Bull. Natl. Mus. Nat. Sci., Ser. A, 46(2), pp. 41–48, May 22, 2020

Description of the Male of *Coelotes insulanus* Shimojana, 2000, and Females of *Coelotes osamui* Nishikawa, 2009 and *Draconarius dialeptus* Okumura, 2013 (Araneae, Agelenidae) from Japan

Ken-ichi Okumura

Department of Zoology, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan
E-mail: okumura@kahaku.go.jp

(Received 9 March 2020; accepted 25 March 2020)

Abstract The male of *Coelotes insulanus* Shimojana, 2000 (Araneae, Agelenidae) is described for the first time based on the specimens collected from its type locality on Amami-oshima Island, Kagoshima Prefecture, Japan. The females of *Coelotes osamui* Nishikawa, 2009 and *Draconarius dialeptus* Okumura, 2013, both hitherto endemic to Yakushima Island, Kagoshima Prefecture, are redescribed based on specimens newly obtained from the same island. A result of the comparison of male and female genital organs of *Coelotes insulanus* (Amami-oshima Island), *C. osamui* (Yakushima Island), *C. gotoensis* (Goto Islands, Nagasaki Prefecture) and *C. koshikiensis* (Koshikishima Islands, Kagoshima Prefecture) shows that these four species are closely related to one another. The differences among these species can be recognized by the shape of genital organs of both sexes.

Key words: Araneae, Coelotinae, taxonomy, Amami-oshima, Yakushima, Japan.

Introduction

Ryukyu Islands and the other southwestern islands of Japan (Nansei Islands) have a rich diversity of the subfamily Coelotinae, and 29 species have been known to date (Shimojana, 2003; Okumura, 2016). Six species, *Coelotes akakinaensis* Shimojana, 2000, *C. amamiensis* Shimojana, 1989, *C. insulanus* Shimojana, 2000, *C. motobuensis* Shimojana, 2000, *C. nasensis* Shimojana, 2000 and *C. oshimaensis* Shimojana, 2000 have been known from Amami-oshima Island (Shimojana, 2003; Okumura *et al.*, 2009). Four species, *Coelotes osamui* Nishikawa, 2009, *C. exilis* Nishikawa, 2009, *C. iriei* Okumura, 2013 and *Draconarius dialeptus* Okumura, 2013 have been recorded from Yakushima Island to date (Okumura, 2016). Of these, *C. insulanus*, *C. osamui*, *C. exilis* and *D. dialeptus* were however described insufficiently viz., *C. insulanus* is described only by its female specimen, *C. osamui*, *C. exilis* and *D. dialeptus* have been described only by the male specimens (Shimojana, 2000; Nishikawa, 2009; Okumura *et al.*, 2009; Okumura, 2013). The author surveyed several times in Amami-oshima Island and Yakushima Island from 2008 to 2019, and collected male specimens of *C. insulanus* and females of *C. osamui* and *D. dialeptus*. In this paper, the male of *C. insulanus* is described for the first time, and females of *C. osamui* and *D. dialeptus* are described. Furthermore, this study revealed that *C. insulanus* and *C. osamui* are closely related to *C. gotoensis* Okumura, 2007 and *C. koshikiensis* Okumura, 2013 by the similarities of the genital organs in both sexes. Therefore, the genital organs of *C. insulanus* and *C. osamui* are compared to those of *C. gotoensis* and *C. koshikiensis*, and the differences

are shown with photographs.

Before going further, the author wishes to express his sincere thanks to Dr. Hirotsugu Ono for reading the manuscript and for practical advices. The part of this study is based on the results of the Spatiotemporal Analyses on Origins and Properties of the Biodiversity Hotspots in Japan from 2018 conducted by the National Museum of Nature and Science, Tsukuba.

