

# A new ant mimicking spider of the genus *Toxeus* C. L. Koch, 1846 (Araneae: Salticidae: Salticinae) from the Western Ghats, India

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**Abstract.** A new species of the jumping spider genus *Toxeus* C. L. Koch, 1846, *T. alboclavus* sp. nov. (♂, ♀), is diagnosed and described from the Wayanad region of the Western Ghats, Kerala, India. A detailed morphological description, diagnostic features, illustrations of the copulatory organs of both sexes, and species locality are presented, along with records on natural history. A distribution record for *Toxeus* in India is mapped as well.

**Keywords.** jumping spider, *Myrmarachne*, *Toxeus alboclavus*

## Introduction

*Toxeus* is a little-known salticid group confined to the Oriental and African regions and was first described by C.L. Koch in 1846, based on the generotype *Toxeus maxillosus*. Pipe-like spermatheca with a modest terminal dilatation characterise this genus (Prozynski, 2016). Currently the genus includes 11 valid species, of which *T. jajpurensis* (Prozynski, 1992) and *T. maxillosus* (C. L. Koch, 1846), have been reported from India (WSC, 2022). The present paper describes and illustrates a new species, *Toxeus alboclavus* sp. nov., collected from the Wayanad, Kerala region of the Western Ghats. The known geographic distribution of *Toxeus* in India is illustrated.

## Materials and methods

Specimens were hand collected and preserved in 70% alcohol, examined under a Leica M205C stereomicroscope, and photographs were taken using Leica DMC4500 digital camera, with the Leica Application Suite (LAS), version 4.3.0. software package. Male palps were detached and examined. Female genitalia were excised using a fine surgical scalpel and cleared in 10% KOH. Bracketed measurements for each leg segment are listed from the proximal to distal position [femur, patella, tibia, metatarsus, tarsus]. All measurements are in millimetres. The terminology follows Logunov (2021).

*Abbreviations used in the text and figure plates:* AE — anterior eyes, ALE — anterior lateral eyes, AME — anterior median eyes, C — cymbium, CC — copulatory channel, E — embolus, FD — fertilization duct, PLE — posterior lateral eyes, PME — posterior median eyes, rtl — retrolateral, RTA — retrolateral tibial apophysis, S — spermatheca T — tegulum, v — ventral, Cx — coxa, Tc — trochanter, Fm — femur, Pt — patella, Tb — tibia, MEP — Median epigynal pocket, Mt — metatarsus, Tr — tarsus.

## Taxonomy

Salticinae: Salticoida: Astioida: Myrmarachnini: Myrmarachnina

Genus *Toxeus* C. L. Koch, 1846

Type species: *Toxeus maxillosus*, C. L. Koch, 1846

### ***Toxeus alboclavus* sp. nov.**

Figures 1 (map), 2-8 (female), 9-12(male), 13-17(genitalia), 18-21(drawings)

