# A Key for Larvae, Nymphs and Adults of Hexapoda

Note that this key excludes **pupae**. Pupae are the resting phase (generally non-mobile) of endopterygote insects (Neuroptera, Diptera, Siphonaptera, Coleoptera, Strepsiptera, Hymenoptera, Lepidoptera, Trichoptera) and a few Hemiptera. **Exarate pupae**, with the developing adult appendages free from the body, are usually identifiable from their developing adult features. This forma of pupa is found in Neuroptera, Trichoptera, Siphonaptera, almost all Hymenoptera, most Coleoptera, a few Diptera and a few Lepidoptera. **Obtect pupae** are smooth walled and have the developing appendages fused into the body – these are difficult to identify but are only present in some Coleoptera, almost all Lepidoptera, and a few chalcidoid Hymenoptera. In Strepsiptera, most Diptera and a few Hemiptera, the pupa is described as a **puparium** because it develops within the tightly enfolding last larval skin. Pupae of many phytophagous insects occur on the host plant and are likely to be countered in field crops. Note that larvae are distinguished from adults by lack of genitalia (usually at apex of abdomen) and never have wings (adults are with or without wings).

1. One or two pairs of wings present, as articulated (moveable point of attachment) membranes or lobes from the meso- and metathorax (forewings and hind wings respectively); forewings may be thickened (opaque) and incapable of flight, covering hind wings (if these are present); genitalia present (may be hidden in apex of abdomen) ..... **2**

\- Wingless, although posterior margins of meso- and metathorax may have short unarticulated lobes (wing buds of nymphs); genitalia present or absent..... **26**

## Full-winged or Brachypterous (short winged) Adults

This part of the key to adults of insects with wings (whether modified as abdomen covers, shortened or fully formed for flight), is relatively simple compared with the rest of the key. However it relies on examination of the whole insect, so requires some time spent learning the basic anatomy of insects. We include all insect orders known to occur in New Guinea, including Plecoptera (a single record from West Papua) and Zoraptera (a single species known from one locality in New Britain). Two additional insect orders are found in Australia (Megaloptera and Mecoptera) but are south-eastern in distribution and absent from the tropics and therefore not in this key.

2(1). Apex of abdomen with two or three very long multi-segmented thread-like appendages (= paired cerci or paired cerci and terminal filament) **(Fig. 1A, 1B)**, usually longer than body **(Fig. 1A)**; antennae short, shorter or not much longer than head **(Fig. 1C)**; wings held upright at rest, without scales (= flattened setae) or setae (= small articulated hairs); hind wing much shorter and smaller than forewing **(Fig. 1A)**, or absent; mouth parts reduced (= without paired mandibles or sucking rostrum or proboscis) **(Fig. 1C)**; usually swarming over water surface or resting on water-side plants, attracted to light..... **Ephemeroptera (adults and subadults) (Fig. 1)**

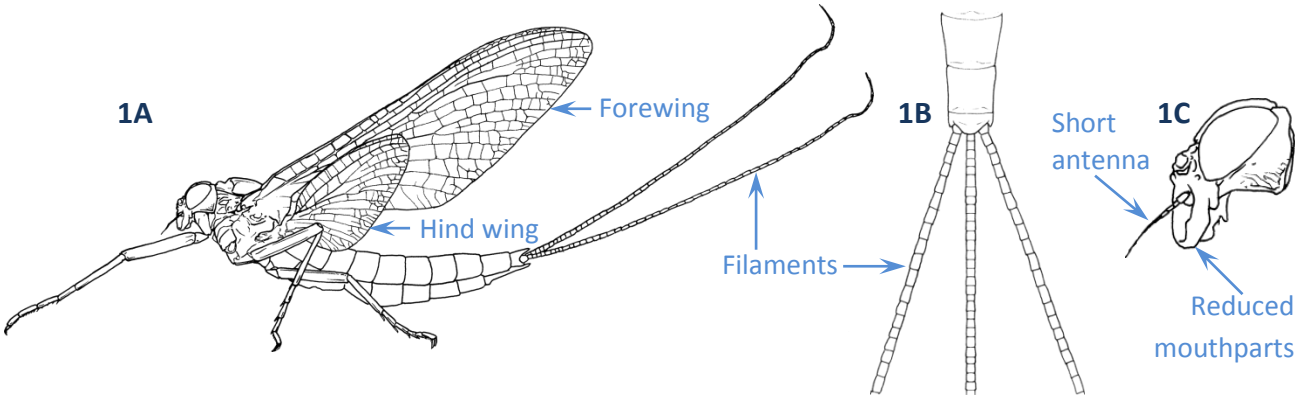


**Fig. 1. EPHEMEROPTERA**

Abdomen most often without very long thread-like terminal appendages, at most with two appendages; if terminal appendages present, usually much shorter than body, or if terminal appendages as long as body, then antennae longer than body, wings at rest held flat over body, and mandibles fully developed (some Orthoptera: Gryllidae: ground crickets); wings usually flat or tent-like at rest, if held vertically above body, without very long terminal appendages..... **3**

3(2). Only single pair of wings present, which are membranous, visible and not folded; second pair of wings absent or reduced to hair-like or club-like (expanded at apex) appendages..... **4**

\- Both pairs of wings developed, sometimes forewings hardened (= elytra), partially hardened (= hemelytra) or leathery (= tegmina); sometimes hind wings reduced, but not knob-like (many Hymenoptera), hind wings sometimes absent, in this case forewings hardened or leathery (some Coleoptera, e.g. Staphylinidae, some Hemiptera)..... **7**

4(3). Forewings small and club-like **(Fig. 2A, 2B)**; hind wings well-developed, venation reduced, without cross-veins **(Fig. 2A)**; antennae fan-shaped, with one or more finger-like lobes (sometimes flabellate) **(Fig. 2C)**; mouth-parts almost absent, not piercing, biting or sponging; delicate insects, rarely seen or collected .....**Strepsiptera (adult males) (Fig. 2)**

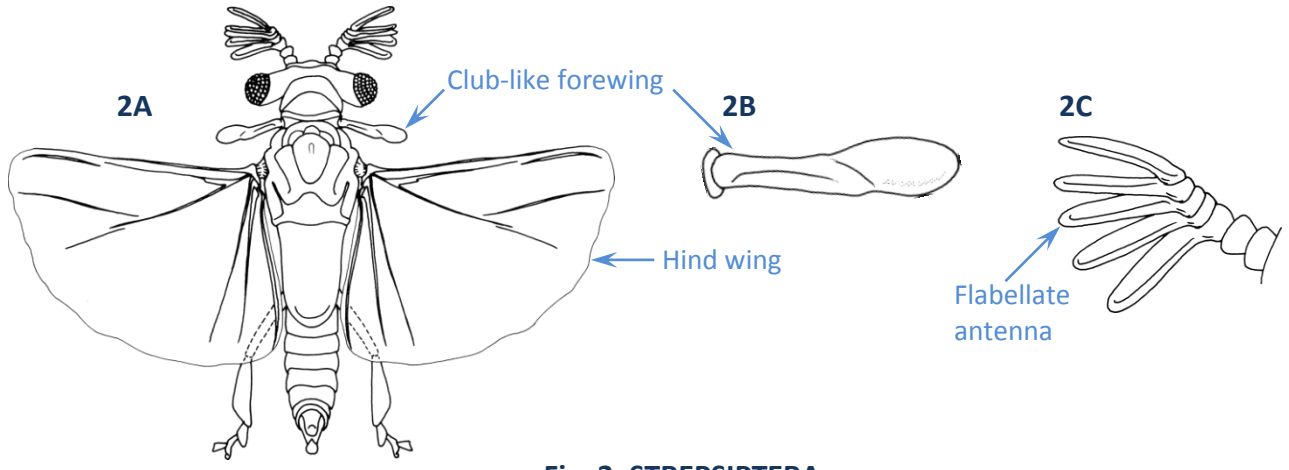


**Fig. 2. STREPSIPTERA**

\- Forewings well developed, venation with or without cross-veins; hind wings reduced to small knobs (= halteres), or hair-like; mouthparts either mandibulate (chewing and biting), piercing, sucking, sponge-like or reduced ..... **5**

5(4). Abdomen waisted, constricted basally (at junction with thorax) **(Fig. 3A)**; wings fringed with long hair-like setae **(Fig. 3A, 3B)**; reduced hind wings hair-like **(Fig. 3A, 3C)**.....
.....**Hymenoptera (adult Mymarommatidae – microscopic) (Fig. 3)**

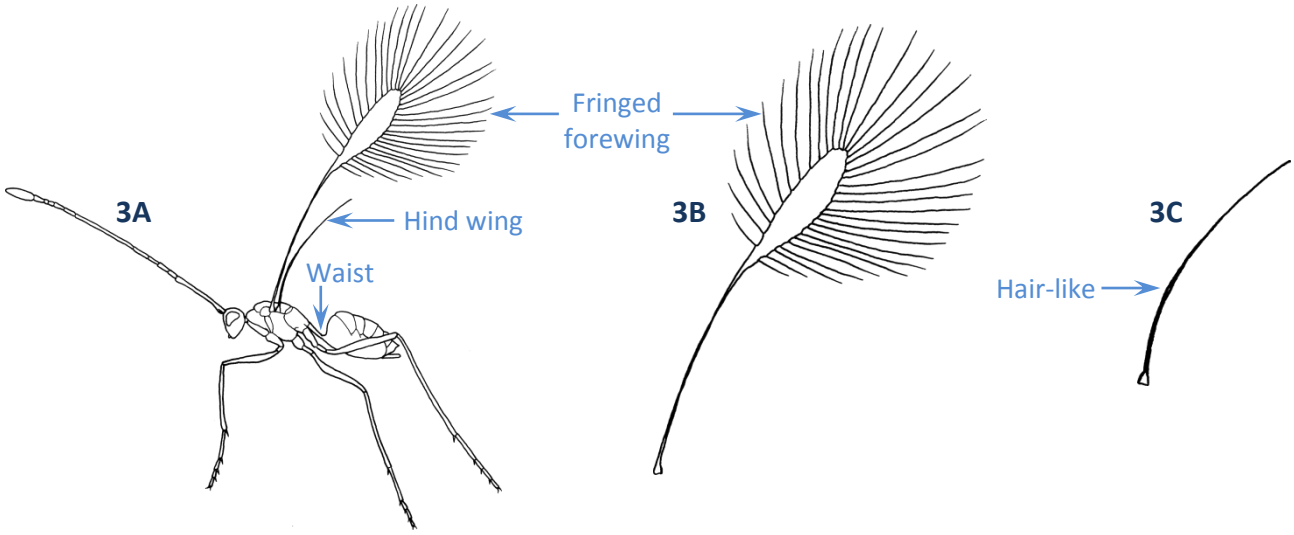


**Fig. 3. HYMENOPTERA (adult MYMAROMMATIDAE – microscopic)**

- Abdomen not constricted, wings not fringed with long hair-like setae; reduced hind wings club-like (= haltere)..... **6**

6(5). Mouth parts sponge-like **(Fig. 4B)** or piercing **(Fig. 4C)**, adapted for sucking, sometimes not developed; mesonotum swollen **(Fig. 4A)** and pronotum greatly reduced, often not visible from above; antennae bristle-like (= aristate) or bead-like (= moniliform) or thread-like (= filiform) or clubbed (= clavate); forewings almost always translucent, nearly always with more than 2 veins and with cross-veins **(Fig. 4D)** ..... **Diptera (adults) (Fig. 4)**

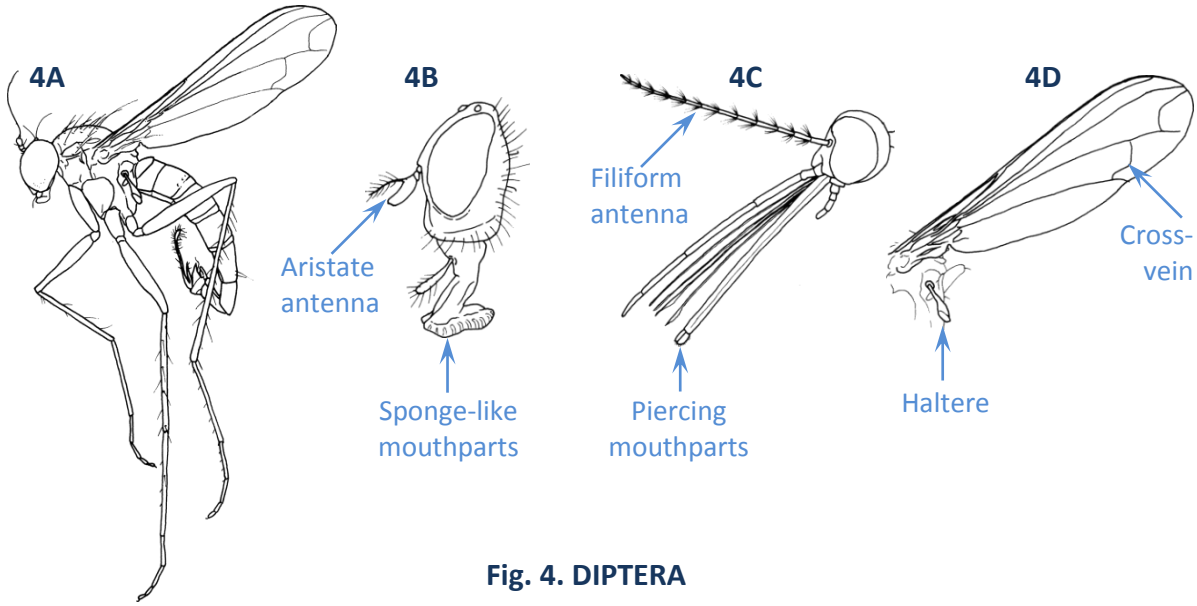


**Fig. 4. DIPTERA**

- Mouth parts reduced, not functional; pronotum short but visible from above; antennae filiform (= thread-like); forewings membranous with only 2 or 3 veins, without cross-veins, thickened and opaque at base **(Fig. 5A)**; rarely seen or collected ..... **Hemiptera (male Coccoidea) (Fig. 5)**

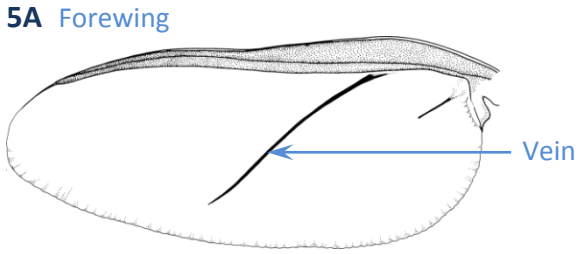


**Fig. 5. HEMIPTERA (male COCCOIDEA)**

7(3). Wings narrow (= thinner than body width), strap-like, with reduced venation, always with fringe of long setae (= hairs), at least on hind margin, wings never with scales **(Fig. 6A, 6B)**; mouthparts minute (microscopic), cone shaped, positioned near thorax ventrally **(Fig. 6C)**; body usually shorter than 5 mm; tarsi 1-2 segmented **(Fig. 6A)** ..... **Thysanoptera (Fig. 6)**

