

# A review of *Tsundayusurika* Sasa, 1985 (Diptera: Chironomidae, Orthocladiinae), with the description of a new species

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*Tsundayusurika* Sasa, 1985 is reviewed based on material from Taiwan and Japan. This orthocladiine genus is characterized by having a female antenna with 10 flagellomeres and large and rhombic cerci. The male antenna has 13 flagellomeres and the anal point is transparent, short and prominently wide. *Tsundayusurika fudosecunda* Sasa, the type species of the genus, and *T. multiannulata* (Tokunaga) are redescribed. A new species, *T. suginoi*, from Okinawa Island is described and figured as male and female. *Kuroyonyusurika* Sasa, 1996 is presented as a new junior synonym of *Tsundayusurika* and the type species *K. kuroheius* is transferred to this genus and redescribed. *Tsundayusurika cladochaita* Wang and *T. yufunivea* (Sasa et Suzuki) are removed from *Tsundayusurika* and tentatively placed in *Bryophaenocladus*.

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## INTRODUCTION

Tokunaga (1940) described a curious orthoclad species, *Spaniotoma* (*Orthocladus*) *multiannulata* from Arisan, Formosa (Taiwan), which was characterized by the female having an antenna with 10 flagellomeres and large, rhombic cercus. Although the body coloration and male antennal ratio were given, details of the male and female genitalia were not described. Sasa (1985) erected the genus *Tsundayusurika* for a new species, *T. fudosecunda*, from Japan, which has a female antenna with 10 flagellomeres in common with *S. multiannulata*, and he illustrated the male genitalia. Further, Sasa (1996) erected the genus *Kuroyonyusurika* for a new species, *K. kuroheius*, from Honshu, Japan. Sæther et al. (2000) transferred this species to *Bryophaenocladus* Thienemann, 1934 and Yamamoto (2004) accepted this placement. Recently by the courtesy of Mr. H. Sugino of Okinawa Prefecture we had the opportunity to examine specimens identified as *Tsundayusurika* collected in Yanbaru Forest, Okinawa Island

and it became clear that *Kuroyonyusurika* is a junior synonym of *Tsundayusurika*.

Identification and delineation of species based on male adults is quite difficult using hypopygial characters, but the females are easily distinguished from each other by the combination of characters in the genitalia, antenna and clypeus. Consequently, we concluded that the specimens collected on Okinawa Island belong to an undescribed species. This species is described and figured below. We also redescribe *Tsundayusurika fudosecunda* Sasa, 1985, *T. kuroheius* (Sasa, 1996) and *T. multiannulata* (Tokunaga, 1940).

## MATERIAL AND METHODS

As the most important taxonomic character appears on the dorsal side of the female genitalia, a few slide-mounted specimens of *T. fudosecunda*, the type species of *Tsundayusurika*,

were remounted. Specimens of the new species and the type specimens of *Spaniotoma multiannulata* had been preserved in alcohol. After being macerated in 5% KOH solution, these specimens were mounted temporarily in glycerol for drawing. The specimens used for description and illustration finally were mounted permanently on slides in Euparal. For the allotype of *Spaniotoma multiannulata*, the number of temporal setae, clypeal setae, dorsocentral setae, prealar setae and scutellar setae were counted before the specimens were macerated.

The terminology and measurements mainly follow Sæther (1980). Paramere and basal lobe are used as neutral term for phallapodeme and inferior volsella in the male hypopygial structure and egg-guide is used as a neutral term for the lobes of gonapophysis VIII of Sæther (1980) in the female genitalia. The measurements are given as ranges, generally followed by mean when 4 or more measurements were made, followed by the number of specimens measured (n) in parentheses.

The holotype of the new species is housed in the collection of the Osaka Prefecture University, Osaka, Japan.

## RESULTS AND DISCUSSION

### *Tsudayusurika* Sasa

*Tsudayusurika* Sasa, 1985: 62.

*Kuroyonysurika* Sasa, 1996: 23. **Syn. nov.**

Type species: *Tsudayusurika fudosecunda* Sasa, 1985, by original designation and monotypy.

Other included species: *Tsudayusurika kuroheius* (Sasa) **comb nov.**; *T. multiannulata* (Tokunaga); *T. suginoi* **sp. nov.**

The male diagnosis given by Sasa (1985) is emended and the female is diagnosed in detail.

#### Diagnosis (emended)

Head. With well-developed coronal suture in both sexes. Temporal setae uniserial. Clypeus with 2-9 setae in male, 1-10 in female. Stipes nearly triangular in shape. Cornua of cibarial pump distinct. Tentorium slender, long, with or without distinct rounded projection anteriorly. Male antenna with 13 flagellomeres and well developed plume, groove beginning at flagellomere 4; female antenna with 10 flagellomeres, ultimate flagellomere with or without subapical seta. Antennal ratio of male excluding *T. kuroheius* 1.30-2.44. Flagellomeres 1-9 in female antenna and flagellomeres 1-5 or 6 in male antenna each with a pair of simple long sensilla basiconica; ultimate flagellomere with several simple sensilla basiconica and a few sensilla coeloconica in both sexes.

Thorax. Anteprepronotum well developed, lobes meeting at distinct V-shaped notch anterior to anterior margin of scutum. Scutum smoothly rounded. Lateral anteprepronotals 1-4; dorsocentrals erect, several, uniserial; acrostichals weak, starting some distance from anteprepronotum; prealars several, uniserial; no supraalar. Scutellum with several uniserially setae.

Wing. Membrane bare, covered with microtrichia; anal lobe distinct, rounded. Squama with or without setae. R and R<sub>1</sub> with several to 10 or more setae; R<sub>4+5</sub> with few to 10 or more setae apically in male, with about 10-20 setae in apical 1/2-3/4 in female.

Legs. Tarsomere 1 and 2 of mid and hind legs with pseudospurs. Sensilla chaetica absent. Claws gradually curved, dentate apically in male, simple in female. Pulvilli absent.

Hypopygium. Anal point very short and prominently wide, hyaline. T IX with paired, low tubercles posteriorlaterally each with about 10 short setae. Paramere large, nearly triangular in shape. Basal lobe of gonocoxite well developed, strongly sclerotized, semicircular or triangular in shape, bare in apical half. Gonostylus gently curved, without crista dorsalis. Megaseta long and slender.