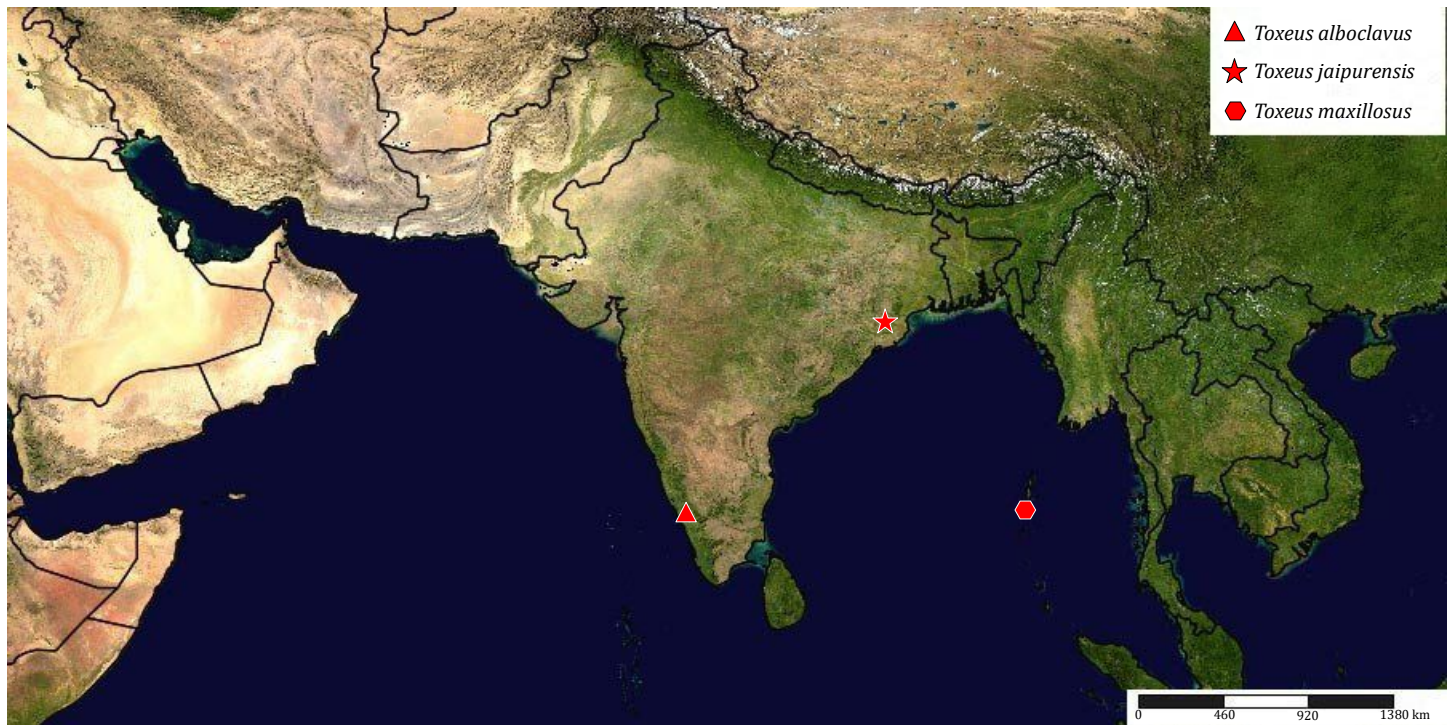
*Type specimens.* 1♀ holotype (CATE 9961001a), from Kattimoola, Wayanad District, Kerala, India (11°48'16"N, 75°55'36"E, 762 m a.s.l., coll. 12 MAY 2021, Athira Jose). 5♀, 8♂ paratypes (CATE 9961001b), from the same locality (11°48'18"N, 75°55'34"E, 790 m a.s.l., coll. 22 SEP 2021, Athira Jose). 3♀, 5♂ paratypes (CATE 9961001c), from Valliyoorkavu, Wayanad District, Kerala, India (11°48'02"N, 76°02'16"E, 752 m a.s.l., coll. 23 SEP 2021, Athira Jose). All type specimens are deposited in the reference collection at the Centre for Animal Taxonomy and Ecology (CATE), Department of Zoology, Christ College (Autonomous), Irinjalakuda, Kerala, India.

*Etymology.* The species group name, *alboclavus*, is an adjective and combination of two Latin words: *albo* (m., adj., *white*) and *clavus* (m., noun, *stripe on the tunic*), referring to the white stripe present on the lateral sides of female abdomen.