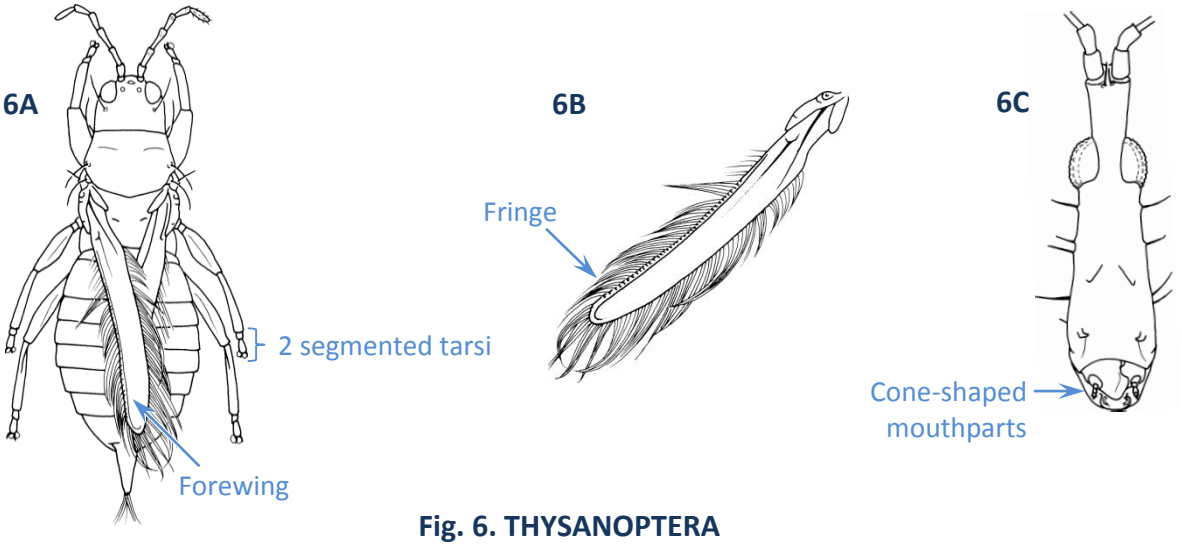


**Fig. 6. THYSANOPTERA**

- Wing shape variable, usually wider than body, very rarely fringed; if wings fringed, then with scales (Lepidoptera) or abdomen constricted or waist-like (some Hymenoptera, e.g., Scelionidae) or only hind wing fringed and folded under hardened forewing (= elytra) (Coleoptera: Ptiliidae); mouthparts various, but rarely minute and conical ..... **8**

8(7). Mouthparts modified into a straight tube-like rostrum or proboscis, articulated at base (only mouthparts, not head projection as in some beetles, such as weevils), anteriorly or ventrally positioned but directed posteriorly, without palps, either short or long, nearly always segmented **(Fig. 7A)**; forewings often partly or entirely hardened (= hemelytra) and held flat over the body at rest (Hemiptera: Heteroptera, Coleorrhyncha), or forewings thickened or membranous and held tent-like at rest (Hemiptera, most Auchenorrhyncha, some Sternorrhyncha) **(Fig. 7B)** or held upright over the body at rest (Hemiptera, most Sternorrhyncha, few Auchenorrhyncha) ..... ..... **Hemiptera (most adults) (Fig. 7)**

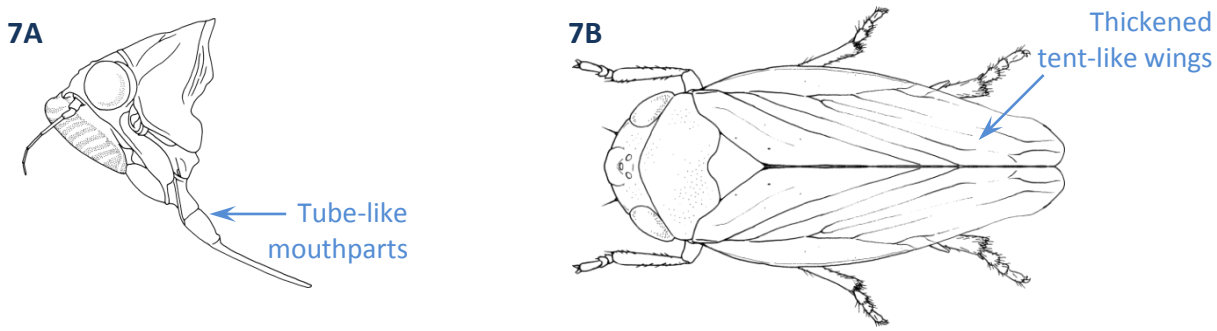


**Fig. 7. HEMIPTERA**

- Mouthparts usually chewing or biting (= mandibulate) **(Fig. 8A)**, sometimes proboscis-like and coiled at rest (= haustellate) **(Fig. 8B)** (Lepidoptera), or sometimes straight but mouth with palps and body with branched hair-like setae (Hymenoptera: Apoidea); narrow elongation of some weevil (also called rostrum) heads not articulated at base and with mandibulate mouthparts at apex **(Fig. 8C)** ..... **9**

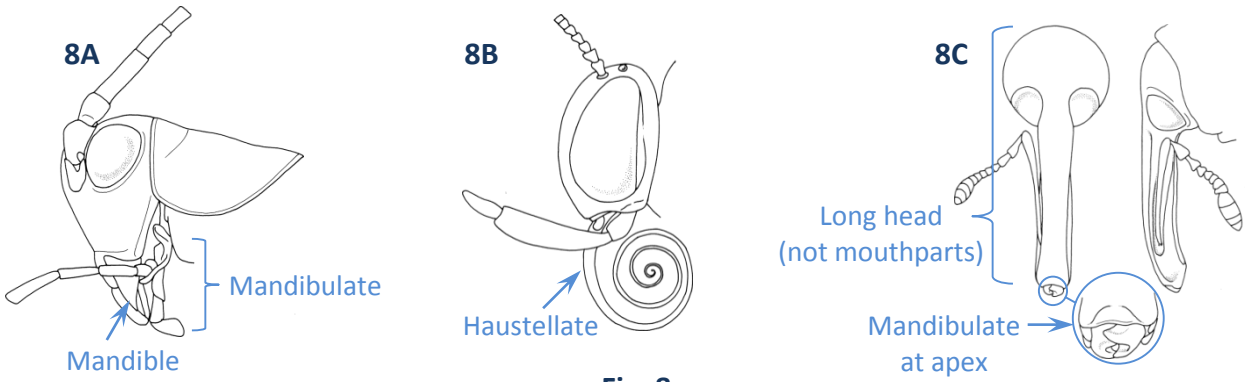


**Fig. 8**

9(8). Wings membranous and veined, densely clothed with hair-like setae in-between veins and nearly always held tent-like over the body (Trichoptera) **(Fig. 9A)**, or with overlapping scale-like setae on both surfaces of the wings (Lepidoptera), sometimes scales reduced to patches (also Lepidoptera); tarsi 5-segmented **(Fig. 9B)**;..... **10**

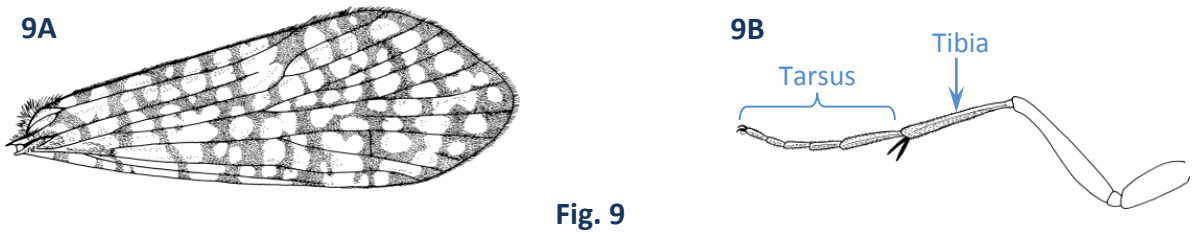


**Fig. 9**

- Wings, if membranous and veined, without scales or hair-like setae, or at most with hair-like setae on wing margins or veins (some Hymenoptera & Neuroptera), or with very short setae visible only under the microscope (some Psocodea, some Hymenoptera); or rarely wings sparsely covered with distinct hair-like setae or scales, but if so, tarsi 2- or 3-segmented **(Fig. 10A, 10B)**, eyes small with head projected in front of eyes (i.e., expanded rounded postclypeus, some Psocodea) ..... **11**

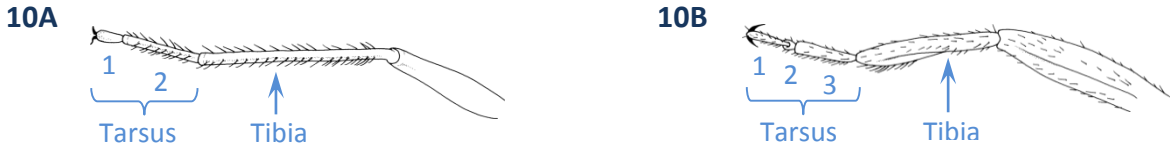


**Fig. 10**

10(9) Wings (on both surfaces) with overlapping, usually broad and flat scales (usually densely distributed) **(Fig. 11A, 11B)**, venation usually hidden by scales; body also usually with scale-like setae, sometimes intermixed with hair-like setae; mouthparts usually in the shape of coiled tube or proboscis (= haustellate) **(Fig. 11C)**, occasionally reduced or distinctly mandibulate; middle of foretibia with large articulated lobe (= epiphysis) in some mandibulate species; wings held horizontally, vertically, flat or tent-like at rest ..... **Lepidoptera (adults) (Fig. 11)**

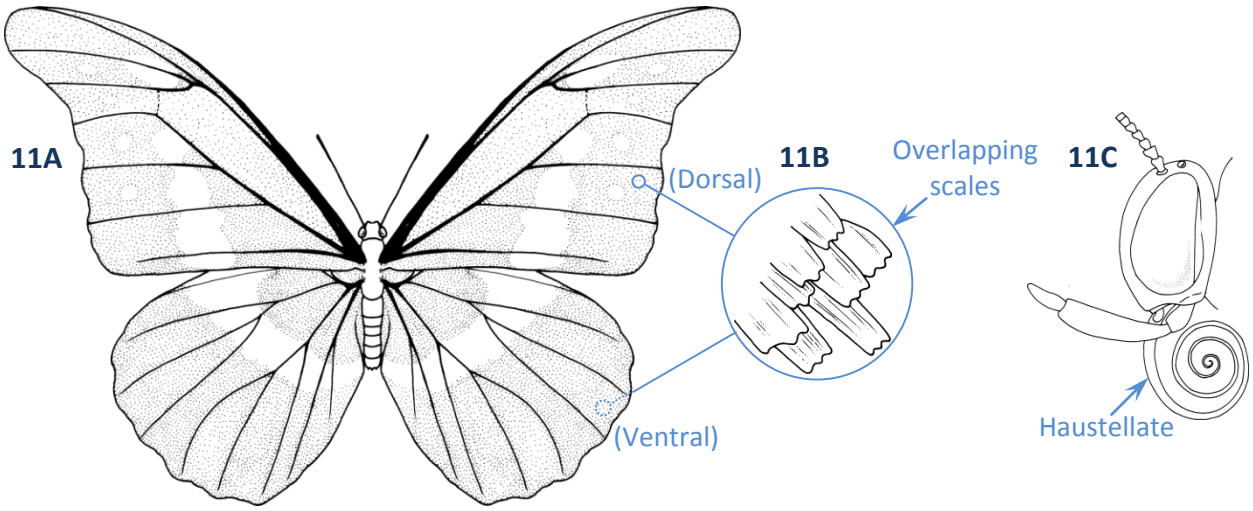


**Fig. 11. LEPIDOPTERA**

- Wings clothed with long hair-like setae, without flat scales, venation clearly visible **(Fig. 12A)**; mouthparts reduced (mandibles vestigial) and never haustellate (= coiled proboscis) **(Fig. 12B)**; middle of foretibia without large articulated lobe (= epiphysis); wings held tent-like over body, rarely flat **(Fig. 12A)** ..... **Trichoptera (adults) (Fig. 12)**

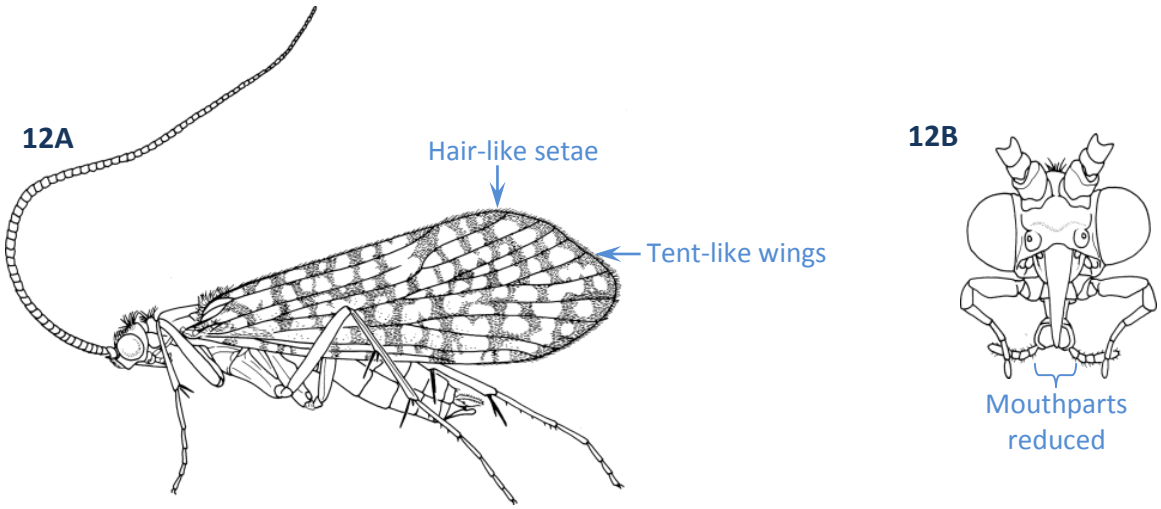


**Fig. 12. TRICOPTERA**

11(9). Forewings opaque, hardened or leathery, or if forewings transparent then hind legs enlarged for hopping and antennae longer than body (some Orthoptera); hind wings membranous, but generally folded under forewings and therefore hidden; hind wings sometimes reduced or absent ..... **12**

- Forewings membranous, transparent, two pairs always present; hind legs not enlarged for hopping and antennae not longer than the body ..... **17**

12(11). Forewings opaque, hardened, thick, without venation (= elytra or tegmina) **(Fig. 13A, 13B)**; forewings not overlapping, with inner margins meeting along midline at rest (sometimes fused in Coleoptera) **(Fig. 13A, 13B)**; without multisegmented cerci at apex of abdomen ..... **13**

- Forewings with visible venation **(Fig. 13C)**; forewings often overlapping at rest **(Fig. 13C)**; pair of short multi-segmented cerci usually present at apex of abdomen (some Orthoptera, Blattodea) or body extremely elongated (Phasmatodea) ..... **14**

