

# Water Mites of the Genus *Aturus* (Acarina: Aturidae) in Korea

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**Eight species of the water mites of the genus *Aturus* are described from Korea. Five are new to science, and these are: *A. multiclavus* n. sp., *A. kumariensis* n. sp., *A. multisetus* n. sp., *A. pilosus* n. sp. and *A. parapilosus* n. sp. In addition, *A. caudatus* and *A. miyazakii* are reported for the first time from this country. One unnamed species is also included. All the species are described on the basis of males.**

**KEY WORDS:** Hydracarina, *Aturus*, new species, Korea

Although over 5,000 species of water mites are currently recognized worldwide (Smith & Cook, 1991), Korean materials have begun to be reported very recently. Chung & Kim (1991) recorded first Korean water mites. They reported 18 named species from south Korea, including three species of *Aturus*. Since then the authors have been engaged in collecting these animals from various regions of this country, chiefly from mountainous streams.

The water mites of the genus *Aturus* inhabit mainly in streams (Mitchell, 1954), and more than 120 species or subspecies are currently known in this genus (Viets, 1987). Many of them were incompletely described, with some of them described on the basis of females which bear less important taxonomic characters.

The materials dealt with in the present paper have been collected by the present authors from streams in several locations of Korea. They are from washings of mosses and stones in water. Materials sorted under a dissecting microscope were preserved in Koenike's fluid (as Cook, 1974). Dissections and observations were done using the wooden slide method (Humes & Gooding, 1964) with soaking in lactic acid. Undisseminated, 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. Dissected paratypes were mounted in polyvinyl lactophenol, and retained in the collection of the senior author. In the description, only males were dealt with; females were ignored in taxonomic treatment due to their poor taxonomical significance and the uncertainty in recognizing their male counterparts, although the number of females in each collection usually exceeds that of males. Descriptions were mainly focused on the morphology of body, and the third and fourth legs. It should be noted that one of the collection sites was found to be inhabited by seven species, including five new species. This site was selected as type locality of all the new species described. Terminology adopted is that of Mitchell (1954). All drawings were made with the aid of a camera lucida.

## Description

***Aturus multiclavus*, n. sp. (Fig. 1A-C)**

**TYPE MATERIALS:** Holotype (male) and paratypes (9 intact and 2 dissected males) from

washings of mosses in a stream at Kumari, Samchok-gun, Kangwon-do (37° 16' N, 129°15' E), on 24 October 1992.

**OTHER MATERIAL EXAMINED:** 5 males from washings of mosses at type locality, on 25 May 1992; 11 males from washings of stones in a stream at Sungsan near Kangreung (37°42' N, 128°49' E), on 10 May 1990.

**MALE:** Body (Fig. 1A) 282  $\mu\text{m}$  long, and 232  $\mu\text{m}$  wide. Dorsal and ventral shields fused posteriorly. Dorsal shield with 5 pairs of dorsoglandularia, anterior 3 of which neighboring, forming triangle. Anterior 4 dorsoglandularia complete. Fifth dorsoglandularia without gland. First dorsoglandularia with long, thick seta. Second to fourth dorsoglandularia with small seta. Dorsal furrow bearing 4 pairs of lateroglandularia. Distance between second and third lateroglandularia about 1.5 times longer than that between first and second lateroglandularia. Third and fourth lateroglandularia neighboring, each with small seta. First and second lateroglandularia with long, thick seta. Posterior end of dorsum with narrow but deep median cleft. Posterior margin of dorsum with transverse row of 6-7 setules and 26-28 peg-like setae. Ventral shield 325  $\mu\text{m}$  long, with 9-10 genital acetabula along posterior edge behind fourth lateroglandularia on each side. Dorsal lengths of palpal segment: P-I, 21  $\mu\text{m}$ ; P-II, 51  $\mu\text{m}$ ; P-III, 26  $\mu\text{m}$ ; P-IV, 63  $\mu\text{m}$ ; P-V, 30  $\mu\text{m}$ . Capitulum 78  $\mu\text{m}$  long. Chelicera 88  $\mu\text{m}$  long. Dorsal lengths of third to sixth segments of third leg: III-Leg-3, 52  $\mu\text{m}$ ; III-Leg-4, 75  $\mu\text{m}$ ; III-Leg-5, 97  $\mu\text{m}$ ; III-Leg-6, 98  $\mu\text{m}$ . Fourth leg (Fig. 1C) rather short and stocky, with dorsal lengths of segments: IV-Leg-1, 62  $\mu\text{m}$ ; IV-Leg-2, 71  $\mu\text{m}$ ; IV-Leg-3, 58  $\mu\text{m}$ ; IV-Leg-4, 64  $\mu\text{m}$ ; IV-Leg-5, 98  $\mu\text{m}$ ; IV-Leg-6, 74  $\mu\text{m}$ . IV-Leg-4 with 1 lanceolate and 1 club-shaped setae (both setae about as long as fourth segment) on ventrodistal corner, and subterminally 7 stiff setae. IV-Leg-5 with 6 stiff, smaller, proximal setae and 6 stiff, distal setae.

**FEMALE:** Unidentified.

**ETYMOLOGY:** The specific name, *multiclavus*, is derived from Latin, *multi* (=many) and *clavus* (=peg). It alludes the presence of a number of peg-like setae on the posterior part of the body.

