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The Pupa and Larva of *Propsilocerus taihuensis* (Wen, Zhou & Rong) (Diptera: Chironomidae), with Complete Keys to all Immatures of the Genus *Propsilocerus*

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Abstract

The pupa and larva of *Propsilocerus taihuensis* (Wen, Zhou & Rong, 1994) are described for the first time. Both are close to *P. akamusi* (Tokunaga). The phylogenetic argumentation of the genus outlined in Sæther and Wang (1996) is confirmed. Revised keys to larvae and pupae of the genus are given. The main morphological characters of the different species of the genus are compared in tables.

Keywords: Chironomidae, Orthocladiinae, *Propsilocerus taihuensis*, pupa, larva.

Introduction

Propsilocerus taihuensis was described by Wen, Zhou and Rong in 1994 based on male and female imagines and placed in the genus *Tokunagayusurika*. When Sæther and Wang revised the orthoclad genus *Propsilocerus* Kieffer in 1996, they transferred the species into that genus. The immature stages, however, were not discovered until the present paper. In November 2002, we collected larvae and pupae from the type locality (Wuli Lake, Taihu Lake, Jiangsu Province). In this paper, the immature stages of *Propsilocerus taihuensis* are described for the first time. The phylogenetic argumentation and synapomorphic diagram of the genus outlined by Sæther and Wang (1996) is revised based on the characters from the immatures of *Propsilocerus taihuensis*.

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Material and Methods

The terminology follows Sæther (1980) with the additions and corrections given by Sæther (1990). The measurements are given as ranges followed by a mean, followed by the number in parentheses (*n*).

Propsilocerus taihuensis (Wen, Zhou & Rong) (Figs. 1–9)

Tokunagayusurika taihuensis (Wen et al., 1994: 205–212).
Propsilocerus taihuensis (Wen, Zhou & Rong) (Sæther & Wang, 1996: 68).

Material

Five larvae, one pupa, China: Jiangsu, Wuxi City, Lake Taihu, Lake Wu-Li. 16.XI.2002, Guo & Yan.

Diagnostic Characters of Immatures

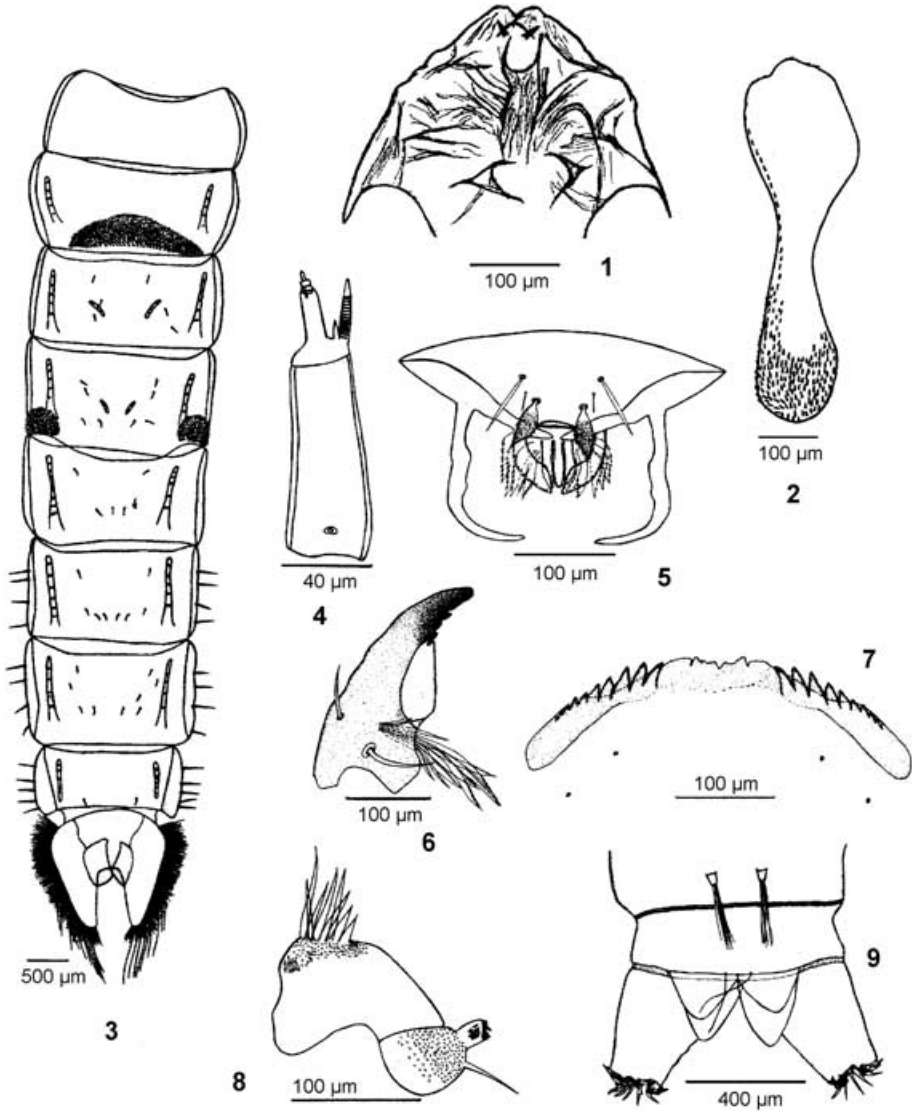
The pupa of *P. taihuensis* can be separated from other known pupae of the genus by having frontal warts, a median apical incision on the frontal apotome, and the anteriormost macroseta placed halfway along lateral margin of the anal lobe. The larva can be separated from other known larvae of the genus by having narrow and simple premandible and fourth antennal segment much longer than third.

