

A Guide to the Freshwater Fauna of Ceylon. Supplement 2

By

C. H. FERNANDO*

(Fisheries Research Station, Colombo 3, Ceylon)

INTRODUCTION

This is the second supplement to "A guide to the freshwater fauna of Ceylon" by A. S. Mendis and C. H. Fernando, Bull. Fish. Res. Stn., Ceylon, No. 12, 160 pp. (1962). In the present supplement additions and corrections are made in the sections on Protozoa, Annelida and Arthropoda. The sections on Platyhelminthes and Nematoda have been expanded and the Acanthocephala added. A list of species recorded and the hosts of the parasitic forms are included. In the "Guide", the insects with only larval stages in aquatic habitats were mentioned only briefly and no species lists were included. In this supplement this gap is largely filled by added notes and inclusion of species lists of all these groups except the Neuroptera, Lepidoptera, Tabanidae, Syrphidae and Stratiomyidae. The orders Neuroptera and Lepidoptera have relatively few members in freshwater habitats and the families Tabanidae, Syrphidae and Stratiomyidae have forms with larvae in aquatic habitats and also in moist places which are not true freshwater habitats. At the present time it is not possible to separate those forms living in freshwater habitats. Short diagnoses of six additional families are given, namely, the Dixidae, Psychodidae, Tabanidae, Stratiomyidae, Rhagionidae and Sciomyzidae.

Keys are provided for the Odonata and Ephemeroptera larvae down to the family level.

An attempt has been made to make the references more comprehensive. Works dealing specifically with the Ceylonese fauna are of course included, but in addition those which are of use in diagnosis of local genera and species have been cited.

Phylum—PROTOZOA

The free-living Protozoa, although by no means completely known as regards the species present, have nevertheless been recorded in some numbers. Two genera of ectoparasitic ciliates are already known from Ceylon and a third *Trichodina* is almost certainly present. The endoparasitic species consisting of the Sporozoa and Trypanosomes are practically unknown. The Myxosporidia (Sporozoa) are of great importance in that they cause serious epizootics among fishes both in culture and the wild state. No species has so far been recorded from Ceylon. The Indian fauna is better known and the literature and a complete species list is given by Tripathi (1952). These parasites are found in the skin, gills and various internal organs. The other sporozoan group found in fishes are the Haemogregarina. They are blood parasites and as far as known do not seem to cause severe disease in fishes. The Trypanosomes (Mastigophora) are not uncommon in fishes but there is only one record, *Trypanosoma saccobranchi* Castellani and Willey from *Heteropneustes fossilis*.

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* Lecturer, Zoology Department, University of Singapore, 1960-64.

Phylum—PLATYHELMINTHES

A general diagnosis has already been given in the "Guide". In this supplement the parasitic groups Trematoda and Cestoda occurring in fishes will be dealt with.

Class—Trematoda

Ecto and endoparasitic forms are common in fishes. The Ceylonese fauna is practically unknown. The recent work of Gussev (1963) has shown both a rich and varied fauna of Monogenea. Until this work appeared not a single species of Monogenea had been recorded. He recorded twenty species of which nineteen were new from a small sample of eleven species of fish. The Monogenea are of considerable importance as disease agents in fishes.

Of the Digenea there is only one record *Transversotrema patialense* metacercaria from *Macropodus cupanus* and a doubtful record of *Clinostomum piscidium* Southwell and Prasad from "*Nandus nandus*".

No Aspidobothria have so far been recorded.

The Indian fauna of these three groups is far better known and some of the more important papers are given in the references. The various types of trematodes are illustrated in Fig. A 1-6 using Ceylonese and Indian genera.

The Trematoda are divided into three sub-classes. They are given below with a short diagnosis.

Sub-class—Monogenea

Oral sucker if present weak. Have paired adhesive structures at the anterior end. Adhesive disc at posterior end provided with hooks. Paired excretory pores opening anteriorly. No alternation of hosts.

e.g., *Dactylogyrus* (Fig. A 1.)

Dactylogyroides (Fig. A 2.)

Sub-class—Aspidobothrea

No oral sucker. No paired adhesive organs at anterior end. Ventral sucker enormous, sub-divided or smaller suckers within. No alternation of host.

e.g., *Aspidogaster* (Fig. A 3.)

