

Water Mites of the Genus *Aturus* (Acarina: Aturidae) from the Eastern Side of Korea, Including Five New Species

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Fifteen species of water mites belonging to the genus *Aturus* are reported from the eastern area of Korea, with the following five of them described as new species: *Aturus glaberus*, *A. paravarus*, *A. quadratus*, *A. sankyeriensis*, and *A. trifurcatus*, n. spp. *A. complexus* Sokolow and *A. terraconfusensis* Habeeb, both new records for Korean fauna, are re-described.

KEY WORDS: Hydracarina, *Aturus*, New Species, Korea

Water mites are among the most abundant and diverse benthic arthropods in many freshwater habitats and consist a large animal group, comprising over 5,000 described species in more than 300 genera (Smith and Cook, 1991). Inasmuch as Korean water mites had been completely ignored in taxonomy and in other branches of biology as well, the authors have recently been engaged in the study on these animals.

Among the water mites, *Aturus* is one of the largest genera incorporating more than 120 known species (Viets, 1987), with majority of them poorly defined. These water mites have been found in streams of all continents in the world. Kim and Chung (1993) reported eight species of *Aturus* from this country, including five new species.

Recently the authors began to examine the possible relationships between the fauna of water mites and the acidity of water they live in. A number of streams in the eastern side of Korea have been investigated for this purpose. The results of this work may be published elsewhere in the near future. Among about 40 species of water mites discovered in the course of this investigation, more than one-third of them turned out to be those of *Aturus*, with many of them

being new to science. This paper is therefore the preliminary report of the work, mainly describing these new species.

The materials examined in this work have been collected by the authors from various streams in the eastern side of Taebaek Mountains in Kangwon-do district. The collectings were done by either brushing the stones lying under the water or by sorting the washings of mosses soaked in the water. The water mites were sorted under the dissecting microscope and then preserved in Koenike's fluid (*sensu* Cook, 1974).

Undissected, intact specimens were selected as type materials, which will be deposited in the U. S. National Museum of Natural History, Smithsonian Institution, Washington, D. C., United States. Other specimens, including dissected paratypes mounted in Hoyer's medium, are kept in the collection of the senior author. Because the females in *Aturus* do not show any important taxonomic characters, nor exhibit species-specific features, the description of each species are based only on the males. The drawings were made with the aid of a camera lucida. Fig. 1 shows the localities where the materials were collected.

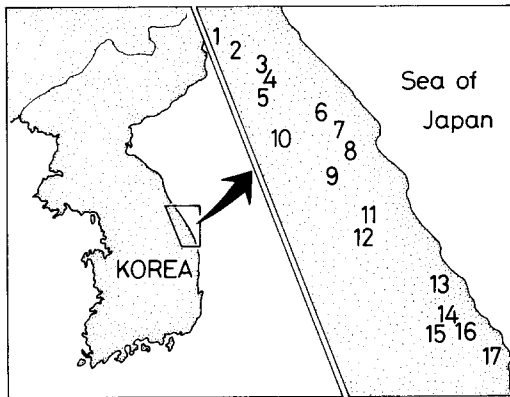


Fig. 1. Sampling localities: 1, Songch'ön (37°50' N, 128°43' E); 2, Sokūmgang (37°49' N, 128°43' E); 3, Sagimak (37°47' N, 128°47' E); 4, Bokwang-ri (37°45' N, 128°47' E); 5, Daekwanryōng (37°41' N, 128°41' E); 6, Danyōng-gol (37°41' N, 128°55' E); 7, Imgok; 8, Ogye (37°37' N, 128°59' E); 9, Sankye-ri (37°37' N, 128°56' E); 10, Daeki-ri (37°35' N, 128°46' E); 11, Dalbang-dong (37°30' N, 129°02' E); 12, Murūnggye (37°28' N, 129°02' E); 13, Ch'odang (37°22' N, 129°12' E); 14, Maip (37°18' N, 129°12' E); 15, Jungmaip (37°15' N, 129°11' E); 16, Kuma-ri (37°16' N, 129°15' E); 17, Imwōn (37°14' N, 129°18' E).

Description

Aturus caudatus Enami, 1940

Aturus caudatus Enami, 1940, p. 249, figs. 39-40; Imamura, 1954, p. 118, figs. 70, 71; 1960, p. 39.

Material examined: Forty-five males from washings of mosses and stones in a stream at Kuma-ri, 14 June 1994; 1 male from washings of stones at Imwōn, 14 June 1994.

Aturus complexus Sokolow, 1934 (Fig. 2)

Aturus complexus: Sokolow, 1940, p. 413, fig. 221a-d.

Material examined: Thirty males from washings of mosses at Sankye-ri, 16 June 1994; 23 males from washings of mosses at Murūnggye, 16 June 1994; 10 males from washings of mosses at Dalbang-dong, 16 June 1994; 1 male from washings of mosses at Ch'odang, 8 December 1994.

Male: Dorsum (Fig. 2A) 375 μm long, and 313 μm wide. Dorsal and ventral shields fused posteriorly. All dorsoglandularia located near lateral sides. First dorsoglandularia with large bifurcate seta. Seta on second dorsoglandularia moderately large. Posterior 3 dorsoglandularia aggregated, each with small seta. Fifth dorsoglandularia located outside of other two on mid-plane between third and fourth dorsoglandularia, without gland. Posterior part of dorsal shield with transverse ridge. Excretory pore positioned just behind this ridge.

First lateroglandularia with large bifurcate seta. Second lateroglandularia located close to third, with large bifurcate seta. Third and fourth lateroglandularia with small seta. Dorsal surface of ventral shield with transverse row of small setae in posterior region, scattered longer setae and more longer marginal setae.

Ventral shield (Fig. 2B) 438 μm long, with 1 ovoid and 1 circular, modified setae on each side of deep median cleft. Genital acetabula 14-16 in number on each side, arranged along posteroventral edge and both sides of median cleft. Dorsal lengths of palpal segments: P-I, 29 μm ; P-II, 58 μm ; P-III, 47 μm ; P-IV, 96 μm ; P-V, 39 μm . Capitulum 93 μm long, excluding apodeme. Chelicera 124 μm long.

Dorsal lengths of segments of third leg (Fig. 2C): III-Leg-1, 50 μm ; III-Leg-2, 85 μm ; III-Leg-3, 88 μm ; III-Leg-4, 133 μm ; III-Leg-5, 155 μm ; III-Leg-6, 150 μm . Fifth segment with 9 stiff, larger setae on distal half of ventral margin.

Dorsal lengths of segments of fourth leg (Fig. 2D): IV-Leg-1, 85 μm ; IV-Leg-2, 110 μm ; IV-Leg-3, 112 μm ; IV-Leg-4, 142 μm ; IV-Leg-5, 170 μm ; IV-Leg-6, 168 μm . Fourth segment with about 10 long setae and 4 ventrodiscal modified setae, 3 of the latter greatly enlarged; proximalmost one of these 4 setae longest, broadened near distal third and then tapering towards tip, with pointed end; second proximal one extremely broadened near base, gradually narrower to distal end, but with blunt tip; smallest third one as in Fig. 2D (indicated by an arrow); distal one relatively straight and distally scalpel-shaped. Fifth segment proximally with about 9 setae, one of which being enlarged and strongly

