Two New Species of Ground Spiders (Araneae: Gnaphosidae) from Okinawa Islands, Japan

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Two new gnaphosid spider species, Cladothela bicolor Suzuki, sp. nov. and Micaria longimana Suzuki, sp. nov. are described on the basis of both sexes, from material collected in the Okinawa Islands in the Ryukyu Islands, Japan. Illustrations and photographs of both species, as well as a map of the sampling locations are provided.

Key Words: Cladothela, Kume Island, Micaria, morphology, Ryukyu Islands, Sesoko Island, taxonomy.

Introduction

Gnaphosidae commonly known as ground spiders, is a diverse family of wandering spiders that comprises over 2500 species in 145 genera worldwide (Murphy 2007; World Spider Catalog 2022). Gnaphosids are small to large (2–15 mm in body length) sized, mostly ground-dwelling hunters, with a few species displaying an arboreal lifestyle (Kamura 2009).

The gnaphosid fauna of the Ryukyu Islands, southwest Japan, has been extensively studied by Kamura (1994, 1997, 1999, 2000, 2011, 2019, 2020), and currently 23 species belonging to 11 genera of this family are known from there (Tanikawa 2022). Due to geographic isolation of the Ryukyu Islands, many gnaphosid species from this area have a restricted distribution (e.g., Zelotes donan Kamura, 1999 and Z. zephyrus Kamura, 1999 are known only from Yonaguni Island), and most of them are endemic to Japan. The gnaphosid fauna of the Ryukyu Islands also comprises some introduced species such as Marinarozelotes kulczynskii (Bösenberg, 1902), presumably introduced from other regions (Kamura 1997; World Spider Catalog 2022). Recent updates on the gnaphosids in the Ryukyu Islands (Kamura 2019, 2020) suggest further potential diversity of this family in the region.

During a field survey in the Okinawa Islands, Japan, the authors obtained several specimens of two unidentified gnaphosid species. On initial examination, it was observed that one of these species possessed a red-and-black bicolor body with copulatory organs corresponding to Cladothela Kishida, 1928, while the other one bearing long male palps seemed to belong to Micaria Westring, 1851. Further morphological examination identified unique features in each species, leading to the conclusion that they are new to science. This paper provides the morphological descriptions of both sexes of these two new gnaphosid species and a distribution map.

Materials and Methods

All specimens were preserved in 80% (v/v) ethanol solution, their morphological features were studied using a stereoscopic microscope (Nikon AZ100M, Japan), and photographs were taken with either microscope imaging software (Nikon NIS-Elements D 4.20.00 64-bit, Japan) or a digital camera (Nikon CF Plan X20 objective lens + Olympus M. Zuiko 75–300 mm attached to Olympus OM-D E-M1) and stacked using imaging software (Zerene Stucker; Zerene Systems, Washington, USA). The internal genitalia were treated with Proteinase K before being photographed. Measurements are given in mm. The value ranges of measurements are indicated in parentheses. Measurements of legs are given in the following formats: [femur + patella + tibia + metatarsus + tarsus = total]. Lengths of palpal segments were measured in the holotype male of M. longimana sp. nov. and shown in the following format: [femur + patella + cymbium = total]. Specimens of the type series designated in this paper have been deposited in the collection of the National Museum of Nature and Science, Tsukuba (NSMT).

The following abbreviations are used. Eyes: ALE, anterior lateral eye; AME, anterior median eye; PLE, posterior lateral eye; PME, posterior median eye. Male palp: CL, cymbial length; Co, conductor; Em, embolus; Eml, embolus length; EmW, embolus width; MA, median apophysis; PBL, palpal bulb length; PBT, palpal bulb thickness; PTL, palpal tibial length; SD, sperm ducts; T, tegulum; TA, palpal tibial apophysis; TO, terminal outgrowth; To, triangular out-
growth. Female genitalia: AEM, anterior epigynal margin; CD, copulatory duct; CDH, copulatory duct height; CDW, copulatory duct width; CO, copulatory opening; COI, copulatory opening interdistance; COW, copulatory opening width; FD, fertilization ducts; G, lateral glands; Sp, spermathecae; SpH, Spermathecae height; SpW, spermathecae width. Spination: d, dorsal; p, prolateral; r, retrolateral; v, ventral. Morphological terminology is mainly according to Kamura (1991, 1997) and Marusik and Omelko (2017).