Sub-class—Digenea

Oral and ventral suckers usually present. No hooks. Excretory pore posterior. Alternation of hosts, one of which is usually a mollusc.

Two groups of Digenea occur in fishes.

Gasterostomata : with the mouth situated near the middle of the body. Oral sucker not in communication with the gut.

e.g., *Bucephalus* (Fig. A 4.)

Prososomata : Oral sucker in communication with gut. Placed at or near anterior end.

e.g., *Transversotrema* (Fig. A 6.)

Ophichorchis (Fig. A 5.)

Trematodes recorded from Ceylonese Freshwater Fishes

<i>Parasite</i>	<i>Host</i>	<i>Location</i>
MONOGENEA		
<i>Ancylodiscus jaini</i> Gussev	<i>Macrones keletius</i>	gills
<i>Ancyrocephalus aequalis</i> Gussev	<i>Rasbora daniconius</i>	gills
<i>Ancyrocephalus daniconii</i> Gussev	<i>Rasbora daniconius</i>	gills
<i>Ancyrocephalus danionis</i> Gussev	<i>Danio aequipinnatus</i>	gills
<i>Ancyrocephalus esomi</i> Gussev	<i>Esomus danrica</i>	gills
<i>Ancyrocephalus etropli</i> Gussev	<i>Etroplus suratensis</i>	gills
<i>Ancyrocephalus heteranchoris</i> Gussev	<i>Rasbora daniconius</i>	gills
<i>Ancyrocephalus kirtisinghei</i> Gussev	<i>Rasbora daniconius</i>	gills
<i>Ancyrocephalus rasborae</i> Gussev	<i>Rasbora daniconius</i>	gills
<i>Ancyrocephalus tripathi</i> Gussev	<i>Rasbora daniconius</i>	gills
<i>Ceylonotrema colombensis</i> Gussev	<i>Etroplus suratensis</i>	gills
<i>Dactylogyrus aequipinnati</i> Gussev	<i>Danio aequipinnatus</i>	gills
<i>Dactylogyrus curiosus</i> Gussev	<i>Rasbora daniconius</i>	gills
<i>Dactylogyrus dorsalis</i> Gussev	<i>Puntius dorsalis</i>	gills
<i>Dactylogyrus fernandoi</i> Gussev	<i>Puntius dorsalis</i>	gills
<i>Dactylogyrus saranae</i> Gussev	<i>Puntius sarana</i>	gills
<i>Dactylogyroides bimaculati</i> Gussev	<i>Puntius bimaculatus</i>	gills
<i>Dactylogyroides macracanthus</i> (Tripathi)	<i>Puntius filamentosus</i>	gills
	<i>Puntius sinhala</i>	gills
	<i>Puntius sarana</i>	gills
<i>Dactylogyroides vittati</i> Gussev	<i>Puntius vittatus</i>	gills

DIGENEA

<i>Clinostomum piscidium?</i> Southw. and Pras.	<i>Nandus nandus?</i>	intestine
<i>Transversotrema patialense</i> (only metacercaria known)		skin

Class—Cestoda

They are not common in freshwater fishes. The three species recorded so far probably represent a high proportion of those present and one of them, *Bothriocephalus gowkongensis* Yeh appears to have been introduced into Ceylon recently with fish imported for stocking. The species recorded from Ceylon are—

Family—Bothriocephalidae

Bothriocephalus gowkongensis Yeh (Fig. B 1.) from *Puntius sarana*

Family—Ptychobothriidae

Senga lucknowensis Johri (Figs. B 2, 3.) from *Mastacembelus armatus*

Family—Proteocephalidae

Gangesia bengalensis (Southwell) (Fig. B 4.) from *Wallago attu*

Another family probably represented in Ceylon are the Caryophyllidae. They are small unsegmented forms and a common genus in South-East Asia is *Lytocestus*.