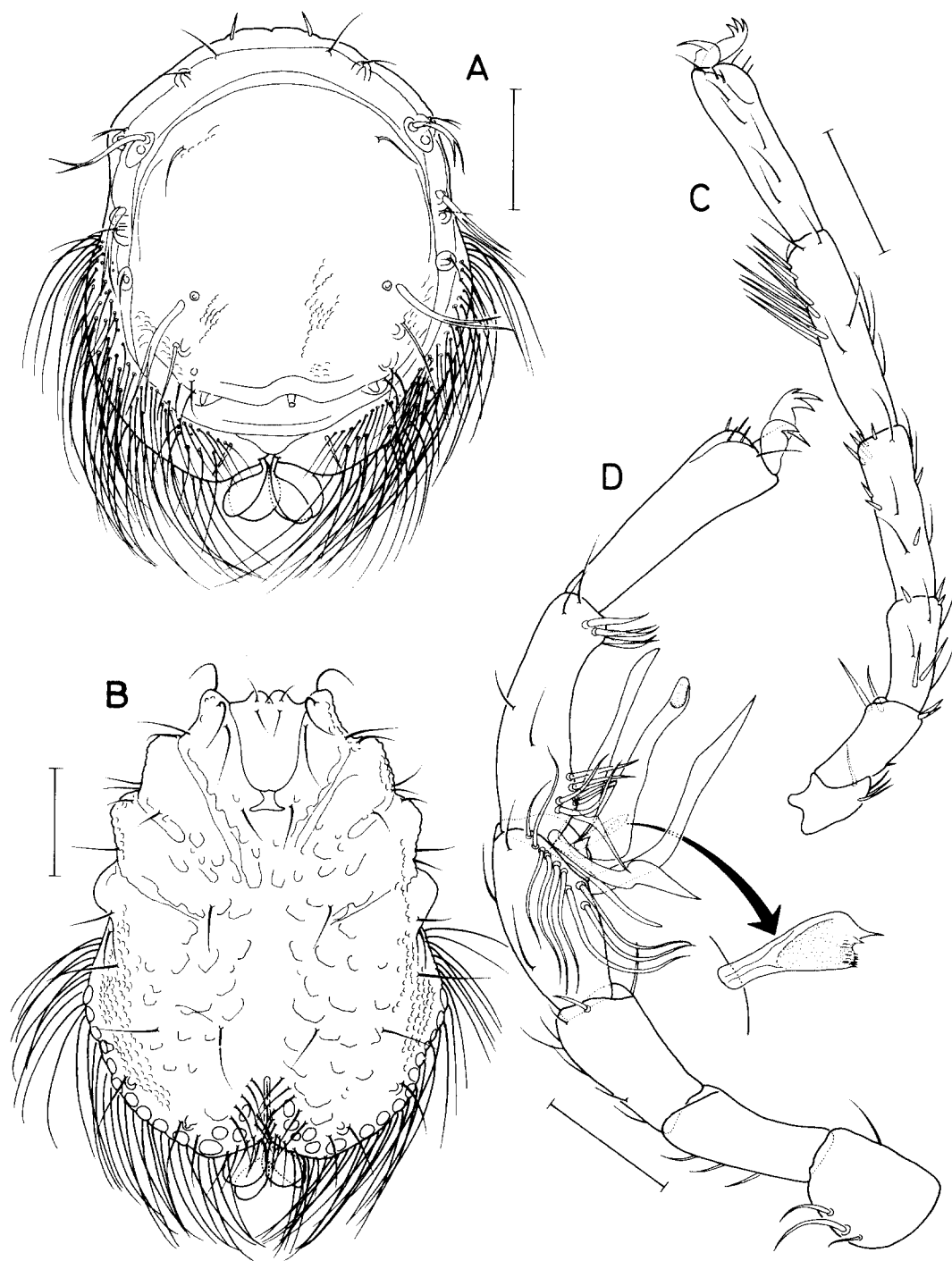


Fig. 2. *Aturus complexus* Sokolow, male: A, dorsum; B, venter; C, third leg; D, fourth leg. Scales: 0.1 mm in all.

curved, and distally with 5 thick setae.

Female: Unidentified.

Remarks: This is the second discovery of *A. complexus*. This species is similar to *A. pilosus* Kim and Chung, 1993, both belonging to "hoplomachus" group of Mitchell (1954), but can be distinguished from it by a transverse ridge located anterior to excretory pore, and by the longer and more slender body. It should be noted that our specimens have a weak posteromedian invagination of body which was not shown in Sokolow's (1940) illustration.

***Aturus glaberus*, n. sp. (Figs. 3 and 8A)**

Type specimens: Holotype male and paratypes (2 intact and 1 dissected males) from washings of mosses and stones at Daekwanryŏng, 29 June 1994.

Other material examined: Two males from washings of stones at Songch'ŏn, 29 June 1994.

Male: Dorsum (Fig. 3A) 344 μm long, and 270 μm wide, with ovoid posterior part. Dorsal shield well delimited from ventral shield, with numerous granules and 5 pairs of dorsoglandularia. Anterior 4 dorsoglandularia complete. Fifth dorsoglandularia without gland. First dorsoglandularia with long, bifurcate, thick seta. Other

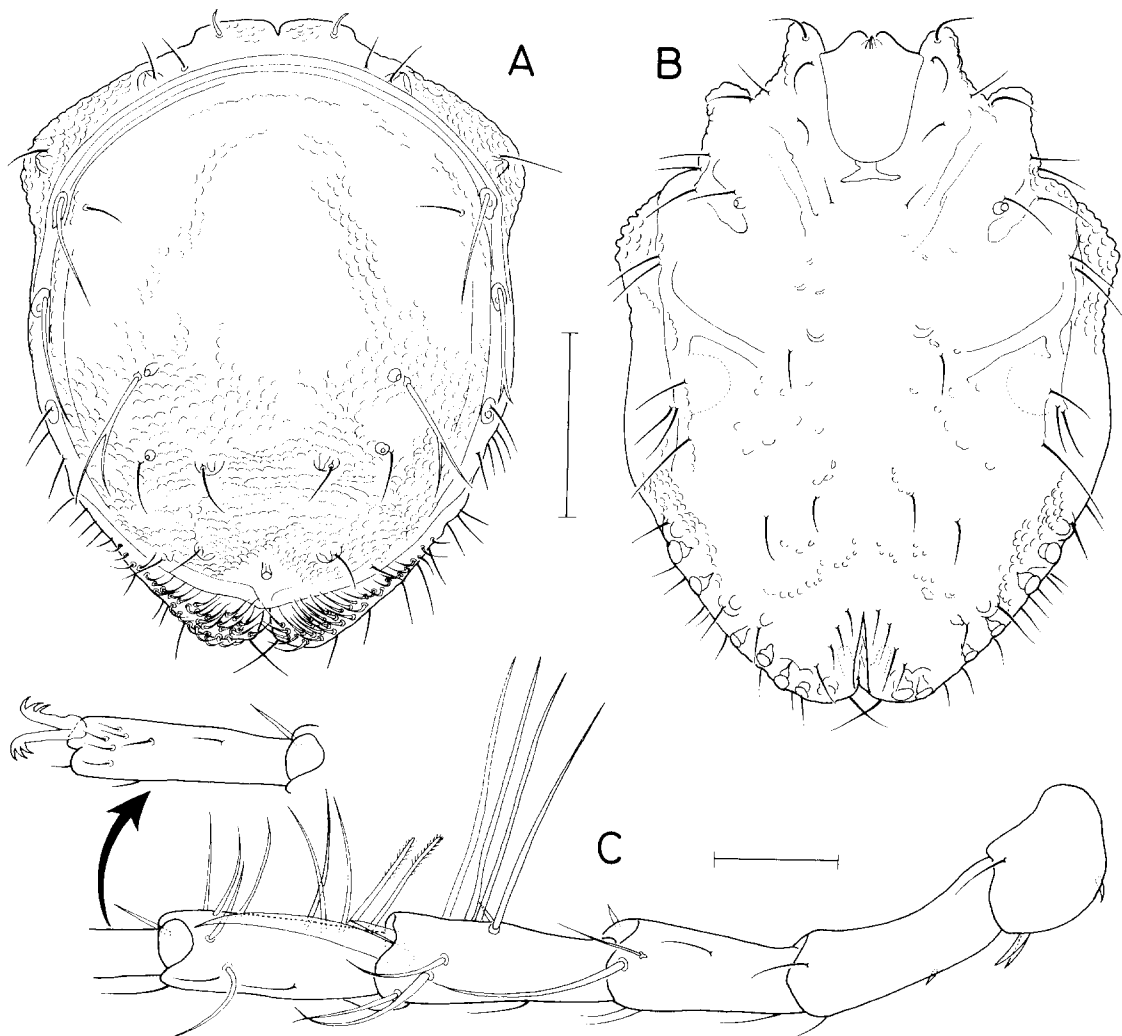


Fig. 3. *Aturus glaberus*, n. sp., male: A, dorsum; B, venter; C, fourth leg. Scales: A, B= 0.1 mm; C= 0.05 mm.

dorsoglandularia with small seta.

Anterior 3 lateroglandularia complete. Fourth lateroglandularia without gland. First lateroglandularia with large seta. Second lateroglandularia with large, simple or bifurcated seta. Other lateroglandularia with small seta. Third lateroglandularia located midway between levels of first and second dorsoglandularia.