Materials and Methods

All the specimens used in this study were collected by the author on Amami-oshima and Yakushima Islands from 2008 to 2019. Examination and illustration were performed using an Olympus SZX-7 stereomicroscope. Photographs were taken using an Olympus E-620 digital camera attached to the microscope. Epigyne was dissected and treated in 10% KOH solution to remove the muscle for examination and illustration of internal genitalia as necessary. Measurements of respective body parts were done using a micrometer mounted on an ocular lens. All measurements are given in millimeters. Leg measurements are given as total length (femur, patella and tibia, metatarsus, tarsus). The abbreviations used in this paper are as follows: ALE, anterior lateral eye; AME, anterior median eye; LTA, lateral tibial apophysis; MOA, median ocular area; PLE, posterior lateral eye; PME, posterior median eye. The specimens used in the description will be deposited in the arachnid collection of the Department of Zoology, National Museum of Nature and Science (NSMT), Japan.

Taxonomy

Family Agelenidae C. L. Koch, 1837
Subfamily Coelotinae F. O. P-Cambridge, 1893
***Coelotes insulanus* Shimojana, 2000**
[Japanese name: Shima-yachigumo]
(Figs. 1–2)

Coelotes insulanus Shimojana, 2000, p. 198, figs. 25–29; Shimojana, 2003, p. 27, fig 2-22; Okumura *et al.*, 2009, p. 194, figs. 2-2-33-319–2-2-33-322.

Fig. 1. *Coelotes insulanus* Shimojana, 2000. Male, dorsal view. Scale bar: 10.0 mm.

Material examined. All the specimens were collected from Amami-oshima Island, Kagoshima Prefecture, Japan. 4 males, 14 December 2019, Seisui, Setouchi Town, Oshima County; 16 males, 16 December 2019, Agina, Setouchi Town, Oshima County; 1 male, 16 December 2019, Nishinakama, Sumiyo Town, Amami City.

Description (NSMT-Ar 17212). One specimen collected from Agina, Setouchi Town, Oshima County in 16 December 2019. Total length 10.2, carapace 5.1 long, 2.9 wide; abdomen 5.1 long, 3.1 wide; sternum 2.3 long, 1.9 wide. Eye sizes; AME 0.14, ALE 0.23, PME 0.18, PLE 0.18. Distances between eyes; AME-AME 0.09, AME-ALE 0.08, PME-PME 0.11, PME-PLE 0.20, AME-PME 0.15, ALE- PLE 0.05. MOA; anterior width 0.37, posterior width 0.47, length 0.47. Leg measurements: I: 15.4 (3.9, 5.0, 4.0, 2.5); II: 13.4 (3.4, 4.4, 3.5, 2.1); III: 12.4 (3.2, 3.8, 3.5, 1.9); IV: 16.4 (4.3, 5.1, 4.7, 2.3).

