stereoscopic microscope. A MShot digital camera attached to the stereomicroscope was used to photograph the structures to be illustrated (photos of the new species were taken by Nelson Ferretti).

All measurements are given in millimeters and were obtained directly from the photographs taken with the digital camera or with a digital dial caliper with an error of 0.01. The total length does not include chelicerae and spinnerets. Leg and palp measurements were made in dorsal view. The bulb was removed with microscissors and photographed in four different views, dorsal, prolateral, retrolateral and ventral. The vulva was dissected and cleared with Naclens enzymes. Spination pattern follows Dupérré & Tapia (2015). The identification of preening-combs and comparative measurements of male palp follows Drolshagen & Bäckstam (2021).

The abbreviations are as follows: A, apical; AME, anterior median eyes; ALE, anterior lateral eyes; BD, bulb width; e, embolus; fe, femur; k, keel; IML, length of metatarsus I; MAD, distance along the line of male metatarsus I length from proximal end of metatarsus to intersection with the perpendicular line passing through the tallest part of metatarsal protuberance; mp, metatarsal protuberance; ms, megaspine; mt, metatarsus; pa, patella; PME, posterior median eyes; PL, length of male palpal organ; PLE, posterior lateral eyes; PLS, posterior lateral spinnerets; PMS, posterior median spinnerets; t, tegulum; ta, tarsus; ti, tibia.

## Taxonomy

Order **Araneae**

Family **Dipluridae** Simon, 1889

Subfamily **Diplurinae** Simon, 1889

Genus ***Linothele*** Karsch, 1879

Type species: *Linothele curvitaris* Karsch, 1879 (Venezuela: Caracas).

*Remarks.* *Linothele* can be distinguished from all other Diplurinae by one morphological feature, the absence of a maxillary lyra (Raven, 1985; Drolshagen & Bäckstam, 2021). Dupérré & Tapia (2015) suggested two additional characteristics to effectively diagnose the genus *Linothele*, i.e. the retrolateral spur on tibia I and a small tubercle on metatarsus I in males, and receptacles joined at the base and medially positioned vesicles in females. However, those characteristics are shared with some species of other diplurid genera, such as *Harmonicon* F.O. Pickard-Cambridge, 1896 (Drolshagen & Bäckstam, 2011), *Trechona* C.L. Koch, 1850 (Guadanucci et al., 2016) and *Diplura* C.L. Koch, 1850 (Pedroso et al., 2016, 2018). Furthermore, the receptacles of some *Linothele* species neither are joined at the base nor have medially positioned vesicles (Drolshagen & Bäckstam, 2021).

Most species of *Linothele* build sheet-webs ending with a tubular retreat (Paz, 1988; Drolshagen & Bäckstam, 2021), with the apparent exception of *L. cavicola* Goloboff, 1994 (Goloboff, 1994). As pointed out by Drolshagen & Bäckstam (2021), the spiders rapidly retreat upon disturbance, making them hard to collect. Consequently, the descriptions of almost 70% of the known species of *Linothele* are only based on females, which are commonly captured by hand from their webs. Males seem harder to collect as they do not build webs, but instead, they wander around in search of females after reaching maturity and possibly also due to seasonal patterns.

All the Peruvian species of *Linothele* are known only from their type localities in Peru and have an unknown natural history. *Linothele jelskii* is known from Peru, but without an exact location; *L. monticolens* is known only from Huadquina, *L. spinosa*, only from Iquitos, and *L. uniformis*, only from Machu-Picchu.

***Linothele mubii* sp. nov.**

(Figs 1–28)

**Holotype.** Female, **Peru**, *Apurimac Department, Andahuaylas Prov.*, Huancarama Distr., Chilhuismi nr. Huancarama, 13°37'59.81"S 73°6'24.21"W, 3363 m, 8.XII.2016, J.C. Chaparro & L. Mamani leg. (MUBI 69).

**Paratype.** **Peru**, *Cusco Department, La Convención Prov.*, Santa Teresa Distr., nr. Choquequirao Archeological Park, 13°23'43.89"S 72°52'22.42"W, 3020 m, 27.VII.2016, J. Vitorino leg., 1 male (MUBI 009).