Posterior surface of dorsum (= dorsal surface of ventral shield) (Fig. 8A) with scattered, small, stiff setae, median ones of them being thicker, densely clustered and directed forwards.

Ventral shield (Fig. 3B) 374 μm long, with deep median cleft and 6-7 genital acetabula along posterior margin of each side.

Dorsal lengths of palpal segments: P-I, 21 μm ; P-II, 49 μm ; P-III, 34 μm ; P-IV, 59 μm ; P-V, 29 μm . Capitulum 72 μm long, excluding apodeme. Chelicera 102 μm .

Dorsal lengths of segments of third leg: III-Leg-1, 46 μm ; III-Leg-2, 47 μm ; III-Leg-3, 51 μm ; III-Leg-4, 88 μm ; III-Leg-5, 97 μm ; III-Leg-6, 98 μm .

Dorsal lengths of segments of fourth leg (Fig. 3C): IV-Leg-1, 64 μm ; IV-Leg-2, 87 μm ; IV-Leg-3, 78 μm ; IV-Leg-4, 97 μm ; IV-Leg-5, 89 μm ; IV-Leg-6, 87 μm . Third segment with 1 large seta distally. Fourth segment with 1 large, sword-like seta, 1 distinctly shorter but thick seta, a cluster of 4 stiff, long setae on ventral margin, and 3 disterodorsal setae. Fifth segment with 2 feathered and 3 stiff setae proximally, and 6 setae distally.

Female: Unidentified.

Etymology: The specific name *glaberus* is from the Latin *glaber* (without hairs), alluding the relatively less hairy state of the body.

Remarks: The new species is allied to *A. imamurai* Habeeb, 1962 and *A. sankyeriensis*, n. sp. The differences among these species will be discussed in the description of *A. sankyeriensis*.

***Aturus kumariensis* Kim and Chung, 1993**

Aturus kumariensis Kim and Chung, 1993, p. 330, fig. 1D-F.

Material examined: One male from washings of mosses at Kuma-ri, 14 June 1994; 7 males from washings of mosses at Dankyöng-gol, 18 June 1994; 1 male from washings of mosses at Ch'odang, 14 June 1994; 1 male from washings

of mosses at Sankye-ri, 16 June 1994; 1 male from washings of stones at Jungmaip, 14 June 1994.

***Aturus miyashitai* Uchida, 1934 (Fig. 4)**

Aturus miyashitai Uchida, 1934, p. 101, figs. 36-42; Imamura, 1953a, p. 237, fig. 26a-d; 1953b, p. 462, fig. 30a-c; 1954, p. 126, fig. 75a-c; Enami, 1940, p. 244, figs. 34-38.

Material examined: Four males from Sankye-ri, 16 June 1994; 1 male from at Murünggye, 16 June 1994; 1 male from Ch'odang, 7 December 1994; 1 male from Imgok, 18 June 1994. All the specimens were collected from washing of the mosses.

Remarks: Our male specimens reveal a minor difference from the illustrations of Uchida (1934), Enami (1940) and Imamura (1953a) in the shape of setae on the fourth leg. However, in other important characters the specimens are coincide with those of the above Japanese authors. The female of this species was already reported in Korea by Chung and Kim (1991).

***Aturus multiclavus* Kim and Chung, 1993**

Aturus multiclavus Kim and Chung, 1993, 1940, p. 329, fig. 1A-C

Material examined: Five males from washings of mosses at Kuma-ri, 14 June 1994; 1 male from washings of stones at Jungmaip, 14 June 1994.

***Aturus multisetus* Kim and Chung, 1993**

Aturus multisetus Kim and Chung, 1993, p. 332, Fig. 2A-D.

Material examined: Thirty males from washings of mosses at Kuma-ri, 14 June 1994; 2 males from washings of stones at Songch'ön, 29 June 1994; 9 males from washings of stones at Dankyöng-gol, 18 June 1994; 9 males from washings of mosses and stones at Maip, 14 June 1994; 1 male from washings of mosses at Dalbang-dong, 16 June 1994; 1 male from washings of mosses at Murünggye, 16 June 1994; 2 males from washings of mosses at Bokwang-ri, 4 July 1994; 13 males from washings of mosses and stones at Daekwanryöng, 2 October 1994; 2 males from washings of stones at Sagimak, 19 January 1995; 2 males from washings of mosses

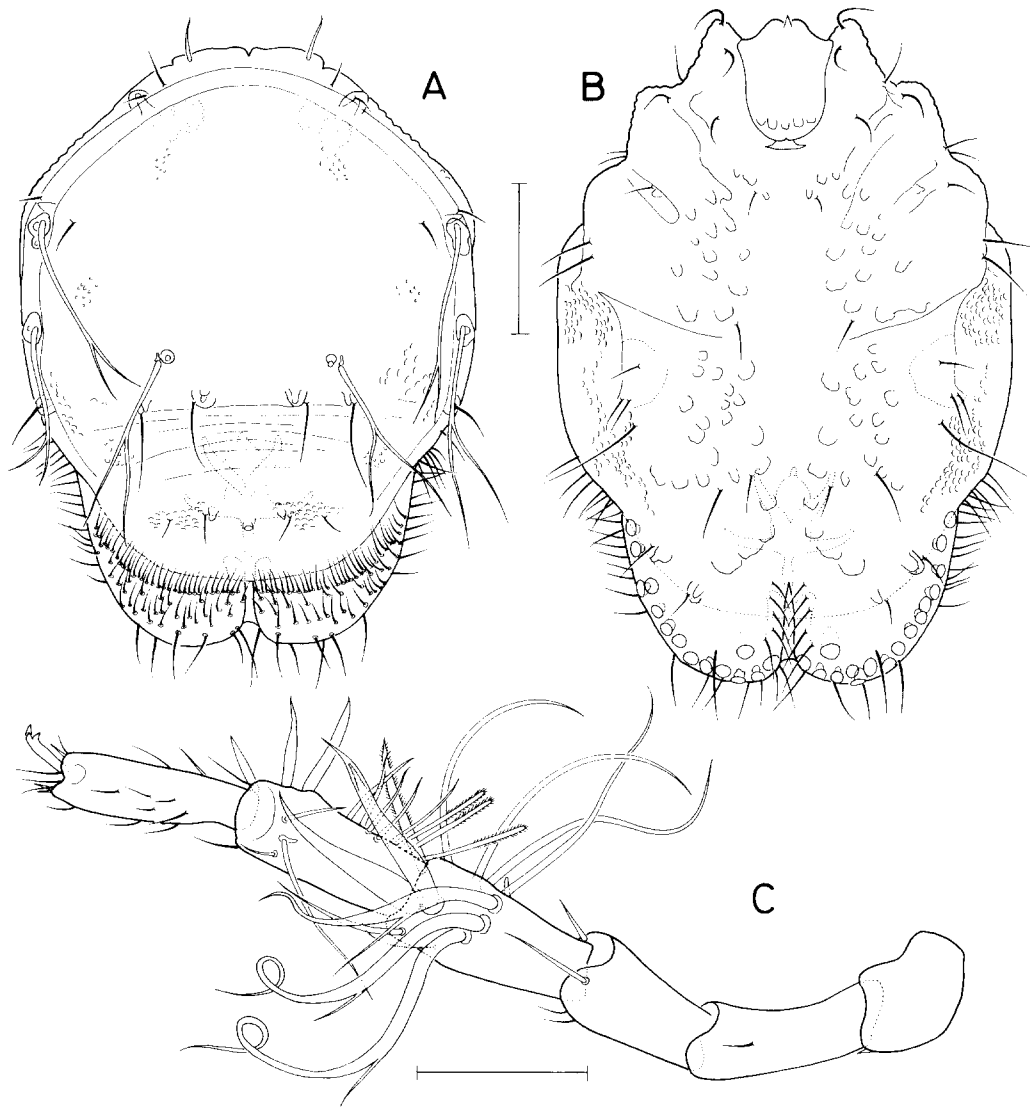


Fig. 4. *Aturus miyashitai* Uchida, male: A, dorsum; B, venter; C, fourth leg. Scales: 0.1 mm in all.

at Sokimgang, 29 June 1994.