Chelicera: promargin of fang furrow with

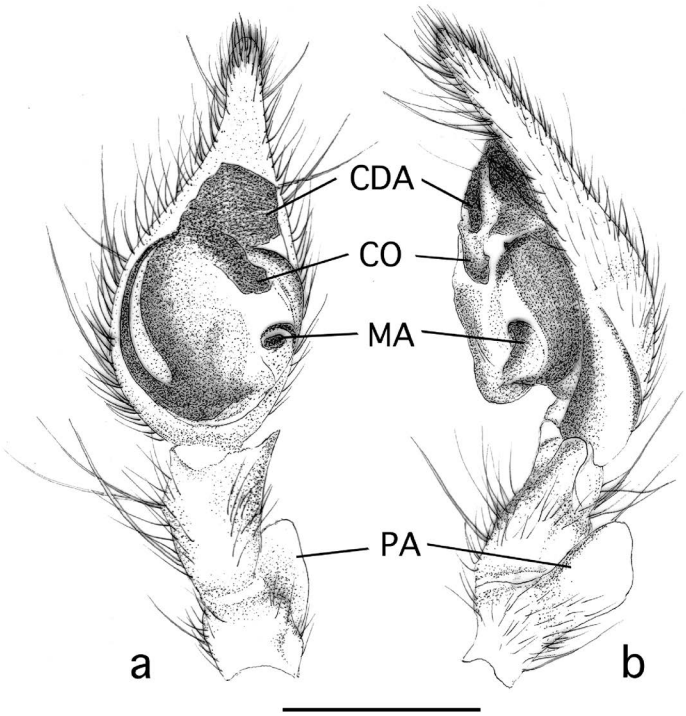

Fig. 2. *Coelotes insulanus* Shimojana, 2000. Male palp, ventral view (a); same retrolateral view (b). Abbreviations: CDA, conductor dorsal apophysis; CO, conductor; MA, median apophysis; PA, patellar apophysis. Scale bar: 1.0 mm.

three teeth, and retromargin with two.

Palp (Fig. 2): Patellar apophysis huge and broad in lateral view, LTA absent, cymbial furrow clear, and one-fourth of cymbial length, conductor short and the tip unpointed, conductor dorsal apophysis large and broad, median apophysis spoon-shaped, embolus flagelliform and short.

Coloration: carapace brown with gray radial flecks; dorsum of abdomen grayish brown with indistinct chevrons; sternum and labium brown; chelicerae and maxillae reddish brown; legs brown with ring flecks.

Coelotes osamui **Nishikawa, 2009**

[Japanese name: Yakushima-yachigumo]

(Figs. 3–4)

Coelotes sp. Shimojana, 2003, p. 30, fig. 2-27.

Coelotes osamui Nishikawa, 2009, p. 66, figs. 94–95; Okumura *et al.*, 2009, p. 194, figs. 2-2-33-332–2-2-33-333; Okumura, 2016, pp. 64–65, figs. 16a–b, 26c.

Material examined. All the specimens were collected from Yakushima Island, Kagoshima Prefecture, Japan. 13 females, 3 January 2008, 2 females, 1 October 2019, 2 females, 3 October 2019, Shiratani-unsuikyo, 700 m alt.; 9 females, 31 December 2013, Shiratani-unsuikyo, 650 m alt.; 5 females, 1 January 2014, Kurio; 3 females, 2 January 2014, Arakawa forest road, Anbou, 850 m alt.; 1 female, 30 September 2019, Onoma, 1200 m alt; 1 female, 30 September 2019, Mugio, 900 m alt.

Description (NSMT-Ar 17213). One specimen collected from Shiratani-unsuikyo, 700 m alt. in 3 January 2008. Total length 9.5, carapace 4.3 long, 2.7 wide; abdomen 5.2 long, 3.5 wide; sternum 2.0 long, 1.8 wide. Eye sizes; AME 0.10, ALE 0.19, PME 0.18, PLE 0.10. Distances between eyes; AME-AME 0.05, AME-ALE 0.05, PME-PME 0.09, PME-PLE 0.19, AME-PME 0.16, ALE- PLE 0.08. MOA; anterior width 0.25,

posterior width 0.45, length 0.44. Leg measurements: I: 10.2 (2.9, 3.5, 2.4, 1.4); II: 9.2 (2.6, 3.1, 2.1, 1.4); III: 8.7 (2.5, 2.8, 2.2, 1.2); IV: 12.0 (3.2, 3.9, 3.3, 1.6).

Chelicera: promargin of fang furrow with three teeth, and retromargin with two.

Epigyne and internal genitalia (Fig. 4): epigynal teeth W-shaped, acuminate, and both processes distant from each other; posterior portion and lateral sides of epigynal plate blackish because the genital organs are seen through the thin surface; spermathecae close to each other, anterior portion slightly elongate.

Coloration: carapace brown with indistinct flecks; dorsum of abdomen grayish brown with indistinct chevrons; sternum and labium brown; chelicerae and maxillae blackish brown; legs brown without ring flecks.

Remark. Distribution areas of the above-mentioned two species and the related species, *C. gotoensis* and *C. koshikiensis* are shown in Fig. 5.

Fig. 3. *Coelotes osamui* Nishikawa, 2009. Female, dorsal view. Scale bar: 10.0 mm.

