

Chapter 25 Order Diptera

Diptera, or true flies, is a large order of insects. Adults have a single pair of wings (di = two, ptera = wing) located on the mesothorax. The hind wings are reduced to a pair of club-like halteres which aid in flight. The mouth parts of adults are variously modified for piercing, licking and sucking. Larval body forms are diverse, ranging from a cylindrical body with a complete head capsule to the maggot-like body with mouth hooks only. Larvae have no jointed thoracic legs but may bear fleshy prolegs, or other structures to aid locomotion. Larvae inhabit almost all types of aquatic habitats, except open seas.

Aquatic and semiaquatic dipterans are in two suborders, Nematocera and Brachycera, with a total of 24 families (Dudgeon, 1999). Much attention and research has focused on Culicidae and Simuliidae because they are vectors of human parasites. The following key to the aquatic immature Diptera of Indochina is modified from Dudgeon (1999) and Yule (2004).

KEY TO SUBORDERS, FAMILIES, SUBFAMILIES AND GENERA OF MATURE AQUATIC DIPTERA LARVAE OF INDOCHINA

- 1 Larvae with a sclerotized head capsule (Fig. 7-17) (although this may be retracted into the body and may not be fully sclerotized posteriorly (Fig. 3-6); mandibles move laterally and have subapical teeth (Fig. 1) SUBORDER NEMATOCERA...2
- 1' Larvae lack a head capsule entirely, or it is partially formed (Fig. 18-22); mandibles move vertically and lack subapical teeth so that they are hook-like (Fig. 2); prolegs sometimes absent and body may be pale and maggot-like..... SUBORDER BRACHYCERA...23
- 2(1) Head, thorax and abdominal segment I fused; body appears divided into seven segments; first six segments with a conspicuous ventral sucker (Fig. 3b)BLEPHARICERIDAE...3
- 2' Body not as above (with more than seven segments and lacking ventral suckers).. 5
- 3(2) Antennae of two poorly delimited segments connected by elongate membranous area (Fig. 3c); ventral prolegs with wide bases, tapering to point apex (Fig. 3a-b) ...*Blepharicera*
- 3' Two antennal segments well delimited, separated by short connecting membrane (Fig. 4a); ventral prolegs elongate, tapering only slightly to blunt apex..... 4
- 4(3') Antennae with two segments; shape normal, distinctly segmented; anal body division distinctly subdivided, segment 6 distinct from posterior segment; body convex, pseudopod insertions freely exposed (Fig. 4b); otherwise, shape and ornamentation variable, but never with erect strong spines*Apistomyia*

- 4' Antennae with three segments; shape reminiscent of chiton, notches between segments and divisions barely apparent; anal body division semicircular, not subdivided, segments 6 and following fused; body depressed, flat, with strongly sclerotized lateral edge, pseudopods inserted in narrow notches; often with very long erect spines which are paired on cephalic division, but single, medial on abdominal segments*Horaia*
- 5(2') Head very poorly developed and retractile into first thoracic segment; horizontally biting mouthparts; abdomen with 9 segments; apex of abdomen with distinctive respiratory disc containing paired spiracles, often with fleshy lobes (anal gills) (Fig. 6)..... TIPULIDAE ...6
- 5' Head capsule fully formed and not retracted into the body cavity (Fig. 8-17); at least one proleg usually present..... 8
- 6(5) Body with row of dorsal and lateral elongate fleshy projections on both thoracic and abdominal segments..... CYLINDROTOMINAE
- 6' Body with short, blunt projections on abdominal segments only..... 7
- 7(6') Spiracular disc bordered by five or fewer lobes variable in shape, with one dorsomedially, two laterally, and two below spiracles (Fig. 5a-b)LIMONIINAE
- 7' Spiracular disc bordered by six subconical lobes, with two dorsally (dorsal lobes), two dorsolaterally (lateral lobes), and two below spiracles (Fig. 6a-b) TIPULINAE
- 8(5') Prolegs present (Fig. 7-13) 9
- 8' Prolegs absent (Fig. 14-17)..... 18
- 9(8) Head directed forwards..... 10
- 9' Head dorsoventrally directed; body segments bearing long fleshy tubercles and usually bearing setae (Fig. 7)..... CERATOPOGONIDAE, in part (FORCIPOMYIINAE)
- 10(9) Paired crochet-bearing prolegs on 1st and usually 2nd abdominal segments; posterior abdomen bearing lateral, frequently setose lobes on each side of conical anal process (Fig. 8).....DIXIDAE ... 11
- 10' Prolegs present on thorax and/or posterior abdomen (Fig. 9-13)..... 12
- 11(10) Five or more segments with crowns of setae; tips of lateral paddles almost reaching tip of the caudal appendage (Fig. 8)*Nothodixa*
- 11' No segments with crown of setae; tips of lateral paddles clearly shorter than the caudal appendage..... *Dixa*
- 12(10') Posterior of abdomen swollen; head well developed with a pair of labral fans and conspicuous mouth-brushes for filtering food from flowing water; attaches to substrate using a single sucker with radially arranged hooks on the base of their

