

1447-2554 (On-line)

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DOI <https://doi.org/10.24199/j.mmv.2023.82.01>

***Skolomystax*, a new genus for the Australian species formerly included in *Centroptilum* Eaton (Ephemeroptera: Baetidae)**

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Abstract

Suter, P.J., Webb, J.M. and Gattolliat, J.-L. 2023. *Skolomystax*, a new genus for the Australian species formerly included in *Centroptilum* Eaton (Ephemeroptera: Baetidae). *Memoirs of Museum Victoria* 82: 1–48.

A new genus, *Skolomystax* n. gen. is described to include the Australian mayflies previously assigned to the genus *Centroptilum* (Baetidae). Based on an integrated taxonomic analysis of mitochondrial cytochrome oxidase I and morphology, 12 species are assigned to this new genus, comprising two new combinations, *S. elongatus* (Suter, 1986) n. comb. and *S. collendus* (Harker, 1957) n. comb., and ten new species described in the nymphal stage: *S. brevis* n. sp., *S. chionotos* n. sp., *S. dyarbi* n. sp., *S. gippslandicus* n. sp., *S. goorudensis* n. sp., *S. hawkingi* n. sp., *S. leichhardti* n. sp., *S. paschei* n. sp., *S. tasmaniensis* n. sp., and *S. vulgaris* n. sp. A species known only from the original description by Harker (1957) is assigned as *S. collendus* n. comb.; the type material is lost, so it is not treated in detail and its validity remains uncertain. Adults of *S. elongatus*, *S. hawkingi* n. sp. and *S. leichhardti* n. sp. are also included.

Skolomystax is closely related to *Apobaetis*, *Callibaetis*, *Callibaetoides* and *Waltzophyphus*, but differs from them in the combination of a wide notch in the labrum with a basal pair of denticles, 3-segmented maxillary palps, hind wing pads present, and single gills without folds.

A key to the nymphs of all species of *Skolomystax*, except *S. collendus*, is given.

Keywords

Mayflies, Baetidae, Taxonomy, COI, integrative taxonomy

Introduction

The initial concept of the genus *Centroptilum* Eaton 1869 was very broad and included all Baetidae with hind wings and single marginal intercalaries in the forewings. Revisionary work in recent decades has shown that concept to be highly polyphyletic (Gattolliat et al., 2008; Gillies, 1990; Kluge and Novikova, 1992) and numerous new genera have been established, especially in Afrotropical region (Gillies, 1990; Lugo-Ortiz and McCafferty, 1996a, 1996b, 1998; Wuillot and Gillies, 1993, 1994). More recently, all Nearctic and Eastern Palearctic species of *Centroptilum* were transferred to *Anafroptilum* Kluge, 2011 (for the species without patella-tibial suture on forelegs of nymphs) or to *Procloeon* Bengtsson, 1915 (for the species with spines on the lateral margins of abdominal segments VIII–IX and greatly enlarged spines on outer margin of cerci). The present concept of *Centroptilum* includes species having a convex mesonotal

suture, single marginal intercalaries in the forewing, and hindwings present or absent, if present then usually with two unforked longitudinal veins, a single hooked costal process and a pointed apex. The nymphs have a small U-shaped median notch in the labrum, deeply cleft incisors on the left mandible with setae between the prostheca and molar region, three segmented maxillary palps with the third segment subequal to or longer than the second segment, truncate labial palps, pointed glossae and paraglossae, patella-tibial suture present on all legs, an arc of setae near the patella-tibial suture, relatively long, straight claws with two similar rows of denticles, gills with a single lamella, abdominal terga without lateral spines, and outer margin of cerci without greatly enlarged spines (Kluge and Novikova, 1992; Kluge, 2011). Therefore, *Centroptilum* now only encompasses three species from the Palearctic region (*C. luteolum* Müller 1776, *C. pirinense* Ikononov 1962 and *C. volodymyri* Martynov, Godunko and Palatov 2022, in Martynov

et al., 2022). The genus is now considered absent from Nearctic, Afrotropical and Oriental realms. The case of the Australian species previously assigned to *Centropitulum* is treated herein.

In Australia, *Centropitulum* was first reported by Harker (1957) when she described *C. collendum* Harker 1957 from male subimagines and nymphs collected along the central coast of New South Wales. Suter (1986) later described all life stages of *C. elongatum* Suter 1986 from streams in eastern South Australia (SA) and western Victoria (Vic). Morphological and molecular analyses of nymphs of *C. elongatum* and several undescribed Australian species indicates that they are not congeneric with *Centropitulum* (Webb and Suter, 2011) and they lack the defining characteristics of *Centropitulum sensu stricto*, such as the convex mesonotal suture, nymphs with a small U-shaped median notch in the labrum, and mandibles with setae between the prostheca and molar region, and share several unusual characters. Webb and Suter (2011) also provided a key for the nymphs of *C. elongatum* and nine morphospecies. In this paper, we describe a new genus for the Australian species, describe ten new species, and hypothesise their relationships based on molecular and morphological characters.

Methods

Specimens used for molecular analyses were preserved in 95–100% ethanol. Total genomic DNA was extracted using a proteinase-K/Chelex solution. Tissue (either whole nymphs, one or two legs, or thoracic muscle) were placed in 100 µl of Chelex solution (containing 5% Chelex [weight/volume], 0.2% sodium dodecyl sulfate, 10 mM Tris pH 8, 0.5 mM Ethylenediaminetetraacetic acid) and 10 µl of 20 mg/ml proteinase-K. Samples were incubated overnight at 55°C. After incubation, the cleared specimens were removed and mounted on a microscope slide with Euparal and Cellosolve. Extractions were then centrifuged for 5 minutes at 1500 rpm and incubated for 5 minutes at 95°C to deactivate the proteinase-K. A portion of the DNA extraction was diluted 1 in 5 with 1X TE and used for subsequent analyses to reduce the number of freeze/thaw cycles and chance of contamination of the original extraction. All samples were stored at 20°C.

Polymerase chain reaction (PCR) was used to amplify fragments of the mtDNA locus cytochrome oxidase 1 (COI) using the primers LCO1490 and HCO2198 (Folmer et al., 1994). GenBank and specimen accession numbers are in Supplementary Table 1. PCR for COI reactions were performed using Platinum Taq (Invitrogen) and consisted of 3.5 µl buffer, 17.5 µl 10% w/v trehalose, 0.7 µl dNTPs, 1.75 µl 50 mM MgCl₂, 0.7 µl of each primer, 0.125 µl taq polymerase, 0.01–5 µl of DNA template, and water to 35 µl. The PCR thermal regime followed that of Webb and Suter (2010). Results were visualised on 1.0% agarose gels stained with SybrSafe (Invitrogen). PCR products were purified and sequenced in both directions by Macrogen Inc. (Seoul, Korea).

Contigs were assembled using DNA Baser v2 (www.dnabaser.com) and manually aligned in MEGA11 (Tamura et al., 2021). All trace files were examined manually for evidence of possible multiple gene copies. COI p-distances were calculated in MEGA11. A maximum likelihood phylogenetic reconstruction with 100 bootstrap replicates was performed in MEGA 11 using the TN+G model, as selected by the model-test module within MEGA 11. Outgroups included *Callibaetis* sp., *Centropitulum luteolum*, *Neocloeon triangulifer* (McDunnough, 1931), and *Offadens spl.*

Illustrations were prepared with a DinoEye Eyepiece camera using a Zeiss Axiolab microscope using both phase contrast and differential interference contrast to obtain the best images. Depth of field was achieved with multiple photographs which were stacked using Helicon Focus Ver. 7.6.1 (Helicon Soft Ltd 2000). These images were used to prepare line drawings. Measurements of individual segments or structures were made using an eyepiece graticule. The labrum notch angle was determined by drawing lines along the edge of the margins of the notch to intersect near the base; the angle was then measured with a protractor. Segment ratios of palps are given as segment I (length in mm): segment II length/segment I length: segment III length/segment I length and the leg ratios are femur length (length in mm): tibia length/femur length: tarsal length/femur length.

Table 1. Genetic divergence (p-distance) within and between nine species of *Skolomystax*.

Values in bold represent maximum intraspecific distances; values below the diagonal are minimum interspecific distances between pairs of species.

Minimum interspecific /Maximum intraspecific	<i>brevis</i>	<i>chionotos</i>	<i>dyarrbi</i>	<i>elongatus</i>	<i>gippslandicus</i>	<i>hawkingi</i>	<i>leichhardti</i>	<i>tasmaniensis</i>	<i>vulgaris</i>
<i>brevis</i>	0.005								
<i>chionotos</i>	0.181	N/A							
<i>dyarrbi</i>	0.193	0.177	0.016						
<i>elongatus</i>	0.181	0.142	0.17	0.017					
<i>gippslandica</i>	0.19	0.186	0.161	0.161	N/A				
<i>hawkingi</i>	0.198	0.196	0.18	0.167	0.172	0.018			
<i>leichhardti</i>	0.19	0.178	0.183	0.164	0.175	0.17	N/A		
<i>tasmaniensis</i>	0.186	0.09	0.178	0.129	0.181	0.174	0.172	0.015	
<i>vulgaris</i>	0.187	0.102	0.186	0.134	0.186	0.181	0.17	0.052	0.043

Table 2. Morphological character matrix comparing the species of *Skolomystax*.

Species/ Character	<i>S. elongatus</i>	<i>S. brevis</i>	<i>S. paschei</i>	<i>S. hawkingi</i>	<i>S. leichhardti</i>	<i>S. gippslandica</i>	<i>S. dyarbi</i>	<i>S. chionotos</i>	<i>S. tasmaniensis</i>	<i>S. vulgaris</i>	<i>S. goorudensis</i>
Spines on outer margins of Tibiae & tarsi	F Tib 3–17 F Tars 0–8 M Tib 3–17 M Tars 0–5 H Tib 4–20 H Tars 0–6	5–8 1–2 4–6 2–4 4–8 0–2	21 0 30 2 10–27 0–2	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0
Dark brown markings on head, mandibles and labrum	No	Yes	No	No	No	No	No	No	No	No	No
Sternite spines on segments	III–IX long and alternating short spines contiguous	V–IX conical spines contiguous	II–IX III–IX long and alternating short spines, contiguous	IV–IX conical spines contiguous	V–IX long and contiguous	VI–IX long and contiguous	VI–IX VII–IX long and contiguous, rare short spines	IV–IX long and contiguous	IV–IX long, contiguous	IV–IX V–IX long, contiguous	IV–IX long and alternating short spines contiguous
Tergite spines	Long and alternating short	All long widely spaced	Long and alternating short	Long, widely spaced	Long, widely spaced	Long, widely spaced	Long and contiguous	Long, widely separated	Long, widely separated	Long, widely separated	Long, widely separated
Body with numerous small spots	No	No	No	Yes	Yes	No	No	No	No	No	No
Labrum notch margins	Deep, rectangular Angle 100°	Deep, rectangular Angle 105°	Shallow square, Angle 132°	Deep, rectangular Angle 96°	Deep, notch rounded Angle 107°	Deep, rectangular Angle 91°	Deep, rectangular Angle 117°	Deep, rectangular Angle 95°	Deep, rectangular Angle 106°	Deep, rectangular Angle 103°	Deep, rectangular Angle 93°
Left Mandible teeth on inner margin of outer incisors	3–4	3	4–5	1	1–4	2	4	4–5	3–6	2–5	1–3
Left Mandible inner margin of inner incisors	Broad, rugose	Broad, smooth	Broad, rugose	Rugose	2–4, rugose	2–3, smooth	Broad slightly rugose	Broad, slightly rugose	Broad, rugose	Broad, rugose	Broad, rugose
Right Mandible teeth on inner margin of inner incisors	0	0	0	0	0–1	0	0	0	0	0–2	3–5

Species/ Character	<i>S. elongatus</i>	<i>S. brevis</i>	<i>S. paschei</i>	<i>S. hawkingi</i>	<i>S. leichhardti</i>	<i>S. gippslandica</i>	<i>S. dyarrii</i>	<i>S. chionotos</i>	<i>S. tasmaniensis</i>	<i>S. vulgaris</i>	<i>S. goorudensis</i>
Right Mandible teeth on outer margin of outer incisors	0	0	0	1	0	0	0	0	0	0	0
Maxillary palp segment I long or short	Long, extends to apical 1/3 of galea-lacinia	Long extends to apical 1/3 of galea-lacinia	Short, extends to mid 1/3 of galea-lacinia	Long, extends to apical 1/3 of galea-lacinia	Short, extends to mid 1/3 of galea-lacinia	Long, extends to apical 1/3 of galea-lacinia	Long, extends to apical 1/3 of galea-lacinia	Long almost extend to apex of galea-lacinia	Long, extends to apical 1/3 of galea-lacinia	Long, extends to apical 1/3 of galea-lacinia	Long extend to near apex of galea-lacinia
Maxillary palp total length	Beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Just beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Well beyond apex of galea-lacinia	Well beyond apex of galea-lacinia
Maxillary palp segment I + II length	Extends beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia	Does not extend beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia	Extends just beyond apex of galea-lacinia	Extends beyond apex of galea-lacinia
Maxillary palp segment III length cw segment I length	Approx equal	Shorter	Shorter	Shorter-longer	Longer	Shorter	Shorter	Shorter, half length of basal segment	Shorter	Shorter-longer	Shorter
Maxillary palp segment II length cw segment III length	Shorter	Shorter	Shorter	Shorter	Shorter	Long, equal to apical segment length	Shorter	Longer than apical segment length	Shorter to equal	Shorter	Shorter
Fore femur setae on outer margin	13-24	8-26	39	20-24	11-12	6	16	23	7-30	12-23	16-17
Fore femur setae on inner margin	4-30	5-11	37	10-18	14	11	17	34	2-24	10-17	13-16
Mid tibia with setae on outer margin	3-17	4-6	30	0	0	0	0	0	0	0-1	0
Mid tibia with setae on inner margin	8-22	9-13	30	7-10	0-5	18	10-12	24	9-18	6-19	12-32
Hind tarsus setae on inner margin	19-24	9-17	33-35	13-17	7-11	21-31	20-21	24-27	17-35	15-27	21-26

Species/ Character	<i>S. elongatus</i>	<i>S. brevis</i>	<i>S. paschei</i>	<i>S. hawkingi</i>	<i>S. leichhardtii</i>	<i>S. gippslandica</i>	<i>S. dyarrii</i>	<i>S. chionotos</i>	<i>S. tasmaniensis</i>	<i>S. vulgaris</i>	<i>S. goorudensis</i>
No. of paraproct spines	17–25	12–17	21–23	14–18	10–11	16–24	16–19	19–21	11–25	18–22	22
Abdominal segment I	Dark	Dark	Light	Numerous black spots	Numerous black spots	Dark antero- medially	Light	Light	Dark anteriorly	Dark	Light
Abdominal segment II	Dark	Dark central medial Y-shaped mark	Light	Numerous black spots	Numerous black spots	Light	Light	Light	Light	Dark	Light
Abdominal segment III	Dark	Light	Shaded	Numerous black spots	Numerous black spots	Light	Light	Light	Light	Light	Light
Abdominal segment IV	Light	Light	Shaded	Numerous black spots	Numerous black spots	Light	Light	Light	Light	Light	Light
Abdominal segment V	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark
Abdominal segment VI	Dark	Dark	Dark	Dark anterior	Dark anterior	Light	Dark	Light	Dark	Dark anterior half	Dark
Abdominal segment VII	Light	Light	Light	Numerous black spots	Numerous black spots	Shaded	Light	Light	Light	Light	Light
Abdominal segment VIII	Light	Light	Light	Numerous black spots	Numerous black spots	Shaded	Light	Light	Light	Light	Light
Abdominal segment IX	Dark	Dark	Dark	Numerous black spots	Numerous black spots	Dark	Dark	Dark	Dark	Dark	Dark
Abdominal segment X	Light	Light	Dark	Numerous black spots	Numerous black spots	Light	Light	Light	Light	Light	Dark
Black stripe morph (Y/N)	Y	N	N	N	Y	N	N	N	N	N	N
Distribution	SA, VIC	SE QLD, N NSW	NSW	N QLD	NT	VIC	NSW	NE VIC	TAS	NSW, VIC	NSW

Specimen unique identifier included with materials examined include a laboratory database code (e. g. JWA413; PS420). The collectors of material are identified with initials as follows: JD, John Dean; JW, Jeff Webb; JHH, John Hawking; MHR, Monitoring River Health; PS, Phil Suter; EFR, Edgar Riek; DB, Dennis Black; AW, Alice Wells; PC, Peter Cranston; MH, Mike Halsey; SWC, State Water Commission; KH, Kent Hortle; RT, Ron Thresher; ZB, Zac Billingham.

All types are deposited in the Australian National Insect Collection in Canberra (ANIC) and each ANIC reference code refers to an individual specimen. Other material is held at the La Trobe University collection in Albury/Wodonga, Vic (no deposition code indicated) or the Museum of Zoology Lausanne (MZL).

Results

Phylogenetic analysis

Morphological analysis recognised 11 distinct species (Table 2). Sequences of COI were obtained for 27 specimens representing nine of these species (Supplementary Table S1). The maximum likelihood reconstruction (fig. 1) showed strong support for each species, although the relationships among species were generally poorly supported. However, the morphologically similar species *S. tasmaniensis* n. sp., *S. vulgaris* n. sp. and *S. chionotos* n. sp. were strongly supported as monophyletic. The presumed sister species relationship between *S. hawkingi* n. sp. and *S. leichhardti* n. sp. was not recovered by our analysis but was when different methods and/or parameters were utilised (e. g. neighbour joining, not shown). Maximum intraspecific p-distances ranged from 0.5 to 4.3%, while minimum interspecific p-distances ranged from 5.2 to 19.8% (Table 1). The lowest interspecific p-distance was between *S. tasmaniensis* n. sp. and *S. vulgaris* n. sp. (5.2%).

Skolomystax n. gen.

LSID urn:lsid:zoobank.org:pub:8746565B-0421-4D37-8A78-22C1AEAD6104

Type species: *C. elongatum* Suter 1986

Skolomystax elongatus (Suter, 1986) n. comb. by present designation

Species composition: *S. brevis* n. sp., *S. chionotos* n. sp., *S. collendus* (Harker, 1957) n. comb., *S. dyarbi* n. sp., *S. elongatus* (Suter, 1986) n. comb., *S. gippslandicus* n. sp., *S. goorudensis* n. sp., *S. hawkingi* n. sp., *S. leichhardti* n. sp., *S. paschei* n. sp., *S. tasmaniensis* n. sp., and *S. vulgaris* n. sp.

Diagnosis

Nymph: wide notch in the labrum with a basal pair of denticles (figs. 2a, b). Mandibles with two completely separated sets of incisors, inner set twisted at right angles to outer, setae between prosthema and mola absent (figs. 4e–h, 6e–h, 8d–g, 10d–g, 12–g, 14e–h, 17e–h, 20a–d, 21d–g, 23d–g). Maxillae broad, crown with arched teeth almost indistinct from setae below; three rows of arched setae along the inner margin of lacinia, maxillary palp 3-segmented, segment I broad and curved, segments II and III slender, segment III equal to or longer than

segment II (figs. 2c, 4c, 6c, 8c, 10c, 12c, 14c, 17c, 19c, 21c, 23c). Segment II of labial palp lacking distomedial projection, segment III apically broad and slightly falcate (figs. 3a, 3b, 7a, 7b, 8h, 8i, 11a, 11b, 12a, 12b, 14i, 14j, 18a, 18b, 20e, 20f, 22a, 22b, 24a, 24b). Gills on abdominal segments I–VII with single lamella, gills on segments I and II curved and pointed; lateral margins of the abdominal segments lack spines.

Adults: forewings with single intercalary veins basal of MP (figs. 3b, 16a, 16b). Hindwings present, with two or three longitudinal veins (figs. 3c, 16b, 18d); costal process well developed in basal third (Suter, 1986: 388, fig. 23b; figs. 3c, 16b, 18d). Genital forceps 3-segmented, segment III long and narrow; area between bases of forceps without projection (Suter, 1986: 388, fig. 23d; fig. 3d).

Description

Nymph: up to 11 mm in length.

Head: antennae ~ 0.3 x length of body.

Mouthparts: labrum square to slightly longer than wide, with wide notch with flat base and pair of small tooth-like projections basally (figs. 2a, 2b, 4a, 4b, 6a, 6b, 8a, 8b, 10a, 10b, 12a, 12b, 14a, 14b, 17a, 17b, 19a, 19b, 21a, 21b, 23a, 23b); dorsal surface with scattered fine setae, and row of long robust setae on distal margin; ventral surface with single row of fimbriate setae on anterior margin and scattered fine setae, those near anterior corners longer, and short pointed robust setae near lateral margin.

Mandibles: two sets of incisors completely separated, outer set with long and slender incisors; inner set rotated 90° relative to outer set; right mandible with outer incisors with three apical teeth, inner incisors with 2–3 apical teeth, fimbriate seta at apex of molar area (figs. 2d, 4e, 4g, 6d, 6f, 8d, 8f, 10d, 10f, 12d, 12f, 14e, 14g, 17e, 17g, 20a, 20c, 21d, 21f, 23d, 23f); left mandible with outer incisors with three apical teeth, inner margin with 1–6 lateral teeth, inner incisors with 2–3 apical teeth, inner margin expanded at base smooth to rugose; patch of fine setae at base of prosthema (figs. 2e, 4f, 4h, 6e, 6g, 8e, 8g, 10e, 10g, 12e, 12g, 14f, 14h, 17 f, 17h, 20b, 20d, 21e, 21g, 23e, 23g); right mandible with prosthema slender and forked, mola highly developed, reducing distance between prosthema and mola; left mandible with thumb of mola in same plane as anterior margin.

Hypopharynx: lingua subrectangular, with distinct median ridge and apical projection; superlingua shorter than lingua and poorly expanded laterally (figs. 4d, 14d, 17d).

Maxillae: broad; crown with arched teeth almost indistinct from arched setae below, 3–6 thin setae at the base of crown in a row or scattered row; three rows of long stout arched setae on inner margin of lacinia, two stout feathered dentisetae, one bifurcate, as long as arched setae; one stout seta perpendicularly to margin and a row of 2–6 setae at base of lacinia; palp three segmented, longer than galealacinia, with rare to numerous long fine hair-like setae, segment I cylindrical and curved medially, broad and long; segments II and III slender (figs. 2c, 4c, 6c, 8c, 10c, 12c, 14c, 17c, 19c, 21c, 23c).

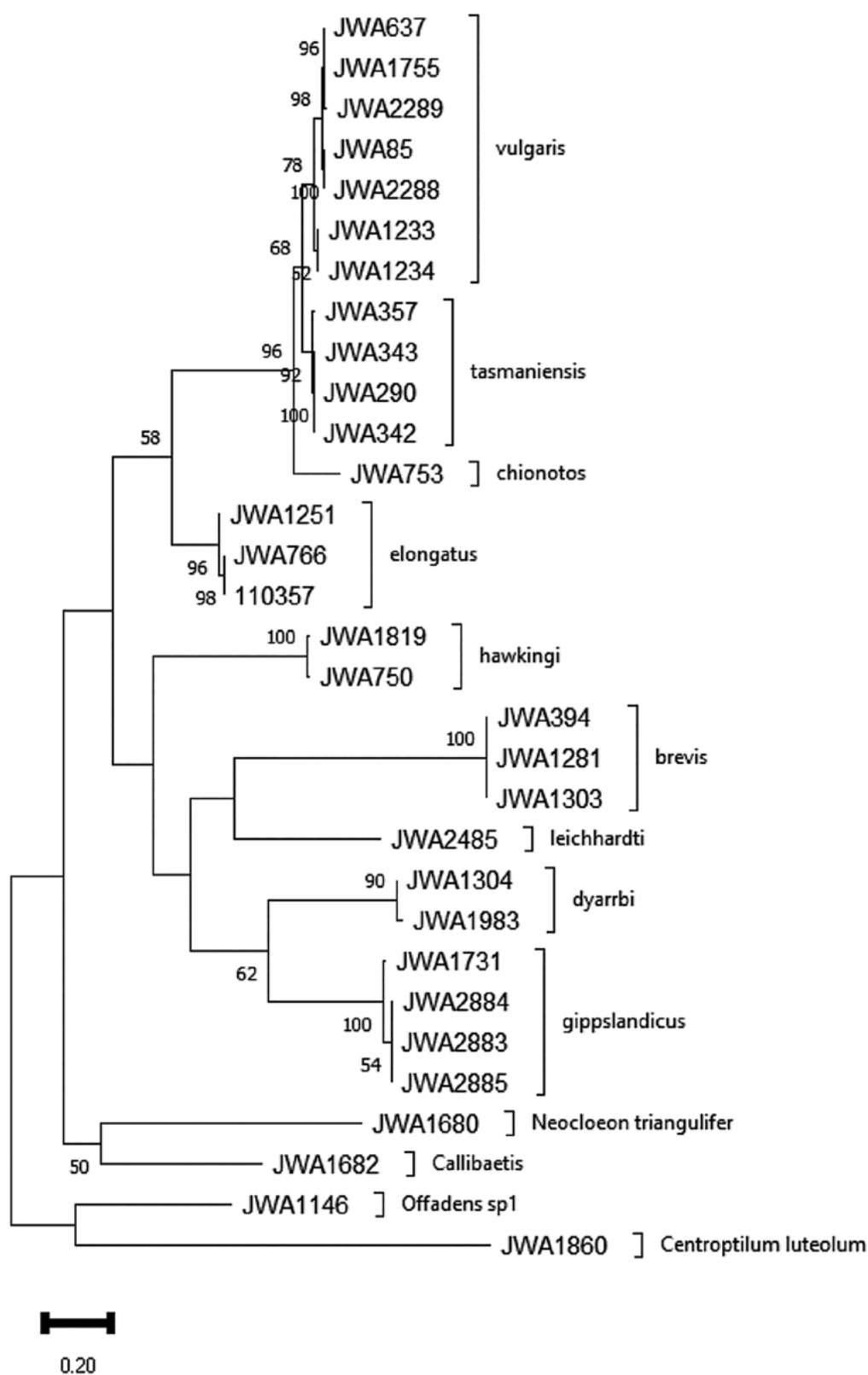


Figure 1. Maximum Likelihood phylogram of a 657 bp fragment of COI for nine species of *Skolomystax* and four outgroup taxa. Branch lengths represent the number of changes per site. Values above or below the branches represent bootstrap support.

Labium: glossae apically rounded or slightly truncate, slightly shorter than paraglossae, with single row of medium stout setae on margins, dorsal surface with single large fimbriate seta without distinct socket near apex, ventral surface with numerous long fine setae; paraglossae curved medially, truncate apically and with single row of long setae on outer margin, dorsal surface with numerous long setae and with dense apical patch of fine setae, ventral surface with numerous long fine setae; labial palp three segmented, outer margin of each segment with hair-like setae and lacking spines, segment I sub rectangular, segment II apically expanded and longer on outer margin than inner margin, dorsal surface with oblique row of fine setae distally, ventral surface with scattered hair-like; segment III broad subequal in width to segment II, subrectangular and slightly falcate, with numerous long robust and short fine setae on margins, dorsal surface with long robust setae distally, ventral surface with scattered hair-like setae (figs. 5a, 5b, 7a, 7b, 8h, 8i, 11a, 11b, 13a, 13b, 14i, 14j, 18a, 18b, 20e, 20f, 22a, 22b, 24a, 24b).

Thorax: much longer than wide; hindwing pads present.

Legs: long and slender; femora with short and stout setae on ventral and dorsal margin, villipore absent, with paired subapical setae; tibiae with tibiopatellar suture present on all legs and without arc of setae, tibiae and tarsi with outer margin with or without setae, inner margin with abundant medium stout setae; tarsal claws elongate and with two rows of abundant minute denticles increasing in length from base, apical setae absent (figs. 3a, 5c, 7c, 9a, 11f, 13c, 15a, 18d, 20g, 22c, 24c).

Abdomen: terga with numerous scales, scale bases and fine setae, posterior margins with triangular long and slender spines (figs. 2f, 2i, 7e, 9c, 11d, 13e, 15b, 17j, 19f, 22e, 24e). Sterna with scales, scale bases and numerous long fine setae, distal segments with spines on posterior margins, distal margins of sternites II–VI to IX with triangular spines depending on species (figs. 2g, 2j, 7f, 9d, 11e, 13f, 15c, 17k, 19g, 22f, 24f), distal margin of other sternites smooth. Lateral margin of terga without spines. Simple plate-like gills present on segments I–VII, well tracheated, margins smooth. Gills I and II narrow and curved away from abdomen, apically pointed; gills III–VII somewhat asymmetrically oval, with sclerotised margin; apically rounded. Three caudal filaments with dense intersegmental setae on median surfaces nearly to tip, with some segments more darkly coloured; articulations of cerci and terminal filament with whorl of spines, those on lateral surfaces of cerci generally longer than those on median surfaces; median caudal filament slightly shorter than cerci.