***Draconarius dialeptus* Okumura, 2013**

[Japanese name: Yakuchibi-yachigumo]

(Figs. 6–7)

Coelotes sp. Shimojana, 2003, p. 64, fig. 2-28.
Draconarius dialeptus Okumura, 2013, p. 95, fig. 7; Okumura, 2016, pp. 69–70, figs. 17e–h, 27c

Material examined. All the specimens were collected from Yakushima Island, Kagoshima Prefecture, Japan. 1 female, 2 January 2014, Arakawa forest road, Anbou, 850 m alt.; 3 females, 3 January 2014, Funayuki.

Description (NSMT-Ar 17214). One specimen collected from Funayuki in 3 January 2014. Total length 4.3, carapace 2.2 long, 1.5 wide; abdomen 2.1 long, 1.4 wide; sternum 1.2 long, 1.0 wide. Eye sizes; AME 0.04, ALE 0.13, PME 0.09, PLE 0.06. Distances between eyes; AME-AME 0.04, AME-ALE 0.02, PME-PME 0.08, PME-PLE 0.06, AME-PME 0.08, ALE- PLE 0.04. MOA; anterior width 0.12, posterior width

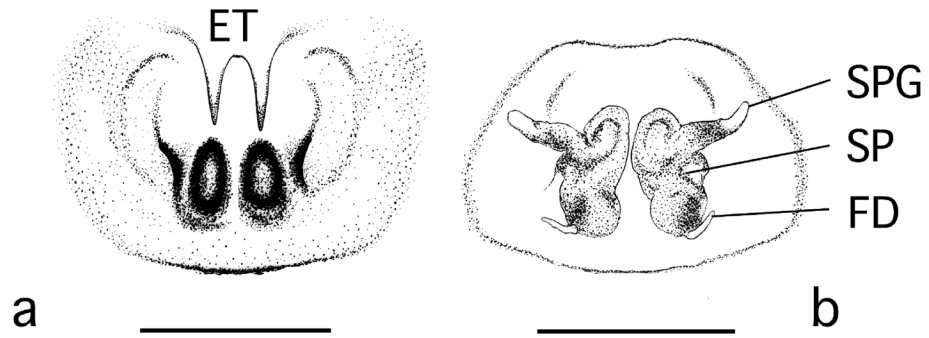

Fig. 4. *Coelotes osamui* Nishikawa, 2009. Epigyne (a); internal genitalia (b). Abbreviations: ET, epigynal teeth; FD, fertilization duct; SP, spermatheca; SPG, spermathecal gland. Scale bars: 0.5 mm.

