

ENTOMOLOGY

***Eurycnemus* v. d. Wulp (Diptera, Chironomidae) newly recorded in China**L. Li,¹ H. Tang²¹Research Centre of Hydrobiology, and ²Institute of Groundwater and Earth Science, Jinan University, Guangzhou, China**Abstract**

Pharate male, pupa and larva of *Eurycnemus* cf. *nozakii* Kobayashi 1998 are described based on the associated material collected from Liaoning Province. This is the first record of this genus in China. The Chinese species is distinctly smaller than the Japanese *E. nozakii* at all stages, which can be separated from congeners by the presence of hind tibial comb and the absence of basal strong seta on the gonostylus in the male, some differences are also found in the immature stage, which suggest an independent new species rather than the true *E. nozakii*. Detailed differences are compared among similar taxa from Japan, Russian Far East and China. Pupal exuviae collected from Fujian and Yunnan Provinces were also examined, which can be separated from the above species by the short male genital sac. Because of few different characters at the immature stage among these similar taxa from a wide range, the possible high diversity within this genus is suspected. Based on the current knowledge, the generic diagnosis is emended.

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Introduction

Genus *Eurycnemus* v. d. Wulp 1874 is a small genus within the *Brillia* group, which is represented by only two species in the world, i.e., *E. crassipes* (Meigen in Panzer, 1810) from Europe and *E. nozakii* Kobayashi, 1998 from Japan (Murray & Ashe, 1981; Kobayashi, 1998; Ashe *et al.*, 2000; Andersen *et al.*, 2013). The previously reported Russian population of *E. nozakii* may be a new species (Makarchenko EA, *pers. commun.*). The immature stage is ectoparasitic on prepupa and pupa of caddisflies, which received extensive attention in recent years (Ashe *et al.*, 2000; Hayashi & Kobayashi, 2000; Ashe *et al.*, 2015). The fat white body, relative small coniform head capsule and the elongated anterior prolegs in the larva, together with the anterior chitinized thoracic projection in the pupa allow separation from other related genera. In the neighboring regions of China, the host of the only recorded species *E. nozakii* is a goerid caddisfly - *Goera japonica* Banks, 1906, which has not yet been recorded in China. However, a sibling caddisfly species, *G. interrogationis* Botosaneanu, 1970 is common in the northeast part of China (Yang *et al.*, 2003). These evidences suggest the possibility that *Eurycnemus* species is present in China.

In this paper, based on the associated materials collected from Liaoning province, we described the pharate male, pupa and larva under the name of *E. cf. nozakii*, representing a different species to the true *E. nozakii*. Since there is no well-preserved male, the exact species status is still unresolved. In addition, two similar pupal exuviae collected from Fujian and Yunnan Province are reported.

Material and methods

Specimens were slide-mounted in Euparal. Descriptions of morphological characters are based on slide-mounted specimens except when otherwise stated. Body coloration is based on specimens preserved in alcohol. Morphological terminology and abbreviations follow Sæther (1980). The number of observations (n) is given at the beginning of the species description, except when otherwise indicated in parenthesis. Measurements and counts are given as ranges, followed by the means.

All the specimens examined here are deposited in the Institute of Groundwater and Earth Science, Jinan University, China.

Taxonomy

***Eurycnemus* v. d. Wulp 1874**

DIAGNOSIS. The specimens examined conform in most diagnostic

features to the generic description for adult, pupa and larva (Cranston *et al.*, 1983, 1989; Coffman *et al.*, 1986; Andersen *et al.*, 2013). Based on the material described below, the generic diagnosis for *Eurycnemus* should be amended as follows.

MALE. Wing membrane with long and extensive dark macrotrichia, distinct bands present (*E. nozakii*, *E. cf. nozakii*) or absent (*E. crassipes*). Hind tibial comb present (*E. cf. nozakii*) or absent (*E. crassipes*, *E. nozakii*). A small and low tubercle with a seta present on the inner part of apical lobe of gonostylus. A rather long and strong basal seta present in the basal stem of gonostylus (before the lobe fork) (*E. nozakii*) or absent (*E. crassipes*, *E. cf. nozakii*).

PUPA. Tergites II-VII/VIII with long posterior spine. Conjunctive T II/III always with spinules, spinules in the conjunctive T III/IV, T V/VI-VI/VII varied in different species. Anal lobe with 4-7 strong long broad anal macrosetae and usually 1-2 shorter macrosetae, inner margin with or without setae. Male genital sac on the dorsal surface, subequal in length or slightly beyond the anal lobe.