Adult: turbinate eyes of male nearly contiguous dorsally. Forewings with single intercalary veins basal of MP (fig. 3b), intercalaries anterior of MP single in described species, but double in some not yet associated with nymphs. Hindwings (figs. 3c, 16a, 16b, 18d) present, with two or three longitudinal veins, second vein forked or unforked; third longitudinal vein when present sometimes poorly developed and joining hind margin in basal third of wing; costal margin with well-developed costal process in basal third, without vein at base, variable in shape; crossveins present or absent. Abdomen terga variable, generally with extensive red markings, especially in females; sterna with

or without red spotting. Forceps 3-segmented, segments I and II mostly fused, segment III long and narrow (Suter, 1986: 388, fig. 22d; fig 3d). Cerci with fine setae, and every other articulation darkened, terminal filament reduced

Discussion

Morphologically, *Skolomystax* may look superficially similar to *Centropilum* (labial palp segment III apically broad and slightly falcated, elongated claw with two rows of abundant denticles, similar mandibles) but it can be easily separated by numerous characters such as the shape of the labrum, the shape of the hypopharynx, the shape and setation of the maxilla and at the imaginal stage by the shape and venation of the hindwing. *Skolomystax* is most similar to *Apobaetis* Day 1955, *Callibaetis* Eaton 1881, *Callibaetoides* Cruz, Salles and Hamada 2013 and *Waltzoyphius* Lugo-Ortiz and McCafferty, 1995. Cruz et al. (2013) noted that the newly described genus *Callibaetoides* from Brazil was most similar to *C. elongatum* (*S. elongatus*) from Australia. A recent study of the phylogeny of the Baetidae using morphological characters found *S. elongatus* was in a clade with *Callibaetis* and *Callibaetodes*, which was the sister group of a clade comprised of *Waltzoyphyus* and *Apobaetis* (Cruz et al., 2020).

The five Baetidae genera share, for example, frontoclypeal suture at the level of the ocelli; scape and pedicel of antennae with cylindrical or subcylindrical setae; external margins of the mandibles convex; inner and outer incisors of mandibles not reduced in size; triangular process present between prostheca and molars on left mandibles; external margin of maxilla convex; maxilla with dense filtering setae on apex of galea-lacinia, with three maxillary canines; labial mentum not elongated; base of glossae not overlapping base of paraglossae; three-segmented labial palps; paraprocts and lateral extension with spines; fork MA1–MA2 absent; male foreleg with first segment of fore tarsus very short and tarsal claws similar; mid- and hind legs with four tarsomeres and tarsal claws different; paracercus vestigial and gonostylus with three segments.

Waltzoyphius and *Apobaetis* differ from the other three genera by having a median concavity on distal margin of labrum not deeply cleft and lacking a pair of denticles on median margin of labrum concavity; labrum width >2 x length; setae between prostheca and molars on mandibles restricted to base of prostheca; glossae longer than paraglossae; distomedial projection on labial palp segment II present; and thoracic mesosternum projection present.

Callibaetis, *Callibaetoides* and *Skolomystax* are unique in having a wide V-shaped notch with a pair of sclerotised denticles on the median margin of the labrum; small tooth laterally on the outer incisors, and a large single seta on the dorsal surface of the glossae (although this appears to be absent in some *Callibaetis*). *Callibaetis* nymphs differ from those of *Skolomystax* and *Callibaetoides* by having two-segmented maxillary palps, maxilla with spine-like setae on surface of maxillary palp; robust maxillary canines apically pointed; distal margin of paraglossae with a single row of setae; segment I of labial palps with spine-like setae; outer and inner margins of segment II of labial palps parallel and distal margin of

segment II oblique; and segment III quadrangular or globose and abdominal terga lacking scale-like setae/sockets.

Callibaetoides differs from *Skolomystax* in possessing very long antennae (3–3.5 x head width); prostheca of left mandible stout with apical denticles; lacks a row of setae on inner margin of the glossae; many long fine-hair-like setae on outer margin of labial palp segments I and II; apex of labial palp segment III on external corner lacking pointed projection; median concavity on labial palp segment III absent; fore femur with blunt setae near dorsal margin on anterior surface; fore claw with denticles extending more than half length of claw; abdominal gill I asymmetric; abdominal terga surface shagreen; long spines on cerci every third segment, male forewing with double free marginal intercalaries; two longitudinal veins in hindwing of imago; and a well-developed centrally located sub-quadrangular costal process.

Baetidae adults are generally rather difficult to identify at the generic level because of the lack of reliable generic characters. *Skolomystax* can usually be differentiated from other adults of Australian Baetidae by the presence of hindwings and the single marginal intercalary veins on forewings basal of MP. The second longitudinal vein in the hindwing when forked has a single intercalary. The abdominal colour patterns, especially of the females, tend to be more complex than those of *Offadens*. At least one species of *Offadens* from northern Queensland (Qld) has single marginal intercalaries in the forewing of the females and may be confused with *Skolomystax*, but has multiple intercalaries in the forked second longitudinal vein of the hind wing.

Etymology: *Skolomystax* is masculine in gender and is a combination of the Greek words *skolops* (pointed or thorny) and *mystax* (lip) in reference to the pointed pair of denticles on the labrum.

Distribution: widespread in eastern mainland Australia from the Northern Territory (NT) to SA and Tasmania (Tas). There are reports of this genus occurring in central Australia, but we have not yet examined specimens. Nymphs occur mostly in sandy, depositional areas in a variety of stream types, including mountain streams below the tree line and temporary lowland streams.

***Skolomystax elongatus* (Suter, 1986) n. comb. (figs. 2, 25a)**

***Centropilum elongatum* Suter, 1986**

***Centropilum* spBlackstripe in Webb and Suter (2011)**

Material examined. *Holotype:* Wannon R above Wannon Falls, 37.68S 141.84E, 30 Oct 1977, PS.

Nymph: New South Wales (NSW): Site 10 Marowan Ck near Glencoe 29.933S 151.716E 26 Nov 1998 PS, JD, JWA1384; MacLaughlin R at Monaro Highway, south of Nimmitabel, JWA1251, 36.5722S 149.2847E, 29 Mar 2009. SA: Mosquito Ck, 37.09S 140.79E, PS Carrickalinga Ck, 35.43S 138.38E, PS; Deep Ck upstream of ford, 35.58S 137.25E, PS; Tent Rock Ck, Deep Ck Conservation Park, 35.633S 137.233E, PS; Kangaroo Island SA Breakneck R 35.93S 136.61E, PS; DeMole R 35.74S 136.79E, PS; Rocky R 35.95S 136.71E, PS; Southwest R 35.98S 136.86E, PS; Stunsail Boom R 35.99S 137.01E, PS; Western R 35.68S 136.97E, PS, MZL. Vic: Wannon R

above Wannon Falls, 37.68S 141.84E, 30 Oct 2007, PS: Jimmy's Ck, Mt Emu Ck, 38.22S 142.99E, PS; Wimmera R at Eversley 37.19S 143.17E, 28 Feb 1994; Eumerella R near Bessiebell JWA766 38.16S 141.95E, 9 Jul 2008, JW; Eumerella R on Princes Highway, JWA2510, 38.26S 141.94E, 19 Nov 2009, JW; Leigh River S of Ballarat at Mt Mercer, PS153, 37.89S 143.94E, 20 Apr 1994, PS; Grangeburn Ck at 30 Clifton Rd, Hamilton '110357', 37.5155S 141.980E, 4 Oct 2014 ZB.

Nymph – description

Body: 8.0–9.8 mm; caudal filaments 0.37–0.59 times body length, terminal filament 0.45 times body length; antennae ~ 0.3 x body length.

Head: uniformly coloured, with some dark vermiculations on vertex. Antennae with scape 1.07–1.40 times length of pedicel.

Mouthparts: labrum 1.22–1.30 times wider than long (fig. 2a), labrum notch rectangular with a pair of small lateral projections (fig. 2b), notch angle 100°, notch depth 0.25–0.31 x notch width, 0.76–0.80 times labrum length; notch lined with 20–27 fimbriate setae on each side, ventrally with single row of fimbriate setae apically, numerous scattered fine setae, those at apical corners distinctly longer and more robust, and laterally with submarginal scattered row of 7–13 short robust setae; dorsally with numerous scattered long fine setae. Right mandible (planate) (fig. 2d) outer incisors with three apical teeth and inner margin smooth; inner incisor with broad surface and with three indistinct teeth; prostheca slender and forked, with patch of fine setae at base. Left mandible (angulate) (fig. 2e) with three apical teeth and 3–4 teeth on inner margin of outer incisor; inner incisor with three apical teeth, inner incisor with broad rugose basal region on inner margin; prostheca slender, simple with few long spines, and with patch of setae at base. Maxillae (fig. 2c) with 3–7 subcrest setae on ventral surface, 1–8 hump setae, and 30–36 lacinial setae, lateral margin below palp with numerous fine hair-like setae; maxillary palp length 0.28–0.45 mm; palp segment I somewhat curved and reaching beyond middle of galealacinia, with dense row of long fine hair-like setae on outer margin; segments II and III together 1.38–1.69 times longer than basal segment and extend beyond apex of galealacinia; segment II shorter than segment III, with numerous long fine hair-like setae; segment III approximately equal in length to segment I, with few long fine hair-like setae and with short fine hair-like setae at apex, 1.16–2.07 times segment II length; segment ratios of palp 1.00 (0.13–0.24 mm) : 0.48–0.67 : 0.78–1.11. Labium with glossae shorter than paraglossae; glossae with single row of long setae on inner margins, dorsal surface with robust seta near apex, ventral surface with numerous long fine setae and single subapical long robust seta; paraglossae curved medially, truncate apically and with single row of long hair-like setae on outer margin, dorsal surface with numerous long setae and with dense apical patch of fine setae, ventral surface with numerous long fine setae; labial palp 3-segmented, length 0.67–0.82 mm, outer margin of each segment with numerous fine setae, basal segment sub-rectangular 2.31–2.54 times longer than wide, segments II and III combined 1.12–1.26 times longer than basal segment, segment II apically expanded and longer on outer margin than inner margin, dorsal surface with oblique row of fine setae distally, ventral surface with

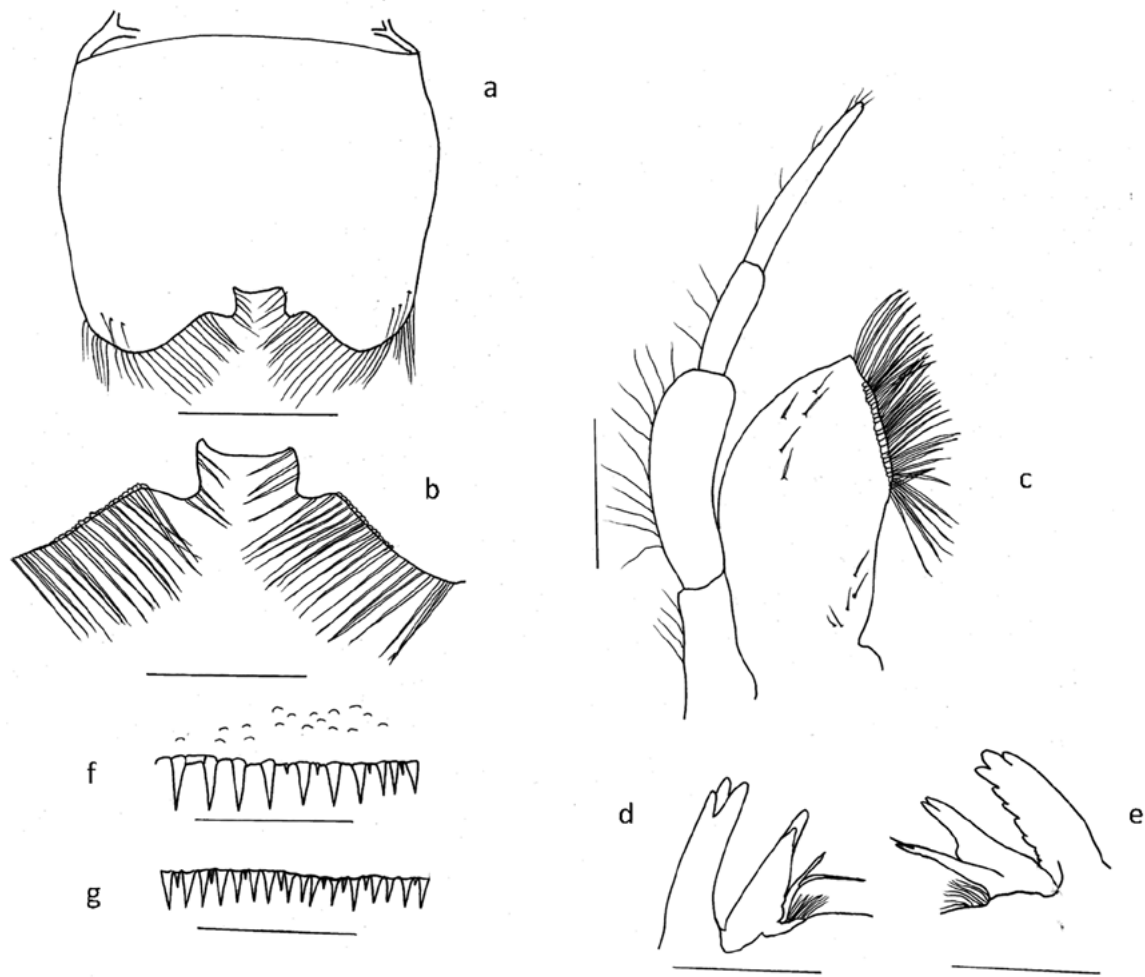


Figure 2. *Skolomystax elongatus*: a, labrum; b, labrum notch; c, maxilla; d, right mandibles incisors; e, left mandible incisors; f, tergite spines; g, sternite spines. Scale lines a, f, g = 0.15 mm, b–e = 0.07 mm.

scattered fine setae; segment III sub-rectangular and slightly falcate, with numerous long robust and short fine setae on margins, dorsal surface with long robust setae distally, ventral surface with scattered fine setae. Segment ratios of labial palp 1.00 (0.34–0.37 mm) : 0.71–1.00 : 0.24–0.35.

Thorax: pronotum with dark spots. Mesonotum uniformly coloured. Sterna uniformly coloured.

Legs: foreleg 2.05–3.11 mm long with ratios of 1.00 (0.91–1.30 mm) : 0.56–0.67 : 0.58–0.73 : 0.32–0.40 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.53–0.65 times tarsus length. Fore femur 4.10–5.17 times longer than wide at midpoint and with subapical dark band, often separated into two dark spots by longitudinal pale area, and usually with dark band basally; dorsal margin of fore femora with row of 13–24 short sharply pointed robust setae and scattered fine setae and with subapical pair of long, pointed robust setae; anterior surface with 3–4 scattered rows of sharply pointed robust setae just

below dorsal margin, ventral half with numerous sharply pointed robust setae; ventral margin with long fine setae and 4–30 sharply pointed robust setae. Fore tibia slightly darker basally, with 3–17 sharply pointed robust setae and scattered fine setae on outer margin, inner margin with 8–24 long pointed robust setae and long fine setae. Fore tarsus slightly darker basally, with 0–8 sharply pointed robust setae, scattered long fine setae and apical patch of long fine setae on outer margin, inner margin with single distinct row of 19–23 long sharply pointed setae, some of robust setae may be slightly fimbriate distally. Tarsal claw with two similar rows of denticles in basal half. Middle leg 2.81–3.01 mm long, with subapical dark band on femora not divided, segment ratios 1.00 (1.07–1.38 mm) : 0.55–0.64 : 0.53–0.73 : 0.34–0.41, tarsal claw 0.50–0.71 times tarsus length; femur 4.50–6.11 times longer than wide. Mid-femur with 20–36 sharply pointed robust setae on outer margin, inner margin with 6–34 sharp setae; mid-tibia with 3–17 sharply pointed robust setae on outer margin and 8–22 short sharply pointed robust setae on

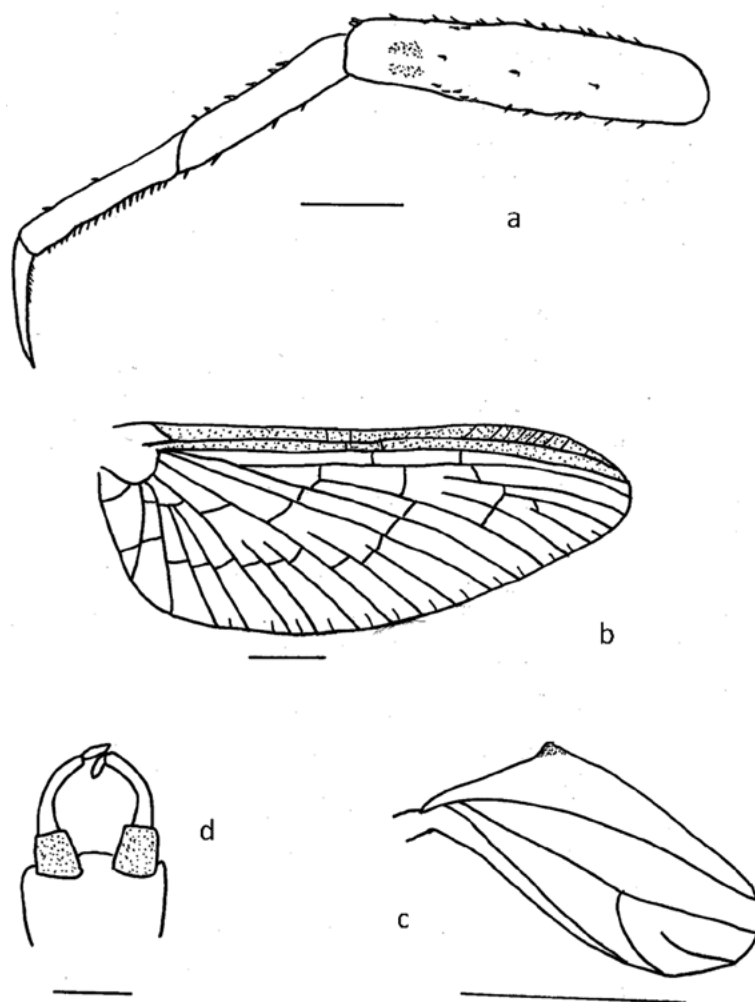


Figure 3. *Skolomystax elongatus*: a, leg of nymph; b, forewing of male imago; c, enlarged hind wing of male imago; d, genitalia of male imago. Scale lines = 1 mm.

inner margin; mid-tarsus with 0–5 sharply pointed robust setae on outer margin and 19–31 short sharply pointed robust setae on inner margin; tarsal claw with two similar rows of denticles in basal half. Hind leg 2.29–3.02 mm long, with subapical dark band on femora not divided, segment ratios 1.00 (1.11–1.47 mm): 0.55–0.64 : 0.52–0.60 : 0.31–0.39, tarsal claw 0.59–0.71 times tarsus length; femur 4.62–7.22 times longer than wide. Hind femur with 18–38 sharp sharply pointed robust setae on outer margin and 0–29 sharply pointed robust setae on inner margin; hind tibia with 4–20 sharply pointed robust setae on outer margin and 8–25 on inner margin; hind tarsus with 0–6 sharply pointed robust setae on outer margin and 19–24 sharply pointed robust setae on inner margin, tarsal claw with two similar rows of denticles in basal half.

Abdomen: abdominal tergites with dark lateral spots on segments III–VII, segments I–III, V–VII and IX dark with other segments light with few dark spots (Suter, 1986: 388, fig. 23f; fig. 25a).

Abdominal terga I–X with numerous alternating long and short spines on posterior margins, long spines 2.70–4.63 times longer than basal width, separated by greater than spine width (fig. 2f). Gills I and II somewhat cordate and pointed, gills III–VII apically rounded. Sterna III–IX with long narrow spines on posterior margin with short spines between, base of spines contiguous, long spines 2.17–3.89 times longer than width (fig. 2g). Paraprocts with 17–25 marginal spines, surface with scattered long fine setae and scale bases; slight gap between main and lateral parts; lateral part of paraproct with small spines. Cerci and terminal filament subequal in size, slightly darkened distally, every other articulation darkly coloured, and inner surfaces with long fine setae nearly to apex.

Male imago: fully described by Suter (1986) and characteristics are given in generic diagnosis. Wings and forceps are illustrated in fig. 3.

Distribution

Widespread in southeastern Australia, including SA, Vic and NSW.

Discussion

The presence of robust setae on the outer margins of the tibiae differentiates *S. elongatus* from all other known species except *S. brevis* and *S. paschei*. *Skolomystax elongatus* is larger (body length >8 mm) than both *S. brevis* (<6.5 mm) and *S. paschei* (6.7 mm). *Skolomystax elongatus* is most easily differentiated from *S. brevis* by the absence of dark markings on mandibles, genae and labrum, the alternating long and short spines on the posterior margins of the terga and sterna (versus equal-sized) and the presence of at least five teeth on the inner margin of the left outer incisors of the mandibles (versus three). Additional discriminating characters are detailed in Table 2.

Skolomystax elongatus differs from *S. paschei* in being larger (see above); having <25 setae on the inner margin of the hind tarsus (versus >30); maxillary palp segment II distinctly shorter than segment I (versus subequal); basally separated tergal spines (versus contiguous); labrum with narrow notch angle of approximately 100° versus approximately 130°; length of labial palp segment II+III <1.3 x longer than basal length and >1.7 x longer for *S. paschei*.

A unique colour morph with a median longitudinal dark stripe on the abdomen and a pair of submedian dark stripes on the mesonotum (fig. 25I) has been encountered and was previously treated as distinct species (Webb and Suter, 2011). Based on COI sequences, however, it appears conspecific with *S. elongatus* (specimen 110357 on fig. 1).

Skolomystax brevis n. sp. (figs. 4, 5, 25b)

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Centropilum spLogan in Webb and Suter (2011)

Material examined. *Holotype*: nymph mounted on slides. Qld: Logan River at Mt. Barney Lodge, JWA394, 28.28S 152.74E, 2 Dec 2007, JW, DB, ANIC6-000083.

Paratypes: nymphs, three mounted on slides. Qld: Coochin Ck at Bruce Hwy, JWA1401, Monitoring River Health (MRH) #1410007, 26.86S 153.02E, 4 Nov 1994, ANIC 6-000084. NSW: Cedar Brush Ck on Cedar Brush Rd, JWA1281, 33.15S 151.26E, 10 Mar 2009, JW, JHH, ANIC 6-000085; Cedar Brush Ck on Cedar Brush Rd, JWA1303, 33.15S 151.26E, 10 Mar 2009, JW, JHH, ANIC 6-000086; Location: Site 27. Bellinger River, 23.7km u/s of Thora, JWA1394, 30.46S 152.58E, 29 Nov 1998, PS, JD, 1 specimen in alcohol, ANIC 6-000087.

Other material examined. *Mature nymph*. Qld: Coochin Ck at Bruce Hwy, JWA1407, JWA1408, 26.86S 153.02E.

Adults: Unknown.

Nymph – description

Body: 5.3–6.5 mm.

Head: light with distinct brown markings, particularly on the genae, at the base of mandibles and anterior margin of the

fronto-clypeus (fig. 5d). Antennae with scape 1.24 times length of pedicel.

Mouthparts: labrum (fig. 4a) 0.76–1.36 times wider than long; labrum notch depth 0.74–0.81 times labrum length, notch depth 0.29–0.32 times width (fig. 4b); notch deep, angled with large lateral projections, notch angle approximately 105°, lined with 19–25 fimbriate setae on each side, ventrally with numerous fimbriate setae apically, numerous scattered fine setae, apical corners with 12–17 long and robust setae and laterally with submarginal scattered row of seven short robust setae. Mandibles with distinct black/brown spot at base (figs. 4e, 4f, 5d). Right mandible (planate) (figs. 4e, g) with three apical teeth and lacking lateral spine on inner margin of outer incisor (fig. 4g); inner incisor with broad surface and with three indistinct apical teeth; prosthema slender with a long setule at midpoint, setule fringed at apex, patch of fine setae at base (fig. 4g). Left mandible (angulate) (figs. 4f, h) with three apical teeth and three inner teeth on inner margin of outer incisor (fig. 4h); inner incisor with three apical teeth, inner margin expanded and smooth; prosthema robust and simple with several long spines on comb, and with patch of setae at base (fig. 4h). Maxillae (fig. 4c) with 4–6 subcrest setae on ventral surface, 2–3 hump setae, and >20 lacinial setae, lateral margin below palp lacking setae; maxillary palp 3-segmented, total length 0.34–0.35 mm, palp extends well beyond apex of galealacinia, segment I and II combined extend beyond apex of galealacinia, all segments with sparse very fine hair-like setae on outer margins (difficult to see), segment I somewhat curved and not reaching apex of galealacinia, with approximately 20 small tubercles; length of palp segments II and III combined 1.40–1.56 times length of basal segment, segment III length 1.22–1.73 times length of segment II; segment ratios of 1.00 (0.18–0.19 mm) : 0.57–0.68 : 0.79–0.99. Hypopharynx (fig. 4d). Labium (figs. 5a, b) with glossae slightly shorter than paraglossae; glossae with 11–12 setae on outer margins, inner with 12–14 fine setae (fig. 5b), inner margins lined with numerous long setae (figs. 5a, b); paraglossae curved medially, truncate apically and with numerous long fine hair-like setae on outer margin and three rows of 10–18 long setae ventrally (fig. 5b) and 3–4 rows dorsally (fig. 5a); labial palp 3-segmented (figs. 5a, b), palp length 0.52–0.55 mm, outer margin of each segment lacking setae; length of segment II and III combined 1.14–1.65 times length of basal segment, segment ratios 1.00 (0.20–0.25 mm) : 0.90–1.37 : 0.21–0.28, segment I sub-rectangular 1.89–2.64 times longer than wide, segment II apically expanded and longer on outer margin than inner margin, dorsal surface with few setae; segment III subrectangular and slightly falcate with 10–12 long robust setae on apical margins, dorsal surface with 6–7 long robust setae distally.

Legs: foreleg (fig. 5c) total length of 1.68–1.85 mm, segment ratios of 1.0 (0.73–0.82 mm) : 0.58–0.68 : 0.61–0.69 : 0.38) (femur : tibia : tarsus : claw). Fore femur 4.31–5.66 times longer than wide with subapical dark band, and usually slightly darker basally; outer margin of fore femora with 8–26 short sharply pointed robust setae, with subapical pair of long, pointed robust setae; inner margin with 5–11 short sharply pointed robust setae. Fore tibia slightly darker basally and apically, outer margin with 5–8 short sharp setae, inner margins with 9–12 long sharp setae. Fore tarsus without darker markings, with outer margin with 1–2

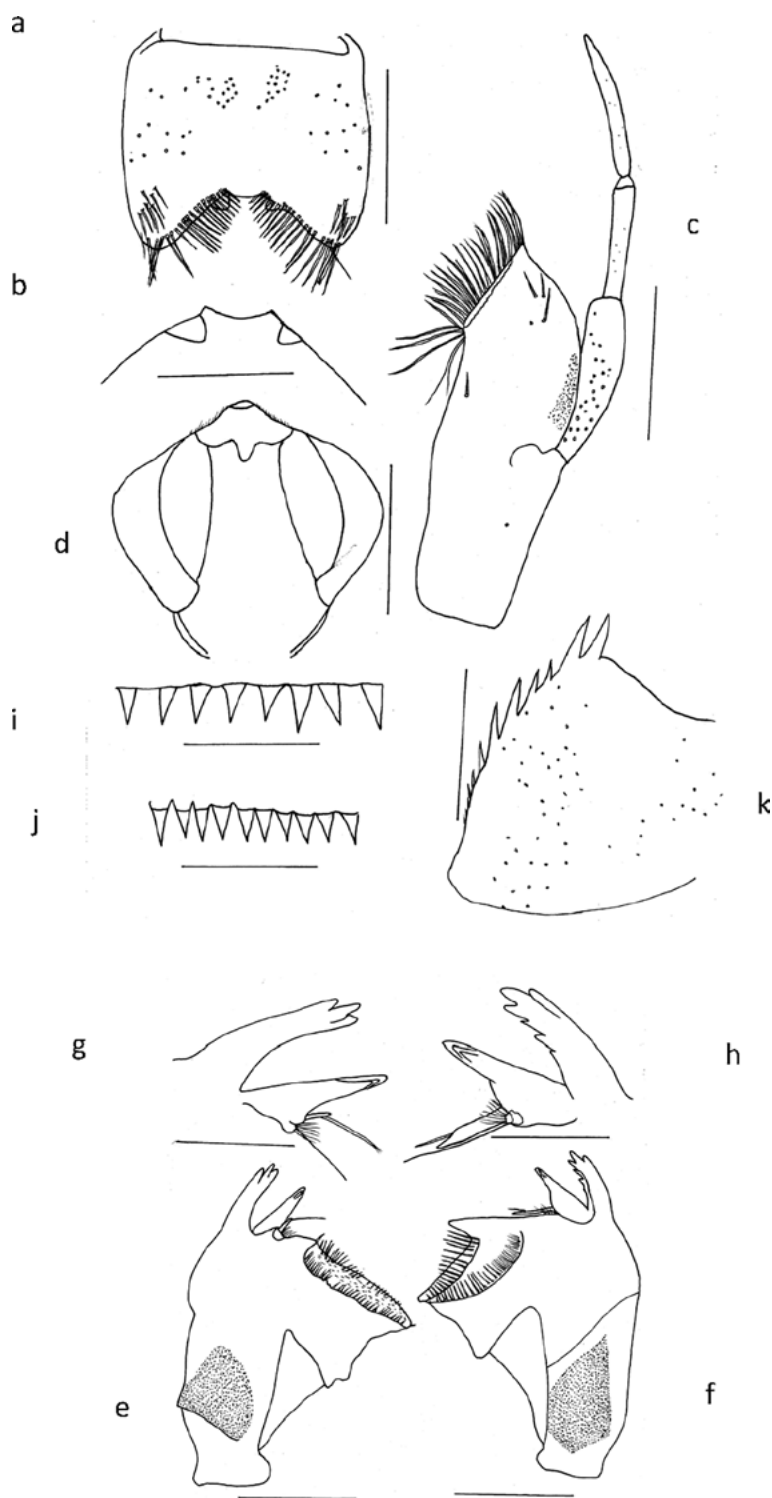


Figure 4. *Skolomystax brevis*: a, labrum; b, labrum notch; c, maxilla; d, hypopharynx; e, right mandible; f, left mandible; g, right mandible incisors; h, left mandible incisors; i, tergite spines; j, sternite spines; k, paraproct. Scale lines: a, c-f, i-k = 0.15 mm; b, g, h = 0.07 mm.