*Diagnosis.* Smooth and elongated terminal dilation of spermatheca followed by long medium-sized pipe-like extension places *T. alboclavus* sp. nov. closest to *T. jajpurensis* (Prozynski, 1992) from India. However, they differ by (1) Small, round fossae (Logunov, 2021) limited between the posterior and anterior extension of the spermatheca. In *T. jajpurensis* the fossae are large, almost D-shaped, the margin of the fossae extends to the dilated base of both dilation (compare Figure 16 with Prozynski, 1992, fig. 91). (2) Spermathecae of *T. alboclavus* sp. nov. are elongated, smooth without a small terminal depression. In *T. jajpurensis* spermathecae are bulged with a small anterior terminal depression (compare Figure 17 with Prozynski, 1992, fig. 92). (3) Posterior tip of spermathecal duct is large, dome shaped and sclerotised. Such an extension is absent in *T. jajpurensis* (compare Figure 17 with Prozynski, 1992, fig. 92). (4) Also, they differ morphologically in colouration, as *T. alboclavus* sp. nov. is olive-grey and *T. jajpurensis* yellow-orange, and habitus patterns. The female of *T. alboclavus* sp. nov. is easily identifiable by a prominent white mark on the lateral side of abdomen that extends ventrally (see Figure 2). The epigyne of *T. alboclavus* sp. nov. also shows a close similarity to *T. latithoracicus* (Yamasaki & Huang, 2012) and *T. cuneatus* (Edmunds & Prozynski, 2003). *T. alboclavus* sp. nov. differs by the position of the fossae and the shape of the spermathecae (compare Figures 16-17 with Yamasaki & Huang, 2012, fig. 12). Although the shape of the spermathecae appears to be the same, they differ in the shape and position of the fossae. The prominent triangular mark on the lateral side of *T. cuneatus* is absent in *T. alboclavus* sp. nov. (compare Figures 3 & 16 with, respectively, Edmunds & Prozynski, 2003, figs. 57 & 62).

The long, elongated abdomen of the male *T. alboclavus* sp. nov. is closest to *T. latithoracicus* (compare Figure 9 with Yamasaki & Huang, 2012, fig. 1), from which it can easily be distinguished by the following combination of characters: (1) Fang substantial with U-shaped bend at the base and one small and one large tooth-like apophysis, not present in *T. latithoracicus* (compare Figure 12 with Yamasaki & Huang, 2012, fig. 3), (2) Each chelicera with 7 promarginal and 7 retromarginal teeth. Each chelicera of *T. latithoracicus* is short with 6 promarginal and 7 retromarginal teeth (compare Figure 12 with Yamasaki & Huang, 2012, fig. 3), (3) The sperm duct of *T. alboclavus* sp. nov. starts at the 2 o'clock position, with a U shaped loop at the 11 o'clock position. The sperm duct of *T. latithoracicus* starts at the 4 o'clock position and loops at 1 o'clock (compare Figure 13 with Yamasaki & Huang, 2012, fig. 5).

*Distribution.* Known only from the type locality (Figure 1).



