

Six New Records of Running Crab Spiders of the Genus *Tibellus* with Four New Species (Araneae: Philodromidae) from Korea

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ABSTRACT

The spider fauna of rice fields, marshes, and reclaimed lands was intensively explored in 2015–2022. During the seasonal survey, six *Tibellus* spiders were collected; two of them, *Tibellus fengi* Efimik, 1999 and *Tibellus japonicus* Efimik, 1999, were new to Korean spider fauna and four of them were identified as new species, *Tibellus deokjeok* sp. nov., *Tibellus gimcheon* sp. nov., *Tibellus sihwa* sp. nov., and *Tibellus yeongdong* sp. nov.. Four new species are similar to each other and known species in the shape of the genital organ and body appearance in both sexes, but can be distinguished from the other *Tibellus* members by the shape of embolus, conductor, retrolateral tibial apophysis, and ventral tibial apophysis in male and median septum, receptaculum, spermatheca, and copulatory duct in female. The present study taxonomically describes these six *Tibellus* spiders with diagnoses, measurements, and morphological photos with a key to the Korean *Tibellus* species.

Keywords: biodiversity, Philodromidae, taxonomy, *Tibellus*, Korea

INTRODUCTION

Tibellus Simon, 1875 in the family Philodromidae Thorell, 1869 currently includes 48 valid species worldwide. Among them, 9 species are distributed in Russia, 8 species in China, 3 species in Japan, and only two species, *Tibellus oblongus* (Walckenaer, 1802) and *Tibellus orientis* Efimik, 1999, are known to distributed in Korea to date (Yoo et al., 2015; World Spider Catalog, 2022). *Tibellus* spiders are primarily epigean hunting spiders commonly found on tall grasses, bushes, sedges, and ferns in fields, meadows, marshes, and rice fields (Levy, 1977; Dondale and Redner, 1978; Kim et al., 2016). The spider fauna of rice fields, marshes, and reclaimed lands was intensively explored in 2015–2022. During the seasonal survey, six *Tibellus* spiders were collected; two of them, *Tibellus fengi* Efimik, 1999 and *Tibellus japonicus* Efimik, 1999, were new to Korean spider fauna and four of them were identified as new species, *Tibellus deokjeok* sp. nov., *Tibellus*

gimcheon sp. nov., *Tibellus sihwa* sp. nov., and *Tibellus yeongdong* sp. nov.. The present study taxonomically describes these six *Tibellus* spiders with diagnoses, measurements, and morphological illustrations.

MATERIALS AND METHODS

All specimens were collected by sweep net and preserved in 98% ethyl alcohol and external morphology was examined under a Leica S8APO (Singapore) stereomicroscope. Images were captured with a Tucsen Dhyana 400DC digital camera (China) mounted on a Leica S8APO and assembled using Helicon Focus 8.2.0 image stacking software (Khmelik et al., 2006). Measurements of body parts were made with an ocular micrometer and are recorded in millimeters. Leg and palp measurements are shown as: total length (femur, patella, tibia, metatarsus, tarsus). The female epigynum was dissected and

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cleared in 10% KOH for 2 h to examine the internal genitalia before illustration. Morphological terminology mainly follows Efimik (1999). The examined specimens including type materials are deposited in the National Institute of Biological Resources in Incheon (NIBR), Nakdonggang National Institute of Biological Resources in Sangju (NNIBR), and Konkuk University in Seoul (KKU), Korea. The following abbreviations are used in the descriptions: ALE, anterior lateral eye; AME, anterior median eye; PLE, posterior lateral eye; PME, posterior median eye; ALE-AME, distance between ALE-AME; ALE-PLE, distance between ALE-PLE; AME-AME, distance between AMEs; AME-PME, distance between AME-PME; PLE-PME, distance between PLE-PME; PME-PME, distance between PMEs; AER, anterior eye row; PER, posterior eye row in eye region; d, dorsal surface; v, ventral surface in leg spination.

SYSTEMATIC ACCOUNTS

Order Araneae Clerck, 1757

Family Philodromidae Thorell, 1869

Genus *Tibellus* Simon, 1875

Description. See Schick (1965), Levy (1977), Dondale and Redner (1978), and Efimik (1999).

Type species. *Tibellus oblongus* (Walckenaer, 1802).

Key to the species of Korean *Tibellus*

Male

1. Cymbium with 3 or 5 dorsal spines 2
 - Cymbium with 4 dorsal spines 3
2. Cymbium with 3 dorsal spines, conductor finger-shaped, retrolateral tibial apophysis thumb-shape *T. oblongus*
 - Cymbium with 5 dorsal spines, conductor triangular, retrolateral tibial apophysis triangular *T. gimcheon* sp. nov.
3. Chelicera with one promarginal tooth
 - *T. yeongdong* sp. nov.
 - Chelicera with two promarginal teeth 4
4. Tegular apex divided into two parts, conductor indistinct
 - *T. fengi*
 - Tegular apex undivided into two parts, conductor distinct 5
5. Conductor small, apart from the embolus 6
 - Conductor large, attached or contiguous to embolus 7
6. Conductor tubercle-shaped, embolic body hidden by tegulum, retrolateral tibial apophysis tetragonal
 - *T. deokjeok* sp. nov.

- Conductor round, embolic body partly visible, retrolateral tibial apophysis triangular *T. orientis*
- 7. Conductor twisted, wrap around embolus, retrolateral tibial apophysis triangular *T. sihwa* sp. nov.
- Conductor rectangular, contiguous to embolus, retrolateral tibial apophysis tetragonal *T. japonicus*

Female (that of *T. yeongdong* sp. nov., *T. gimcheon* sp. nov. unknown)

1. Median septum wide posteriorly 2
 - Median septum narrow posteriorly 3
2. Receptaculum small and spherical, receptaculum duct short
 - *T. sihwa* sp. nov.
 - Receptaculum large and elliptical, receptaculum duct long *T. orientis*
3. Spermatheca contiguous to each other, receptaculum large
 - *T. deokjeok* sp. nov.
 - Spermatheca separated from each other, receptaculum small 4
4. Copulatory duct thick, receptaculum duct short *T. fengi*
 - Copulatory duct slender, receptaculum duct long 5
5. Spermatheca large, receptaculum elliptical *T. japonicus*
 - Spermatheca small, receptaculum spherical *T. oblongus*

¹**Tibellus deokjeok* sp. nov. (Fig. 1)

<http://zoobank.org:act:ECED89BE-4CED-4F63-9092-45E167500A01>

Type materials. Holotype: Korea: ♂ (NIBR #HVBNI000007504), Incheon-si, Ongjin-gun, Deokjeok-myeon, Buk-ri, Deokjeokdo Island, 37.261924N, 126.103576E, alt. 10 m, 25 Jul 2022, leg. C. M. Jang. **Paratypes:** 1♂ (NIBR #NUHGIV000000644), 2♀♀ (NIBR #NUHGIV000000645–646), same data as holotype, leg. C. M. Jang.