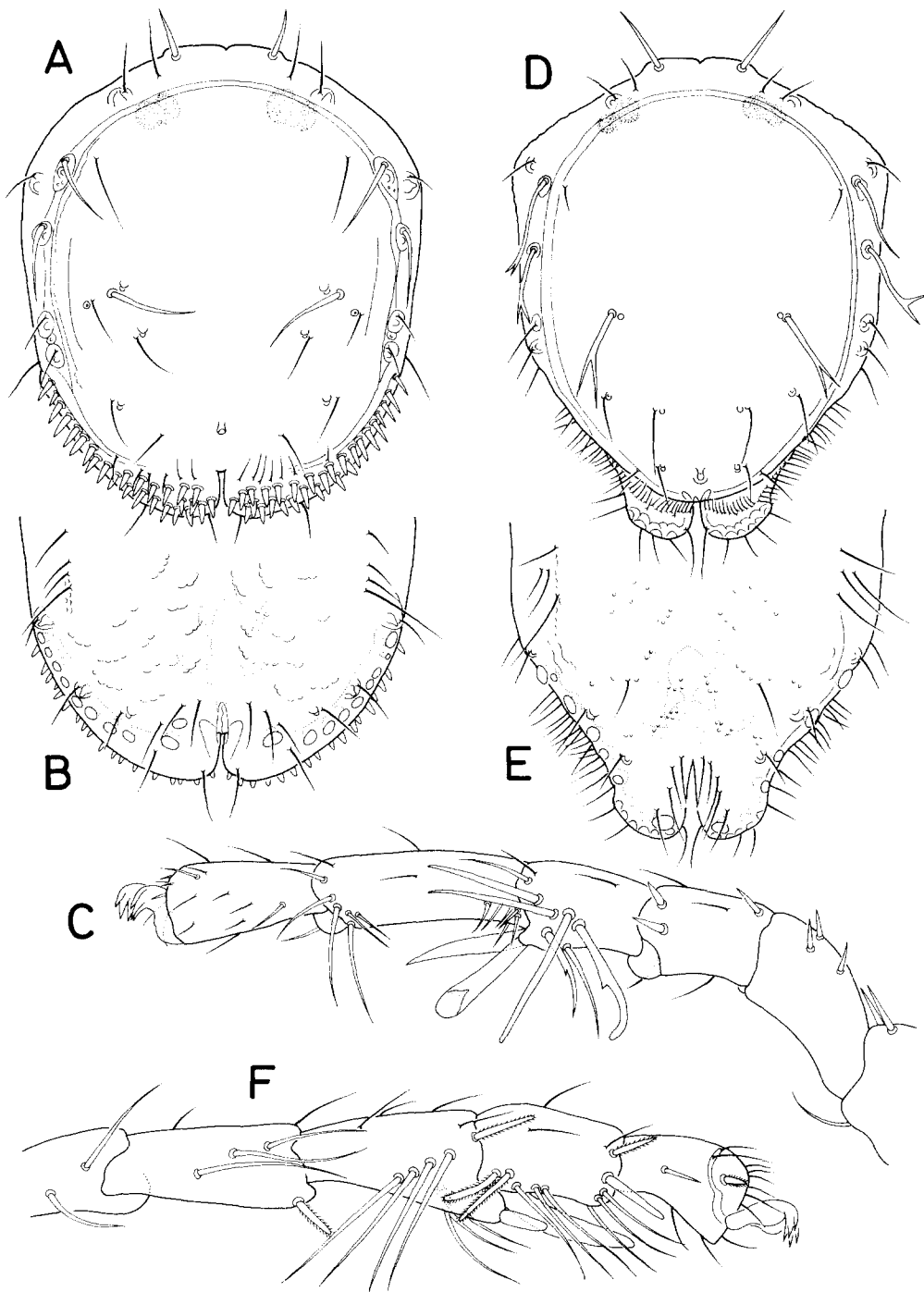
**REMARKS:** The new species, belonging to the

"*desquamatus* group" of Mitchell (1954), has characteristically about 25 peg-like setae on the posterior portion of male body. This kind of setae on the body also can be found in *Aturus obtusisetus* Viets, 1935, *A. hamiger* Viets, 1935, and *A. hiatosomus* Cook, 1967, and all of these three species are found in Oriental region. The new species is most close to *A. hiatosomus*; both have similar body shape and size, and the segments of fourth leg of the two are short and stocky. The former two Indonesian species have more slender body. *A. multiclavus*, n. sp. can be easily distinguished by the number of peg-like setae of the body which is about three times more than the number of setae found in the above three species. The other differences of the new species from its allies are observed in the arrangement of dorsoglandularia and the chaetotaxy of fourth leg.

***Aturus kumariensis*, n. sp. (Fig. 1D-F)**

**TYPE MATERIALS:** Holotype (male) and paratypes (1 intact and 2 dissected males) from washings of mosses in a stream at Kumari, Samchok-gun (37°16' N, 129° 15' E), on 25 May 1992.

**MALE:** Body (Fig. 1D) 378  $\mu\text{m}$  long, and 288  $\mu\text{m}$  wide, attenuating posteriorly. Dorsal shield well defined from ventral shield, with 5 pairs of dorsoglandularia. Anterior 4 dorsoglandularia complete. Fifth dorsoglandularia without gland. First dorsoglandularia with long, bifurcate, thick seta. Other dorsoglandularia with small seta. Dorsal furrow with 4 pairs of lateroglandularia. First lateroglandularia with long, sometimes bifurcate, thick seta. Second lateroglandularia with long, thick, bifurcate seta. Longest distance among lateroglandularia measured between second and third lateroglandularia. Third and fourth lateroglandularia neighboring, each with small seta. Third lateroglandularia located at level of first dorsoglandularia. Posterior surface of dorsum (actually dorsal surface of ventral shield) with transverse row of small setae. Ventral shield (Fig. 1E) 423  $\mu\text{m}$  long, tapering posteriorly, with deep posteromedian cleft, and 6 genital acetabula along posterior margin on each side. Dorsal lengths of palpal segments: P-I, 31  $\mu\text{m}$ ; P-II, 57  $\mu\text{m}$ ; P-III, 39  $\mu\text{m}$ ; P-IV, 65  $\mu\text{m}$ ; P-V, 31  $\mu\text{m}$ . Capitulum 91  $\mu\text{m}$



**Fig. 1.** *Aturus multiclavus*, n. sp., male: A, dorsum; B, posterior portion of venter; C, fourth leg. *Aturus kumariensis*, n. sp., male: D, dorsum; E, posterior part of venter; F, fourth leg.

long. Chelicera 115  $\mu\text{m}$  long. Dorsal lengths of third to sixth segments of third leg: III-Leg-3, 71  $\mu\text{m}$ ; III-Leg-4, 103  $\mu\text{m}$ ; III-Leg-5, 113  $\mu\text{m}$ ; III-Leg-6, 112  $\mu\text{m}$ . Segments of fourth leg (Fig. 1F) short and stocky. Dorsal lengths of segments of fourth leg: IV-Leg-1, 75  $\mu\text{m}$ ; IV-Leg-2, 111  $\mu\text{m}$ ; IV-Leg-3, 94  $\mu\text{m}$ ; IV-Leg-4, 115  $\mu\text{m}$ ; IV-Leg-5, 64  $\mu\text{m}$ ; IV-Leg-6, 67  $\mu\text{m}$ . Fifth and sixth segments distinctly shorter. Fourth and sixth segments expanded. Fourth segment with 2 broad, extremely unequal, roundly ended, setae (larger one reaching beyond fifth segment) on ventrodiscal corner, and 7 stiff medio-distal and 1 distal, feathered seta. Fifth segment with 2 feathered and 3 stiff, thick setae, and distally 1 feathered, 1 thick and 3 stiff setae.

**FEMALE:** Unidentified.

**ETYMOLOGY:** The specific name is derived from the type locality, Kumari.

**REMARKS:** Four species were selected as relatives of the new species, they are: *Aturus estellae* Habeeb, 1953, *A. mugyonensis* Habeeb, 1962, *A. terraconfusensis* Habeeb, 1965, all the three known from America, and *A. vietsi* Imamura & Nagatsuka, 1983, a Japanese species. These species have in common the posteriorly protruded ventral shield. Among them *A. mugyonensis* has the posterior portion of ventral shield most resembling to the new species. In the other three species this portion of ventral shield is less prominent than the two. The new species differs from *A. mugyonensis* in bearing the following differences: The anterior four dorsoglandularia are located more posteriorly than in *A. mugyonensis*; the fifth and sixth segments of fourth leg are distinctly shorter than those of *A. mugyonensis*; the posterior two ventroglandularia are obliquely positioned, whereas in *A. mugyonensis* these are horizontally positioned.