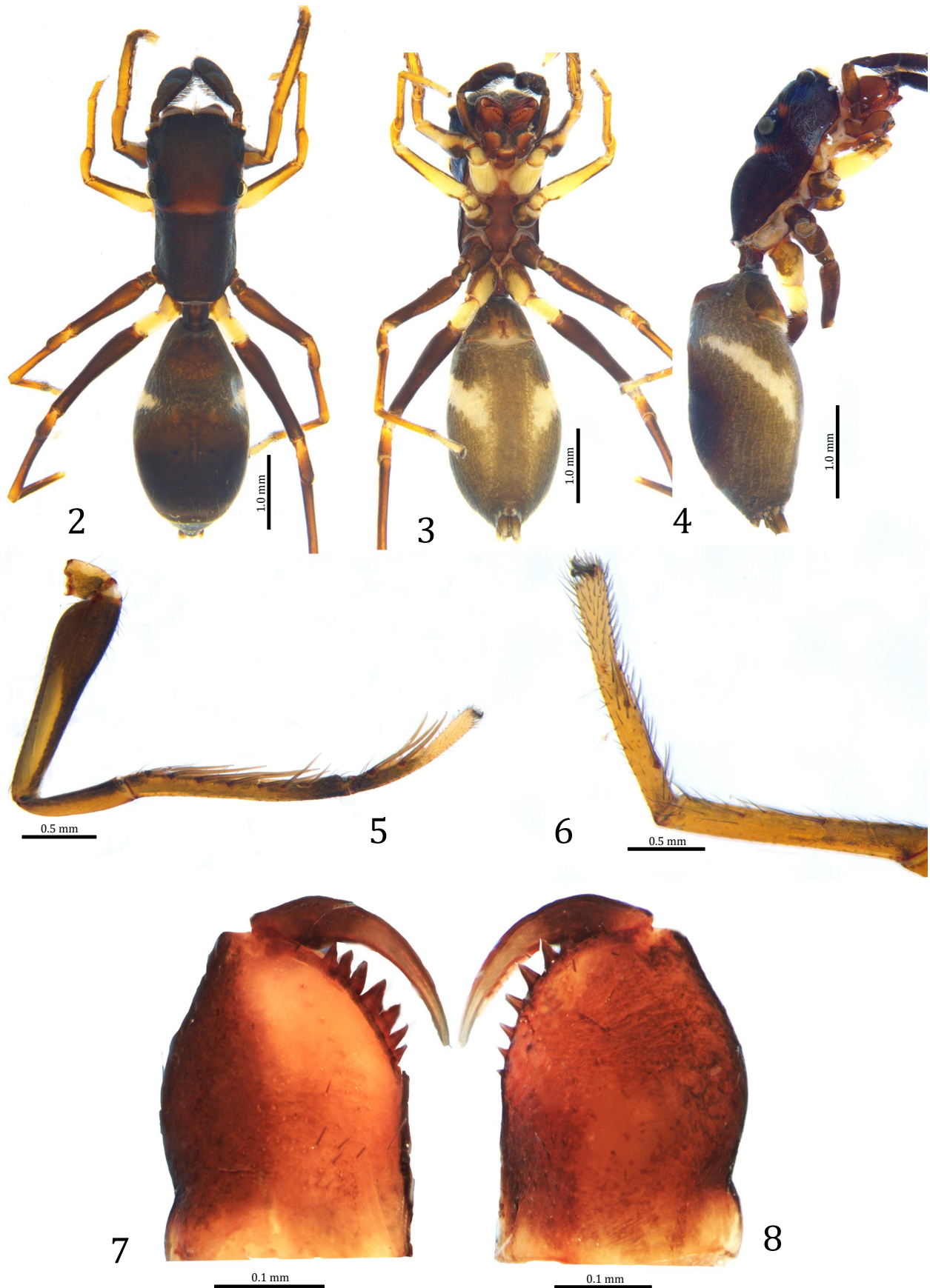
**Figure 1.** Distribution of *Toxeus* in India.

*Description of female* (holotype; Figures 2–8, 15–17). Measurements: body length 6.34, carapace length 2.56, cephalic region length 1.35, width 1.22, thoracic region length 1.23, width 1.15, abdomen length 3.43, width (at the middle) 1.58, pedicel length 0.40, carapace height at PLE 0.652. Eye diameters: AME 0.439, ALE 0.226, PME 0.074, PLE 0.234. Eye interdistances: AME-AME 0.10, AME-ALE 0.07, PME-PME 1.11, ALE-ALE 0.97, PME-PLE 0.30, PLE-PLE 1.13, AME-PME 0.539. Clypeus height 0.488. Length of chelicera 0.77, fang length 0.43. Leg measurements: leg I 4.65 [1.47, 0.70, 1.58, 0.52, 0.39], II 4.21 [1.27, .52, .95, 1.01, .46], III 4.38 [1.53, 0.41, 0.94, 0.96, 0.54], IV 6.3 [1.83, .69, 1.63, 1.53, .62]. Leg formula: 4132. Cephalic region of prosoma higher and broader than thoracic region, olive brown in colour with dark eye patches, between ALE and PME blue tinged patches present. Ocular quadrangle almost square in shape. Thoracic region dark brown, weakly rectangular, sloped laterally at the posterior tip. Cephalic and thoracic region divided by notch, orange coloured, U-shaped in lateral view. Clypeus narrow with tuft of long golden-brown hairs present between AE; small white hairs below ALE. A small orange triangle present between AME and PME (not prominent in live specimen). Chelicera small, sub-vertical, reddish brown with long grey setae on either cheliceral margin. Fang small, curved, pointed to the tip. Endite reddish brown with scopula on inner margin. Labium scopulate, with a white tip. Sternum broad, orange-red, constricted near coxae II, blunt at front, pointed at back. Pedicel with two segments, first segment reddish brown and appears as large, second segment dark comparatively small. Abdomen pear shaped, above and below the constriction slightly sclerotised, mainly reddish brown. The non-sclerotised area is olive grey with thin corrugated lines, also a prominent white mark present on the lateral side that extends ventrally; to the posterior tip few small white-haired spots are seen. Ventrally dark grey, corrugated lines present, a pair of small creamy dotted lines start from the epigastric plate and extend in parallel to the posterior tip. Anal tubercle dark to the base and light to the tip with grey coloured hairs. Spinnerets dark to the base and pale to the tip, anterior lateral spinnerets are the largest. Dentition: 7 promarginal (first teeth small, fifth teeth the largest, all are uniformly spaced) and 7 retromarginal teeth (first teeth small, third and fourth the largest, closely placed). Leg I Cx yellow, Tc brown, Fm dorsal dark, ventrally pale yellow, Pt yellow with dark patch laterally, Tb and Mt yellowish with 7 spines on v of Tb and