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Phylum—ACANTHOCEPHALA

(Spiny headed worms)

Endoparasitic forms found in all classes of vertebrates. The body is divided into an anterior portion (presoma) made up of a spiny proboscis and a neck. The proboscis can be withdrawn into a sheath. The posterior portion consists of a trunk. There is no alimentary canal. A pair of structures called lemnisci project from the junction of the presoma and trunk into the "body cavity". The sexes are separate. The testes are paired and the accessory glands consist of cement glands and a Saeftigens pouch. The ovary breaks up into masses of cells which lie in the general body cavity. The eggs pass out through a complicated apparatus by an opening at the posterior end. The life cycle involves an intermediate host which is usually an arthropod.

Two species have so far been recorded :

Zelanechinorhynchus longinuchalis Fernando and Furtado (Figs. B 5, 6.) from *Mystus vittatus*.

Pallisentis nagpurensis Bhalerao (Fig. B 7.) from *Ophiocephalus striatus*.

Both these species were found in the intestine.

It is likely that the common Indo-Malayan genus *Acanthosentis* also occurs in Ceylon.

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Class—NEMATODA

Records of both free-living and parasitic forms are at present very meagre. Nematodes are very common in freshwater habitats. The use of suitable extraction techniques will show their abundance. The orders of Nematoda found commonly in freshwater habitats or parasitic in fishes are given, with a short diagnosis and illustrations of South-East Asian genera. Short notes are given on the parasitic species recorded. They are listed together with the hosts.

Order—Rhabditida

Oesophagus with two broadened portions, the anterior corpus and the posterior bulb with a thin isthmus in between. No buccal stylet. Includes free living saprophytic forms, e.g., *Rhabditis* (Fig. C 1.); *Diplogastero des* (Fig. C 2.)

This order also includes the Strongylyna (true bursate) forms including the hookworms and their numerous allies and the *Ascaridina* (*Ascaris*, "the roundworm"). All of these are parasitic.

Order—Spirurida

No buccal stylet. Oesophagus usually with an anterior muscular portion and a posterior glandular portion, without bulbs or isthmus. Parasitic in vertebrates. Require intermediate host.

Family—Camallanidae

Three genera have been recorded from freshwater fishes in Ceylon, *Camallanus* (Fig. D 1. 1 A.) with a buccal capsule having two distinct valves with vertical thickenings, *Zeylanema* (Fig. D 2.) similar to *Camallanus* except that the buccal thickenings have teeth and *Procamallanus* (Fig. D 3, 4.) with a continuous buccal capsule. The larvae are found in copepods and small fishes.

Family—Hedruridae

Female with a characteristic posterior sucker. Larvae in freshwater fishes. Adults in Fishes Amphibia and reptiles, e.g., *Hedruris* (Fig. D 5.)

Order—Araeolaimida

Head with four cephalic bristles well back from labial papillae. Oesophagus with anterior and terminal bulbs. The latter may be absent. No buccal stylet.

e.g., *Plectus* (Fig. C 3.)

Order—Monohysterida

Cuticle often with bristles. Oesophagus cylindrical. With or without terminal bulb. Ends of oesophageal radii convergent. No buccal stylet. Free living.

e.g., *Monohystera* (Fig. C 4.)

Order—Chromodorida

Head with papillae or bristles. Oesophagus with or without terminal bulb. Oesophageo-intestinal valve triradiate or vertically flattened. No buccal stylet. Free living.

e.g., *Monochromodora* (Fig. C 6, 7.)

Order—Enoplida

Head with many setae. Oesophageal glands opening in region of stoma. No buccal stylet. Free living.

e.g., *Tobrilus* (Figs. C 8, 9.)

Actinolaimus (Fig. C 15.)

Bathyonchus (Figs. C 10)

Order—Dorylaimida

No setae on head or body. Glands within oesophagus. Stoma with teeth on wall or with buccal stylet. Very common in freshwater habitats.

eg., *Dorilaimus* (Figs. C 12-14.)

Mononchus (Fig. C 16.)

Order—Dioctophymida

Large forms. Female with a single ovary. Male with a single spicule. Parasitic in vertebrates; Larvae in fishes and amphibians. Adults in birds and mammals.

e.g., *Eustrongylides* (Fig. D 6.) Larva

Order—Trichosyringida

No setae, alimentary canal degenerate or forms a narrow one-celled portion in the anterior region. Parasitic.

An unidentified mermithid was recorded by Weerakoon and Samarasinghe (1958) from a chironomid. A common Asiatic genus *Hydromermis* found in chironomids is shown in (Figs. D 7-9.)