***Aturus multisetus*, n. sp. (Fig. 2A-D)**

**TYPE MATERIALS:** Holotype (male) and paratypes (13 intact and 2 dissected males) from washings of mosses in a stream at Kumari, Samchok-gun (37°16' N, 129°15' E), on 4 August 1992.

**OTHER MATERIAL EXAMINED:** 28 males from washings of mosses and stones at type

locality, on 25 May 1992; 1 male from washings of stones in a stream at Ohulri near Kangreung, on 25 October 1990; 1 male from washings of mosses in a small stream in Taekwanryong (37° 41' N, 128°41' E), on 16 August 1991; 1 male from washings of stones in a stream in Mt. Toham near Kyongju (approximately 37° 48' N, 129° 22' E), on 25 September 1991; 5 males from washings of stones in a stream in Mt. Toham near Kyongju, on 20 May 1992; 1 male from washings of stones in a stream in Mt. Sorak (38°10' N, 128°25' E), on 16 May 1991; 2 males from washings of mosses in a stream in Mt. Taegi (37° 31' N, 128°22' E), on 16 August 1991.

**MALE:** Body (Fig. 2A) 290  $\mu\text{m}$  long, and 265  $\mu\text{m}$  wide, with widest area across posterior portion of dorsal shield. Dorsal shield with numerous granules on surface, longitudinal ridge on both sides, and slightly arched, transverse ridge posterior to third and fourth dorsoglandularia. Posterior portion behind latter ridge sunken. First dorsoglandularia well separated from other ones, with thick, bifurcate seta. Other dorsoglandularia with small seta. Second and third dorsoglandularia located at about same level. First lateroglandularia with extremely long, thick seta reaching third lateroglandularia. Second lateroglandularia separated from first by distance slightly longer than that from third, with long, bifurcate, thick seta. Third and fourth lateroglandularia well separated from each other, but less distant than distance between second and third, with small seta. Posterior portion of dorsum (dorsal surface of ventral shield) with numerous setae of various length (those near posterior margin longer) and feathered setae near posteromedian edges of each side. Ventral shield (Fig. 2B) 332  $\mu\text{m}$  long, nearly straight posteriorly, with narrow but deep posteromedian cleft, 3 pairs of spatulate, sac-like, modified setae, and 6-7 genital acetabula on each side along posterior margin. Dorsal lengths of palpal segments: P-I, 21  $\mu\text{m}$ ; P-II, 53  $\mu\text{m}$ ; P-III, 28  $\mu\text{m}$ ; P-IV, 68  $\mu\text{m}$ ; P-V, 36  $\mu\text{m}$ . Capitulum 85  $\mu\text{m}$  long. Chelicera 104  $\mu\text{m}$  long. Dorsal lengths of third to sixth segments of third leg (Fig. 2C): III-Leg-3, 67  $\mu\text{m}$ ; III-Leg-4, 98  $\mu\text{m}$ ; III-Leg-5, 140  $\mu\text{m}$ ; III-Leg-6, 128  $\mu\text{m}$ . Fourth segment of third leg with about 12 long distal setae. Fifth segment

with about 30 long setae. Dorsal lengths of segments of fourth leg: IV-Leg-1, 77  $\mu\text{m}$ ; IV-leg-2, 89  $\mu\text{m}$ ; IV-Leg-3, 104  $\mu\text{m}$ ; IV-Leg-4, 95  $\mu\text{m}$ ; IV-Leg-5, 81  $\mu\text{m}$ ; III-Leg-6, 79  $\mu\text{m}$ . All segments of fourth leg elongate. Fourth segment with 1 extremely broad setae near ventrodistal corner and 8 thick setae on distal half of ventral margin. Fifth segment with 8 thick setae (2 of which feathered) on proximo-ventral margin and 5 thick setae distally.

**FEMALE:** Unidentified.

**ETYMOLOGY:** The specific name is derived from the characteristic state of the posterior part of dorsum which has numerous small setae.

**REMARKS:** *Aturus multisetus*, n. sp. is related to *A. arizonensis* Habeeb, 1959 and *A. nikkoensis* Imamura, 1961 in having the following features: Body is quadrate; the posterior end of body with sac-like, modified setae; third leg with numerous setae on the fourth and fifth segments; posterodorsal surface of body (dorsal surface of ventral shield) with numerous setae. The new species can be distinguished from these two species by the following manners: The dorsoglandularia, excretory pore and inner ridges of dorsal shield of the new species are more posteriorly positioned than in *A. arizonensis*; the largest, ventrodistal seta of the fourth segment of fourth leg in the new species is tapered and pointed, whereas it is scalpel-shaped, parallel on both sides in *A. arizonensis*, or abruptly broadened, leaf-like at tip in *A. nikkoensis*; the inner ridges of dorsal shield are distinct in the new species, whereas these are absent in *A. nikkoensis*.

***Aturus caudatus* Enami, 1940 (Fig. 2E, F)**

*Aturus caudatus* Enami, 1940, p. 249, figs. 39-43.

*Aturus (Aturus) caudatus*: Imamura, 1954, p. 118, figs. 70, 71; 1960, p. 39

**MATERIAL EXAMINED:** 40 males from washings of mosses in a stream at Kumari, Samchok-gun, on 10 May 1992; 1 male from washings of stones in a stream near Jindong, Chanwon-gun (35°08' N, 128°30' E), on 21 August 1992; 1 male from washings of stones in a

stream near Sangri, Kosong-gun (approximately 34°59' N, 128°13' E), on 21 August 1992.

