TWO NEW SPECIES OF CERATOPHYSELLA (COLLEMBOLA: HYPOGASTURIDAE) FROM KOREA

Authors: Kyung-Hwa Park, and Nam-Yee Park
Source: Florida Entomologist, 89(4) : 489-496
Published By: Florida Entomological Society
TWO NEW SPECIES OF CERATOPHYSELLA (COLLEMBOLA: HYPOGASTRURIDAE) FROM KOREA

KYUNG-HWA PARK AND NAM-YEE PARK
Department of Biology Education, Chonbuk National University, Jeonju 561-756, Korea

ABSTRACT

Two new species of the genus Ceratophysella from Korea, Ceratophysella biclavata n. sp. and Ceratophysella platyna n. sp. are described and illustrated. Ceratophysella biclavata differs from the closely related species Ceratophysella sigillata (Uzel 1891) by the shape of antennal bulb on antennal segment IV, the number of clavate tenent hairs and the number of granules between p, upon abdominal segment V. Ceratophysella platyna resembles Ceratophysella denticulata (Bagnall 1941) and Ceratophysella communis (Folsom 1898), but distinctly differs from the latter by the shape of tenent hairs. A key to the identification of the Korean species of Ceratophysella is included. In addition, the known species Hypogastrura gracilis (Folsom 1899) is described and recorded for the first time from Korea.

Key Words: Hypogastrura, Poduromorpha, Arthroleona, springtail, Apterygota, South Korea

The family Hypogastruridae is common, widespread, and has cosmopolitan distribution containing approximately 659 world species in about 40 genera. The genus Ceratophysella also with worldwide distribution is one of the largest genera in the family, with more than 108 known species (Bellinger et al. 2006). Their habits were noted by Hopkin (2002), who stated that they often form enormous swarms on roads, glaciers, snow, and on the surfaces of puddles. Individuals in the swarms all leap together in the same direction using the orientation of the sun to navigate. They have small expandable sticky sacs on their antennae that help them adhere to the substrate when they land after a jump to stabilize them (Hopkin 2002).


The purpose of this paper is to describe 2 new species and to provide an identification key to the species of Ceratophysella from Korea. Lee & Kim (1995) described C. dolsana as a new species, but there is no description of the genus in their work. Most authors regarded dolsana as belonging in the genus Hypogastrura (Bellinger et al. 2006; Thibaud et al. 2004). However, we include in the key of Ceratophysella, primarily on the basis of long p, seta on thoracic segments II-III and on the shape of micro in holotype and paratypes. Morphological abbreviations used in this paper are as follows: Ant. I-IV: antennal segments I-IV; Th. I-III: thoracic segments I-III; Abd. I-VI: abdominal segments I-VI; seta a and b: seta a and b among the 7 dorsal sensory setae of Ant. IV; a1, 2 . . . : of the anterior row counted from the “middle line”; m1, 3 . . . : of the middle row, counted from the “middle line”; p1, 2 . . . : of the posterior row, counted from the “middle line”.

MATERIALS AND METHODS

Material was collected from 3 localities in Korea. Either an aspirator for direct collection or a Tullgren apparatus for extracting specimens was used. Collembola were fixed in 90% ethanol. Marc André I and II solutions were used to clear and...
prepare specimen slides (Massoud 1967). KOH solution (10%) was used for rapid de-coloration. To prepare permanent slides, glycerine was placed along the cover glass edge to prevent the slide medium from drying. All type specimens are deposited in the Insect Collection of Biology Education Department, Chonbuk National University, Jeonju, Korea.