LARVA. Premandible with 2 apical and 0-1 pale basal tooth. Mandible with seta interna (*E. crassipes*, *E. cf. nozakii*, *E. sp. FE*) or not (*E. nozakii*). Mentum with 3 median teeth and 5 pairs of lateral teeth. The first lateral teeth set off from three median teeth clearly. Centre median mental teeth simple or with further subdivisions, usually lower than outermost median teeth. Ventromentum clearly present (*E. nozakii*, *E. cf. nozakii*) or vestigial (*E. crassipes*, *E. sp. FE*). Seta submenti posterior clearly to the base of mentum. Anal seta normally simple, seldom bifurcated in some individuals (*E. nozakii*). Procercus sclerotized laterally (*E. cf. nozakii*) or normal (*E. crassipes*, *E. nozakii*).

Eurycnemus cf. nozakii Kobayashi, 1998

Eurycnemus sp., Kobayashi, 1993: 401; 1995: 317.

Eurycnemus nozakii Kobayashi, 1998: 109; Hayashi & Kobayashi, 2000: 292.

Pharate male (n=1).

Total length 7.5 mm. Body length 5.5 mm. Wing pads 2 mm.

COLORATION. Head, abdomen and legs brownish. Eye dark brown. Wing with 2 distinct dark and broad crossbands in the middle and apical 2/5, slightly 2 pale areas in the basal and sub-middle section. **HEAD.** Terminal flagellomere length 950 µm. AR 2.11. Temporals 43, including 20 inner verticals, 19 outer verticals and 4 posterior verticals. Clypeal with 66 setae. Palpomere lengths (µm): 50; 72.5; 210; 190; 165.

THORAX. Thoracic setae is hard to discern in present material since most parts is covered by the pupal skin.

WING. Enclosed by the wing pad, with numerous setae in the membrane. Squama with ca. 40 setae. VR ca. 1.20.

LEGS. Fore tibia with one spur, 110 µm long; two spurs of mid tibia 90 µm and 110 µm long, respectively; two spurs of hind tibia 110 µm and 160 µm long, respectively, tibial comb present, with 7 long bristles. Lengths and proportions of legs as in Table 1.

HYPOPYGIUM (Figure 1A). Tergite IX each side with a tuft of 45 strong setae. Gonocoxite 353 µm long. Superior volsella clavate with 18-24 strong setae on ventral surface and 4-5 weak setae on the dorsal surface. Gonostylus bifurcate, main stem 208 µm long, with a subapical lobe 133 µm long, between two lobes, a dark-brown tubercle present. Ratio of subapical lobe/main lobe 0.64. Apex of gonostylus with 4 stout lamelliform megasetae, 50-60 µm long, followed by 7-9 slender setae in the subapical 1/3, 45-80 µm long. No basal strong seta in the basal portion of gonostylus (before the lobe fork). HR 1.70; HV 3.60.

Pupa (n=3).

Total length 6.7-7.6, 7.1 mm. Body length 4.7-5.6, 5.2 mm.

COLORATION. Whole pupa yellowish brown, the chitinized scutal projections black.

CEPHALOTHORAX (Figure 1B). Thoracic horn 680-820, 744 µm long, 50-90, 78 µm wide, with weak spines in the middle swollen and apical slender parts. Basal half (0.40-0.51, 0.47) of male horn slightly swollen, unobvious or weak in female horn (Figure 1C), horn ratio 8.75-13.60, 9.87. The prominent chitinized thoracic projection truncated, 140-180, 160 µm long and 130-160, 140 µm in basal width. Thorax with two anteprenotals, 70-90, 75 µm and 110-150, 130 µm long, respectively. Each length of three pre-corneals (in µm): 70-85, 79; 120-170, 145; 60-75, 66; Dorsocentrals inserted posteriorly, with Dc₁ and Dc₄ distinctly stronger than Dc₂ and Dc₃.

ABDOMEN (Figure 1D). Tergite II-VIII with posterior transverse band of alternatively arranged long spines and small spines, the number of long spines and the length of longest spine are listed in Table 2. Conjunctive only presents in T II/III, with 2-3 rows of weak hooklets, 0.71-0.80, 0.74 times as wide as corresponded segment width.