- abdomen; single thoracic proleg present; retractile gills near anus (Fig. 9-10)
 SIMULIIDAE, *Simulium*... 13
- 12' Not as above; pair of prolegs present on first thoracic and last abdominal segment
 (the front ones may be fused giving a single appearance); narrow, elongated
 segmented body, segment length less than twice segment width; finger-like anal
 gills may be present near posterior prolegs; terminal abdominal segment bears
 paired procerci, each with a tuft of setae which may be very long (Fig. 11-13)
 CHIRONOMIDAE... 16
- 13(12) Hypostomium very wide, with 12 or 13 apical teeth, of which median tooth is the
 most prominent; mandible with only one large tooth; posterior sucker composed of
 over 400 rows of hooks *Simulium (Daviesellum)*
- 13' Hypostomium not so wide, with 9 apical teeth in almost horizontal row (Fig. 9b),
 of which lateral teeth are as prominent as, or more prominent than, median tooth;
 mandible with at least 2 mandibular teeth; posterior sucker composed of less than
 200 rows of hooks..... 14
- 14(13') Last abdominal segment with ventral papillae (Fig. 10b)..... 15
- 14' Last abdominal segment without ventral papillae *Simulium (Simulium)*
- 15(14) Lateral margin of hypostomium smooth (Fig. 10c); mandibular serrations
 composed of one large and one small teeth but lacking any supernumerary serration
*Simulium (Gomphostilbia)*
- 15' Lateral margin of hypostomium dentate; mandibular serrations composed of
 one large and one small teeth with supernumerary serration, if lateral margins of
 hypostomium smooth*Simulium (Nevermannia)*
- 16(12') Antennae retractile into head; hypopharynx with distinctive toothed ligula,
 mentum usually weakly sclerotised (Fig. 11) TANYPODINAE
- 16' Antennae non-retractile; mentum a strongly sclerotised plate (the main mouthpart),
 with hypopharynx lacking strong ligula 17
- 17(16') Mentum associated with variably developed, but always broad and usually
 striated, ventromental plates (Fig. 12a-b)..... CHIRONOMINAE
- 17' Mentum without, or at most with relatively small, non-striate ventromental plates
 (Fig. 13a-b) ORTHOCLADIINAE
- 18(8') Thoracic and abdominal segments similar; body slender, with bead-like segments
 often more than twice as long as wide; variable body shape but typically long,
 white and worm-like with no prolegs or gills (Fig. 14)..... CERATOPOGONIDAE
- 18' Thoracic segments differentiated from abdominal segments; abdominal segment
 length often less than segment width..... 19

- 19(18') Three thoracic segments fused and enlarged, broader than abdominal segments; thoracic and abdominal segments with prominent lateral fanlike tufts of long setae and/or terminal segment with an anal setal fan 20
- 19' Elongate, usually darkly-sclerotized and setose, with conspicuous sclerotized head capsule that is not retracted; mouthpart sunk in preoral cavity; trunk with 10 clearly demarcated segments and terminal region of two or more fused abdominal segments; many body segments bearing dorsal sclerotized plates PSYCHODIDAE
- 20(19) Antennae prehensile (grasping), with long apical setae; mouth brushes absent; two prominent air sacs in each of abdominal segment VII and the thorax (Fig. 15)..... CHAOBORIDAE
- 20' Antennae not prehensile and with only short apical setae; prominent mouth brushes present on either side of labrum (Fig. 16-17) CULICIDAE... 21
- 21(20') Abdominal seta I usually with well developed leaflets (palmate) on most abdominal segments; siphon absent (Fig. 16a-b) ANOPHELINAE, *Anopheles*
- 21' Abdominal seta I never with well developed leaflets (palmate); siphon present (Fig. 7) 22
- 22(21') Very large; purplish or reddish in life; mouth brushes with about 10 flattened, non-pectinate blades; comb scales and pectin teeth absent from siphon TOXORHYNCHITINAE, *Toxorhynchites*
- 22' Not unusually large; reddish in life; mouth brushes with numerous fine, simple filaments, if thick, the filament not simple; comb scales always present and pectin teeth on siphon present or absent (Fig. 17)..... CULICINAE
- 23(1') Head capsule partially developed (Fig. 18-20), with some sclerotization visible and protruding from thorax, palps and antennae visible; mandibles usually sickle shaped; without cephalopharyngeal skeleton (Fig. 2) 24
- 23' Head capsule not developed, with no external visible sclerotization and antennae absent; mandibles replaced by hooks attached to a characteristic cephalopharyngeal skeleton 28
- 24(23) Posterior spiracles close together and concealed within terminal fissure of last segment (Fig. 18,19)..... 25
- 24' Posterior spiracles quite widely separated, not concealed on last segment (Fig. 21,22) 26
- 25(24) Terminal fissure of last segment vertical; body soft, cylindrical in form, usually white, green or some shade of brown in color, often patterned with darker band; head capsule completely retractable and includes a pair of curved mandibles; respiratory siphon is present at the tip of the anal segment (Fig. 18)..... TABANIDAE

