

## Notes on Japanese Spiders of the Genera *Paikiniana* and *Solenysa* (Araneae, Linyphiidae)

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**Abstract** Japanese spiders of the genera *Paikiniana* Eskov, 1992, and *Solenysa* Simon, 1894 (Araneae, Linyphiidae) are taxonomically studied. Specimens obtained from Toyota-shi, Aichi Prefecture, are identified with *Paikiniana lurida* (Seo, 1991) hitherto known only from Korea and China. This species is recorded from Japan for the first time. *Walckenaeria keikoeae* described by Saito (1988) is transferred to *Paikiniana* from the original genus. Nomenclatorial problems about *Solenysa mellottei* Simon, 1894 are discussed, and emended names, *S. mellottei* and *S. mellottei* proposed by Bösenberg and Strand (1906) and Bonnet (1958), respectively are regarded as junior synonyms of the original name. A new species of the genus *Solenysa* is described from Okazaki-shi, Aichi Prefecture under the name of *Solenysa ogatai* sp. nov.

**Key words:** Taxonomy, new species, Araneae, Linyphiidae, *Paikiniana*, *Solenysa*, Japan.

Containing about 600 genera and 4,400 species mainly in the Northern Hemisphere, Linyphiidae is one of the largest families in spiders. Of these, 282 species of 111 genera are at present known in Japan (Saito and Ono, 2001; Ono and Saito, 2001; Ono, Matsuda and Saito, 2009; Ono, 2010 a). However, there is no clear overall picture of the linyphiid fauna of Japan, because further field investigations and precise studies are required on many genera and species. In the present paper, notes on two genera, *Paikiniana* Eskov, 1992 and *Solenysa* Simon, 1894 are provided as primary materials for a complete revision, including descriptions of *Paikiniana lurida* (Seo, 1991) and a new species of *Solenysa* both from Aichi Prefecture, Honshu.

The abbreviations used are as follows: ALE, anterior lateral eye; AME, anterior median eye; PLE, posterior lateral eye; PME, posterior median eye; Tm, trichobothrium on metatarsus of legs.

The specimens used for this study including types of the new species are deposited in the

arachnid collection of the Department of Zoology, National Museum of Nature and Science, Tokyo (NSMT-Ar).

### Family Linyphiidae

#### Genus *Paikiniana* Eskov, 1992

[Japanese name: Tengu-nukagumo-zoku]

*Paikiniana* Eskov, 1992, p. 164. Type species: *Cornicularia bella* Paik, 1978. — Ono, Matsuda and Saito, 2009, p. 296.

*Notes.* Spiders of the genus are characterized by the structure of male palpal tibia with a large dorsal apophysis and a strange lamellate apophysis occasionally and presence of a developed scape-like projection on the dorsal plate of female genitalia as well as the peculiar shape of horn on the male eye field with many strong hairs on its tip. General characters are as follows: body lengths 1.7–2.3 mm, the order of tibial spines of legs 2-2-1-1, the ratio of Tm I between 0.35 and 0.46, and Tm IV present. The distributional range of the genus is restricted in temperate zone

of East Asia, and spiders of the genus occur only in Japan, Korea and China. Eight known species are listed below, including an addition of *Paikiniana keikoe* comb. nov. after transfer from original *Walckenaeria*. *Paikiniana lurida* (Seo, 1991) hitherto known in Korea and China (Hunan, Sichuan) was recently found in Japan. These two species are reported herein.

*Species included* (in alphabetical order): 1, *Paikiniana bella* (Paik, 1978), type species, from Korea; 2, *Paikiniana biceps* Song et Li, 2008, from China (Hebei, Beijing); 3, *Paikiniana iriei* (Ono, 2007), from Japan (Kyushu); 4, *Paikiniana keikoe* (H. Saito, 1988), comb. nov., from Japan (Honshu); 5, *Paikiniana lurida* (Seo, 1991), from Japan (Honshu), Korea and China (Hunan, Sichuan); 6, *Paikiniana mikurana* Ono, 2010, from Japan (Mikurajima Island, Tokyo); 7, *Paikiniana mira* (Oi, 1960), from Japan (Honshu, Kyushu) and Korea; 8, *Paikiniana vulgaris* (Oi, 1960), from Japan (Honshu, Kyushu) and Korea.