ANAL LOBE. 570-690, 610 µm long, with distinct anterior median band. Anal lobe ratio 1.46-1.64, 1.56. Distal margin 1/5 with 4-5 strong, 480-620 µm long and 1 weak macrosetae, 280-450 µm long. The most 2 apical setae with minute lateral spine near sub-apical area. Male genital sac reaching as far as anal lobe tips or slightly beyond the tips, but distinctly shorter in the female. Furthermore, 2-3 tubercles clearly present at the subapical margin of female anal lobe (Figure 1E) but absent in the male.

Larva (n=2).

Total length 6.8-7.1 mm. Head capsule 520-540 µm long, and 390-400 µm wide, cephalic index 0.74-0.75.

COLORATION. Generally, the body is very fat and milk-white in color. Head capsule yellow. Apical part of mandible, whole mentum and premandible dark brown. Posterior occipital margin yellowish brown.

Dorsal surface of head capsule in Figure 2A. Labral sclerites arrangement resembles that observed in *Brillia* Kieffer, frons separated from clypeus, anterior margin with a clear pale membrane band, where a distinct tubular-based S3 seta placed. Labral sclerites fragmentary, at least split into 2 pairs, a small pair in the middle, and another in the lateral. Clypeal sclerites also split into 2 parts, S2 placed in the anterior sclerites, which somewhat interrupted in the middle. Lateral sclerite 1 and 2 absent, 3 complete.

ANTENNA (Figure 2B). Antennal reduced, each segments length (in µm): 25-30; 10-13; 2-3; 4-5; AR 1.20-1.38. Basal segment 2.12-

Table 1. Lengths (in µm) and proportions of leg segments of *Eurycnemus cf. nozakii* based on Chinese material.

	P ₁	P ₂	P ₃
fe	1200	1425	1625
ti	1400	1400	1575
ta ₁	1050	700	950
ta ₂	650	340	550
ta ₃	500	280	430
ta ₄	450	200	300
ta ₅	270	180	210
LR	0.75	0.5	0.6
BV	1.95	3.5	2.79
SV	2.48	4.04	3.37

