

Chapter 15 Order Ephemeroptera

The Ephemeroptera, or mayflies, is the most primitive and ancient group of aquatic insects. They have two adult stages, the **subimago** and the **imago**. Both adult stages are short lived and do not feed. Mayflies are cosmopolitan and found in various freshwater habitats ranging from streams and rivers to standing ponds. Taxon richness is greater in lotic habitats. All nymphal stages are aquatic. Nymphs have gills on various abdominal segments, and the last abdominal segment bears three **caudal filaments**, although occasionally the middle one is absent or reduced. Nymphs feed mainly on algae on rock surfaces, on fine-particle detritus or on suspended particles. Only a very few mayflies are predators. Mayflies are used extensively as indicators to assess pollution and environmental change.

Ephemeroptera is a small order of insects, with about 3,000 described species and more than 375 genera and 37 families (Brittain & Sartori, 2003). The ephemeropteran fauna of the Indochina region is relatively poorly studied compared to that of temperate regions (Soldán, 2001). Only the Leptophlebiidae, Neoephemeridae and Potamanthidae have been treated in detail (Peters & Edmund, 1970; Bae & McCaffery, 1991, 1998). To date, approximately 58 genera and species of 18 ephemeropteran families have been recorded from the region, and many unclear taxonomic identifications at the generic level remain. This reflects a need in taxonomic studies for the immature stages to be associated with their respective adults. The following keys of Ephemeroptera of Indochina are modified from several publications (Allen, 1971; Bae & McCafferty, 1991, 1998; Dudgeon, 1999; Hubbard, 1994; Nguyen, 2003; Peters, 1967; Peters & Edmunds, 1970; Sites *et al.*, 2001; Soldán & Braasch, 1984).

KEY TO FAMILIES, GENERA AND KNOWN SPECIES OF MATURE MAYFLY NYMPHS (EPHEMEROPTERA) OF INDOCHINA

- 1 Body smooth and hemispherical (beetle-like); all gills and much of the abdomen covered by a thoracic shield (Fig. 1); PROSOPISTOMATIDAE, *Prosopistoma* ... 2
- 1' Body form not as above; abdominal gills partially or completely exposed 5

- 2(1) Mesonotum with posterior and anterior dark brown band separated, with light band as wide as anterior dark one (Fig. 1) *P. funanense*
- 2' Mesonotum with connected band with numerous pale spots or bands separated by narrow W-shaped lighter band (Fig. 2a, 3a) 3

- 3(2') Antennae 4 segmented (Fig. 2c); apical segment of maxillary palps longer than 1/3 length of segment II (Fig. 2b) *P. sinense*
- 3' Antennae usually 5 segmented (sometimes 4 segmented, if 4 segmented they have apical segment of maxillary palps a little shorter than 1/3 length of segment II) ... 4

- 4(3') Apex of inner margin of fore tibiae with 6 or 7 serrated spines (Fig. 3c); segment III of maxillary palps a little shorter than 1/3 length of segment II (Fig. 3b).....
 *P. annamense*
- 4' Apex of inner margin of fore tibia with 8 equal-sized fine serrated spines (Fig. 4b); segment III of maxillary palps a little longer than 1/3 length of segment II
 *P. wouterae*
- 5(1') Head and prothorax with conspicuous crown of bristles; without mandibular tusks; gill ventral; legs are modified for burrowing (Fig. 6a) BEHNINGIIDAE...6
- 5' Head and prothorax lacking crowns of bristles; mandibular tusks present (Fig. 7b); gill lateral or dorsal; legs not modified for burrowing..... 7
- 6(5) Tibiae of hindlegs not reduced (Fig. 5b), tarsi of forelegs fused to tibiae (Fig. 5a), claw present*Protobehningia (P. merga)*
- 6' Tibiae of hindlegs reduced (Fig. 6b), tarsi of forelegs not fused to tibiae (Fig. 6a), claw absent*Behningia*
- 7(5') Mandibles with tusk-like projection (except some species of *Afromera* (Fig. 17) bear atrophied tusk); gill II-VII double and uniform in structure with fringed margin (Fig. 7a,8,16a), gill I variable 8
- 7' Mandibles without tusk-like projection, gills otherwise 19
- 8(7) Legs slender for running or crawling, tibiae cylindrical; gills project laterally (Fig. 7a) 9
- 8' Legs (especially tibiae) robust or flattened for digging; gills angled backwards dorsally over the body (Fig. 16a)..... 14
- 9(8) Mandibular tusks with numerous distinct long setae (Fig. 7b); caudal filaments with inconspicuous fine setae (Fig. 7a)..... EUTHYPLIOCIDAE, *Polyplocia*
- 9' Mandibular tusks lacking long setae (Fig. 8) or have only inconspicuous setae (Fig. 9b); caudal filaments with distinct long setae POTAMANTHIDAE... 10
- 10(9') Mandibular tusks roughly equal to or longer than the length of the head
 *Rhoenanthus*...11
- 10' Mandibular tusks shorter than one half of the length of the head (Fig. 8)
 *Potamanthus (Potamanthodes) (P. formosus)*
- 11(10') Mandibular tusks with a large lateral spine (so that the tusks appear forked) (Fig. 10); maxillary palp slender, with weakly-developed setae on the terminal segment*Rhoenanthus (Rhoenanthus)*...12

- 11' Mandibular tusks lack a large lateral spine (not appearing apically forked) (Fig. 9a-b), but sometimes have a small lateral spine; mandibular tusks strongly convergent and abruptly curved inward; maxillary palp thick, with strongly-developed setae on the terminal segment..... *Rhoenanthus (Potamanthindus)*... 13
- 12(11) Leg unicolorous, at most with diffuse smudges; 28-46 simple stout setae and 4-5 bipectinate hair-like setae laterally on mandibles; no medial row of spines developed (Fig. 10) *R. (R.) speciosus*
- 12' Leg with conspicuous dark marking (band and stripes) (Fig. 11b); 40-55 simple stout setae and about 15 simple hair-like long setae laterally on mandibles (Fig. 11c); bipectinate setae absent; medial row of 15-20 spines well developed.....
..... *R. (R.) distafurcus*
- 13(11') Mandibular tusks greatly long (1.4x length of head), gradually curved inward; body large (18.2-21.2 mm) *R. (P.) magnificus*
- 13' Mandibular tusks moderately long (0.8x length of head), abruptly curved inward; body medium sized (12.5-16.7 mm)..... *R. (P.) obscurus*
- 14(8') Tusks curved inwards, inner edges concave (Fig. 12)..... POLYMITARCYIDAE... 15
- 14' Tusks curved outwards, inner edges convex (Fig. 16b) 16
- 15(14) Slender tusk with setae and small tubercles (Fig. 12) ; a single gill on abdominal segment I..... *Ephoron*
- 15' Broad and flat tusks which are strongly toothed close to the apex (Fig. 13).....
..... *Povilla*
- 16(14')..... Broad, flat tusks with outer edge notched; tusks with shallow indentation along outer margin (Fig. 15a-b)..... PALINGENIIDAE
- 16' Tusks smooth and slender (Fig. 14,16b)..... EPHEMERIDAE... 17
- 17(16') Frontal process on the head reduced; rather inconspicuous and not bifid (Fig. 14); mandibular tusks are triangular in cross-section; tarsal claws on forelegs reduced relative to those of the mid- and hindlegs..... *Eatonigenia*
- 17' Frontal process on the head well-developed and bifid (Fig. 16b); mandibular tusks are circular in cross-section; tarsal claws on forelegs not reduce 18
- 18(17') Mandibular tusks well-developed (Fig. 16a-b); abdominal gill I with two lobes of roughly equal size..... *Ephemera*
- 18' Mandibular tusks reduced or atrophied (Fig. 17); abdominal gill I asymmetrical with a relatively large outer lobe *Afromera*
- 19(7') Gills on abdominal segment II large and plate-like (operculate) (Fig. 18a, 19).... 20
- 19' Gills on abdominal segment II not greatly enlarged..... 27

20(19) Gills on abdominal segment II meet along the midline (Fig. 18a, 19).....	
.....NEOEPHEMERIDAE, <i>Potamanthellus</i> ...	21
20' Gills on abdominal segment II overlap along the midline (Fig. 20a).....	
..... CAENIDAE...	23
21(20) Operculate gills with diagonal ridge (Fig. 18a).....	22
21' Operculate gills without diagonal ridge (Fig. 19).....	<i>P. edmundsi</i>
22(21) Dorsal fore femora with transverse row of setae (Fig. 18b), abdominal terga VI- VIII with distinct posteromedian tubercle	<i>P. caenoides</i>
22' Dorsal fore femora without transverse row of setae, abdominal terga VI-VIII with rudimentary posteromedian tubercle	<i>P. amabilis</i>
23(20') Head with ocelli on raised tubercles (Fig. 20b)	24
23' Head lacks ocular tubercles (although ocelli are present)	25
24(23) Femora wide (three times wider than the tibiae); fore coxae nearly contiguous; maxillary and labial palps with 3 segments (Fig. 20c); posterolateral spines on abdomen segments IV-VII (Fig. 20a)	<i>Caenoculis</i>
24' Femora narrow (no more than twice as the tibiae); fore coxae widely separated; maxillary and labial palps with 2 segments; posterolateral spines on abdomen segments III-VI, those on segment VI are strongly bent medially (Fig. 21a-b); the anterior margin of the mesosternum bear numerous long bristles.....	<i>Cercobrachys</i>
25(23') Fore tibiae with two transverse rows of filtering setae (Fig. 22), long setae protruding from the front of the head between and below the antennae; gill covers with a simple ridge	<i>Clypeocaenis</i>
25' Fore tibiae without two transverse rows of filtering setae; gill covers may have a triangular or Y-shaped ridge (Fig. 23a-b)	26
26(25') Gill covers with stout spines on the mesal fork of the triangular ridge; submarginal spine lacking but marginal fringe of hairs is present (Fig. 23b)	<i>Caenodes</i>
26' Gill covers without stout spines on the upper surface, but a row of submarginal spines is present	<i>Caenis</i>
27(19') ..Forelegs with conspicuous rows of long setae along the inner margins of femora and tibiae (Fig. 25b).....	28
27' Forelegs without rows of long setae along the inner margins	29
28(27) Body flat, gills are rather small (Fig. 24)	OLIGONEURIIDAE, <i>Chromarcys</i>
28' Body streamlined (Fig. 25a), possession of coxal gill tufts (Fig. 25b)..... ISONYCHIDAE, <i>Isonychia</i>