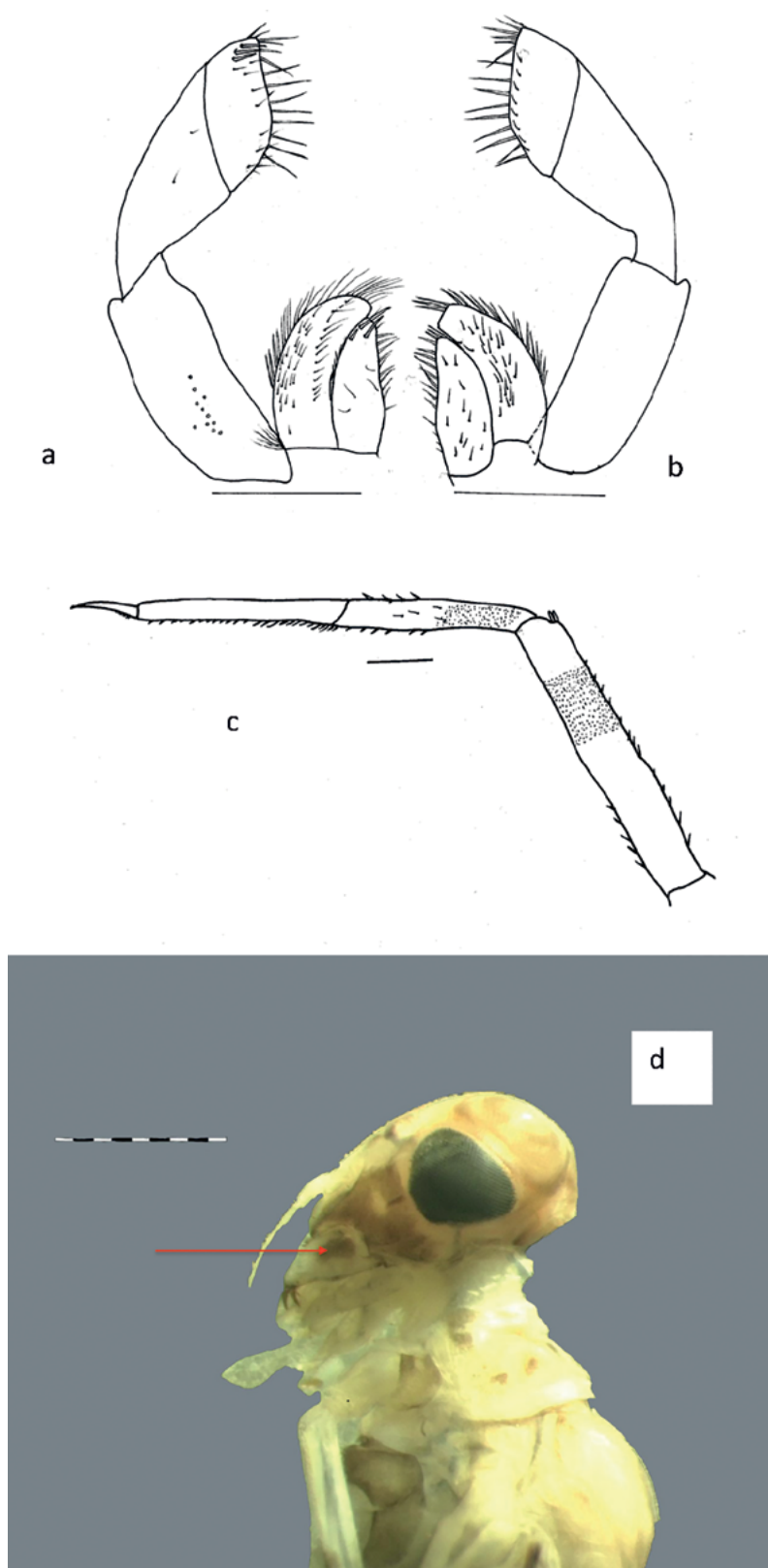


Figure 5. *Skolomystax brevis*: a, labium dorsal; b, labium ventral; c, leg; d, lateral of head showing dark markings and mandibular marking arrowed. Scale lines a, b = 0.15 mm, c, d = 1 mm.

short sharp robust setae, inner margin with 18–30 long sharp setae some of robust setae may be slightly fimbriate distally. Tarsal claw 0.55–0.56 times length of tarsus, with two similar rows of denticles in basal half. Middle leg total length of 1.99–2.06 with segment ratios of 1.00 (0.92–0.97 mm): 0.59: 0.55: 0.25–0.37. Mid-femur 6.48–6.53 times longer than wide with subapical dark band, and slightly darker basally; outer margin of mid-femora with 16–26 short sharply pointed robust setae and with subapical pair of long, pointed robust setae; inner margin with 5–10 short sharply pointed robust setae. Mid-tibia slightly darker basally, outer margin 4–6 sharp setae, inner margins with 9–13 long sharp setae. Mid-tarsus without markings, with outer margin with 2–4 sharp pointed robust setae, inner margin with 13–20 long sharp setae; some robust setae may be slightly fimbriate distally. Tarsal claw 0.46–0.67 times length of tarsus, with two similar rows of denticles in basal half. Hind leg total length 1.90–2.36 mm, with segment ratios of 1.00 (0.99–1.19 mm): 0.52–0.61: 0.46–0.56: 0.29–0.40. Hind femur 6.40–6.71 times longer than wide with subapical dark marking and slightly darker basally; outer margin of hind femora with 20–23 short sharply pointed robust setae and scattered fine setae and with subapical pair of long, pointed robust setae; inner margin with 2–9 short sharply pointed robust setae. Hind tibia slightly darker basally, outer margin 4–8 sharp setae, inner margins with 9–16 long sharp setae. Hind tarsus without dark markings, with outer margin with 0–2 short sharp robust setae, inner margin with 9–17 long sharp setae; some robust setae may be slightly fimbriate distally. Tarsal claw 0.64–0.71 times length of tarsus, with two similar rows of denticles in basal half.

Abdomen: abdominal tergites with a distinct colour pattern (fig. 25b), dark lateral marks on segment II–VII, light IV, dark saddle on V and VI, light VII and VIII and dark IX; segment VI with central posterior light spot and darker C-shaped marking anterior to light spot, segment VII with dark marking medial to centre. Posterior margin of abdominal terga with long and widely spaced spines of equal size (fig. 4i), length (0.03 mm) 1.88–2.64 times width. Sterna V–IX with conical spines on posterior margin with bases contiguous (fig. 4j), spine length (0.03 mm) 1.86–2.25 times width. Paraprocts (fig. 4k) with 12–17 marginal spines, surface with scattered scale bases.

Discussion

Webb and Suter (2011) included this species in a key under the informal name of *Centroptilum* spLogan. The presence of robust setae on the outer margins of the tibiae and tarsi differentiates *S. brevis* from all other known species except *S. elongatus* and *S. paschei*. It can be differentiated from both of those species by having black “cheeks” (the base of the mandibles, genae and labrum fig. 5d) and by having all the spines of the posterior margins of the abdominal terga subequal in size and distinctly separated basally (fig. 4i). Additionally, *S. brevis* is smaller than *S. elongatus* and has many fewer robust setae on the legs than *S. paschei*.

Etymology: the specific epithet *brevis* is an adjective and refers to the small size relative to other species, which have robust setae on the outer margin of the tibiae.

Distribution: eastern NSW north of Sydney, southeast Qld.

Skolomystax chionotos n. sp. (figs. 6, 7, 25c)

urn:lsid:zoobank.org:act:C28AF825-92EE-475E-A91F-ED44C4AF1296

Centroptilum spSnowy in Webb and Suter (2011).

Material examined. *Holotype:* nymph mounted on slides. Vic: Snowy Ck on Omeo Highway near Mitta Mitta, JWA753, 36.545S 147.384E, 3 Sept 2007, JW, ANIC6–000104.

Paratype: one nymph mounted on slides. Vic: Snowy Ck on Omeo Highway near Mitta Mitta, JWA353, 36.55S 147.38E, 9 Mar 2007, JW, ANIC6–000105.

Nymph – description

Body: 8.0–10.0 mm; terminal filament 0.96 times cerci length.

Head: antennae with scape 1.35 times length of pedicel.

Mouthparts: labrum (fig. 6a) 1.14–1.22 times wider than long, notch depth 0.34–0.36 times notch width (fig. 6b), depth 0.72–0.74 times labrum length, notch angle 95°, notch with 26 setae on each side, five setae laterally. Right mandible (planate) (figs. 6d, f) with three apical teeth and no lateral spines on inner margin of outer incisor; inner incisor with broad surface and with 2–3 indistinct teeth incisor, inner margin smooth; prostheca slender and forked with patch of fine setae at base (fig. 6f); dorsal surface lacking fine setae or scales. Left mandible (angulate) (figs. 6e, g) with three apical teeth and 4–5 inner teeth on outer incisor; inner incisor with three apical teeth and no inner teeth on expanded base, slightly rugose (fig. 6g); prostheca robust, simple, with patch of setae at base (fig. 6g); dorsal surface without scattered fine setae or scales. Maxillae (fig. 6c) with two subcrest setae on ventral surface, 5–7 hump setae, and 20–26 lacinial setae; maxillary palp 3-segmented, 0.27–0.37 mm long, extending well beyond apex of galea-lacinia; segment I somewhat curved, reaching apical third of galea-lacinia, with rare long fine hair-like setae on outer margin; segments I and II combined extend beyond galea-lacinia, segments II and III together 1.12 times longer than segment I; segment II with rare long fine hair-like setae, 1.33 times segment III length; segment III with rare long fine hair-like setae; segment ratios of 1.00 (0.25–0.27 mm): 0.64: 0.48. Hypopharynx as for *S. elongatus*. Labium (figs. 7a, b) with glossae slightly shorter than paraglossae; glossae with 15 long setae on outer margin, inner margin with 13 setae, ventral surface with numerous long fine setae (fig. 7b), dorsal surface with two rows of setae (fig. 7a); paraglossae curved medially, truncate apically and with single row of 37 long setae on outer margin, ventral surface with multiple rows of long setae, dorsal surface with patch of setae (fig. 7a); palp 3-segmented, 0.79–0.80 mm long, segment ratios 1.00 (0.36–0.37 mm): 0.97–1.03: 0.18–0.19, segments II and III combined 1.16–1.20 times basal segment length; segment I lacking setae on inner and outer margins, length 2.64–3.52 times width, segment II apically expanded and longer on outer margin than inner margin, ventral surface with scattered fine setae; segment III sub-rectangular and slightly falcate, with 7–16 long robust setae on terminal margins, dorsal surface with robust setae distally, ventral surface with scattered fine setae.

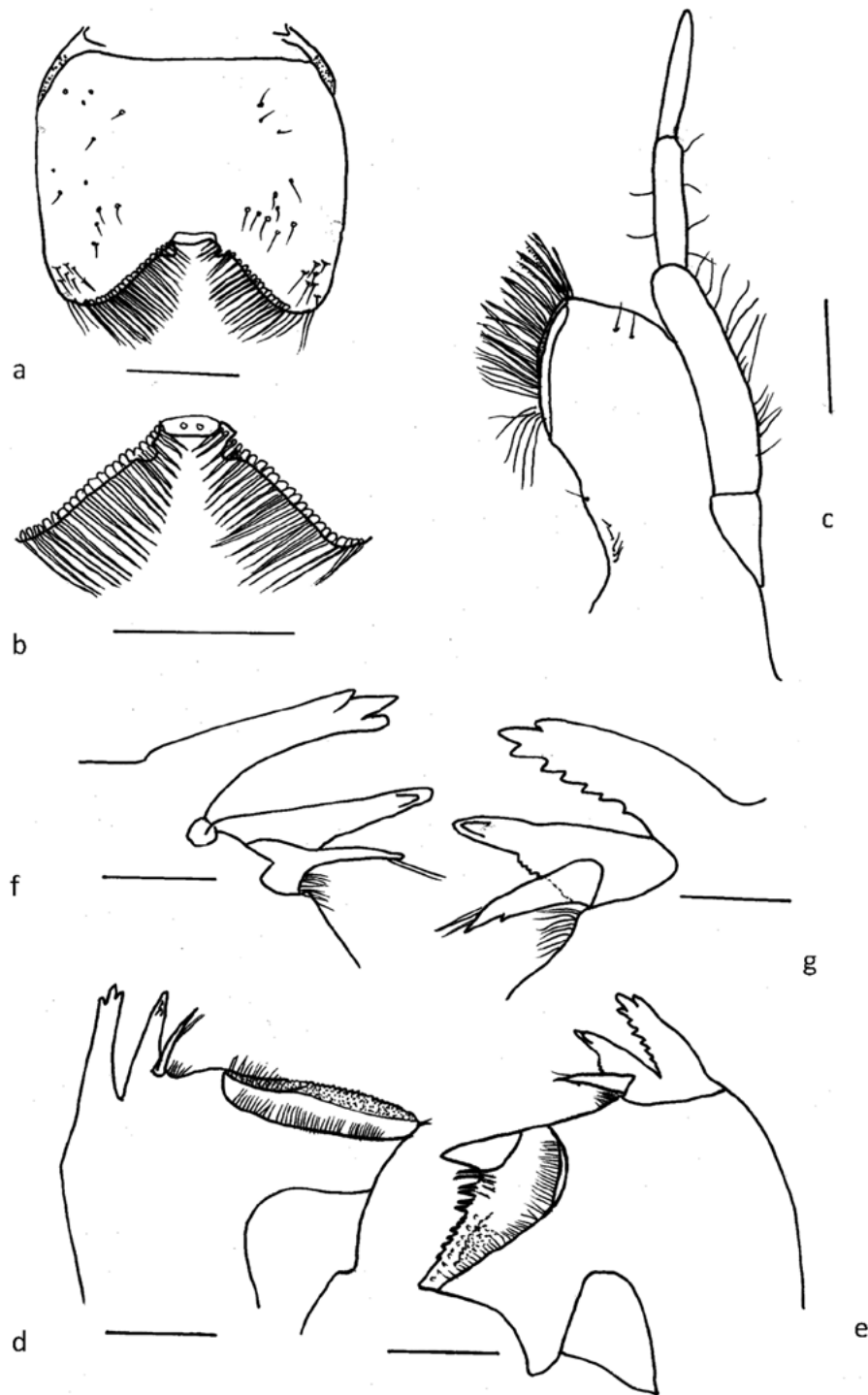


Figure 6. *Skolomystax chionotos*: a, labrum; b, labrum notch; c, maxilla; d, right mandible; e, left mandible; f, right mandible incisors; g, left mandible incisors; Scale lines: a, c–e = 0.15 mm; b, f, g = 0.07 mm.

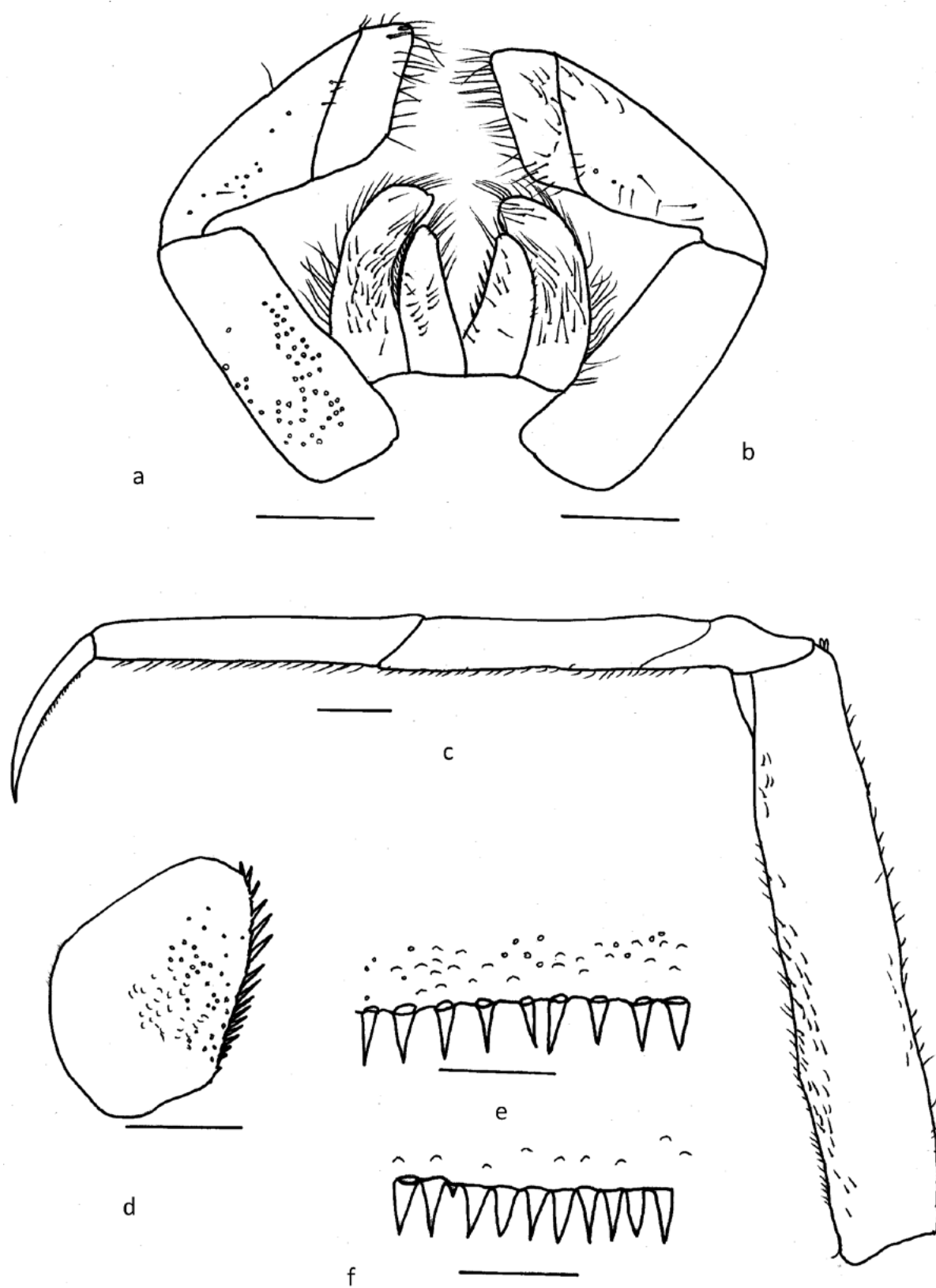


Figure 7. *Skolomystax chionotos*: a, labium dorsal; b, labium ventral; c, leg; d, paraproct; e, tergite spines; f, sternite spines. Scale lines: a–f = 0.15 mm.

Thorax: pronotum without any distinct spots. Mesonotum light with darker medial markings. Sterna uniformly coloured.

Legs: legs with indistinct markings in specimens examined (fig. 7c). Foreleg 2.62 mm long, segment ratios of 1.00 (1.27 mm) : 0.55 : 0.51 : 0.31. Fore femur 6.35 times longer than wide. Fore femur with dorsal margin of fore femora with row of 23 long sharply pointed robust setae and scattered short setae, with subapical pair of short, blunt setae; ventral margin with 34 long pointed robust setae. Fore tibia slightly darker basally, without setae on outer margin, inner margin with 13 long robust setae. Fore tarsus slightly darker basally, without setae on outer margin, inner margin with 12 long pointed setae. Tarsal claw length 0.61 times tarsal length with two similar rows of denticles in basal half. Mid-leg 3.10 mm long, segment ratios of 1.00 (1.50 mm) : 0.60 : 0.47 : 0.33. Mid-femur 6.00 times longer than wide. Mid-femur with dorsal margin of mid-femora with row of 37 long sharply pointed robust setae and scattered short setae, and subapical pair of short, blunt setae; ventral margin with 26 long pointed robust setae. Mid-tibia slightly darker basally, without setae on outer margin, inner margin with 24 long robust setae; mid-tarsus slightly darker basally, without setae on outer margin, inner margin with 25 long pointed setae. Tarsal claw length 0.71 times tarsus length with two similar rows of denticles in basal half. Hind leg 2.69–3.00 mm long, segment ratios of 1.00 (1.20–1.50 mm) : 0.60–0.62 : 0.40–0.61 : 0.30–0.34 (femur: tibia: tarsus: claw measured on outer margin). Hind femur 5.03–6.00 times longer than wide. Femora with dorsal margin of femora with row of 27–39 long sharply pointed robust setae and scattered short setae and with subapical pair of short, blunt setae; ventral margin with 24–30 long sharp robust setae. Hind tibia slightly darker basally, without setae on outer margin, inner margin with 22–31 long robust setae. Hind tarsus slightly darker basally, without setae on outer margin, inner margin with 24–27 long pointed setae. Tarsal claw length 0.55–0.75 times tarsal length with two similar rows of denticles in basal half.

Abdomen: abdominal tergites with a distinct colour pattern (fig. 25c), segments I dark medially and laterally with light patches, segment II and III light darker anteriorly with medial and lateral dark markings, segment IV light, segments V dark, light VI–VIII light with antero-medial elongate spot and lateral dark patches, segments IX and X dark both with antero-medial dark elongate spot. Abdominal terga with numerous long spines on posterior margins (fig. 7e), spine length 1.93–2.45 times basal width, bases of spines separated by width of spine. Surfaces of terga with pointed scales and scale bases. Gills I and II somewhat cordate and pointed. Sterna IV–IX with spines on posterior margin (fig. 7f), spine length 2.34–2.67 times basal width, bases contiguous. Surfaces of sterna with scale bases. Paraprocts (fig. 7d) with 19–21 marginal spines, surface with scale bases. Cerci and terminal filament subequal in size inner surfaces with long fine setae nearly to apex.

Adults: unknown.

Etymology: a noun in apposition formed from the Greek words *chioni* (snow) and *notos* (south), in reference to the type locality, Snowy Creek.

Distribution: Vic.

Discussion

The absence of setae on the outer margins of the tibiae and tarsi differentiates *S. chionotos* from *S. elongatus*, *S. brevis* and *S. paschei*. All other *Skolomystax* lack setae on the tibiae and tarsi, but *S. chionotos* can be differentiated from *S. hawkingi* and *S. leichhardti* by the absence of fine black spotting on the abdomen, by having 4–5 teeth on the inner margin of the outer incisor of the left mandible vs. 1–3 teeth, and by its more southern distribution. *Skolomystax chionotos* differs from *S. dyarri* and *S. gippslandicus* in having spines on the posterior margins of abdominal sterna IV–IX, vs. VI–IX or VII–IX, and from *S. goorudensis* by having only long spines on the posterior margins of the abdominal terga, instead of alternating long and short spines. The remaining species, *S. tasmaniensis* and *S. vulgaris*, are difficult to distinguish from *S. chionotos*, but they have maxillary palp segment II short than or equal in length to segment III, whereas maxillary palp segment II is longer than segment II in *S. chionotos*.

Skolomystax dyarri n. sp. (figs. 8, 9, 25d)

urn:lsid:zoobank.org:act:BD722B7E-0C48-4AB6-84E5-54649AC6556F

Centroptilum sp6 in Webb and Suter (2011).

Material examined. *Holotype:* nymph mounted on slides. NSW: Cedar Brush Ck, JWA1304, 33.15S 151.26E, 10 Mar 2009, JW, JHH, ANIC6–000100.

Paratype: one nymph mounted on slides. NSW: McCarrs Ck, JWA1983, 33.66S 151.25E, 11 May 2009, SWC, ANIC6–000101.

Nymph – description

Body: 5.95–7.5 mm.

Head: light medial band edged by two dark linear markings lateral to eyes. Antennae with scape 1.30–1.65 times length of pedicel.

Mouthparts: labrum (fig. 8a) 1.27–1.36 times slightly wider than long, labrum notch wide, depth 0.24–0.30 times notch width (fig. 8b), labrum notch depth 0.73–0.76 times labrum length, notch angle approximately 117°, notch lined with >30 setae, ventrally with ten fimbriate setae apically, numerous scattered fine setae, those at apical corners distinctly longer and more robust, and laterally with submarginal row of 7–10 short robust setae; dorsally with numerous scattered long fine hair-like setae. Right mandible (planate) (figs. 8d, f) with three apical teeth on outer incisor, lacking lateral spine on inner margin of outer incisor; inner incisor with broad surface and with three indistinct teeth, no lateral teeth; prostheca slender with bifid setae near apex, patch of fine setae at base (fig. 8f); dorsal surface without scattered fine setae or scales. Left mandible (angulate) (figs. 8e, g) three apical teeth and four teeth on the inner margin of outer incisor (fig. 8g); inner incisor with three apical teeth, inner margin expanded near base; prostheca robust, setae near apex, sparse patch of setae at base (fig. 8g); dorsal surface lacking

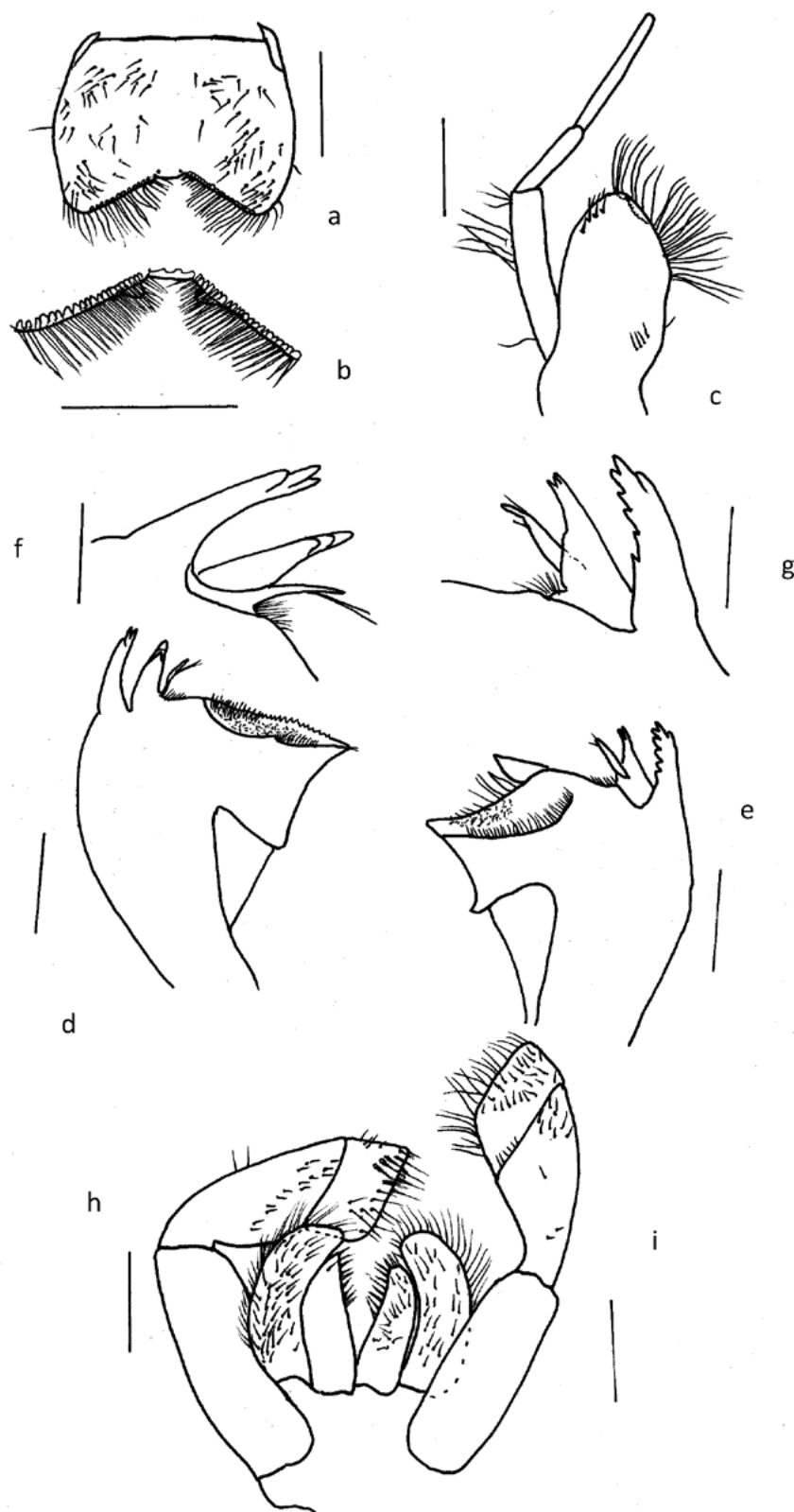


Figure 8. *Skolomystax dyarri*: a, labrum; b, labrum notch; c, maxilla; d, right mandible; e, left mandible; f, right mandible incisors; g, left mandible incisors; h, labium dorsal; i, labium ventral. Scale lines: a, c–e, h, i = 0.15 mm; b, f, g = 0.07 mm.