Pupa (*n* = 1) (Figs. 1–3)
Total length 13.5 mm. Coloration brownish black.

Cephalothorax. Frontal seta absent. Frontal apotome rugulose with a median apical incision (Fig. 1). Frontal warts present. Two postorbitals present. Thoracic horn (Fig. 2) indistinctly bifid, basal part and outer margin with spines, otherwise bare, 710 µm long; 220 µm wide, 3.23 times as long as wide, 1.48 times as long as macrosetae. Precorneal setae and median antepronotals each about 92 µm long. Dorsocentrals and lateral antepronotals not observed. Wing sheath 3.10 mm long, with strong sclerotised margin.

Abdomen (Fig. 3). Tergites I and VIII bare, without spinules or shagreen. Tergites II–VII with extensive fine shagreen. Tergite II with about 313 caudal hooklets in 10 transverse rows. Tergites III and IV with MD_1 (Dorsal muscle marks 1) and all segments with MD_2 (Dorsal muscle marks 2). Pedes spurii A present on sternite IV. Apophyses apparently absent. Segments VI and VII each with four taeniate L setae; VIII with five taeniate L setae. Segment III with three pairs of D setae, segments IV–VII each with 4–5 pairs of D setae, and VIII has only a pair of D setae. Anal lobe 1210 µm long, with 10 macrosetae in caudal half; 400–560 (480) µm; macrosetae 0.33–0.46, 0.40 times as long as anal lobe; about 178–197 taeniae in fringe, 240–320 µm long.

Fourth instar larva (*n* = 5) (Figs. 4–9)
Large, red in coloration. Total length 14.2–16.7, 15.2 mm. Head capsule length 660–760, 704 µm; width 720–820,780 µm; cephalic index 1.01–1.24, 1.11.



Figures 1–9. Propsilocerus taihuensis Wen, Zhou & Rong: (1) pupal frontal apotome; (2) pupal thorax horn; (3) pupal abdomen (4) larval antenna, (5) larval labrum and epipharyngeal area, (6) larval mandible, (7) larval mentum, (8) larval maxilla, (9) larval abdomen.

Head. Frontoclypeal apotome present, with apical granulation. S_1 and S_2 distinct. Antenna as in Fig. 4. Four segments, last segment usually difficult to discern. Length of antennal segments (in µm): 110–114, 110; 18–26, 23; 3–4, 3.8; 5–6, 5.8. AR (Antennal Ratio) = 3.03–4.22, 3.58. Basal antennal segment 40–48, 44 µm wide.