29(27')	Flat plate-like head, with dorsally situated eyes, concealing the mouthparts when viewed from above; body dorsoventrally compressed (Fig. 29a, 30a, 32a)	HEPTAGENIIDAE...30
29'	Mouthparts clearly visible from above; head not plate like	41
30(29)	Two filaments at the end of the abdomen.....	31
30'	Three filaments at the end of the abdomen.....	32
31(30)	Gills I-VII modified to form 'sucking disc' (Fig. 26).....	<i>Iron</i>
31'	Gills I-VII not modified to form 'sucking disc' (Fig. 27).....	<i>Epeorus</i>
32(30')	Gills overlap ventrally to form a 'sucking disc' (Fig. 28).....	<i>Rhithrogena</i>
32'	Gills not as above	33
33(32')	Gill I with tracheal tufts well developed and lamellae reduced or vestigial	34
33'	Gill not as above	35
34(33)	Labrum laterally elongated; lamellae of gill III vestigial; lamellae of gill VII with hairs on lateral margin (Fig. 29a-e)	<i>Trichogenia (T. maxillaris)</i>
34'	Labrum laterally triangular; lamellae of gill III developed; lamellae of gill VII without hairs	<i>Paegniodes</i>
35(33')	Spiniform lateral process on segments II-VIII well develop (Fig. 30a-b)	<i>Thalerosphyrus</i>
35'	Lateral processes less well develop or lacking.....	36
36(35')	Lamellae of gills V and VI with pointed apical prolongation (Fig. 31a-b).....	<i>Cinygmina</i>
36'	Gills lamellate without apical prolongation.....	37
37(36')	Gill VII lanceolate with pointed tip, 3x longer than broad and without tracheal tufts (Fig. 33a-b).....	<i>Asionurus (A. primus)</i>
37'	Gill VII not lanceolate, not more than twice as long as broad, with or without tracheal tufts	38
38(37')	Fore femora with patches of stout setae on dorsal surface; gill VII with tracheal tufts	<i>Componeuria (C. thienemanni)</i>
38'	Fore femora without patches of stout setae on dorsal surface; gill VII with or without tracheal tufts	39

39(38')	Caudal filaments with alternating segmented of light and dark bands.....	<i>Ecdyonurus</i>
39'	Caudal filament not as above.....	40
40(39')	Cerci bear spines as well as lateral bristles and segments of the cerci with stout spines alternate with those lacking such spines (Fig. 32); gills I-VII with row of sparse marginal set.....	<i>Rhithrogeniella (R. tonkinensis)</i>
40'	Cerci not as above; gills I-VII without row of sparse marginal setae	<i>Afronurus</i>
41(29')	Gills on abdominal segment II absent (Fig. 34-39)	EPHEMERELLIDAE... 42
41'	Gills on abdominal segment II present (Fig. 44, 45).....	54
42(41)	Larvae with lamellate gills on abdominal segment III-VI; gill III operculate and completely covers the rest of the gill series; head bears tubercle (Fig. 34).....	<i>Hyrtanella</i>
42'	Larvae with lamellate gills on abdominal segment III-VII; gill III maybe semioperculate but does not cover the rest of the gill series completely; head may or may not bear tubercle or spine	43
43(42')	Gills on segment III-VII; gill III enlarged and semioperculate, covering most of remaining gills; maxillary palpi absent	<i>Torleya</i>
43'	Gills on segment III-VII; gill III not enlarged as above; maxillary palpi developed or absent.....	44
44(43')	Femora of mid- and hindlegs expanded and much broader than those of the forelegs; anterolateral corners of the pronotum projecting forward, and the anterior portion of the mesonotum is expanded (Fig. 35-38)	<i>Cincticostella</i> ... 45
44'	Femora of forelegs either at least as broad or broader than those the mid- and hindlegs; pronotum and mesonotum not projecting or expanded.....	48
45(44)	Middle and hind femora narrow and margin entire; head without suboccipital tubercles; head with three pale maculae on fronts; maxillae without palpi (Fig. 35).	<i>C. gosei</i>
45'	Middle and hind femora expand and margin serrate; head with suboccipital tubercles.....	46
46(45')	Abdominal terga with paired submedian tubercles on segments I-X (Fig. 36a); fore femora with median band of tubercles; head, body and legs with numerous pale spots (Fig. 36b-c)	<i>C. insolta</i>
46'	Abdominal terga with paired submedian tubercles on segments II-X; fore femora without median band of tubercles; head, body and legs without numerous pale spots.....	47

- 47(46') Head quadrangular; abdominal terga with paired submedian tubercles on segments II-X (Fig. 37) *C. boja*
- 47' Head round; abdominal terga with paired submedian tubercles on segments IV-IX (Fig. 38) *C. femorata*
- 48(44') Body and appendages covered with long setae (Fig. 39); body lacks tubercles; mandibles are asymmetrical *Crinitella*
- 48' Body not covered with long setae; body with tubercles or spines on the head, thorax or the abdomen 49
- 49(48') Head with spines or tubercles (Fig. 40a); fore femora usually expanded, bearing spines along the anterior margin (Fig. 40b); body robust *Drunella*
- 49' Head lacks spines or tubercles; fore femora not markedly expanded and without spines along the anterior margin 50
- 50(49') Apical mandibular tooth greatly elongated and extending beyond anterior margin of head (Fig. 41) *Kangella (K. brocha)*
- 50' Apical mandibular tooth not greatly elongated and not extending beyond anterior margin of head 51
- 51(50') Mesonotum with an anterolateral spine or projection (Fig. 42) *Ephacerella* ... 52
- 51' Mesonotum lacks lateral spines or projections 53
- 52(51) Mesonotum with long, acute anterolateral spine and without dorsal tubercles
..... *E. longicaudata*
- 52' Mesonotum with rudimentary anterolateral spine and with 5 dorsal tubercles
..... *E. commodema*
- 53(51') Abdominal terga lack paired tubercles; dorsal surface of the body strongly marked with paired longitudinal stripes (Fig. 43) *Uracanthella*
- 53' Abdominal terga with paired tubercles; body *may* lack stripes; maxillary palpi absent *Serratella*
- 54(41') Gills borne dorsally on abdominal segment II-VII 57
- 54' Gills borne laterally on abdominal segment I-VII 55
- 55(54') Median caudal filament absent; posterior margin of abdominal terga I-X each with mid-dorsal tubercle (Fig. 44) TELOGANODIDAE, *Teloganodes (T. tristis)*
- 55' Median caudal filament present 56

- 56(55') Lamellate gills on segment II-VII; head with cephalic horns (Fig. 45)
 VIETNAMELLIDAE, *Vietnamella* (*V. thani*)
- 56' Posterior margin of abdominal terga IV-VI forming mid-dorsal notch; terga II-IX
 expanded laterally and well developed projection (Fig. 46); head without cephalic
 hornTELOGANELLIDAE, *Teloganella* (*T. umbrata*)
- 57(54) Head rectangular; gills various types; terminal filament well-developed (Fig. 49,
 50, 52, 53) LEPTOPHLEBIIDAE...58
- 57' Head round, gills lamellate or plate-like (Fig. 54-59); perminial filament sometimes
 reduced or lacking (Fig. 56, 57) BAETIDAE...64
- 58(57) Abdominal terga extending around to venter of abdomen on segments III-VII
 (Fig. 47)*Isca*
- 58' Abdominal terga extending to lateral sides of abdomen, all abdominal gills lateral
 or dorsal 59
- 59(58') Maxillary and labial palpi greatly elongated and extending beyond side of head
 (Fig. 48); gills present on abdominal segments II-VII, denticle of claws about equal
 length *Choroerterpides*
- 59' Maxillary and labial palpi not greatly elongated and usually not extending beyond
 side of head 60
- 60(59') Middle abdominal gills plate-like with fringed margin (Fig. 49).....*Thraululus*
- 60' Middle abdominal gills without a fringed margin, *may be* plate or leaf-like, or
 bifurcate and long and slender 61
- 61(60') Gill I similar to others in the series (Fig. 50)*Habrophlebiodes*
- 61' Gill I differing from the others 62
- 62(61') Posterolateral spine on abdominal segments III-IX, those on VIII and IX with
 curved inner edge (Fig. 51b), a large tooth-like process on the anterior apex of the
 maxilla (Fig. 51a) *Cryptopenella*
- 62' Posterolateral spine on abdominal segments IV or V-IX; spine on segments VIII
 and IX not as above, no large tooth-like process on the anterior apex of the maxilla
 as above (Fig. 52a)..... *Choroerterpes*...63
- 63(62') Abdominal gills III-VII terminate in 3 slender, subequal process (Fig. 53).....
 *Choroerterpes* (*Euthraululus*)
- 63' Abdominal gills III-VII terminate in 3 processes, with middle one being longer
 than laterals (Fig. 52b)..... *Choroerterpes* (*Choroerterpes*)