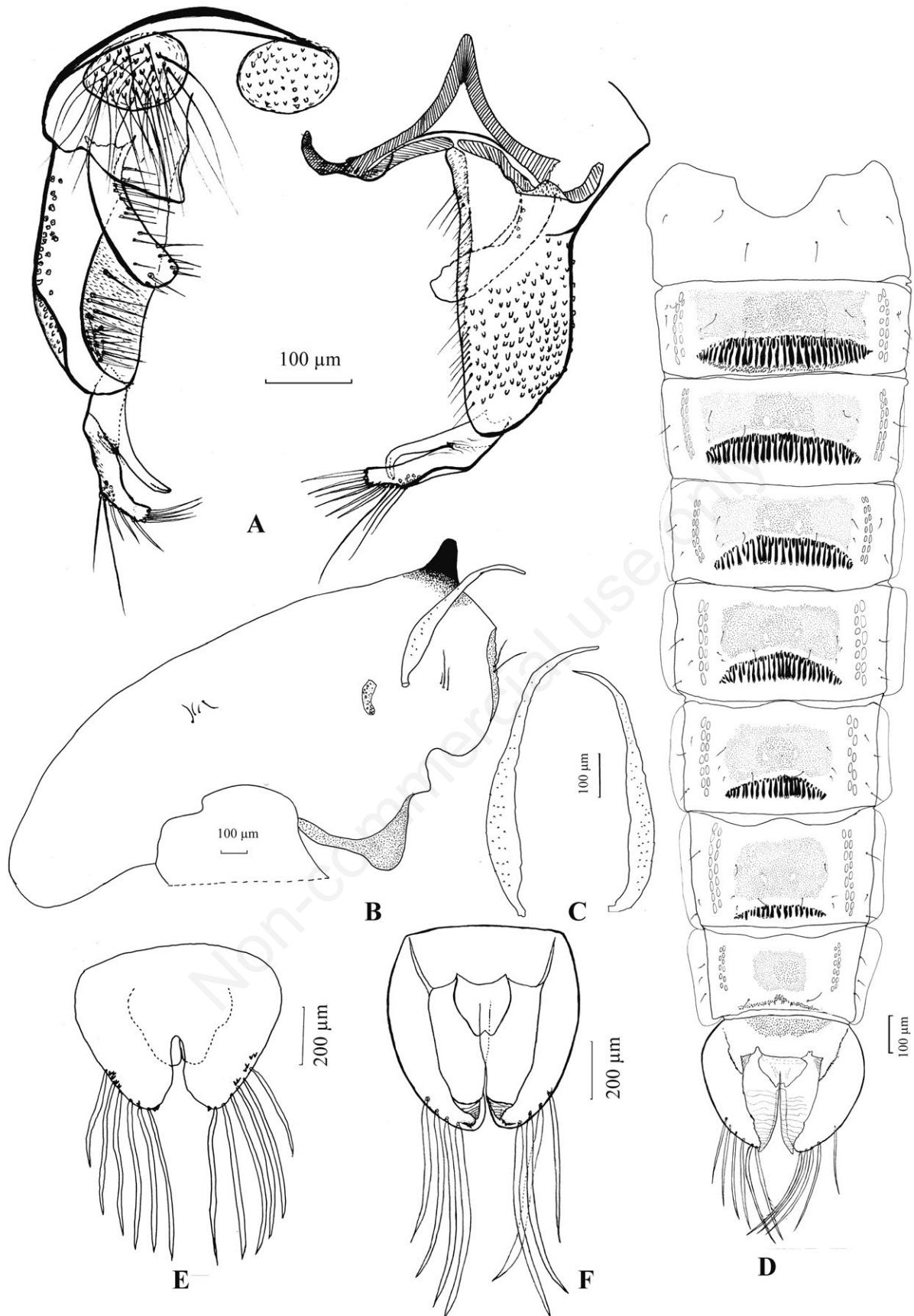


Figure 1. *Eurycnemus* cf. *nozakii* Kobayashi, A) male, B-F) pupa. A) hypopygium; B) thorax (lateral view); C) thoracic horn (left, male; right, female); D) pupal abdomen; E) details of female anal lobe, indicating the lateral spines; F) Anal lobe of *E. sp.*, indicating the relative length of genital sac.

2.40 times as long as width. Ring organ around in the middle. LABRUM (Figure 2C). SI simple but lamella like, SII and SIII tightly placed, SIII minute, SIV a and SIV b vestigial, without clear pits. Labral lamellae with 2 slightly separated lobes or closely touched, giving appearance of a single comb, each lobe bearing 4-5 serrate teeth distally. Ungula with well-developed basal sclerite, 3 pairs of chaetulae laterals and 3-4 pairs of chaetulae basales present, all simple. Pecten epipharyngis with 2 or 3 isolated scales. Premandible 65-75 μm long, with 2 fairly separately apical teeth and one pale basal tooth.

MANDIBLE (Figure 2D). Total length 125-150 μm long, with a shallow notch at apical 1/3; Seta subdentalis 35-43 μm long, extending to the beneath of fourth inner tooth. Seta interna weak, with 4 simple branches.

MENTUM (Figure 2E). Almost trapezoid, 105-120 μm wide, 90-93 μm high; centre median tooth 13-15 μm wide, shorter and lower than lateral median teeth, easy to broken. Ventromental plate present, 18-20 μm in basal width; Distance between setae submenti 135-153 μm . Postmentum 260-265 μm long.

BODY. Procerus sclerotized laterally, 25 μm high, 18 μm wide ($n=1$), bearing 4 simple anal setae, usually 2 strong setae together with one median and one weak seta, 90-285 μm long, lateral setae minute, 60-70 μm long.

MATERIAL EXAMINED. 1 pharate male, CHINA: Liaoning province, Benxi City, Huanren County, Hunhe catchment, Suzi River, site H6, viii.2014, C.B. Duan 2 pupae and 1 larva with partial pupal character, as previous; 1 pupa and 1 larva, CHINA: Liaoning province, Benxi City, Xinbin County, Liaohe catchment, north branch of Taizi River, site T70, viii.2009, C.B. Duan.

DISTRIBUTION. China (Liaoning Province).

BIOLOGICAL NOTE. The material was collected from the upstream of Suzi and Taizi River, both of which are the headwaters. The conductivity ranges from 60 to 101 $\mu\text{s}/\text{cm}$, and pH from 7.4 to 8.6. The co-occurring caddisflies are *Goera interrogationis* Botosaneanu, 1970 and *Hydropsyche* spp. No direct links between the midge larva and caddisfly pupa was observed. Thus, both of the above caddisflies are suspected here to be the host of *E. cf. nozakii*.