- 25' Terminal fissure of last segment horizontal; head capsule complete, strongly sclerotized and non-retractile; body flat with strongly sclerotized head capsule; 3 thoracic and 8 abdominal body segments; cuticle has a rough, honeycomb or mosaic appearance originating from calcium carbonate excretions; tapering posterior end bearing an apical coronet of plumose hydrofuge setae (Fig. 19).....
..... STRATIOMYIDAE, *Odontomyia*
- 26(24') Abdominal segments I-VII each bear a ventral pair of prolegs, and slender dorsal and ventral finger-like projections (Fig. 20), or apex of abdomen with one proleg and two long, setose 'tails' (Fig. 21).....
..... ATHERICIDAE...27
- 26' Larva not flattened, without lateral tubercles on abdominal segments; anal segment with a single median projection below the posterior spiracles; if aquatic larvae their anal segment with several finger-like lobes and body with pseudopods or welts (Fig. 22) EMPIDIDAE
- 27(26) Elongate projections on abdominal segments VI-VIII distinctively longer than these segments combined; segments I-V with no elongate projections; segment VIII with no pseudopod (Fig. 20)..... *Atrichops*
- 27' Elongate projections on abdominal segments VI-VIII distinctly shorter than those segments combined; segments II-V with elongate projections; segment VIII with pseudopods; either side of abdominal segment VIII and that of terminal projection without horizontal row of setae (Fig. 21) *Suragina*
- 28(23') Larvae with an extendable, posterior respiratory tube which is well over half the length of the body; anterior end of the body rather blunt..... SYRPHIDAE
- 28'. Body ends in a short respiratory tube that is divided at the apex EPHYDRIDAE

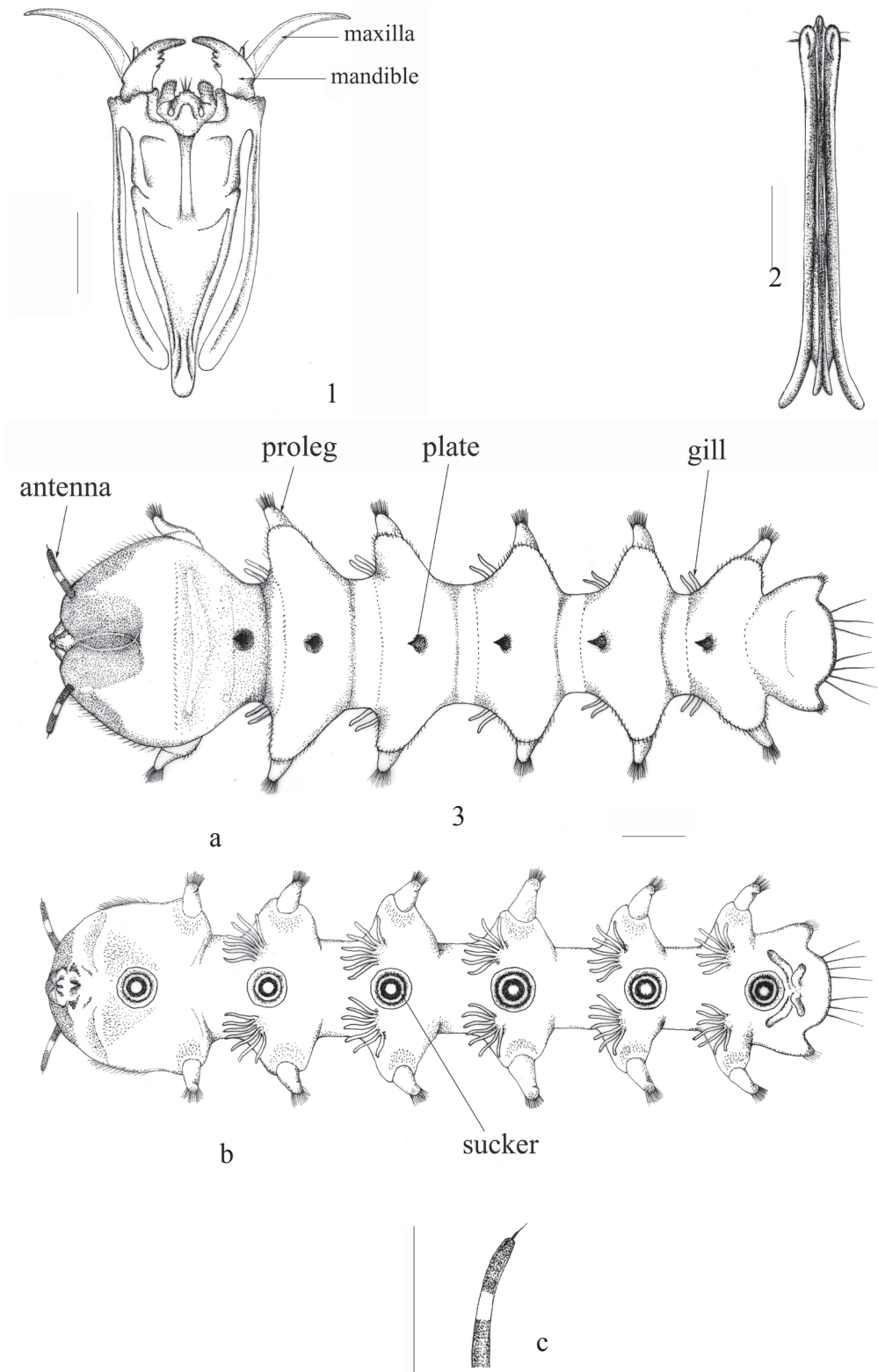


Fig. 1-3 1. Ventral view of head capsule of *Hexatoma* sp. (Tipulidae); 2. Ventral view of head capsule of *Suragina* sp. (Athericidae); 3. Dorsal view (a), ventral view (b) and right antenna (c) of *Blepharicera* sp. (Blephariceridae). Scale: (2,3a,3b) 1 mm; (1,3c) 0.5 mm.

