



The millipede genus *Anaulaciulus* Pocock, 1895 in Taiwan, with descriptions of four new species (Diplopoda, Julida, Julidae)

ELENA V. MIKHALJOVA¹, SERGEI I. GOLOVATCH² & HSUEH-WEN CHANG^{3,4}

¹Institute of Biology and Soil Science, Far Eastern Branch of the Russian Academy of Sciences, prospekt Stoletiya Vladivostoka 159, Vladivostok 690022, Russia. E-mail: mikhailjova@biosoil.ru

²Institute for Problems of Ecology and Evolution, Russian Academy of Sciences, Leninsky prospekt 33, Moscow 119071, Russia. E-mail: sgolovatch@yandex.ru

³Department of Biological Sciences, National Sun Yat-Sen University, 70 Lien-Hai Road, Kaohsiung 804, Taiwan, ROC. E-mail: hwchang@mail.nsysu.edu.tw

⁴Corresponding author

Abstract

The genus *Anaulaciulus* Pocock, 1895 is represented in Taiwan by eight nominate species, all keyed and nearly all mapped, including four new ones: *A. immensus* sp. nov., *A. oligosegmentatus* sp. nov., *A. multiarticulatus* sp. nov. and *A. setulifer* sp. nov. One species, *A. tonginus* (Karsch, 1881), is confirmed to be present in the fauna of the island, while the remaining three require revision. Taxonomic and distributional remarks are provided for all of the species.

Key words: Millipede, julid, taxonomy, new species, key, distribution, Taiwan

Introduction

Anaulaciulus Pocock, 1895 is a fairly large genus of the Eurasian diplopod family Julidae, typical of temperate climates. Only two genera in the entire family are East to Southeast Asian, one of which is *Anaulaciulus*. It currently contains about 50 species or subspecies occurring in the Russian Far East, Japan, Korea, northeastern China, Taiwan, northern Myanmar, the Himalaya of India, Nepal and Bhutan, as well as in Pakistan (Enghoff 1986; Korsós 1996).

Korsós (2004) provided an extensive catalogue of the millipedes of Taiwan, which is still fully relevant as regards the Julidae. So we only briefly reiterate it in the historical section below, but quote it fully in the catalogue sections under each of the known species.

Anaulaciulus had remained an obscure name until Causey (1966) showed it to be a senior synonym of *Fusiulus* Attems, 1909. The first record of a species of *Anaulaciulus* in Taiwan belonged to Wang (1955), who described and illustrated it as *Fusiulus trapezoidus* Wang, 1955. The original description being very incomplete, while the line drawings highly schematic, this species, later reported from still another locality in northern Taiwan (Wang 1958, 1963), requires revision (see also Korsós 2004). In addition, Wang (1963) described: *Fusiulus trilobus quemoyensis* Wang, 1963, and *Fusiulus trilobus kuuuae* Wang, 1963, from Taiwan “mainland” and an adjacent islet. The latter subspecies was later shown to be a junior synonym of *Anaulaciulus tonginus* (Karsch, 1881), originally a Hong Kong species (Korsós 1994), whereas the former subspecies was elevated to a full species, *A. trilobus* Wang, 1963, even though it remains obscure as well (Enghoff 1986; Korsós 1994, 2004). Finally, Wang (1963) reported also *Anaulaciulus simplex* (Verhoeff, 1936) from an unknown locality in Taiwan. Since *A. simplex* was originally described from northern and central Japan (Verhoeff 1936), Wang's (1963) record in Taiwan is likewise questionable (Korsós 2004).

As a result, four nominate species of *Anaulaciulus* have hitherto been known from Taiwan (Korsós 1996, 2004), all requiring revision or verification.

Among the diplopod samples from Taiwan received for study, four new species of *Anaulaciulus* have been

found. The present paper provides their descriptions, as well as a provisional key to all of the nominate species of the genus so far reported from the island. In addition, the distributions of all Taiwanese *Anaulaciulus* species are mapped and discussed.

Material and methods

Material treated here has been shared between the collections of the National Museum of Natural Science, Taichung, Taiwan (NMNS), Institute of Biology and Soil Science, Far Eastern Branch, Russian Academy of Sciences, Vladivostok, Russia (IBSS), Zoological Museum, State University of Moscow, Russia (ZMUM), Hungarian Natural History Museum, Budapest, Hungary (HNHM) and Department of Biological Sciences, National Sun Yat-Sen University, Kaohsiung, Taiwan (NSYSUB), as indicated in the text.

Specimens were kept in 70–75% ethanol. During the study, the gonopods and some other parts were dissected from a limited number of specimens and mounted in glycerin as temporary micropreparations. Specimens were studied and illustrated using standard stereomicroscopic, photographic and drawing equipment. SEM micrographs were prepared at the Centre for Collective Use “Biotechnology and Gene Engineering” of the IBSS in Vladivostok, using a Zeiss Evo 40 scanning electron microscope. Mounts for SEM were made by airdrying after transfer to acetone via 96% alcohol, mounting on stubs, and coating with gold. After examination, SEM material was removed from stubs and returned to alcohol, all such samples being kept at IBSS.

A "body segment formula" indicates the number of podous (including gonopod segment) and apodous segments before the telson in an individual. This formula is $x(-y)$ where x = sum of podous and apodous body segments excluding telson, y = number of apodous body segments before telson.

Catalogue sections include the literature references for Taiwan only, coupled with references to the original description and taxonomic changes for the other regions.

Taxonomic part

Anaulaciulus immensus sp. nov.

Figs 1–14

Material examined. *Holotype*: male (NSYSUB), Taiwan, Kaohsiung County, Liouguei, Shanping Workstation, 750 m a.s.l., March 2004, leg. M. J. Hung; *Paratypes*: 3 males, 2 females (NSYSUB), 1 male, 1 female (ZMUM), same locality, March 2004; 2 males, 1 female (IBSS), 2 males (NMNS, 6702–001), same locality, April 2004, all leg. M.J. Hung.

Diagnosis. Differs from congeners mainly by the structure of the gonopod opisthomere supplied with two apical outgrowths directed laterad and a subapical front projection of the fold forming a furrow for flagellum accommodation.

Description. Male. Length 37–50 mm, vertical diameter 2.9–4.0 mm, with 57(–1), 57(–2), 58(–2), 59(–1), 59(–2), 61(–1), 62(–1) segments, excluding telson. Holotype 39 mm long, with vertical diameter 3.0 mm, with 58(–2) segments, excluding telson. Coloration dark brown with more dark transverse bands on metazonites. Antennae and legs brown, eye patches black.

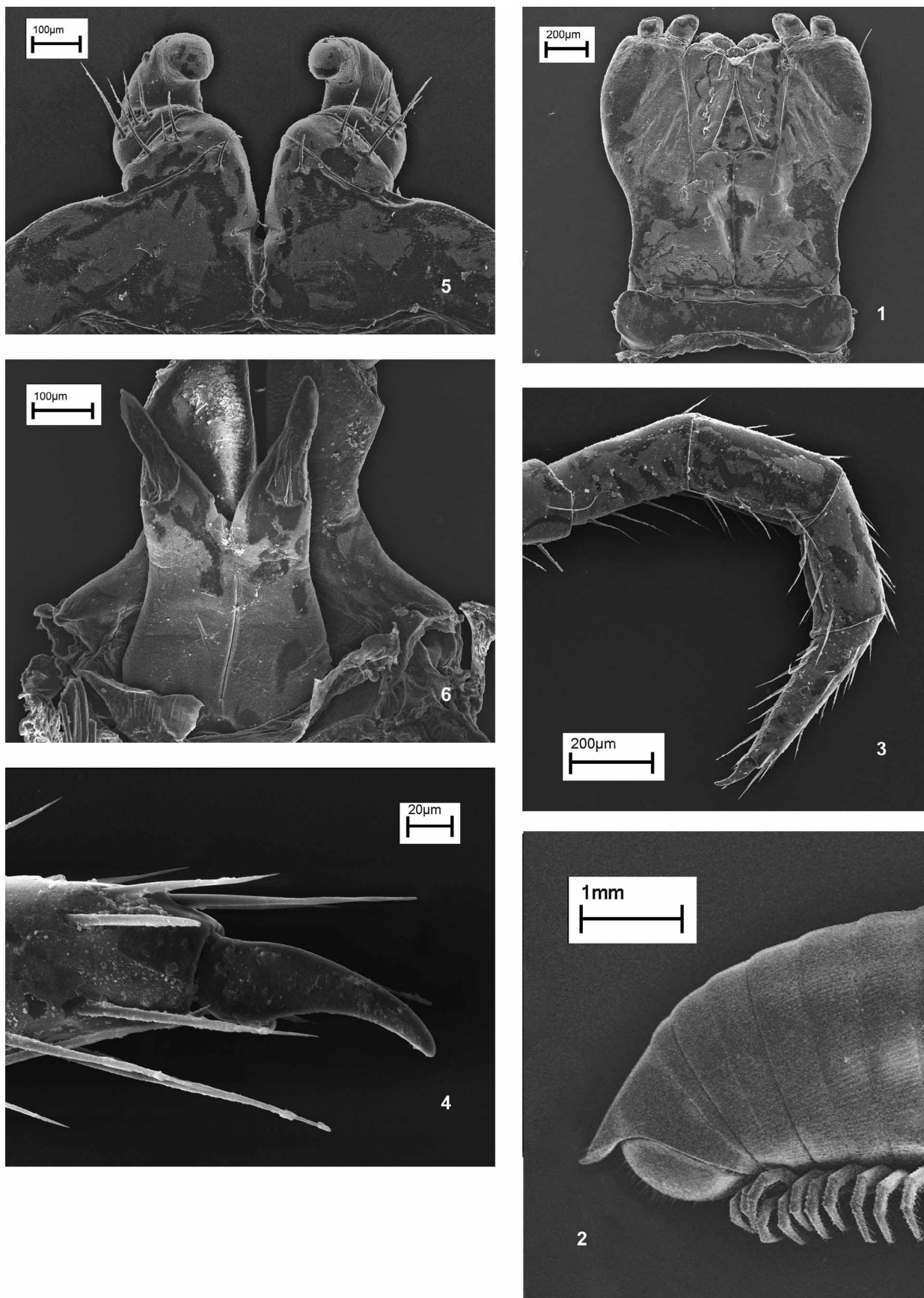
Eye patches subquadrate, composed of 40–45 ocelli. Front margin of collum can cover posterolateral corner of eye patch. Labral setae 8+8. Antennae medium-sized, rather slender and clavate, in situ extending behind to segment 6. Gnathochilarium obliquely striate medially and excavate at base of stipites (Fig. 1). Length ratios of antennomeres 2–7 as 2.5:2.6:2.2:2.7:1.3:1, width ratios as 1.3:1.3:1.5:1.7:1.5:1, respectively. Antennomeres 5 and 6 each with a distodorsal corolla of numerous sensory bacilli: that on antennomere 5 incomplete, counting in the male studied at least 12 sensory bacilli, while that on antennomere 6 nearly complete, counting in the male studied at least 18 sensory bacilli.

Body compressed laterally. Ozopores lying behind stricture between pro- and metazona without touching it. Metazona with striae reaching hind margin; 26–28 striae on metazonital surface between dorsal midline and ozopore, or 11–12 striae per square lying between ozopore and axial line. Caudal projection of epiproct somewhat flattened dorsoventrally, covered with sparse setae and carrying a small claw-shaped process curved dorsally (Fig. 2).