***Paikiniana keikoe*** (H. Saito, 1988), comb. nov.

[Japanese name: Futae-tsuno-nukagumo]

*Walckenaeria keikoe* Saito, 1988, p. 20, figs. 6–10. Holotype (male) from Nikko, Tochigi Prefecture, Honshu, Japan, 8-XI-1979, K. Nijima leg. (NSMT-Ar 5243), and a female collected from Sendai-shi, Miyagi Prefecture, 5-XII-1982, K. Sasaki leg. (NSMT-Ar 5244) of the paratype series, examined. — Ono, Matsuda and Saito, 2009, p. 286, figs. 373–377.

*Specimens examined.* Other than type material as given above: Two females and two males from Tsuchiura-shi, Ibaragi Prefecture, Honshu, Japan, 24-V-2006 (one female), 26-VI-2006 (one female) and 4-IV-2007 (two males), E. Mizuyama leg. (NSMT-Ar 9707–9709); one female from Setagaya-ku, Tokyo, 27-XII-1986, K. Kumada and T. Umabayashi leg. (NSMT-Ar 9023); one male from Mikurajima Island, Tokyo, 5-III-2010, H. Ono leg. (NSMT-Ar 8736); one male from Tama-ku, Kawasaki-shi, Kanagawa Prefecture, 15-XII-1992, M. Ban leg. (NSMT-Ar 10087); and others.

*Notes.* This species was originally described

by Saito (1988) under the genus *Walckenaeria* Blackwall, 1833, in a wide sense. He explained in that paper *Cornicilaria mira* and *C. vulgaris* should be transferred to “*Walckenaeria*,” both of which were afterwards transferred by Eskov (1992) to his new genus *Paikiniana*. Although *Walckenaeria* is still heterogeneous, characteristics of this species correspond exactly to those of *Paikiniana*. Spiders of the species were frequently found in lowland forests of Honshu.

***Paikiniana lurida*** (Seo, 1991),

new to the Japanese fauna

[Japanese name: Tairiku-tengu-nukagumo]

(Figs. 1–10)