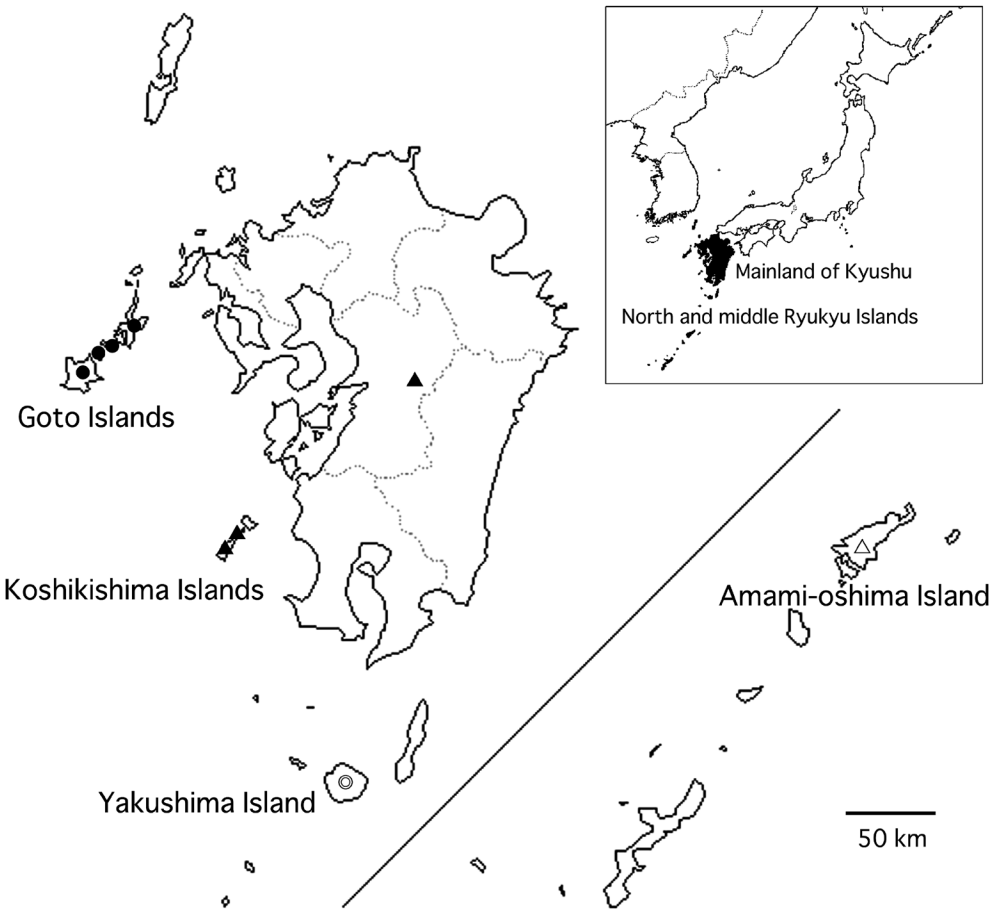

Fig. 5. Distribution of *Coelotes insulanus* and related species. Open triangle denotes *C. insulanus*; double circle, *C. osamui*; closed circles, *C. gotoensis*; closed triangles, *C. koshikiensis*.

0.26, length 0.21. Leg measurements: I: 6.2 (1.9, 2.2, 1.2, 0.9); II: 5.8 (1.6, 1.9, 1.4, 0.9); III: 5.5 (1.5, 1.8, 1.4, 0.8); IV: 7.6 (2.0, 2.4, 2.1, 1.1).

Chelicera: promargin of fang furrow with three teeth, and retromargin with two.

Epigyne and internal genitalia (Fig. 7): epigynal plate pear-shaped; epigynal teeth absent, single tiny protrusion present on center of posterior margin of epigyne; spermathecae and copulatory ducts conglutinate, hypertrophy, and complexly convoluted several times; spermathecal glands large, and situated in lateral portion of spermathecae distant from each other.

Coloration: Almost same as that of male holotype (Okumura, 2013).

Discussion

Judging from the genital organs, it is considered that *Coelotes insulanus* and *Coelotes osamui* are closely related to *Coelotes gotoensis* Okumura, 2007 and *Coelotes koshikiensis* Okumura, 2013. However, the male of *C. insulanus* can be distinguished from the other species by having large and broad conductor dorsal apophysis, and huge patellar apophysis (Fig. 8). The male of *C. osamui* can be distinguished from other species by having longish conductor and thin patellar apophysis. For male of *C. osamui*, refer to Nishikawa (2009). The female of *C. insulanus* can be distinguished from the other species by having the almost square epigyne, and

the needle-shaped epigynal teeth situated close to each other (Fig. 9a). Epigynal teeth of *C. osamui* is W-shaped, and two processes are distant from each other, however, those of *C. insulanus* and *C. gotoensis* are close to each other (Fig. 9a–c). The blackish markings derived from the internal genitalia situated posterior portion close to each other in *C. osamui*, but distant from each other in *C. gotoensis* and *C. koshikiensis* (Fig. 9b–d).