Antennal blade 32 µm long, about as long as combined length of segments 2nd to 4th. Accessory blade 8 µm long. Ring organ 20–30 µm (about 1/5 to 1/7) from base. Lauterborn organ not apparent. Labrum as in Fig. 5. SI (setae anteriores on labrum) plumose, SII (setae posteriores on labrum) long and simple. Pecten epipharyngis consisting of three subequal distally pointed elongate scales. Labral lamellae well developed with pectinate apex. Six chaetulae laterales, all serrate. Premandible narrow and simple; 140–170, 159 µm long. Mandible (Fig. 6) 250–310, 274 µm long; with four inner teeth, apical tooth subequal to combined width of inner teeth. Seta subdentalis short, reaching third inner teeth. Seta interna of 12–14 branches with 6–7 serrate and 6–8 simple branches. Mentum (Fig. 7) divided into three parts by having lighter median teeth set off from the rest and in contact with the anteriorly produced median ends of ventromental plates. Median portion of mentum broad, four median teeth with median pair notched or subdivided into small teeth. Median part with irregular anterior margin with some toothlets; 10 pairs of lateral teeth, first to seventh pairs of lateral teeth large and easy to distinguish, following 3–4 pairs beneath ventromentum, small and not easy to discern, apex of first lateral teeth medially bent. Ventromental plate large; caudolateral extension 30–34, 36 µm wide; beard absent, two pairs of submental setae. Maxilla as in Fig. 8.

Abdomen (Fig. 9). Body setae simple. Anterior parapods separated, with 71–78 apical claws. Posterior parapods 520–600, 524 µm long; with 11–14, 12 apical claws, 7–9 claws brown, 3–4 dark, triangular. Procercus 50–90, 71 µm high; 40–70, 47 µm wide; with seven anal setae 424–480, 452 µm long. Supraanal seta 344–376, 360 µm long; about 0.8 times as long as anal setae. Anal tubules short and broad.

Key to Pupae of *Propsilocerus* Kieffer

1. Frontal setae absent, anal lobe fringe with more than 100 taeniae 2
— Frontal setae present, anal lobe fringe with less than 60 taeniae 4
2. Pedes spurii A present on sternite IV and V ..... *P. jacuticus* (Zvereva)
— Pedes spurii A present on sternite IV only 3
3. Anterior macroseta at middle of anal lobe margin, frontal apotome with apical incision ..... *P. taihuensis* (Wen, Zhou & Rong)
— Macrosetae in apical third of anal lobe, frontal apotome without apical incision ..... *P. akamusi* (Tokunaga)
4. Pedes spurii A present on sternite V–VI, anal macrosetae 0.38–0.49 times as long as anal segment ..... *P. lacustris* Kieffer
— Pedes spurii A present on sternite V–VII, anal macrosetae 0.54–0.65 times as long as anal segment 5
5. Tergite I bare, thoracic horn about 2.2 times as long as anal macrosetae, anal lobe with about 65 taeniae ..... *P. sinicus* Sæther et Wang
— Tergite I with a few median spinules, thoracic horn about 1.4 times as long as anal macrosetae, anal lobe with about 43 taeniae .... *P. paradoxus* (Lundström)

Key to Larvae of *Propsilocerus* Kieffer

1. Antenna with 5 segments, SI plumose on one side .... *P. sinicus* Sæther & Wang
— Antenna with 4 segments, SI plumose on both sides 2
2. Mentum with 6–7 pairs of lateral dorsomental teeth 3
— Mentum with 9–10 pairs of lateral dorsomental teeth 4
3. Mentum with 6 pairs of lateral teeth, first lateral tooth distinctly shorter than the second. Four median mental teeth subequal in size ..... *P. lacustris* Kieffer
— Mentum with 7 pairs of lateral teeth, first lateral tooth larger than the second, one median mental tooth larger than the other 3 teeth remarkably ..... *P. paradoxus* (Lundström)
4. Median portion of mentum concave with one strong lateral pair and 4–10 minute sharply triangular teeth ..... *P. jacuticus* (Zvereva)
— Median portion of mentum approximately straight with fewer teeth 5
5 Third and fourth antennal segment subequal in length; mentum with 9–10, usually 9, pairs of lateral teeth ..... *P. akamusi* (Tokunaga)
— Fourth antennal segment 1.5–2 times longer than third, mentum with 10 pairs of lateral teeth ..... *P. taihuensis* (Wen, Zhou & Rong)

Pupal and larval characters of the different species of *Propsilocerus* are compared in Tables 1 and 2.