Female genitalia. Tergum IX completely divided into two parts by rather wide or narrow median longitudinal membranous area; each part rather small and completely fused with larger laterosternite (gonocoxite IX *sensu* Sæther, 1977, 1980). Segment X without setae. Sternum VIII long, with posteromedian lobe (gonapophysis VIII *sensu* Sæther, 1977, 1980) with distinct concavity on lateral margin and horizontal concavity anterior to median cleft. Egg-guide divided into large ventrolateral lobe and small dorsomedian lobe. Apodeme lobe small, indistinct. Gonocoxapodeme distinctly curved. Notum as long as or longer than length of sternum VIII. Postgenital plate triangular. Cercus large, long, rhombical and directed posteriorly. Spermathecal duct long, slightly curved. Seminal capsule large, about 1/2-2/3 as long as length of VIII sternum.

**Systematic remarks.** The genus *Tsudayusurika* keys to *Bryophaenocladus* Thienemann in the Holarctic key (Cranston et al. 1989), and in the Manual of Palaearctic Diptera (Sæther et al. 2000). Although *Tsudayusurika* is characterized by the presence of pseudospurs on tarsomeres, a wide, short, transparent anal point and large, sclerotized basal lobe of gonocoxite in the male, the characters are not sufficient to define *Tsudayusurika* as a separate genus distinct from *Bryophaenocladus*. For example, *Tsudayusurika* shares a wide and short anal point with *Bryophaenocladus dentatus*, and some species of *Bryophaenocladus* have comparatively large, sclerotized, bare basal lobes of the gonocoxites in the male. In contrast, although *Tsudayusurika* shares the egg-guide divided into large, rounded ventrolateral lobe and small, narrow dorsomesal lobe with *Bryophaenocladus*, the females of the genus are distinct based on the following combination of characters: 1) flagellum with 10 flagellomeres; 2) each flagellomere with simple long sensilla basiconica. As a note here, Cranston (1987) redescribed the parthenogenetic species *Bryophaenocladus furcatus* (Kieffer, 1916) with unusual forked long sensilla basiconica on each flagellomere. This character also is observable in the Japanese species of the *Bryophaenocladus* such as *B. oirasextus* (Sasa, 1991) and *B. tusimocedeus* (Sasa et Suzuki, 1999); 3) tergum IX completely divided into two parts by a median longitudinal membrane;

4) laterosternite (gonocoxite IX *sensu* Sæther, 1977, 1980) completely fused with tergum IX; 5) lateral margins of posteromedian lobes of sternum VIII (gonapophysis VIII *sensu* Sæther, 1977, 1980) distinctly concave, and posteromedian area of sternum VIII anterior to median cleft with a horizontal concavity; 6) cercus large, long and rhombical, projecting posteriorly. Characters 1, 3, 5 and probably 6 may be suggested as autapomorphous characters for *Tsodayusurika*. Character 5 may be related to mating behavior; when mating, the anal point and the basal lobes may be fitted in the horizontal and lateral concavities of the posteromedian lobes, respectively. However, to clarify the systematic position of *Tsodayusurika*, further studies of the immature stages are required.

### Keys to species of the genus *Tsodayusurika*

#### Adult males

*Tsodayusurika kuroheius* is not included due to insufficient knowledge of diagnostic characters.

- 1 Ultimate antennal flagellomere with or without subapical seta; clypeus with 2-4 setae ..... 2
- Ultimate antennal flagellomere with subapical seta; clypeus with 7-9 setae ..... *T. suginoi*
- 2 Ultimate antennal flagellomere without subapical seta ..... *T. fudosecunda*
- Ultimate antennal flagellomere with subapical seta ..... *T. multiannulata* might be placed here, judging from the female characters.

#### Adult females

The female of *T. kuroheius* is not known.

- 1 Median longitudinal membranous area on T IX very wide (Figure 2A, Figure 8A); ultimate antennal flagellomere with or without subapical seta ..... 2
- Median longitudinal membranous area on T IX narrow (Figure 3B, Figure 5A); ultimate antennal flagellomere with subapical seta (Figure 4C) ..... *T. multiannulata*
- 2 Ultimate antennal flagellomere with subapical seta; clypeus with 8-10 setae (Figure 7D) ..... *T. suginoi* sp. n.
- Ultimate antennal flagellomere without subapical seta; clypeus with 1-4 setae (Figure 1C) ..... *T. fudosecunda*

### *Tsodayusurika fudosecunda* Sasa

(Figures 1-2)

*Tsodayusurika fudosecunda* Sasa, 1985: 62.

*Tsodayusurika fudosecunda* Sasa; Sæther et al. (2000: 183); Yamamoto (2004: 109).

#### Material examined.

Holotype male (NMST Type No. 079:051), Japan, Kyushu, Miyazaki Prefecture, Mts. Kirishima, Lake Fudo, sweep net, 17.xi.1981, M. Sasa; 3 male & 4 female paratypes (NMST 79: 52-53, 63, 67-68) as holotype; 8 male paratypes (NMST 79: 54-59, 61-62), as previous except 18.xii.1981.

#### Diagnostic characters.

The female of this species shares the median wide longitudinal membranous area with *T. suginoi* sp. n. However the species can be separated from the latter by the ultimate antennal flagellomere lacking subapical seta, fewer setae on clypeus and the semicircular basal lobe of the gonocoxite.

#### Male (n = 12, unless otherwise stated)

Total length 3.4-4.0, 3.7 mm. Wing 2.3-2.4, 2.4 mm long, 0.5-0.6, 0.6 mm wide; wing length / wing width 3.77-4.20, 4.00.

Coloration. Head dark brown; mouth parts pale brown. Thorax including antepnotum and pleura predominantly dark brown, scutellum pale brown. Halter pale brown. Squama brown. Legs predominantly brown, all coxae dark brown. Abdomen including genitalia dark brown.

Head. Temporal setae 6-9. AR 1.30-1.60, 1.41. Ultimate flagellomere without subapical seta (Figure 1A). Palpomere lengths (in  $\mu\text{m}$ : n = 9): 22-34, 29; 54-66, 61; 124-164, 145; 108-136, 125; 150-180, 161; with 0, 2-5, 14-22, 9-11, 7-9 setae, respectively; third palpomere with 3-6 sensilla clavata. Cornua well developed. Clypeus with 2-4 setae.

Thorax. Lateral antepnotals 2-4; dorsocentrals 6-8, uniserial; acrostichals 5-9, biserial; prealars 4-6, uniserial; supraalar 0. Scutellum with 5-8 setae, uniserial.

