

## Two New Species of the Spider Family Amaurobiidae from the Ryukyu Islands, Japan

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(Received 13 September 2022; accepted 28 September 2022)

<http://zoobank.org/urn:lsid:zoobank.org:pub:5E6DEE1F-5DD3-4043-AF60-2889F74F0C0B>

**Abstract** Two new species of the family Amaurobiidae are described from the Ryukyu Islands, southwestern Japan, under the names *Callobius cavernarius* sp. n. (Okinoerabu Island) and *Callobius shimojanai* sp. n. (Okinawajima Island). Both species are closely related to each other and there are three further known species related to the new species: *C. yakushimensis* Okumura 2010, *C. amamiensis* Okumura *et al.*, 2018 and *C. breviprocellus* Okumura *et al.*, 2020. The morphological differences between these five species are discussed in detail, especially those in the structure of the male palpal organ and the female genitalia. Although this species group includes cavernicolous species, no particular adaptations to living in caves, for example degeneration of the eyes, was observed. A map showing the distribution of these species is given.

**Key words:** genus *Callobius*, Okinawajima Island, Okinoerabu Island, taxonomy.

### Introduction

The genus *Callobius* Chamberkin, 1947 (Amaurobiidae) is diverse and abundant in species number in North America, although 33 described species of the genus are distributed widely in the Northern Hemisphere (World Spider Catalog, 2022). This genus is characterized by having three well-developed tibial apophyses in the male palp, and two visible lateral lobes in the epigyne (Chamberkin, 1947; Leech, 1972). Four species are known in Japan, and three of them inhabit the Ryukyu Islands, southwestern Japan (Okumura, 2010; Okumura *et al.*, 2018, 2020). A new material with specimens collected from Okinoerabu Island and Okinawajima Island, the Ryukyu Islands, Japan, was obtained this time. After

careful taxonomical examinations, two new species of the genus are recognized. We describe them herein with a discussion on their morphological differences and distribution.

### Materials and Methods

Examination and illustration were performed using an Olympus SZX-7 stereomicroscope. In order to examine the copulatory organs, the left male palp was cut as necessary. As for female vulva, the epigyne was dissected and treated in 10% KOH solution to remove the muscles, etc. Photographs were taken using an Olympus E-620 digital camera attached to the microscope. Measurements of respective body parts were done using a micrometer mounted on an ocular lens. All measurements are given in millimetres. Leg measurements are given as total length (femur,