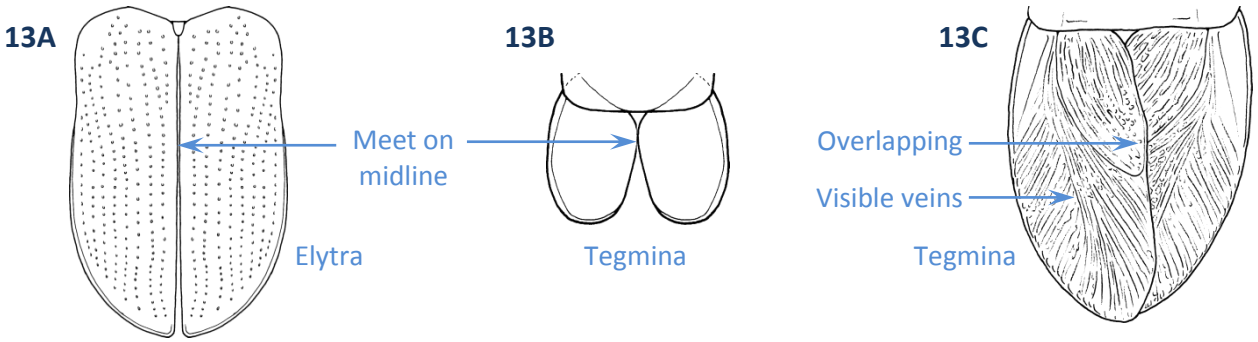


**Fig. 13**

13(12). Terminal abdominal appendages present as paired symmetrical or asymmetrical forceps (= robust unsegmented cerci) **(Fig. 14A, 14B)**; forewings short and leathery with no venation (= tegmina) **(Fig. 14C)**, exposing 7-8 abdominal segments **(Fig. 14A)**; hind wing large and semi-circular when expanded, with fan-like veins radiating from base, folding under tegmina with apices of folded hind wings projecting beyond apices of tegmina; hind wings sometimes reduced or absent; tarsi 3-segmented with the 2nd segment shortened ..... **Dermaptera (adults) (Fig. 14)**

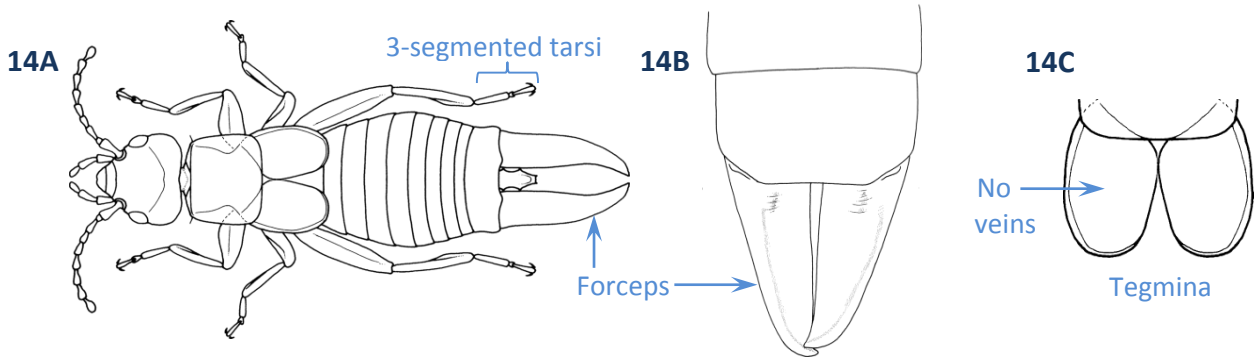


**Fig. 14. DERMAPTERA**

- Terminal abdominal appendages nearly always absent, if present then short (not longer than apical abdominal segment) and not forceps-like **(Fig. 15C)**; forewings (= elytra) usually long and covering all or most of abdominal segments **(Fig. 15A, 15B)**; if elytra short then hind wings not projecting beyond apices of elytra at rest; if short elytra and paired terminal appendages present (some Staphylinidae) **(Fig. 15C)**, then tarsi 5-segmented; hind wings not semi-circular when extended, without radiating veins; hind wings sometimes reduced or absent ..... **Coleoptera (adults) (Fig. 15)**

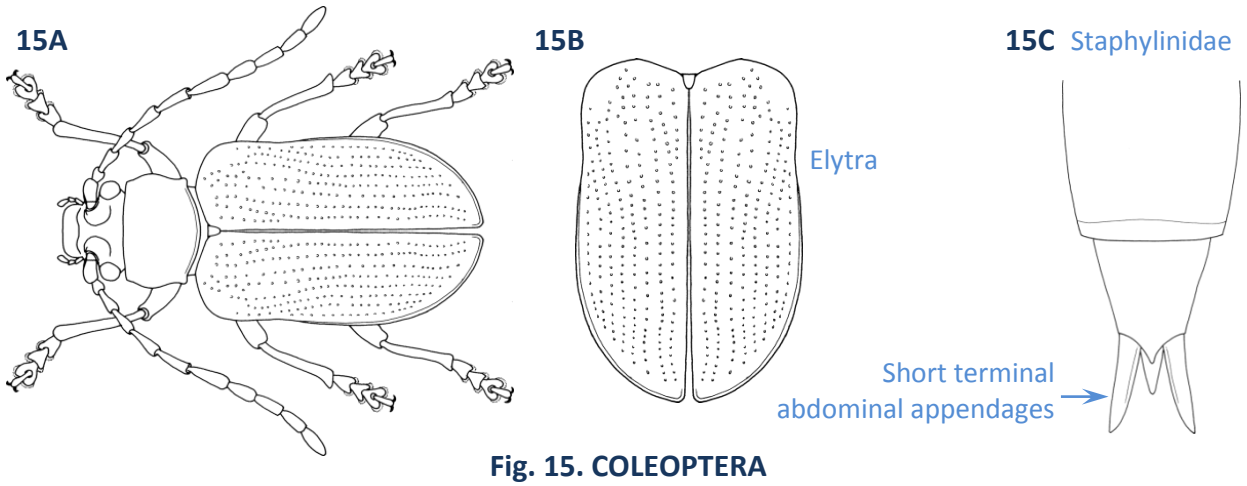


**Fig. 15. COLEOPTERA**

14(12). Forelegs raptorial (= grasping), much larger than mid and hind legs, with large elongated coxae, internally spined femora, hooked tip of tibiae and long tarsi, usually held together anteriorly in characteristic flexed position **(Fig. 16B)**; forelegs contrasting with simple thin and non-spined mid and hind legs **(Fig. 16A)**; (pronotum usually elongate and freely articulated, longer than relatively short mesothorax) ..... **Mantodea (adults) (Fig. 16)**

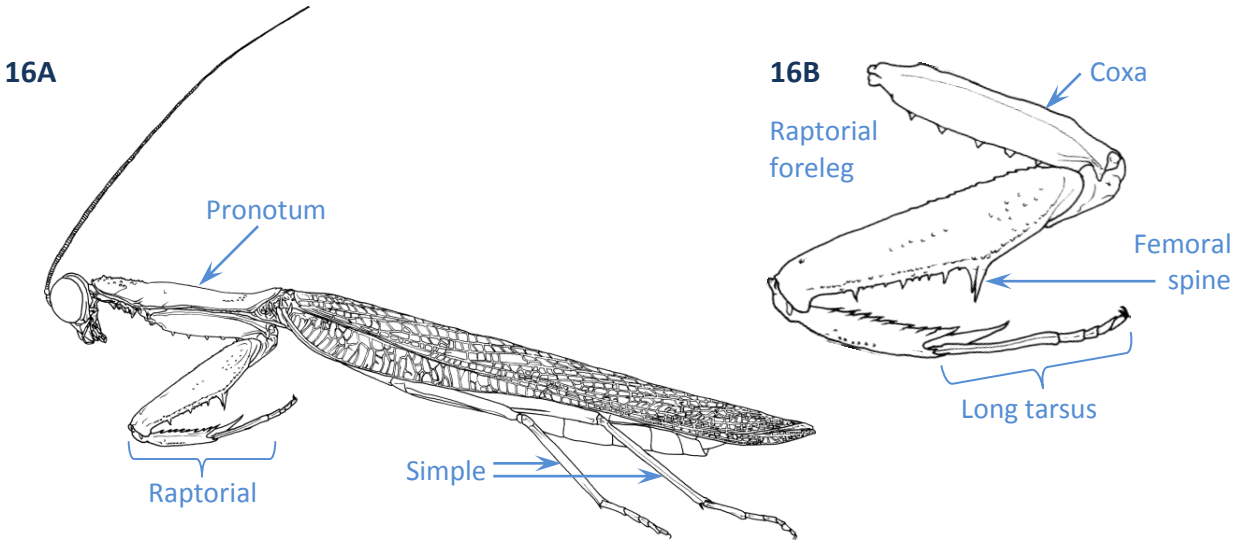


**Fig. 16. MANTODEA**

- Forelegs not raptorial, with small hidden forecoxae, and apex of tibiae not hooked; sometimes relatively enlarged compared with mid legs, if so front legs modified for digging without femoral spines and with short tarsi (Gryllotalpidae in Orthoptera), or flattened and expanded and whole animal imitating leaves (Phylliidae in Phasmatodea) ..... **15**

15(14). Pronotum relatively small, not covering mesonotum, which is elongate and freely articulated on metathorax, and not overlapping base of wings **(Fig. 17A, 17B)**; body either stick or leaf mimicking; head prognathous (oriented horizontally, mouthparts pointing forward), not concealed beneath pronotum **(Fig. 17B)**; hind legs generally similar sized to mid legs; cerci unsegmented **(Fig. 17A)**..... **Phasmatodea (adults) (Fig. 17)**

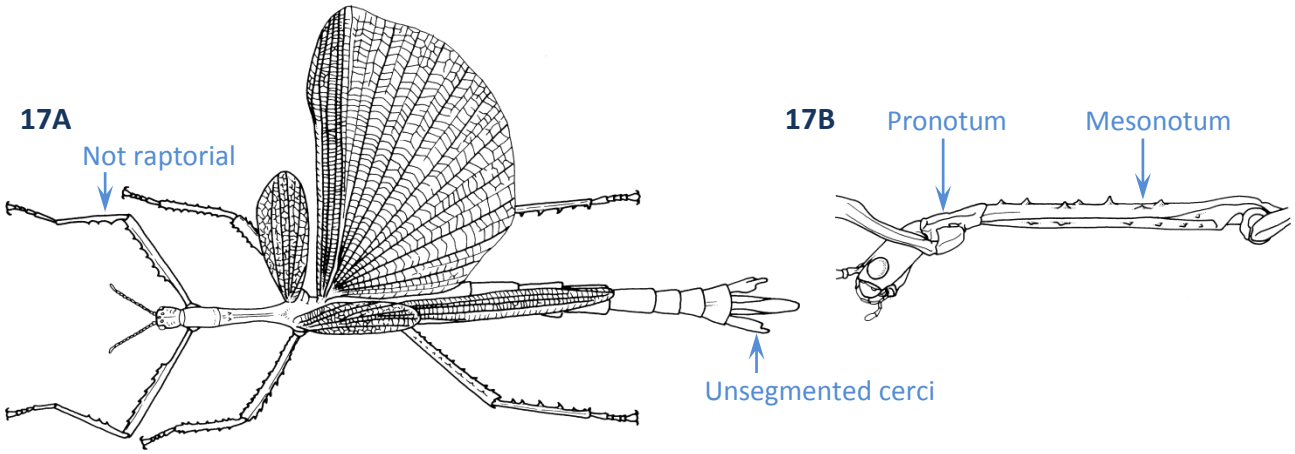


**Fig. 17. PHASMATODEA**

- Pronotum relatively large, entirely or partially covering mesonotum (if latter, only small triangular scutum visible), overlapping bases of wings **(Fig. 18A, 18B)**; mesothorax fused to metathorax; body usually robustly cylindrical (Orthoptera) **(Fig. 18A)** or strongly flattened (Blattodea) **(Fig. 18B)**; hind legs generally larger than mid legs; cerci multi-segmented ..... **16**

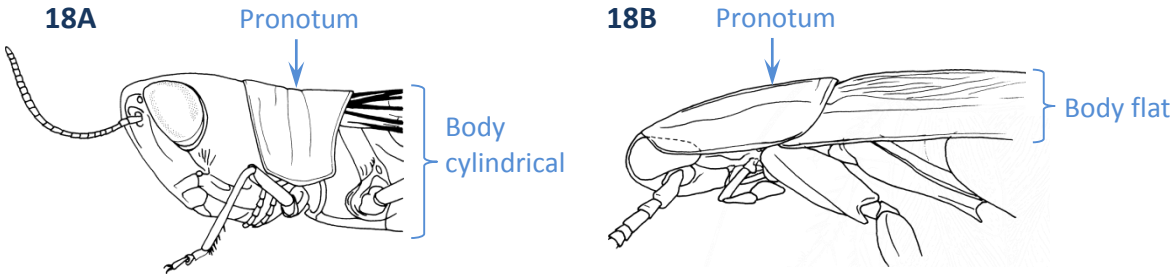


**Fig. 18**

16(15). Hind legs modified for jumping (= saltatorial), with femora elongated and thickened compared with middle femora and tibiae relatively elongated **(Fig. 19A, 19C)**; sides of pronotum projecting ventrally as descending lobes **(Fig. 19B)**; anterior of pronotum not concealing head, eyes visible from above; body usually cylindrical ..... **Orthoptera (adults) (Fig. 19)**

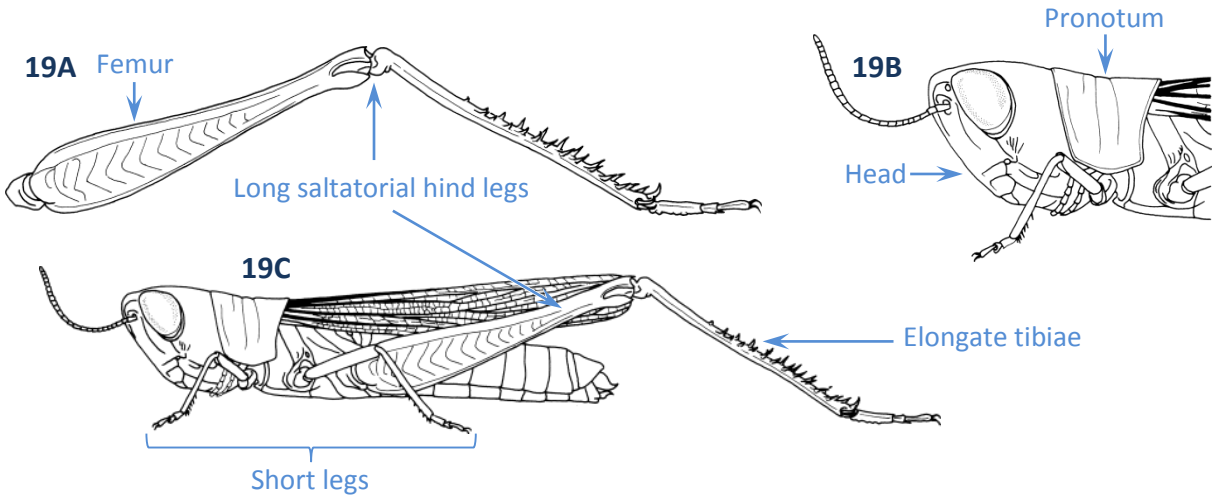


**Fig. 19. ORTHOPTERA**

- Hind legs not specially modified, similar in shape to middle legs, although often slightly larger **(Fig. 20A)**; pronotum flat, sides without ventrally directed lobes; anterior of pronotum generally concealing head, eyes not usually visible **(Fig. 20B);** body flat ..... **Blattodea (adults) (Fig. 20)**