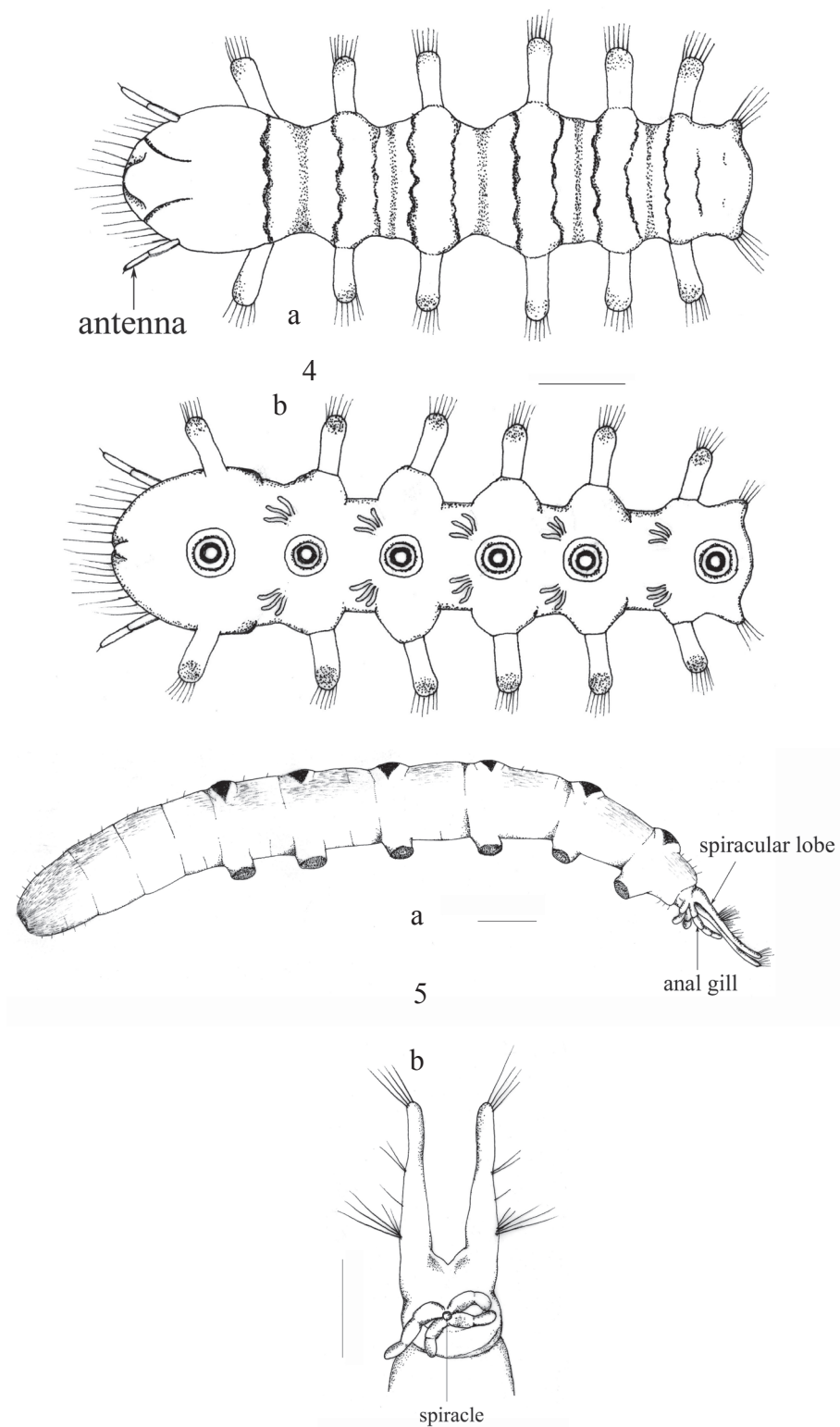


Fig. 4-5 4. Dorsal view (a) and ventral view (b) of *Apistomyia* sp. larva (Blephariceridae); 5. Lateral view (a) and caudal filaments (b) of *Antocha* sp. larva (Limoninae, Tipulidae). Scale = 0.5 mm.