Systematic Remarks

The larvae of *P. taihuensis*, *P. akamusi* and *P. jacuticus* are very close, forming a species group within *Propsilocerus*. The three species share the following characters: Mentum with 9–10 lateral teeth, ventromentum broad extending beyond the tip of 7th–10th lateral teeth, body size remarkably larger than the other three known species (except *P. paradoxus*). *P. taihuensis* appears more close to *P. akamusi* than to *P. jacuticus.* Both *P. taihuensis* and *P. akamusi* have approximately straight apex of mentum with four median teeth which may be subdivided, and narrow and indistinctly bifid or simple premandible; while *P. jacuticus* has a distinct concave median part of mentum with more numerous teeth and distinctly bifid premandible.

The pupal characters also show that *P. taihuensis*, *P. akamusi* and *P. jacuticus* are closely related. They can easily be distinguished from the other three species (*P. sinicus*, *P. lacustris*, *P. paradoxus*) by the following characters: seven or more macrosetae, more than 100 taeniae in fringe; frontal setae absent, wing sheath with strongly sclerotic margin, and thoracic horn simple or very indistinctly bifid. The pupa of *P. taihuensis* resembles *P. akamusi* in having spurii A on sternite IV only. In *P. jacuticus* pedes spurii A are present on both sternites IV and V.

The discovery of the immatures of *P. taihuensis* generally confirms the phylogenetic argumentation of the genus outlined in Sæther and Wang (1996). Based on his first description of imagines and pupa of *P. jacuticus*, Sæther (1997) suggested that *P. jacuticus* may form the sister species of *P. taihuensis.* The median projection of the superior volsella in the male and the long and narrow, digitiform extension of

Table 1. Comparison of pupae of *Propsilocerus* Kieffer (length in µm, unless otherwise stated, *L* = length, *W* = width, *N* = number, TH = thoracic horn, AM = anal macrosetae, AL = anal lobe, PSA = pedes spurii A, Pc = precorneals, Maps = median antepronotal setae, Laps = lateral antepronotal setae; TI–VIII = tergites I–VIII) (Wiederholm, 1986)

Characters	*taihuensis*	*akamusi*	*jacuticus*	*paradoxus*	*lacustris*	*sinicus*
Total length, mm	13.5	12.1–15.7	11.9–14.5, 13.3	7.6	4.73–9.64, 7.33	7.83
Frontal seta *L* TH	absent indistinctly bifid	absent simple or indistinctly bifid	absent simple	94 bifid	36–98, 72 distinctly bifid	109 bifid
TH L	710	845–985, 906	851–960, 885	539	482–775, 695	803
TH L/*W*	3.23	4.47–5.81, 5.13	3.25–3.84, 3.61	4.77	3.50–6.83, 4.97	5.67
THL/AML	1.48	1.41–1.71, 1.55	1.22–1.45,1.33	1.43	1.82–2.16, 1.97	2.24
PSA	on S-IV	on S-IV	on S-IV & V	on S-V-VII	on S-V-VI	on S-V-VII
Anal lobe *L*	1210	1418–1588	1304–1465, 1423	652	567–898, 758	671
AM *N*	10	7–12, 10	8–11, 10	38–74	5–7, 7	7
AM *L*	400–560, 480	540–622, 587	614–728, 664	378	265–397, 333	359
AM *L*/AL *L*	0.33–0.46, 0.40	0.36–0.43, 0.39	0.40–0.50, 0.46	0.65	0.38–0.49, 0.44	0.54
Taeniae in fringe	178–197	105–170, 136	130–170, 156	43	28–48, 36	65
L, Pc, MAps, Laps	92	56–142, 89	113–150, 130	75–130	60–169	108–188
Wing sheath margin	sclerotized	sclerotized	sclerotized	not sclerotized	not sclerotized	not sclerotized
T-I	bare	anteriolateral spinules	bare	median spinules	median spinules	bare
T-II hooklets	313 in 10 rows	280–450, 360 in 7–9, 8 rows	400–500 in 12–15 rows	64 in 4 rows	46–102, 69 in 3–4 rows	82 in 4 rows
T-VI L setae	4	4	2 L & 2 hair-like	3–4, 4		3–4L
T-VII L setae	4	4	—	4	3–4, 4L	4L
T-VIII L setae	5	5	5	4	4L	4L

