Guides to the

Freshwater Invertebrates of Southern Africa

Volume 7: Insecta I

Ephemeroptera, Odonata & Plecoptera

Editors: IJ de Moor, JA Day & FC de Moor

TT 207/03

Water Research Commission

CHAPTER 2

EPHEMEROPTERA

by

H. M. Barber-James & C. R. Lugo-Ortiz

The ancient insect order Ephemeroptera, or mayflies, is considered to be the most primitive surviving group of insects, dating back to the late Carboniferous or early Permian periods, about 290 m years ago. The Ephemeroptera and Odonata are the only living relicts of an ancient group, the Palaeoptera, of which another four orders (the Meganisoptera, Megasecoptera, Palaeodictyoptera and Archodonata) are extinct, being known only from the fossil record (Riek 1970). Adults ephemeropterans (Fig. 2.4A) exhibit a number of primitive traits. For example, they are unable to fold their wings flat over their bodies, instead holding them vertically, and they have long caudal filaments.

At least 2500 species of Ephemeroptera are recognized worldwide, in 23 families (CSIRO web site) and 371 genera, of which 61 are known only as fossils (Hubbard 1990). The order is well represented in the Afrotropical region, defined by Crosskey & White (1977) to include Africa south of the Sahara Desert, conveniently delimited by the 254 mm rainfall isohyets (Fig. 2.1). In this region, mayflies are represented by 13 families, 94 genera and approximately 382 species reported thus far (see Appendix, p. 143). Considering South Africa alone, the figures stand at 11 families, 47 genera and 102 species. The number of genera and species is expected to rise significantly as the mayfly fauna of the region continues to be more thoroughly documented. Although intended mainly for southern African freshwater ecologists and water-quality managers, the nymphal identification key includes all known Afrotropical mayfly genera because, in the course of our research on the mayfly fauna of the Afrotropics, we have consistently found genera previously known to occur north of the

catchments of the Cunene and Zambezi rivers to extend their ranges to southern Africa. Madagascan mayflies have also been included as the region has many genera in common with Africa.

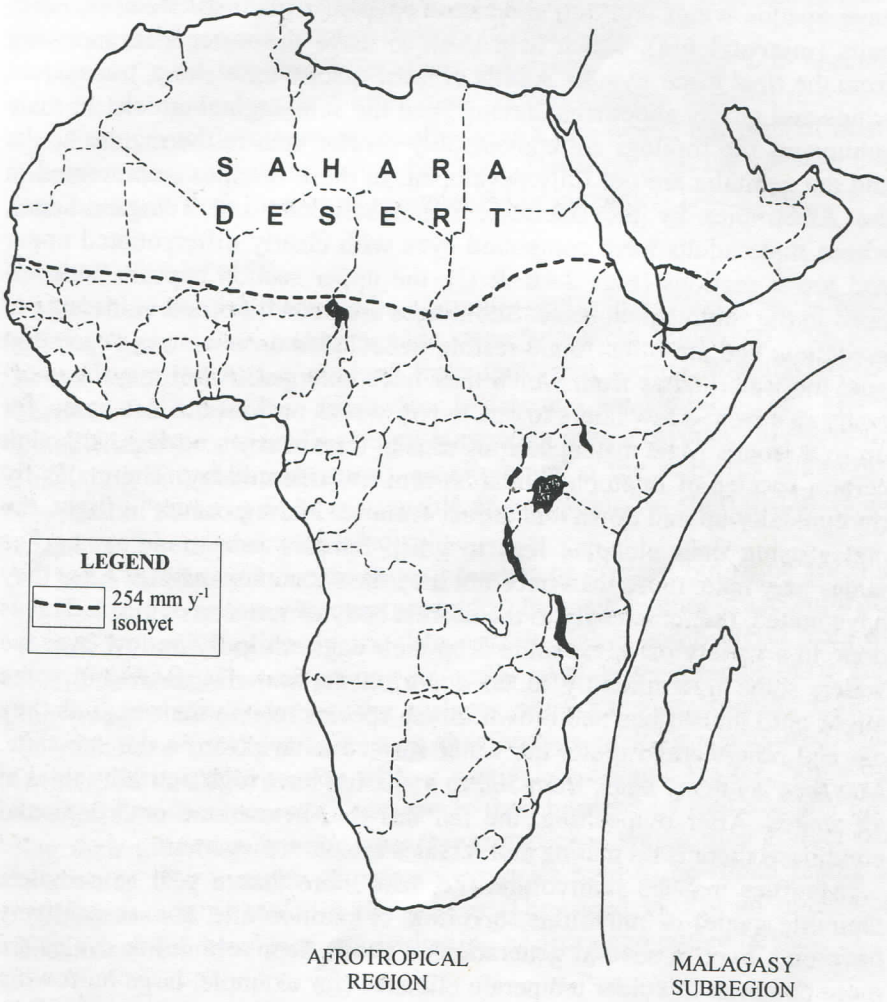

Fig. 2.1. The Afrotropical Region, including the Malagasy Subregion. The northern 254 mm y^{-1} (10 inches y^{-1}) rainfall isohyet forms a useful boundary to demarcate the border of the Sahara Desert.

Life history and biology

Mayflies undergo hemimetabolous, or incomplete, metamorphosis; that is, they hatch from eggs, grow and mature as nymphs through several moults, and transform into adults, without undergoing a pupal stage. Mayflies, however, have a unique maturation stage, called the **subimago**, between the nymph and adult. Subimagos are similar to adults but they have opaque wings and dull abdomens covered with small water-resistant hairs (**microtrichia**), which help them to leave the water after moulting from the final instar nymph. Adults of most species have shiny, transparent wings and glossy abdomens, having shed the subimaginal cuticle. In male subimagos the forelegs are considerably shorter than in the mature adults and the genitalia are not fully developed. In those families (represented in the Afrotropics by the Baetidae, Leptophlebiidae and Teloganodidae), whose male adults have compound eyes with clearly differentiated upper and lower sections (Figs 2.4B & C), the upper section appears undeveloped in the subimaginal stage. Subimagos are poor fliers and vulnerable to predation, and are often found resting in secluded areas among vegetation near the waterbodies from which they have emerged. Adult mayflies normally live from a few hours to one to two weeks or, in some rare cases, for up to a month. Male mating swarms usually form at dawn or dusk, although certain species of Leptophlebiidae swarm towards midday The males fly rhythmically up and down and attract females. Mating occurs in flight, the males using their elongate legs to grasp females from underneath. The males may mate more than once but they die soon after mating. After they have mated, the females fly to the nearest body of water to oviposit. This is done in a variety of ways: some drop their eggs while flying low over the water; some intermittently touch down on the water surface, and some alight onto the surface and drown. Some species release their eggs as they die and others crawl under the water surface to oviposit on the substrate. Mayflies lay many eggs, from 500 to 4500, but have high mortality rates at all stages. After ovipositing, the females die. In extreme environmental conditions there is no mating and females are parthenogenetic.

Mayflies may be semivoltine (i.e. take more than a year to complete their life cycle) or univoltine, bivoltine or multivoltine, (i.e. respectively have one, two, or several generations a year). Semivoltine life cycles are more common in colder temperate climates (for example, large burrowing species in Canada take over two years to mature). In tropical and subtropical regions most species are bi- or multi-voltine. Having a very short developmental (aquatic) stage in the life cycle may be an adaptation to living in intermittent streams. The number of nymphal instars varies between 10 and 50, with the most common being between 15 and 30 (Peters &

Campbell 1991). The number of instars within a species is flexible, and correlated with temperature regimes. Development speeds up with increasing temperatures, resulting in fewer instars and smaller individuals. In populations developing in cooler conditions, individuals tend to go through more instars, grow bigger, produce larger, more darkly-coloured adults, and females tend to produce more eggs, than individuals of the same species from warmer waters. Such differences can result in taxonomic confusion. About 50 species are known to be parthenogenetic, although in most cases, parthenogenesis is not obligatory (Brittain 1982).

Eggs of most mayflies have sticky coverings, frequently with specialized anchoring devices, and often have species-specific external morphology Embryonic development usually takes a few weeks but eggs of many species undergo diapause before hatching. Depending on the species, diapause can last from three to eleven months or longer

Ecology and feeding

Mayflies are considered to be a primary group of aquatic insects, meaning they have always had an aquatic stage (secondary aquatic groups, such as the waterbugs, have evolved from terrestrial forms). Mayfly nymphs occur in lentic and lotic freshwater bodies and are benthic. They can be found clinging to, sprawling on, or burrowing into, a diversity of substrates (including silt, clay and wood), or climbing on the stems of submerged vegetation. Some nymphs are capable of swimming for short distances and others drift in the current periodically

Most mayfly nymphs are deposit feeders or grazers, but some are filter feeders and a small number are predatory Deposit feeding is accomplished mainly by browsing fine particulate organic matter and bacteria from different surfaces, whereas grazing primarily involves the scraping of periphyton (mostly diatoms) from the surfaces of rocks. Filter-feeding taxa are characterized by the presence on the forelegs of long specialized setae, which aid in the collection of fine particulate organic matter Some burrowing filter-feeders create currents in their burrows by rhythmically moving their gills, thus stirring up organic particles, which they collect from the water The nymphs of predatory species tend to be found facing the current on top of rocks in riffle areas. They feed mostly on other small macroinvertebrates, particularly drifting or dislodged midge larvae.

Diagnostic characters

Both nymphal and adult stages are important for identification. The keys in this chapter deal only with the nymphal stages however, because this series of volumes deals with the aquatic stages of freshwater organisms only

Ephemeropteran nymphs (Fig. 2.2) are distinguished by the following characteristics: the presence of compound eyes, which may be particularly well developed in mature male nymphs, as these develop into the **turbinate eyes** characteristic of adult males in some families (Fig. 2.4B); slender antennae and well-developed legs; **forewing pads** (note that **hindwing pads** may or may not be present, and if they are present they are obscured from dorsal view by the forewing pads; variously-developed and variously-orientated abdominal gills; two or three elongate 'tails' or **caudal filaments** (the lateral filaments are also known as **cerci**, while the middle filament is usually known as the **medial caudal filament**: Fig. 2.2) and chewing mouthparts (Fig. 2.3), which may be variously modified.

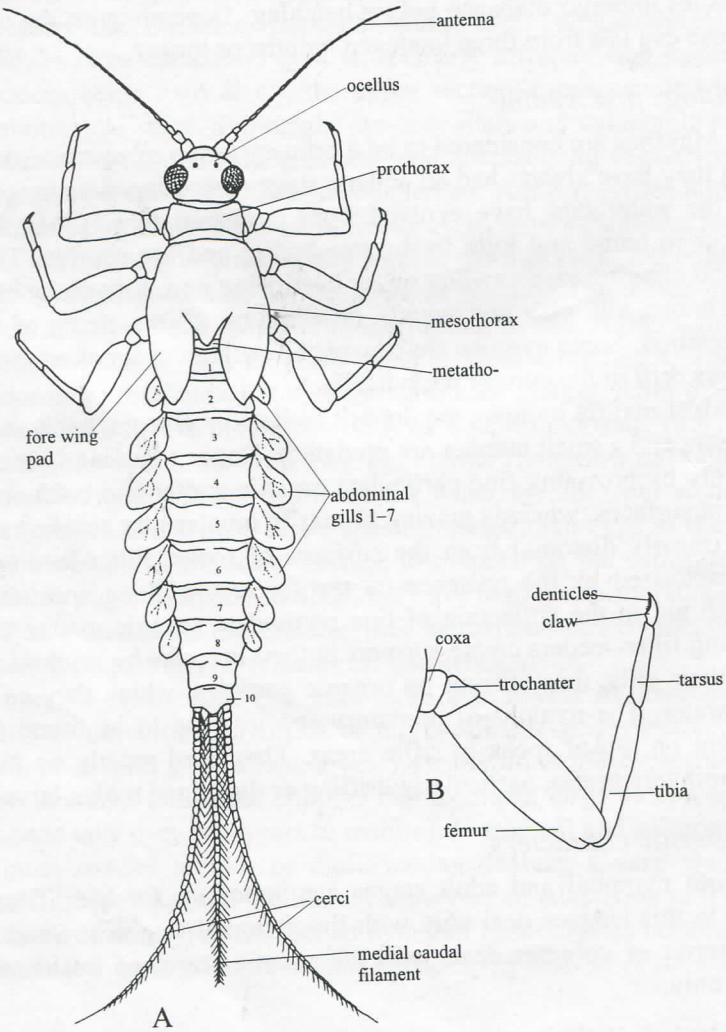

Fig. 2.2. Ephemeroptera: morphologically-important features of a baetid nymph, useful for identification. **A**, whole nymph in dorsal view; **B**, leg.

In summary, the following criteria are important for nymphal identification:

* the structure of the mouthparts (including the 'tusks' in burrowers)
* gill number, shape and size
* the presence or absence of operculate gills (Figs 2.13; 2.14A, B & C; 2.15A & 2.16A)
* the presence or absence of setae and spines on legs and other parts of the body
* the number of denticles (teeth) on the claws
* the colour and pattern of various parts of the body, although this characteristic may not always be reliable.

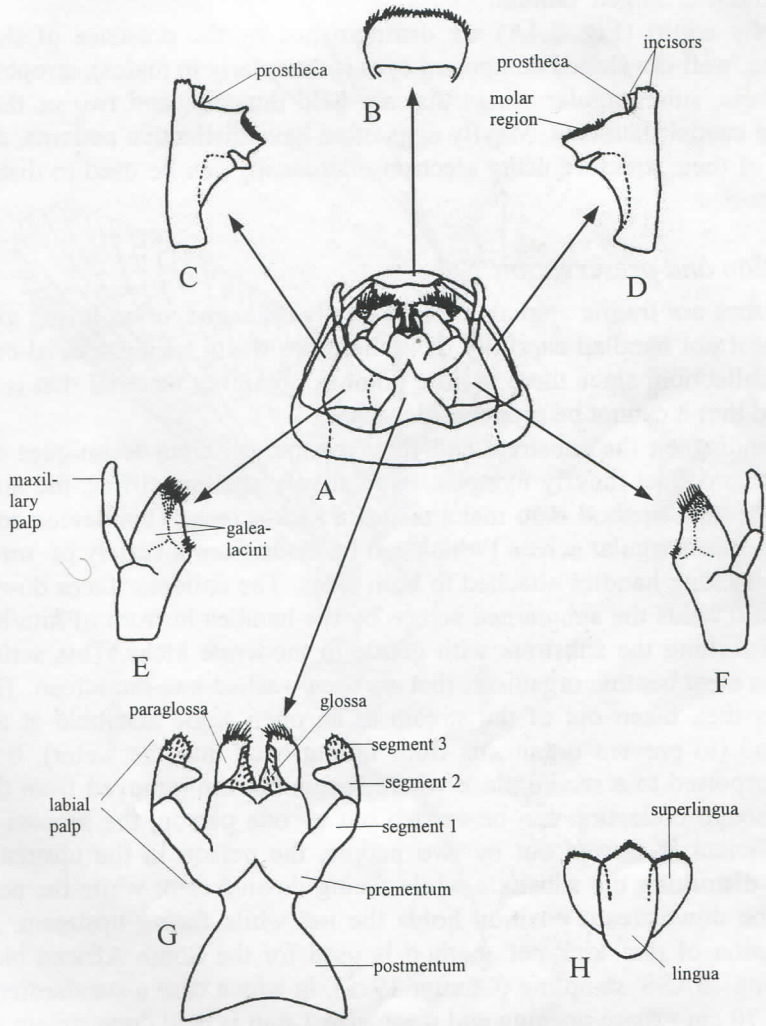

Fig. 2.3. Mouthparts of a typical mayfly nymph (Baetidae), ventral views: **A**, head, ventral view, indicating position of various mouthparts: **B**, labrum; **C**, right mandible; **D**, left mandible; **E**, right maxilla; **F**, left maxilla; **G**, labium; **H**, hypopharynx (dissected out from it's position beneath the labium).

Mayfly nymphs may be confused with stoneflies (Plecoptera); stoneflies, however, have double tarsal claws and lack dorsal abdominal gills, though may have branched gills ventrally on the thorax and/or on the first few abdominal segments. Stoneflies always have only two caudal filaments; while most mayflies have three, a few have only two. Stoneflies also always have two sets of wingpads, both of which are visible, whereas in mayflies the upper wingpads lie over the lower wingpads (if these are present). Mayfly nymphs may also be confused with immature nymphs of the order Odonata, particularly with those of the suborder Zygoptera, but odonate nymphs lack abdominal gills; zygopteran caudal gills are fleshy (as opposed to the filamentous cerci of mayflies) and their mouthparts have a mobile, hinged labium.

Mayfly adults (Fig. 2.4A) are distinguished by the presence of short antennae, well-developed compound eyes (particularly in males), atrophied mouthparts, subtriangular wings that are held dorsally, and two or three elongate caudal filaments. Mayfly eggs often have distinctive patterns, and studies of their structure using electron microscopy can be used to distinguish species.

Collection and preservation

Mayflies are fragile animals that are easily damaged, often losing gills and legs if not handled carefully It is therefore worth taking special care during collection, since there is little point in obtaining material that is so damaged that it cannot be properly identified.

Depending on the substrate and flow regime, different techniques are required to collect mayfly nymphs. In relatively shallow riffles, the simplest collecting method is to make use of a kick-screen. This device consists of a quadrangular screen (which can be made from a variety of mesh sizes) with long handles attached to both sides. The collector faces downstream and holds the submerged screen by the handles in front of him/her while disturbing the substrate with gentle to moderate kicks. This action dislodges most benthic organisms that are then washed into the screen. The screen is then taken out of the stream at an open angle and held at the lower end (to prevent organisms from falling back into the water). It is then transported to a secure place where specimens are removed from the net. Although collection can be carried out by one person, the process is more efficient if carried out by two people, the person in the upstream position disturbing the substrate while facing downstream, while the person in the downstream position holds the net while facing upstream. A modification of this 'kick-net' method is used for the South African biomonitoring 'SASS' sampling (Chutter 1998), in which case a standardized net with 70 cm square opening and mesh size 1 mm is held downstream of the person collecting the sample. It is important to note, however, that such

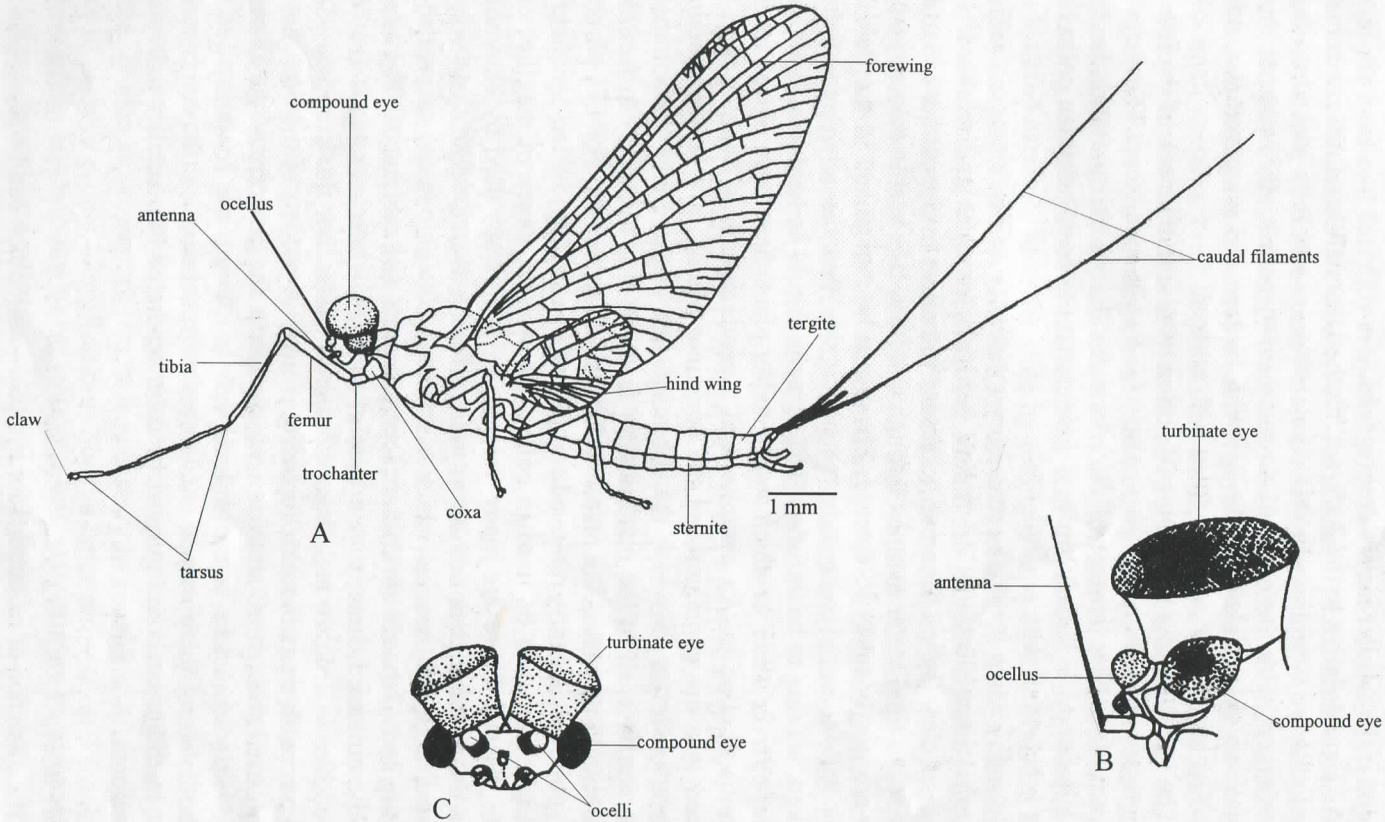

Fig. 2.4. Distinctive anatomical features of mayfly adults. **A**, adult in lateral view. **B–C**, baetid adult males showing turbinate eyes: **B**, head, in lateral view; **C**, head, in anterior view.

a coarse mesh size misses smaller individuals, and a finer mesh size is needed if the smaller instars are required.

As an alternative to the 'kick-net' method, a small hand net can be used for qualitative sampling. In this case stones are carefully picked up from the benthos, with the net held downstream to collect any escapees. Individuals are then picked off the net with forceps and preserved in a small tube that has been previously filled with ethanol.

The insertion of a small plug of cotton wool into the neck of the tube is sometimes recommended, particularly for fragile specimens. This helps to prevent air-bubble damage of the specimens during transportation back to the laboratory In such samples it is important to ensure that the collection tube is brim-full with ethanol.

In many cases it may be necessary to identify adults, either to confirm nymphal identifications, or to link particular nymphs and adults of the same species. It then becomes necessary to collect live specimens in order to rear the final instar nymphs through to adults. It is best to select nymphs that are nearly ready to emerge. These can be recognized in the field by their dark-coloured wingbuds, which signify that the wings are tightly packed, waiting to be unfurled. The nymphs should be kept in a small container of river water in which stones and/or plants have been placed for the nymphs to cling to. An airstone with a gentle stream of bubbles must be placed into the container and the container placed in a larger container with a gauze lid on which the subimago can alight. Since the subimago does not have all of the mature adult features, it is necessary to facilitate final moulting so that the mature adult can be examined. For this purpose the subimago is gently removed and placed in a smaller, lidded container

Light traps can be used to collect the winged stages of mayflies and other insects. There are many versions of light traps used by entomologists, but for mayflies nothing is more effective than a white sheet with a super-actinic light source (which has a stong *UV* component) suspended at the top end of the sheet. This attracts the adults and subimagos. The adults can be collected directly in a tube of ethanol, while subimagos are collected live in order to rear them through to adults. For this purpose, a lidded box with a small corked opening is used. A section of the box should be covered with gauze so that one can observe the progress of the animals inside. Care must be taken to insert specimens into the container gently, without letting them escape. A number of specimens can be temporarily kept in the same box, but must be soon separated into smaller individual containers.

Dissection of mouthparts and preparation of microscope slides

The dissection of mouthparts for nymphal identification can be accomplished with the aid of a dissecting microscope (at X50 magnification), forceps with

acute tips, and a thin dissecting needle. The mouthparts are gently dislodged from the head and carefully removed with forceps or a dissecting needle. They are then soaked in Cellusolve™ for at least five minutes before being transferred to a drop of Euparal™ on a microscope slide. A direct transfer from alcohol to the Euparal™ is not advisable, as this produces a cloudy effect, obscuring the mounted pieces. A small amount of Euparal™ (one or two small drops) should be put in the centre of the microscope slide and spread evenly in a circular motion so as to cover an area equal to the size of the coverslip. The mouthparts should be then transferred from the Cellusolve (taking care to dry off drops of Cellusolve from the forceps) to the mounting medium. Once arranged in the desired position, the coverslip can be lowered carefully onto the slide by letting it drop slowly from the edge of the medium. This method lessens the chances of air bubble formation and the movement of mouthparts, but should this happen, the coverslip can be delicately tapped to expel the bubbles and reposition the mouthparts. It is best to leave the prepared slide to cure on an even surface in a dry place for at least 24 hours before examination under a compound microscope under magnifications of x100 to x1000. If handled with extreme care, however, the specimen can be examined immediately

IDENTIFICATION OF MATURE MAYFLY NYMPHS

Although the keys provided in this chapter deal only with the nymphal stages of mayflies, an abundant literature deals with adults. These keys only go as far as generic level, and the primary literature has to be sought for identification to species.

Use of the identification key

In the identification key we have attempted to concentrate on the most conspicuous morphological characters that can be seen at magnifications of X50 under a dissecting microscope. The identification of most genera, particularly in the family Baetidae, relies, however, on the examination of mouthparts, claws and other small features, for which dissection and mounting on microscope slides, followed by examination under a compound microscope, may be necessary (see above). On the other hand, the identification of the genera of the Heptageniidae and Leptophlebiidae depends primarily on the morphology of the abdominal gills, which may become easily dislodged and lost while collecting and handling the specimens. If such structures are lost, it is necessary to consult specialist literature to achieve proper identifications. For the latter purpose, and for cases where identifications require further corroboration, a list of useful references is provided below the discussion of each genus.

Measurements are of assistance in identification. Note that, unless otherwise indicated, size measurements given in keys refer to the **body length**

(the length excluding the antennae and cerci). The **cerci length** is also sometimes noted.

Identification should be carried out on late-instar nymphs (recognized by the fact that their developing wingpads are darker), as some of the diagnostic features are less apparent in the immature stages. Note that these keys are meant for identification purposes only and are in no way intended to reflect phylogenies. In the generic keys, if a genus occurs in the Malagasy subregion (Madagascar, Comores or Seychelles) this is indicated in parenthesis in the key. If it occurs in Africa only, then this is not noted in the key

Useful general references

Allan (1995); Brittain (1982); Chutter (1998); Demoulin (1981); Edmunds et al. (1976); Edmunds & McCafferty (1988); Ward (1992); McCafferty (1981); Merritt & Cummins (1996); Wang & McCafferty (1996);

KEY TO FAMILIES OF MATURE MAYFLY NYMPHS

1. Nota fused, forming a dorsal carapace-like structure covering the legs and gills, giving nymphs an ellipsoid appearance (Fig. 2.5); minute (≤ 4 mm).. ..... .Prosopistomatidae, *Prosopistoma*

   Nota not fused as above, legs and gills visible in dorsal view; length of nymph > 4 mm 2

2. Head with compound eyes on short, dorsally-oriented protruberances (Fig. 2.6B); terga 3–7 dorsally expanded, forming open V-shaped compartment protecting gills (Fig. 2.6A). ....Machadorythidae, *Machadorythus*

– Head with compound eyes not raised on protruberances; terga not modified as above.. 3

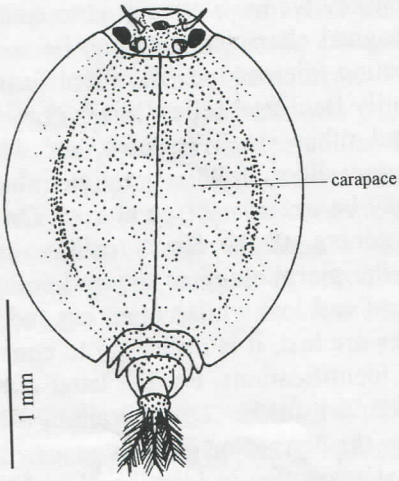

Fig. 2.5. *Prosopistoma*, whole nymph, dorsal view.

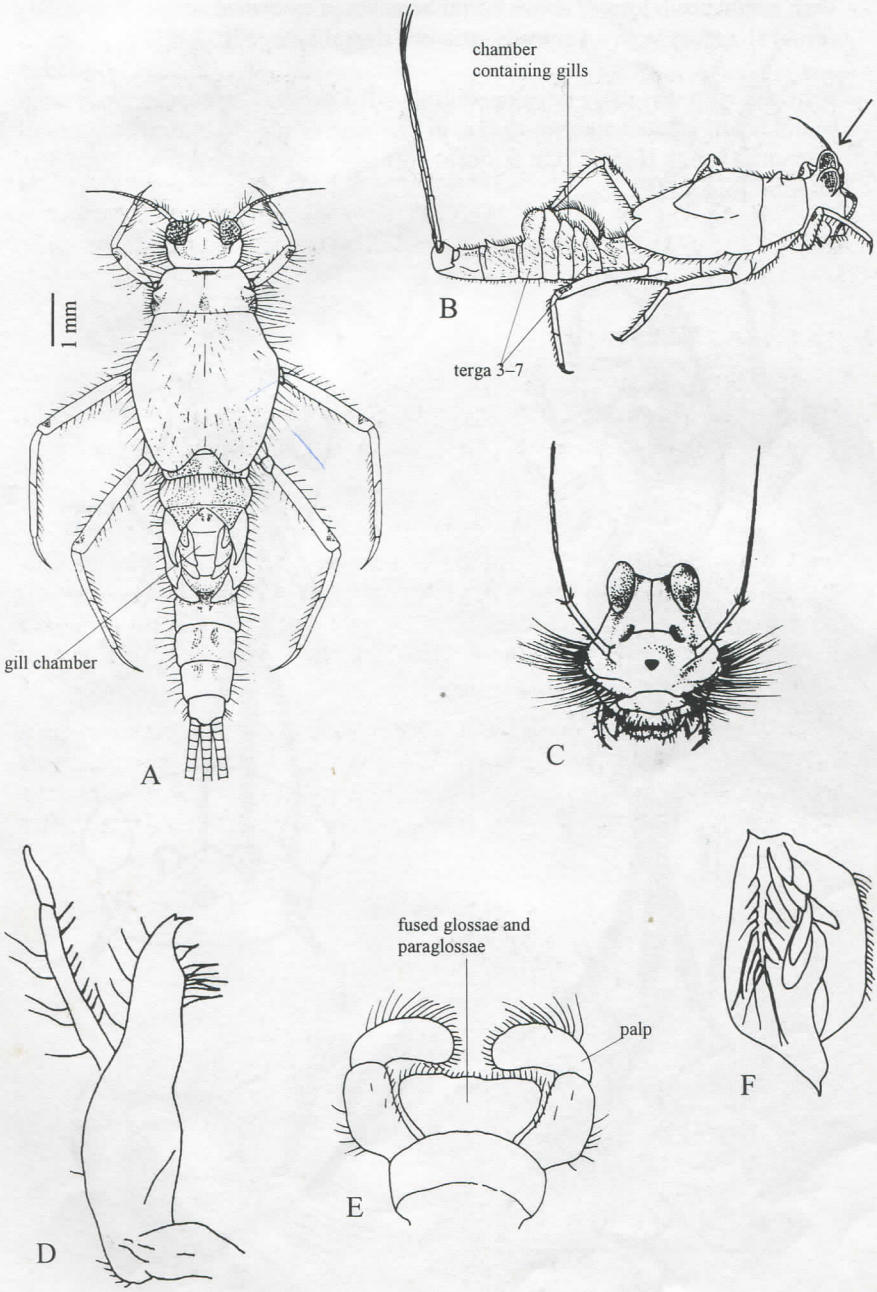

Fig. 2.6. *Machadorythus* sp.. **A**, whole nymph in dorsal view; **B**, whole nymph, in lateral view, indicating protruding eyes (arrowed); **C**, head, anterior view; **D**, maxilla; **E**, labium; **F**, gill 4. (A & C–F redrawn from McCafferty & Wang 2000; B redrawn from Demoulin 1959).

3. Nymph usually with seven simple gills including gill 1 (Fig. 2.7A); head with lateral ocelli located above lateral branches of epicranial suture (Fig. 2.7B): femoral apices with a ventrally-oriented dorsal lobe (Fig. 2.7D). ... .Baetidae

– Nymphs with variously developed gills, gill 1 present or absent; head with lateral ocelli located anterior to (i.e. in line with or below) lateral branches of epicranial suture (Fig. 2.7C); femoral apices without ventrally-oriented dorsal lobe (Fig. 2.7E) 4

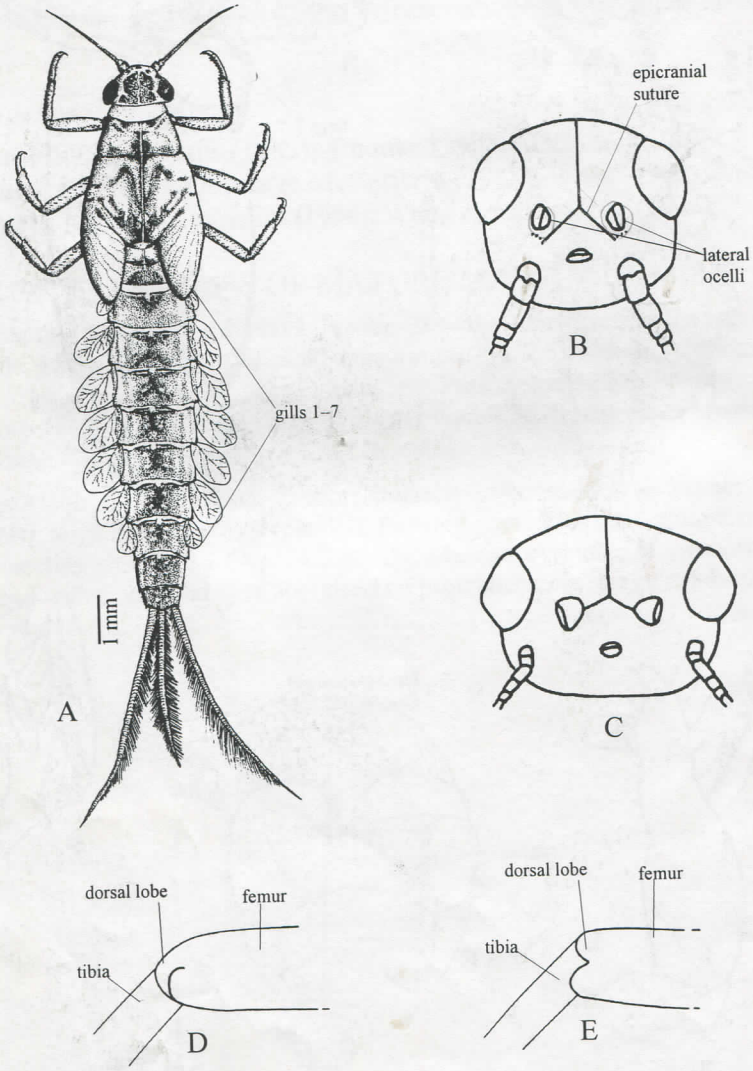

Fig. 2.7. Mayfly nymphs, showing distinctive characteristics. **A**, baetid nymph, in dorsal view. **B–C**, anterior views of the head showing epicranial sutures: **B**, of a baetid, showing lateral ocelli above the lateral branches of the suture; **C**, of a non-baetid, showing lateral ocelli that connect with the lateral branches of the suture, or may be situated below the suture. **D–E**, distal apices of femora: **D**, of baetids, showing a ventral orientation of the dorsal lobe of the femoral apex; **E**, of non-baetids indicating a different orientation. (B–D after Wang & McCafferty 1996).

4. Gill 1 ventrally oriented, lamellate section reduced, fibrilliform section pronounced (Fig. 2.8C); gills 2–7 laterally-orientated, lamellate, with fibrilliform tufts on ventral surface (Fig. 2.8D); labium fused, forming a plate-like structure (Fig. 2.8E); base of maxillae with fibrilliform tufts (Fig. 2.8F), maxillary palps two-segmented; forelegs with rows of long setae along margin of femur and tibia (Figs. 2.8A, B) .. ..Oligoneuriidae

– Gills 1 present or absent; if present, laterally, dorsally, or dorsolaterally oriented, and variously developed; gills 2–7 not as above; labium not fused; maxillae without fibrilliform extensions; forelegs without filtering setae... ..5

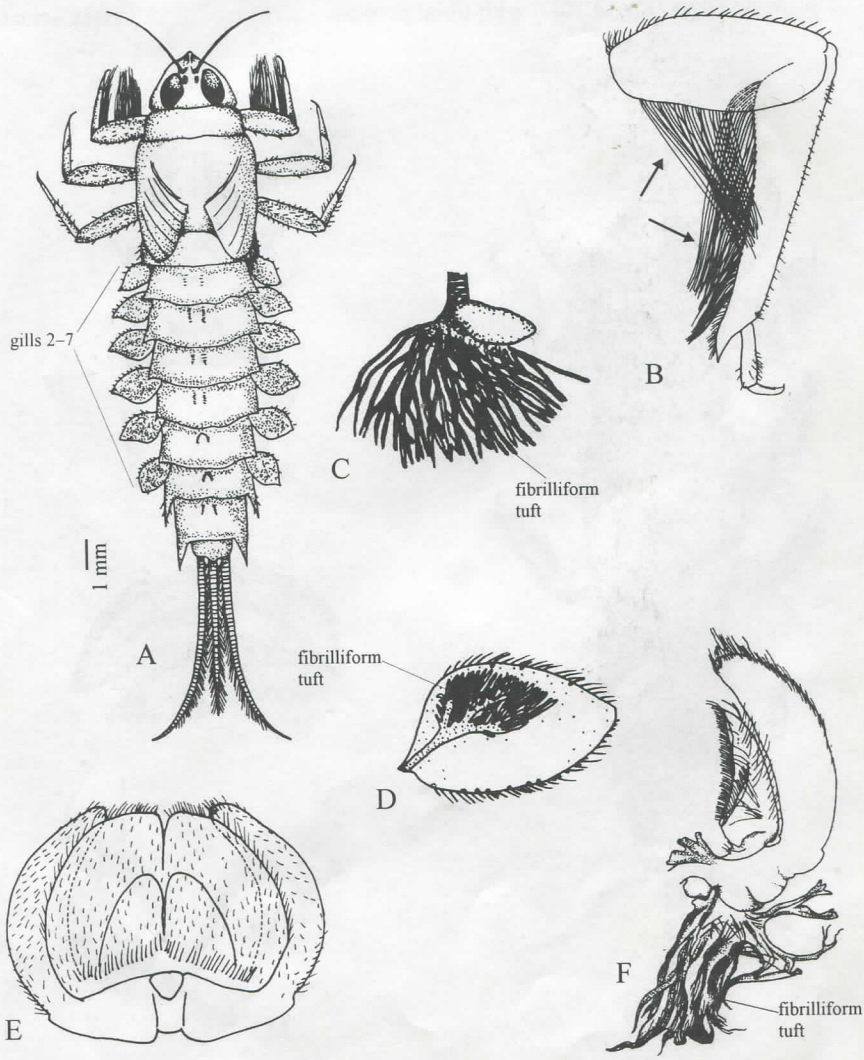

Fig. 2.8. Oligoneuriidae: generalized figures, showing distinctive morphological characters of the family: **A**, a whole nymph, dorsal view; **B**, details of foreleg; **C**, gill 1, **D**, gill 4; **E**, labium, showing fusion of parts; **F**, maxilla, showing fibrilliform tuft.

5. Head with long mandibular tusks projecting forward and arising from lateral margin (Figs. 2.9A,B; 2.10E) or, if tusks short, frontal process pronounced (Fig. 2.10A,B); gill 1 reduced, not feather-like or fringed; gills 2–7 fold upwards over the abdomen, each consisting of two elongate lamellae with fringed margins (Figs 2.9C, 2.10C).. 6
– Head without mandibular tusks; gills 2–7 not as above. 7

6. Mandibular tusks apically convergent (Figs. 2.9A,B); frontal process absent, or reduced; posterior legs (Fig. 2.9D) without tibial process ....Polymitarcyidae
– Mandibular tusks apically divergent, frontal process present (Fig. 2.10B,E); posterior legs (Fig. 2.10D) with tibial process .... Ephemeridae

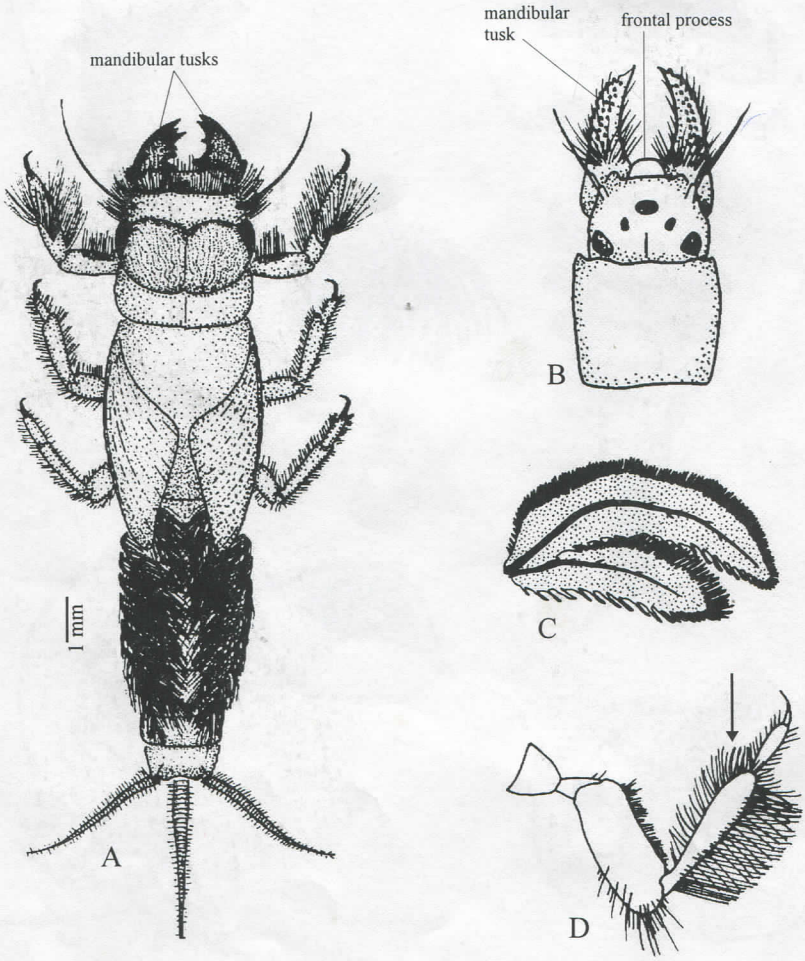

Fig. 2.9. Polymitarcyidae: morphological features of taxonomic importance. **A**, *Povilla* sp., whole nymph in dorsal view. **B–D**, *Ephoron*, sp., **A**, head and prothorax, in dorsal view, showing detail of tusks; **C**, gill 4; **D**, hind leg (*note* the absence of a tibial extension—arrowed). (A & B redrawn from Agnew 1980; C & D redrawn from Crass 1947).

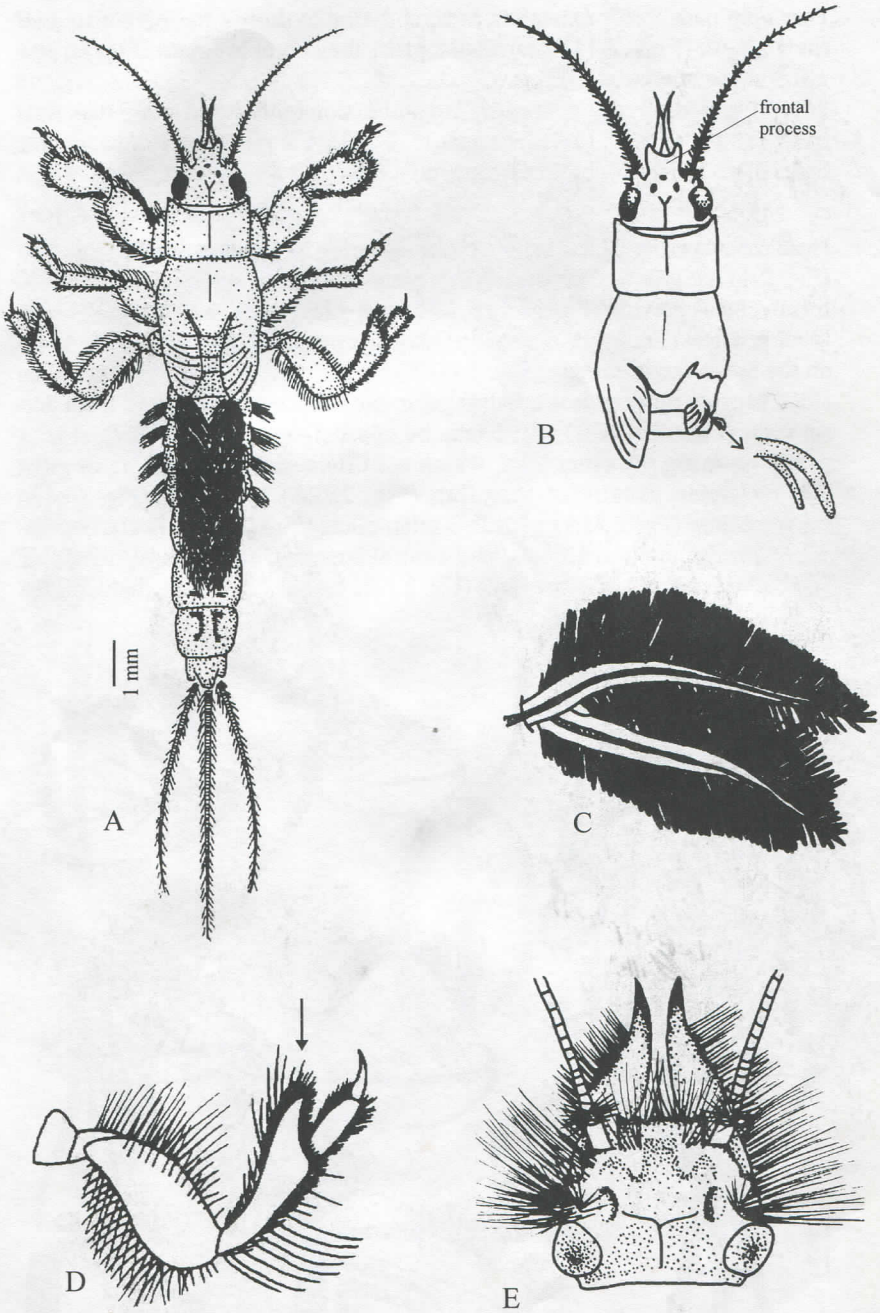

Fig. 2.10. Ephemeridae: morphological features of taxonomic importance. **A–D,** *Ephemera* sp.. **A**, whole nymph in dorsal view; **B**, head and thorax with right forewing pad removed to show small hindwing pad and detail of gill 1 (enlarged); **C**, gill 4; **D**, hindleg (note pointed tibial extension—arrowed). **E**, *Cheirognesia* sp., detail of head showing tusks; (A redrawn from Agnew 1980; C redrawn from McCafferty & Edmunds 1976; B, D & E redrawn from Crass 1947).

7 Forewing pads freely extending beyond fusion to thorax for more than half their length (Figs. 2.11A, 2.12A,B); gill 1 may be operculate (Fig. 2.12B); gill 2 never operculate. 8

– Forewing pads freely extending beyond fusion to thorax for less than half their length (Figs 2.13A, 2.14A, 2.15A, 2.16A); gill 1 never operculate; operculate gills present on abdominal segment 2 (Figs 2.13A, 2.14A, 2.15A & 2.16A) or absent 9

8. Head capsule more or less semi-circular, covering mouthparts from dorsal view (Fig. 2.11A); gills 1–6 consisting of a plate-like dorsal lamella with a fibrilliform ventral portion (Figs. 2.11B,C,D); gill 7 lamellate, without the fibrilliform portion (Fig 2.11E); maxilla without a prominent brush of long setae on the apicolateral margin (Fig. 2.11F). .. .. Heptageniidae

– Head capsule more or less quadrangular, not covering mouthparts from dorsal view (Figs. 2.12A,B); gill 1 may be operculate (Fig. 2.12B & I), at least partly covering the other gills, which are bilamellate (Fig. 2.12J), or gill 1 may be simple, usually unilamellate (Fig,. 2.12E), lanceolate (Fig. 2.84A) or filamentous (Fig. 2.85A); gills 2–7 bilamellate (Figs 2.12 D, F–H), consisting of similar, separate, dorsal and ventral lamellae; apicolateral margin of maxilla with a brush of dense setae (Fig. 2.12K). ....Leptophlebiidae

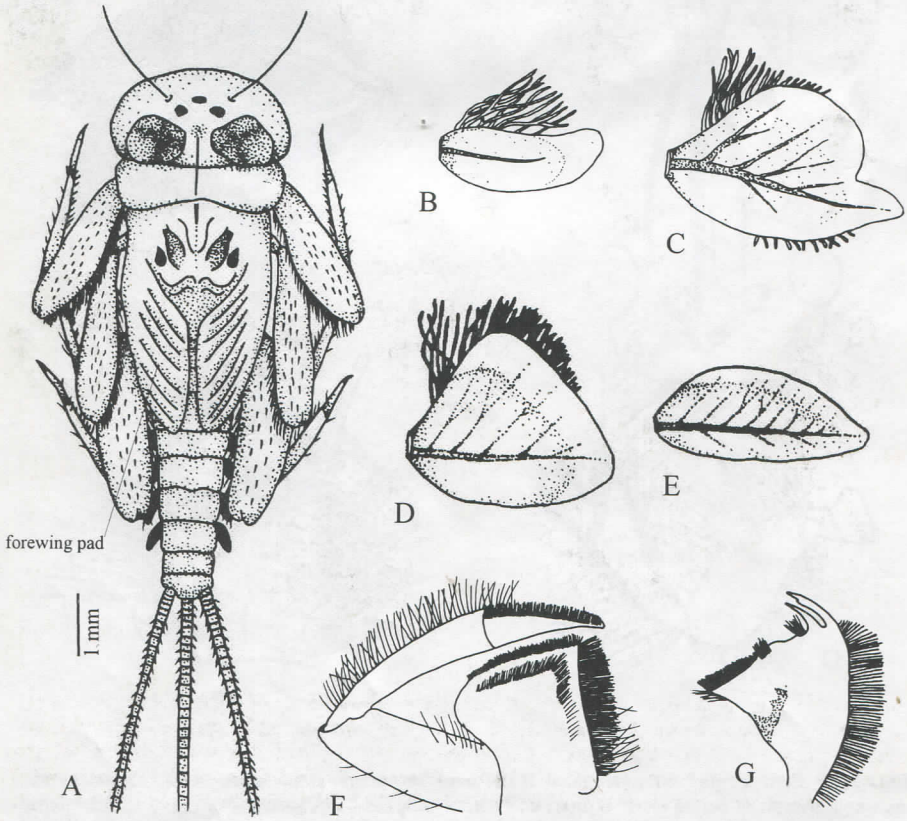

Fig. 2.11. Heptageniidae: morphological features of taxonomic importance. **A–G**, *Afronurus* sp.. **A**, whole nymph; **B**, gill 1, **C**, gill 3; **D**, gill 5; **E**, gill 7· **F**, maxilla; **G**, mandible. (A redrawn from Agnew 1980; B–G redrawn from Schoonbee 1968).

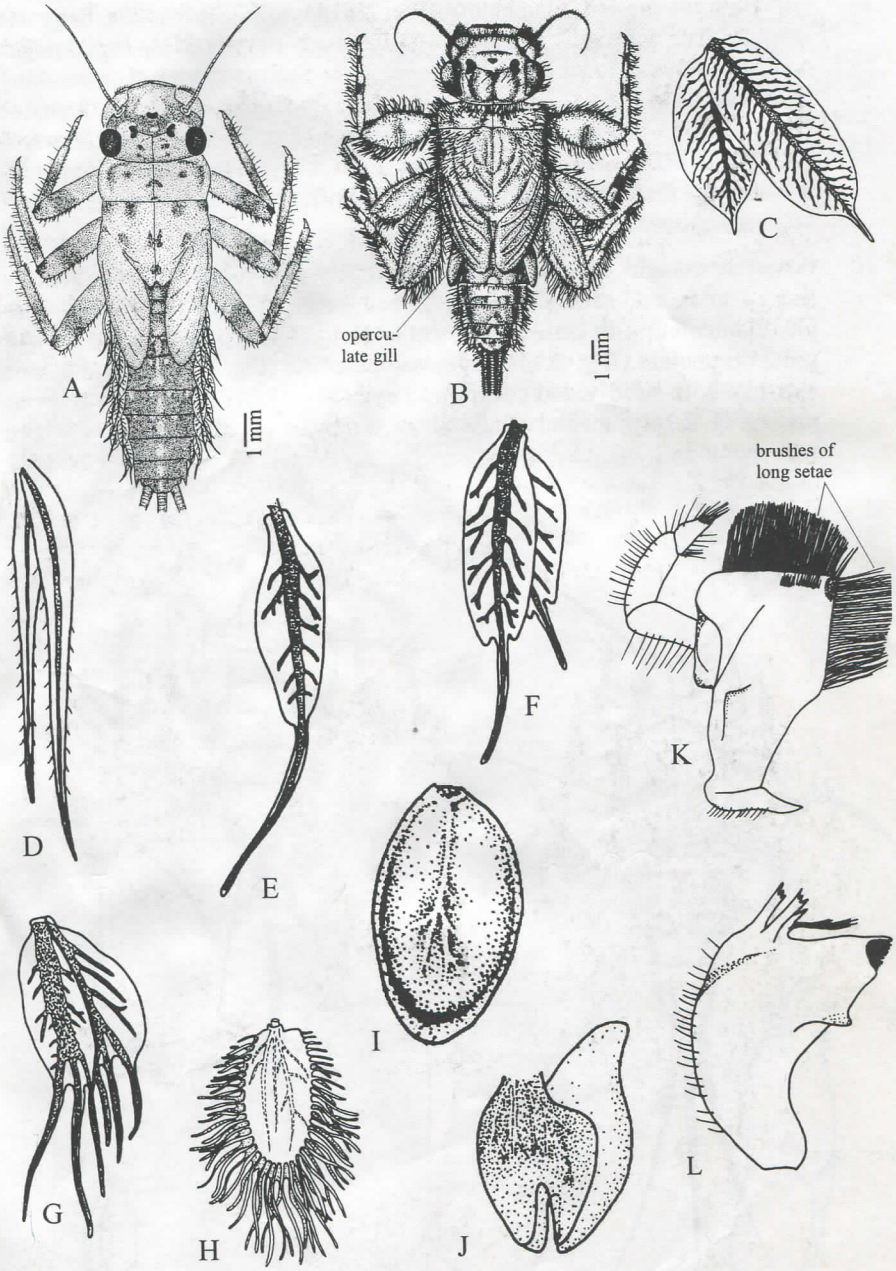

Fig 2.12. **A**. Leptophlebiidae (*Adenophlebia* sp.), whole immature nymph (with cerci truncated) in dorsal view, showing double lamellate gills. **B**, *Adenophlebiodes* sp., whole nymph (with cerci truncated), in dorsal view, showing operculate gills 1 covering the lower gills. **C–J**, variety of gill types in Leptophelbiidae: **C**, *Adenophlebia* sp., gill 4; **D**, lanceolate, bilammelate (*Castanophlepia* sp., gill 4); **E**, unilamellate (*Choroterpes* sp. gill 1); **F**, bilamellate (*Choroterpes* sp. gill 4); **G**, bilamellate (*Euthraulus* sp. gill 4); **H**, bilamellate with finger-like projections (*Thraulus* sp. gill 4); **I**, operculate (*Adenophlepiodes* sp. gill 1); **J**, bifid (*Adenophlebiodes* sp. gill 4). **K–L**, typical leptophlebiid mouthparts: **K**, maxilla, showing apicolateral margin with brush of dense setae. **L**, left mandible. (A redrawn from Agnew 1980; B redrawn from Peters & Edmunds 1964; C–L redrawn from Peters & Edmunds 1964).