***Aturus parapilosus* Kim and Chung, 1993**

Aturus parapilosus Kim and Chung, 1993, p. 335, fig. 4A-D.

Material examined: Twenty-five males from washings of mosses at Kuma-ri, 14 June 1994; 1 male from washings of mosses at Songch'on, 29 June 1994; 15 males from washings of mosses and stones at Maip, 14 June 1994; 1 male from

washing of stones at Jungmaip, 14 June 1994; 5 males from washings of mosses at Munnggye, 16 June 1994; 5 males from washings of mosses at Bokwang-ri, 4 July 1994.

***Aturus paravarus*, n. sp. (Fig. 5)**

Type specimens: Holotype male and paratypes (1 intact and 1 dissected males) from washings of mosses at Sankye-ri on 16 June 1994.

Other material examined: One male from

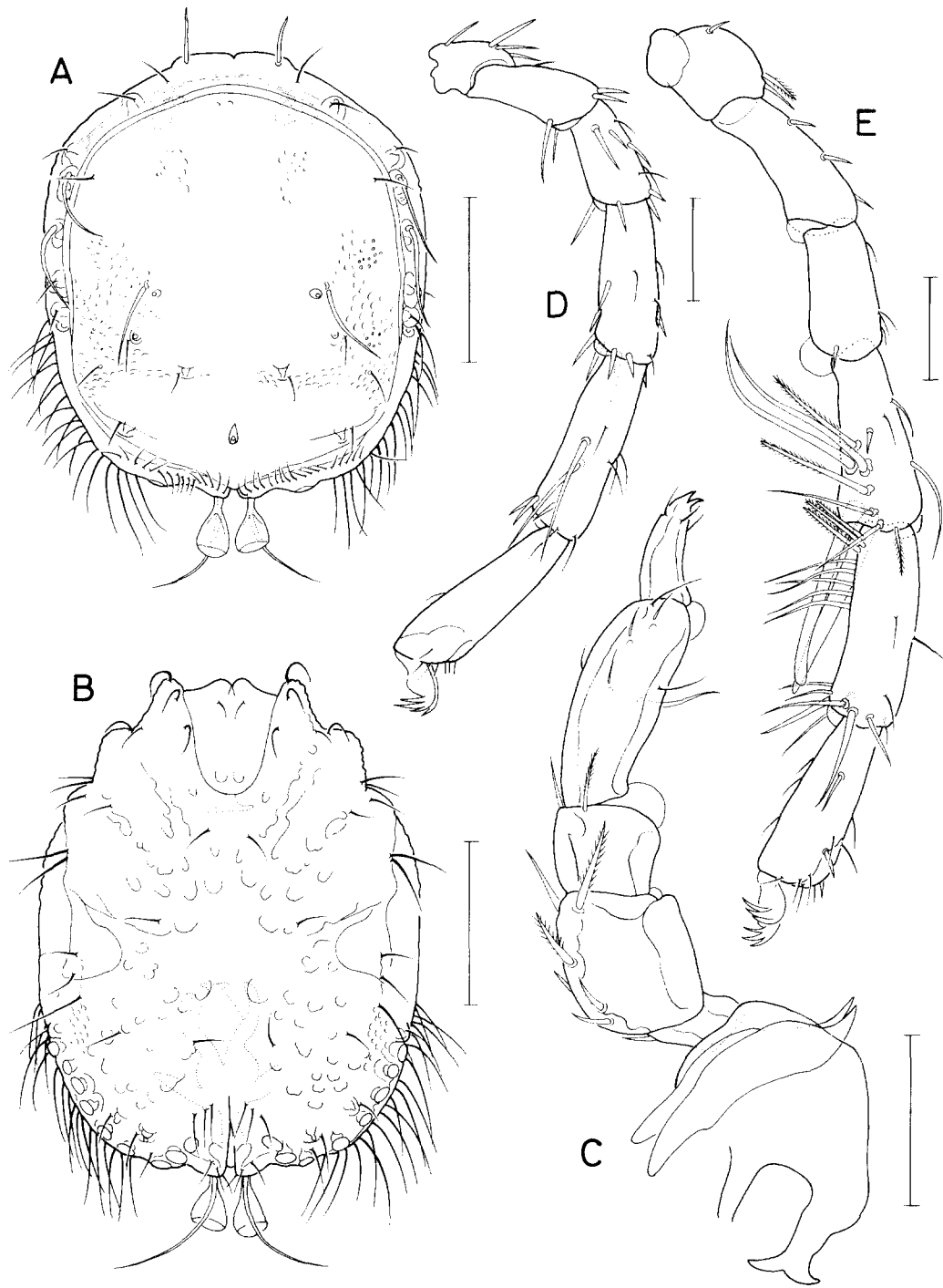


Fig. 5. *Aturus paravarus*, n. sp., male: A, dorsum; B, venter; C, capitulum, chelicera and palp; D, third leg; E, fourth leg. Scales: A, B= 0.1 mm; C-E= 0.05 mm.

washings of mosses at Ch'odang on 7 December 1994; 1 male from washings of mosses at Sagimak, 17 January 1995.

Male: Dorsum (Fig. 5A) 328 μm long, and 274 μm wide. Dorsal shield well defined from ventral shield, with 5 pairs of dorsoglandularia. Anterior 4 dorsoglandularia complete. First dorsoglandularia with large seta. Setae on other dorsoglandularia small. Fifth dorsoglandularia without gland, positioned in same level of third lateroglandularia.

First and second lateroglandularia each with large seta. Third and fourth lateroglandularia neighboring, each with small seta. Third lateroglandularia located in same level of first dorsoglandularia.

Posterior surface of ventral shield with transverse row of small setae; posterolateral margin with 18-21, moderately long setae.

Ventral shield (Fig. 5B) 366 μm long, with deep median cleft, and 1 spatulate, modified seta and 1 unmodified but enlarged seta on each side near median cleft. Genital acetabula 8-9 in number on each side.

Palp as Fig. 5C. Dorsal lengths of palpal segments: P-I, 20 μm ; P-II, 47 μm ; P-III, 25 μm ; P-IV, 65 μm ; P-V, 35 μm . Capitulum 85 μm , excluding apodeme. Chelicera 78 μm long.

Dorsal lengths of segments of third leg (Fig. 5D): III-Leg-1, 51 μm ; III-Leg-2, 72 μm ; III-Leg-3, 64 μm ; III-Leg-4, 98 μm ; III-Leg-5, 114 μm ; III-Leg-6, 120 μm . Fifth segment with 1-2 stiff setae distally.

Dorsal lengths of segments of fourth leg (Fig. 5E): IV-Leg-1, 68 μm ; IV-Leg-2, 90 μm ; IV-Leg-3, 76 μm ; IV-Leg-4, 105 μm ; IV-Leg-5, 120 μm ; IV-Leg-6, 106 μm . Fourth segment with 2 enlarged setae on ventrodistal corner, and 4 stiff and 3 feathered setae. Fifth segment proximally with 3 feathered and 5 stiff setae on proximal half, and with 7 stiff distal setae.

Female: Unidentified.

Etymology: The specific name *paravarus* derived from the similarity ("par" in Latin means "similar") to *A. varus* in having two kinds of modified setae near genital cleft.

Remarks: As a diagnostic character, this species has 1 spatulate and 1 large, unmodified setae near median cleft. This character is shared only with

Aturus varus Habeeb, 1954. However, *A. paravarus*, n. sp. is easily distinguished from *A. varus* because the latter species carries fewer and shorter setae on the posterior margin of body, and very different chaetotaxy on the third and fourth legs.

***Aturus pilosus* Kim and Chung, 1993**

Aturus pilosus Kim and Chung, 1993, p. 333, fig. 3A-E.

Material examined: Forty males from Kuma-ri, 14 June 1994; 10 males from Ogkye, 16 June 1994; 14 males from washings of mosses and stones at Matip, 14 June 1994; 3 males from washings of stones at Jungmatip, 14 June 1994; 16 males from washings of mosses and stones at Dankyong-gol, 18 June 1994.

***Aturus quadratus*, n. sp. (Fig. 6)**

Type specimens: Holotype male and paratypes (6 intact and 2 dissected males) from washings of mosses at Daekwanryong, on 29 June 1994.

Other material examined: Three males from washings of mosses at type locality, 2 October 1994; 1 male from washings of stones at Daeki-ri, November 1993.