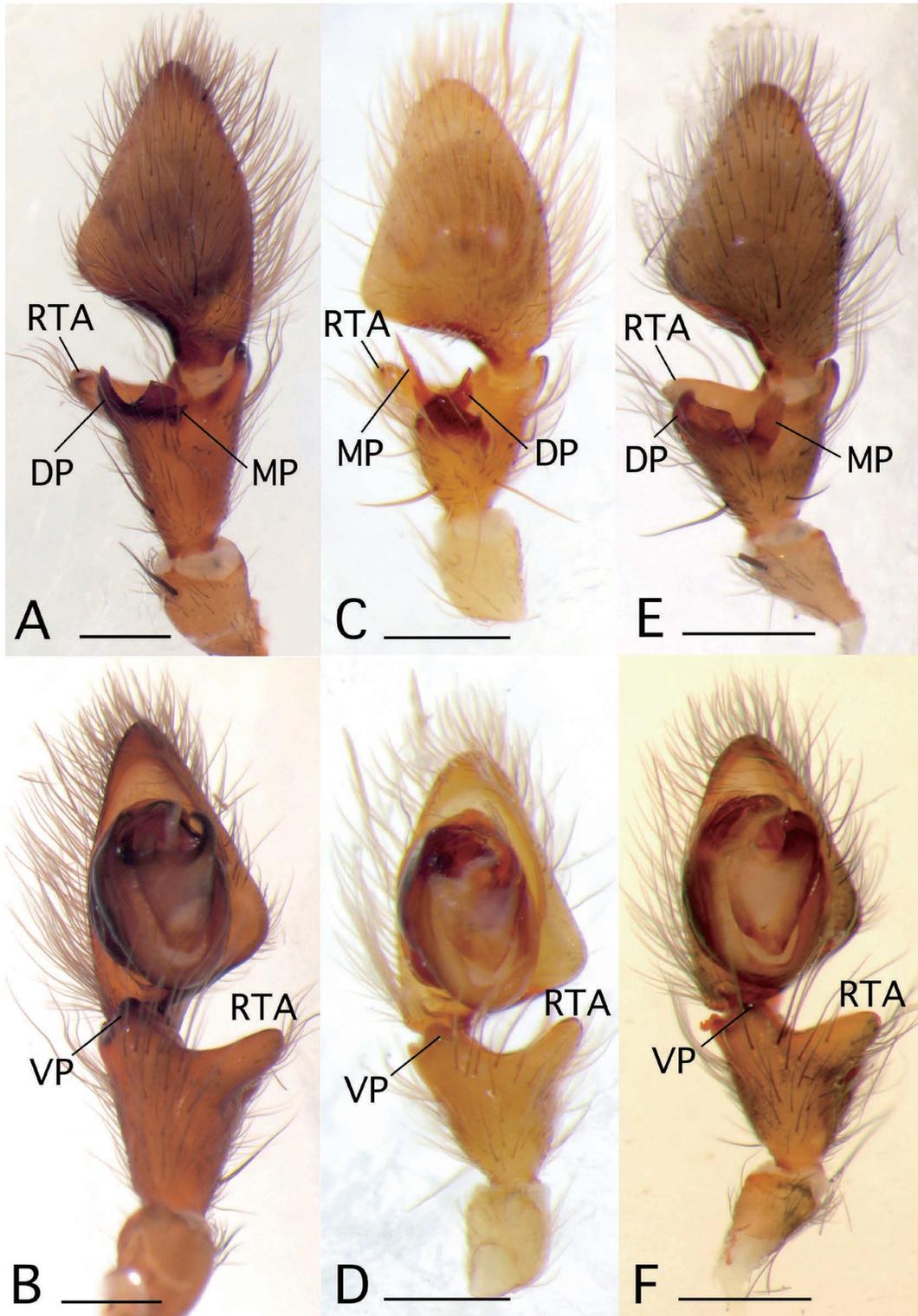


Fig. 1. Comparison of male palps of *Callobius cavernarius* sp. n. (A–B); *C. shimojanai* sp. n. (C–D); and *C. breviprocessus* (E–F). Male palp (left), dorsal view (A, C, E); same, ventral view (B, D, F). Scale bars = 0.5 mm.

patella & tibia, metatarsus, tarsus). Descriptive terminology follows Leech (1972), Ono (2009) and Lew (2011).

Abbreviations: ALE = anterior lateral eye, AME = anterior median eye, CO = conductor, DP = dorsal process, LL = lateral lobe, MOA =