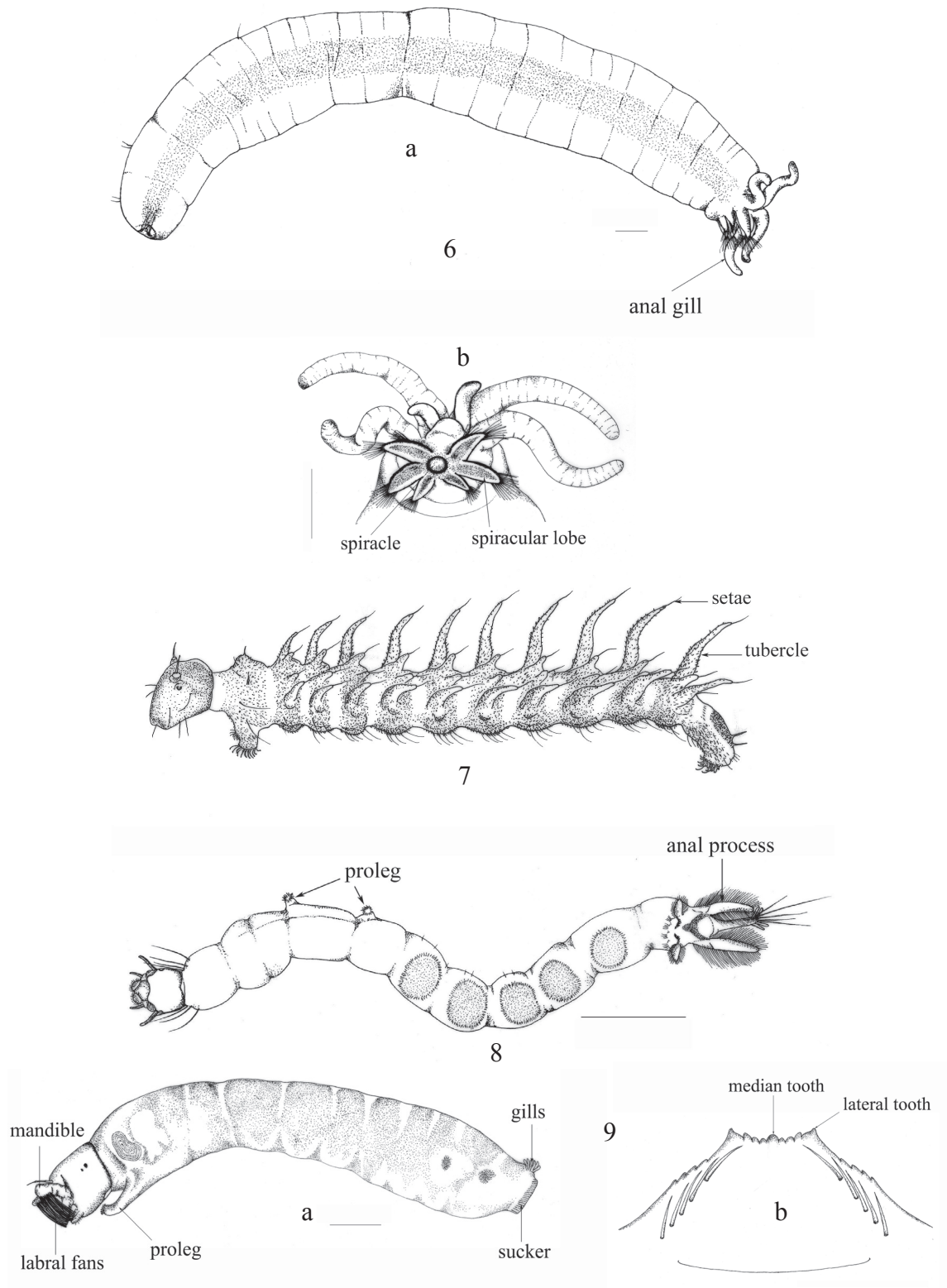


Fig. 6-9 6. Lateral view (a) and terminal abdominal segment (b) of *Tipula* (*Arctotipula*) sp. (Tipulinae, Tipulidae); 7. Lateral view of *Atrichopogon* sp. (Forcipomyiinae, Ceratopogonidae) (redrawn from Courtney, 1994, fig. 18.23); 8. Dorsal view of *Nothodixa* sp. (Dixidae); 9. Lateral view (a) and hypostoma (b) of *Simulium* (*Simulium*) *fenestratum* (Simuliidae). Scale: (6a-b, 7, 8, 9a) 1 mm; (9b) 0.1 mm.