Male: Dorsum (Fig. 6A) quadrate, 270 μm long, and 255 μm wide. Dorsal shield concave at posterolateral sides, well defined from ventral shield, completely covering ventral shield near median cleft, with 5 dorsoglandularia. Anterior 4 dorsoglandularia complete. Fifth dorsoglandularia without gland. Second dorsoglandularia positioned laterally close to fourth lateroglandularia. First dorsoglandularia with large seta. Setae on other dorsoglandularia small.

First and second lateroglandularia with large seta. Third and fourth lateroglandularia with small seta.

Dorsal surface of ventral shield with transverse row of small setae near posterior margin, a number of large setae on posterolateral surface, and approximately 8, more larger setae on each posterolateral margin, as in Fig. 6A. These setae turned up on dorsal shield when the animal is alive.

Ventral shield (Fig. 6B) 318 μm long, with deep median cleft, and 6-7 genital acetabula along on

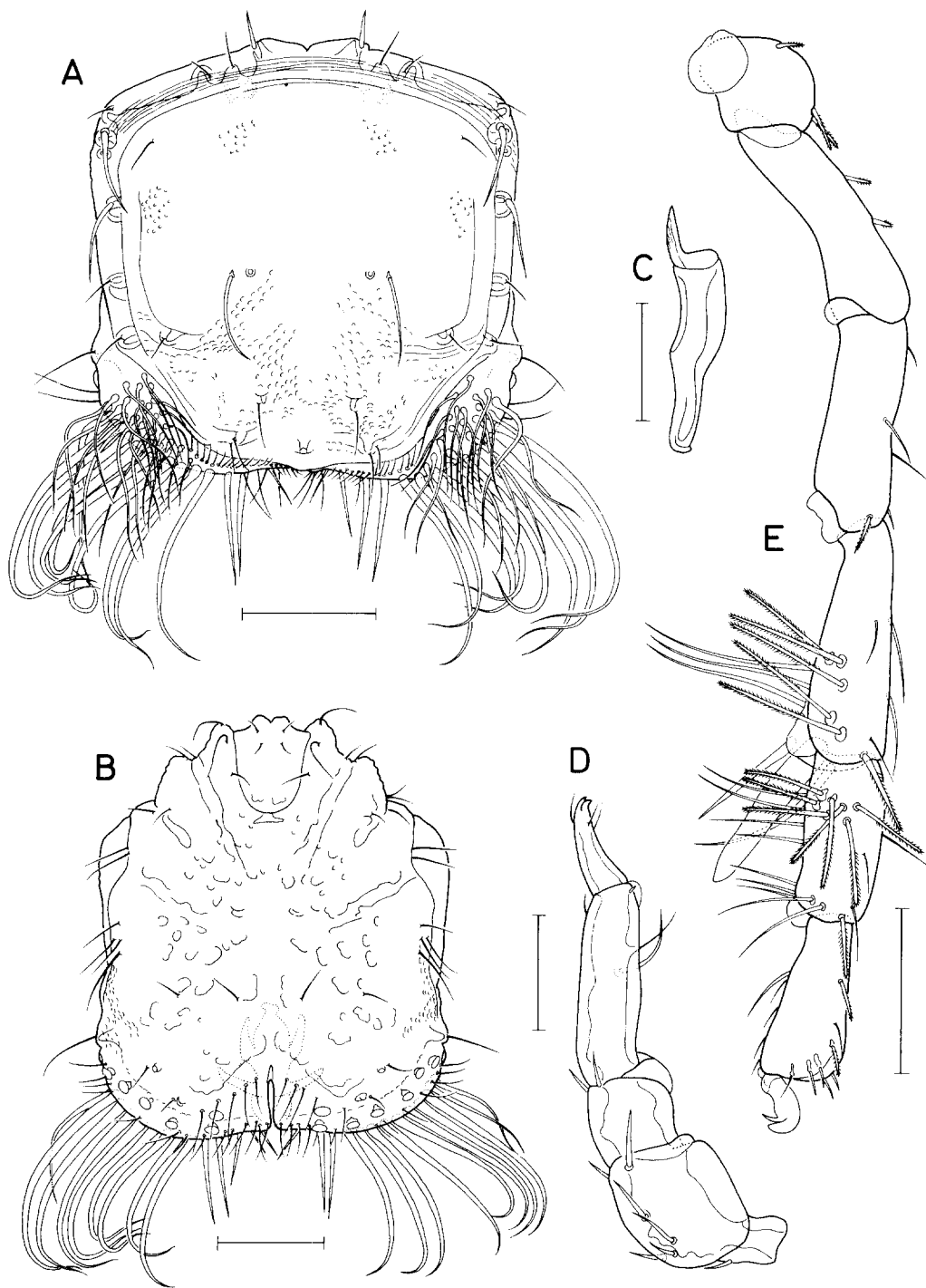


Fig. 6. *Aturus quadratus*, n. sp., male: A, dorsum; B, venter; C, chelicera; D, palp; E, fourth leg. Scales: A, B, E= 0.1 mm; C, D= 0.05 mm.

each side of posterior margin.

Dorsal lengths of segments of palp (Fig. 6D): P-I, 25 μm ; P-II, 60 μm ; P-III, 36 μm ; P-IV, 82 μm ; P-V, 42 μm . Capitulum 74 μm long, excluding apodeme. Chelicera (Fig. 6C) 110 μm long.

Dorsal lengths of segments of third leg: III-Leg-1, 50 μm ; III-Leg-2, 75 μm ; III-Leg-3, 70 μm ; III-Leg-4, 110 μm ; III-Leg-5, 120 μm ; III-Leg-6, 115 μm .

Dorsal lengths segments of fourth leg (Fig. 6E): IV-Leg-1, 78 μm ; IV-Leg-2, 128 μm ; IV-Leg-3, 122 μm ; IV-Leg-4, 146 μm ; IV-Leg-5, 100 μm ; IV-Leg-6, 100 μm . Fourth segment with 1 enlarged, blade-shaped seta near ventrodistal corner, and 6 feathered and 5 plain setae. Fifth

segment with 7 feathered and 4 plain setae, and distally with 1 feathered and 5 simple setae.

Female: Unidentified.

Etymology: The specific name *quadratus* (*quadra* in Latin means a square) derived from the quadrate body of the new species.

Remarks: The new species resembles *A. crinitus* Thor, 1902 and *A. spatulifer* Piersig, 1904 in the respects that they have quadrate body and large setae near posterolateral corners. The latter two species were clearly illustrated by Viets (1936) and Szalay (1964), respectively. *A. quadratus* can be differentiated from these two species by the following ways: 1) The large posterolateral setae of the new species are about 8 in number, but they