Diagnosis. *Tibellus deokjeok* sp. nov. is similar to *T. japonicus* Efimik, 1999 in the shape of the genital organ and body appearance in both sexes, but can be distinguished from the latter by the combination of following characters: Male - conductor small and tubercle-shaped, embolus apart from the conductor, ventral tibial apophysis indistinct (Fig. 1J, K) *versus* conductor large and rectangular, embolus and conductor contiguous, ventral tibial apophysis distinct in *T. japonicus* (Fig. 4F, G) (Ono and Ban, 2009: 478, f. 24, 25). Female - spermatheca small and contiguous to each other, copulatory duct thick, receptaculum large, receptaculum duct short, copulatory opening narrow (Fig. 1F–H) *versus* spermatheca large and apart from each other, copulatory duct slender, receptaculum small, receptaculum duct long, copulatory opening broad in *T. japonicus* (Efimik, 1999, Figs. 35, 46, 52, 65).

Korean name: ¹*덕적가재거미 (신칭)

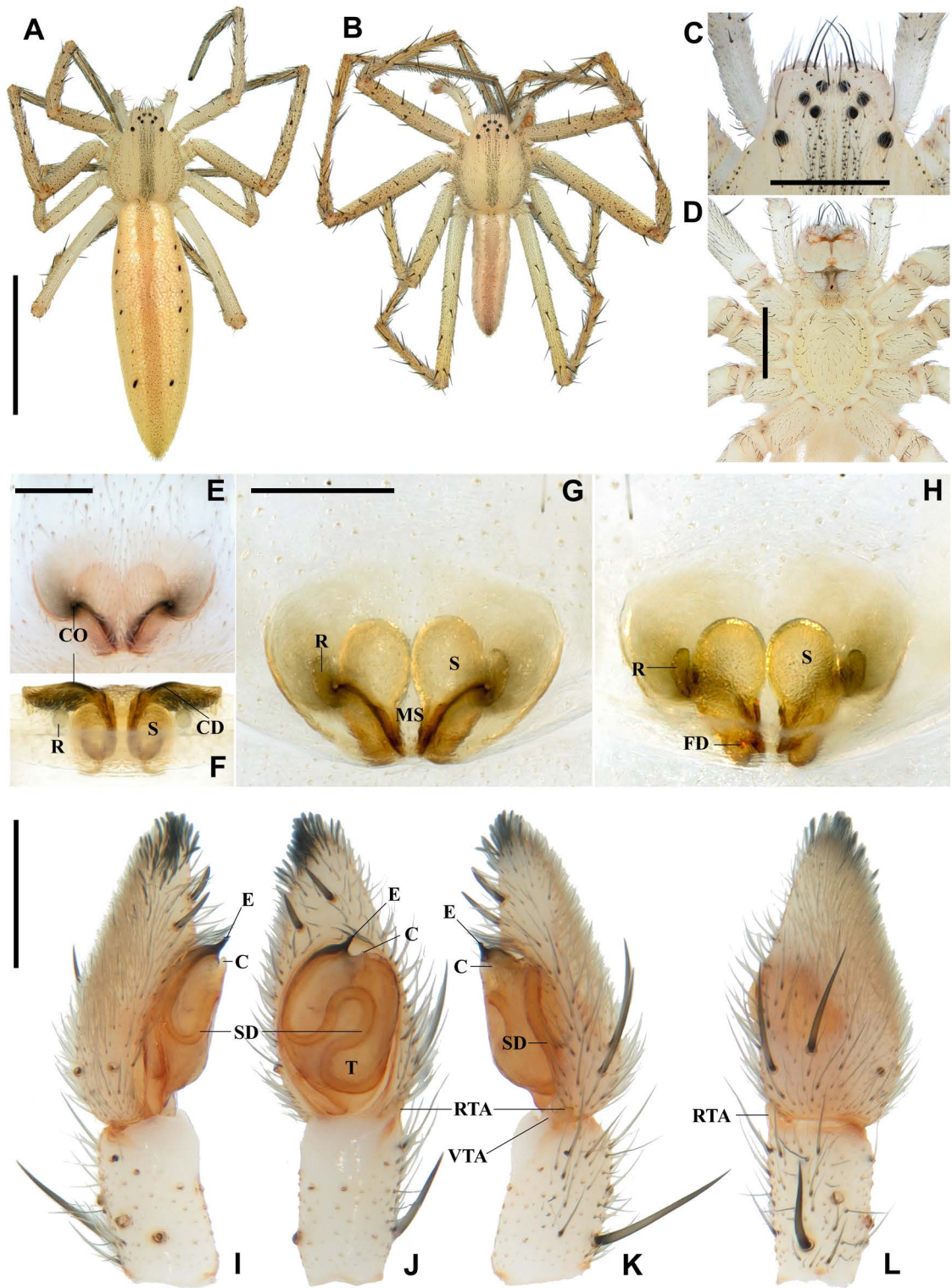


Fig. 1. *Tibellus deokjeok* sp. nov.: A, Paratype female (habitus); B, Holotype male (habitus); C, Female eye area; D, Female sternum; E, Female epigynum, ventral view; F, Female internal genitalia, caudal view; G, *Ditto*, ventral view; H, *Ditto*, dorsal view; I, Male palp, prolateral view; J, *Ditto*, ventral view; K, *Ditto*, retrolateral view; L, *Ditto*, dorsal view (C, conductor; CD, copulatory duct; CO, copulatory opening; E, embolus; FD, fertilization duct; MS, median septum; RTA, retrolateral tibial apophysis; R, receptaculum; S, spermatheca; SD, sperm duct; T, tegulum; VTA, ventral tibial apophysis). Scale bars: A, B=4 mm, C, D=1 mm, E-H=0.3 mm, I-L=0.5 mm.

Etymology. The specific name is a noun in apposition referred to the type locality, Deokjeokdo Island.

Description. Male (Holotype). Total length 7.00. Carapace: 2.93 long/2.27 wide. Eyes: AER 0.58, PER 0.99, ALE 0.09, AME 0.10, PLE 0.10, PME 0.09, ALE-PLE 0.36, ALE-AME 0.08, AME-AME 0.12, AME-PME 0.17, PLE-PME 0.33, PME-PME 0.24. Chelicera: 0.83 long/0.45 wide. Endite: 0.67 long/0.38 wide. Labium: 0.35 long/0.32 wide. Sternum: 1.54 long/1.16 wide. Legs: I 15.56 (4.32, 1.63, 3.98, 3.50, 2.13)/II 18.60 (5.12, 1.78, 4.70, 4.32, 2.68)/III 10.57 (3.15, 1.10, 2.55, 2.29, 1.48)/IV 16.86 (5.11, 1.46, 4.15, 4.04, 2.10), leg formula II-IV-I-III. Abdomen: 4.07 long/1.10 wide. Palp: 3.10 (1.02, 0.61, 0.47, -, 0.96).

Habitus as in Fig. 1B. Carapace pear-shaped, slightly flattened, pale greenish yellow, longer than wide, cervical and radial furrows indistinct, longitudinal fovea faint with needle-shaped, cephalic region pale reddish yellow, greenish yellow midband and a pair of marginal bands present (Fig. 1B). Chelicera strongly developed with two pointed promarginal teeth. Legs long and strongly developed, pale greenish and reddish yellowish, leg spination; I (femur 1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), III (femur 1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-2d, 2-2-0v) (Fig. 1B). Abdomen elongate with pointed posterior end, pale reddish ivory, dark colored median band present, clothed densely with short black and white hairs, narrower than carapace, markedly longer than wide (Fig. 1B). Palp (Fig. 1I-L): cymbium with four long dorsal spines, retrolateral tibial apophysis tetragonal with rounded corners, ventral tibial apophysis indistinct, embolus tip long with a distinct frontal ridge, embolic body hidden by tegulum, conductor small and tubercle-shaped, embolus apart from the conductor.