**Taxonomy**

Family **Gnaphosidae** Banks, 1892  
Genus **Cladothela** Kishida, 1928

**Type species.** *Cladothela boninensis* Kishida, 1928. Holotype from Ogasawara Islands (type specimen lost).

**Remarks.** Currently, 11 species are known in this genus in East Asia (World Spider Catalog 2022). This genus can be distinguished from other gnaphosids by the presence of a conspicuous, hook-like, retrolateral sclerotized spine on the male palpal femur (Kamura 1999). Three *Cladothela* species have been recorded in the Ryukyu Islands, namely: *C. auster* Kamura, 1997; *C. parva* Kamura, 1991; *C. oculinotata* (Bösenberg and Strand, 1906) (Shimojana 1977, 1981; Kamura 1991, 1997; Tanikawa and Sasaki 1999).

*C. bicolor* Suzuki, sp. nov.  
[New Japanese Name: Himune-washigumo]  
(Figs 1–3)

**Type material.** Holotype: female, NSMT-Ar 22039, Sesoko Island, Sesoko, Motobu Town, Kunigami District, Okinawa, Japan (26.643978°N, 127.867065°E), 2 June 2021, K. Okazaki leg. Paratypes: 1 male, NSMT-Ar 22040, Kijyoka, Ōgimi Village, Kunigami District, Okinawa, Japan (26.694485°N, 128.146732°E), 15 April 2021, Y. Suzuki leg.; 1 male, NSMT-Ar 22041, Kume Island, Ōta, Kumejima Town, Shimajiri District, Okinawa, Japan (26.348345°N, 126.755051°E), 18 May 2022, N. Nakama leg.

**Other specimens examined.** One juv. Kuroishimori Park, Majya, Kumejima Town, Shimajiri District, Okinawa, Japan (26.365306°N, 126.805788°E), 16 May 2022, K. Yoshi-

![Fig. 1. Cladothela bicolor Suzuki, sp. nov., holotype female from Sesoko Island (NSMT-Ar 22039: A, C, D) and paratype male from Okinawa Island (NSMT-Ar 22040: B, E, F). A, B, Habit of living individuals; C, E, habitus, dorsal view; D, F, ditto, ventral view. Scale bars: 1.0 mm.](image-url)
Fig. 2. *Cladothela bicolor* Suzuki, sp. nov., holotype female from Sesoko Island (NSMT-Ar 22039: A, C, E–G, K–M) and paratype male from Okinawa Island (NSMT-Ar 22040: B, D, H–J, N–R). A, B, Eye region, dorsal view; C, D, mouthparts, ventral view; E, H, left chelicerae, posterior view; F, I, ditto, anterior view; G, J, ditto, ventral view; K, epigyne, ventral view; L, ditto, clarified view; M, internal genitalia, dorsal view; N, right palp, dorsal view; O, ditto, retrolateral view; P, left palp, retrolateral view; Q, ditto, ventral view; R, ditto, prolateral view. Arrows in K and L indicate pit-like structures on posterior margin and window-like regions on epigynal plate, respectively. Scale bars: 1.0 mm (O); 0.5 mm (A–D, N); 0.2 mm (E–M, P–R).
Etymology. The specific name refers to the bicolored body of the holotype.