**Additional material examined.** 3 juveniles, with same data as for holotype (MUBI 131).

**Diagnosis.** The female of *L. mubii* sp. nov. can be distinguished from congeners by undivided scopula on tarsi I, vulva consisting of two short stalks bearing a single isolated retrolateral vesicle (Fig. 14), together with dorsal pattern on opisthosoma consisting of several dots forming in-

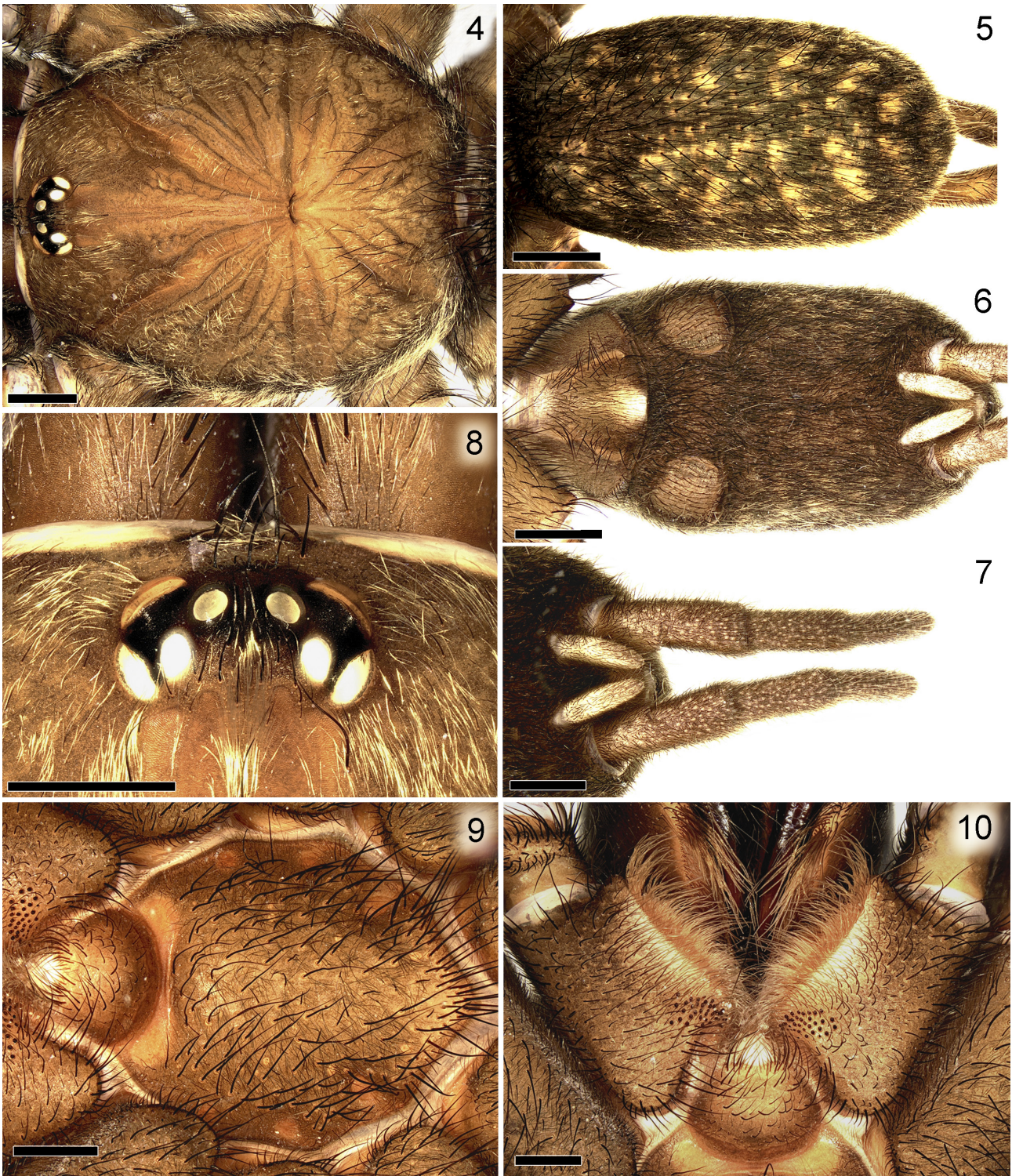
complete chevrons (Fig. 5). The male of *L. mubii* sp. nov. differs from congeners in the presence of a keel on embolus (Figs 23–26), leg formula 4123 and well-developed v-shaped apex of metatarsal protuberance (Fig. 22).