9. Gill 1 always present, filamentous (Fig. 2.13A); gill 2 operculate, large and quadrangular or broadly rounded, with variously-developed Y-shaped ridges on dorsal surface, touching or overlapping medially, covering the remaining gills (Figs. 2.13A,B) ....Caenidae

– Gill 1 present or absent, if present, filamentous (Fig. 2.14A,B); gill 2 operculate (Fig. 2.14B), semi-operculate (Fig. 2.14C), or not operculate; if operculate, smaller than above and generally oval, without Y-shaped ridge on dorsal surface, never overlapping 10

10. Posterior margin of mesonotum, between wingpads, with prominent V-shaped notch, and generally slightly lobed basally (Fig. 2.14D); lateral, simple, filamentous gills generally present on abdominal segment 1 (Fig. 2.14A); gill 2 operculate (Fig. 2.14B) or semi-operculate (Fig. 2.14C); mature male nymphs with subdivided compound eyes (Fig. 2.14E); maxillae without palps (Fig. 2.14F); medial caudal filament may be present or reduced; claws with denticles ....Teloganodidae

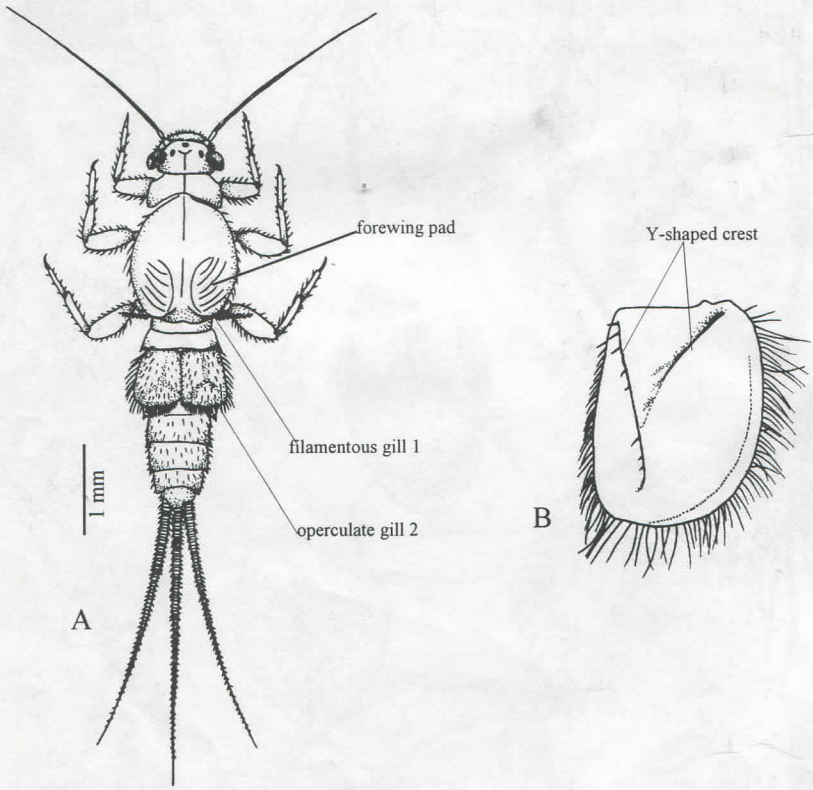

Fig. 2.13. Caenidae. **A**, whole nymph; **B**, dorsal view of operculate gill. (A redrawn from Agnew 1980).

– Mesonotum posteriorly without V-shaped medial notch and submedial lobes (Figs 2.15A, 2.16A, F); lateral, simple, filamentous gills present (like Fig. 2.14A) or absent on abdominal segment 1 (Figs 2.16A, F); gill 2 semi-operculate or not operculate; mature male nymphs without subdivided compound eyes; maxillae with or without palps; claws with or without denticles 11

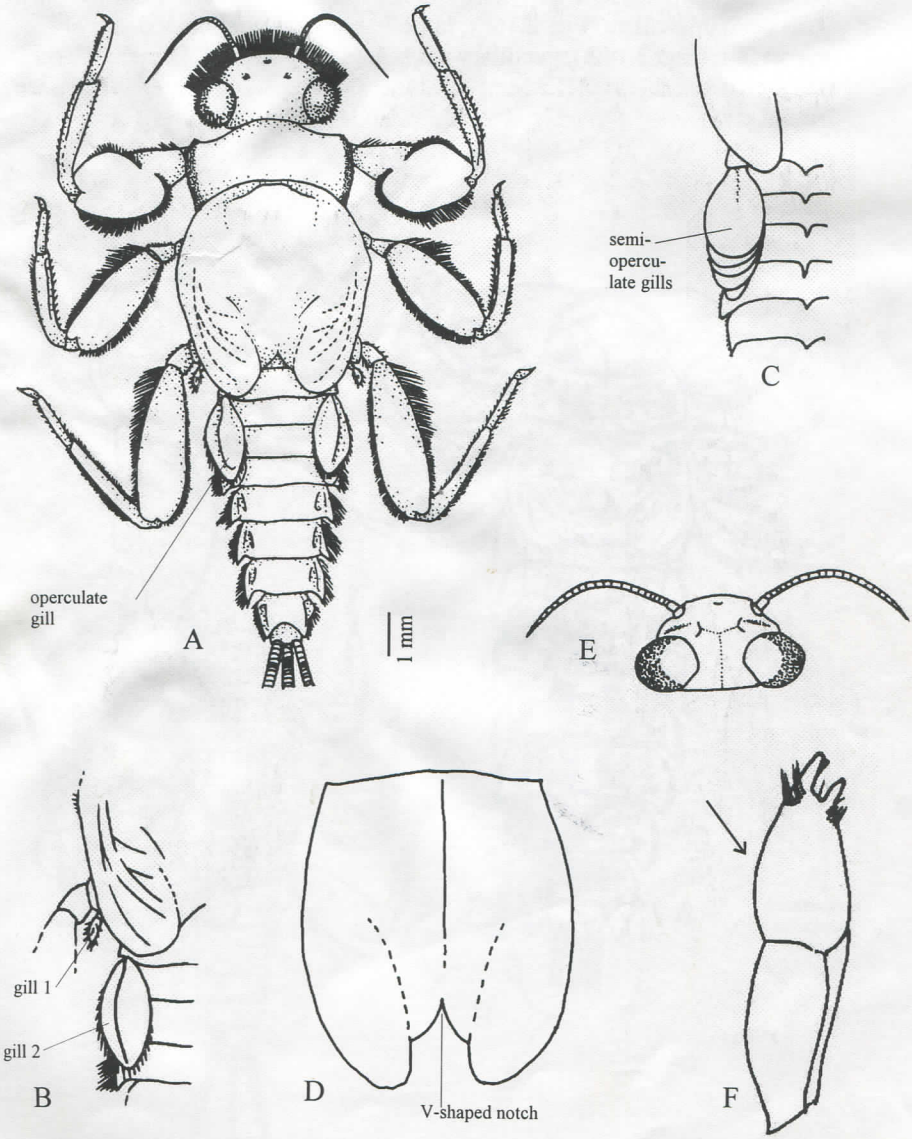

Fig. 2.14. Teloganodidae. **A–B,** *Lestagella penicillata*: **A**, whole nymph (with cerci truncated), in dorsal view; **B**, dorsal view of left posterior thorax and anterior segments of the abdomen, showing detail of filamentous gill 1 and operculate gill 2. **C–F,** *Ephemerellina* sp.. **C**, semioperculate gills; **D**, posterior margin of the mesonotum, in dorsal view; **E**, subdivided eyes of male, in dorsal view; **F**, maxilla (*note* absence of palps—arrowed). (All figures redrawn from McCafferty & Wang 1997).

11 Filamentous gill 1 present; lamellate gills present on segments 2–5, gill 2 operculate (Fig. 2.15A); maxillae without palps (Fig. 2.15B); medial caudal filament developed; claws without denticles (Madagascar only). ... . Teloganellidae, *Telagonella*

– Filamentous gill 1 absent; claws with denticles (Fig 2.16E). .. 12

12. Gill 2 operculate, narrow-elongate (Fig. 2.16A); gill 6 absent; maxillary palps absent.. ... ...Ephemerythidae, *Ephemerythus*

– Gill 2 not operculate (Fig. 2.16F); lamellate gills present on abdominal segments 2–6 (Fig. 2.16G); maxillary palps present (Fig. 2.16H). ... . Tricorythidae

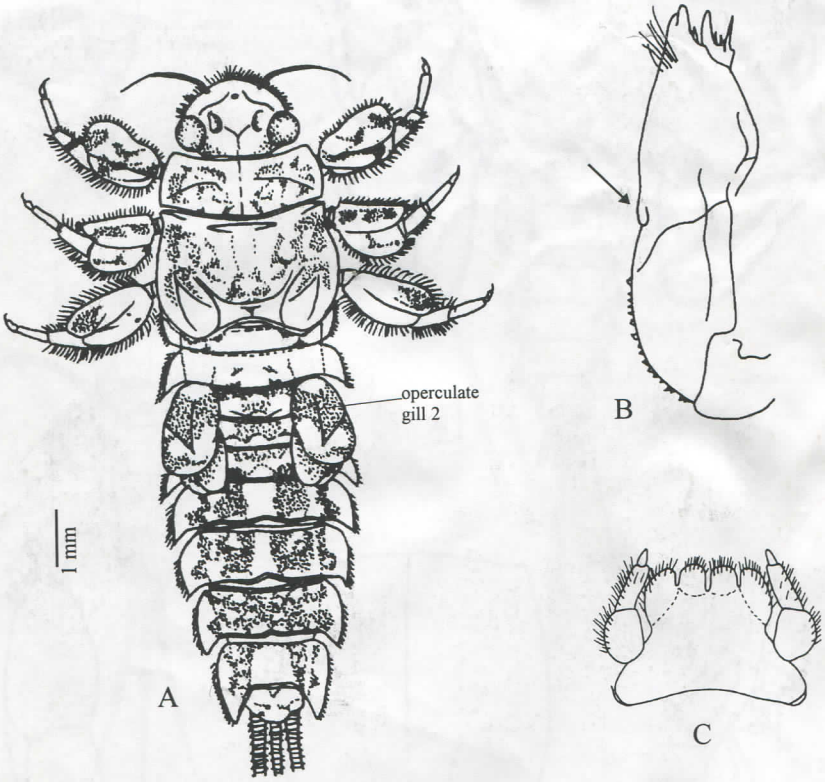

Fig. 2.15. Teloganellidae: distinctive characteristics (generalized figures): **A**, whole nymph; **B**, maxilla (*note* absence of palps); **C**, labium. (Redrawn from McCafferty & Wang 2000).

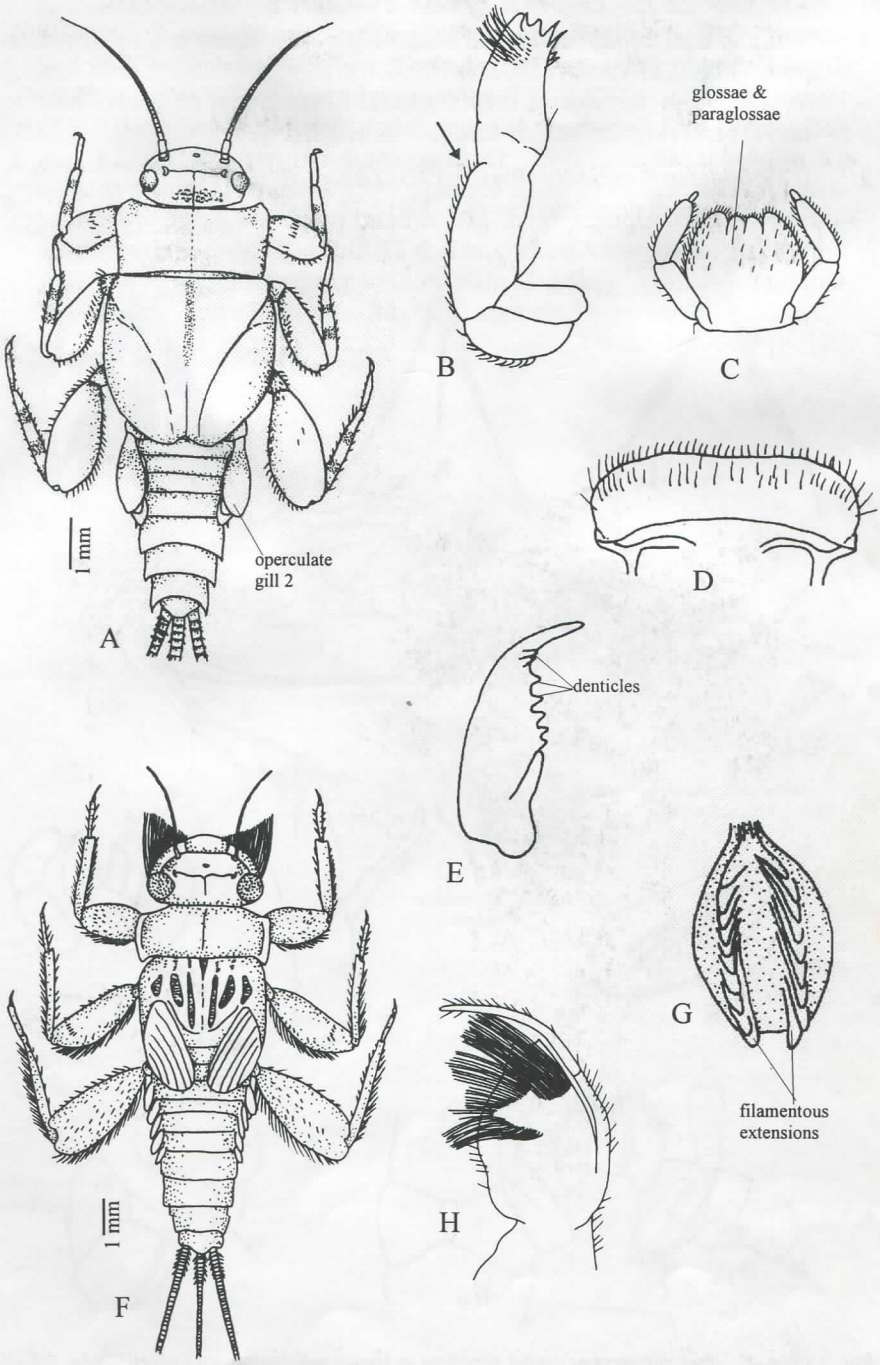

Fig. 2.16. Ephemerythidae and Tricorythidae. **A–E**, Ephemerythidae (*Ephemerythus* sp.): **A**, whole nymph, with cerci truncated; **B**, maxilla (*note* absence of palps); **C**, labium; **D**, labrum; **E**, claw showing prominent denticles. **F–H**, Tricorythidae (*Tricorythus* sp.): **F**, whole nymph; **G**, gill 4, in ventral view; **H**, maxilla. (A–D redrawn from McCafferty & Wang 2000; E redrawn from Demoulin 1964).

BAETIDAE: KEY TO GENERA

1 Nymphs with two cerci, medial caudal filament reduced to a small conical point (Fig. 2.17A). 2

– Nymphs with three cerci, medial caudal filament may be shorter than the lateral cerci (Fig. 2.17B), or subequal in length (Fig. 2.17C).. 10

2. Gills orientated ventrally (Figs. 2.17D, 2.18A), six pairs 3

– Gills orientated dorsolaterally (e.g. Fig. 2.2A), usually seven pairs. 4

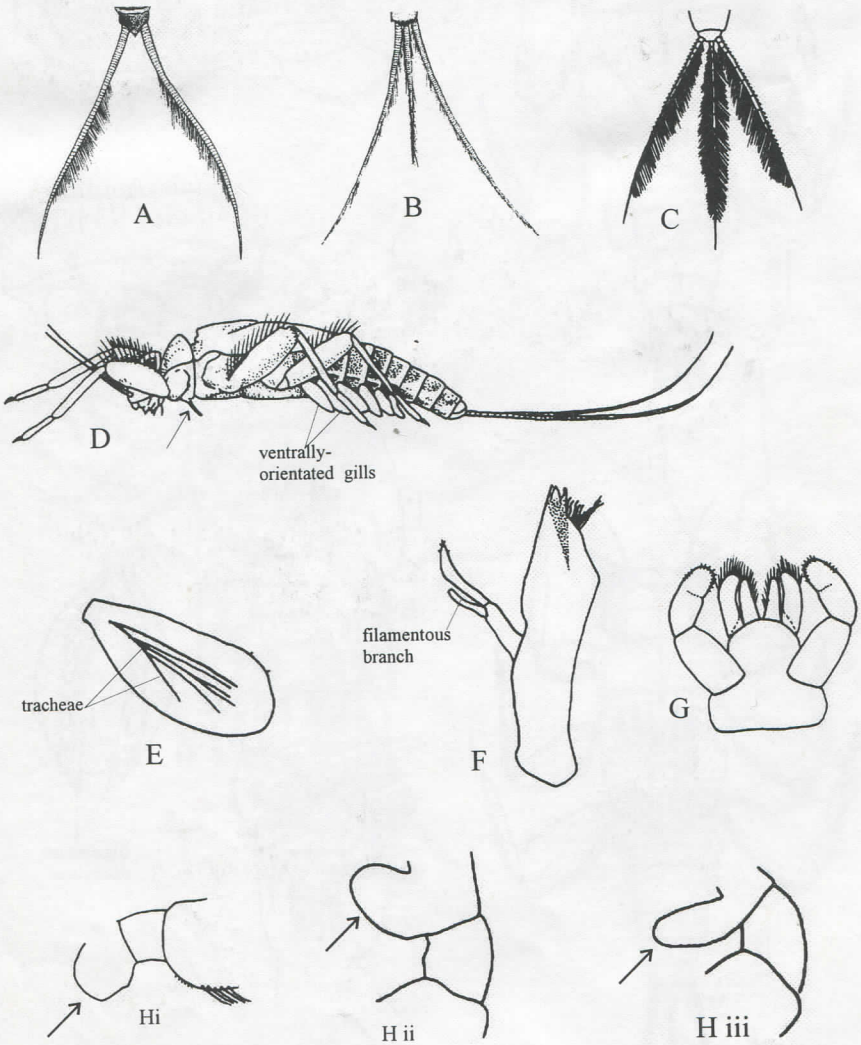

Fig. 2.17 **A–C**, cerci and median caudal filaments in baetid nymphs: **A**, no median caudal filament (e.g. *Acanthiops tsitsa*); **B**, median caudal filament shorter than lateral cerci (e.g. *Pseudocloeon glaucum*); **C**, median caudal filament and cerci subequal in length (e.g. *Cloeon* spp.). **D–H**. *Afrobaetodes* sp. **D**, lateral view of nymph (arrow indicates small thoracic gill). **E**, abdominal gill 4 (*note* subparallel tracheation); **F**, maxilla; **G**, labium; **H**, coxal spurs on (i) the foreleg (ii) the midleg (iii) the hindleg. (D redrawn from Kimmins 1955; E–G redrawn and adapted from Gillies 1991).

3. Gills on abdominal segments 1–6, all with entire margins and with multiple unbranched tracheae arising from the base of each gill (Fig. 2.17E); abdomen with weak dorsal tubercles or no tubercles; one small filamentous gill ventrolaterally on each side of prosternum (Fig. 2.17D); coxal spur present (Fig. 2.17H); maxillary palp two-segmented, segment 1 with filamentous branch (Fig. 2.17F) (Africa & Madagascar) .. .... *Afrobaetodes* (p. 93)

– Gills on abdominal segments 2–7 elongate, apically fringed with filamentous projections, devoid of trachea (Fig. 2.18B); abdomen with prominent dorsal tubercles (Fig. 2.18A); thorax without ventrolateral filamentous gills; coxae without spurs, maxillary palp (Fig. 2.18C) three-segmented, segment 1 without filamentous branch, segment 3 very small. ....*Thraulobaetodes* (p. 110)

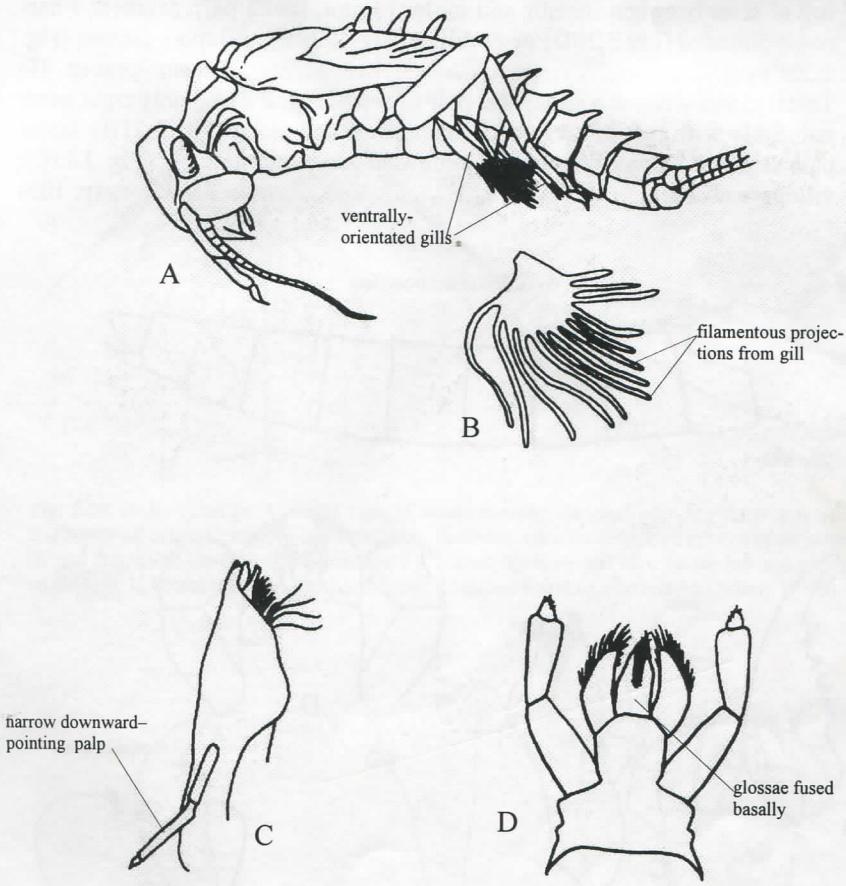

Fig. 2.18. *Thraulobaetodes:* **A**, whole nymph, lateral view; **B**, abdominal gill 4; **C**, maxilla; **D**, labium. (Redrawn from Elouard & Hideux 1991b).

4. Tarsal claws with denticles in a single row (e.g. Fig. 2.19B)... 5
– Tarsal claws with two rows of denticles, one row of which may be more well developed than the other (insert, Fig. 2.22B). 7

5. Small tubercles present dorsally on abdominal terga 1–7 or 1–8 (Fig. 2.19A); metanotum with blunt dorso-median tubercle; maxillary palps two-segmented, short and stout, shorter than galea-lacinia (Fig. 2.19C); labial palp with segments 2 and 3 partially fused, segment 3 broadly rounded (Fig. 2.19D); labrum basally broad, well developed medial lobe (Fig. 2.19E), ventral margin with strong marginal and submarginal setae (Fig. 2.19E).. ... .*Tanzaniella* (p. 109)
– Dorsal abdominal tubercles absent; metanotum without tubercles; maxillary palp two- or three-segmented; labium and labrum variously developed, not as above. 6

6. Tarsal claws with subapical pair of setae (Fig. 2.20B); mandibles without tuft of setae between incisor and molar region; labial palp segment 3 narrowly rounded (Fig 2.20D) or clublike (Fig. 2.20E); villopore present (Fig. 2.20F) .. ..*Demoreptus* (p. 98)
– Tarsal claws without a subapical pair of setae (Fig. 2.21A); only right hand mandible with tuft of setae between incisors and molar (Fig. 2.21B); labial palp segment 3 broadly rounded, somewhat produced medially (Fig 2.21C); villopore absent ... . *Micksiops* (p. 103)

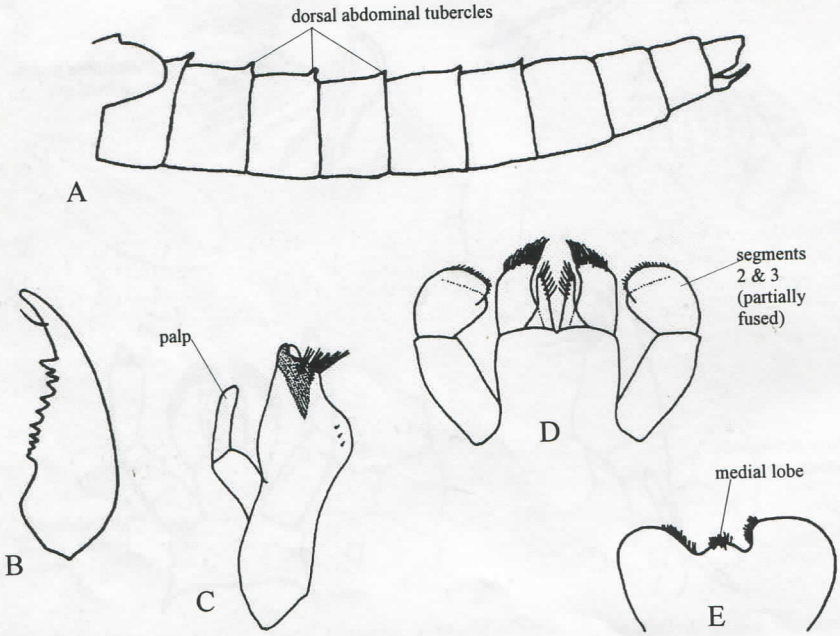

Fig. 2.19. *Tanzaniella*: **A**, lateral view of abdomen; **B**, detail of foreclaw, showing single row of denticles; **C**, maxilla; **D**, labium; **E**, labrum. (Redrawn from Gillies 1991a).

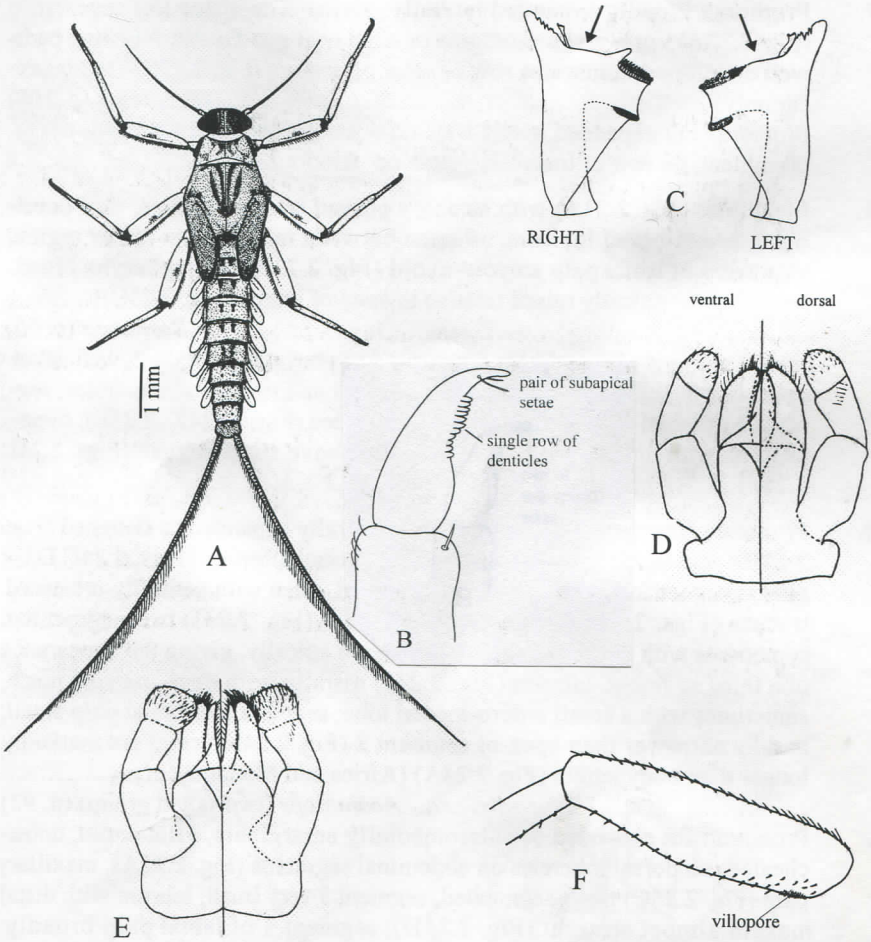

Fig. 2.20. *Demoreptus sp.* **A**, dorsal view of whole nymph; **B**, claw, showing single row of denticles and subapical setae; **C**, right & left mandibles, in ventral view (*note* lack of tufts of setae between molar and prosthecae—arrowed); **D**, labium (of *D. capensis*), in ventral view on the left and in dorsal view on the right; **E**, labium (of *D. monticola*); **F**, femur. (Redrawn from Lugo-Ortiz & McCafferty 1997b).

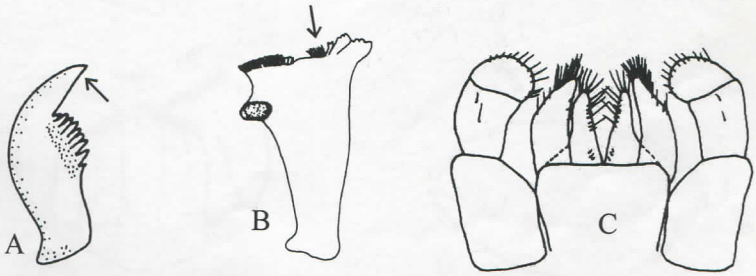

Fig. 2.21. *Micksiops* sp. **A**, claw (*note* the absence of subapical setae); **B**, right mandible (*note* tufts of setae between molar region and prostheca—arrowed); **C**, labium. (From McCafferty et al. 1997).

7 Prothorax broadly expanded laterally, giving a carapace-like appearance (Fig. 2.22A); pro- and mesothorax covered with small warts; forewing pads well developed; transverse row of setae on femora (Fig. 2.22B) (Madagascar only) . ...*Scutoptilum* (p. 108)

– Prothorax not expanded in this way, no warts present, forewing pads not as prominent, no row of transverse setae on femora..... 8

8. Mandibles (Fig. 2.23A) with strongly curved lateral margins, well-developed, broad-based incisors, no setae between incisors and molar region; segment 3 of labial palp narrow-ovoid (Fig. 2.23B); hypopharynx broad, superlinguae apically raised relative to apex of lingua (Fig. 2.23C). .. ..*Barnumus* (p. 95)

– Lateral margins of mandibles not curved as above; incisors not well developed, tuft of setae present between incisors and molae of mandibles; segment 3 of labial palp narrow-ovoid or rounded (Figs. 2.24K, 2.25E); hypopharynx with linguae prominent apically above superlinguae (Figs. 2.24L, 2.25F). 9

9. Pronotum anteromedially emarginate, laterally expanded or flattened (Fig. 2.24B); abdomen with variously-developed dorsal tubercles (Figs. 2.24C,D,E); gills asymmetrical, well to poorly tracheated, often with ventrally-orientated trachea (Figs. 2.24F, G,H); maxillary palp (Fig. 2.24I) two-segmented, sometimes with small nipple-like projection apically, giving the appearance of a third segment; labrum (Fig. 2.24J) distally with deep, narrow notch, sometimes with a small antero-medial lobe; segment 3 of labial palp small, basally narrower than apex of segment 2 (Fig. 2.24K); cerci not markedly longer than body length (Fig. 2.24A) (Africa and Madagascar). ....*Acanthiops* (two-tailed group) (p. 92)

– Pronotum not expanded or anteromedially emarginate, gills ovoid, untracheated; no dorsal tubercles on abdominal segments (Fig. 2.25A); maxillary palp (Fig. 2.25C) three-segmented, segment 3 very small; labrum with distal margin almost straight (Fig. 2.25D); segment 3 of labial palp broadly rounded, slightly asymmetrical (Fig. 2.25E); cerci longer than length of body (Fig. 2.25A) (Madagascar only) ...*Rheoptilum* (p. 108)

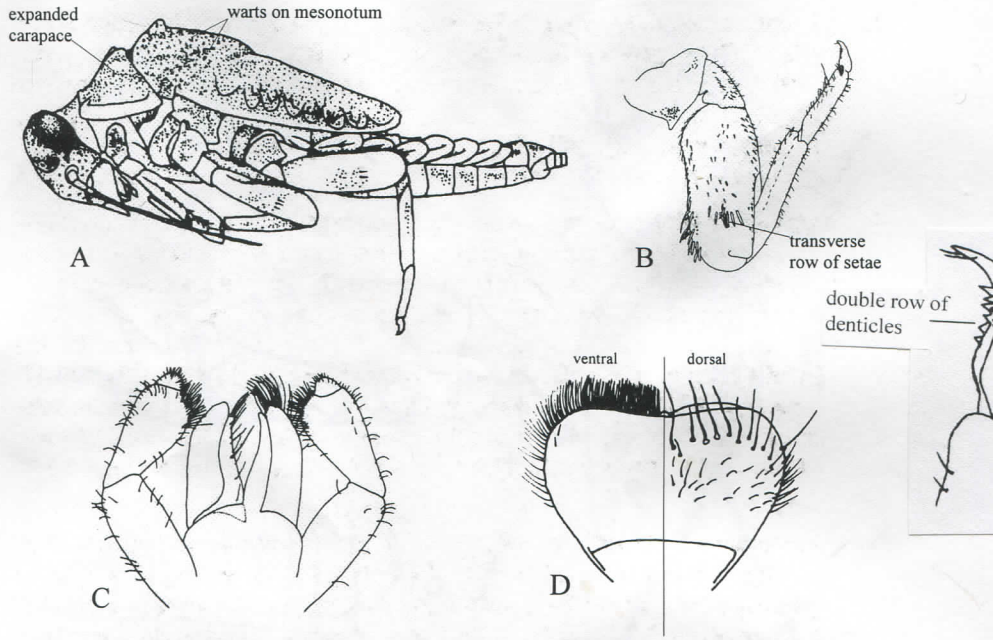

Fig. 2.22. *Scutoptilum*: **A**, whole animal, lateral view; **B**, foreleg; **C**, labium; **D**, labrum, in ventral view on the left and dorsal view on the right. (Redrawn from Gattolliat 2002b).

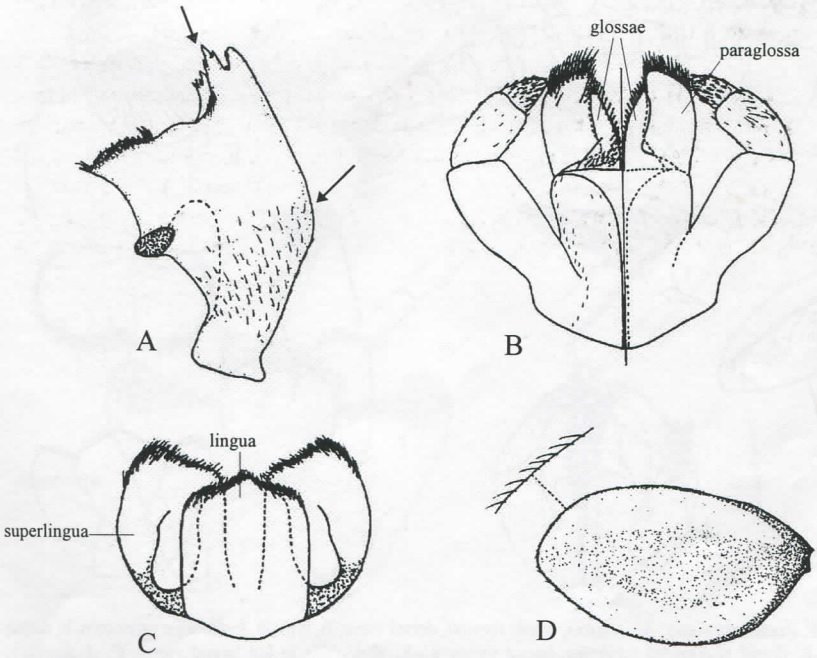

Fig. 2.23. *Barnumus* sp. **A**, mandible (*note* well-developed incisors and strongly curved shape—arrowed); **B**, labium in ventral view on the left and dorsal view on the right; **C**, hypopharynx; **D**, gill 4. (Redrawn from Lugo-Ortiz & McCafferty 1998a).

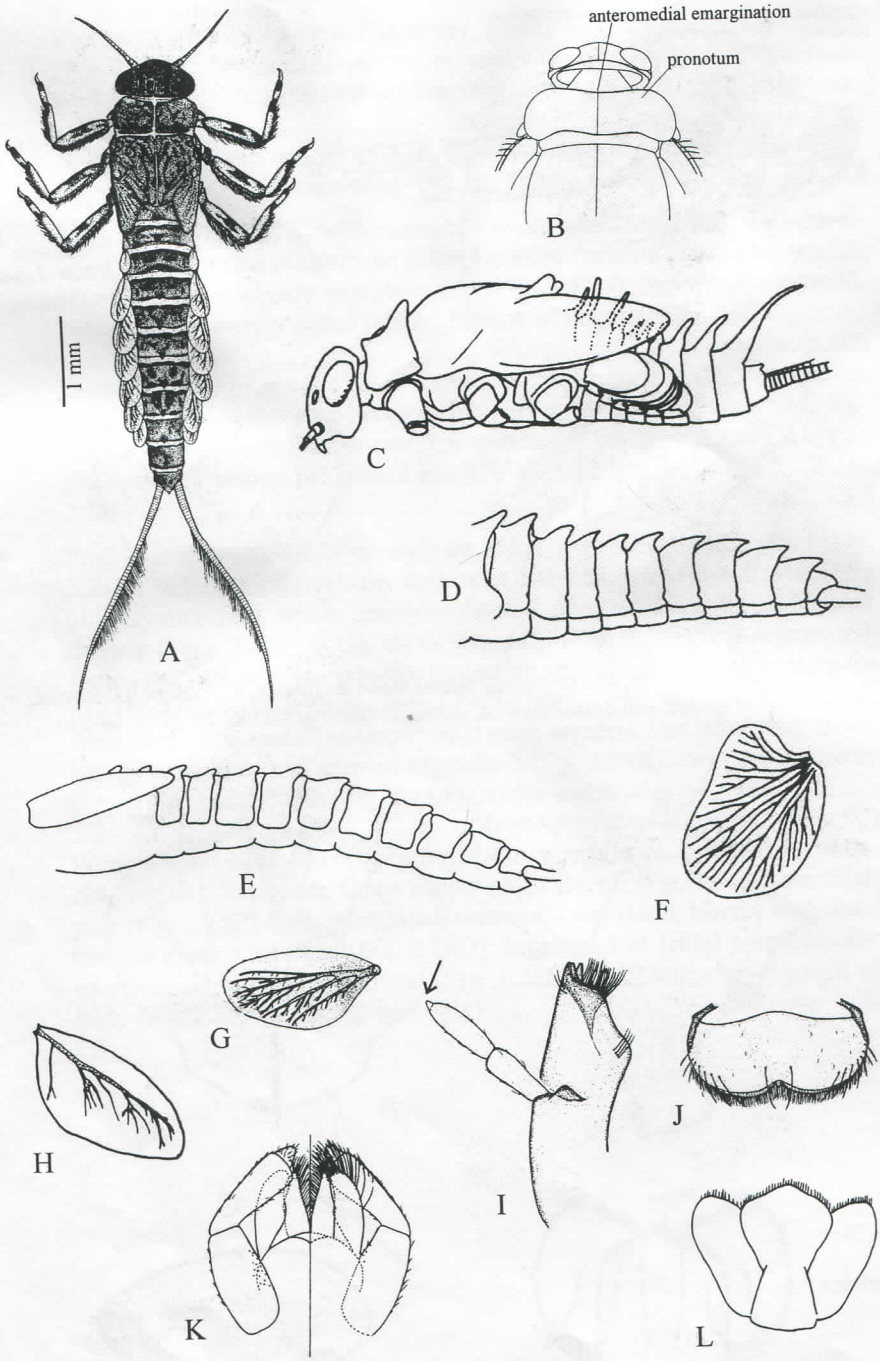

Fig. 2.24. *Acanthiops* spp. **A,** *A. tsitsa*, whole nymph, dorsal view; **B**, typical *Acanthiops* pronotum, in dorsal view. **C–E,** dorsal abdominal tubercles, lateral views: **C–E,** abdomens in left lateral views: **C**, *A. marlieri*; **D**, *A. io*; **E**, *A. tsitsa*. **F–H**, gills 4: **F**, *A. marlieri*; **G**, *A. io*; **H**, *A. tsitsa*. **I–K**, diagnostic features of *A. io*: **I**, maxilla, showing nipple-like tip at end of palpal segment 2 (arrowed); **J**, labrum; **K**, labium, in ventral view on the left and dorsal view on the right. **L**. *A. tsitsa*, hypopharynx. (A, E, H,& L from Barber-James & McCafferty 1997· C from Demoulin 1967· B,D & F from Lugo-Ortiz et al. 2001).

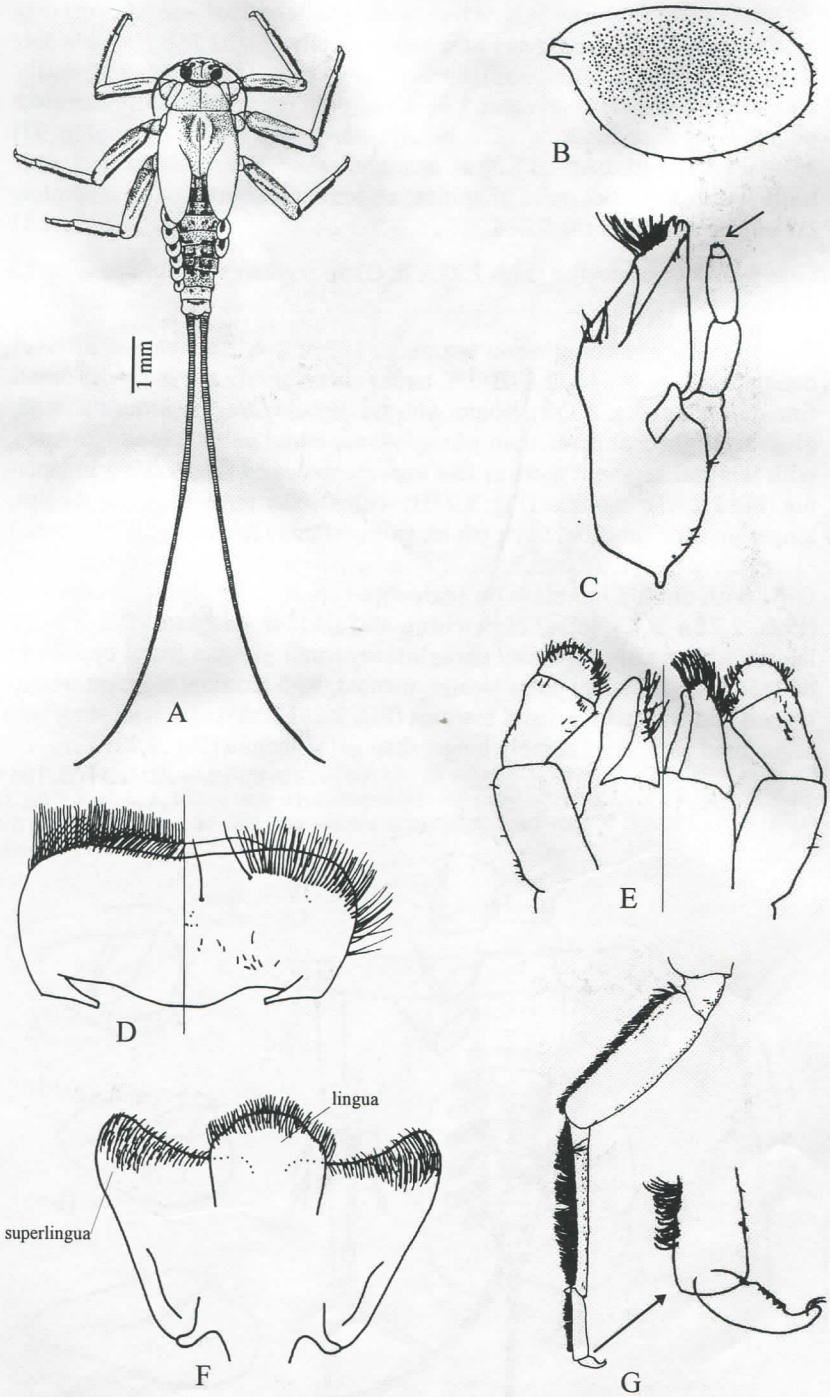

Fig. 2.25. *Rheoptilum* sp. **A**, whole nymph in dorsal view; **B**, gill 4; **C**, maxilla (*note* small size of segment 3 on palp—arrowed); **D**, labrum, in ventral view on the left and dorsal view on the right; **E**, labium, in ventral view on the left and dorsal view on the right; **F**, hypopharynx; **G**, leg with detail of claw. (Redrawn from Gattolliat 2001b).

10. Medial caudal filament half to two thirds the length of lateral cerci (Fig. 2.26A), bearing medial pairs of spines ventrally (Fig. 2.26B) (visible only with compound microscope); abdominal terga 1–3, 1–4, or 1–8 medially with small tubercles, segment 3 of labial palp reduced, basally narrower than apex of segment 2 ....*Acanthiops* (three-tailed group) (p. 92)
Medial caudal filament as long as, or slightly shorter than, lateral cerci, ventrally without medial pairs of spines; abdominal terga without tubercles; labial palp variously modified 11

11 Gills with double lamellae (Figs 2.27A & C) on segments 1–5 or 2–6.. 12
– Gills always single 13

12. Gills with double lamellae on segments 1–5 or 2–6, tracheation distinct, dendritic (Figs. 2.27A, 2.27B–D); tarsal claws gently curved, with small, fine denticles (Fig. 2.33E); labium with glossae and paraglossae tusk-shaped, glossae slightly shorter than paraglossae, labial palps three-segmented, with teminal segment more or less trapezium-shaped (Fig. 2.27F), or tapering (Fig 2.27G); maxillae (Fig. 2.27H) with slender three-segmented palps, longer than, or subequal in length to, galea-lacinia (Africa and Madagascar) ....*Cloeon* & *Procloeon* (p. 97)
– Gills with double lamellae on segments 1–5, tracheation asymmetrical (Figs. 2.28A,B,C); tarsal claws long and slender, edentate (Fig. 2.28D); labium with greatly expanded paraglossae, small glossae fused basally for half their length, labial palps two-segmented, with terminal segment wedge-shaped and with setose distal margins (Fig. 2.28E); maxillae with stout two-segmented palp, considerably longer than galea-lacinia (Fig. 2.28F). .. . .*Potamocloeon* (p. 105)

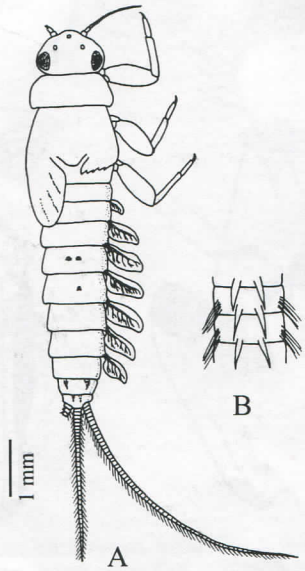

Fig. 2.26. *Acanthiops erepens*: **A**, whole nymph (with left appendages truncated), in dorsal view; **B**, detail of ventral surface of median caudal filament. (A redrawn from Crass 1947· B redrawn from Lugo-Ortiz et al. 2000).

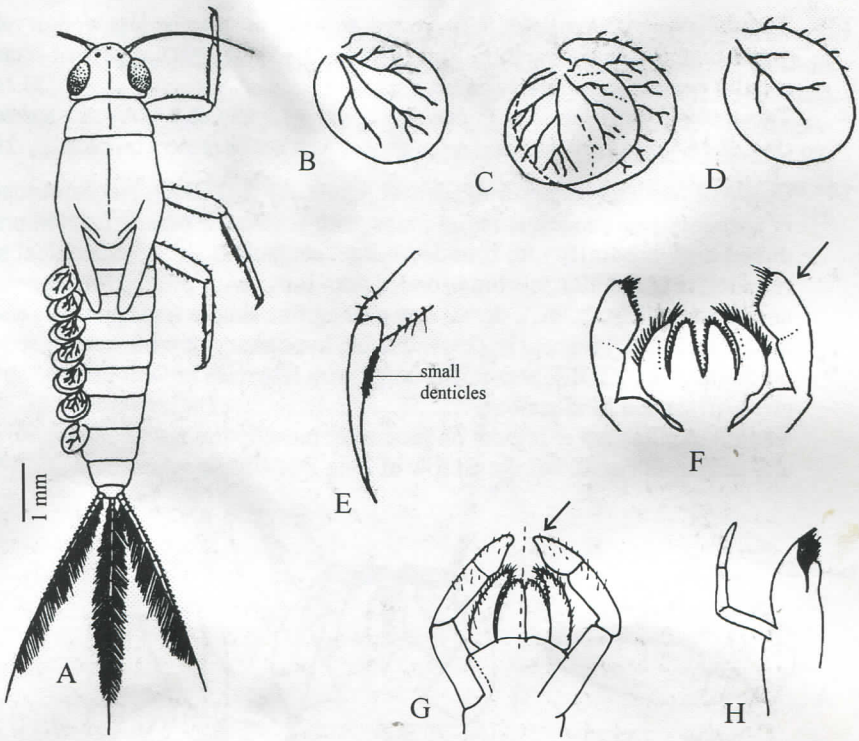

Fig. 2.27. *Cloeon* sp. **A**, whole nymph (with left legs and antenna truncated), dorsal view, **B**, gill 1, **C**, gill 3; **D**, gill 7· **E**, claw; **F**, labium (*note* wedge-shaped terminal palp—arrowed); **G**, labium, in ventral view on the left and dorsal view on the right (*note* tapering terminal palp—arrowed); **H**, maxilla. (A–D redrawn from Barnard 1932).

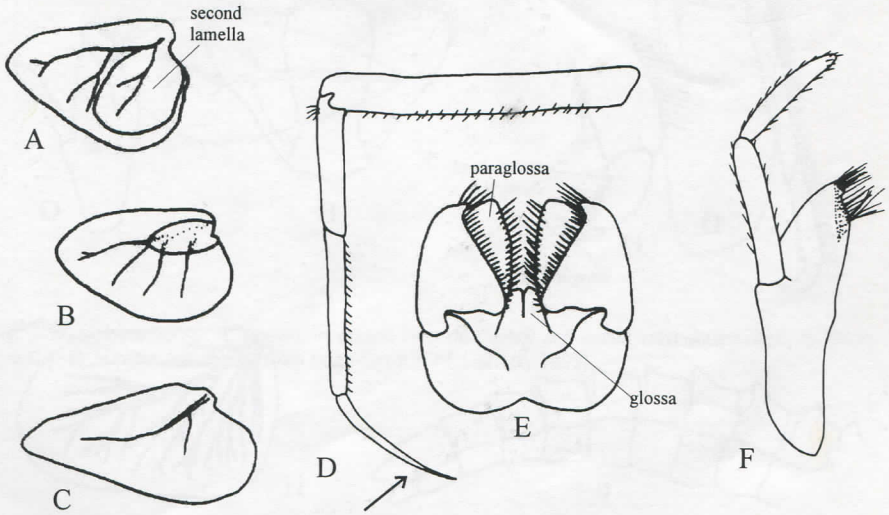

Fig. 2.28. *Potamocloeon* sp.. **A**, gill 2; **B**, gill 4; **C**, gill 7· **D**, leg (*note* long tapering claw without denticles—arrowed); **E**, labium; **F**, maxilla. (A–C redrawn from Gillies 1988; D–F from Lugo-Ortiz & McCafferty 1996).

13. Tarsal claws with denticles in two rows, second row may be less well developed than the first row (e.g. Figs. 2.29D, 2.35E, 2.36H); a pair of setae usually present subapically on claw 14
– Tarsal claws with denticles in one row (e.g. Figs 2.42A & 2.43A), or edentate (Fig. 2.38A); pair of subapical setae may or may not be present on claw..... .25

14. Coxae of forelegs with pair of ventral papillae (Fig. 2.29A), inconspicuous or absent in some species; labial palps with segment 2 basally narrow, produced distomedially into rounded bulge, segment 3 short, subconical to rounded (Fig. 2.29B); labrum broader than long, with pinched-up appearance basally (Fig. 2.29C); dorsal row of long fine simple setae on tibiae and tarsi (Fig. 2.29D) (except in *D. decipiens*); hypopharynx with crest of setae on lingua (Fig. 2.29E); abdominal terga with tubercles present in some species (Africa and Madagascar) .. .. *Dicentroptilum* (p. 99)
– Ventral papillae never present on procoxae; mouthparts not as above; tibiae and tarsi usually without dorsal row of long fine simple setae.. 15

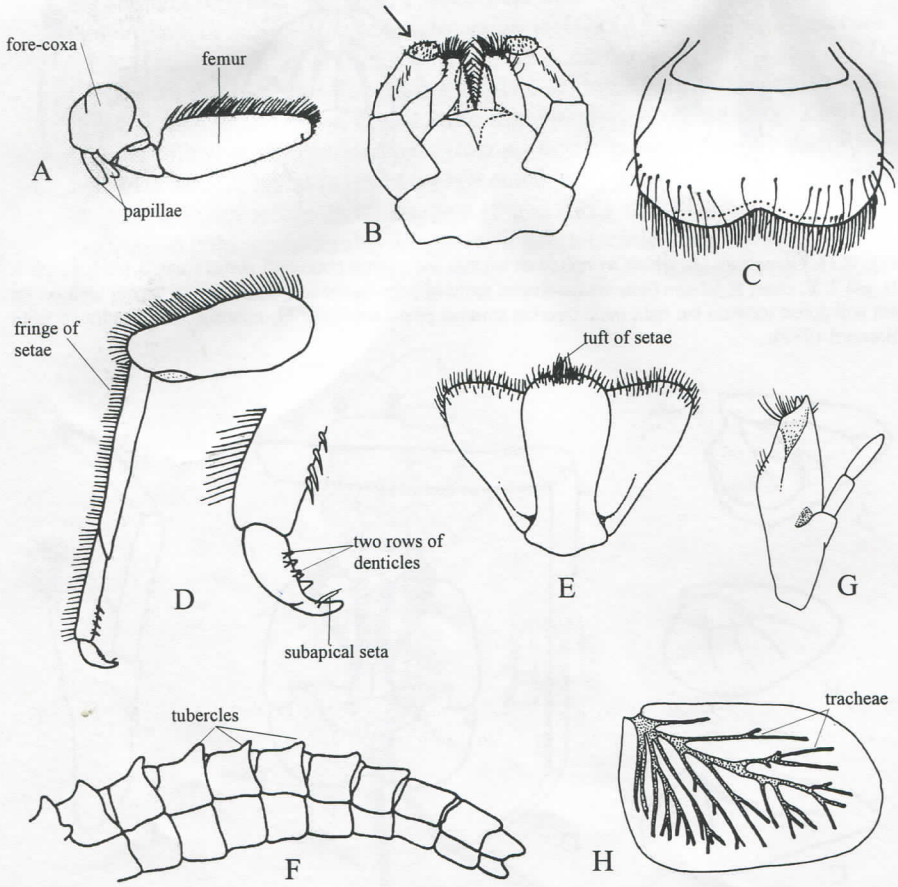

Fig. 2.29. *Dicentroptilum* sp. **A**, papillae on procoxa; **B**, labium; **C**, labrum; **D**, leg, with detail of claw; **E**, hypopharynx; **F**, abdomen, in left lateral view; **G**, maxilla; **H**, gill 4. (Redrawn from Lugo Ortiz & McCafferty 2001).

15. Labial palp segment 2 deeply falcate apically, bluntly pointed apicolaterally, rounded medioapically (Fig. 2.30A); tarsal claws with two rows of short denticles (Fig. 2.30B); gills on abdominal segments 1–7 well tracheated, narrow-elongate, gill 1 narrower that the other gills (Fig. 2.30C) (Madagascar only) .. . . *Delouardus* (p. 98)
– Labial palp segment 2 not falcate; tarsal claws not elongate; gills not as above. 16

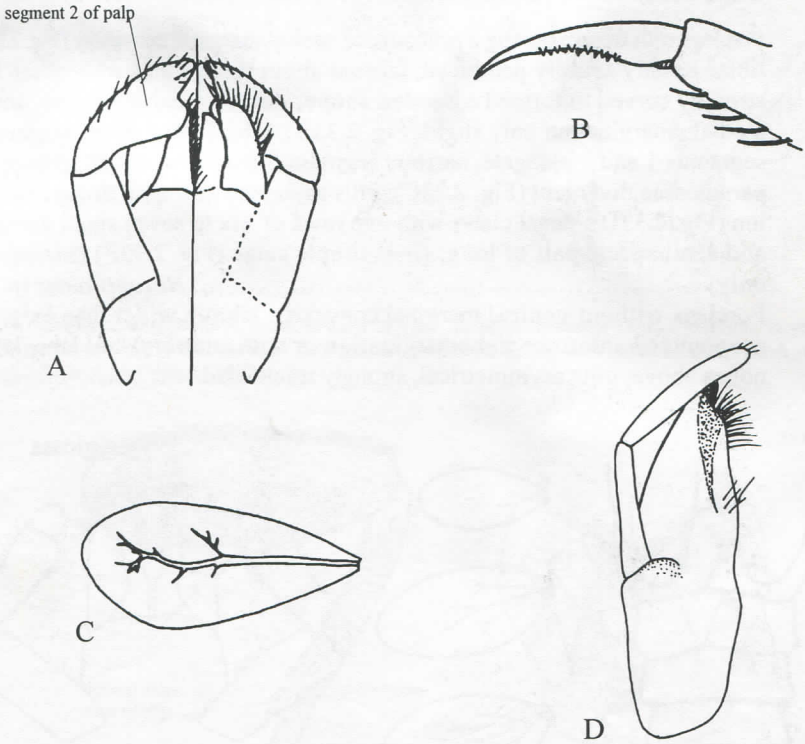

Fig. 2.30. *Delouardus* sp. **A**, labium, in ventral view on the left and dorsal view on the right; **B**, claw; **C**, gill 4; **D**, maxilla. (Redrawn from Lugo-Ortiz & McCafferty 1999).