Female (Paratype). Total length 9.79. Carapace: 2.60 long/2.17 wide. Eyes: AER 0.61, PER 1.02, ALE 0.10, AME 0.09, PLE 0.09, PME 0.08, ALE-PLE 0.39, ALE-AME 0.09, AME-AME 0.16, AME-PME 0.20, PLE-PME 0.35, PME-PME 0.27. Chelicera: 1.02 long/0.53 wide. Endite: 0.50 long/0.44 wide. Labium: 0.28 long/0.35 wide. Sternum: 1.44 long/1.09 wide. Legs: I 12.51 (3.61, 1.51, 3.07, 2.57, 1.75)/II 14.63 (4.28, 1.64, 3.62, 3.14, 1.95)/III 8.62 (2.74, 1.03, 2.01, 1.70, 1.14)/IV 12.85 (4.12, 1.30, 3.17, 2.63, 1.63), leg formula II-IV-I-III. Abdomen: 7.19 long/2.28 wide. Palp: 3.13 (1.02, 0.59, 0.54, -, 0.98). Epigynum 0.63 wide.

General appearance similar to male, habitus as in Fig. 1A. Eight eyes in two rows, anterior eye row recurved and posterior eye row strongly recurved, posterior eye row much longer

than anterior eye row, subequal in size (Fig. 1C). Sternum heart-shaped, ivory, slightly convex, anterior end truncated, clothed sparsely with long and short black hairs, longer than wide, posterior end pointed and slightly protruding between the coxae of leg IV (Fig. 1D). Leg spination; I (femur 0-1-2-1-2-2d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), III (femur 0-1-1-1-1-2d, 0v/tibia 3-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 1-1-3d, 0v/tibia 3-2-3d, 2-2-2v/metatarsus 2-2-1d, 2-2-0v). Abdomen yellowish brown, four to six pairs of small black spots present laterally. Epigynum (Fig. 1E): posterior end of median septum narrow, copulatory opening near lateral margin of epigynum. Internal genitalia (Fig. 1F-H): copulatory duct thick, spermatheca relatively small, kidney-shaped, and contiguous to each other, receptaculum large and elliptical, receptaculum duct short.

Habitat. Bush layer in coastal wetlands.

Distribution. Korea (Deokjeokdo Island, Incheon).

¹**Tibellus fengi* Efimik, 1999 (Fig. 2)

Tibellus tenellus Feng, 1990: 196, f. 171.1-4 (♂ ♀ misidentified).

Tibellus fengi Efimik, 1999: 110, f. 37, 44, 54, 64; Ono & Ban, 2009: 478, f. 28-33; Serita, 2019: 153, f. 11.

Material examined. Korea: 3♀♀ (NNIBR #NNIBR2023 552IV3131, KKKU #Ara_Phil_Tibellus_fengi_20210723_01-2), Gyeonggi-do, Hwaseong-si, Seosin-myeon, Yongdu-ri, 37.148333N, 126.713333E, alt. 4 m, 23 Jul 2021, leg. S. T. Kim & S. Y. Lee.

Description. Female. Total length 10.50. Carapace: 3.75 long/2.70 wide. Eyes: AER 0.74, PER 1.29, ALE 0.10, AME 0.10, PLE 0.10, PME 0.09, ALE-PLE 0.48, ALE-AME 0.13, AME-AME 0.20, AME-PME 0.26, PLE-PME 0.44, PME-PME 0.36. Chelicera: 1.11 long/0.58 wide. Endite: 0.80 long/0.55 wide. Labium: 0.40 long/0.54 wide. Sternum: 1.95 long/1.35 wide. Legs: I 15.53 (4.50, 1.83, 3.85, 3.25, 2.10)/II 18.16 (5.32, 2.03, 4.48, 3.87, 2.46)/III 10.88 (3.53, 1.33, 2.49, 2.24, 1.29)/IV 16.12 (5.27, 1.67, 3.94, 3.36, 1.88), leg formula II-IV-I-III. Abdomen: 6.83 long/1.71 wide. Palp: 3.89 (1.30, 0.73, 0.67, -, 1.19). Epigynum 0.80 wide.

Habitus as in Fig. 2A, B. Carapace pear-shaped, slightly flattened, orange, longer than wide, cervical furrow and fovea indistinct, radial furrow faintly visible, blackish brown midband and a pair of marginal bands present (Fig. 2A). Eight eyes in two rows, anterior eye row recurved and posterior eye row strongly recurved, posterior eye row much longer than anterior eye row, subequal in size (Fig. 2C). Chelicera strongly developed with two pointed teeth. Sternum heart-shaped, ivo-

Korean name: ¹*중국가재거미 (신칭)

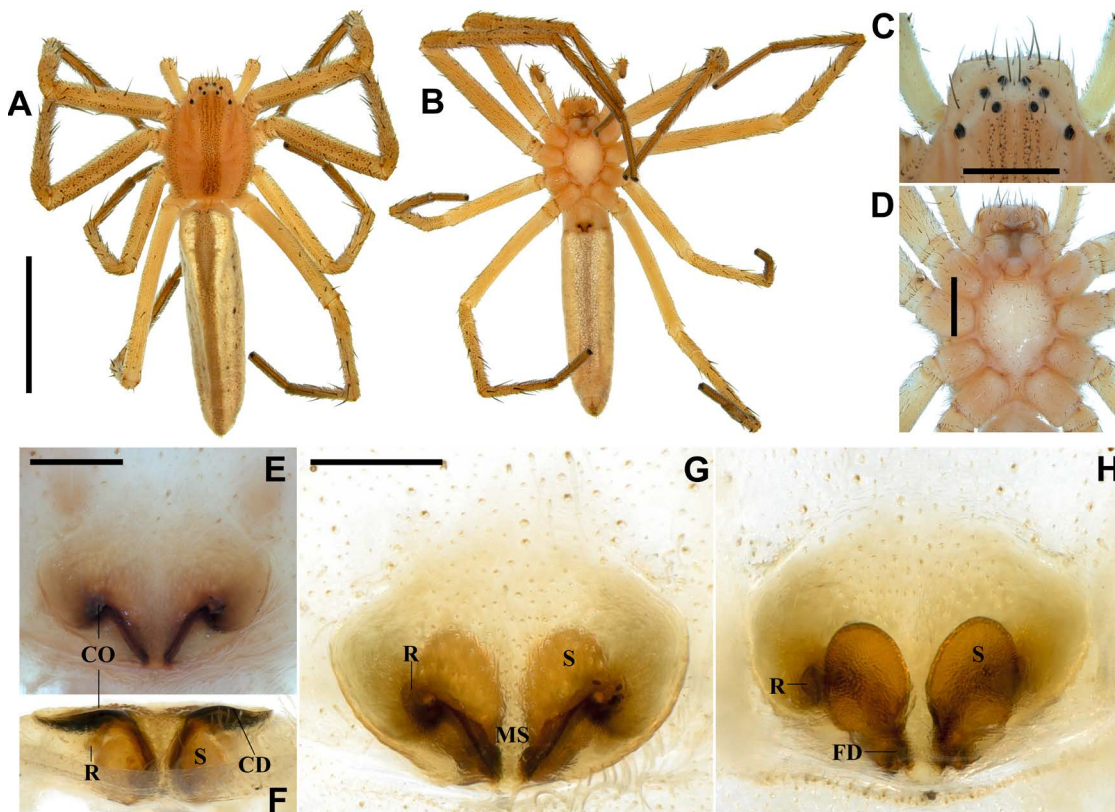


Fig. 2. *Tibellus fengi* Efimik, 1999: A, Female (habitus, dorsal); B, Female (habitus, ventral); C, Female eye area; D, Female sternum; E, Female epigynum, ventral view; F, Female internal genitalia, caudal view; G, *Ditto*, ventral view; H, *Ditto*, dorsal view (CD, copulatory duct; CO, copulatory opening; FD, fertilization duct; MS, median septum; R, receptaculum; S, spermatheca). Scale bars: A, B=4 mm, C, D=1 mm, E-H=0.3 mm.