The epigyne of *Draconarius dialeptus* resembles that of *Draconarius venustu*s Ovtchinnikov, 1999, the type species of this genus, as well as *Draconarius pakistanicus* Ovtchinnikov and Inayatullah, 2005, *Draconarius naranensis* Ovtchinnikov and Inayatullah, 2005, and *Draconarius latellai* Marusik and Ballarin, 2011 in having enlarged spermathecae and copulatory ducts conglutinated from each other. However, *D. dialeptus* is distinguished from the above four species by the absence of epigynal teeth and the presence of a single, tiny protrusion. Furthermore, it became clear that female of *D. dialeptus* is extremely resembles that of *Draconarius verrucifer* Okumura, 2013 described only by the female specimen (refer to Okumura, 2013). A close resemblance found between female genital organs of *D. dialeptus* (Yakushima Island) and *D. verrucifer* (the mainland of Kyushu) requires further studies with males and the molecular analysis. There is a possibility that both species are conspecific.

Fig. 6. *Draconarius dialeptus* Okumura, 2013. Female, dorsal view. Scale bar: 5.0 mm.

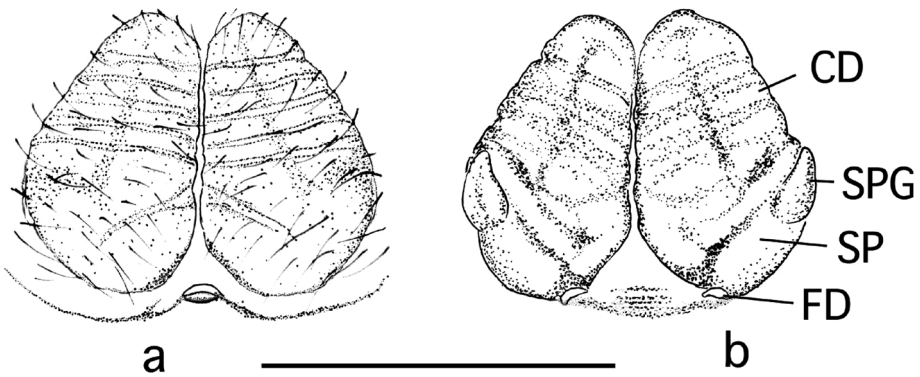

Fig. 7. *Draconarius dialeptus* Okumura, 2013. Epigyne (a); internal genitalia (b). Abbreviations: CD, copulatory duct; FD, fertilization duct; SP, spermatheca; SPG, spermathecal gland. Scale bar: 0.5 mm.