16. Abdominal segment 1 enlarged relative to other abdominal segments (arrowed in Fig. 2.31A); gills 1 and 7 poorly tracheated, gills 2–6 well tracheated. ... (Fig. 2.31B). .. .. *Peuhlella* (p. 105)
– Abdominal segment 1 not enlarged relative to other abdominal segments; gills with other distinctive features 17

17 Head large relative to body (Fig. 2.32B); labial palp segment 2 with well-developed distomedial thumb, segment 3 subconical (Fig. 2.32C); mandibles large, robust, molar area with a few well-developed, broad-based denticles (Fig. 2.32D); tarsal claws (Fig. 2.32E) with small, evenly-sized denticles in two rows with approximately 12 denticles in each row and no subapical setae (Madagascar only)... .. .. *Edmulmeatus* (p. 100)
– Head not enlarged; mouthparts with various other modifications; tarsal claws not as above 18

18. Forelegs with femora having a pronounced ventral marginal convexity (Fig. 2.33A), tibiae basally acutely produced; labrum about three times wider than long, strongly curved to formed a hooded shape, dorsally densely setose, antero-medial emargination only slight (Fig. 2.33B); labial palps three- segmented, segments 1 and 2 elongate, narrow, segment 3 narrow conical, glossae and paraglossae divergent (Fig. 2.33C); gills asymmetrical, with strong tracheat-ion (Fig. 2.33D); tarsal claws with two rows of six to seven small denticles, and a subapical pair of long, fine, simple setae (Fig. 2.33E) (Madagascar only) .. ..*Nesoptiloides* (p. 103)
– Forelegs without ventral marginal convexity; labrum wider than long, with pronounced anteromedial emargination or with anteromedial lobe; labium not as above; gills asymmetrical, strongly tracheated. 19

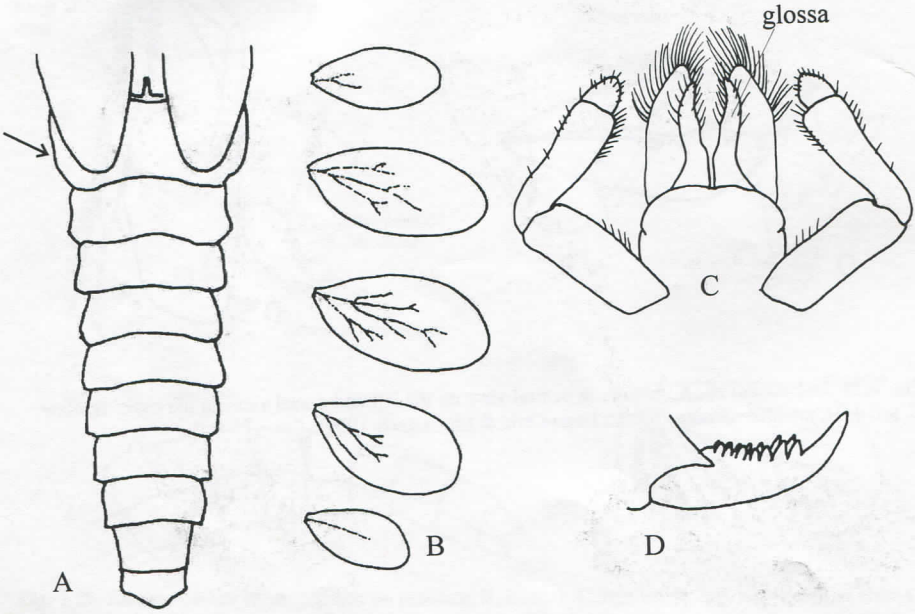

Fig. 2.31. *Peuhlella* sp. **A**, abdomen, dorsal view (*note* enlarged segment 1); **B**, gills (from top down) 1,2,3,5 & 7· **C**, labium; **D**, claw. (Redrawn from Wuillot & Gillies 1993b).

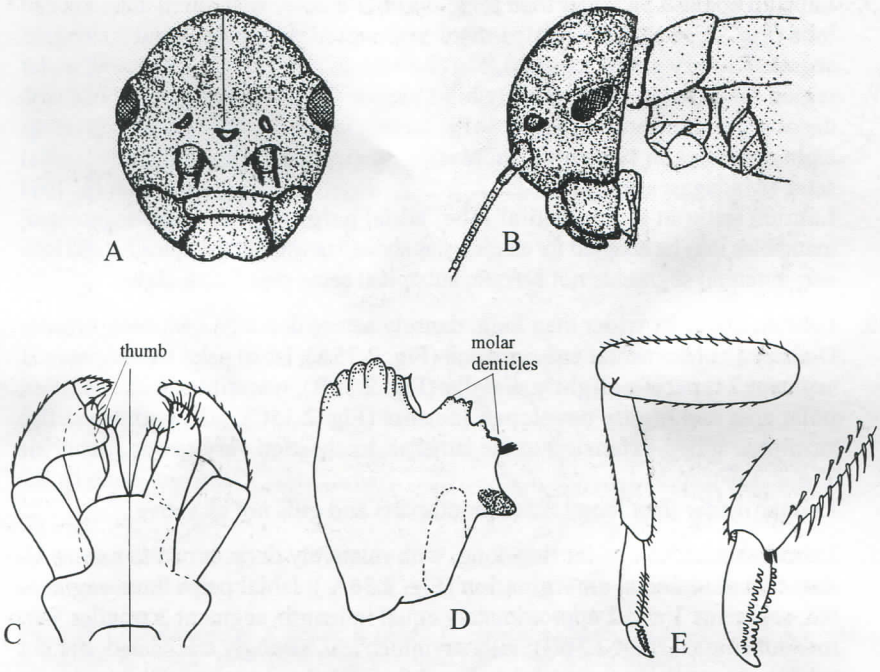

Fig. 2.32. *Edmulmeatus grandis* **A**, head, in anterior view; B, head, in lateral view; **C**, labium, in ventral view on the left and dorsal view on the right; **D**, mandible; **E**, leg with detail of claw. (Redrawn from Lugo-Ortiz & McCafferty 1997c).

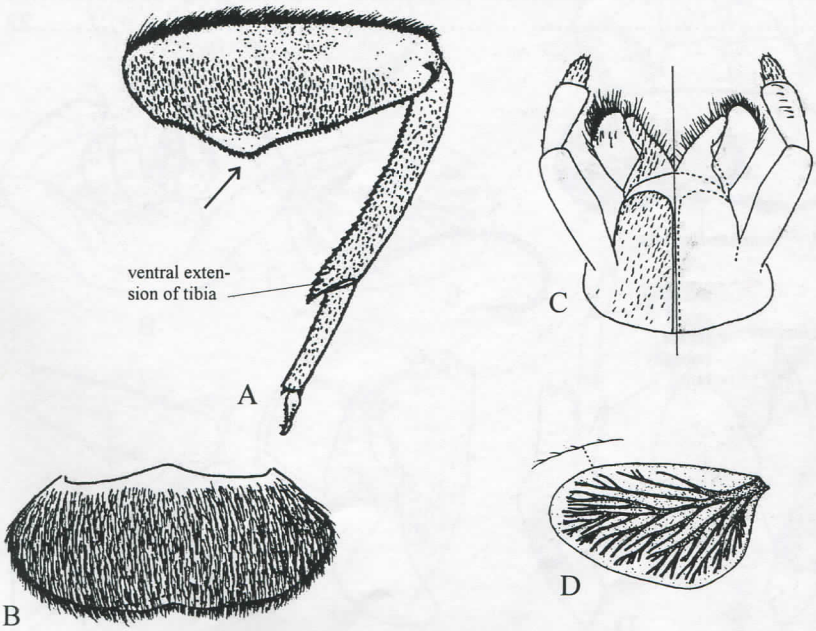

Fig. 2.33. *Nesoptiloides* sp. **A**, foreleg; **B**, labrum; **C**, labium, in ventral view on the left and dorsal view on the right; **D**, gill 4.

19. Labrum about 2.5x wider than long, dorsally setose, with small anteromedial lobe (Fig. 2.34A); labial palps three-segmented, segments 1 and 2 elongate, segment 3 very small, conical (Fig. 2.34B); mandibles long, narrow, molar region modified to form apically bifid incisor (Figs. 2.34C,D); antennae with distal segments serrate (Fig. 2.34E); tarsal claws (Fig. 2.34G) with seven to eight denticles in two rows, increasing in size towards apex, no subapical setae (Madagascar only) .. ..*Guloptiloides* (p. 101)

– Labrum without anteromedial lobe; labial palps two- or three-segmented; mandibles may be adapted for carnivory as above, but without the apically bifid incisor; antennal segments not serrate; subapical setae present on claws. ... 20

20. Labrum about 3x wider than long, densely setose dorsally, with deep, broadly U-shaped anteromedial emargination (Fig. 2.35A); labial palps two-segmented, segment 2 tapering slightly distally (Fig. 2.35B); mandibles with modified molar area and highly developed incisors (Fig. 2.35C); gills with basal flap forming a lobed extension to the lamellae, tracheation very strong, dendritic (Fig. 2.35F).... ... .*Centroptiloides* (p. 95)

– Labrum wider than long; other mouthparts and gills not as above ... .21

21. Labrum about 2.5x wider than long, with relatively deep, broad to narrow U-shaped anteromedial emargination (Fig. 2.36A); labial palps three-segmented, segments 1 and 2 approximately equal in length, segment 3 smaller, narrow-subconical (Fig. 2.36B); gills asymmetrical, strongly tracheated, but not produced basally to form a lobe (Fig. 2.36C,D) (Madagascar only). .. ..*Herbrossus* (p. 101)

– Labrum only slightly wider than long (about 1.2x wider); labial glossae narrower than the paraglossae, but not more than 1.5x as wide; labial palps with variously developed distomedial projections; tarsal claws not as above.. ... .22

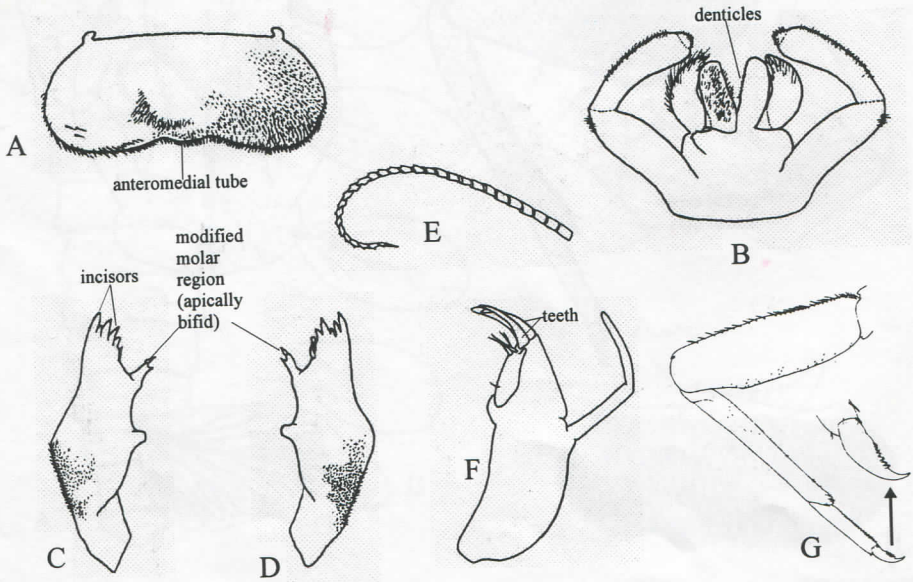

Fig. 2.34. *Guloptiloides* sp. **A**, labrum; **B**, labium; **C**, right mandible; **D**, left mandible; **E**, antenna; **F**, maxilla; **G**, leg with detail of claw. (Redrawn from Gattolliat & Sartori 2000).

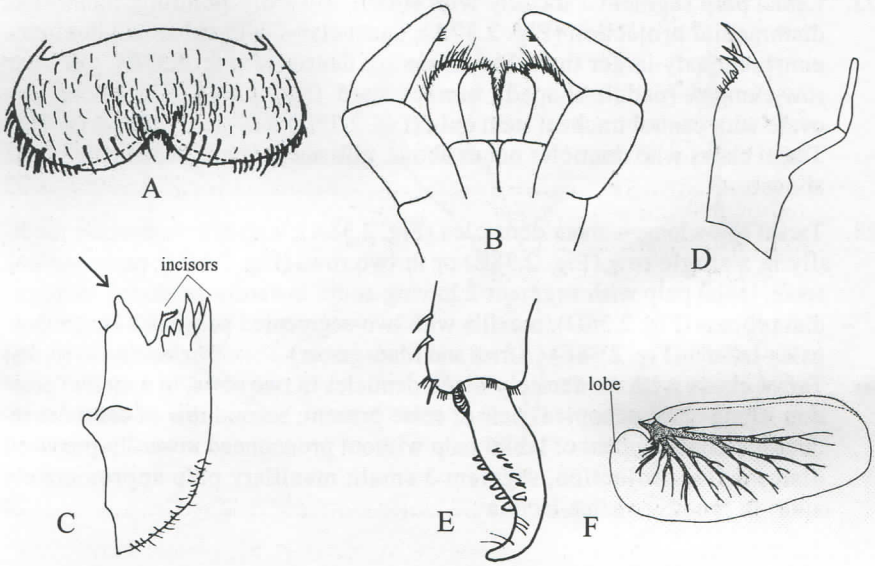

Fig. 2.35. *Centroptiloides* sp. **A**, labrum; **B**, labium; **C**, mandibles, showing modified molar region (arrowed); **D**, maxilla; **E**, claw; **F**, gill 4. (C & E redrawn from Lugo-Ortiz & McCafferty 1998a).

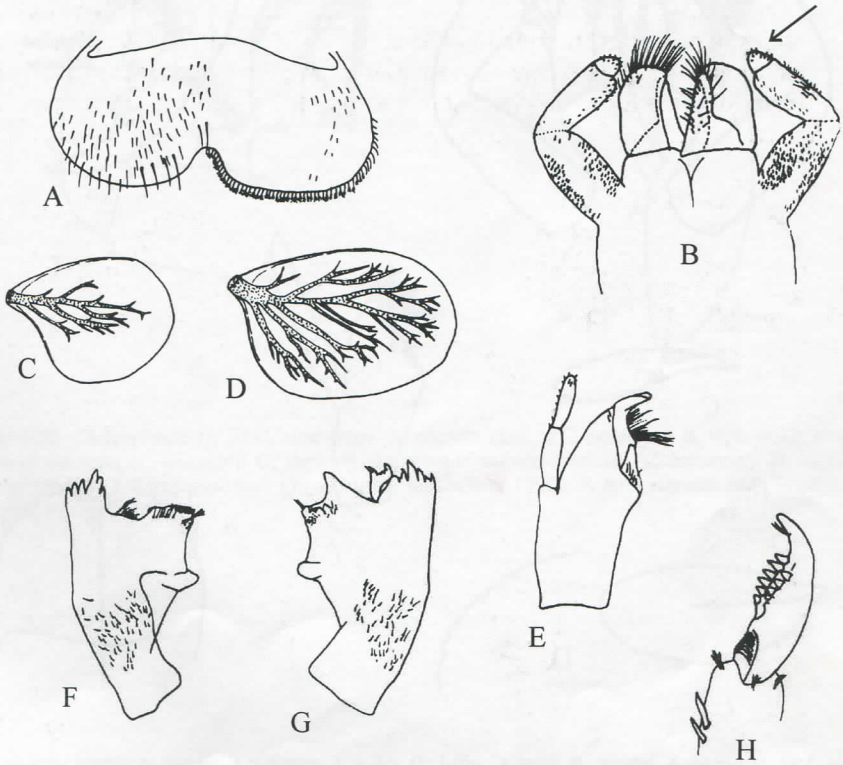

Fig. 2.36. *Herbrossus* sp. **A**, labrum; **B**, labium (*note* small palps—arrowed); **C**, gill 1 **D**, gill 3; **E**, maxilla; **F**, right mandible; **G**, left mandible; **H**, claw. (Redrawn from Gattolliat & Sartori 1998).

22. Labial palp segment 2 distally with small, upwardly-pointing, thumb-like distomedial projection (Fig. 2.37A); tarsal claws with subapical denticles conspicuously larger than the remaining denticles (Fig. 2.37B); gill 1 narrow-elongate (paddle-shaped), untracheated (Fig. 2.37C), gills 2–7 narrow-ovate with central tracheal stem only (Fig. 2.37D).. .. *Susua* (p. 109)
– Tarsal claws with denticles not as above; gills not as above; labial palp not as above 23

23. Tarsal claws long, without denticles (Fig. 2.38A), with minute denticle medially in a single row (Fig. 2.38B) or in two rows (Fig. 2.38C), no subapical setae; labial palp with segment 2 having acute inwardly-produced distomedial process (Fig. 2.38D); maxilla with two-segmented palp much longer than galea-lacinia (Fig. 2.38E) (Africa and Madagascar) .. ...*Cheleocloeon* (p. 96)
– Tarsal claws with moderately-sized denticles in two rows, in a medial position along claw, subapical pair of setae present; second row of denticles reduced; second segment of labial palp without pronounced inwardly-produced distomedial projection, segment 3 small; maxillary palp approximately equal in length to galea-lacinia ..... .24

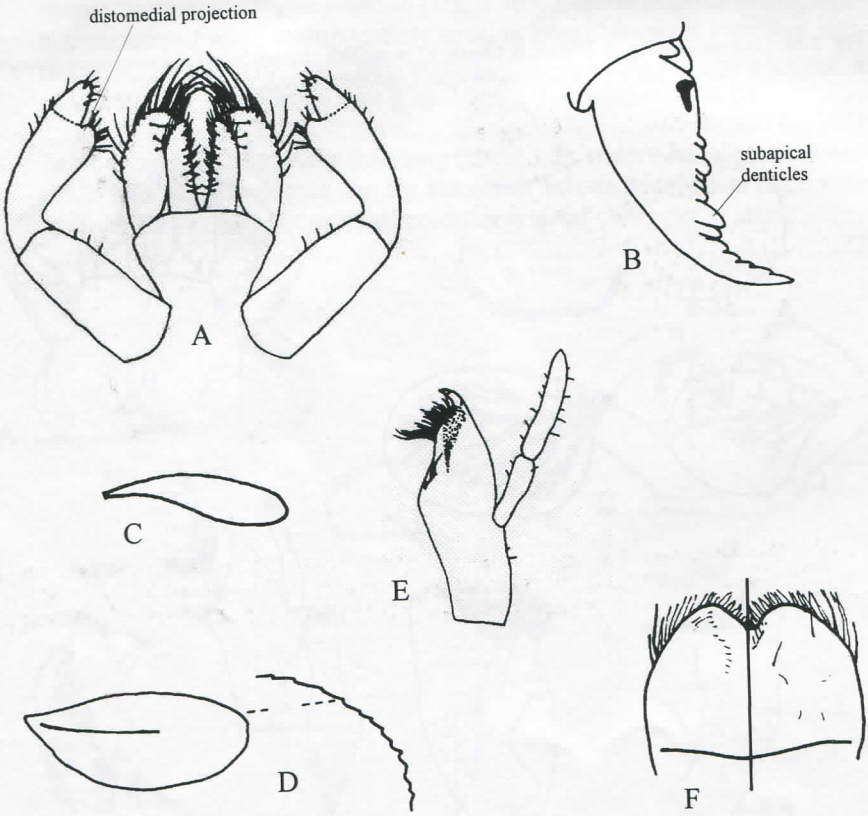

Fig. 2.37 *Susua* sp. **A**, labium; **B**, claw; **C**, gill 1, **D**, gill 4; **E**, maxilla; **F**, labrum in ventral view on the left and dorsal view on the right. (Redrawn from Wuillot & Gillies 1993b).

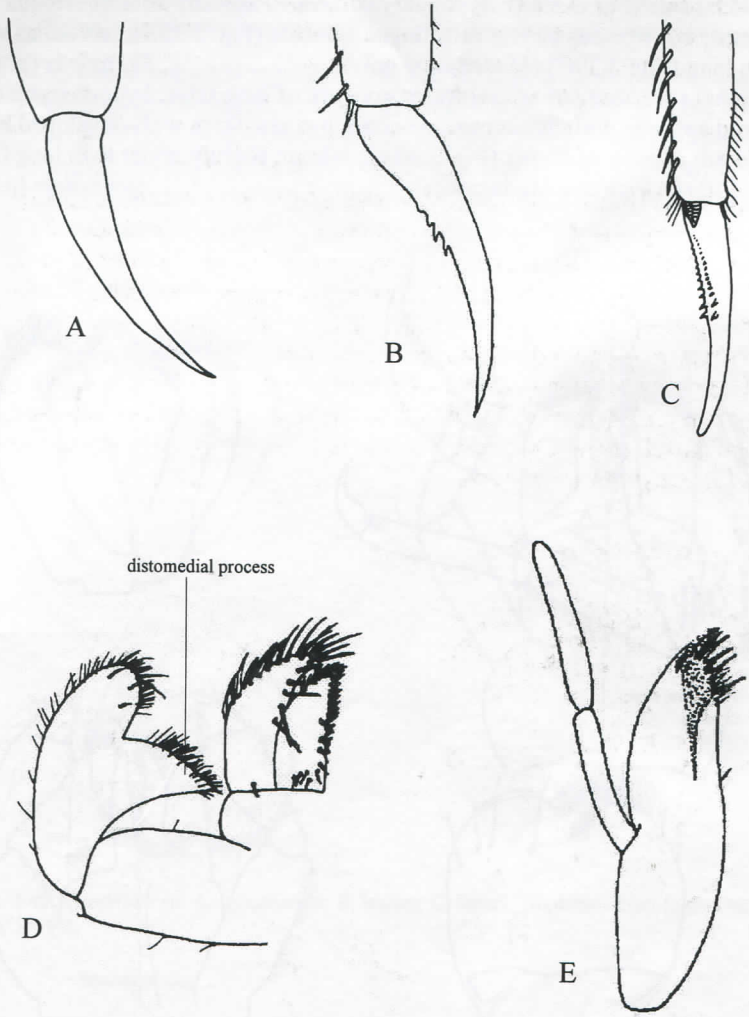

Fig. 2.38. *Cheleocloeon* sp. **A–C**, claw types: **A**, edenate claw of *C. yolandae*; **B**, with small, single row of denticles (*C. excisum*); **C**, showing two rows of minute denticles (*C. mirandei*). **D**, labium; **E**, maxilla. (B & E redrawn from Lugo-Ortiz & McCafferty 1997a; A & D redrawn from Wuillot & Gillies 1993a).

24. Forefemur with transverse arc of long, stout, blunt setae subapically on the dorsal side (Fig. 2.39A); hypopharynx covered apically with numerous fine setae, but without bristle tuft, lingua trilobate (Fig. 2.39B); labrum as wide as long (Fig. 2.39C) (Madagascar only). .... *Echinopus* (p. 100)

– Femora without subapical transverse arc of long setae; hypopharynx covered apically with numerous fine setae, but also with well-developed bristle tuft at apex of lingua (Fig. 2.40A); labrum slightly wider than long (Fig. 2.40B) (Africa and Madagascar) .. .. *Afroptilum* (p. 93)

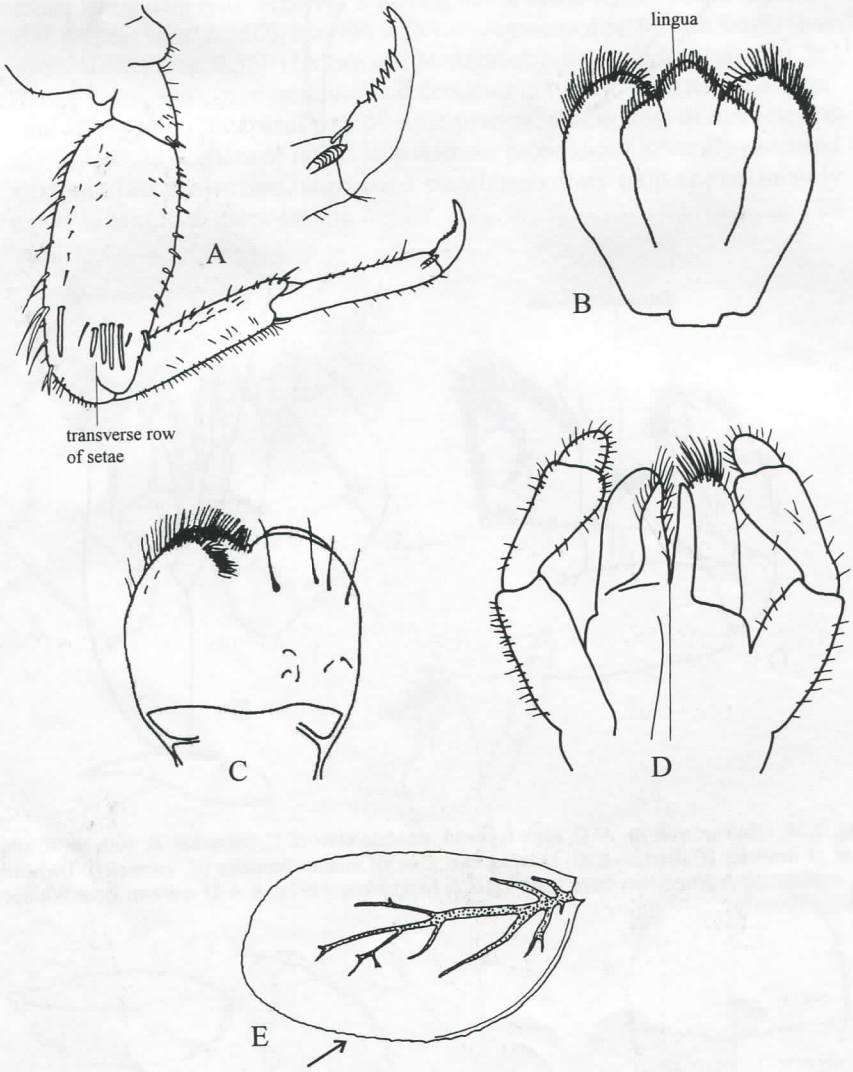

Fig. 2.39. *Echinopus* sp. **A**, forefemur, showing arc of setae and enlargement of claw; **B**, hypopharynx; **C**, labrum, in ventral view on the left and dorsal view on the right; **D**, labium, in ventral view on the left and dorsal view on the right; **E**, gill 4 (note serrated margin—arrowed). (Redrawn from Gattolliat 2002b).

25. Tarsal claws usually stongly hooked, with small to well-developed denticles in a single row 26
– Tarsal claws edentate, or with a single row of minute denticles. 36

26. Mouthparts highly modified, labium with glossae and paraglossae divergent, greatly elongate, slender, terminally with a fringe of long, fine, simple setae (Fig. 2.41A); labial palps segments 2 & 3 fused into slender club, angled inwardly at base of club (Fig. 2.41A); tarsal claws with four to six large denticles basally (Fig. 2.41B) ... .. .*Ophelmatostoma* (p. 105)
– Mouthparts not modified as above .. .27

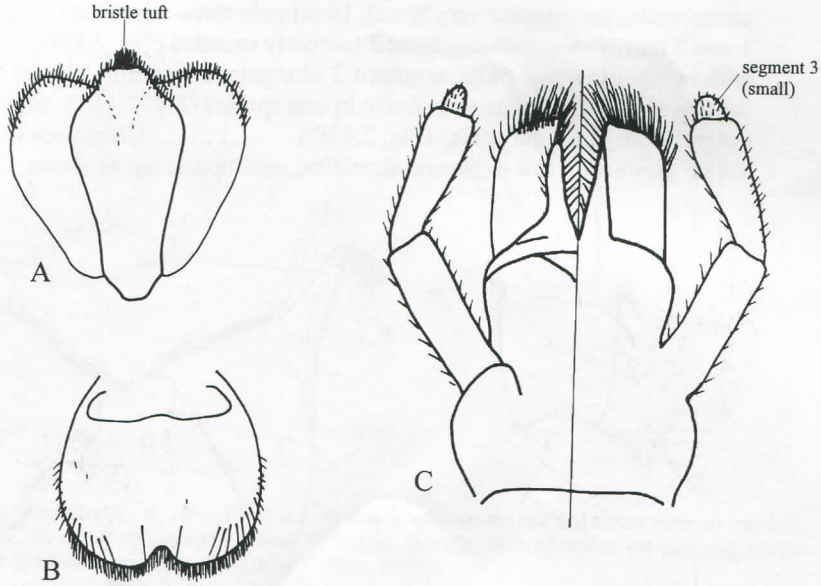

Fig. 2.40. *Afroptilum* sp. **A**, hypopharynx; **B**, labrum; **C**, labium. (Redrawn from Lugo-Ortiz & McCafferty 1998a).

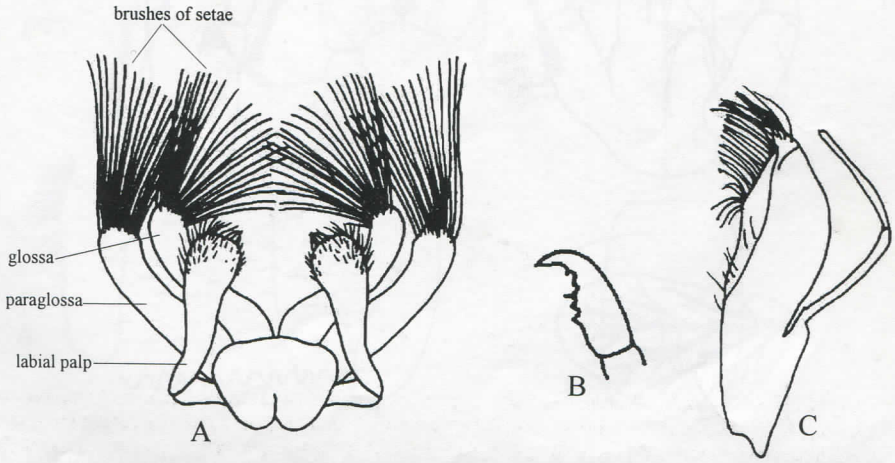

Fig. 2.41. *Ophelmatostoma* sp. **A**, labium; **B**, claw; **C**, maxilla. (Redrawn from Gillies et al. 1990).

27 Tarsal claws with four stout, broadly-based denticles (Fig. 2.42A); mandibles with incisors fused, elongate, bladelike (Fig. 2.42B); labium (Fig. 2.42C) with glossae very narrow, paraglossae narrow, labial palp segment 2 basally narrow, distomedially bulbous, segment 3 very short, rounded, offset from center to the outside; gills strongly tracheated (Fig. 2.42E) (Africa and Madagascar) .. .. *Xyrodromeus* (p. 110)

– Tarsal claws with few or many denticles; mandibles without blade-like incisors .. .. .28

28. Tarsal claws with well-developed denticles, smaller basally, larger towards apex (Fig. 2.43A); labium with glossae much shorter and narrower than paraglossae, paraglossae very broad; labial palp three-segmented, segments 1 and 2 narrow-elongate, segment 3 narrowly rounded (Fig. 2.43B); maxilla with two-segmented palp, segment 2 elongate, extending beyond galea-lacinia, slightly bulbous terminally in one species (Fig. 2.43C); terga without posterior marginal spines (Fig. 2.43D). .... *Glossidion* (p. 100)

– Tarsal claws with few to several denticles; mouthparts not as above .. 29

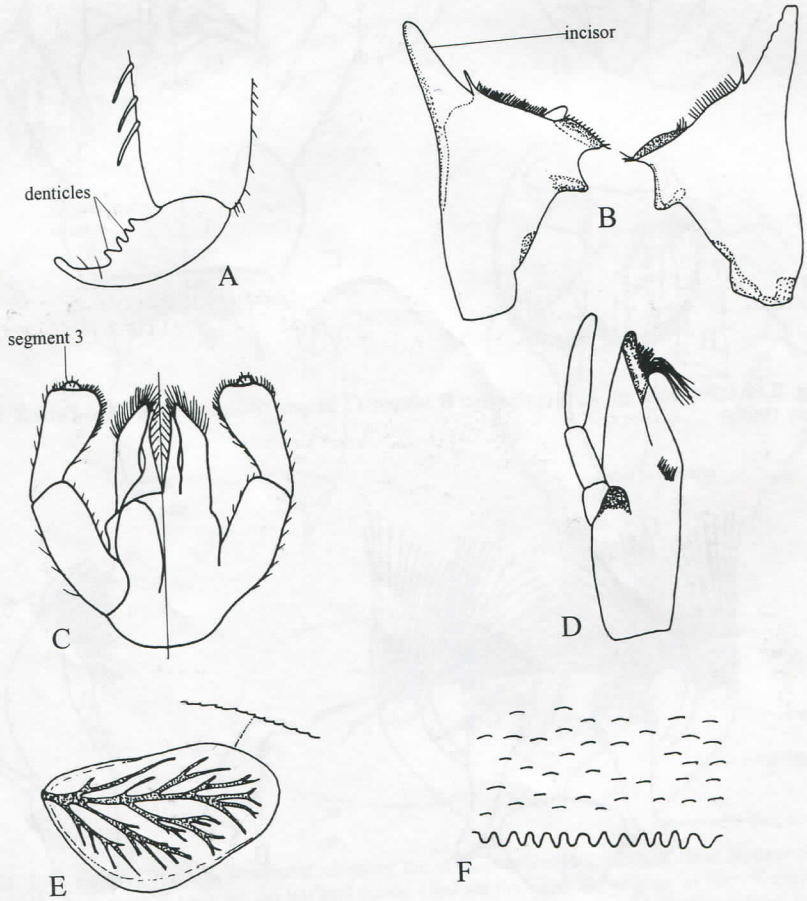

Fig. 2.42. *Xyrodromeus* sp. **A**, claw; **B**, mandibles; **C**, labium, in ventral view on the left and dorsal view on the right; **D**, maxilla; **E**, gill 4; **F**, terga with spines. (Redrawn from Lugo-Ortiz & McCafferty 1997f).

29. Maxillary palps three-segmented, extending well beyond galea-lacinia (Fig. 2.44A); labium with glossae and paraglossae broad, usually rounded apically, labial palps two-segmented, segment 2 apically expanded or bulbous, all fringed with long fine setae (Fig. 2.44B); tarsal claws hooked, with few to several large denticles (Fig. 2.44C) (Africa and Madagascar) ... . *Pseudopannota* (p. 107)

(Thorax with forewing pads fused for more than half their length (Fig. 2.44D: subgenus *Pseudopannota*) or less than half their length (Fig. 2.44E: subgenus *Hemipannota*))

– Maxillary palps two-segmented, labium not as above; tarsal claws with numerous denticles of variable size. 30

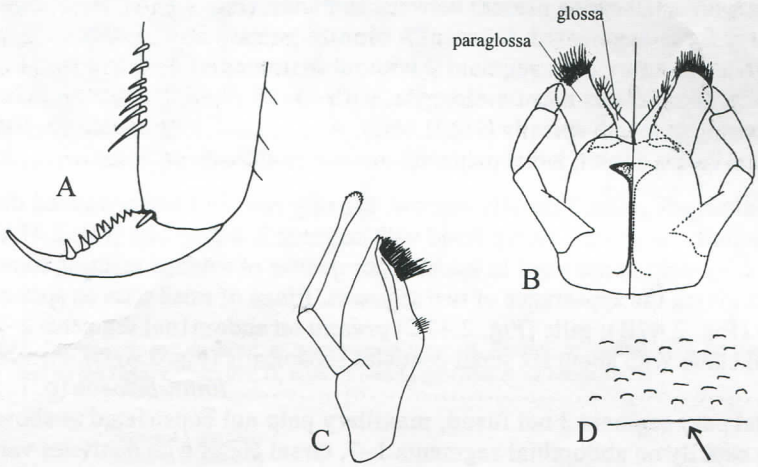

Fig. 2.43. *Glossidion* sp. **A**, claw; **B**, labium, in ventral view on the left and dorsal view on the right; **C**, maxilla; **D**, detail of posterior portion of tergite, showing lack of spines on posterior margin (arrowed). (Redrawn from Lugo-Ortiz & McCafferty 1998b).

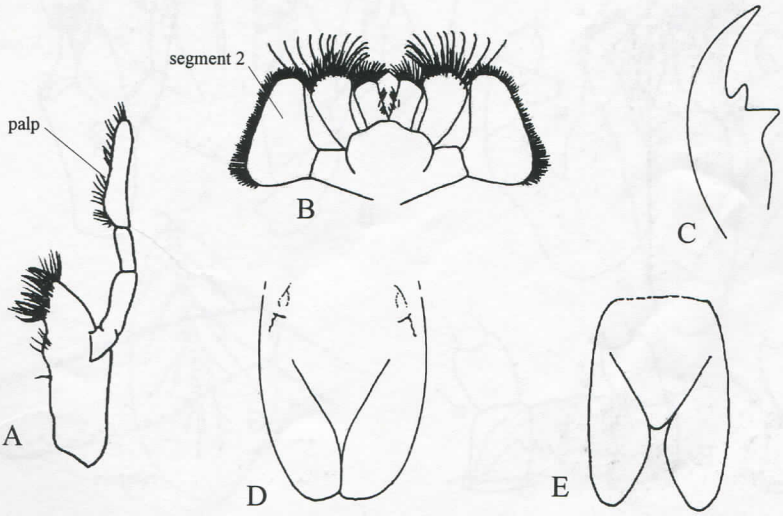

Fig. 2.44. *Pseudopannota* spp. **A–D**, *P Pseudopannota* subgenus: **A**, maxilla; **B**, labium; **C**, claw; **D**, thoracic forewing pads. **E**, *P Hemipannota* subgenus, thoracic forewing pads. (Redrawn from Elouard et al. 1990).

30. Segment 2 of labial palp with variously-developed, thumblike, distomedial process (Fig. 2.45A), segment 3 rounded to subconical; maxillary palp segment 2 distomedially concave (Fig. 2.45B) or constricted (Fig. 2.45C); antennal scapes distolaterally with notch (Fig. 2.45D), chamfered (Fig. 2.45E) or unmodified (Fig. 2.45F); villopore present (Fig. 2.45G), reduced, or absent; tarsal claws with numerous denticles that may be evenly sized, or may increase in size towards the apex, (Africa and Madagascar) . ... *Pseudocloeon & Labiobaetis* (See discussion on pp. 102 & 106)

– Labial palp segment 2 variously developed: if thumb-like, then maxillary palp segment 2 without constrictions or concavities..... 31

31 Head with small carina present between antennae; (Fig. 2.46A); labial palps clearly three-segmented, segment 3 bluntly pointed apicolaterally (Fig. 2.46B); maxillary palp segment 2 without distomedial constriction (Fig. 2.46C); tarsal claws narrow-elongate, with 13–15 slender, sharp denticles, increasing in length apically (Fig. 2.46D). ... .. *Nigrobaetis* (p. 104)

– Frontal carina absent; labial palp with various modifications. 32

32. Labial palp segment 2 basally narrow, broadly rounded and produced distomedially; segment 3 partly fused with segment 2, nipple-like (Fig. 2.47A); maxillary palp constricted in apical upper quarter of terminal segment, sometimes giving the appearance of two segments, fringe of small setae on apex of palp (Fig. 2.47B); gills (Fig. 2.47C) present on abdominal segments 2–7; tarsal claws with about six small denticles subapically (Fig. 2.47D)... ... .*Rhithrocloeon* (p. 107)

– Labial palp segment 3 not fused; maxillary palp not constricted as above; gills usually on abdominal segments 1–7, tarsal claws with denticles variously modified .. .. .33

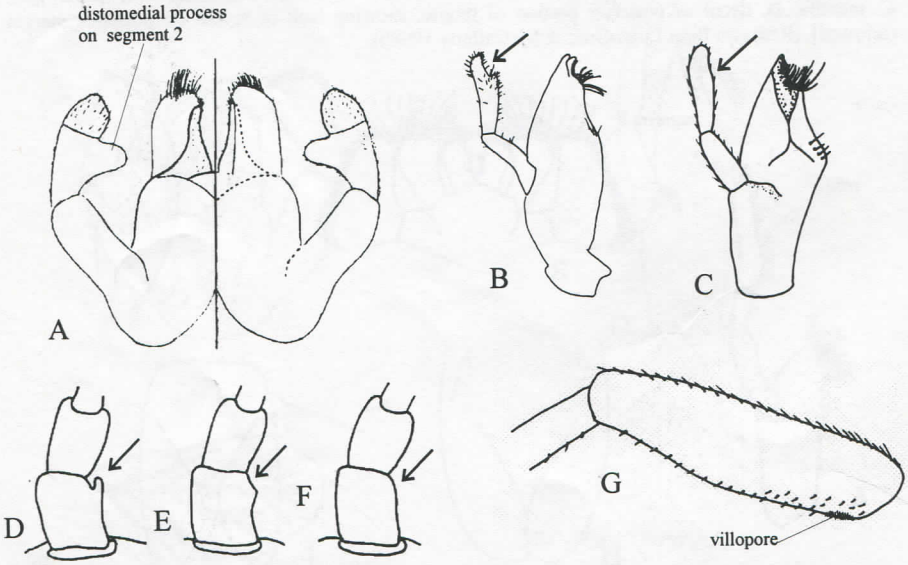

Fig. 2.45. *Labiobaetis* sp. and *Pseudocloeon* sp.. **A**, labium, in ventral view on the left and dorsal view on the right; **B**, maxilla, with concave palpal segment (arrowed); **C**, maxilla, with constricted palpal segment (arrowed); **D**, antenna, with notched scape (arrowed); **E**, antenna, with chamfered scape (arrowed); **F**, antenna, with unmodified scape (arrowed); **G**, femur, showing villopore. (A–F redrawn from Lugo-Ortiz & McCafferty 1997d).

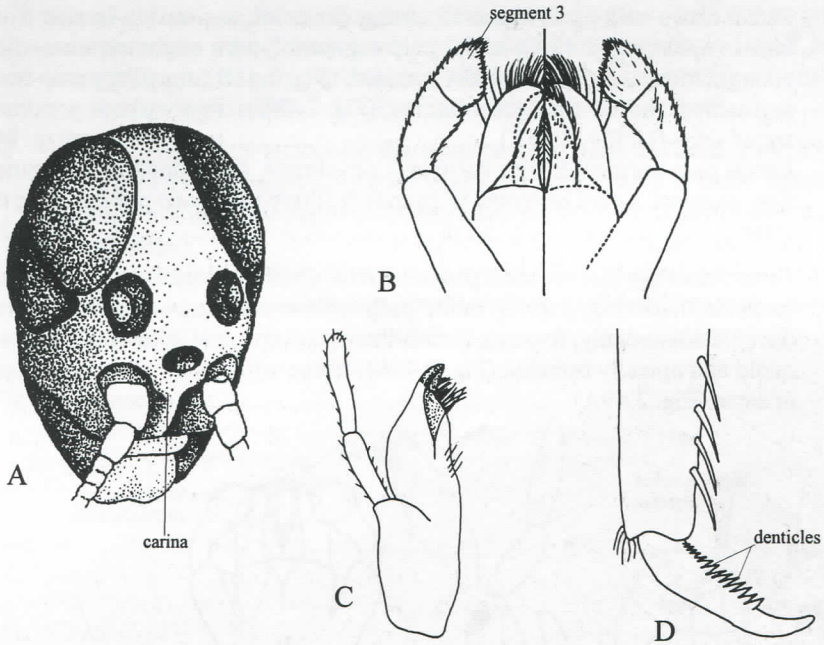

Fig. 2.46. *Nigrobaetis* sp.. **A**, head, in anterolateral view; **B**, labium, in ventral view on the left and dorsal view on the right; **C**, maxilla; **D**, claw. (From Lugo-Ortiz & de Moor 2000).

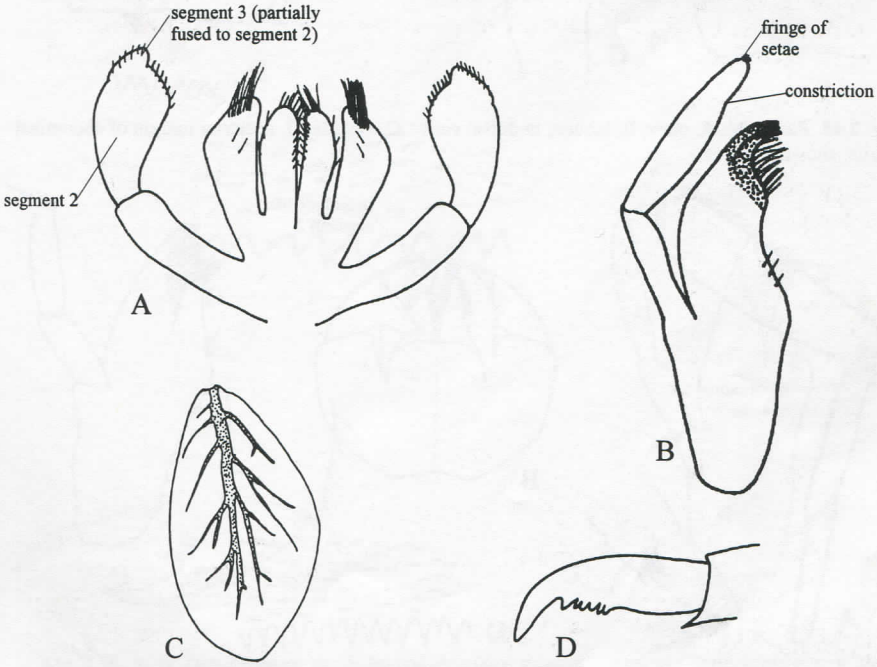

Fig. 2.47. *Rhithrocloeon* sp.. **A**, labium, in ventral view , **B**, maxilla; **C**, gill 4; **D**, claw. (Redrawn from Gillies 1988).

33. Tarsal claws with up to about 10 strong denticles, increasing in size from base to apex (Fig. 2.48A); labial palp segment 2 with slight anteromedial emargination, segment 3 broadly rounded, (Fig. 2.48B); maxillary palp two-segmented, shorter than galea-lacina; (Fig. 2.48C); tibia without proximal arc of setae (cf. Fig. 2.49A). .. .. *Baetis* (p. 94)

– Labial palp segment 2 with variously developed, anteromedial emargination, segment 3 may be ovoid to rounded; tibiae may have proximal arc of setae. 34

34. Tarsal claws with two enlarged subapical denticles and four to six small basal denticles (Fig. 2.49A); labial palp with second segment strongly produced distomedially, forming thumb-like projection, and with third segment ovoid and apically rounded (Fig. 2.49B); tibiae with small subproximal arc of setae (Fig. 2.49A) .. .. .*Crassabwa* (p. 97)

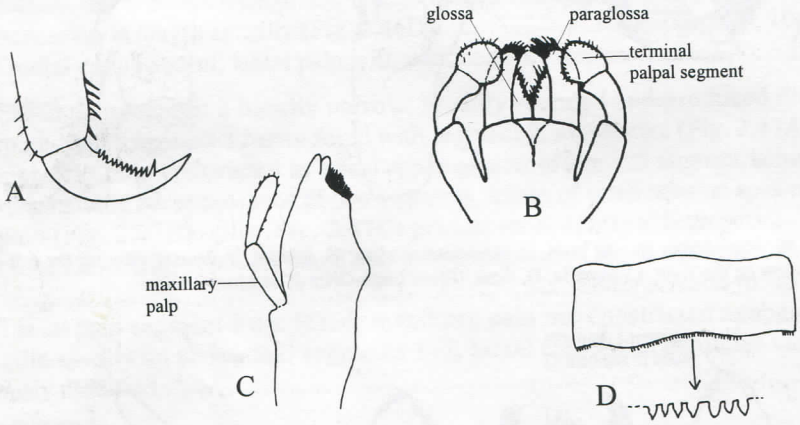

Fig. 2.48. *Baetis* sp.. **A**, claw; **B**, labium, in dorsal view **C**, maxilla; **D**, posterior margin of abdominal tergite, showing spines.

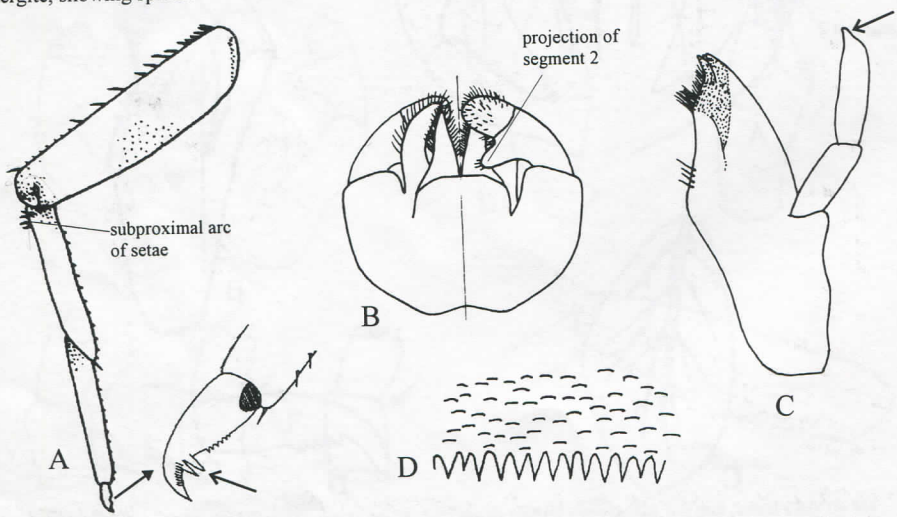

Fig. 2.49. *Crassabwa* sp.. **A**, leg, showing subproximal arc of setae, with claw enlarged to show denticles (arrowed); **B**, labium, in ventral view on the left and dorsal view on the right; **C**, maxilla (*note* pointed tip of palp—arrowed); **D**, marginal spines from posterior of abdominal segments. (Redrawn from Lugo-Ortiz & McCafferty 1996).

– Tarsal claws may have enlarged subapical denticles or, if not notably enlarged, then a gradation from smaller denticles basally to larger ones subapically; labial palp with second segment without inwardly-produced thumb (e.g. Figs. 2.50B, 2.52D) and with third segment bulbous... .... .35

35. Tarsal claws (Fig. 2.50A) with few to numerous denticles, usually weak basally and stronger apically; maxillary palp segment 2 usually apically rounded but apically papilliform in some species (Fig. 2.50B) (Africa and Madagascar)..... .. .. *Dabulamanzia* (p. 98)

– Tarsal claws (Fig. 2.50E) with poorly developed denticles basally, and pair of enlarged denticles medially; maxillary palp segment 2 apically papilliform (Fig. 2.50F) (Madagascar only) .. .. ..*Nesydemius* (p. 104)

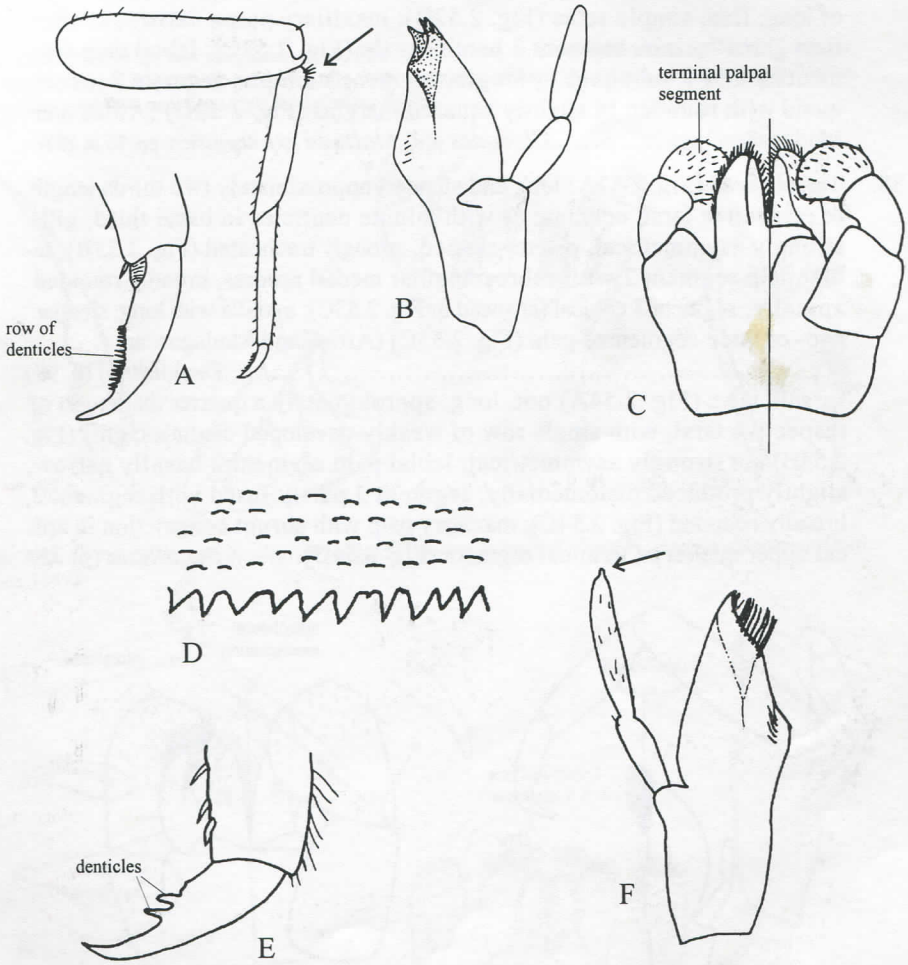

Fig. 2.50. A–D, *Dabulamanizia* sp.. **A**, leg and claw (*note* subproximal arc of setae—arrowed); **B**, maxilla, showing palps with unmodified rounded tips; **C**, labium, in ventral view on the left and dorsal view on the right; **D**, posterior margin of abdominal tergite, showing spines. **E–F**, *Nesydemius* sp. **E**, claw; **F**, maxilla showing palp with papilliform tip (arrowed). (Redrawn from Lugo-Ortiz & McCaftferty 1996).

36. Tarsal claws short, edentate or with minute denticles subapically .... .37
– Tarsal claws usually elongate, edentate or with small to minute denticles in one row 38

37 Tarsal claws short, blunt, edentate (Fig. 2.51A); legs devoid of setae except for posterior margin of hind tibiae; antennae short (only slightly longer than width of head); cerci short; maxilla with very short two-segmented palp (Fig. 2.51B); labium with glossae and paraglossae subequal, paraglossae with apicolateral emargination (Fig. 2.51C), palps two-segmented, terminal segments large, bulbous; nymphs living in association with freshwater mussels (Africa and Madagascar) .... *Mutelocloeon* (p. 103)
– Tarsal claws short, pointed, edentate or with minute subapical denticles (Fig. 2.52A); tibiae and tarsi with long row of distinctive setae (Fig. 2.52A); antennae very long in some species; abdominal sterna 2–6 with sublateral tufts of long, fine, simple setae (Fig. 2.52B); maxillary palps narrow, shorter than galea-lacinia, segment 2 bent near tip (Fig. 2.52C); labial palp segments 2 and 3 subequal in length, segment 2 simple, segment 3 ovoid ovoid with rounded to slightly squared margins (Fig. 2.52D) (Africa and Madagascar) ..*Cloeodes* and *Maliqua* (see discussion, pp. 96 & 102)

38. Tarsal claws (Fig. 2.53A) long and slender, approximately two thirds length of respective tarsi, edentate or with minute denticles in basal third; gills strongly asymmetrical, palette-shaped, strongly tracheated (Fig. 2.53B); labial palp segment 2 with subrectangular medial process, broadly rounded apically, segment 3 conical (arrowed in Fig. 2.53C); maxilla with long, slender two- or three-segmented palp (Fig. 2.53C) (Africa and Madagascar) ....*Demoulinia* (p. 99)
– Tarsal claws (Fig. 2.54A) not long, approximately a quarter the length of respective tarsi, with single row of weakly-developed denticles; gills (Fig. 2.54B) not strongly asymmetrical; labial palp segment 2 basally narrow, slightly produced distomedially, segment 3 partly fused with segment 2, broadly rounded (Fig. 2.54C); maxillary palp with abrupt constriction in apical upper quarter of terminal segment (Fig. 2.54D). ....*Bugilliesia* (p. 95)

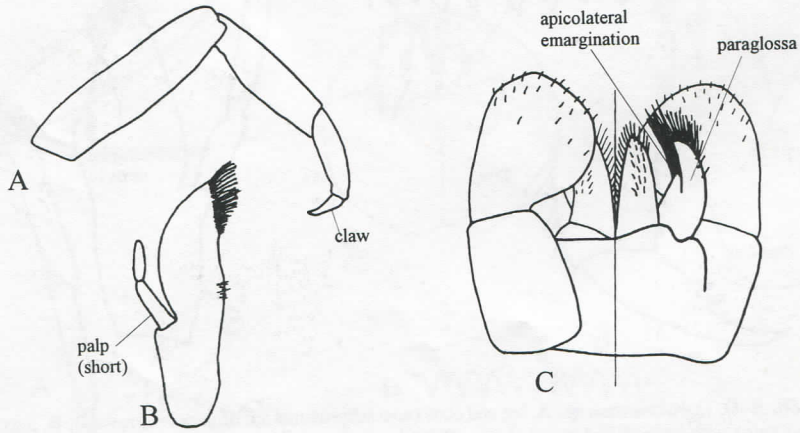

Fig. 2.51. *Mutelocloeon* sp.. **A**, leg and claw; **B**, maxilla; **C**, labium, in ventral view on the left and dorsal view on the right. (Redrawn from Gillies & Elouard 1990).

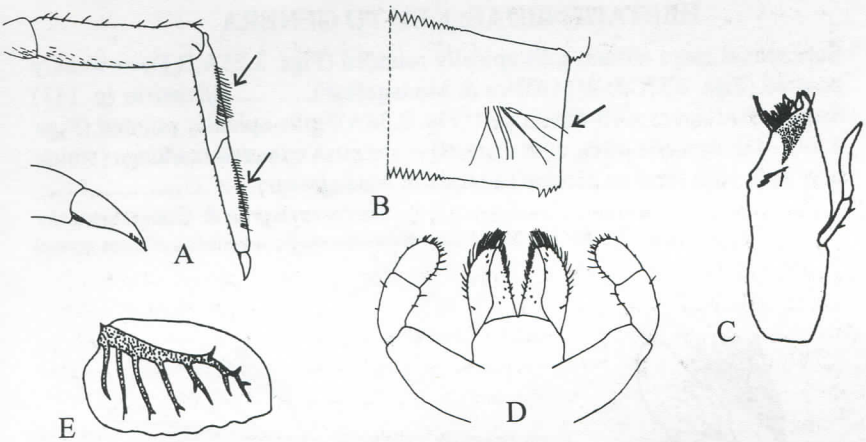

Fig. 2.52. *Cloeodes* sp. and *Maliqua* sp.. **A**, foreleg and claw; **B**, ventral abdominal setal tuft; **C**, maxilla; **D**, labrum; **E**, gill 4. (See p. 96 for a discussion on the systematics of these two genera). (A redrawn from Waltz & McCafferty 1994; C–E from Lugo-Ortiz & McCafferty 1997e).