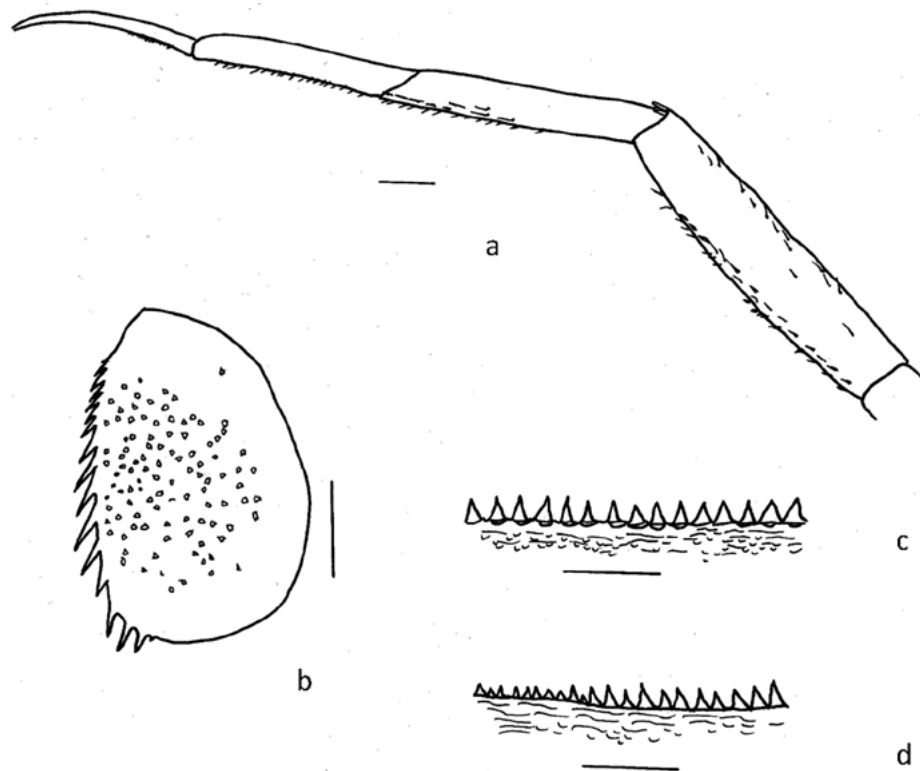


Figure 9. *Skolomystax dyarrii*: a, leg; b, paraproct; c, tergite spines; d, sternite spines. Scale lines: a–d = 0.15 mm.

scattered fine setae and scales. Maxillae (fig. 8c) with apical 2–3 long broad spines apically and 37–38 lacinial setae, with 2–5 subcrest setae on ventral surface, 4–5 hump setae, lateral margin below palp lacking fine setae; maxillary palp 3-segmented, 0.24–0.37 mm long, palp long extending well beyond the galealacinia, segment I extends nearly to apex of galealacinia, segments I+II combined reaching well beyond apex of galealacinia; segment ratios 1.00 (0.20–0.24 mm) : 0.54 : 0.83; segment II and III combined 1.37 times basal segment length, segment III 1.55 times segment II length; palp segment I slightly curved with long fine hair-like setae on outer margin, segment II with rare long fine setae; segment 3 with rare long fine setae. Hypopharynx as for *S. elongatus*. Labium (figs. 8h, i) with glossae slightly shorter than paraglossae; glossae with 12 outer setae, 9–11 inner setae and 3–6 apically, ventral surface with numerous long fine setae (fig. 8i); paraglossae curved medially, truncate apically with single row of >20 fine setae on outer margin, ventral surface with four rows of numerous long fine setae; labial palp 3-segmented, length 0.65 mm, outer margin of each segment without setae, segment I 3.00 times longer than wide, segments II and III combined 1.18 times basal segment length, segment II apically expanded and longer on outer margin than inner margin; segment III subrectangular and slightly falcate with 7–14 long robust and short fine setae on apical margins, dorsal surface with seven long robust setae distally (fig. 8h), ventral surface with scattered fine hair-like setae, segment

ratios (Basal Length (BL)/BL (BL length) : Mid Length (ML)/BL : Apical Length (AL)/BL) 1.00 (0.30 mm) : 0.92 : 0.27.

Thorax: pronotum dark. Mesonotum dark medially with postero-lateral light patches; uniformly coloured. Sterna uniformly light coloured.

Legs: foreleg length 1.93 mm (not including claw length) with segment ratios of 1.00 (0.86 mm) : 0.63 : 0.63 : 0.47 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.74 times length of tarsus. Fore femur 4.97 times longer than wide without subapical dark marking, dorsal margin of fore femora with row of 16 short sharply pointed robust setae with subapical pair of short, robust setae; anterior surface with 17 setae. Fore tibia with faint basal dark patch and segment shaded, without setae and scattered fine setae on outer margin, inner/posterior surface with 11 sharply pointed setae. Fore tarsus shaded without setae on outer margin and 22 short sharp spine setae on inner margin. Tarsal claw with two similar rows of denticles in basal half. Middle leg (fig. 9a) 2.18–2.75 mm long (not including claw length), segment ratios of 1.00 (1.03–1.50 mm) : 0.56–0.62 : 0.54–0.65 : 0.36–0.41 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.55–0.74 times length of tarsus, femur 6.00–6.24 times longer than wide, dorsal margin of mid-femora with row of 16–20 short sharply pointed robust setae with subapical pair of short, robust setae; ventral margin with 18–21 sharply pointed short setae. Mid-tibia without setae or fine setae

on outer margin, 10–12 setae on inner margin. Mid-tarsus without setae on outer margin and inner margin with single distinct row of 23–29 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half. Hind leg length 1.99–2.48 mm, segment ratios of 1.00 (0.87–1.18 mm) : 0.55–0.59 : 0.56–0.57 : 0.34–0.45 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.62–0.80 times length of tarsus, hind femur 5.81–7.34 times longer than wide, dorsal margin of hind femora with row of 14–25 short sharply pointed robust setae with subapical pair of short, robust setae; ventrally with 11–19 sharply pointed short setae. Hind tibia without setae or scattered fine setae on outer margin, with 11–18 setae on inner margin. Hind tarsus without setae on outer margin and inner margin with 20–21 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half.

Abdomen: abdominal tergites segments II–III with dark Y-shaped marking medially, lighter laterally and dark patch on lateral margins, segment IV light with posterior margin dark, segments V dark with three small light spots on posterior margin, segment VI dark with light markings laterally, segments VII–VIII light with dark patch on posterior-medial margin of segment VIII, segment IX dark with light Y-shaped medial marking, segment X light with anterio-medial dark spot (fig. 25d). Abdominal terga I–X with numerous short triangular spines on posterior margins, those on posterior segments 2.05–2.89 times longer than basal width, bases of spines slightly separated (fig. 9c). Surfaces of terga with pointed scales and scale bases. Gills I and II somewhat cordate and pointed, gills III–VII apically rounded. Sternites with triangular spines on posterior margin of segments VI or VII–IX, spines 1.88–2.55 times longer than basal width (fig. 9d), bases of spines nearly contiguous, some spines slightly shorter. Paraprocts (fig. 9b) with 16–19 marginal spines, surface with scale bases.

Adults: unknown.

Discussion

The absence of setae on the outer margins of the tibiae and tarsi differentiates *S. dyarri* from *S. elongatus*, *S. brevis* and *S. paschei*. All other *Skolomystax* lack setae on the tibiae and tarsi, but *S. dyarri* can be differentiated from *S. hawkingi* and *S. leichhardti* by having four teeth on the inner margin of the outer incisor of the left mandible vs. only 1–3 teeth in *S. leichhardti* and one in *S. hawkingi* by the more southern distribution, and by the absence of black spotting on the dorsum. The absence of spines on the posterior margins of sterna anterior to segment VI differentiates *S. dyarri* from *S. goorudensis*, *S. chionotos*, *S. tasmaniensis* and *S. vulgaris*, which have spines beginning on sterna III, IV, and V, respectively. *Skolomystax dyarri* resembles *S. gippslandicus* in most characters, but the inner margin of outer incisor of left mandible has four teeth in *S. dyarri* vs. two in *S. gippslandicus*, and maxillary palp segment II is much shorter than segment III in *S. dyarri*, whereas they are approximately equal in *S. gippslandicus*.

Etymology: an adjective from the Sydney aboriginal word *dyarri* meaning short (Troy, 1994), referring to the short second segment of the maxillary palp.

Distribution: NSW.

Skolomystax gippslandicus n. sp. (figs. 10, 11, 25e)

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Centroptilum spWonnangatta in Webb and Suter (2011)

Material examined. *Holotype:* nymph mounted on slides. Vic: Wonnangatta R on Moroka Junction Track, JWA1731, 37.35S 146.96E, 19 Nov 2008, Vic EPA, ANIC6–000097.

Paratypes: two nymphs mounted on slides. NSW: Little George Ck on Kempsey Rd, JWA2884, 30.709S 152.194E, 27 Feb 2011, JM, MS, ANIC6–000098; Little George Ck on Kempsey Rd, JWA2885, 30.7424S 152.1902E, 27 Feb 2011, JM, MS, ANIC6–000099.

Other material examined. Vic: Cann River, 37.4988S 149.1543E, Vic EPA, No date. NSW: Little George Ck on Kempsey Rd, JWA2883, 30.709S 152.194E, 27 Feb 2011, JM and MS.

Nymph – description

Body: <8.5 mm.

Head: light medially with lateral brown markings beside eyes. Antennae with scape 1.35 times length of pedicel.

Mouthparts: labrum 1.15–1.25 times wider than long (fig. 10a); depth of apical notch 0.76–0.77 times labrum length (fig. 10b), notch with pair of projections on inner margin, notch depth 0.26–0.33 times notch width, notch angle approx. 91°, with 23–24 fimbriate setae lining each side of notch, shorter basally, ventrally with numerous scattered fine setae, apical corners with 8–10 long robust setae, submarginal row of four short robust setae. Right mandible (planate) (figs. 10d, f) with three apical teeth and inner margin lacking teeth; inner incisor with broad surface and with 2–3 indistinct teeth, inner margin smooth lacking ornamentation; prostheca slender and forked with long setule extending beyond apex and with dense patch of fine setae at base (fig. 10f); dorsal surface lacking fine setae and scales. Left mandible (angulate) (figs. 10e, g) with three apical teeth and two inner teeth on outer incisor; inner incisor with 2–3 apical teeth, inner margin slightly rugose (fig. 10g); prostheca robust and simple with two short apical spines and a short setule, and with dense patch of setae at base (fig. 10g); dorsal surface lacking scattered fine setae and pointed scales. Maxillae (fig. 10c) with 4–5 subcrest setae on ventral surface, 4–5 hump setae, and 20–26 lacinial setae with three comb setae; maxillary palp 3-segmented, palp length 0.47 mm, segment I extending to apical third of galealacinia; segments II and III together extend well beyond apex of galealacinia; segment I somewhat curved, sparse long fine hair-like setae on outer margin, patch of numerous round tubercles basally; segment II and III with rare long fine hair-like setae, length of these segments combined 1.31 times basal segment length, segment III equal to segment II length; segment ratios 1.00 (0.29 mm): 0.65 : 0.65. Hypopharynx as for *S. elongatus*. Labium (figs. 11a, b) with glossae slightly shorter than paraglossae; glossae with single row of 15–17 long setae on outer margin, 8–13 on inner margin, ventral surface (fig. 11b) with numerous long hair-like setae; dorsal surface (fig. 11a) with 2–3 rows of paraglossae curved medially, truncate apically, ventral surface with sparse setae; dorsal surface with four rows of setae (fig. 11a); labial palp 3-segmented, 0.35–

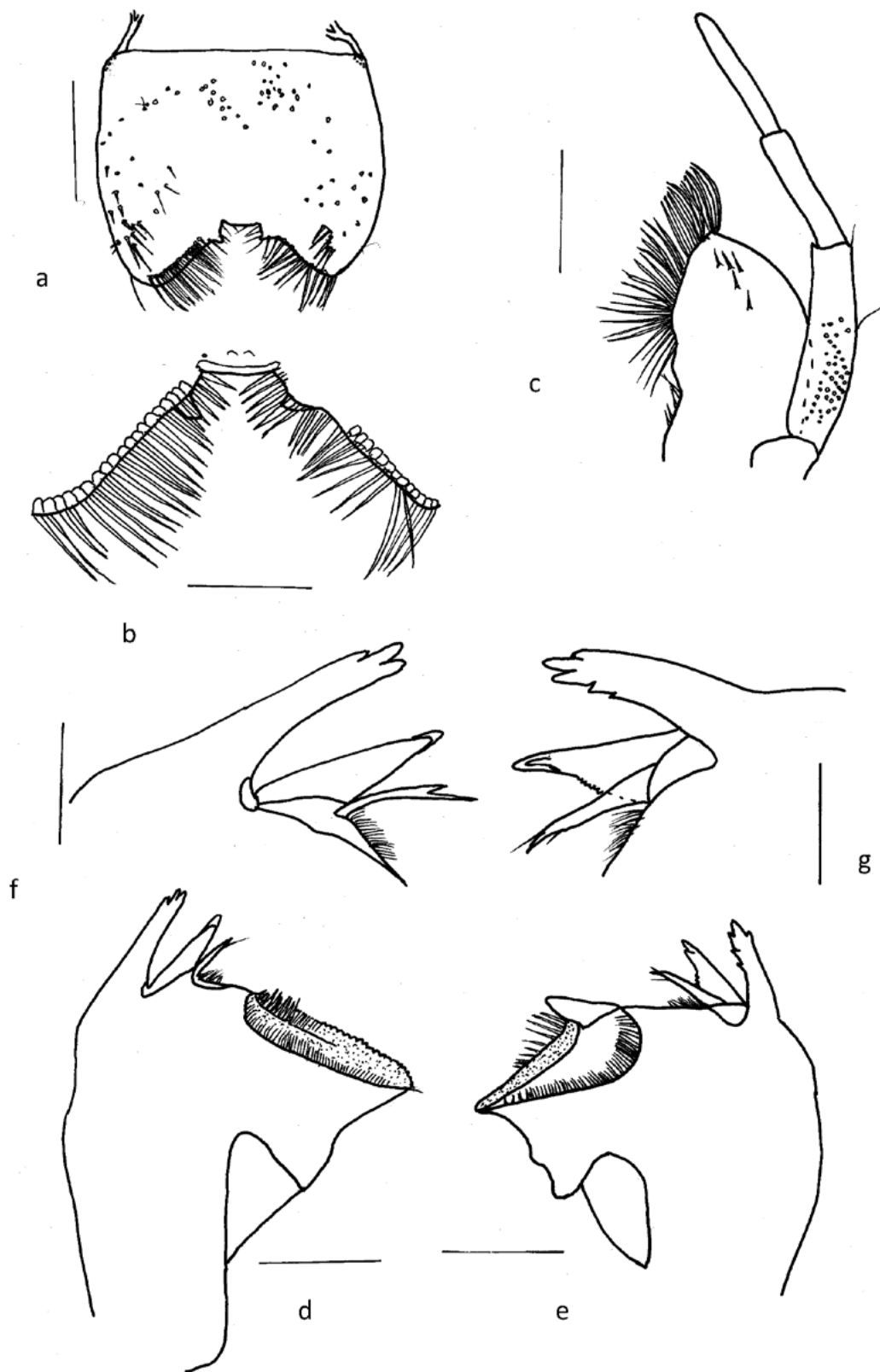


Figure 10. *Skolomystax gippslandicus*: a, labrum; b, labrum notch; c, maxilla; d, right mandible; e, left mandible; f, right mandible incisors; g, left mandible incisors. Scale lines: a, c–e = 0.15 mm; b, f, g = 0.07 mm.

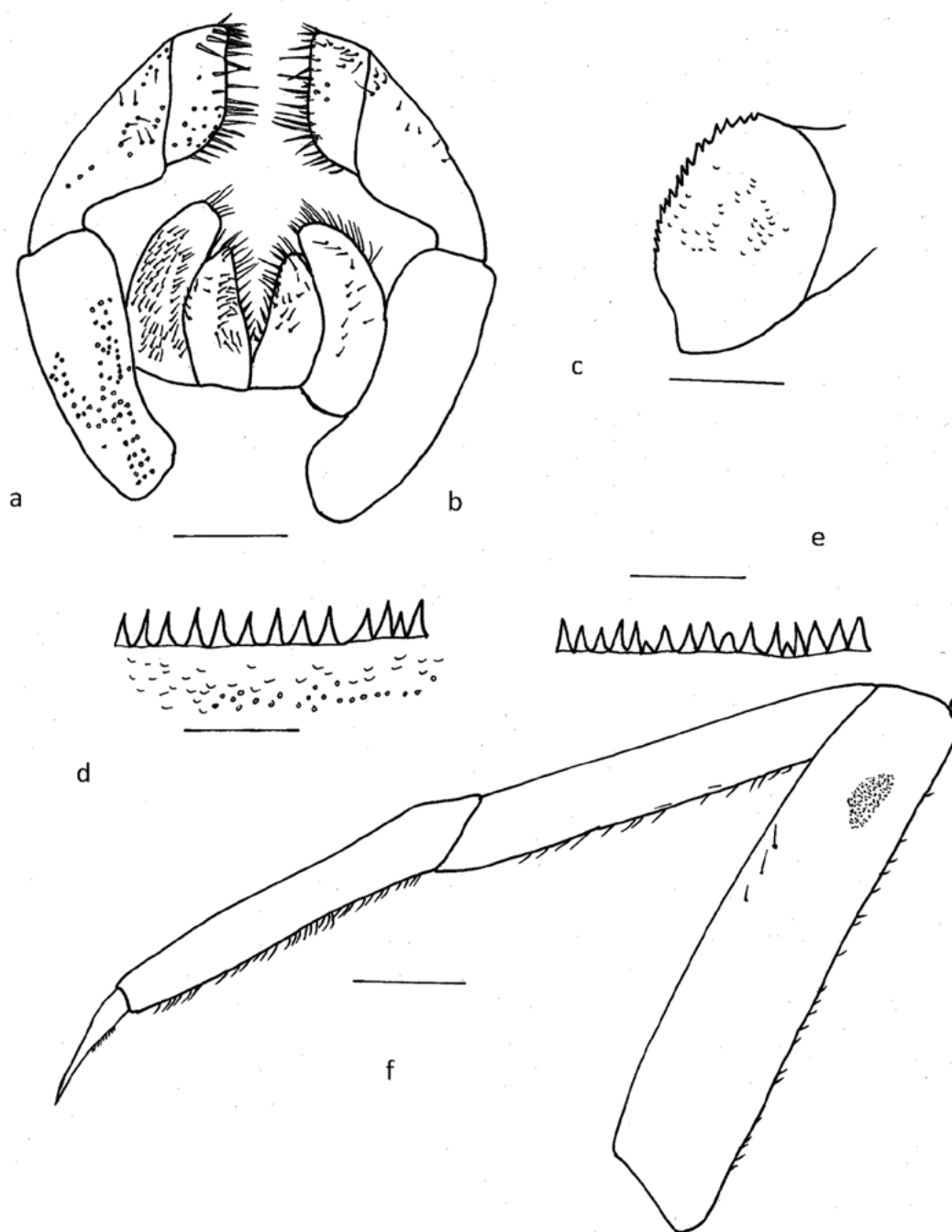


Figure 11. *Skolomystax gippslandicus*: a, labium dorsal; b labium ventral; c, paraproct; d, tergite spines; e, sternite spines; f, leg. Scale lines: a–f = 0.15 mm.

0.69 mm long, outer margin of basal and mid-segments lacking setae, segment ratios 1.00 (0.27–0.35 mm) : 1.25 : 0.28; segment I rectangular 2.08–3.50 times longer than wide, segment II apically expanded and longer on outer margin than inner

margin, segment III subrectangular and slightly falcate apical segment with five setae on outer margin and 14 terminal setae and six dorsal setae; length of segment II and III combined 1.54 times basal segment length.

Thorax: pronotum dark medially with lateral light patch containing two dark spots. Mesonotum dark medially with light area anterior to wing pads and dark patch antero-laterally. Sterna uniformly coloured.

Legs: foreleg total length 1.80 mm, segment ratios of 1.00 (0.80 mm) : 0.71: 0.57: 0.24 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw length 0.43 times tarsus length. Fore femur 4.73 times longer than wide with subapical elongate dark paired markings, outer margin with six short sharp setae, and pair of apical setae, inner margin with 11 short setae. Fore tibia slightly darker basally and apically, outer margin lacking setae, inner margin with 7–9 long spine setae. Fore tarsus without markings, outer margin lacking setae, inner margin with 13–15 long sharp setae. Mid-leg total length 1.77 mm (fig. 11f), segment ratios of 1.00 (0.78 mm) : 0.57: 0.55: 0.31 (femur: tibia: tarsus: claw measured on outer margin), mid-tarsal claw length 0.56 times tarsus length. Mid-femur 5.95 times longer than wide with subapical dark marking, which may be paired, outer margin with 12–20 short sharp setae, and pair of broad apical setae, inner margin with 21 short setae. Mid-tibia slightly darker basally and apically, outer margin lacking setae, inner margin with 15–18 long spine setae. Fore tarsus without markings, outer margin lacking setae, inner margin with 25 long sharp setae. Hind leg total length 2.64–3.02 mm, segment ratios of 1.00 (1.29–1.45 mm) : 0.55–0.57: 0.45–0.49: 0.26–0.35 (femur: tibia: tarsus: claw measured on outer margin), hind claw length 0.53–0.77 times tarsus length. Hind femur 5.56–7.59 times longer than wide with subapical elongate dark paired marking, outer margin with 25–32 short sharp setae, and pair of apical setae, inner margin with 0–29 short setae. Hind tibia slightly darker basally and apically, outer margin without setae, inner margin with 22–31 long spine setae. Hind tarsus without markings, outer margin lacking setae, inner margin with 24–27 long sharp setae.

Abdomen: abdominal tergites with a distinct colour pattern (fig. 26e), segments I dark antero-medially, segments II–IV predominantly light with dark lateral marks and darker posterior margins, segment V dark, segment VI mainly light with a dark anterior line and v-shaped marking medially, segments VII–VIII light with tinged with darker colour with darker anterior marking, segment IX dark with postero-medial light spot, and segment X light with antero-medial dark spot and posterior margin. Abdominal terga with numerous long spines on posterior margins, 3.20–3.40 times longer than basal width (fig. 11d), bases of spines separated by approximately spine width, shorter spines sometimes present. Gills I and II somewhat cordate and pointed, gills III–VII apically rounded. Sterna VI–IX with spines on posterior margin (fig. 11e), spines long, 2.70–3.05 times longer than basal width, bases almost contiguous. Paraprocts (fig. 11c) with 16–24 marginal spines, surface with scattered scale bases.

Adults: unknown.

Discussion

The absence of setae on the outer margins of the tibiae and tarsi differentiates *S. gippslandicus* from *S. elongatus*, *S. brevis* and *S. paschei*. The absence of fine, dark spotting, the thinner maxillary canines and more southern distribution distinguishes

S. gippslandicus from *S. hawkingi* and *S. leichhardti*, and the absence of spines on the posterior margins of sterna anterior to segment VI distinguishes it from *S. goorudensis*, *S. chionotos*, *S. tasmaniensis* and *S. vulgaris*. The most similar species is *S. dyarrii*, but *S. gippslandicus* possesses an elongate dark spot sub-apically on the femora, two teeth on the inner margin of outer incisor of the left mandible rather than four. Additionally, the lengths of maxillary palp segments II and III are subequal, but in *S. dyarrii* segment II is much shorter than III.

Etymology: named from the region (Gippsland, Vic), where this species was first recorded.

Distribution: Gippsland, Vic and southern NSW.

Skolomystax goorudensis n. sp. (figs. 12, 13, 25f)

urn:lsid:zoobank.org:act:4E6BD899-92E3-4D5E-ADB2-D0D8361F732E

Material examined. *Holotype:* nymph mounted on slides. **NSW:** Goorudee Rivulet in Upper Murrumbidgee R north of Adaminaby, JWA257, 35.98S 148.77E, 11 Mar 2000, PS, ANIC6-000102.

Paratype: one nymph mounted on slides. Hacking R at McKells Ave, JWA2494, 34.15S 151.03E, 15 Sept 2009, SWC, ANIC6-0001103.

Nymph – description

Body: 6.6–7.4 mm.

Head: antennae with scape 1.16–1.39 times length of pedicel.