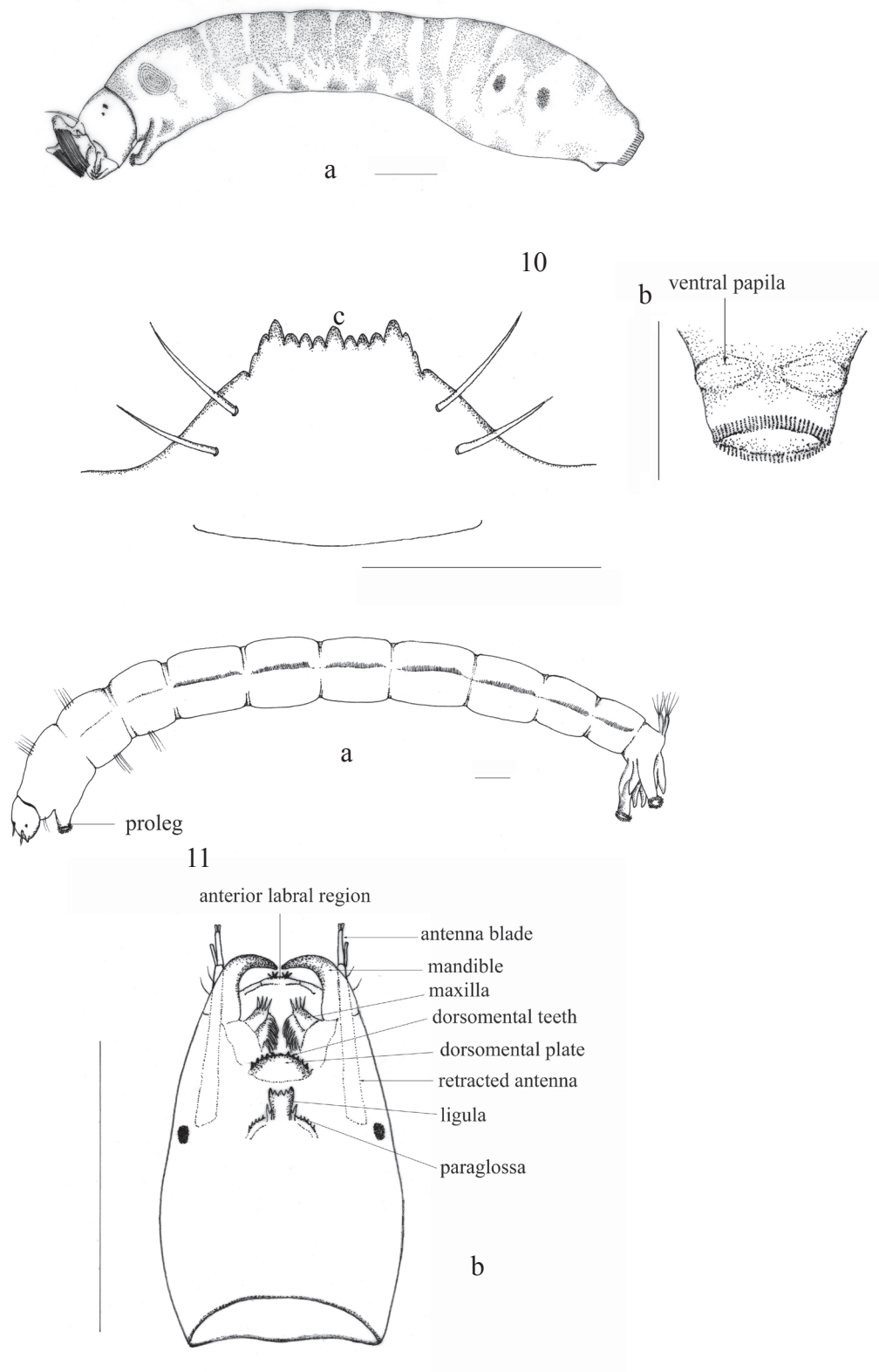


Fig. 10-11 10. Lateral view (a), ventral papillae (b), and hypostoma (c) of *S. inthanonense* (Simuliidae); 11. Lateral view (a) and ventral view of head capsule (b) of *Thiennemannimyia* sp. (Tanypodinae, Chironomidae). Scale: (10a-b, 11a) 1 mm; (10c, 11b) 0.5 mm.