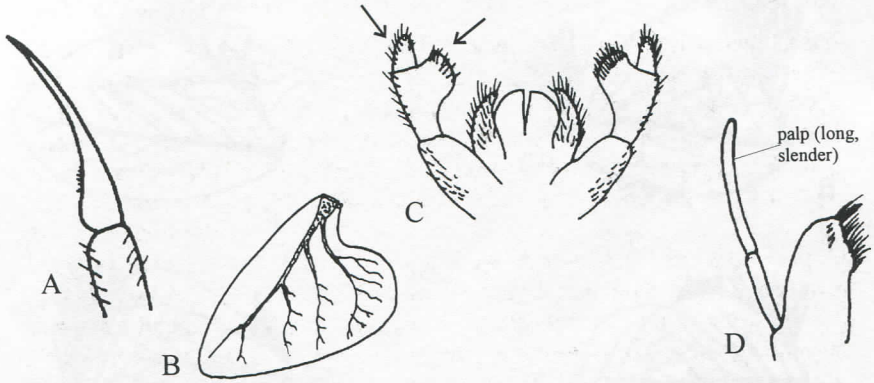

Fig. 2.53. *Demoulinina* sp.. **A**, claw; **B**, gills; **C**, labium in ventral view; **D**, maxilla. (Redrawn from Crass 1947).

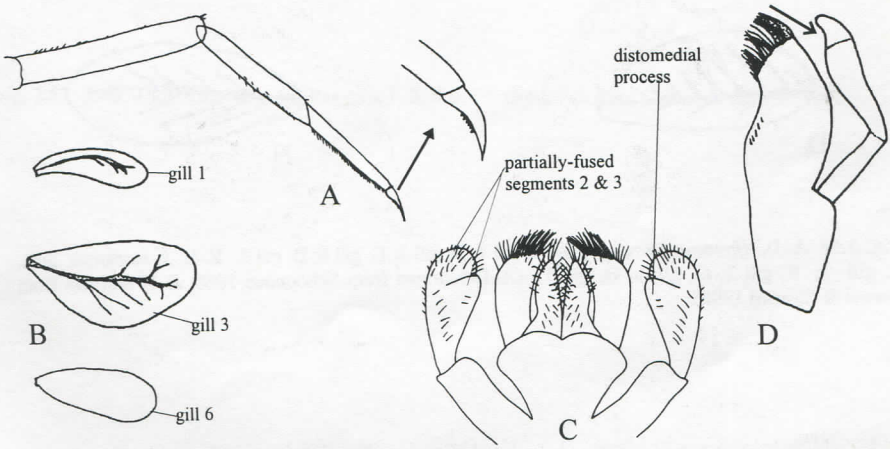

Fig. 2.54. *Bugilliesia* sp.. **A**, leg with detail of claw; **B**, gills; **C**, labium, in ventral view; **D**, maxilla (*note* constriction in palp—arrowed). (Redrawn from Gillies 1990a).

HEPTAGENIIDAE: KEY TO GENERA

1 Supracoxal spurs absent; gills apically rounded (Figs. 2.55A,B,D) or weakly pointed (Figs. 2.55C,E–H) (Africa & Madagascar)... ..... *Afronurus* (p. 111)

– Supracoxal spurs well-developed (Fig. 2.56A); gills apically pointed (Figs 2.57A–D); nymphs often with distinctive purplish coloured markings (which may fade with time on alcohol) (Africa & Madagascar). .... *Thalerosphyrus* & *Compsoneuria*

(see pp. 110 & 112 for a discussion on the systematics of these genera)

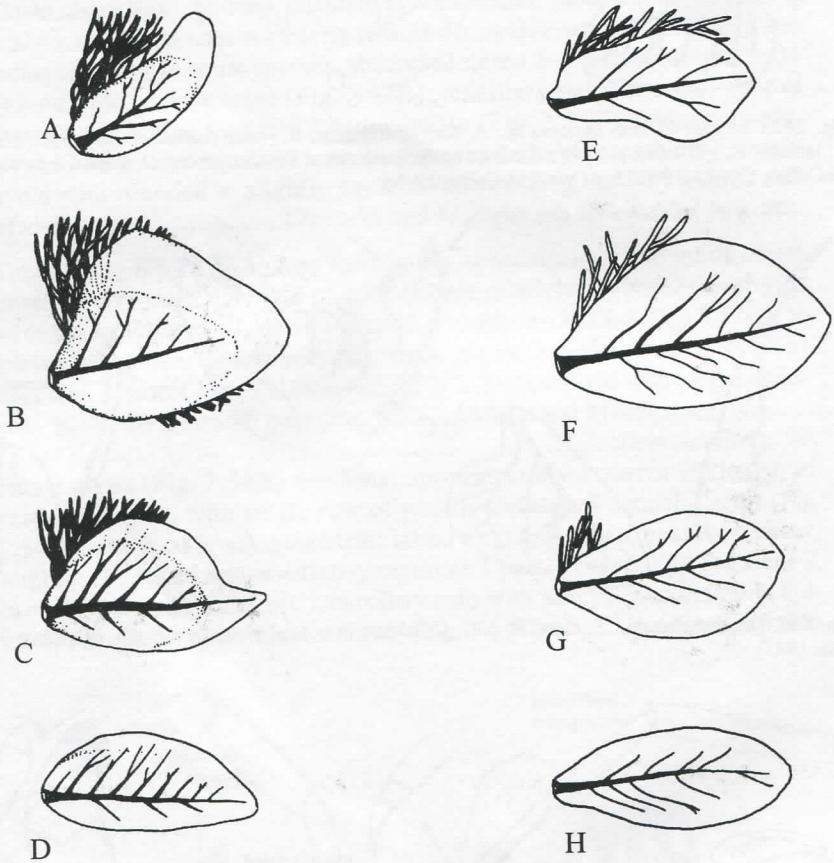

Fig. 2.55. **A–D**, *Afronurus barnardi* gills: **A**, gill 1, **B**, gill 3; **C**, gill 6; **D**, gill 7 **E–H**, *A. matitensis*, gills: **E**, gill 1, **F**, gill 3; **G**, gill 6; **H**, gill 7 (A–D redrawn from Schoonbee 1968; E–H redrawn from Sartori & Elouard 1996).

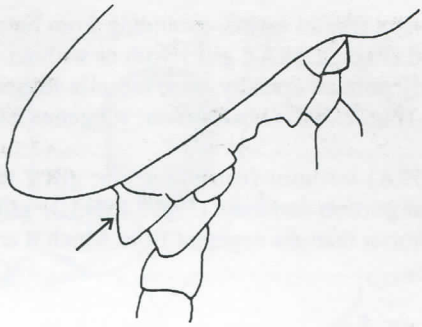

Fig. 2.56. *Compsoneuria bequaerti,* supra coxal spurs (arrowed).

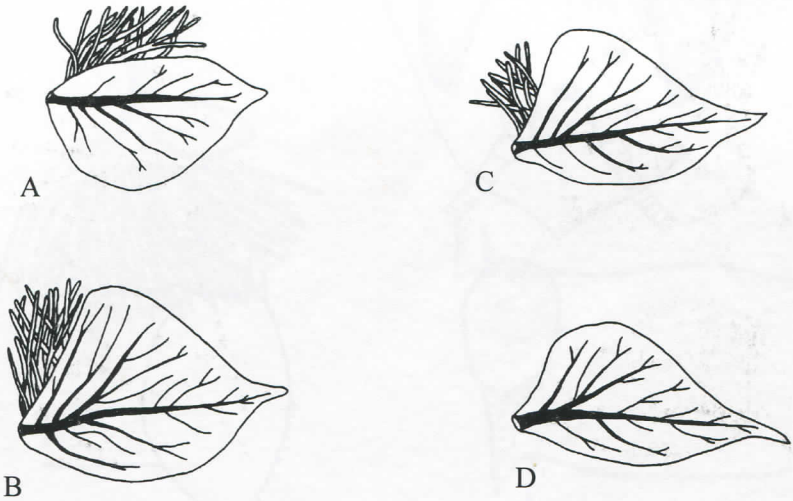

Fig. 2.57 A–D, *Thalerosphyrus josettae* gills 1, 3, 6 and 7 (Redrawn from Sartori & Elouard 1996).

OLIGONEURIIDAE: KEY TO GENERA

1 Head with distinct frontal carina, extending from base of antennae to the margin of the head (Figs. 2.58A); gill 1 with or without well developed lamella, gills 2–7 slightly pointed apically, each lamella longer than the segment from which it arises (Fig. 2.598) (Madagascar· subgenus *Madeconeuria*). .... *Elassoneuria* (p. 112)

– Head (Fig. 2.59A) without frontal carina, gill 1 with poorly developed lamella, fibrillar portion dominant (Fig. 2.59B,C), gills 2–7 rounded apically, each lamella shorter than the segment from which it arises (Fig. 2.59D)... .. ..*Oligoneuriopsis* (p. 112)

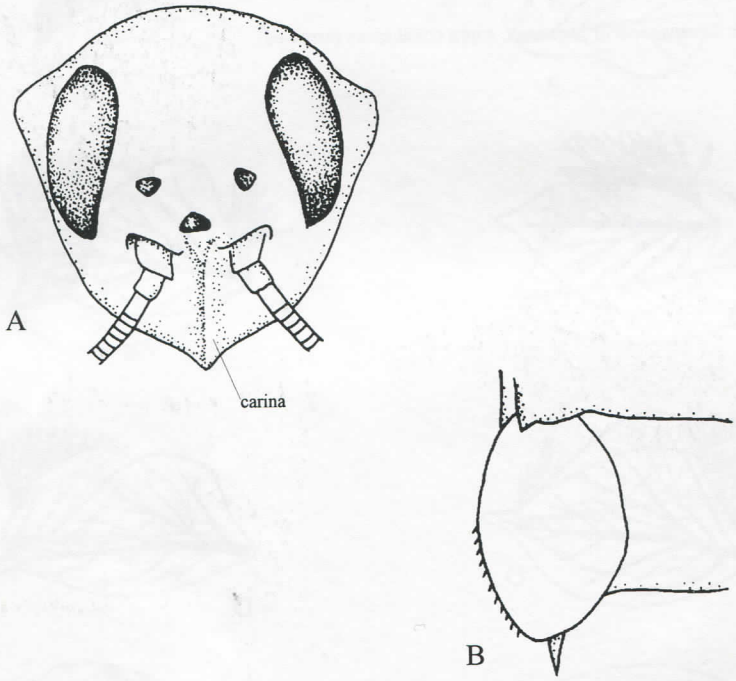

Fig. 2.58. *Elassoneuria* sp.. **A**, head; **B**, gill 7 (Redrawn from Agnew 1980).

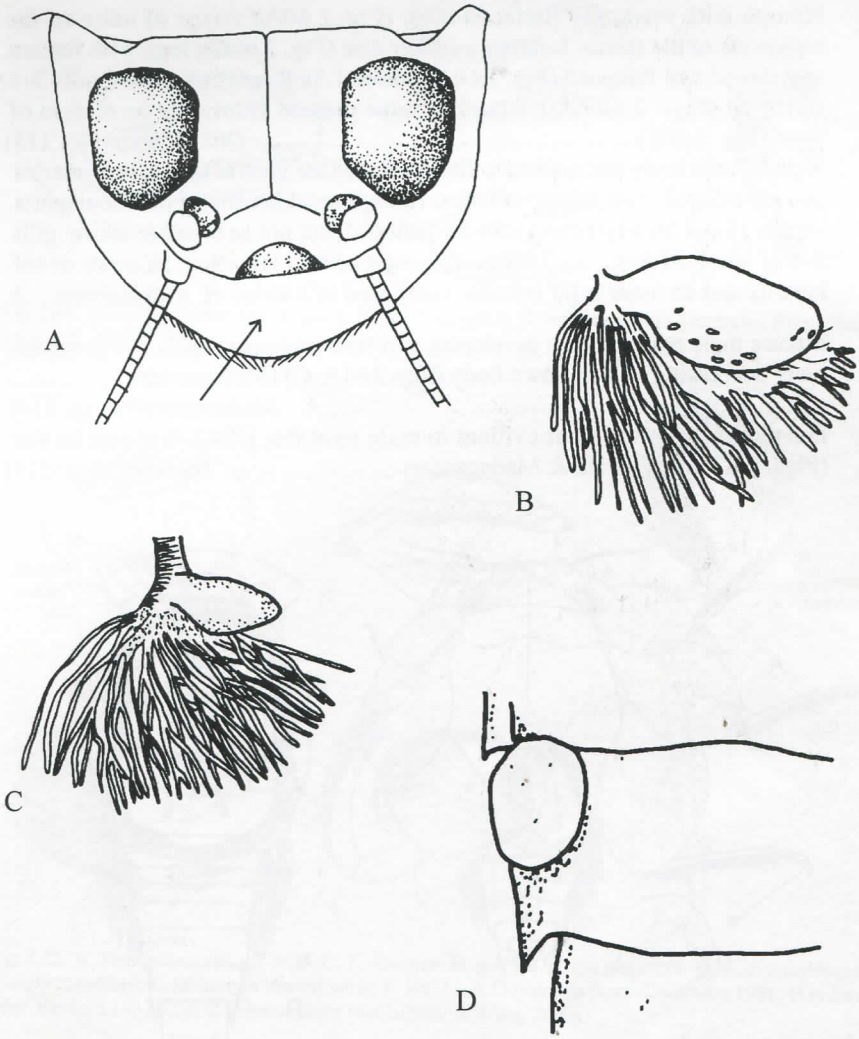

Fig. 2.59. A, *Oligoneuriopsis* sp., **A**, head (note lack of carina—arrowed). **B**, *O. elizabethae,* gill 1. **C–D**, *Oligoneuriopsis lawrencei*: **C**, gill 1; **D**, gill 7 (Redrawn from Agnew 1980).

TRICORYTHIDAE: KEY TO GENERA

1 Nymph with markedly flattened body (Fig. 2.60A); fringe of hairs on the underside of the thorax forming a sucker disc (Fig. 2.60B); legs with femora very broad and flattened (Fig. 2.60A), about 1.5x longer than broad; gills 2–6 fibrillate (Figs. 2.60C,D); fringe of setae present anteriorly on margin of head (Fig. 2.60E) .... *Dicercomyzon* (p. 113)

– Nymph with body not markedly flattened; neither ventral thorax nor anterior margin of head with fringe of hairs, though setal brushes from mouthparts visible (Fig 2.16 F); femora may be flattened, but not as broad as above; gills 2–6 (Figs. 2.61A–C, 2.62A,B) composed of two lamellae, an outer ovoid lamella and an inner bifid lamella, composed of a series of evaginations. .2

2. Mature male nymphs with developing genitalia prominent; gills 2–6 progressively decreasing in size down body (Figs 2.61A–C) (Madagascar). ... .*Madecassorythus* (p. 114)

– Developing genitalia not evident in male nymphs; gills 2–6 of similar size (Figs. 2.62A,B) (Africa & Madagascar).. ... ... *Tricorythus* (p. 115)

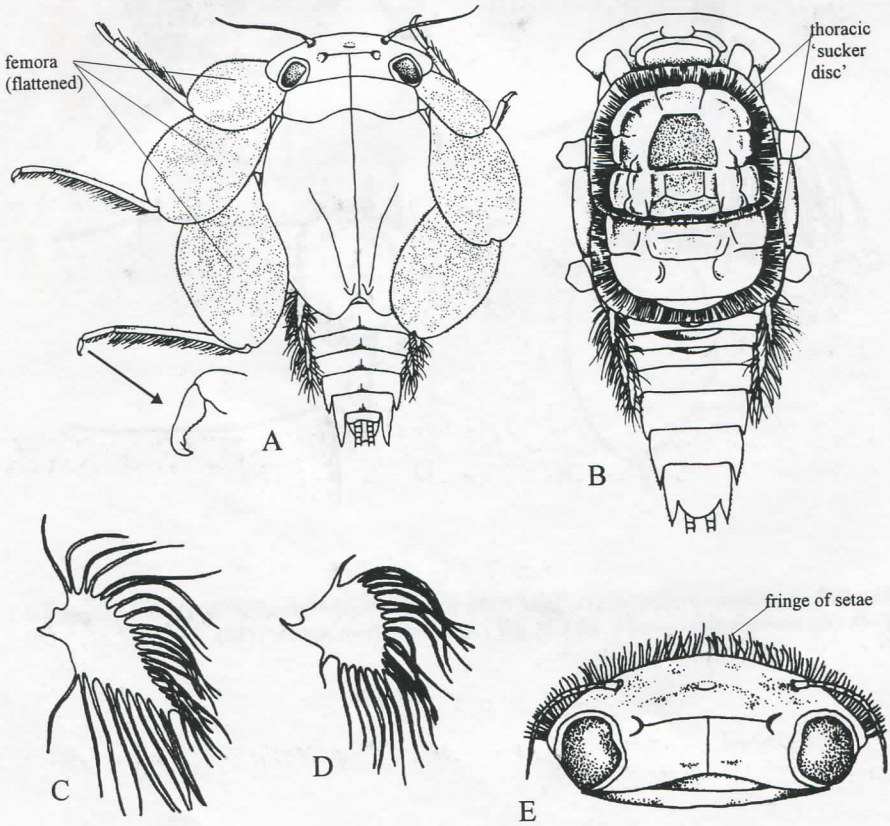

Fig. 2.60. *Dicercomyzon* sp. **A–B**, nymph with various appendages truncated: **A**, dorsal view, with detail of hindclaw; **B**, ventral view. **C–D**, gills: **C**, gill 2; **D**, gill 6. **E**, head, in dorsal view. (A–D redrawn from Demoulin 1964; E redrawn from McCafferty & Wang 2000).

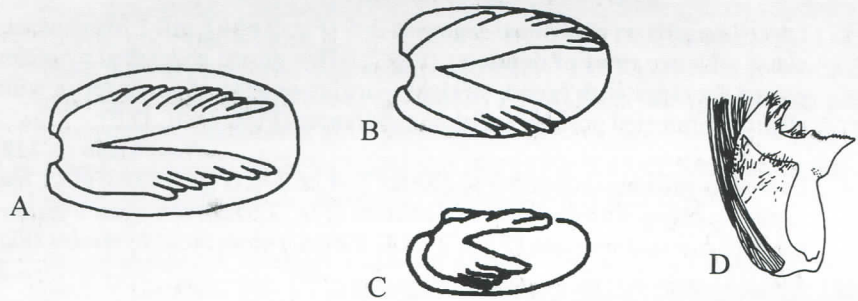

Fig. 2.61. *Madecassorythus sp.*. **A**, gill 1 **B**, gill 3; **C**, gill 5; **D**, right mandible. (Redrawn from Oliarinony et al. 2000).

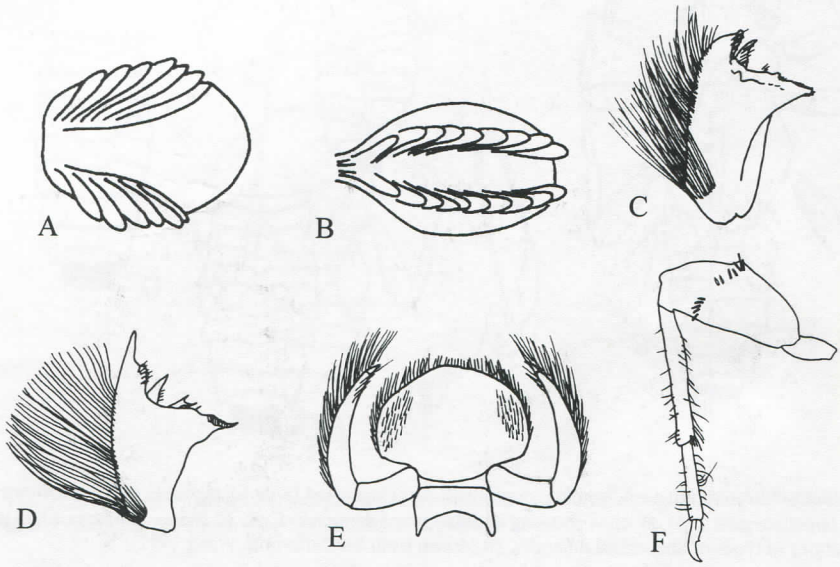

Fig. 2.62. **A**, *Tricorythus* sp., gill 3. **B–C**, *T discolor*· **B**, gill 3; **C**, right mandible. **D–E**, *Tricorythus* sp.. **D**, right mandible; **E**, labium, in ventral view; **F**, leg. (A & D redrawn from Demoulin 1981, B redrawn from Barnard 1932; C & E redrawn from McCafferty & Wang 2000).

EPHEMERYTHIDAE

No key to genera, as only one genus currently known. *Ephemerythus*. (See Figs. 2.16A–E & p. 115).

MACHADORYTHIDAE

No key to genera, as only one genus currently known. *Machadorythus*. (See Figs. 2.6A–F & p. 116).

TELOGANELLIDAE

No key to genera, as only one genus currently known. *Teloganella*. (Madagascar only· see Figs. 2.15A–C & p. 116).

TELOGANODIDAE: KEY TO GENERA

1 Lamellate gills on abdominal segments 2–5 (Fig. 2.63A), gill 1 filamentous; claws with two rows of denticles (Fig. 2.63B); dorsal abdominal tubercles paired, or terga with broad, straight margins or at least some terga with slightly bifurcated posteromedial protuberances (Figs. 2.63C,D,E).. ....*Nadinetella* (p. 118)

– Lamellate gills on abdominal segments 2–4 or 2–6 (Figs 2.65A), gill 1 filamentous; claws with one row of denticles (Fig. 2.65B); abdomen with single mid-dorsal tubercles (Figs. 2.65A, 2.66A) or without tubercles (Fig. 2.64).... 2

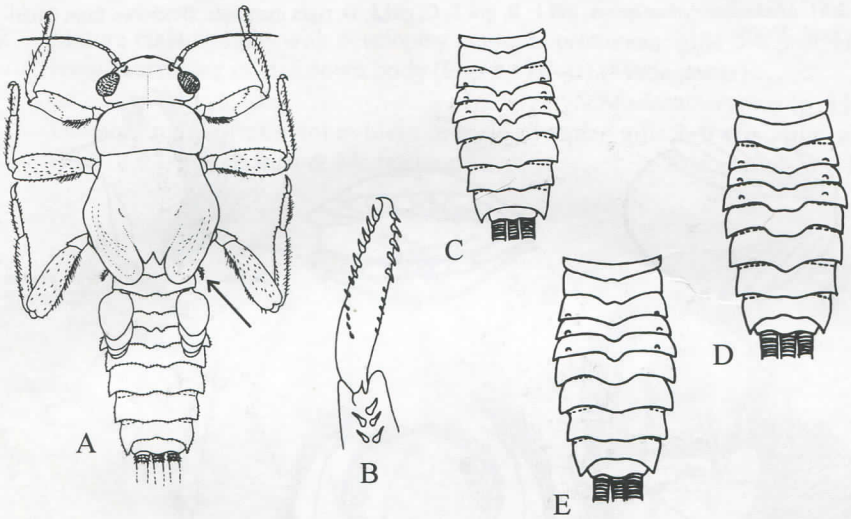

Fig. 2.63. *Nadinetella* sp.. **A**, whole nymph, with cerci truncated (*note* filamentous gills 1—arrowed—and lamellate gills 2–5); **B**, claw showing double row of denticles; **C–E**, *N. crassi*, abdomen, showing variations in types of abdominal tubercles. (Redrawn from McCafferty & Wang 1997).

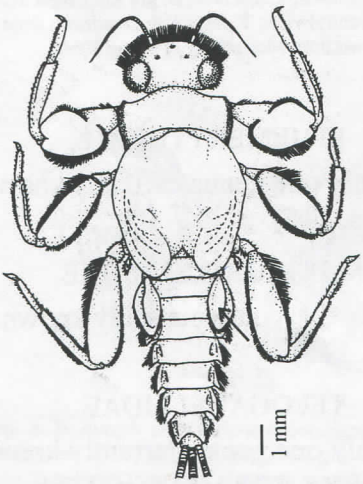

Fig. 2.64. *Lestagella penicillata*, nymph with cerci truncated. (Redrawn from McCafferty & Wang 1997).

2. Head margined with long setae anteriorly (Fig. 2.64); gills on abdominal segment 2 operculate (arrowed in Fig. 2.64), covering lamellate gills on segments 3 and 4, gill 1 filamentous.. .. ..*Lestagella* (p. 118)
– Head not margined with long setae (Figs. 2.65A, 2.66A); gills on abdominal segment 2 semi-operculate (Figs. 2.65A, 2.66A), with part of following gill pair exposed; filamentous gill 1 present or absent 3
3. Dorsal abdominal tubercles single and sharp (Fig. 2.65A); filamentous gill 1 absent, lamellate gills on abdominal segments 2–6 (Fig. 2.65A)..... .. ..*Ephemerellina* (p. 117)
– Dorsal abdominal tubercles broad and rounded (Fig. 2.66A); filamentous gill 1 present, lamellate gills on abdominal segments 2–6. *Lithogloea* (p. 118)

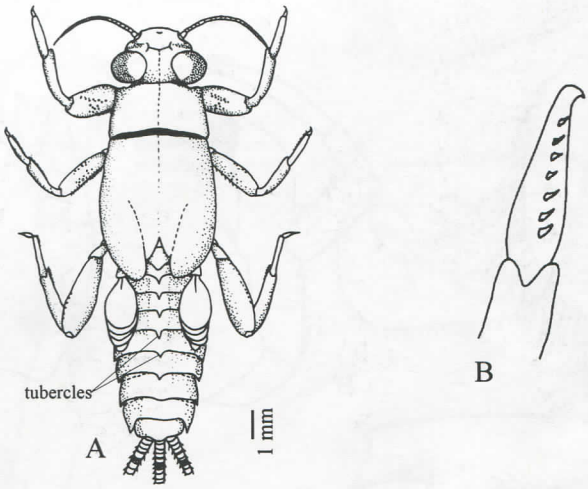

Fig. 2.65. *Ephemerellina* sp.. **A**. nymph, with cerci truncated, in dorsal view; **B**, claw, showing single row of denticles. (Redrawn from McCafferty & Wang 1997).

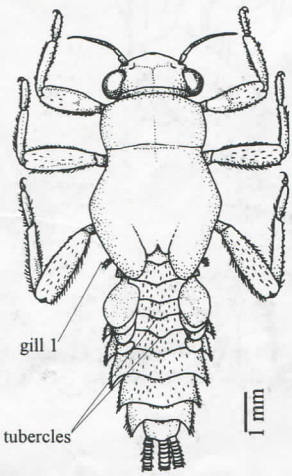

Fig. 2.66. *Lithogloea* sp., nymph with cerci truncated.

CAENIDAE. KEY TO GENERA

1 Operculate gills with Y-shaped ridge on dorsal surface (Figs. 2.68A&C, 2.69A, 2.70B, 2.71A, 2.72A); maxillary palps two-segmented (Figs. 2.71B, 2.72B), three-segmented (Figs. 2.67B, 2.69B, 2.70D) or absent (Fig. 2.68B). ...2

– Operculate gills without Y-shaped ridge on dorsal surface (Fig. 2.67A); maxillary palps 3-segmented (Fig. 2.67B) .. .. .*Caenospella* (p. 121)

2. Maxillae without palp (Fig. 2.68F); claws hooked, without denticles (Fig. 2.68H); head, body and legs fringed with long hairs (Fig. 2.68A) (Madagascar only) .. .. *Madecocercus* (p. 121)

– Maxillae with two- or three-segmented palps; claws tapering or hooked, with or without denticles; body not markedly fringed with hairs... 3

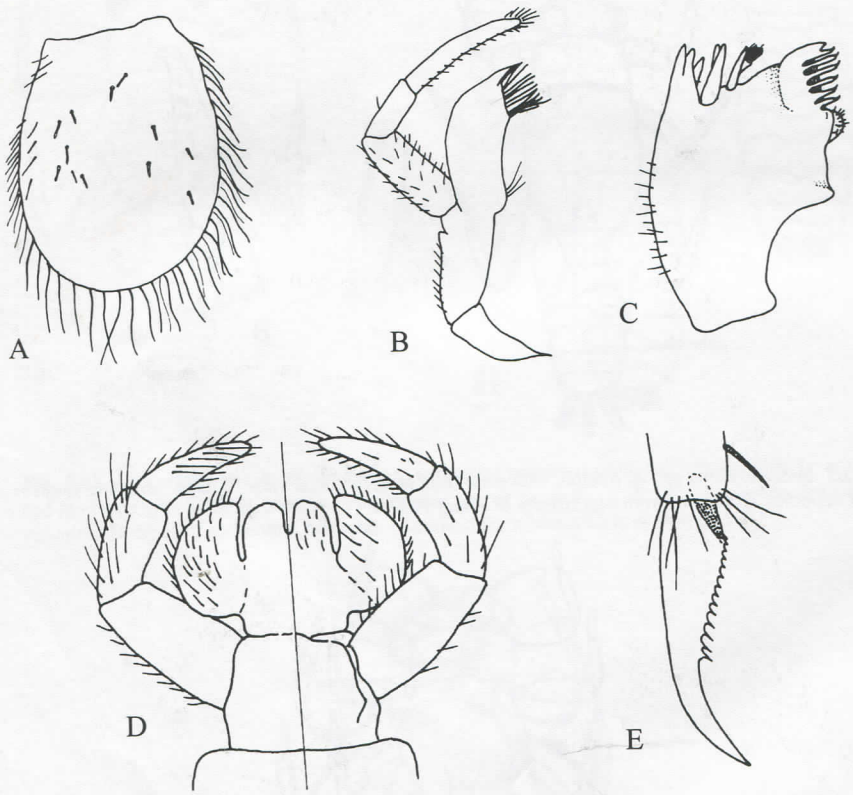

Fig. 2.67 *Caenospella* sp. **A**, operculate gill 2; **B**, maxilla; **C**, mandible; **D**, labium, in ventral view on the left and dorsal view on the right; **E**, claw. (Redrawn from Gillies 1977).

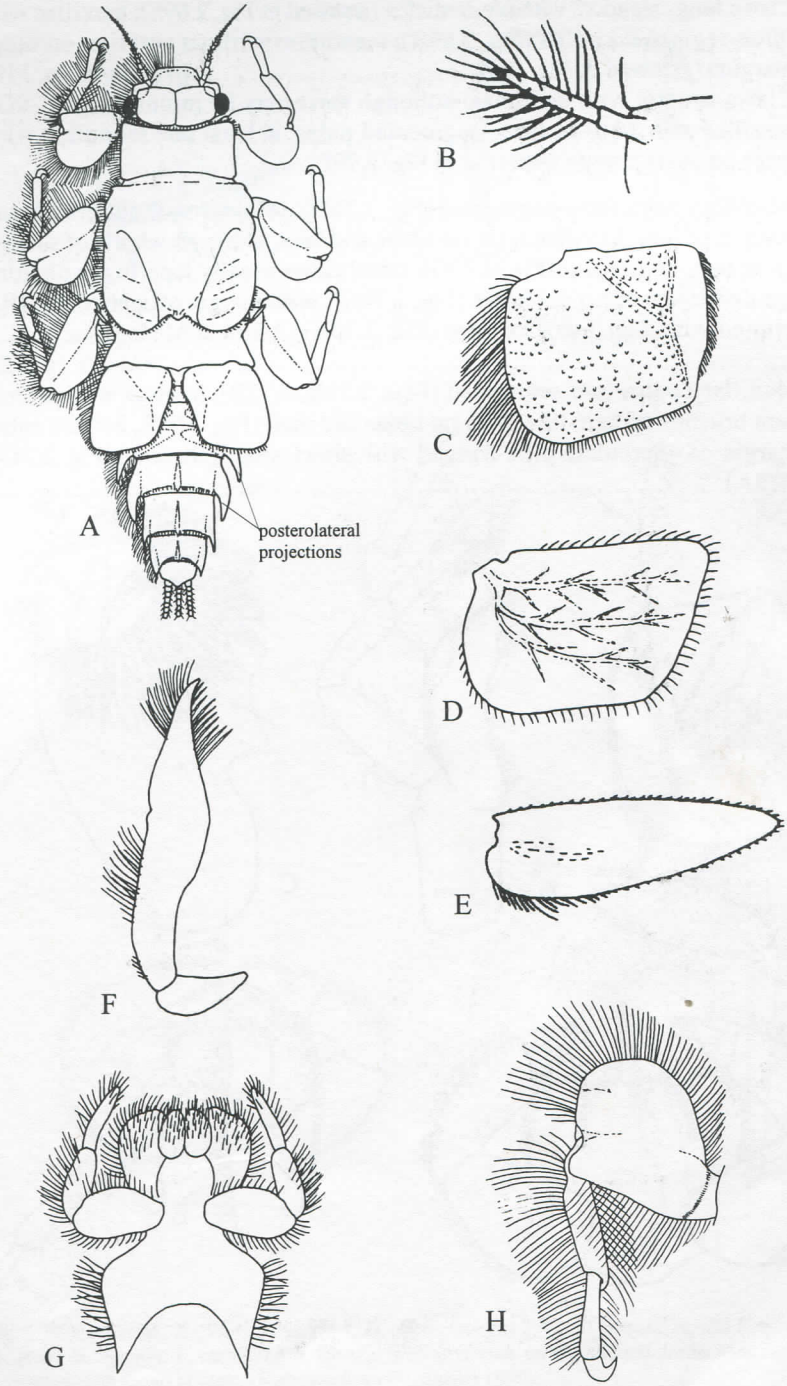

Fig. 2.68. *Madecocercus* sp.. **A**. nymph, with truncated cerci **B**, gill 1, **C**, quadrate operculate gill 2; **D**, gill 3; **E**, gill 5; **F**, maxilla; **G**, labium, in ventral view; **H**, foreleg and claw. (Redrawn from McCafferty & Wang 1995).

3. Claws long, slender, without denticles (arrowed in Fig. 2.69E); maxillae with three-segmented palps (Fig. 2.69B); mandibles without setation on outer margins (arrowed in Fig. 2.69C) *Afrocaenis* (p. 119)

– Claws usually with denticles, although these may be minute (Fig. 2.70G); maxillae with two- or three-segmented palps; at least one mandible with setae on outer margin (arrowed in Fig. 2.70E) 4

4. Maxillary palps three-segmented (Fig. 2.70D); forelegs without prominent brushes of long hair-like setae on tibiae and tarsi, although whorls of shorter setae may be present (Fig. 2.70G); tarsal claws usually tapering, with minute denticles, or no denticles (Fig. 2.70G); outer margin of operculate gills fringed with long, hair-like setae (Fig. 2.70A) (Africa & Madagascar).... ... . *Caenis* (p. 120)

– Maxillary palps two-segmented (Figs. 2.71B, 2.72B); forelegs with prominent brushes of hair-like setae on tibiae and tarsi (Fig. 2.71E, 2.72E); outer margin of operculate gills fringed with short, spatulate setae (Fig. 2.71A, 2.72A) 5

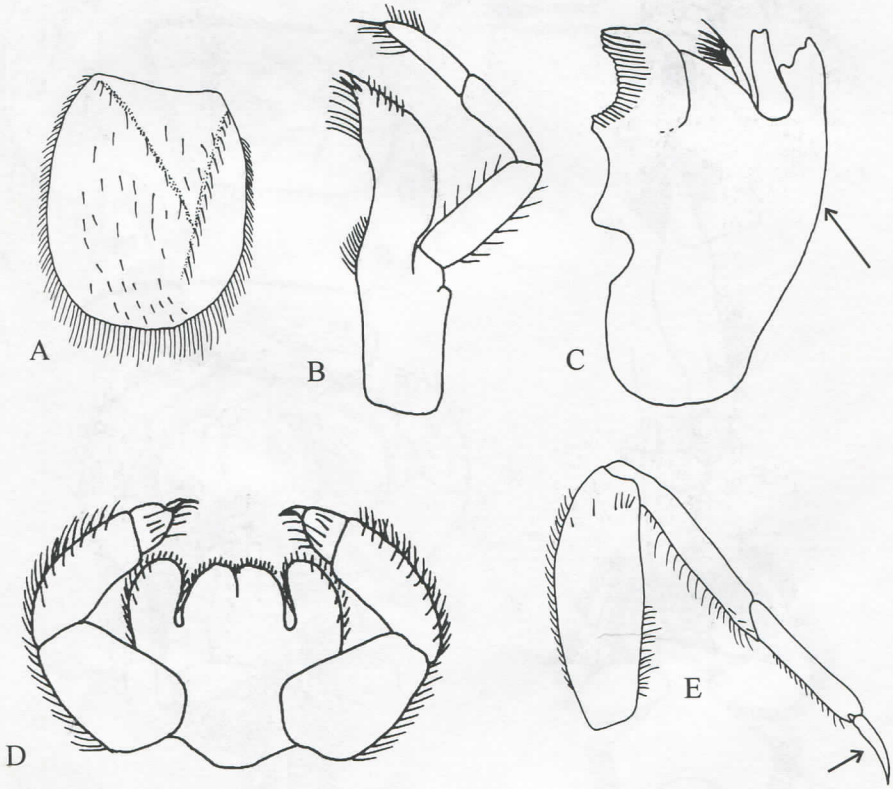

Fig. 2.69. *Afrocaenis* sp.. **A**, operculate gill 2; **B**, maxilla; **C**, mandible; **D**, labium, in ventral view; **E**, foreleg. (Redrawn from Gillies 1982).

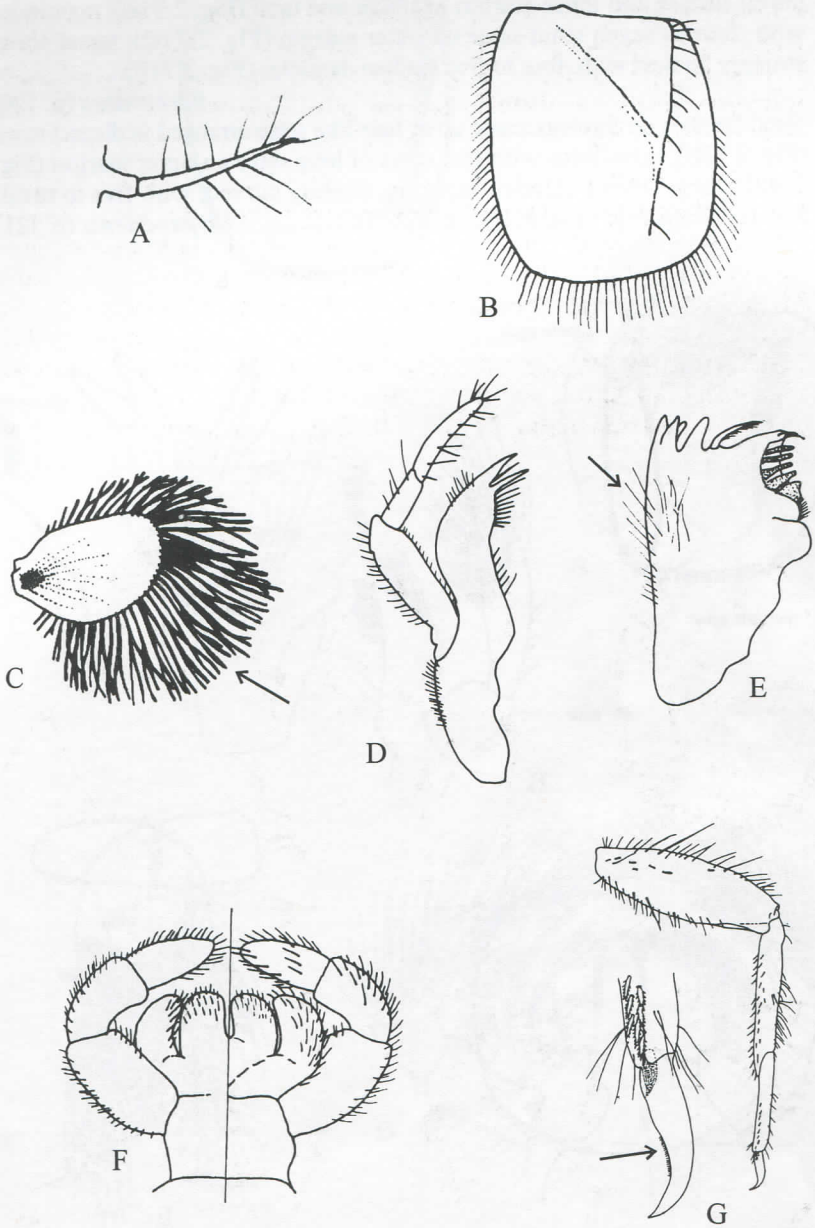

Fig. 2.70. *Caenis* sp.. **A**, filamentous gill 1; **B**, operculate gill 2; **C**, gill 3 (*note* typical fibrillar fringe–arrowed); **D**, maxilla; **E**, mandible; **F**, labium, in ventral view on the left and dorsal view on the right; **G**, foreleg, with detail of claw. (Redrawn from Provonsha 1990).

5. Setal brushes on forelegs made up of randomly-arranged, hair-like setae on dorsal surface and inner margin of tibiae and tarsi (Fig. 2.71E); mandibles with four to seven stout setae on outer margin (Fig. 2.71C); tarsal claws strongly hooked with four to five median denticles (Fig. 2.71E)... .. ..*Barnardara* (p. 120)

– Setal brushes on forelegs made up of hair-like setae arranged in distinct rows (Fig. 2.72E); mandibles with two rows of long setae on outer margin (Fig. 2.72C); tarsal claws slender, tapering, slightly curved, with five to seven minute denticles in basal half (Fig. 2.72E).. .. ...*Clypeocaenis* (p. 121)

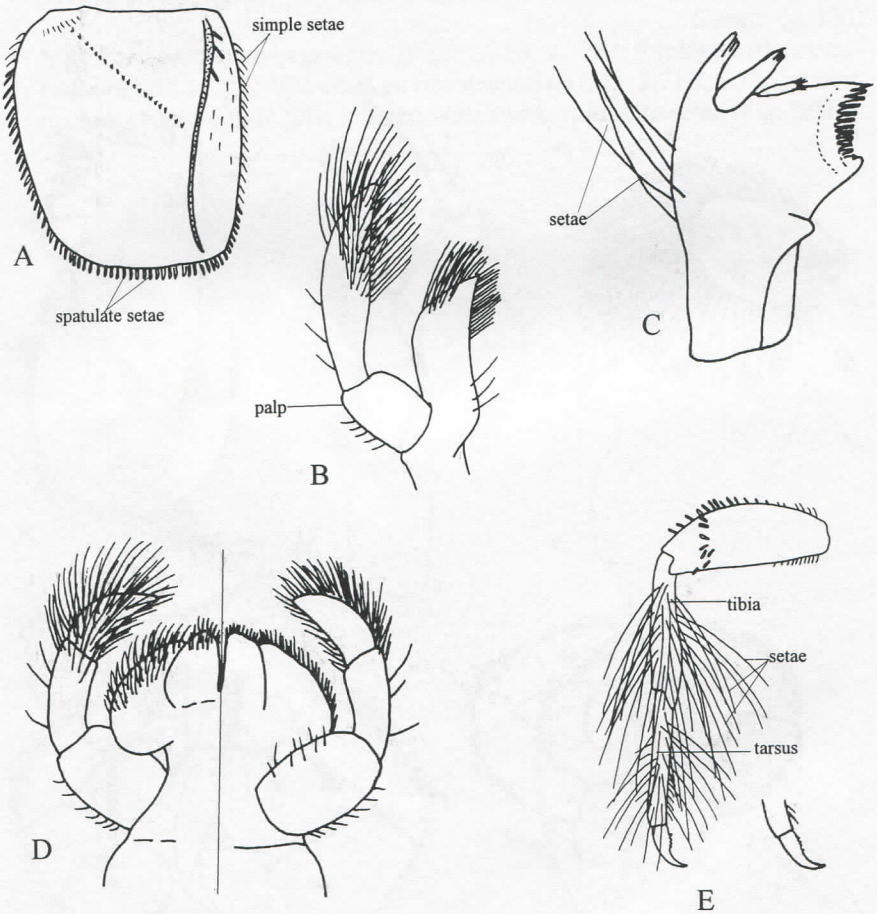

Fig. 2.71. *Barnardara* sp.. **A**, operculate gill 2; **B**, maxilla; **C**, mandible; **D**, labium, in ventral view on the left and dorsal view on the right; **E**, foreleg, with detail of claw. (Redrawn from Provonsha & McCafferty 1995).

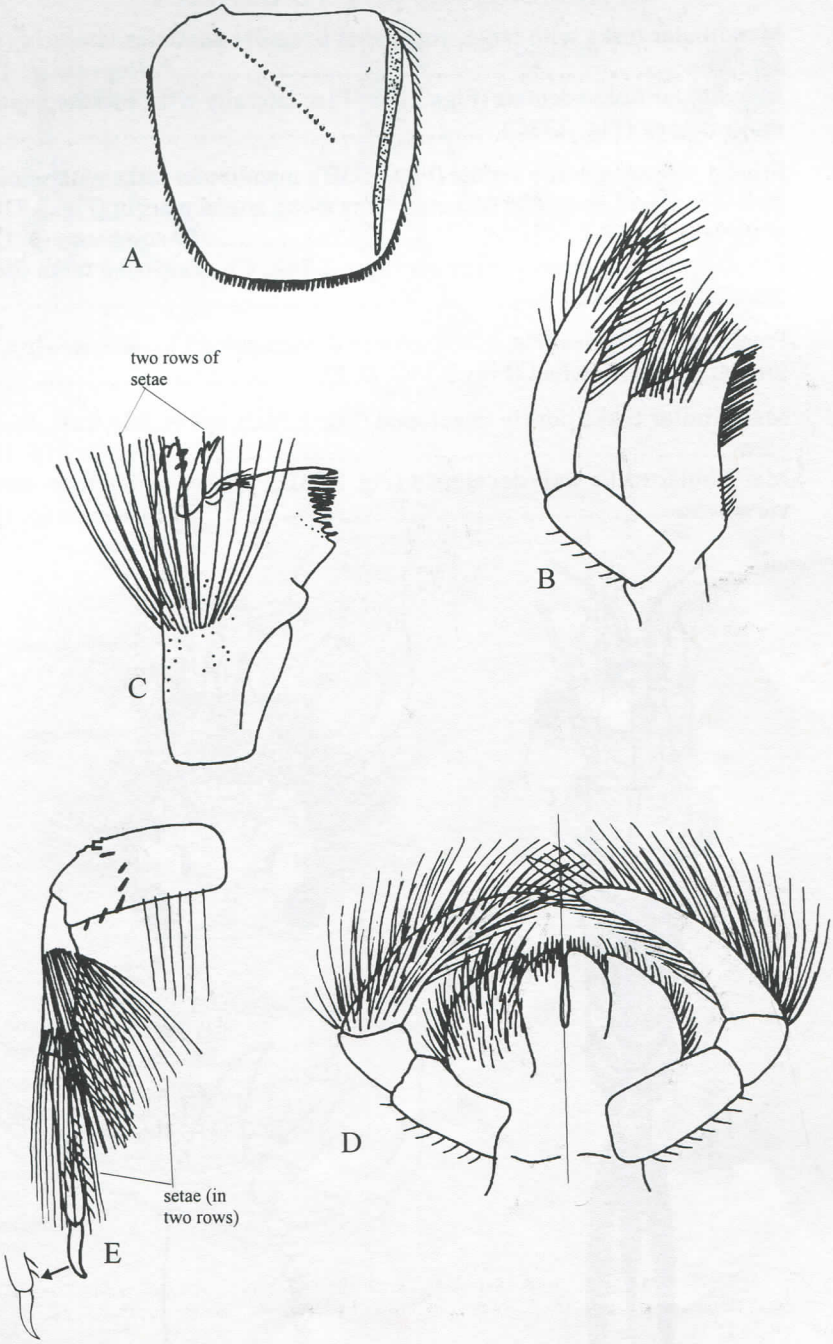

Fig. 2.72. *Clypeocaenis* sp.. **A**, operculate gill 2; **B**, maxilla; **C**, mandible; **D**, labium, in ventral view on the left and dorsal view on the right; **E**, foreleg (with detail of claw). (Redrawn from Provonsha & McCafferty 1995).

EPHEMERIDAE: KEY TO GENERA

1. Mandibular tusks with large, somewhat irregular denticles laterally (Fig. 2.73A)..... *Palingenia* (p. 124)
– Mandibular tusks edentate (Figs 2.74B–F) or laterally with socketed spurs towards apex (Fig. 2.73C).....2

2. Frontal process apically serrate (Fig. 2.73B); mandibular tusks with smooth, well-sclerotized apex, and socketed spurs along lateral margin (Fig. 2.73C); (Madagascar only)..... .....*Cheirognesia* (p. 123)
– Frontal process concave or convex (Figs. 2.74A, C); mandibular tusks edentate (Figs 2.74B, C, D).....3

3. Frontal process convex (Fig. 2.74A) (Africa & Madagascar)..... *Eatonica* (p. 123)
– Frontal process notched (Figs 2.74C, D, E).....4

4. Mandibular tusks poorly developed (Fig. 2.74C), not visible from dorsal view..... *Afromera* (p. 122)
– Mandibular tusks well developed (Fig. 2.74D), clearly visible from dorsal view..... .....*Ephemera* (p. 123)

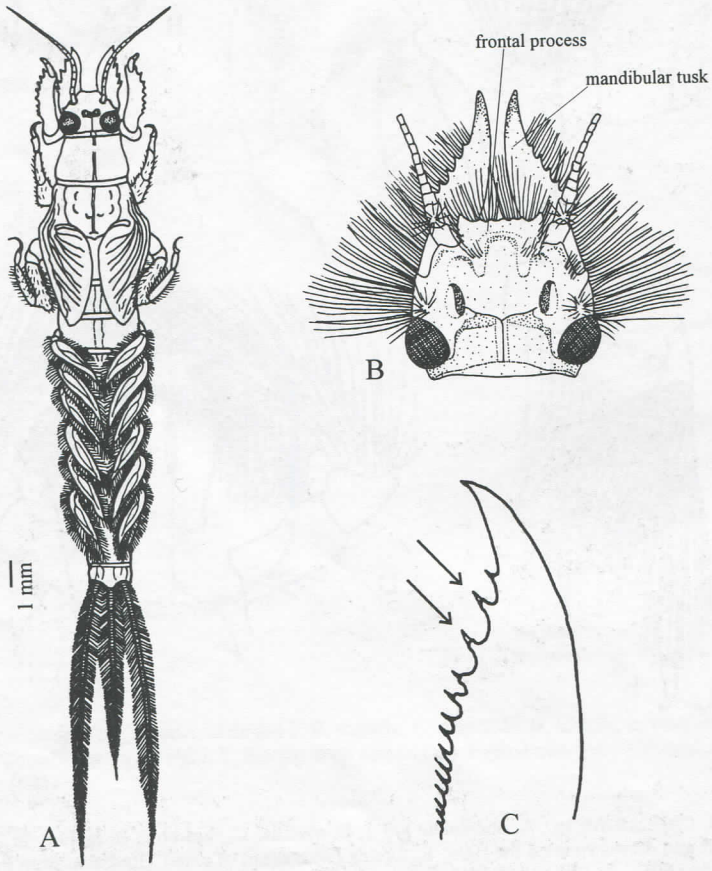

Fig. 2.73. **A**, *Palingenia* sp., whole nymph. **B–C**, *Cheirogenesia* sp.: **B**, dorsal view of head. **C**, detail of left mandible showing socketed spurs (arrowed). (B & C redrawn from Mcafferty & Edwards 1976).

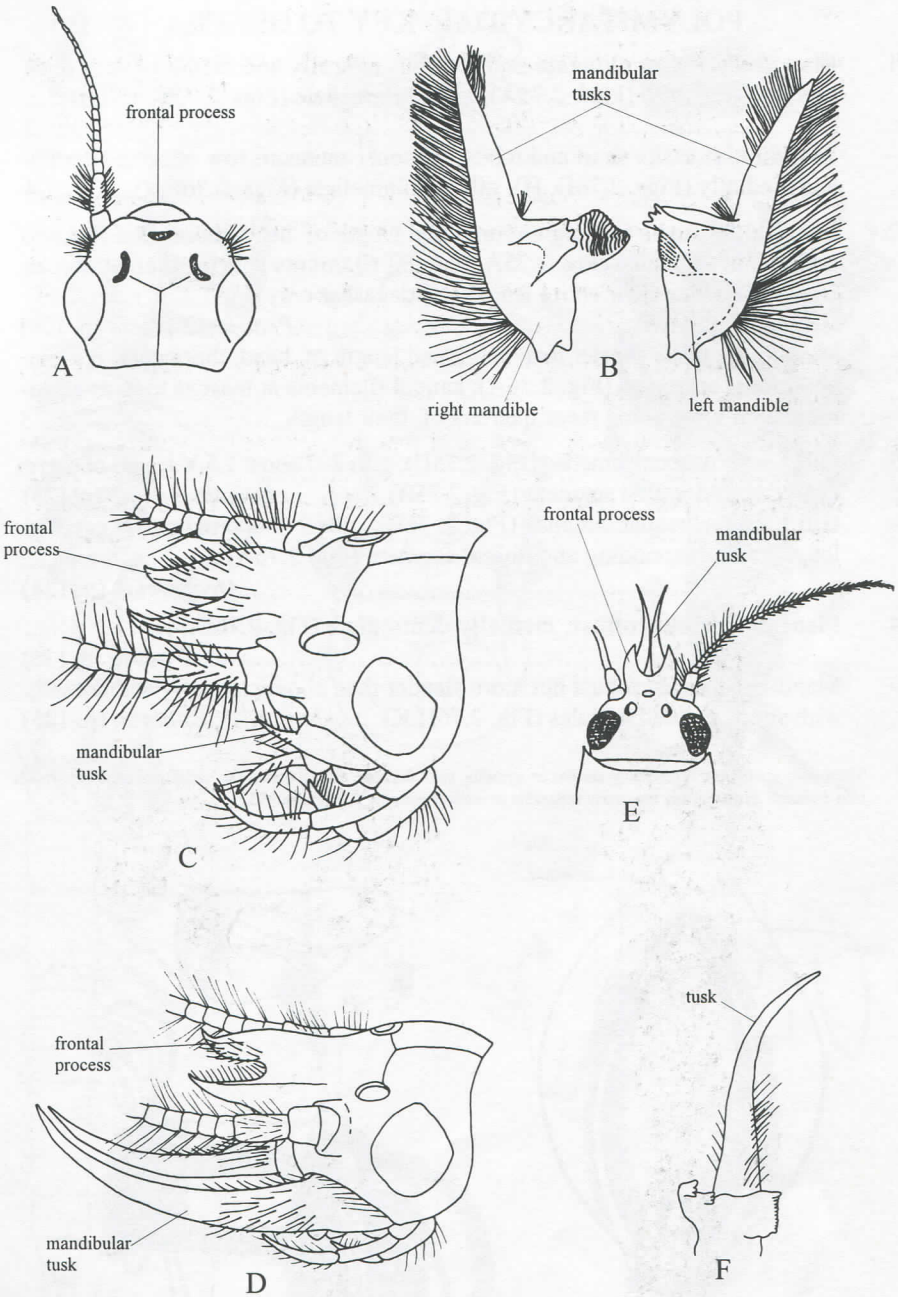

Fig. 2.74. **A–B**, *Eatonica* sp.: **A**, head, in dorsal view, with mandibles and right antenna removed; **B**, detail of mandibles, in ventral view. **C**, *Afromera* sp., head in lateral view. **D–E**, *Ephemera* sp.: **D**, head, in lateral view, showing long mandibular tusks; **E**, head (with left antenna truncated), in dorsal view; **F**, detail of left mandible. (A & B redrawn from Demoulin 1968; C & D redrawn from McCafferty & Gillies 1979; E redrawn from Crass 1947).

EPHEMERIDAE: KEY TO GENERA

1. Mandibular tusks with large, somewhat irregular denticles laterally (Fig. 2.73A)..... *Palingenia* (p. 124)
– Mandibular tusks edentate (Figs 2.74B–F) or laterally with socketed spurs towards apex (Fig. 2.73C).....2

2. Frontal process apically serrate (Fig. 2.73B); mandibular tusks with smooth, well-sclerotized apex, and socketed spurs along lateral margin (Fig. 2.73C); (Madagascar only)..... .....*Cheirognesia* (p. 123)
– Frontal process concave or convex (Figs. 2.74A, C); mandibular tusks edentate (Figs 2.74B, C, D).....3

3. Frontal process convex (Fig. 2.74A) (Africa & Madagascar)..... *Eatonica* (p. 123)
– Frontal process notched (Figs 2.74C, D, E).....4

4. Mandibular tusks poorly developed (Fig. 2.74C), not visible from dorsal view..... *Afromera* (p. 122)
– Mandibular tusks well developed (Fig. 2.74D), clearly visible from dorsal view..... .....*Ephemera* (p. 123)

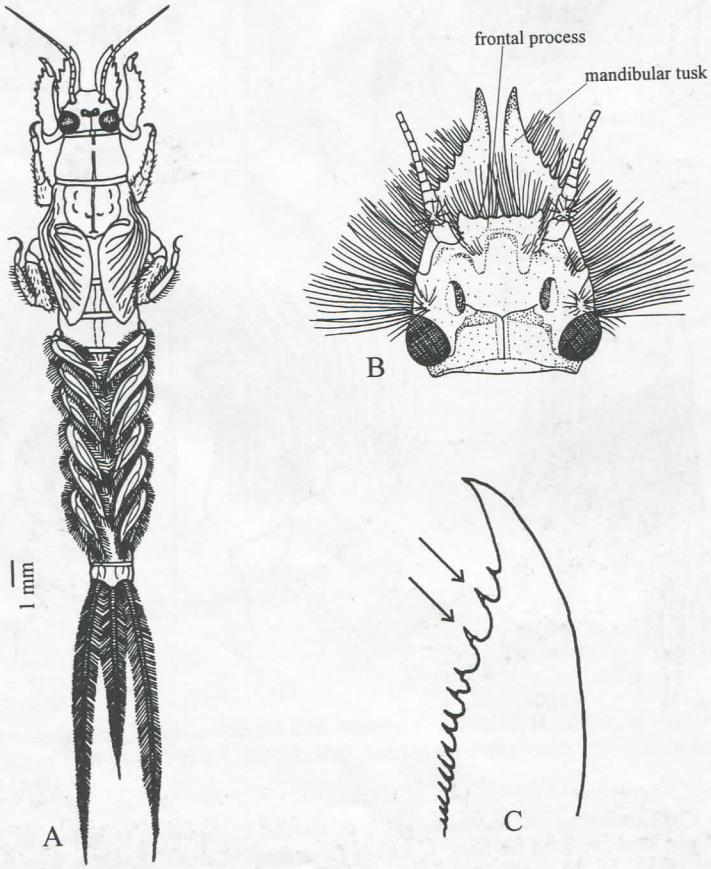

Fig. 2.73. **A**, *Palingenia* sp., whole nymph. **B–C**, *Cheirogenesia* sp.: **B**, dorsal view of head. **C**, detail of left mandible showing socketed spurs (arrowed). (B & C redrawn from Mcafferty & Edwards 1976).