- 64(57') Abdominal gills on one or more segments bilamellate (double) (Fig. 54,55)..... 65
64' All abdominal gills single (Fig. 56-59) 66
- 65(64) Lamellae of gills I-VI doubled (Fig. 54), but gill VII is single.....*Cloeon*
65' Lamellae of gills I-V distinctly asymmetrical and bear small dorsal flap (Fig. 55),
gills VI-VII are single.....*Procloeon*
- 66(64') Terminal filament absent or reduced, always shorter than 0.5x cerci (Fig. 58) .. 67
66' Terminal filament developed, always longer than 0.5x cerci (Fig. 60) 71
- 67(66) Abdominal terga with spiniform tubercles (Fig. 56) 68
67' Abdominal terga without spiniform tubercles (Fig. 59) 70
- 68(67) The tergites of the metathorax and the abdomen (I-IX) bear a single median
spiniform tubercle (Fig. 56a).....*Gratia*... 69
68' The tergites bear single median (I-III) or paired submedian dorsal tubercles (IV-IX)
(Fig. 58); apex of labial palp conical.....*Baetiella*
- 69(68) Glossae subequal to paraglossae in length; margin of gills with both scales and
setae (Fig. 57) *G. sororculaenadinae*
69' Glossae shorter than paraglossae ; margin of gills with fine setae (Fig. 56b)
..... *G. narumonae*
- 70(67') Terminal filament shorter than 1/2 length of cerci (Fig. 59a); margin of gills
smooth, without setae (Fig. 59b) *Platybaetis*
70' Terminal filament shorter than 1/4 -1/6 length of cerci; margin of gills with simple
hair-like setae (Fig. 60).....*Acentrella*
- 71(66') Labium with the 2nd and 3rd palpal segments almost completely fused together to
form one large stout segment; tarsal claws without teeth and strongly hooked at
apex (nymph lives in bivalves).....*Symbiocloen (S. heardi)*
71' Labium not as above..... 72
- 72(71') Venter of thorax with distinct thread-like thoracic gills attached near base of
forelegs or hindlegs (Fig. 61b)*Heterocloeon*
72' Venter of thorax without thread-like thoracic gills 73
- 73(71') Dorsal surface of all tibiae with long transverse hair like setae (Fig. 62).....
.....*Centroptella*
73' Dorsal surface of all tibiae without long transverse hair like setae 74

- 74(73') Labial palpi enlarged, terminal segment of maxillary palpi excavate
..... *Labiobaetis*
- 74' Labial palpi not enlarged, terminal segment of maxillary palpi not excavate..... 75
- 75(74') Body colour dark brown, posterior margin of abdominal segment V with row of
acute spines (Fig. 63)..... *Nigrobaetis*
- 75' Body colour light brown, posterior margin of abdominal segment V with row of
blunt setae (Fig. 64)..... *Baetis*

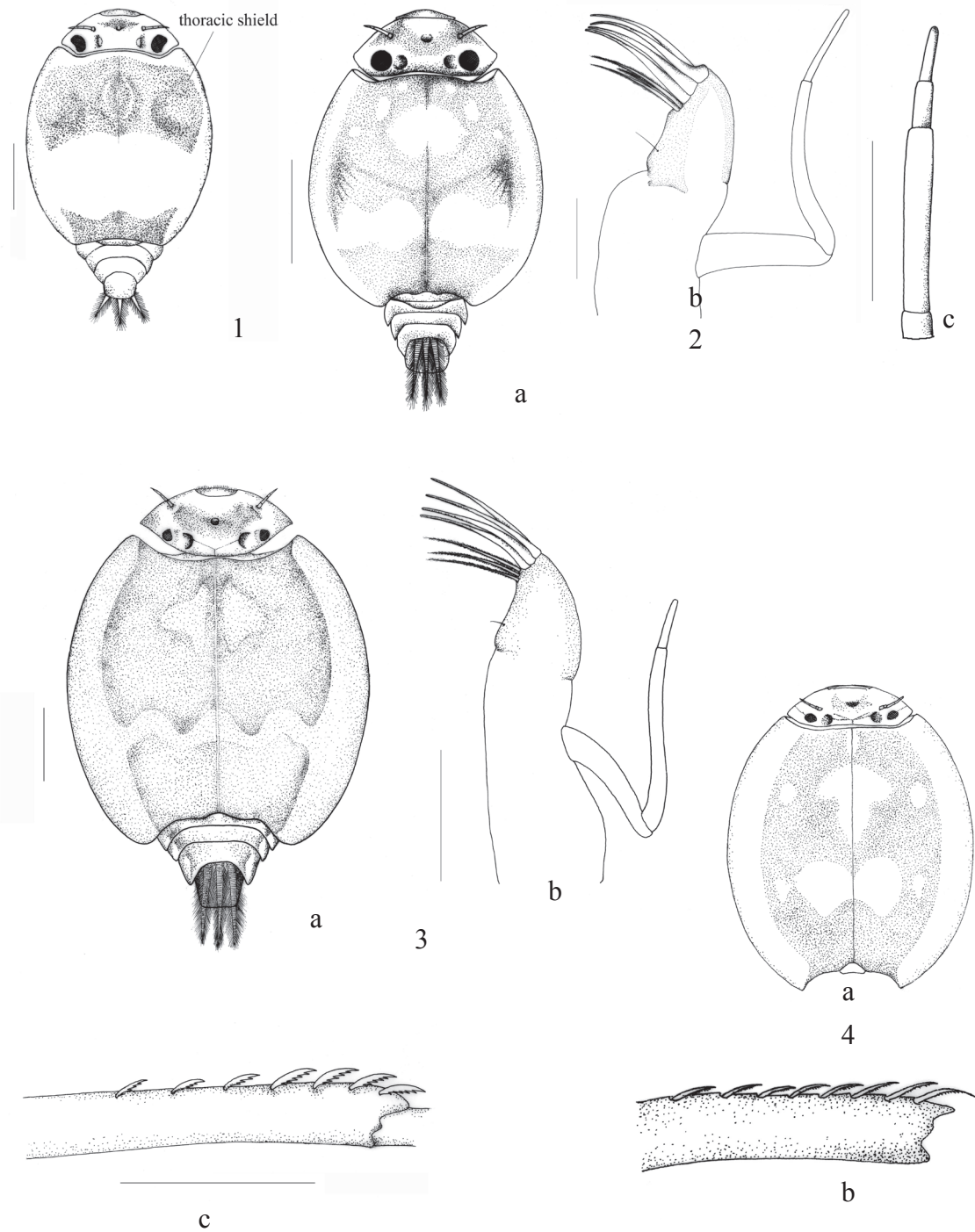


Fig. 1-4 1. Dorsal view of nymph of *Prosopistoma funanense* (redrawn from Soldán & Braasch, 1984, fig. 1); 2. Dorsal view of nymph (a), maxillary palp (b) and antenna (c) of *P. sinense*; 3. Dorsal view of nymph (a), maxillary palp and (b) apex of inner margin of fore tibiae (c) of *P. annamense*; 4. Dorsal view of nymph (a) and apex of inner margin of fore tibiae (b) of *P. wouterae* (redrawn from Peters, 1967, fig. 2, fig. 6).
Scale: (2b, 2c, 3b-c) 0.5 mm; (1, 2a, 3a) 1 mm