REMARKS. The Chinese species shows some differences to the Japanese population (Kobayashi, 1998). Some measures from the examined adult are slightly lower than that in the original description of *E. nozakii*, but the ratios, such as AR and LR are close to each other. However, the distinct hind tibial comb and absence of basal strong gonostylus seta in our species is distinct. In the pupa and larva, the longest pupal macrosetae are usually less than the anal lobe, conjunctive present only on T II/III, and the larval anal setae are simple, While, in true *E. nozakii*, the anal macrosetae usually longer than the length of anal lobe, conjunctive present on T

II/III/IV, larval anal setae bifurcated at basal 1/3 (Kobayashi, 1998). In addition, the Russian specimens described as *E. nozakii* (Makarchenko & Makarchenko, 2008) was soon changed into an unnamed species after the new material became available (Makarchenko & Makarchenko, 2012). Some detailed comparisons among the Japanese, Far East of Russia and Chinese *Eurycnemus* are listed in Table 3. Perhaps, there are more sibling species in East Asia.

Eurycnemus sp.

Pupa ($n=3$).

Total length 6.0-8.5, 7.5 mm. Body length 4.6-6.1, 5.4 mm.

COLORATION. As above description.

CEPHALOTHORAX. Thoracic horn 600-980, 740 μm long, 45-80, 59 μm wide, with weak spines in the middle swollen and apical slender parts. Basal half (0.32-0.53, 0.43) of male horn slightly swollen, while, weak in female horn. Horn ratio 8.3-12.0, 10.5. The prominent chitinized thoracic projection truncated in the male while sharp in the female, 160-180, 170 μm long and 90-100, 95 μm in basal width. Thorax with two anteprenotals, 60-85, 73 μm and 90-110, 100 μm long, respectively. Each length of precorneals (in μm): 85-90, 88; 120-125, 123; 70-105, 88; Dorsocentrals inserted posteriorly, with Dc_1 and Dc_4 distinctly stronger than Dc_2 and Dc_3 .

ABDOMEN. Tergite II-VIII with posterior transverse band of alternatively arranged long spines and small spines, the number of long spines and the length of longest spine are list in Table 2. Conjunctive only present in T II/III, with 2-3 rows of weak hooklets, 0.58-0.60, 0.59 times as wide as corresponded segment width.

ANAL LOBE. 575-675, 625 μm long, without spinulation anteriorly. Anal lobe ratio 0.92-1.0, 0.97. Distal margin 1/5 with 4 strong macrosetae, 490-620 μm long. Male genital sac shorter than anal lobe tips (Figure 1F), 3-7 tubercles clearly present at the subapical margin of female anal lobe, whereas no such structure found in the male.

MATERIAL EXAMINED. 1 Pe, China: Fujian Province, Wuyishan City, Wuyishan National Nature Reserve, Tongmu Country, Sangang, 05.viii.2014, H.Q. Tang & J. Liu. 2 Pe, China: Yunnan Province, Ruili City, a brook in Municipal Botanical Garden, 25.x.2016, H.Q. Tang.

REMARKS. Except the shorter male genital sac and tergite IX without spinulations, there is no other substantial characters to separate the present pupal type from *E. cf. nozakii*. Since the locations are very far from each other and belong to different zoogeographic regions, pupal type collected from Oriental region (Fujian and Yunnan) are treated separately here.

Table 2. The number of long spines (the short basal small spine not counted) and length of longest spines in posterior transverse bands of tergite II to VIII in Chinese species *Eurycnemus cf. nozakii* and *Eurycnemus* sp.

Posterior band	<i>Eurycnemus cf. nozakii</i>		<i>Eurycnemus</i> sp.	
	Number	Max length	Number	Max length
T II	30-35	150-170	32-33	165-170
T III	28-30	160-180	30-31	165-170
T IV	24-30	160-170	27-29	150-160
T V	20-25	150-170	24-26	140-160
T VI	18-24	120-130	22-23	115-130
T VII	16-22	50-80	18-21	65-80
T VIII	4-10	25-30	0	0