Mouthparts: labrum 1.07–1.16 times wider than long (fig. 12a), margins curved, convex; notch deep and broad (fig. 12b), depth 0.35–0.46 width, notch depth 0.66–0.73 times labrum length, notch angle approx. 93°, notch lined with 27–29 setae; ventrally with 10–12 fimbriate setae apically, numerous scattered fine setae; dorsally with numerous scattered long fine hair-like setae. Right mandible (planate) (figs. 12d, f) with three apical teeth on outer incisor; inner incisor with broad surface and with three indistinct teeth, inner margin smooth without lateral teeth; prosthema slender and bifid with patch of fine setae at base (fig. 12f); dorsal surface without scattered fine setae or scales. Left mandible (angulate) (figs. 12e, g) three apical teeth and 1–3 teeth on the inner margin of outer incisor (fig. 12g); inner incisor with three apical teeth, inner margin rugose at base; prosthema robust with patch of setae at base (fig. 12g); dorsal surface lacking scattered fine setae or scales. Maxillae (fig. 12c) with 2–3 long broad spines apically and 22–31 crown setae; with 4–5 subcrest setae on ventral surface, five hump setae, lateral margin below palp with long fine hair-like setae; palp III segmented, 0.45 mm long extending well beyond galealacinia, segment ratios (BL/BL (BL length) : ML/BL : AL/BL) 1.00 (0.25–0.26 mm) : 0.49–0.61 : 0.71–0.77; palp segment I slightly curved reaching apical third of galealacinia, with long fine hair-like setae on outer margin, segments I+II extending well beyond apex of galealacinia; segment II with long fine hair-like setae; segment III with rare long fine hair-like setae; segments II and III combined 1.26–1.32 times basal segment length, segment III length 1.16–1.59 times segment II length. Hypopharynx as for *S. elongatus*. Labium (figs. 13a, b) with glossae slightly shorter than paraglossae; glossae with 2–15 outer setae, 15–16 inner setae and >20 long

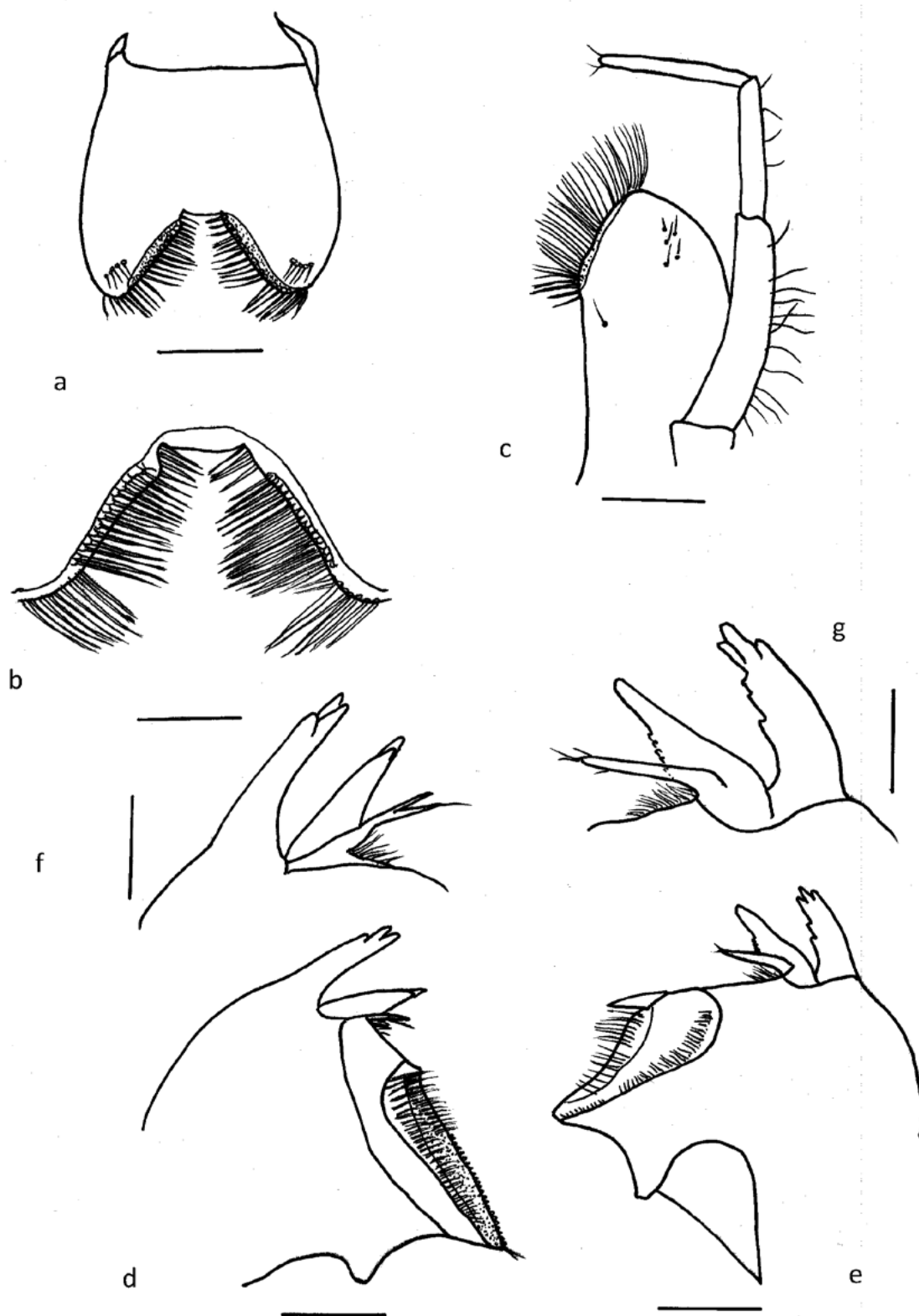


Figure 12. *Skolomystax goorudensis*: a, labrum; b, labrum notch; c, maxilla; d, right mandible; e, left mandible; f, right mandible incisors; g, left mandible incisors. Scale lines: a, c–e = 0.15 mm; b, f, g = 0.07 mm.

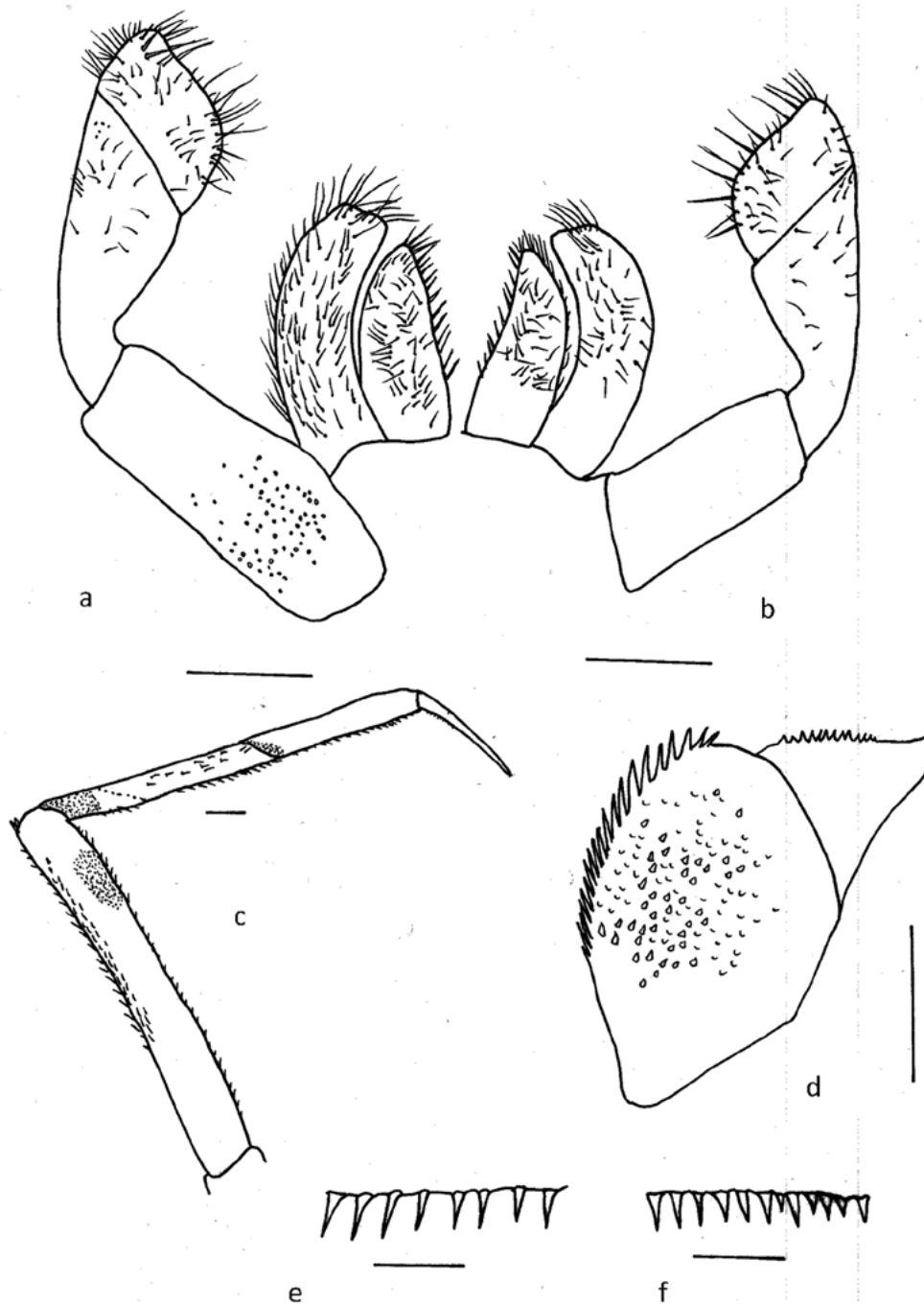


Figure 13. *Skolomystax goorudensis*: a, labium dorsal; b, labium ventral; c, leg; d, paraproct; e, tergite spines; f, sternite spines. Scale lines: a–f = 0.15 mm.

fine setae on dorsal surface (fig. 13a); paraglossae curved medially, truncate apically, with four rows of long setae dorsally; ventral surface with scattered fine setae (fig. 13b), labial palp

3-segmented, 0.72–0.75 mm long, outer margin of basal and mid-segments without setae, apical segment with fine hair-like setae on margin, segment I length 2.77–3.05 times width, slightly

shorter than segments II and III combined (1.02–1.28), segment II apically expanded and longer on outer margin than inner margin; segment III sub-rectangular and slightly falcate with numerous 16–17 long robust and short fine setae on apical margins, dorsal surface with 3–5 long robust setae distally, segment ratios (BL/BL (BL length) : ML/BL : AL/BL) 1.00 (0.32–0.37 mm) : 0.81–1.05 : 0.20–0.23.

Legs: foreleg (fig. 13c) 2.72–2.88 mm long (not including claw length) with ratios of 1.00 (1.19–1.28 mm) : 0.65–0.67 : 0.57–0.63 : 0.35 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.55–0.61 times length of tarsus. Fore femur 5.80–6.02 times longer than wide with subapical elongated dark band partially divided, dorsal margin of fore femora with row of 16–17 short sharply pointed robust setae with subapical pair of short, ventrally with 13–16 sharply pointed short setae. Fore tibia with basal dark patch and whole segment shaded, without setae or scattered fine setae on outer margin inner/posterior surface with 10–11 sharply pointed setae. Fore tarsus shaded, without setae on outer margin, inner margin with single distinct row of 23–26 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half. Middle leg 2.94–3.03 mm long (not including claw length), segment ratios of 1.00 (1.34 mm) : 0.61–0.63 : 0.56–0.65 : 0.30–0.37 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.46–0.67 times length of tarsus, femur 5.65–8.17 times longer than wide with subapical elongate dark band, partially divided, dorsal margin of mid-femora with row of 19–31 short sharply pointed robust setae with subapical pair of short, robust setae; ventrally with 13–24 sharply pointed short setae. Mid-tibia without setae and scattered fine setae on outer and 12–32 setae on inner margin. Mid-tarsus without setae on outer margin and inner margin with single distinct row of 16–24 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half. Hind leg length 2.95–3.00 mm, segment ratios of 1.00 (1.30–1.43 mm) : 0.58–0.70 : 0.53–0.57 : 0.34–0.36 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.60–0.68 times length of tarsus, hind femur 6.03–7.97 times longer than wide with subapical dark band, dorsal margin of hind femora with row of 19–22 short sharply pointed robust setae with subapical pair of short, robust setae; ventrally with 14–18 sharply pointed short setae. Hind tibia without setae or fine setae on outer margin, inner margin with 14–16 setae. Hind tarsus without setae on outer margin and inner margin with single distinct row of 21–26 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half.

Abdomen: abdominal tergites with dark colour pattern on segments V and VI and segments IX and X (fig. 25f). Abdominal tergites I–X with numerous short triangular spines on posterior margins, those on posterior segments 3.00 times longer than basal width, bases of spines widely separate, twice width of spines (fig. 13e). Surfaces of terga with pointed scales and scale bases. Sternites with short triangular spines on posterior margin of segments IV–IX, long spines 2.40 times longer than basal width, short spines half-length of long spines, base of spines nearly contiguous (fig. 13f). Paraprocts (fig. 13d) with 22 marginal spines, surface with scale bases.

Adults: unknown.

Discussion

The absence of setae on the outer margins of the tibiae and tarsi differentiates *S. goorudensis* from *S. elongatus*, *S. brevis* and *S. paschei*. The very deep labral notch with an angle of near 90° distinguishes *S. goorudensis* from all species lacking robust setae on the outer margins of the tibiae.

Etymology: From the type locality at Goorudee Rivulet, NSW.

Distribution: Southern NSW.

Skolomystax hawkingi n. sp. (figs. 14, 15, 16, 25g)

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Centroptilum spNQLD in Webb and Suter (2011)

Material examined. *Holotype:* nymph mounted on slides. Qld: Granite Creek at Mareeba to Mt Malloy Road, JWA1888, 16.98S 145.42E, 1 Jul 2009, JW, JHH; ANIC6–000092.

Paratypes: three nymphs mounted on slides. Qld: Granite Creek at Mareeba to Mt Malloy Road, JWA2094, 16.98S 145.42E, 1 Jul 2009, JW, JHH, ANIC6–000093; Endeavour Falls, Endeavour R, at Endeavour Falls Caravan Park, JWA1819, 15.37S 145.03E, 9 Oct 2009 JW, JHH, ANIC6–000094; Pioneer River at Marian-ReVeg, 21.14S 148.96E, JWA1421, MRH#1250035, ANIC6–000095; one female imago mounted on slide: Granite Creek at Mareeba to Mt Malloy Road, JWA507, 16.98S 145.42E, 1 Jul 2009, JW, JHH, ANIC6–000096.

Other material examined. Qld: Granite Creek at Mareeba to Mt Malloy Road, JWA1887 and JWA750, 16.98S 145.42E, 1 Jul 2009, JW, JHH; Murray Ck below Mt Charlton, JWA1422, 21.01S 148.74E, 21 Oct 1994, MRH#1240051; Condamine at Courboy Crossing, JWA1406, MRH#4223062; South Johnston River at Corsi's, 17.60S, 145.90E, JWA1405, MRH#1121017; St George R, 15.61S 144.02E, JWA1403, MRH#1051012; Walsh River at Rockwood, 16.98S 144.29E, JWA1402, MRH#919310A; MZL: Burdekin R at Sellheim, 19.998S 146.438E, 21 Oct 1994. Sandy Bed. DPI. One specimen on slide and two specimens in alcohol.

Nymph – description

Body: 4.5–5.2 mm.

Head: uniformly coloured. Antennae with scape 1.23–1.48 times length of pedicel.

Mouthparts: labrum (fig. 14a) slightly wider than long (W/L = 1.29–1.44); labrum notch depth 0.70–0.79 times labrum length (fig. 14b), lacking lateral projections, notch depth 0.22–0.31 times notch width, notch angle approx. 96°, notch lined with 21–25 fimbriate setae; ventrally with dense patch of >20 fimbriate setae apically, numerous scattered fine setae dorsally with numerous scattered long fine setae. Right mandible (planate) (figs. 14e, g) with two apical teeth and a small tooth on outer margin of outer incisor, lacking lateral spine on inner margin of outer incisor; inner incisor with three indistinct teeth, inner margin smooth (fig. 14g); prostheca slender and bifid with patch of fine setae at base (fig. 14g); dorsal surface without scattered fine setae and scales. Left mandible (angulate) (figs. 14f, h) three apical teeth and one tooth on the inner margin of outer incisor; inner incisor with three apical teeth, inner

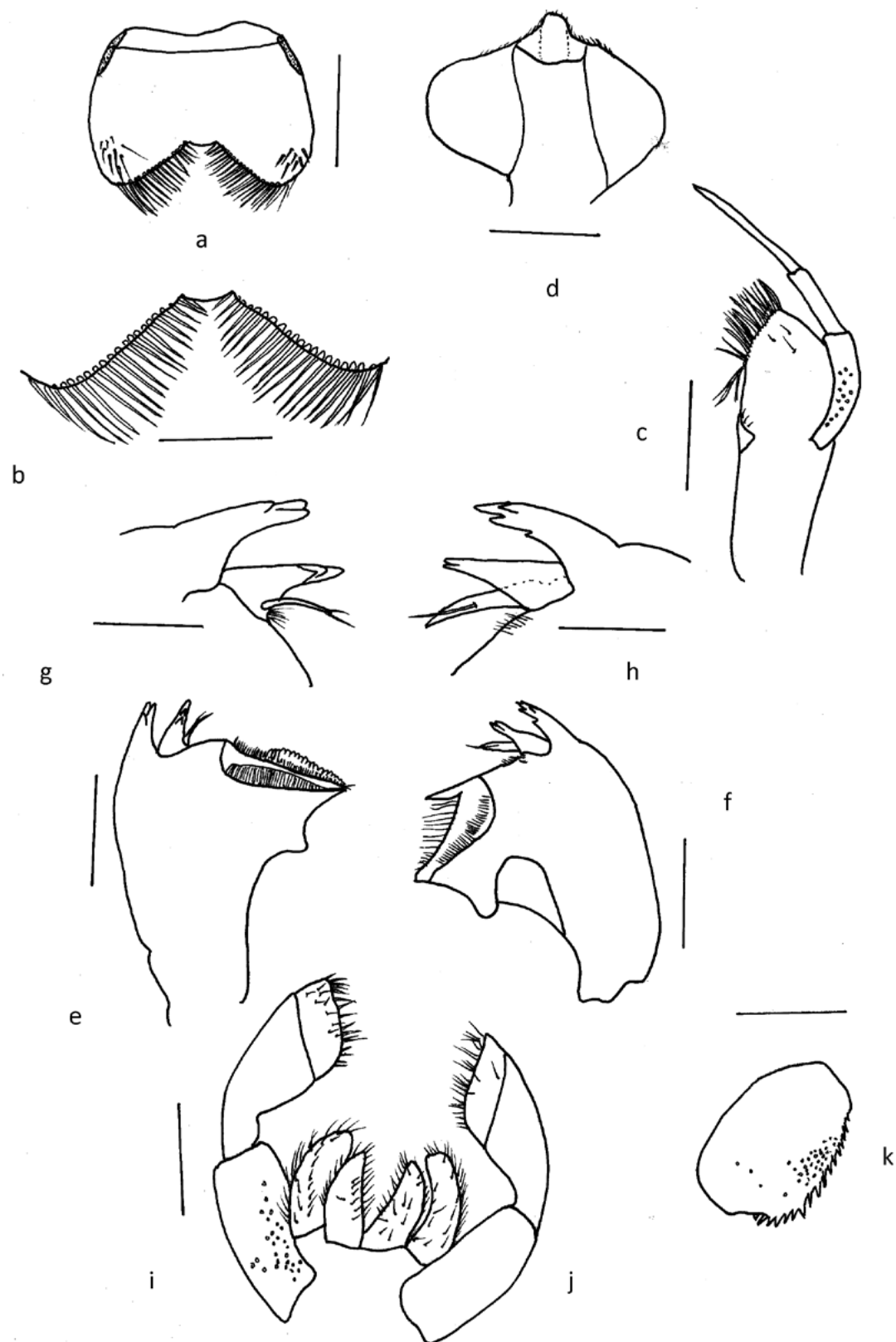


Figure 14. *Skolomystax hawkingi*: a, labrum; b, labrum notch; c, maxilla; d, hypopharynx; e, right mandible; f, left mandible; g, right mandible incisors; h, left mandible incisors; i, labium dorsal; j, labium ventral; k, paraproct. Scale lines: a, c-f, i-k = 0.15 mm; b, g, h = 0.07 mm.

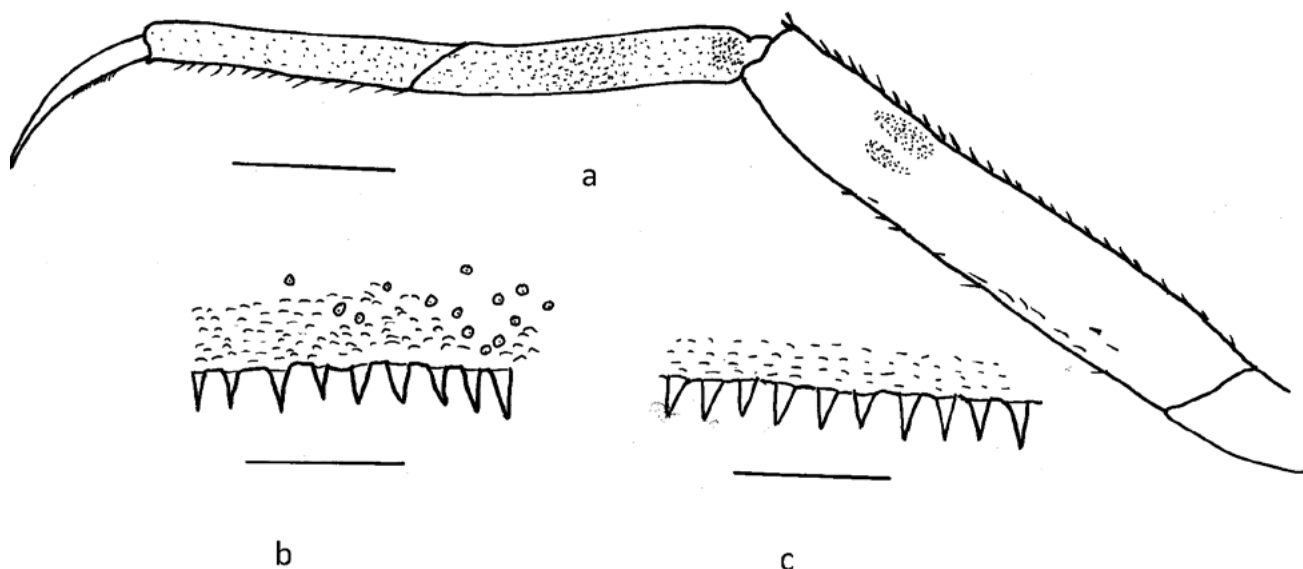


Figure 15. *Skolomystax hawkingi*: a, leg; b, tergite spines; c, sternite spines. Scale lines: a = 0.15 mm; b, c = 0.07 mm.

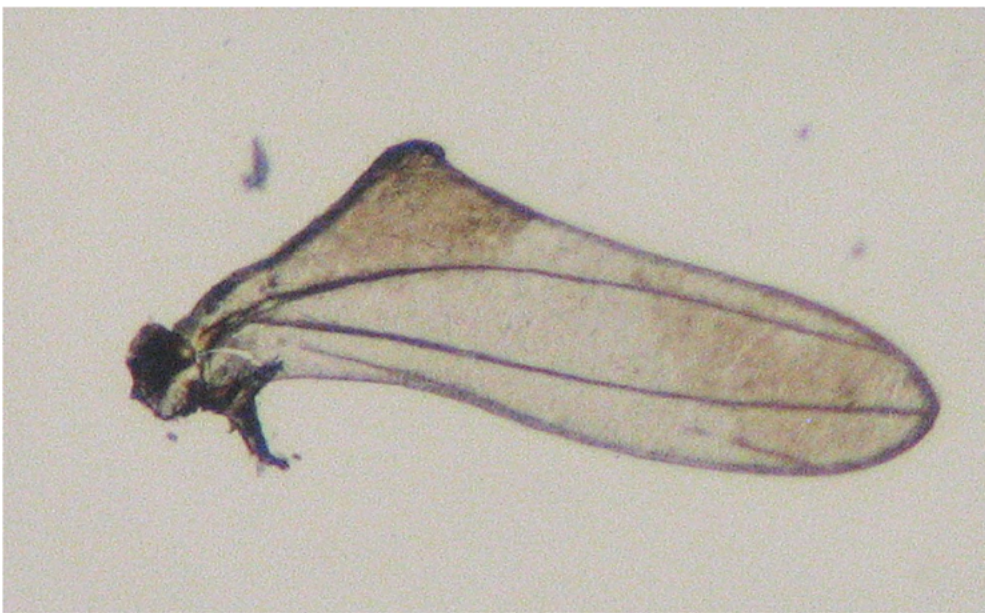
margin expanded, slightly rugose; prostheca robust bifid with patch of setae at base (fig. 14h); dorsal surface lacking scattered fine setae and scales. Maxillae (fig. 14c) with canines distinctly broader than lacinial setae, with 1–4 subcrest setae on ventral surface, 3–6 hump setae, and 20–24 lacinial setae, lateral margin below palp lacking fine setae; maxillary palp 3-segmented, length of palp 0.26–0.31 mm, palp extending well beyond apex of galealacinia, segment I extends to apical third of galealacinia, segments I and II combined extend beyond apex, segments with very sparse fine hair-like setae (difficult to see), segment II and III combined 1.24–1.79 times basal length, segment III 1.24–1.73 times length of segment II, segment I curved with approx. 10–15 round small tubercles; palp segment ratios (BL/BL (BL length) : ML/BL : AL/BL) 1.00 (0.14–0.17 mm) : 0.46–0.66 : 0.75–1.13. Hypopharynx (fig. 14d). Labium with glossae slightly shorter than paraglossae (figs. 14i, j); glossae with 5–7 outer setae, 6–9 long setae on inner margin, ventral surface >20 long fine hair-like setae; paraglossae curved medially, truncate apically and with single row of 11–14 long hair-like setae on outer margin, dorsal surface with two rows of long setae (fig. 14i), ventral surface with numerous long fine setae (fig. 14j); labial palp 3-segmented, palp length 0.38–0.52 outer margin of each segment without setae, segment I 2.14–2.46 times longer than wide, with segments II+III length 1.24–1.95 times basal length; segment II apically expanded and longer on outer margin than inner margin; segment III subrectangular and slightly falcate with 19–23 long robust and short fine setae on apical margin, dorsal surface with 4–6 long robust setae distally, ventral surface with scattered fine setae, segment ratios (BL/BL (BL length) : ML/BL : AL/BL) 1.00 (0.20–0.22 mm) : 0.66–1.14 : 0.19–0.24.

Thorax: pronotum with small distinct spots. Mesonotum uniformly coloured with small distinct dark spots. Sterna uniformly coloured.

Legs: foreleg 1.54–1.82 mm long (not including claw length) with ratios of 1.00 (0.69–0.88 mm) : 0.55–0.65 : 0.52–0.75 : 0.36–0.40 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.53–0.74 times length of tarsus. Fore femur 4.49–5.21 times longer than wide and with subapical dark band partially divided, dorsal margin of fore femora with row of 20–24 short sharply pointed robust setae with subapical pair of short, robust setae; ventrally with 10–18 sharply pointed short setae. Fore tibia with basal dark patch and segment uniformly shaded, lacking setae or scattered fine setae on outer margin, inner/posterior surface with 7–14 sharply pointed setae. Fore tarsus shaded but no dark patch, without setae on outer margin and spine setae on inner margin with single distinct row of 15–24 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half. Middle leg (fig. 15a) 1.62–1.84 mm long (not including claw length), segment ratios of 1.00 (0.75–0.80 mm) : 0.55–0.65 : 0.55–0.67 : 0.36–0.37 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.54–0.68 times length of tarsus, femur 4.30–5.19 times longer than wide with subapical dark band, dorsal margin of mid-femora with row of 16–21 short sharply pointed robust setae with subapical pair of short, robust setae; ventrally with 6–11 sharply pointed short setae. Mid-tibia without setae and scattered fine setae on outer and 7–10 setae on inner margin. Mid-tarsus without setae on outer margin and inner margin, with single distinct row of 15–19 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half. Hind leg length 1.62–1.81 mm, segment ratios of 1.00 (0.78–0.90 mm) : 0.47–0.57 : 0.49–0.54 : 0.29–0.39 (femur:



a



b

Figure 16. *Skolomystax hawkingi*: a, forewing of female imago, length = 6.0mm; b, hindwing of female imago, length = 1.1 mm.

tibia: tarsus: claw measured on outer margin), tarsal claw 0.57–0.75 times length of tarsus, hind femur 4.63–6.08 times longer than wide with subapical dark band, dorsal margin of fore femora with row of 22–25 short sharply pointed robust setae with subapical pair of short, robust setae; ventrally with 10–19 sharply pointed short setae. Hind tibia without setae and scattered fine

setae on outer and 8–11 setae on inner margin. Hind tarsus without setae on outer margin and inner margin, with single distinct row of 13–17 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half.

Abdomen: abdominal tergites marked with fine dark spotting (fig. 25g), segments II–VII with a dark patch on lateral margins,

dark colour pattern on segments V, anterior area of VI dark. Abdominal terga with numerous short triangular spines on posterior margins present on terga I–X, those on posterior segments 2.00–2.44 times longer than basal width, bases of spines separated by approximately width of spine (fig. 15b). Surfaces of terga with pointed scales and scale bases. Sternites with short triangular spines on posterior margin on segments IV–IX, spines 1.70–2.08 times longer than basal width, bases of spines separated (fig. 15c). Gills I and II somewhat cordate and pointed, gills III–VII apically rounded. Paraprocts (fig. 14k) with 14–18 marginal spines, surface with scale bases. Cerci and terminal filament inner surfaces with long fine setae nearly to apex.

Male: unknown.