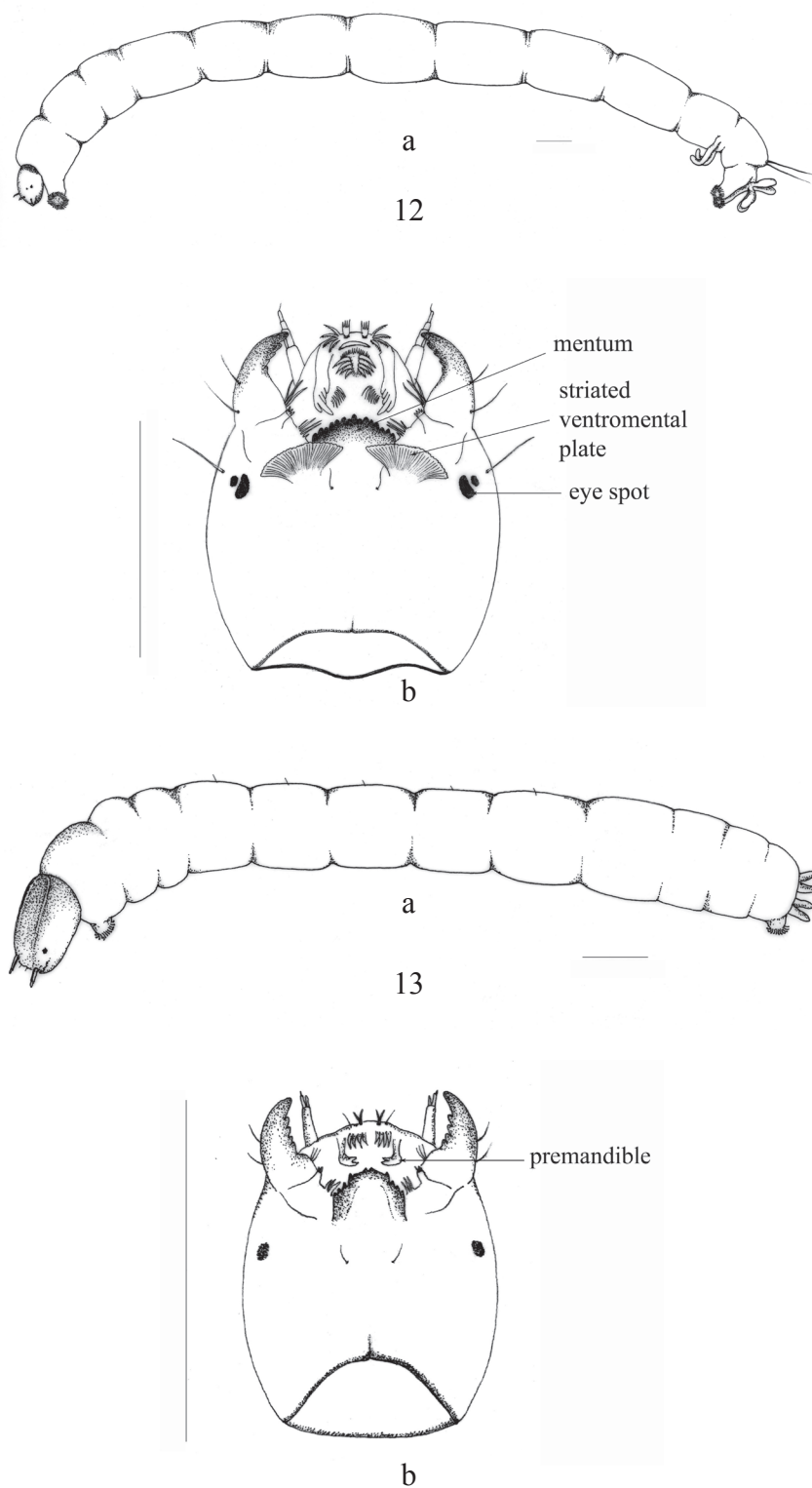


Fig. 12-13 12. Lateral view (a) and ventral view of head capsule (b) of *Kiefferulus* sp. (Chironominae, Chironomidae); 13. Lateral view (a) and ventral view of head capsule (b) of *Nanocladius* sp. (Orthoclaadiinae, Chironomidae). Scale: (12a, 13a) 1 mm; (12b, 13b) 0.5 mm.

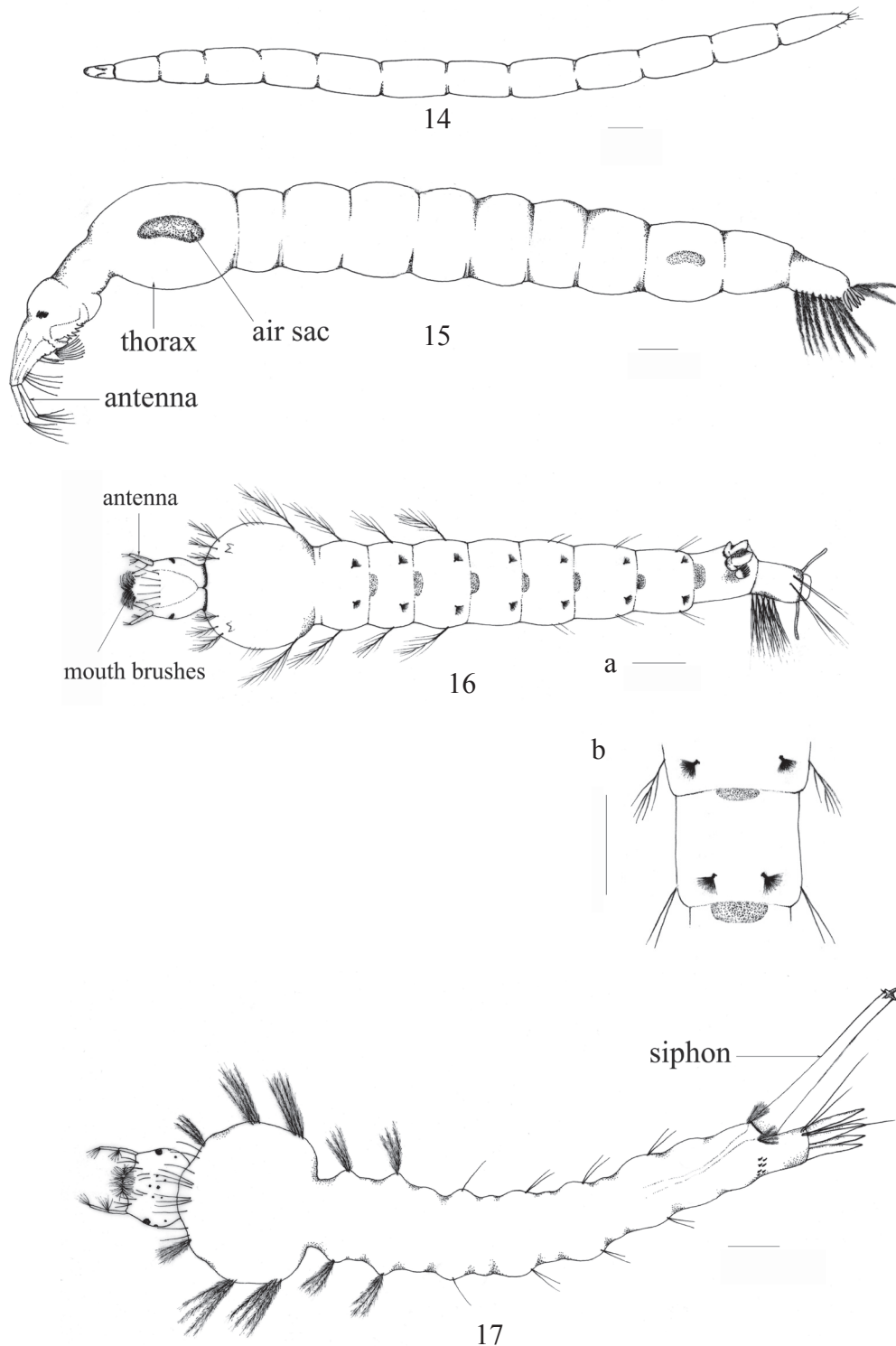


Fig. 14-17 14. Dorsal view of *Bezzia* sp. (Ceratopogonidae); 15. Lateral view of *Chaoborus* sp. (Chaoboridae); 16. Dorsal view (a) and ventral view of abdomen (b) of *Anopheles* sp. (Anophelinae, Culicidae); 17. Dorsal view of culicid (Culicinae, Culicidae).

Scale = 1 mm.