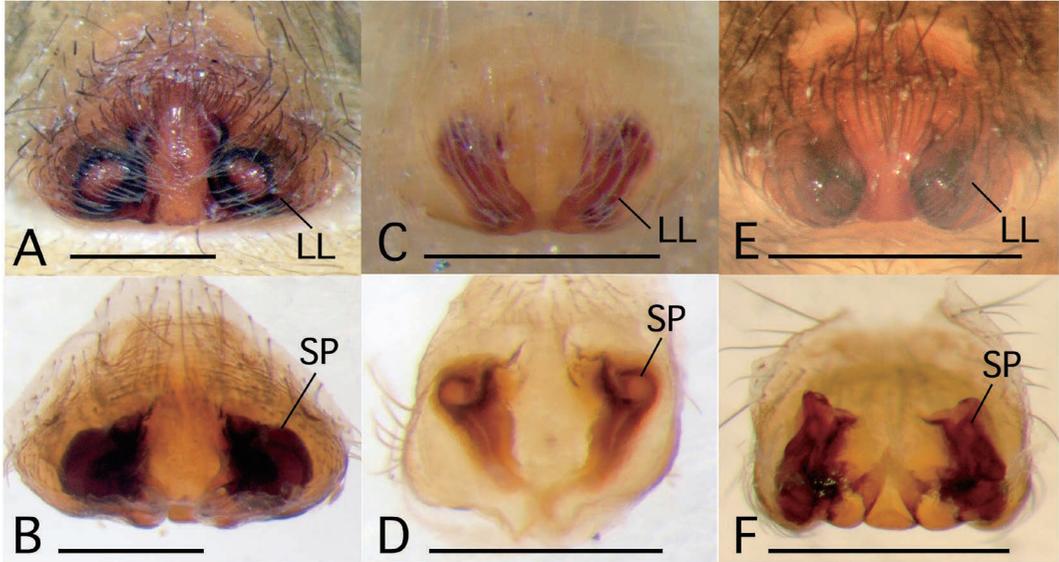


Fig. 2. Comparison of female genital organs of *Callobius cavernarius* sp. n. (A–B); *C. shimojanai* sp. n. (C–D); and *C. breviproessus* (E–F). Epigyne, ventral view (A, C, E); female internal genitalia (B, D, F). Scale bars = 0.5 mm.

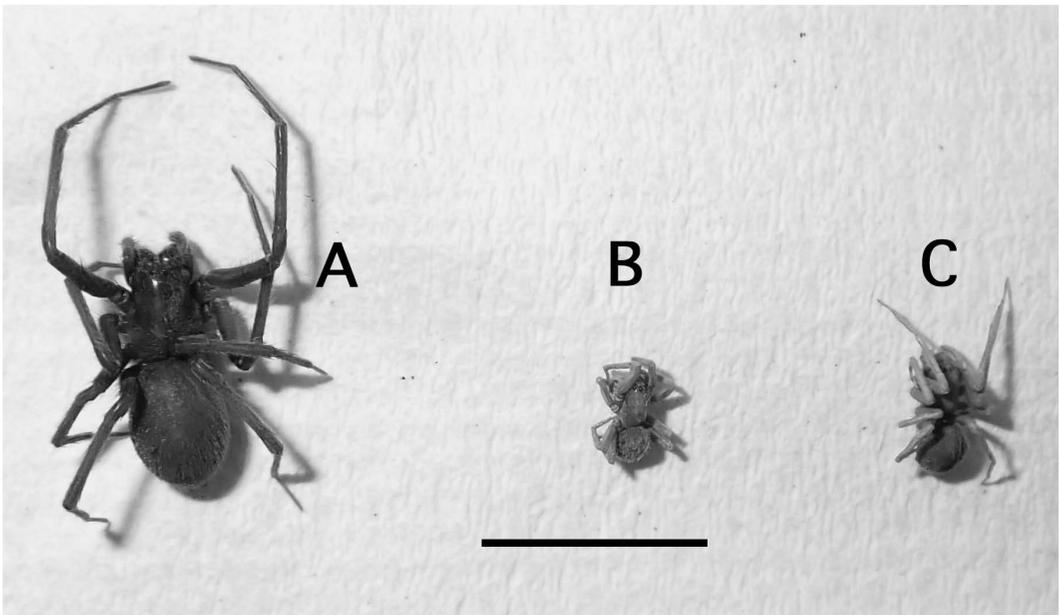


Fig. 3. Comparison of body appearance of female specimens. *Callobius cavernarius* sp. n. (A); *C. shimojanai* sp. n. (B); and *C. breviproessus* (C). Scale bars = 10 mm.

median ocular area, MP = mesal process, PA = patellar apophysis, PLE = posterior lateral eye, PME = posterior median eye, RTA = retrolateral tibial apophysis, SP = spermatheca, VP = ventral process.

The specimens used in this study are deposited in the collection of the Department of Zoology, National Museum of Nature and Science (NSMT), Japan.

### Taxonomy

Family Amaurobiidae Thorell, 1870

Genus *Callobius* Chamberlin, 1947

*Callobius cavernarius* sp. n.