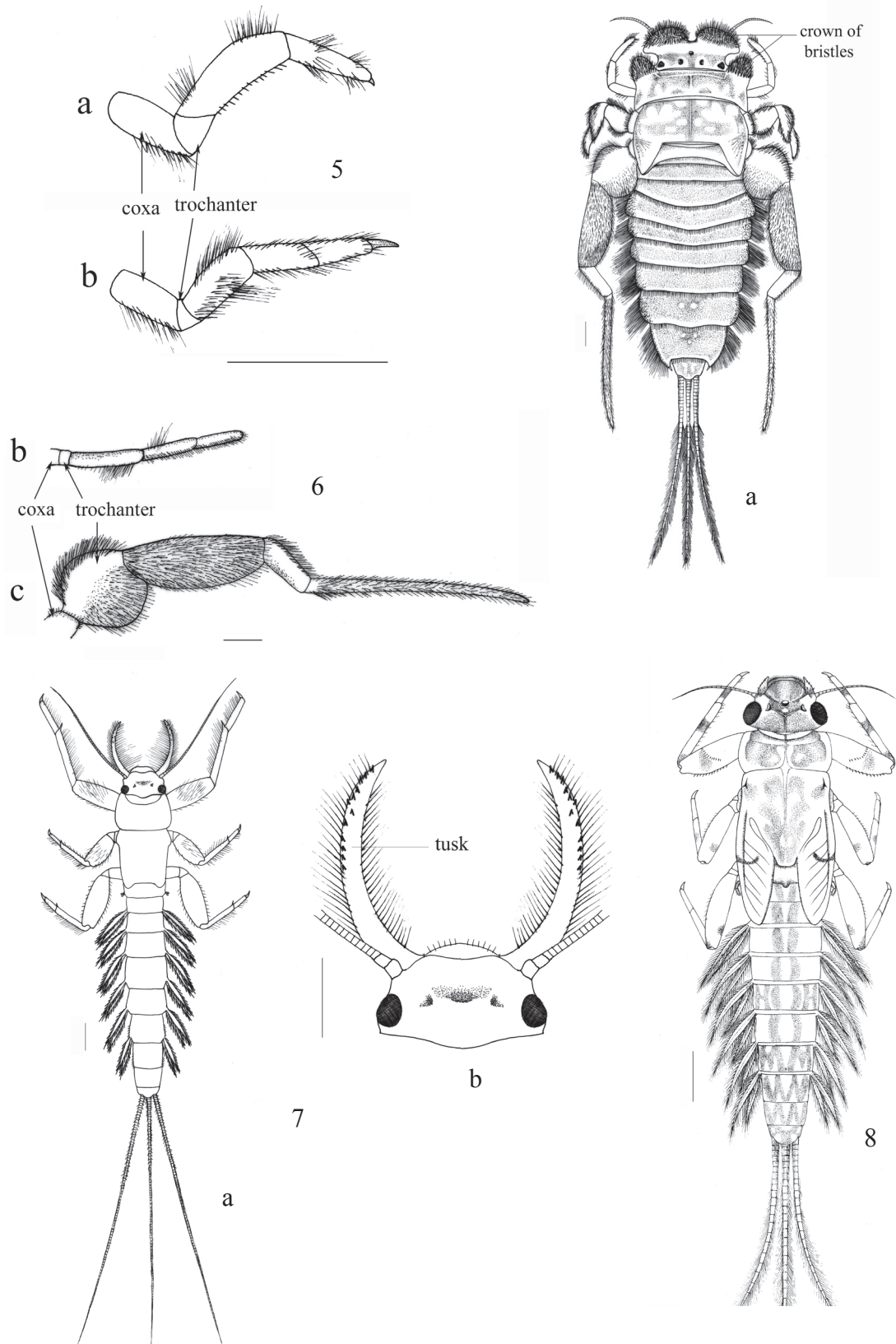


Fig. 5-8 5. Foreleg (a) and hindleg (b) of *Protobehningia merga*; 6. Dorsal view of nymph (a), foreleg (b) and hindleg (c) of *Behningia* sp.; 7. Dorsal view of nymph (a) and dorsal view of head (b) of *Polyplocia* sp.; 8. Dorsal view of nymph of *Potamanthus (Potamanthodes) formosus*. Scale = 1 mm.

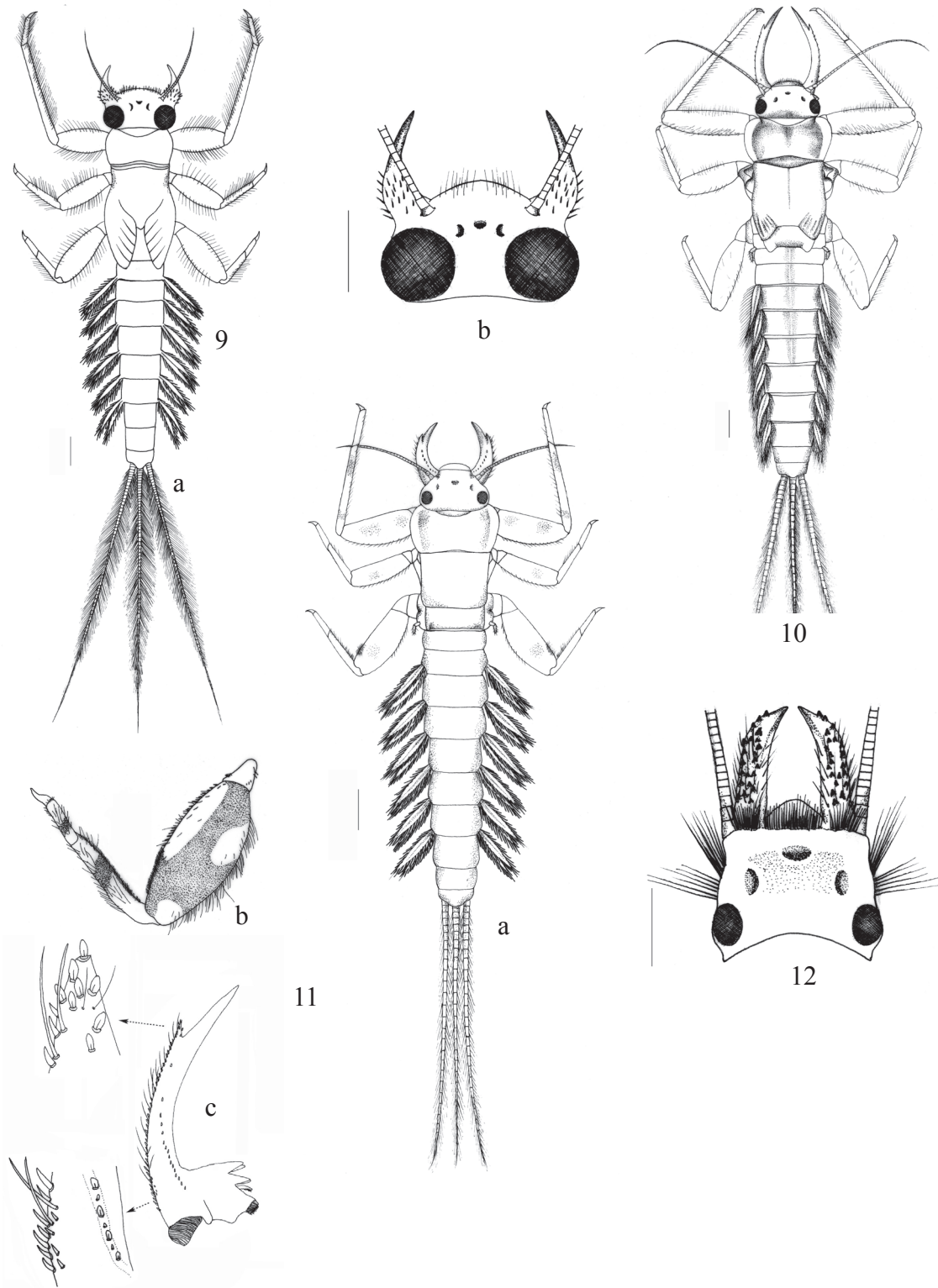


Fig. 9-12 9. Dorsal view of nymph (a) and dorsal view of head (b) of *Rhoenanthus (Potamanthindus) obscurus*; 10. Dorsal view of nymph of *Rhoenanthus (Rhoenanthus) speciosus*; 11. Dorsal view of nymph (a), dorsal view of hind leg (b) and mandibular tusk (c) of *R. (R.) distafurcus* (redrawn from Soldán & Putz, 2000, fig. 3, fig. 10); 12. Dorsal view of head of *Ephoron* sp.
Scale = 1 mm.