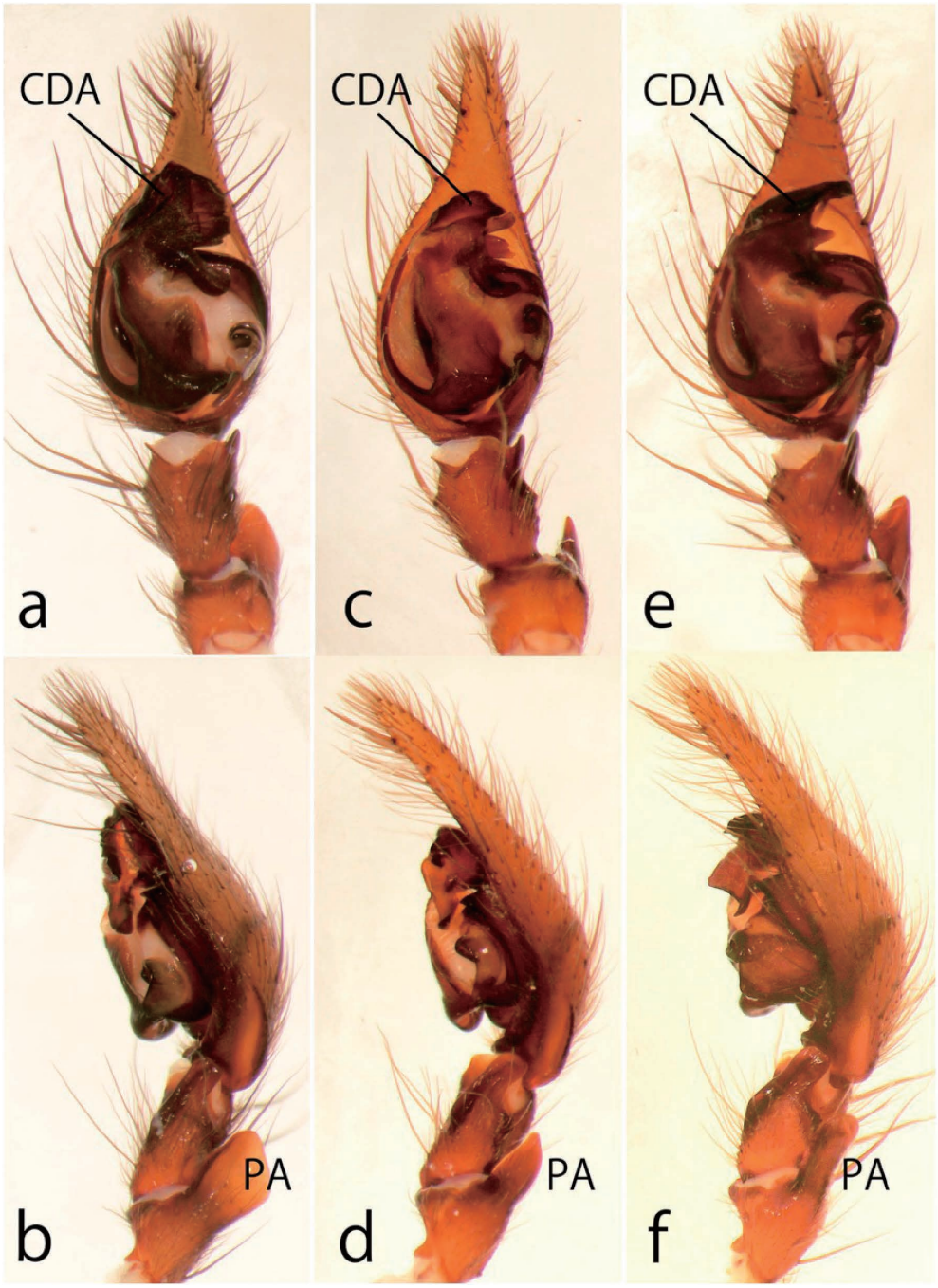

Fig. 8. Comparison of the male palp of *Coelotes insulanus* Shimojana, 2000 and the related species. *C. insulanus* Shimojana, 2000 (a, b); *C. gotoensis* Okumura, 2007 (c, d); *C. koshikiensis* Okumura, 2013 (e, f). a, c, e, Ventral views; b, d, f, retrolateral views. Abbreviations: CDA, conductor dorsal apophysis; PA, patellar apophysis.