[Japanese name: Erabuhoraana-gakejigumo]

(Figs. 1A–B, 2A–B, 3A, 4, 5)

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*Type material.* Holotype ♂, JAPAN: Ginsuido Cave, Okinoerabu Island, Kagoshima Pref., 28 April 2004, T. Tamura leg. (NSMT-Ar 22142). Paratypes: 2 ♀, same data as the holotype (NSMT-Ar 22143); 1 ♂, Suirendo cave, Okinoerabu Island, Kagoshima Pref., 30 April 2004, T. Tamura leg. (NSMT-Ar 22144); 1 ♀, Ogimi, Ogimi-son, Kunigami-gun, Okinawajima Island, Okinawa Pref., 19 December 2021, Y. Suzuki leg. (NSMT-Ar 22145)

*Other materials examined.* 1 ♂, 6 ♀, Shoryudo Cave, Okinoerabu Island, Kagoshima Pref., 9 December 2021, Y. Suzuki leg. 2 ♂, 2 ♀, Shoryudo Cave, Okinoerabu Island, Kagoshima Pref., 6 March 1982, M. Shimojana leg. 5 ♂, 3 ♀, Suirendo Cave, Okinoerabu Island, Kagoshima Pref., 6 March 1982, M. Shimojana leg. 2 ♂, 3 ♀, Ogimi, Ogimi-son, Kunigami-gun, Okinawajima Island, Okinawa Pref., 19 December 2021, Y. Suzuki leg.

*Etymology.* The specific name is derived from the Latin adjective *cavernarius* “concerning caves,” referring to the discovery of the type specimens in caves.

*Diagnosis.* Male specimens of *Callobius cavernarius* sp. n. can be distinguished from



Fig. 4. *Callobius cavernarius* sp. n.; one specimen of female paratypes. Scale bar = 5 mm.

other congeners by the narrow cymbium, the long tibia and the trapezoidal MP with an extremely small projection in the palp. Female can be distinguished by the triangular lateral lobes located distant from each other in the epigyne and the semicircular spermathecae of the internal genitalia. As an example, the differences from *C. breviproductus* that lives in the most neighboring areas are shown (Figs. 1, 2). For differences from the other two species, *C. yakushimensis* and *C. amamiensis* in the Ryukyu Islands, refer to Okumura *et al.*, 2020. The body size of the species is also much larger than the other species living on Okinawajima Island (Fig. 3).

*Description.* Male (holotype). Total length 9.8, carapace 5.5 long, 3.8 wide; abdomen 4.3 long, 2.7 wide; sternum 2.3 long, 1.9 wide. Eye sizes and interdistances AME 0.19, ALE 0.26, PME 0.21, PLE 0.24; AME-AME 0.09, AME-ALE 0.11, PME-PME 0.21, PME-PLE 0.30, AME-PME 0.31, ALE-PLE 0.10. MOA; anterior width 0.47, posterior width 0.63, length 0.71.