Female: forewing 5.7–6.0 mm; hindwing 1.1 mm. Head pale brown with pair reddish brown longitudinal stripes on vertex. Pronotum pale brown, paler medially and with longitudinal brown stripe and small pair submedian reddish brown spots. Mesonotum pale brown and with pair submedian reddish brown spots on anterior margin. Metanotum pale brown, metascutum pale with pair reddish brown spots basally. Forewing (fig. 16a) transparent with slight brown tinge between C and R_1 , all marginal intercalaries single, longitudinal veins yellowish to brownish; area between C and Sc with 7–8 crossveins in pterostigma, 0 crossveins basal of bulla and 2–3 crossveins between bulla and pterostigma. Hindwing narrow (fig. 16b); costal projection with wide base and single point curved towards body; crossveins absent; three longitudinal veins and single intercalary between second and third veins; second longitudinal vein unforked; third longitudinal vein short, joining hind margin distal of apex of costal projection. Legs pale, femora with three orange bands. Abdominal terga pale brown, paler medially; tergum I reddish; tergum II with pale circle surrounded by reddish ring sublaterally; terga III–VII with pair transverse reddish brown dashes on posterior margin; terga III–VI and X with reddish median spot or streak near anterior margin; tergum V with distinct submedian pair reddish brown spots. Abdominal sterna pale, anterior margins of VII–X slightly darker. Cerci broken and missing.

Discussion

The absence of setae on outer margins of the tibiae and tarsi differentiates this species from *S. brevis*, *S. elongatus* and *S. paschei*. *Skolomystax hawkingi* differs from all other species of *Skolomystax* except *S. leichhardti* in having fine dark spotting over the body and being restricted to northern Australia. From *S. leichhardti*, *S. hawkingi* differs by having the spines on the posterior margins of sterna IV–IX, vs. V–IX; left mandible inner incisor lacking distinct teeth on the inner margin vs. 1–3 in *S. leichhardti*; paraprocts with 14–18 teeth vs. 10–11; maxillary palp extends well beyond apex of galealacinia vs. just extending beyond galealacinia, and segments I and II combined extend beyond apex whereas in *S. leichhardti* palp segments I and II combined do not reach the apex of galealacinia; outer margin of femora with >15 spines vs. <15; inner margin of mid- and hind tarsi with >13 spines vs. <12 spines.

Etymology: the species is named in honour of our colleague John Hawking from the Murray Darling Freshwater Research Centre, who helped collect much of the type material in northern Qld.

Distribution: northern Qld.

Skolomystax leichhardti n. sp. (figs. 17, 18, 25h, m)

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Centroptilum sp1 in Suter (1992)

Centroptilum spARR in Webb and Suter (2011)

Material examined. *Holotype*: nymph and associated male imago mounted on slides. NT: Magela Ck near Corndorl Billabong, PS430, 12.62S 132.88E, 17 May 1988, PS, AW, PC, cast skin and male imago, ANIC6–000088.

Paratypes: one nymph and one reared male imago mounted on slides; Magela Ck at Ranger outlet, PS420, 12.68S 133.93E, 19 May 1988, PS, AW, PC, ANIC6–000089, 90; one male imago on two slides, South Alligator R. Site 1 at Gimbat OSS field station, PS431, 13.60S 132.60E, 30 Sept 1988, PS, AW, PC, ANIC6–000091.

Other material examined. NT: nymph; pool nr Sandy Billabong, JWA1380, 12.62S 132.87E, 28 May 1988, PS, AW, PC; Barramundie Ck, JWA2478/2485, 13.31S 132.44E, 2 Oct 2009, JW, JHH, PS, MH; Magela Ck below Bowerbird Billabong, 12.78S 133.03E, May 1988, PS, AW, PC; Magela Ck below Magela Falls, 12.77S 133.10E, April 1989, PS, AW, PC; Jim Jim Ck above Jim Jim Falls, 13.28S 132.85E, May 1988, PS, AW, PC; Magela Ck upstream of Georgetown Billabong, 12.68S 132.93E, 4 Feb 2019, JH.

Nymph – description

Body: 4.5–5.4 mm; terminal filament length 1.00–1.45 mm; caudal filaments 2.73 mm; caudal filaments 0.6 times body length, terminal filament 0.22–0.27 times body length.

Head: uniformly coloured with labrum tinged brown at base. Antennae with scape 1.23 times length of pedicel.

Mouthparts: labrum (fig. 17a) slightly wider than long (W/L = 1.25–1.37); notch depth 0.27 times notch width (fig. 17b) and 0.73 times labrum length, notch angle approx. 107°, lined with 19–25 setae; ventrally with numerous fimbriate setae apically, numerous scattered fine setae, apical corners with 12–15 long, robust setae, and laterally lacking setae; dorsally with numerous scattered long fine setae. Right mandible (planate) (figs. 17e, g) with three apical teeth on outer incisor, lacking lateral spine on inner margin of outer incisor (fig. 17g); inner incisor with broad surface and with three teeth and with 0–1 lateral tooth; prosthema slender and bifid with long setae, sparse patch of fine setae at base (fig. 17g); patch of broad setae at base of molar area; dorsal surface without scattered fine setae and scales. Left mandible (angulate) (figs. 17f, h) three apical teeth and 1–3 inner teeth on outer incisor; inner incisor with three apical teeth and 2–4 inner teeth giving a rough rugose appearance; prosthema robust bifid with sparse patch of setae at base (fig. 17h); dorsal surface lacking scattered fine setae and scales. Maxillae (fig. 17c) with canines distinctly broader than lacinial setae, 2–7 subcrest setae

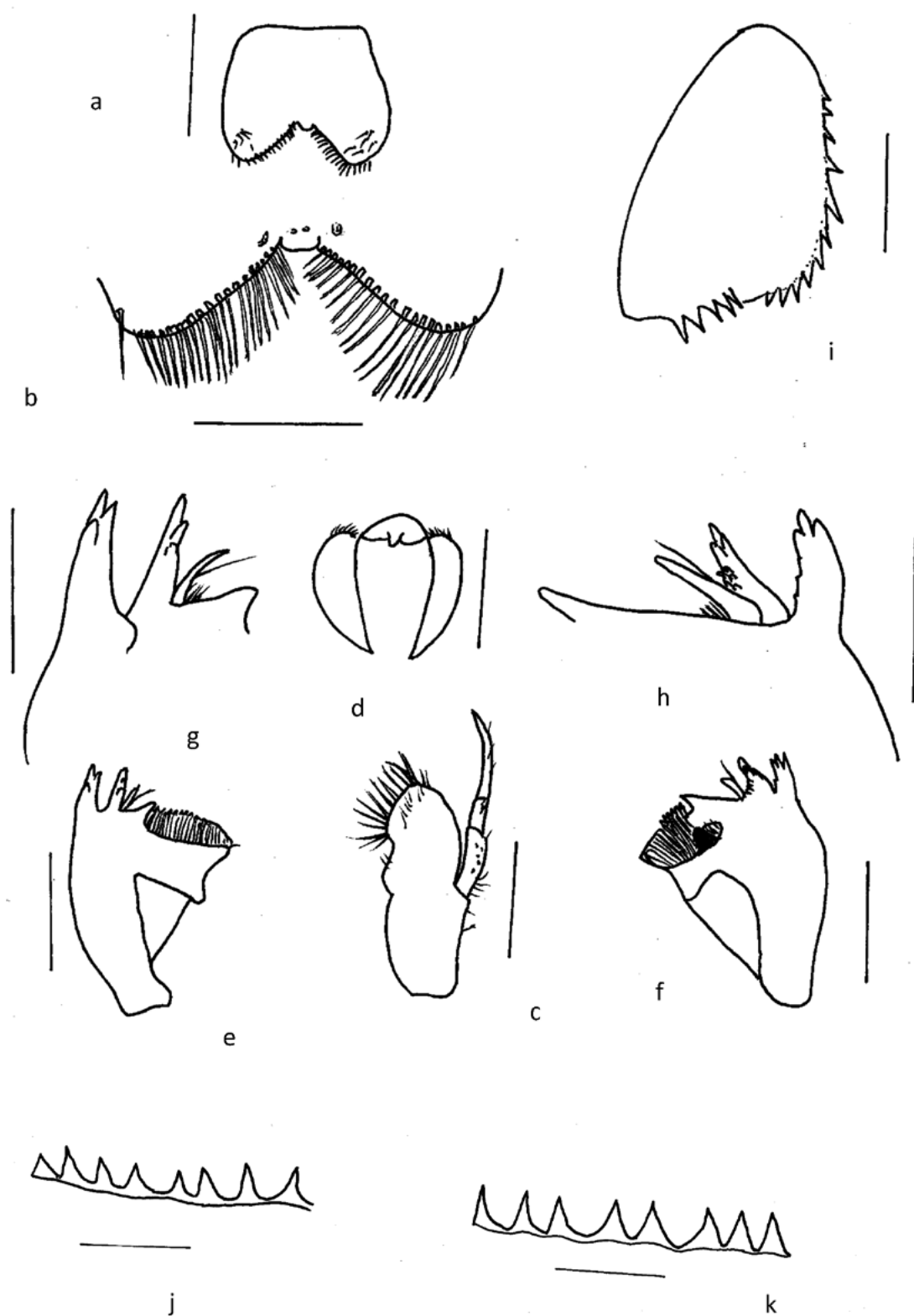


Figure 17. *Skolomystax leichhardti*: a, labrum; b, labrum notch; c, maxilla; d, hypopharynx; e, right mandible; f, left mandible; g, right mandible incisors; h, left mandible incisors; i, paraproct; j, tergite spines; k, sternite spines. Scale lines: a, c-f = 0.15 mm; b, g-k = 0.07 mm.

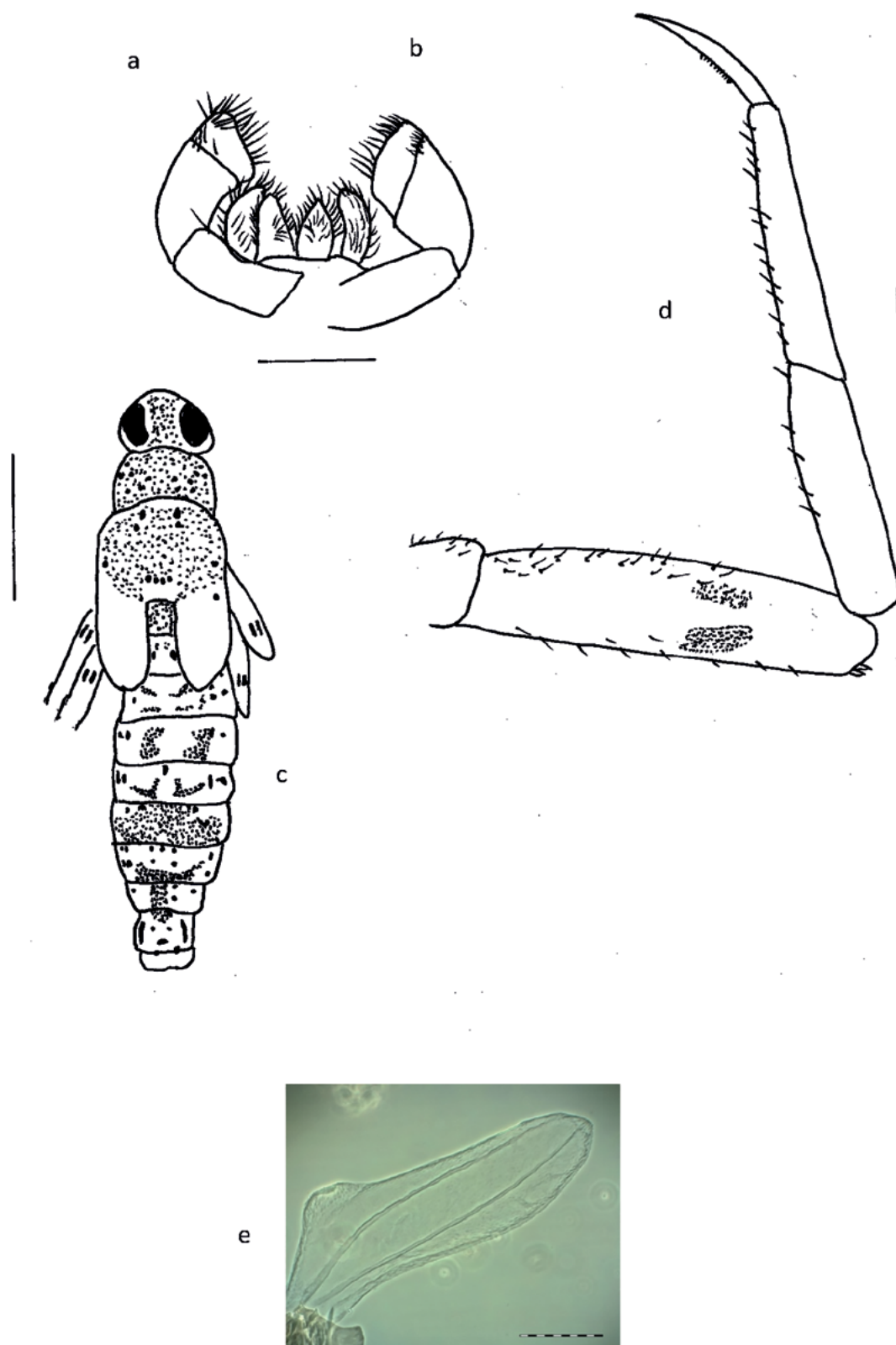


Figure 18. *Skolomystax leichhardti*: a, labium dorsal; b, labium ventral; c, body colour pattern; d, leg; e, hindwing of male imago. Scale lines: a, b, d = 0.15 mm; c = 1 mm; e = 0.1 mm.

on ventral surface, 2–5 hump setae and 27–28 lacinial setae, lateral margin below palp with few fine hair-like setae; maxillary palp 3-segmented, extending beyond apex of galealacinia, segment I extends to mid-galealacinia, with few fine lateral hair-like setae, segments I and II combined reach apical 1/3 of galealacinia (fig. 17c), all segment with fine hair-like setae, basal segment with numerous round tubercles; palp length 0.22 mm, palp segment ratios (BL/BL (BL length) : ML/BL : AL/BL) 1.00 (0.095 mm) : 0.82 : 1.27, length of segment II and III combined 2.09 times basal segment length, segment III 1.55 times length of segment 2. Hypopharynx (fig. 17d). Labium (figs. 18a, b) with glossae slightly shorter than paraglossae; glossae with 7–9 outer setae, 3–9 inner setae and two apically, >20 long fine setae on margins, dorsal surface (fig. 18a) with numerous long fine setae and single subapical long robust seta; paraglossae curved medially, truncate apically and with single row of 13–14 setae on outer margin, dorsal surface with numerous 11–14 long setae, ventral surface (fig. 18b) with numerous long fine setae on glossae and paraglossae; labial palp 3-segmented, 0.40–0.52 mm, outer margin of each segment without setae, basal segment 1.85–2.01 times longer than wide, slightly shorter than segments II and III combined, subrectangular, segment II apically expanded and longer on outer margin than inner margin; segment III subrectangular and slightly falcate with 16 long robust and short fine setae on margins, dorsal surface with 3–5 long robust setae distally, ventral surface with scattered fine setae, segment ratios (BL/BL (BL length) : ML/BL : AL/BL) 1.00 (0.17–0.22 mm) : 1.08–1.11 : 0.25–0.34, segment 2 and segment 3 combined 1.33–1.45 times longer than basal segment.

Thorax: pronotum with small distinct spots, with dark markings (figs. 18c, 25i, 25j). Mesonotum uniformly coloured. Sterna uniformly coloured.

Legs: foreleg 1.42–1.51 mm long (not including claw length) with segment ratios of 1.00 (0.62–0.65 mm) : 0.61–0.62 : 0.69–0.71 : 0.39–0.40 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.55–0.58 times length of tarsus. Fore femur 4.00–4.04 times longer than wide, with elongate pair of subapical dark bands (fig. 18d), dorsal margin of fore femora with row of 11–12 short sharply pointed robust setae with subapical pair of short, robust setae; inner margin with 14 sharply pointed long setae. Fore tibia without setae or hair-like setae on outer margin, inner surface with 8–10 long sharp setae. Fore tarsus without setae on outer margin, inner margin with single distinct row of 15–16 short sharply pointed setae, slight dark marking at base. Tarsal claw with two similar rows of denticles in basal half. Middle leg 1.48–1.70 mm long (not including claw length), mid-femur 5.52–5.58 times longer than wide with ratios of 1.00 (0.71–0.78 mm) : 0.57–0.59 : 0.52–0.57 : 0.37 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.71 times length of tarsus. Mid-femur with pair of elongate subapical dark markings, dorsal margin of fore femora with row of 10–11 short sharply pointed robust setae with subapical pair of short, robust setae; inner margin with 12–16 sharply pointed long setae. Mid-tibia without setae or hair-like setae on outer margin, inner surface with 0–5 long sharp setae. Mid-tarsus without setae on outer margin, inner margin with

single distinct row of 10–12 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half. Hind leg length 1.28–1.49 mm, femur 4.92–5.30 times longer than wide with pair of elongate subapical dark markings, segment ratios 1.00 (0.56–0.87 mm) : 0.47–0.66 : 0.47–0.55 : 0.31–0.41 (femur: tibia: tarsus: claw measured on outer margin), tarsal claw 0.56–0.87 times length of tarsus, outer margin of hind femora with row of 8–10 sharply pointed robust setae with subapical pair of short, robust setae; inner margin with 10–15 sharply pointed short setae. Hind tibia without setae or hair-like setae on outer margin, 5–8 setae on inner margin. Hind tarsus without setae on outer margin and inner margin with single distinct row of 7–11 short sharply pointed setae. Tarsal claw with two similar rows of denticles in basal half.

Abdomen: abdominal tergites with dark colour pattern on segments V and anterior area of VI, pair of black spots on segment II and numerous minute black spots on all segments (fig. 25h), tergum I with small median reddish brown spot, terga III–V with pair transverse reddish brown dashes on posterior margin; tergum V with distinct submedian pair reddish brown spots. Abdominal terga I–X with numerous short triangular spines on posterior margins (fig. 17j), those on posterior segments 0.91–1.27 times longer than basal width, bases of spines separate by approximately width of spines. Sternites with triangular spines on posterior margin of segments V–IX, spines 1.25–1.30 times longer than basal width, bases of spines separated (fig. 17k). Gills I–III narrow and pointed, IV–VII ovate with slight acute apex. Paraprocts (fig. 17i) with 10–11 marginal spines, surface with scale bases. Cerci longer than terminal filament, slightly darkened distally, every other articulation darkly coloured, and inner surfaces with long fine setae nearly to apex.

Adult male: body length 3.8–4.5 mm. Dorsal turbinate eyes reddish-brown. Forewing length 3.6 mm, hyaline, opaque along costal margin and also at base of wing (Suter, 1992, fig. 110), all marginal intercalaries single and short; length 2.9 times width, pterostigma area opaque with 6–7 crossveins. Hindwing length 0.5 mm with basal costal projection and two main veins, second longitudinal vein unforked, costal projection and apex of wing slightly opaque (fig. 18d; fig. 110 in Suter, 1992). Terminal filament reduced to a stump. Foreleg segment ratios 0.77 : 1.00 (1.16 mm) : 0.58 : 0.43 : 0.31 : 0.16 : 0.11 (Suter, 1992).

Etymology: the species is named in honour of Ludwig Leichhardt, a German explorer and naturalist famous for his exploration of northern Australia.

Discussion

The absence of setae on outer margins of the tibiae and tarsi differentiates this species from *S. brevis*, *S. elongatus* and *S. paschei*. *Skolomystax leichhardti* differs from all other *Skolomystax* species except *S. hawkingi* in having distinct dark spots over the body, broad maxillary canines, and being restricted to northern Australia. *Skolomystax leichhardti* differs from *S. hawkingi* in having posterior marginal spines on sterna V–IX, vs. IV–IX; distinct teeth on the inner margin of the left inner incisor vs. lacking distinct teeth; paraprocts with 10–11 teeth vs. 14–18; apex of maxillary palp segment II

combined not reaching apex of galealacinia in *S. leichhardti* vs. extending distinctly beyond the apex of galealacinia in *S. hawkingi*; outer margin of femora with <15 spines vs. >15; inner margin of mid- and hind tarsi with <12 spines vs. >13 spines. Females of *S. leichhardti* are slightly smaller than those of *S. hawkingi* and lack a distinct marking on the femora. Some of the nymphs of *S. leichhardti* have a colour morph with a distinctive median longitudinal dark stripe on the abdomen (similar to the colour morph of *S. elongatus*) and two stripes on thorax (fig. 25m)

Distribution: NT.

Skolomystax paschei n. sp. (figs. 19, 20, 25i)

urn:lsid:zoobank.org:act:FB1BE4F7-8722-4BCB-931C-908400447643

Material examined. *Holotype*: nymph mounted on slides. NSW: MacLaughlin R, JWAANIC1, 36.65S 149.11E, 19 Dec 1974 EFR, ANIC 6-000079.

Paratypes: three nymphs mounted on slides. NSW: MacLaughlin R, JWAANIC2, 36.65S 149.11E, 23 Oct 1965, EFR, ANIC 6-000080; Bobundara Ck on Maffra Rd, JWA1431, 36.49S 148.99E, 19 Dec 1974, EFR, ANIC 6-000081; MacLaughlin R at Monaro Highway, south of Nimmitabel, JWA1632, 36.5722S 149.2847E, 29 Mar 2009, ANIC 6-000082.

Nymph – description

Body: 6.7 mm.

Head: light without distinct brown markings. Antennae with scape 1.04–1.23 times length of pedicel.

Mouthparts: labrum (fig. 19a) 1.22–1.25 times wider than long; labrum notch shallow distinctly rectangular at base, lacking lateral projections (fig. 19b), notch angle approx. 130°, depth 0.19–0.22 times width; notch depth 0.82–0.84 times labrum length; notch lined with 19–22 fimbriate setae on each side, ventrally with numerous fimbriate setae apically, numerous scattered fine setae, apical corners with 12–17 long and robust setae and laterally with submarginal scattered row of 7–11 short robust setae. Right mandible (planate) (figs. 20a, c) with three apical teeth and lacking lateral spine on inner margin of outer incisor; inner incisor with broad surface and with three indistinct apical teeth incisors, inner margin smooth; prosthema slender, bifid with a long setule at midpoint, patch of fine setae at base (fig. 20c). Left mandible (angulate) (figs. 20b, d) with three apical teeth and 4–5 teeth on inner margin of outer incisor; inner incisor with three apical teeth, inner margin enlarged and rugose (fig. 20d); prosthema robust and simple with several long spines apically, with patch of setae at base (fig. 20d). Maxillae (fig. 19c) with 2–6 subcrest setae on ventral surface, 5–6 hump setae, and >20 lacinial setae, lateral margin below palp lacking setae; maxillary palp 0.51 mm long, palp extends well beyond apex of galealacinia, segment I extends just beyond mid-galealacinia, and segments I and II combined extend beyond apex of galealacinia, all segments with sparse very fine hair-like setae on outer margins (difficult to see); segments II and III combined 1.54 times basal length, segment III 1.52–1.55 times segment II length; segment ratios of 1.00 (0.26–0.27 mm) : 0.60–0.61 :

0.93–0.94. Hypopharynx (fig. 19d). Labium with glossae slightly shorter than paraglossae (fig. 20a, b); glossae with 5–7 setae on outer margins, inner with 8–9 fine setae, ventral surface with numerous long hair-like setae; paraglossae curved medially, truncate apically and with numerous long fine hair-like setae on outer margin and a multiple rows of long setae ventrally; labial palp 3-segmented, 0.87–0.98 mm long, outer margin of each segment lacking setae, segment ratios 1.00 (0.42–0.46 mm) : 0.82–0.88 : 0.25–0.26, segment I sub-rectangular 2.50–2.94 times longer than wide, segment II apically expanded and longer on outer margin than inner margin, dorsal surface with few setae; segment III subrectangular and slightly falcate with >20 long robust setae on apical margins, dorsal surface with four long robust setae distally; segments 2 and 3 combined 1.70–1.97 times basal segment length.

Legs: foreleg total length of 3.57 mm, segment ratios of 1.0 (1.58 mm) : 0.67 : 0.59 : 0.37, tarsal claw 0.63 times tarsal length. Fore femur 5.67 times longer than wide; outer margin of fore femora with 39 short sharply pointed robust setae, with subapical pair of long, pointed robust setae; inner margin with 37 short sharply pointed robust setae. Fore tibia slightly darker basally and apically, outer margin with 21 short sharp setae (fig. 20g), inner margins with 27 long sharp setae. Fore tarsus without darker markings, with outer margin with lacking robust setae, inner margin with 38 long sharp setae. Tarsal claw with two similar rows of denticles in basal half. Middle leg total length of 3.70 mm with segment ratios of 1.00 (1.68 mm) : 0.67 : 0.54 : 0.39, tarsal claw 0.72 times tibia length. Mid-femur 6.06 times longer than wide; outer margin of fore femora with 48 short sharply pointed robust setae and with subapical pair of long, pointed robust setae; inner margin with 33 short sharply pointed robust setae. Mid-tibia slightly darker basally, outer margin with 30 sharp setae, inner margins with 30 long sharp setae. Mid-tarsus without markings, outer margin with two sharp pointed robust setae, inner margin with 40 long sharp setae. Tarsal claw with two similar rows of denticles in basal half. Hind leg total length 3.78–3.85 mm, with segment ratios of 1.00 (1.74 mm) : 0.61–0.66 : 0.54–0.56 : 0.33–0.36, tarsal claw 0.58–0.67 times tarsal length. Hind femur 6.53–7.13 times longer than wide; outer margin of hind femora with 37–48 short sharply pointed robust setae and scattered fine setae and with subapical pair of long, pointed robust setae; inner margin with 34–37 short sharply pointed robust setae. Hind tibia slightly darker basally, outer margin with 10–27 short sharp setae, inner margins with 28–32 long sharp setae. Hind tarsus without dark markings, with outer margin with 0–2 sharp robust setae, inner margin with 33–35 long sharp setae. Tarsal claw with two similar rows of denticles in basal half.

Abdomen: abdominal tergites with a distinct colour pattern (fig. 25i), dark lateral marks on segment II–VII, dark shaded on III–IV, darker saddle on V and VI, light VII and VIII and dark IX with medial Y-shaped light marking segment X, dark patch on anterior margin. Posterior margin of abdominal terga with long and short and widely spaced spines (fig. 19f), long spines length 2.60–3.07 times width and short spines 0.50–0.67 times long spine. Gills I and II somewhat cordate, gills III–VII apically rounded. Sterna II or III–IX with long spines of equal length

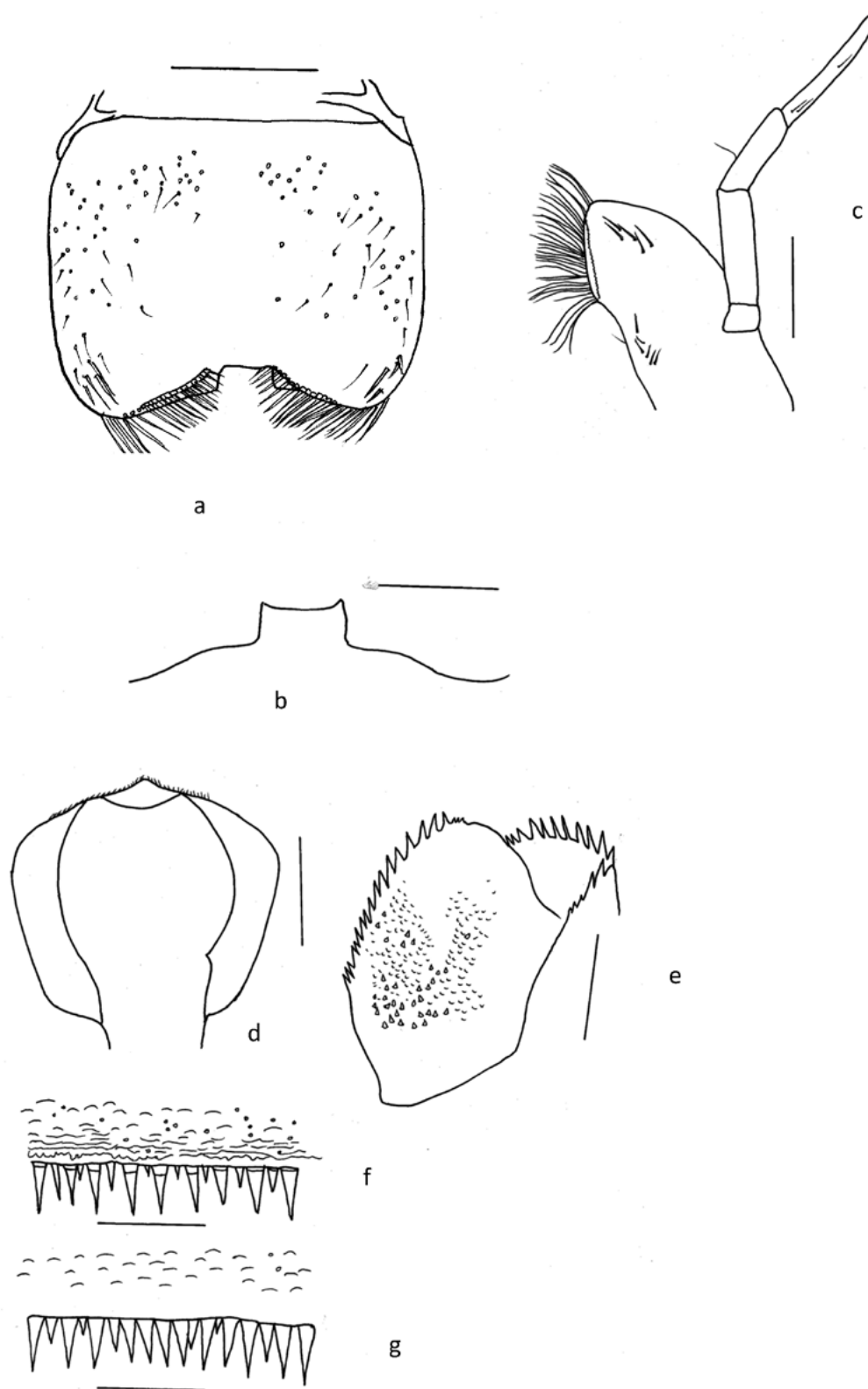


Figure 19. *Skolomystax paschei*: a, labrum; b, labrum notch; c, maxilla; d, hypopharynx; e, paraproct; f, tergite spines; g, sternite spines. Scale lines: a, c–f = 0.15 mm; b, g = 0.07 mm.