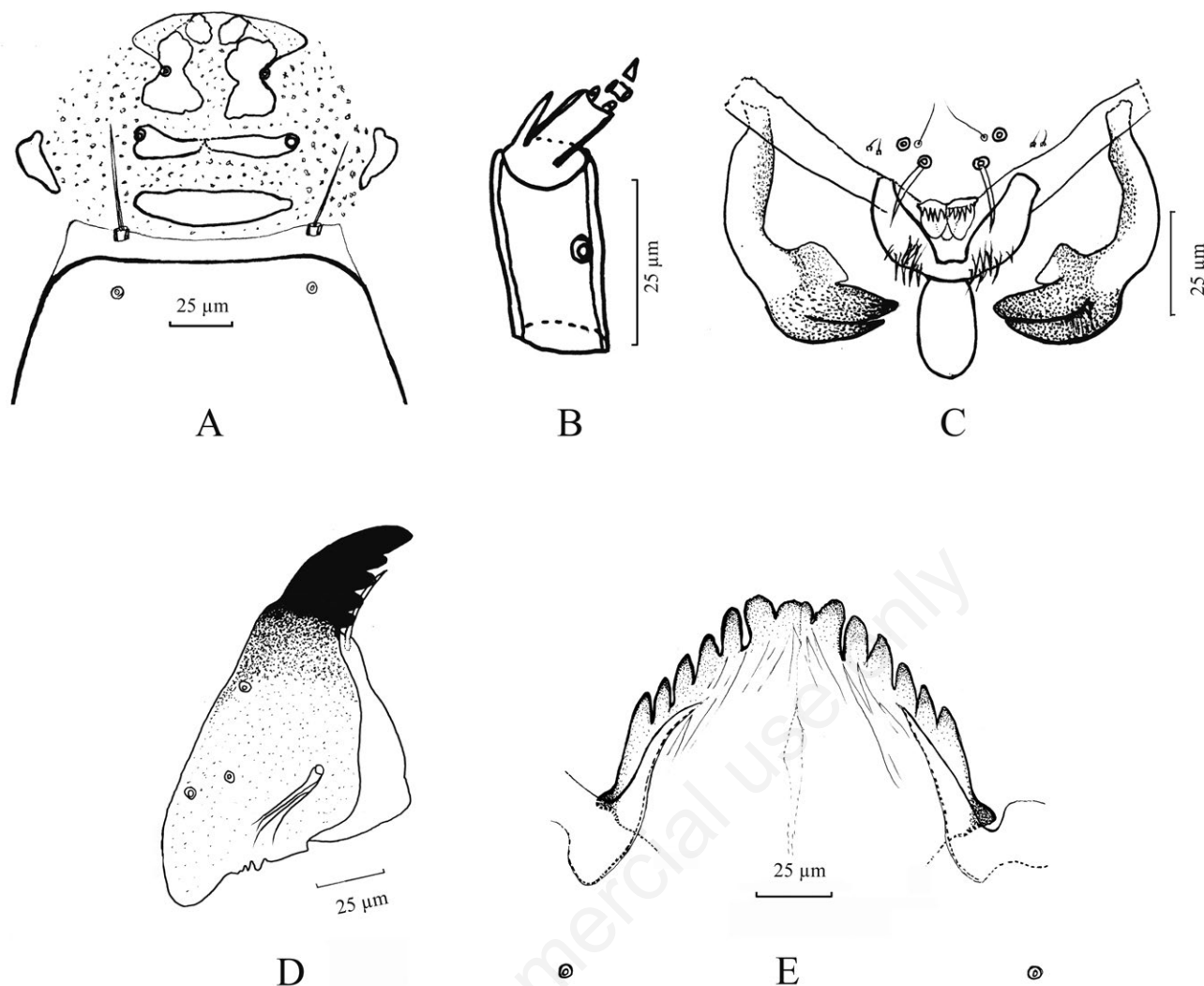


Figure 2. *Eurycnemus cf. nozakii* Kobayashi, larva. A) dorsal sclerites of head capsule; B) antenna; C) labro-epipharyngeal region; D) mandible; E) mentum.

Table 3. Comparisons among Japanese, Far East of Russia and Chinese species of *Eurycnemus cf. nozakii* Kobayashi.

Characters	Japanese	Russian FE	Chinese
Pupa/pupal exuviae			
Total length	8.0-8.7	7.1	6.7-7.6
Horn length	715-869	670	680-820
Anal lobe length	ca. 850	500-600	570-690
Anal lobe (♀)	Smooth	Smooth	With 2-3 spines
Anal macrosetae	4-8	6-7	4-6
Inner seta of anal lobe	Absent	Present	Absent
Larva (IV instar)			
Total length	7.2-11.5	4.5-7.2	6.8-7.1
Head color	Yellow	Light-brown	Yellow
Seta interna	Absent	Present	Present
AR	0.81-1.00	1.20-1.44	1.20-1.38
Middle tooth of mentum	Simple, subequal in height	Subdivided into 4 small teeth, lower and wider	Simple, lower than outermost median tooth
Anal seta	Bifurcated	Simple	Simple

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