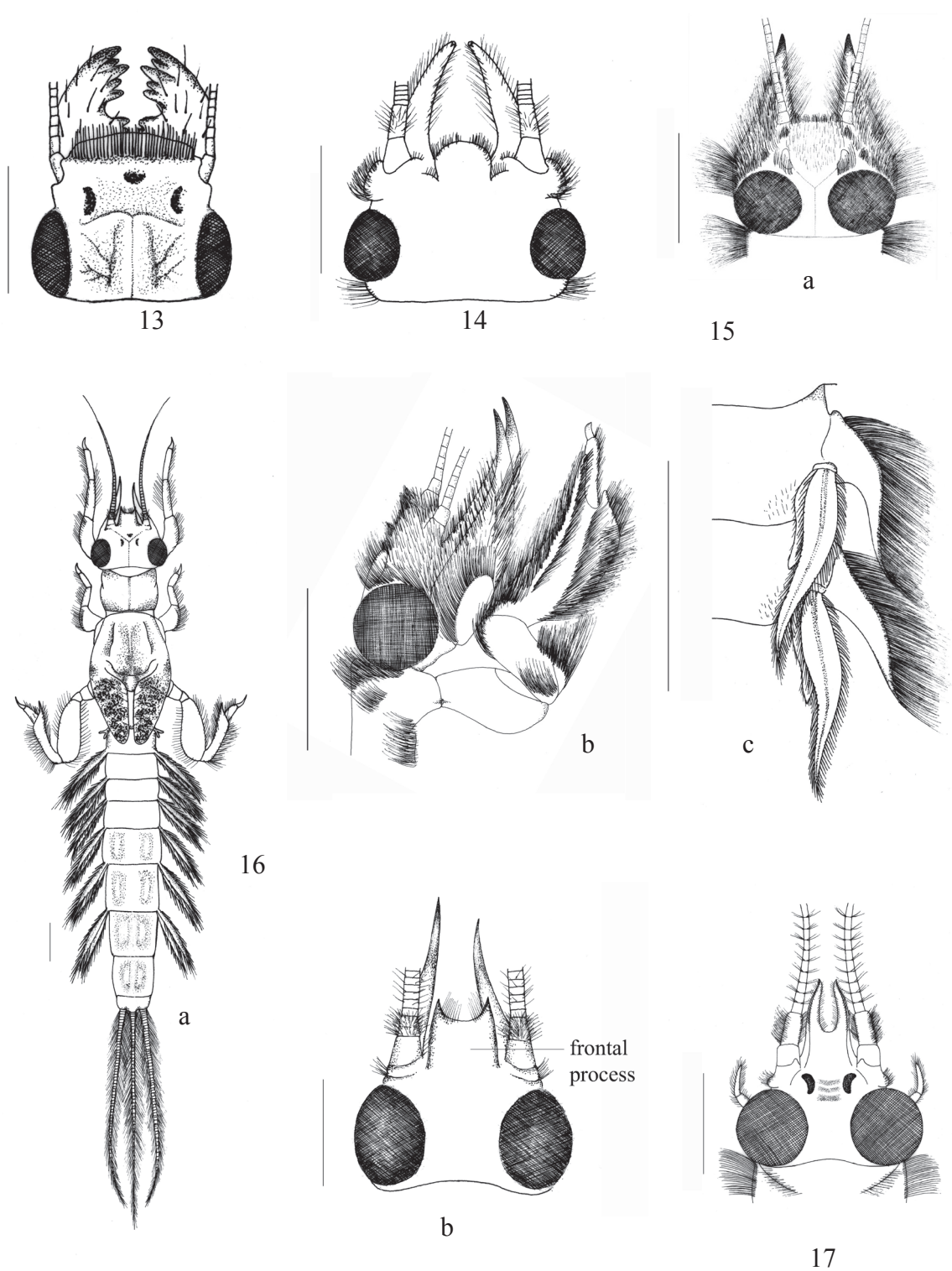


Fig. 13-17 13. Dorsal view of head of *Povilla (Povilla)* sp.; 14. Dorsal view of head of *Eatonigenia* sp. 15. Dorsal view of head (a), side view of head (b) and right abdomen (c) of Palingeniidae; 16. Dorsal view of nymph (a) and dorsal view of head (b) of *Ephemera (Ephemera)* sp.; 17. Dorsal view of head of *Afromera* sp. Scale = 1 mm.

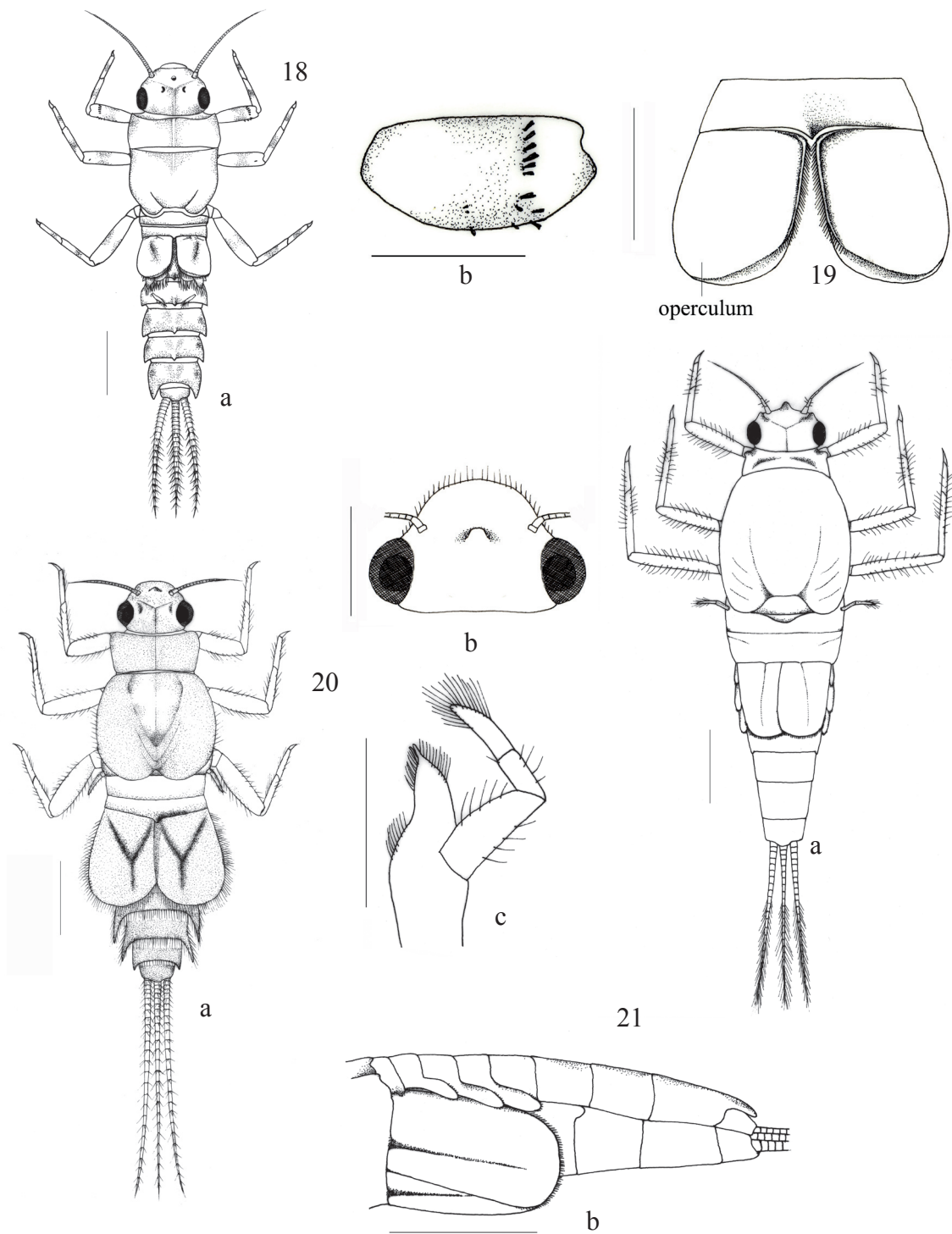


Fig. 18-21 18. Dorsal view of nymph (a) and dorsal view of fore femora (b) of *Potamanthellus caenoides*; 19. Dorsal view of opercular gills of *P. edmundsi*; 20. Dorsal view of nymph (a), dorsal view of head (b) and maxilla (c) of *Caenoculis* sp.; 21. Dorsal view of nymph (a) and side view of abdomen (b) of *Cercobrachys* sp.
Scale: (18b, 20c, 21b) 0.5 mm; (18a, 19, 20a-b, 21a) 1 mm.

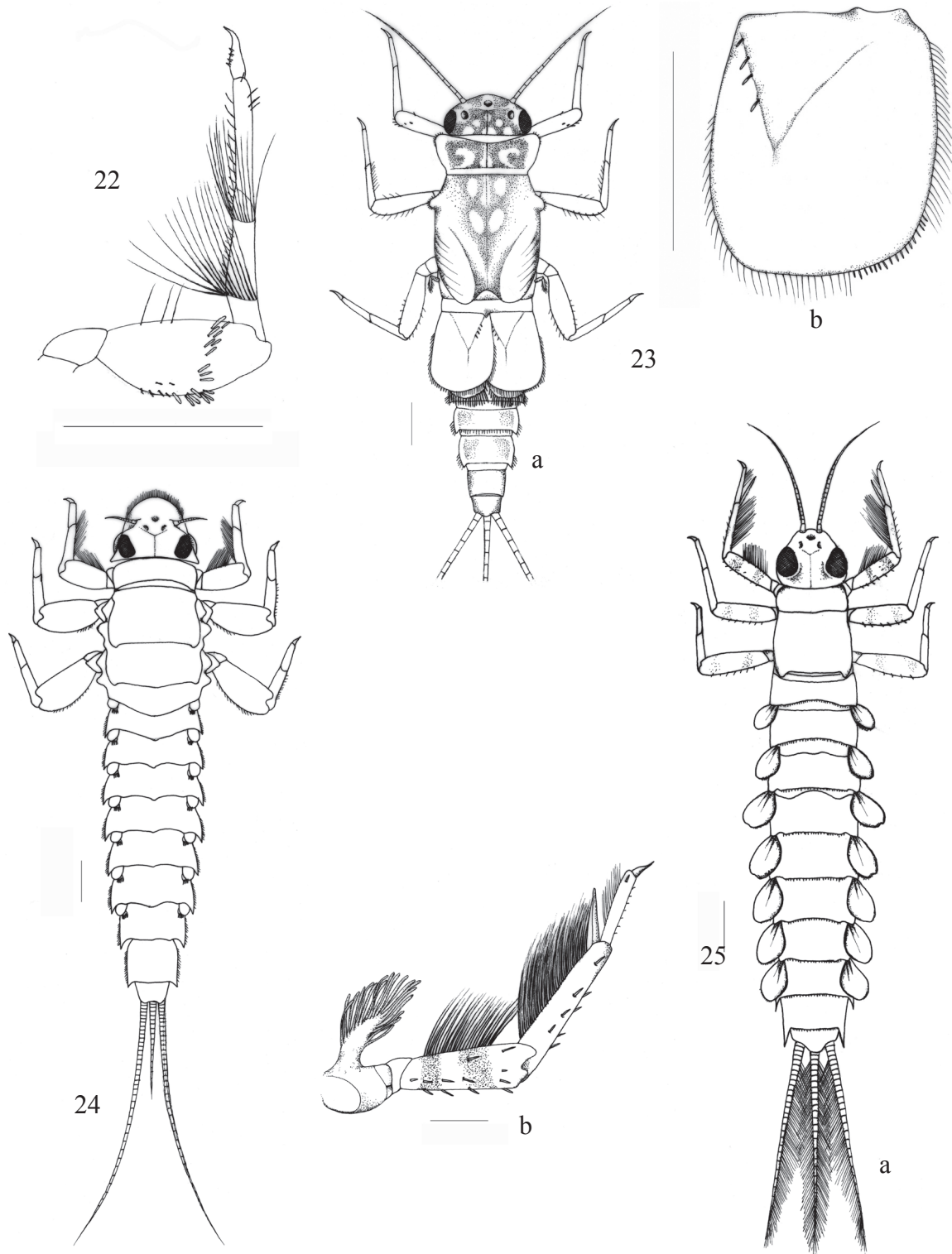


Fig. 22-25 22. Dorsal view of fore leg of *Clypeocaenis* sp.; 23. Dorsal view of nymph (a) and dorsal view of gill cover (b) of *Caenodes* sp.; 24. Dorsal view of nymph of *Chromarcys* sp.; 25. Dorsal view of nymph (a) and dorsal view of fore leg (b) of *Isonychia* sp.
Scale: (22, 23b) 0.5 mm; (23a, 24, 25) 1 mm.