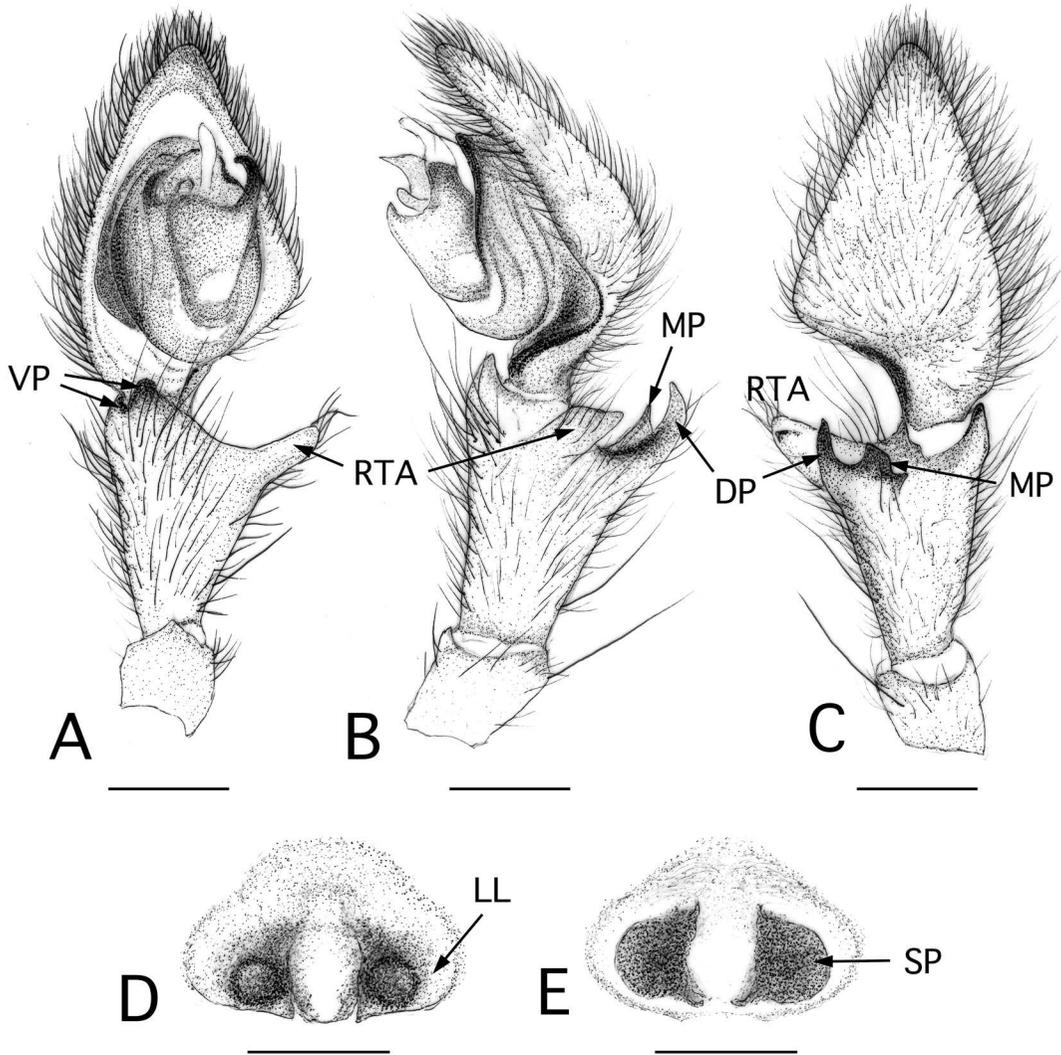


Fig. 5. Copulatory organs of *Callobius cavernarius* sp. n. holotype (A, B, C), paratypes (D, E). Male palp (left), ventral view (A); same, retrolateral view (B); same, dorsal view (C); epigyne, ventral view (D); female internal genitalia (E). Scale bars = 0.5 mm.

Leg measurements: I: 27.7 (7.1, 9.2, 7.5, 3.9); II: 19.2 (5.3, 6.6, 4.8, 2.5); III: 16.5 (4.8, 5.4, 4.3, 2.0); IV: 21.8 (6.1, 7.0, 6.0, 2.7).

Palp (Figs. 1A–B, 5A–C): three projections present in the lateral to dorsal portion of long tibia; RTA thick and has a small process in the tip, DP slightly curved and pointed in the tip, MP trapezoid with an extremely small projection, cymbial excavation clear; CO thin and semitransparent, median apophysis large and claw-shaped, embolus short and conglutinates with the tegu-

lum.

Chelicerae: promargin with 5 teeth, retromargin with 5 teeth.

Colouration: carapace yellowish brown with indistinct radial flecks, dorsum of abdomen blackish brown but grayish brown only in the anteromedian part, and venter blackish brown with white lines in both lateral sides, sternum yellowish brown, chelicerae blackish brown, maxillae and labium brown, legs yellowish brown without ring flecks.