**Description.** **Female** (holotype). Coloration (live specimen): carapace black with golden setae (Figs 1–2), setae on margins longer; chelicerae, coxae and trochanters black with golden setae; legs and palps black; abdomen dorsally black with several golden dots forming incomplete chevrons and with long proximal black setae (Fig. 1); spinnerets black.

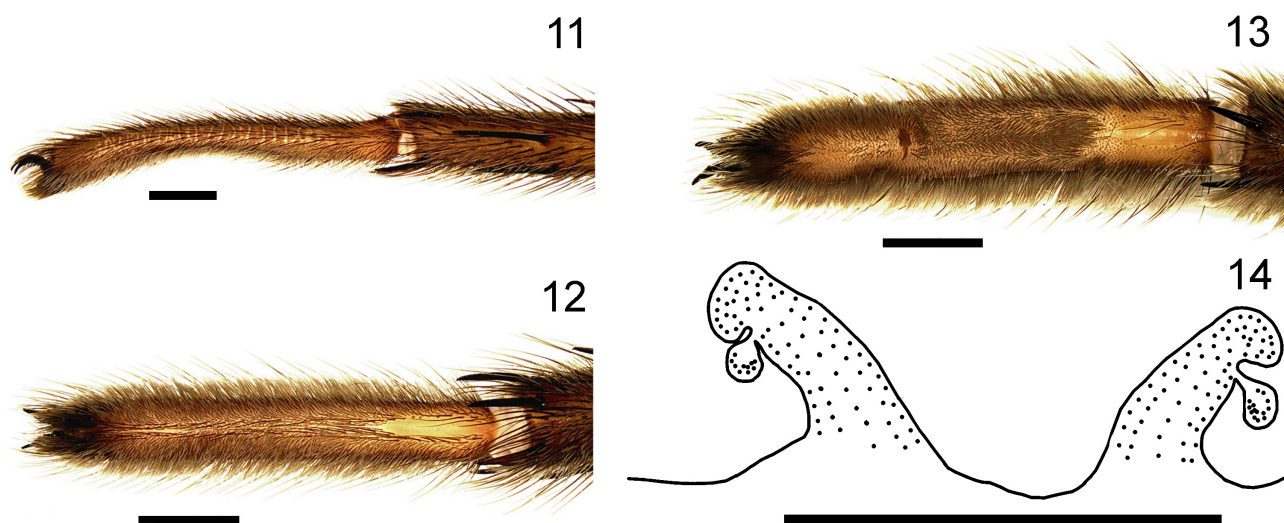
Coloration (in ethanol): carapace reddish brown, abundantly covered with golden setae on margins (Fig. 4); chelicerae dark brown with long golden setae; legs reddish brown, covered with black setae; coxae, labium, maxillae and sternum dark brown (Figs 9–10); dorsal pattern of abdomen consisting



**Figs 1–3.** *Linothele mubii* sp. nov., female (holotype). **1**, carapace and abdomen, dorsal view; **2**, general appearance, dorsal view; **3**, collecting habitat of the holotype (photo by J.C. Chaparro). Scale bars: 10 mm.



**Figs 4–10.** *Linothele mubii* sp. nov., female (holotype). 4, carapace, dorsal view; 5, abdomen, dorsal view; 6, abdomen, ventral view; 7, spinnerets, ventral view; 8, eyes, dorsal view; 9, labium and sternum, ventral view; 10, labium and maxillae, ventral view. Scale bars: 1 mm.



**Figs 11–14.** *Linothele mubii* sp. nov., female (holotype). **11**, right tarsus IV, prolateral view; **12**, right tarsus IV, ventral view; **13**, right tarsus I, ventral view; **14**, vulva, dorsal view. Scale bars: 1 mm.

of several golden dots forming incomplete chevrons (Fig. 5); venter with slight mottling (Fig. 6).

Cephalic region as in Fig. 4. Postlabial sigillae fused.