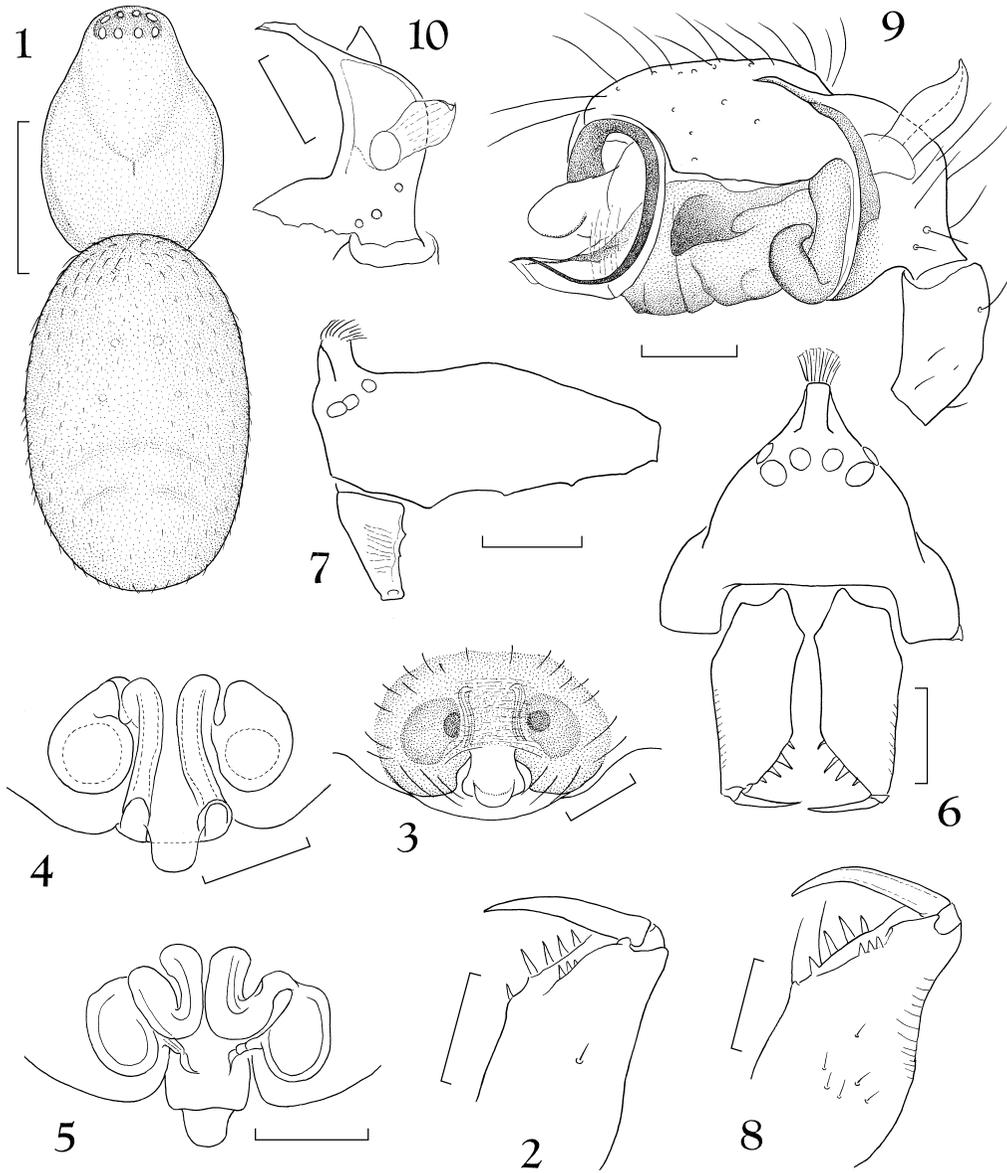
*Walckenaeria lurida* Seo, 1991, p. 37, figs. 7–13. Holotype (male) from Gachang-myeon, Dalseong-gun, Gyeongsangbuk-do, Korea, 3-V-1986, B. K. Seo leg., deposited in Keimyung University, Taegu, Korea, not examined. — Namkung, 2001, p. 211, 3 figs.; Kim, Yoo and Kim, 2002, p. 388; Namkung, 2003, p. 213, 3 figs.

*Paikiniana lurida*: Song and Li, 2008, p. 96, figs. 46–57.

*Notes.* This species was originally described by Seo (1991) from Korea under the genus *Walckenaeria* (Namkung, 2001, 2003), but was recently transferred to *Paikiniana* by Song and Li (2008) on the basis of specimens obtained in Hunan and Sichuan Provinces of China. Several specimens collected in Japan were identified with this East Asian species, and the present report indicates a new record of the species from Japan.

*Specimens examined.* One female and one male from Kazue-cho, Toyota-shi, altitude around 20 m above sea level, Aichi Prefecture, Honshu, Japan, 12-III-2011 (NSMT-Ar 9737–9738); one male from the same place as former specimens, 2-V-2011 (NSMT-Ar 9739); one female from Iwasaki-cho, around 100 m above sea level, Nisshin-shi, Aichi Prefecture, 10-XI-2010 (NSMT-Ar 9740); all specimens K. Ogata leg.