*Ceratophysella biclavata*, new species

Description (Fig. 1). Body length 1,110-1,400 µm (1,200 µm long in holotype). Color dark brown or blackish brown on whole body except inter-segmental portions and the ventral side. Body cylindrical, being narrower abruptly at Abd.V (Fig. 1A). Head length 220 µm in holotype. Antenna shorter than head, 0.9 in ratio to head; ratio of length of antennal segments I:II:III:IV is 5:5:6:4. Ant. IV with a simple apical bulb and a closely associated small papilla, a socket seta and some weak setae (Fig. 1B), and with 7 dorsal sensory setae of which seta a and b thickened. Eversible sac between Ant. III and Ant. IV distinctly developed. Ant. III organ with 2 short sensory and 2 guard sensilla (Fig. 1D). Mandible with 4 apical teeth (Fig. 1F). Eyes 8 + 8, eye patch with 3 setae. Postantennal organ (PAO) consists of 4 peripheral tubercles, about 1.2-1.5 times as long as the diameter of the nearest ocelli, with anterior lobes distinctly larger than posterior and with a small accessory tubercle (Fig. 1C). Tenent hairs 2, 2, 2 with distal end weakly clavate. Unguis elongate, with an inner tooth and a pair of lateral teeth. Unguiculus setaceous and with broad, rounded apex; lacking ventral file, but with 11-13 granules between p₁ upon Abd.V. Number of granules between p₁, of Abd. V is 20-25 in *C. sigillata* and 11-13 in the present new species. Also, the present species differs from *C. sigillata* by the strongly developed eversible sac (weakly developed in *C. sigillata*) and the absence of hook-like sensilla upon fourth antennal segment (Table 1).

*Ceratophysella platyna*, new species

Description (Fig. 2). Body length 1,200-1,400 µm (1,200 µm long in holotype). Body dark brown with blue pigment scattered over dorsum of segments in the form of irregular transverse bands (Fig. 2A). Head length 270 µm in holotype. Antenna shorter than head, 0.8 length of head; ratio of length of antennal segments I:II:III:IV is 3:4:5:6. Fourth antennal segment with a simple apical bulb and a closely associated protective papilla, giving a bilobed appearance to the antennal apex; lacking ventral file, but with 11-13 relatively long straight setae and seven clear blunt setae (Figs. 2B, E). Eversible sac between Ant. III and IV distinctly differentiated. Left mandible with 5 apical teeth and right with 4 apical teeth (Figs. 2D, H). Postantennal organ with 4 peripheral tubercles, a small accessory tubercle, anterior lobes strikingly larger than posterior and about 1.5 times as long as nearest ocelli. Eye patch with 8 ocelli on each side (Fig. 2C). Unguis slender, slightly curving distally, with 1 inner tooth on internal lamella. Unguiculus pointed and with a basal lamella tapering into a filament, almost ½ as longer internal lamella of unguis. Tenent hairs 1, 1, 1 almost as long as outer unguis and truncate to feebly clavate (Fig. 2G). Ventral tube with 3 + 3 setae. Tenaculum with 4 + 4 barbs. Dens about twice as long as macro, with 7 posterior setae, without basally enlarged angled setae (Fig. 2P). Outer unguis 1.5 times as long as macro. Macro 0.8-0.9 times as long as anal spines. Body setae all smooth and slender. Integument
moderately granular. Granular stripe on Abd. V arranged regularly, 9-12 granules lying between the p₁ setae on Abd. V (Fig. 2I). Fovea lying between the p₁. Anal spines slender, on unusually large contiguous papillae. On Abd. VI, a nearly as long as anal spine including anal papilla (Fig. 2J).

Chaetotaxy. Area verticalis confluent with area occipitalis and with 2 + 2 setae. Th. I with 3
+ 3 setae in a row. Th. II and III with 3 rows of setae, m
... grains 11-13 grains

Eversible sac weakly developed strongly developed

hook-like sensilla upon Ant. IV Present absent

Type Materials

Holotype: Male, 700 m a.s.l., Mt. Moacksan, Gui-myeon, Wanju-gun, Jeollabuk-do Province, collected from the leaf litter under snow, 14 Feb 2004, collection no. 204-01-1. Paratypes: 2 males and 2 females, same data as holotype.

Etymology: The specific name, *platyna*, refers to the shape of body in this species.

Remarks: This species is characterized by the presence of an antennal bulb and the shape of tenent hairs. In many respects this species resembles *C. pratorum* of the *Boletivora*-group from North America (Christiansen & Bellinger 1998), but they differ in chaetotaxy. The present species is a member of Gisin’s A type (Gisin 1947) with p2 absent, p3 the sensory seta. Abd. IV with 2 rows of setae, without a2’, p1 longer than p2, a2 lacking and p4 the sensory seta (Fig. 2K).