List of Parasitic Nematoda recorded from freshwater fishes in Ceylon

<i>Parasite</i>	<i>Host</i>
<i>Camallanus' ceylonensis</i> Fern. and Fur.	<i>Wallago attu</i>
<i>Eustrongylides</i> sp. (larva)	<i>Heteropneustes fossilis</i> <i>Ompok bimaculatus</i> <i>Wallago attu</i>
<i>Hedruris</i> sp. (larva)	<i>Glossogobius giuris</i> <i>Ompok bimaculatus</i> <i>Wallago attu</i>
<i>Procamallanus confusus</i> Fern. and Fur.	<i>Heteropneustes fossilis</i>
<i>Procamallanus planoratus</i> Kulk.	<i>Clarias teysmanni</i> <i>Ophiocephalus punctatus</i> <i>Ophiocephalus striatus</i>
<i>Procamallanus spiculogubernaculus</i> Agarwal	<i>Clarias teysmanni</i>
<i>Procamallanus</i> sp.	<i>Wallago attu</i>
<i>Zeylanema anabantis</i> (Pearse)	<i>Anabas testudineus</i> <i>Puntius filamentosus</i> <i>Rasbora daniconius</i>
<i>Zeylanema fernandoi</i> Yeh	<i>Ophiocephalus punctatus</i> <i>Ophiocephalus striatus</i>
<i>Zeylanema kulasirii</i> Yeh	<i>Anabas testudineus</i> <i>Ophiocephalus punctatus</i>
<i>Zeylanema sweeti</i> (Moorty)	<i>Clarias teysmanni</i> <i>Rasbora daniconius</i> <i>Ophiocephalus punctatus</i> <i>Ophiocephalus striatus</i>

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Phylum—ANNELIDA

Family—Aeolosomatidae

Aeolosoma ternarium Schmarda is of doubtful validity. Probably refers to *Aeolosoma bengalense* Steph. a common Indo-Malayan species.

Family—Tubificidae

Limnodrilus hoffmeisteri Clap. Delste *Limnodrilus socialis* which is a synonym of the above species.

Class—Hirudinea

Zelanicobdella arugumensis De Silva

References

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Phylum—ARTHROPODA

Class—Crustacea.

Order Anostraca

Streptocephalus spinifer Gurney
not *Stegocephalus spinifer*

Sub-Class—Ostracoda

There are so many omissions and corrections in the species list that a fresh list of Ceylonese species is given.

Cypriceruus reticulatus Daday
Cypridopsis assimilis Sars
Cypridopsis globosa Brady
Cypridopsis marmorata Brady
Cypreeta globulus (Sars)
Cypreeta minna (King)
Cypria purpurescens (Apstein)
Cyprinotus cingalensis Brady
Cyprinotus dentatomarginatus Sars
Cypris furfuracea Brady
Cypris granulata Daday

Cypris halyi Brady
Cypris luxata Brady
Cypris monilifera Brady
Cypris tenuicauda Brady
Cypris subglobosa (Sowerby)
Illiciocypris australiensis Sars
Notodromas entzi Daday
Pseudocypris sp
Stenocypris ceylonica Daday
Stenocypris major (Baird)

Order—Decapoda

Macrobrachium kistensis (Tiwari)

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Class—Insecta

Order—Collembola

The earlier records of Ceylonese species in the references given below are in most if not all cases doubtful. Often they refer to species complexes or are not good species. Two truly aquatic genera are certain to occur namely *Sminthurides* and *Isotomurus*. A number of other genera commonly found either on the edges or on emergent vegetation include:—*Hypogastrura* (one species *H. communis* (Folsom) is pantropical and often aquatic); *Onychiurus*, *Proisotoma*, *Homidia*; *Setogaster*; and *Salina*.

I am indebted to Mr. D. H. Murphy, Zoology Department, University of Singapore, for these comments on Ceylonese Collembola.

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Order—Hemiptera

Family—Hydrometridae

Hydrometra lineata Esch.

Family—Veliidae

Rhagovelia ceylanica Lundb.

Tetraripis ravana (Kirk).