Wing. Anal lobe rounded. Costal extension as long as RM, ca. 70  $\mu\text{m}$  long. VR 1.07-1.22, 1.14 (9). R with 13-19 setae, R<sub>1</sub> with 7-10, and apical 1/2-1/7 of R<sub>4+5</sub> with 0-7 setae. Brachiolium with 1-4, 3 median setae; with 8-11 basal, 3 median and 7-10 subapical sensilla companiformia. Squama with 0-1 seta.

Legs. Fore, mid and hind coxae with 2-3, 5-9, 5-7 marginal setae, respectively; fore, mid and hind trochanters with 5-9, 7-9, 5-9 marginal setae, respectively. Spur of fore tibia 60-70, 66  $\mu\text{m}$  long; mid tibia with anteroventral spur 26-32, 29  $\mu\text{m}$  and posteroventral spur 42-52, 48  $\mu\text{m}$  long; hind tibia with anteroventral spur 30-36, 33  $\mu\text{m}$  long and posteroventral spur 66-80, 74  $\mu\text{m}$  long. Tibial comb with 7-13 spine-like setae. Lengths and proportions of legs as in Table 1.

Hypopygium (Figure 1B). Tergum IX with 7-11 setae on each side, sternum IX with 11-16 setae dorsolaterally. Gonocoxite 236-276, 254  $\mu\text{m}$  long, with large, nearly semicircular basal lobe. Sternapodeme narrow, slightly convex medially, with weak, rounded anterolateral projections. Virga of 4-7 needle-like spines, 20-28, 23 (8)  $\mu\text{m}$  long. Gonostylus 112-124, 118  $\mu\text{m}$  long; megaseta 20-23, 21  $\mu\text{m}$  long. HR 2.03-2.37, 2.15.

#### Female (n = 4, unless otherwise stated)

Total length 3.3-3.9, 3.7 mm. Wing 1.5-1.6, 1.6 mm long; 0.4-

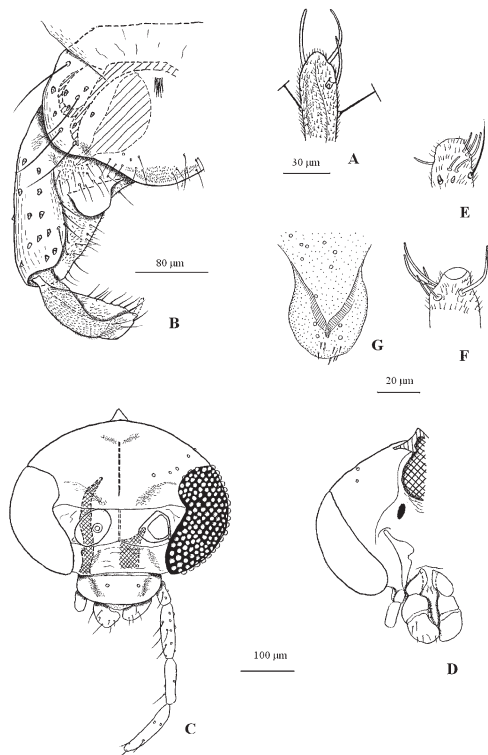


Figure 1. *Tsudayusurika fudosecunda* Sasa, 1985, male (A-B: holotype) and female (C-G: paratypes). A. apex of antenna. B. male hypopygium, dorsal view. C. head, frontal view. D. head, caudal view. E, F. apices of 3<sup>rd</sup> maxillary palp. G. posterior surface of epipharynx.

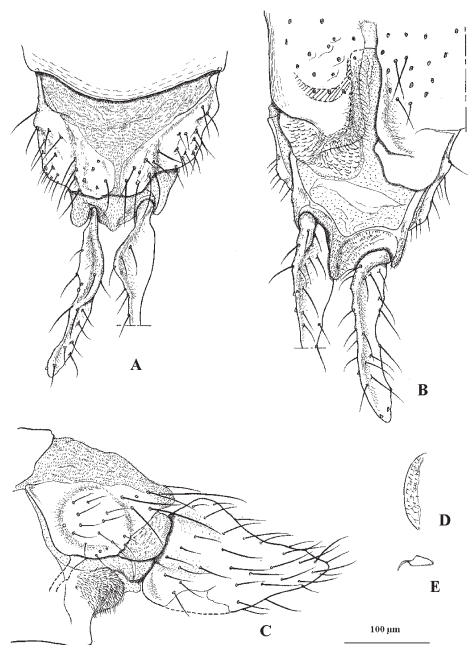


Figure 2. *Tsudayusurika fudosecunda* Sasa, 1985, female genitalia (paratype). A. dorsal view. B. ventral view. C. lateral view. D. dorsomesal lobe of egg-guide. E. apodeme lobe of egg-guide.

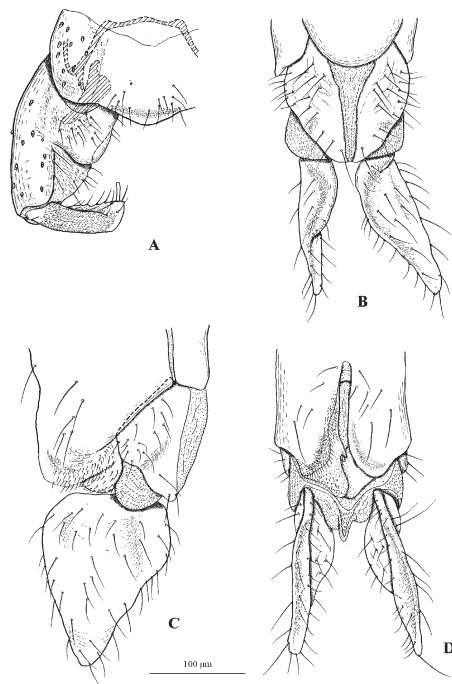


Figure 3. *Tsudayusurika* spp. A. *T. kuroheius* (Sasa, 1996), male hypopygium (holotype of *Kuroyonyusurika kuroheiuu*). B-D. *T. multiannulata* (Tokunaga, 1940), female genitalia (allotype of *Spaniotoma multiannulata*). A. dorsal view. B. dorsal view. C. lateral view. D. ventral view.