**MALE:** Body (Fig. 2E) 255  $\mu\text{m}$  long, and 220  $\mu\text{m}$  wide. Anterior portion of dorsum widest. Posterior portion of dorsum slightly narrower and rounded. Dorsal shield with numerous granules on surface. First dorsoglandularia with thick seta. Fourth dorsoglandularia with short but thick, bifurcate seta. Other dorsoglandularia with small seta. Second dorsoglandularia located close to first. Third dorsoglandularia located near longitudinal axis of dorsum. Fourth and fifth dorsoglandularia neighboring, latter one without gland. Dorsal furrow 4 pairs of lateroglandularia. Each of first and second lateroglandularia with thick seta. Third and fourth lateroglandularia neighboring, with small seta. Posterior end of dorsum with deep median cleft, 2 rows of 8-10 small setae, and 2 pairs of large, rod-like setae. Ventral shield 302  $\mu\text{m}$  long, posteriorly with deep median cleft, and 6-8 genital acetabula on each side. Dorsal lengths of palpal segments: P-I, 21  $\mu\text{m}$ ; P-II, 49  $\mu\text{m}$ ; P-III, 26  $\mu\text{m}$ ; P-IV, 63  $\mu\text{m}$ ; P-V, 29  $\mu\text{m}$ . Capitulum 82  $\mu\text{m}$  long. Chelicera 87  $\mu\text{m}$  long. Dorsal lengths of third to sixth segments of third leg: III-Leg-3, 49  $\mu\text{m}$ ; III-Leg-4, 72  $\mu\text{m}$ ; III-Leg-5, 90  $\mu\text{m}$ ; III-Leg-6, 93  $\mu\text{m}$ . Fourth leg with rather short and stocky segments. Dorsal lengths of segments of fourth leg: IV-Leg-1, 62  $\mu\text{m}$ ; IV-Leg-2, 68  $\mu\text{m}$ ; IV-Leg-3, 56  $\mu\text{m}$ ; IV-Leg-4, 62  $\mu\text{m}$ ; IV-Leg-5, 104  $\mu\text{m}$ ; IV-Leg-6, 72  $\mu\text{m}$ . Fourth segment distally with 1 broad, 2 brush-tipped, and about 6 thick setae (Fig. 2F). Fifth segment with 3 thick, distally feathered and 4 smaller setae, and distally with 2 thick and 4 thinner setae.

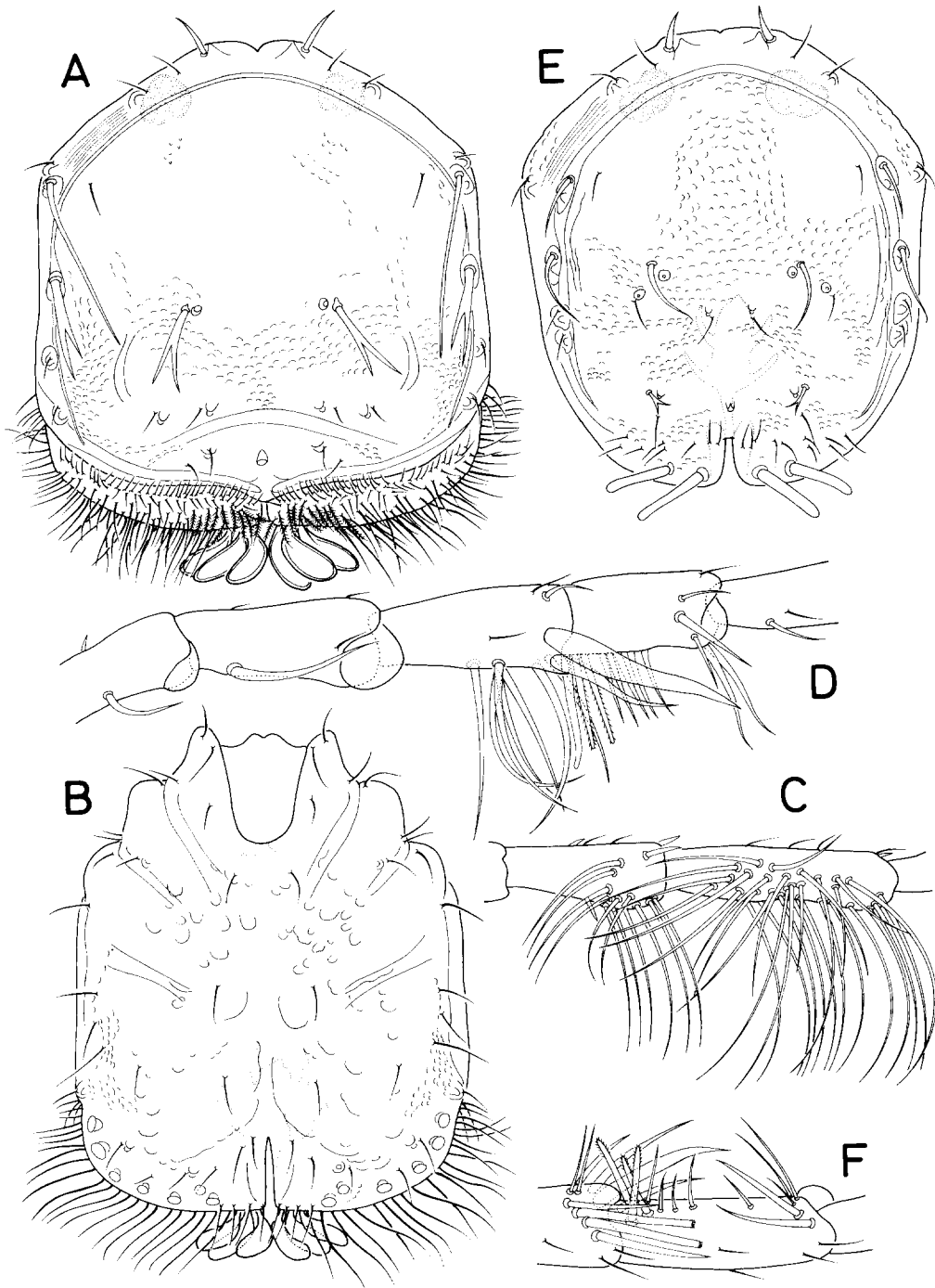
**FEMALE:** Unidentified.

**REMARKS:** This species has been known only from Japan. It is easily recognizable by the two large, rod-like setae on each side of the posterior end of body.

***Aturus pilosus*, n. sp. (Fig. 3A-E)**

**TYPE MATERIALS:** Holotype (male) and paratypes (18 intact and 2 dissected males) from washings of mosses in a stream at Kumari, Samchok-gun (37°16' N, 129°15' E), on 24 October 1992.

**OTHER MATERIAL EXAMINED:** 4 males from



**Fig. 2.** *Aturus multisetus*, n. sp., male: A, dorsum; B, venter; C, fourth and fifth segments of third leg; d, third and fourth segments of fourth leg. *Aturus caudatus* Enami: E, dorsum; F, fifth segment of fourth leg.

washings of mosses in a stream at Ohulri near Kangreung, on 10 May 1990; 12 males from washings of stones in a stream near Keundok, Samchok-gun (Approximately 37°20' N, 129°15' E) on 11 July 1990; 5 males from washings of stones in a stream at Seongsan near Kangreung, on 24 October 1990; 41 males from washings of mosses at type locality, on 25 May 1992.