**Measurements.** Total length 25.46; carapace 12.34 long, 11.16 wide; abdomen 13.38 long, 8.0 wide; fovea recurved, 1.42 wide. Chelicerae: right with 10 large promarginal teeth and fang furrow with 16 denticles, left with 11 large teeth and fang furrow with 19 denticles. Labium without cusps (Figs 9–10), 1.83 long, 2.34 wide. Maxillae with 27/34 (right/left) cusps (Fig. 10), lyra absent. Sternum 6.59 long, 5.95 wide, with three pairs of rounded to oval sigillae (Fig. 9); diameters of sigillae: pair I 0.17, pair II 0.29, pair III 0.56; distances from sigillae to margin of sternum: pair I 0.24, pair II 0.29, pair III 0.36. Eyes sizes and interdistances: AME 0.36, ALE 0.57, PME 0.30, PLE 0.48, AME–AME 0.30, AME–ALE 0.19, PME–PME 0.95, PME–PLE 0.09, ALE–PLE 0.17 (Fig. 8). Clypeus 0.25 long. Spinnerets: PLS total length 8.44, basal segment 2.95 long, median segment 1.94 long, apical segment 3.29 long; PMS total length 2.09 (Fig. 7). Legs and palp measurements as in Table 1.

**Spination.** Legs: I: fe d1-1-2; pa p1; ti p1-1, v1-1-2; mt: v1-1-1-1-2. II: fe d1-1-1-1; pa p1; ti p1-1, v1-1-2; mt p1, v2-2-2. III: fe d1-3-1-1-1-1-1; pa r1, d1; ti p1-1, r1-1, d1, v2-2-2; mt p1-1-1, r1-1-1, d3-3-2, v1-1-1-1-3. IV: fe d1-1-1-2-2; ti p1-1, r1-1, d1, v2-2-2; mt p1-1-1-1, r1-1-1-1-1, d1-1-1-1, v1-1-1-1-2. Palp: fe

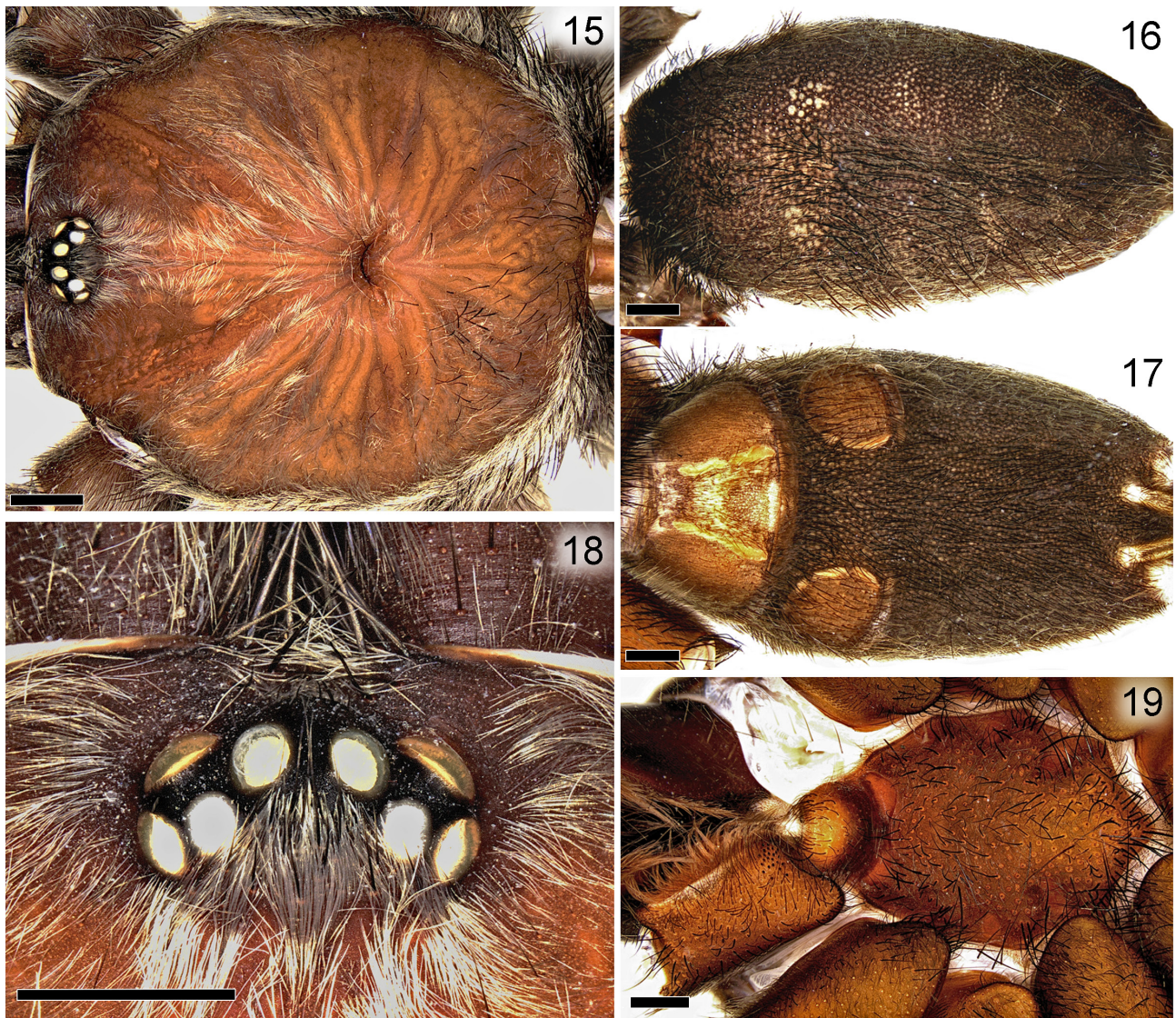
d2; ti p1-1, r1, v2-2-2; ta p1, r1. Preening-combs absent. Leg tarsi pseudosegmented (Figs 11–13); scopulae on tarsi I undivided; tarsi III and IV with abundant scopuliform setae; metatarsi I fully scopulated (Fig. 13), metatarsi III 50% scopulated, metatarsi IV 25% scopulated. Claws of legs I with rows of 7/9 and 8/7 teeth; claws of legs II with rows of 6/9 and 10/7 teeth; claws of legs III with rows of 7/8 and 9/7 teeth; claws of legs IV with rows of 5/8 and 8/6 teeth.