ry, convex, anterior end truncated, longer than wide, posterior end pointed and slightly protruding between the coxae of leg IV (Fig. 2D). Legs long and strongly developed, yellowish brown, leg spination; I (femur 0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), III (femur 0-1-1-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 0-1-0-1-1-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-1d, 2-2-0v) (Fig. 2A, B). Abdomen elongate with pointed posterior end, thick ivory, brown median band present, three to four pairs of small black spots present laterally, clothed densely with short black and white hairs, narrower than carapace, markedly longer than wide (Fig. 2A, B). Epigynum (Fig. 2E): posterior end of median septum narrow, copulatory opening near lateral margin. Internal genitalia (Fig. 2F-H): copulatory duct thick, spermatheca small, kidney-shaped, and apart from each other, receptaculum small and elliptical.

Habitat. Rice fields.

Distribution. Korea (Hwaseong-si, new record), Russia (Far East), China, Japan.

¹Tibellus gimcheon* sp. nov. (Fig. 3)**

<http://zoobank.org:act:43236E73-0300-4A6D-ADC0-A60CAE1B7740>

Type material. Holotype: Korea: ♂ (NIBR #NUHGIV0000 000648), Gyeongsangbuk-do, Gimcheon-si, Daehang-myeon, Unsu-ri, 36.101667N, 128.003333E, alt. 257 m, 6 Jul 2016, leg. S. T. Kim & S. Y. Lee.

Diagnosis. *Tibellus gimcheon* sp. nov. is similar to *T. yeongdong* sp. nov. in the shape of embolus tip in male, but can be easily distinguished from the latter by the combination of following characters: chelicera with two promarginal teeth, cymbium with five dorsal spines, conductor triangular (Fig. 3F-H) *versus* chelicera with one promarginal tooth, cymbium with

Korean name: ¹*김천가재거미 (신칭)

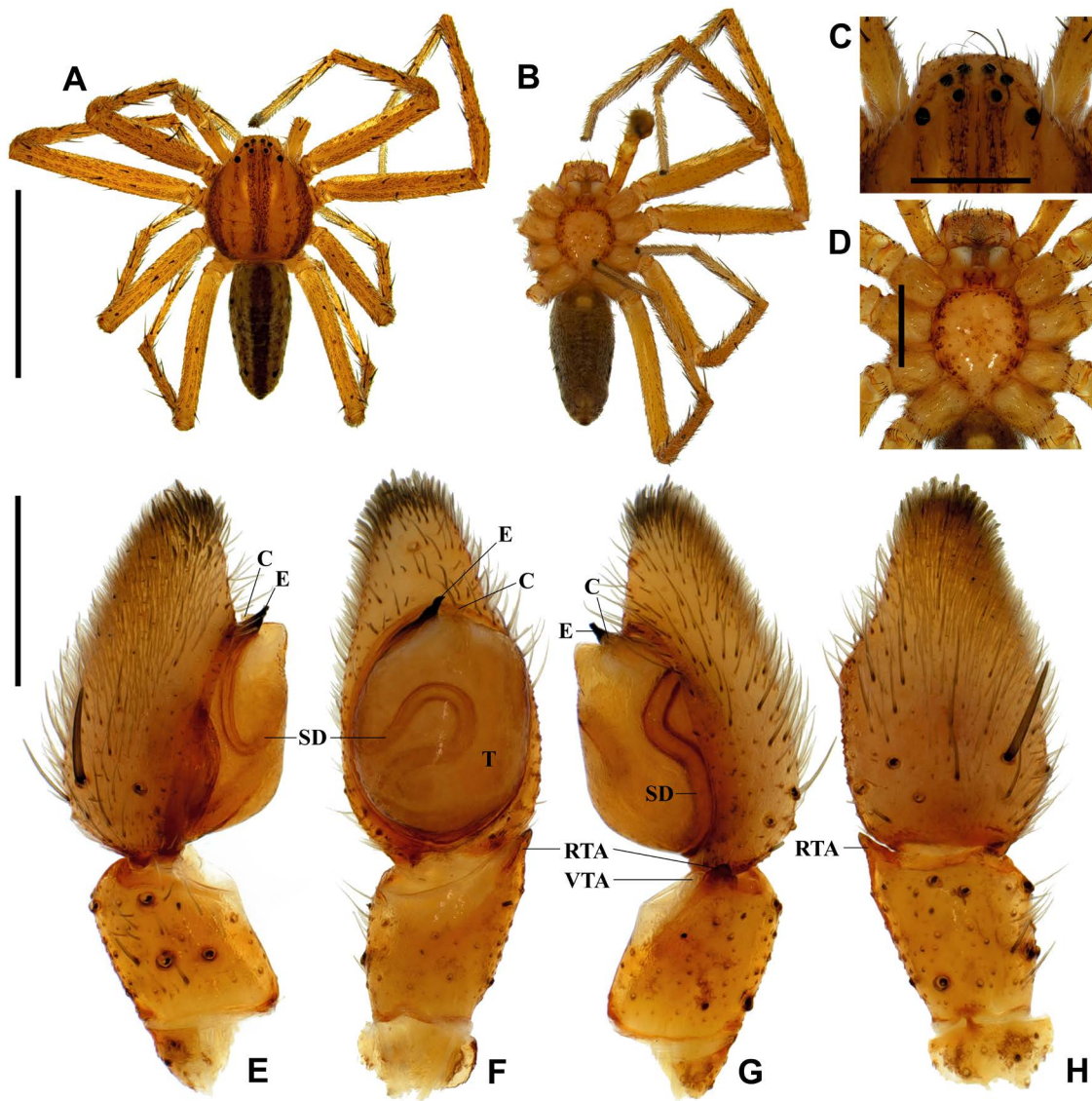


Fig. 3. *Tibellus gimcheon* sp. nov.: A, Holotype male (habitus, dorsal); B, Holotype male (habitus, ventral); C, Male eye area; D, Male sternum; E, Male palp, prolateral view; F, *Ditto*, ventral view; G, *Ditto*, retrolateral view; H, *Ditto*, dorsal view (C, conductor; E, embolus; RTA, retrolateral tibial apophysis; SD, sperm duct; T, tegulum; VTA, ventral tibial apophysis). Scale bars: A, B=4 mm, C, D=1 mm, E-H=0.5 mm.

four dorsal spines, conductor rectangular in *T. yeongdong* sp. nov. (Fig. 6F-H).