**MALE:** Body (Fig. 3A) 324  $\mu\text{m}$  long, and 304  $\mu\text{m}$  wide. Maximum width measured at area slightly posterior to midlength. Dorsoglandularia located near margin of dorsal shield. First dorsoglandularia with long, bifurcate, thick seta. Second dorsoglandularia more close to first than third, with long, simple, thick seta. Posterior 3 dorsoglandularia located closely, each with small seta. Fifth dorsoglandularia located at outer side and on plane between third and fourth ones, without gland. First lateroglandularia separated anteriorly from second, with long, thick, bifurcate seta. Second lateroglandularia located close to third, with long, thick, bifurcate seta. Third and fourth lateroglandularia with small seta. Posteromedian end of dorsum with deep, wide invagination. Posterodorsal surface of dorsum from third lateroglandularia to posteromedian invagination with 1 row of long setae and about 6 shorter setae anteriorly on each side. Ventral shield (Fig. 3B) 390  $\mu\text{m}$  long, with wide posteromedian invagination, deep cleft, and on each side with 1 pair of sac-like, modified setae. Genital acetabula 12 in number on each side, arranged along posteroventral edge and outer side of posteromedian cleft. Dorsal lengths of palpal segments: P-I, 25  $\mu\text{m}$ ; P-II, 59  $\mu\text{m}$ ; P-III, 31  $\mu\text{m}$ ; P-IV, 88  $\mu\text{m}$ ; P-V, 37  $\mu\text{m}$ . Capitulum 100  $\mu\text{m}$  long. Chelicera 122  $\mu\text{m}$  long. Dorsal lengths of third to sixth segments of third leg: III-Leg-3, 45  $\mu\text{m}$ ; III-Leg-4, 113  $\mu\text{m}$ ; III-Leg-5, 132  $\mu\text{m}$ ; III-Leg-6, 133  $\mu\text{m}$ . Fifth segment with 6 stiff, distal setae (Fig. 3C, D). Dorsal lengths of segments of fourth leg (Fig. 3E): IV-Leg-1, 78  $\mu\text{m}$ ; IV-Leg-2, 97  $\mu\text{m}$ ; IV-Leg-3, 85  $\mu\text{m}$ ; IV-Leg-4, 102  $\mu\text{m}$ ; IV-Leg-5, 157  $\mu\text{m}$ ; IV-Leg-6, 147  $\mu\text{m}$ . First segment with 1 ventral and 3 dorsal, thick seta, 2 of latter longer and curved in middle. Second segment with 3 short, thick setae. Fourth segment ventrodistally with 4 modified setae (Proximal seta longest and

curved at distal third, with expansion at portion just distal to curved portion; second proximal one broadest, appearing as horse's leg, with expansion near base; third one small and foliaceous; distal one nearly straight and broad), and disterolaterally with about 10, aggregated, large setae, medial 5 of them curved in middle. Fifth segment proximally with 2 large modified and 8 stiff setae, and distally with 6 stiff setae.

**FEMALE:** Unidentified.

**ETYMOLOGY:** The "*pilosus*" in Latin means "hairy". The new species is named as such because it has a number of long setae on the posterior margin of body.

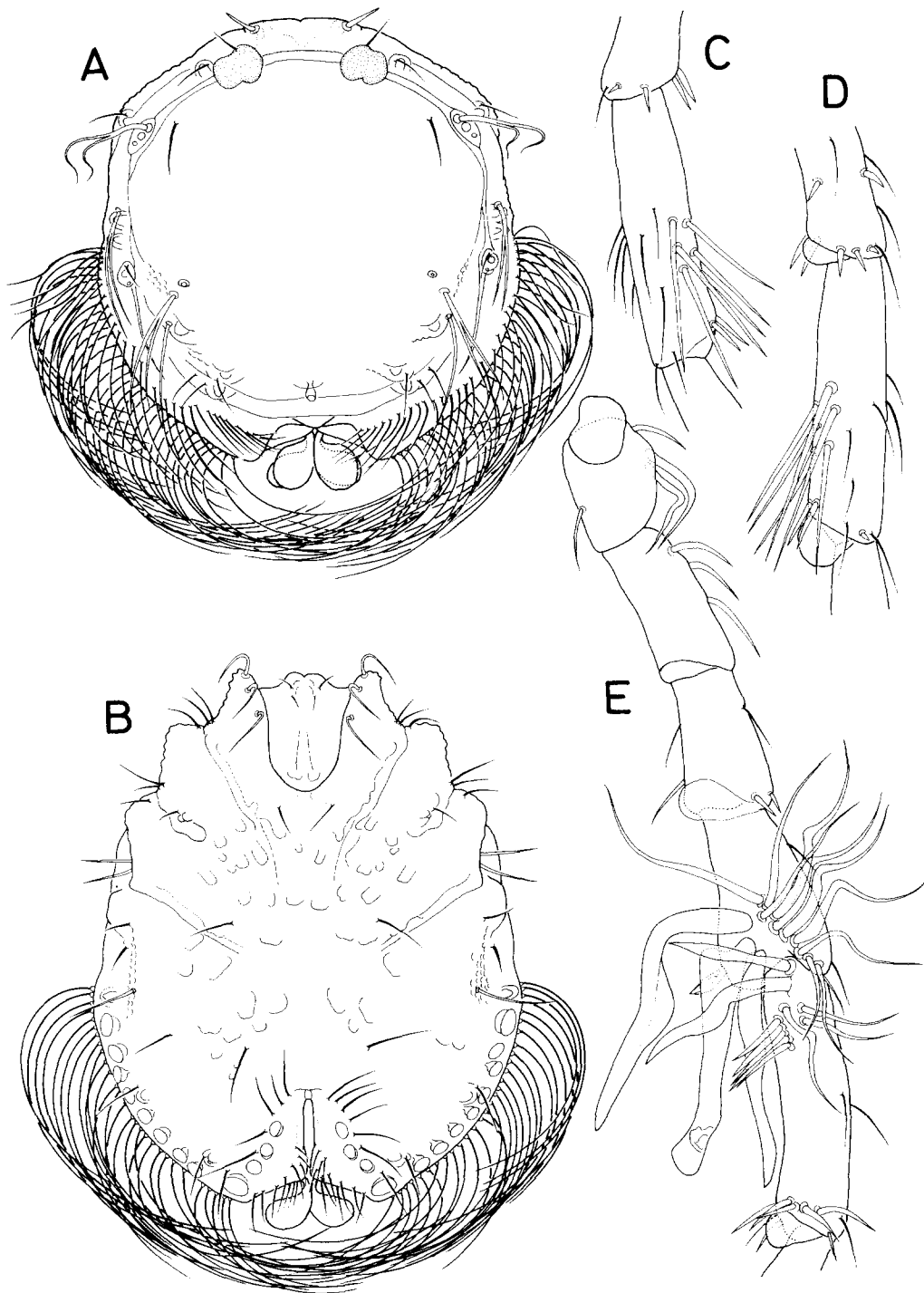
**REMARKS:** The new species is most closely related to *Aturus complexus* Sokolow, 1934. Both species have similar arrangement of dorsoglandularia, two pairs of sac-like, modified setae on the posterior end of body, and similar setae on the fourth and fifth segments of fourth leg except for the small modified seta on the ventrodistal corner of fourth segment. The new species can be distinguished from this eastern Siberian species by the following manners: *A. pilosus* has the body more shorter than that of *A. complexus*; *A. pilosus* has posteromedian invagination which is absent in *A. complexus*; the smallest setae on the ventrodistal corner of fourth leg differ between two species; distance between excretory pore and posterior margin of body in *A. pilosus* is more shorter than in *A. complexus*.