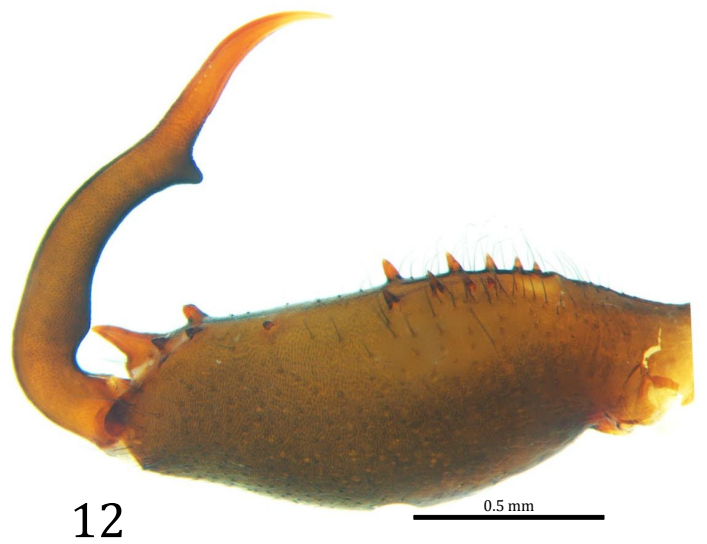
2 on v Mt. Leg II Cx dark, Tc and Fm pale yellow with dark lateral patches all other segments yellow with 2 spines each on both Mt and Tr. Leg III Cx, Tc, Fm reddish brown, Pt, Tb, and Mt yellow, Mt possess preening comb, Tr pale coloured with tarsal spines. Leg IV Cx (black patches on lateral side of coxa) and Tr pale yellow, Fm dark brown with Pt, Tb and Mt reddish yellow also, ventrally Mt possesses rows of hairs, Tr pale coloured. Epigynal plate white, small, orange red colouration at book lungs opening. Fossae round, centrally placed, copulatory channel (Prozynski, 2003) starts from an indistinct slit at the anterior rim of fossae, coils and joins to the posterior end of spermatheca. Spermatheca sclerotised with slight terminal dilatation, forms a chamber of small size. Fertilisation duct small, thin, curved, roughly S-shaped.