Etymology. The specific name is a noun in apposition referred to the type locality, Gimcheon-si.

Description. Male (Holotype). Total length 5.53. Carapace: 2.61 long/2.29 wide. Eyes: AER 0.60, PER 1.00, ALE 0.10, AME 0.09, PLE 0.11, PME 0.17, ALE-PLE 0.34, ALE-AME 0.07, AME-AME 0.18, AME-PME 0.20, PLE-PME 0.31, PME-PME 0.26. Chelicera: 0.74 long/0.38 wide. Endite: 0.55 long/0.37 wide. Labium: 0.30 long/0.33 wide. Sternum: 1.50 long/1.21 wide. Legs: I 10.95 (3.21, 1.28, 2.81,

2.33, 1.32)/II 13.28 (3.87, 1.48, 3.45, 2.91, 1.57)/III 9.18 (2.89, 1.12, 2.28, 1.99, 0.91)/IV 12.00 (3.72, 1.13, 2.98, 2.78, 1.39), leg formula II-IV-I-III. Abdomen: 2.92 long/1.35 wide. Palp: 3.04 (0.99, 0.60, 0.42, -, 1.03).

Habitus as in Fig. 3A, B. Carapace pear-shaped, slightly flattened, dark yellowish brown, longer than wide, cervical furrow and fovea indistinct, radial furrow faintly visible, dark brown midband, a pair of paramedian stripes, and a pair of marginal bands present (Fig. 3A). Eight eyes in two rows, anterior eye row recurved and posterior eye row strongly recurved, posterior eye row much longer than anterior eye row

(Fig. 3C). Chelicera strongly developed with two pointed promarginal teeth. Sternum heart-shaped, yellowish brown, convex, mottled with blackish brown spots along the lateral margin and faintly flecked medially, anterior end truncated, longer than wide, posterior end blunt and deeply protruding between the coxae of leg IV (Fig. 3D). Legs long and strongly developed, dark yellowish brown, leg spination; I (femur 0-0-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 0-0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), III (femur 0-1-2-0-0-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 0-0-1-1-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-2v) (Fig. 3A, B). Abdomen elongate with pointed posterior end, dark grayish yellow, blackish brown median band present, three pairs of rather large black spots present laterally, clothed densely with short white hairs, black bristles on both sides of median band in line, narrower than carapace, markedly longer than wide (Fig. 3A). Palp (Fig. 3E-H): retrolateral tibial apophysis triangular with rounded tip, ventral tibial apophysis broad and membranous, cymbium with five dorsal spines, embolus tip short with a frontal ridge, embolic body hidden by tegulum, conductor large and triangular, embolus and conductor contiguous.

Female. Unknown.

Habitat. Bush layer in mountains.

Distribution. Korea (Gimcheon-si).

¹**Tibellus japonicus* Efimik, 1999 (Fig. 4)

Tibellus tenellus Bösenberg & Strand, 1906: 271 (♀♂, misidentified); Saitō, 1934: 327 (♀, misidentified); 1959: 134 (♀, misidentified); Chikuni, 1989: 133 (♀♂, misidentified); Kim & Lee, 2017: 90 (♂, misidentified).

Tibellus japonicus Efimik, 1999: 112; Chen, Zhang & Song, 2003: 91; Ono & Ban, 2009: 478; Zhu & Zhang, 2011: 431; Yin et al., 2012: 1252; Baba & Tanikawa, 2015: 89.

Material examined. Korea: 2♂♂ (NIBR #NUHGIV0000 000647, KGU #Ara_Phil_Tibellus japonicus_20150805_01), Gyeonggi-do, Suwon-si, Dangsudong, 37.294444N, 126.948333E, alt. 35 m, 5 Aug 2015, leg. S. T. Kim.

Description. Male. Total length 7.65. Carapace: 3.19 long/2.33 wide. Eyes: AER 0.64, PER 1.10, ALE 0.09, AME 0.09, PLE 0.11, PME 0.09, ALE-PLA 0.41, ALE-AME 0.11, AME-AME 0.10, AME-PME 0.23, PLE-PME 0.36, PME-PME 0.27. Chelicera: 0.88 long/0.44 wide. Endite: 0.78 long/0.36 wide. Labium: 0.39 long/0.39 wide. Sternum: 1.63 long/1.26 wide. Legs: I 16.34 (4.54, 1.78, 4.15, 3.72, 2.15)/II 19.63 (5.52, 1.88, 5.00, 4.59, 2.64)/III 11.39 (3.56, 1.26, 2.64, 2.50, 1.43)/IV 16.84 (5.20, 1.49, 4.19, 4.01, 1.95), leg formu-

la II-IV-I-III. Abdomen: 4.53 long/1.21 wide. Palp: 3.46 (1.22, 0.69, 0.50, -, 1.05).

Habitat as in Fig. 4A, B. Carapace pear-shaped, slightly flattened, dark yellowish brown, longer than wide, cervical furrow and fovea indistinct, radial furrow faintly visible, dark brown midband, a pair of paramedian stripes, and a pair of marginal bands present (Fig. 4A). Eight eyes in two rows, anterior eye row recurved and posterior eye row strongly recurved, posterior eye row much longer than anterior eye row (Fig. 4C). Chelicera strongly developed with two pointed promarginal teeth. Sternum heart-shaped, yellowish brown, convex, mottled with blackish brown spots along the lateral margin and faintly flecked medially, anterior end truncated, longer than wide, posterior end blunt and strongly protruding between the coxae of leg IV (Fig. 4D). Legs long and strongly developed, dark yellowish brown, leg spination; I (femur 0-0-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 0-0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), III (femur 0-1-2-0-0-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 0-0-1-1-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-2v) (Fig. 4A, B). Abdomen elongate with pointed posterior end, dark grayish yellow, blackish brown median band present, three pairs of rather large black spots present laterally, clothed densely with short white hairs, black bristles on both sides of median band in line, narrower than carapace, markedly longer than wide (Fig. 4A). Palp (Fig. 4E-H): retrolateral tibial apophysis tetragonal with rounded tip, ventral tibial apophysis broad and membranous, cymbium with four dorsal spines, embolus tip long with a frontal ridge, embolic body hidden by tegulum, conductor large and rectangular, embolus and conductor almost contiguous.

Habitat. Rice fields.

Distribution. Korea (Suwon-si, new record), Russia (Far East), China, Japan.

²**Tibellus sihwa* sp. nov. (Fig. 5)

<http://zoobank.org:act:CEB0662A-A1E7-4C85-805F-45BA31DFA201>

Type materials. Holotype: Korea: ♂ (NIBR #HVBIV0000 007515), Gyeonggi-do, Hwaseong-si, Namyang-eup, Munho-ri, Sihwa reclaimed land, 37.267849N, 126.807992E, alt. 4 m, 30 Jul 2017, leg. S. T. Kim & S. Y. Lee. **Paratype:** 1♀ (NIBR #NUHGIV0000000649), same data as holotype, leg. S. T. Kim & S. Y. Lee.