Diagnosis. *Cladothela bicolor* sp. nov. bears flattened cheliceral fangs and endites, with dense short stiff bristles (Fig. 1C–I), a character shared with *C. auster* and *C. oculinotata* (Kamura 1991, 1997). However, female of *C. bicolor* sp. nov. can be distinguished from both species based on the following unique characteristics: an elliptical, transversely wider copulatory openings surrounded with distinctive sclerotized ridges [vs. ridges located on mesial and anteriors sides of copulatory openings in *C. auster*; mesial and posterior sides in *C. oculinotata*; Figs 2K, L, 3A vs. fig. 3 in Kamura (1997) and figs 30, 31 in Kamura (1991)]; copulatory ducts as wide as and 2.5 times as tall as spermathecae, and curved, and close to each other before inserting to spermathecae [vs. copulatory ducts straight and narrower than spermatheca width in *C. auster* and 1.5 times as tall as spermathecae and bent before inserting to spermathecae in *C. oculinotata*; Figs 2M, 3B (CD) vs. fig. 4 in Kamura (1997) and fig. 32 in Kamura (1991)]; spermathecae close to each other [vs. further apart from each other in *C. auster* and *C. oculinotata*; Figs 2M, 3 vs. fig. 4 in Kamura (1997) and fig. 32 in Kamura (1991)]. Male of *C. bicolor* sp. nov. can be
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Two new gnaphosid species from Japan; Figs 2R, 3E vs. fig. 1 in Kamamura (1991), tegulum very weakly protruded [vs. strongly 2P–R, 3C–E vs. fig. 1 in Kamura (1997) and fig. 26 in Kamura (1991)], conductor with a dark-colored distinct angular ridge on the retrolateral margin of conductor rounded in C. oculinotata; Figs 2C; conductor having a sclerotized lobe-like structure in C. auster, ride on retrolateral margin of conductor rounded in C. oculinotata; Figs 2P–R, 3C–E vs. fig. 1 in Kamura (1997) and fig. 26 in Kamura (1991), conductor lateral margin of conductor rounded in C. oculinotata; Figs 2R, 3E vs. fig. 27 in Kamura (1991)).

Live individuals of C. bicolor sp. nov. possess a clear bicolor body: vivid red prosoma and black abdomen (Fig. 1A, B), readily to distinguish the new species from its congeners, which possess uniformly dark reddish brown or dark brown body color.

**Description.** Female (holotype: NSMT-Ar 22039). Body 5.66 long. Carapace 2.44 long, 2.07 wide, 0.74 high. Eye size and interdistances: AME 0.184, ALE 0.211, PME 0.200, PLE 0.157, AME–AME 0.091, AME–ALE 0.038, PME–PME 0.084, PME–PLE 0.069, ALE–PLE 0.059. Leg length: I: 1.87 + 0.99 + 1.41 + 0.91 + 0.69 = 5.87; II: 1.60 + 0.93 + 1.28 + 0.85 + 0.68 = 5.34; III: 1.39 + 0.82 + 1.06 + 0.92 + 0.70 = 4.89; IV: 1.79 + 0.93 + 1.45 + 1.62 + 0.95 = 6.74. Abdomen 3.06 long, 2.33 wide, 1.71 high.

Chelicerae as long as wide (length/width 1.21) with 3 small promarginal teeth almost in form of small denticles and bearing dense short stiff bristles, retromarginal teeth absent. Fang wide, flat and curved. Epigyne (Figs 2K, L, 3A): epigynal plate trapezoidal, wider than long (plate length/width 0.78); pair of window-like, weakly pigmented regions on anterolateral sides of epigynal plate (arrows in Fig. 2K); posteromedian part weakly sclerotized with two pigmented, pit-like structures on posterior margin (arrows in Fig. 2L); interdistances of copulatory openings longer than copulatory opening width: interdistance/width 2.15, elliptical, transversely wider with clear sclerotized ridges surrounding the openings; anterior side of epigynal plate sclerotized and pigmented, posterior side membranous and less pigmented. Internal genitalia (Figs 2M, 3B): copulatory ducts massive, elongated, curved, contiguous before inserting to spermalthecae; lateral glands attenuating transversely; spermalthecae globular, juxtaposed; fertilization ducts arising from mesial sides of spermalthecae.

Coloration. As in female.

**Habitat.** Specimens were collected from litter layers and under stones in primary and secondary broad-leaf forests.

**Distribution.** Okinawa Islands (Sesoko, Okinawa and Kume Islands), Japan.

**Note.** Males and females are regarded conspecific because of the similarity in body color and morphology of cheliceral fangs and endites.

**Genus Micaria** Westring, 1851

**Remarks.** Currently, 123 named species of Micaria have been recorded from the Holarctic, Indomalayan, Australasian, and Afrotropical zoogeographic regions (World Spider Catalog 2022). Four species of Micaria are known in Japan: M. alpina L. Koch, 1872, M. dives (Lucas, 1846), M. japonica Hayashi, 1985 and M. pulticaria (Sundevall, 1831) (Tanikawa 2022).