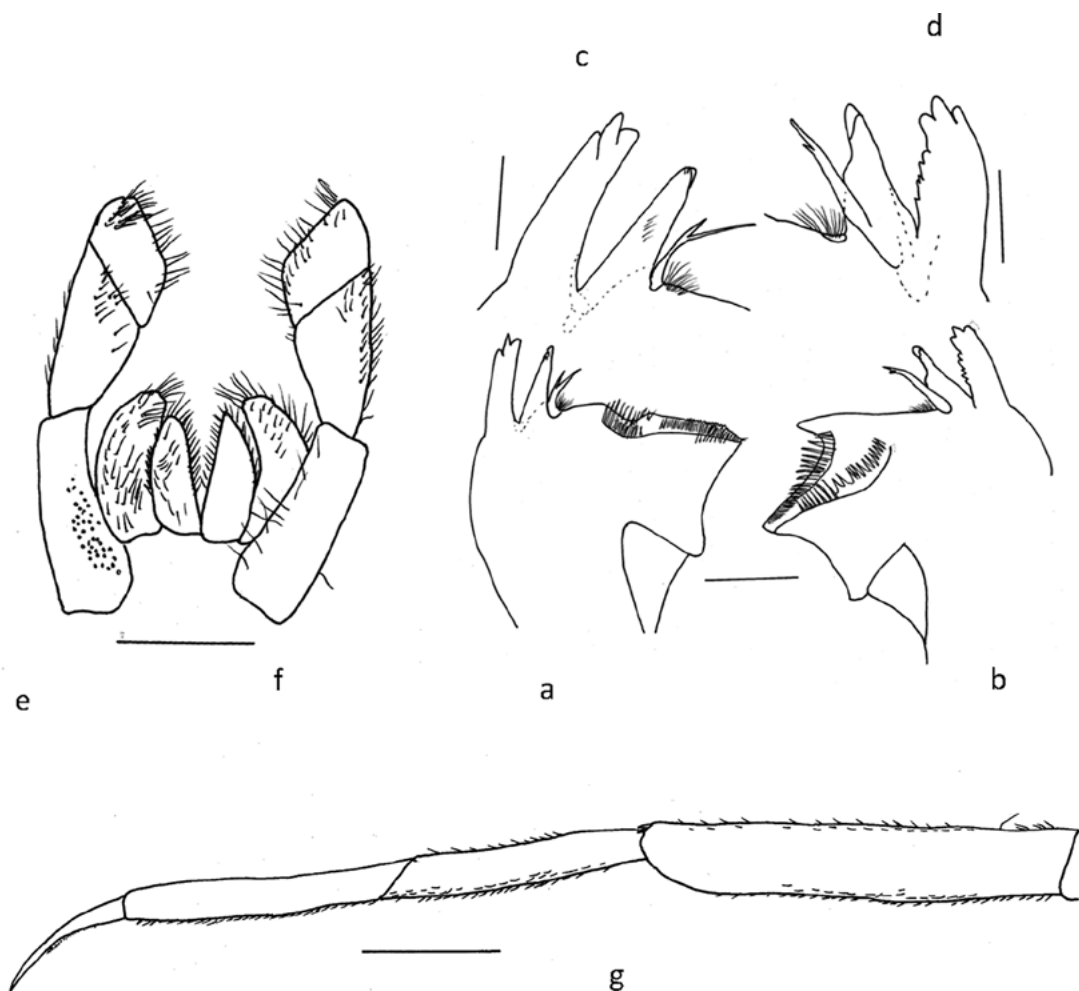


Figure 20. *Skolomystax paschei*: a, right mandible; b, left mandible; c, right mandible incisors; d, left mandible incisors; e, labium dorsal; f, labium ventral; g, leg. Scale lines: a, b, e, f, g = 0.15 mm; c, d = 0.07 mm.

(2.42–2.47 times longer than wide) with occasional short inter-spines (0–3) between long spines on posterior margin, bases contiguous (fig. 19g). Paraprocts (fig. 19e) with 21–23 marginal spines, surface with scattered scale bases. Cerci and terminal filament subequal in size, slightly darkened distally, every other articulation darkly coloured, and inner surfaces with long fine setae nearly to apex.

Adults: unknown.

Etymology: Named in honour of J–LG's late father-in-law, Michel Pasche.

Distribution: NSW.

Discussion

The presence of robust setae on the outer margins of the tibiae and tarsi differentiates *S. paschei* from all other known species

except *S. elongatus* and *S. brevis*. The absence of black markings on the base of the mandibles, labrum and genae, the presence of alternating short and long spines on the posterior margins of the terga and spines on posterior margins of sterna II or III–IX distinguishes *S. paschei* from *S. brevis*. *S. paschei* differs from *S. elongatus* in having a distinctly broad notch of the labrum (notch angle 130°) vs. a shallowly angled notch (notch angle 100°) and more numerous spines on the outer margins of the femora.

Skolomystax tasmaniensis n. sp. (figs. 21, 22, 25j)

urn:lsid:zoobank.org:act:AB4BAE04-2561-480F-9B41-C9E5F475BEA1

Centroptilum spTAS in Webb and Suter (2011)

Material examined. *Holotype*: nymph mounted on slides. Tas: Shannon R at C178 Waddamana Rd, JWA357, 42.05S 146.76E, 1 Mar 2008, JW, JHH, ANIC6–000111.

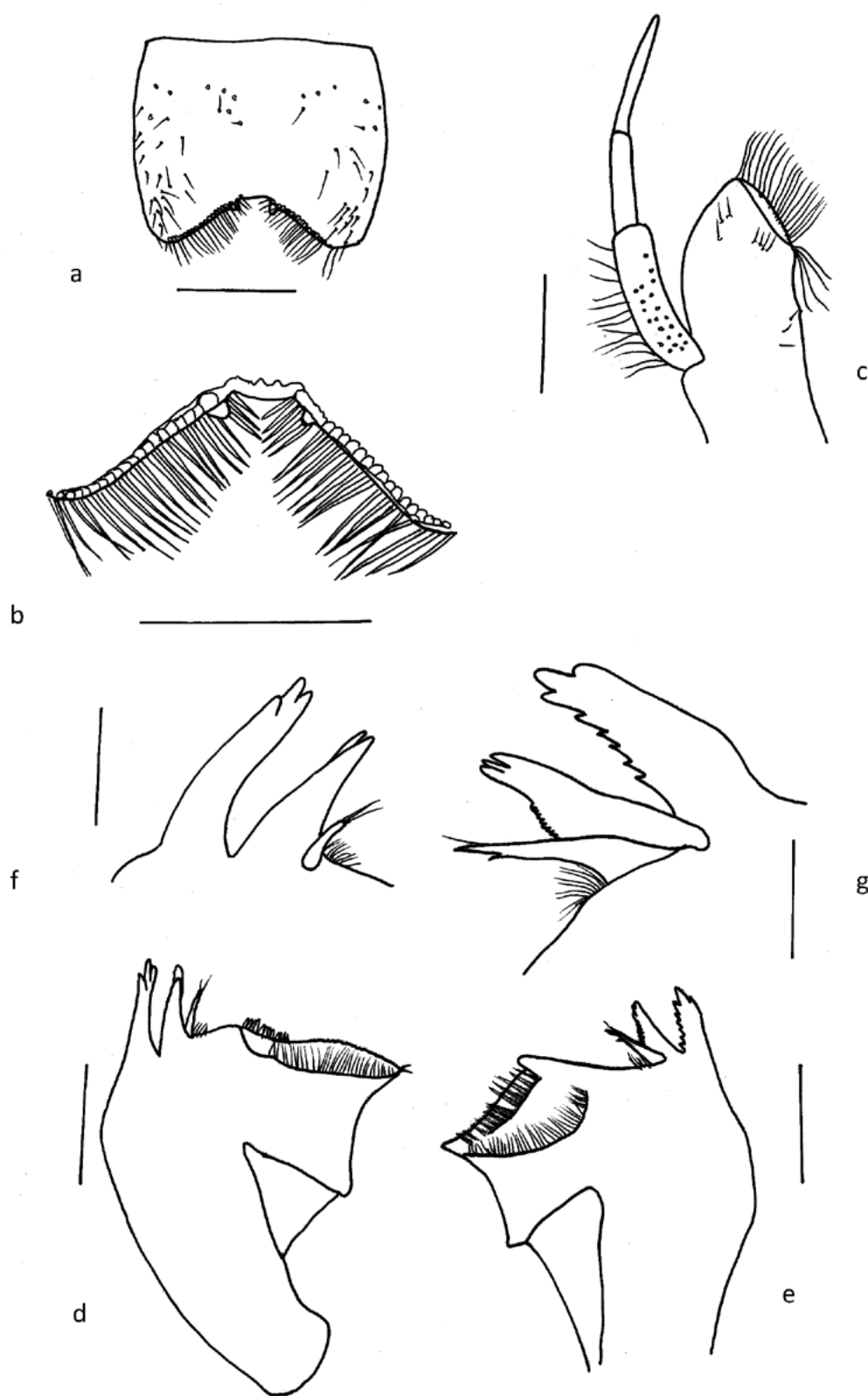


Figure 21. *Skolomystax tasmaniensis*: a, labrum; b, labrum notch; c, maxilla; d, right mandible; e, left mandible; f, right mandible incisors; g, left mandible incisors. Scale lines: a, c–e = 0.15 mm; b, f, g = 0.07 mm.

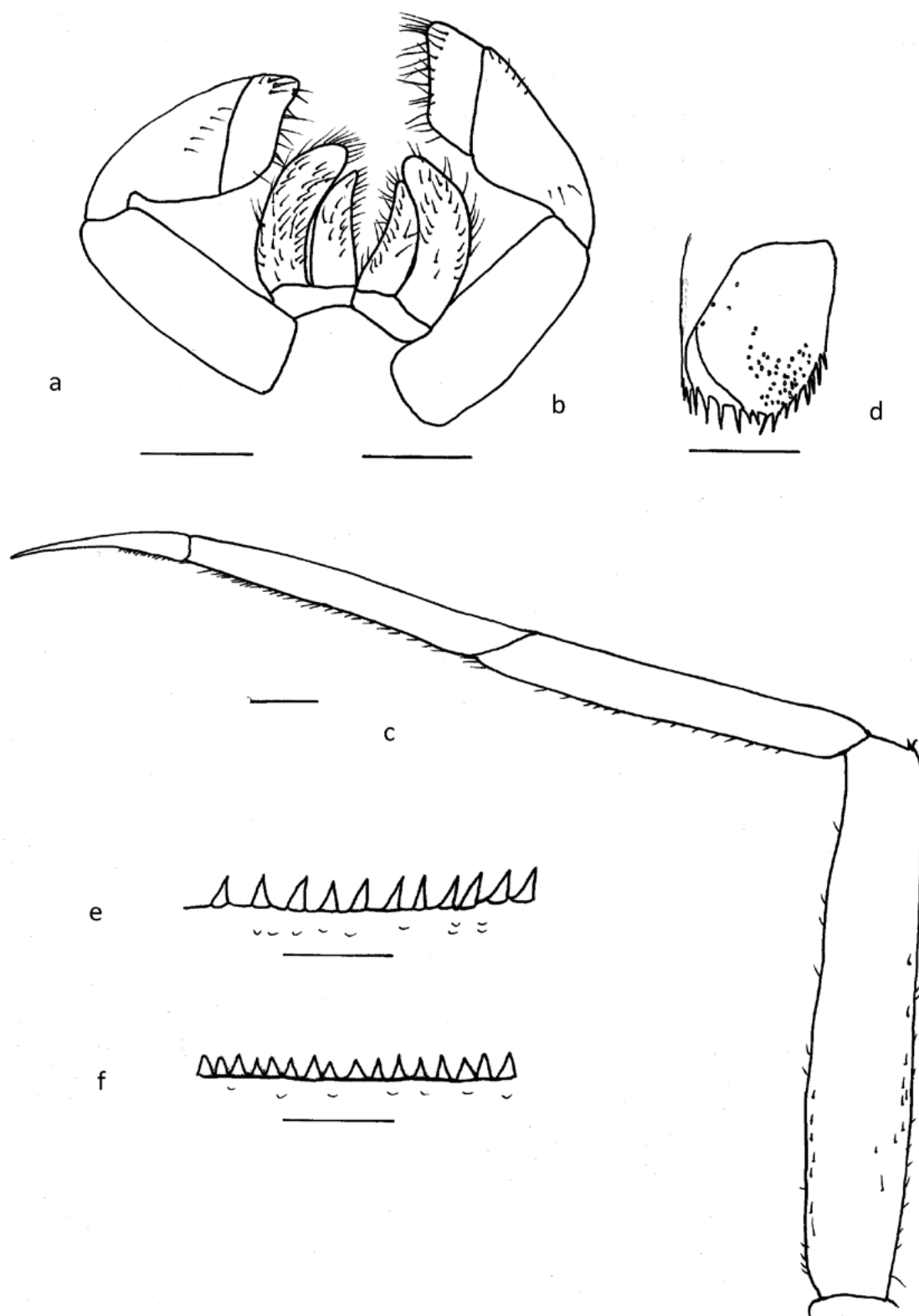


Figure 22. *Skolomystax tasmaniensis*: a, labium dorsal; b, labium ventral; c, leg; d, paraproct; e, tergite spines; f, sternite spines. Scale lines: a–f = 0.15 mm.

Paratypes: seven nymphs mounted on slides. Tas: Emu R at Fern Glade Reserve near Burnie, JWA342, 41.0843S 145.9190E, 26 Feb 2008, JW, JHH, ANIC6-000112, same location, JWA343, ANIC6-000113; Wilmot R at Alma Reserve, PS514, 41.27S 146.23E, 13 Oct 1994, Tas MRH, ANIC6-000114; St Patricks R Nunamara, PS589, 41.40S 147.30E, 29 Sept 1994, Tas MRH, ANIC6-000115; Inglis R on Jessie Rd, PS541, 41.10S 145.58E, 19 Oct 1994 Tas MRH, ANIC6-000116; Franklin R lower Reaches C5, PS561, 41.28S 146.60E, 13 Oct 1994, Tas MRH, ANIC6-000117; Bronte Lagoon PS571, 42.1845S 146.5036E, 16 March 2020, RT, ANIC6-000118.

Other material examined. Tas: Elizabeth R at Campbell Town, PS63-66, 41.95S 147.48E, 9 Mar 1994, PS; Wilmot R at Alma Reserve, PS511-513, 514, 41.27S 146.23E, 13 Oct 1994, Tas MRH; Wilmot R on Spelman Rd, PS518-520/522, 41.35S 146.17E, 13 Oct 1994, Tas MRH; Dasher R off Claude Rd, PS516/517, 41.45S 146.25E, 11 Oct 1994, Tas MRH; Inglis R on Jessie Rd, PS540,542, 41.10S 145.58E, 19 Oct 1994, Tas MRH; Franklin R lower reaches C5, PS560, 41.28S 146.60E, 13 Oct 1994, Tas MRH; South Esk R at Beauty Flat near Mathinna, PS558/559, 41.52S 147.98E, 27 Sept 1994, Tas MRH; Leven R downstream of Gunns Plains, PS534-537, 41.25S 146.05E, 13 Oct 1994, Tas MRH; Flowerdale R on Lapoinya Rd, PS538/539, 41.00S 145.58E, 19 Oct 1994, Tas MRH; Mersey R upstream of Union Bridge, PS562, 41.53S 146.45E, 17 Oct 1994, Tas MRH; Meander R upstream of Deloraine, PS563-566, 41.53S 146.63E, 17 Oct 1994, Tas MRH; Keith R on Farquhars Rd, PS588, 41.20S 145.45E, 19 Oct 1994, Tas MRH; MZL: Weld River at A3 E of Welborough, 41.212S 147.926E, 2 Mar 2008, JMW, JH; Emu River at Fern Glade Reserve near Burnie, JWA290, 41.084S 145.919E, 26 Feb 2008, JMW, JH.

Nymph – description

Body: 6.2–10.0 mm; caudal filaments 0.35–0.47 times body length; terminal filament 0.86–0.96 times caudal filament length.

Head: uniformly pale, with some dark vermiculations on vertex, dorsal eyes of males orange. Antennae with scape 1.04–1.41 times length of pedicel.

Mouthparts: labrum (fig. 21a) 1.19–1.32 times wider than it is long; length at base of apical notch 0.74–0.79 times maximum length; labrum notch depth 0.24–0.32 times width (fig. 21b), notch angle approx. 106° , notch lined with 20–23 setae, ventrally with single row of fimbriate setae apically all similar length, numerous scattered fine setae, and laterally with submarginal scattered row of 4–9 robust setae; dorsally with numerous scattered long fine setae. Right mandible (planate) (figs. 21d, f) with three apical teeth, inner margin smooth; inner incisor with broad surface and with three indistinct teeth, inner margin lined with a comb of short hair-like setae; prostheca simple, very slender spine with 14 setae and with patch of fine setae at base (fig. 21f); dorsal surface without scattered fine setae or scales. Left mandible (angulate) (figs. 21e, g) with three apical teeth and 3–6 inner teeth on outer incisor giving a serrated appearance (fig. 21g); inner incisor with three apical teeth, with rugose expanded base on inner margin; prostheca robust and simple with several long spines apically, patch of setae at base (fig. 21g); dorsal surface without scattered fine setae and scales. Maxillae (fig. 21c) with 1–3 subcrest setae on ventral surface, 1–7 hump setae, and 25–33 lacinial setae; lateral margin below palp with few fine hair-like setae; palp 3-segmented, 0.21–0.47 mm long; palp segment I somewhat curved, reaching apical half of galealacinia,

long hair-like setae on lateral margins, segment I+II reaching beyond galealacinia, outer margins lacking setae but may be a few sparse fine hair-like setae; segments II and III together 1.10–1.46 times longer than segment I; segment II lacking setae but may be a few sparse fine hair-like setae; segment III lacking setae but may be a few sparse fine hair-like setae, 1.01–1.64 times length segment II; segment ratios BL/BL (BL in mm), ML/BL, AL/BL; 1.00 (0.19–0.26 mm) : 0.49–0.65 : 0.58–0.85. Hypopharynx: as for *S. elongatus*. Labium with glossae slightly shorter than paraglossae (figs. 22a, b); glossae with single row of 11–20 long setae on outer margin, dorsal surface with single fimbriate robust seta near apex, ventral surface with one row of long fine setae and single subapical long robust seta (fig. 22b); paraglossae curved medially, truncate apically and with single row of 16–18 long setae on outer margin, dorsal surface with numerous long setae in 3–4 rows and with dense apical patch of fine setae (fig. 22a), ventral surface with long fine setae; labial palp 3-segmented, 0.55–0.82 mm long, outer margin of each segment lacking setae, basal segment sub-rectangular length 1.75–3.37 times width, segments I and III combined 1.09–1.58 times segment I length; segment II apically expanded and longer on outer margin than inner margin, dorsal surface with oblique row of fine setae distally, ventral surface with scattered fine setae; segment III sub-rectangular and slightly falcate, with numerous 3–7 long robust and short fine setae on margins, dorsal surface with long robust setae distally, ventral surface with scattered fine setae; segment ratios 1.00 (0.24–0.35 mm) : 0.82–1.23 : 0.21–0.35 (BL/BL (BL in mm), ML/BL, AL/BL).

Thorax: pronotum without any distinct spots, light patch laterally and three light patches within a dark medial area. Mesonotum dark medial area with light area laterally; forewing pads with dark stripes. Sterna uniformly coloured.

Legs: foreleg length 1.90–2.99 mm with ratios of 1.0 (0.88–1.38 mm) : 0.52–0.62 : 0.53–0.68 : 0.30–0.37. Fore femur 3.90–5.36 times longer than wide at midpoint and with subapical elongated dark band, often separated into two dark bands by longitudinal pale area, and usually with dark band basally; dorsal margin of fore femora with row of 7–30 short sharp pointed spines with subapical pair of short globular setae; ventral margin with 2–24 short sharp pointed spines. Fore tibia slightly darker basally, without spines on outer margin, inner margin with 6–16 long pointed robust setae. Fore tarsus darker, without setae, spines, or fine setae on outer margin, inner margin with 18–27 long sharp pointed setae in two rows. Tarsal claw length 0.53–0.65 times length of tarsus, with two similar rows of denticles in basal half. Middle leg (fig. 22c) length 1.13–3.68 mm, segment ratios; 1.00 (1.05–1.88 mm) : 0.52–0.61 : 0.46–0.56 : 0.25–0.34; middle femur 4.65–6.61 times longer than wide; tarsal claw 0.52–0.63 times tarsal length, outer margin of femur with 16–29 short spine setae, inner margin with 10–24 short spine seta; mid-tibia and tarsus lacking spine setae on outer margin; inner margin of tibia with 9–18 short spine setae, and inner margin of tarsus with 18–23 spine setae; segment banding as for foreleg. Hind leg length 2.21–3.93 mm, segment ratios 1.00 (1.04–1.41 mm) : 0.51–0.69 : 0.52–0.58 : 0.29–0.37, tarsal claw 0.54–0.68 times length of tarsus; hind femur 4.60–8.13 times longer than wide; outer margin of femur with 11–34 short spine setae, inner margin

with 12–28 short spine setae; hind tibia and tarsus lacking spine setae on outer margin; inner margin of tibia with 11–36 short spine setae, and inner margin of tarsus with 17–35 spine setae; segment banding as for foreleg.

Abdomen: abdominal tergites with a distinct colour pattern (fig. 25j), segment I dark anteriorly with pale median area posteriorly with two red spots, segment II–IV pale with dark lateral marks, dark saddle on segments V and VI each with a postero-medial light patch, segment VII and VIII light segment, IX dark and segment X light. Abdominal terga I–X with numerous long spines on posterior margins, those on posterior segments 1.33–4.17 times longer than basal width (fig. 22e), bases of spines separate by approximately two times spine width. Sterna IV–IX with spines on posterior margin, spines contiguous, 1.47–2.77 times width (fig. 22f). Paraprocts (fig. 22d) with 11–25 marginal spines, surface with scale bases. Cerci and terminal filament subequal in length, slightly darkened distally, every other articulation darkly coloured, inner surfaces of cerci with long fine setae nearly to apex, and terminal filament with long fine setae on outer margins.

Adults: unknown.

Etymology: Named from Tas, where this species is endemic.

Distribution: Tas.

Discussion

The absence of robust setae on the outer margins of the tibiae differentiates *S. tasmaniensis* from *S. elongatus*, *S. paschei* and *S. brevis*. It differs from *S. gippslandicus* and *S. dyarrii* in having the spines on the posterior margins of terga IV–IX vs. VI–IX or VII–IX. The absence of short spines between the long spines on the posterior margins of terga distinguishes *S. tasmaniensis* from *S. goorudensis*. The species most like *S. tasmaniensis* are *S. vulgaris* and *S. chionotos*, but they are not known to occur in Tas, where *S. tasmaniensis* is endemic, and *S. chionotos* has a maxillary palp with segment II longer than segment III as opposed to shorter than or subequal segment III. *Skolomystax tasmaniensis* has the inner margin of the left mandible rugose vs. a smooth inner margin in *S. vulgaris*.

Skolomystax vulgaris n. sp. (figs. 23, 24, 25k)

urn:lsid:zoobank.org:act:7AB15BA4-C3C0-4DDE-AB3A-4DAEE3201474

Centroptilum spl in Webb and Suter (2011)

Material examined. Holotype: nymph mounted on slides. Vic: Rocky Valley River at Bogong Village, JWA85 36.81S 147.23E, 16 Jan 2008, JW, PS, ANIC6–000106.

Paratypes: four nymphs mounted on slides. Vic: Aire R at Beech Forest to Apollo Bay Rd, Otways Ranges, JWA1233, 38.67S 143.58E, 26 Nov 2008, JW, SM, ANIC6–000107; Tanjil R East Branch at Tanjil, JWA637, 37.94S 146.21E, 26 Mar 2008, EPA, ANIC6–000108; Buffalo Ck above Rollasons Falls, Mt Buffalo, JWA1755, 36.69S 146.82E, 22 Feb 2009, JW, ANIC6–000109. NSW: Paddy's R at C548, JWA1254 35.85S 148.14E 19 Mar 2009, JW, SM, ANIC6–000110.

Other material examined. NSW: Bedford Creek (N629) in the Blue Mts at altitude 530 m, PS182–184, 33.75S 150.48E, 28 Oct 1992; Paddy's

R at C548, 19 Mar 2009, JW, SM; N269 28 Oct 1992; N629 Bedford Creek in the Blue Mts, 33.75S 150.48E, altitude 530 m, MRH. Vic: Snowy Ck on Omeo Highway near Mitta Mitta, JWA2288/2289, 36.55S 147.38E, 16 Apr 2010, JW; Fyans Ck at Grampians Rd, JWA1234, 37.20S 142.55E, 25 Nov 2008, JW, SM; Tambo R at Bindi Station, PS157/158, 37.12S 147.82E, 17 Mar 1994, KH; Middle Ck on Middle Ck Rd, PS43, 4546, 38.40S 146.38E, 24 Oct 1979, LTCS; Cabungra R at Anglers Rest on Omeo Highway, PS162163, 36.99S 147.49E, 1 Oct 1982, Vic EPA. MZL: Triplet Falls, Youngs Creek, Great Otway National Park, 38.671S 143.494E, 27 Nov 2008, JW, SM, two slides and four specimens in alcohol.

Nymph – description

Body: 6.4–9.6 mm; caudal filaments length 0.30–0.44 times body length.

Head: antennae with scape 1.01–1.19 times length of pedicel.