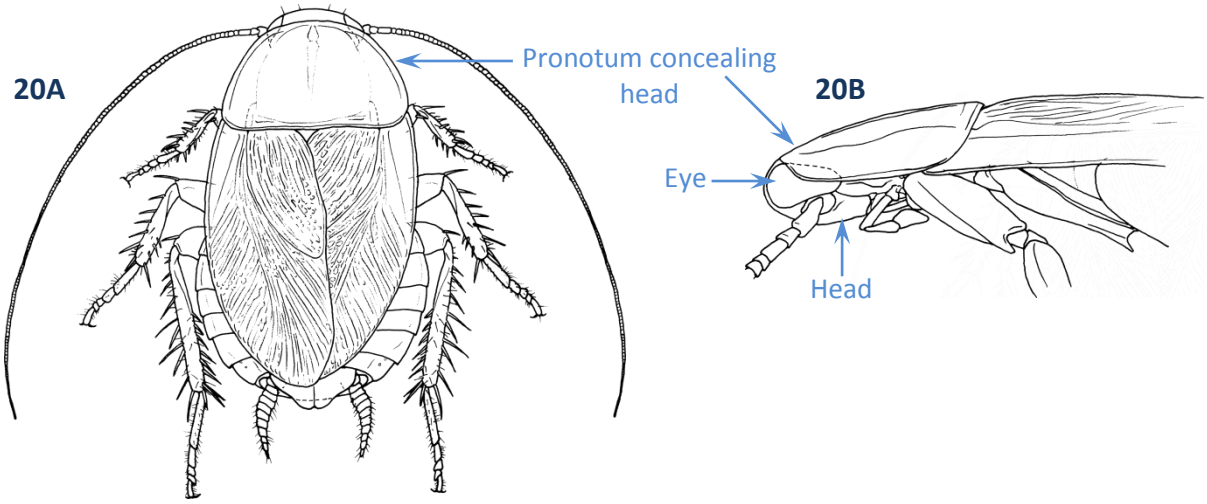


**Fig. 20. BLATTODEA**

17(11) Forelegs raptorial, usually held in characteristically flexed position, enlarged compared with mid and hind legs, with long elongated coxae, forefemora with row of spines; pronotum elongate .... **18**

- Forelegs not raptorial, without elongated coxae, forefemora without row of spines; pronotum not elongate ..... **19**

18(17) Fore tarsi longer than foretibiae **(Fig. 21A)**; apex of foretibiae with large curved spine **(Fig 21A)**; segmented cerci present ..... **Mantodea (Fig. 21A)**

- Fore tarsi shorter than foretibiae **(Fig. 21B)**; apex of foretibiae simple, without spine; cerci absent. ..... **Neuroptera (Mantispidae) (Fig. 21B)**

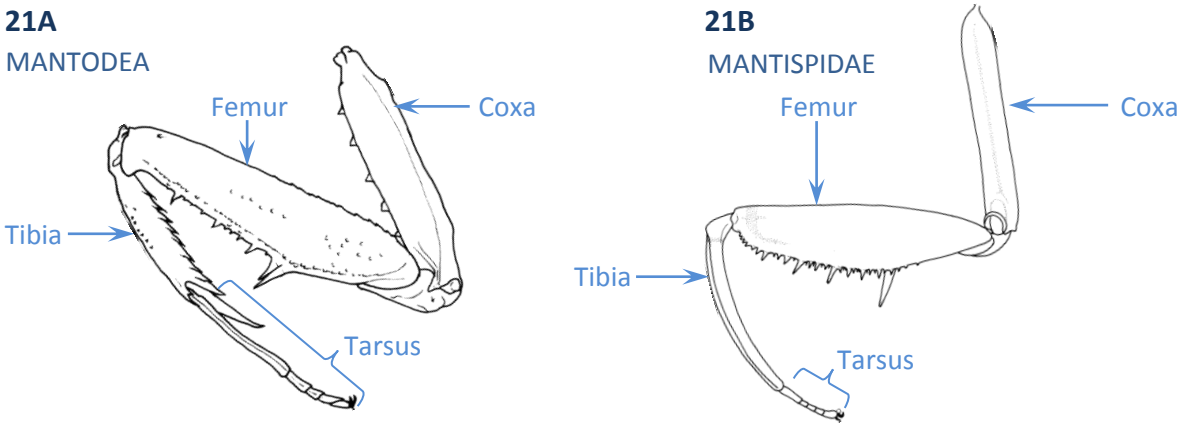


**Fig. 21. RAPTORIAL FORE LEG**

19(17). Apex of abdomen with pair of long multi-segmented cerci (>5 segments) **(Fig. 22A, 22B)**; pronotum large, almost as long as mesonotum; wings with numerous cross-veins, hind wings larger than forewings (rarely brachypterous); tarsi 3-segmented **(Fig. 22C)**; wings usually folded flat along body **(Fig. 22A)**; body relatively flat ..... **Plecoptera (adults) (Fig. 22)**

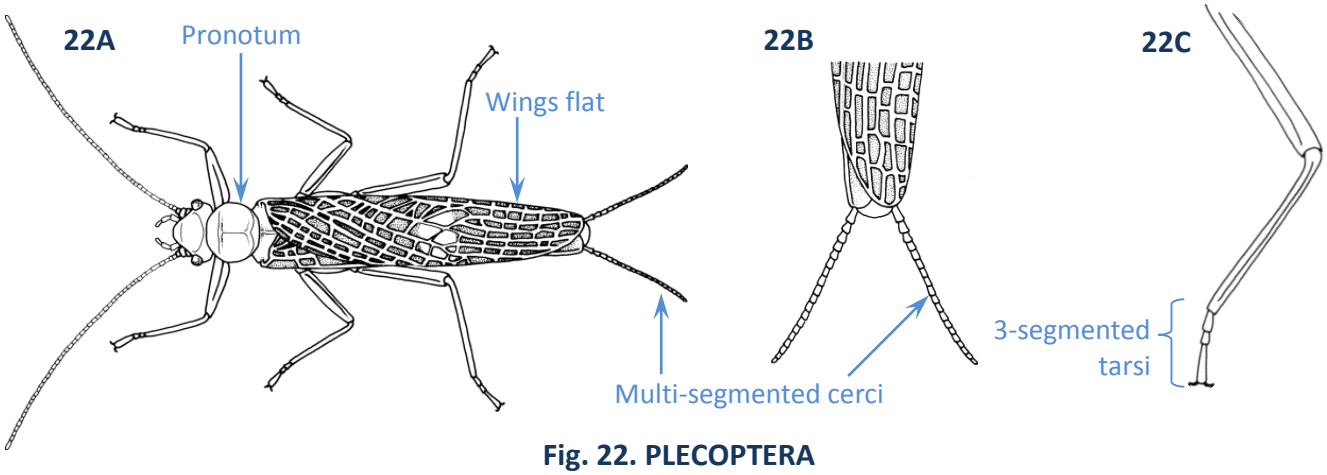


**Fig. 22. PLECOPTERA**

- Apex of abdomen with minute 1-5-segmented cerci, or cerci absent; pronotum, wings & tarsi variable, but hind wings rarely larger than forewings; wings rarely folded flat along body..... **20**

20(19). Pronotum large, half length of mesonotum, or longer; mesothorax loosely articulated with metathorax (except Neuroptera, with 5-segmented tarsi and without narrow 'waist' between thorax and abdomen) **(Fig. 23A)**..... **21**

- Pronotum very short, much shorter than mesonotum; at least mesothorax and metathorax fused into a spherical pterothorax **(Fig. 23B)**; tarsi 2-5 segmented, if tarsi 5-segmented then usually with narrow 'waist' between thorax and abdomen ..... **24**

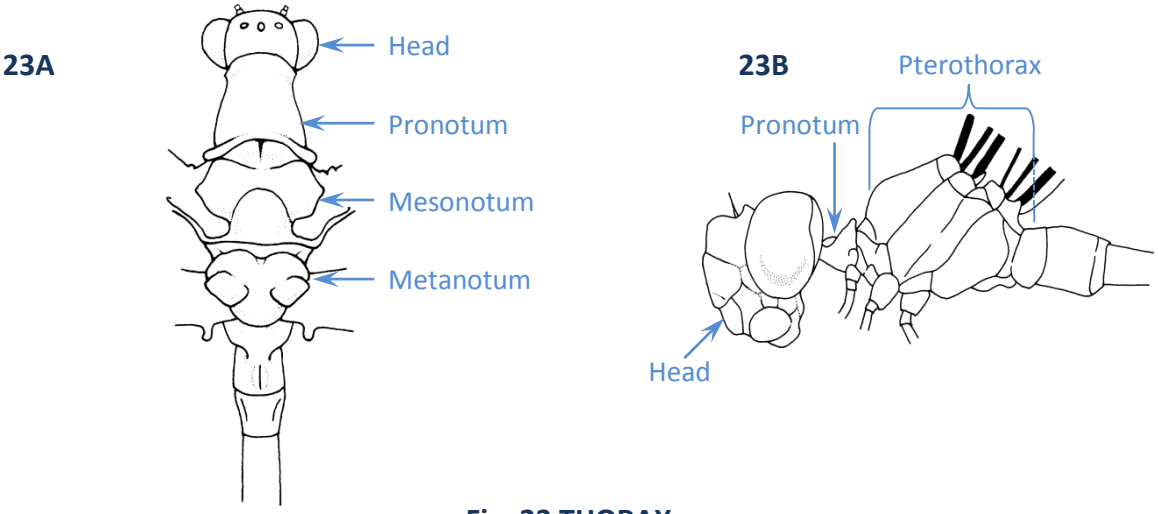


**Fig. 23 THORAX**

21(20). Tarsi 2-3 segmented; wings with 5 or less longitudinal veins, with 1-3 veins reaching hind margin of wing; rarely seen or collected insects ..... **22**

- Tarsi 4-5 segmented; wings with more than 5 longitudinal veins, with more than 4 veins reaching posterior margin of wing; common insects ..... **23**

22(21). First segment of foretarsus swollen compared with other tarsi **(Fig. 24A, 24B)**; tarsi 3-segmented; abdomen flat, tergites thickened, surrounded by membrane; cerci asymmetrical **(Fig. 24A)** ..... ..... **Embioptera (male adults) (Fig. 24)**

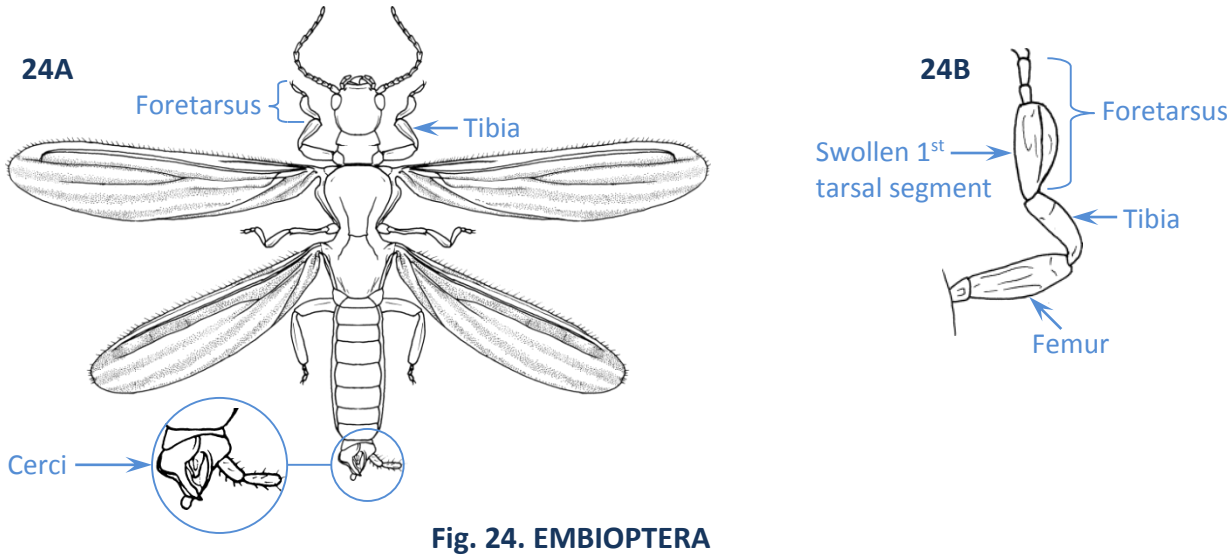


**Fig. 24. EMBIOPTERA**

- First segment of foretarsus not swollen; tarsi 2-segmented; abdomen cylindrical and tergites fused with sternites; cerci symmetrical..... **Zoraptera (adults)**

23(21). Several cross-veins present in wings **(Fig. 25A)**, giving net-like effect (small species with relatively few cross-veins have waxy whitish wing surfaces); cerci absent; eyes large; tarsi 5-segmented **(Fig. 25B)**; wings folded roof-like over body **(Fig. 25A)** or held away from body, not flat along body when at rest; wings not dehiscent..... **Neuroptera (adults) (Fig. 25)**

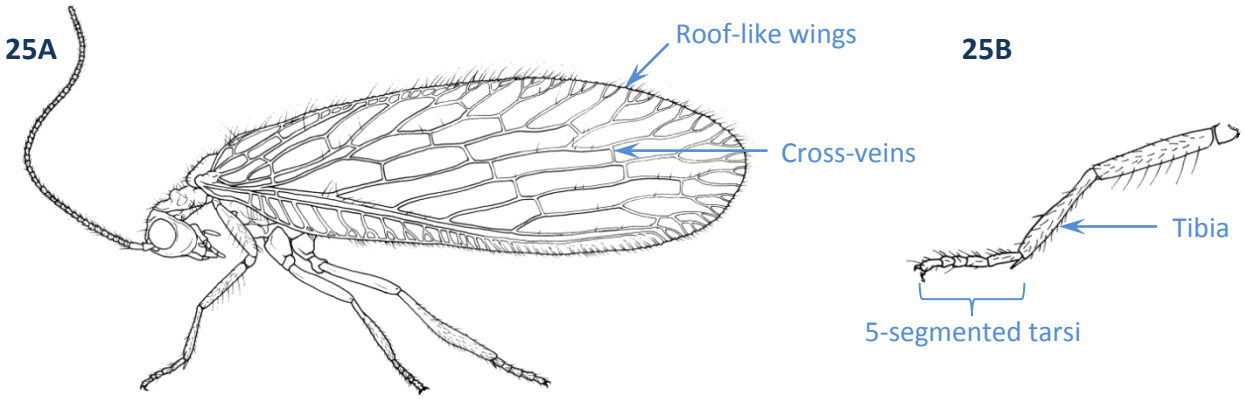


**Fig. 25. NEUROPTERA**

- Wings without cross-veins, without waxy surfaces **(Fig. 26C)**; short cerci present **(Fig. 26B)**; eyes small; tarsi 4-5 segmented; wings held flat over body at rest; wings often dehiscent = (partly lost) **(Fig. 26A)** ..... **Blattodea: Termitoidea (some adults) (Fig. 26)**

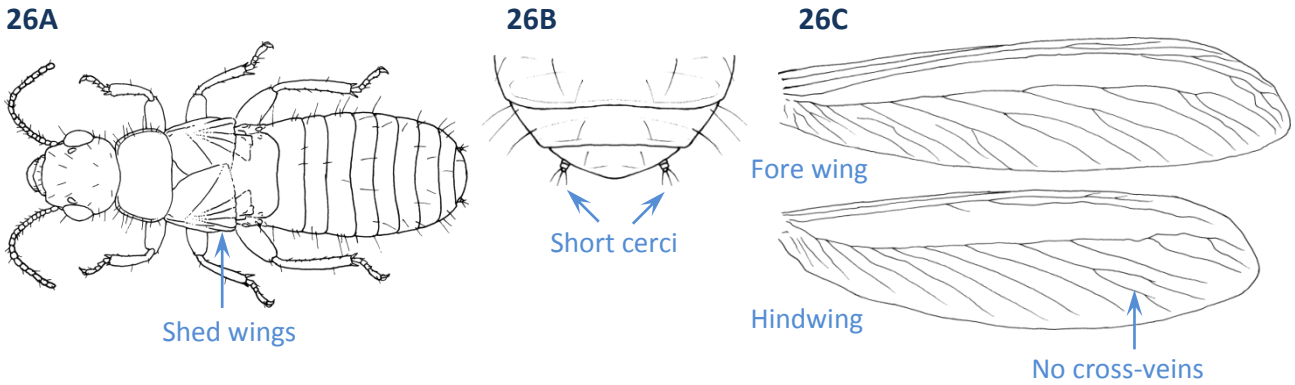


**Fig. 26. BLATTODEA (TERMITOIDEA)**

24(20). Size large, 20 - 150 mm body length; wings almost entirely net-like, including many regular similar sized rectangular cells **(Fig. 27A)**; wings not foldable, held rigidly laterally or along body; legs obliquely displaced, situated anterior to wings in lateral view **(Fig. 27B)**; antennae minute, appearing 2-3 segmented, with large basal scape and tiny apical flagellum **(Fig. 27B)**; mandibles large, well-developed **(Fig. 27B)** ..... **Odonata (adults) (Fig. 27)**