***Aturus parapilosus*, n. sp. (Fig. 4A-D)**

**TYPE MATERIALS:** Holotype (male) and paratypes (27 intact and 3 dissected males) from washings of mosses in a stream at Kumari, Samchok-gun (37°16' N, 129°15' E), on 24 October 1992.

**OTHER MATERIAL EXAMINED:** 1 male from washings of mosses in a small stream near Taekwanryong, on 16 August 1991; 20 males from washings of mosses at type locality, on 25 May 1992; 15 males from washings of mosses at type locality, on 4 August 1992.

**MALE:** Body (Fig. 4A) 356  $\mu\text{m}$  long, and 336  $\mu\text{m}$  wide. Posterior third of dorsum convex and widest. Posterior surface of dorsum with numerous, long setae, some of which near posteromedian



**Fig. 3.** *Aturus pilosus*, n. sp., male: A, dorsum; B, venter; C, D, fifth segment of third leg; E, proximal segments of fourth leg.



invagination feathered. Dorsal and ventral shields fused posteriorly. Dorsal shield with several patches of granules on surface and inner ridges in middle as in Fig 4A. All dorsoglandularia with thick seta. First 3 dorsoglandularia well separated from each other, almost linearly arranged obliquely. Posterior 2 dorsoglandularia (one of them without gland) each with feathered seta located closely. First lateroglandularia well separated anteriorly, with long, thick seta. Second lateroglandularia with thick seta. Posterior 2 lateroglandularia with small seta. Third lateroglandularia close to second. Posteromedian invagination wide and deep. Ventral shield (Fig. 4B) 420  $\mu\text{m}$  long, posteriorly with median cleft and 1 pair of sac-like, modified setae on each side. Genital acetabula 10 in number on each side, and arranged along posterior edge and posterior cleft. Dorsal lengths of palpal segments: P-I, 30  $\mu\text{m}$ ; P-II, 61  $\mu\text{m}$ ; P-III, 32  $\mu\text{m}$ ; P-IV, 92  $\mu\text{m}$ ; P-V, 38  $\mu\text{m}$ . Capitulum 105  $\mu\text{m}$  long. Chelicera 117  $\mu\text{m}$  long. Dorsal lengths of third to sixth segments of third leg: III-Leg-3, 75  $\mu\text{m}$ ; III-Leg-4, 121  $\mu\text{m}$ ; III-Leg-5, 138  $\mu\text{m}$ ; III-Leg-6, 137  $\mu\text{m}$ . Fifth segment (Fig 4C) with 8 stiff setae on distal half of ventral margin. Dorsal lengths of segments of fourth leg (Fig. 4D): IV-Leg-1, 84  $\mu\text{m}$ ; IV-Leg-2, 84  $\mu\text{m}$ ; IV-Leg-3, 80  $\mu\text{m}$ ; IV-Leg-4, 104  $\mu\text{m}$ ; IV-Leg-5, 148  $\mu\text{m}$ ; IV-Leg-6, 140  $\mu\text{m}$ . First segment with 1 stiff proximal seta and 2 broadened, blunt, extremely unequally long, setae. Second segment narrower proximally, but not sulcate. Fourth segment ventrodistally with 3 large and 1 smaller, modified setae (proximal one longest, blunt, curved near distal third; second proximal smaller one recurved; third one greatly expanded near base and circular terminally; distal one scalpel-shaped), and laterally with 11 long, thick setae, about half of latter curved. Fifth segment with 3 groups of setae: proximolateral group arranged longitudinally, composed (from proximal to distal) of large, sickle-shaped seta, distally broadened, ax-like seta, 2 brush-tipped setae and bluntly tipped seta; ventral group located midway segment, composed of 5 stiff setae; distal group composed 7 stiff setae.

**FEMALE:** Unidentified.

**ETYMOLOGY:** The specific name, *parapilosus* (“para,” a Latin, means “neighboring”), is made to

reveal the superficial resemblance of the new species to *A. pilosus*, n. sp.

**REMARKS:** This species is characterized by the following characters: the convex posterolateral sides of body; the presence of two pairs of sac-like, modified setae on the posterior end of body; the close location of the second to fourth lateroglandularia, forming triangle; the bearing of four modified setae near ventrodistal corner of fourth leg, of which proximalmost one is longest and curved in basal half, and the second proximal one is small and recurved. This combination of characters of the new species is shared with *A. miyazakii* Imamura, 1953 and *A. orientalis* Imamura, 1960. However, the new species is separable from these Japanese species: From *A. orientalis* by the presence of the deep and wide posteromedian invagination of body (absent in *A. orientalis*), and from *A. miyazakii* by the simple postocularia (trifurcate in *A. miyazakii*), by simple, unmodified lateral setae on the fourth segment of fourth leg, by the thick, feathered seta of the fourth and fifth dorsoglandularia (only the seta of the fifth is feathered in *A. miyazakii*). The arrangement of dorsoglandularia, the shape of the second segment and the setae on the first segment of fourth leg are also different between two species.