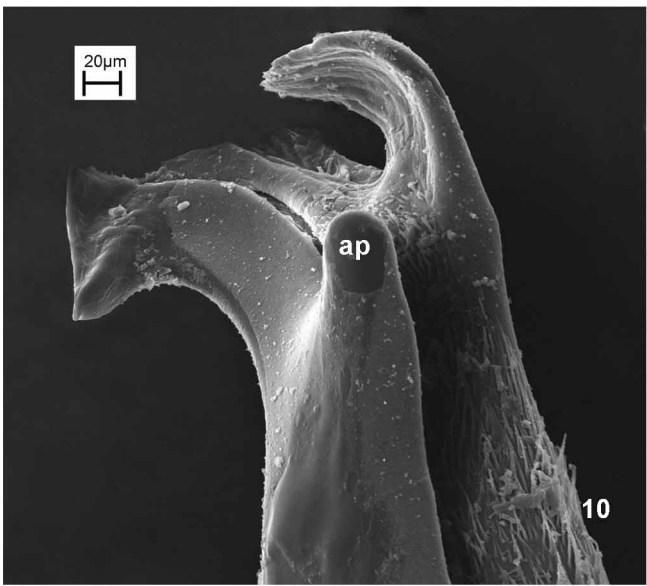
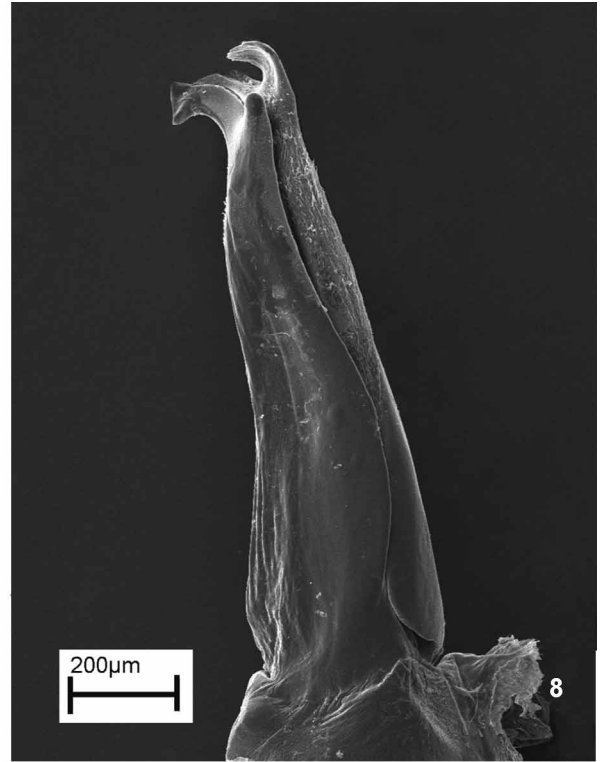
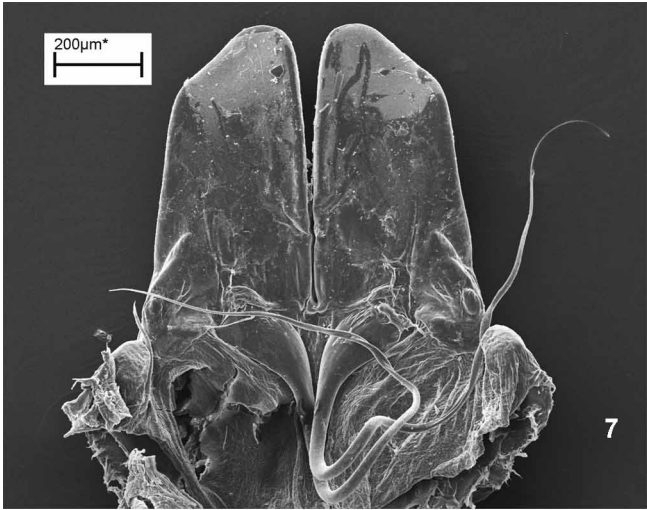
TERMS OF USE

This pdf is provided by Magnolia Press for private/research use.

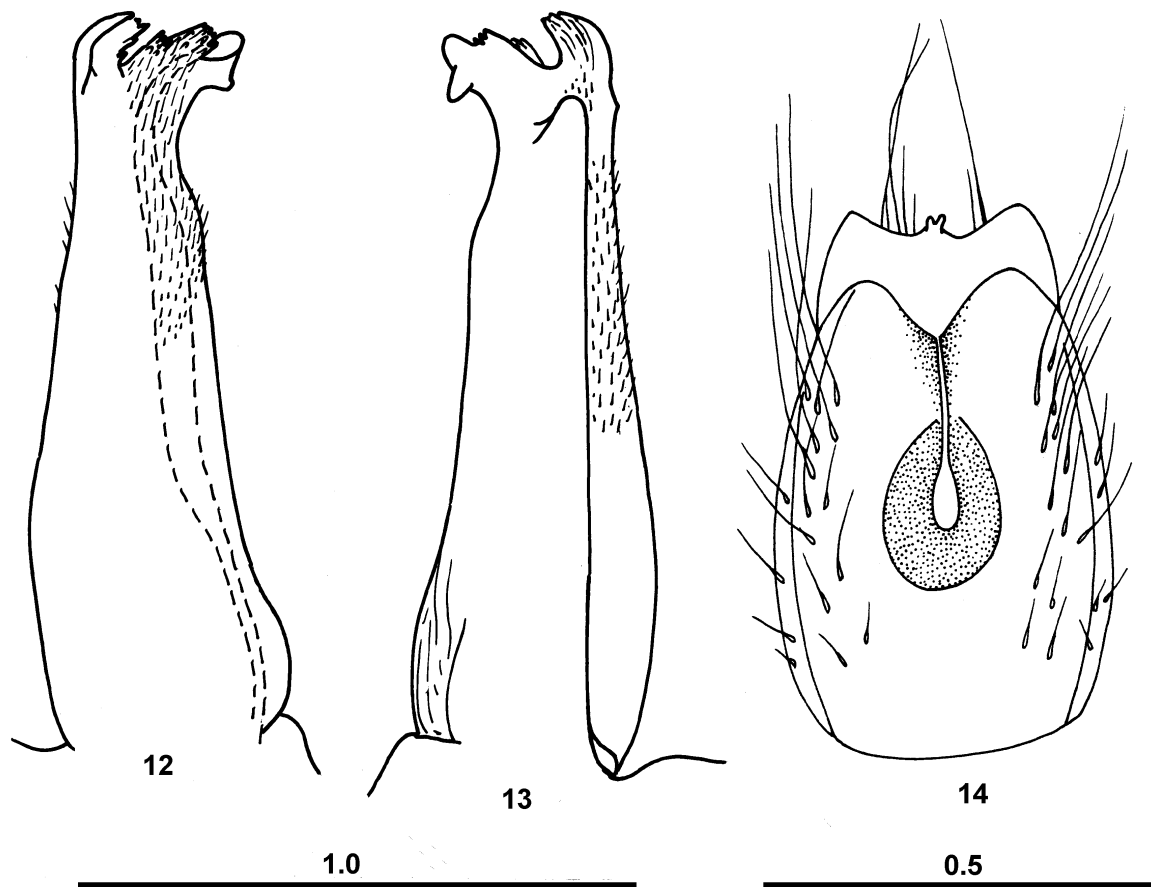
Commercial sale or deposition in a public library or website is prohibited.



FIGURES 1–6. *Anaulaciulus immensus* sp. nov., male paratype. 1, gnathochilarium; 2, posterior part of body; 3, distal part of a midbody leg; 4, claw of a midbody leg; 5, leg pair 1; 6, penes.



FIGURES 7–11. *Anaulaciulus immensus* sp. nov., male paratype. 7, promeres, caudal view; 8, opisthomere, front view; 9, opisthomere, mesal view; 10, apex of opisthomere, front view; 11, apex of opisthomere, mesal view; **ap**, front projection of fold forming a furrow for flagellum accommodation along opisthomere axis.



FIGURES 12–14. *Anaulaciulus immensus* sp. nov., male (12–13) and female (14) paratypes. 12, opisthomere, caudal view; 13, opisthomere, front view; 14, vulva, caudal view. Scales in mm.

Legs relatively short and slender. Ventral pads present on postfemur and tibia (Fig. 3), starting from legs 2; pads decreasing in size towards telson, totally disappearing on postfemur near posterior body end. Claw curved, at base with a tiny knob ventrally (Fig. 4). Claws of legs 2 of same conformation. Leg pair 1 with strong setae lateroventrally (Fig. 5). Penes deeply bifid, with strongly diverging branches (Fig. 6).

Gonopods. Promere subtriangular in distal part, rounded apically, posterior surface somewhat concave, flagellum relatively long, rudimentary telopodites well-visible (Fig. 7). Promere about half the length of opisthomere. Opisthomere (Figs 8, 9, 12, 13) long and straight, with an anteromesal furrow along its axis for flagellum accommodation. Fold forming the furrow extended in distal part into a front subapical outgrowth (**ap**). Opisthomere tip (Figs 10, 11) supplied with two flat, laterally curved outgrowths, one of which beak-shaped. Middle and distal parts of opisthomere partly clothed with small setoid filaments.

Female. Length 38–43 mm, vertical diameter 3.0 mm, with 57(–3), 57(–2), 59(–2) segments, excluding telson. Claws as in male. Vulvae as in Fig. 14. Operculum longer than bursa, with two rows of setae on front face (12 setae in the vulva examined). Apical margin of operculum with three low prominences, middle one of which with two minute outgrowths. Bursa abundantly setose; the vulva examined with four setae on lateral sclerite, with 13 setae on each side of median plate of posterior sclerite, and with five setae on mesal sclerite, i.e., a total of 35 setae. Caudally, bursa with a smooth central concavity.

Name. The specific epithet refers to the largest body size as compared to the other julids of Taiwan.

Anaulaciulus oligosegmentatus sp. nov.

Figs 15–26

Material examined. *Holotype*: male (NMNS, 6702–002, D–0632), Taiwan, Nantou County, Huisun timberland, 23 January 1998, leg. S.H. Wu; *Paratypes*: 1 male (NMNS, 6702–003, D–0300), Taiwan, Hualien County, Zhuoxi Township, Juisui forest road, 15 February 1997, leg. S.H. Wu; 1 male (HNHM) Taiwan, Hualien County, Taroko National Park, Mt Hohuan-Shan, Shihmon Trail, high mountain bamboo shrub (*Yushania niitakayamensis*), 24°08.785' N, 121°17.056' E, ca 3140 m, 23 May 2008, leg. L. Dányi, Z. Korsós & E. Lazányi; 2 males, 6 females, 1 juvenile (NMNS, 6702–004, D–0011), 1 male (devoid of gonopods, presumably lost), 3 females (NMNS, 6702–005, D–0008), 1 male, 1 female (IBSS), 1 female (HNHM), Taiwan, Nantou County, Huisun timberland, 24 October 1997, leg. S.H. Wu; 1 male, 1 female (IBSS), 1 male, 1 female (NSYSUB), 2 males, 11 females (NMNS, 6702–006, D–0298), same locality, 26 December 1997, leg. S.H. Wu; 1 male (NMNS, 6702–007, D–0373), same locality, 27 December 1997, leg. S.H. Wu; 1 male (NMNS, 6702–007, D–0376), same locality, 20 January 1998, leg. S.H. Wu; 1 male, 1 female (ZMUM, D–0620), same locality, 20 January 1998, leg. S.H. Wu; 1 male, 5 females, 2 juveniles (NSYSUB), Taiwan, Chiayi County, Alishan Township, Nansi Forest Road, 2000 m, 29 October 2010, leg. H.W. Chang.

Diagnosis. Differs from congeners mainly by the shape of the opisthomere carrying an anterolateral lamella broadening distally at the lateral margin into a round lobe, as well as by the subtriangular promere, with the apex somewhat varying from simply rounded to rounded with an extended mesal margin. This new species differs from the obviously especially similar *A. multiarticulatus* sp. nov. by the stouter body showing less numerous body segments.