Diagnosis. *Tibellus sihwa* sp. nov. is similar to *T. gimcheon* sp. nov. and *T. yeongdong* sp. nov. in the shape of the palpal organ and body appearance in male, but can be easily distin-

Korean name: ¹*일본가재거미, ²*시화가재거미(신칭)

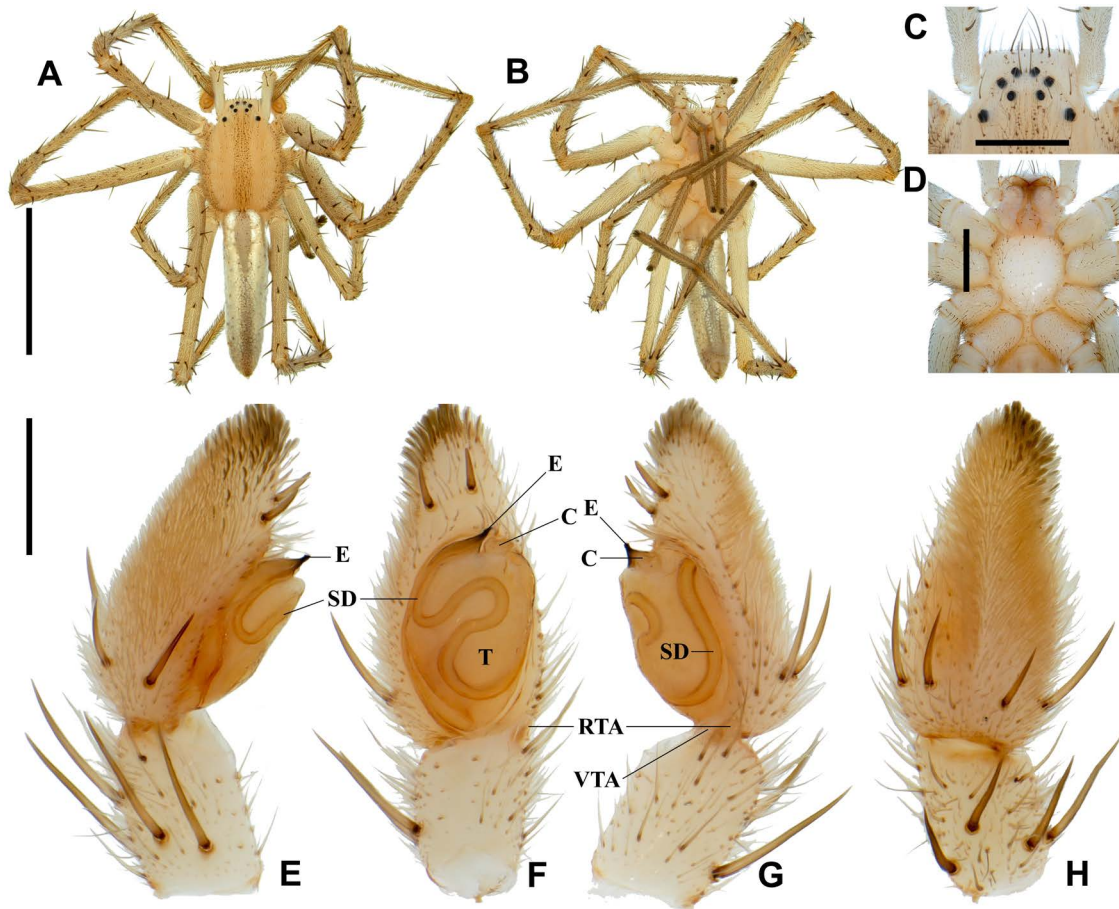


Fig. 4. *Tibellus japonicus* Efimik, 1999: A, Male (habitus, dorsal); B, Male (habitus, ventral); C, Male eye area; D, Male sternum; E, Male palp, prolateral view; F, *Ditto*, ventral view; G, *Ditto*, retrolateral view; H, *Ditto*, dorsal view (C, conductor; E, embolus; RTA, retrolateral tibial apophysis; SD, sperm duct; T, tegulum; VTA, ventral tibial apophysis). Scale bars: A, B=4 mm, C, D=1 mm, E-H=0.5 mm.

guished from *T. gimcheon* by the cymbium with four dorsal spines, twisted conductor wrapping the embolus (Figs. 3F, H, 5J, L) and from *T. yeongdong* by the chelicera with two promarginal teeth and twisted conductor wrapping the embolus (Figs. 5J, 6F). The female of *T. sihwa* is similar to *T. orientis* Efimik, 1999 in the shape of the epigynum and body appearance, but can be easily distinguished from the latter by the small and spherical receptaculum, and short receptaculum duct (Fig. 5F, H) (Efimik, 1999: 121, f. 36, 43, 53).

Etymology. The specific name is a noun in apposition referred to the type locality, Sihwa reclaimed land.

Description. Male (Holotype). Total length 7.52. Carapace: 3.01 long/2.57 wide. Eyes: AER 0.67, PER 1.12, ALE 0.10, AME 0.10, PLE 0.11, PME 0.08, ALE-PLE 0.39, ALE-AME 0.09, AME-AME 0.20, AME-PME 0.22, PLE-PME 0.36, PME-PME 0.27. Chelicera: 0.97 long/0.47 wide. Endite: 0.74 long/0.48 wide. Labium: 0.38 long/0.43 wide. Sternum: 1.74

long/1.41 wide. Legs: I 13.51 (3.78, 1.61, 3.39, 2.88, 1.85)/II 16.16 (4.60, 1.72, 4.07, 3.58, 2.19)/III 10.95 (3.42, 1.21, 2.69, 2.37, 1.26)/IV 14.41 (4.46, 1.35, 3.60, 3.32, 1.68), leg formula II-IV-I-III. Abdomen: 4.51 long/1.57 wide. Palp: 3.42 (1.14, 0.65, 0.51, -, 1.12).

Habitus as in Fig. 5B. Carapace pear-shaped, slightly flattened, orange, longer than wide, cervical furrow and fovea indistinct, radial furrow faintly visible, dark brown midband, a pair of faint paramedian stripes, and a pair of marginal bands present (Fig. 5B). Chelicera strongly developed with two pointed promarginal teeth. Legs long and strongly developed, pale yellow, leg spination; I (femur 0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 0-1-2-1-0-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), III (femur 0-0-1-2-1-0-2-0-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 0-0-2-1-0-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-2v) (Fig. 5B). Ab-