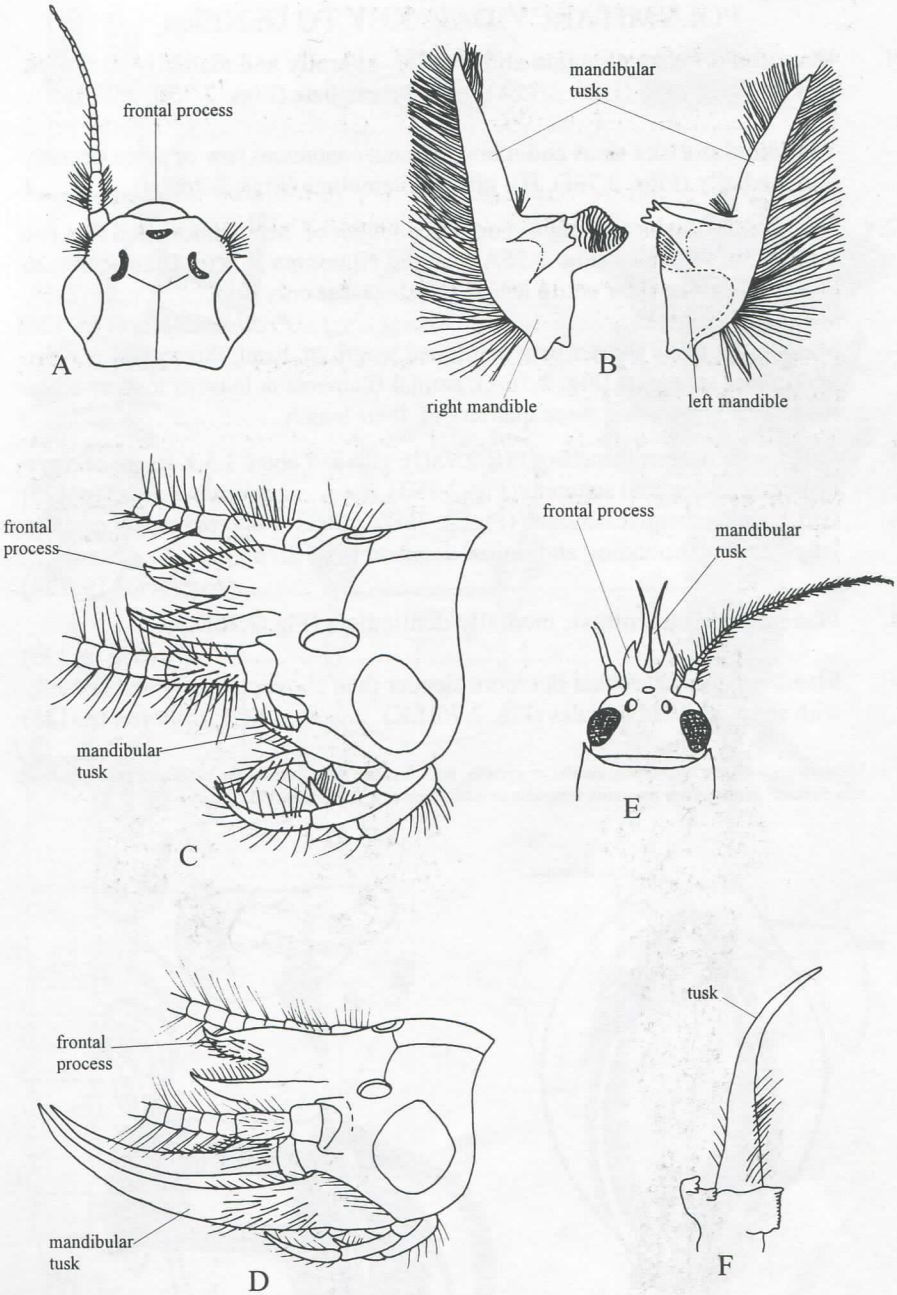

Fig. 2.74. **A–B**, *Eatonica* sp.: **A**, head, in dorsal view, with mandibles and right antenna removed; **B**, detail of mandibles, in ventral view. **C**, *Afromera* sp., head in lateral view. **D–E**, *Ephemera* sp.: **D**, head, in lateral view, showing long mandibular tusks; **E**, head (with left antenna truncated), in dorsal view; **F**, detail of left mandible. (A & B redrawn from Demoulin 1968; C & D redrawn from McCafferty & Gillies 1979; E redrawn from Crass 1947).

POLYMITARCYIDAE: KEY TO GENERA

1. Mandibular tusks elongate and slender, laterally and medially with thick rows of long setae (Figs. 2.75A); gill 1 bilamellate (Figs. 2.75B, 2.76B)..... 2
– Mandibular tusks short and robust, without continuous row of setae laterally and medially (Figs. 2.76D, H); gill 1 unilamellate (Figs. 2.76E, I).....4

2. Mandibular tusks as long as combined length of head, thorax and first two abdominal segments (Fig. 2.75A); caudal filaments shorter than abdomen, with setae along their entire length (Madagascar only)..... .....*Proboscidoplocia* (p. 126)
– Mandibular tusks shorter than combined length of head, thorax and first two abdominal segments (Fig. 2.76A); caudal filaments at least as long as abdomen, with setae along three quarters of their length 3

3. Gill 1 with unequal lamellae (Fig. 2.75B); gills 2–7 about 1.5 X length of corresponding abdominal segment (Fig. 2.75B)..... *Exeuthyplocia** (p. 125)
– Gill 1 with subequal lamellae (Fig. 2. 76B); gills 2–7 approximately equal in length to corresponding abdominal segment (Fig. 2.76A) ....*Afroplocia** (p. 124)

4. Mandibular tusks robust, medially denticulate (Fig. 2.76D,F,G)..... .....*Povilla* (p. 126)
– Mandibular tusks robust but more slender than above, laterally and dorsally with short, pointed nodules (Fig. 2.76H,K).....*Ephoron* (p. 125)

* These two genera are remarkably similar as nymphs, such that one may question the validity of their separation into different genera. They are easily separable as adults, however (Demoulin 1952).

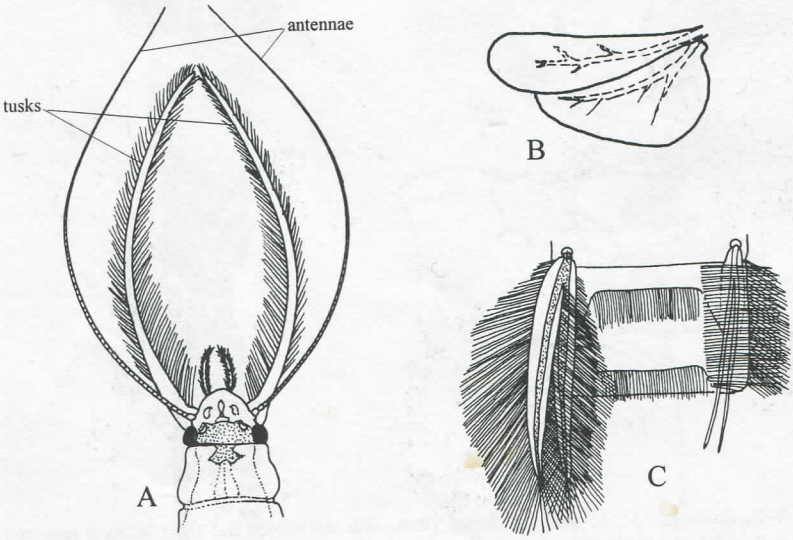

Fig. 2.75. A, *Proboscidoplocia* sp. dorsal view of head showing long, narrow tusks. **B-C**, *Exeuthyplocia* sp.: **B**, gill 1; **C**, abdominal segment, showing typical arrangement of setae on the right, and structure of gill 5 on the left. (A redrawn from Elouard et al. 2001; B & C redrawn from Gillies 1980b).

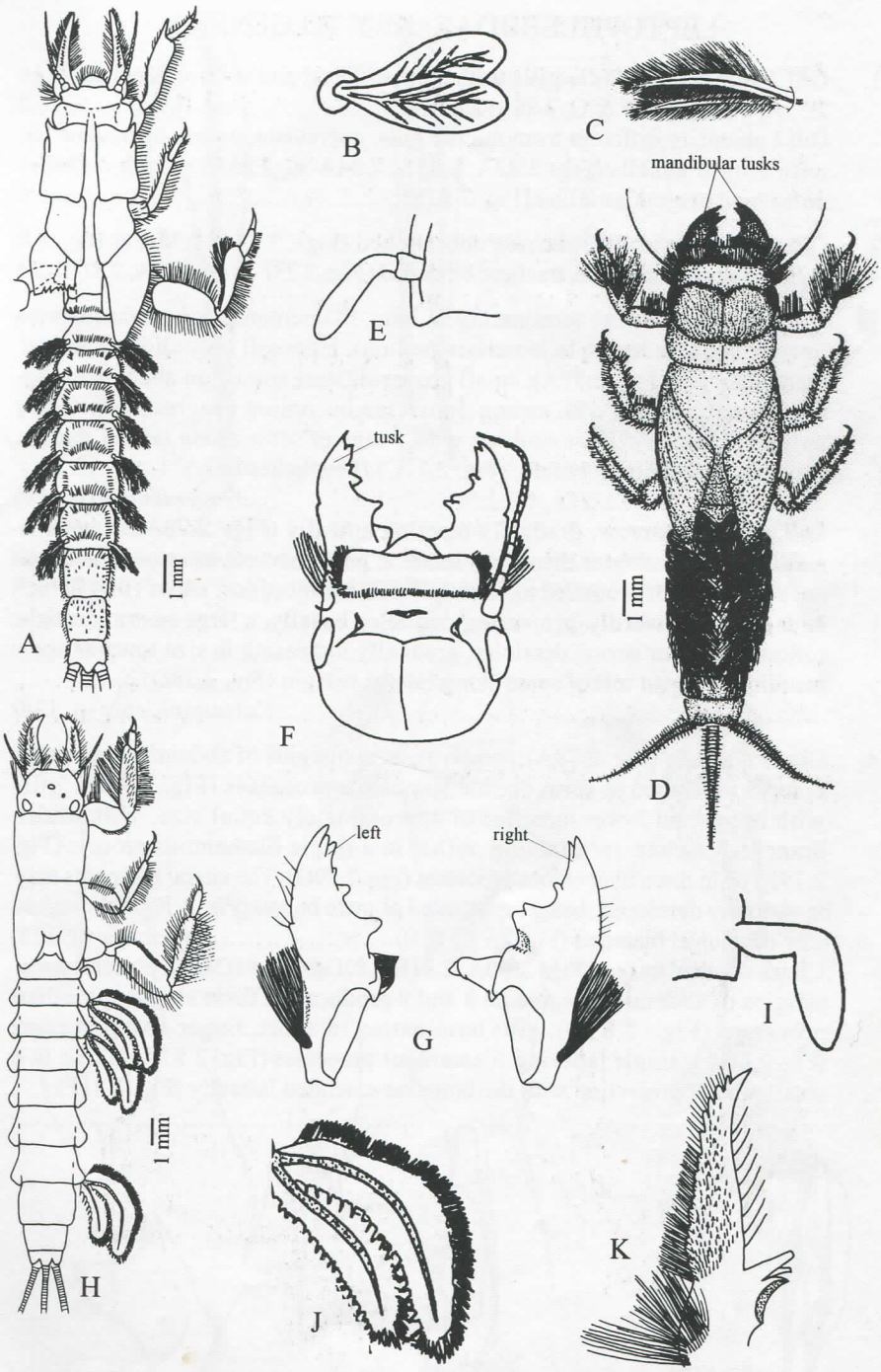

Fig. 2.76. **A–C**, *Afroplocia* sp.: **A**, nymph (with cerci truncated and left appendages removed), in dorsal view; **B**. gill 1; **C**, gill 2. **D–G**, *Povilla* sp.: **D**, whole nymph, in dorsal view; **E**, gill 1; **F**, detail of head, in dorsal view; **G**, left and right mandibles, in dorsal view; **H–K**, *Ephoron* sp.: **H**, nymph (with cerci truncated and left appendages removed), in dorsal view; **I**, gill 1; **J**, gill 2; **K**, left mandible. (A–C redrawn from Barnard 1940; D redrawn from Agnew 1980; E–G redrawn from Demoulin 1956b; H–K redrawn from Crass 1947).

LEPTOPHLEBIIDAE: KEY TO GENERA

1. Gill 1 similar to middle gills with similar dorsal and ventral lamellae (Figs. 2.77A, 2.78B, 2.79F & G, 2.80A, 2.81A–C).....2
– Gill 1 absent, or different from middle gills, operculate, or non-operculate but with single lamella (Figs 2.82A, 2.83A, 2.84A–C, 2.85A) or with different dorsal and ventral lamellae (Fig. 2.82E) 7

2. Gills long and slender, tracheae unbranched (Figs. 2.77A, 2.78A & B).....3
– Gills with broad lamellae, tracheae branched (Figs 2.79F & G, 2.80A, 2.81).....4

3. Gill lamellae narrow, terminating in long, filamentous projections (approximately equal in length to lamellate portion), inner gill only slightly shorter than outer gill (Fig. 2.77A); small posterolateral spines on abdominal segment 9 only; claws with strong denticles becoming progressively larger apically (Fig. 2.77B); mandible with fringe of setae along lateral margin, extending medially to basally (Fig. 2.77C) (Seychelles only)..... .....*Hagenulodes* (p. 129)
– Gill lamellae narrow, gradually tapering apically (Figs. 2.78A,B), inner lamella distinctly shorter than outer lamella; posterolateral margins of abdominal segments not produced to form spine-like projections; claws (Fig. 2.78C) with small, forwardly-projecting denticles basally, a large central denticle, followed by four strong denticles, gradually increasing in size towards apex; mandible without tuft of setae along lateral margin (Fig. 2.78D)..... .....*Castanophlebia* (p. 128)

4. Claws edentate (Fig. 2.79A); posterolateral margins of abdominal segments 8 and 9 produced to form double spine-like processes (Fig. 2.79B); gills with upper and lower lamellae of approximately equal size, with multibranched trachea, terminating either in a single filamentous process (Fig. 2.79F) or in three filamentous processes (Fig. 2.79G). The lateral filaments may be variously developed, being represented as mere bulges (Fig. 2.79C), through to fully-developed filaments (Fig. 2.79D & E).....*Aprionyx* (p. 128)
– Claws denticulate (e.g. Figs 2.80A, 2.81E, 2.82D&G, 2.83C&G); posterolateral margins of abdominal segments 8 and 9 produced to form single spine-like processes (Fig. 2.81D); gills terminating in short, finger-like processes (Fig. 2.80A), single tapering filamentous processes (Fig. 2.81A–C), or in a small medial projection with the lamellae extended laterally (Fig. 2.81F)..... 5

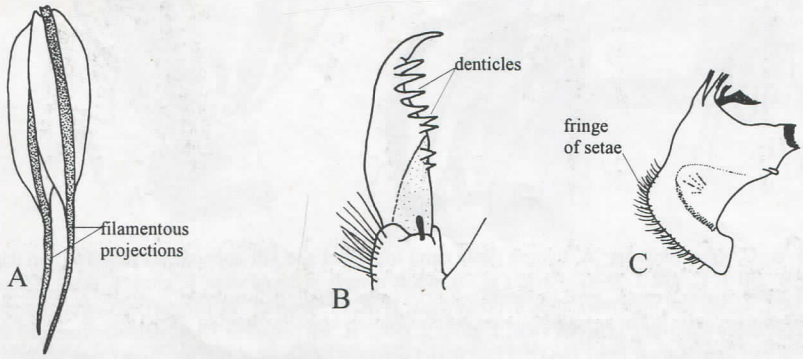

Fig. 2.77. *Hagenulodes* sp.: **A**, gill 4; **B**, claw of foreleg; **C**, left mandible. (Redrawn from Peters & Edmunds 1966).

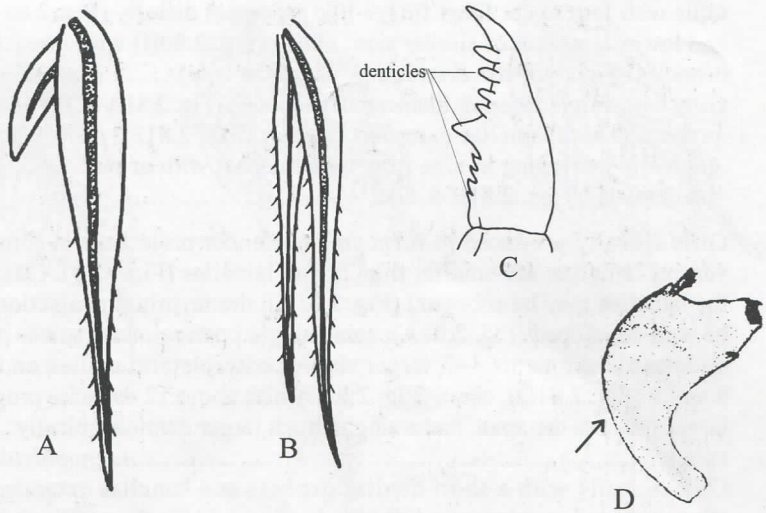

Fig. 2.78. *Castanophlebia* sp.: **A**, gill 7; **B**, gill 2; **C**, claw of foreleg; **D**, left mandible (*note* absence of setae on lateral margin—arrowed). (A-C redrawn from Barnard 1932; D redrawn from Peters & Edmunds 1964).

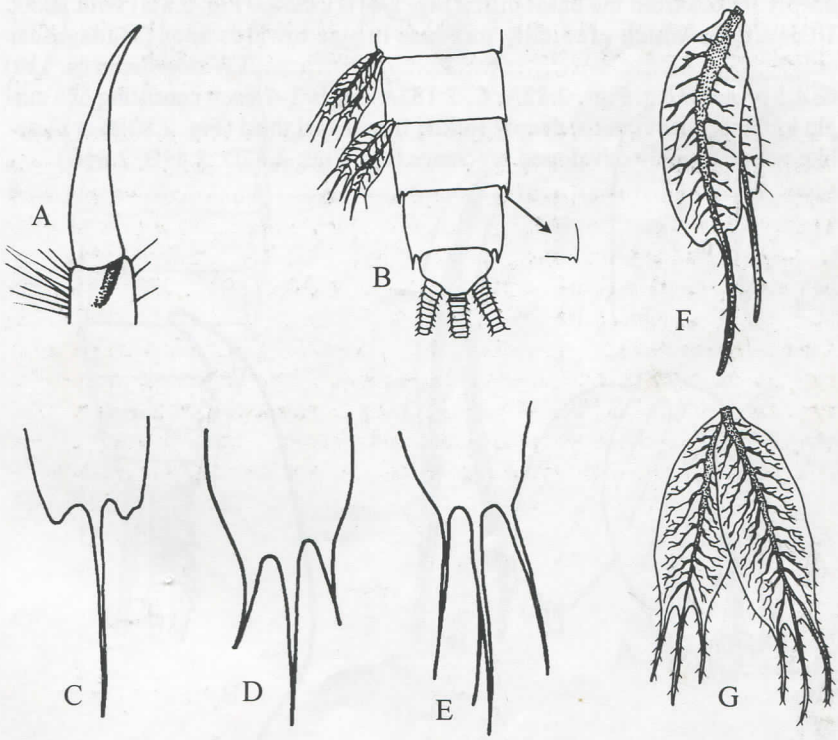

Fig. 2.79. **A–E**, *Aprionyx* sp., distinctive features of the genus: **A**, edentate claw; **B**, terminal abdomen, showing detail of biacuminate endings of lateral margins of segments 8 and 9; **C–E**, *A. tricuspidatus*, terminal sections of gills, showing variation in the development of gill filaments within this species. **F**. *A. intermedius* gill 4. **G**. *A. tricuspidatus* gill 4. (A, F & G redrawn from Peters & Edmunds 1964; B–E redrawn from Crass 1947).

5. Gills with four to six short finger-like processes distally (Fig. 2.80A), upper and lower lamellae of similar size; claws (Fig. 2.80B) with many (about 10) denticles of more-or-less even size (Madagascar only)..... *Polythelais* (p. 131)
– Gills with single tapering filamentous processes (Fig. 2.81A–C) or small medial projection with lamellae extended laterally (Figs 2.81F); claws with denticles gradually increasing in size from base to apex, with or without larger terminal denticle (Figs. 2.81E & G) 6

6. Gills apically produced to form single, slender projection; in some species, ventral lamellae are smaller than dorsal lamellae (Figs. 2.81A,B), in others the lamellae may be subequal (Fig. 2.81C); the terminal projection may not be well developed (Fig. 2.81A); small single posterolateral spines present on abdominal segments 3–7, larger single posterolateral spines on segments 8 and 9 (Fig. 2.81D); claws (Fig. 2.81E) with about 12 denticles progressively larger towards the apex, and a single much larger denticle apically..... .....*Adenophlebia* (p. 127)
– Gills apically with a short medial process and lamellae extended to form short, rounded processes on either side (Fig. 2.81F); claws (Fig. 2.81G) with about 11 strong denticles (Madagascar only).....*Petersophlebia* (p. 130)

7. Gill 1 absent; gills 2–7 each consisting of a single long, slender lamella, deeply forked from the basal third (Fig. 2.81H); claws (Fig. 2.81I) with about 10 denticles which gradually increase in size towards apex (Madagascar only) .....*Nesophlebia* (p. 130)
– Gill 1 present (e.g. Figs. 2.82A, C, 2.183A); gills 2–7 each consisting of a single long, slender lamella, deeply forked from basal third (Fig. 2.82B) or plate-like with variously developed processes (e.g. Figs. 2.82D, 2.83B, 2.84B)..... 8

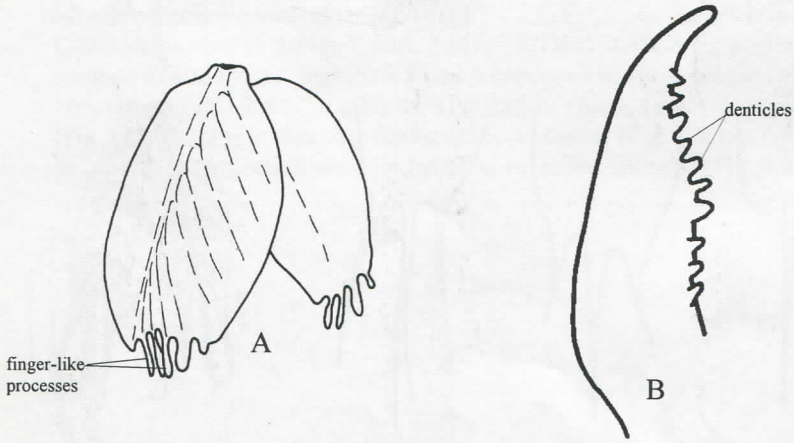

Fig. 2.80. *Polythelais* sp.: **A**, gill 4; **B**, claw of foreleg. (Redrawn from Demoulin 1973).

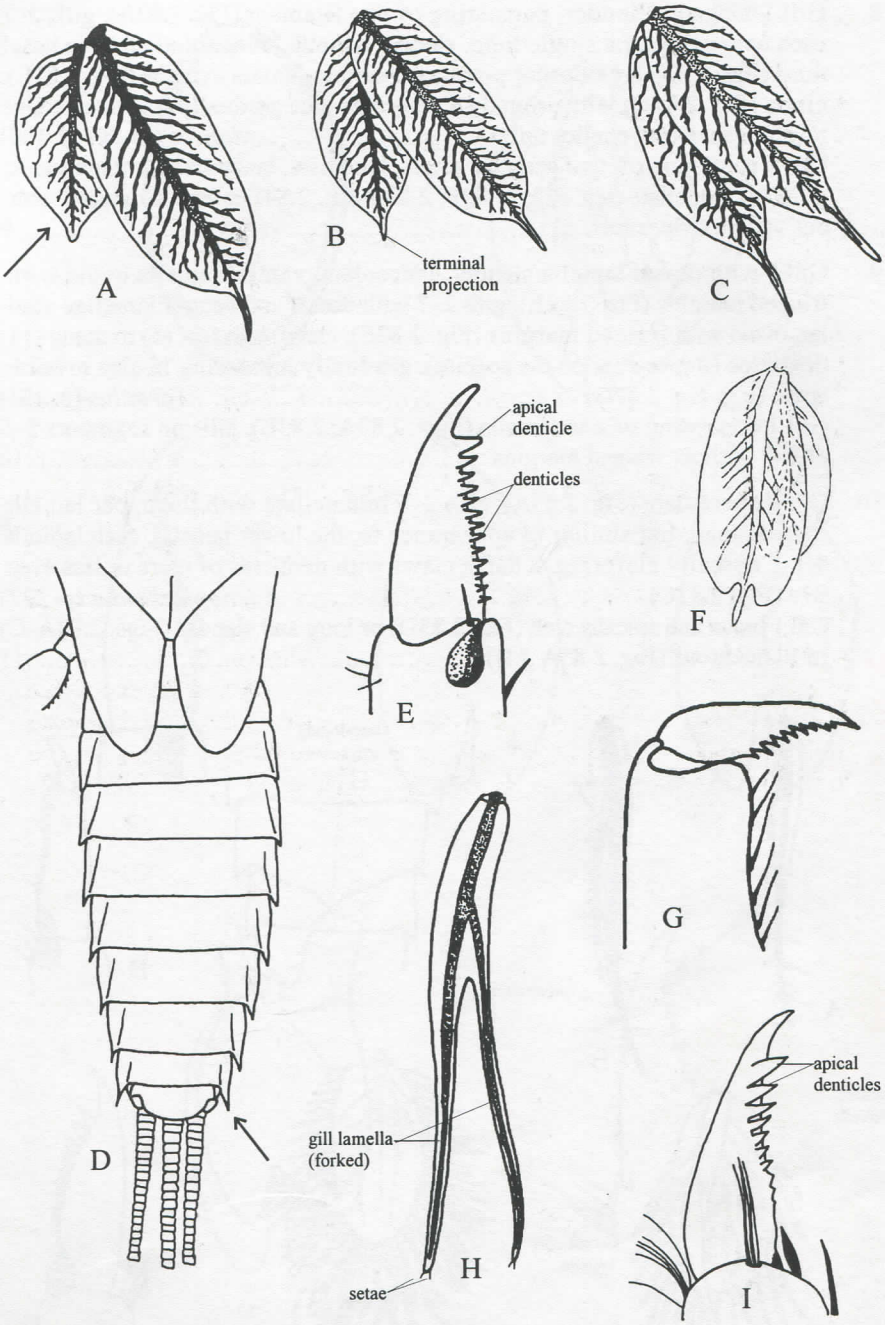

Fig. 2.81. **A–B**, *Adenophlebia auriculata*, various types of gills: **A**, gill 1 (*note* the relatively short basal lamella–arrowed); **B**, gill 4. **C–D**, *A. sylvatica* : **C**, gill 4 (*note* the subequql lamellae); **D**, posterior abdomen showing single posterolateral spines (arrowed); **E**, claw of foreleg. **F–G**, *Petersophlebia* sp.: **F**, gill 4. **G**, claw of foreleg. **H–I**, *Nesophlebia* sp.: **H**, gill 4. **I**, claw of foreleg. (A, B & C redrawn from Crass 1947; D redrawn from Demoulin 1981; E redrawn from Peters & Edmunds 1964; F redrawn from Demoulin 1973; G redrawn from Demoulin 1955b; H & I redrawn from Peters & Edmunds 1964).

8. Gill 1 long and slender, consisting of one filament (Fig. 2.82A); gills 2–7 each consisting of a single long, slender lamella, deeply forked from basal third (Fig. 2.82B); ovipositor present on mature female nymphs (Fig. 2.82C); claws (Fig. 2.82D) with around 14 denticles that gradually increase in size towards apex (Seychelles only) .....*Maheathraulus* (p. 130)
– Gill 1 consisting of two parts, or single, lamellate, lanceolate or filamentous; gills 2–7 lamellate (e.g. Figs. 2.82F, 2.83B &E, 2.84D); female nymphs without visible ovipositor 9

9. Gill 1 with dorsal lamella slender, lanceolate, ventral lamella ovoid with fringed margins (Fig. 2.82E); gills 2–7 with dorsal and ventral lamellae similar, ovoid with fringed margins (Fig. 2.82F); claws with few (5) to many (11) denticles (depending on the species), gradually increasing in size towards apex (e.g. Fig. 2.82G) .....*Thraulus* (p. 131)
– Gill 1 consisting of one lamella (Figs. 2.83A, 2.83E); gills on segments 2–6 or 2–7 without fringed margins 10

10. Gill 1 operculate (Fig. 2.83A); gills 2–6 bilamellate with the upper lamella smaller than, but similar in appearance to, the lower lamella, each lamella being apically cleft (Fig. 2.83B); claws with denticles of more or less even size (Fig. 2.83C) .....*Adenophlebiodes* (p. 127)
– Gill 1 broad and apically cleft (Fig. 2.83D) or long and slender (Figs. 2.84A–C) to filamentous (Fig. 2.85A &B).....11

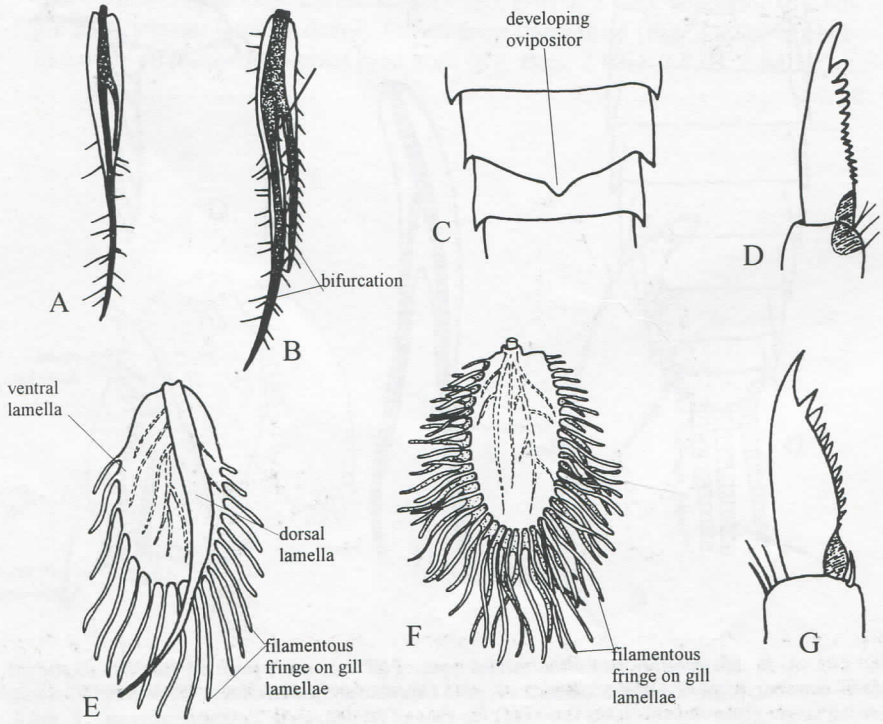

Fig. 2.82. **A–D**, *Maheathraulus* sp.: **A**, gill 1; **B**, gill 4; **C**, ventral view of abdomen of mature female nymph, showing ovipositor; **D**, claw of foreleg. **E–G**, *Thraulus* sp.: **E**, gill 1; **F**, gill 4; **G**, claw of foreleg. (A—G redrawn from Peters & Edmunds 1964).

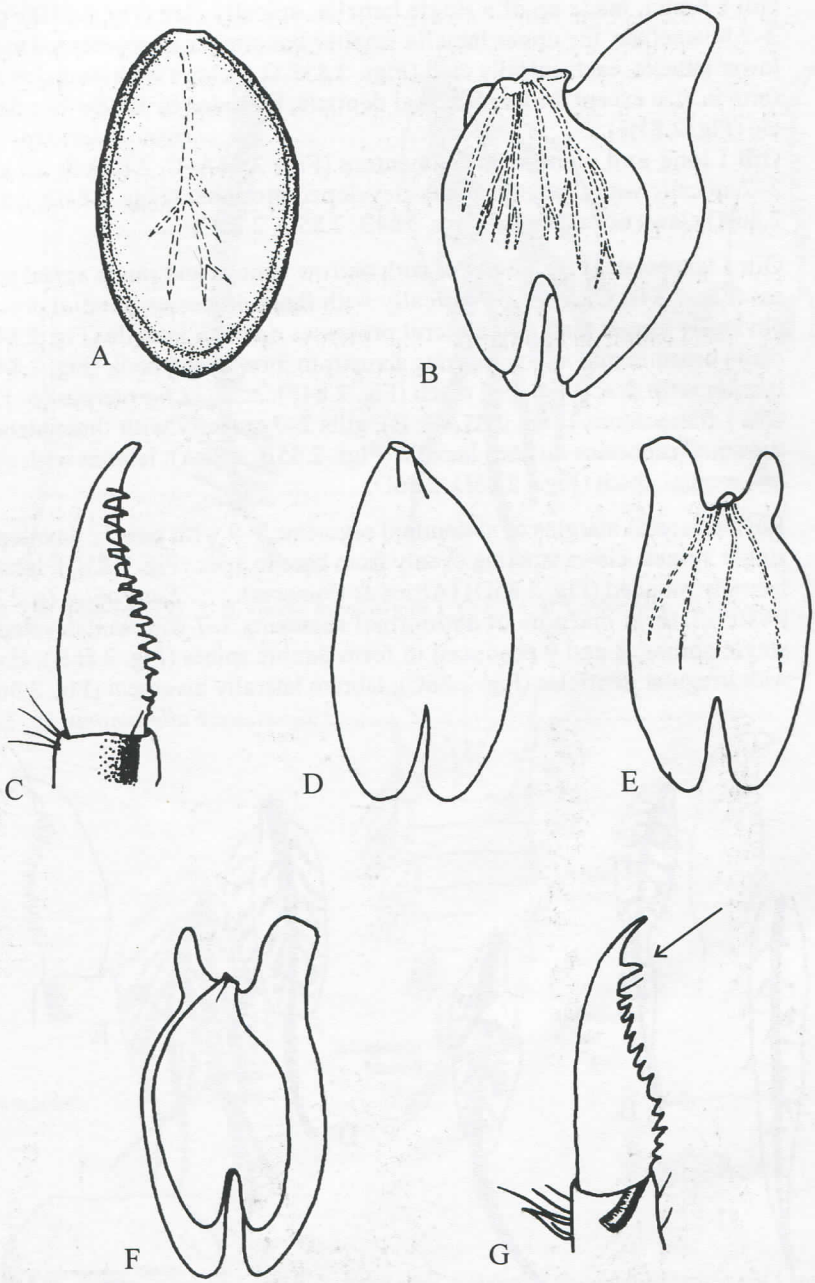

Fig. 2.83. **A–C**, *Adenophlebiodes* sp.: **A**, operculate gill 1; **B**, gill 4; **C**, claw of foreleg. **D–G**, *Hyalophlebia:* sp.: **D**, gill 1; **E**, detail of lamella of gill 4, in dorsal view; **F**, gill 4, in dorsal view, showing smaller upper lamella; **G**, claw of foreleg (*note* needle-like denticle just below last enlarged denticle). (A–C redrawn from Peters & Edmunds 1964; D–G redrawn from Agnew 1962b).

11. Gill 1 broad, made up of a single lamella, apically cleft (Fig. 2.83D); gills 2–7 bilamellate, the upper lamella smaller but similar in appearance to the lower lamella, each apically cleft (Figs. 2.83F,G); claws with denticles uniform in size except for larger apical denticle, preceded by needle-like denticle (Fig. 2.83G) .....*Hyalophlebia* (p. 130)
– Gill 1 long and slender, to filamentous (Figs 2.84A–C, 2.85A & B); gills 2–7 apically with three variously-developed processes (Figs. 2.84D, 2.85C, 2.86A) claws not as above (Figs 2.84E, 2.85D, 2.86C).....12

12. Gill 1 lanceolate (Fig. 2.84A) or with narrow lamella and single apical process (Fig. 2.84B,C); gills 2–7 apically with three processes, medial process obviously longer than apicolateral processes on each lamella (Fig. 2.84D); claws broad in mid region, tapering abruptly to form strong hook (Fig. 2.84E); labrum with deep V-shaped notch (Fig. 2.84F)..... *Choroterpes* (p. 128)
– Gill 1 filamentous (Figs 2.85A & B); gills 2–7 apically with three slender, subequal processes on each lamella (Figs. 2.85B, 2.86A); labrum with shallow medial notch (Figs. 2.85D, 2.86D).....13

13. Posterolateral margins of abdominal segments 3–9 with poorly developed single spines; claws tapering evenly from base to apex (Fig. 2.85C); labrum laterally rounded (Fig. 2.85D) (Africa & Comores).....*Euthraulus* (p. 129)
– Posterolateral margins of abdominal segments 3–7 with well developed single spines, 8 and 9 produced to form double spines (Fig. 2.86B); claws with irregular denticles (Fig. 2.86C); labrum laterally divergent (Fig. 2.86D) ..... *Fulletomimus* (p. 129)

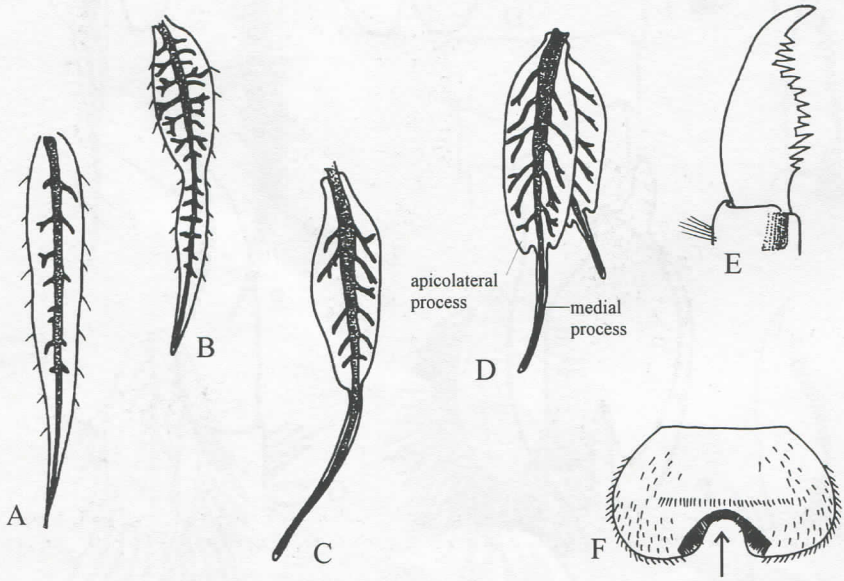

Fig. 2.84. *Choroterpes* sp.: **A–C**, variations in the form of gill 1 in *C. nigrescens*; **D**, gill 4; **E**, claw of foreleg; **F**, labrum (note deep notch—arrowed). (A, B & E redrawn from Barnard 1932; C, D & F redrawn from Peters & Edmunds 1964).

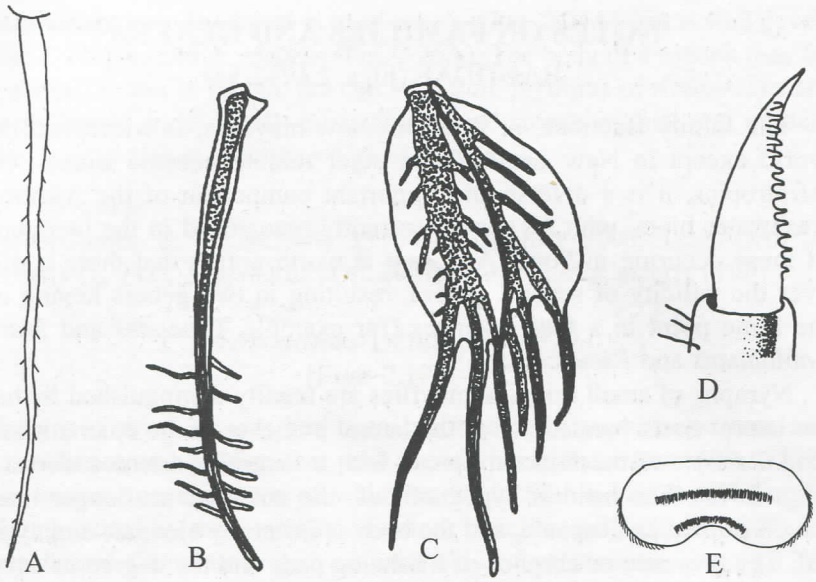

Fig. 2.85. *Euthraulus* sp. **A–B**, various forms of gills 1; **C**, gill 4; **D**, foreleg claw; **E**, labrum.

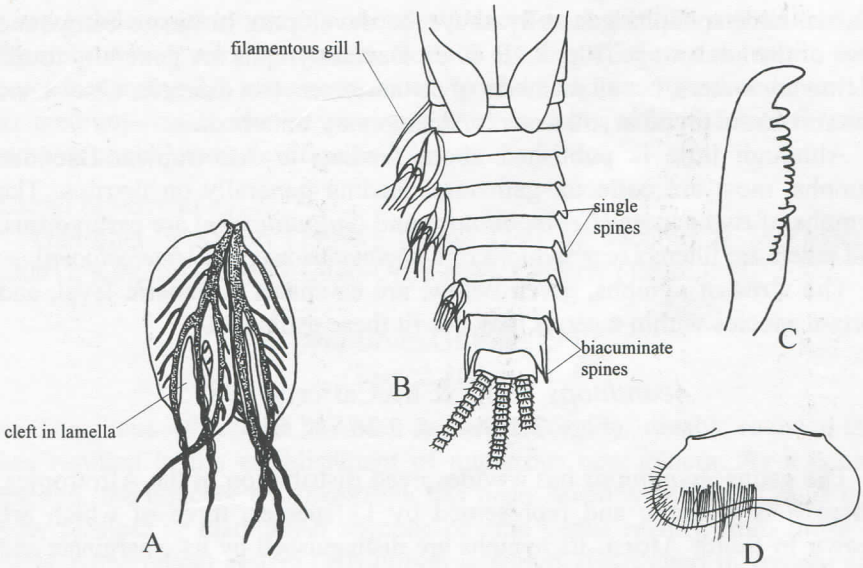

Fig. 2.86. *Fulletomimus* sp.: **A**, gill 4; **B**, dorsal view of abdomen showing filamentous gill 1 and the posterolateral biacuminate endings of abdominal segments 8 and 9; **C**, claw of foreleg; **D**, labrum.

PROSOPISTOMATIDAE

There is no key to genera, as only one genus (*Prosopistoma:* Fig. 2.6) is currently known.

NOTES ON FAMILIES AND GENERA

BAETIDAE (Figs. 2.17–2.54)

The family Baetidae, or small minnow mayflies, is widespread in the world except in New Zealand and other remote oceanic islands. In the Afrotropics, it is a diverse and important component of the Afrotropical freshwater biota, with 40 genera currently recognized in the literature, 18 of these occuring in South Africa. It is worth noting that there is dispute over the validity of several genera, resulting in two genera keying out at the same point in a few instances (for example, *Cloeodes* and *Maliqua*; *Labiobaetis* and *Pseudocloeon*).

Nymphs of small minnow mayflies are readily distinguished by having the lateral ocelli located above the lateral branches of the epicranial suture (Fig. 2.7B) and the femoral apices with a ventrally oriented dorsal lobe (Fig. 2.7D). The head is hypognathous, the antennae are longer than the length of the head capsule, and the body is generally elongate and cylindrical. The presence or absence of hindwing pads and the degree of development of the medial caudal filament has previously been used to delineate genera. These characteristics have been shown to be inconsistent, however, even within individual genera, and are, therefore, of little diagnostic value. Mature male nymphs generally show the developing turbinate compound eyes of the adult stage (Fig. 2.4B & C). Baetid nymphs are generally found in flowing waters, but all members of certain genera (for example, *Cloeon* and *Procloeon*) are found in still waters and temporary waterbodies.

Although little is published about feeding in Afrotropical Baetidae nymphs, most are collector-gatherers, feeding generally on detritus. The nymphs of two genera (*Centropiloides* and *Guloptiloides*) are carnivorous, and others are filterers (e.g. nymphs of *Ophelmatostoma* and *Mutelocloeon*).

The sizes of nymphs, given below, are estimates at generic level, and certain species within a genus may not fit these estimates.

Acanthiops Waltz & McCafferty, 1987
(Figs. 2.24A–L & 2.26A & B)

The genus *Acanthiops* has a widespread distribution in the Afrotropics, where it is endemic and represented by 13 species, three of which are known in South Africa. Its nymphs are distinguished by its emarginate and laterally expanded and flattened pronotum (Fig. 2.24B). Other characteristics that aid in distinguishing nymphs of *Acanthiops* include the variously developed dorsal abdominal tubercles (Figs. 2.24C,D,E). With the exception of one species reported from Kenya, nymphs of *Acanthiops* have two rows of denticles on the tarsal claws (similar to Fig. 2.20B). The medial

caudal filament is undeveloped in most species (Fig. 2.24A), but is well developed in *A. cooperi* and *A. erepens* (Fig. 2.26A). The body of a nymph may be up to about 7.0 mm in length, the cerci 4.0 mm. Nymphs of *Acanthiops* are primarily found under small- to medium-sized stones in fast- and moderate-flowing streams at middle to high elevations.

Useful references

Barber-James & McCafferty (1997); Gattolliat 2000; Lugo-Ortiz & McCafferty (1998a); Lugo-Ortiz et al. 2001; Waltz & McCafferty (1987).

Afrobaetodes Demoulin, 1970
(Figs. 2.17D–H)

The genus *Afrobaetodes* has been reported from western, eastern and southern Africa and Madagascar, and is endemic to the Afrotropics. There are six known species, three of which occur in South Africa. Its nymphs are distinguished by the ventrally-oriented, lamellate gills (Figs. 2.17D,E), a ventrolateral filamentous gill on each side of prosternum (Fig. 2.17D) and the presence of a distolateral process on maxillary palp segment 1 (Fig. 2.17F). With the exception of the species reported from Madagascar, nymphs of *Afrobaetodes* have one row of denticles on the tarsal claws. Dorsal abdominal tubercles are either present or absent. The medial caudal filament is undeveloped. Mature nymphs are about 3.2 mm in length, with cerci measuring 2.7 mm. Nymphs of *Afrobaetodes* are found under small- to medium-size stones or among gravel in fast- and moderate-flowing streams at moderate elevations.

Useful references

Gattolliat & Sartori (1999a); Gillies (1991b); Jacobus & McCafferty (2001); Kimmins (1955); Lugo-Ortiz & McCafferty (1996c).

Afroptilum Gillies, 1990
(Figs. 2.40A–C)

The genus *Afroptilum* has been the subject of considerable revision that has resulted in the establishment of numerous new genera. As a consequence, the concept of *Afroptilum* has been severely restricted, and it is now feasible to distinguish nymphs of the genus readily from those of other Afrotropical genera. *Afroptilum* is widely distributed in eastern and southern Africa, and it has been reported from Madagascar and the Comoros Islands. Ten species are recognized in total, of which two are known in South Africa.

Afroptilum nymphs are distinguished by the presence of a tuft of robust, stiff, simple setae apically on the lingua of the hypopharynx (Fig. 2.40A),

and small terminal segments of the labial palp (Fig 2.40B). Other characteristics that aid in distinguishing nymphs of *Afroptilum* include the two rows of denticles on the tarsal claws (similar to Fig. 2.20B) and the somewhat dorsoventrally-flattened abdomen. The medial caudal filament is well developed, but may be shorter than the cerci. The body lengths of nymphs are about 6.0–8.5 mm, and the cerci lengths 4.0–6.0 mm. The common African species *A. sudafricanum* is distinguished by having only six pairs of gills, stout setae on fore-femora lying in a cross-cross pattern, and minute terminal segment of labial palp. Nymphs of *Afroptilum* are found under small- to medium-sized stones in slow- and fast-flowing streams at a wide range of elevations.

Useful references

Barnard (1932); Lugo-Ortiz & McCafferty (1998a).

Baetis Leach, 1815
(Figs. 2.48A–D)

Systematics of the genus *Baetis* is highly problematic and has undergone considerable worldwide revision. In the Afrotropics, several species originally described under *Baetis* have been transferred to *Pseudocloeon,* whereas others still assigned to *Baetis* have a dubious taxonomic status because they are known only from subimagos or adults and cannot be adequately identified. In any case, the genus is widespread on the African continent, but has not been reported from Madagascar. There are currently ten species assigned to this genus, three of which occur in South Africa.

Baetis nymphs are distinguished by the following combination of characteristics: labial glossae subequal or shorter than paraglossae, palp segment 3 broadly rounded (Fig. 2.48B); absence of a tuft of setae on the mandibles between the prostheca and molar region; presence of the villopore (Fig. 2.20F); terga with posterior marginal spines (Fig. 2.48D). The medial caudal filament is well developed, but may be shorter than the cerci. The most common species in southern Africa is *Baetis harrisoni,* mature nymphs of which measure about 6.0 mm, with cerci between 2.5 mm and 3.0 mm. Nymphs of *Baetis* are found in riffle areas under small- to medium-sized stones at a wide range of elevations.

Useful references

Barnard (1932); Soldán (1977).

Barnumus McCafferty & Lugo-Ortiz, 1998
(Figs 2.23A–D)

The genus *Barnumus* is known from only one species, *B. editus*, from South Africa (KwaZulu-Natal and Mpumalanga provinces). Apart from having an undeveloped medial caudal filament, nymphs of *Barnumus* spp. can be identified by their relatively large size and robust body, the presence of two rows of denticles on the tarsal claws (similar to Fig. 2.20B), and the untracheated gills (Fig. 2.23D). Nymphs are large, measuring between 9.5–13.0 mm. They are found under, and on top of, stones in fast-flowing streams at high elevations.

Useful references

Lugo-Ortiz & McCafferty (1998a).

Bugilliesia Lugo-Ortiz & McCafferty, 1996
(Figs 2.54A–D)

Bugilliesia is a widespread genus in the Afrotropics, represented by five species, but has not been reported from southern Africa or Madagascar. Its nymphs are distinguished by having labial palp segment 2 with a variously-developed distomedial process and segment 3 partly fused and broadly rounded (Fig. 2.54C), and the maxillary palp has an abrupt constriction in the apical upper quarter of the terminal segment (Fig. 2.54D). The medial caudal filament is well developed. Nymphs measure up to about 5.5 mm and are found in slow- and fast-flowing streams at low and high elevations.

Useful references

Gillies (1990a); Lugo-Ortiz & McCafferty (1996c).

Centroptiloides Lestage, 1918
(Figs 2.35A–F)

The genus *Centroptiloides* is known from only one species, *C. bifasciata*, that has a widespread distribution in the Afrotropics. The genus has not been reported from Madagascar. Nymphs of *Centroptiloides* are distinguished by having a labrum with a broad, deep, U-shaped anteromedial emargination (Fig. 2.35A) and two-segmented labial palps (Fig. 2.35B). Other important distinguishing characteristics include their relatively large size (body up to 14.0 mm; cerci 10.5 mm; medial caudal filament 4.5 mm) and robust body, the presence of two rows of denticles on the tarsal claws (Fig. 2.35E), and well-tracheated gills that often have basal folds (Fig. 2.35F). The medial caudal filament, although shorter than the cerci, is well

developed in mature nymphs, but greatly reduced in immature nymphs. The nymphs are predatory and generally found on top of rocks in fast-flowing waters at a wide range of elevations.

Useful references

Agnew (1962a); Crass (1947); Lugo-Ortiz & McCafferty (1998a).

Cheleocloeon Wuillot & Gillies, 1993
(Figs. 2.38A–E)

The genus *Cheleocloeon* has a widespread distribution in the Afrotropics, including Madagascar, with a total of eight species known, two of which occur in South Africa. Its nymphs are distinguished by having a labial palp segment 2 with an anteriorly-convex medial process that is distally pointed (Fig. 2.38D). Denticulation of tarsal claws varies considerably between species, some having edentate claws (Fig. 2.38A), one species with a poorly-developed row of denticles (Fig. 2.38B), and other species with two rows of minute denticles (Fig. 2.38C). Dorsal abdominal tubercles are either present or absent. The medial caudal filament is well developed. Mature nymphs measure about 6.0–7.0 mm in length, with a cerci length of about 3.0 mm. Nymphs of *Cheleocloeon* are found in riffles and stony backwaters.

Useful references

Lugo-Ortiz & McCafferty (1997a, 1997g); Wuillot & Gillies (1993a).

Cloeodes Traver, 1938
(Figs 2.52A–E)

The genus *Cloeodes* is pantropical. In the Afrotropics it has been reported from southern Africa and Madagascar only, but is probably more widespread on the African continent. Five species have been described, only one from South Africa. Its nymphs are distinguished by the following combination of characteristics: the presence of a subproximal arc of setae on the tibiae and tarsi (Fig. 2.52A); sublateral tufts of long, fine, simple setae on abdominal sterna 2–6 (Fig. 2.52B); and edentate tarsal claws, with minute striations subapically (Fig. 2.52A). The medial caudal filament is well developed. Nymphs measure up to about 3.5–6.0 mm, with the cerci about 2.0–3.0 mm. Nymphs of *Cloeodes* are found in a wide range of flowing-water habitats and elevations.

Although treated as separate genera in this chapter (since this is the state of the current literature), evidence suggests that *Cloeodes* and *Maliqua* are synonyms (J-L. Gattolliat, pers. comm., Museum of Zoology, Lausanne, Switzerland). Further work is required to clarify this.

Useful references

Gattolliat (2001a); Lugo-Ortiz et al. (1999a); Waltz & McCafferty (1994).

Cloeon Leach, 1815 and *Procloeon* Bengtsson, 1915
(Figs 2.27A–H)

The genera *Cloeon* and *Procloeon* are found on all continents except South America. The systematics is in a state of flux, and it is possible that *Procloeon* is equivalent to *Cloeon*. On the African continent, reports of *Procloeon* are particularly troublesome because none of the species are known from the nymphal stage. In any case, nymphs of species currently assigned to *Cloeon* and *Procloeon* are extremely difficult to separate, and consequently in the key provided here we treat both genera together. There are 22 Afrotropical species of *Cloeon* in the literature (nine in South Africa), and three species of *Procloeon* (one in South Africa)

Cloeon and *Procloeon* nymphs are distinguished by the following combination of characteristics: gills 1–5 or 2–6 are double (Figs. 2.27A,B,C, D); the tarsal claws are less than one-half the length of the tarsi, with small denticles in the basal one-third of the claw (Fig. 2.27E), the labium has subequal glossae and paraglossae, with palp segment 3 being broad and truncate (Fig. 2.27F) or narrow and apically tapering (Fig. 2.27G). Mature nymphs range in size from about 5.0–8.0 mm in length, and cerci up to about 2.5–6.0 mm, according to species. Nymphs of both genera are primarily found in temporary waterbodies and among vegetation in ponds, dams, stream-pools and slow-flowing streams.

Useful references

Barnard (1932); Crass (1947); Gattolliat (In Press a); Gillies (1980a, 1985); Lugo-Ortiz & McCafferty (1998c).

Crassabwa Lugo-Ortiz & McCafferty, 1996
(Figs 2.49A–D)

The genus *Crassabwa* is widely distributed in the Afrotropics, represented by four species (one in South Africa), but has not been reported from Madagascar. Its nymphs are distinguished by the following combination of characteristics: a labial palp with a thumb-like distomedial process on segment 2 (Fig. 2.49B), the presence of a subproximal arc of setae on the tibiae (Fig. 2.49A), and an enlarged subapical pair of denticles on the tarsal claws (Fig. 2.49A). The medial caudal filament is well developed. Mature nymphs of *C. flava* measure 7.5–8.5 mm, with cerci 2.7–3.0 mm (Lugo-Ortiz & McCafferty 1996a). Nymphs of *Crassabwa* are found in medium-sized streams in shallow riffles at low to moderate elevations.

Useful references

Lugo-Ortiz & McCafferty (1996a).

Dabulamanzia Lugo-Ortiz & McCafferty, 1996
(Figs 2.50A–D)

The genus *Dabulamanzia* is widespread in the Afrotropics, including Madagascar, with 11 species known in total, four occurring in South Africa. The nymphs are distinguished by the following combination of characteristics: an apically-rounded maxillary palp segment 2 (Fig. 2.50C), the presence of a subproximal arc of setae on the tibiae (Fig. 2.50A), and tarsal claws with one row of denticles (Fig. 2.50A). The medial caudal filament is well developed. Body lengths vary from 4.8–7.2 mm and cerci lengths from 2.5–3.5 mm (with the exception of the larger nymphs of *D. gigantea*). Nymphs of *Dabulamanzia* spp. are found in riffle areas in streams at a range of altitudes, and could easily be confused with those of *Nesydemius* spp.

Useful references

Crass (1947); Gattiollat, et al. (1999); Gattolliat & Sartori (2000a); Gillies (1990a); Lugo-Ortiz & McCafferty (1996b, 1997g); Wuillot & Gillies (1993b).

Delouardus Lugo-Ortiz and McCafferty, 1999
(Figs 2.30A–D)

This genus, known only from Madagascar where it is represented by two species, is distinguished by having the second segment of the labial palp deeply falcate (Fig. 2.30A), weakly-pectinate setae on the legs, and elongate, weakly-hooked claws with two rows of small, evenly sized denticles (Fig. 2.30B). *D. djabala* nymphs measure 3.7 mm, with cerci 2.1 mm (Lugo-Ortiz and McCafferty 1999). Members of this genus tend to be found in slow-flowing water, in streams without aquatic vegetation that are 3–8m wide, 10–80 cm deep, and have sandy substrates (J-L. Gattolliat, pers. comm.).