Delete *Rhagovelia nigricans* which is Ethiopian in distribution. *Tetraripis ravana* has been referred to as *Rhagovelia ravana* in the "Guide".

Family—Gerridae

Delete *Cylindrostethus bituberculatus*

Cylindrostethus nieneri

Both these are synonyms of *Cylindrostethus productus*.

Delete *Metrocoris illustrarius* which is a synonym of *M. stali*.

Family—Notonectidae

Anisops projectus Brooks.

Family—Corixidae

Micronecta ceylanica Wrobl.

Micronecta fernandoi Wrobl.

Micronecta memonides Kirk.

Micronecta sp.

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Order—Ephemeroptera

Ephemeropteran larvae are very common in all types of freshwater habitats. Some occur in standing waters of lakes, ponds and even small pools. Others are stream dwellers and occur even in torrential streams. The Ceylonese fauna is poorly known. Members of eight families numbering 17 species are on record, but it is likely that genera and even families have gone unrecorded. The adults can be identified down to the family level using the key of Ulmer (1936). The keys of Kimmins (1942) and Macan (1961) are useful for the nymphs.

A key has been drawn up for the families (nymphs) of the Ceylonese Ephemeroptera on record so far.

Key to the Families (nymphs) of Ceylonese Ephemeroptera :

1. Body consists of large, smooth, ovoid anterior portion and a small posterior portion. (Fig. E 1.)
.....PROSOPISTOMIDAE
Body not so shaped.....2
2. Mandibles visible dorsally, extending beyond anterior margin of head.....3
Mandibles not extending beyond anterior margin of head.....5
3. Mandibles long, tusk shaped (Fig. E 4.)
.....EPHEMERIDAE
Mandibles short (Fig. E 2.).....4
4. Legs short and stout (Fig. E 2.)
.....POLYMITARCHIDAE
Legs slender (Fig. E 3).
.....POTAMANTHIDAE
5. Outer tails with hairs only on inner side (Fig. 6.)
.....BAETIDAE
Outer tails with hairs on inner and outer sides.....6
6. Seven pairs of gills (Fig. E 5.)
.....LEPTOPHLEBIIDAE
Five or six pairs of gills.....7
7. Gills on segments 3-7, more or less equal in size (Fig. E 7.)
.....EPHEMERELLIDAE
Gills on segments 1-6, second pair greatly enlarged (Fig. E 8.)
.....CAENIDAE

The following species have been recorded from Ceylon:—

Family—Prospistomidae

Prospistoma sp.

Family—Ephemeridae

Ephemera supposita Etn.

Family—Polymitarcidae

- Ephoron indicus* (Pictet)
Povilla corporaali (Lestage)

Family—Potamanthidae

- Rheonanthus posticus* Banks

Family—Baetidae

- | | |
|---------------------------------|-------------------------------------|
| <i>Baetis conseutus</i> (Hagen) | <i>Cloeon marginale</i> (Hagen) |
| <i>Baetis feminalis</i> Etn. | <i>Procloeon bimaculatum</i> (Etn.) |
| <i>Baetis solidus</i> (Hagen) | |

Family—Leptophlebiidae

- | | |
|---------------------------------------|---|
| <i>Atalophlebia annulata</i> (Hagen) | <i>Atalophlebia taprobanes</i> (Walker) |
| <i>Atalophlebia fasciatus</i> (Hagen) | <i>Thraulius signatus</i> (Hagen) |
| <i>Atalophlebia femoralis</i> (Hagen) | |

Family—Ephemerellidae

- Teloganodes major* Etn.

Family—Caenidae

- Caenis perpusilla* Walker

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Order—Plecoptera

Only four species have been recorded so far, namely—

Neoperla angulata (Walker)

Panoperla testacea (Hagen)

Panoperla limosa (Hagen)

Tetropina fulgescens (Enderlein)

Recently Professor Per Brinck of the Zoological Institute, University of Lund, collected Plecoptera from Ceylon. He informed me in reply to my queries about Ceylonese species that *Neoperla angulata* will probably remain unchanged whilst the others are very likely to need alteration when his material is worked out.

Neoperla in shown is Fig. F 1.