Vulva with two receptacles, each consisting of short, almost rectangular stalk about 4 times as long as wide, with a small retrolateral vesicle in anterior one-fourth of receptacle (Fig. 14). Fine-grained stalks 0.59 long, 1.33 wide.

**Male** (paratype). Coloration (in ethanol): carapace reddish brown, abundantly covered with golden setae on margins (Fig. 15); chelicerae dark brown, with long golden setae; legs reddish brown,

**Table 1.** Measurements of palp and leg segments in the holotype female of *Linothele mubii* sp. nov.

	I	II	III	IV	Palp
Femur	8.83	8.97	7.84	9.98	7.00
Patella	5.24	5.45	4.51	4.57	3.77
Tibia	6.44	6.47	5.66	6.98	4.65
Metatarsus	6.00	6.87	7.82	10.35	–
Tarsus	5.62	5.55	5.13	6.94	4.24
Total	31.62	31.56	27.14	35.94	17.95



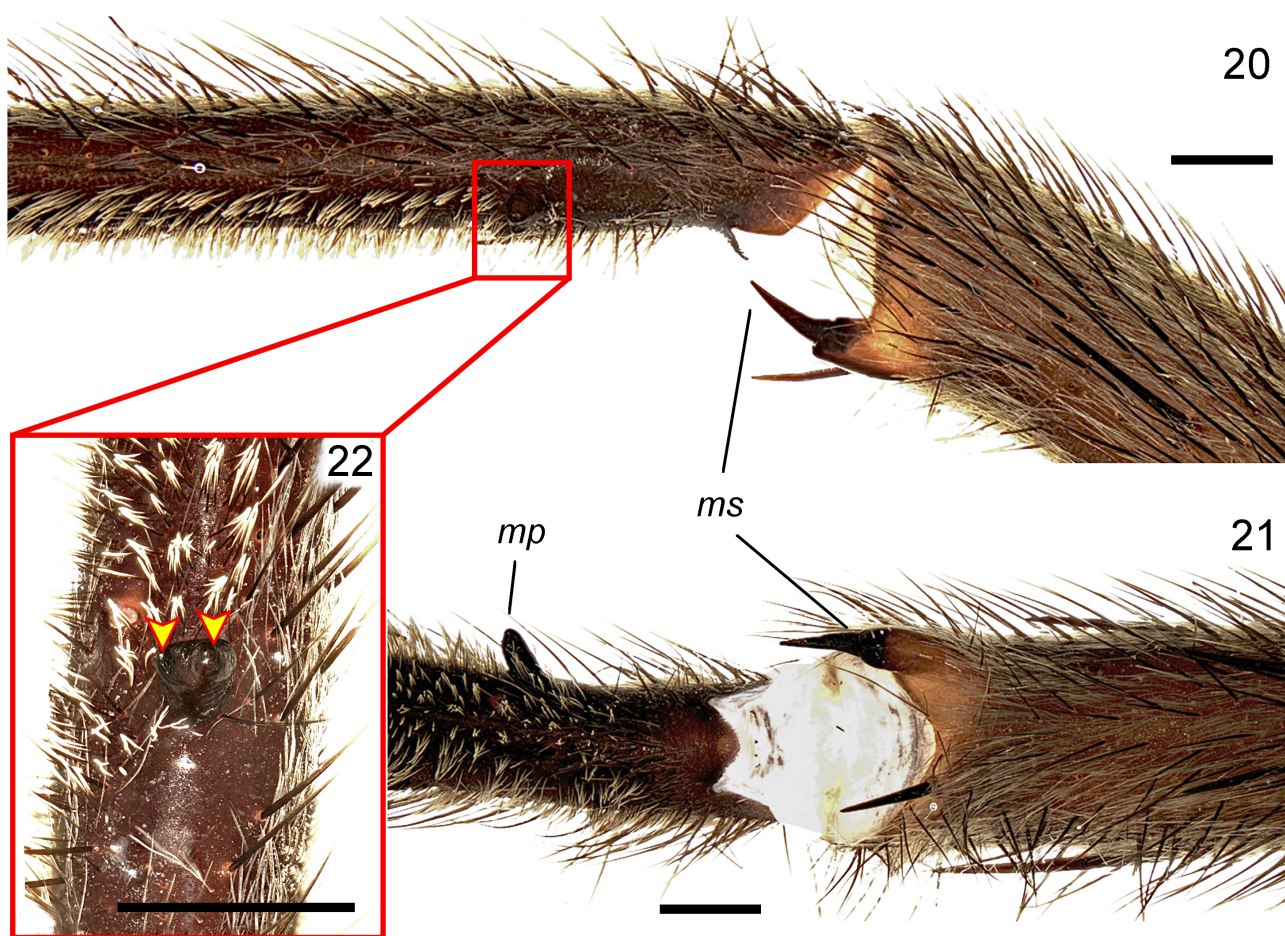
**Figs 15–19.** *Linothele mubii* sp. nov., male (paratype). **15**, carapace, dorsal view; **16**, abdomen, dorsal view; **17**, abdomen, ventral view; **18**, eyes, dorsal view; **19**, labium, sternum and maxillae, ventral view. Scale bars: 1 mm.

covered with black and golden setae; coxa, labium, maxillae and sternum brown; abdomen with dorsal pattern consisting of several golden dots not forming chevrons and ventral pattern lacking (Figs 16, 17).

Cephalic region as in Fig. 15. Postlabial sigillae divided. Eyes as in Fig. 18.

Measurements. Total length 27.43; carapace 12.84 long, 10.8 wide; abdomen 13.45 long, 6.75 wide; fovea 1.03 wide. Chelicerae: right with 11 large promarginal teeth, left with 11 large teeth and one small tooth on promargin. Labium without cusps (Fig. 19), 5.31 long, 5.11 wide. Maxil-

lae with 29/30 (right/left) cusps. Sternum 5.31 long, 5.11 wide, with three pairs of oval to rounded sigillae (Fig. 19); diameters of sigillae: pair I 0.36, pair II 0.5, pair III 0.75; distances from sigillae to margin of sternum: pair I 0.17, pair II 0.15, pair III 0.17. Eyes sizes and interdistances: AME 0.32, ALE 0.46, PME 0.28, PLE 0.34, AME–AME 0.18, AME–ALE 0.09, PME–PME 0.75, PME–PLE 0.05, ALE–PLE 0.10. Clypeus 0.29 long. Spinnerets: PLS total length 5.71, basal segment 3.07 long, median segment 2.52 long, apical segment broken; PMS total length 2.08. Legs and palp measurements as in Table 2.