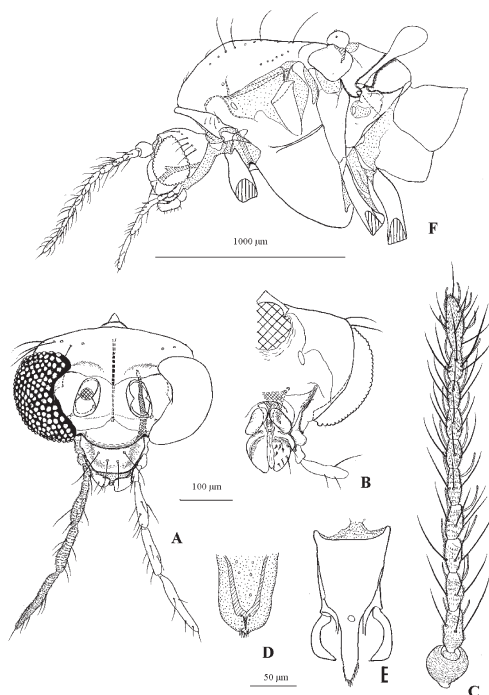


Figure 4. *Tsudayusurika multiannulata* (Tokunaga, 1940), female (Yakuno, Kyoto Pref., Honshu, Japan). A. head, frontal view. B. head, caudal view. C. antenna. D. posterior surface of epipharynx. E. cibarial pump. F. head and thorax, lateral view.

Table 1. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsudayusurika fudosecunda* Sasa, 1985, male (n=12).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>
p <sub>1</sub>	1040-1200, 1108	1180-1360, 1248	860-1020, 918 (11)	460-560, 507 (11)	280-340, 306 (11)
p <sub>2</sub>	1040-1180, 1103	1060-1240, 1135	620-800, 686	320-380, 358	220-260, 248
p <sub>3</sub>	1120-1240, 1195	1280-1500, 1380	760-900, 835 (11)	420-480, 460 (11)	300-340, 320 (10)
	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	180-200, 195 (11)	120-140, 129 (11)	0.69-0.77, 0.74 (11)	2.71-3.08, 2.88 (11)	2.41-2.65, 2.56 (1)
p <sub>2</sub>	140-160, 158	100-120, 118 (11)	0.58-0.68, 0.61	3.16-3.43, 3.31	3.00-3.39, 3.26
p <sub>3</sub>	160-200, 188 (10)	120-140, 129 (9)	0.58-0.62, 0.60 (11)	3.04-3.23, 3.13 (9)	2.98-3.24, 3.10 (11)

Table 2. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsudayusurika fudosecunda* Sasa, 1985, female (n=4).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>
p <sub>1</sub>	960-1020 (3)	1020-1200, 1125	700-840, 800	420-480, 460	280 (3)
p <sub>2</sub>	960-1000 (3)	920-1060, 1010	620-700, 650	340-420, 360	220-260, 230
p <sub>3</sub>	1040-1100 (3)	1140-1260, 1215	700-780 (3)	380-420 (3)	280-300 (3)
	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	180 (3)	120 (3)	0.69-0.74, 0.71	2.75-2.83 (2)	2.56-2.57 (3)
p <sub>2</sub>	140-180, 155	81 (3)	0.60-0.70, 0.64	3.14-3.20 (2)	3.09-3.29 (3)
p <sub>3</sub>	160-180 (2)	120 (2)	0.61-0.63 (3)	3.02 (1)	2.92-3.05 (2)

0.6, 0.4 mm wide; wing length / wing width 3.44-3.67, 3.53.

Coloration. As in male. Cercus brown.

Head. (Figures 1C-G). Temporal setae 5-6, uniserial. Flagellomere lengths (in  $\mu\text{m}$ , n = 2): 58-62; 50; 56; 50-54; 54; 42; 44-46; 40-42; 48; 80-98; with 2, 6, 6-7, 6, 6-7, 6, 6, 6, 5, 6-8 setae, respectively. Ultimate flagellomere without subapical seta. Palpomere lengths (in  $\mu\text{m}$ ): 22 (2); 34-52, 47; 98-110, 105; 78-81, 80; 90-120, 107; palpomeres with 0, 2-4, 12-15, 6-9, 6-7 setae, respectively; third palpomere with 4-8 sensilla clavata (Figures 1E, F). Clypeus with 1-4 setae. Cornua well developed.

Thorax. Lateral anteprenotals 3 (3); dorsocentrals 6-8, uniserial; prealars 4-5, uniserial; acrostichals 3-9, biserial, supraalar 0. Scutellum with 6 (3) setae, uniserial.

Wing. VR 1.07-1.17, 1.13. Costal extension as long as RM, ca. 90  $\mu\text{m}$  long. R with 16-18 setae, R<sub>1</sub> with 11-13 setae and apical 1/2 of R<sub>4+5</sub> with 11-15 setae. Brachiolum with 2-4 setae medially; with 8-12 basal, 3 median and 8 subapical sensilla campaniformia. Squama without setae.

Legs. Fore, mid and hind coxae with 2, 4-5, 4-6 marginal setae, respectively; fore, mid and hind trochanters with 7-8, 8-10, 5-7 marginal setae, respectively. Spur of fore tibia 48-54  $\mu\text{m}$  long (3); mid tibia with anteroventral spur 24-26  $\mu\text{m}$  long (2) and posteroventral spur 42-46, 45  $\mu\text{m}$  long; hind tibia with anteroventral spur 24-28  $\mu\text{m}$  long and posteroventral spur 62-72  $\mu\text{m}$  long (n=2). Tibial comb with 7-11 spine-like setae. Lengths and proportions of legs as in Table 2.

Genitalia (Figures 2A-E). Sternum VIII with 28-33 setae. Tergum IX completely divided into two parts by a wide median longitudinal membrane. Tergite IX with 6-8 setae, laterostenite of T IX with 16-19 setae. Notum 180-224, 202  $\mu\text{m}$  long.

#### Remarks.

The type locality, Lake Fudo, is a crater lake situated in volcanic area in mid Kyushu. If the larvae are aquatic, they live in the highly acidic water in the crater lake where also *Chironomus acerbiphilus* Tokunaga, 1939 has been recorded.

#### Distribution.

Japan (Kyushu).

### *Tsudayusurika kuroheius* (Sasa) comb nov.

(Figure 3A)

*Kuroyonyusurika kuroheius* Sasa, 1996: 23.

*Bryophaenocladus kuroheius* (Sasa); Sæther et al. (2000: 173); Yamamoto (2004: 10).

#### Material examined.

Holotype male (NMST, No. 284:24), Japan, Honshu, Toyama Pref., Mt. Tate, Kuroyon Lake, sweep net, 14. x. 1994, M. Sasa.