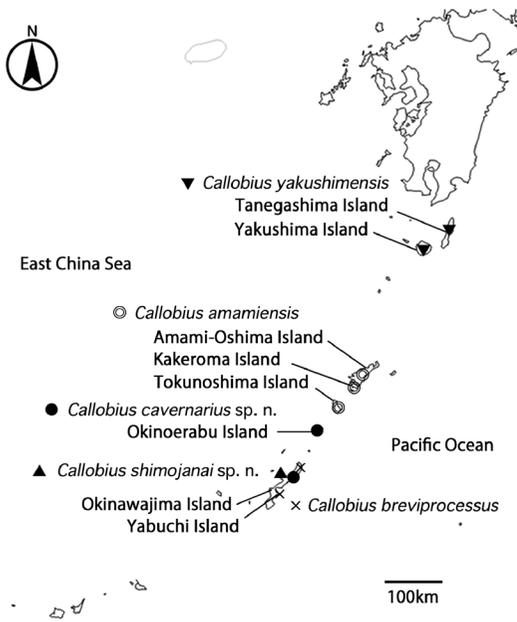


Fig. 6. Distribution records of *Callobius cavernarius* sp. n. and *C. shimojanai* sp. n. including three closely related species living on the Ryukyu Islands.

Female (one of paratypes). Total length 10.4, carapace 3.9 long, 2.4 wide; abdomen 6.5 long, 4.7 wide; sternum 1.7 long, 1.6 wide. Eye sizes; AME 0.13, ALE 0.20, PME 0.16, PLE 0.18. Distances between eyes; AME-AME 0.11, AME-ALE 0.10, PME-PME 0.15, PME-PLE 0.28, AME-PME 0.21, ALE-PLE 0.08. MOA; anterior width 0.37, posterior width 0.47, length 0.50. Leg measurements: I: 14.3 (4.0, 4.9, 3.4, 2.0); II: 11.5 (3.3, 3.9, 2.7, 1.6); III: 10.2 (3.0, 3.4, 2.5, 1.3); IV: 13.0 (3.8, 4.6, 3.4, 1.2).

Epigyne and internal genitalia (Figs. 2A–B, 5D–E): lateral lobes almost semicircular, swollen and distant from each other, median lobe almost circular from the posterior view, ectal lobe and posterior lobe absent. SP semicircular and distant from each other, fertilization ducts small and indistinct.

Chelicerae: promargin with 6 teeth on the left, and 5 on the right, retromargin with 6 teeth on the left, and 5 teeth on the right.

Colouration: almost same as that of the male holotype.

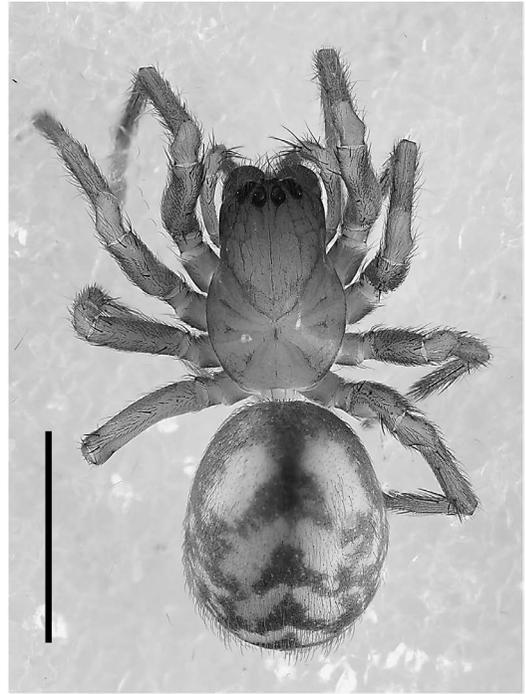


Fig. 7. *Callobius shimojanai* sp. n.; one specimen of female paratypes. Scale bar = 2 mm.

Distribution: Okinoerabu Island, Okinawajima Island (Fig. 6)

Remarks. Although the number of the marginal teeth in the female type specimen using for the description is different between the right chelicera and the left one, we considered this is a case of variation because the variation of the number of the marginal teeth can easily occurs (Okumura *et al.* 2020). The main habitat of this new species is in caves in Okinoerabu Island, but some specimens have also been collected from the ground in the mountainous areas on Okinawajima Island.

***Callobius shimojanai* sp. n.**

[Japanese name: Motobu-gakejigumo]

(Figs. 1C–D, 2C–D, 3B, 7, 8)

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*Type material.* Holotype ♂, JAPAN: Mt. Katsudake, Katsuyama, Nago-shi, Okinawajima Island, Okinawa Pref., 13 February 1982, M.