Useful references

Lugo-Ortiz and McCafferty (1999).

Demoreptus Lugo-Ortiz & McCafferty, 1997
(Figs 2.20A–F)

The genus *Demoreptus* is known only from southern Africa, where there are three species. Its nymphs are distinguished by the following combination of characteristics: relatively narrow-elongate body; mandibles

without tufts of setae between the prostheca and molar region; labial palp segment 3 narrowly rounded (Fig. 2.20E) or clublike (Fig. 2.58D); elongate and outstretched legs (Fig. 2.20A); the presence of a villopore (Fig. 2.20F); claws with two rows of denticles and a pair of subapical setae (Fig. 2.20B), and an undeveloped medial caudal filament. Body sizes of nymphs vary in different species, as illustrated by the following measurements: *D. natalensis* (body length about 5.0 mm; cerci length about 5.0 mm); *D. capensis* (body length about 7.0 mm; cerci length about 4.0 mm), and *D. monticola* (body length about 7.0 mm; cerci length about 6.0 mm). Nymphs are found in fast-flowing mountain streams.

Useful references

Lugo-Ortiz & McCafferty (1997b).

Demoulinia Gillies, 1990
(Figs 2.53A–D)

The genus *Demoulinia* is known from southern Africa (one species) and Madagascar (two species). Its nymphs are distinguished by having a labial palp segment 2 with a subrectangular medial process that is broadly rounded apically (Fig. 2.53C) and slender tapering tarsal claws that are approximately two-thirds the length of the respective tarsi (Fig. 2.53A). The medial caudal filament is well developed. Mature nymphs measure up to 8.0 mm with cerci 4.0 mm. Nymphs of *Demoulinia* are psammophilous (associated with sandy substrates), but are found in a wide variety of flow regimes in lowland streams.

Useful references

Gattolliat (2003); Gillies (1990a); Lugo-Ortiz & McCafferty (1998c).

Dicentroptilum Wuillot & Gillies, 1994
(Figs 2.29A–H)

The genus *Dicentroptilum* is widely distributed in the Afrotropics, including Madagascar, where it is represented by four species, with one species in South Africa. The nymphs are distinguished by the following characteristics: relatively large size (up to about 8.5 mm, with cerci 6.0 mm, up to nearly 10.0 mm) and robust body, the pair of ventral papillae on the pro-coxae (Fig. 2.29A), the presence of a dorsal row of long, fine, simple setae on the tibiae and tarsi (Fig. 2.29D), two rows of denticles on the tarsal claws (Fig. 2.29D), and the off-set terminal segment of the labial palp (Fig. 2.29B). Dorsal abdominal tubercles (as in Fig. 2.29F) are either present or absent. The medial caudal filament is well developed. Nymphs of *Dicentroptilum* are found in fast-flowing streams at high and low elevations.

Useful references

Lugo-Ortiz & McCafferty (1998a, 2001); Wuillot & Gillies (1994).

Echinopus Gattolliat (2002b)
(Figs 2.39A–E)

Echinopus is only known from Madagascar, represented by two species. The nymphs are distinguished by a relatively narrow labrum (Fig. 2.39C); the labium (Fig. 2.39D) has slender glossae slightly shorter than the apically-rounded paraglossae; the labial palp is three segmented, segment 3 being conical and longer than broad; the outer margin of the forefemur (Fig. 2.39A) has an apico-tranverse arc of three or four long setae; the villopore is absent; the tarsal claws (Figs. 2.39A) have two rows of teeth—the second row being reduced in number—and two small subapical setae; the asymmetrical gills (Fig. 2.39E) on segments 1 to 7 have serrated margins. The medial caudal filament is slightly shorter than the cerci, and has abundant setae on both margins and the cerci each have abundant setae on the inside margin. Nymphs are small: *E.giboni* measures 4.1 mm with cerci 1.8 mm (Gattolliat 2002b), while *E. minutus* measures 3.0 mm with cerci 2.3 mm (Gattolliat 2002b).

Useful references

Gattolliat (2002b).

Edmulmeatus Lugo-Ortiz & McCafferty, 1997
(Figs 2.32A–E)

The genus *Edmulmeatus* is known from only one species, *E. grandis*, which is endemic to Madagascar. Nymphs of the genus are distinguished by the relatively large size (middle instar nymphs with lengths of 7.3–7.5 mm and cerci of 4.9–5.1 mm) and robust body, enlarged hemispherical head (Fig. 2.32A), and massive mandibles with incisors and molars forming a series of large denticles (Fig. 2.32D). The medial caudal filament is well-developed. Details of the habitat requirements of the nymphs of *Edmulmeatus* remain unknown.

Useful references

Lugo-Ortiz & McCafferty (1997c).

Glossidion Lugo-Ortiz & McCafferty, 1998
(Figs 2.43A–D)

The genus *Glossidion* is known only from Uganda, where it is represented by two species, but it is probably more widespread in the Afrotropics.

In mature nymphs the body length ranges from 7.0 mm–8.3 mm. Nymphs of the genus are distinguished by the following combination of characteristics: glossae significantly shorter than paraglossae (shorter in *G. demoulini* than in *G. mysticum*) (Fig. 2.43B), presence of the villopore (similar to Fig. 2.20F), and the absence of posterior tergal spines. Nymphs are found in fast-flowing streams at high elevations.

Useful references

Lugo-Ortiz & McCafferty (1998b).

Guloptiloides Gattolliat & Sartori, 2000
(Figs 2.34A–G)

The genus *Guloptiloides* is known from only one species, *G. gargantua,* which is endemic to Madagascar. Its nymphs are distinguished by the following combination of characteristics: a large size—body length 12.0 mm, cerci 5.2 mm (Gattolliat & Sartori 2000)—and robust body; an apically serrate antennal flagellum (Fig. 2.34E); a labrum that is wider than long, with an anteromedial lobe (Fig. 2.34A), and tarsal claws with two rows of denticles (Fig. 2.24G). The medial caudal filament is well developed. Nymphs of *Guloptiloides* are predatory, and found in fast- to moderately-flowing streams at medium elevations.

Useful references

Gattolliat & Sartori (2000b).

Herbrossus McCafferty & Lugo-Ortiz, 1998
(Figs 2.36A–H)

The genus *Herbrossus* is endemic to Madagascar, where three species are known. Its nymphs are distinguished by the following combination of characteristics: a relatively large size (body length 8.5–10.0 mm, cerci 9.0–10.5 mm—Lugo-Ortiz & McCafferty 1998a) and robust body, a conspicuously wider-than-long labrum that has a relatively narrow, deep, U-shaped anteromedial emargination (Fig. 2.36A), well-tracheated asymmetrical gills (Fig. 2.36C,D) and a small third segment on the labial palp (Fig. 2.36 B). There are two rows of denticles on the tarsal claws (Fig. 2.36H). The medial caudal filament is well developed. Nymphs of *Herbrossus* are found at shallow depths in medium-sized streams at moderate elevations.

Useful references

Gattolliat & Sartori (1998); Lugo-Ortiz & McCafferty (1998a).

Kivua McCafferty & Lugo-Ortiz, 1996

Only described as adults, from the Ivory Coast and Congo, where two species are known.

Useful references

Lugo-Ortiz & McCafferty (1996c).

Labiobaetis Novikova & Kluge 1987
(Figs 2.45A–G)

This genus was originally erected as a sub-genus to incorporate several species placed in *Baetis*, but was then raised to generic level by McCafferty & Waltz (1995). Lugo-Ortiz & McCafferty (1997d) described several more species in *Labiobaetis*, but then Lugo-Ortiz et al. (1999b) transferred all *Labiobaetis* species to *Pseudocloeon*. Gattolliat (2001c) refutes this, but has not reassigned all *Pseudocloeon* species back to *Labiobaetis*. Hence the genus is in a state of flux that cannot be clarified until the nymphal stage of the type species of *Pseudocloeon* (*P. kraepelini*) is known. (See the description of diagnostic generic features below under *Pseudocloeon*).

Useful references

Gattolliat (2001c); Lugo-Ortiz & McCafferty (1997d); Lugo-Ortiz et al. (1999b); McCafferty & Waltz (1995).

Maliqua Lugo-Ortiz & McCafferty, 1997
(Figs 2.52A–E)

The genus *Maliqua* is known from two species: *M. plumosa* from Mali and Guinea and *M. abdallahi* from Lake Malawi. Its nymphs are distinguished by the following combination of characteristics: edentate claws (Fig. 2.52A); the presence of a subproximal arc of setae on the tibiae and tarsi (Fig. 2.52A) (J-L. Gattolliat, pers. comm; McCafferty 2000); labial palp segments 2 and 3 that are subequal in length, with segment 3 being somewhat elongate and apically rounded (Fig. 2.52D), and a well-developed medial caudal filament. Nymphs of *Maliqua* from West Africa were collected from rivers, while those from Malawi were from the littoral zone in the lake, where they were exposed to wave action. Nymphs measure from about 3.5–6.0 mm in length, with the cerci being about 2.0–3.0 mm.

Although treated as separate genera in this chapter (since this is the state of the current literature), evidence suggests that *Cloeodes* and *Maliqua* are synonyms (J-L. Gattolliat, pers. comm.). Further work is required to clarify this.

Useful references

Lugo-Ortiz & McCafferty (1997e); McCafferty (2000); Wuillot & Gillies (1993b).

Micksiops McCafferty, Lugo-Ortiz & Barber-James, 1997
(Figs 2.21A–C)

The genus *Micksiops* is known only from one species—*M. bicaudatum* from Guinea—but is possibly more widespread in the Afrotropics. Its nymphs are distinguished by the following combination of characteristics: medial caudal filament reduced; the right mandible has a small tuft of setae between the prostheca and the molar (Fig. 2.21B), segment 3 of the labial palp is broadly rounded and somewhat medially produced (Fig. 2.21C); the villopore is absent, and the medial caudal filament is undeveloped. Body length of the nymph is 4.5 mm. Details of the habitat requirements of the nymphs are unknown.

Useful references

McCafferty et al. (1997).

Mutelocloeon Gillies & Elouard, 1990
(Figs 2.51A–C)

The genus *Mutelocloeon* is widespread in the Afrotropics, represented by two African species, and adults of a third species have been reported from Madagascar, but since freshwater mussels do not occur in Madagascar (Gattolliat pers. comm), this is unlikely. The nymphs are unique among small minnow mayflies in that they are found in symbiosis with mutelid mussels, attached to the folds of the branchiae within the mantle cavity. They are distinguished by having two-segmented labial palps, with segment 2 being apically bulbous (Fig. 2.51C), short maxillary palps (Fig 2.51B) and edentate tarsal claws (Fig. 2.51A). The medial caudal filament is equal in length to the cerci, and varies from one sixth to one third of the length of the body (Gillies & Elouard 1990). While the body length of the nymph has not been reported, the adult male measures 10.0 mm, and the female 12.0 mm (Gillies & Elouard 1990).

Useful references

Gillies & Elouard (1990); Kimmins (1956); Lugo-Ortiz & McCafferty (1997g).

Nesoptiloides Demoulin, 1973
(Figs 2.33A–D)

The genus *Nesoptiloides* is known from only one species: *N. electroptera*, endemic to Madagascar. Its nymphs are distinguished by the following

combination of characters: robust body and relatively large size (about 7.0 mm); forelegs with femora with broadly-based ventral humps (Fig. 2.33A), tibiae with ventrodistal processes (Fig. 2.33A), and tarsal claws with two rows of denticles (Fig. 2.33A). The glossae and paraglossae on the labium are divergent (Fig. 2.33C); the labrum is covered with setae; the asymmetrical gills are well tracheated (Fig. 2.33D), and the medial caudal filament is well developed. Nymphs of *Nesoptiloides* are found in riffles of fast-flowing streams at moderate elevations.

Useful references

Demoulin (1973); Gattolliat & Sartori (1999b); Lugo-Ortiz & McCafferty (1998a).

Nesydemius Lugo-Ortiz & McCafferty, 1998
(Figs 2.50E & F)

This genus is known only from one species in Madagascar. Its nymphs are distinguished by the following combination of characteristics: maxillary palp segment 2 with a papillaform apex (Fig. 2.50F); the presence of a subproximal arc of setae on the tibiae (similar to Fig. 2.50A), and tarsal claws with one row of denticles, two enlarged subapically (Fig. 2.50E). The medial caudal filament is well developed. The body length of nymphs varies from 5.0–7.0 mm and the cerci from 2.5–3.5 mm. Details of the habitat requirements of nymphs have not yet been described. Nymphs of this genus can easily be confused with those of *Dabulamanzia*.

Useful references

Lugo-Ortiz & McCafferty (1998d).

Nigrobaetis Novikova & Kluge, 1987
(Figs 2.46A–D)

This genus has a widespread distribution in the Palaearctic. In Africa members of the genus are widely separated, being known only from North Africa (Soldán 1977; Soldán & Thomas 1983) and Namibia (Lugo-Ortiz & de Moor 2000). Its nymphs are distinguished by the following combination of characteristics: the presence of a frontal carina (Fig. 2.46A); three-segmented labial palps, with segment 3 bluntly pointed apicolaterally (Fig. 2.46B); maxillary palps without a distomedial constriction on segment 2 (Fig. 2.46C), and the absence of the villopore. The medial caudal filament is well developed. Nymphs of *N. bethunae* measure 3.6–3.8 mm in length, with caudal filaments 1.9–2.0 mm (Lugo-Ortiz & de Moor 2000). Nymphs of *Nigrobaetis* are found in riffles of medium-size, fast-flowing streams.

Useful references

Lugo-Ortiz & de Moor (2000); Soldán (1977); Soldán & Thomas (1983).

Ophelmatostoma Waltz & McCafferty, 1987
(Figs 2.41A–C)

The genus *Ophelmatostoma* is widespread in the Afrotropics, represented by only one species, but has not been reported from Madagascar. Its nymphs have the following distinguishing characteristics: labium with glossae and paraglossae that are divergent, greatly elongate and slender with a terminal fringe of long, fine, simple setae; two-segmented labial palps, with segment 1 being abruptly angled towards the interior, and segment 2 being apically bulbous (Fig. 2.41A); the maxilla has a very slender, two-segmented palp (Fig. 2.41C); the tarsal claws have four to six large denticles basally (Fig. 2.41B), and the medial caudal filament is well developed and slightly shorter than the cerci. Nymphs measure about 4.0 mm, with cerci of about 1.5 mm. Nymphs of *Ophelmatostoma* are mostly found among vegetation in moderate-flowing, lowland streams.

Useful references

Gillies et al. (1990); Kimmins (1955); Waltz & McCafferty (1987).

Peuhlella Lugo-Ortiz & McCafferty, 1998
(Figs 2.31A–D)

This genus is known only from one species (*P. christinae* from Guinea), but it is possible that the genus is more widespread. Its nymphs are distinguished by the enlarged abdominal segment 1 (Fig. 2.31A) and the presence of two rows of denticles on the tarsal claws (Fig. 2.31D). The labium (Fig. 2.31C) has narrow glossae, and small terminal segments on the palps. The medial caudal filament is well developed. Nymphs measure about 4.0 mm; cerci length not known. Details of the habitat requirements of the nymphs of *Peuhlella* remain unknown.

Useful references

Lugo-Ortiz & McCafferty (1998a); Wuillot & Gillies (1993b).

Potamocloeon Gillies, 1990
(Figs 2.28A–F)

The genus *Potamocloeon* is widespread in the Afrotropics, with one species known from Africa north of the equator. A second species has been

described from north-eastern South Africa. The nymph of a species from Madagascar has been described but not named. Adult male specimens have also been described, but as they have not yet been associated with the nymph, these have not yet been named either (Gattolliat 2003). *Potamocloeon* nymphs are distinguished by having elongate and edentate tarsal claws (Fig. 2.28D), a labium with glossae considerably shorter than paraglossae and labial palp segment 2 that is broadly wedge-shaped (Fig. 2.28E). Mature nymphs have a body length of about 5.5 mm and a cerci length of about 1.8 mm. Nymphs of *Potamocloeon* are found on silt/clay substrates in slow currents and shallow waters.

Useful references

Gattolliat (2003); Gillies (1988 & 1990b); Lugo-Ortiz & McCafferty (1996c).

Pseudocloeon Klapálek, 1905
(Figs 2.45A–G)

The taxonomy of this genus has a history of worldwide confusion. In the Afrotropics, several species assigned to *Baetis* and all species assigned to *Labiobaetis* were reassigned to *Pseudocloeon* (Lugo-Ortiz et al. 1999b). The genus is found on all continents except South America, and is widespread in the Afrotropics, including Madagascar.

In the Afrotropics, nymphs of *Pseudocloeon* are distinguished by the following combination of characteristics: a labial palp segment 2 with a variously developed, thumb-like distomedial process (Fig. 2.45A) and a maxillary palp segment 2 with a distomedial concavity (Fig. 2.45B) or constriction (Fig. 2.45C). Other characteristics associated with nymphs of *Pseudocloeon* elsewhere may be present or absent in Afrotropical species. These include the presence of the villopore (Fig. 2.45G) and a distolateral modification of the antennal scapes (Figs 2.45D, E, F). The medial caudal filament is well developed. Nymphs of *Pseudocloeon* are found under stones and among vegetation in a wide range of flowing water regimes and elevations.

More recent work (Gattolliat 2001c) refutes the validity of placing so many species in the all-encompassing *Pseudocloeon*, and recognizes the genus *Labiobaetis*, describing six new species from Madagascar (see discussion under *Labiobaetis* above). As the literature stands, there are 15 Afrotropical species of *Pseudocloeon*, with eight in South Africa.

Useful references

Gattiollat (2001c); Lugo-Ortiz & McCafferty (1997d); Lugo-Ortiz, et al. (1999b); Lugo-Ortiz et al. (1999b).

Pseudopannota Waltz & McCafferty, 1987
(Figs 2.44A–E)

This genus *Pseudopannota* is widespread in the Afrotropics, including Madagascar. It is represented by eight species, one of which occurs in South Africa. Its nymphs are distinguished by the following combination of characteristics: two-segmented labial palps, with segment 2 being apically expanded or bulbous (Fig. 2.44B); three-segmented maxillary palps that extend well beyond the galea-laciniae (Fig. 2.44A), and forewing pads that are generally fused for more than one half of their length. There are two subgenera, based on how far this fusion extends: subgenus *P. Pseudopannota* has a thorax with forewing pads that are fused for more than half their length (Fig. 2.44D), while subgenus *P. Hemipannota* has forewing pads fused for less than half their length (Fig. 2.44E). Nymphs of *Pseudopannota* measure up to 6.5 mm, with cerci up to 4.0 mm. The medial caudal filament is well developed, but shorter (about 2.0 mm) than the cerci. Nymphs of *Pseudopannota* are found under stones and among vegetation in moderately-flowing streams at high and low elevations.

Useful references

Elouard et al. (1990); Elouard & Hideux (1991a); Gattolliat, (2002c); Waltz & McCafferty (1987).

Rhithrocloeon Gillies, 1985
(Figs 2.47A–D)

This genus *Rhithrocloeon* is known only from eastern and central Africa, where two species are known, but it probably extends to southern Africa. Its nymphs are distinguished by having gills on abdominal segments 2–7 (Fig. 2.47C) and labial palps with segment 2 basally narrow, distomedially broadly rounded, and produced, and with segment 3 nipple-like and partially fused to segment 2 (Fig. 2.47A). The median caudal filament is well developed, about half to two-thirds the length of the cerci. Mature nymphs are about 6.0–7.0 mm long (basing this on adult measurements). Nymphs of *Rhithrocloeon* are found under medium- to small-size stones in fast- and moderate-flowing streams.

Useful references

Gillies (1985, 1988); Lugo-Ortiz & McCaffety (1996c).

Rheoptilum Gattolliat, 2001
(Figs 2.25A—G)

The genus *Rheoptilum* is known only from two species in Madagascar. These have the following distinguishing characteristics: dense rows of long setae on the dorsal margins of the femora, tibiae and tarsi (Fig. 2.25A & G); tarsal claws with two rows of denticles and a pair of subapical setae (Fig. 2.25G); very long cerci—approximately twice the length of the body— with the medial caudal filament reduced to a point (Fig. 2.25A); untracheated gills (Fig. 2.25B), and both mandibles with well-developed tufts of setae between the molar and the incisor regions. The maxillary palp has a small third segment (Fig. 2.24C). The labrum (Fig. 2.25D) is wide and densely setose submarginally, while the distal margin is only very shallowly notched. Nymphs of one species measure 6.4 mm with cerci of 12.2 mm; the second species measures 4.0 mm with cerci of 9.5 mm. The nymphs are found in fast-flowing, shallow streams, usually in areas of primary forest.

Useful references

Gattolliat (2001b).

Scutoptilum Gattolliat, 2002b
(Figs 2.22A—D)

The genus *Scutoptilum* is known from Madagascar only, represented by one species. The nymph is distinguished by the following combination of characteristics: it is easily recognized by having a prothorax that is broadly expanded laterally (Fig. 2.22A), and a head that is subrectangular, with prominent eyes. The pro- and mesothorax are covered with small black warts (Fig. 2.22A), as are the abdominal terga, but not the sterna. The forewing pads are well developed, and hindwing pads are present. The labrum (Fig. 2.22D) is broad, with an almost-straight distal margin, and an arc of abundant long stout setae lying subparallel to the distal margin. There is a tuft of setae between the prostheca and molar region of both mandibles. The maxillary palp is two-segmented and subequal in length to the galea-lacinia. The labium (Fig. 2.22C) has glossae that are slightly shorter than the paraglossae, a three-segmented palp with the second segment being slightly produced apicomedially, and segment 3 being short and subconical. The forelegs (Fig. 2.22B) are short and stout and characterized by the presence of subapico-transverse arcs of long spatulate setae on the outer margins of the femora, the absence of a villopore, a dorsal margin with a row of stout setae, tibiae and tarsi that lack long setae on the dorsal margin, and the presence of two rows of denticles on the tarsal claws, the second row being reduced; two subapical setae present. The gills are asymmetrical (Fig. 2.22A)

on segments 1–7, have tracheation that is extremely reduced or not visible, and margins that are smooth. The medial caudal filament is reduced to a single segment, the cerci have swimming setae on the last third of the inside margin. Mature nymphs measure 4.0 mm, with cerci 1.9 mm.

Scutoptilum is found in fast-flowing waters. It mouthparts are modified for scraping the tops of the stones.

Useful references

Gattolliat (2002b).

Susua Lugo-Ortiz & McCafferty, 1998
(Figs 2.37A–F)

The genus *Susua* is known only from one species (*S. niandanensis,* from Guinea), but the genus may be more widespread in the Afrotropics. The nymphs are distinguished by having the subapical denticles of the two rows of denticles of the tarsal claws conspicuously larger than the rest of the denticles (Fig. 2.37B) and gill 1 being narrow-elongate and poorly tracheated (Fig. 2.37C). The second segment of the labial palp has a small, upwardly- pointing, thumb-like distomedial projection (Fig. 2.37A). The medial caudal filament is well developed. Nymphs measure about 4.0 mm; the length of cerci is unknown. Details of the habitat requirements of the nymphs of *Susua* are unknown.

Useful references

Gillies (1985, 1988); Lugo-Ortiz & McCaffety (1998a).

Tanzaniella Gillies, 1991
(Figs 2.19A–E)

The genus *Tanzaniella* is known from only one species (*T. spinosa,* from Tanzania). Its nymphs are distinguished by the following combination of characters: a relatively narrow-elongate body; the presence of small dorsal abdominal tubercles on terga 1–7 or 1–8 (Fig. 2.19A); a labial palp with segments 2 and 3 appearing fused, and with segment 3 broadly rounded (Fig. 2.19D); outstretched legs, and the presence of a villopore (similar to Fig. 2.20F). The medial caudal filament is undeveloped. Mature nymphs measure about 5.0 mm, and the cerci are approximately as long as the body. Nymphs of *Tanzaniella* are found under stones in fast-flowing mountain streams.

Useful references

Gillies (1991a).

Thraulobaetodes Elouard & Hideux, 1991
(Figs 2.18A–D)

The genus *Thraulobaetodes* is known from only one species: *T. cumminsorum* from Guinea. The nymphs are distinguished by the ventrally-oriented, fringed gills on abdominal segments 2–7 (Figs. 2.18A,B), the presence of dorsal abdominal tubercles (Fig. 2.18A), and two rows of denticles on the tarsal claws. The maxilla (Fig. 2.18C) has a small downwardly-orientated palp with the third segment minute, and the labium (Fig. 2.18D) has the glossae fused in their basal half. The medial caudal filament is undeveloped. Nymphs of *Thraulobaetodes* are found crawling under stones in fast-flowing mountain streams.

Useful references

Elouard & Hideux (1991b).

Xyrodromeus Lugo-Ortiz & McCafferty, 1997
(Figs 2.42A–F)

This genus has been reported from Kenya and Uganda, where it is represented by one species, and Madagascar, where four species are known. It is possible that on the African continent the genus extends farther south. Its nymphs are distinguished by the following combination of characteristics: mandibles with bladelike incisors (Fig. 2.42B); labium with glossae subequal to, but narrower than, three-segmented labial palps, with segment 2 basally narrow and distomedially expanded, and segment 3 small and caplike (Fig. 2.42C); three-segmented maxillary palps, with no distomedial constriction on segment 3 (Fig. 2.42D), and the absence of a villopore. The medial caudal filament is well developed. Nymphs vary in size from about 5.0–7.0 mm, with cerci of about 6.0 mm. Details of the habitat requirements of the nymphs of *Xyrodromeus* remain unknown.

Useful references

Gattolliat (2002a); Lugo-Ortiz & McCafferty (1997f).

HEPTAGENIIDAE

The family Heptageniidae, or flat-headed mayflies, is known from all continents except Australia and South America. In the Afrotropics three genera are currently recognized, with *Afronurus* and *Compsoneuria* having a widespread distribution. *Thalerosphyrus* is found in the extreme north of the region, and has also recorded from Madagascar. As the literature stands at present, the genus *Compsoneuriella* has been put into synonymy with

Compsoneuria (Braasch & Soldan 1986), although there are conflicting opinions about the validity of this, and some papers refer, instead, to the genus *Compsoneuriella.* There is difficulty in distinguishing the Afrotropical species described as *Compsoneuria* and *Thalerosphyrus*, indicating problems with the assignment of species to these genera.

Heptageniid nymphs are distinguished by having a prognathous head capsule that is more or less circular and, from the dorsal view, covers the mouthparts (Fig. 2.11A), and gills 2–5 consisting of plate-like dorsal lamellae and fibrilliform ventral portions (e.g. Figs 2.55A–C & E–G; Figs 2.57A–C). In addition, the body is dorsoventrally flattened, and the legs are outstretched to the sides (Fig. 2.11A). Heptageniid nymphs are found at a wide range of elevations in riffle areas under stones, where they feed on periphyton.

Afronurus Lestage, 1924
(Figs 2.55A–H)

This genus is widespread in Africa and is also found in Madagascar. There are 13 species in the Afrotropical Region, with six species in South Africa. The nymphs are distinguished by the lack of supracoxal spurs (cf. Fig. 2.56) and have apically-rounded (Fig. 2.55A,B,D), or weakly-pointed to pointed gills (Figs. 2.55C, E–H). *Afronurus* nymphs are relatively large, the females being generally larger than the males (with body lengths being, respectively, up to about 11.0 mm and 10.0 mm). Nymphs of *Afronurus* are found under stones in riffle areas.

Useful references

Sartori & Elouard (1996); Schoonbee (1968).

Compsoneuria Ulmer, 1939
(Fig. 2.57A–D)

This genus is widespread in the Afrotropics. Its nymphs are distinguished by the presence of well-developed supracoxal spurs (Fig. 2.56) and apically-pointed gills (like Figs 2.57A–D). According to current literature, there are four species of *Compsoneuria,* with two species in South Africa. Nymphs of *Compsoneuria* are found under stones in riffle areas.

Useful references

Crass (1947); Sartori & Elouard (1996); Schoonbee (1967).

Thalerosphyrus Eaton, 1881
(Figs 2.57A–D)

Only one species of this genus has been described from Africa, on the extreme northern border of the Afrotropical region, in the mist oasis of Erkwit, Sudan (Soldán 1977). Edmunds (pers. comm. in Soldán 1977) reports an undescribed species from Madagascar. Subsequently, Sartori & Elouard (1996) have described a species from Madagascar. Like *Compsoneuria*, it has apically pointed gills (Figs. 2.57A–D).

Useful references

Sartori and Elouard (1996); Soldán (1977).

OLIGONEURIIDAE

Oligoneuriidae, or brush-legged mayflies, are known from all continents except Australia. In the Afrotropics, the family is represented by two genera, *Elassoneuria* and *Oligoneuriopsis*, with a distinct subgenus of *Elassoneuria, Madeconeuria*, in Madagascar. A new genus has recently been recognized from material collected in Tanzania (pers. obs.). The mature nymphs are large (up to about 30.0 mm) and are distinguished by the following characteristics: gill 1 is ventrally oriented and fibrilliform (Figs. 2.58B,C); the presence of fibrilliform filaments at the base of the maxillae (Fig. 2.8F), and forelegs with long setae that are used for filtering. Oligoneuriid nymphs are found in fast-flowing streams at high elevations (Figs 2.8A & B).

Elassoneuria Eaton, 1881
(Figs 2.58A–B)

This genus is widespread in the Afrotropics, where six species are known, including Madagascar. In Madagascar, the genus is represented by the subgenus *Madeconeuria.* The nymphs of *Elassoneuria* are distinguished by the presence of a distinct frontal carina on the head (Fig. 2.58A) and slightly apically-pointed gills (Fig. 2.58B), which are slightly longer than the length of the adjacent abdominal segment. Nymphs of *Elassoneuria* are found under stones in fast-flowing streams at low to high elevations.

Useful references

Demoulin (1966a); Gillies (1974).

Oligoneuriopsis Crass, 1947
(Figs 2.59A–D)

The genus *Oligoneuriopsis* is known only from Africa, with one species

from East Africa, and three from Lesotho and South Africa. Its nymphs are distinguished by the absence of a frontal carina (Fig. 2.59A) and the apically-rounded gills (Fig. 2.59D), which are shorter than the length of the adjacent abdominal segment. These nymphs measure up to about 20.0 mm body length, with a cerci length of about 8.0 mm. Nymphs of *Oligoneuriopsis* are found under stones in mountain streams.

Useful references

Agnew (1973); Crass (1947).

TRICORYTHIDAE

The family Tricorythidae has recently undergone a revision (McCafferty & Wang 2000), resulting in the separation of several families (including the Afrotropical families Ephemerythidae and Machadorythidae), that were formerly part of Tricorythidae. In addition, several new genera have recently been described from Madagascar (Elouard & Oliarinony 1997; Oliarinony & Elouard 1997; Oliarinony et al. 1998a). There are currently seven genera recognized in the Afrotropics, three of which are endemic to Madagascar, with only two genera in South Africa. The nymphs of Tricorythidae (as it is now defined) do not have operculate gills. Filamentous gill 1 is absent and lamellate gills are present on abdominal segments 2–6. The maxillae are broad with well-developed apical setae. Hindwing pads are absent. Nymphs of Tricorythidae tend to be found under rocks in moderate to swiftly-flowing currents, or among plants in slower currents. The Afrotropical tricorythids generally feed by filtering. The nymphs are not known for all genera, however, and feeding behaviour may vary between species.

Dicercomyzon Demoulin, 1954
(Figs 2.60A–E)

This genus is widespread in the Afrotropics, but has not been reported from Madagascar. There are four species. The nymphs are distinguished by the dorsoventrally-flattened body (Fig. 2.60A), the enlarged and flattened femora (Fig. 2.60A), the ventral plastron that is fringed with setae, forming a 'sucker disc' (Fig. 2.60B), and the marginally-fringed gills on terga 2–6 (Figs. 2.60C, D). The anterior margin of the head is fringed with setae (Fig. 2.60E). The nymphs measure about 5.0 mm in length. Nymphs of *Dicercomyzon* are found among vegetation in slow sections of streams and among leaf litter in mountain streams.

Useful references

Demoulin (1954, 1957 & 1964); Kimmins (1957).

Madecassorythus Elouard & Oliarinony, 1997
(Figs 2.61A–D)

There are four species of *Madecassorythus*, all of which occur in Madagascar. The nymphs of this genus can be very easily confused with those of *Tricorythus*. Like *Tricorythus*, the mandibles (Fig. 2.61D) are robust and prominent, with a strong fringe of long setae along the lateral margin, which are clearly visible in dorsal view. The labrum is quadrate, with minimal anteromedial emargination. The labium has the same structure seen in *Tricorythus* (Fig. 2.62E) with the glossae and paraglossae fused with the prementum, forming a single flat surface; labial palps are three segmented with the terminal segment being very small. The three-segmented maxillary palp extends well beyond the galea-lacinia. The morphology of the adult males of the two genera is clearly different, and it is this which forms the basis for the separation of the two genera. Nymphs vary in size between 6.0 mm to nearly 9.0 mm, depending on the species.

Madecassorythus is localized in the eastern coastal forest zones and the plateau region of Madagascar.

Useful references

Elouard & Oliarinony (1997); Oliarinony, Sartori & Elouard (2000).

Manohyphella Allen, 1973*

Originally placed as a member of the Ephemerellidae (subfamily Teloganodinae) (Allen 1973), this genus was moved to the Tricorythidae by McCafferty & Wang (1995). Some authors (e.g. Elouard et al. 2001) still consider it to belong to the Teloganodidae. Occurs in Madagascar. Apparently, only the adults of this genus are known.

Useful references

Allen (1973); McCafferty & Wang (1995, 2000).

Ranorythus Oliarinony & Elouard, 1997

Occurs in Madagascar. Only the adults of this genus are known.

Useful references

Oliarinony & Elouard (1997)

Spinirythus Oliarinony & Elouard, 1998

Occurs in Madagascar. Only the adults of this genus have been described.

Useful references

Oliarinony et al. (1998a).

*At the time of going to press it was noted that McCafferty & Wang (2000) have now placed this genus in the Teloganodidae.

Tricorythus Eaton, 1868
(Figs 2.16F–H & 2.62A–F)

The nymphs of *Tricorythus* share many similarities with those of *Madecassorythus*. The mandibles are robust and prominent, with a strong fringe of long setae along the lateral margin (Figs. 2.62C, D), which is clearly visible when viewing the nymph from above (Fig. 2.16F). The labrum is quadrate, with minimal anteromedial emargination. The labium has the glossae and paraglossae fused with the prementum, forming a single flat surface (Fig. 2.62E); labial palps are three segmented with the terminal segment very small. The maxillae (Fig. 2.16H) have strong brushes of setae laterally and apically, with a long two-segmented palp extending well beyond the galea-lacinia. The femora are broad and stout, with stong spatulate setae arranged in various patterns dorsally (Fig. 2.62F). The claws have one to a few strong denticles medially (Fig. 2.62F). It is interesting to note that the male nymphs of African *Tricorythus* species have much larger eyes than the female nymphs (personal observations), a feature which is not evident in Madagascan species of *Tricorythus* (Sartori, pers. comm., Museum of Zoology, Lausanne, Switzerland). In fact, one of the features used to separate *Madecassorythus* from Madagascan species of *Tricorythus* is that *Madecassorythus* male nymphs have larger eyes than females (Oliarinony et al. 2000). Male nymphs are generally smaller (6.0–7.0 mm) than female nymphs (9.0–10.0 mm), and cerci are about as long as the body. The nymphs are usually found on stones in fast- flowing sections of a river.

Useful references

Barnard (1932); Crass (1947); Oliarinony et al. (1998b).

EPHEMERYTHIDAE
(Figs 2.16A–E)

The family Ephemerythidae was originally placed as a subfamily within the Tricorythidae (Gillies 1960), but McCafferty and Wang (2000) raised the group to family status. The Ephemerythidae are endemic to and widespread in Africa (including Morocco), being known in the Afrotropics ss. from South Africa, Congo, Tanzania and Nigeria. The family is represented by only one genus (*Ephemerythus)* of which there are five species. Gills are only present on segments 2–5 (there is no filamentous gill 1), and gill 2 is operculate (Fig. 2.16A). The maxillae do not have palps (Fig. 2.16B), and the third segment of the labial palp is small in comparison to the other segments (Fig. 2.16C). The tarsal claws are distinctive, with larger, widely-spaced denticles basally and several smaller, closely-spaced denticles towards the apex (Fig. 2.16E). Nymphs measure up to about

6.0 mm with cerci about 4.0 mm. *Ephemerythus* nymphs are found on a variety of substrates (rocks, plants, roots, submerged logs and amongst litter in back water eddies). They occur in cool mountain streams, to warm lowland rivers, and generally prefer moderate to fast-flowing current.

Useful references

Demoulin (1964); Gillies (1960) (adult only); Kimmins (1955) (described as an unknown genus of Ephemerellidae); McCafferty & Wang (2000).

MACHADORYTHIDAE
(Figs 2.6A–F)

The family Machadorythidae (elevated to this status by McCafferty & Wang 2000), is represented by one species only: *Machadorythus maculatus*, which is widely distributed in the Afrotropics, including South Africa, but has not been reported from Madagascar. The nymphs have narrowly-set, dorsally-protruding eyes (Figs 2.6A & C) and terga 3–7 dorsally expanded, forming an open V-shaped compartment protecting the gills (Figs. 2.6 A, B). Mature nymphs are about 5.0 mm in length. Nymphs are apparently predatory and found on unstable substrates (sand, silt and organic detritus) in slow-flowing stretches of streams.

Useful references

Demoulin (1959), Elouard & Gillies (1989); McCafferty & Wang (2000).

TELOGANELLIDAE
(Figs 2.15A–C)

The family Teloganellidae is represented in the Afrotropics by an undescribed genus from Madagascar, where only a female adult has been collected. The family is also known from one species from Malaysia: *Teloganella umbrata*, the female adults of which show the same characteristics as the undescribed species from Madagascar. The Malaysian nymphs (Fig. 2.15A) apparently have a filamentous gill 1, an operculate gill 2, and lamellate gills on segments 2–5. The maxillary palps are absent (Fig. 2.15B), and the labial palps are three-segmented (Fig. 2.15C). The forefemora are expanded anteriorly and all femora are fringed with short, stout setae (Fig. 2.15A). Hindwing pads are present but small. The nymphs are moderately small (4.5–5.0 mm) (Wang et. al. 1995). Ecological information on this family is entirely lacking.

Useful references

McCafferty & Wang (2000).

TELOGANODIDAE
(Figs 2.13, 2.14A–F & 2.63–2.66)

Afrotropical members of the family Teloganodidae were originally placed as a subfamily, Teloganodinae, in the family Ephemerellidae. This was elevated to family level (McCafferty & Wang 1997). The Teloganodidae are Gondwanan in origin, and are currently represented by eight described genera from South Africa, the Orient and Australia (McCafferty & Wang 1997). In the Afrotropics the family is represented by four genera that are found primarily in the southern and southwestern region of the Cape, and an undescribed genus from Madagascar (Elouard et al. 2001). The Madagascan genus, *Manohyphella,* was originally placed in the Ephemerellidae (Allen 1973), but was subsequently moved to the Tricorythidae (McCafferty & Wang 1997). Some authors, however, still consider it to be a teloganodid (Elouard et al. 2001). In this guide it will, therefore, be considered under the Tricorythidae*.

Teloganodid nymphs are distinguished by the following characteristics: a posterior V-shaped medial notch and submedial lobes on the mesonotum (e.g. Figs. 2.14D, 2.63A, 2.64A); lateral, simple, filamentous gills that are generally present on abdominal segment 1 (Figs. 2.63A & C, 2.64A), and operculate (Fig. 2.64A) or semioperculate (Fig. 2.63A, 2.65A, 2.66A) gills 2; a hypognathous head, and a squat and somewhat dorsoventrally-flattened body. Mature male nymphs show subdivided compound eyes (e.g. Fig. 2.65A). Teloganodid nymphs are found in clean, fast-flowing mountain streams, and feed on periphyton and fine detritus (McCafferty & Wang 1997).

Ephemerellina Lestage, 1924
(Figs 2.65A & B)

The genus *Ephemerellina* is known only from one species: *E. barnardi* from the Western Cape. Its nymphs are distinguished by the presence of single, sharp dorsal abdominal tubercles (Fig. 2.65A) and semi-operculate gills on abdominal segments 2–6. Its claws have a single row of denticles (Fig. 2.65B). Mature nymphs measure up to 10.0 mm. Nymphs of *Ephemerellina* are found in moss on vertical rock faces of waterfalls of small mountain tributaries and on leaves of *Isolepis* (Cyperaceae) in swiftly-flowing acidic streams.

Useful references

McCafferty & Wang (1997).

* At the time of going to press it was, however, noted that McCafferty & Wang (2000) have now placed this genus in the Teloganodidae. In the Appendix it has been placed in the Teloganodidae.

Lestagella Demoulin, 1970
(Fig. 2.64)

The genus *Lestagella* is known from only one species, *L. penicillata*, from the southern and Western Cape. Its nymphs are distinguished by having the head anteriorly fringed with long setae (Fig. 2.64) and operculate gills on abdominal segment 2 (Fig. 2.64). Mature nymphs are relatively small, measuring about 8.0 mm, with cerci measuring about 0.4 mm. Nymphs inhabit fast-flowing streams, clinging to the underside of stones.

Useful references

Demoulin (1970); McCafferty & Wang (1997).

Lithogloea Barnard, 1932
(Figs 2.66)

The genus *Lithogloea* is known from only one species: *L. harrisoni*, from the southern and western Cape. Its nymphs are distinguished by the presence of broadly-based dorsal abdominal tubercles (Fig. 2.66) and filamentous gills on abdominal segment 1. Mature nymphs measure about 7.0 mm. Nymphs of *Lithogloea* are found in swift mountain streams among leaves of *Isolepis* (Cyperaceae).

Useful references

Barnard (1932); McCafferty & Wang (1997).

Nadinetella McCafferty & Wang, 1998
(Figs 2.63A–E)

The genus *Nadinetella* is known from two species: *N. brincki* and *N. crassi*, both from the South Western Cape. The nymphs of this genus are distinguished by the following combination of characteristics: lamellate, semi-operculate gills on abdominal segments 2–5; claws with two rows of denticles (Fig. 2.63B) and paired dorsal abdominal tubercles (Figs 2.63A & C), or terga with broad, straight margins or at least some terga with slightly bifurcated posteromedial protuberances (Figs 2.63D & E). Mature nymphs measure about 9.0 mm. Nymphs are found in moss growing on the rock faces of waterfalls and other lower-gradient biotopes in mountain streams.

Useful references

Allen & Edmunds (1963); McCafferty & Wang (1997, 1998).

CAENIDAE
(Figs 2.13 & 2.67–2.72)

The family Caenidae is found worldwide, but like most mayflies, they are not found on oceanic islands. The family is poorly known from Africa, and it is likely that several new genera await discovery. Seven genera are currently known from the Afrotropics, with one of these endemic to Madagascar. A further Madagascan genus awaits description (Elouard et al. 2001). Only three genera are recognized in South Africa, but further research will no doubt add to this. The fact that much current literature on African species focuses only on adults, while stream surveys tend to focus on nymphs, compounds problems relating to systematics, and adult and nymphal stages need to be correlated in order to clear up some of the confusion in the literature. The genus *Caenis* has the highest diversity of species amongst the African genera.

Caenidae are renowned for being small in size, reaching up to about 2.0–9.0 mm when mature. They are characterized by gill 1 being filamentous (Figs 2.13A & 2.70A), and gill 2 being large, square-shaped and operculate, usually with a prominent Y-shaped crest (Figs 2.13B, 2.68A & C, 2.69A, 2.70B, 2.71A, 2.72A) covering the remaining gills, which are usually fine and frilly in appearance (Fig. 2.70C). They do not have hindwing pads. The nymphs are often associated with conditions where there is little or no flow, such as in pools and ponds. In streams they are often found among the silty substrates of backwaters, or among aquatic vegetation, where they feed on fine particulate detritus and periphyton. Their bodies are often covered with small detrital particles.

Afrocaenis Gillies, 1982
(Figs 2.69A–E)

This genus is known from cool streams in the East African highlands (Kenya, Tanzania and Ethiopia), and is represented by two species. Adult males and mature male nymphs have very large eyes. Tarsal claws are long and slender, devoid of denticles (Fig. 2.69E). Mouthparts are characterized by maxillary palps being three segmented (Fig. 2.69B), and by the absence of setae along the outer margins of the mandibles (Fig. 2.69C). Gills 2 (Fig. 2.69A) are operculate with Y-shaped crests and upper surfaces with many small, stout setae, but no submarginal spine-like hairs. Nymphs of some species in this genus are very large, reaching about 9.0 mm in length.

Useful references

Gillies (1982).

Afrocercus Malzacher, 1987

Known only from the male imago, from Uganda.

Useful references
Malzacher (1987).

Barnardara McCafferty & Provonsha, 1995
(Figs 2.71A–E)

Barnardara nymphs belong to the so called 'brush-legged' Caenidae, because of the long hair-like setae on their forelegs that form a brush. In *Barnardara* these are arranged in a random fashion over the dorsal surface and along the inner margins of the tibiae and tarsi (Fig. 2.71E). The mandibles have four to seven long setae along the outer margins (Fig. 2.71C). The operculate gills (Fig. 2.71A) have the lateral and posterior margins fringed with broad, spatulate setae and the inner margins fringed with short, simple setae. The nymphs are small, only 2.5–3.0 mm in length. They are only known from the north eastern regions of South Africa, found in shallow, slow-flowing reaches of rivers over cobbled substrates interspersed with alluvial deposits. Only one species is currently known.

Useful references
Provonsha & McCafferty (1995).

Caenis Stephens, 1835
(Figs 2.70A–G)

This is by far the most common genus in the Afrotropics, with 35 described species, only three of which are known in South Africa. Four species are known in Madagascar. The nymphs usually have at least some denticulation on the claws (Fig. 2.70G), although these denticles can be can be very small and may sometimes be overlooked. The inner margins of the tibiae and tarsi are edged with stout spine-like setae (Fig. 2.70G). The size of the nymphs varies considerably between species. Many of the Afrotropical species are known only as adults.

Useful references
Barnard (1932); Demoulin (1970); Malzacher (1990, 1993, 1995).

Caenospella Gillies, 1977
(Figs 2.67A–E)

This genus is easily recognized by the absence of the Y-shaped crest on the operculate gills (Fig. 2.67A). The claws have many denticles, increasing in size from the base to the mid-section, where the denticles are

pronounced (Fig. 2.67E), the distal third being devoid of denticles so that the claw curves smoothly to a point. Only one species is known, from Lake Kalimawe (Tanzania), where nymphs shelter in papyrus. These are very small caenids, measuring just over 2.0 mm in length.

Useful references
Gillies (1977).

Clypeocaenis Soldán, 1978
(Figs 2.72A–E)

Clypeocaenis has a disjunct distribution, with one Africa species being known from Ghana and Upper Volta, the another being from KwaZulu-Natal. Other species are known from the Oriental region.

Like *Barnardara, Clypeocaenis* has 'brush-legs'. The hairs on *Clypeocaenis* are arranged in two distinct rows on the foretibiae (Fig. 2.72E), whereas those of *Barnardara* are randomly scattered (Fig. 2.71E). The mandibles of *Clypeocaenis* are also more setose than those of *Barnardara*, having two rows of long setae on the outer margin (Fig. 2.72C). The nymphs measure about 3.5–4.5 mm in length, with cerci measuring between 2.0–3.0 mm. In West Africa *Clypeocaenis* occurs in large, relatively rapidly-flowing rivers with stony bottoms (Soldán 1983). In South Africa it has been recorded from the Mgeni River (Provonsha & McCafferty 1995) from moderate- to steep-gradient reaches (determined from Brand et. al. 1967). On first describing the genus, Soldán (1978) deduced that the nymphs occur in rapidly-flowing water.

Useful references
Provonsha & McCafferty (1995); Soldán (1983).

Madecocercus Malzacher, 1995
(Figs 2.68A–H)

Known only from Madagascar, this genus has a number of distinctive characteristics: the body is covered with hairs; the margins of the head, thorax, abdomen, legs and operculate gills are fringed with long, hairlike setae (Fig. 2.68A); the tarsal claws are strongly hooked and lack denticles (Fig. 2.68H); gill 1 is filiform (Fig. 2.68B), gill 2 is operculate and trapezium-shaped (Fig. 2.68C), and gills 3–6 are without marginal filaments (Figs 2.68D & E); abdominal segments have well-developed posterolateral projections, which are particularly pronounced on segments 2, 6 & 7 in mature nymphs (Fig. 2.68A), and the maxillae are without palps (Fig. 2.68F). The cerci have well developed setae on their basal third. Nymphs measure about 5.0–6.0 mm, with cerci 2.5–3.0 mm. Nothing has been reported on the

feeding behaviour or habitat preferences of nymphs in this genus.

Useful references

Elouard et al. (2001); Elouard & Sartori (2001); Malzacher (1995); McCafferty & Wang (1995, 2000).

EPHEMERIDAE
(Figs 2.10, & 2.73–2.74)

The family Ephemeridae is known from all continents except Australia. There are five known genera in the Afrotropics, but the presence of one of these is doubtful (see discussion under *Palingenia)*. At one time *Palingenia* and *Cheirogenesia* were placed in the family Palingeniidae, but McCafferty (1991) placed them in the subfamily Palingeniinae within the Ephemeridae.

Ephemeridae nymphs are similar to those of the family Polymitarcyidae (see below), but are distinguished by having apically-divergent mandibular tusks (Figs 2.10A & B), a frontal process with diverse morphologies (Figs 2.10B, 2.73B & 2.74A, C, D & E) and a process on the tibiae of the posterior legs (Fig. 2.10D). Gills 2–7 consist of two elongate lamellae with fringed margins (Figs 2.10A & C & 2.73A). Mature nymphs measure from 12.0–32.0 mm (McCafferty 1981). Ephemerid nymphs are primarily found in lentic waters, burrowing in silt, sand-silt, sand-gravel and silt-clay substrates. They feed on particles, and some may directly ingest sediment.

Afromera Demoulin, 1955a
(Figs 2.74C)

This genus is known from the Orient and the Afrotropics, but is absent from Madagascar. *Afromera* is currently represented by three species in West Africa, one in the Congo, one in Uganda and one in South Africa. Only *A. evae*, from Gambia, is known from the nymphal stage, and it is distinguished by the presence of a concave frontal process (Fig. 2.74C) and poorly-developed mandibular tusks (Fig. 2.74C). Mature nymphs measure 11.0–13.0 mm, with cerci 4.0–4.5 mm. Nymphs of *Afromera* burrow in silt substrates in perennially warm, lentic waters.

Useful references

Elouard (1986b) (adults only); McCafferty & Gillies (1979).

Cheirogenesia Demoulin, 1952
(Figs 2.73B & C)

The genus *Cheirogenesia* is endemic to Madagascar, known from three species. Its nymphs are distinguished by the presence of an apically-serrate

frontal process on the head (Fig. 2.73B) and socketed spurs on the outer margins of the mandibular tusks (Fig. 2.73C) (below the heavily sclerotized apex). Nymphs measure about 20.0–23.0 mm, with cerci measuring 7.0 mm. The nymphs burrow in soft silt substrates in warm, lentic waters.

Useful references

McCafferty & Edmunds (1976); Sartori & Elouard (1999) (adults only).

Eatonica Navás, 1913
(Figs 2.74A & B)

The genus *Eatonica* is widespread in the Afrotropics, with four species from Africa and two described from Madagascar. The only described nymph is the presumed nymph of *E. schoutedeni* (Navás) from Africa, and despite considerable collecting effort, only one nymph (currently undescribed) has been found in a forest zone in Madagascar (Elouard et al. 1998). The nymphs are distinguished from those of other Afrotropical ephemerids by the convex frontal process on the head (Fig. 2.74A). Nymphal size has not been established, but an adult female of *E. schoutedeni* measures 12 mm (Barnard 1932).

Useful references

Demoulin (1968); Elouard (1986a) (adults only); Elouard et al. (1998) (adults only).

Ephemera Linnaeus, 1758
(Figs 2.74D, E & F)

Although the genus *Ephemera* is widespread in the Holarctic and the Orient, its only representative in the Afrotropics is the species *E. mooiana*, reported from KwaZulu-Natal, South Africa. Since its original description as *Eatonica schoutedeni* (in part: Crass 1947), *E. mooiana* has not been collected again, despite intensive collecting effort (Conor Cahill pers. comm., University of Natal, Pietermaritzburg). It is therefore likely that the species is extinct.

The tentative association of the nymph with the male adult has not yet been confirmed by rearing. Nymphs of *Ephemera* are fairly similar to those of *Afromera* (see above) in that they have a concave frontal process on the head (Fig. 2.74D & E), but differ in having well-developed mandibular tusks (Fig. 2.74D, E & F). The precise habitat requirements of *E. mooiana* are not known, but nymphs of *Ephemera* generally burrow in sand, sand-gravel or sand-silt substrates, and are found in waters that are not perennially warm and with more flow than those in which *Afromera*

occurs. The nymphs of *E. mooiana* measure up to 29.0 mm, with cerci measuring 9.0 mm, and the median caudal filament 11.0 mm (Crass 1947).

Useful reference

Crass (1947); McCafferty (1971); McCafferty & Gillies (1979).

Palingenia Burmeister, 1839
(Figs 2.73A)

The genus *Palingenia* has a Palearctic distribution. The record from the Afrotropics consists of a doubtfully-assigned species (*P. apatris*) from Liberia, which is known only from male adults. In any case, nymphs of *Palingenia* elsewhere are distinguished by having the mandibular tusks laterally with large, somewhat irregular denticles (Fig. 2.73A). The known nymphs of *Palingenia* are among the largest mayflies, measuring up to about 32.0 mm. They burrow in clay substrates in lentic waters.

Useful references

Demoulin (1965).

POLYMITARCYIDAE
(Figs 2.9A–D & 2.75–2.76)

The family Polymitarcyidae is pantropical in distriubution, but is not found in Australia. Three genera are found in Africa, and one in Madagascar. Its nymphs are most similar to those of the family Ephemeridae, but differ in having the mandibular tusks apically convergent (Figs. 2.75A, 2.76A, F, H) and in lacking frontal process on the head and a tibial process on the posterior legs (Fig. 2.9D). Polymitarcyid nymphs are usually found in slow-flowing waters, either in burrows in hard substrates—such as wood—or interstitially in substrates such as silt, silt-gravel or clay.

Afroplocia Lestage, 1939
(Figs 2.76A–C)

The genus *Afroplocia* is known from only one species: *A. sampsoni*, from KwaZulu-Natal. Although the association of the nymphal and adult stages has not been confirmed through rearing, it appears that the assigned nymph indeed belongs to *A. sampsoni.* The nymph is distinguished from those of other polymitarcyids by the following characteristics: mandibular tusks as long as, or slightly longer than, the head and pronotum combined, with thick rows of long setae laterally and medially (Fig. 2.76A); caudal filaments at least as long as the abdomen, with setae along three-quarters of their length, and a reduced gill 1 with subequal lamellae (Fig. 2.76B).

Details of the habitat requirements of the nymphs of *A. sampsoni* remain unknown, but it appears that they are found interstitially in mixed substrates.

Useful references
Barnard (1940); Crass (1947).

Ephoron Williamson, 1802
(Figs 2.76H–K)

The genus *Ephoron* is found in the Holarctic, Orient and Afrotropics. In the Afrotropics, it is represented by only one described species: *E. savignyi*, which is apparently widely distributed throughout tropical Africa. It has been suggested, based on observation of specimens in the British Museum, that there may actually be more than one species (Conor Cahill, pers. comm.). *Ephoron* nymphs are distinguished from those of other Afrotropical polymitarcyids by having robust mandibular tusks with short spines laterally and dorsally (Fig. 2.76H & K). Mature nymphs measure about 16.0 mm, with cerci about 6.0 mm (Crass 1947). Nymphs occur in U–shaped burrows, with each arm of the U about 3.2 mm long, along river banks, among dense clay-silt substrate (F.C. de Moor pers. comm., Albany Museum, Grahamstown) where conditions are suitable.

Useful references
Crass (1947); Demoulin (1952)

Exeuthyplocia Lestage, 1918
(Figs 2.75B & C)

The genus *Exeuthyplocia* is known from one species only: *E. minima*, which is widely distributed in central Africa. Its nymphs are similar to those of *Afroplocia*, but differ from the latter species in having unequal gills 1 (Fig. 2.75B). Mature nymphs may measure up to about 15.0 mm. Details of the habitat requirements of *E. minima* remain uncertain.

Useful references
Gillies (1980b).

Povilla Navás, 1912
(Figs 2.76D–G)

The genus *Povilla* is known from one species only: *P. adusta*, which is widespread and common from central Africa south to KwaZulu-Natal. Its nymphs are distinguished by having short, robust mandibles that are medially

denticulate (Figs. 2.76D, F, G). Mature nymphs measure about 10.0–16.0 mm, with cerci about 4.0–6.0 mm. Nymphs of *P. adusta* are found in lentic waters, and burrow into clay and hard substrates such as wood. Nymphs are known to secrete a silk-like substance to line their burrows. They are filter-feeders, creating a feeding current in their burrows by means of gill movements (Hartland-Rowe 1953), and feeding largely on microscopic algae (Kimmins 1949).

Useful references

Corbet (1957); Demoulin (1956a, b); Hartland-Rowe (1953, 1958).

Proboscidoplocia Demoulin, 1966
(Figs 2.75A)

The genus *Proboscidoplocia* is endemic to Madagascar. They are large mayflies, adult males reaching an average size of about 20.0 mm,although Elouard et al. (2001) indicate that some females of some species reach a length of 7.0 cm. Of the eight known species, only one—*P. sikorai*—is known from the nymphal stage. Its nymphs are similar to those of *Afroplocia* and *Exeuthyplocia,* but the mandibular tusks (Fig. 2.75A) are as long as the length of the head and thorax combined, and the caudal filaments are shorter than the abdomen and setaceous along the whole length. The nymphs occur mainly in forest streams along the east coast and the upper basins of western Madagascar.