*Description of male* (paratype; Figures 2, 9–14, 18–19). Measurements: body length 6.29, carapace length 2.7, cephalic region length 1.51, width 1.55, thoracic region length 1.23, width 1.29, abdomen length (at the middle) 3.10, width 1.003, pedicel length 0.45, carapace height at PLE 0.92. Eye diameters: AME 0.36, ALE 0.26, PME 0.05, PLE 0.24. Eye interdistances: AME-AME 0.14, AME-ALE 0.143, PME-PME 1.17, ALE-ALE 1.05, PME-PLE 0.30, PLE-PLE 1.24, AME-PME 0.581. Clypeus 0.55. Length of chelicera 2.048, fang length 2.06. Palp and leg measurements: Palp: 2.10 [0.53, 0.36, 0.56, 0.65], leg I 4.65 [1.47, 0.70, 1.58, 0.52, 0.39], II 4.21 [1.27, .52, .95, 1.01, .46], III 4.38 [1.53, 0.41, 0.94, 0.96, 0.54], IV 6.3 [1.83, .69, 1.63, 1.53, .62]. Leg formula: 4132. Carapace reddish brown, cephalic region broader and higher than thorax, covered with small brown hairs, thoracic region orange-red, brighter at the anterior end and getting darker posteriorly, lateral sides bordered by dark brown colour. Relatively long white pubescence lines the orange-brown margin. Width reduced posteriorly. Ocular quadrangle almost square, eye patches black. Thoracic notch step-like. Small, dark, fovea present on the notch. Clypeus black with white small hairs beneath ALE and orange yellow hairs around AME. Chelicera horizontal, reddish brown. Paturon granulated dorsally, scopulated to the lateral margin, 7 promarginal and 7 retromarginal teeth, all differ in size, placed distantly. Fang long, prominent with U-shaped bend at the base, one small and large apophysis, former near to the base, other prominent with sharp edge, to the tip pointed and curved. Endite orange-brown, inner margin lined with scopulae. Labium longer than wide, reddish brown, scopulate with white tip. Sternum broad, blunt to the front, pointed to the back, constricted near to coxa II, yellowish red. Pedicel two segmented, first segment longer than the other. Abdomen 2 times longer than wide, elongated, constricted at 1/4 of its length, constriction and lateral sides grey, covered by white pubescence. Above and below the constriction slightly sclerotised, black, to the basal tip two inverted U-shaped markings present. Laterally olive grey with corrugated lines, a median broad reddish line starting from the epigastric plate directed posteriorly is present, either side of this line pale. Epigastric plate yellowish brown with pale white epigastric furrow. Anal tubercle with dark base and light tip. Spinnerets greyish black with pale end, on the base black and white patches present like a ring, anterior lateral spinnerets the largest. Leg I and II golden yellow, III and IV brownish yellow. Leg I Cx longer than wide, somewhat elongated, Tb with 7 and Mt with 2 spines. Leg II on Fm light black patch present. For leg III and IV Cx and Tc golden yellow with dark femur, Tr pale coloured. Mt IV dark with black patches on rtl. Patella possess a small hump. Palp small, dark brown in colour, tibia and patella slightly golden tinted, cymbium oval, with 2 apical spines, pale yellow coloured, non-hairy slanted suture present. Tegulum round, seminal duct broad following the edge of tegulum, starts at 2 o'clock position, thin, broader at 4-5 o'clock position, uniform until 11 o'clock position and forms a U-shaped loop and ends at 1 o'clock position. Embolus forms 2 coils around the bulb, hairy thin, covered by semi-transparent sheath. RTA small, hooked at the tip. Tibia and cymbium with long, dense, stiff dark hairs prolaterally.

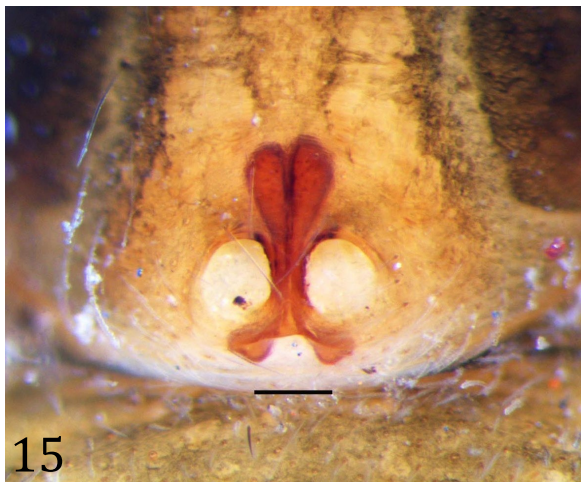
*Variation.* In mature male, size and colour varies slightly. Male: 5.13-6.29 (6 specimens), carapace colour varies from brown (smaller individuals) to orange red. Female: 5.22-6.42 (5 specimens), colour varies from yellowish grey (smaller individuals) to olive grey.