Mouthparts: labrum (fig. 23a) slightly wider than long (1.15–1.43); depth of notch 0.17–0.46 times width (fig. 23b), length at base of apical notch 0.74–0.93 times maximum length, notch angle approx. 103°, notch lined with 28–32 fimbriate setae on each side, ventrally with single row of fimbriate setae apically, numerous scattered fine setae, those at apical corners distinctly longer, and laterally with submarginal scattered row of 7–13 short robust setae; dorsally with numerous scattered long fine setae. Right mandible (planate) (figs. 23d, f) with three apical teeth on outer incisor, inner margin usually with zero but up to two teeth; inner incisor with broad surface and with three indistinct apical teeth, inner margin with a fine comb of very short hair-like setae; prostheca slender, bifid with long seta, patch of fine setae at base (fig. 23f). Left mandible (angulate) (figs. 23e, g) with three apical teeth and 2–5 teeth on inner margin of outer incisor; inner incisor with three apical teeth and bulge at base, smooth (fig. 23g); prostheca robust, with 13 long apical setae (fig. 23g), and with patch of setae at base. Maxillae (fig. 23c) with 2–6 subcrest setae on ventral surface, 2–6 hump setae, and 25–40 lacinial setae; lateral margin below palp with few fine long hair-like setae; palp 3-segmented 0.22–0.48 mm long, palp extending well beyond apex of galealacinia, segment I reaching apical third of galealacinia, segments I and II reaching just beyond apex of galealacinia, with long fine hair-like setae on outer margin of segment I; segment II short, lacking fine hair-like setae; segment III lacking fine hair-like setae, segments II and III combined 1.21–1.65 times basal length, segment III length 1.09–2.32 times length of segment II; segment ratios 1.00 (0.18–0.24 mm) : 0.43–0.66 : 0.72–1.08. Hypopharynx as for *S. elongatus*. Labium (figs. 24a, b) with glossae slightly shorter than paraglossae; glossae with single row of 8–16 setae on outer margin, 10–18 setae on inner margin, dorsal surface with fimbriate robust setae near apex, dorsal surface with numerous long fine setae (fig. 24a), ventrally with few fine setae (fig. 24b); paraglossae curved medially, truncate apically and with single row of long setae on outer margin, dorsal surface with numerous long setae (fig. 24a), ventral surface with numerous long fine setae (fig. 24b); labial palp 3-segmented, 0.61–0.79 mm long, outer margin of each segment lacking setae but may have few sparse fine hair-like setae, segment I sub rectangular, 2.36–4.43 times longer than wide, 0.94–1.30 times longer than segments II and III combined,

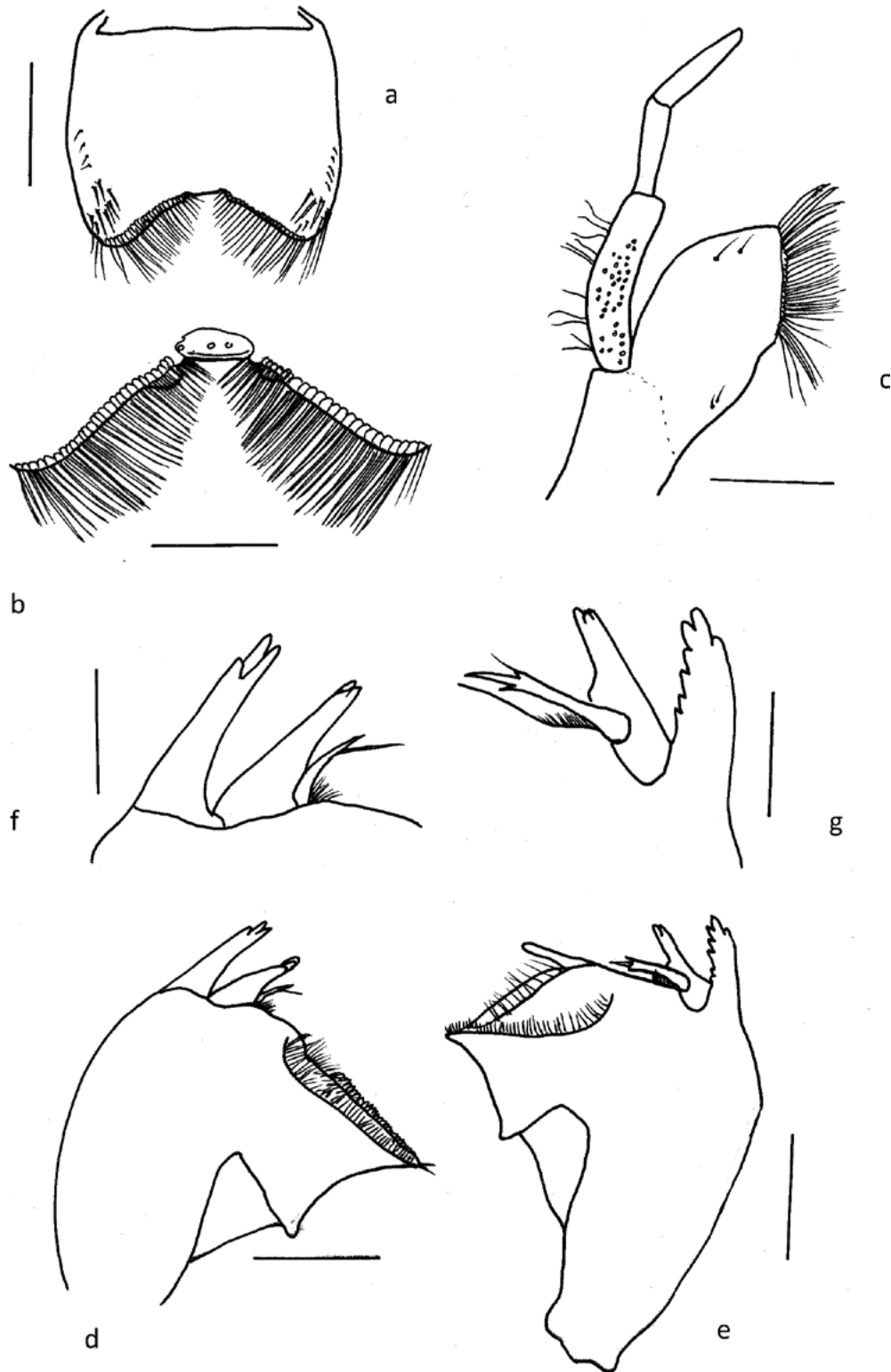


Figure 23. *Skolomystax vulgaris*: a, labrum; b, labrum notch; c, maxilla; d, right mandible; e, left mandible; f, right mandible incisors; g, left mandible incisors. Scale lines: a, c–e = 0.15 mm; b, f, g = 0.07 mm.

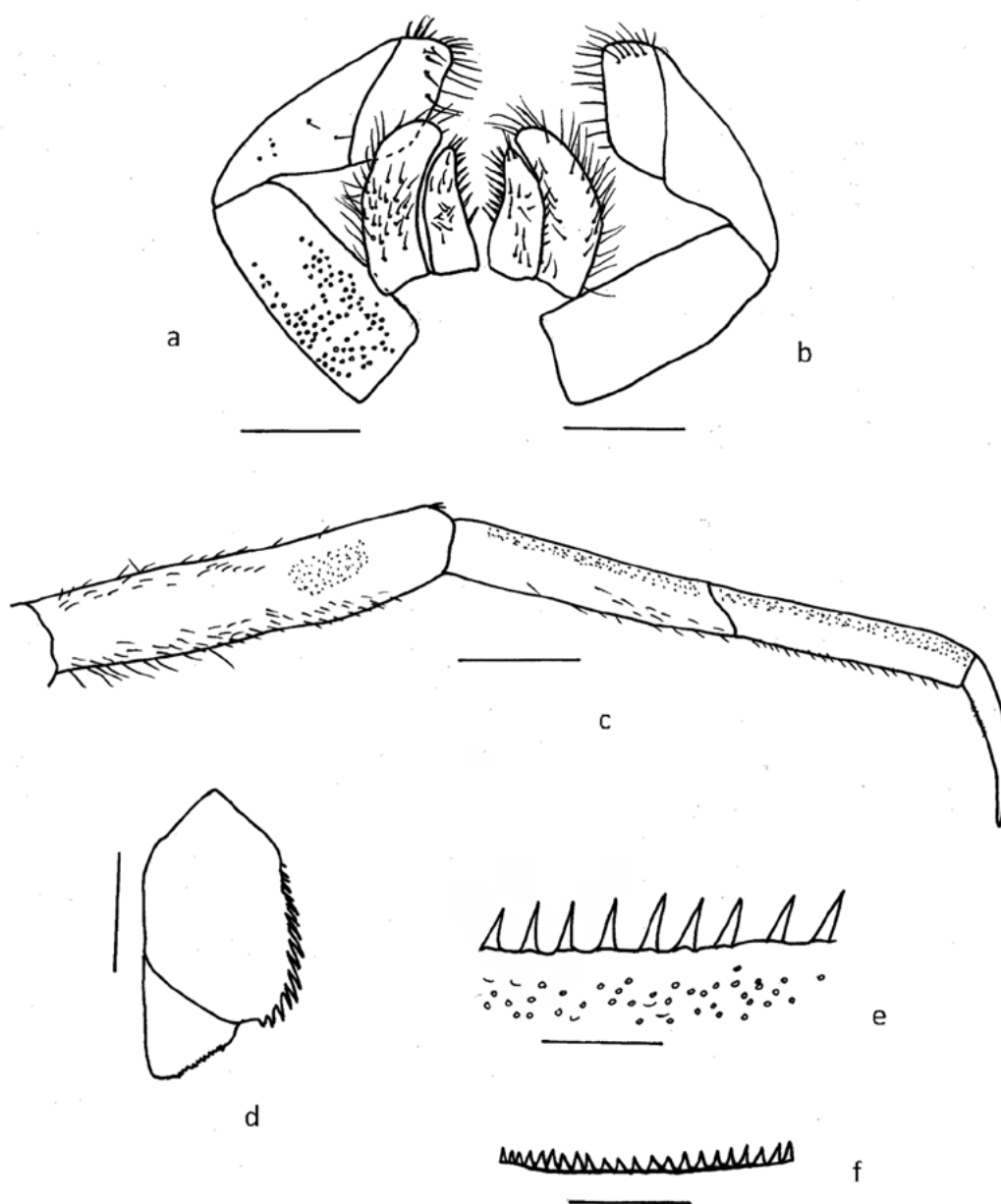


Figure 24. *Skolomystax vulgaris*: a, labium dorsal; b, labium ventral; c, leg; d, paraproct; e, tergite spines; f, sternite spines. Scale lines: a–f = 0.15 mm.

segment II apically expanded and longer on outer margin than inner margin, dorsal surface with oblique row of fine setae distally, ventral surface with scattered fine setae; segment III subrectangular and slightly falcate, with 11–21 long robust and short fine setae on margins, dorsal surface with long robust setae distally, ventral surface with scattered fine setae. Segment ratios, 1.00 (0.28–0.38 mm) : 0.74–1.09 : 0.19–0.25.

Legs: foreleg length 2.34–3.18 mm, with segment ratios of 1.00 (0.92–1.35 mm) : 0.54–0.67 : 0.61–0.78 : 0.32–0.43. Fore femur

4.02–5.81 times longer than wide at midpoint and with indistinct subapical dark band; dorsal margin of fore femora with row of 12–23 short sharply pointed robust setae and with subapical setae usually short and blunt (globular); anterior surface with 3–4 scattered rows of sharply pointed robust setae just below dorsal margin, ventral half with numerous sharply pointed robust setae; ventral margin with 10–17 sharply pointed robust setae. Fore tibia outer margin without robust setae, darker band along outer margin, inner margin with 5–17 long pointed robust setae and few scattered hair-like setae. Fore tarsus outer margin

lacking spines, darker along outer margin, inner margin with distinct row of 21–30 long sharply pointed setae and several scattered long robust setae appearing as additional rows, some robust setae may be slightly fimbriate distally. Tarsal claw length 0.48–0.61 times tarsus length, with two similar rows of denticles in basal half. Middle leg (fig. 24c) length 1.71–2.89 mm, with ratios of 1.00 (1.06–1.50 mm) : 0.50–0.67 : 0.51–0.68 : 0.29–0.38. Middle femur 4.58–6.89 times longer than wide at midpoint and with subapical dark band; dorsal margin of middle femora with row of 12–25 short sharply pointed robust setae and with subapical setae usually short and blunt (globular); anterior surface with 3–4 scattered rows of sharply pointed robust setae just below dorsal margin, ventral half with numerous sharply pointed robust setae; ventral margin with 10–29 sharply pointed robust setae. Middle tibia outer margin usually without robust setae but may have a single setule, slightly darker along outer margin, inner margin with 6–19 long pointed robust setae and few scattered hair-like setae. Middle tarsus outer margin lacking spines, slightly darker along outer margin, inner margin with distinct row of 15–27 long sharply pointed setae and several scattered long robust setae appearing as additional rows, some of robust setae may be slightly fimbriate distally. Tarsal claw length 0.53–0.66 times tarsal length, with two similar rows of denticles in basal half. Hind leg length 2.25–3.23 mm, with ratios of 1.0 (1.08–1.48 mm) : 0.51–0.66 : 0.52–0.59 : 0.29–0.39 (femur : tibia : tarsus : claw measured on outer margin). Hind femur 4.31–7.00 times longer than wide at midpoint and with dark band along outer margin; dorsal margin of hind femora with row of 8–27 short sharply pointed robust setae and with subapical setae usually short and blunt (globular); anterior surface with 3–4 scattered rows of sharply pointed robust setae just below dorsal margin, ventral half with numerous sharply pointed robust setae; ventral margin with 2–22 sharply pointed robust setae. Hind tibia outer margin without robust setae, but may have sparse fine hair-like setae, slightly darker along outer margin, inner margin with 16–22 long pointed robust setae and few scattered hair-like setae. Hind tarsus outer margin lacking spines but may have a sparse fine hair-like setae slightly darker along outer margin, inner margin with distinct row of 15–27 long sharply pointed setae and several scattered long robust setae appearing as additional rows, some robust setae may be slightly fimbriate distally. Tarsal claw length 0.56–0.67 times tarsal length, with two similar rows of denticles in basal half.

Abdomen: abdominal tergites with a distinct colour pattern (fig. 25k), segments VII, VIII and X light, other segments mostly dark. Abdominal terga I–X with numerous long spines on posterior margins, those on posterior segments 1.83–3.25 times longer than basal width, bases of spines separated by greater than spine width (fig. 24e). Surfaces of terga with pointed scales and scale bases. Sterna IV–IX or V–IX with spines on posterior margin, spine length 1.60–3.14 times width, bases contiguous (fig. 24f). Surfaces of sterna with scale bases. Paraprocts (fig. 24d) with 18–22 marginal spines, surface lacking long fine setae, scale bases sparse. Cerci and terminal filament subequal in size, slightly darkened distally, every other articulation darkly coloured, and inner surfaces with long fine setae nearly to apex.

Adults: unknown.

Etymology: “Vulgaris” is Latin for “common”.

Distribution: Widespread in Vic and NSW.

Discussion

The absence of robust setae on the outer margins of the tibiae differentiates *S. vulgaris* from *S. elongatus*, *S. paschei* and *S. brevis*. *Skolomystax vulgaris* is most similar to *S. chionotos*, *S. goorudensis*, and *S. tasmaniensis*. The absence of short spines between the long spines on the posterior margins of the terga and shallower labral angle distinguish *S. vulgaris* from *S. goorudensis*, and *S. tasmaniensis* is restricted to Tas and has the inner margin of the left inner incisor rugose, rather than smooth. *Skolomystax vulgaris* differs from *S. chionotos* in having the second maxillary palp shorter than the third.

Skolomystax collendus (Harker, 1957) n.comb.

Discussion. We have found no specimens that match the description of the male subimago or nymph described by Harker (1957), and we have been unable to locate the type material. Harker (1957) stated type material was deposited in the British Museum, but it has no record of the types and this material was not deposited in the Australian Museum where Harker placed material from earlier papers. Therefore, we consider this species of uncertain status until collections are made at the type locality. The hindwing illustrated by Harker (1957: 75, fig. 59) shows three unforked longitudinal veins with several crossveins between them and a sharply pointed costal projection that differentiates it from the other adults we have seen. The nymphal description is not sufficiently detailed to be of diagnostic value. It is possible *S. collendus* is conspecific with *S. dyarrii*, as suggested by Webb and Suter (2011), because both are known from the area around Sydney, NSW. Consistent with this is the presence of teeth on the inner margin of the outer incisors of the left mandible and a rugose base of the inner incisors, as illustrated by Harker (1957: 75). In addition, *S. dyarrii* has a short second segment of the maxillary palp and the basal segment is nearly as long as the galealacinia, as noted by Harker (1957: 76) for *S. collendus*. However, the illustration of the left mandible by Harker (1957) shows distinct teeth on the outer margin of the outer incisor, a characteristic we have not observed in any specimens of *Skolomystax*.

Key to nymphs of *Skolomystax* from Australia

- 1 Legs with spine-like setae on the outer (dorsal) margins of tibiae and tarsi (figs. 3a, 5c, 20g) 2
- 1' Legs lacking spine-like setae on the outer margin of tibiae and usually on the tarsi, very rarely with one or two present (figs. 7c, 9a, 11f, 13c, 15a, 18d, 22c, 24c) 4
- 2(1) Dark brown markings on head, mandibles and labrum (figs. 4e, 5d); sternite spines on distal margin of abdominal segments V–IX conical with bases contiguous (fig. 4j; spines on distal margin of tergites long and widely spaced at base (fig. 4i) *Skolomystax brevis*

- 2' Head, mandibles and labrum without distinct brown markings; sternite spines on distal margin of abdominal segments II–IX or III–IX, tergites and sternite spines long with alternating shorter spines (figs. 2f–g, 19f–g) 3
- 3(2) Labrum with notch with margins angled, notch depth >25% of total length (figs. 2a, b); segment I of maxillary palp long, extending to apical third of galealacinia, segments I+II length extends beyond apex of galealacinia (fig. 2c); fore femur with <25 setae on outer margin and <35 on inner margin; mid-tibia with <20 setae on outer margin and <25 setae on inner margin; hind tarsus with <25 spines on the inner margin *Skolomystax elongatus*
- 3' Labrum with notch margins parallel (square notch), notch depth <22% of total length (figs. 19a, b); segment I of maxillary palp long, extending to mid-third of galealacinia, segments I+II length extends to apex of galealacinia (fig. 19c); fore femur with >35 setae on outer margin and >35 on inner margin; mid-tibia with >25 setae on outer margin and >25 setae on inner margin; hind tarsus with >30 spines on the inner margin *Skolomystax paschei*
- 4(1) Body with numerous small dark spots (figs. 18c, 25h–j); canines of maxillae distinctly broader than lacinial setae; left mandible with inner margin of outer incisors with 1–3 small indistinct spines (figs. 14h, 17h); northern Australia 5
- 4' Body lacking numerous small dark spots (figs. 25d–g, 25l–m); canines of maxillae similar to lacinial setae; left mandible with inner margin of outer incisors with 2–5 distinct spines (figs. 6g, 8g, 10g, 12g, 21g, 23g), southern Qld, southeast mainland Australia, and Tas. 6
- 5(4) Maxillary palp long, with apex of segment II extending beyond apex of galealacinia (fig. 14c); sternite spines on abdominal segments IV–IX *Skolomystax hawkingi*
- 5' Maxillary palp short, with apex of segment II not extending beyond apex of galealacinia (fig. 17c); sternite spines on abdominal segments V–IX *Skolomystax leichhardti*
- 6(4) Sternite spines on distal margin of abdominal segments VI–IX or VII–IX 7
- 6' Sternite spines on distal margin of abdominal segments IV–IX or V–IX 8
- 7(6) Femora with distinct elongate sub-apical spot; maxillary palp segment II equal in length to segment III (fig. 10c); left mandible with inner margin of outer incisor with two teeth (fig. 10g), sternite spines on distal margin of abdominal segments VI–IX *Skolomystax gippslandicus*
- 7' Femora without distinct sub-apical spot; maxillary palp segment II shorter than segment III (fig. 8c); left mandible with inner margin of outer incisor with four teeth (fig. 8g), sternite spines on abdominal segments VI–IX or VII–IX *Skolomystax dyarri*
- 8(6) Tergite X tinged dark; tergite spines long but with occasional short spines; left mandible with outer incisor with three teeth on inner margin (fig. 12g) *Skolomystax goorudensis*
- 8' Tergite X light; tergite spines all long (figs. 7e, 22e, 24e); left mandible outer incisor with 3–5 teeth on the inner margin (figs. 6g, 21g, 23g) 9
- 9(8) Maxillary palp segment II longer than segment III (fig. 6c) with segment I extending nearly to apex of galealacinia; left mandible with base of inner incisors rugose (fig. 6g); labial notch angle <100° (fig. 6a) *Skolomystax chionotos*
- 9' Maxillary palp segment II shorter than segment III (figs. 21c, 23c) with segment I extending no more than to the apical third of galealacinia; labial notch angle >100° (figs. 21a, 23a) 10
- 10(9) Maxillary palp segment II shorter but almost equal to segment III (fig. 23c); left mandible with base of inner incisors smooth (fig. 23g); Australian mainland *Skolomystax vulgaris*
- 10' Maxillary palp segment II shorter than segment III (fig. 21c); left mandible with base of inner incisors rugose (fig. 21g); endemic to Tasmania *Skolomystax tasmaniensis*

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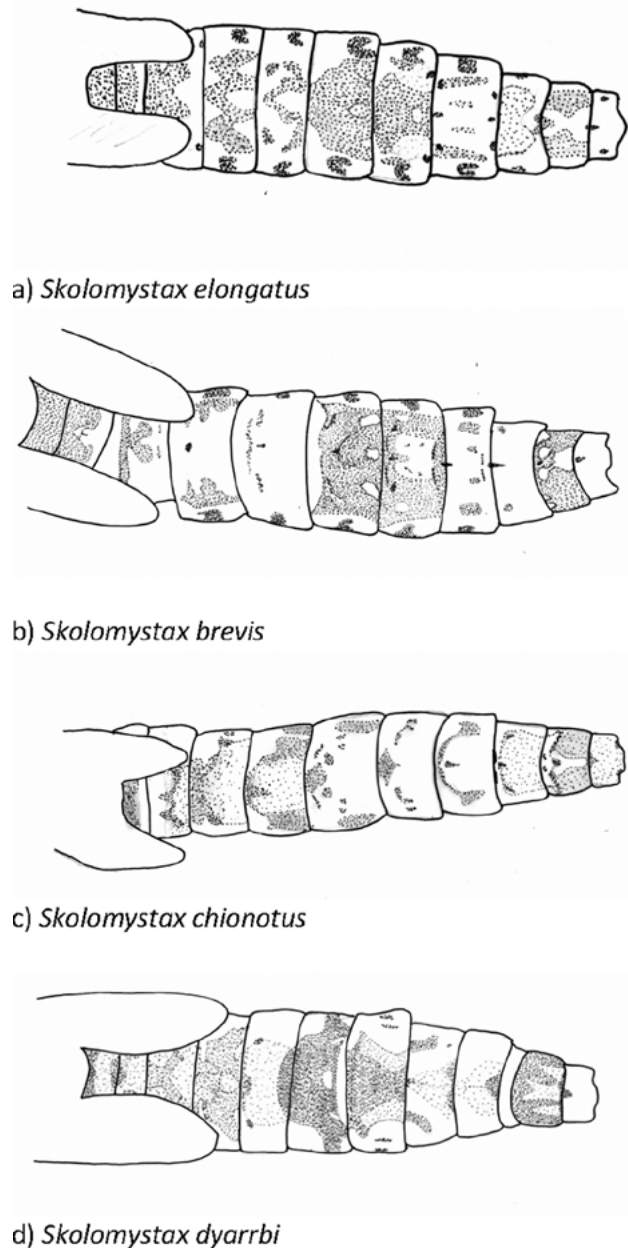
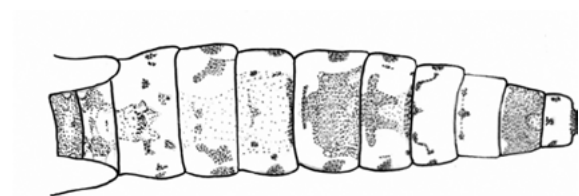
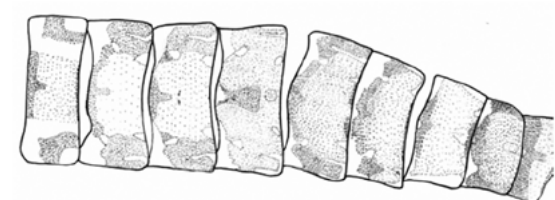


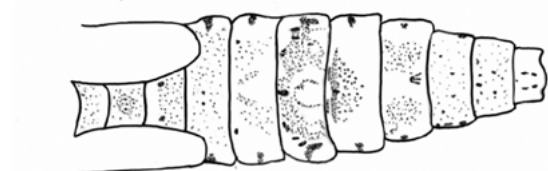
Figure 25. *Skolomystax* spp dorsal colour patterns of nymphs.



e) *Skolomystax gippslandicus*



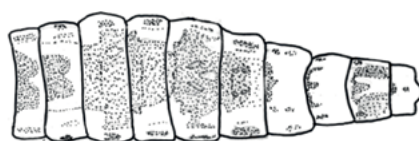
f) *Skolomystax goorudensis*



g) *Skolomystax hawkingi*



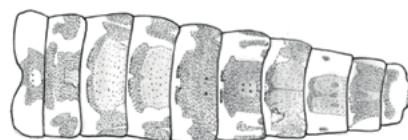
h) *Skolomystax leichhardti*



i) *Skolomystax paschei*



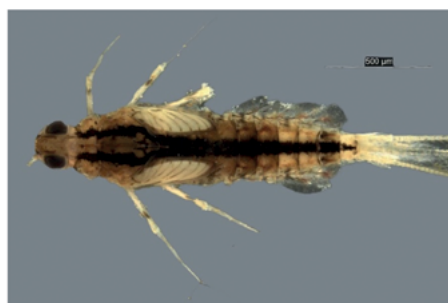
j) *Skolomystax tasmaniensis*



k) *Skolomystax vulgaris*



l) *Skolomystax elongatus* (Black stripe).



m) *Skolomystax leichhardti* (Black stripe)

Figure 25 (Continued) *Skolomystax* spp dorsal colour patterns of nymphs.

Supplementary Table 1. Genbank sequence data used as a genetic backbone for the morphological examination of *Skolomystax* species. Genbank accession numbers, type status, specimen voucher code and new species determinations for the sequences (Chakrabarty et al., 2013)

Taxon	Identifier	Type Status	GenBank# (COI)	GenSeq designation	Specimen Voucher Code
<i>Callibaetis</i>	JWA1682		OP709301	genseq-4 COI	JWA1682
<i>Centropitulum luteolum</i>	JWA1860		OP709304	genseq-4 COI	JWA1860
<i>Neocloeon triangulifer</i>	JWA1680		OP709300	genseq-4 COI	JWA1680
<i>Offadens sp1</i>	JWA1146		OP709285	genseq-4 COI	JWA1146
<i>Skolomystax brevis</i>	JWA394	holotype	OP709290	genseq-1 COI	ANIC6-000083
<i>Skolomystax brevis</i>	JWA1303	paratype	OP709295	genseq-2 COI	ANIC6-000086
<i>Skolomystax brevis</i>	JWA1281	paratype	OP709298	genseq-2 COI	ANIC6-000085
<i>Skolomystax chionotos</i>	JWA753	holotype	OP709308	genseq-1 COI	ANIC6-000104
<i>Skolomystax dyarrii</i>	JWA1304	holotype	OP709299	genseq-1 COI	ANIC6-000100
<i>Skolomystax dyarrii</i>	JWA1983	paratype	OP709309	genseq-2 COI	ANIC6-000101
<i>Skolomystax elongatus</i>	JWA766		OP709292	genseq-3 COI	JWA766
<i>Skolomystax elongatus</i>	JWA1251		OP709297	genseq-3 COI	JWA1251
<i>Skolomystax elongatus</i>	110357		OP709313	genseq-3 COI	110357
<i>Skolomystax gippslandicus</i>	JWA1731	holotype	OP709302	genseq-1 COI	ANIC6-000097
<i>Skolomystax gippslandicus</i>	JWA2883		OP709312	genseq-3 COI	JWA2883
<i>Skolomystax gippslandicus</i>	JWA2884	paratype	JN289957	genseq-2 COI	JWA2884
<i>Skolomystax gippslandicus</i>	JWA2885	paratype	JN289958	genseq-2 COI	JWA2885
<i>Skolomystax hawkingi</i>	JWA1819	paratype	OP709296	genseq-2 COI	ANIC6-000094
<i>Skolomystax hawkingi</i>	JWA750		OP709307	genseq-3 COI	JWA750
<i>Skolomystax leichhardti</i>	JWA2485		OP709305	genseq-3 COI	JWA2485
<i>Skolomystax tasmaniensis</i>	JWA290		OP709287	genseq-3 COI	JWA290
<i>Skolomystax tasmaniensis</i>	JWA343	paratype	OP709288	genseq-2 COI	ANIC6-000113
<i>Skolomystax tasmaniensis</i>	JWA357	holotype	OP709289	genseq-1 COI	ANIC6-000111
<i>Skolomystax tasmaniensis</i>	JWA342	paratype	OP709306	genseq-2 COI	ANIC6-000112
<i>Skolomystax vulgaris</i>	JWA85	holotype	OP709286	genseq-1 COI	ANIC6-000106
<i>Skolomystax vulgaris</i>	JWA637	paratype	OP709291	genseq-2 COI	ANIC6-000108
<i>Skolomystax vulgaris</i>	JWA1233	paratype	OP709293	genseq-2 COI	ANIC6-000107
<i>Skolomystax vulgaris</i>	JWA1234		OP709294	genseq-3 COI	JWA1234
<i>Skolomystax vulgaris</i>	JWA1755	paratype	OP709303	genseq-2 COI	ANIC6-000109
<i>Skolomystax vulgaris</i>	JWA2288		OP709310	genseq-3 COI	JWA2288
<i>Skolomystax vulgaris</i>	JWA2289		OP709311	genseq-3 COI	JWA2289