**Figs 20–22.** *Linothele mubii* sp. nov., male (paratype). **20**, right tibia and metatarsus I, prolateral view; **21**, right tibia and metatarsus I, ventral view; **22**, detail of metatarsal protuberance (yellow arrows indicate v-shaped protuberance). Abbreviations: *mp*, metatarsal protuberance; *ms*, megaspine. Scale bars: 1 mm.

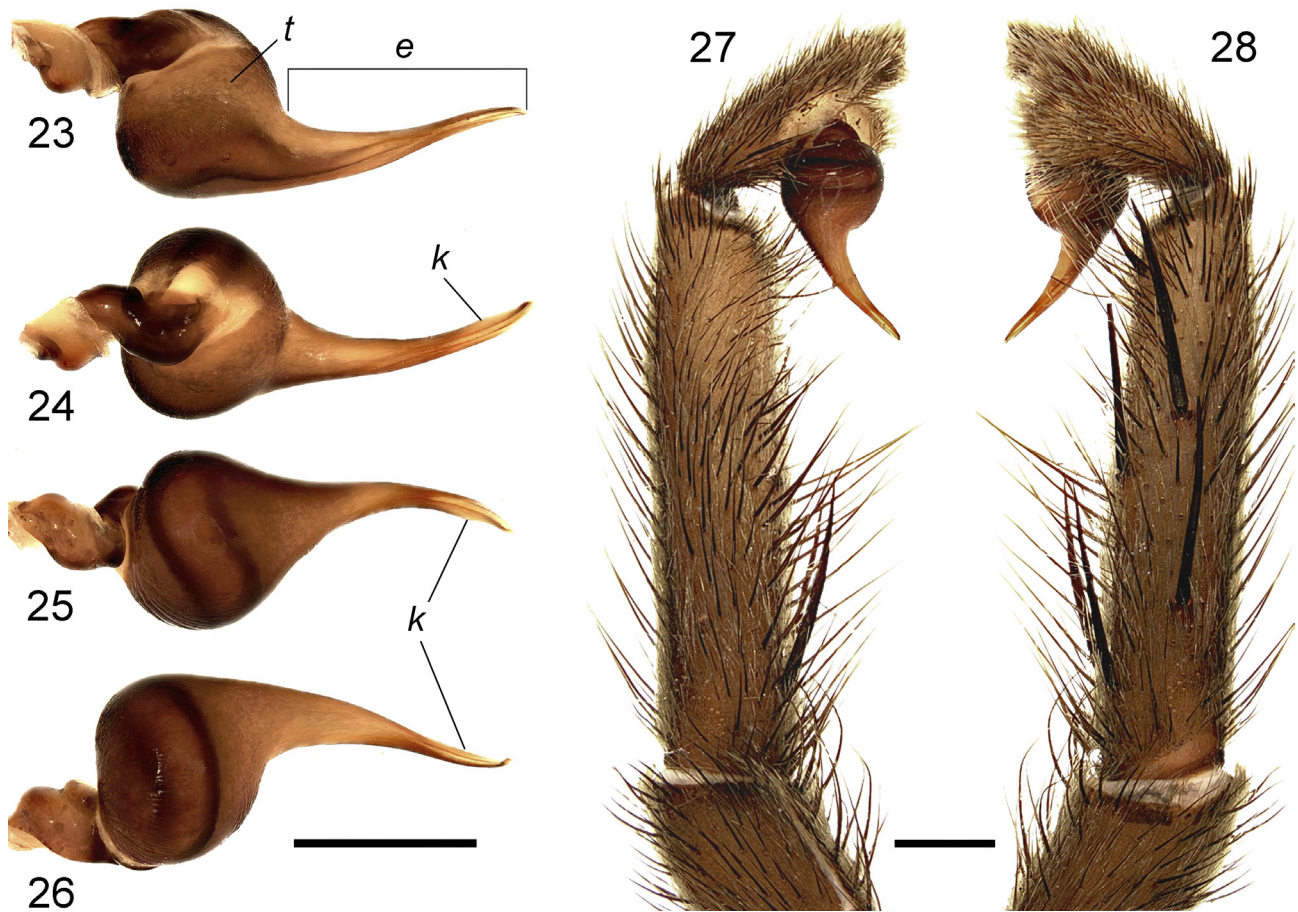
Spination. Legs: I: fe d1-1-1-2-1-1-1-2; pa p1; ti p1-1, r1, v2-2; mt: p1, v1-2. II: fe p1-1-1, d1-2-1-1-1-1-3-2-1; pa p1; ti p1-1, v2-2-2; mt p1, v2-2-1. III: fe p1, d1-2-3-2-2; pa r1; ti p1-1, r1-1, d1-1-1, v2-2-2; mt p1-1-1-1, r1-1-1, d1, v1-1-2-2. IV: fe d3-2-1-2-2-2-2-2;