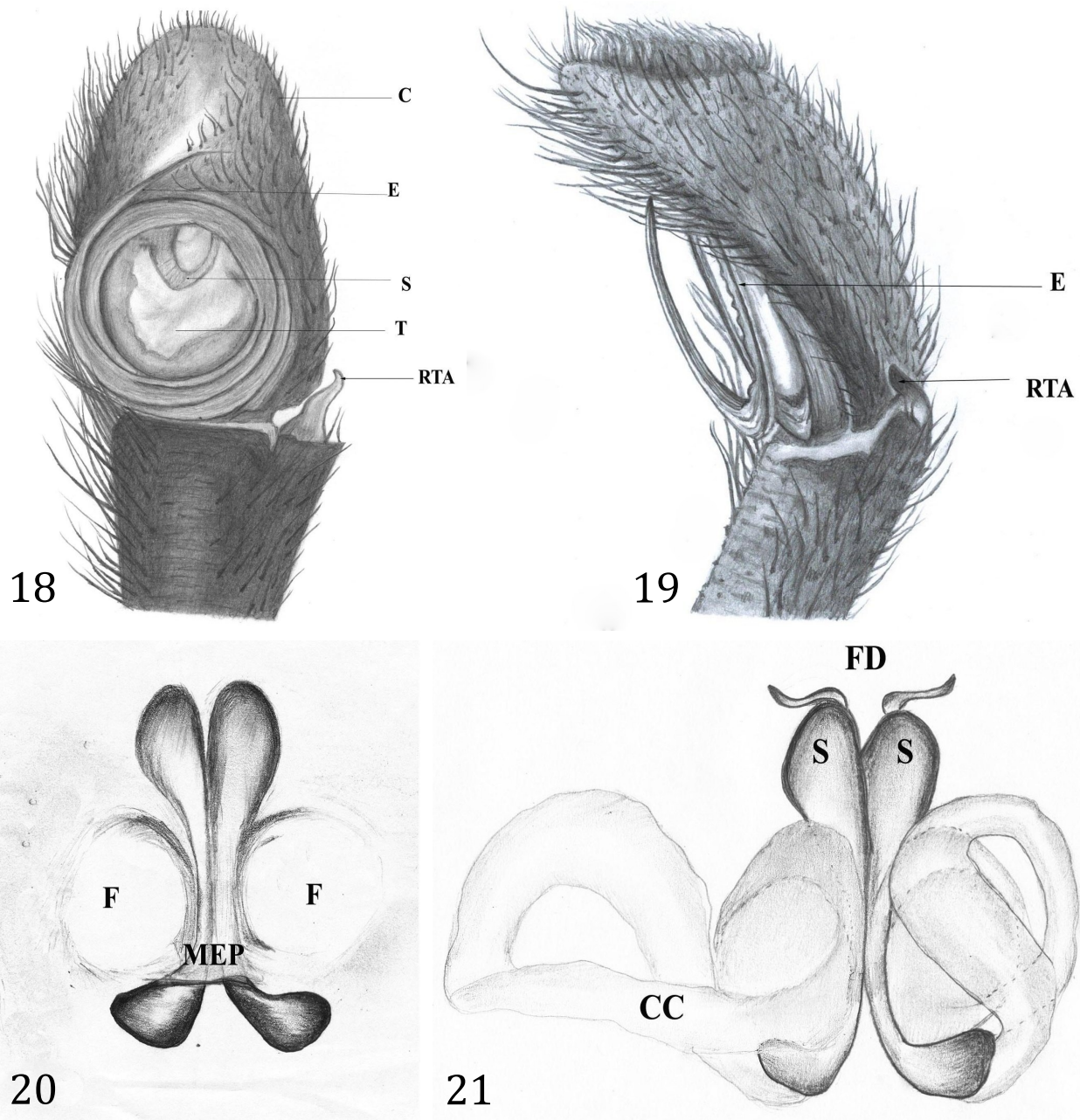
**Figures 2-8.** ♀ *Toxeus alboclavus* sp. nov. 2, Habitus, dorsal view. 3, ventral view. 4, lateral view. 5, Leg I. 6, Leg II. 7, Right chelicera, retrolateral margin. 8, Prolateral margin.