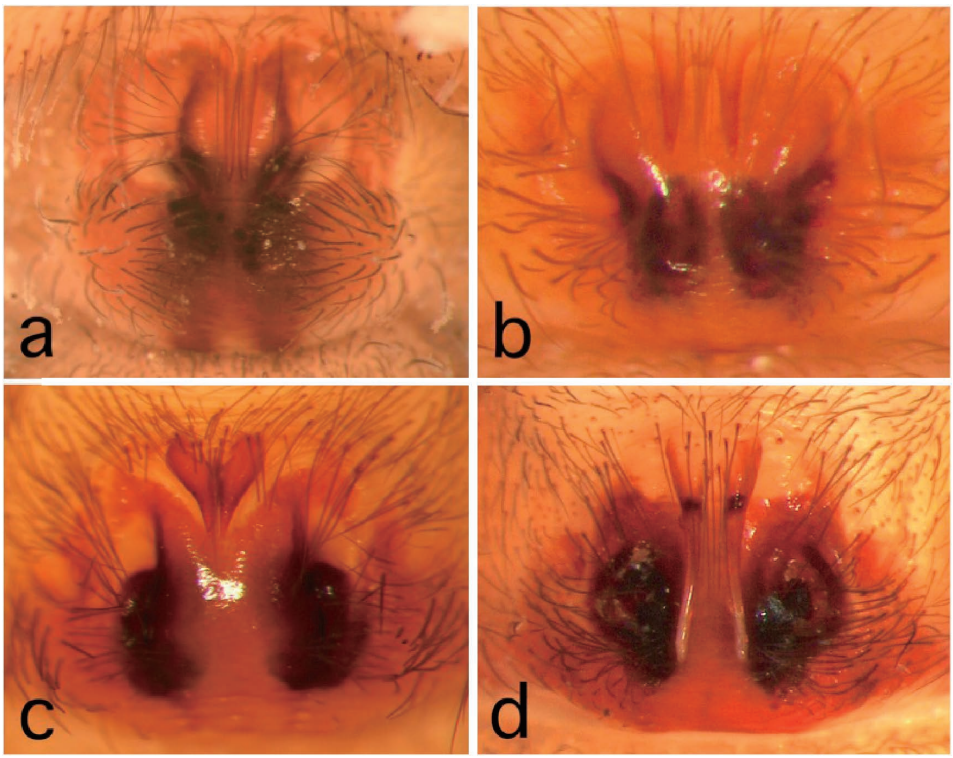

Fig. 9. Comparison of the epigyne of *Coelotes insulanus* Shimojana, 2000 and the related species. *C. insulanus* Shimojana, 2000 (a); *C. osamui* Nishikawa, 2009 (b); *C. gotoensis* Okumura, 2007 (c); *C. koshikiensis* Okumura, 2013 (d).

References

Koch, C. L. 1837. Übersicht des Arachnidensystems, Heft 1. 39 pp. C. H. Zeh'sche Buchhandlung, Nürunberg.

Marusik, Y. M. and F. Ballarin 2011. A new species of *Draconarius* Ovtchinnikov, 1999 (Araneae, Amaurobioidea, Coelotinae) from northern Pakistan. Zootaxa, 2739: 27–32.

Nishikawa, Y. 2009. A new genus and 44 new species of the family Coelotidae (Arachnida, Araneae) from Japan. In Ono, H. (ed.): The Spiders of Japan, pp. 51–70. Tokai Univ. Press, Kanagawa.

Okumura, K. 2007. Three new species of the subfamily Coelotinae (Araneae: Amaurobiidae) from Kyushu, Japan. Acta Arachnologica, 56: 85–90.

Okumura, K. 2013. Seven new species of spiders of the subfamily Coelotinae (Araneae: Agelenidae) from Kyushu, Japan. Species Diversity, 18: 87–97.

Okumura, K. 2016. Distribution and diversity of the spider subfamily Coelotinae (Araneae, Agelenidae) in Kyushu, Japan. Doctoral thesis, Kyushu University, 167 pp.

Okumura, K., Y. Nishikawa, M. Shimojana and H. Ono 2009. Coelotidae. In Ono, H. (ed.): The Spiders of Japan, pp. 174–205. Tokai Univ. Press, Kanagawa. (In Japanese)

Ovtchinnikov, S. V. 1999. On the supraspecific systematics of the subfamily Coelotinae (Araneae, Amaurobiidae) in the former USSR fauna. Tethys Entomological Research, 1: 63–80.

Ovtchinnikov, S, V. and M. Inayatullah 2005. Two new spider species of the genus *Draconarius* (Araneae, Amaurobiidae, Coelotinae) from Pakistan. Vestnik Zoologii, 39: 85–88.

Pickard-Cambridge, F. O. 1893. Handbook to the study of British spiders (Drassidae and Agelenidae). British Naturalist (Supplement), 3: 117–170.

Shimojana, M. 2000. Description of seven new species of the genus *Coelotes* (Arachnida: Araneae: Amaurobiidae) from the Amami and the Tokara Islands, Japan. Acta arachnologica, 49: 191–204.

Shimojana, M. 2003. Geographical distribution and speciation of the coelotine spiders (Araneae, Amaurobiidae) in the Ryukyu Islands. Doctoral thesis, Tohoku University, 300 pp. (In Japanese)