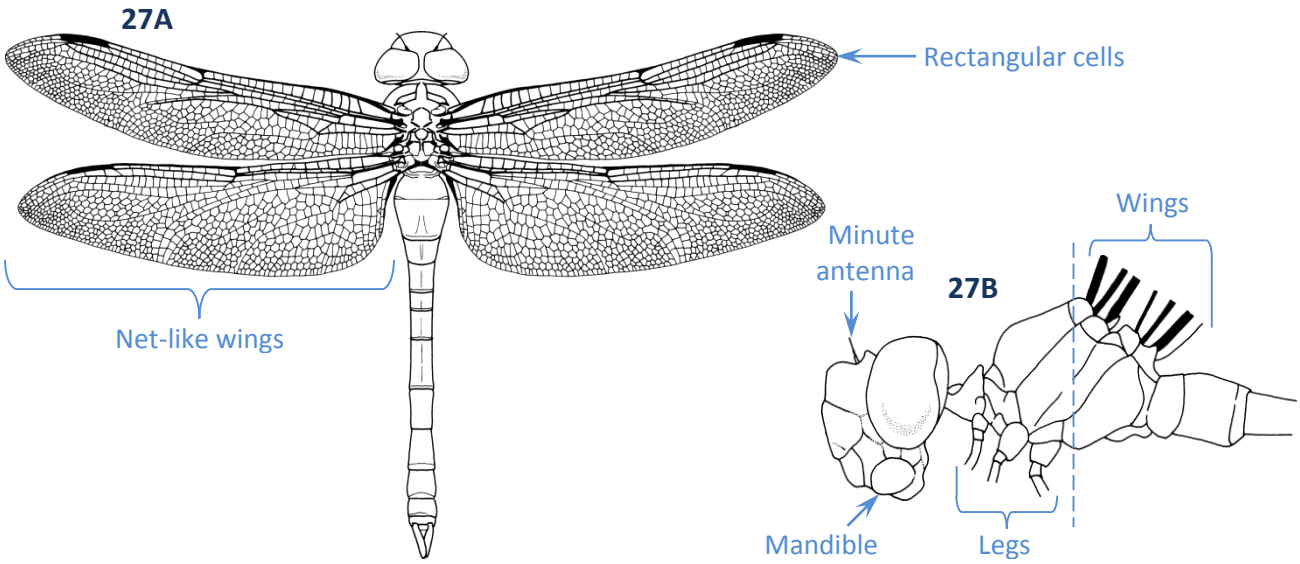


**Fig. 27. ODONATA**

- Size variable, 0.5 - 55 mm body length; wings variable but wing cells if present forming irregular polygons not a regular mesh; wings often foldable in species with more numerous veins; antennae conspicuous, filiform or clavate or flabellate, often geniculate at base; mouthparts variable ..... **25**

25(24). Body length 1 - 10 mm; face with swollen area above clypeus (postclypeus) and eyes relatively small **(Fig. 28A, 28B)**; forewing venation distinct with strongly curved veins, no closed cells and no cross-veins **(Fig. 28A)**; wings at rest often held tent-like over body; antennae filiform, with numerous segments (13 or more) **(Fig. 28A)**; tarsi 2-3 segmented; abdomen sometimes constricted at junction with thorax; abdomen without protruding ovipositor; rarely metallic in colour; body soft, thin walled ..... **Psocodea (some adults) (Fig. 28)**

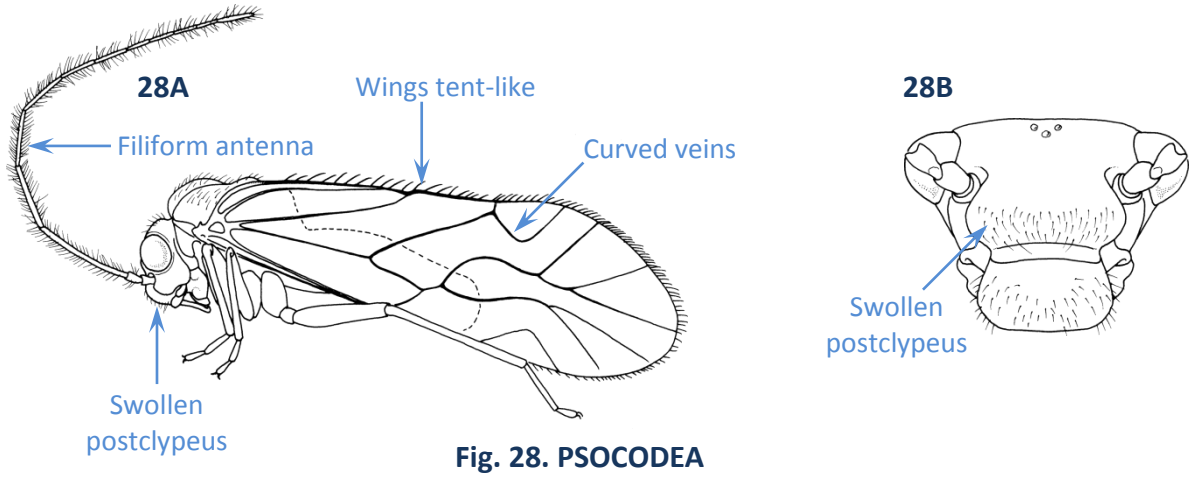


**Fig. 28. PSOCODEA**

- Body length 0.5 - 55 mm; face without swollen postclypeus and eyes often large; wing venation not as above, either with closed cells forming irregular polygons **(Fig. 29B)** or with a single submarginal vein **(Fig. 29C)**; wings not held tent-like/roof-like over body at rest (but may be held upright at rest); antennae either geniculate **(Fig. 29A)**, clavate or filiform or flabellate or moniliform, usually less than 14 segments; tarsi 4-5 segmented, except Trichogrammatidae (with single submarginal vein); abdomen not constricted, or constricted between first and second segments (waist-like) **(Fig. 29A)**, in which first segment fused to metathorax (determined by presence of spiracle); female often with prominent apical ovipositor; sometimes metallic; body hard, thick walled..... **Hymenoptera (most adults) (Fig. 29)**

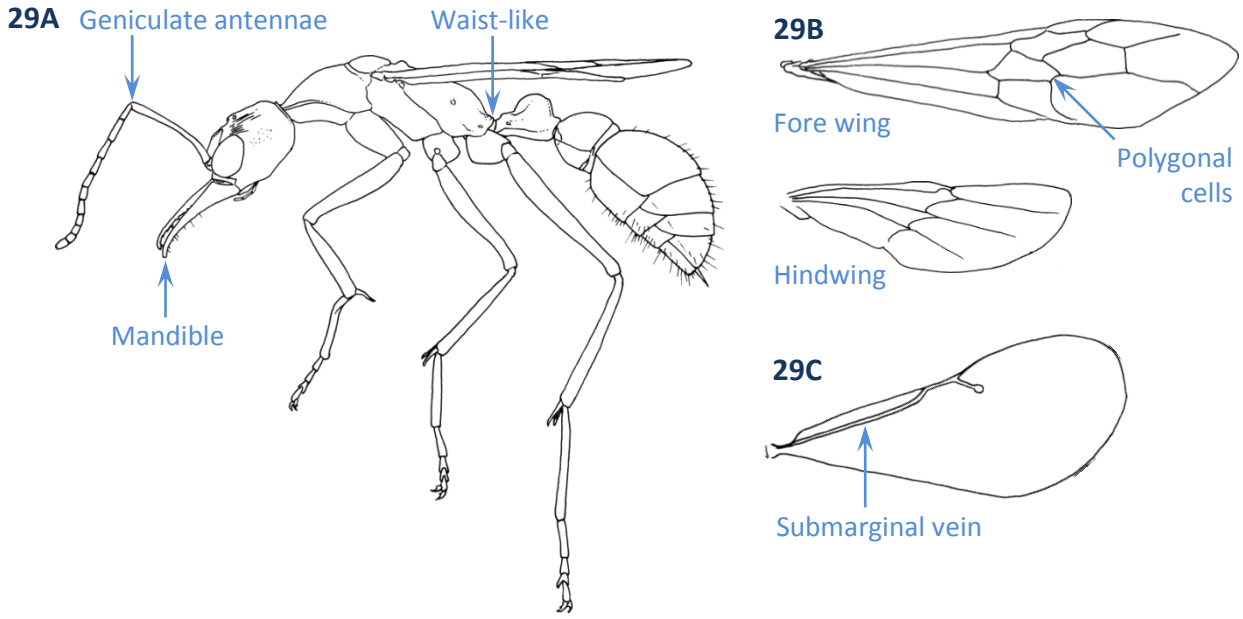


**Fig. 29. HYMENOPTERA**

## Larvae, Nymphs or Apterous Adults

At this point the key to orders becomes much more difficult to use. Immature stages are not fully developed and therefore often lack the characters that usefully distinguish adults (genitalia, wings, sensory organs on head, body appendages). The key therefore also incorporates life history information, but only where it should be obvious (aquatic or parasitic species). It may not be possible to determine the order of some specimens.

26(1). Ventral part of mouthparts modified into a hinged flat extensible labium, with labial palps modified into sharp pincers **(Fig. 30C)**; abdomen bearing three apical filaments **(Fig. 30B)**, usually strongly flattened (damselflies), or without obvious apical appendages (dragonflies) **(Fig. 30A)**; eyes large, compound **(Fig. 30A, 30C)**; length greater than 4mm; aquatic ..... .....**Odonata (nymph) (Fig. 30)**

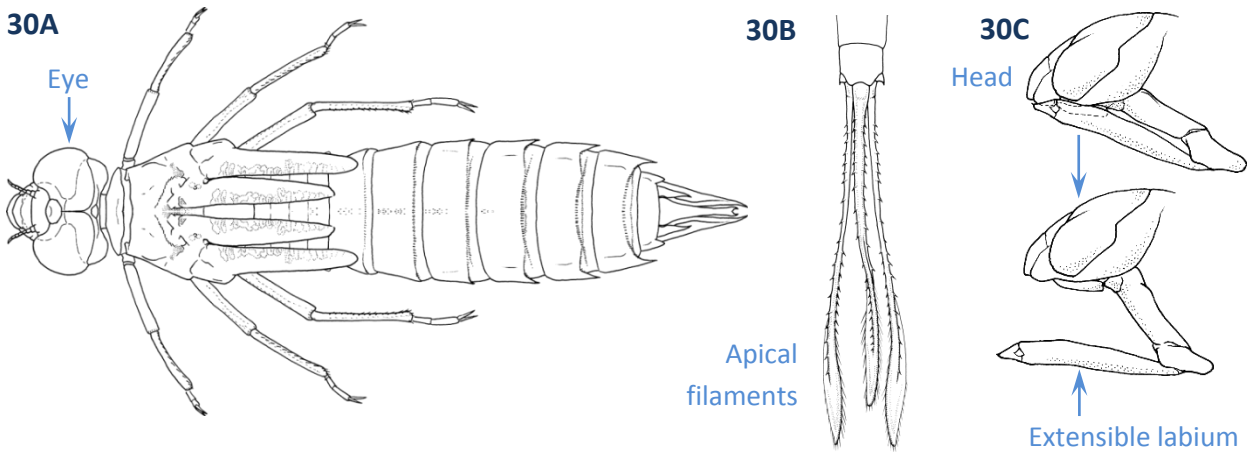


**Fig. 30. ODONATA**

- Mouthparts never modified as a ventral hinged extensible lobe; abdomen sometimes with 2 or 3 filiform apical filaments, never flattened; eyes and length variable ..... **27**

27(26). Three long, multisegmented apical abdominal filaments present, median as long as or longer than lateral ..... **28**

- At most two long multisegmented apical abdominal filaments ..... **30**

28(27). Thoracic segments structurally differentiated from abdominal, mesonotum much longer than pronotum **(Fig. 31A)** or basal abdominal segment, flat, quadrate; abdominal segments with paired lateral gills **(Fig. 31A)**, at least on one segment; maxillary palp 1-segmented; body dorsally flat; aquatic ..... **Ephemeroptera (most nymphs) (Fig. 31)**

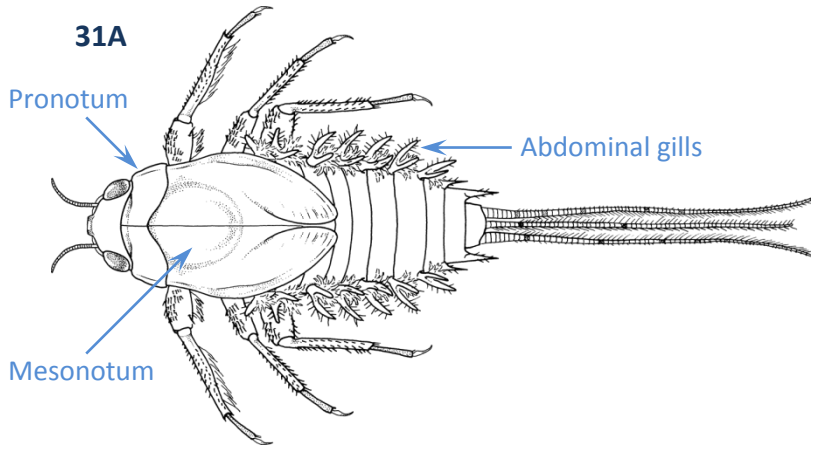


**Fig. 31. EPHEMEROPTERA**

- Thoracic segments similar in shape to abdominal, evenly convex; abdominal segments without gills but short ventral appendages may be present; maxillary palp 5- or 7-segmented; body dorsally convex with flat venter; not aquatic ..... **29**

29(28). Eyes not compound, present as isolated laterally placed single lenses (= stemmata), or absent; 5-segmented maxillary palp **(Fig. 32A)** .....**Zygentoma (adults and nymphs) (Fig. 32)**

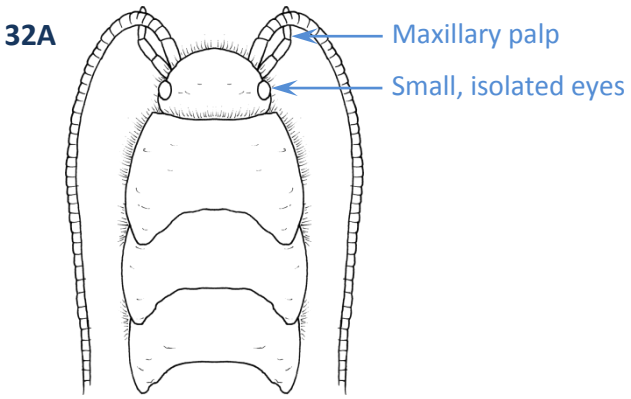


**Fig. 32. ZYGENTOMA**

- Eyes compound, large and dorsally contiguous; 7-segmented maxillary palp **(Fig. 33A)** ..... ..... **Archaeognatha (adults and nymphs) (Fig. 33)**