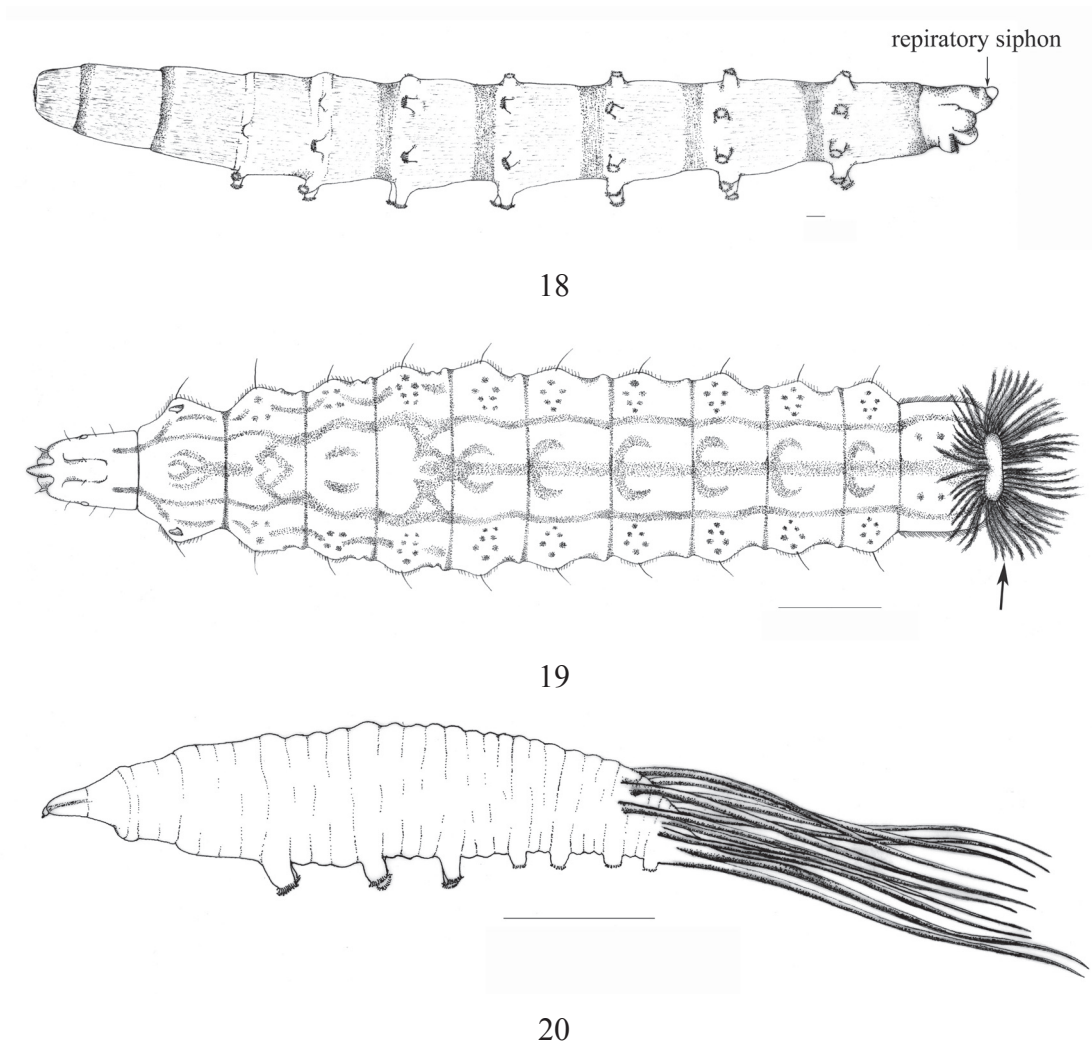
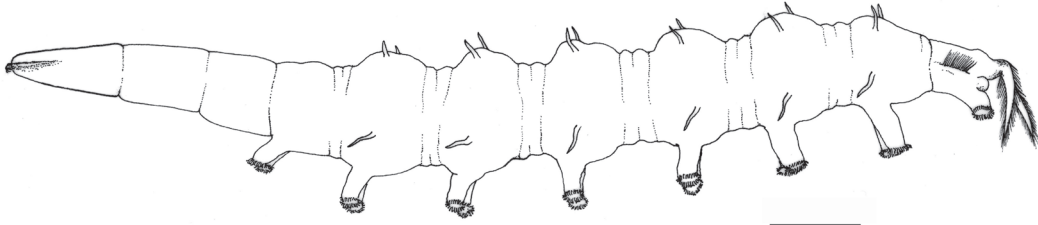
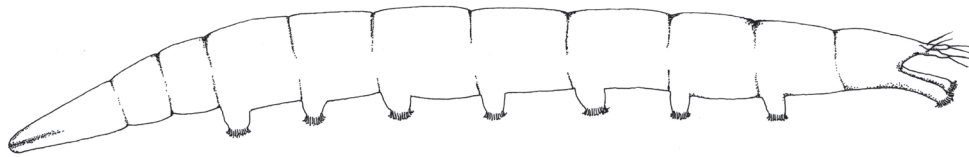


Fig. 18-20 18. Lateral view of Tabanidae; 19. Dorsal view of *Odontomyia* sp. (Stratiomyidae); 20. Lateral view of *Atrichops* sp. (Athericidae). Scale = 1 mm.



21



22

Fig. 21-22 21. Lateral view of *Suragina* sp. (Athericidae); 22. Lateral view of *Hemerodromia* sp. (Empididae).
Scale = 1 mm.