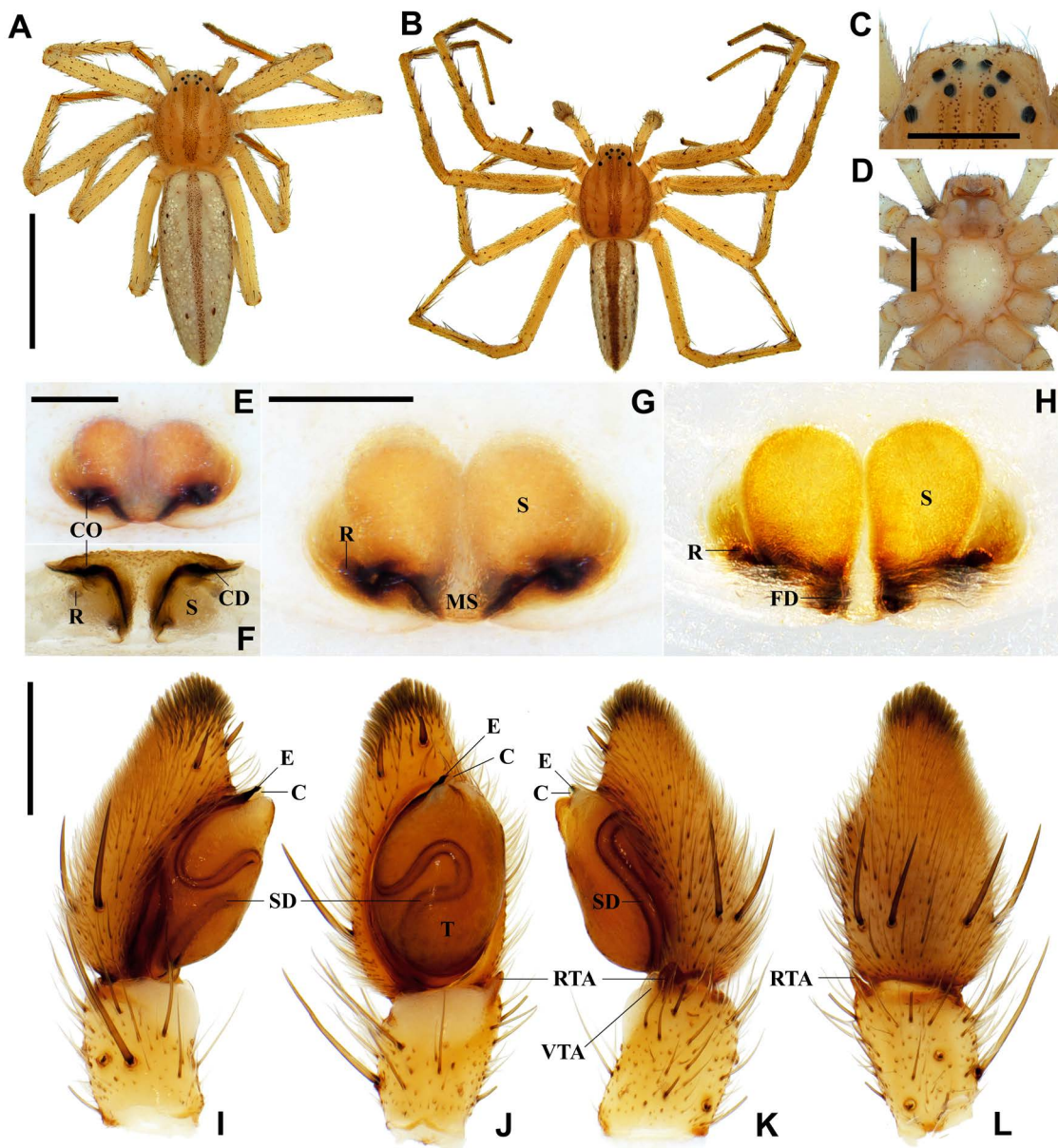


Fig. 5. *Tibellus sihwa* sp. nov.: A, Paratype female (habitus); B, Holotype male (habitus); C, Female eye area; D, Female sternum; E, Female epigynum, ventral view; F, Female internal genitalia, caudal view; G, *Ditto*, ventral view; H, *Ditto*, dorsal view; I, Male palp, prolateral view; J, *Ditto*, ventral view; K, *Ditto*, retrolateral view; L, *Ditto*, dorsal view (C, conductor; CD, copulatory duct; CO, copulatory opening; E, embolus; FD, fertilization duct; MS, median septum; RTA, retrolateral tibial apophysis; R, receptaculum; S, spermatheca; SD, sperm duct; T, tegulum; VTA, ventral tibial apophysis). Scale bars: A, B=4 mm, C, D=1 mm, E-H=0.3 mm, I-L=0.5 mm.

domen elongate with pointed posterior end, pale brown, dark colored median band present, four pairs of small black spots present laterally, clothed densely with short white hairs and sparsely with black hairs, narrower than carapace, markedly longer than wide (Fig. 5B). Palp (Fig. 5I-L): retrolateral tibial apophysis triangular, ventral tibial apophysis broad, membranous, and protrudent, cymbium with four dorsal spines, embolus tip long with a frontal ridge, embolic body hidden

by tegulum, conductor twisted, embolus wrapped by the conductor.

Female (Paratype). Total length 9.55. Carapace: 3.15 long/2.70 wide. Eyes: AER 0.70, PER 1.21, ALE 0.10, AME 0.09, PLE 0.12, PME 0.08, ALE-PLE 0.41, ALE-AME 0.08, AME-AME 0.22, AME-PME 0.19, PLE-PME 0.38, PME-PME 0.32. Chelicera: 1.01 long/0.54 wide. Endite: 0.79 long/0.47 wide. Labium: 0.38 long/0.46 wide. Sternum: 1.73