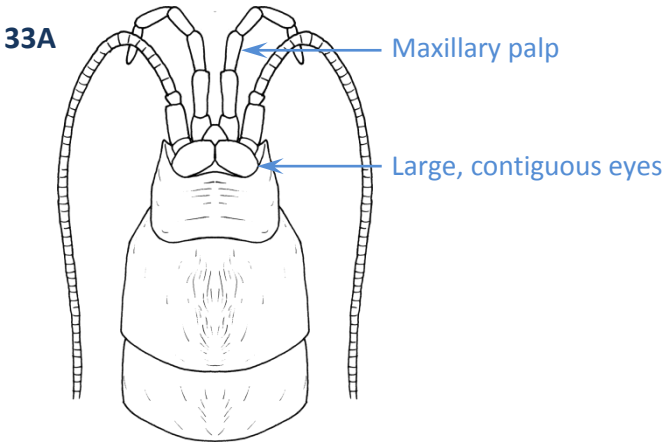


**Fig. 33. ARCHAEOGNATHA**

30(27). Ectoparasites on birds and mammals, rarely found away from hosts or host nests; strongly flattened dorsoventrally or laterally; compound eyes absent or not obvious/small; short piercing or mandibulate mouthparts; antennae short, with 3-5 segments; thoracic segments small, without trace of wing lobes; modified thickened legs with large apical claws and thickened setae for gripping; apical abdominal appendages absent; length less than 5mm .....**31**

- Not ectoparasites on birds and mammals; or if so (Hemiptera: Cimicidae) then dorsoventrally flattened, with simple unmodified antennae & legs, long segmented piercing rostrum and distinct compound eyes.....**33**

31(30). Laterally flattened/compressed body **(Fig. 34A)**; mouthparts modified into a piercing stylet **(Fig. 34B)**; apical antennal segment ovate, subdivided with 8 transverse grooves, antenna placed in a lateral hollow on head; hind legs enlarged, for jumping; legs with 5 tarsal segments **(Fig. 34A)**; on birds and mammals, and in nests .....**Siphonaptera (adults) (Fig. 34)**

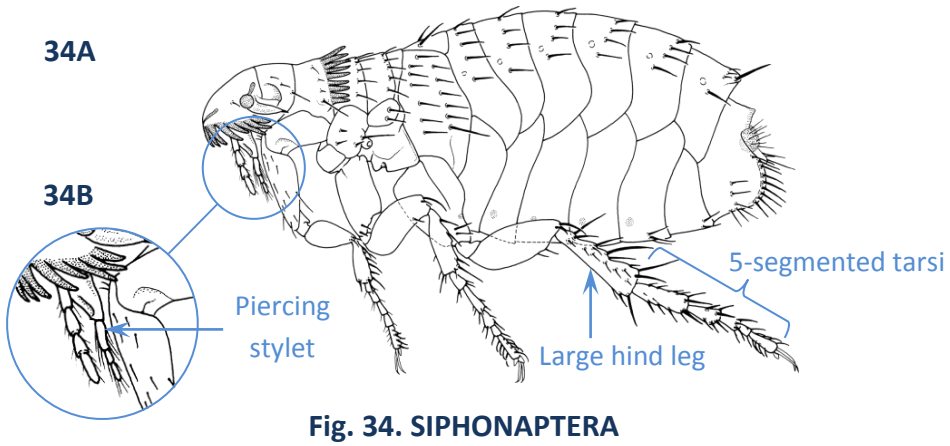


**Fig. 34. SIPHONAPTERA**

- Dorsoventrally flattened body; mouthparts variable or absent; antennae without ovate last segment; hind legs laterally splayed, incapable of jumping; legs with no more than 4 tarsal segments..... **32**

32(31). Spider-like, with long anterodorsally flexed legs, hind leg longer than body when stretched out **(Fig. 35A)**; 4 tarsal segments **(Fig. 35A)**; head reflexed to middle of body **(Fig. 35A)**; antennae obscured; on bats ..... **Diptera (adult Nycteribiidae) (Fig. 35)**

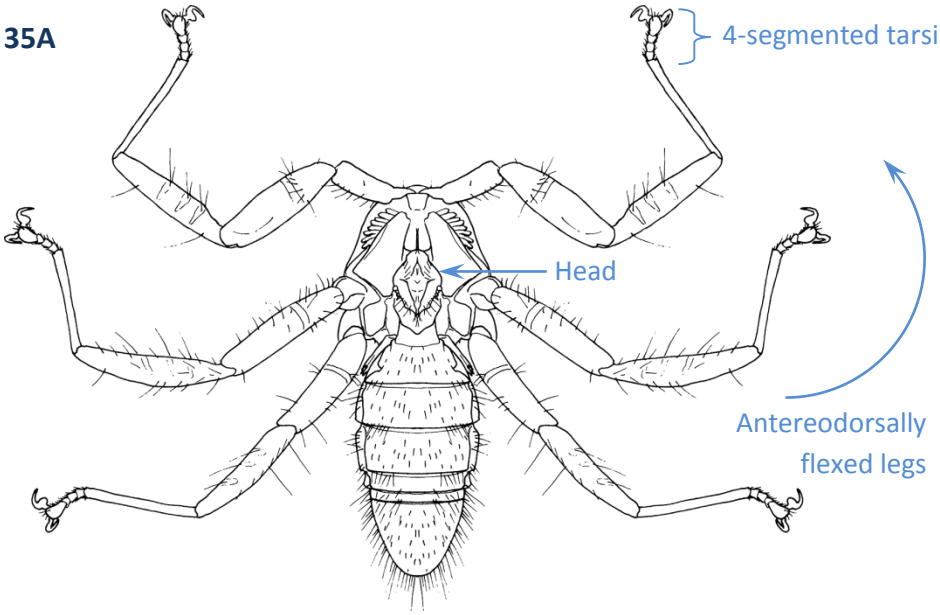


**Fig. 35. DIPTERA (adult NYCTERIBIIDAE)**

- Not spider-like, with short legs, not dorso-anteriorly flexed, hind legs much shorter than body length; tarsi 1-2 segmented **(Fig. 36A)**; head clearly distinguishable at anterior of body **(Fig. 36A)**; 3-5 segmented antennae usually visible **(Fig. 36A)**; on birds and mammals ..... ..... **Psocodea (suborder Phthiraptera) (Fig. 36)**

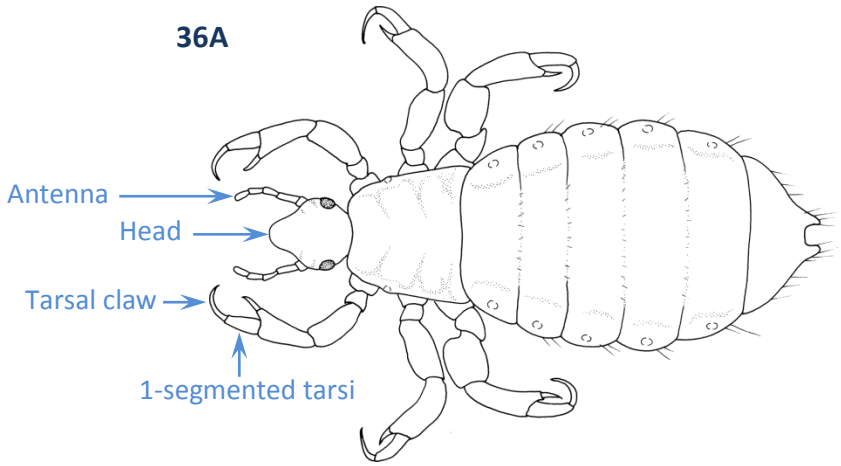


**Fig. 36. PSOCODEA (PHTHIRAPTERA)**

33(30). Compound eyes absent, eye replaced by 6 or less isolated stemmata, or stemmata absent; head not distinctly delimited from thorax; legs present or absent ..... **34**

- Compound eyes present (reduced to 3 facets in larval Thysanoptera), often also 1-3 centrally placed ocelli on dorsum of head; head distinctly delimited from thorax; legs present ..... **49**

34(33). Endoparasitic on insects, but with apex of abdomen partly exerted from host ..... **35**

- Not endoparasitic in insects, or if so, body entirely within host (but spiracles may be exerted through host body wall) ..... **36**

35(34). Body U-shaped **(Fig. 37A)**; on Hemiptera: Auchenorrhyncha ..... ..... **Hymenoptera (Dryinidae larvae) (Fig. 37)**

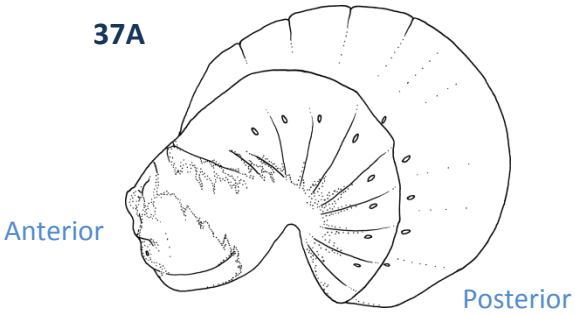


**Fig. 37. HYMENOPTERA (DRYINIDAE larvae)**

- Body simply cylindrical; on Hemiptera, Blattodea, Orthoptera, Diptera, Hymenoptera ..... ..... **Strepsiptera (larvae and female adults)**

36(34). Mouthparts modified into thin segmented rostrum and stylet **(Fig. 38C)**; if head not distinguishable and stylet ventrally placed and minute animal sessile on plant surfaces, and legs usually very short, often obscured by body or absent **(Fig. 38A, 38B)**; usually secreting white wax .. ..... **Hemiptera (some adults and nymphs of Coccoidea, Aleyrodoidea, Aphidoidea) (Fig. 38)**

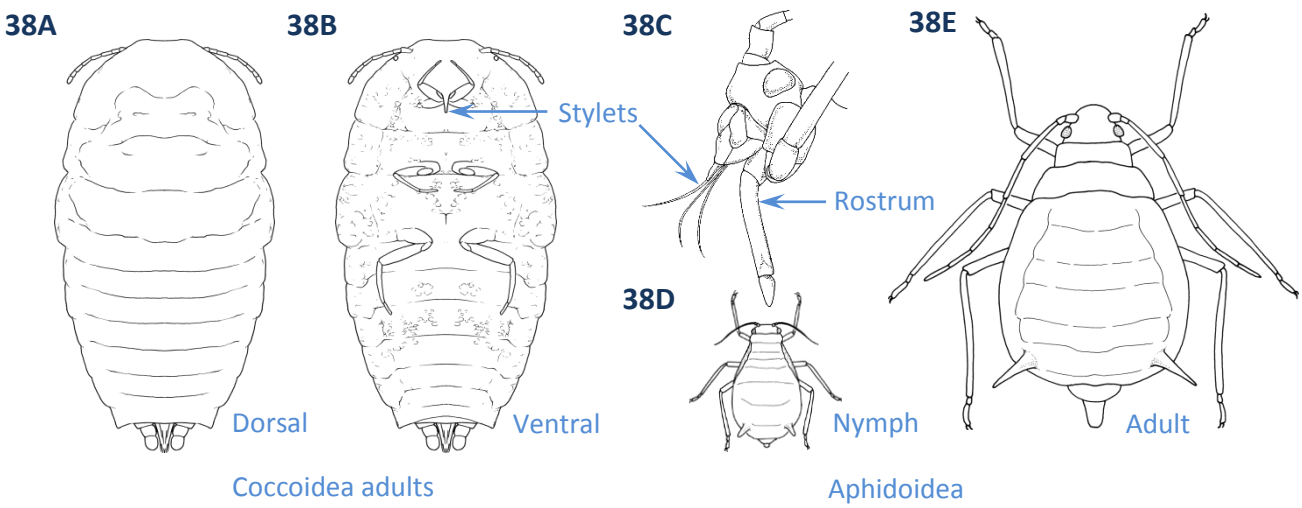


**Fig. 38. HEMIPTERA**

- Mouthparts not modified into segmented rostrum and stylet; if sessile on plants then with mandibulate mouthparts; if secreting white wax, then mandibulate with well-developed legs (Coleoptera: some Coccinellidae larvae) ..... **37**

37(36). Thoracic legs absent ..... **38**

- Thoracic legs present ..... **40**

38(37). Distinct head absent, mouth reduced to a pair of strongly sclerotised hooks **(Fig. 39A, 39B)** ..... ..... **Diptera, Cyclorrhapha larvae (typical fly maggots) (Fig. 39)**

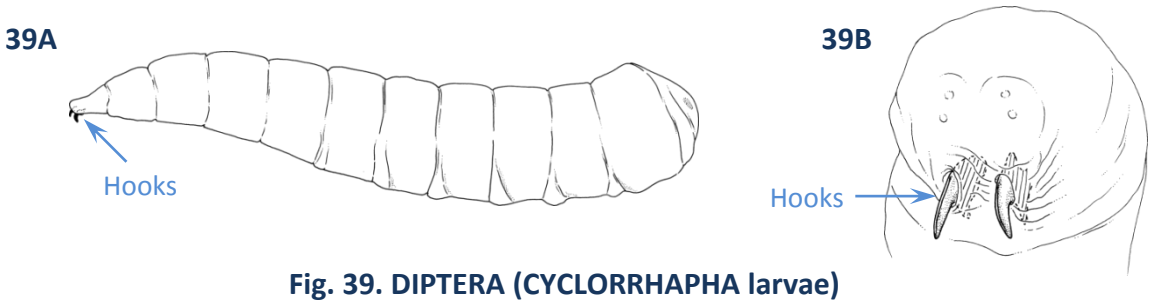


**Fig. 39. DIPTERA (CYCLORRHAPHA larvae)**

- Distinct head present; mouth not a pair of hooks ..... **39**

39(38). Living in bird or mammal nests; abdominal segment 10 bearing a pair of prolegs or anal struts; body with long and stiff setae **(Fig. 40A)**; body elongate and cylindrical ..... ..... **Siphonaptera (larvae) (Fig. 40)**

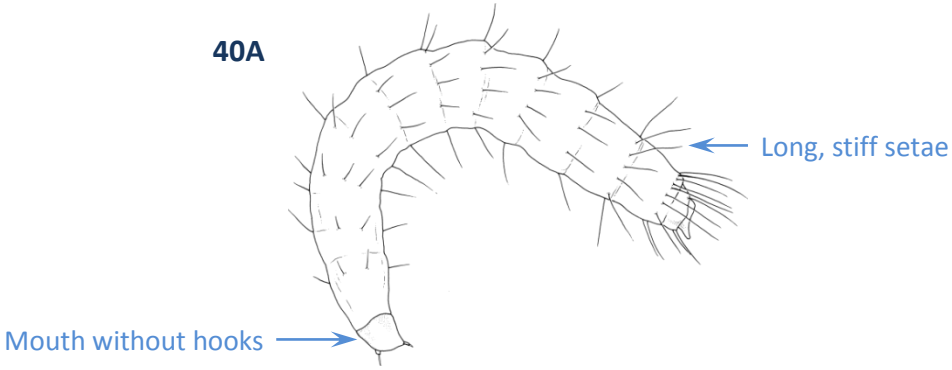


**Fig. 40. SIPHONAPTERA**

- Without the above combination .....

This group of legless endopterygote insect larvae is very difficult to separate into different orders. There are exceptions to all character combinations therefore habitat is also useful for diagnosis.