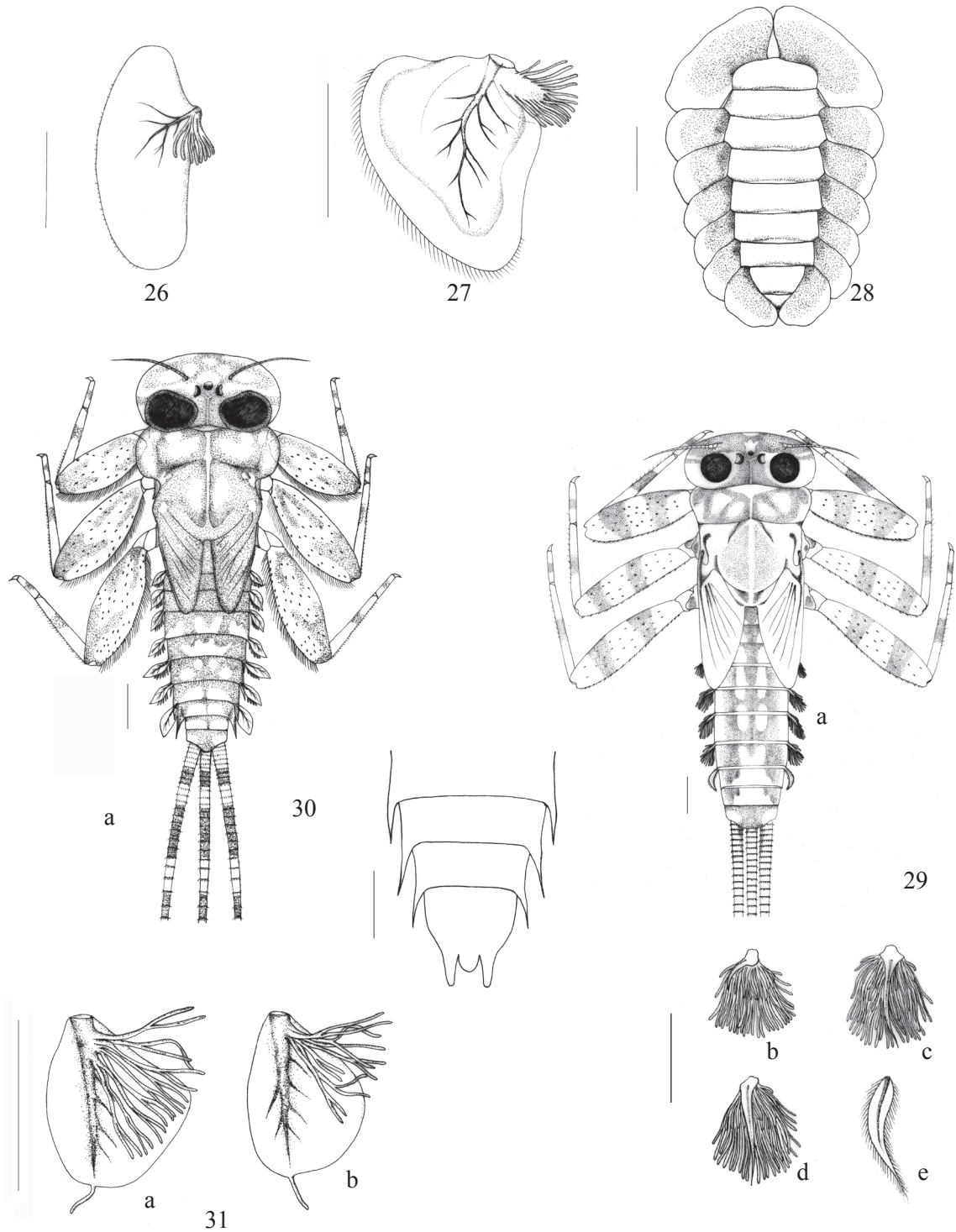


Fig. 26-31. 26. Gill I of *Iron* sp.; 27. Gill I of *Epeorus* sp.; 28. Ventral view of abdomen of *Rhithrogena* sp.; 29. Dorsal view of nymph (a) and gill I (b), III (c), V (d) and VII (e) of *Trichogenia maxillaris*; 30. Dorsal view of nymph (a) and ventral view of abdomen (b) of *Thalerosphyrus* sp.; 31. Ventral view of gills V (a) and VI (b) of *Cinygmina* sp.

Scale: (26, 27, 29b-e, 31) 0.5 mm; (28, 29a, 30) 1 mm.

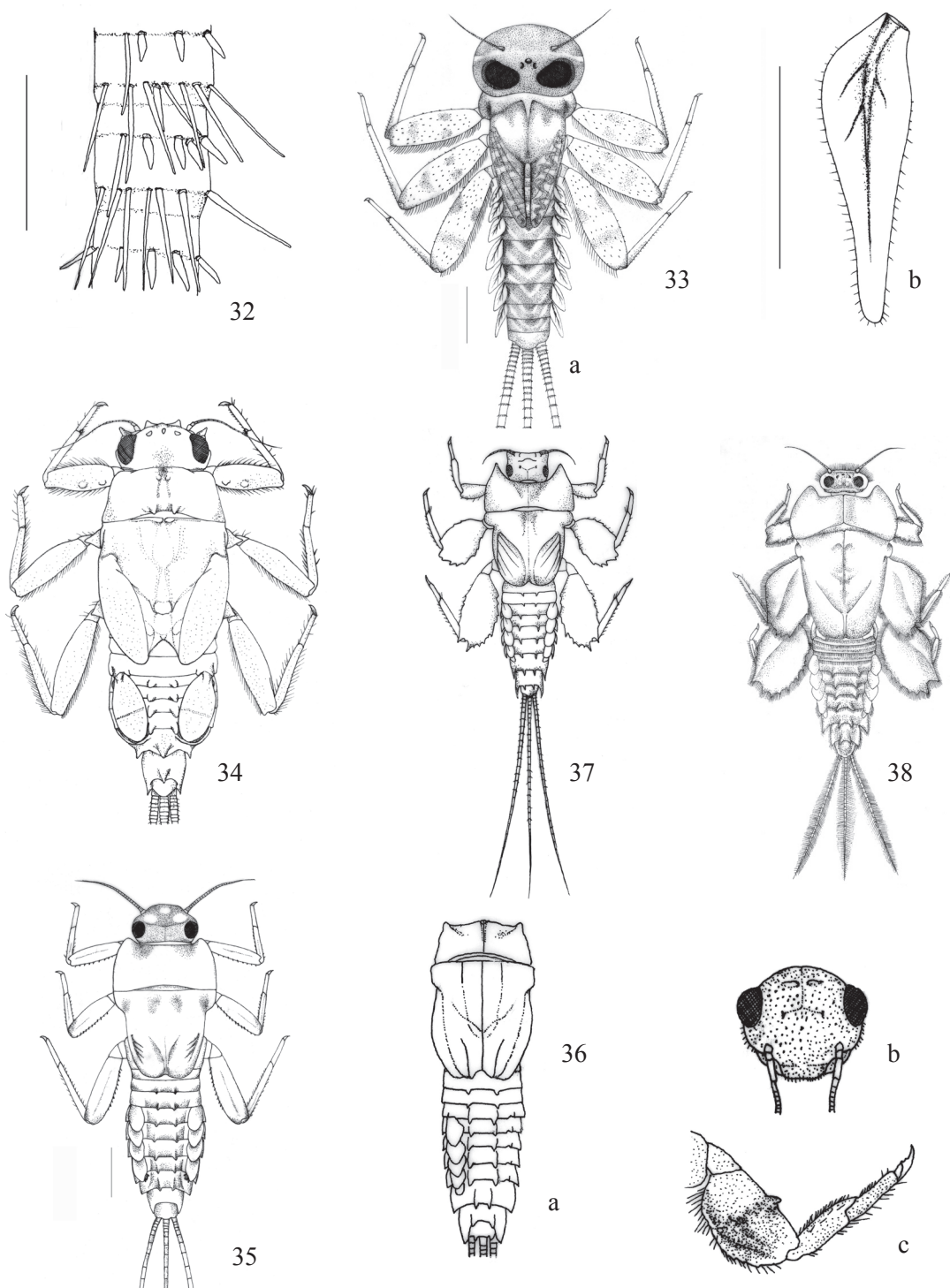


Fig. 32-38. 32. Spines on cerci of *Rhithrogeniella* sp.; 33. Dorsal view of nymph (a) and gill VII (b) of *Asionurus* sp.; 34. Dorsal view of nymph of *Hyrtanella* sp. (redrawn from Allen & Edmunds, 1976, fig.1); 35. Dorsal view of nymph of *Cincticostella gosei* ; 36. Dorsal view of thorax and abdomen (a) head (b) and fore leg (c) of *C. insolta* (redrawn from Allen, 1971, fig. 12, 14, 18); 37. Dorsal view of nymph of *C. boja* (redrawn from Gose, 1961, fig. 23); 38. Dorsal view of nymph of *C. femorata* (redrawn from Tshernova, 1972, fig. 5). Scale: (32, 33b) 0.5 mm; (33a, 34, 35, 37, 38) 1 mm.