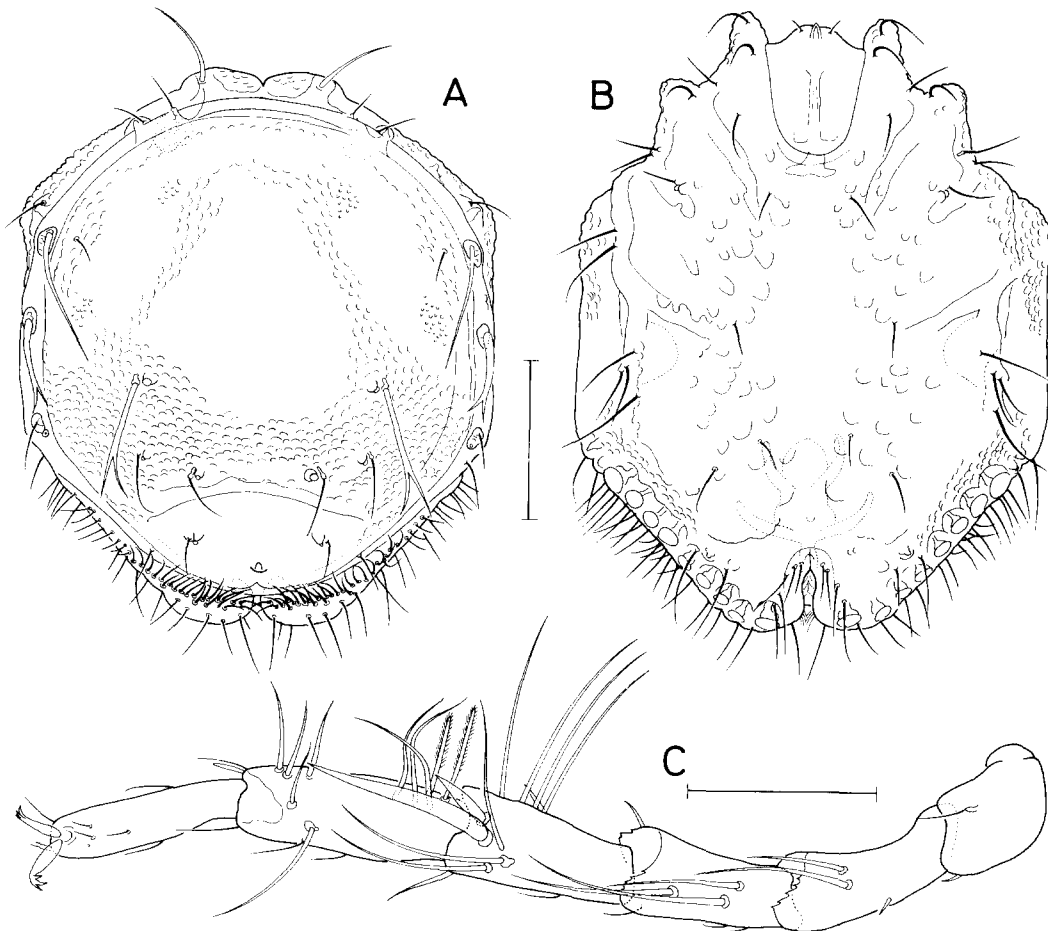


Fig. 7. *Aturus sankyeriensis*, n. sp., male: A, dorsum; B, venter; C, fourth leg. Scales: 0.1 mm in all.

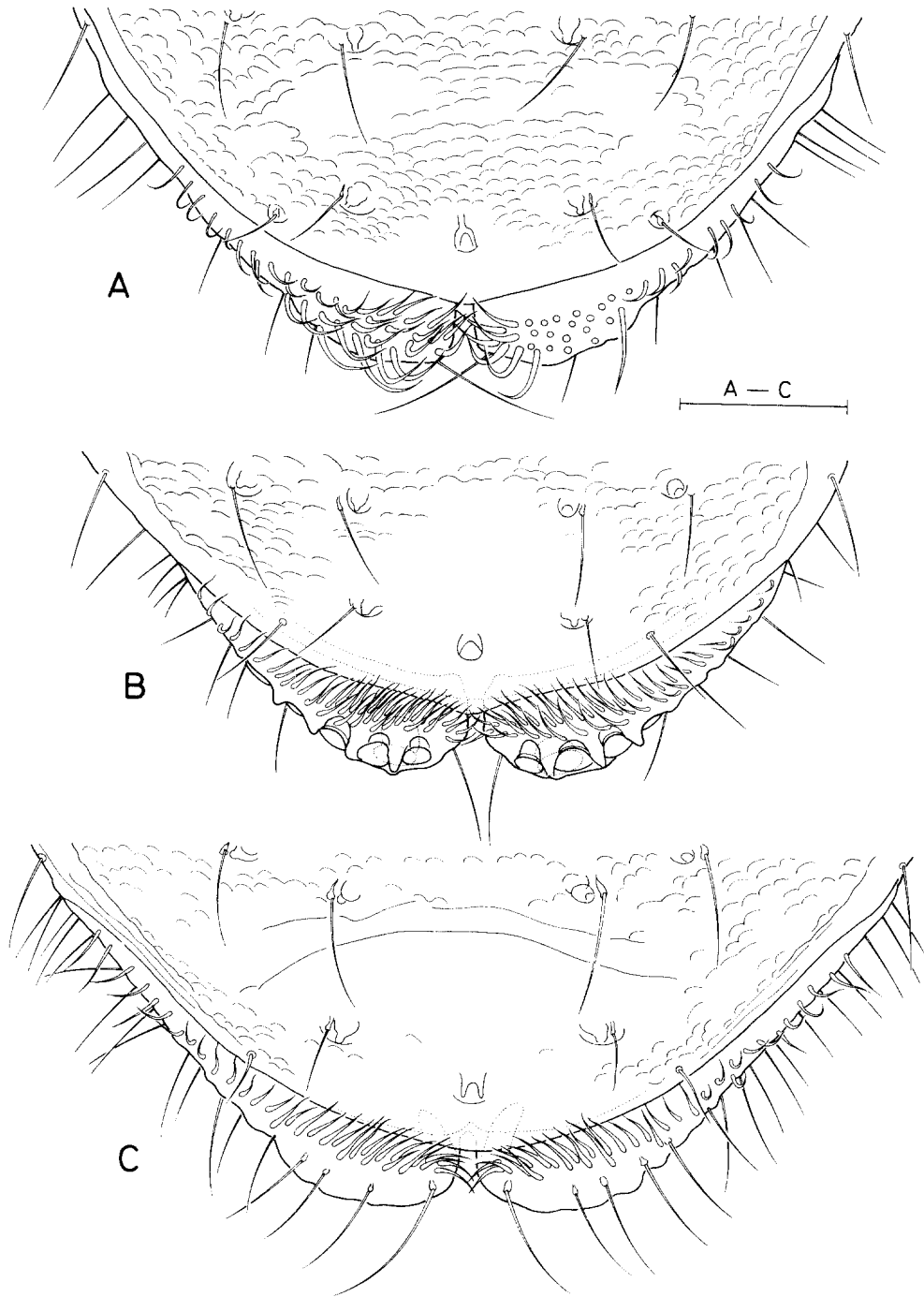


Fig. 8. Posterodorsal part of body of *A. glaberus* (A), *A. terraconfusensis* (B), and *A. sankyeriensis* (C). Scales: 0.05 mm in all.

are 3 in *A. spatulifer* or numerous in *A. crinitus*. 2) The new species has no enlarged or modified setae near median cleft, but at the same region there are paddle-like modified setae in *A. spatulifer* or chisel-like setae in *A. crinitus*. 3) The new species has more laterally positioned second dorsoglandularia than in *A. spatulifer*, and has distinctly defined dorsal and ventral shields which are indistinctly delimited in *A. crinitus*.

In the chaetotaxy of the fourth leg, the new species is characteristic in bearing unusually increased number of feathered setae on the fourth and fifth segments. The increased number of the feathered setae on the fifth segment in particular is remarkable when one consider that most species of *Aturus* bear no modified setae near median cleft and carry fewer, simple setae on the fourth and fifth segments of the fourth leg.

***Aturus sankyeriensis*, n. sp. (Figs. 7 and 8C)**

Type specimens: Holotype male and paratypes (4 intact and 1 dissected males) from washings of mosses in a stream at Sankye-ri, on 16 June 1994.

Male: Dorsum (Fig. 7A) 350 μm long, and 292 μm wide. Dorsal and ventral shields well delimited from each other. Dorsal shield with numerous granules on surface and slightly arched transverse lines (anterior one indistinct) between third and fourth dorsoglandularia; this lines often absent depending on specimens. Anterior 4 dorsoglandularia complete. Fifth dorsoglandularia

without gland. First dorsoglandularia with large bifurcate seta. Other dorsoglandularia with small seta.

Anterior 3 lateroglandularia complete. Fourth lateroglandularia without gland. First lateroglandularia with large seta. Second lateroglandularia with large bifurcate seta. Third lateroglandularia located midway of levels between first and second dorsoglandularia.

Dorsal surface of ventral shield (Fig. 8C) with transverse row of small setae, and on posterior margin with several small setae.

Ventral shield (Fig. 7B) 390 μm long, with deep median cleft, and with 8-9 genital acetabula along posterior margin of each side.

Dorsal lengths of palpal segments: P-I, 23 μm ; P-II, 49 μm ; P-III, 35 μm ; P-IV, 65 μm ; P-V, 34 μm . Capitulum 80 μm long, excluding apodeme.

Dorsal lengths of segments third leg: III-Leg-1, 50 μm ; III-Leg-2, 70 μm ; III-Leg-3, 64 μm ; III-Leg-4, 92 μm ; III-Leg-5, 114 μm ; III-Leg-6, 114 μm .