*Description.* Based on the Japanese specimens (NSMT-Ar 9737–9738). Measurements: Body length female 1.91 mm, male 1.88 mm; prosoma length female 0.79 mm, male 0.84 mm, width



Figs. 1–10. *Paikiniana lurida* (Seo, 1991): 1–5, female (NSMT-Ar 9737), 6–10, male (NSMT-Ar 9738), both from Toyota-shi, Aichi Prefecture. — 1, Pro- and opisthosomata (appendages omitted), dorsal view; 2, 8, chelicerae, ventral view; 3, epigynum, ventral view; 4–5, inner organ of female genitalia, ventral and dorsal views; 6–7, prosoma, frontal and lateral views; 9, palpal organ, retrolateral view; 10, tibial apophyses, dorsal view. [Scales for Figs. 1, 0.5 mm, for Figs. 2–5, 8–10, 0.1 mm, for Figs. 6–7, 0.25 mm.]

female 0.56 mm, male 0.59 mm; opisthosoma length female 1.13 mm, male 1.16 mm, width female 0.77 mm, male 0.75 mm; lengths of legs [total length (femur+patella+tibia+metatarsus+tarsus)]: female I 1.91 mm (0.55+0.20+0.43+

0.35+0.29), II 1.71 mm (0.52+0.19+0.40+0.32+0.28), III 1.44 mm (0.43+0.17+0.29+0.29+0.26), IV 1.99 mm (0.58+0.17+0.51+0.42+0.31), male I 1.97 mm (0.60+0.21+0.48+0.39+0.29), II 1.87 mm (0.55+0.21+0.47+0.35+0.29),

III 1.54 mm (0.44+0.17+0.35+0.34+0.24), IV 2.13 mm (0.58+0.19+0.60+0.47+0.29).

Prosoma: Carapace longer than wide (length/width female 1.41, male 1.42), its surface smooth, median furrow distinct, cephalic part sexually dimorphic: in male, a peculiar projection with long hairs present on the eye field, and eyes compactly set around the projection (Figs. 6–7); in female, flat without such projection. Eyes relatively large, PLE=ALE>PME>AME (7:7:6:4) in female, PLE>ALE>PME=AME (7:6:5:5) in male, the anterior eye row recurved and the posterior eye row procurved in both the sexes, AME–AME=AME–ALE, PME–PME=PME–PLE, median ocular area longer than wide (length/width female 1.25, male 1.14), wider behind than in front (anterior width/posterior width female 0.75, male 0.71), clypeus very wide. Chelicerae (Figs. 2, 8) with four or five teeth on the promargin of fang furrow, three teeth on retro-margin, labium fused with the anterior margin of sternum, wider than long (length/width 0.44 in female, 0.69 in male), maxillae twice as long as labium, its anterior margin slightly sclerotized, sternum slightly longer than wide (length/width around 1.09), female palp without claw. Legs relatively robust, tibial spines of legs 2-2-1-1 (those of the legs III and IV of male indistinct, distance between coxae IV less than their diameter, Tm I 0.36 in female, 0.35 in male, Tm IV present, leg formula: IV-I-II-III.

Male palp (Figs. 9–10): Ratio of the length of femur to that of patella 2:1, tibia as long as patella, dorsally with three trichobothria, without long spines, dorsal tibial apophysis large, very wide at the base and sharp at the peak, an additional apophysis present at its base, which is wide and depressed with pointed tip and a large basal hollow (Fig. 10). Cymbium wide, paracymbium strongly sclerotized, curved distally and with digitiform tip. Tegular apophysis long and spiniform, extending to the tip of embolus, conductor membranous, embolus acicular, winding, with a large snub-like projection at the base.

Opisthosoma: Longer than wide (length/width 1.47 in female, 1.55 in male), its dorsum smooth

with short hairs.

Female genitalia (Figs. 3–5): Genital field wider than long, a short scape with median pocket present on the dorsal plate. Intromittent canals short and thick, extending in anterior direction, spermathecae simple and large, oval.