**Hypogastrura gracilis** (Folsom, 1899), **new record**

Diagnosis (Fig. 3). Body length 1,500-1,900 μm (1,700 μm long in holotype). Color grey or blackish brown on whole body except only intersegmental portions and the ventral side. Body laterally swollen at Abd. II and III, being gradually narrower toward posterior end (Fig. 3A). Head length 310 μm in holotype. Antenna longer than head, ratio 1.1 to head length; ratio of length of antennal segments I:II:III:IV is 12:13:18:30. Fourth antennal segment with a distal, slightly trilobed end-bulb and a number of socket setae, with 3 weak setae each on a slightly differentiated, small subapical papillae (Figs. 3C, E). Third antennal segment organ of 2 small rods in a shallow groove accompanied by 2 curved setae. Labrum with 4/5, 5, 4 setae, their distal row very weak. Labral margin with 4 rounded tubercles (Fig. 3H). Postantennal organ of 4 peripheral tubercles, with or without a small accessory tubercle, subequal to nearest ocelli (Figs. 3B, D). Eyes 8 + 8, on black patches. Unguis of all legs subequal, relatively small, dorsally carinate and with 1 inner tooth near the distal end. Unguiculus setaceous and reaching three-quarters of the distance from base to apex of unguis. Basal half with lamella on the inner side apically arcuate. Tenent hairs 2, 3, 3 rather thick and conspicuously swollen at apex. Median tenent hairs larger than others and above the level of others on the second and third legs (Fig. 3F). Ventral tube with 4+4 setae. Tenaculum with 3 + 3 barbs. Dens almost smooth dorsally with 7 setae, about 4 times as long as mucro. Mucro strongly compressed bilaterally and somewhat blade-shaped (Fig. 3G). Mucro 3.7-5.5 (mostly 4) times as long as anal spines. Outer unguis 1.3-1.8 times as long as mucro. Anal spines 0.25 times as long as inner unguis and subequal to anal papillae. All body setae short and fine.

Chaetotaxy. Th. I with 3+3 setae in a row. Th. II and III composed of 3 rows of setae, p1 a little longer than others, sensory seta on Th. II without m1 seta and Th. III without m2, m3, a1 setae. Abd.

**Table 1. Diagnostic characters for *CeratophySELLA sigillATA* AND *CeratophySELLA biclavATA* n. sp.**

<table>
<thead>
<tr>
<th>Species/Character</th>
<th><em>C. sigillata</em></th>
<th><em>C. biclavata</em> n. sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of clavate tenent hairs</td>
<td>1, 1, 1</td>
<td>2, 2, 2</td>
</tr>
<tr>
<td>Ant. IV antennal bulb</td>
<td>a simple apical bulb</td>
<td>a simple apical bulb and a closely associated small papilla</td>
</tr>
<tr>
<td>The number of granules between p1 upon Abd. V</td>
<td>20-25 grains</td>
<td>11-13 grains</td>
</tr>
<tr>
<td>Eversible sac</td>
<td>weakly developed</td>
<td>strongly developed</td>
</tr>
<tr>
<td>hook-like sensilla upon Ant. IV</td>
<td>Present</td>
<td>absent</td>
</tr>
</tbody>
</table>

Terms of Use: https://bioone.org/terms-of-use

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 22 Jun 2019
### Table 2. Diagnostic Characters for Ceratophysella platyna n. sp.

<table>
<thead>
<tr>
<th>Species/Character</th>
<th>C. denticulata</th>
<th>C. communis</th>
<th>C. platyna n. sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of tenent hair</td>
<td>acuminata</td>
<td>acuminata</td>
<td>clavata</td>
</tr>
<tr>
<td>The number of granules between p₁ upon Abd. V</td>
<td>9-12 grains</td>
<td>20 grains</td>
<td>9-12 grains</td>
</tr>
<tr>
<td>a₂’ seta on Abd. V present</td>
<td>absent</td>
<td>absent</td>
<td>absent</td>
</tr>
</tbody>
</table>

I-III bearing two rows of setae, p₂ a macroseta and p₅ the sensory seta. Abd. IV with three rows of setae and p₃ sensory seta. Abd. V bearing 2 rows of setae, p₁ longer than p₂, and p₅ the sensory seta (Fig. 31).