- Free-living, aquatic ..... **Diptera** (**different nematoceran families**)
- Endoparasitic ..... **few Diptera (rare Cecidomyidae), many Hymenoptera: Apocrita, few Coleoptera (rare Rhipiphoridae)**
- Leaf mining ..... **some Hymenoptera: Apocrita, some Coleoptera, some Lepidoptera**
- In soil..... . **many Coleoptera, many Diptera, few Hymenoptera: Apocrita**
- With median labial spinneret or silk gland ..... ..... **almost all Lepidoptera, some Hymenoptera: Apocrita**
- Two pairs of thoracic spiracles ..... **some Hymenoptera: Apocrita**
- With inverted Y-shaped ridge on frons (adfrontal lines)..... **most Lepidoptera**
- Prolegs present on abdominal venter, with crotchets ..... **most Lepidoptera**
- Maxillary palpi with one segment ..... ..... **most Hymenoptera: Apocrita, few Coleoptera, few Lepidoptera**
- Maxillary palpi with 3 segments..... **most Coleoptera, most Lepidoptera**

40(37). 5-segmented maxillary palps; 9-segmented antennae **(Fig. 41A)**; 2-segmented tarsi on well-developed walking legs; pair of small 1-segmented cerci at apex of abdomen **(Fig. 41A)**; small (<4mm long) soft bodied insects with paired claws similar to termite workers (Blattodea superfamily Termitoidea) but these have 4-5 segmented tarsi; living in rotting wood; rarely seen or collected (one locality in New Britain) ..... **Zoraptera (adults and nymphs) (Fig. 41)**

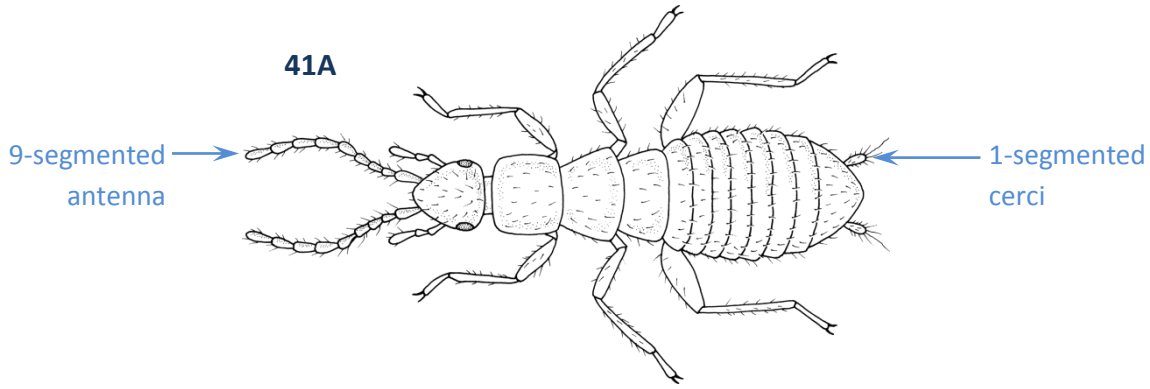


**Fig. 41. ZORAPTERA**

- Without above combination of characters; maxillary palpi with no more than 4 segments..... **41**

41(40). Mandibles elongated, needle-like or forceps-like, without internal tooth **(Fig. 42A)**; length of legs usually equal to or wider than thorax; antennae often with more than 3 segments, as long as or longer than head capsule; if antennae only 3-segmented and shorter, then larva ectoparasitic on spiders, head capsule without distinct sutures and legs very short (Mantispidae); maxillary palpi absent; mostly free-living terrestrial predators, but including one rarely collected aquatic group of freshwater sponge predators ..... **Neuroptera (larvae) (Fig. 42)**

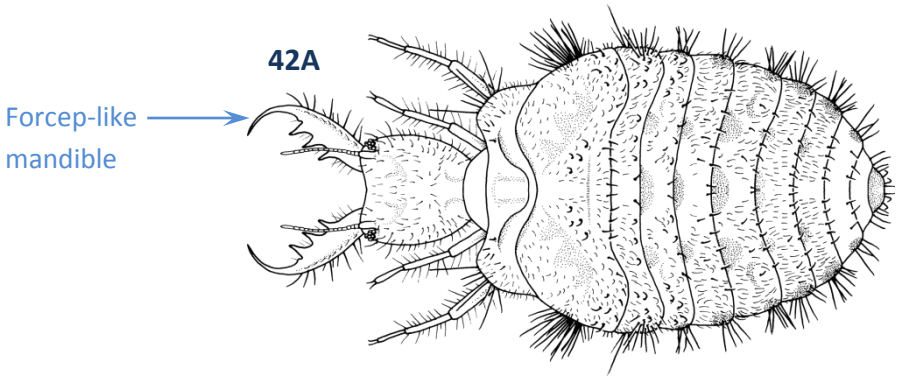


**Fig. 42. NEUROPTERA**

- Mandibles usually not elongate; if jaws greatly elongated (some Coleoptera larvae), then with internal tooth and maxillary palpi well-developed, with 3-4 segments..... **42**

42(41). 2-segmented anal prolegs at apex of abdomen (short, hooked leg-like appendages either side of anus); aquatic larvae, usually case-bearing (living in a self-constructed case) **(Fig. 43B)**; all legs long thin, 5-6 segmented, with single apical claw **(Fig. 43A)**; antenna tiny, one-segmented, thread-like, conical or absent **(Fig. 43A)**; adfrontal lines absent from frons; body segments not smoothly contiguous; silk glands present in labium..... **Trichoptera (larvae) (Fig. 43)**

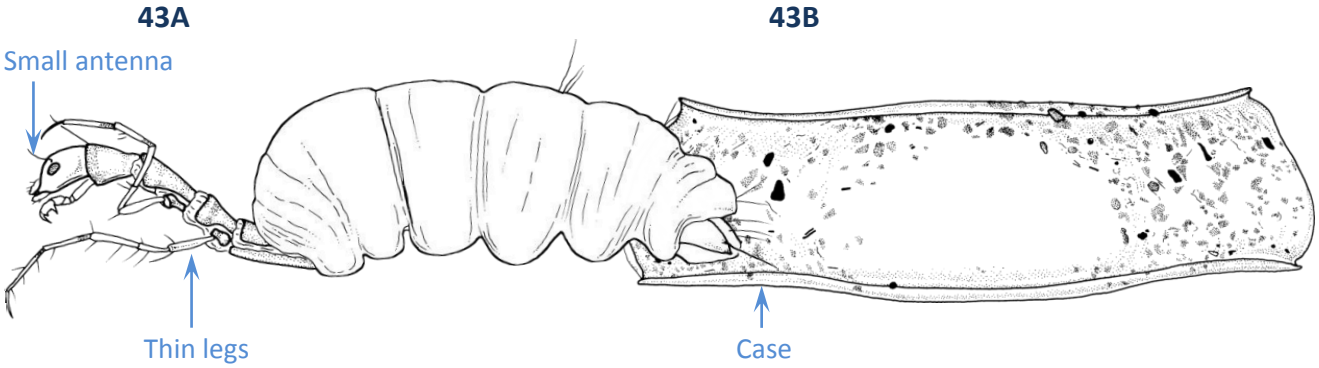


**Fig. 43. TRICHOPTERA**

- Without 2-segmented prolegs at apex of abdomen; aquatic or not aquatic; if aquatic and with a pair of apical hooks adjacent to anus, then hooks unsegmented, antennae 3-segmented, body smooth and cylindrical with contiguous segments and without silk glands (aquatic larvae of Coleoptera: Elmidae) ..... **43**

43(42). 'Caterpillars' = free-living eruciform larvae with well-developed thoracic legs, usually also abdominal prolegs, chewing leaves, sometimes flowers or bark..... **44**

- Not eruciform larvae (not caterpillar-like)..... **46**

44(43). Abdominal prolegs present **(Fig. 44A)**, at most with four pairs on segments 3-6, and one pair of prolegs on segment 10, each with small ring or band of hooks (crotchet) **(Fig. 44C)**; head with adfrontal lines (inverted Y-shaped ridge) usually present on frons **(Fig. 44B)**; median labial silk gland present ..... **Lepidoptera (larvae) (Fig. 44)**

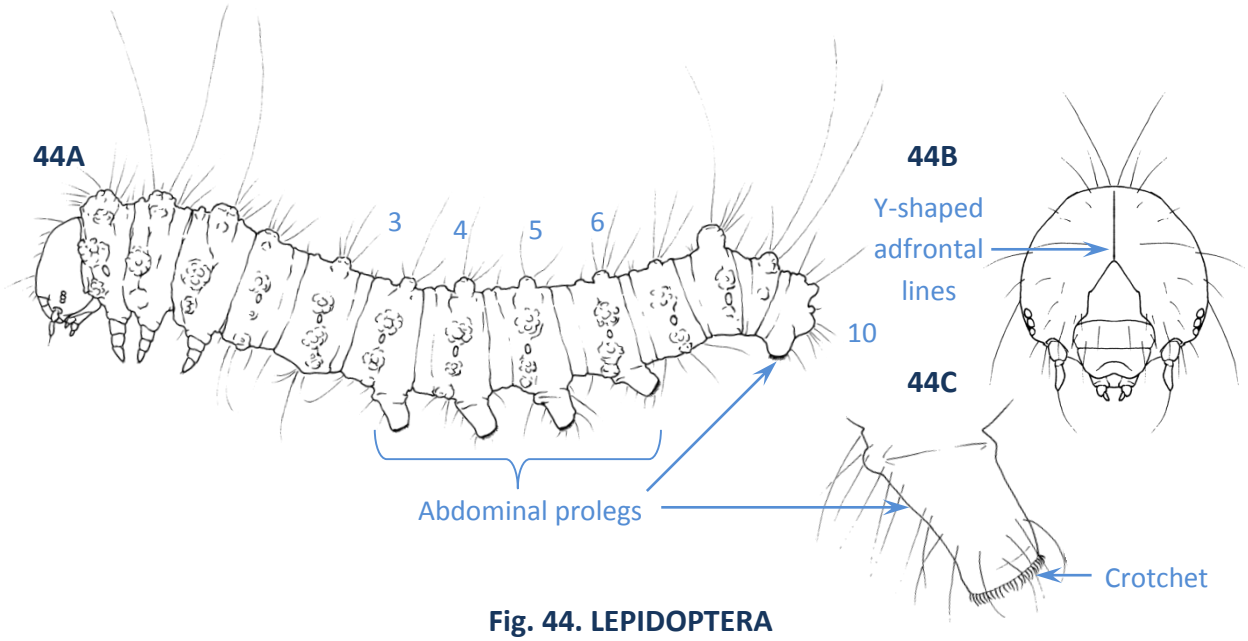


**Fig. 44. LEPIDOPTERA**

- If abdominal prolegs present, then without crotchets..... **45**

45(44). Well-developed abdominal prolegs usually present **(Fig. 45A)**, on segments 2-6, 2-7, 2-8 or 3-8, and 10, sometimes only on 10 or completely absent; if prolegs absent, only one pair of large stemmata present **(Fig. 45A)**, antennae dome-like and unsegmented, and metathoracic spiracle present..... **Hymenoptera (some Tenthridinoidea larvae) (Fig. 45)**

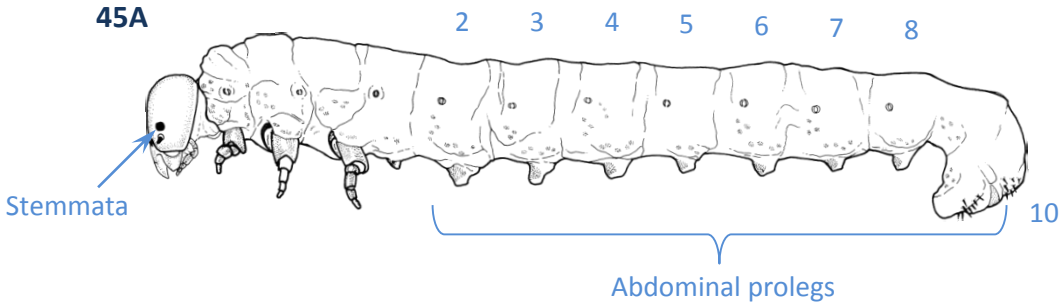


**Fig. 45. HYMENOPTERA (TENTHRIDINOIDEA larvae)**

- Abdominal prolegs absent, or weakly developed on segments 6-8 **(Fig. 46B)**, in which case 6 stemmata present **(Fig. 46A)**; antennae never dome-like, 1-3 segmented; metathoracic spiracle absent ..... **Coleoptera (some Chrysomelidae larvae) (Fig. 46)**

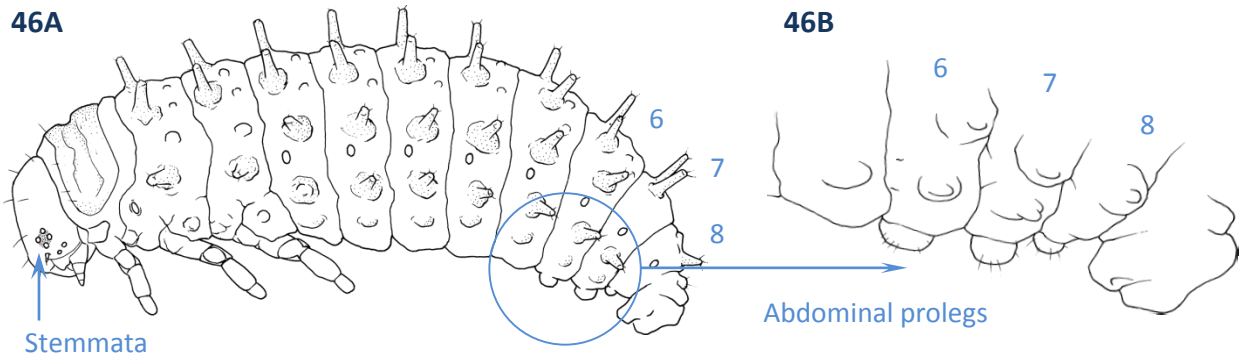


**Fig. 46. COLEOPTERA (CHRYSOMELIDAE larvae)**

46(43). Antennae elongate, at least as long as head, with 10-32 segments **(Fig. 47A)**; head enlarged, broader and longer than thorax **(Fig. 47A)**; pair of short 1-5 segmented cerci at apex of abdomen **(Fig. 47A)**; tarsi with 4-5 segments **(Fig. 47A)**; soft bodied terrestrial insects with long thin well-developed walking legs and usually either produced mandibles **(Fig. 47A)** or a needle-like anterior extension of the head ..... **Blattodea superfamily Termitoidea (adults & nymphs) (Fig. 47)**

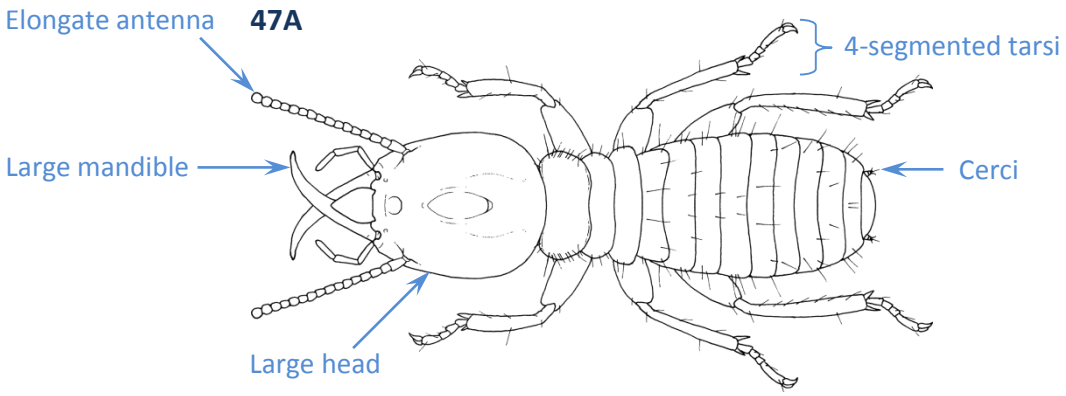


**Fig. 47. BLATTODEA (TERMITOIDEA)**

- Antennae shorter than head, with 5 or less segments; if antennae with elongate 10-25 segmented antennae, then body setose, cylindrical, with short legs and 1-segmented tarsi, head smaller than prothorax, with short mandibles, and aquatic or in wet soil and wood (larvae of Coleoptera: Scirtidae) ..... **47**