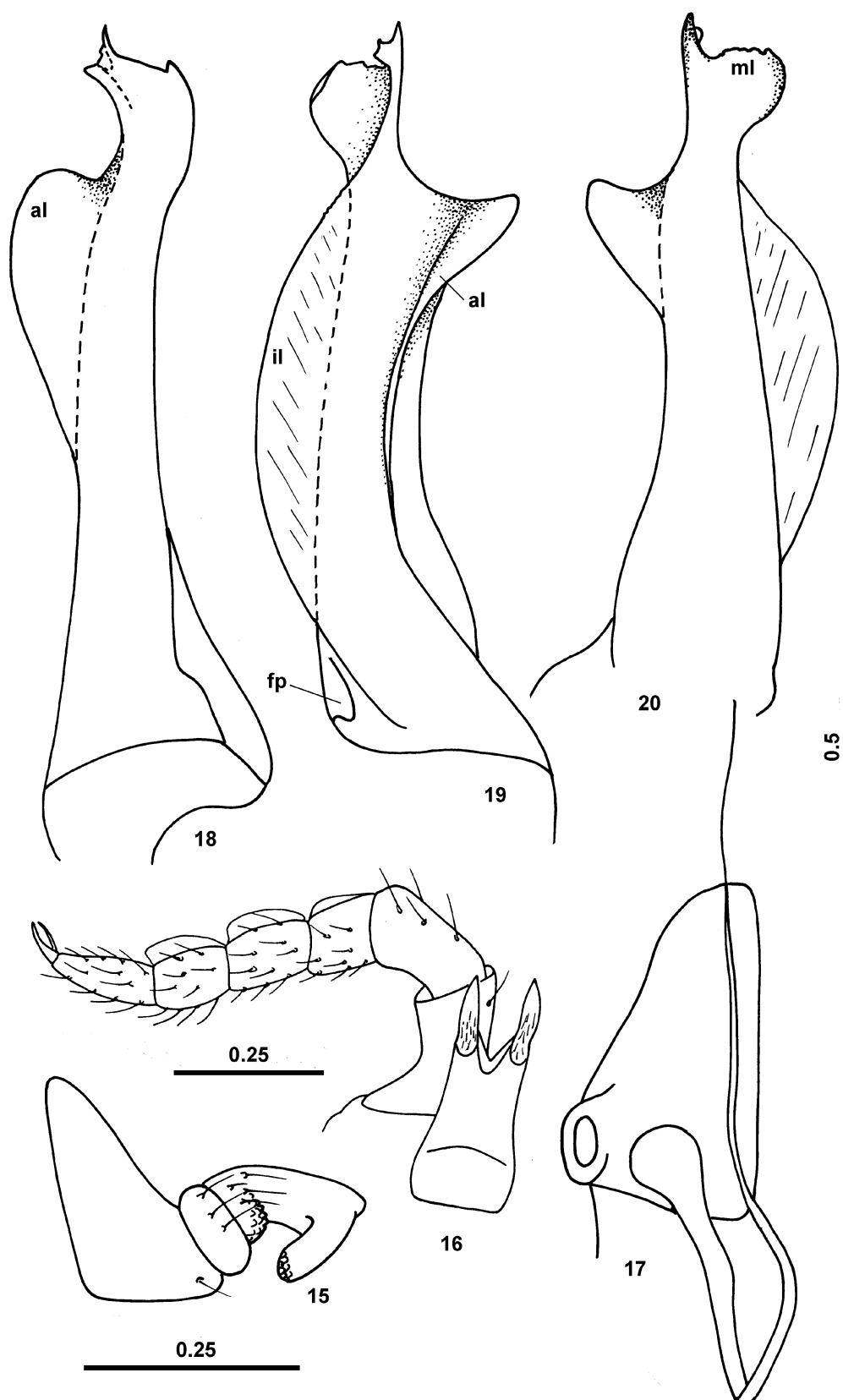
Description. Male. Length 17–24 mm, vertical diameter 1.0–1.3 mm, with 47(–2), 48(–4), 48(–3), 49(–3), 51(–3), 52(–3), 52(–2), 53(–3), 54(–2) segments, excluding telson. Male with 49(–3) segments, one of the last legs undeveloped/absent. Coloration brown, light brown or grey-brown with three narrow longitudinal dark brown stripes (one mid-dorsal and two lateral bands at ozopore level), so that dorsum showing two broad, ribbon-shaped, longitudinal stripes varying in the degree of expression depending on locality. Collum with two large, transversely-oval, yellowish spots. Legless segments in front of telson can also show two transversely-oval, yellowish spots on dorsal side. Clypeolabral region of head lighter. Individuals collected in 2010 showing broader brown stripes, one mid-dorsal and two lateral, these latter stripes can be marbled, similarly marbled can be dorsum as well. A male paratype from Hualien County (D–0300) pallid. Antennae and legs brown or beige, eye patches black.

Eye patches subtriangular, composed of at least 43 ocelli. Labral setae as in *A. immensus* sp. nov. Gnathochilarium with four setae on apical parts of stipites, with 4–5 setae on each lamella lingualis. Length ratios of antennomeres 2–7 as 2.1:3.1:2.9:2.9:1.6:1, width ratios as 1.1:1.4:1.7:2.0:1.7:1, respectively. Antennomeres 5 and 6 each with an incomplete distodorsal corolla of a few sensory bacilli.

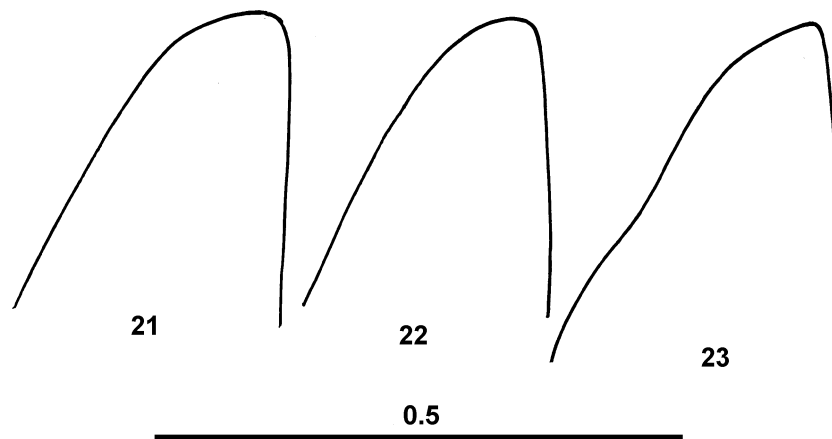
Ozopores lying behind stricture, in touch with stricture only in anterior body part, set off from stricture in posterior body part. Metazona with striae reaching hind margin; 15–16 striae on metazonital surface between dorsal midline and ozopore, or 7–8 striae per square lying between ozopore and axial line. Striations on dorsum directed at a slight angle to axial line on both sides. Caudal projection of epiproct somewhat flattened dorsoventrally, subtriangular in dorsal view, covered with sparse, relatively long setae and carrying a tiny claw-shaped process, the latter either curved dorsally or directed caudad, or missing altogether.

Legs slender and relatively short, with broad, very delicately serrate pads on tibia, postfemur and femur, these pads gradually growing reduced towards posterior body end to totally disappear on last legs. Claw at base with a long and strong filament ventrally. Legs 1 with strong setae ventrolaterally and a ventral papillate knob on telopodiotomere 2, apex covered with low papillae (Fig. 15). Penes long, deeply bifid (Fig. 16).

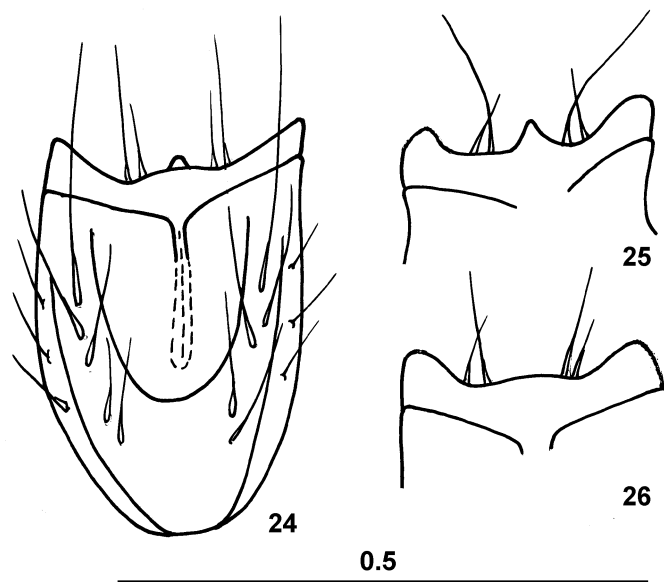
Gonopods. Promere subtriangular, with a slightly curved, rectangularly retrorse, mesal margin and a long flagellum; rudimentary telopodites well-visible (Fig. 17). Promere about half the length of opisthomere. Apex of promere somewhat varying from simply rounded to rounded with an extended mesal margin (Figs 21–23). Opisthomere (Figs 18–20) long, straight, with a front furrow and a thin, membranous, intermediate lamella (**il**) along its axis for flagellum accommodation. Lamella **il** is termed "intermediate", following both Enghoff (1986) and Korsós (2001), even though its base is located on the front side of the opisthomere, while by itself it is curved mesad; the free margin of **il** overlaps with that of the **il** of the second opisthomere. Apex of **il** with acutangular projections. Both **il** and opisthomere subequal in length. In addition, opisthomere's anterolateral face supporting a proximally very narrow anterolateral lamella (**al**) ["anterior", in terms of Enghoff (1986), or "lateral", in terms of Korsós



FIGURES 15–20. *Anaulaciulus oligosegmentatus* sp. nov., male paratype. 15, leg 1, front view; 16, leg 2 and penes; 17, promere, caudal view; 18, left opisthomere, lateral view; 19, left opisthomere, front view; 20, left opisthomere, caudal view; **il**, intermediate lamella of opisthomere; **al**, anterolateral lamella of opisthomere; **ml**, mesal lobe of opisthomere apex; **fp**, basal flap of opisthomere. Scales in mm.



FIGURES 21–23. *Anaulaciulus oligosegmentatus* sp. nov., male paratypes. Variation in shape of promere apex: 21, individual from sample D–0620, 22, individual from sample D–0298, 23, individual from sample D–0011. Scale in mm.



FIGURES 24–26. *Anaulaciulus oligosegmentatus* sp. nov., female paratypes. 24, vulva, caudal view; 25, distal part of left vulva from sample D–0298, caudal view; 26, distal part of right vulva from sample D–0298, caudal view. Scale in mm.

(2001)], with its distal part turning onto lateral side of opisthomere to form a broad lobe (velum?) with a rounded lateral corner. Opisthomere longer than **al**. Apex of opisthomere with a small, thin, mesal lobe (**ml**) of variable breadth. Base of opisthomere with a front flap (**fp**) to guide promere's flagellum.

Female. Length 14–25 mm, vertical diameter 1.0–1.8 mm, with 43(–5), 43(–4), 46(–4), 47(–2), 47(–4), 47(–3), 48(–4), 48(–2), 49(–4), 51(–2), 52(–2), 53(–2), 54(–2), 58(–2) segments, excluding telson. There are shorter females showing fewer body segments compared to males, e.g. those from D–0011 and D–0298 samples. However, these females, like all females with four apodous segments in front of the telson, have fully-developed vulvae, thus being adults. Vulva as in Fig. 24. Operculum somewhat longer than bursa, with two rows of setae on anterior face (6–8 setae, i.e. 3–4 in each row, in the vulvae examined). Apical margin of operculum with three low prominences, of which middle one either well-developed (Figs 24, 25) or not (Fig. 26). Lateral and mesal outgrowths at operculum's apex varying from rounded (Figs 25, 26) to acute (Fig. 24). Furthermore, variation in the shape of both lateral and mesal outgrowths, as well as the presence or absence of a middle prominence can be observed within a single individual (Figs 25, 26), possibly as a result of abrasion with age. Bursa setose, with 3–4 setae both on lateral and

mesal sclerites, 5–7 setae on each side of median plate of posterior sclerite. Caudally, bursa with a smooth central concavity.