**Micaria longimana** Suzuki, sp. nov. [New Japanese name: Tenaga-tsubagumo] (Figs 4–6)

**Type material.** Holotype: male, NSMT-Ar 22042, Moriguchi-koen Park, Oroku, Naha City, Okinawa, Japan (26.197408°N, 127.673565°E), 9 March 2021, Y. Suzuki leg. Paratypes: 1 male 2 females, NSMT-Ar 22043, same data as the holotype; 3 males 2 females, NSMT-Ar 22044, same locality as the holotype, 11 March 2020, Y. Suzuki leg.; 1 male 1 female, NSMT-Ar 22045, same locality as the holotype, 30 March 2020, R. Shida leg.; 1 female 1juv., NSMT-Ar 22046, Urasoe-daikouen Park, Iso, Urasoe City, Okinawa, Japan (26.246425°N, 127.731277°E), 8 March 2021, Y. Suzuki leg.

**Specimens used for comparison.** Micaria dives: 1 male 1 female, NSMT-Ar 22047, Kaname, Tsukuba City, Ibaraki, Japan, 27 July 2019, Y. Suzuki leg; 1 female, Tennodai, Tsu-
kuba City, Ibaraki, Japan, 17 August 2019, Y. Suzuki leg.; 2 males 2 females, Kurihara, Tsukuba City, Ibaraki, Japan, 25 April 2020, Y. Suzuki leg.; 1 female, Mitsugi, Musashimurayama City, Tokyo, 27 April 2014, T. Ichikawa leg.; 1 male, Mt. Tenran-zan, Hanno City, Saitama, Japan, 21 July 2014, T. Ichikawa leg.; 1 male, Kofuchu Town, Kofu City, Yamanashi, 4 April 2014, T. Ichikawa leg.; 1 female, Ikaruga Town Ikoma District, Nara, 17 July 2014, T. Ichikawa leg.; 1 female, Ōzukanishi, Asaminami-ku, Hiroshima City, Hiroshima, 30 May 2020, M. Honda leg.; 1 male, Kitatakami Town, Kochi City, Kochi, 15 July 2019, R. Serita leg.

Etymology. The specific name is an adjective (“long-handed” in Latin) refers to the elongated palps of males in the species.

Diagnosis. *Micaria longimana* sp. nov. closely resembles *M. dives* in general appearance and elongated male palps, but can be distinguished based on the following characters: spines on the prolateral side of cymbium and palpal tibia relatively thicker (vs. relatively thin in *M. dives*; Fig. 5B, C, cf. Fig. 5E); blunt, membranous median apophysis located on distal end of the bulb (vs. MA thin and apophysis with hook-like tip in *M. dives*; Figs 5A–C, 6A–C, cf. Fig. 5D–F); TA short, blunt and very weakly developed (vs. TA distinctly developed in *M. dives*; Fig. 6A, cf. Fig. 5D); bulb thinner and shorter in relation to the cymbium length (PBT/CL 0.218, PBL/CL 0.465 in *M. longimana* sp. nov. vs. PBT/CL 0.401, PBL/CL 0.670 in *M. dives*; Figs 5B, 6B vs. Fig. 5E); palpal tibia longer in relation to the cymbium length (PTL/CL 1.014 in *M. longimana* sp. nov. vs. PTL/CL 0.792 in *M. dives*; Fig. 5A, B vs. Fig. 5D, E); AEM absent (vs. present in...
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M. dives; cf. Fig. 5G, cf. Fig. 5H) and a pair of short transverse furrows at CO (vs. longitudinal furrows in M. dives; Fig. 5G, cf. Fig. 5H); CD positioned at anterior side of internal genitalia and inserted to anterior-mesial side of Sp (vs. CO and Sp are close to each other and CD inserted to posterior-mesial side of Sp in M. dives; Fig. 5G, I, J, cf. Fig. 5H; Fig. 6D, E).

Micaria pulcherrima Caporiacco, 1935, M. formicaria (Sundevall, 1831) and M. yeniseica Marusik and Koponen, 2002 also possess elongated male palpal tibia, but can easily be distinguished from M. longimana sp. nov. by having distinctive TA (Yin et al. 2012: fig. 636E–G; Tuneva 2007: figs 36–38; Marusik et al. 2002: figs 1, 2).