47(46). With at least one of the following features: abdominal prolegs **(Fig. 48A)**, each with small ring or band of hooks (crotchet) **(Fig. 48B)**; adfrontal lines on frons; median labial silk gland; metathorax without spiracles..... **Lepidoptera (larvae) (Fig. 48)**

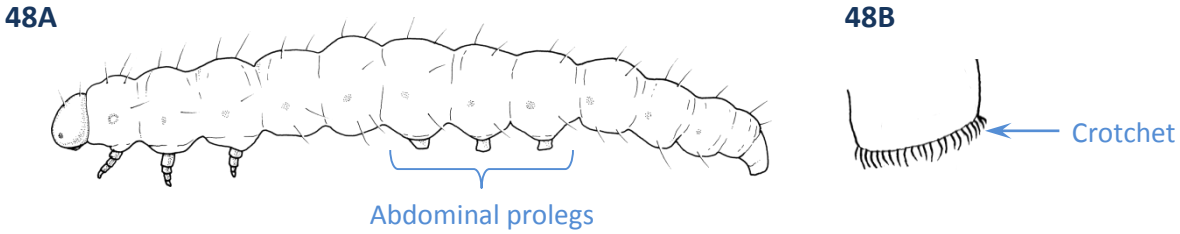


**Fig. 48. LEPIDOPTERA**

- If prolegs present, without crotchets, or if crotchets present then aquatic (some larval Coleoptera: Hydrophilidae); adfrontal lines absent; metathorax with or without spiracles ..... **48**

48(47). Combination of elongate abdominal spiracles, metathoracic spiracle present, labial silk glands; rarely seen or collected ..... **Hymenoptera (leaf mining and stem boring Symphyta larvae)**

- Without the above combination; abundant and diverse in form ..... **Coleoptera (larvae)**

49(33). Pair of multisegmented filamentous cerci present at apex of abdomen; aquatic, usually with lateral abdominal gills; antennae with numerous segments, much longer than head; body slightly flattened, with legs splayed out laterally; head entirely exposed, not hidden by pronotum; forelegs not raptorial; hind legs not saltatorial (enlarged for jumping)..... **50**

- Without the above combination; if aquatic, without multisegmented cerci; if pair of multisegmented abdominal cerci present, either with pronotum covering most or all of head viewed from above, or with raptorial forelegs or with saltatory hind legs..... **51**

50(49). Tarsi with single apical claw; metanotum much shorter than mesonotum, with wing buds overlapped by mesonotum wing buds **(Fig. 31A)**; apex of abdomen usually with long multisegmented median filament **(Fig. 31A)**..... **Ephemeroptera (nymphs) (Fig. 31)**

- Tarsi with pair of apical claws; metanotum of similar size to mesonotum **(Fig. 49A)**, wing buds not overlapped by mesonotum wing buds; apex of abdomen without multisegmented median filament.....**Plecoptera (nymphs) (Fig. 49)**

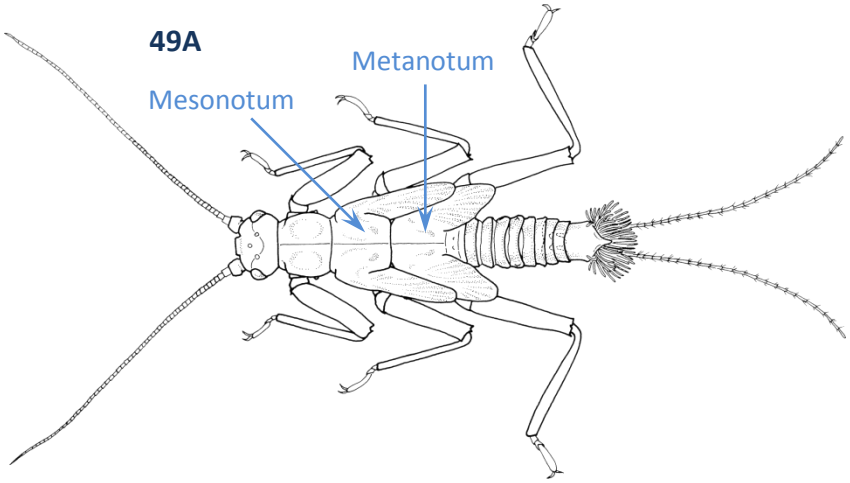


**Fig. 49. PLECOPTERA**

51(49). Body clothed in erect overlapping scales **(Fig 50A)**; mouthparts haustellate (short or curled unsegmented tube / proboscis) or absent **(Fig 50A)**; legs not raptorial or saltatorial; eyes large **(Fig 50A)**; rarely seen or collected.....**Lepidoptera (completely wingless adult females) (Fig. 50)**

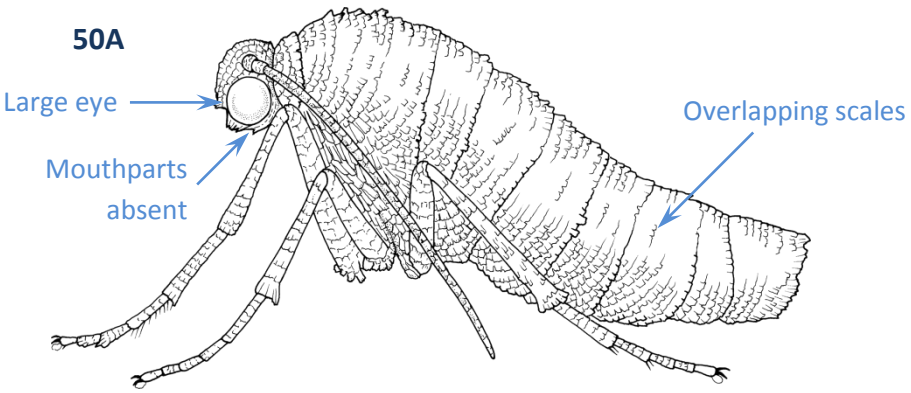


**Fig. 50. LEPIDOPTERA**

- Body not clothed in scales or, if present, scales flat, legs saltatorial and mouthparts mandibulate; mouthparts proboscis-like (short stylet or straight segmented rostrum) or mandibulate..... **52**

52(51). Tarsus 1-2 segmented with apical eversible bag (= arolium) and mouthparts postero-ventrally directed **(Fig. 51B)**, with stylets; small 0.5-12mm long soft-bodied insects with conically tapering abdominal apex; head not separated from thorax by narrow neck; legs simple, of similar size and shape **(Fig. 51A, 51C)**; antennae with 4-9 segments, not geniculate..... ..... **Thysanoptera (nymphs and wingless adults) (Fig. 51)**

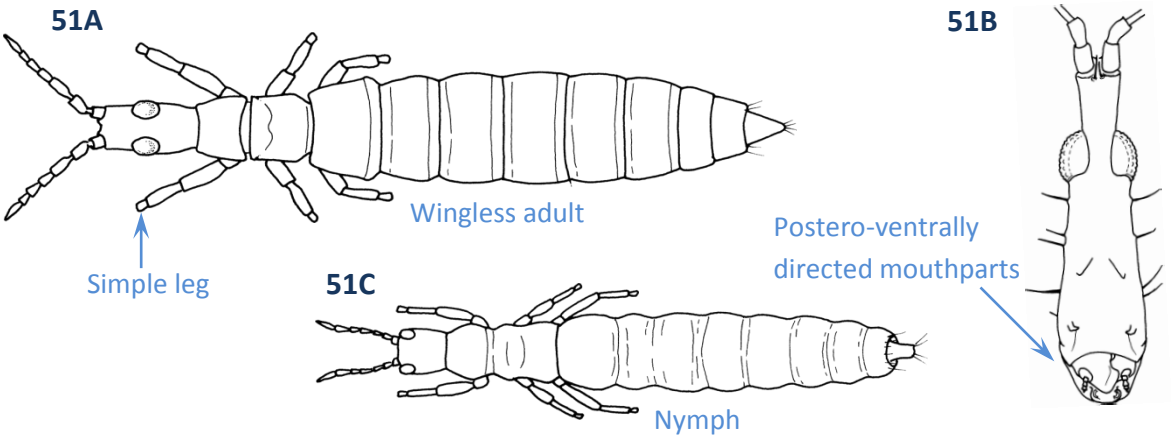


**Fig. 51. THYSANOPTERA**

- Tarsus 1-5 segmented; without combination of arolium and stylet mouthparts ..... **53**

53(52). Mouthparts modified into a straight tube-like rostrum or proboscis (only mouthparts, not head projection), ventrally positioned, oriented posteriorly, without palps, usually segmented, sometimes reduced to thin stylet **(Fig. 52B)**; without visible abdominal cerci **(Fig. 52A)** ..... ..... **Hemiptera (most nymphs, some adults) (Fig. 52)**

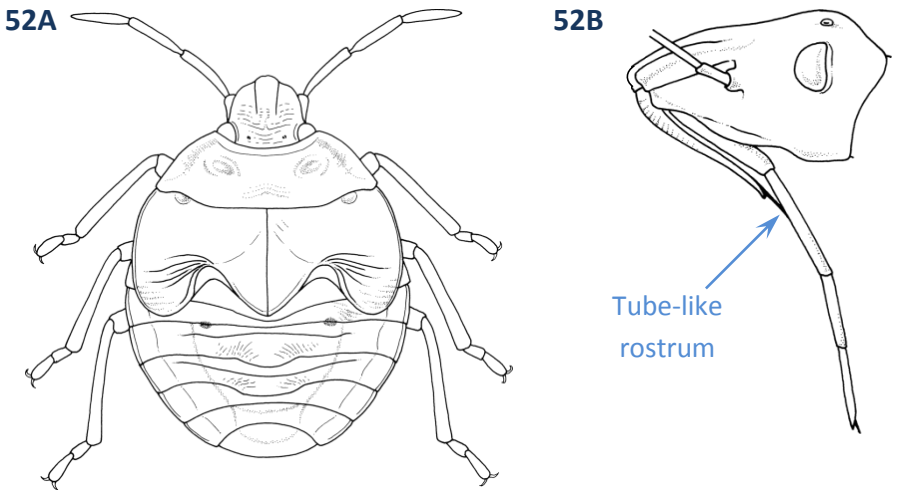


**Fig. 52. HEMIPTERA**

- Mouthparts usually mandibulate (chewing), or mouthparts vestigial (reduced or not visible); with or without abdominal cerci ..... **54**

54(53). Forelegs raptorial, enlarged compared with mid and hind legs, with large elongated forecoxae, internally spined femora, hooked tip of tibiae and long tarsi, usually held together anteriorly in characteristic flexed position **(Fig. 16A, 16B)**; mid and hind legs simple, thin and without spines **(Fig. 16A)**; pronotum usually elongate and freely articulated, longer than relatively short mesothorax **(Fig. 16A)** ..... **Mantodea (nymphs) (Fig. 16)**

- Forelegs not raptorial, with small forecoxae, and apex of foretibiae not hooked ..... **55**

55(54). Paired forceps (modified single-segmented cerci) at apex of abdomen **(Fig. 14A, 14B)**; head separated from thorax by a narrow neck and mouth prognathous; body relatively flattened; all legs of similar size, tarsi 3-segmented ..... **Dermaptera (nymphs and wingless adults) (Fig. 14)**

- Without paired forceps at apex of abdomen ..... **56**

56(55). Base of abdomen strongly constricted between first and second segments, first segment strongly fused to metathorax (recognised by presence of spiracle); sometimes two constrictions at base of abdomen, rarely without; if without abdominal constriction, antennae geniculate; foretibiae usually with an enlarged spur, (= calcar); cerci absent or 1-segmented; mandibles strongly developed **(Fig. 29A)**; hard-bodied insects, with thoracic and abdominal segments thick-walled and rigid (or soft-bodied, but living inside figs) ..... **Hymenoptera (wingless adults) (Fig. 29)**

- Without strong constriction between abdomen and thorax, or if present soft bodied insects with simple antennae and legs; antennae never geniculate; foretibiae without calcar ..... **57**

57(56). Hind legs modified for jumping (= saltatorial), with femora elongated and thickened compared with middle femora **(Fig. 19A, 19C)**; tibiae relatively elongated; pronotum saddle-shaped with sides projecting ventrally as descending lobes **(Fig. 19B, 19C)**; tarsi 4-segmented; head generally hypognathous ..... **Orthoptera (nymphs and wingless adults) (Fig. 19)**

- Hind legs not modified for jumping (not saltatorial); if hind femora greatly thickened, then pronotum flat and first tarsal segment of foreleg enlarged (Embioptera), or tarsi 5-segmented (Phasmatodea); pronotum not saddle-shaped ..... **58**

58(57). Face with swollen area above clypeus (= postclypeus) **(Fig. 28A, 28B)**; antennae filiform, with 2 broad basal segments and numerous thin apical segments **(Fig. 28A)**; tarsi 2-3 segmented; abdomen sometimes constricted at junction with thorax; abdomen without protruding ovipositor; body soft, thin walled; body length 0.5 - 6 mm; cerci absent ..... ..... **Psocodea (nymphs and wingless adults) (Fig. 28)**

- Face not swollen above clypeus; only first antennal segment enlarged or all segments similar; abdomen never constricted at junction with thorax; cerci often present ..... **59**

59(58). First tarsal segment of forelegs enlarged (elongated and thickened) **(Fig. 24A, 24B)**; tarsi 3-segmented; head prognathous, mouthparts visible from above; body parallel-sided; rarely seen or collected..... **Embioptera (nymphs and wingless adults) (Fig. 24)**

- First tarsal segment not enlarged; tarsi 4-5 segmented (termite tarsal segments difficult to see); head pro- or hypognathous, sometimes hidden by pronotum; common insects..... **60**

60(59). Pronotum relatively large, semicircular, often covering most or all of head **(Fig. 20A, 20B)**; head strongly hypognathous; body flattened **(Fig. 20B)**; legs covered in strong stiff spine-like setae ..... ..... **Blattodea excluding Termitoidea (nymphs and wingless adults) (Fig. 20)**

- Pronotum not enlarged, never covering head which is entirely visible in dorsal view and usually prognathous; body rarely flattened, if so legs without obvious setae or spines ..... **61**

61(60). Stick or leaf mimics, >10 mm long; mesothorax elongate (thinner than wide) (only slightly so in leaf-mimics) **(Fig. 17A, 17B)**; femora and tibiae often spined along edges; front legs extending well beyond front of head (by several head lengths) **(Fig. 17A)**..... **Phasmatodea (nymphs and wingless adults)**

- Not mimicking sticks or leaves, 2.5 - 15 mm long; mesothorax transverse (wider than long); femora and tibiae without lateral spines; front legs as long as to reach front of head or shorter (not extending past front of head) **(Fig. 26A)**..... **Blattodea: Termitoidea (nymphs and wingless adults) (Fig. 26)**