Table 2. Comparison of larvae of *Propsilocerus* Kieffer (lengths in µm, W = width; *L* = length; *H* = height, *N* = number, RO = ring organ) (Sasa, 1978; Wang and Sæther, 2001; Wiederholm, 1983).

Characters	*taihuensis*	*akamusi*	*jacuticus*	*paradoxus*	*sinicus*	*lacustris*
Head capsule *L*	660–760	610–780,710	760–800	840–1,000	600–640	660–820
Antenna	4-segmented	4-segmented	4-segmented	4-segmented	5-segmented	4-segmented
Segment *L*	110, 23, 4, 6	120, 26, 8, 7	118, 26, 8, 8	90, 22, 6, 6	80, 28, 6, 2, 2	108, 25, 8, 6
Basal segment *W*	40–48, 44	41–47, 45	41–53, 46	30	22	35
Blade	32	36–41, 38	28–36, 32	30	28	37
Accessory blade	8	12	not measurable	8	16	18
RO distance from base	20–30	15–30, 23	19–53	20–26	13–16	19–28, 23
AR	3.58	3.03	2.76	3.75	1.83	2.77
SI	plumose	plumose	plumose	plumose	plumose in one side	plumose
Labral lamellae	plumose	plumose	plumose	smooth	smooth	smooth
Chaetulae laterales	serrated	serrated	serrated	simple	simple	simple
Premandible *L*	140–170, 159	143–184	131–180, 164	120–132	130–144	105–150,132
Premandible	narrow bifid or simple	narrow bifid	wide bifid	wide, indistinct bifid	wide bifid	wide simple
Mandible *L*	250–310	289–311, 301	289–338	184–224	118–202	218–259
Median mental teeth	4, notched	4, notched or subdivided	4–10 small teeth	4, notched or subdivided	4 2–3 teeth	4
Median part of mentum	straight	straight	concave	straight	straight	straight
Lateral teeth *N*	10	9–10	9–10	7	7	6
Ventromental plate *W*	30–44, 36	41–53, 47	45–71, 54	14	10	narrow
Posterior parapod *L*	520–600, 524	709–1009, 818	756–945, 820	300	200–208	425–473
Procercus *H*	50–90, 71	75–94, 84	56–68, 60	50–60	40	53–71, 60
Procercus *W*	40–70, 47	45–56, 50	45	44–45	24–34	34–49, 43
Anal setae *L*	424–480, 452	450–506, 469	413–450	440–520	424–512	400–563, 494
Supraanal seta *L*	344–376, 360	304–394, 338	338	248–416	110–120	250–330, 305
Anal setae, *N*	7	7	7	7	6	6

gonocoxite IX in the female were regarded as clear and unique synapomorphies. A comparison of the characteristics of immatures (see Tables 1 and 2) both show possible synapomorphies between *P. taihuensis* and *P. akamusi* such as the lack of pedes spurii A on segment V and the similar mentum and between *P. taihuensis* and *P. jacuticus* such as the forward placed anterior macroseta of the pupal anal lobe. While the similarities between *P. taihuensis* and *P. akamusi* probably are symplesiomorphies the forward placed macroseta may be a synapomorphy between *P. jacuticus* and *P. taihuensis*. The relationships suggested by Sæther (1997) thus are not contradicted.

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