Juvenile. Shorter, with fewer body segments, including 5–6 legless ones in front of telson.

Name. The specific epithet refers to the fewer body segments as compared to *A. multiarticulatus* **sp. nov.**

***Anaulaciulus multiarticulatus* sp. nov.**

Figs 27–39

Material examined. *Holotype*: male (NMNS, 6702–008, D–0293), Taiwan, Nantou County, Huisun timberland, 27 December 1997, leg. S.H. Wu; *Paratypes*: 7 males, 7 females, 5 juveniles, (NMNS, 6702–009, D–0293), 1 male, 2 females (IBSS), 1 male, 1 female (ZMUM), 1 male, 1 female (NSYSUB), 1 male, 1 female (HNHM), same locality, together with holotype, 27 December 1997; 4 males (1 male devoid of gonopods, presumably lost), 1 female (NMNS, 6702–010, D–0294), 1 male, 1 female (IBSS), same locality, 27 December 1997, all leg. S.H. Wu.

Diagnosis. Differs from congeners mainly by the shape of the gonopod opisthomere showing an anterolateral lamella broadening at the lateral margin distally into a rounded lobe, as well as by the subrectangular promere with its apex ranging from rather clearly rounded to excavated. This new species differs from the obviously especially similar *A. oligosegmentatus* **sp. nov.** by the lesser body diameter and more numerous segments.

Description. Male. Length 19–35 mm, vertical diameter 0.9–1.1 mm (the overwhelming majority of males show a vertical diameter of 1.0 mm), with 58(–8), 59(–9), 60(–9), 61(–5), 63(–6), 64(–4), 65(–6), 66(–5), 67(–7), 68(–6), 69(–5), 69(–7), 80(–3) segments, excluding telson. A male with 64(–4) body segments showing last podous segment with legs developed only on the right side. Coloration brown or light brown with three narrow, longitudinal, dark brown stripes, one mid-dorsal and two lateral level to ozopores, so that dorsum showing two somewhat lighter, broad, ribbon-shaped, longitudinal stripes, these being less distinct as compared to those in *A. oligosegmentatus* **sp. nov.** Collum with two transversely-oval, large, yellowish spots. Segments in front of telson can also be with two transversely-oval yellowish spots on dorsal side. Clypeolabral part of head lighter. Anal valves lighter, as usual. Antennae and legs brown or beige, eye patches black.

Eye patches subtriangular, composed of at least 26 ocelli. Labral setae as in *A. immensus* **sp. nov.** Gnathochilarium as in *A. oligosegmentatus* **sp. nov.** Length ratios of antennomeres 2–7 as 2.7:2.4:2.4:2.3:1.5:1, width ratios as 1.1:1.1:1.2:1.5:1.4:1, respectively.

Ozopores lying behind stricture without touching it. Striations on metazona not reaching caudal margin, thus making metazona look like being rimmed caudally; 15–16 striae on metazonal surface between dorsal midline and ozopore, or 7–8 striae per square lying between ozopore and axial line. Antennomeres 5 and 6, striations on dorsum and caudal projection of epiproct (including a tiny claw-shaped process) as in *A. oligosegmentatus* **sp. nov.**

Legs as in *A. oligosegmentatus* **sp. nov.**, but pads on femora absent. Anterior legs with narrow pads on post-femora. Claw at base with a presumably long filament ventrally, but without accessory claw dorsally. All claws examined under a microscope (seven claws in 2–3 individuals) showed a ventrobasal stump which could presumably be considered as the rest of a long, broken-off filament, but hardly a short filament. Legs 1 with strong setae ventrally and a ventral papillate knob on telopoditomere 2, apex with several low papillae (Fig. 27). Penes of medium length, deeply bifid (Fig. 28).

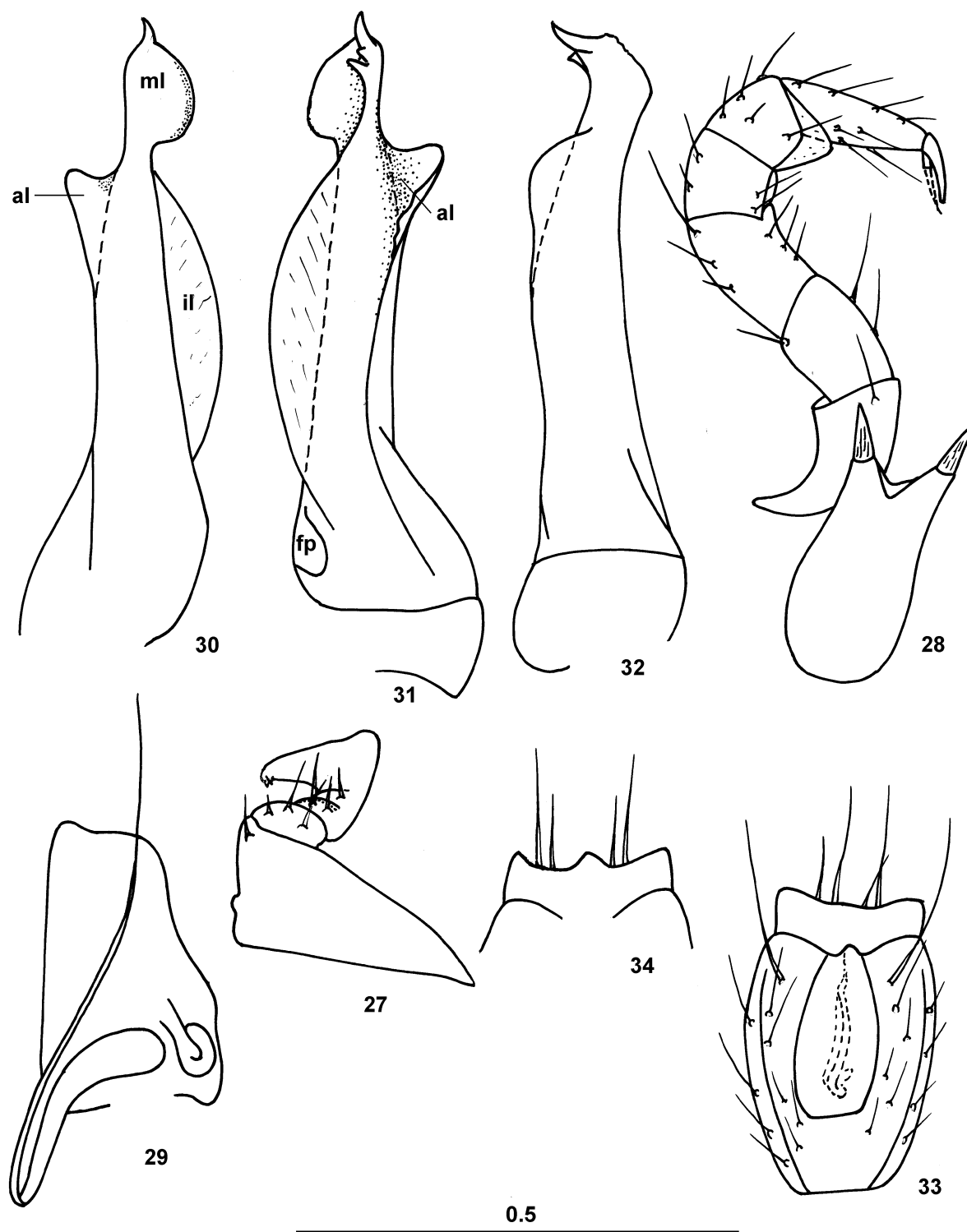
Gonopods. Promere subquadrate, its mesal margin slightly curved rectangularly caudad; flagellum relatively long; rudimentary telopodites well-visible (Fig. 29). Apex of promere varying from relatively well rounded to excavated with a rounded mesal outgrowth (Figs 35–39), this variation being observed even within a single individual, possibly as a result of abrasion with age (Figs 37, 39).

Opisthomere (Figs 30–32) as in *A. oligosegmentatus* **sp. nov.**, but distal part of **al** narrower.

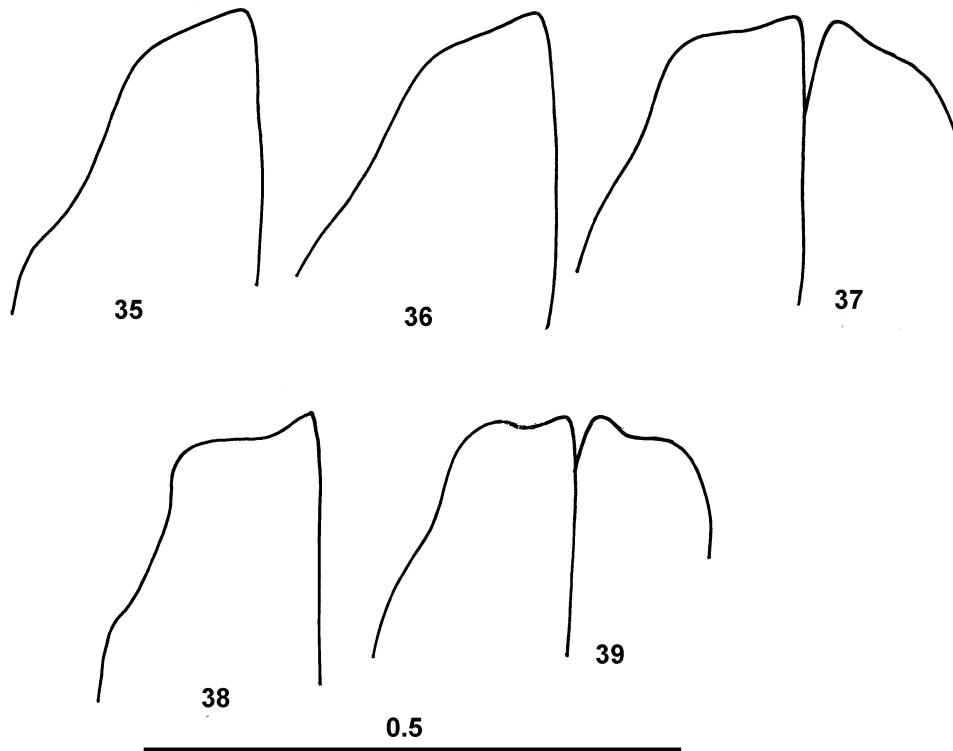
Female. Length 17.5–27 mm, vertical diameter 1.0–1.4 mm, with 53(–6), 53(–7), 54(–7), 54(–8), 57(–4), 58(–5), 59(–5), 60(–3), 63(–4) segments, excluding telson. Claws with long ventral filaments only, these often broken off, leaving short stumps instead. Vulvae as in Fig. 33. Operculum longer than bursa, with two rows of setae on anterior face (6–8 setae, i.e. 3–4 in each row, in the vulvae examined). Apical margin of operculum with three low prominences, of which middle one either well-developed (Fig. 34) or not (Fig. 33). Lateral and mesal outgrowths at operculum's apex varying from rounded (Fig. 33) to acute (Fig. 34). Variation in structure of vulva in one and the same individual not noted, Figures 33 and 34 showing vulvae of different specimens from the same sample D–

0293. Bursa setose, with four setae both on lateral and mesal sclerites, six setae on each side of median plate of posterior sclerite.

Juvenile. Length not exceeding 9–10 mm, body with 9–10 apodous segments in front of telson.