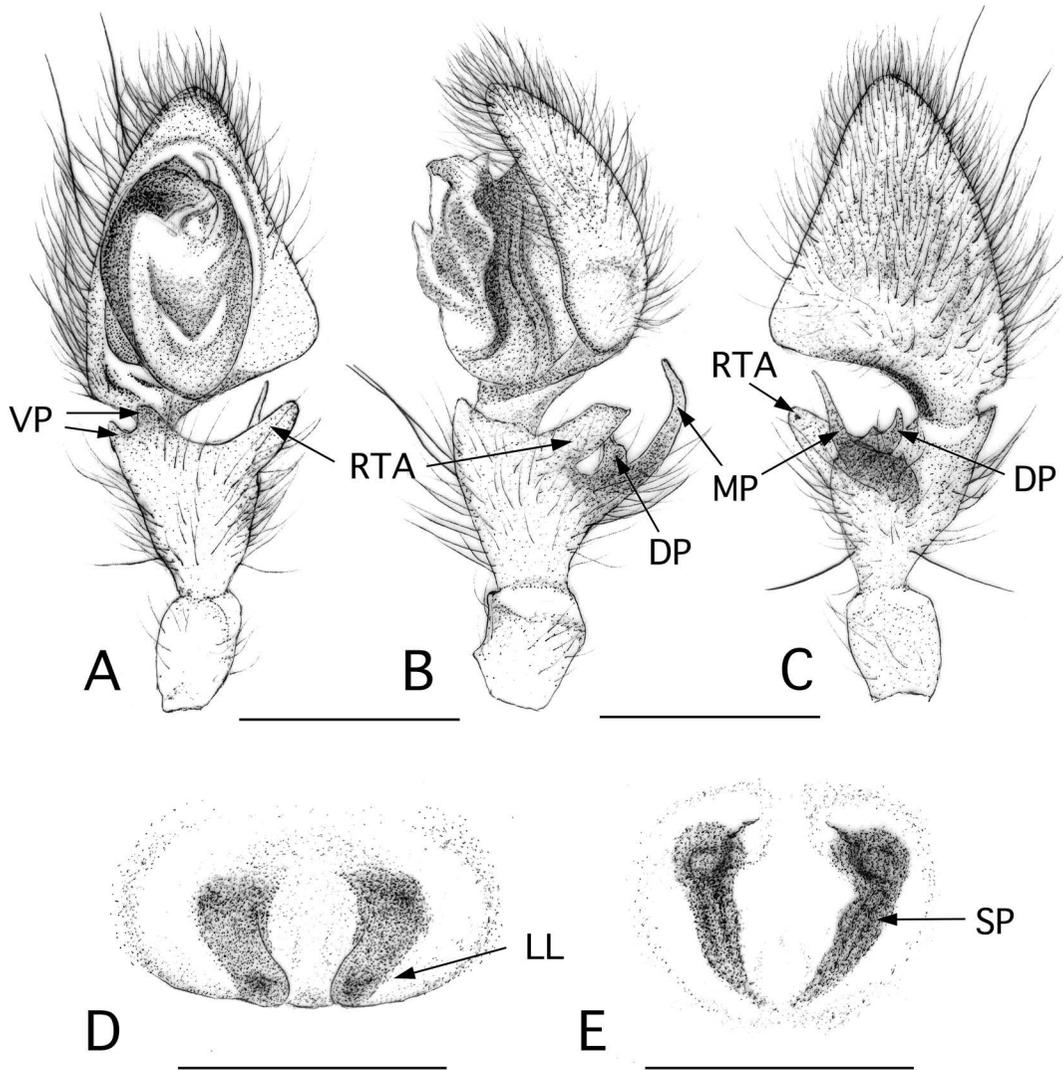


Fig. 8. Copulatory organs of *Callobius shimojanai* sp. n. holotype (A, B, C), paratypes (D, E). Male palp (left), ventral view (A); same, retrolateral view (B); same, dorsal view (C); epigyne, ventral view (D); female internal genitalia (E). Scale bars = 0.5 mm.