Coloration and markings: Female (Fig. 1) and male: carapace light yellowish brown or orange, chelicerae, maxillae and labium light yellowish brown, sternum yellowish brown, palps and legs light yellowish brown, without annulations. Opisthosoma gray, lighter in female and darker in male.

*Distribution.* Japan (Honshu), Korea, China.

#### Genus *Solenysa* Simon, 1894

[Japanese name: Arimanegumo-zoku]

*Solenysa* Simon, 1894, p. 675. Type species: *Solenysa mellottei* Simon, 1894. — Ono, Kamura and Nishikawa, 1999, p. 544; Tu and Li, 2006, p. 88; Ono, Matsuda and Saito, 2009, p. 330.

*Notes.* Spiders of the genus are readily distinguishable from other genera by peculiar shape of prosoma with scattered round pits on surface, waving lateral margin and tubular posterior end connecting to the pedicel. In the palpal organ, cymbium has a large proximal apophysis, paracymbium is developed and with a distal hook, lamella characteristica is divided into two braches with secondary spiniform apophyses. Female genitalia are complicated and with epigynum lying on a membranous stem called solenoid base (Tu and Li, 2006). General characters are as follows: body lengths 1.1–1.8 mm, the order of tibial spines of legs 1-1-1-1, the ratio of Tm I between 0.17 and 0.26, and Tm IV absent. The distributional range is restricted in East Asia (Japan, Korea and China). Nine species were known, but further new species may be undiscovered.

*Species included* (in alphabetical order): 1, *Solenysa circularis* Gao, Zhu et Sha, 1993, from China; 2, *Solenysa geumoensis* Seo, 1996, from Korea; 3, *Solenysa longqiensis* Li et Song, 1992, from China; 4, *Solenysa mellottei* Simon, 1894, type species of the genus, from Japan (type local-

ity: Yokohama, Kanagawa Prefecture); 5, *Solenysa ogatai* Ono, sp. nov., from Japan (type locality: Okazaki-shi, Aichi Prefecture), described in the present paper; 6, *Solenysa partibilis* Tu, Ono et Li, 2007, from Japan (type locality: Mt. Ibuki-yama, Shiga Prefecture); 7, *Solenysa protrudens* Gao, Zhu et Sha, 1993, from China; 8, *Solenysa reflexilis* Tu, Ono et Li, 2007, from Japan (type locality: Itsuki-mura, Kumamoto Prefecture); 9, *Solenysa wulingensis* Li et Song, 1992, from China.

***Solenysa mellottei* Simon, 1894, nom. reviv.**

[Japanese name: Arimanegumo]

*Solenysa Mellottei* Simon, 1894, p. 677. Holotype (male) from Yokohama, Kanagawa Prefecture, Honshu, Japan, deposited in the collection of the Muséum National d'Histoire Naturelle, Paris, not examined. [Probably based on an incorrect omission of the ending “e” at composing the specific epithet.] — *Solenysa mellottei*: Petrunkevitch, 1928, p. 124; Roewer, 1942, p. 569; Oi, 1960, p. 153 (misidentification of *Solenysa partibilis* Tu, Ono and Li, 2007); Platnick, N. I., 1989, p. 282; Yaginuma, Hirashima and Okuma, 1990, p. 131; Ono, Kamura and Nishikawa, 1999, p. 544; Ono, 2001, p. 5; Shinkai, 2006, p. 153; Ono, Matsuda and Saito, 2009, p. 330.

*Solenysa Mellottéei* Bösenberg et Strand, 1906, p. 170, nomen emendatum pro *Solenysa Mellottei* Simon, 1894. [Based on correct patronym of collector.] — *Solenysa mellottei*: Yaginuma, 1986, p. 78 (*sensu lato*): Irie and Saito, 1987, p. 23 (misidentification of *Solenysa reflexilis* Tu, Ono and Li, 2007); Chikuni, 1989, p. 56; Chikuni, 2008, p. 56. (New synonymy.)