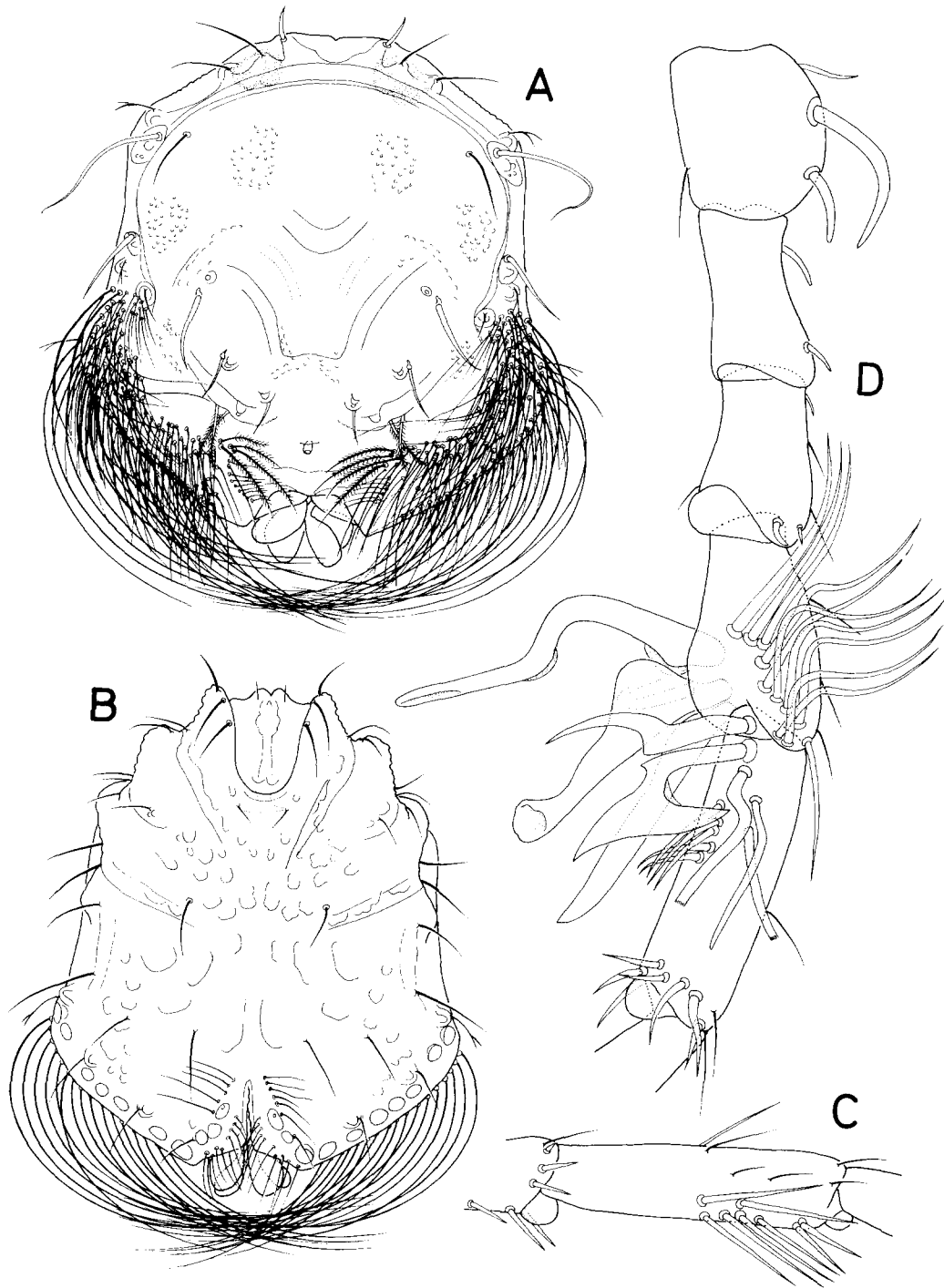
***Aturus miyazakii* Imamura, 1953 (Fig. 5A-C)**

*Aturus (Aturus) miyazakii* Imamura, 1953, p. 464, figs. 31-32.

*Aturus miyazakii*: Cook, 1974, p. 292, 358; Viets, 1987, p. 171.

**MATERIAL EXAMINED:** 8 males from washings of mosses in a stream at Sogwipo, Cheju Island, on 28 April 1991; 1 male from washings of stones in a stream at Kangjong near Sogwipo in Cheju Island, on 28 April 1991.

**MALE:** Body (Fig. 5A) 376  $\mu\text{m}$  long, and 364  $\mu\text{m}$  wide. Dorsum with numerous, long setae posterolaterally, and deep, wide posteromedian invagination. Posterior third of dorsum widest and protruded. Dorsal and ventral shields fused posteriorly. Dorsal shield sunken at both sides of center, with several inner ridges near center, and



**Fig. 4.** *Aturus parapilosus*, n. sp., male: A, dorsum; B, venter; C, fifth segment of third leg; D, proximal segments of fourth leg.

about 10 curved lines outside of second dorsoglandularia, as in Fig. 5A. First dorsoglandularia with thick, bifurcate seta. Second dorsoglandularia with thin seta. Third dorsoglandularia with small, bifurcate seta. Fourth dorsoglandularia with small seta. Fifth dorsoglandularia without gland, but with thick, feathered seta; latter located anterior to fourth. Postocularia characteristically with trifurcate, feathered seta. First lateroglandularia well-separated anteriorly, with large, bifurcate seta. Second lateroglandularia with thick seta. Second to fourth lateroglandularia aggregated. Third and fourth lateroglandularia with small seta. Area posterior to fourth lateroglandularia with patch of 10 small setae. Ventral shield 422  $\mu\text{m}$  long, with posteromedian cleft. Posteromedian invagination of ventral shield with 1 pair of sac-like, modified setae on each side. Posteroventral margin of ventral shield with 6-8 genital acetabula on each side. Dorsal lengths of palpal segments: P-I, 29  $\mu\text{m}$ ; P-II, 69  $\mu\text{m}$ ; P-III, 41  $\mu\text{m}$ ; P-IV, 99  $\mu\text{m}$ ; P-V, 42  $\mu\text{m}$ . Dorsal lengths of third to sixth segments of third leg: III-Leg-3, 80  $\mu\text{m}$ ; III-Leg-4, 128  $\mu\text{m}$ ; III-Leg-5, 152  $\mu\text{m}$ ; III-Leg-6, 143  $\mu\text{m}$ . Fifth segment (Fig. 5B) with 8 thick, medio-ventral and 2 thick, disteroventral setae. Dorsal lengths of segments of fourth leg: IV-Leg-1, 68  $\mu\text{m}$ ; IV-Leg-2, 82  $\mu\text{m}$ ; IV-Leg-3, 92  $\mu\text{m}$ ; IV-Leg-4, 112  $\mu\text{m}$ ; IV-Leg-5, 167  $\mu\text{m}$ ; IV-Leg-6, 140  $\mu\text{m}$ . First segment with 3 large, curved sub-branched setae (Fig. 5C). Second segment characteristically sulcate dorsally, with 3 thick setae. Fourth segment with 13 setae, disteroventral 4 and lateral 2 of them modified; proximalmost one bifurcate. Fifth segment with 2 proximal modified setae, 3 broad setae (2 of them brush-tipped), 6 shorter setae, and 5 distal, thick setae.

**FEMALE:** Unidentified.

**REMARKS:** This species has been known only from Japan. It is easily distinguishable from other species of *Aturus* by the complicated inner ridges of dorsal shield, the trifurcate postocularia, and the sulcate second segment of fourth leg.