FIGURES 27–34. *Anaulacius multiarticulatus* sp. nov., male (27–32) and female (33–34) paratypes. 27, leg 1, front view; 28, leg 2 and penes; 29, promere, caudal view; 30, left opisthomere, caudal view; 31, left opisthomere, front view; 32, left opisthomere, lateral view; 33, right vulva of a smaller female from sample D-0293, caudal view; 34, distal part of vulva of a larger female from sample D-0293, caudal view; **il**, intermediate lamella of opisthomere; **al**, anterolateral lamella of opisthomere; **ml**, mesal lobe of opisthomere apex; **fp**, basal flap of opisthomere. Scale in mm.



FIGURES 35–39. *Anaulaciulus multiarticulatus* **sp. nov.**, male paratypes. Variation in shape of promere apex: 35–36, different individuals from sample D–0294, 37–39, different individuals from sample D–0293. Scale in mm.

Name. The specific epithet refers to the more numerous body segments as compared to that in *A. oligosegmentatus* **sp. nov.**

Remarks. Superficially, *A. multiarticulatus* **sp. nov.** is rather similar to *A. oligosegmentatus* **sp. nov.**, but differs mainly by the slenderer body and more numerous segments. In most cases, males of *A. multiarticulatus* **sp. nov.** are longer than those of *A. oligosegmentatus* **sp. nov.** One could suggest that the slenderer body in the former species is attained due to its greater length. Yet this is not so. In these two species, males of the same or a similar length show different diameters: 0.9–1.1 mm in *A. multiarticulatus* **sp. nov.**, versus 1.0–1.3 mm in *A. oligosegmentatus* **sp. nov.** In addition, longitudinal stripes are far less distinct, up to virtually missing, on the dorsum of *A. multiarticulatus* **sp. nov.**, with most of the specimens (except one) also showing more numerous apodous segments in front of the telson. This latter is evidence of further potential growth, meaning the animals would become still longer and attain more segments. In other words, this is a stable feature to securely distinguish both of these new species.

As regards gonopod structure, the main differences are observed in the structure of the promere apex: however variable and partly overlapping (= regularly convex) in shape, it is sometimes excavate in *A. multiarticulatus* **sp. nov.**, but never so in *A. oligosegmentatus* **sp. nov.**, ranging from regularly convex to excavate (Figs 35–39) versus oval to regularly convex (Figs 21–23), respectively. In addition, the shape of the promere in *A. multiarticulatus* **sp. nov.**, is rather subquadrate, as opposed to subtriangular in *A. oligosegmentatus* **sp. nov.** The breadth of lamella **al** on the opisthomere somewhat differs as well. The vulvae are morphologically very similar and highly variable, offering no reliable features to distinguish these two species.

It is also noteworthy that, based both on opisthomere structure (**al** and **ml** breadths) and a vertical body diameter of 1.0 mm, males of *A. oligosegmentatus* **sp. nov.** from Hualien County approach closely those of *A. multiarticulatus* **sp. nov.** Yet the shapes of the promere, coupled with fewer body segments, i.e. 47(–2), allow for a secure identification of these samples to be made as belonging to *A. oligosegmentatus* **sp. nov.** Molecular analyses would be indispensable to further clarify the identities of these two very similar species.

***Anaulaciulus setulifer* sp. nov.**

Figs 40–45

Material examined. *Holotype*: male (NSYSUB), Taiwan, Pingtung County, Chunri Township, Mt Dahan, 22°24'25" N, 120°45'21" E, 1200 m a.s.l., 15 December 2009, leg. M.H. Hsu; *Paratypes*: 11 males, 25 females, 1 fragment (NSYSUB), 2 males, 2 females (IBSS), 2 males, 2 females (ZMUM), 1 male, 1 female (NMNS, 6702–011), 1 male, 1 female (HNHM), same locality, together with holotype, 15 December 2009, leg. M.H. Hsu.

Diagnosis. Differs from congeners mainly by the shape of the gonopod opisthomere, in which the anterolateral lamella is broadened distally into a lobiform plate with a curved apical outgrowth, as well as by the presence of minute setules at the caudal margin of metazona.

Description. Male. Length 23–28 mm, vertical diameter 1.0 mm with 64(–4), 64(–5), 69(–5), 69(–3) segments, excluding telson. Coloration dark brown with three narrow, longitudinal, dark brown stripes, one mid-dorsal and two lateral ones level to ozopores, so that dorsum showing two vague, somewhat lighter, broad, ribbon-shaped, longitudinal stripes. Collum with two transversely-oval, large, yellowish spots. Clypeolabral part of head lighter. Anal valves lighter, as usual. Antennae and legs brown, eye patches black.

Eye patches subtriangular, composed of at least 29 ocelli. Labral setae as in *A. immensus* sp. nov. Genae with a small low knob on cardo. Gnathochilarium as in *A. oligosegmentatus* sp. nov. Length ratios of antennomeres 2–7 as 5.4:5.0:4.0:5.0:2.8:1, width ratios as 1.1:1.1:1.2:1.7:1.6:1, respectively. Antennomeres 5 and 6 each with an incomplete distodorsal corolla of a few sensory bacilli, these being especially few on 6th antennomere.

Body subcylindrical, slender. Ozopores lying behind stricture without touching it. Metazona with striations extending behind to caudal margin; 12–13 striae on metazonital surface between dorsal midline and ozopore, or 7–8 striae per square lying between ozopore and axial line. Caudal margins of metazona with minute, very sparse, barely visible setules. Caudal parts of prozona lying below ozopore level, finely striolate longitudinally and slightly obliquely. Caudal projection of epiproct as in *A. oligosegmentatus* sp. nov., but a tiny claw-shaped process curved dorsally.

Legs as in *A. oligosegmentatus* sp. nov. Claw at base with a long filament ventrally. Legs 1 with strong setae ventrally and a ventral papillate knob on telopoditome 2, apex with traces of papillae (Fig. 40). Penes of medium length, deeply bifid (Fig. 41).

Gonopods. Promere somewhat intermediate in shape between a quadrangle and a triangle, mesal margin somewhat curved rectangularly caudad; flagellum relatively long; rudimentary telopodites well-visible (Fig. 42).

Opisthomere (Figs 43, 44) as in *A. oligosegmentatus* sp. nov., but distal part of **al** extended into a curved apical outgrowth (**p**) while opisthomere apex with an elongate, thin, mesal lobe (**ml**).

Female. Length 20–30 mm, vertical diameter 1.0–1.8 mm, with 53(–4), 55(–4), 57(–4), 58(–4), 61(–3), 70(–3) segments, excluding telson. Broad, ribbon-shaped, light, longitudinal stripes on dorsum rather distinct. Claws with long ventral filaments only, these often broken off, leaving short stumps instead. Vulvae as in Fig. 45. Operculum longer than bursa, with two rows of setae on anterior face (at least four setae in each row in the vulvae examined). Apical margin of operculum with two low prominences. Bursa setose, with four setae on lateral and with three setae on mesal sclerites, five setae on each side of median plate of posterior sclerite.

Name. The specific epithet refers to the minute setules present at the caudal edge of metazona.

***Anaulaciulus tonginus* (Karsch, 1881)**

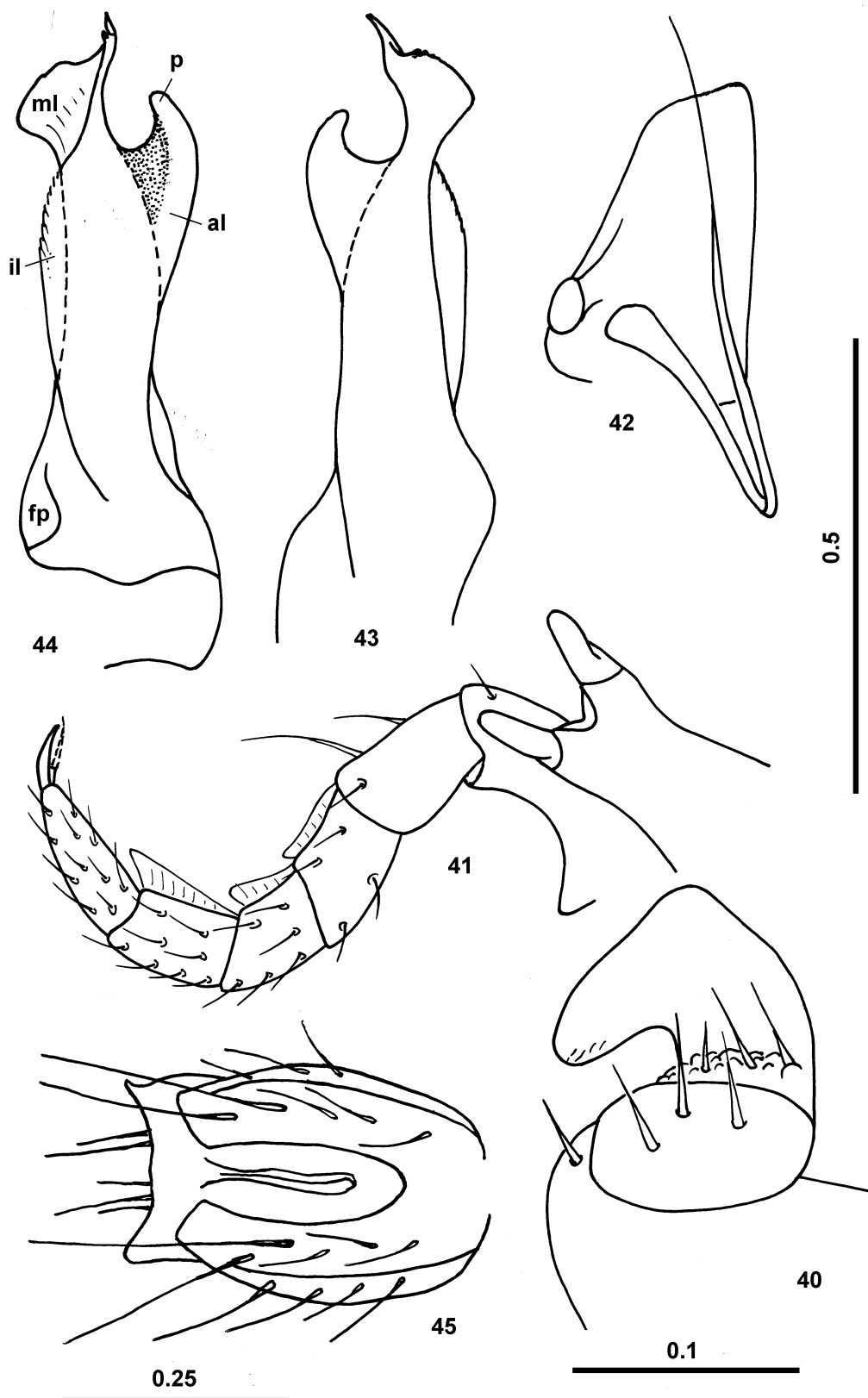
Figs 46–62

Iulus tonginus Karsch, 1881: 20 (Hong Kong).