*Solenysa mellottei* Bonnet, 1958, p. 4091, nomen emendatum pro *Solenysa Mellottei* Simon, 1894. [Based on performance in the title of the article made by Simon (1889).] — Platnick, 1993, p. 352; Platnick, 1997, p. 428; Tu and Li, 2006, p. 91. (New synonymy.)

**Notes.** There are interesting nomenclatorial problems around the name of this spider. The story started in the year 1881 of the end of 19th century. After the Meiji Restoration from long-term national isolation during the Edo (Tokugawa) Period (1603–1867), many western people visited Japan to simply collect or to study spiders (Ono, 1987, 2010 b). An interpreter was sent to Japan and assigned to the French Consulate at

Yokohama. As a unique case he stayed about two years (1881–1882) in the foreign settlement at Yokohama and collected spiders in the surrounding area, which were contributed to the National Museum of Natural History, Paris (Ono, 1987; Takahashi, 2000). His name was A. Mellottée and the name would act an important role in science. His career as a diplomat, however, has been almost unknown other than the registration in the Japan Gazette Directory with a correct spelling of his name.

The spider specimens collected by Mellottée from Yokohama were studied and published in six articles by Simon (1886 a, b, 1889, 1893, 1894, 1895). Of 15 new species described in the series, five species were dedicated to the collector, that is, *Heriaeus mellottei* Simon, 1886 (Thomisidae), *Cicurina mellotei* Simon, 1886 (at present Cybaeidae), *Maevia mellottei* Simon, 1889 (Salticidae), *Solenysa mellottei* Simon, 1894 (Linyphiidae) and *Araneus melloteei* Simon, 1895 (Araneidae), already with three different spellings. Simon confused the situation or made a trick? Because Simon (1889) used “Mellotée” in the title of an article, having made this matter even worse, some follower believed that it should be a correct spelling of the collector’s name, as Bonnet (1955–1958) standardized the names into “*melloteei*.”

A correct standardization was made through Bösenberg and Strand (1906). They emended every name dedicated to the French interpreter into “*mellottei*” from the original spelling, probably because they experienced the correct name through W. Dönitz, who had been staying in Japan in the same time with A. Mellottée. However, this spelling was not recognized in the catalogues, for instance, Roewer (1942, 1954) used the original and various spelling in his “*Katalog der Araneae*.” Strangely, Yaginuma (in Yaginuma, Hirashima and Okuma, 1990; non 1986), who gave unstinting praise to Bonnet, followed Roewer, while Platnick (1993, 1997; non 1989), who revised the Roewer’s catalogue, followed Bonnet.

Thus, there is the alternative of using the origi-

nal spelling “*mellotteri*” or the correct but emended spelling “*mellottei*” according to Bösenberg and Strand (1906). In the present paper, the specific epithet with original spelling is accepted and the two other names based on unjustified emendations are validated with the revisers as the authors but regarded to be synonymous with the original one.

*Solenysa ogatai* sp. nov.

[Japanese name: Aichi-arimanegumo]

(Figs. 1–10)

*Notes.* The male of this species resembles *Solenysa partibilis* Tu, Ono et Li, 2007, from Shiga Prefecture in the structure of palpal organ, but differs from the latter by the shape of lamella characteristica. The second branch of the new species is simple and with a long proximal (third?) branch. Although the female of the latter species has been unknown, the shape of epigynum and the construction of inner organs of this new species are quite unique and different from those of the other congeners in having a narrow septum and a median strong hair.