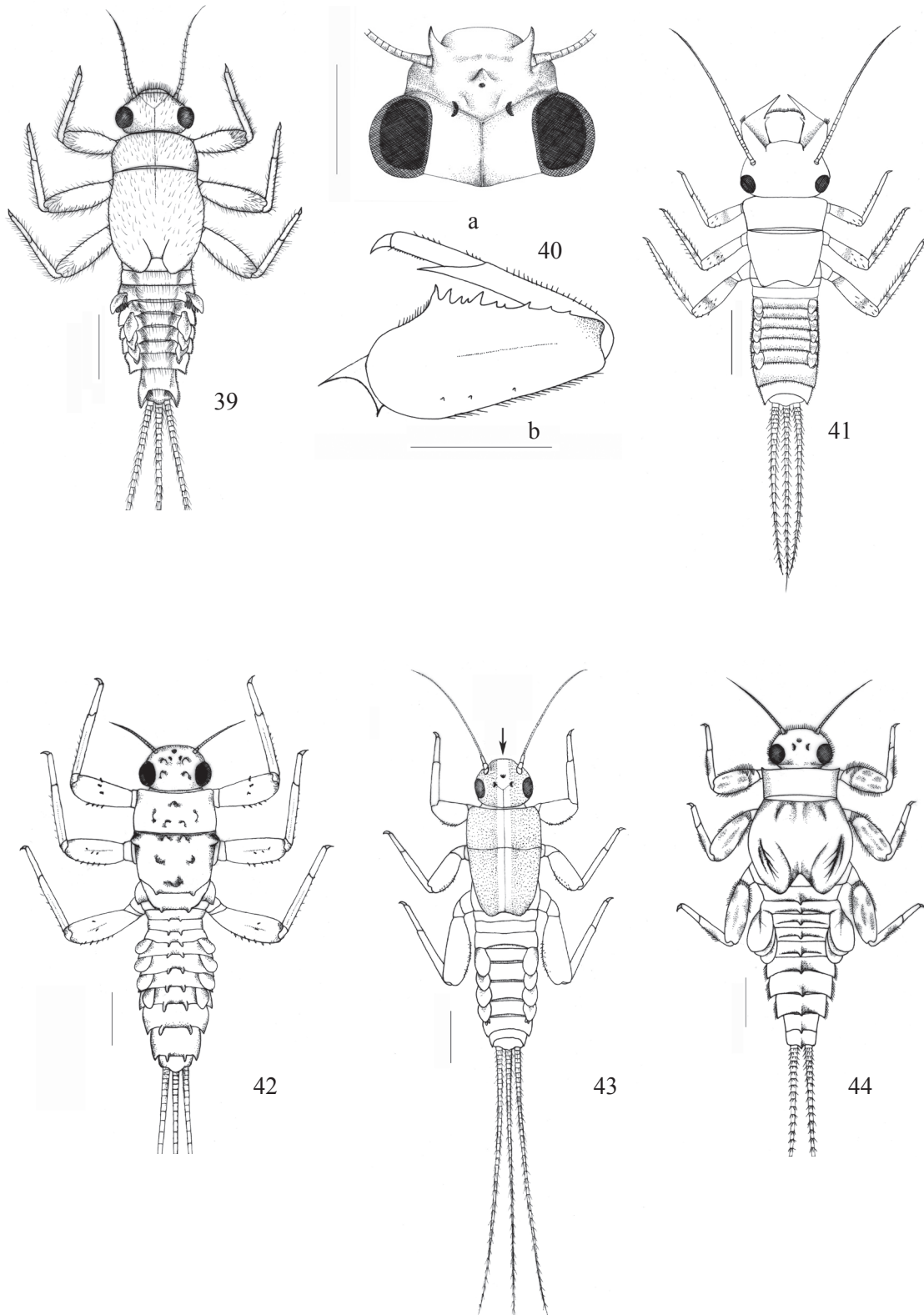


Fig. 39-44 39. Dorsal view of nymph of *Crinitella* sp.; 40. Dorsal view of head (a) and fore femur (b) of *Drunella* sp.; 41. Dorsal view of nymph of *Kangella* sp.; 42. Dorsal view of nymph of *Ephacerella commodema*; 43. Dorsal view of nymph of *Uracanthella* sp.; 44. Dorsal view of nymph of *Teloganodes* sp. Scale = 1 mm.

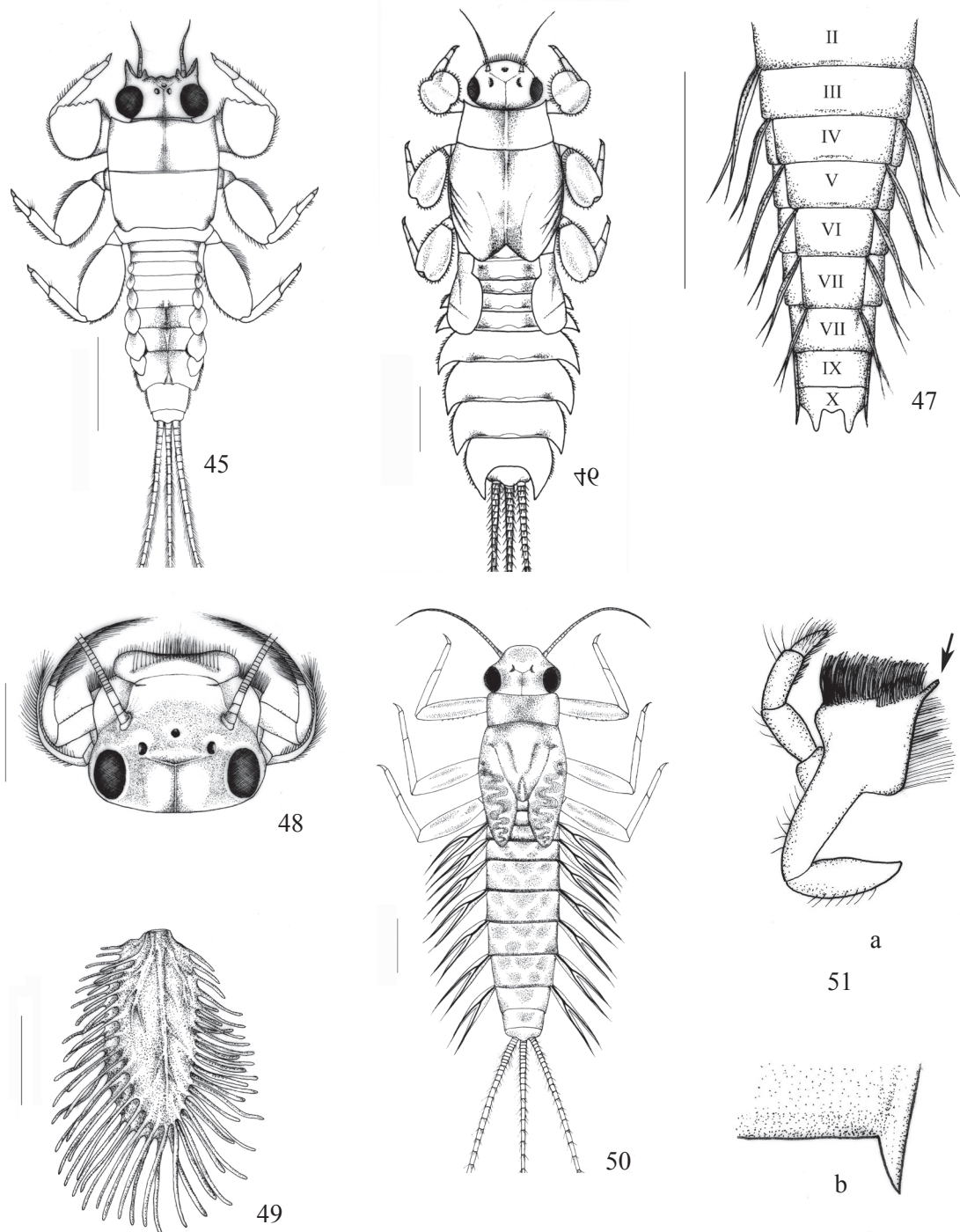


Fig. 45-51. 45. Dorsal view of nymph of *Vietnamella* sp.; 46. Dorsal view of nymph of *Teloganella* sp.; 47. Ventral view of abdomen of *Isca* sp.; 48. Dorsal view of head of *Choroterpides* sp.; 49. Lamellate gill of *Thraululus* sp.; 50. Dorsal view of nymph of *Habrophlebiodes* sp.; 51. Maxilla (a) and posterolateral spine (b) of *Cryptopenella* sp. (redrawn from Peters & Edmunds, 1970, fig. 336, fig. 344). Scale: (49) 0.5 mm; (45-48, 50) 1 mm.