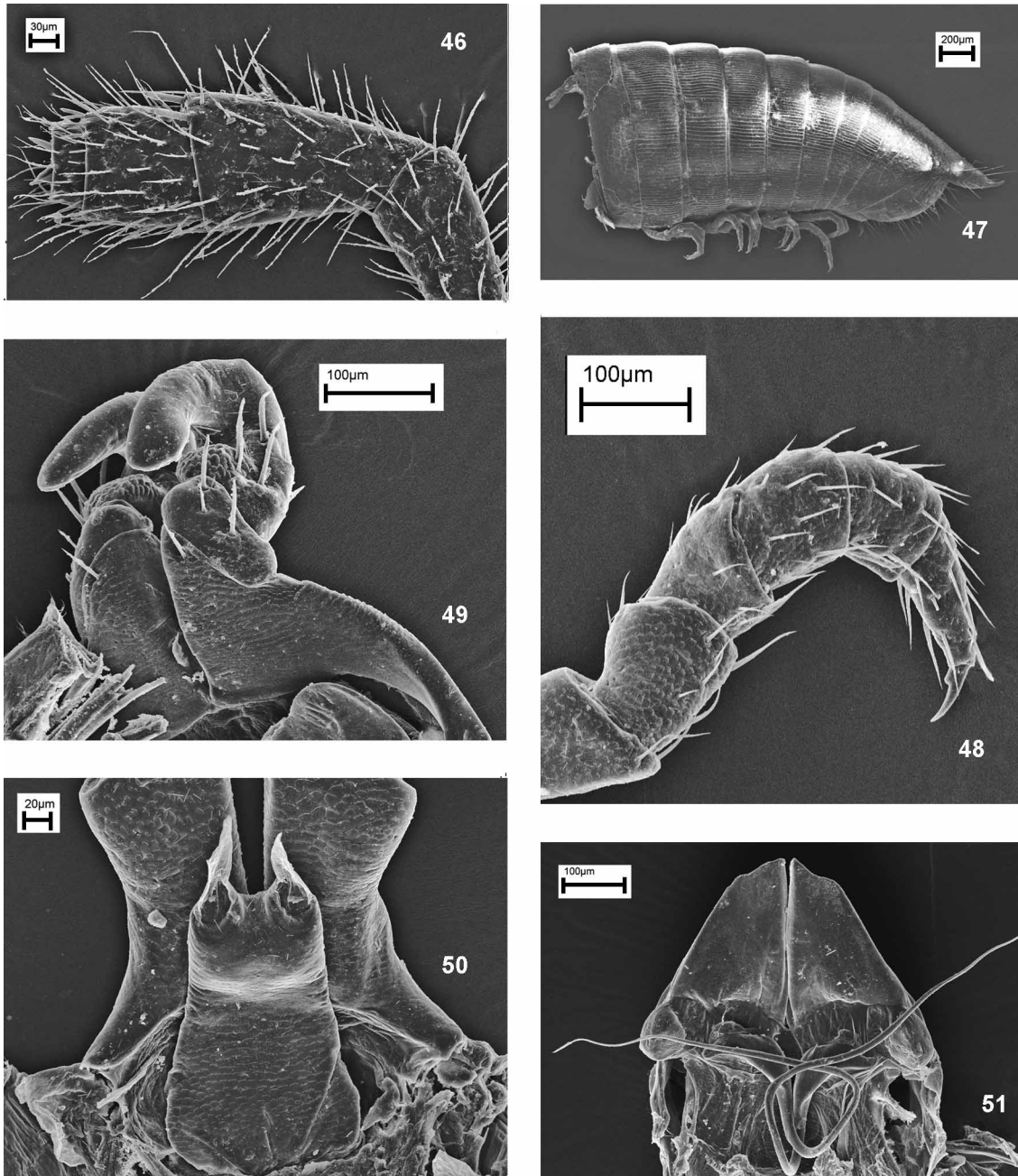
Fusiulus trilobus khuuae Wang, 1963: 92: fig. 3; Korsós 1994: 181.

Anaulaciulus tonginus—Enghoff 1986: 124; Korsós 1994: 177–183, 179: figs 1–4, 180: figs 5–8; 1996: 39, 41–42; 2004: 15.

Material examined. 1 male (NMNS, 6702–012, D–0010), 1 male (IBSS), Taiwan, Nantou County, Huisun timberland, 13 August 1997; 1 male (NMNS, 6702–013, D–0073), 2 males (IBSS), same locality, 15 August 1997; 1 male (NMNS, 6702–014, D–0391), same locality, October 1997; 1 male (NMNS, 6702–015, D–0069), same locality, 25 October 1997; 1 male, 1 female (ZMUM), 1 female (NMNS, 6702–016, D–0290), 1 female (IBSS), same locality, 27 December 1997; 2 males, 1 female (IBSS, D–0627), same locality, 21 January 1998; 2 males, 2 females



FIGURES 40–45. *Anaulaciulus setulifer* sp. nov., male (40–44) and female (45) paratypes. 40, leg 1, front view; 41, leg 2 and penes; 42, promere, caudal view; 43, opisthomere, caudal view; 44, opisthomere, front view; 45, left vulva, caudal view; **il**, intermediate lamella of opisthomere; **al**, anterolateral lamella of opisthomere; **p**, outgrowth of anterolateral lamella of opisthomere; **ml**, mesal lobe at opisthomere apex; **fp**, basal flap of opisthomere. Scales in mm.

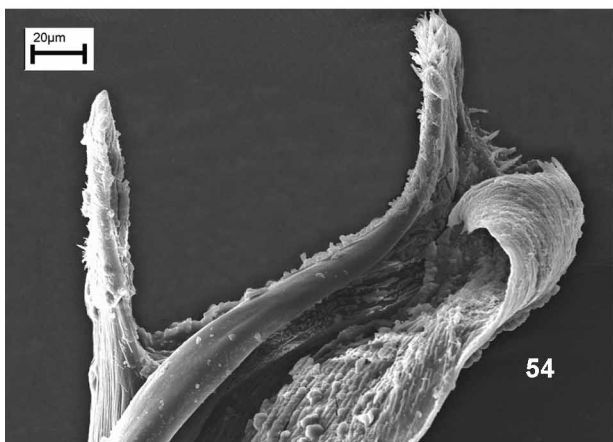
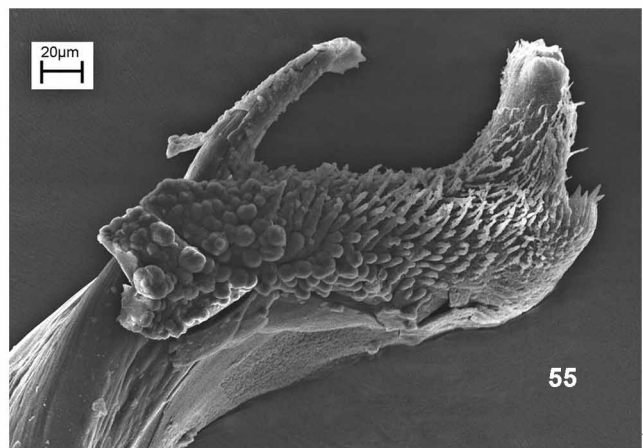
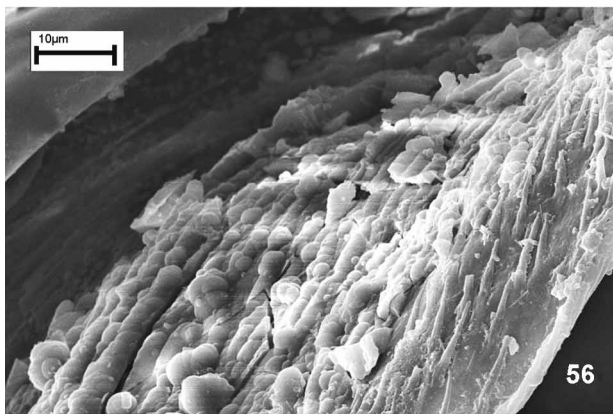
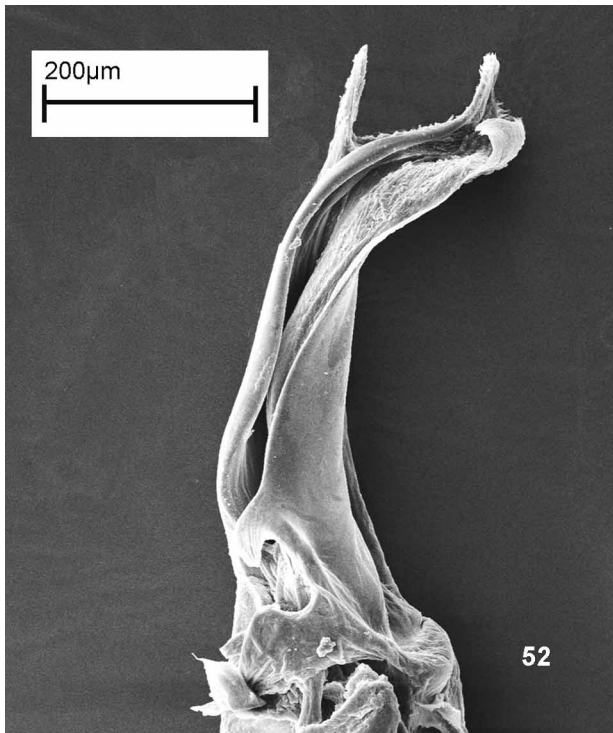


FIGURES 46–51. *Anaulaciulus tonginus* (Karsch, 1881), male. 46, distal part of antenna; 47, posterior portion of body; 48, leg 2; 49, leg pair 1; 50, penes; 51, promeres, caudal view.

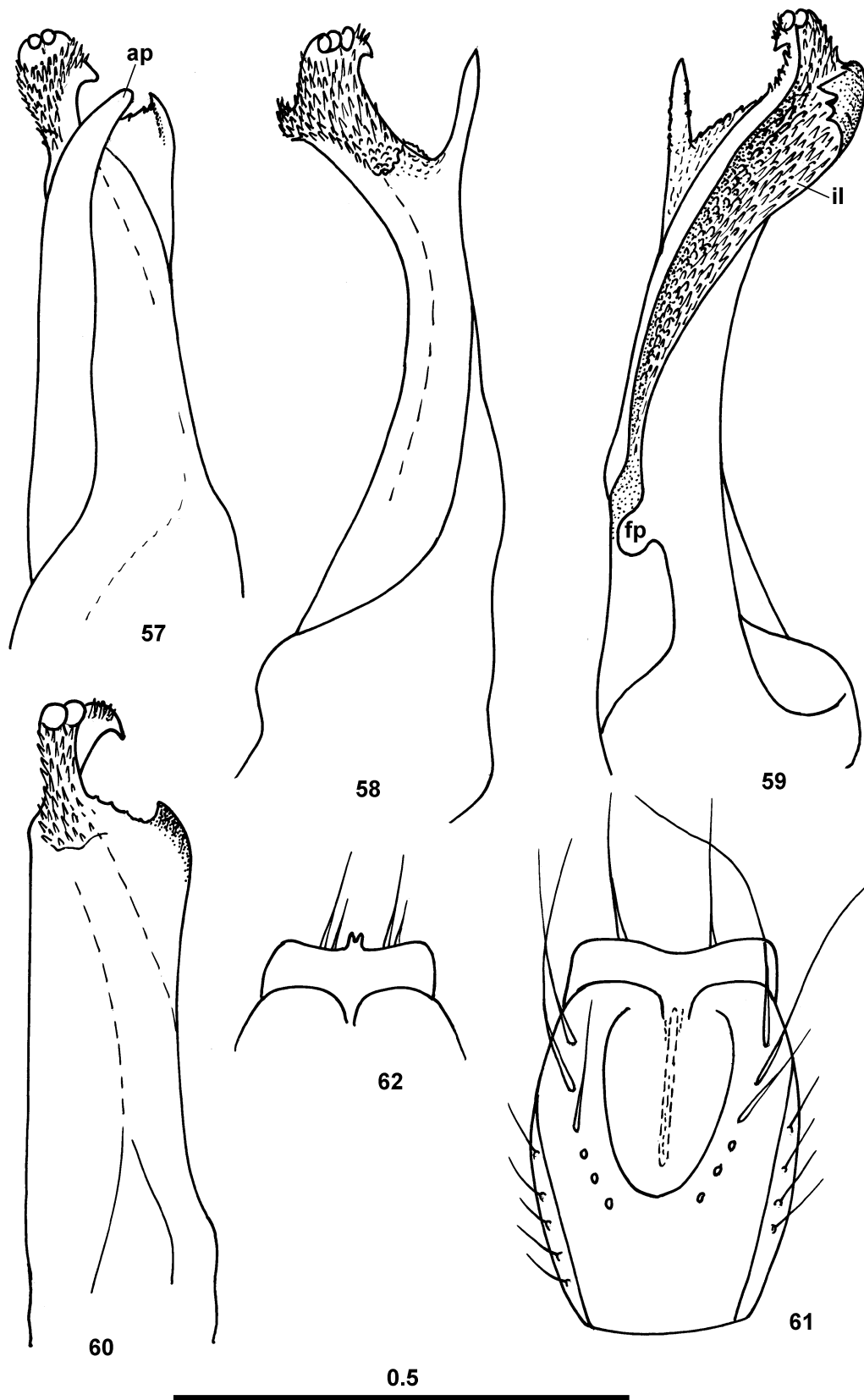
(NMNS, 6702–017, D–0631), 1 male, 1 female (NSYSUB), same locality, 28 February 1998; 2 males (NMNS, 6702–018, D–0634), same locality, 1 March 1998; 1 male, 1 female (NMNS, 6702–019, D–0029), same locality, 7 April 1998; 1 female (NMNS, 6702–020, D–0617), same locality, 24 April 1998; 3 males (NMNS, 6702–021, D–0245, D–0254, D–0325), same locality, 25 April 1999, all leg. S.H. Wu; 1 male (NSYSUB), Taiwan, Kaohsiung County, Liouguei, Shanping Workstation, 750 m a.s.l., May 2004, leg. M.J. Hung; 5 males, 3 females (NSYSUB), 1 male, 1 female (ZMUM), 1 male, 1 female (HNHM), Taiwan, Miaoli City, Guishan, 6 January 2006, leg. M.H. Shu; 1 female (NSYSUB), Taiwan, Yilan County, Datong Township, logging road No. 100, 1600 m a.s.l., 19k, 9 September 2009, leg. J. Ding; 1 female, 1 juvenile (NSYSUB), Taiwan, Pingtung County, Kenting National Park, 5 October 2009, leg. E.V. Mikhaljova, S.I. Golovatch *et al.*; 2 females (NSYSUB), Taiwan, Pingtung County, Chunri Township, Mt Dahan, 22°24'25" N, 120°45'21" E, ca. 1500 m a.s.l., 15 December 2009, leg. M.H. Hsu.