Dorsal lengths of segments of fourth leg (Fig. 7C): IV-Leg-1, 72 μm ; IV-Leg-2, 94 μm ; IV-Leg-3, 86 μm ; IV-Leg-4, 96 μm ; IV-Leg-5, 112 μm ; IV-Leg-6, 100 μm . Second segment with 2 large setae ventrodistally. Third segment with 3 large thick setae near ventral margin. Fourth segment with 1 large, sword-like seta, 1 distinctly shorter but thick seta, a cluster of 4 stiff, long setae on ventral margin, and with 3 disterodorsal setae. Fifth segment with 2 feathered and 3 stiff setae proximally, and 6 setae distally.

Table 1. A comparison of *Aturus imamurai* Habeeb, *A. sankyeriensis* n. sp. and *A. glaberus*, n. sp. (DG: dorsoglandularia; LG: lateroglandularia).

Species	Location of DG II & III	Large setae of 4th leg		Number of acetabula	Seta on LG II	Posterior part of body
		2nd seg.	3rd seg.			
<i>A. imamurai</i> 1) Habeeb	anterior to LG III	unknown	none	6-7	simple	rounded
<i>A. glaberus</i> n. sp.	posterior to LG III	none	1	6-7	bifurcate	conic
<i>A. sankyeriensis</i> n. sp.	posterior to LG III	2	3	8-9	bifurcate	sub-conic

1) *A. imamurai* is based on Imamura (1961) who named it at first as *A. semilineatus*.

Female: Unidentified.

Etymology: The specific name is derived from the type locality, Sankye-ri.

Remarks: *A. sankyeriensis*, n. sp. is similar to *A. glaberus*, n. sp. and *A. imamurai* Habeeb, 1962, all of which being the members of “*desquamatus*” group of Mitchell (1954), in the body shape, and in the shape of posterodorsal surface of ventral shield in particular (dorsal surface of genital field). A careful comparison of these species allows them to be differentiated as in

Table 1.

***Aturus terraconfusensis* Habeeb, 1965 (Figs. 8B and 9)**

Aturus terraconfusensis Habeeb, 1965, p. 4, figs. 15, 16.

Material examined: Four males from Ch'odang, 14 June 1994; 4 males from Dankyöng-gol, 18 June 1994; 1 male from Sankye-ri, 4 December 1994. All the specimens were collected from washings of mosses.

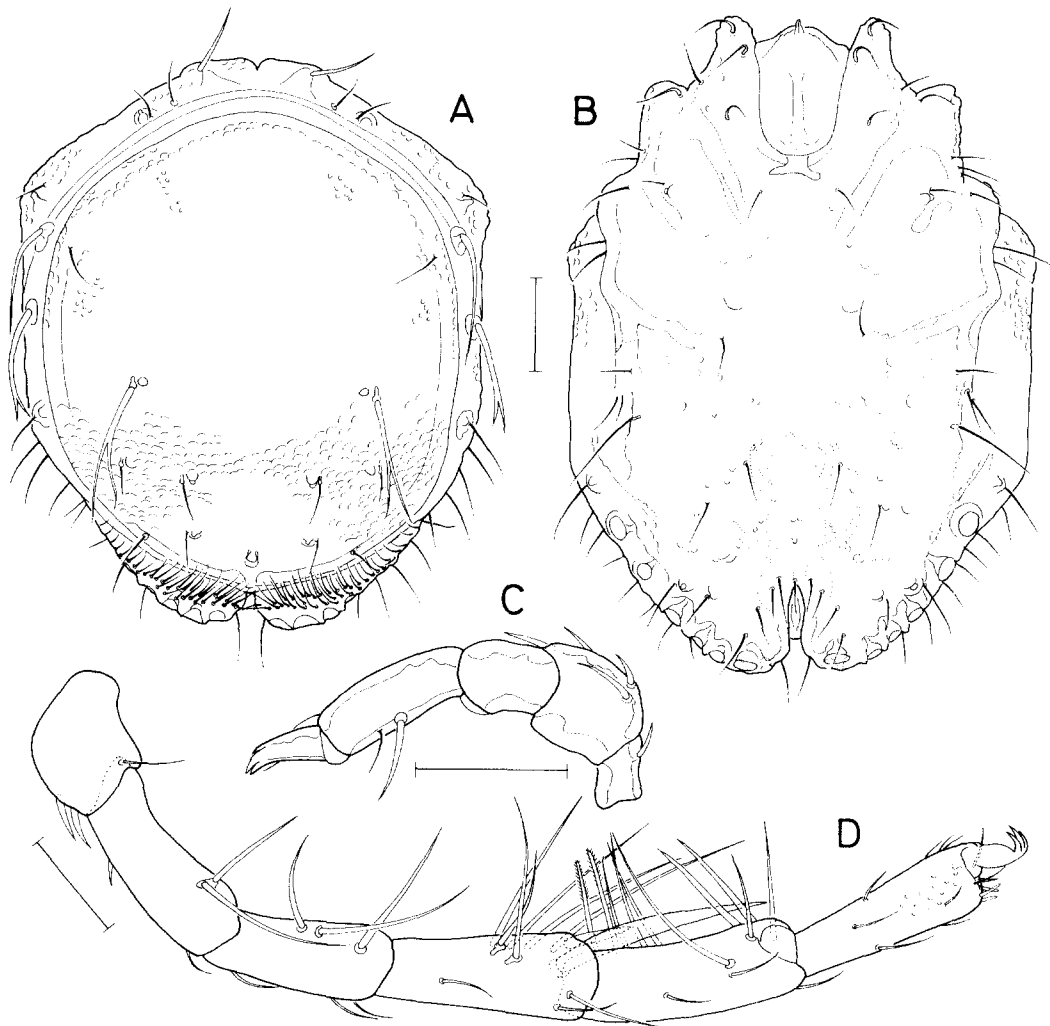


Fig. 9. *Aturus terraconfusensis* Habeeb, male: A, dorsum; B, venter; C, palp; D, fourth leg. Scales: 0.05 mm in all.

Male: Dorsum (Fig. 9A) 306 μm long, and 250 μm wide. Dorsal shield well defined from ventral shield, with numerous granules on surface, and with 5 pairs of dorsoglandularia. Anterior 4 dorsoglandularia complete. Fifth dorsoglandularia without gland. First dorsoglandularia with elongate, thick, bifurcate seta. Other dorsoglandularia with small seta.

Anterior 3 lateroglandularia complete. Fourth lateroglandularia without gland. First lateroglandularia with large seta. Second lateroglandularia with large bifurcate seta. Setae on other lateroglandularia small. Third lateroglandularia located in midway levels between first and second dorsoglandularia.

Dorsal surface of ventral shield (Fig. 8B) with many small setae. Ventral shield (Fig. 9B) 350 μm , with deep median cleft.

Genital acetabula 8 in number, with 2 of them completely exposed from dorsal view, 4 located on ventral side, and remaining 2 partly exposed from both dorsal and ventral views.

Dorsal lengths of segments of palp (Fig. 9C): P-I, 21 μm ; P-II, 43 μm ; P-III, 33 μm ; P-IV, 54 μm ; P-V, 28 μm . Capitulum 70 μm long, excluding apodeme. Chelicera 99 μm long.

Dorsal lengths of segments of third leg: III-Leg-1, 40 μm ; III-Leg-2, 40 μm ; III-Leg-3, 42 μm ; III-Leg-4, 80 μm ; III-Leg-5, 93 μm ; III-Leg-6, 94 μm .

Dorsal lengths of segments of fourth leg (Fig. 9D): IV-Leg-1, 63 μm ; IV-Leg-2, 80 μm ; IV-Leg-3, 78 μm ; IV-Leg-4, 90 μm ; IV-Leg-5, 93 μm ; IV-Leg-6, 94 μm . Second segment with 2 large setae ventrodistally. Third segment with 3 large, thick setae near ventral margin. Fourth and fifth segments armed as in the preceding species, *A. sankyeriensis*, n. sp.

Female: Unidentified.

Remarks: This is the second record of the species since the original description and the first record outside the North America. Our specimens are identified with *A. terraconfusensis* Habeeb, because they and the Habeeb's specimens have dorsally exposed acetabula, and the identical chaetotaxy of fourth leg, the identical arrangement of dorsoglandularia and the similar body size. Only the noticeable difference is the number of acetabula which is 8 in Korean specimens, but is 6

in the Habeeb's (1965) specimen. We do not consider this difference taxonomically important.