***Aturus* sp. (Fig. 5D-F)**

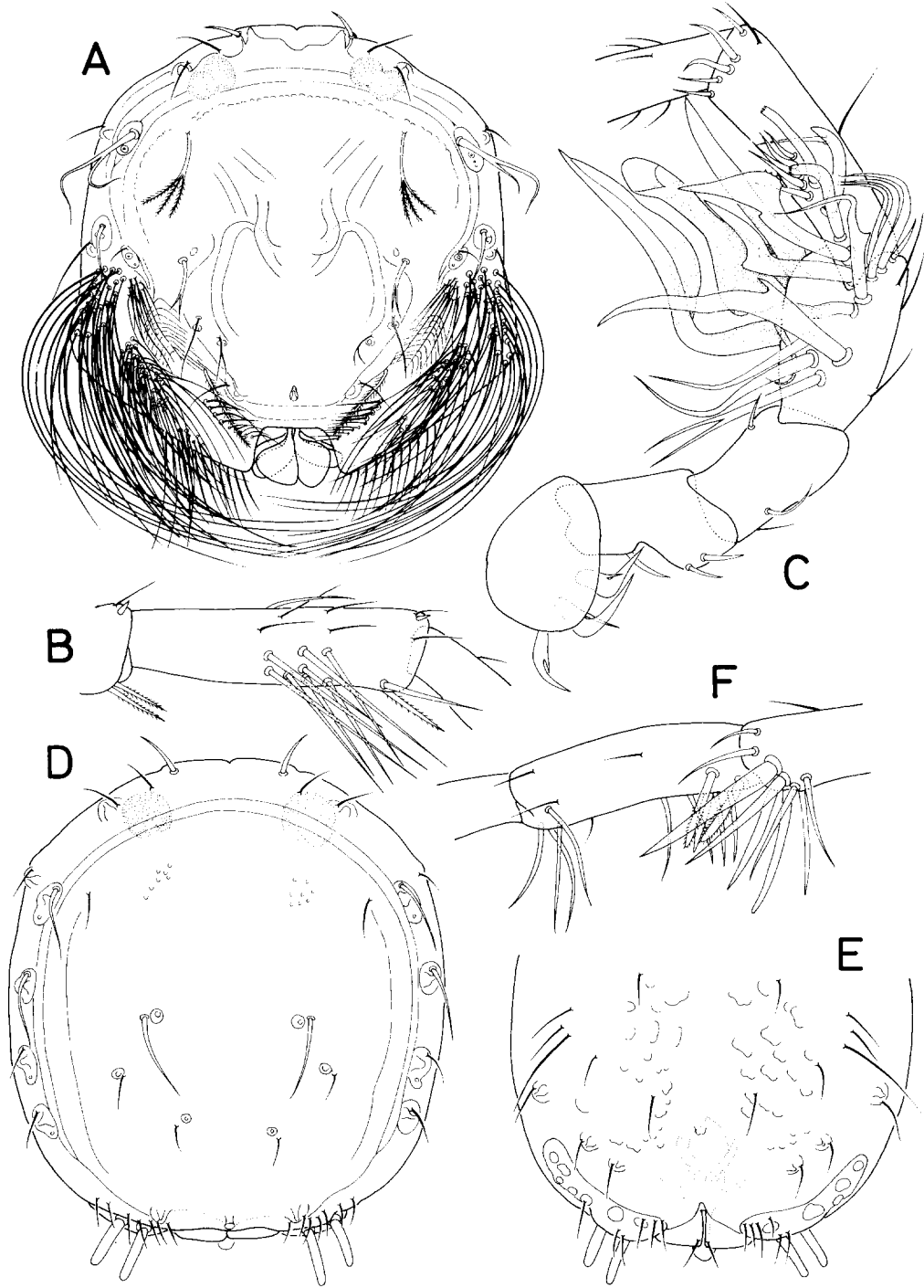
**MATERIAL EXAMINED:** 1 male from washings of mosses in a stream at Kumari, on 25 May

1992.

**MALE:** Body (Fig. 5D) nearly circular, 287  $\mu\text{m}$  long, and 254  $\mu\text{m}$  wide, with weak chaetotaxy. Anterior 3 dorsoglandularia well separated from one another. First dorsoglandularia positioned at midlength of dorsal shield, with thick seta. Other dorsoglandularia with small seta. Posterior 2 dorsoglandularia very close to each other, both remotely separated from third and located near posterior end of dorsum. Fifth dorsoglandularia without gland. Excretory pore located near posterior end of dorsum. First and second lateroglandularia with thick seta. Posterior 2 lateroglandularia neighboring, each with small seta. Anterior 3 lateroglandularia well separated from one another by about same intervals. Posterior end of dorsum almost straight, without cleft or invagination, with row of 6 small setae near posterior margin of each side. Ventral shield 330  $\mu\text{m}$  long, posteriorly with narrow median cleft (Fig. 5E), and on each side 2 large, rod-like setae and 5-7 genital acetabula. Dorsal lengths of palpal segments: P-I, 21  $\mu\text{m}$ ; P-II, 52  $\mu\text{m}$ ; P-III, 28  $\mu\text{m}$ ; P-IV, 65  $\mu\text{m}$ ; P-V, 30  $\mu\text{m}$ . Dorsal lengths of fourth to sixth segments of third leg: III-Leg-4, 71  $\mu\text{m}$ ; III-Leg-5, 91  $\mu\text{m}$ ; III-Leg-6, 95  $\mu\text{m}$ . Dorsal lengths of third to sixth segments of fourth leg: IV-Leg-3, 64  $\mu\text{m}$ ; IV-Leg-4, 88  $\mu\text{m}$ ; IV-Leg-5, 111  $\mu\text{m}$ ; IV-Leg-6, 98  $\mu\text{m}$ . Fourth segment distally with 1 large and 8 variously sized setae, all of these setae not modified (Fig. 5F). Fifth segment proximally with 2 feathered and 1 smooth, thick setae, 4 thick, ordinary setae, and distally 4 thick setae.

**FEMALE:** Unidentified.

**REMARKS:** In bearing two pairs of large, rod-like setae on the posterior margin, this species resembles *Aturus caudatus* Enami, 1940. The differences between them lie in the body shape, the arrangement of dorsoglandularia, the absence of posteromedian cleft in the new species, and the position of two pairs of posterior, rod-like setae. This species is certainly new to science. However, we decided not to give it a scientific name due to the insufficient number of specimen.



**Fig. 5.** *Aturus miyazakii* Imamura, male: A, dorsum; B, fifth segment of third leg; C, proximal segments of fourth leg. *Aturus* sp., male: D, dorsum; E, posterior part of venter; F, fifth segment of fourth leg.

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### **Aturus** 속의 한국산 물응애 (진드기목) 김일희 · 정경숙 (강릉대학 생물학과)

*Aturus* 속의 한국산 물응애 8종을 기재한다. 이 중에서 다음의 5종은 신종이다: *A. multiclavus* n. sp., *A. kumariensis* n. sp., *A. multisetus* n. sp., *A. pilosus* n. sp., *A. parapilosus* n. sp. 이와 함께 한국산 미기록종 *A. caudatus* 및 *A. miyazakii*, 그리고 명명하지 않은 1종도 포함하여 기재한다. 기재는 모두 수컷을 기초로 이루어졌다.