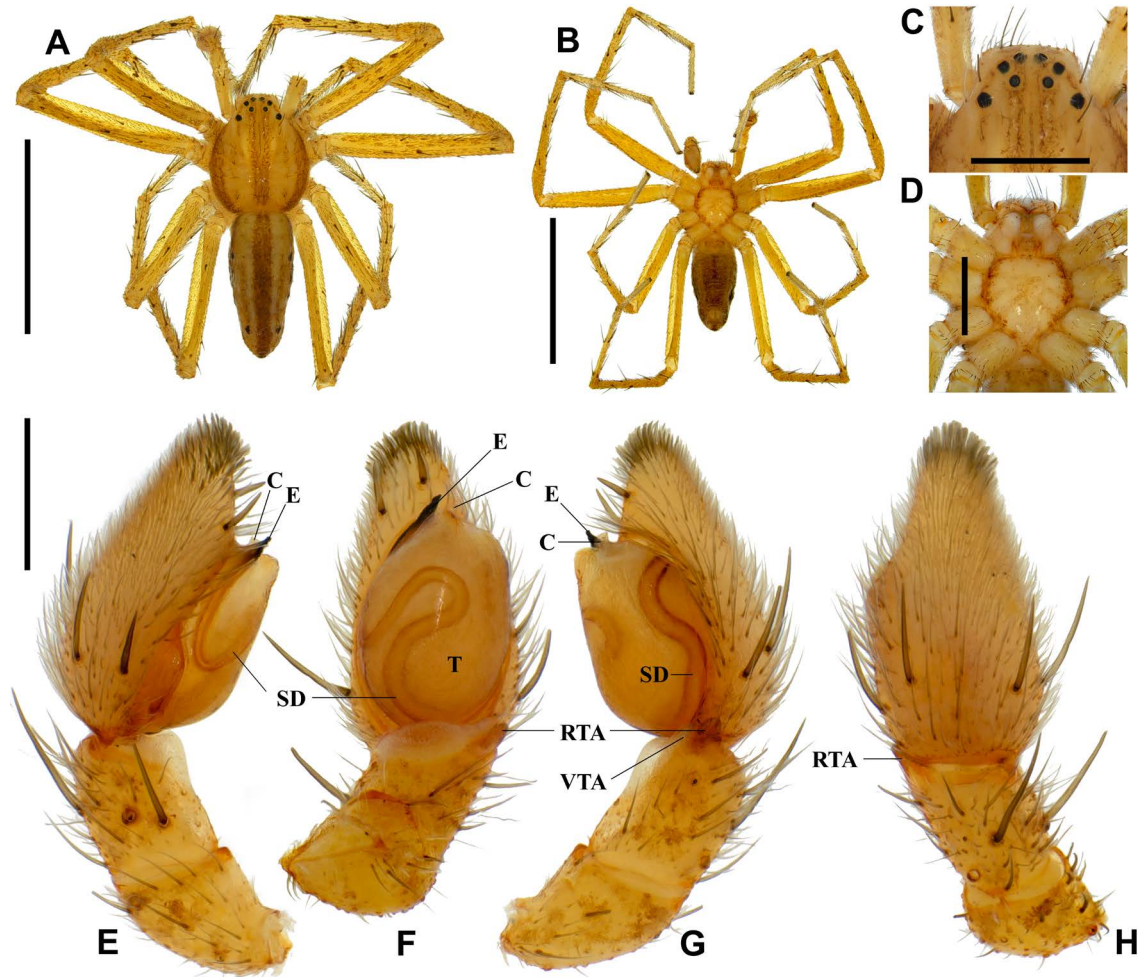


Fig. 6. *Tibellus yeongdong* sp. nov.: A, Holotype male (habitus, dorsal); B, Holotype male (habitus, ventral); C, Male eye area; D, Male sternum; E, Male palp, prolateral view; F, *Ditto*, ventral view; G, *Ditto*, retrolateral view; H, *Ditto*, dorsal view (C, conductor; E, embolus; RTA, retrolateral tibial apophysis; SD, sperm duct; T, tegulum; VTA, ventral tibial apophysis). Scale bars: A, B=4 mm, C, D=1 mm, E-H=0.5 mm.

long/1.38 wide. Legs: I 11.99 (3.51, 1.60, 3.02, 2.40, 1.46)/II 14.31 (4.22, 1.71, 3.60, 2.92, 1.86)/III 9.83 (3.17, 1.17, 2.41, 1.93, 1.15)/IV 12.28 (4.03, 1.34, 3.05, 2.46, 1.40), leg formula II-IV-I-III. Abdomen: 6.40 long/2.46 wide. Palp: 3.32 (1.02, 0.62, 0.63, -, 1.12). Epigynum 0.67 wide.

General appearance similar to male, habitus as in Fig. 5A. Eight eyes in two rows, anterior eye row recurved and posterior eye row strongly recurved, posterior eye row much longer than anterior eye row (Fig. 5C). Sternum heart-shaped, ivory, convex, anterior end straight, longer than wide, posterior end pointed and deeply protruding between the coxae of leg IV (Fig. 5D). Leg spination; I (femur 0-0-2-1-2-2d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 0-0-0-1-1-2-0-2d, 0v/tibia 2-2-1-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v),

III (femur 0-1-1-0-2d, 0v/tibia 1-0-1-1-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 0-1-1-0-3d, 0v/tibia 2-1-1-0-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-2v). Epigynum (Fig. 5E): posterior end of median septum broad, copulatory opening near posterior margin of epigynum. Internal genitalia (Fig. 5F-H): copulatory duct slender, spermatheca large, kidney-shaped, contiguous to each other, receptaculum small and spherical, receptaculum duct short.

Habitat. Bush layer in reclaimed land.

Distribution. Korea (Sihwa reclaimed land, Hwaseong-si).

¹**Tibellus yeongdong* sp. nov. (Fig. 6)

<http://zoobank.org:act:05E76314-BA5A-4E7B-85D5-145F31207724>

Korean name: ¹*영동가재거미 (신칭)

Type material. Holotype: Korea: ♂ (NIBR #NUHGIV0000 000650), Chungcheongbuk-do, Yeongdong-gun, Chupungnyeong-myeon, Jukjeon-ri, 36.220556N, 128.026944E, alt. 259 m, 15 Jun 2017, leg. S. T. Kim & S. Y. Lee.

Diagnosis. *Tibellus yeongdong* sp. nov. is similar to *T. gimcheon* sp. nov. and *T. sihwa* sp. nov. in the shape of the palpal organ and body appearance in male, but can be easily distinguished from *T. gimcheon* by the chelicera with one promarginal tooth, cymbium with four dorsal spines, and rectangular conductor (Figs. 3F, H, 6F, H) and from *T. sihwa* by the chelicera with one promarginal tooth, rectangular conductor, and embolus contiguous to conductor (Figs. 5J, 6F).

Etymology. The specific name is a noun in apposition referred to the type locality, Yeongdong-gun.

Description. Male (Holotype). Total length 5.03. Carapace: 2.28 long/2.01 wide. Eyes: AER 0.59, PER 0.94, ALE 0.10, AME 0.09, PLE 0.10, PME 0.07, ALE-PLA 0.32, ALE-AME 0.06, AME-AME 0.13, AME-PME 0.19, PLE-PME 0.29, PME-PME 0.23. Chelicera: 0.71 long/0.36 wide. Endite: 0.57 long/0.38 wide. Labium: 0.30 long/0.36 wide. Sternum: 1.30 long/1.20 wide. Legs: I 10.50 (2.99, 1.27, 2.72, 2.14, 1.38)/II 12.76 (3.70, 1.38, 3.36, 2.71, 1.61)/III 8.60 (2.72, 1.01, 2.11, 1.71, 1.02)/IV 11.12 (3.52, 1.04, 2.77, 2.47, 1.27), leg formula II-IV-I-III. Abdomen: 2.75 long/1.27 wide. Palp: 2.72 (0.87, 0.54, 0.38, —, 0.93).

Habitus as in Fig. 6A, B. Carapace pear-shaped, slightly flattened, dark yellowish brown, longer than wide, cervical furrow and fovea indistinct, radial furrow faintly visible, brown midband, a pair of faint paramedian stripes and a pair of marginal bands present (Fig. 6A). Eight eyes in two rows, anterior eye row recurved and posterior eye row strongly recurved, posterior eye row much longer than anterior eye row (Fig. 6C). Chelicera strongly developed with one pointed promarginal tooth. Sternum heart-shaped, pale yellowish brown, margin mottled, convex, anterior end truncated, longer than wide, posterior end pointed and deeply protruding between the coxae of leg IV (Fig. 6D). Legs long and strongly developed, yellowish brown, leg spination: I (femur 0-0-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), II (femur 0-0-1-2-1-2-3d, 0v/tibia 2-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), III (femur 0-1-1-1-1-3d, 0v/tibia 0-2-3d, 2-2-2v/metatarsus 2-2-0d, 2-2-0v), IV (femur 0-0-1-1-1-2-3d, 0v/tibia 0-2-3d, 2-2-2v/metatarsus 2-2-1d, 2-2-1v) (Fig. 6A, B). Abdomen elongate with pointed posterior end, dark grayish brown, dark colored median band present, four pairs of small black spots present laterally, clothed densely with short white hairs, narrower than carapace, markedly longer than wide (Fig. 6A, B). Palp (Fig. 6E-H): retrolateral tibial apophysis triangular, ventral tibial apophysis broad, membranous, and protrudent, cymbium with 4 dorsal spines, embolus tip long with a frontal ridge, embolic body hidden by tegulum, conductor

large, rectangular, and membranous, embolus and conductor contiguous.

Female. Unknown.

Habitat. Rice fields.

Distribution. Korea (Yeongdong-gun).

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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