***Aturus trifurcatus*, n. sp. (Fig. 10)**

Type specimens: Holotype male and paratypes (70 intact and 5 dissected males) from washings of mosses in a stream of limewater at Ch'odang, 14 June 1994.

Other material examined: Forty males from a stream at type locality, 29 May 1994; 30 males from the same locality, 7 December 1994; 9 males from Sankye-ri, 4 December 1994; 5 males from Ogkye, 16 June 1994; 3 males from Dankyŏng-gol, 18 June 1994. Specimens were all from washings of mosses soaked in streams.

Male: Dorsum (Fig. 10A) 320 μm long. Maximum width 292 μm measured at level of posterior one-fifth of body length. Dorsal shield well defined from ventral shield, with 5 pairs of dorsoglandularia. Anterior 4 dorsoglandularia complete but fifth one without gland. First dorsoglandularia with large trifurcate seta. Setae on other dorsoglandularia small.

First lateroglandularia with large seta. Second lateroglandularia with rather long, thick, distally bifurcated seta. Third and fourth lateroglandularia neighboring, each with small seta. Third lateroglandularia located in same level of first dorsoglandularia.

Dorsal surface of ventral shield with transverse row of small setae near posterior margin of dorsal shield, and with numerous, thick, but variously long setae along posterior margin, of which about 7-10 posterolateral ones and 5 posterior ones on each side near median cleft distinctly larger. When the animal is alive, these setae of posterior and posterolateral margins turned up on dorsal shield. Ventral shield (Fig. 10B) 370 μm long, posteriorly with deep median cleft and 9-11 genital acetabula on each side.

Dorsal lengths of palpal segments: P-I, 24 μm ; P-II, 49 μm ; P-III, 32 μm ; P-IV, 76 μm ; P-V, 34 μm . Capitulum 76 μm long, excluding apodeme. Chelicera 102 μm long.

Dorsal lengths of segments of third leg (Fig. 10C): III-Leg-1, 54 μm ; III-Leg-2, 60 μm ; III-Leg-3, 78 μm ; III-Leg-4, 112 μm ; III-Leg-5, 126 μm ; III-Leg-6, 104 μm . Fifth segment with 12 stiff

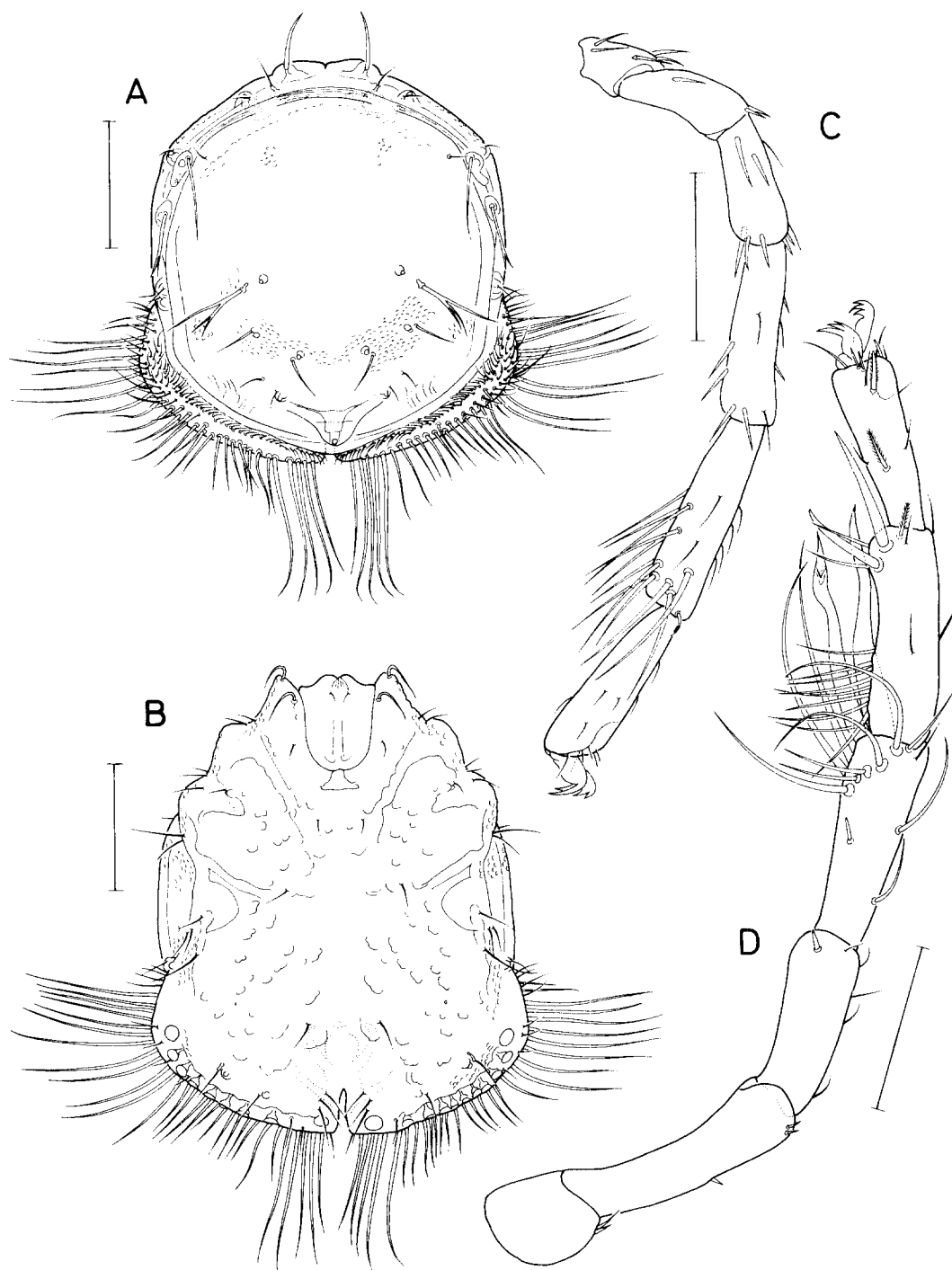


Fig. 10. *Aturus trifurcatus*, n. sp., male: A, dorsum; B, venter; C, third leg; D, fourth leg. Scales: 0.1 mm in all.

setae on distal half of the segment.

Dorsal lengths of segments of fourth leg (Fig. 10D): IV-Leg-1, 62 μm ; IV-Leg-2, 131 μm ; IV-Leg-3, 105 μm ; IV-Leg-4, 131 μm ; IV-Leg-5, 132 μm ; IV-Leg-6, 108 μm . Fourth segment with 2 enlarged setae near ventrodial corner, and distally with 8 thick setae of various lengths. Fifth segment with 9 setae on proximo-ventral margin, and with 5 thick setae, smaller one of which feathered.

Female: Unidentified.

Etymology: The specific name *trifurcatus* alludes the seta of the first dorsoglandularia which is trifurcate.

Remarks: The new species is most related to *Aturus helior* Habeeb, 1973. In both species the dorsal and ventral shields are clearly delimited. According to Habeeb's (1973) Fig. 2, *A. helior* has, like the new species, larger setae on posterolateral and posteromedian margins which seem the unique feature of the two species. The differences of the new species from *A. helior* are that the seta of first dorsoglandularia is trifurcate (bifurcate in *A. helior*) and the posterior part of body is wider (it is narrower and tapering in *A. helior*).

***Aturus vietsi* Imamura and Nagatsuka, 1983**

Aturus vietsi Imamura and Nagatsuka, 1983, p. 233, figs. 4, 5; Chung and Kim, 1991, p. 77, figs. 9G-I, 10A.

Material examined: One male from washings of mosses at Dalbang-dong, 16 June 1994.

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한국 영동 지방의 *Aturus* 속의 물진드기

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영동 지방에 서식하는 *Aturus* 속의 물진드기 15종을 기록하였다. 이 중에서 *Aturus glaberus*, *A. paravarus*, *A. quadratus*, *A. sankyeriensis*, *A. trifurcatus*는 신종으로 기재하였다. *A. complexus* Sokolow와 *A. terraconfusensis* Habeeb 도 재기재하였는데 이 두 종은 각각 러시아와 북아메리카에서 한 차례만 기록된 적이 있다.