Useful references

Demoulin (1966b); Elouard & Sartori (1997) (adults only); Elouard et al. (1999) (adults and ecology); Elouard et al. (2001); Sartori et al. (1999) (adult females and egg morphology).

LEPTOPHLEBIIDAE
(Figs 2.77–2.86)

The family Leptophlebiidae, or 'prong gills', has a worldwide distribution, but attain their highest diversity in the tropics. In the Afrotropics, the family is represented by 16 genera. The nymphs of different species within this genus are easily distinguished by their gills; gill 1 may be filamentous (Figs 2.82A; 2.85A & B), operculate (Fig. 2.83A), apically cleft (Fig. 2.83D), or entirely absent; gills 2–6 or 7 are double, and are either lanceolate (Figs 2.78A & B), or lamellate with pointed projections (Figs 2.79C–G), or lamellate with multiple finger-like projections (Fig. 2.80A). The cerci of Leptophlebiidae nymphs are usually widely spread, with the medial filament slightly longer than the cerci.

Leptophlebiid nymphs generally occur in flowing waters, but some species occur in standing water, and are associated with rocks, gravel and woody debris or roots along stream banks. Leptophlebiidae nymphs are brushers, scrapers, or collector-gatherers, feeding largely on detritus, and a few are shredders, feeding on leaf fragments (Palmer 1998).

The genera *Fulleta* and *Ulmerophlebia* are known from adults only. As a consequence, they are not considered in the key above or in the generic treatment below.

Adenophlebia Eaton 1881
(Figs 2.81A–E)

The genus *Adenophlebia* has a widespread distribution in the Afrotropics and is represented by six species, four of which occur in South Africa. It has not been reported from Madagascar. Its nymphs are distinguished by having well-tracheated gills on segments 1–7 with similar lamellae that taper off to a point in the last apical quarter (Figs 2.81A–C), claws with denticles increasing progressively in size apically, and an enlarged apical denticle (Fig. 2.81E). Mature nymphs measure between 9.0 and 13.0 mm. Nymphs usually occur on stones, and can tolerate a range of flow conditions, from still pools to more fast-flowing water.

Useful references

Barnard (1932); Crass (1947); Peters & Edmunds (1964).

Adenophlebiodes Eaton, 1881
(Figs 2.83A–C)

The genus *Adenophlebiodes* is represented by eight species in the Afrotropics, with two species in South Africa, but has not been reported from Madagascar. Its nymphs are distinguished by having large, operculate gills on abdominal segment 1 (Fig. 2.83A). Mature nymphs measure between 9.0–10.0 mm, with cerci 15–20 mm. Nymphs of *Adenophlebiodes* tend to be found in relatively deep pools with floating detritus and vegetation.

Useful references

Agnew (1961); Crass (1947); Elouard-Hideux & Elouard (1991c) (adults only); Peters & Edmunds (1964).

Aprionyx Barnard, 1932
(Figs 2.79A–G)

The genus *Aprionyx* is known from southern Africa only, where eight species are known. Its nymphs are distinguished by having edentate tarsal

claws (Fig. 2.79A) and lamellate gills with branched tracheae (Figs 2.79C–G). Nymphs of *Aprionyx* can measure up to 16.0 mm with cerci up to 20.0 mm. They occur under large stones in fast-flowing water and in pools in mountain streams, and are often associated with patches of natural forest.

Useful references
Barnard (1932); Crass (1947); Peters & Edmunds (1964).

Castanophlebia Barnard, 1932
(Figs 2.78A–D)

The genus *Castonophlebia* is known from only two species: *C. albicauda* and *C. calida,* which are endemic to southern Africa. Both are common in mountain streams throughout South Africa and Lesotho. The nymphs are distinguished by having long, slender lanceolate gills that taper gradually towards the apex (Fig. 2.78A & B). Mature nymphs measure up to 11.0 mm, with cerci between 15.0 and 18.0 mm. Nymphs prefer fast-flowing waters and have been observed on the rock faces of small waterfalls.

Useful references
Barnard (1932, 1940); Crass (1947); Peters & Edmunds (1964).

Choroterpes Eaton, 1881
(Figs 2.84A–F)

The genus *Choroterpes* has a worldwide distribution. In the Afrotropics, the genus is represented by two species only, *C. ndebele* and *C. nigrescens,* both from South Africa. The nymphs are distinguished by having the shape of gill 1 varying from long and slender to narrow-lamellate with a long point (Figs 2.84A–C) and gills 2–7 apically with three processes, with the medial process being much longer than the apico-lateral processes, which appear as little more than rounded lateral extensions (Fig. 2.84D) (more pronounced in *C. ndebele*—not illustrated). Nymphs measure up to 10.0 mm, with cerci 12.5–17.5 mm. Nymphs of *Choroterpes* are found under stones in a wide variety of flowing-water regimes.

Useful references
Agnew (1962b); Barnard (1932); Peters & Edmunds (1964, 1970).

Euthraulus Barnard, 1932
(Figs 2.85A–E)

The genus *Euthraulus* occurs in Europe and Asia, and is widespread in the Afrotropics, including the Comoros Islands. It has not yet been recorded from Madagascar. There are eight known Afrotropical species, one of

which (*E. elegans*) is widespread in South Africa. Its nymphs are distinguished by having gill 1 long and slender (Fig. 2.85A & B) and gills 2–7 apically with three slender, subequal processes (Fig. 2.85C). Nymphs of *Euthraulus* measure about 7.0 mm, with cerci 8.0–10 mm. They occur in stony-bottomed streams, preferring slow-flowing waters and tolerating stillwater conditions.

Useful references

Barnard (1932); Demoulin (1970); Peters & Edmunds (1964, 1970).

Fulletomimus Demoulin, 1956
(Figs 2.86A–D)

Originally described only in the adult stage from the Democratic Republic of the Congo (Demoulin 1956a), but a questionably-associated nymph has been described by Demoulin (1956b). It is distinguished by its gills having the lamellae with two deep clefts apically, terminating in three apical processes (Fig. 2.86A). The posterolateral margins of abdominal segments 3–7 have well developed single spines, while segments 8 and 9 are produced to form double-pointed biacuminate) spines (Fig. 2.86B). Nymphs measure 4.6 mm in length, and the cerci 5.5 mm (Demoulin 1956b). The nymphs of this species are considered to be lacustrine.

Useful references

Demoulin (1956b).

Hagenulodes Ulmer, 1919
(Figs 2.77A–C)

The genus *Hagenulodes* is known from one species only—*H. braueri* from the Seychelles. Its nymphs are distinguished by having gills 1–7 that have unbranched tracheae (Fig. 2.77A), the upper portion of the gill being narrow-lamellate, the lower portion being a filamentous projection. Details of the habitat requirements of *H. braueri* remain unknown.

Useful references

Peters & Edmunds (1966).

Hyalophlebia Demoulin, 1955
(Figs 2.83D–G)

The genus *Hyalophlebia* is known from central and southern Africa only. Of the four species known to date, only one (*H. patriciae*) is known from the nymphal stage. Its nymphs are distinguished by having gill 1

broad and apically cleft (Fig. 2.83D), and gills 2–7 that are similar to gill 1 in most respects, but have two lamellae (Fig. 2.83E & F). Nymphs of *H. patriciae* measure about 9.5 mm in length, and are found on stones in slow-flowing streams.

Useful references
Agnew (1962b).

Maheathraulus Peters, Gillies & Edmunds, 1964
(Figs 2.82A–D)

The genus *Maheathraulus* is known from one species only: *M. scotti*, from the Seychelles. Its nymphs are distinguished by the having gill 1 filamentous (Fig. 2.82A) and gills 2–7 long and slender, with a bifurcation in the basal one-third (Fig. 2.82B). Interestingly, unlike the nymphs of most other species, the ovipositor is visible in the female nymphs of *Maheathraulus* (Fig. 2.82C). Nymphs of *M. scotti* are found under small stones in streams with moderate flows.

Useful references
Peters & Edmunds (1964).

Nesophlebia Peters & Edmunds, 1964
(Figs 2.81H & I)

The genus *Nesophlebia* is known from one species only: *N. adusta*, from Madagascar. Its nymphs are distinguished by lacking the first pair of gills and by having gills 2–7 long and slender and deeply forked from the basal third (Fig. 2.81H), sometimes with small setae on the gill tips. Nymphs of *Nesophlebia* are found under large stones and among gravel in fast-flowing streams.

Useful references
Peters & Edmunds (1984).

Petersophlebia Demoulin, 1973
(Figs 2.81F–G)

The genus *Petersophlebia* is known from two species only: *P. inequalis* and *P. insularis*, both from Madagascar. The gills of nymphs in this genus are narrowly- or broadly-rounded apicolaterally, with short medial processes apically (Figs 2.81F). Nymphs are about 9.0 mm long. Details of the habitat requirements of the nymphs remain unknown.

Useful references
Demoulin (1955b, 1973); Peters & Edmunds (1964).

Polythelais Demoulin, 1973
(Figs 2.80A & B)

The genus *Polythelais* is known from one species only: *P. digitata*, from Madagascar. Its nymphs are distinguished by the broadly lamellate gills with four to six short processes distally and branched tracheae (Fig. 2.80A). Mature nymphs measure about 10.0 mm, with cerci about 10.0 mm. Details of the habitat requirements of the nymphs of this species remain unknown.

Useful references

Demoulin (1973).

Thraulus Eaton, 1881
(Figs 2.82E–G)

The genus *Thraulus* is known from the Afrotropical, Oriental and Palaearctic regions. In the Afrotropics, it is known from central Africa and the Comoros Islands. Its nymphs are distinguished by having gill 1 with different dorsal and ventral lamellae (Fig. 2.82E) and gills 2–7 with similar dorsal and ventral lamellae, both with fringed margins (Fig. 2.82F). Mature nymphs measure up to about 9.0 mm, males being larger than females. Nymphs of some species of *Thraulus* are found under stones in fast-flowing mountain streams, while those from other species are lacustrine, being found along lake shores.

Useful references

Peters, Gillies & Edmunds (1964); Peters & Edmunds (1964, 1970).

PROSOPISTOMATIDAE
(Fig. 2.6)

The family Prosopistomatidae is known only from one genus: *Prosopistoma*, which has been reported from the Afrotropics, Australia, the Orient and Europe. In the Afrotropics, the genus is widespread, represented by four described species, one of which occurs in Madagascar. Another four species from southern Africa await description (Barber-James In Press), one from Guinea (Elouard pers. Comm: Institute de Recherche pour le Developpment, Montpellier, France) and three from Madagascar (Elouard, pers. comm). Prosopistomatidae nymphs are minute, measuring up to about 3.0 mm, with short cerci of less than 1.0 mm. They are therefore easily overlooked in the field, but are easily distinguished by having fused nota that form a carapace-like structure covering the legs and

gills from dorsal view. Prosopistomatid nymphs are found on stones at the edge of riffle areas, and under boulders on bedrock in fairly swift current.

Useful references

Barber-James (In Press); Gillies (1954).

ACKNOWLEDGEMENTS

A number of people (listed in alphabetical order by surname) are acknowledged for generously giving of their time to help with various queries related to the production of this chapter: Jean-Mark Elouard, Jean-Luc Gattolliat, Patrick McCafferty, Arwin Provonsha, Alain Thomas and Michel Sartori. Thanks also to Nancy Bonsor, Sylvia de Moor, and Nikki Kőhly for helping with the drawings; the Water Research Commission for providing funding; the Department of Sport, Recreation, Arts and Culture (Bisho, South Africa) for continued funding of the Albany Museum, and Illovo Sugar for donating ethanol for the maintainance of the material in the collection.

The Albany Museum is an associated Research Institute of Rhodes University.

USEFUL REFERENCES

AGNEW, J.D. 1961. New Transvaal leptophlebiid (Ephem.). *Novos Taxa Entomológicos* **26**: 1–9.

AGNEW, J.D. 1962a. The distribution of *Centroptiloides bifasciata* (E.-P.) (Baëtidae: Ephem.) in Southern Africa, with ecological observations on the nymphs. *Hydrobiologia* **20**: 367–372.

AGNEW, J.D. 1962b. New Leptophlebiidae (Ephem.) from the Transvaal. *Archiv für Hydrobiologie* **58**: 358–366.

AGNEW, J.D. 1973. Two new species of *Oligoneuriopsis* Crass from the Republic of South Africa (Oligoneuriidae: Ephemeroptera). *In:* Peters, W.L. & Peters, J.G. (Eds.). *Proceedings of the First International Conference on Ephemeroptera.* E. J. Brill, Leiden, Netherlands: 114–121.

ALLAN, J.D. 1995. *Stream Ecology: Structure and Function of Running Waters.* Chapman & Hall, London, England.

ALLEN, R.K. 1973. New Ephemerellidae from Madagascar and Afghanistan. *The Pan-Pacific Entomologist* **49**: 160–164.

ALLEN, R.K. & EDMUNDS, G.F. Jr. 1963. New and little known Ephemerellidae from southern Asia, Africa and Madagascar. *Pacific Insects* **5**(1): 11–22.

BARBER-JAMES, H. M. & McCAFFERTY, W. P. 1997. Review and a new species of the African genus *Acanthiops* (Ephemeroptera: Baetidae). *Annales de Limnologie* **33**: 85–92.

BARBER-JAMES, H.M. (In Press). The biogeography of the Prosopistomatidae, with a particular emphasis on southern African species. *In*: Gaino, E. (Ed). *Proceedings of the X International Conference on Ephemeroptera, XIV International Symposium on Plecoptera.* Perugia, Italy.

BARNARD, K.H. 1932. South African may-flies (Ephemeroptera). *Transactions of the Royal Society of South Africa* **20**: 201–259.

BARNARD, K.H. 1940. Additional records and descriptions of new species of South African alder-flies (Megalopetera), may-flies (Ephemeroptera), caddis-flies (Trichoptera), stone-flies (Perlaria) and dragon-flies (Odonata). *Annals of the South African Museum* **32**: 609–661.

BRAASCH, D. & SOLDÁN, T. 1986. Die Heptageniidae des Gombak River in Malaysia (Ephemeroptera). *Reichenbachia* **24**(3): 41–52.

BRAND, P.A.J., KEMP, P.H., PRETORIUS, S.J & SCHOONBEE, H.J. 1967. *Water Quality and Abatement of Pollution in Natal Rivers*. Part II. Survey of the three rivers region. Natal Town and Regional Planning Report 13.

BRITTAIN, J.E. 1982. Biology of mayflies. *Annual Review of Entomology* **27**: 119–147.

CHUTTER, F.M. 1998. *Research on the Rapid Biological Assessment of Water Quality Impacts in Streams and Rivers*. Water Research Commission Report No. 422/1/98.

CORBET, P.S. 1957. Duration of the aquatic stages of *Povilla adusta* Navás (Ephemeroptera: Polymitarcyidae). *Bulletin of Entomological Research* **48** (2): 243–250.

CRASS, R.S. 1947. The may-flies (Ephemeroptera) of Natal and the Eastern Cape. *Annals of the Natal Museum* **11**: 37–110.

CROSSKEY, R.W. & WHITE, G.B. 1977. The Afrotropical Region. A recommended term in zoogeography. *Journal of natural History* **11**: 541–544.

CSIRO entomology web site: http://www.ento.csiro.au/education/insects/ephemeroptera/families.html.

DEMOULIN, G. 1952. Contribution a l'étude des Ephoronidae Euthyplociinae (Insectes Éphéméroptères). *Institut royal des Sciences naturelles de Belgique. Bulletin.* **28**: 1–22.

DEMOULIN, G. 1954. Description préliminaire d'un type larvaire nouveau d'Ephéméroptères Tricorythidae du Congo Belge. *Bulletin de l'Institut Royale des Sciences Naturelles, Belgique* **30**(6): 1–4.

DEMOULIN, G. 1955a. *Afromera* gen. nov., Ephemeridae de la fauna Éthiopienne (Ephemeroptera). *Bull. Ann. Soc. Roy. Ent. Belg,* **91** (11–12): 291–295.

DEMOULIN, G. 1955b. *Atalophlebioides inequalis* sp. nov. Ephéméroptère Leptophlebiidae nouveau de Madagascar. *Bulletin de l'Institut Royale des Sciences Naturelles, Belgique* **31**(15): 1–4.

DEMOULIN, G. 1956a. Quelqes Éphéméroptères du Kivu. *Bulletin et Annales de la Société Royale Entomologiqie de Belge* **92**: 277–284.

DEMOULIN, G. 1956b. Ephemeroptera. Exploration hydrobiologique du Lac Tanganika [sic] (1946-1947). *Resultats Scientifiques* **3**(7): 3–24.

DEMOULIN, G. 1957. New species of the genus *Dicercomyzon* Demoulin

(Ephemeroptera, Fam. Tricorythidae). *Bulletin of the British Museum (Natural History) Entomology* **6**(5): 129–136.

DEMOULIN, G. 1959. Une curieuse larve d'éphéméroptère de l'Angola portugais. *Bulletin et Annales de la Société Royale Entomologiqie de Belge* **95**: 249–252.

DEMOULIN, G. 1964. Parc National de l'Upemba, Mission G.F. de White–Ephemeroptera. *Inst. Parcs nationaux Congo et Rwanda* **68**(2): 13–27.

DEMOULIN, G. 1965. Contribution a l'étude des Palingeniidae (Insecta, Ephemeroptera). *Nova Guinea, Zoology* **33**: 305–344.

DEMOULIN, G. 1966a. Quelques Éphéméroptères nouveaux de Madagascar. *Annales de la Société Entomologique de France, Nouvelle Serie* **2**: 711–717.

DEMOULIN, G. 1966b. Contribution a l'étude des Euthyplociidae Ephemeroptera) Un nouveau genre de Madagascar. *Annales de la Société Entomologique de France, Nouvelle Serie* **2**: 941–949.

DEMOULIN, G. 1968. Les larves des Ephemeridae (Ephemeroptera) d'Afrique. *Bulletin de l'Institut Royale des Sciences Naturelles, Belgique* **44**: 1–3.

DEMOULIN, G. 1970. Ephemeroptera des faunes ethiopienne et malgache. *South African Animal Life* **14**: 24–170.

DEMOULIN, G. 1973. Éphéméroptères de Madagascar. III. *Bulletin de l'Institut Royale des Sciences Naturelles, Belgique* **49**: 1–20.

DEMOULIN, G. 1981. Chapter 18: Éphéméroptères. *In*: Durand, J.-R. & Lévêque, C. (Eds). *Flora et Faune aquatiques de'l Afrique sahelo-soudanienne.* Vol. 2. ORSTOM. Paris: 407–443.

EDMUNDS, G.F., Jr., JENSEN, S.L. & BERNER, L. 1976. The mayflies of North and Central America. University of Minneapolis Press, Minneapolis.

EDMUNDS, G.F., Jr., & McCAFFERTY, W.P. 1988. The mayfly subimago. *Annual Review of Entomology* **33**: 509–529.

ELOUARD, J.-M. 1986a. Éphémères d'Afrique de l'Ouest: le genre *Eatonica* (Éphémèridae). *Revue d'Hydrobiologie tropicale* **19**(2): 87–92.

ELOUARD, J.-M. 1986b. Éphémères d'Afrique de l'Ouest: le genre *Afromera* (Ephemeridae). *Revue d'Hydrobiologie tropicale* **19**(3-4): 169–176.

ELOUARD, J.-M. & GILLIES, M.T. 1989. West African Ephemeroptera. The genus *Machadorythus* (Tricorythidae). *Aquatic Insects* **11**(1): 1–10.

ELOUARD, J.-M., GILLIES, M.T. & WUILLOT, J. 1990. Ephemeroptera from West Africa: the genus *Pseudopannota* (Baetidae). *Revue d'Hydrobiologie Tropicale* **23**(1): 27–39.

ELOUARD, J.-M. & HIDEUX, P. 1991a. Éphémères d'Afrique de l'ouest: deux nouvelles espèces du genre *Pseudopannota* (Ephem. Baetidae). *Bulletin de la Société Entomologique de France* **95**: 247–252.

ELOUARD, J.-M. & HIDEUX, P. 1991b. Mayflies of West Africa. *Thraulobaetdes,* an atypical new genus of crawling Baetidae. *In:* Alba-Tercedor, J. & Sánchez-Ortega, A. (Eds.). *Overview and strategies of Ephemeroptera and* B. *Plecoptera.* Sandhill Crane Press, Gainesville, Florida: 169–174.

ELOUARD J.-M. & OLIARINONY, R., 1997. Biodiversité aquatique de Madagascar. 6—*Madecassorythus* un nouveau genre de Tricorythidae définissant la nouvelle sous-famille des Madecassorythinaes (Ephemeroptera, Pannota). *Bulletin de la Société Entomologique de France* **102**(3): 225–232.

ELOUARD J.-M., OLIARINONY R. & SARTORI, M. 1998. Biodiversitè aquatique de Madagascar. 9. Le genre *Eatonica* Navás (Ephermeroptera, Ephemeridae). *Mitteillung der Schweizerischen Entomologischen Gesellschaft / Bulletin de la Société Entomologique Suisse* **71**: 1–9.

ELOUARD J.-M. & SARTORI, M., 1997. Aquatic biodiversity of Madagascar, *Proboscidoplocia* a singular plural (Ephemeroptera: Polymitarcyidae: Euthyplociinae). *In*: Landolt, P. & Sartori, M. (Eds). Ephemeroptera and Plecoptera—Biology, Ecology, Systematics, *MTL-Mauron-Tinguem & Lachat S.A.*, Fribourg: 439–448.

ELOUARD & J.-M. & SARTORI, M., 2001. A revision of the Malagasy genus *Madecocercus* Malzacher, 1995 (Ephemeroptera, Caenidae). *Bulletin de la Société Vaudoise des Sciences Naturelles* **87**(3): 229–235.

ELOUARD, J.-M., SARTORI, M, GATTOLLIAT, J.-L. & OLIARIINONY, R. 1999. *Proboscidoplocia* (Ephemeroptera: Polymitarcyidae) from and around the Réserve Naturelle Intégrale d'Andohahela and surrounding areas, with a description of a new species. *In*: Goodmann (Ed): A floral and faunal inverntory of the Réserve Naturelle Intégrale d'Andohahela, Madagascar. *Fieldiana Zoology*. Chicago. **94**: 111–114.

ELOUARD J.-M, SARTORI, M., GATTOLLIAT, J.-L. & OLIARINONY, R. 2001. Travaux d'inventaire et de systematique. Ordere des Ephemeropteres. *In:* Elouard J.-M. & Gibon, F.-M. (Eds). *Biodiversité et Biotypologie des Eaux Continentales de Madagascar*. IRD, CNRE, LRSAE.

ELOUARD-HIDEUX, P. & ELOUARD, J.-M. 1991. Mayflies of West Africa: the adults of the subgenus *Adenophlebiodes* s.s (Ephemeroptera: Leptophlebiidae). *Aquatic Insects* **13** (3): 133–150.

GATTOLLIAT, J.-L. 2000. Three new species of *Afroptiloides* (Insecta: Ephemeroptera) and first report of this genus from Madagascar. *Mitteillung der Schweizerischen Entomologischen Gesellschaft / Bulletin de la Société Entomologique Suisse* **73**: 305–315

GATTOLLIAT, J.-L. 2001a. The genus *Cloeodes* (Ephemeroptera: Baetidae) in Madagascar. *Revue Suisse de Zoologie* **108**: 387–402.

GATTOLLIAT, J.-L. 2001b. *Rheoptilum*: a new genus of two tailed Baetidae (Ephemeroptera) from Madagascar. *Aquatic Insects* **23**: 67–81.

GATTOLLIAT, J.-L. 2001c. Six new species of *Labiobaetis* Novikova & Kluge (Ephemeroptera: Baetidae) from Madagascar with comments on the validity of the genus. *Annales Limnologie* **37**(2): 97–123.

GATTOLLIAT, J.-L. 2002a. Three new Malagasy species of *Xyrodromeus* (Ephemeroptera: Baetidae) with the first generic description of the adults. *Revue Suisse de Zoologie* **109**(2): 325–341.

GATTOLLIAT, J.-L. 2002b. Two new genera of Baetidae (Ephemeroptera: Insecta) from Madagascar. *Aquatic Insects* **24**(2): 143–159.

GATTOLLIAT, J.-L. 2002c. A new species of *Pseudopannota* (Baetidae: Ephemeroptera) from Madagascar. *Bulletin de la Société Vaudoise de Science Naturelle* **88**(1): 19–29.

GATTOLLIAT, J.-L. 2003. The genera *Demoulinia* Gillies and *Potamocloeon* Gillies (Ephemeroptera: Baetidae) in Madagascar. *Zootaxa* **184**: 1–18.

GATTOLLIAT, J.-L. (In Press). The genus *Cloeon* (Insecta: Ephemeroptera) in Madagascar. *Mitteillung der Schweizerischen Entomologischen Gesellschaft/ Bulletin de la Société Entomologique Suisse.*

GATTOLLIAT, J.-L. & SARTORI, M. 1998. Two new species of *Herbrossus* (Ephemeroptera: Baetidae) from Madagascar with the first generic description of the adults. *Annales de Limnologie* **34**: 305–314.

GATTOLLIAT, J.-L. & SARTORI, M. 1999a. A new species of *Afrobaetodes* (Ephemeroptera: Baetidae) and first report of this genus Madagascar. *Annales de Limnologie* **35**: 179–184.

GATTOLLIAT, J.-L. & SARTORI, M. 1999b. Revision of the Malagasy genus *Nesoptiloides* (Ephemeroptera, Baetidae). *Mitteillung der Schweizerischen Entomologischen Gesellschaft / Bulletin de la Société Entomologique Suisse* **72**: 23–30.

GATTOLLIAT, J.-L. & SARTORI, M. 2000a. Contribution to the systematics of the genus *Dabulamanzia* (Ephemeroptera: Baetidae) in Madagascar. *Revue Suisse de Zoologie* **107**: 561–577.

GATTOLLIAT, J.-L. & SARTORI, M. 2000b. *Guloptiloides:* an extraordinary new carnivorous genus of Baetidae (Ephemeroptera). *Aquatic Insects* **22** (2): 148–159.

GATTOLLIAT, J.-L., SARTORI, M. &. ELOUARD, J-M. 1999. Aquatic biodiversity from Madagascar 12: three new species of Baetidae (Ephemeroptera) from the Réserve Naturelle Intégrale d'Andohahela. *Fieldiana.* Field Museum, Chicago **94**: 115–124.

GILLIES, M.T. 1954. The adult stages of *Prosopistoma* Latreille (Ephemeroptera), with descriptions of two new species from Africa. *Transactions of the Royal Entomological Society of London.* **105**: 355–372.

GILLIES, M.T. 1960. A new genus of Tricorythidae (Ephemeroptera) from East Africa. *Proceedings of the Royal Entomological Society of London.* **29**(3-4): 35–40.

GILLIES, M.T. 1974. Three new species of *Elassoneuria* (Ephemeroptera: Oligoneuriidae) from tropical Africa. *Journal of Entomology* **43**(1): 73–82.

GILLIES, M.T. 1977. A new genus of Caenidae (Ephemeroptera) from East Africa. *Journal of Natural History* **11**: 451–455.

GILLIES, M.T. 1980a. An introduction to the study of *Cloeon* Leach (Baetidae, Ephemeroptera) in West Africa. *Bulletin de l'I.F.A.N* **42**(1): 135–156.

GILLIES, M.T. 1980b. The African Euthyplociidae (Ephemeroptera subfam. n.). *Aquatic Insects* **2**(4): 217–224.

GILLIES, M.T. 1982. A second large-eyed genus of Caenidae (Ephemeroptera) from Africa. *Journal of Natural History* **16**: 15–22.

GILLIES, M.T. 1985. A preliminary account of the East African species of *Cloeon* Leach and *Rhithrocloeon* gen. n. (Ephemeroptera). *Aquatic Insects* **7** (1): 1–17.

GILLIES, M.T. 1988. Descriptions of the nymphs of some Afrotropical Baetidae (Ephemeroptera). I. *Cloeon* Leach and *Rhithrocloeon* Gillies. *Aquatic Insects* **10** (1): 49–59.

GILLIES, M.T. 1990a. A revision of the African species of *Centroptilum* Eaton (Baetidae, Ephemeroptera). *Aquatic Insects* **12** (2): 97–128.

GILLIES, M.T. 1990b. A new genus for the Afrotropical mayfly, *Cloeon dentatum* Kimmins (Ephem., Baetidae). *Entomologist's Monthly Magazine* **126**: 207–208.

GILLIES, M.T. 1991a. A diphyletic origin for the two-tailed baetid nymphs occurring in east African stony streams with a description of the new genus and species *Tanzaniella spinosa* gen. nov. sp. nov. *In:* Alba-Tercedor, J. & Sánchez-Ortega, A. (Eds) *Overview and Strategies of Ephemeroptera and Plecoptera.* Sandhill Crane Press, Gainesville, Florida: 175–187.

GILLIES, M.T. 1991b. New records and a new species of *Afrobaetodes* Demoulin (Baetidae, Ephemeroptera) from Tanzania. *Revue d'Hydrobiologie Tropicale.* **24**(2): 105–110.

GILLIES, M.T. & ELOUARD, J.-M. 1990. The mayfly-mussel association, a new example from River Niger basin. *In:* Campbell, J.C. (Ed.) *Mayflies and Stoneflies.* Kluwer Academic Publishers, Dordrecht, The Netherlands: 289–297.

GILLIES, M.T., ELOUARD, J.-M. & WUILLOT, J. 1990. Ephemeroptera from West Africa: the genus *Ophelmatostoma* (Baetidae). *Revue d'Hydrobiologie Tropicale* **23** (2): 115–120.

HARTLAND-ROWE, R. 1953. Feeding mechanism of an Ephemeropteran nymph., *Nature*, London. **172**: 1109–1110.

HARTLAND-ROWE, R. 1958. The biology of a tropical mayfly *Povilla adusta* Navás (Ephemeroptera: Polymitarcyidae), with special reference to the lunar rhythm of emergence. *Revue de Zoologie et de Botanique Africaines* **58**: 185–202.

HUBBARD, M.D. 1990. *Mayflies of the World. A Catalogue of the Family and Genus Group Taxa (Insecta: Ephemeroptera).* Flora and Fauna Handbook No. 8. Sandhill Crane Press, Inc. Florida.

JACOBUS, L.M. & MCCAFFERTY, W.P. 2001. Contribution to the systematics of *Afrobaetodes* Demoulin (Ephemeroptera: Baetidae). *African Entomology* **9** (2): 97–103.

KIMMINS, D.E. 1949. Ephemeroptera from Nyasaland, with descriptions of new species. *Annals and Magazine of Natural History* **12**(1): 825–836.

KIMMINS, D.E. 1955. Ephemeroptera from Nyasaland with descriptions of three new species and some interesting nymphal forms. *Annals and Magazine of Natural History* (London) **12** (8): 859-880.

KIMMINS, D.E. 1956. New species of Ephemeroptera from Uganda. *Bulletin of the British Museum (Natural History) Entomology* **4**: 71–87.

KIMMINS, D.E. 1957. New species of *Dicercomyzon* Demoulin (Ephemeroptera, fam. Tricorythidae). *Bulletin of the British Museum (Natural History) Entomology* **6**(5): 129–136.

LUGO-ORTIZ, C.R., BARBER-JAMES, H.M, MCCAFFERTY, W.P. & DE MOOR, F.C. 2001. A non-paraphyletic classification of the Afrotropical genus *Acanthiops* Waltz & McCafferty (Ephemeroptera: Baetidae) *African Entomology* **9**(1): 1–15.

LUGO-ORTIZ, C.R. & DE MOOR, F.C. 2000. *Nigrobaetis* Novikova & Kluge (Ephemeroptera: Baetidae): first record and new species from southern Africa,

with reassignment of one northern African species. *African Entomology* **8**(1): 69–73.

LUGO-ORTIZ, C.R., DE MOOR, F.C. & BARBER-JAMES, H.M. 2000. A taxonomic and ecological review of *Pseudocloeon glaucum* (Agnew) (Ephemeroptera: Baetidae). *African Entomology* **8**(2): 281–288.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1996a. *Crassabwa:* a new genus of small minnow mayflies (Ephemeroptera: Baetidae) from Africa. *Annales de Limnologie* **32**: 235–240.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1996b. The composition of *Dabulamanzia,* a new genus of Afrotropical Baetidae (Ephemeroptera), with descriptions of two new species. *Bulletin de la Société d'Histoire Naturelle, Toulouse* **132**: 7–13.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1996c. The *Bugilliesia* complex of African Baetidae (Ephemeroptera). *Transactions of the American Entomological Society* **122**: 175–197.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1997a. Contribution to the systematics of the genus *Cheleocloeon* (Ephemeroptera: Baetidae). *Entomological News* **108**: 283–289.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1997b. A new genus and redescriptions for African species previously placed in *Acentrella* (Ephemeroptera: Baetidae). *Proceedings of the Entomological Society of Washington* **99**: 429–439.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1997c. *Edmulmeatus grandis:* an extraordinary new genus and species of Baetidae (Insecta: Ephemeroptera) from Madagascar. *Annales de Limnologie* **33**: 191–195.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1997d. *Labiobaetis* Novikova & Kluge (Ephemeroptera: Baetidae) from the Afrotropical region. *African Entomology* **5**: 241–260.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1997e. *Maliqua*: a new genus of Baetidae (Ephemeroptera) for a species previously assigned to *Afroptilum. Entomological News* **108**: 367–371.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1997f. New Afrotropical genus of Baetidae (Insecta: Ephemeroptera) with bladelike mandibles. *Bulletin de la Société d'Histoire Naturelle, Toulouse* **133**: 41–46.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1997g. New species and first species reports of the genera *Cheleocloeon, Dabulamanzia,* and *Mutelocloeon* (Insecta: Ephemeroptera: Baetidae) from Madagascar. *Bulletin de la Société d'Histoire Naturelle, Toulouse* **133**: 47–53.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1998a. The *Centroptiloides* complex of Afrotropical small minnow mayflies (Ephemeroptera: Baetidae). *Annals of the Entomological Society of America* **91**: 1–26.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1998b. A new *Baetis*-complex genus (Ephemeroptera) from the Afrotropical region. *African Entomology* **6**(2): 297–301.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1998c. New species of *Cloeon* and *Demoulinia* (Ephemeroptera: Baetidae) from Madagascar. *Entomological News* **109**: 357–362.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1998d. Phylogeny and Biogeography of *Nesydemius*, n. gen., and related Afroptropical genera (Insecta: Ephemeroptera: Baetidae). *Bulletin de la société d'Histoire Naturelle, Toulouse* **134**: 7–12.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 1999. *Delouardus*, a new *Centroptiloides* complex genus from Madagascar and its relationship with *Cheleocloeon* Wuillot & Gillies (Ephemeroptera: Baetidae). *African Entomology* **7**(1): 63–66.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 2000. Global biodiversity of the mayfly family Baetidae (Ephemeroptera): a generic perspective. *Trends in Entomology* **2**: 45–54.

LUGO-ORTIZ, C.R. & McCAFFERTY, W.P. 2001. A new species of *Dicentroptilum* (Ephemeroptera: Baetidae) from Kenya. *Entomological News* **112**(1): 52–55.

LUGO-ORTIZ, C.R., McCAFFERTY, W.P & GATTOLLIAT, J.-L. 1999a. The small minnow mayfly genus *Cloeodes* Traver (Ephemeroptera: Baetidae) in Madagascar. *Proceedings of the Entomological Society of Washington* **101**: 208–211.

LUGO-ORTIZ, C.R., McCAFFERTY, W.P. & WALTZ, R.D. 1999b. Definition and reorganization of the genus *Pseudocloeon* (Ephemeroptera: Baetidae) with new species descriptions and combinations. *Transactions of the American Entomological Society* **125**: 1–37.

MALZACHER, P. 1987. Eine neue Caenidae—Gattung *Afrocercus* gen. nov. und Bemerkungen zu *Tasmanocaenis tillyardi* (Insecta: Ephemeroptera). *Stuttgarter Beiträge zur Naturkunde* Ser. A (Biologie) **407**(10): 1–10.

MALZACHER, P. 1990. Caenidae der äthiopischen Region (Insecta: Ephemeroptera). Teil 1. Beschreibung neuer Arten. *Stuttgarter Beiträge zur Naturkunde* Ser. A (Biologie) **454**(28): 1–28.

MALZACHER, P. 1993. Caenidae der äthiopischen Region (Insecta: Ephemeroptera). Teil 2. Systematische Zusammenstellung aller bisher bekannten Aten. *Mitteilung der Schweizerischen Entomoligischen Gesellschaft / Bulletin de la Société Entomologique Suisse* **66**: 379–416.

MALZACHER, P. 1995. Caenidae from Madagascar (Insecta: Ephemeroptera). *Stuttgarter Beiträge zur Naturkunde* Ser. A (Biologie) **530**(12): 1–12.

McCAFFERTY, W.P. 1971. New burrowing mayflies from Africa (Ephemeroptera: Ephemeridae). *Journal of the Entomological Society of Southern Africa* **34**: 57–62.

McCAFFERTY, W.P. 1981. *Aquatic Entomology: the Fishermen's and Ecologists' Illustrated Guide to Insects and their Relatives*. Jones & Bartlett Publishers, Boston, Massachusetts.

McCAFFERTY, W.P. 1991. Toward a phylogenetic classification of the Ephemeroptera (Insecta): a commentary on systematics. *Annals of the Entomological Society of America.* **84** (4): 343–360.

McCAFFERTY, W.P. 2000. New Baetidae (Insecta: Ephemeroptera) from Lake Malawi. *Bulletin de la Société d'Histoire Naturelle, Toulouse* **136**: 65–72.

McCAFFERTY, W.P. 2003. Mayfly Central. The Mayflies of North America. http:// www.entm.purdue.edu/entomology/research/mayfly.

McCAFFERTY, W.P. & EDMUNDS, G.F, JR 1973. Subgeneric Classification of *Ephemera* (Ephemeroptera:Ephemeridae). *The Pan-Pacific Entomologist* **49** (4): 300–307.

McCAFFERTY, W.P. & EDMUNDS, G.F, Jr. 1976. The larvae of the Madagascar genus *Cheirogenesia* Demoulin (Ephemeroptera: Palingeniidae). *Systematic Entomology* **1**: 189–194.

McCAFFERTY, W.P. & GILLIES, M.T. 1979. The African Ephemeridae Ephemeroptera). *Aquatic Insects* **1**: 169–178.

McCAFFERTY, W.P., LUGO-ORTIZ, C.R. & BARBER-JAMES, H.M. 1997. *Micksiops,* a new genus of small minnow mayflies (Ephemeroptera: Baetidae) from Africa. *Entomological News* **108**: 363–366.

McCAFFERTY, W.P. & WALTZ, R.D. 1995. *Labiobaetis* (Ephemeroptera: Baetidae): new status, new North American species, and related new genus. *Entomological News* **106:** 19–28.

McCAFFERTY, W.P. & WANG, T.Q. 1995. A new genus and species of Tricorythidae (Ephemeroptera: Pannota) from Madagascar. *Annales de Limnologie* **31**: 179–183.

McCAFFERTY, W.P. & WANG, T.Q. 1997. Phylogenetic systematics of the family Teloganodidae. *Annals of the Cape Provincial Museums Natural History* **19**: 387–437.

McCAFFERTY, W.P. & WANG, T.Q. 1998. New name for a generic homonym in Teloganodidae (Ephemeroptera). *Entomological News* **109**: 344.

McCAFFERTY, W.P. & WANG, T.Q. 2000. Phylogenetic systematics of the major lineages of pannote mayflies (Ephemeroptera: Pannota). *Transactions of the American Entomological Society* **126**: 9–101.

MERRITT, R.W. & CUMMINS, K.W. 1996. An Introduction to the Aquatic Insects of North America. (3rd ed..). Kendall/Hunt publishing company, Dubuque, Iowa.

OLIARINONY R. & ELOUARD J.-M. 1997. Biodiversité aquatique de Madagascar: 7—*Ranorythus*, un nouveau genre de Tricorythidae définissant la nouvelle sous-famille des Ranorythinae (Ephemeroptera, Pannota). *Bulletin de la Société entomologique de France* **102**(5): 439–447.

OLIARINONY R., ELOUARD J.-M. & RABERIAKA N.H, 1998a. Biodiversité aquatique de Madagascar. 8. *Spinirythus* un nouveau genre de Tricorythidae (Ephemeroptera Pannota). *Bulletin de la Société entomologique de France* **103** (3): 237–244.

OLIARINONY R., ELOUARD J.-M. & RABERIAKA N.H, 1998b—Biodiversité aquatique de Madagascar. 19. Neuf nouvelles espèces de *Tricorythus* Eaton (Ephemeroptera Pannota, Tricorythidae). *Revue Française d'Entomologie (N.S.)* **20** (3): 73–90.

OLIARINONY, R., SARTORI, M. & ELOUARD, J.-M., 2000. Première description des larves et des oeufs du genre malgache *Madecassorythus* (Ephemeroptera, Tricorythidae). *Mitteillung der Schweizerischen Entomologischen Gesellschaft / Bulletin de la Société Entomologique Suisse.* **73**: 369–378.

PALMER, C.G. 1998. Setae and Microtrichia: Structures for Fine-Particle Feeding in Aquatic Larvae. *Microscopic Anatomy of Invertebrates. Vol. 11A: Insecta.* 289–302.

PESCADOR, M.L. & ELOUARD, J.-M., In Press. New generic status of *Madeconeuria* from Madagascar (Ephemeroptera: Oligoneuriidae). *In*: Gaino, E. (Ed.). *Proceedings of the X International Conference on Ephemeroptera, XIV International Symposium on Plecoptera.* Perugia, Italy.

PETERS, W. L. & CAMPBELL, I. C. 1991. Chapter 16: Ephemeroptera (Mayflies). *In: The Insects of Australia.* (2nd ed.) Vol. 1. CSIRO Australia: 279–293.

PETERS, W. L. & EDMUNDS, G. F., JR. 1964. A revision of the generic classification of the Ethiopian Leptophlebiidae (Ephemeroptera). *Transactions of the Royal Entomological Society of London* **116**: 225–253.

PETERS, W. L. & EDMUNDS, G. F., JR. 1966. The nymph of *Hagenulodes* Ulmer (Ephemeroptera: Leptophlebiidae). *Proceedings of the Royal Entomological Society of London (B)* **35**: 26–28.

PETERS, W. L. & EDMUNDS, G. F., JR. 1970. Revision of the generic classification of the Eastern Hemisphere Leptophlebiidae. *Pacific Insects* **12**: 157–240.

PETERS, W. L. & EDMUNDS, G. F., JR. 1984. A redescription and phylogenetic relationships of *Nesophlebia* (Ephemeroptera, Leptophlebiidae, Atalophlebiinae). *In:* Landa, V., Soldán, T. & Tonner, M. (Eds.). *Proceedings of the Fourth International Conferences on Ephemeroptera.* Czechoslovac Academy of Sciences, Ceske Budejovice: 27–35.

PETERS, W.L., GILLIES, M.T. & EDMUNDS, G.F., JR. 1964. Two new genera of mayflies from the Ethiopian and Oriental regions (Ephemeroptera: Leptophlebiidae). *Proceedings of the Royal Entomological Society of London* (B) **33**: 117–124.

PROVONSHA, A.V. 1990. A revision of the genus *Caenis* in North America (Ephemeroptera: Caenidae). *Transactions of the American Entomological Society* **116**(4): 801–884.

PROVONSHA, A.V. & McCAFFERTY, W.P. 1995. New Brushlegged Caenid Mayflies from South Africa (Ephemeroptera: Caenidae). *Aquatic Insects* **17** (4): 241–251.

RIEK, E.F. 1970. Fossil History. *In: The Insects of Australia.* A Textbook for Students and Research Workers. CSIRO, Melbourne University Press: 168–186.

SARTORI, M. & ELOUARD, J.-M. 1996. New Heptageniidae (Insecta: Ephemeroptera) from the Réserve Naturelle Intégrale d'Andringitra, Madagascar. *In:* Goodman, S.M. (Ed). A Floral and Faunal Inventory of the Eastern Slopes of the Réserve Naturelle Intégrale d'Andringitra, Madagascar: with reference to Elevational Variation. *Fieldiana* **85**: 121–130.

SARTORI, M. & ELOUARD, J.-M. 1999. Biodiversité aquatique de Madagascar 30: le genre *Cheirogenesia* Demoulin, 1952 (Ephemeroptera, Palingeniidae). *Revue Suisse de Zoologie* **106**(2): 325–337.

SARTORI, M., ELOUARD, J.-M. & RUFFIEUX, L. 1997. Biogeography and biodiversity of malagasy mayflies (Ephemeroptera): the genus of *Cheirogenesia* (Palingeniidae). *Proceedings of the 20th International Congress of Entomology*, Firenze, Italy. August 24–31.

SARTORI, M., ELOUARD, J.-M., RUFFIEUX, L. & L'EPLATTENIER, G. 1999. Description des femelles et morphologie des oeufs de quelques espèces de *Proboscidoplocia* (Ephemeroptera, Ephemeroidea). *Bulletin de la Société Entomologique Suisse* **72**: 55–63.

SARTORI, M., GATTOLLIAT, J.-L., OLIARINONY, R. &. ELOUARD, J-M. 2000. Biogeography of Malagasy Mayflies (Insecta, Ephemeroptera): preliminary results. *In:* Lourenço, W.R. & Goodman, S.M. (Eds) *Diversité et Endémisme à Madagascar. Mémoire de la Société de Biogéographie, Paris:* 307–317

SCHOONBEE, H.J. 1967. A new record of *Compsoneuriella njalensis* (Kimmins) (Ephemeroptera: Heptageniidae) from South Africa. *Journal of the Entomological Society of South Africa* **29**: 151–156.

SCHOONBEE, H.J. 1968. A revision of the genus *Afronurus* Lestage Ephemeroptera: Heptageniidae) in South Africa. *Memoirs of the Entomological Society of Southern Africa* **10**: 1–61.

SOLDÁN, T. 1977. Three new species of mayflies (Ephemeroptera) from the mist oasis of Erkwit, Sudan. *Acta Entomologica Bohemoslovaca* **74**: 289–294.

SOLDÁN, T. 1978. New genera and species of Caenidae (Ephemeroptera) from Iran, India and Australia. *Acta Entomologica Bohemoslovaca* **75**: 119–129.

SOLDÁN, T. 1983. Two new species of *Clypeocaenis* (Ephemeroptera: Caenidae) with a description of adult stge and biology of the genus. *Acta Entomologica Bohemoslovaca* **80**: 196–205.

SOLDÁN, T. & THOMAS, A.G.B. 1983. New and little-known species of mayflies (Ephemeroptera) from Algeria. *Acta Entomologica Bohemoslovaca* **80**: 667–670.

WALTZ, R.D. & McCAFFERTY, W.P. 1987. New genera of Baetidae Ephemeroptera) from Africa. *Proceedings of the Entomological Society of Washington* **89**: 95–99.

WALTZ, R. D. & McCAFFERTY, W. P. 1994. *Cloeodes* (Ephemeroptera: Baetidae) in Africa. *Aquatic Insects* **16**: 165–169.

WANG, T.-Q. & McCAFFERTY, W.P. 1996. New diagnostic characters for the mayfly family Baetidae (Ephemeroptera). *Entomological News* **107**(4): 207–212.

WANG, T.-Q., McCAFFERTY, W.P. & EDMUNDS, G.F. Jr. 1995. Larva and Adult of *Teloganella* (Ephemeroptera: Pannota) and assessment of Familial Classification. *Annals of the Entomological Society of America* **88**: 324-327.

WARD, J.V. 1992. *Aquatic Insect Ecology 1. Biology and Habitat*. John Wiley & Sons, New York.

WUILLOT, J. & GILLIES, M.T. 1993a. *Cheleocloeon,* a new genus of Baetidae (Ephemeroptera) from West Africa. *Revue d'Hydrobiologie Tropicale* **26**(3): 213–217.

WUILLOT, J. & GILLIES, M. T. 1993b. New species of *Afroptilum* (Baetidae, Ephemeroptera) from West Africa. *Revue d'Hydrobiologie Tropicale* **26**(4): 269–277.

WUILLOT, J. & GILLIES, M.T. 1994. *Dicentroptilum,* a new genus of mayflies (Baetidae, Ephemeroptera) from Africa. *Aquatic Insects* **16**(3): 133–140.

CHAPTER 2: APPENDIX

CHECKLIST OF AFROTROPICAL EPHEMEROPTERA

This checklist includes all known species, and their synonyms, from the Afrotropical region as defined by Crosskey & White (Fig. 2.1). Several species awaiting description have not been included. Readers are advised to check the following website for periodic revisions of the list given below:
http://www.ru.ac.za/academic/departments/zooento/Martin/EphemeropteraAfrica.html.
Note that in the list below, the current valid names of the species (indicated by •) are followed by subordinate names (indicated by ○) when these exist. The subordinate names are followed by an abbreviation in parentheses, indicating their status. All names, valid or subordinate, are followed by the actual author of that name and the date that the name was published. The authors responsible for the current names are indicated at the end of each list. (Adapted after McCafferty 2003).

Definitions of abbreviations and terms used:
(comb.) combination: a name recombined with a generic name different from the original.
(dub.) nomen dubium: a name that is of dubious status in that it cannot presently be determined what the species named as such actually is; although all nomina dubia have a generic name associated with them, some of them cannot actually be placed to any genus with confidence due to the lack, or loss of, original material on which the names were based.
(hom.) homonym: the name (as the unique combination of genus and species names) is or becomes the same as one used for another species at an earlier time; the subordinate homonym, therefore, had to be replaced with a new name.
(id.) misidentification: another valid species (not a subordinate name) with which the species has incorrectly been associated in the past.
(orig.) original: the original name, including the original name in its correct form, if it has been changed from an incorrectly formed name.
(renam.) renamed: a new name given because the original or recombination of the original is a secondary homonym (the same as that which has been given to another species previously).
(spell.) spelling: a misspelled or incorrect form of the name.
(stat.) status: represents a change from species to subspecies status within the same species.
(syn.) synonym: another name that was proposed independently for the same species. Normally, the earliest published name takes priority.
(in part): some of the members of this species were originally described as another species.
[sic]: name written as stated by author, even though incorrect
†: extinct

Suborder PISCIFORMA
Superfamily SIPHLONUROIDEA
Family **BAETIDAE**

1. Genus ***Acanthiops***
- *Acanthiops cooperi* (Gillies & Wuillot, 1997)
  - *Platycloeon cooperi* Gillies & Wuillot, 1997 (orig.)
  - *Acanthiops cooperi* Lugo-Ortiz & McCafferty, 1998 (comb.)
- *Acanthiops delphinae* (Gattolliat, 2000) [Madagascar]
  - *Afroptiloides delphinae* Gattolliat, 2000 (orig.)
  - *Acanthiops delphinae* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops elgonensis* Lugo-Ortiz &McCafferty 1998
  - *Centoptilum* sp. no. 3. Demoulin 1964 (syn.)
  - *Acanthiops elgonensis* Lugo-Ortiz & McCafferty 1998 (orig.)
  - *Afroptiloides elgonensis* Gillies 1999 (comb.)
  - *Acanthiops elgonensis* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops erepens* (Gillies, 1990)
  - *Baetis cataractae* Crass, 1947 (in part)
  - *Baetis* sp. A. Kimmins, 1955 (in part)
  - *Afroptilum erepens* Gillies, 1990 (orig.)
  - *Platycloeon erepens* Gillies & Wuillot, 1997 (comb.)
  - *Acanthiops erepens* Lugo-Ortiz & McCafferty, 1998 (comb.)
- *Acanthiops faro* Barber-James & McCafferty, 2001
- *Acanthiops griffithsi* Lugo-Ortiz &McCafferty 1998
  - *Afroptiloides griffithsi* Gillies 1999 (orig.)
  - *Acanthiops griffithsi* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops io* Lugo-Ortiz & McCafferty, 2001
- *Acanthiops marlieri* (Demoulin, 1967)
  - *Centroptilium marlieri* Demoulin 1967 (orig.)
  - *Acanthiops marlieri* Waltz & McCafferty, 1987 (comb.)
- *Acanthiops namorona* (Gattolliat, 2000) [Madagascar]
  - *Afroptiloides namorona* Gattolliat, 2000 (orig.)
  - *Acathiops namorona* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops spinosum* (Gattolliat, 2000) [Madagascar]
  - *Afroptiloides spinosum* Gattolliat, 2000 (orig.)
  - *Acanthiops spinosum* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops tsitsa* Barber-James & McCafferty, 1997
  - *Afroptiloides tsita* [sic] Gillies, 1999 (spell.)
  - *Acanthiops tsitsa* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops variegatus* (Gillies, 1991)
  - *Afroptilum variegatum* Gillies, 1991 (orig.)
  - *Acanthiops variegatus* Barber-James & McCafferty, 1997 (comb.)
  - *Afroptiloides variegatum* [sic]Gillies, 1999 (comb.)
  - *Acanthiops variegatus* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops varius* (Crass, 1947)
  - *Centroptilum varium* Crass, 1947 (orig.)
  - *Acentrella* sp. Demoulin, 1956 (syn.)
  - *Afroptilum (Afroptiloides) varium* Gillies, 1990 (comb.)
  - *Acanthiops varius* McCafferty & de Moor, 1995 (comb.)
  - *Acanthiops tsitsa* Lugo-Ortiz & McCafferty, 1998 (id.)
  - *Afroptiloides varium* [sic] Gillies, 1999 (comb.)
  - *Acanthiops varius* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)
- *Acanthiops zomba* Lugo-Ortiz & McCafferty, 1998
  - *Acentrella* sp. A. Kimmins, 1955 (syn.)
  - *Baetis* sp. A. Kimmins, 1955 (in part) (syn.)
  - *Centroptilum* sp. A. Demoulin, 1970 (syn.)
  - *Afroptilum (Afroptiloides)* sp. A. Gillies, 1990 (syn.)
  - *Acanthiops zomba* Lugo-Ortiz & McCafferty, 1998 (orig.)
  - *Afroptiloides njombae* [sic.] Gillies, 1999. (comb., spell.)
  - *Acanthiops zomba* Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (comb.)

2. Genus ***Afrobaetodes*** Demoulin, 1970
- *Afrobaetodes berneri* Demoulin, 1970
- *Afrobaetodes delicatissimus* (Barnard, 1932)
  - *Cloeon delicatissimum* Barnard, 1932 (orig.)
  - *Afrobaetodes delicatissimus* Gillies, 1979 (comb.)

- *Afrobaetodes intermedius* Lugo-Ortiz & McCafferty, 1996
- *Afrobaetodes lenae* Gattolliat & Sartori, 1999 [Madagascar]
- *Afrobaetodes pugio* Gillies, 1991
- *Afrobaetodes pusillus* (Navás, 1930)
  - *Cloeon pusillus* Navás, 1930 (orig.)
  - *Afrobaetodes pusillus* Gillies, 1979(comb.)

3. Genus ***Afroptilum*** Gillies, 1990
- *Afroptilum biarcuatum* (Kopelke, 1980)
  - *Centroptilum biarcuatum* Kopelke, 1980 (orig.)
  - *Afroptilum biarcuatum* Gillies, 1990 (comb.)
- *Afroptilum bicorne* (Ulmer, 1909)
  - *Centroptilum bicorne* Ulmer, 1909 (orig.)
  - *Afroptilum bicorne* Gillies, 1990 (comb.)
- *Afroptilum boettgeri* (Kopelke, 1980)
  - *Centroptilum boettgeri* Kopelke, 1980 (orig.)
  - *Afroptilum boettgeri* Gillies, 1990 (comb.)
- *Afroptilum confusum* Lugo-Ortiz & McCafferty, 1998 [Madagascar]
- *Afroptilum dicentrum* (Demoulin, 1956)
  - *Centroptilum dicentrum* Demoulin, 1956 (orig.)
  - *Afroptilum dicentrum* Gillies, 1990 (comb.)
- *Afroptilum gilberti* Gattolliat & Sartori, 1999 [Madagascar]
- *Afroptilum lepidum* Lugo-Ortiz & McCafferty, 1998 [Madagascar]
- *Afroptilum mathildae* Gattolliat & Sartori, 1999 [Madagascar]
- *Afroptilum parvum* (Crass, 1947)
  - *Centroptilum parvum* Crass, 1947 (orig.)
  - *Afroptilum parvum* Gillies, 1990 (comb.)
- *Afroptilum sudafricanum* (Lestage, 1924)
  - *Centroptilum sudafricanum* Lestage, 1924 (orig.)
  - *Centroptilum montanum* Kimmins, 1960 (syn.)
  - *Afroptilum sudafricanum* Gillies, 1990 (comb.)

4. Genus ***Baetis*** Leach, 1815
- *Baetis aeneus* Navàs, 1936
- *Baetis harrisoni* Barnard, 1932
- *Baetis lawrencei* Crass, 1947
- *Baetis magae* (Barnard, 1932)
  - *Pseudocloeon magae* Barnard, 1932 (orig.)
  - *Baetis magae* Gillies, 1994 (comb.)
- *Baetis monikae* Kopelke, 1980
- *Baetis parvulus* Crass, 1947
- *Baetis permultus* Kopelke, 1980
- *Baetis pseudogemellus* Soldàn, 1977
- *Baetis spatulatus* Gillies, 1994
- *Baetis tripunctatus* Gillies, 1994

5. Genus *Barnumus* Lugo-Ortiz & McCafferty, 1998
- *Barnumus editus* McCafferty & Lugo-Ortiz, 1998

6. Genus ***Bugilliesia*** Lugo-Ortiz &McCafferty, 1998
- *Bugilliesia grisea* (Gillies, 1990)
  - *Afroptilum griseum* Gillies, 1990 (orig.)
  - *Bugilliesia grisea* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Bugilliesia guineensis* (Gillies, 1990)
  - *Afroptilum guineensis* Gillies, 1990 (orig.)
  - *Bugilliesia guineensis* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Bugillesia nitida* (Ulmer, 1916)
  - *Centroptilum nitidum* Ulmer, 1916 (orig.)
  - *Cloeon nigroalbum* Navás, 1932 (syn.)
  - *Cloeon bredoanum* Navás, 1933 (syn.)
  - *Centroptilum nitidum* Demoulin, 1957 (comb.)
  - *Bugillesia nitida* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Bugilliesia notabilis* (Kimmins, 1956)
  - *Centroptilum notabile* Kimmins, 1956 (orig.)
  - *Afroptilum notabile* Gillies, 1990 (comb.)
  - *Bugilliesia notabilis* Lugo-Ortiz & McCafferty, 1996 (comb.)