Table 3. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsodayusurika kuroheius*, male (n=1) (Holotype).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	-	-	-	-	-	-	-	-	-	-
p <sub>2</sub>	1024	1112	640	344	248	152	112	0.58	3.24	3.34
p <sub>3</sub>	1168	1344	-	-	-	-	-	-	-	-

### Diagnostic characters.

Due to missing antennae of the holotypes of *K. kuroheius* and *S. multiannulata* and the missing hypopygium of the holotype of *S. multiannulata*, no certain diagnosis to separate the species from other taxa in *Tsodayusurika* can be given.

### Male (n = 1).

Total length 3.7 mm. Wing 2.4 mm long, 0.6 wide; wing length / wing width 3.97.

Coloration. As in *T. fudosecunda*.

Head (Sasa 1996: Figure 7a). Temporal setae 7. Antenna lost. Palpomere 1-4 lengths (in  $\mu\text{m}$ ; palpomere 5 lost): 32, 72, 160, 130; with 0. 4-5, 18, 11 setae, respectively; third palpomere with 4 sensilla clavata. Clypeus with 3 setae. Cornua weakly developed.

Thorax (Sasa 1996: Figure 7b, c). Lateral anteprenotals 3; dorsocentrals 7, uniserial; acrostichals 6, biserial; prealars 6, uniserial; spuraalar 0. Scutellum with 6 setae, uniserial.

Wing (Sasa 1996: Figure 7d). Membrane with moderately strong punctuation. Anal lobe rounded. Costal extension as long as RM, 100  $\mu\text{m}$  long. VR 1.23. R with 10 seta, R<sub>1</sub> with 14, apical 1/2 of R<sub>4+5</sub> with 6 setae. Brachiolum with 4 median seta; with 9 basal, 3 median, and 8 subapical sensilla companiformia. Squama without setae.

Legs. Fore, middle and hind coxae with 2, 8, 6 marginal setae, respectively; fore, mid and hind trochanters with 8, 8, 6 marginal setae, respectively. Mid tibia with anteroventral spur 42  $\mu\text{m}$  long, and with posteroventral spur broken; hind tibial spur broken. Distal portion of hind tibia do not form a distinct terminal comb as mentioned by Sasa's original description. Lengths and proportions of legs as in Table 3.

Hypopygium (Figure 3A; Sasa 1996: Figure 7j). Tergum IX with 15 setae on each side, sternum IX with 11 setae dorsolaterally. Gonocoxite 256  $\mu\text{m}$  long, with large, semicircular basal lobe, without microtrichia on dorsal surface, with microtrichia on basal 1/2 of ventral surface. Sternapodeme narrow, with weak rounded anterolateral projection; anterior margin slightly convex medially. Virga composed of 6 needle-like spines, 28  $\mu\text{m}$  long (Sasa, 1996). Gonostylus 122  $\mu\text{m}$  long. HR 2.10.

### Remarks.

The presence or absence of a subapical seta on the ultimate flagellomere and a few setae (1-4 in number) on the clypeus are important taxonomic characters for identifying *Tsodayusurika* species. Unfortunately, we could not confirm the former character state because the antennae were lost in both holotypes

of *Kuroyonyusurika kuroheius* and *Spaniotoma multiannulata*. The male shares the latter character state with *T. fudosecunda* and *T. multiannulata*. The paramere of the species are smaller than those of *T. fudosecunda* and *T. suginoi*, but as the male genitalia of the holotype is lost, we cannot compare the paramere with that of *T. multiannulata*. The species might thus be a synonym of either *T. fudosecunda* or *T. multiannulata*. If so, it is most probably a synonym of *T. multiannulata* due to the small paramere.

### Distribution.

Japan (Honshu).

## *Tsodayusurika multiannulata* (Tokunaga)

(Figures 3-5.)

*Spaniotoma (Orthocladus) multiannulata* Tokunaga, 1940: 287.

*Tsodayusurika multiannulata* (Tokunaga); Sasa & Kikuchi (1995: 74, 185).

### Material examined.

Holotype male (Tokunaga Collection No. 2: 16, Kyushu University), Formosa, Arisan, 27.xii.1936, M. Tokunaga (head and genitalia lost). Allotype female, as holotype. 1 female, Japan, Honshu, Kyoto Prefecture, Yakuno, 13.viii.2003, light trap, M. Sasakawa.

### Diagnostic characters.

The species can be easily separated from both *T. fudosecunda* and *T. suginoi* sp. n. on the comparative narrow median longitudinal membranous area on T IX in the female. Furthermore, in the female, the species is also distinct from *T. suginoi* sp. n. by having 4 setae on the clypeus and from *T. fudosecunda* as the ultimate antennal flagellomere has a subapical seta. Diagnostic characters in the male are not certain due to the missing antennae of the holotype. However, based on female characteristics, the ultimate antennal flagellomere should bear a subapical seta and this would separate *T. multiannulata* from *T. fudosecunda*, the other species with 8-10 setae on clypeus.

### Holotype male.

Tokunaga (1940) give the total length as about 3.8 mm, the antennal ratio as about 2.44, and the coloration as follows: thorax black, shiny; leg entirely dark brown, abdomen of male

Table 4. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsudayusurika multiannulata*, male (n =1) (Holotype).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	1320	1580	1240	660	380	220	140	0.78	2.96	2.34
p <sub>2</sub>	1320	1440	840	460	300	190	140	0.58	3.30	3.29
p <sub>3</sub>	1400	1860	-	-	-	-	-	-	-	-

Table 5. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsudayusurika multiannulata*, female (n =1) (Allotype).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	1280	1540	1300	720	420	200	140	0.84	2.78	2.17
p <sub>2</sub>	1280	1340	860	440	280	160	120	0.64	3.48	3.05
p <sub>3</sub>	1380	1740	1080	540	380	200	140	0.62	3.33	2.89

Table 6. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsudayusurika multiannulata*, female (n =1) (Yakuno).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	940	1140	800	420	280	180	120	0.70	2.88	2.60
p <sub>2</sub>	1020	1020	560	300	200	140	100	0.55	3.51	3.62
p <sub>3</sub>	1100	1280	720	380	300	160	120	0.56	3.23	3.31

dark brown, each tergum with a narrow dark caudal band.

Thoracic and cephalic setation not observable.

Anal lobe of wing distinct, rounded. Squama with weak 1 seta.