Redescription. Male. Length 17–22 mm, vertical diameter 1.0–1.9 mm, with 45(–2), 46(–2), 47(–2), 47(–3), 48(–2), 48(–3), 49(–2), 50(–1), 50(–2), 51(–1), 51(–2) segments, excluding telson. Coloration brown or light

brown with three, longitudinal, dark brown stripes, one mid-dorsal and two lateral ones level to ozopores. Antennae and legs pale brown to brown. Head pallid or light brown with a brown vertex. Specimens from Miaoli City darker than others.



FIGURES 52–56. *Anaulaciulus tonginus* (Karsch, 1881), male. 52, opisthomere, mesal view; 53, opisthomere, lateral view; 54, apex of opisthomere, mesal view; 55, apex of opisthomere, lateral view; 56, fragment of front face of intermediate lamella.

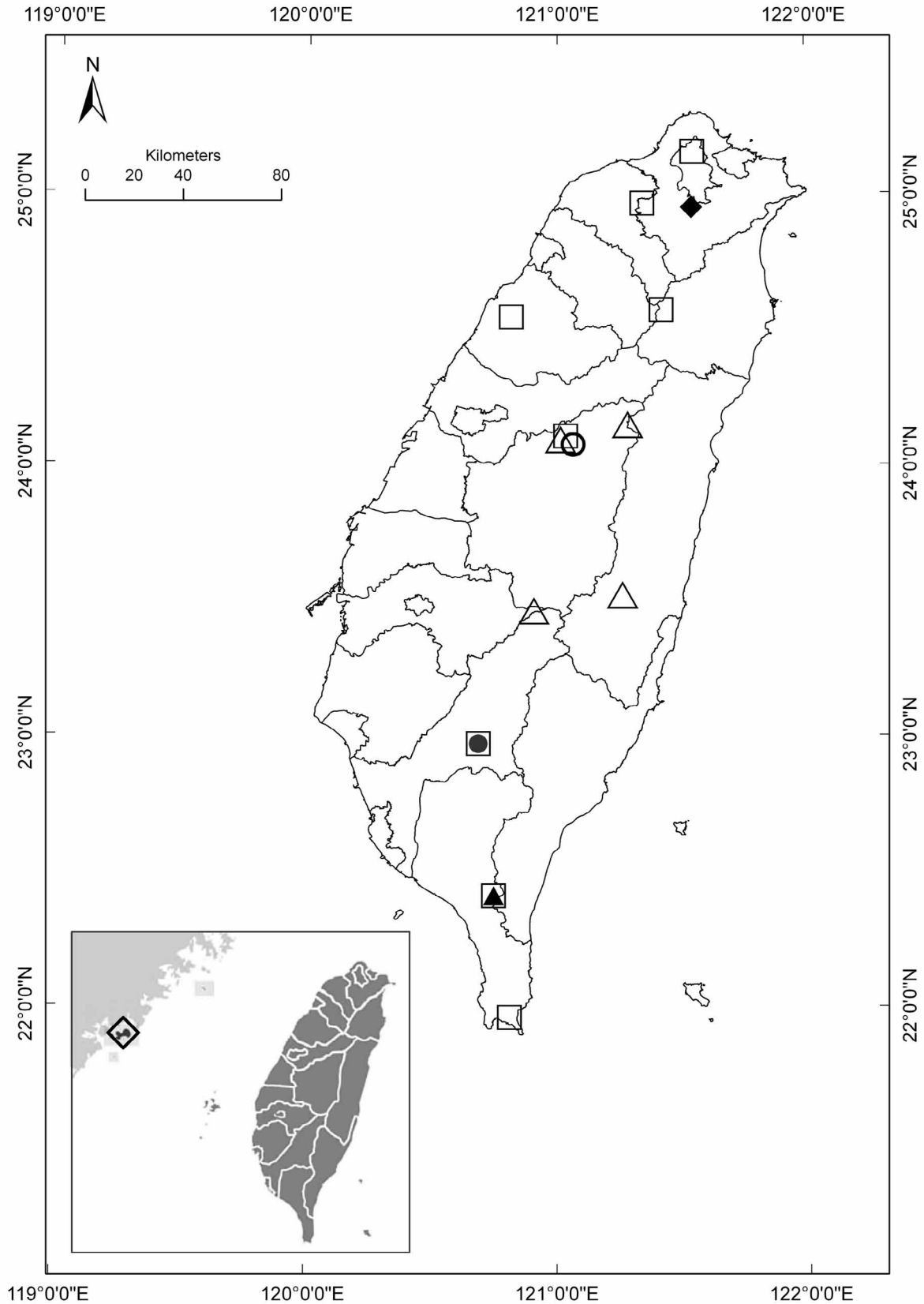


FIGURES 57–62. *Anaulaciulus tonginus* (Karsch, 1881), male (57–60) and females (61–62). 57, opisthomere, front view; 58, opisthomere, lateral view; 59, opisthomere, mesal view; 60, opisthomere, caudal view; 61, vulva from sample D–0631, caudal view; 62, distal part of vulva from sample D–0627, caudal view; **il**, intermediate lamella of opisthomere; **ap**, anterior process of opisthomere; **fp**, basal flap of opisthomere. Scale in mm.

TERMS OF USE

This pdf is provided by Magnolia Press for private/research use.

Commercial sale or deposition in a public library or website is prohibited.



Map. Distribution of *Anaulaciulus* species in Taiwan. Borderlines show borders between the counties. Filled circle: *A. immensus* **sp. nov.**; open triangle: *A. oligosegmentatus* **sp. nov.**; open circle: *A. multiarticulatus* **sp. nov.**; filled triangle: *A. setulifer* **sp. nov.**; open square: *A. tonginus* (Karsch, 1881); open diamond: *A. trilobus* (Wang, 1963); filled diamond: *A. trapezoidus* (Wang, 1955).

Eye patches subquadrate, composed of 47–49 small ocelli. Front margin of collum can cover posterolateral corner of eye patch. Labral setae 8+8 or 9+9. Antennae in situ extending behind to segment 5. Length ratios of antennomeres 2–7 as 4.4:4.4:4.0:4.4:3.0:1, width ratios as 1.1:1.1:1.25:1.6:1.4:1, respectively. Antennomeres 5 and 6 each with an incomplete distodorsal corolla of a few sensory bacilli (Fig. 46).

Body slightly compressed laterally. Stricture dividing pro- and metazona deep, slightly sinuate caudally level to ozopores. Ozopores very small, lying behind stricture, touching it in anterior body part, set off in posterior body part. Metazona with striations reaching hind margin; 22–23 striae on metazonal surface between dorsal midline and ozopore, or 11–12 striae per square lying between ozopore and axial line. Striations on dorsum as in *A. oligosegmentatus* **sp. nov.** Caudal parts of prozona finely striolate longitudinally and slightly obliquely, growing increasingly distinct ventrad. Caudal projection of epiproct coniform, covered with sparse, relatively long setae and carrying a small claw-shaped process curved dorsally (Fig. 47).

Legs slender and relatively short. Claw at base with a long and strong filament ventrally. Only claws of legs 2 with a ventrobasal stump, this apparently meaning a long filament broken off (at least so in all four males studied in this respect) (Fig. 48). Anterior legs with a broad and very delicately serrate pad on tibia and postfemur, these pads gradually reduced caudad to disappear near middle of body. Legs 1 with strong setae ventrolaterally and a ventral papillate knob on telopoditomere 2 (Fig. 49). Penes bifurcate (Fig. 50).

Gonopods. Promere (Fig. 51) subtriangular, about half the length of opisthomere; flagella of medium length; rudimentary telopodites in caudolateral corner well-visible. Mesal margin of promere curved rectangularly caudad, so that, when viewed from mesal side, a flat surface of the curved margin becomes visible (this can give the false impression of the promere being thickened). In addition, it is noteworthy that the mesal margin of the promere is curved more strongly than in other three new congeners described above. Apex of promere with a small medial outgrowth. Opisthomere (Figs 52, 53, 57–60) long and straight, with a deep mesal furrow along its axis. Apex of opisthomere curved forward and beset with minute setules and papillae (Figs 54, 55). Front face of intermediate lamella (**il**) beset with minute structures as well: setules at **il** margin and papillar cushions over remaining parts (Fig. 56). Apex of **il** with minute lunules and a small, beak-shaped outgrowth. Front face of opisthomere with a large and flattened process (**ap**) curved mesad (Fig. 57). Process **ap** can be suggested to represent the free distal part of an anterolateral lamella, in which the basal two-thirds have become fused to the remaining portion of the opisthomere. Base of opisthomere with a flap (**fp**) to guide promere's flagellum.

Female. Length 21–24 mm, vertical diameter 1.8–2.0 mm, with 45(–3), 47(–2), 48(–2), 49(–2), 50(–2), 51(–2), 52(–2) segments, excluding telson. One of the females from Nantou County (female D–0617) pallid. Ocelli within 50 in number. Claws as in male. Only legs 1 with claws devoid of a long filament at base, just like in male legs 2 showing a short stump instead. Vulvae as in Fig. 61. In some females, tip of vulvae covered with brown material. A similar observation has already been made by Korsós (1994) who, when redescribing the species, suggested this material be left by the male to cork and close the bursal opening upon mating. Operculum longer than bursa, with two rows of setae on anterior face (3–4 setae in each row). Apical margin of operculum with three prominences, of which middle one either well-developed (Fig. 62) or not (Fig. 61). Both lateral and mesal outgrowths at operculum's apex rounded and very low. Bursa setose, with four setae on lateral sclerite, five setae on mesal sclerite, and at least six setae on each side of median plate of posterior sclerite. Caudally, bursa with a smooth central concavity.