#### DISCUSSION

The species of Ceratophysella are characterized by having a well developed unguiculus and a spoon-shaped mucro with a lateral lamella. Posterior arms of postantennal organ are large, and seta m₄ on thoracic segment II is absent. In Japan, about 12 species are recorded (Furuno et al. 2000; Tamura 2001). Three species are known to occur in China (Zhao et al. 1997).

The taxonomic status of the members of genus Ceratophysella have been described by several researchers world-wide (Yosii 1960, 1962; Bourgeois & Cassagnau 1972; Bonet et al. 1973; Christiansen & Bellinger 1998; Babenko et al. 1994; Thibaud 2004). According to Yosii (1960, 1962), 3 species-groups are recognized in the genus Ceratophysella: communis, armata, and denisana-groups. The communis-group has the chaetotaxy of Gisin’s A type (1947), which seta p₁ on Abd. IV larger than p₂ and is represented by C. denticulata Bagnall 1941 in Europe. The chaetotaxy of armata-group represents Gisin’s B type (1947), which seta p₁ on Abd. IV smaller than p₂. Chaetal arrangement of Ceratophysella biclavata n. sp. is typical for the armata-group in the chaetotaxy of Abd. IV. Ceratophysella platyna n. sp. is clearly different from armata-group in the chaetotaxy of Abd. IV, where seta p₁ is longer than p₂ and p₅. Microsetae and macrosetae of the species weakly differentiated, but some setae as p₁ on Th. II and III, p₂ on Abd. I-IV and p₅ on Abd. V are longer than others, thus indicating the communis-group of chaetotaxy, that is Gisin’s A type. Ceratophysella platyna n. sp., commonly forms enormous swarms under leaves covered with snow.

In the present study, 2 new species and 1 newly recorded species are recognized in Korea. As a result of this study, the Korean faunal list of Hypogastruridae consists of 28 species in 6 genera.

#### KEY TO 10 SPECIES OF Ceratophysella FROM KOREA

1. Fourth abdominal segment with seta p₁ longer than seta p₂ .......................... 2
   —. Fourth abdominal segment with seta p₁ shorter than seta p₂ .......................... 8

2. Fourth abdominal segment with seta p₂ and seta p₅ short, sensory seta p₃  ........ 3
   —. Fourth abdominal segment with seta p₂ short and seta p₅ long, sensory seta p₃  .... 7

3. Fifth abdominal segment, an integumentary process “languette” present ................ liguladorsi
   —. Fifth abdominal segment, an integumentary process “languette” absent .............. 4

4. Dens with bladder-like swelling .......................... bengtssonii
Fig. 3. Hypogastrura gracilis. A. Habitus. B. Postantennal organ (PAO) and 8 ocelli. C. Dorsal view of antenna IV segment. D. Various types of postantennal organ (PAO). E. Various types of fourth antennal segment apical bulb. F. Second leg. G. Dorsal view of mucro and dens. H. Labrum. I. Dorsal chaetotaxy of body.

—. Dens without bladder-like swelling ................................................................. 5
5. Fourth antennal segment with conspicuous ventral “file”, tenent hair acuminata .................................. armata
—. Fourth antennal segment without conspicuous ventral “file”, tenent hair clavate or truncate ............ 6
6. p₆, p₅, and p₄ sensory setae upon Abd. I-III, Abd. IV and Abd. V, respectively. Tenent hairs 1, 1, 1
and apical bulb of fourth antennal segment trilobed .............................................. dolsana
ACKNOWLEDGMENTS

We are grateful to Professor B.-H. Lee for reviewing the draft, and adding many helpful comments. Particular thanks due to Professor P. Greenslade of Australian National University for critical review and reading through the manuscript. We express our gratitude to Professor J. H. Shim for assisting with the collection the materials. This research was supported by a grant (No. 052-052-04-0) from the Core Environmental Technology Development Project for Next Generation funded by the Ministry of Environment of the Korean Government.

REFERENCES CITED