Lengths and proportions of legs are given from the holotype

as in Table 4.

Tokunaga (1940: Figure 57) gives the illustration of the gonostylus. However it is difficult to separate this species from other congeneric species based on the shape of the gonostylus.

#### Allotype female.

Total length 2.7 mm.

Head. Temporal setae 5. Second to ultimate flagellomere lengths (in  $\mu\text{m}$ ): 50, 52, 44, 52, 50, 50, 48, 54, 102; 4<sup>th</sup> to ultimate flagellomere with 6, 6, 6, 6, 6, 6, at least 7 setae, respectively. Ultimate flagellomere with subapical seta. Maxillary palpus broken. Clypeus with 4 setae. Cornua short but distinct.

Thorax. Lateral anteprenotals 2; dorsocentrals 7, uniserial; prealars 5, uniserial; acrostichals not countable; supraalar 0.

Wing. Squama with 4 setae. Setae on veins not countable.

Legs. Fore, mid coxae with 2, 8 marginal setae, respectively; mid trochanter with 9 marginal setae. Spur of fore tibia 66  $\mu\text{m}$  long; mid tibia with posteroventral spur 54  $\mu\text{m}$  long. Tibial comb with 12 spine-like setae. Lengths and proportions of legs as in Table 5.

Genitalia (Figures 3B-D). Tergum IX completely divided into two parts by comparatively narrow median longitudinal membrane, and each tergite with 3 or 4 setae; laterosternite with 15 setae. Notum ca. 200  $\mu\text{m}$  long.

#### Additional female specimen (n = 1)

Total length 3.7 mm. Wing 2.6 mm long, 0.8 mm wide, wing length / wing width 3.12.

Head (Figures 4A-E). Temporal setae 7. Flagellomere lengths

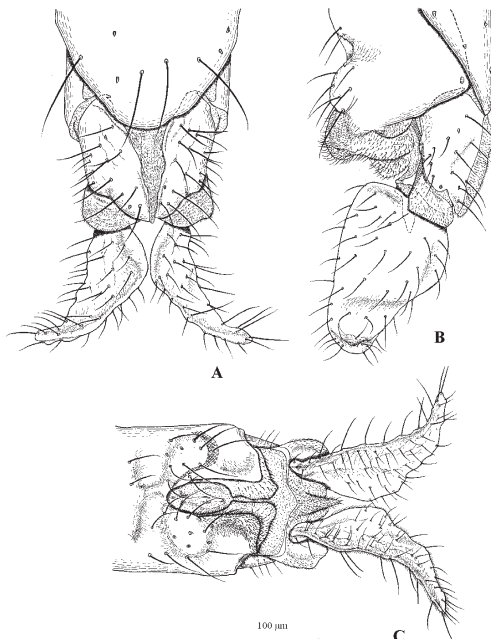


Figure 5. *Tsudayusurika multiannulata* (Tokunaga, 1940), female genitalia (Yakuno, Kyoto Pref., Honshu, Japan). A. dorsal view. B. lateral view. C. ventral view.

(in  $\mu\text{m}$ ): 78, 60, 56, 56, 52, 52, 52, 48, 56, 106; with 6, 6, 6, 6, 6, 6, 6, 6, 10 setae, respectively. Ultimate flagellomere with subapical seta. Palpomere lengths (in  $\mu\text{m}$ ): 30, 50, 100, 96, 138; palpomeres with 0, 1, 9, 8, 4 setae, respectively; third palpomere with 3 sensilla clavata. Clypeus with 4 setae. Cornua short but distinct.

Thorax (Figure 4F). Lateral anteronotals 3; dorsocentrals 1 1 or 12, prealars 6, both uniserial; acrostichals 3; supraalar 0. Scutellum with 8 setae, uniserial.

Wing. VR 1.10. Costal extension as long as RM, 108  $\mu\text{m}$  long. R with 17 setae,  $R_1$  with 14 setae and apical 3/4 of  $R_{4+5}$  with 26 setae. Brachiolum with 3 or 4 median setae; with 12 basal, 3 or 4 median, 10 subapical sensilla campaniformia. Squama with 8 or 10 setae.

Legs. Fore, mid and hind coxae with 2, 6, 7 marginal setae, respectively; fore, mid and hind trochanters each with 9 marginal setae. Spur of fore tibia 64  $\mu\text{m}$  long; mid tibia with anteroventral spur 18  $\mu\text{m}$  long and posteroventral spur 50  $\mu\text{m}$  long; hind tibia with anteroventral spur broken and posteroventral spur 70  $\mu\text{m}$  long. Tibial comb with 10 spine-like setae. Lengths and proportions of legs as in Table 6.

Genitalia (Figures 5A-C). Sternum VIII with 31 setae. Tergum IX completely divided into two parts by a narrow median longitudinal membrane, and each tergite with 4 setae; laterosternite with 10 or 12 setae. Notum ca. 260  $\mu\text{m}$  long. Postgenital plate slender and long.

#### Distribution.

Taiwan (Arisan), Japan (Honshu).

### *Tsudayusurika suginoi* sp. n.

(Figures 6-8)

#### Type material:

Holotype: male (OPU-IN-DI2001X0001), slide mounted in Euparal: Japan, Ryukyus, Okinawa Prefecture, Okinawa Island, Kunigami-son, Aha, malaise trap. 17-23.i.2009, K. Sugino. Paratypes: 9 males, 4 females, as previous except 7-17.i.2009; 3 females, as holotype; 3 females, as previous except 23.i.-4.ii.2009.

#### Diagnostic characters.

The species is distinct from the other species by the ultimate antennal flagellomere bearing a subapical seta, clypeus with several to 10 setae and the triangular basal lobe of gonocoxite in hypopygium.

#### Etymology.

Named in honour of Mr. K. Sugino of Okinawa Prefecture, the collector of the material examined.