Figures 9-12. ♂ *Toxeus alboclavus* sp. nov. 9, Habitus, dorsal view. 10, Ventral view. 11, Sternum. 12, Right chelicera.



**Figures 13-17.** *Toxeus alboclavus* sp. nov. **13**, Left palp, ventral view. **14**, retrolateral view. **15**, intact epigyne, ventral. **16**, epigyne ventral. **17**, epigyne dorsal. Scale bars 0.1 mm.



**Figures 18-21.** *Toxeus alboclavus* sp. nov. **18**, Left palp, ventral view. **19**, retrolateral view. **20**, epigyne, ventral. **21**, epigyne, dorsal.

*Comments.* The males can easily be spotted by their prominent antler shaped fang. Along with the prominent white stripe on the female abdomen, the blue tinted base of ALE is prominent. In both sexes palps are kept above the chelicera in resting position while walking. Juveniles are small in size, with black coloured habitus, small chelicerae, and a constriction of the abdomen, making it hard to differentiate them from ants. The site of collection was semiarid, covered by mahogany and coffee plantations. The locality was at 752-805 m above sea level. Though Prozynski (2016) didn't follow synapomorphies, quantitative analysis, or previously published phylogenetic analyses when he split *Toxeus* from *Myrmarachne* MacLeay 1839, to avoid confusion we have decided to place this new species in *Toxeus*. A more recent study of the phylogeny of the Myrmarachnini (Maddison & Szűts, 2019) suggests that this split will need to be revisited.



*Natural History.* Usually we found mature individuals and juveniles between September-November. A few mature individuals were spotted in March-May. They prefer sites where ants are numerous. They are most active on sunny days between 09:00-16:00. This varies by season. They make their retreats in dry, rolled leaves in the leaf litter. Rarely they were spotted on buildings.

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### References

- Edmunds, M. and J. Prószyński. 2003.** On a collection of *Myrmarachne* spiders (Araneae: Salticidae) from peninsular Malaya. Bulletin of the British Arachnological Society 12(7): 297-323.
- Koch, C. L. 1846.** Die Arachniden. Dreizehnter Band. J. L. Lotzbeck, Nürnberg: 1-234.
- Logunov, D. V. 2021.** Jumping spiders (Araneae: Salticidae) of the Na Hang Nature Reserve, Tuyen Quang Province, Vietnam. Arachnology 18 (9): 1021-1055.
- MacLeay, W. S. 1839.** On some new forms of Arachnida. Annals of Natural History 2 (7): 1-14, pl. 1-2.
- Maddison, W. P. and T. Szűts. 2019.** Myrmarachnine jumping spiders of the new subtribe Levieina from Papua New Guinea (Araneae, Salticidae, Myrmarachnini). Zookeys 842: 85-112.
- Prószyński, J. 1992.** Salticidae (Araneae) of India in the collection of the Hungarian National Natural History Museum in Budapest. Annales Zoologici, Warszawa 44 (8): 165-277.
- Prószyński, J. 2016.** Delimitation and description of 19 new genera, a subgenus and a species of Salticidae (Araneae) of the world. Ecologica Montenegrina 7 (special volume): 4-32.
- WSC. 2022.** World Spider Catalog. Version 23.0. Natural History Museum Bern, *online at* <http://wsc.nmbe.ch>, accessed on 17 FEB 2022. doi: 10.24436/2
- Yamasaki, T. and J. N. Huang. 2012.** A new species of the genus *Myrmarachne* (Araneae: Salticidae) from the central Ryukyus and Taiwan. Acta Arachnologica 61 (1): 7-10.