pa d1-1; ti p2-1, r1-1-1, d1-1-1, v2-2-2; mt p1-1-1, r1-1-1-1-1, d1-1, v1-1-1-1-2. Palp: fe d1-1-1-2; pa p1; ti p1-1, r1, d1, v2-2-1. Preening-combs absent. Tibia I with apical retrolateral megaspine (Figs 20, 21); metatarsus I with well-developed, v-shaped metatarsal protuberance (Fig. 22); MAD 3.1. Tarsi pseudosegmented; scopulae on tarsi I undivided; tarsi III and IV with numerous scopuliform setae; metatarsi I, II and III fully scopulated, metatarsi IV 80% scopulated. Claws of legs I with rows of 8/9 and 11/8 teeth; claws of legs II with rows of 8/11 and 12/8 teeth; claws of legs III with rows of 8/8 and 8/7 teeth; claws of legs IV with rows of 8/12 and 10/8 teeth.

Palpal tibia twice as long as bulb (Figs 27, 28); cymbium elongate; bulb pyriform, with globose tegulum about half the bulb length, with embo-

**Table 2.** Measurements of palp and leg segments in the paratype male of *Linothele mubii* sp. nov.

	I	II	III	IV	Palp
Femur	11.55	10.39	9.16	13.08	8.03
Patella	6.37	6.35	5.08	5.26	4.21
Tibia	10.24	9.01	7.15	9.98	5.99
Metatarsus	11.19	10.27	10.63	11.75	–
Tarsus	8.27	7.41	6.81	8.33	2.87
Total	47.72	43.03	38.76	48.04	20.92



**Figs 23–28.** *Linothele mubii* sp. nov., male (paratype), right palp. **23**, bulb, prolateral view; **24**, bulb, dorsal view; **25**, bulb, retrolateral view; **26**, bulb, ventral view; **27**, palp, prolateral view; **28**, palp, retrolateral view. Abbreviations: *e*, embolus; *k*, keel; *t*, tegulum. Scale bars: 1 mm.

lus curved in prolateral view and bearing well-developed retrolateral keel occupying one-third of embolus but not extending on to apex (Figs 23–26). Bulb 3.05 long, 1.02 wide. PL \* 100 / BD = 299. IML \* 100 / MAD = 361.

**Remarks.** An adult female was designated as a holotype because most of the described species of *Linothele* are diagnosed and known only from females. We preferred to designate a female for a better comparison of species, since most differences arise from the shape of the vulva.

The male and the female were matched considering that they both share the pseudosegmented tarsi, which differs from *L. monticolens* (characterised by having only a few medial cracks), and share the presence of a dorsal abdominal pattern, which differs from *L. uniformis*

(with no evident pattern on the dorsal side of abdomen).

**Etymology.** The species name is a noun in genitive case, derived from the abbreviated name of the Peruvian Institution Museo de Biodiversidad del Perú (MUBI) in Cusco, Peru. The species is named in recognition for the contribution of this institution to science as a biodiversity repository.

**Distribution and habitat.** *Linothele mubii* sp. nov. is known from two localities in the departments of Apurimac and Cusco, in southern Peru, at elevations between 3020 and 3363 m. The male was collected at night in a montane rainforest, and the female was collected at daylight under rocks among bushes surrounded by *Eucalyptus* tree plantations (Fig. 3).



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