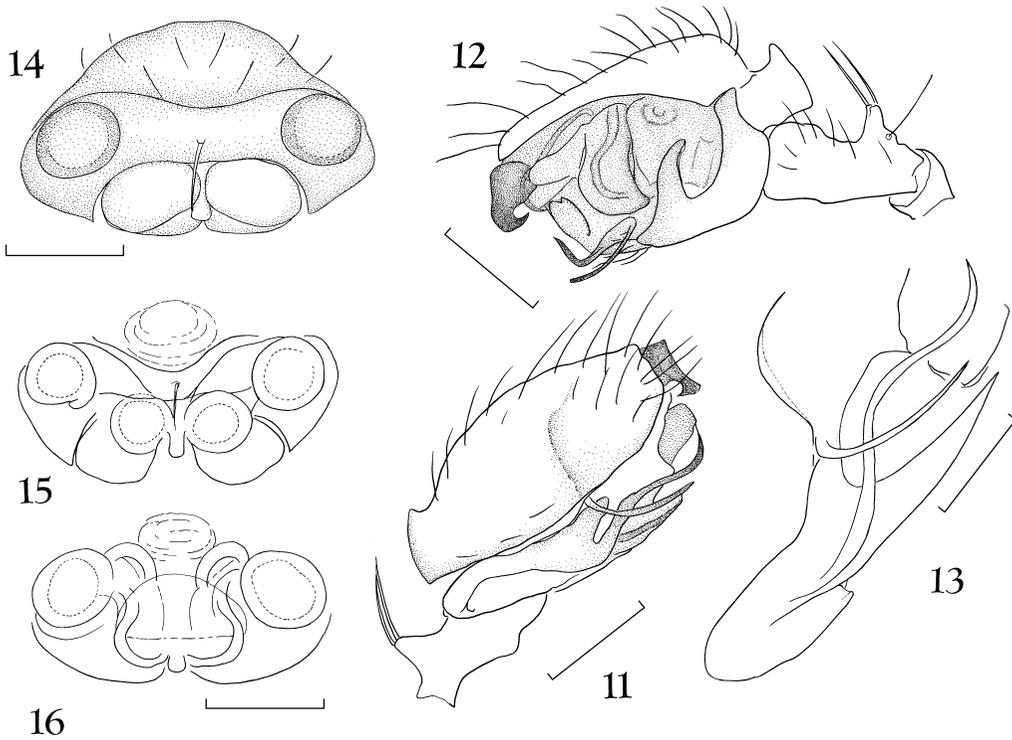
*Type series.* Holotype: male, from Mt. Murazumi-yama, altitude 200–250 m above sea level, Okuyamada-cho, Okazaki-shi, Aichi Prefecture, Honshu, Japan, 5-V-2011, K. Ogata leg. (NSMT-Ar 9741); paratypes: one female (allotype; NSMT-Ar 9742), two females and two males (NSMT-Ar 9743), same data as for the holotype; one female and one male from Yasudo-cho, altitude about 200 m above sea level, Okazaki-shi, 29-X-2010 (NSMT-Ar 9744); one female from Kitasasadaira-cho, altitude 30–40 m above sea level, Toyota-shi, Aichi Prefecture, 24-X-2010 (NSMT-Ar 9745); one male from Ubayagi-cho, Toyota-shi, 8-V-2011 (NSMT-Ar 9762); all specimens K. Ogata leg.

*Description* (holotype and allotype). Measurements: Body length female 1.40 mm, male 1.27 mm; prosoma length female 0.71 mm, male 0.70 mm, width female 0.44 mm, male 0.46 mm; opisthosoma length female 0.72 mm, male 0.75 mm, width female 0.53 mm, male 0.40 mm; lengths of

legs [total length (femur+patella+tibia+metatarsus+tarsus)]: female I 2.43 mm (0.65+0.16+0.61+0.53+0.48), II 2.10 mm (0.60+0.14+0.49+0.47+0.40), III 1.70 mm (0.45+0.13+0.37+0.39+0.36), IV 2.10 mm (0.55+0.16+0.52+0.48+0.39), male I 2.50 mm (0.68+0.16+0.65+0.55+0.46), II 2.18 mm (0.60+0.14+0.54+0.48+0.42), III 1.72 mm (0.47+0.13+0.39+0.39+0.34), IV 2.17 mm (0.62+0.14+0.53+0.49+0.39).