Micaria atropatene Zamani and Marusik, 2021 also has a similar palp but differs by lacking strong spines on prolateral side of cymbium and tibia, and bearing a distal tegular process (Zamani and Marusik 2021: fig. 8A, B).

Description. Male (holotype: NSMT-Ar 22042). Body 2.92 long. Carapace 1.47 long, 0.93 wide. Eye sizes: AME 0.04 ALE 0.05, PME 0.04, PLE 0.03. MOA anterior width 0.22, posterior width 0.30, length 0.14. Length of palp. 0.665 + 0.339 + 0.417 + 0.411 = 1.832. Cymbial length/width...
2.91. Palpal femur length/cymbial length 1.58. Length of legs: I, 1.08 + 0.40 + 0.85 + 0.79 + 0.67 = 3.79; II, 0.87 + 0.33 + 0.62 + 0.66 + 0.64 = 3.12; III, 0.74 + 0.29 + 0.55 + 0.64 + 0.46 = 2.68; IV, 1.12 + 0.41 + 0.94 + 1.00 + 0.73 = 4.20. Abdomen 1.44 long, 0.70 wide.

Anterior surface of chelicera with macrosetae. Ventral side of Tibia I and metatarsus I covered with long thin setae. Leg spination. Femur: I d1-1, p1; II d1. Tibia: II v1; III v1; IV v2. Metatarsus: II v1; III v2-2-2; IV: v2-2-2. Palp (Figs 5A–C, 6A–C): femur with an array of short spines on ventral and anterolateral sides; patella with a spine on prolateral side; tibia as long as cymbium (PTL/CL 1.014), with 2 long and strong spines on prolateral and dorso-prolateral sides; TA short, rounded, weakly developed; cymbium with 2 strong spines on the basal prolateral side; palpal bulb longer than wide; SD visible, emerging from distal part, running toward posterior side and strongly curved at posterior prolateral side, end at Em; Em short, slightly curved, with pointed tip; MA membranous with blunt, wide tip, positioned along with TO.

Coloration and markings. Carapace reddish brown with flat, glittering purple hairs on cephalic region and transverse white line on thoracic region. Mouthparts and sternum dark reddish brown. Coxae of legs pale yellow, femora dark brown, from patella to the tip of leg I pale yellowish brown. All legs lacking annulations. Abdomen dark brown with glittering purple hairs. Dorsum of abdomen with two pairs of white spots.

Female (paratype: NSMT-Ar 22043). Body 2.96 long. Carapace 1.15 long, 0.68 wide. Eye sizes: AME 0.04, ALE 0.05, PME 0.03, PLE 0.03. MOA anterior width 0.20, posterior width 0.28, length 0.12. Length of legs: I, 0.75 + 0.34 + 0.59 + 0.55 + 0.50 = 2.73; II, 0.87 + 0.33 + 0.62 + 0.66 + 0.64 = 3.12; III, 0.74 + 0.29 + 0.55 + 0.64 + 0.46 = 2.68; IV, 0.92 + 0.36 +
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0.77 + 0.82 + 0.54 = 3.41. Abdomen 1.46 long, 0.83 wide.

Carapace, mouthparts and legs as in males. Palp spination. Tibia: p1-1, tarsus: p1, d1-1, v1-1. Leg spination. Femur I: d1, p1. Tibia: I p1-1; II v1; III v1-2; IV v2. Metatarsus: I p1, r1; II v1; III v2-2; IV v2. Internal genitalia (Figs 5H, I, 6D, E). Palpal femur with an array of short spines on venter. Abdomen as in male. Epigyne (Fig. 5F): furrows absent on anterior epigynal margin, a pair of furrows carved laterally from copulatory openings to the center; Sp oval, apart each other; globular pockets present on lateral sides of CO (arrow in Fig. 6E); CD curved, apart each other, inserted to upper side of Sp; FD emerging from ventral side of Sp and running to dorsal side.

Coloration and markings as in males.

Habitat. The specimens were collected from open and disturbed environments such as grasslands in parks at urban area, suggesting that the species might be introduced from other regions.

Distribution. Okinawa Is., Japan.

Note. Males and females are regarded conspecific because no other species of Micaria was sympatrically collected.

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