#### Male (n = 10, unless otherwise stated)

Total length 3.1-3.5, 3.3 mm. Wing 2.1-2.2, 2.1 mm long, 0.5-

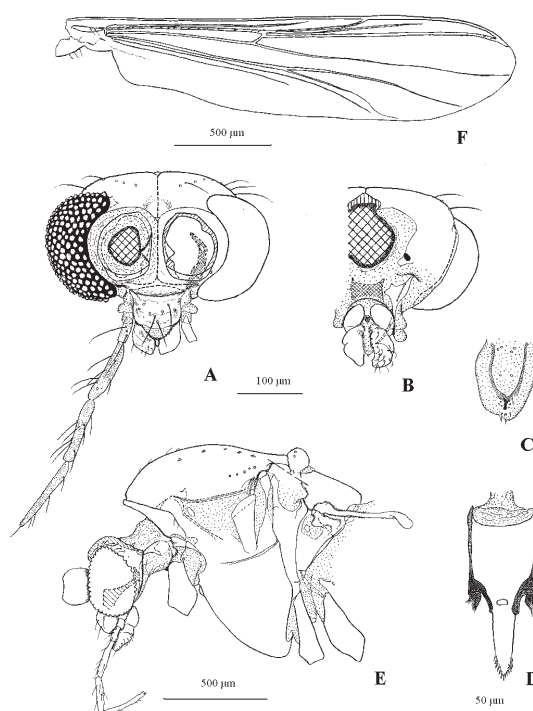


Figure 6. *Tsudayusurika suginoi* sp. nov., male. A. head, frontal view. B. head, caudal view. C. epipharynx, dorsal view. D. cibarial pump, dorsal view. E. head and thorax, lateral view. F. wing.

0.6, 0.5 mm wide; wing length / wing width 3.71-4.04, 3.87.

Coloration. As in *Tsudayusurika fudosecunda*.

Head (Figures 6A-D). Temporal setae 6-11. AR 1.65-1.90, 1.75. Ultimate flagellomere with subapical seta. Palpomere lengths (in  $\mu\text{m}$ ): 26-36, 30; 48-66, 56; 126-142, 133; 120-140, 131; 146-176, 165; with 0, 2-6, 11-15, 9-11, 6-9 setae, respectively. Cornua weakly developed. Clypeus with 7-9 setae.

Thorax (Figure 6E). Lateral anteprenotals 1-3; dorsocentrals 5-9, uniserial; acrostichals 2-7, biserial; prealars 4-6, uniserial; supraalar 0. Scutellum with 5-9 setae, uniserial.

Wing (Figure 6F). VR 1.08-1.16, 1.13. Costal extension as long as RM, ca. 80  $\mu\text{m}$  long. R with 12-14 setae,  $R_1$  with 4-8 setae and apical 1/6-1/3 of  $R_{4+5}$  with 2-7 setae. Brachiolum with 3-4 (mostly 3) median setae, with 10-11 basal, 3 median, 9-10 subapical sensilla campaniformia. Squama with 2-4 setae.

Legs. Fore, mid and hind coxae with 1-2 (mostly 2), 4-7, 4-8 marginal setae, respectively; fore, mid and hind trochanters with 8-11, 8-11, 7-12 marginal setae, respectively. Spur of fore tibia 46-64, 56  $\mu\text{m}$  long; mid tibia with anteroventral spur 18-26, 23  $\mu\text{m}$  long and posteroventral spur 38-42, 41  $\mu\text{m}$  long; hind tibia with anteroventral spur 24-32, 27  $\mu\text{m}$  long and posteroventral spur 46-62, 56  $\mu\text{m}$  long. Tibial comb of hind leg with 11-15 spine-like setae. Lengths and proportions of legs as in Table 7.

Hypopygium (Figures 7A-C). Tergum IX with 5-7 (6) setae on each side, S IX with 10-13 (6) setae dorsolaterally. Gonocoxite



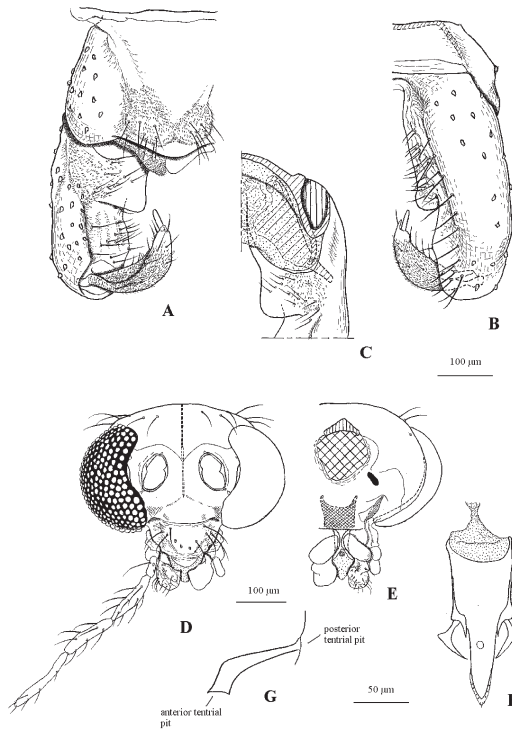


Figure 7. *Tsudayusurika suginoi* sp. nov., male hypopygium (A-C) and female head (D-G). A. dorsal view. B. ventral view. C. basal portion of gonocoxite, excluding T IX. D. head, frontal view. E. head, caudal view. F. cibarial pump, dorsal view. G. tentorium, lateral view.

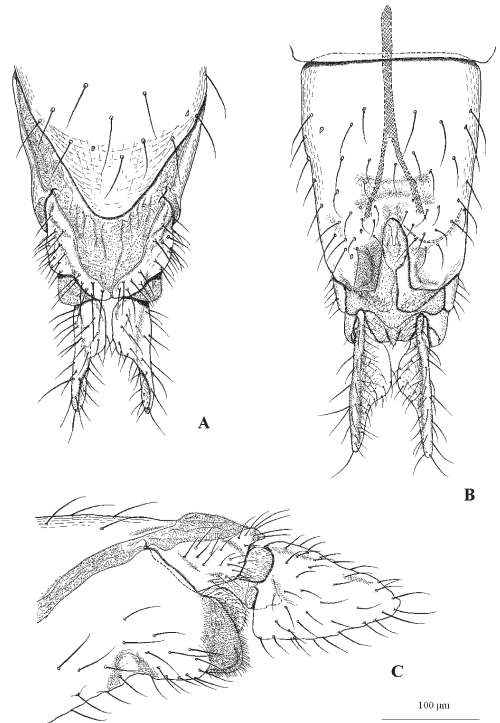


Figure 8. *Tsudayusurika suginoi* sp. nov., female genitalia. A. dorsal view. B. ventral view. C. lateral view.