Prosoma: Carapace longer than wide (length/width female 1.61, male 1.52), its surface with large round dents, lateral margin depressed between each coxa of legs and united with sternum, median furrow indistinct, radial furrows present, cephalic part not dimorphic sexually: eye area projected, also in female, and eyes compactly set on the projection. Eyes relatively large, ALE>PLE=PME>AME (8:7:7:2 in female, 7:6:6:2 in male), the anterior eye row recurved and the posterior eye row procurved in both the sexes, both the lateral eyes close to each other, AME-AME<AME-ALE (3:4 in female, 1:3 in male), PME-PME>PME-PLE (4:3 in female, 3:2 in male), median ocular area nearly as long as wide (length/width female 1.06, male 0.89), wider behind than in front (anterior width/posterior width female 0.50, male 0.44), clypeus very wide. Chelicerae with four long teeth on the promargin of fang furrow, two or three small teeth on retromargin, labium fused with the anterior margin of sternum, wider than long (length/width 0.50 in female and male), maxillae twice as long as labium, convergent, sternum longer than wide (length/width around 1.30), tarsus of female palp slightly expanded and without claw. Legs relatively slender, tibial spines of legs 1-1-1-1 (indistinct in male), distance between coxae IV very wide, Tm I 0.20 in female, 0.27 in male, Tm IV absent, leg formula: I-II=IV-III in female, I-II-IV-III in male.

Male palp (Figs. 11–13): Tibia shorter than cymbium, much longer than patella, proximal process furnished with two spines. Proximal apophysis of cymbium wide, with an obtuse hook, paracymbium developed, with a large



Figs. 11–16. *Solenysa ogatai* Ono, sp. nov.: 11–13, holotype, male (NSMT-Ar 9741); 14–16, allotype, female (NSMT-Ar 9742). — 11–12, Palpal organ, pro- and retrolateral views; 13, basal part of embolic division, dorsal view; 14, epigynum, ventral view; 15–16, inner organ of female genitalia, dorsal and ventral views. [Scales for Figs. 11–12, 0.1 mm for Figs. 13–16, 0.05 mm.]

apophysis distally. Tegular triangle much wider than long and with a digitiform suprettegular apophysis, embolus strongly sclerotized, short and plate-like, with a curved and sharp tip, anterior branch of lamella characteristica with a sclerotized, spiniform and curved process extending ventrad, the second one large and simple with a long and sigmoid branch proximally, which is extending across the anterior branch into near embolus (Fig. 13).

Opisthosoma: Longer than wide (length/width 1.36 in female, 1.38 in male), its dorsum smooth with short hairs.

Female genitalia (Figs. 14–16): Epigynum wider than long, s strong hair present at the middle. Epigynal collar round, posterior median plate wide with a pair of lateral wings, spermathecae globular, a narrow septum present between both

the spermathecae, copulatory openings situated at each side of septum, intromittent canals enter spermathecae from inside.

Coloration and markings: Female and male: carapace dark yellowish brown, chelicerae, maxillae, labium and sternum yellowish brown, palps and legs light yellowish brown, without annulations. Opisthosoma light gray, without markings. [Coloration of living spider (one male paratype, NSMT-Ar 9762) is as shown in Fig. 17.]

*Variation.* Body lengths of paratypes: females 1.30–1.48 mm, males 1.20–1.32 mm. Opisthosoma in some individuals is whitish in color.

*Distribution.* Japan (Aichi Prefecture).

*Etymology.* This species is dedicated to Mr. Kiyoto Ogata, the collector of the specimens examined.



Fig. 17. *Solenysa ogatai* Ono, sp. nov., male, one of the paratypes from Toyota-shi (NSMT-Ar 9762), body length 1.22 mm. [Photograph: Kiyoto Ogata.]

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