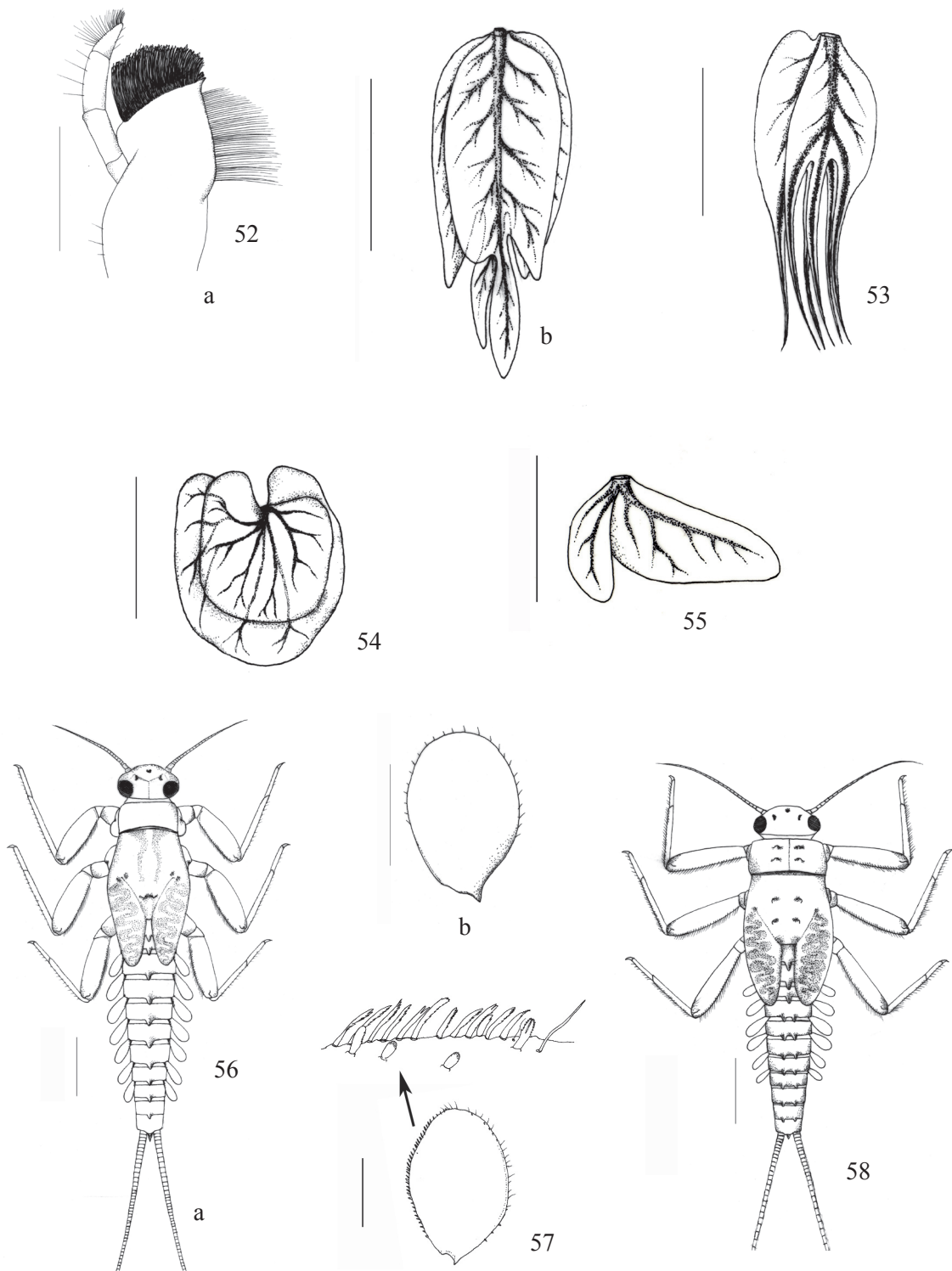


Fig. 52-58 52. Maxilla (a) and gills III-VII (b) of *Choroterpes (Choroterpes)* sp.; 53. Abdominal gills III-VII of *Choroterpes (Euthraulius)* sp.; 54. Gills I-VI of *Cloeon* sp.; 55. Gill of *Procloeon* sp.; 56. Dorsal view of nymph (a) and gill VI (b) of *Gratia narumonae*; 57. Gill VI of *Gratia sororculaenadinae* (redrawn from Thomas, 1992, fig. 16); 58. Dorsal view of nymph of *Baetiella* sp. Scale: (56b, 57) 0.3 mm; (52-55) 0.5 mm; (56a, 58) 1 mm.

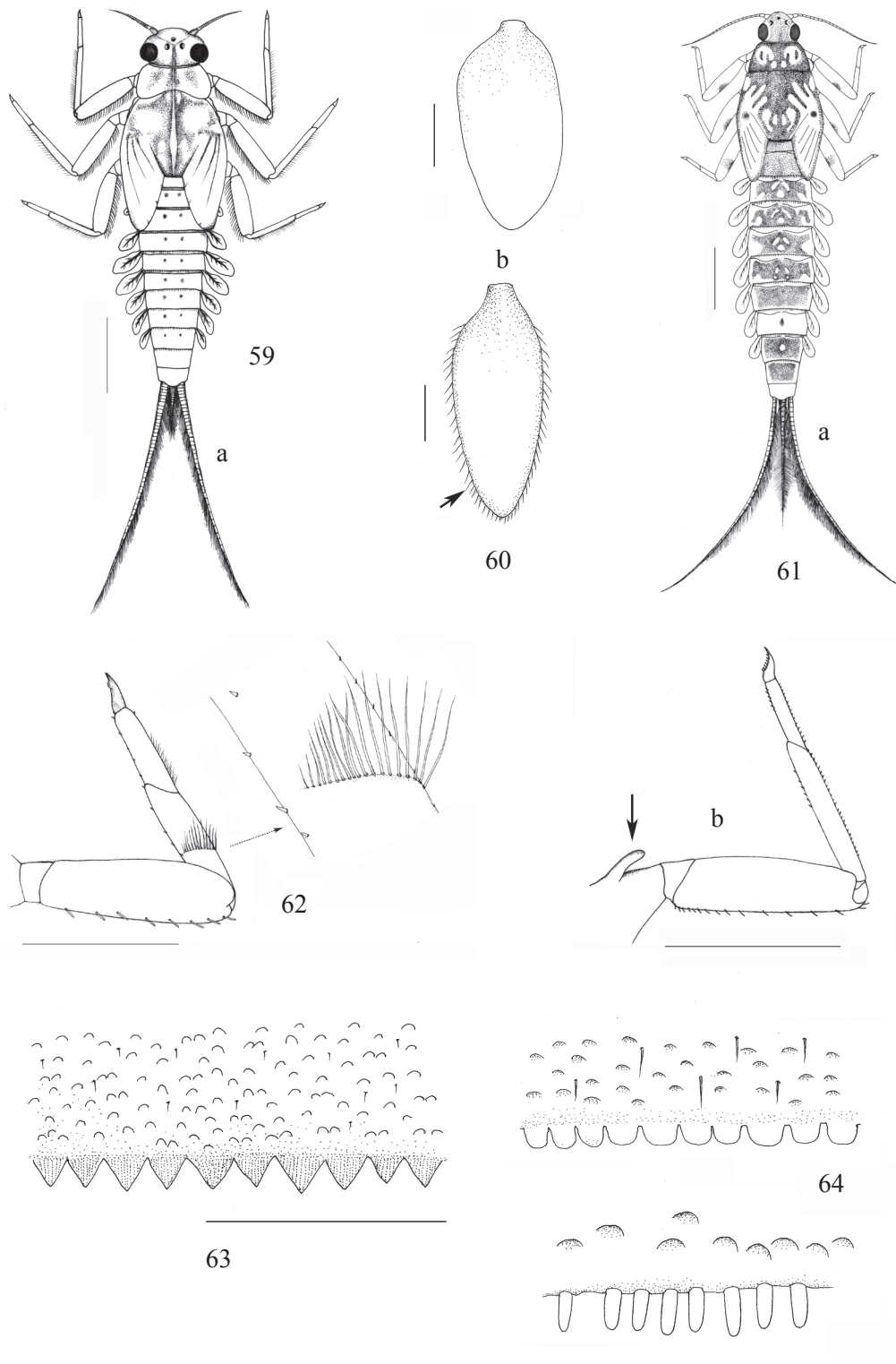


Fig. 59-64 59. Dorsal view of nymph (a) of and gill V (b) of *Platybaetis* sp.;
 60. Gill V of *Acentrella* sp.; 61. Dorsal view of nymph (a) and foreleg (b) of
Heterocloeon sp.; 62. Dorsal view of foreleg of *Centroptella* sp.; 63. Posterior
 margin of abdominal segment V of *Nigrobaetis* sp.; 64. Posterior margin of
 abdominal segment V of *Baetis* sp. (modified from Nguyen, 2003, fig. 399,403).
 Scale: (59b, 60, 63, 64) 0.1 mm; (61b, 62) 0.5 mm; (59a, 61a) 1 mm.