Remarks. Originally described very succinctly (without illustrations) from Hong Kong (Karsch 1881), this species has been redescribed by Korsós (1994), based on fresh topotype material previously so identified by Eng-hoff (1986), based on a side-by-side comparison with the female holotype. In Taiwan, *A. tonginus* has hitherto been recorded as a result of its synonymization with *Fusiulus trilobus khuuuae* Wang, 1963, yet without a comparative study of relevant material (Korsós 1994). *A. tonginus* in Taiwan actually appears to be among the most widespread and common congeners.

The above detailed redescription is deemed to be helpful in properly assessing the pronounced variation range of the species.

Anaulaciulus trilobus (Wang, 1963)

Fusiulus trilobus (sic!) *quemoyensis* Wang, 1963: 91–92, 91: figs 1–2.

Fusiulus trilobus quemoyensis—Korsós 1994: 181.

Anaulaciulus trilobus quemoyensis—Enghoff 1986: 124.

Anaulaciulus trilobus—Enghoff 1986: 124; Korsós 1994: 181; 1996: 39; 2004: 15.

Remarks. Wang (1963) described this species as two subspecies: *Fusiulus trilobus quemoyensis*, from "Quemoy (Kin-Men) Island, Fukien Province" [Kingman Island, Fu-chien Province], an islet lying ca. 160 km west of Taiwan, and *F. trilobus khuuae*, from "Yan Min Shan and Yin Ko", near Taipei, Taiwan. Neither has since been revised. Even though their original descriptions and accompanying illustrations were very far from adequate, Enghoff (1986), without a study of type material, elevated *quemoyensis* to a full species, noting that "A nominate subspecies of *trilobus* has never been described, and *quemoyensis* must be sunk in synonymy of *trilobus* s.s." Korsós (1994), likewise without a restudy of pertinent material, synonymized *khuuae* with *A. tonginus*.

We include this dubious species in our key below, based only on the original sketches of the gonopods. Since these sketches are far too schematic to unequivocally interpret, the incorporation of *A. trilobus* in the key must be understood as being highly provisional, pending a revision of topotype material. The same actually concerns the following species *A. trapezoidus* as well, whereas the record of *A. simplex* from an unknown locality in Taiwan is likely to represent still another of the numerous taxonomic and faunistic errors in Wang's diplopodological heritage. We consider these two latter taxa in our key only for the sake of completeness.

Anaulaciulus trapezoidus (Wang, 1955)

Fusiulus trapezoidus Wang, 1955: 14: fig.1–3.

Fusiulus trapezoidus—Wang 1958: 344; 1963: 91–92.

Anaulaciulus trapezoidus—Enghoff 1986: 124; Korsós 1996: 39; 2004: 15.

Remarks. Originally described quite inadequately from "Hsin-Tien, Taipei" (Wang 1955), this species was later recorded first from "Taipei" (Wang 1958) and then from Dah Ren Jen (Wang 1963). Topotype material from the Taipei region is necessary to revise *A. trapezoidus*. Wang's types, claimed to have been deposited in the Taiwan Museum, can be presumed to be lost.

Anaulaciulus simplex (Verhoeff, 1936)

Fusiulus simplex Verhoeff, 1936: 166–168, 171–172, pl. IV: figs 19–22 (Japan).

Fusiulus simplex—Wang 1963: 92.

Anaulaciulus simplex—Shinohara 1973: 241; Korsós 1996: 38; 2004: 15.

Remarks. This species has originally been described from northern and central Japan: Hirosaki and Atami near Tokyo (Verhoeff 1936), while Wang's (1963) record in Taiwan, without reference to any material whatsoever, is most probably false, probably best to be neglected.

Key to species of *Anaulaciulus* reported from Taiwan

- 1(2) Caudal edges of metazona with tiny, very sparse setules. Gonopods as in Figs 42–44. *A. setulifer* sp. nov.
- 2(1) Caudal edges of metazona without setae, however small. Gonopods different. 3
- 3(4) Gonopod opisthomere rather stout, with three apical outgrowths showing their apices at about the same level. *A. trilobus*
- 4(3) Gonopod opisthomere slender, devoid of three apical outgrowths showing their apices at about the same level. 5
- 5(12) Apex of gonopod opisthomere devoid of an elongate, thin, mesal lobe 6
- 6(7) Gonopod opisthomere frontally with one large flat process curved mesad *A. tonginus*
- 7(6) Gonopod opisthomere frontally without large flat process curved mesad. 8
- 8(9) Gonopod opisthomere with a broad anterolateral lamella *A. trapezoidus*
- 9(8) Gonopod opisthomere without broad anterolateral lamella 10
- 10(11) Adults 37–50 mm long. Gonopods as in Figs 7–9 *A. immensus* sp. nov.
- 11(10) Adults 20–21 mm long. Gonopods different *A. simplex*
- 12(5) Apex of gonopod opisthomere with an elongate, thin, mesal lobe 13
- 13(14) Body vertical diameter 0.9–1.4 mm. Adult body (males and females) with at least 53 segments, excluding telson. Gonopod

- promere subquadrate, with apex varying from relatively evenly rounded to excavated. *A. multiarticulatus* **sp. nov.**
 14(13) Body vertical diameter 1.0–1.8 mm. Adult body (males and females) with at least 43 segments, excluding telson. Gonopod promere subtriangular, with apex somewhat varying from simply rounded to rounded with an extended mesal margin. . *A. oligosegmentatus* **sp. nov.**

Conclusion

The Taiwanese fauna of *Anaulaciulus* appears to be rather rich and highly peculiar. At the moment, it is represented by eight nominate species, of which two are dubious as taxa (thus requiring revision), while one more, *A. simplex*, is highly dubious as an element of the Taiwanese fauna. Similar levels of diversity of *Anaulaciulus* are observed in continental China and Korea, with at least six and nine species or subspecies involved, respectively. In contrast, in Japan the genus is represented by 25 species or subspecies. Yet, because mainland China is still very poorly prospected as regards its millipede fauna, the actual diversity of *Anaulaciulus* is certainly considerably underestimated. Considering the above qualifications, six *Anaulaciulus* species are formally endemic to the island of Taiwan together with its adjacent islets, whereas *A. tonginus* is shared with the fauna of Hong Kong, while the highly dubious *A. simplex* is shared with the fauna of Japan.

The distribution of *Anaulaciulus* in Taiwan (Map) shows only one of the species, *A. tonginus*, as being widespread and occurring at various elevations throughout the island. The remaining congeners in Taiwan tend to be more local in distribution: *A. oligosegmentatus* **sp. nov.** seems to be confined to the central and central-eastern regions of the “mainland”, sharing the central, mostly high-montane part of Taiwan (Huisun timberland, Nantou County) with the morphologically similar *A. multiarticulatus* **sp. nov.** Two further species, *A. immensus* **sp. nov.** and *A. setulifer* **sp. nov.**, seem to be endemic to the southern, tropical (midmontane) parts of the island.

As regards *A. trilobus*, its identity is questioned not only because of its very poor original description, but also due to its provenance from the small islet of Kingman, i.e. about 160 km west of “mainland” Taiwan, just off the coast of continental China (Map). Formally, *A. trilobus* is still to be treated as a Taiwanese endemic (Wang 1963; Enghoff 1986; Korsós 1996, 2004), but such a small islet seems highly unlikely to support an endemic diplopod species altogether. More probably, *A. trilobus*, maybe as a synonym, is more widespread, especially in mainland China.

The distribution of *A. trapezoidus* is currently restricted to Taipei and presumably its environs, northern Taiwan. Unfortunately, Wang’s (1963) report of *A. trapezoidus* from Dah Ren Jen remains dubious, since such a locality could not be traced on any map. Similarly, the record of *A. simplex* in Taiwan by Wang (1963) is questionable and cannot be mapped.

To summarize, Taiwan appears to support several presumably endemic *Anaulaciulus* species, some of which are restricted to the montane northern and central parts of the island. Since the only congener truly widespread in Taiwan, *A. tonginus*, occurs at least in Hong Kong as well, it might actually have been introduced on both of the islands from mainland Asia.

Acknowledgements

We are most grateful to the National Science Council (NSC), Taiwan, Republic of China, and to the Russian Academy of Sciences, Moscow, Russian Federation, for the support rendered to the Taiwanese and Russian teams, headed by H. W. Chang and S. I. Golovatch, respectively, to actively collaborate in our joint ecofaunistic studies on the Myriapoda of Taiwan (NSC grant No. 98-2923-B-110-002-MY2; Russian Foundation for Fundamental Investigations, grant No. 09-04-92005-HHC_a). K. S. Lee (NMNS, Taichung, Taiwan) kindly provided material under his care on loan. We are most grateful to Z. Korsós (HNHM, Budapest, Hungary) for loaning some topotype material of *Anaulaciulus tonginus* for comparative studies. We are deeply obliged to collectors whose material has been treated in this paper. Our special thanks are extended to Mrs N. N. Naryshkina (IBSS, Vladivostok, Russia) for the preparation of scanning electron micrographs. Mrs. G.A. Sinelnikova (IBSS, Vladivostok, Russia) helpfully inked the line drawings. H.Y. Hsu (NSYSUB, Kaohsiung, Taiwan) skillfully executed the map.

References

- Causey, N.B. (1966) Redescription of two Chinese species of *Anaulaciulus* (Diplopoda, Julidae, Nemasomatidae), a genus also known in Taiwan, Korea and Japan. *Proceedings of the Louisiana Academy of Sciences*, 29, 63–66.
- Enghoff, H. (1986) Leg polymorphism in a julid millipede, *Anaulaciulus inaequipus* n. sp. With a list of congeneric species (Diplopoda, Julida, Julidae). *Steenstrupia*, 12(7), 117–125.
- Karsch, F. (1881) Neue Juliden des Berliner Museums, als Prodrömus einer Juliden-Monographie. *Zeitschrift für die Gesamten Naturwissenschaften*, 54, 1–79.
- Korsós, Z. (1994) Redescription of *Anaulaciulus tonginus* (Karsch, 1881) (Diplopoda, Julida, Julidae). *Steenstrupia*, 20(7), 177–183.
- Korsós, Z. (1996) An approach to the revision of the East Asian millipede genus *Anaulaciulus*. In Geoffroy, J.J., Mauriès, J.P. & Nguyen Duy-Jacquemin, M. (eds), *Acta Myriapodologica. Mémoires du Muséum national d'Histoire naturelle*, Paris, 169, 35–43.
- Korsós, Z. (2001) Diplopoda from the Nepal Himalaya: Towards the clarification of the genus *Anaulaciulus* Pocock 1895 (Diplopoda, Julida, Julidae, Brachyiulini). *Senckenbergiana biologica*, 81(1/2), 61–86.
- Korsós, Z. (2004) Checklist and bibliography of millipedes (Diplopoda) of Taiwan. *Collection and Research*, 17, 11–32.
- Shinohara, K. (1973) The fauna of the lava caves around Mt. Fuji-san XIII. Diplopoda and Chilopoda. *Bulletin of the National Science Museum*, 16(2), 217–251.
- Verhoeff, K.W. (1936) Ueber Diplopoden aus Japan, gesammelt von Herrn Y. Takakuwa. *Transactions of the Sapporo Natural History Society*, 14, 148–172.
- Wang, Y-H.M. (1955) Serica 1a: Records of myriapods on Formosa with description of new species. *Quarterly Journal of the Taiwan Museum*, 8(1), 13–16.
- Wang, Y-H.M. (1958) Serica 1i: On Diplopoda from Taiwan with a new strongylosomids (sic!). *Quarterly Journal of the Taiwan Museum*, 11(3/4), 340–344.
- Wang, Y-H.M. (1963) Serica 1q: Millipedes and centipedes of Quemoy, Fukien Province and Taiwan Island, Botel Tobago (Lan Yu), Taiwan Province and of Singapore. *Quarterly Journal of the Taiwan Museum*, 16(1/2), 89–96.