Shimojana leg. (NSMT-Ar 22146). Paratypes: 4 ♂ 3 ♀, same data as the holotype (NSMT-Ar 22147); 1 ♀, Mt. Nagodake, Nago, Nago-shi, Okinawajima Island, Okinawa Pref., 10 February 2022, Y. Suzuki leg. (NSMT-Ar 22148)

*Etymology.* The specific name is dedicated to Dr. Matsuei Shimojana who collected the new species for the first time.

*Diagnosis.* *Callobius shimojanai* sp. n. can be distinguished from other congeners by the

mutually crossing DP and MP in the tibia of male palp and the tip of the lateral lobes located close to each other in the epigyne. The new species clearly different from *C. breviprocessus*, which inhabit the same island, by the above characteristics (Figs. 1, 2). For differences from the other two species, *C. yakushimensis* and *C. amamiensis* in the Ryukyu Islands, refer to Okumura *et al.*, 2020.

*Description.* Male (holotype). Total length

4.6, carapace 2.5 long, 1.8 wide; abdomen 2.1 long, 1.5 wide; sternum 1.2 long, 1.0 wide. Eye sizes and interdistances AME 0.06, ALE 0.11, PME 0.13, PLE 0.13; AME-AME 0.04, AME-ALE 0.06, PME-PME 0.09, PME-PLE 0.11, AME-PME 0.23, ALE-PLE 0.05. MOA; anterior width 0.16, posterior width 0.35, length 0.42. Leg measurements: I: 11.3 (2.9, 3.8, 2.8, 1.8); II: 7.1 (2.1, 2.5, 1.5, 1.0); III: 6.0 (1.9, 2.0, 1.2, 0.9); IV: 7.9 (2.2, 2.6, 2.0, 1.1).

Palp (Figs. 1C–D, 8A–C): three projections present in the lateral to dorsal portion of tibia; RTA thick and has a minute process in the tip, DP somewhat small and pointed in the tip, MP long, the two processes mentioned above cross each other. cymbial excavation clear; CO thin and semitransparent, median apophysis thick and claw-shaped, embolus short and conglutinates with the tegulum.

Chelicerae: promargin with 6 teeth, retromargin with 6 teeth.

Colouration: carapace yellowish brown with indistinct radial flecks, dorsum of abdomen grayish brown with five pairs of white markings, and venter with two pairs of white lines in both lateral sides, sternum grayish brown, chelicerae, maxillae and labium blackish brown, legs yellowish brown without ring flecks.

Female (one of paratypes). Total length 5.6, carapace 2.6 long, 1.8 wide; abdomen 3.0 long, 2.3 wide; sternum 1.2 long, 1.0 wide. Eye sizes; AME 0.05, ALE 0.13, PME 0.11, PLE 0.11. Distances between eyes; AME-AME 0.06, AME-ALE 0.08, PME-PME 0.10, PME-PLE 0.15, AME-PME 0.20, ALE-PLE 0.06. MOA; anterior width 0.16, posterior width 0.32, length 0.36. Leg measurements: I: 6.8 (1.9, 2.4, 1.4, 1.1); II: 5.4 (1.6, 1.9, 1.1, 0.8); III: 4.8 (1.4, 1.6, 1.1, 0.7); IV: 6.3 (1.8, 2.2, 1.5, 0.8).

Epigyne and internal genitalia (Figs. 2C–D, 8D–E): lateral lobes ligulate and close to each other at the tip, median lobe quite small and indistinct, ectal lobe and posterior lobe absent. SP anteroposteriorly elongated, slender toward the posterior margin and distant from each other, fertilization ducts small and indistinct.

Chelicerae: promargin with 5 teeth, retromargin with 6 teeth.

Colouration: almost same as that of the male holotype.

*Distribution*: Okinawajima Island (Fig. 6)

### Acknowledgments

For providing the specimens used in this study, we are grateful to Dr. Matsuei Shimojana (University of the Ryukyus) and Dr. Akio Tanikawa (University of Tokyo). We also express sincere thanks to Dr. Hirotsugu Ono (National Museum of Nature and Science) for reading the manuscript and for practical advices, to Mr. Andrew Garrison for correcting the English grammar and to Mr. Motoaki Iwata (Kagoshima University) for his support for the field survey.

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