Table 7. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsudayusurika suginoi* n. sp., male (n=9).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>
p <sub>1</sub>	940-1100, 1017	1020-1200, 1135	860-900, 880	440-480, 460	260-300, 287
p <sub>2</sub>	920-1040, 989	980-1180, 1031	600-660, 625 (8)	300-340, 313 (8)	200-240, 220 (8)
p <sub>3</sub>	1000-1160, 1080	1200-1280, 1231	720-780, 753	360-400, 380	260-280, 275
	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	140-180, 167	100-120, 117	0.72-0.88, 0.77	2.81-3.09, 2.94	2.20-2.56, 2.45
p <sub>2</sub>	120-140, 133 (8)	100-120, 105 (8)	0.53-0.64, 0.60	3.26-3.89, 3.44	3.09-3.58, 3.24
p <sub>3</sub>	140-160, 158	100-120, 113	0.59-0.63, 0.62	3.13-3.52, 3.31	2.97-3.21, 3.07

Table 8. Lengths (in  $\mu\text{m}$ ) and proportions of legs of *Tsudayusurika suginoi* n. sp. female (n=10).

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>
p <sub>1</sub>	5840-980, 912	980-1200, 1086	760-980, 874	420-560, 484 (9)	200-300, 267 (9)
p <sub>2</sub>	780-960, 902	840-1020, 978	500-660, 608	260-340, 312	160-240, 204
p <sub>3</sub>	820-1040, 988	1060-1240, 1180	660-760, 711 (7)	360-400, 366 (7)	240-280, 263 (7)
	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	120-160, 148 (9)	100-120, 104 (9)	0.78-0.83, 0.80	2.73-2.98, 2.87 (9)	2.19-2.40, 2.29
p <sub>2</sub>	120-140, 126	80-100, 96	0.60-0.65, 0.62	3.21-3.50, 3.37	2.91-3.24, 3.09
p <sub>3</sub>	120-160, 137 (7)	100-120, 103 (7)	0.58-0.62 (7)	3.22-3.42, 3.31 (7)	2.85-3.14, 3.04 (7)

200-220, 213  $\mu\text{m}$  long, with large, nearly triangular basal lobe. Sternapodeme narrow, convex medially, with moderately produced anterolateral projection. Virga of several needle-like spines, about 10  $\mu\text{m}$  long. Gonostylus 92-104, 99  $\mu\text{m}$  long; megaseta 16-22, 20  $\mu\text{m}$  long. HR 2.04-2.27, 2.16.

#### Female (n = 10, unless otherwise stated)

Total length 2.8-3.5, 3.1 mm. Wing 2.0-2.2, 2.1 mm long; 0.6-0.7, 0.6 mm wide; wing length / wing width 3.31-3.49, 3.29 (7). Coloration. As in male. Cercus pale brown.

Head (Figures 7D-G). Temporal setae 5-7. Flagellomere lengths (in  $\mu\text{m}$ ): 60-66, 63; 50-56, 51; 46-56, 52; 46-56, 49; 42-50, 48; 40-48, 44; 38-44, 43 (9); 40-42, 41 (8); 40-48, 44 (8); 66-86, 77 (8); with 3-4, 5-6, 5-6, 5-6, 6-7, 5-6, 5-6 (9), 5-6 (8), 5-6 (8), 6-7 (8) setae, respectively. Ultimate flagellomere with subapical seta. Palpomere lengths (in  $\mu\text{m}$ ; n=8): 20-34, 27; 40-50, 45; 100-116, 105; 94-118, 107; 138-164, 150; palpomeres with 0, 2-5, 8-16, 9-12, 5-9 setae, respectively. Clypeus with 8-10 setae.

Thorax. Lateral anteprenotals 1-3; dorsocentrals 6-9, uniserial; prealaras 4-6, uniserial; acrostichals 2-6, biserial; supraalar 0. Scutellum with 6-8 (9) setae, uniserial.

Wing. VR 1.00-1.17, 1.11. Costal extension as long as RM, ca. 80  $\mu\text{m}$  long. R with 12-17 setae (7), R<sub>1</sub> with 7-12 (7) setae and apical 1/3-1/2 of R<sub>4+5</sub> with 12-17 (7) setae. Brachiolum (8) with 2-3 median setae; with 10 basal, 3 median, 9-11 subapical sensilla campaniformia. Squama with 1-5 (7) setae.

Legs. Fore, mid and hind coxae with 1-3, 4-6 (9), 2-7 (9) marginal setae, respectively; fore, mid and hind trochanters with 6-10, 8-10 (9), 8-10 (9) marginal setae, respectively. Spur of fore tibia 30-48, 40  $\mu\text{m}$  long; mid tibia with anteroventral spur 12-28, 20  $\mu\text{m}$  long and posteroventral spur 32-42, 38  $\mu\text{m}$  long; hind tibia with anteroventral spur 16-24, 20  $\mu\text{m}$  long and posteroventral spur 46-54, 50  $\mu\text{m}$  long. Tibial comb with 8-12 spine-like setae. Lengths and proportions of legs as in Table 8. Genitalia (Figures 8A-C). Sternum VIII with 46-53 setae (6). Tergum IX completely divided into two parts by a wide median longitudinal membrane, and tergite with 6-9 setae; laterostenite with 13-18 setae. Notum 216-228, 222  $\mu\text{m}$  long.

#### Distribution.

Japan (Okinawa Island).

### “*Tsudayusurika cladochaita*” Wang

Wang 1995, Figure 1. (A-F).

*Tsudayusurika cladochaita* Wang, 1995: 49.

This species differs from all other known species of *Tsudayusurika* in having an extremely short maxillary palp, branched sensilla chaetae (long sensilla basiconica) on flagellomere, conspicuously extended costa, no anal point, no virga and no basal lobe of gonocoxite. This species certainly does not belong to *Tsudayusurika*, but quite possibly to

*Bryophaenocladus*, or perhaps to a hitherto unnamed genus. Further study of the species and particularly of the female is required for a certain assignment.

### “*Tsudayusurika yufunivea*” (Sasa et Suzuki)

Sasa and Suzuki 1991, Figure 5.3. (a-c).

*Epoicocladious yufuniveus* Sasa et Suzuki, 1991: 98.

*Tsudayusurika yufunivea* (Sasa et Suzli); Yamamoto (2004: 109).

Unfortunately the holotype of this species is missing. This species was transferred to the genus *Tsudayusurika* by Yamamoto (2004) based on the original description. The setose basal lobe with a few comparatively long setae on its posterior margin and the gonostylus with inner convex margin at about mid-length are different from any *Tsudayusurika*. This species certainly does not belong to *Tsudayusurika*, but possibly to *Bryophaenocladus*.

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