- *Bugilliesia sudanensis* (Ulmer, 1916)
  - *Centroptilum sudanense* Ulmer, 1916 (orig.)
  - *Afroptilim sudanense* Gillies, 1990 (comb.)
  - *Bugilliesia sudanensis* Lugo-Ortiz & McCafferty, 1996 (comb.)

7. Genus ***Centroptiloides*** Lestage, 1918
- *Centroptiloides bifasciata* (Esben-Petersen, 1913)
  - *Centroptilum bifasciatum* Esben-Petersen, 1913 (orig.)
  - *Centroptiloides bifasciatus* Lestage, 1918 (comb.)
  - *Centroptiloides bifasciatum* Ulmer, 1920 (renam.)
  - *Haplobaetis umbratus* Navás, 1922 (syn.)
  - *Centroptiloides bifasciata* Navás, 1922 (renam.)
  - *Centroptiloides marginata* Lestage, 1924 (syn.)
  - *Centroptiloides collarti* Navás, 1930 (syn.)
  - *Centroptiloides umbratus* Lestage, 1945 (syn.)
  - *Centroptiloides bifasciatum* (form *hyalinum*) Crass, 1947 (stat.)
  - *Centroptiloides bifasciata* (form *marginata*) Demoulin, 1957 (stat.)

8. Genus ***Cheleocloeon*** Wuillot & Gillies, 1993
- *Cheleocloeon carinatum* Wuillot, 1993
- *Cheleocloeon dimorphicum* (Soldàn & Thomas, 1985)
  - *Centroptilum dimorphicum* Soldàn & Thomas, 1985 (orig.)
  - *Afroptilum dimorphicum* Gillies, 1990 (comb.)
  - *Cheleocloeon dimorphicum* Lugo-Ortiz & McCafferty, 1997 (comb.)
- *Cheleocloeon excisum* (Barnard, 1932)
  - *Centroptilum excisum* Barnard, 1932 (orig.)
  - *Afroptilum excisum* Gillies, 1990 (comb.)
  - *Cheleocloeon excisum* Lugo-Ortiz & McCafferty, 1997 (comb.)
- *Cheleocloeon falcatum* (Crass, 1947)
  - *Centroptilum falcatum* Crass 1947 (orig.)
  - *Afroptilum falcatum* Gillies 1990 (comb.)
  - *Cheleocloeon falcatum* Lugo-Ortiz & McCafferty 1998 (comb.)
- *Cheleocloeon littorale* McCafferty, 2000
- *Cheleocloeon madagascariense* Gattolliat (*in press*) [Madagascar]
- *Cheleocloeon mirandei* Lugo-Ortiz & McCafferty, 1997 [Madagascar]
- *Cheleocloeon yolandae* Wuillot, 1993

9. Genus ***Cloeodes*** Traver 1938
- *Cloeodes bicoloratus* Gattolliat, 2001 [Madagascar]
- *Cloeodes inzingae* (Crass, 1947)
  - *Pseudocloeon inzingae* Crass 1947 (orig.)
  - *Pseudocloeon saxophilus* Agnew 1961 (syn.)
  - *Baetis inzingae* Gillies 1994 (comb.)
  - *Baetis saxophilus* Gillies 1994 (comb.)
  - *Cloeodes inzingae* Waltz & McCafferty 1994 (comb.)
  - *Cloeodes saxophilus* de Moor & McCafferty 1996 (syn.)
- *Cloeodes freitagae* Gattolliat, 2001 [Madagascar]
- *Cloeodes portabilis* Lugo-Ortiz & McCafferty, 1999 [Madagascar]
- *Cloeodes pseudogladius* Gattolliat, 2001 [Madagascar]

10. Genus ***Cloeon*** Leach 1815
- *Cloeon aeneum* Barnard, 1932
- *Cloeon agnewi* Hubbard, 1973
  - *Austrocloeon exiguum* Crass 1947 (*nec* Navás 1918) (orig.)
  - *Cloeon exiguum* Demoulin 1970 (comb.)
  - *Cloeon agnewi* Hubbard 1973 (hom, renam.)
- *Cloeon amaniensis* Gillies, 1985
- *Cloeon areolatum* Navàs, 1930
- *Cloeon bellum* Navàs, 1931
- *Cloeon cambouei* Navàs, 1930 [Madagascar] (*nomen dubium* - Lugo-Ortiz & McCafferty, 1998)
- *Cloeon chaplini* Barnard, 1932
- *Cloeon crassi* Agnew, 1961
  - *Austrocloeon* sp. A. Allanson, 1961 (syn.)
- *Cloeon durani* Navás, 1926 [Madagascar]
  - *Cloeon durani* Navás, 1926 (orig.)
  - *Cloeon waterloti* Demoulin, 1966 (syn.)
  - *Cloeon durani* Gattolliat & Rabeantoandro, 2002 (redescribed)

- *Cloeon elevatum* Agnew, 1961
- *Cloeon emmanueli* Lugo-Ortiz & McCafferty, 1998 [Madagascar]
- *Cloeon gambiae* Gillies, 1980
- *Cloeon irretitum* Navàs, 1936 [Madagascar] (*nomen dubium* - Lugo-Ortiz & McCafferty, 1998)
- *Cloeon lacunosum* Barnard, 1932
- *Cloeon madhouae* McCafferty & Mauremootoo, 2000 [Madagascar]
- *Cloeon perkinsi* Barnard, 1932
- *Cloeon rhodesiae* Barnard, 1932
  - *Cloeon carneum* Navás, 1936 (syn.)
  - *Cloeon stigmale* Navás, 1936 (syn.)
- *Cloeon scitulum* Kimmins, 1955
- *Cloeon smaeleni* Lestage, 1924 [Africa & Madagascar]
  - *Procloeon smaeleni* Kimmins, 1960 (orig.)
  - *Procloeon fraudulentum* Demoulin, 1957 (syn.)
  - *Cloeon affine* Navás, 1930 (syn.)
  - *Cloeon incertum* Demoulin, 1957 (syn.)
  - *Cloeon punctatum* Navás, 1931 (syn.)
  - *Cloeon smaeleni* Gattolliat & Rabeantoandro, 2002 (comb.)
- *Cloeon tanzaniae* Gillies, 1985
- *Cloeon virgiliae* (Barnard, 1932)
  - *Austrocloeon virgiliae* Barnard, 1932 (orig.)
  - *Austrocloeon paludinosum* Crass, 1947 (syn.)
  - *Cloeon virgiliae* Demoulin, 1970 (comb.)
- *Cloeon viridellum* Lestage, 1923

11. Genus ***Crassabwa*** Lugo-Ortiz & McCafferty, 1996
- *Crassbwa badia* (Kopelke, 1980)
  - *Centroptilum badium* Kopelke, 1980 (orig.)
  - *Crassbwa badia* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Crassbwa flava* (Crass, 1947)
  - *Centroptilum flavum* Crass, 1947 (orig.)
  - *Afroptilum flavum* Gillies, 1990 (comb.)
  - *Crassabwa flava* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Crassbwa loweae* (Kimmins, 1949)
  - *Centroptilum loweae* Kimmins, 1949 (orig.)
  - *Crassbwa loweae* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Crassbwa vitrea* Navàs, 1930
  - *Centroptilum vitreum* Navàs, 1930 (orig.)
  - *Crassbwa vitrea* Lugo-Ortiz & McCafferty, 1996 (comb.)

12. Genus ***Dabulamanzia*** Lugo-Ortiz & McCafferty, 1996
- *Dabulamanzia babaora* (Wuillot, 1993)
  - *Afroptilum babaorum* Wuillot, 1993 (orig.)
  - *Dabulamanzia babaora* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Dabulamanzia concolorata* Gattolliat, 2000 [Madagascar]
- *Dabulamanzia duci* Gattolliat & Elouard, 1999 [Madagascar]
- *Dabulamanzia fica* Lugo-Ortiz & McCafferty, 1996
- *Dabulamanzia gigantea* Gattolliat, 2000 [Madagascar]
- *Dabulamanzia gladius* Gattolliat, 2000 [Madagascar]
- *Dabulamanzia helenae* Lugo-Ortiz & McCafferty, 1996
- *Dabulamanzia improvida* Lugo-Ortiz & McCafferty, 1997 [Madagascar]
- *Dabulamanzia indusii* (Crass, 1947)
  - *Centroptilum indusii* Crass, 1947 (orig.)
  - *Afroptilum indusii* Gillies, 1990 (comb.)
  - *Dabulamanzia indusii* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Dabulamanzia media* (Crass, 1947)
  - *Centroptilum medium* Crass, 1947 (orig.)
  - *Afroptilum medium* Gillies, 1990 (comb.)
  - *Dabulamanzia media* Lugo-Ortiz & McCafferty, 1996 (comb.)
- *Dabulamanzia tarsale* (Gillies, 1990)
  - *Afroptilum tarsale* Gillies, 1990 (orig.)
  - *Dabulamanzia tarsale* Lugo-Ortiz & McCafferty, 1996 (comb.)

13. Genus ***Delouardus*** Lugo-Ortiz & McCafferty, 1999 [Madagascar]
- *Delouardus djabala* Lugo-Ortiz & McCafferty, 1999 [Madagascar]
- *Delouardus vetustus* Gattolliat (*in press*) [Madagascar]

14. Genus ***Demoreptus*** Lugo-Ortiz & McCafferty 1997
- *Demoreptus capensis* (Barnard, 1932)
  - *Acentrella capensis* Barnard, 1932 (orig.)
  - *Baetis capensis* Demoulin, 1970 (comb.)
  - *Acentrella capensis* McCafferty & de Moor, 1995 (comb.)
  - *Demoreptus capensis* Lugo-Ortiz & McCafferty, 1997 (comb.)
- *Demoreptus monticola* (Crass, 1947)
  - *Acentrella monticola* Crass, 1947 (orig.)
  - *Baetis monticola* Demoulin, 1970 (comb.)
  - *Acentrella monticola* McCafferty & de Moor, 1995 (comb.)
  - *Demoreptus monticola* Lugo-Ortiz & McCafferty, 1997 (comb.)
- *Demoreptus natalensis* (Crass, 1947)
  - *Acentrella natalensis* Crass, 1947 (orig.)
  - *Baetis natalensis* Demoulin, 1970 (comb.)
  - *Acentrella natalensis* McCafferty & de Moor, 1995 (comb.)
  - *Demoreptus natalensis* Lugo-Ortiz & McCafferty, 1997 (comb.)

15. Genus ***Demoulinia*** Gillies, 1990
- *Demoulinia assimilis* Gattolliat (2003) [Madagascar]
- *Demoulinia crassi* (Demoulin, 1970)
  - *Centroptilum pulchrum* Crass, 1947 (*nec* Eaton, 1869) (orig.)
  - *Centroptilum crassi* Demoulin, 1970 (hom, renam.)
  - *Demoulinia crassi* Gillies, 1990 (comb.)
- *Demoulinia insularis* Lugo-Ortiz & McCafferty, 1998 [Madagascar]

16. Genus ***Dicentroptilum*** Wuillot & Gillies, 1994
- *Dicentroptilum decipiens* (Gillies, 1990)
- *Dicentroptilum papillosum* Wuillot, 1994
- *Dicentroptilum spinulosum* (Demoulin, 1970)
  - *Centroptiloides spinulosa* Demoulin, 1970 (orig.)
  - *Afroptilum spinulosum* Gillies, 1990 (comb.)
  - *Dicentroptilum spinulosum* Wuillot & Gillies, 1994 (comb.)
- *Dicentroptilum merina* Lugo-Ortiz & McCafferty, 1998 [Madagascar]

17. Genus ***Echinopus*** Gattolliat (2002) [Madagascar]
- *Echinopus giboni* Gattolliat (2002) [Madagascar]
- *Echinopus minutus* Gattolliat (2002) [Madagascar]

18. Genus ***Edmulmeatus*** Lugo-Ortiz & McCafferty, 1997 [Madagascar]
- *Edmulmeatus grandis* Lugo-Ortiz & McCafferty, 1997 [Madagascar]

19. Genus ***Glossidion*** Lugo-Ortiz & McCafferty, 1998
- *Glossidion demoulini* Lugo-Ortiz & McCafferty, 1998
- *Glossidion mysticum* Lugo-Ortiz & McCafferty, 1998

20. Genus ***Guloptiloides*** Gattolliat & Sartori, 2000
- *Guloptiloides gargantua* Gattolliat & Sartori, 2000 [Madagascar]

21. Genus ***Herbrossus*** McCafferty & Lugo-Ortiz, 1998 [Madagascar]
- *Herbrossus christinae* Gattolliat & Sartori, 1998 [Madagascar]
- *Herbrossus edmundsorum* McCafferty & Lugo-Ortiz, 1998 [Madagascar]
- *Herbrossus elouardi* Gattolliat & Sartori, 1998 [Madagascar]

22. Genus ***Kivua*** Lugo-Ortiz & McCafferty, 1997
- *Kivua elouardi* (Gillies, 1989)
  - *Rhithrocloeon elouardi* Gillies, 1989 (orig.)
  - *Kivua elouardi* Lugo-Ortiz & McCafferty, 1997 (comb.)
- *Kivua insuetum* (Kopelke, 1980)
  - *Cloeon insuetum* Kopelke, 1980 (orig.)
  - *Kivua insuetum* Lugo-Ortiz & McCafferty, 1997 (comb.)

23. Genus ***Labiobaetis*** Novikova & Kluge, 1987
- *Labiobaetis dambrensis* Gattolliat, 2001 [Madagascar]

- *Labiobaetis fabulosus* Lugo-Ortiz & McCafferty, 1997 [Madagascar]
  - *Labiobaetis fabulosus* Lugo-Ortiz & McCafferty, 1997 (orig.)
  - *Pseudocloeon fabulosum* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
  - *Labiobaetis fabulosus* Gattolliat, 2001 (comb.)
- *Labiobaetis gambiae* (Gillies, 1993)
  - *Baetis gambiae* Gillies, 1993 (orig.)
  - *Labiobaetis gambiae* Lugo-Ortiz & McCafferty, 1997 (comb.)
- *Labiobaetis gilliesi* Gattolliat, 2001 [Madagascar]
- *Labiobaetis longicercus* Gattolliat, 2001 [Madagascar]
- *Labiobaetis plumbago* Lugo-Ortiz & McCafferty, 1997 [Madagascar]
  - *Labiobaetis plumbago* Lugo-Ortiz & McCafferty, 1997 (orig.)
  - *Pseudocloeon plumbago* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
  - *Labiobaetis plumbago* Gattolliat, 2001 (comb.)
- *Labiobaetis nigrocercus* Gattolliat, 2001 [Madagascar]
- *Labiobaetis punctatus* Gattolliat, 2001 [Madagascar]
- *Labiobaetis vulgaris* Gattolliat, 2001 [Madagascar]

24. Genus ***Maliqua*** Lugo-Ortiz & McCafferty, 1997
- *Maliqua abdallahi* McCafferty, 2000
- *Maliqua plumosa* (Wuillot, 1993)
  - *Afroptilum plumosum* Wuillot, 1993 (orig.)
  - *Maliqua plumose* Lugo-Ortiz & McCafferty, 1997 (comb.)

25. Genus ***Mickiops*** *McCafferty,* Lugo-Ortiz & Barber-James, 1997
- *Micksiops bicaudatum* (Gillies, 1990)
  - *Afroptilum (Afroptiloides) bicaudatum* Gillies, 1990 (orig.)
  - *Mickiops bicaudatum* McCafferty, Lugo-Ortiz & Barber-James, 1997 (comb.)

26. Genus ***Mutelocloeon*** Gillies & Elouard, 1990
- *Mutelocloeon bihoumi* Gillies & Elouard, 1990
- *Mutelocloeon corbeti* (Kimmins, 1956)
  - *Centroptilum corbeti* Kimmins, 1956 (orig.)
  - *Mutelocloeon corbeti* Gillies & Elouard, 1990 (comb.)
- *Mutelocloeon thomasorum* Lugo-Ortiz & McCafferty, 1997 [Madagascar]

27. Genus ***Nesoptiloides*** Demoulin, 1973 [Madagascar]
- *Nesoptiloides electroptera* (Demoulin, 1966) [Madagascar]
  - *Centroptilum electropterum* Demoulin, 1966 (orig.)
  - *Nesoptiloides intermedia* Demoulin, 1973 (syn.)
  - *Nesoptiloides electroptera* Gattolliat & Sartori, 1999 (comb.)

28. Genus ***Nesydemius*** Lugo-Ortiz & McCafferty, 1998
- *Nesydemius polhemusorum* Lugo-Ortiz & McCafferty, 1998 [Madagascar]

29. Genus ***Nigrobaetis*** Novikova & Kluge, 1987
- *Nigrobaetis bethunae* Lugo-Ortiz & de Moor, 2000
- *Nigrobaetis harasab* (Soldàn, 1977)
  - *Baetis harasab* Soldàn, 1977 (orig.)
  - *Nigrobaetis harasab* Lugo-Ortiz & de Moor, 2000 (comb.)

30. Genus ***Ophelmatostoma*** Waltz & McCafferty, 1987
- *Ophelmatostoma camerunense* (Ulmer, 1920)
  - *Pseudocloeon camerunense* Ulmer, 1920 (orig.)
  - *Pseudocloeon* sp. A. Kimmins, 1955 (syn.)
  - *Ophelmatostoma kimminsi* Waltz & McCafferty, 1987 (syn.)
  - *Ophelmatostoma camerunense* Gillies, Elouard & Wuillot, 1990

31. Genus ***Peuhlella*** Lugo-Ortiz & McCafferty, 1998
- *Peuhlella christinae* (Wuillot, 1993)
  - *Afroptilum christinae* Wuillot, 1993 (orig.)
  - *Peuhlella christinae* Lugo-Ortiz & McCafferty, 1998 (comb.)

32. Genus ***Potamocloeon*** Gillies, 1990
- *Potamocloeon dentatum* (Kimmins, 1956)
  - *Cloeon dentatum* Kimmins, 1956 (orig.)
  - *Potamocloeon dentatum* Gillies, 1990 (comb.)
  - *Potamocloeon macafertiorum* Lugo-Ortiz, 1996 (syn.)
- *Potamocloeon* sp. A Gattolliat, 2003 [Madagascar]
- *Potamocloeon* sp. B Gattolliat, 2003 [Madagascar]

33. Genus ***Procloeon*** Bengtsson, 1915
- *Procloeon africanum* (Esben-Petersen, 1913)
  - *Cloeon africanum* Esben-Petersen, 1913 (orig.)
  - *Clqeon marginale* Ulmer, 1916 (syn.)
  - *Austrocloeon africanum* Barnard, 1932 (comb.)
  - *Cloeon africanum* Demoulin, 1970 (comb.)
  - *Procloeon africanum* Gillies, 1997 (comb.)
- *Procloeon cylindroculum* Kimmins, 1955
- *Procloeon sylvicola* Gillies, 1997

34. Genus ***Pseudocloeon*** Klapàlek, 1905
- *Pseudocloeon aquacidum* (Lugo-Ortiz & McCafferty, 1997)
  - *Labiobaetis aquacidus* Lugo-Ortiz & McCafferty, 1997 (orig.)
  - *Pseudocloeon aquacidum* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon bellum* (Barnard, 1932)
  - *Baetis bellus* Barnard, 1932 (orig.)
  - *Pseudocloeon bellum* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon boussoulium* (Gillies, 1993)
  - *Baetis boussoulius* Gillies, 1993 (orig.)
  - *Labiobaetis boussoulius* Lugo-Ortiz & McCafferty, 1997 (comb.)
  - *Pseudocloeon boussoulium* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon cataractae* (Crass, 1947)
  - *Baetis cataractae* Crass, 1947 (orig.)
  - *Acanthiops erepens* (in part) Lugo-Ortiz, Barber-James, McCafferty & de Moor, 2001 (id.)
  - *Pseudocloeon cataractae* Lugo-Ortiz & de Moor, 2001 (comb.)
- *Pseudocloeon elouardi* (Gillies, 1993)
  - *Baetis elouardi* Gillies, 1993 (orig.)
  - *Labiobaetis elouardi* Lugo-Ortiz & McCafferty, 1997 (comb.)
  - *Pseudocloeon elouardi* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon fastigatum* Kopelke, 1980
- *Pseudocloeon glaucum* (Agnew, 1961)
  - *Baetis glaucus* Agnew, 1961 (orig.)
  - *Baetis quintus* Agnew, 1961 (syn.)
  - *Labiobaetis masai* Lugo-Ortiz & McCafferty, 1977 (syn.)
  - *Labiobaetis nadineae* Lugo-Ortiz & McCafferty, 1997 (syn.)
  - *Pseudocloeon masai* Lugo-Ortiz, de Moor & Barber-James, 2000 (comb., syn)
  - *Pseudocloeon nadineae* Lugo-Ortiz, de Moor & Barber-James, 2000 (comb., syn)
  - *Pseudocloeon quintum* Lugo-Ortiz, de Moor & Barber-James, 2000 (comb., syn.)
  - *Pseudocloeon glaucum* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon grandiculum* Kopelke, 1980
- *Pseudocloeon insolitum* (Kopelke, 1980)
  - *Baetis insolitus* Kopelke, 1980 (orig.)
  - *Labiobaetis insolitum* Lugo-Ortiz & McCafferty, 1997 (comb.)
  - *Pseudocloeon insolitum* Lugo-Ortiz, McCafferty & Waltz 1999 (comb.)
- *Pseudocloeon kalengoense* (Kopelke, 1980)
  - *Baetis kalengoensis* Kopelke, 1980 (orig.)
  - *Labiobaetis kalengoensis* Lugo-Ortiz & McCafferty, 1997 (comb.)
  - *Pseudocloeon kalengoense* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon latum* (Agnew, 1961)
  - *Baetis latus* Agnew, 1961 (orig.)
  - *Labiobaetis aquacidus* Lugo-Ortiz & McCafferty, 1997 (syn.)
  - *Pseudocloeon aquacidum* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb., syn.)
  - *Baetis* sp. B. Harrison & Elsworth, 1958 (syn.)
  - *Baetis* sp. 2. Agnew, 1961 (syn.)
  - *Pseudocloeon latum* Lugo-Ortiz & de Moor, 2000 (comb.)
- *Pseudocloeon mtone* (Gillies, 1994)
  - *Baetis mtonis* Gillies, 1994 (orig.)
  - *Labiobaetis mtonis* Lugo-Ortiz & McCafferty, 1997 (comb.)
  - *Pseudocloeon mtone* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon piscis* (Lugo-Ortiz & McCafferty, 1997)
  - *Labiobaetis piscis* Lugo-Ortiz & McCafferty, 1997 (orig.)
  - *Pseudocloeon piscis* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)
- *Pseudocloeon tenuicrinitum* Kopelke, 1980

- *Pseudocloeon vinosum* Barnard, 1932
  - *Pseudocloeon vinosum* Barnard, 1932 (orig.)
  - *Baetis vinosus* Gillies, 1994 (comb.)
  - *Pseudocloeon minutum* Crass, 1947 (syn.)
  - *Baetis minutus* Gillies, 1994 (comb., syn.)
  - *Labiobaetis vinosus* Lugo-Ortiz & McCafferty, 1997 (comb.)
  - *Pseudocloeon vinosum* Lugo-Ortiz, McCafferty & Waltz, 1999 (comb.)

35. Genus ***Pseudopannota*** Waltz & McCafferty, 1987
- *Pseudocloeon camillae* Gattolliat (*in press*) [Madagascar]
- *Pseudopannota bergerardi* Elouard & Hideux, 1990
- *Pseudopannota bertrandi* (Demoulin, 1967)
  - *Pseudocloeon bertrandi* Demoulin, 1967 (orig.)
  - *Pseudopannota bertrandi* Waltz & McCafferty, 1987 (comb.)
- *Pseudopannota maculosa* (Crass, 1947)
  - *Pseudocloeon maculosum* Crass, 1947 (orig.)
  - *Pseudopannota maculosa* Elouard, Gillies & Wuillot, 1990 (comb.)
- *Pseudopannota modesta* Elouard & Gillies, 1990
- *Pseudopannota muganinani* Elouard & Gillies, 1990
- *Pseudopannota sartorii* Elouard & Hideux, 1990
- *Pseudopannota vinckei* (Demoulin, 1973) [Madagascar]

36. Genus ***Rhithrocloeon*** Gillies, 1985
- *Rhithrocloeon indicator* Gillies, 1985
- *Rhithrocloeon permirum* (Kopelke, 1980)
  - *Cloeon permirum* Kopelke, 1980 (orig.)
  - *Rhithrocloeon permirum* Gillies, 1985 (comb.)

37. Genus ***Rheoptilum*** Gattolliat, 2001 [Madagascar]
- *Rheoptilum arni* Gattolliat, 2001 [Madagascar]
- *Rheoptilum lokohensis* Gattolliat, 2001 [Madagascar]

38. Genus ***Scutoptilum*** Gattolliat, (2002) [Madagascar]
- *Scutoptilum verrucosum* Gattolliat (2002) [Madagascar]

39. Genus ***Susua*** Lugo-Ortiz & McCafferty, 1998
- *Susua niandanensis* (Wuillot, 1993)
  - *Afroptilum niandanensis* Wuillot, 1993 (orig.)
  - *Susua niandanensis* Lugo-Ortiz & McCafferty, 1998 (comb.)

40. Genus ***Tanzaniella*** Gillies, 1991
- *Tanzaniella spinosa* Gillies, 1991

41. Genus ***Thraulobaetodes*** Elouard & Hideux, 1991
- *Thraulobaetodes cumminsorum* Elouard & Hideux, 1991

42. Genus ***Xyrodromeus*** Lugo-Ortiz & McCafferty, 1997
- *Xyrodromeus africanus* Lugo-Ortiz &McCafferty, 1997
- *Xyrodromeus namarona* Lugo-Ortiz & McCafferty, 1997 [Madagascar]
- *Xyrodromeus modestus* Gattolliat (2002) [Madagascar]
- *Xyrodromeus sartorii* Gattolliat (2002) [Madagascar]
- *Xyrodromeus latipalpus* Gattolliat (2002) [Madagascar]

Suborder SETISURA
Superfamily HEPTAGENIOIDEA
Family **HEPTAGENIIDAE** Needham, 1901

1. Genus ***Afronurus*** Lestage, 1924
- *Afronurus aethereus* (Navàs, 1936)
  - *Ecdyonurus aethereus* Navàs, 1936 (orig.)
  - *Afronurus aethereus* Demoulin, 1965 (comb.)
- *Afronurus barnardi* Schoonbee, 1968
- *Afronurus elgonenis* Puthz, 1971
- *Afronurus gilliesi* Corbet, 1962
- *Afronurus harrisoni* Barnard, 1932
- *Afronurus matitensis* Sartori & Elouard, 1996

- *Afronurus muehlenbergi* Puthz, 1971
- *Afronurus negi* Cornert, 1960
- *Afronurus oliffi* Schoonbee, 1968
- *Afronurus peringueyi* (Esben-Petersen, 1913)
  - *Ecdyurus peringueyi* Esben-Petersen, 1913 (orig.)
  - *Afronurus peringueyi* Lestage, 1924 (comb.)
- *Afronurus pulcher* Ulmer, 1930
  - *Adenophlebia collarti* Navàs, 1930 (orig.)
  - *Afronurus collarti* Demoulin, 1970 (comb.)
- *Afronurus scotti* Schoonbee, 1968
- *Afronurus subflavus* Kopelke, 1980
- *Afronurus ugandanus* Kimmins, 1956

2. Genus ***Compsoneuria*** Eaton, 1881
- *Compsoneuria bequaerti* (Navás, 1930)
  - *Adenophelbia bequaerti* Navás, 1930 (orig.)
  - *Adenophelbia eatoni* Navás, 1931 (syn.)
  - *Adenophelbia inflexa* Navás, 1932 (syn.)
  - *Notonurus cooperi* Crass, 1947 (syn.)
  - *Notonurus bequaerti* Demoulin, 1956 (comb.)
  - *Compsoneuriella bequaerti* Gillies, 1984 (comb.)
  - *Compsoneuria bequaerti* Braasch & Soldàn, 1986 (comb.)
- *Compsoneuria njalensis* (Kimmins, 1937)
  - *Afronurus njalensis* Kimmins, 1937 (orig.)
  - *Notonurus njalensis* Demoulin, 1970 (comb.)
  - *Compsoneuriella njalensis* Gillies, 1984 (comb.)
  - *Compsoneuria njalensis* Braasch & Soldàn, 1986 (comb.)
  - *Thalerosphyrus njalensis* de Moor, Barber-James, Harrison & Lugo-Ortiz, 2000 (syn.)
- *Compsoneuria sinuosus* (Navás, 1931)
  - *Adenophlebia sinuosa* Navás, 1931 (orig.)
  - *Notonurus sinuosus* Demoulin, 1970 (comb.)
  - *Compsoneuriella sinuosus* Gillies, 1984 (comb.)
  - *Compsoneuria sinuosus* Braasch & Soldàn, 1986 (comb.)
- *Compsoneuria tortinervis* (Navás, 1930)
  - *Adenophlebia tortinervis* Navás, 1930
  - *Notonurus tortinervis* Demoulin, 1970
  - *Compsoneuriella tortinervis* Gillies, 1984
  - *Compsoneuria tortinervis* Braasch & Soldàn, 1986
  - *Thalerosphyrus tortinervis* de Moor, Barber-James, Harrison & Lugo-Ortiz, 2000 (syn.)

3. Genus ***Thalerosphyrus*** Eaton, 1881
- *Thalerosphyrus ethiopicus* Soldàn, 1977
- *Thalerosphyrus josettae* Sartori & Elouard, 1996 [Madagascar]

Family **OLIGONEURIIDAE** Ulmer, 1920

1. Genus ***Elassoneuria*** Eaton, 1881
- *Elassoneuria candida* Eaton, 1913
- *Elassoneuria disneyi* Gillies, 1974
- *Elassoneuria grandis* Gillies, 1974
- *Elassoneuria insulicola* Demoulin, 1966 [Madagascar]
- *Elassoneuria kidahi* Gillies, 1974
- *Elassoneuria trimeniana* (McLachlan, 1868)
  - *Oligoneuria trimeniana* McLachlan 1868 (orig.)
  - *Elassoneuria trimeniana* Eaton, 1881 (comb.)
  - *Elassoneuria congolana* Navàs, 1911 (syn.)

2. Genus ***Oligoneuriopsis*** Crass 1947
- *Oligoneuriopsis dobbsi* (Eaton, 1912)
  - *Oligoneuria dobbsi* Eaton, 1912 (orig.)
  - *Oligoneuriella dobbsi* Ulmer, 1924 (comb.)
  - *Oligoneuriella grandevea* Navàs, 1936 (syn.)
  - *Oligoneuriopsis grandevea* Demoulin, 1965 (comb.,syn.)
  - *Oligoneuriopsis dobbsi* Kimmins, 1960 (comb.)
- *Oligoneuriopsis elizabethae* Agnew, 1973
- *Oligoneuriopsis jessicae* Agnew, 1973
- *Oligoneuriopsis lawrencei* Crass, 1947

Suborder FURCATERGALIA
Superfamily EPHEMERELLOIDEA
Family **TRICORYTHIDAE** Lestage, 1942

1. Genus ***Dicercomyzon*** Demoulin, 1954
- *Dicercomyzon costale* Kimmins, 1957
- *Dicercomyzon femorale* Demoulin, 1954
- *Dicercomyzon sjösterdti* Ulmer, 1910
  - *Caenis sjösterdti* Ulmer, 1909 (orig.)
  - *Tricorythus sjösterdti* Lestage, 1918 (comb.)
  - *Dicercomyzon sjösterdti* Demoulin 1954 (comb.)
  - *Dicercomyzon marginatum* Kimmins, 1957 (syn.)
- *Dicercomyson verrierae* Demoulin, 1964

2. Genus ***Madecassorythus*** Elouard & Oliarionony, 1997 [Madagascar]
- *Madecassorythus hertui* Elouard & Oliarionony, 1997 [Madagascar]
- *Madecassorythus linae* Elouard & Oliarionony, 1997 [Madagascar]
- *Madecassorythus ramanankasinae* Elouard & Oliarionony, 1997 [Madagascar]
- *Madecassorythus raphaeli* Oliarionony & Sartori, 2000 [Madagascar]

3. Genus ***Ranorythus*** Oliarinony & Elouard, 1997 [Madagascar]
- *Ranorythus violettae* Oliarinony & Elouard, 1997 [Madagascar]
- *Ranorythus langrani* Elouard & Oliarinony, 1997 [Madagascar]

4. Genus ***Spinirythus*** Oliarinony & Elouard, 1998 [Madagascar]
- *Spinirythus colasi* Elouard & Oliarinony, 1998 [Madagascar]
- *Spinirythus martini* Oliarinony & Elouard, 1998 [Madagascar]
- *Spinirythus rosae* Oliarinony & Raberiaka, 1998 [Madagascar]

5. Genus ***Tricorythafer*** *Lestage, 1942*
- *Tricorythafer fugitans* (Needham, 1921)
  - *Caensopsis fugitans* Needham, 1921 (orig.)
  - *Needhamocaenis figitans* Lestage, 1945 (in part) (comb.)
  - *Tricorythafer fugitans* Lestage, 1942 (comb.)

6. Genus ***Tricorythus*** Eaton, 1868
- *Tricorythus abyssinica* Ulmer, 1930
  - *Neurocaenis abyssinica* Demoulin, 1954 (orig.)
  - *Tricorythus abyssinica* Oliarinony, Elouard & Raberiaka, 1998 (comb.)
- *Tricorythus ambinintsoae* Oliarinony & Elouard, 1998 [Madagascar]
- *Tricorythus discolor* (Burmeister, 1839)
  - *Oxycypha discolor* Burmeister, 1839 (orig.)
  - *Cloeon discolor* Walker, 1853 (comb.)
  - *Caenis discolor* Eaton, 1871 (comb.)
  - *Tricorythus discolor* Eaton, 1884 (comb.)
  - *Neurocaenis discolor* Demoulin, 1954 (comb.)
  - *Tricorythus discolor* McCafferty & de Moor, 1995 (comb.)
- *Tricorythus fyae* Oliarinony & Raberiaka, 1998 [Madagascar]
- *Tricorythus fuscata* (Navás, 1936)
  - *Neurocaenis fuscata* Navás, 1936 (orig.)
  - *Tricorythus fuscata* Oliarinony, Elouard & Raberiaka, 1998 (comb.)
- *Tricorythus goodmani* Elouard & Oliarinony, 1998 [Madagascar]
- *Tricorythus jeanne* Oliarinony & Elouard, 1998 [Madagascar]
- *Tricorythus lanceolatus* Ulmer, 1916
- *Tricorythus latus* Ulmer, 1916
- *Tricorythus longus* Ulmer, 1916
  - *Caenis regia* Navás, 1932 (orig.)
  - *Caenis collarti* Navás, 1933 (comb.)
- *Tricorythus pierrei* Elouard & Oliarinony, 1998 [Madagascar]
- *Tricorythus poincinsi* Navás, 1926
  - *Neurocaenis poincinsi* Demoulin, 1954 (orig.)
  - *Tricorythus poincinsi* Oliarinony, Elouard & Raberiaka, 1998 (comb.)
- *Tricorythus reticulatus* Barnard, 1932
  - *Neurocaenis reticulata* Demoulin, 1954 (orig.)
  - *Tricorythus reticulatus* McCafferty & de Moor, 1995 (comb.)

- *Tricorythus rolandi* Oliarinony & Raberiaka, 1998 [Madagascar]
- *Tricorythus sylvestris* Oliarinony & Elouard, 1998 [Madagascar]
- *Tricorythus tinctus* Kimmins, 1956
- *Tricorythus variabilis* Oliarinony & Raberiaka, 1998 [Madagascar]
- *Tricorythus varicauda* (Kollar & Pictet, 1843)
  - *Caenis varicauda* Kollar & Pictet, 1843 (orig.)
  - *Tricorythus varicauda* Eaton, 1868 (comb.)
- *Tricorythus vulgaris* Raberiaka & Oliarinony, 1998 [Madagascar]

Family **EPHEMERYTHIDAE** McCafferty & Wang, 2000

1. Genus ***Ephemerythus*** Gillies, 1960
- *Ephemerythus dissimillimus* Kopelke, 1981
- *Ephemerythus kiboensis* Gillies, 1960
- *Ephemerythus niger* Gillies, 1960
- *Ephemerythus pictus* Gillies, 1960
- *Ephemerythus straeleni* Demoulin, 1964

Family **MACHADORYTHIDAE** McCafferty & Wang, 2000

1. Genus ***Machadorythus*** Demoulin, 1959
- *Machadorythus maculatus* (Kimmins, 1949)
  - *Tricorythus maculatus* Kimmins, 1949 (orig.)
  - *Machadorythus palaquim* Demoulin, 1959 (syn.)
  - *Machadorythus maculatus* Elouard & Gillies, 1989 (comb.)

Family: **TELOGANODIDAE** McCafferty & Wang, 1997

1. Genus ***Ephemerellina*** Lestage, 1924
- *Ephemerellina barnardi* Lestage, 1924

2. Genus ***Lestagella*** Demoulin, 1970
- *Lestagella penicillata* (Barnard, 1940)
  - *Lithogloea penicillata* Barnard, 1940 (orig.)
  - *Lestagella penicillata* Demoulin, 1970 (comb.)

3. Genus ***Lithogloea*** Barnard, 1932
- *Lithogloea harrisoni* Barnard, 1932
  - *Ephemerellina harrisoni* Demoulin, 1970 (orig.)
  - *Lithogloea harrisoni* McCafferty & de Moor, 1995 (comb.)

4. Genus ***Manohyphella*** Allen, 1973
- *Manohyphella keiseri* Allen, 1973

5. Genus ***Nadinetella*** McCafferty & Wang, 1998 (= *Nadinella* McCafferty & Wang, 1997 preoccupied)
- *Nadinetella brincki* (Demoulin, 1970)
  - *Ephemerellina brincki* Demoulin, 1970 (orig.)
  - *Nadinella brincki* McCafferty & Wang, 1997 (hom.)
  - *Nadinetella brincki* McCafferty & Wang, 1998 (comb.)
- *Nadinetella crassi* (Allen & Edmunds, 1963)
  - *Ephemerellina crassi* Allen & Edmunds, 1963 (orig.)
  - *Nadinella crassi* McCafferty & Wang, 1997 (hom.)
  - *Nadinetella crassi* McCafferty & Wang, 1998 (comb.)

6. Undescribed genus [Madagascar] Elouard et al., 2001

Family **TELOGANELLIDAE** McCafferty & Wang, 2000 [Madagascar]

1. Undescribed genus and species. [Madagascar] McCafferty & Wang, 2000

Superfamily CAENOIDEA
Family **CAENIDAE** Ulmer, 1920

1. Genus ***Afrocaenis*** Gillies, 1982
- *Afrocaenis browni* Gillies, 1983

- *Afrocaenis major* (Gillies, 1977)
  - *Caenospella major* Gillies, 1977 (orig.)
  - *Afrocaenis major* Gillies, 1982 (comb.)

2. Genus ***Afrocercus*** Malzacher, 1987
- *Afrocercus forcipatus* Malzacher, 1987

3. Genus ***Barnardara*** McCafferty & Provonsha, 1995
- *Barnardara demoori* McCafferty & Provonsha, 1995

4. Genus ***Caenis*** Stephens, 1835
- *Caenis aethiopica* Navás, 1935
- *Caenis aliciae* Malzacher, 1990
- *Caenis antelucana* Malzacher, 1990
- *Caenis basuto* Demoulin, 1970
- *Caenis berneri* Kimmins, 1955
- *Caenis brevipes* Kimmins, 1956
  - *Caenomedea brevipes* Thew, 1960 (orig.)
  - *Caenis brevipes* Malzacher, 1993 (comb.)
- *Caenis capensis* (Barnard, 1932)
  - *Austrocaenis capensis* Barnard, 1932 (orig.)
  - *Caenis capensis* McCafferty & de Moor, 1995 (comb.)
- *Caenis cibaria* Eaton, 1879
  - *Caenis cibaria* Eaton, 1879 (orig.)
  - *Caenomedea cibaria* Thew, 1960 (comb.)
  - *Caenis cibaria* Malzacher, 1993 (comb.)
- *Caenis cincta* Demoulin, 1956
  - *Caenomedea cincta* Demoulin, 1965 (orig.)
  - *Caenis cincta* Malzacher, 1993 (comb.)
- *Caenis corbeti* Malzacher, 1990
- *Caenis douglasi* Malzacher, 1993
  - *Caenis cibaria* Ulmer, 1916 (*nec* Eaton 1879) (hom, syn.)
  - *Caenodes cibaria* Ulmer, 1924 (comb.)
  - *Caenodes ulmeri* Kimmins, 1949 (renam.)
  - *Caenis ulmeri* Malzacher, 1993 (comb.)
  - *Caenis douglasi* Malzacher, 1993 (renam.) (hom. *Caenis ulmeri* Brodsky ,1930)
- *Caenis duodecima* Malzacher, 1990
- *Caenis edwardsi* Kimmins, 1939
- *Caenis elouardi* Malzacher, 1990
- *Caenis fasciata* Navás, 1927
- *Caenis ghibana* Malzacher, 1990
- *Caenis gilliesi* Malzacher, 1990
- *Caenis inflexa* (Kolpelke, 1981)
  - *Caenomedea inflexa* Kolpelke, 1981 (orig.)
  - *Caenis inflexa* Malzacher, 1993 (comb.)
- *Caenis jinjana* (Kimmins, 1956)
  - *Caenodes jinjana* Kimmins, 1956 (orig.)
  - *Caenis jinjana* Malzacher, 1993 (comb.)
- *Caenis johannae* Malzacher, 1990 [Madagascar]
- *Caenis knowlesi* Gillies & Knowles, 1990
- *Caenis kivuensis* Demoulin, 1956
  - *Caenis kivuensis* Demoulin, 1956 (orig.)
  - *Caenomedea kivuensis* Thew, 1960 (comb.)
  - *Caenis kivuensis* Malzacher, 1993 (comb.)
- *Caenis kungu* Eaton, 1879
  - *Caenis kungu* Eaton, 1879 (orig.)
  - *Caenodes kungu* Thew, 1960 (comb.)
  - *Caenis kungu* Malzacher, 1993 (comb.)
- *Caenis libenauae* Malzacher, 1990
- *Caenis magnipilosa* (Kopleke, 1980)
  - *Caenomedea magnipilosa* Kopelke, 1980 (orig.)
  - *Caenis magnipilosa* Malzacher, 1993 (comb.)
- *Caenis margherita* Malzacher, 1990
- *Caenis namorana* Malzacher, 1995 [Madagascar]
- *Caenis nervulosa* Malzacher, 1990

- *Caenis noctivaga* Malzacher, 1990
- *Caenis occulta* Malzacher, 1990
- *Caenis pallida* Malzacher, 1990
- *Caenis rugosa* Malzacher, 1995 [Madagascar]
- *Caenis rutila* Malzacher, 1995
- *Caenis scotti* Ulmer, 1930
- *Caenis spinosa* Malzacher, 1995 [Madagascar]

5. Genus ***Caenospella*** Gillies, 1977
- *Caenospella meridies* Gillies, 1977

6. Genus ***Clypeocaenis*** Soldán, 1978
- *Clypeocaenis afrosetosa* Soldán, 1978
- *Clypeocaenis umgeni* Provonsha & McCafferty 1995

7. Genus ***Madecocerus*** Malzacher, 1995 [Madagascar]
- *Madecocerus tauroides* Malzacher, 1995 [Madagascar]
  - *Provonshaka thomasorum* McCafferty & Wang, 1995 (syn.)
  - *Madecocerus tauroides* Elouard & Sartori, 2001

Superfamily EPHEMEROIDEA
Family **EPHEMERIDAE** Ulmer 1920

1. Genus ***Afromera*** Demoulin, 1955 (= *Dicrephemera* McCafferty & Edmunds, 1973)
- *Afromera aequatorialis* (Kimmins, 1956)
  - *Ephemera aequatorialis* Kimmins, 1956 (orig.)
  - *Afromera aequatorialis* Kimmins, 1960 (comb.)
- *Afromera congolana* Demoulin, 1955
  - *Ephemera congolana* McCafferty & Edmunds, 1973 (orig.)
  - *Afromera congolana* McCafferty & Gillies, 1979 (comb.)
- *Afromera evae* Gillies, 1979
- *Afromera gilliesi* Elouard, 1986
- *Afromera natalensis* (Barnard, 1932)
  - *Ephemera natalensis* Barnard, 1932 (orig.)
  - *Afromera natalensis* Demoulin, 1955 (comb.)
- *Afromera troubati* Elouard, 1986

2. Genus ***Cheirogenesia*** Demoulin, 1952
- *Cheirogenesia decaryi* (Navás, 1926) [Madagascar]
  - *Anagenesia decaryi* Navás, 1926 (orig.)
  - *Cheirogenesia decaryi,* Demoulin, 1952 (comb.)
  - *Fontanica josettae* McCafferty, 1968 (syn.)
- *Cheirogenesia edmundsi* Sartori & Elouard, 1999 [Madagascar]
- *Cheirogenesia laurencae* Sartori & Elouard, 1999 [Madagascar]

3. Genus ***Eatonica*** Navás, 1913
- *Eatonica crassi* McCafferty, 1971
- *Eatonica denysae* Elouard & Sartori, 1998 [Madagascar]
- *Eatonica jossettae* Demoulin, 1968
- *Eatonica luciennae* Elouard & Oliarinony, 1998 [Madagascar]
- *Eatonica patriciae* Elouard, 1986
- *Eatonica schoutedeni* (Navás, 1911)
  - *Ephemera schoutedeni* Navás, 1911 (orig.)
  - *Hexagenia illustris* Eaton, 1913 (syn.)
  - *Hexagenia fulva* Esben-Petersen, 1913 (syn.)
  - *Hexagenia reticulata* Navás, 1913 (syn.)
  - *Eatonica schoutedeni* Navás, 1913 (comb.)
  - *Ephemera nimia* Navás, 1915 (syn.)
  - *Pentagenia schoutedeni* Umler, 1916 (comb.)
  - *Eatonica illustris* Kimmins, 1960 (comb., syn.)
  - *Eatonica schoutedeni* Demoulin, 1970 (comb.)

4. Genus ***Ephemera*** Linnaeus, 1758
- *Ephemera mooiana* McCafferty, 1971 †
  - *Eatonica schoutedeni* (in part) Crass, 1947 (id.)
  - *Afromera natalenis* (in part) Demoulin, 1968 (id.)

5. Genus ***Palingenia*** Burmeister, 1839
- *Palingenia apatris* Demoulin, 1965

Family **POLYMITARCYIDAE** Ulmer, 1920

1. Genus ***Afroplocia*** Lestage, 1939
- *Afroplocia sampsoni* (Barnard, 1937)
  - *Exeuthyplocia sampsoni* Barnard, 1937 (orig.)
  - *Afroplocia sampsoni* Lestage, 1939 (comb.)

2. Genus ***Ephoron*** Williamson, 1802
- *Ephoron savignyi* (Pictet, 1843)
  - *Palingenia savignyi* Pictet, 1843 (orig.)
  - *Polymitarcys savignyii* Eaton, 1871 (comb.)
  - *Polymitarcys savignyi* Eaton, 1883 (comb.)
  - *Polymitarcys capensis* Esben-Petersen, 1913 (syn.)
  - *Polymitarcys temerata* Navás, 1916 (syn.)
  - *Ephoron savignyi* Spieth, 1940 (comb.)

3. Genus ***Povilla*** Navás, 1912
- *Povilla adusta* Navás, 1912

4. Genus **Proboscidoplocia** Demoulin, 1966 [Madagascar]
- *Proboscidoplocia auberti* Elouard & Sartori, 1997 [Madagascar]
- *Proboscidoplocia billi* Elouard & Sartori, 1997 [Madagascar]
- *Proboscidoplocia leplatternierae* Elouard & Sartori, 1997 [Madagascar]
- *Proboscidoplocia magdeleinae* Elouard & Sartori, 1997 [Madagascar]
- *Proboscidoplocia mccaffertyi* Elouard & Sartori, 1999 [Madagascar]
- *Proboscidoplocia ruffieuxae* Elouard & Sartori, 1997 [Madagascar]
- *Proboscidoplocia sikorai* (Vassiére, 1895) [Madagascar]
  - *Euthyplocia sikoria* Vassiére, 1895 (orig.)
  - *Proboscidoplocia sikorai* Demoulin, 1966 (comb.)
- *Proboscidoplocia vayssierei* Elouard & Sartori, 1997 [Madagascar]

Superfamily LEPTOPHLEBIOIDEA
Family **LEPTOPHLEBIIDAE** Ulmer 1920

1. Genus ***Adenophlebia*** Eaton, 1881
- *Adenophlebia auriculata* (Eaton, 1871)
  - *Leptophlebia auriculata* Eaton, 1871 (orig.)
  - *Adenophlebia auriculata* Barnard, 1932 (comb.)
- *Adenophlebia burgeoni* Navás, 1929
- *Adenophlebia dislocans* (Walker, 1860)
  - *Ephemera dislocans* Walker, 1860 (orig.)
  - *Leptophlebia dislocans* Eaton, 1871 (comb.)
  - *Adenophlebia dislocans* Eaton, 1881 (comb.)
  - *Adenophlebia westermanni* Esben-Petersen, 1913 (syn.)
  - *Esbenophlebia westermanni* Lestage, 1924 (comb., syn.)
- *Adenophlebia infuscata* Navás, 1936
- *Adenophlebia peringueyella* Lestage 1924
- *Adenophlebia sylvatica* Crass 1947

2. Genus ***Adenophlebiodes*** Ulmer, 1924
- *Adenophlebiodes adrieni* Elouard-Hideux & Elouard, 1991
- *Adenophlebiodes bicolor* (Crass, 1947)
  - *Euphlebia bicolor* Crass, 1947 (orig.)
  - *Habrophlebia delamarei* Verrier, 1951 (syn.)
  - *Adenophlebiodes bicolor* Edmunds, 1953 (comb.)
- *Adenophlebiodes callasae* Elouard-Hideux & Elouard, 1991
- *Adenophlebiodes decoratus* (Navás, 1931)
  - *Adenophlebia decora* Navás, 1931 (orig.)
  - *Adenophlebiodes decorata* Marlier, 1958 (comb.)
  - *Adenophlebiodes decoratus* Elouard-Hideux & Elouard, 1990 (comb.)

- *Adenophlebiodes masonella* Agnew, 1961
- *Adenophlebiodes massirius* Elouard-Hideux & Elouard, 1991
- *Adenophlebiodes ornata* Ulmer, 1916
- *Adenophlebiodes rubeus* Elouard-Hideux & Elouard, 1991

3. Genus ***Aprionyx*** Barnard, 1932
- *Aprionyx argus* Barnard, 1940
- *Aprionyx intermedius* Barnard, 1932
- *Aprionyx natalicus* (Lestage, 1924)
  - *Atalophlebia tabularis* Esben-Petersen 1913 (nec. Eaton 1884) (orig.)
  - *Atalophlebia natalica* Lestage, 1924 (comb., renam., hom.)
  - *Aprionyx natalica* Barnard, 1932 (comb.)
  - *Aprionyx natalicus* Demoulin, 1970 (spell.)
- *Aprionyx pellucidulus* (Esben-Petersen)
  - *Atalophlebia pellucida* Esben-Petersen 1920 (orig.)
  - *Aprionyx pellucidulus* Barnard 1932 (comb.)
- *Aprionyx peterseni* (Lestage, 1924)
  - *Atalophlebia peterseni* Lestage, 1924 (orig.)
  - *Aprionyx peterseni* Barnard, 1932 (comb.)
- *Aprionyx rubicundus* Barnard, 1932
- *Aprionyx tabularis* (Eaton, 1884)
  - *Atalophlebia tabularis* Eaton, 1884 (orig.)
  - *Atalophlebia phoeocera* Lestage, 1924 (syn.)
  - *Aprionyx tabularis* Barnard, 1932
- *Aprionyx tricuspidatus* Crass, 1947

4. Genus ***Castanophlebia*** Barnard, 1932
- *Castanophlebia albicauda* Barnard, 1940
- *Castanophlebia calida* Barnard, 1932

5. Genus ***Choroterpes*** Eaton, 1881
- *Choroterpes ndebele* Agnew, 1962
- *Choroterpes nigrescens* Barnard, 1932

6. Genus ***Euthraulus*** Barnard, 1932
- *Euthraulus arabica* Sartoir & Gillies, 1990
- *Euthraulus bugandensis* Kimmins, 1956
- *Euthraulus curtus* Kimmins, 1956
- *Euthraulus elegans* Barnard, 1932
  Choroterpes elegans Peters & Edmunds, 1964 (orig.)
  Euthraulus elegans McCafferty & de Moor, 1995 (comb.)
- *Euthraulus magnaculeata* Kopelke, 1980
- *Euthraulus starmuehlneri* Peters, 1980 [Comoros]
- *Euthraulus tropicalis* Gillies, 1957
- *Euthraulus usambarae* Gillies, 1957

7. *Genus* ***Fulleta*** *Navás, 1930*
- *Fulleta dentata* Navás, 1930

8. Genus ***Fulletomimus*** Demoulin, 1956
- *Fulletomimus marlieri* Demoulin, 1956

9. Genus ***Hagenulodes*** Ulmer, 1920 [Seychelles only]
- *Hagenulodes braueri* Ulmer, 1920 [Seychelles only]

10. Genus ***Hyalophlebia*** Demoulin, 1955
- *Hyalophlebia demoulini* (Kimmins, 1960)
  - *Adenophlebiodes demoulini* Kimmins, 1960 (orig.)
  - *Hyalophlebia demoulini* McCafferty & de Moor, 1995 (comb.)
- *Hyalophlebia dentifera* (Navás, 1930)
  - *Atalophlebia dentifera* Navás, 1930 (orig.)
  - *Hyalophlebia dentifera* McCafferty & de Moor, 1995 (comb.)
- *Hyalophlebia patriciae* (Agnew, 1962)
  - *Adenophlebiodes patriciae* Agnew, 1962 (orig.)
  - *Hyalophlebia patriciae* McCafferty & de Moor, 1995 (comb.)

- *Hyalophlebia seydeli* (Navás, 1930)
  - *Adenophlebia seydeli* Navás, 1930 (orig.)
  - *Hyalophlebia seydeli* McCafferty & de Moor, 1995 (comb.)

11. Genus ***Maheathraulus*** Peters, Gillies & Edmunds, 1964 [Seychelles only]
- *Maheathraulus scotti* (Eaton, 1913) [Seychelles only]
  - *Hagenulus scotti* Eaton, 1913 (orig.)
  - *Maheathraulus scotti* Peters, Gillies & Edmunds, 1964 (comb.)

12. Genus ***Nesophlebia*** Peters & Edmunds, 1964 [Madagascar]
- *Nesophlebia adusta* Peters & Edmunds, 1964 [Madagascar]

13. Genus ***Petersophlebia*** Demoulin, 1973 [Madagascar]
- *Petersophlebia inequalis* (Demoulin, 1955) [Madagascar]
  - *Atalophlebiodes inequalis* Demoulin, 1955 (orig.)
  - *Petersophlebia inequalis* Demoulin, 1973 (comb.)
- *Petersophlebia insularis* Demoulin, 1973 [Madagascar]

14. Genus ***Polythelias*** Demoulin, 1973 [Madagascar]
- *Polythelias digitata* Demoulin, 1973 [Madagascar]

15. Genus ***Thraulus*** Eaton, 1881
- *Thraulus fasciatus* (Kimmins, 1956)
  - *Hagenulus fasciata* Kimmins, 1956 (orig.)
  - *Marsharikella fasciata* Peters, Gillies & Edmunds, 1964 (comb.)
  - *Thraulus fasciatus* Peters & Edmunds, 1970 (comb.)
- *Thraulus torrentis* (Gillies, 1964)
  - *Marsharikella torrentis* Gillies, 1964 (orig.)
  - *Thraulus torrentis* Peters & Edmunds, 1970 (comb.)
- *Thraulus turbinatus* (Ulmer, 1909)
  - *Hagenulus turbinatus* Ulmer, 1909 (orig.)
  - *Marsharikella turbinata* Peters, Gillies & Edmunds, 1964 (comb.)
  - *Thraulus turbinatus* Peters & Edmunds, 1970 (comb.)

16. Genus ***Ulmerophlebia*** Demoulin, 1955
- *Ulmerophlebia succinea* Demoulin, 1955 [Madagascar]
- *Ulmerophlebia variegata* Demoulin, 1955 [Madagascar]

Suborder: CARAPACEA
Family: **PROSOPISTOMATIDAE** Lestage, 1921

1. Genus ***Prosopistoma*** Latreille, 1833
- *Prosopistoma africanum* Gillies, 1954
- *Prosopistoma crassi* Gillies, 1954
  - *Binoculus crassi* Demoulin, 1970 (orig.)
  - *Prosopistoma crassi* Hubbard, 1975 (comb.)
- *Prosopistoma guernei* (Vayssière, 1893)
  - *Prosopistoma de Guernei* Vayssière, 1893 (orig.)
  - *Prosopistoma Deuernei* Ulmer, 1916 (spell.)
  - *Binoculus guernei* Demoulin, 1970 (comb., spell)
  - *Prosopistoma guernei* Hubbard, 1975 (comb.)
- *Prosopistoma variegatum* Latreille, 1833 [Madagascar]