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Order—Odonata

The general features of odonata larvae have been given in the "Guide" p. 93. Lieftinck (1955) has given a synopsis of Ceylonese species. The present list is essentially the same as his except that the order of the species is different and no sub-family divisions are given. The larval forms are not well known in many cases but some have been described in the literature given below.

A key to the families of Ceylonese Odonata larvae has been drawn up by Mr. J. I. Furtado of the Zoology Department, University of Malaya, and is included.

Of the 106 species recorded from Ceylon 42 are endemic. For quick reference a table has been drawn up with the numbers in each family and the number of endemic species.

	<i>Families</i>	<i>Endemic</i>	<i>Total</i>
<i>Zygoptera</i>			
	Chlorocyphidae ..	.. 3	.. 4
	Epallagidae ..	.. 1	.. 1
	Calopterygidae ..	.. 1	.. 2
	Lestidae ..	.. 3	.. 5
	Platystictidae ..	.. 14	.. 14
	Protoneuridae ..	.. 5	.. 5
	Platycnemidae ..	.. —	.. 1
	Caenagrionidae ..	.. 1	.. 14
<i>Anisoptera</i>			
	Libellulidae ..	.. 3	.. 40
	Corduliidae ..	.. 2	.. 2
	Gomphidae ..	.. 12	.. 13
	Aeschnidae ..	.. —	.. 5
	Total ..	42	106

Key to families of Ceylonese Odonata larvae

1. Larva slender, usually with cylindrical abdomen not widening behind thorax ; cercibranchiate, with 2-3 caudal appendages (gill lamellae) projecting externally from tip of abdomen ;
Suborder ZYGOPTERA or damselflies ; 2
- Larva stout, with abdomen somewhat widened behind thorax ; proctobranchiate, without external caudal gills but with numerous gills in a rectal gill-chamber ; anus surrounded externally by an anal pyramid consisting of 3 stiff pointed valves (1 medio-dorsal and 2 latero-ventral) and 2 lateral cercoids ;
Suborder ANISOPTERA or dragonflies 9
2. Antennal segment 1 as long as or longer than remaining 6 segments ; labial mask without setae ; 3
- Antennal segment 1 much shorter than the remaining segments combined ; labial mask with or without setae ; 5
3. Median lobe of prementum with a deep open apical cleft ; lateral lobes of prementum (labial palps) narrow, with distal margin deeply incised and a long movable hook ; long and slender larvae, with long spidery legs and elongate caudal gills ; CALOPTERYGIDAE (= AGRIONIDAE)
- Median lobe of prementum with a shallow closed apical cleft ; labial mask flat 4
4. Caudal gills saccoid with acuminate terminations ; 7 pairs of lateral abdominal gills present ; larva of robust build ; labial palps narrow and terminating distally into 1-2 teeth and a long movable hook ; EPALLAGIDAE
- Caudal gills consisting of 2 long sharply-triquetral lateral spines armed with strong spines, and a rudimentary triangular medio-dorsal gill ; larval head subtriangular, strongly projecting in front ; labial palps narrow terminating distally into sharp and a movable hook ; CHLOROCYPHIDAE
5. Median lobe of prementum apically cleft ; 6
- Median lobe of prementum apically entire 8
6. Prementum subtriangular to claviform, distally concave ; labial mask with setae on prementum, palp and movable hook ; labial palp distally expanded and terminating in movable hook and teeth ; caudal lamellae elongate, with main trachea parallel and secondary tracheae arising at right angles to main stems ; larvae elongate and slender LESTIDAE
- Prementum subpentagonal, short and flat ; setae absent on movable hook ; secondary tracheae never arising at right angles to main stems 7
7. Premental and palpal setae absent ; labium flat ; prementum large, somewhat parallel-sided ; labial palps relatively small ; caudal lamellae inflated into elongate oval sacs with acuminate tips PLAYSTICTIDAE
- Premental and palpal setae present ; labium flat ; labial palp terminating into short movable hook and shortly-dentate distal margin ; gills slightly inflated, vertical, elongate-oval lamellae, obtuse apically ; PROTONEURIDAE
8. Premental setae arranged in single horizontal row ; palpal setae present, with palps distally dentate ; caudal gills petiolated basally, broadened apically, subnodate or denodate, with secondary tracheae arising obliquely from primary ; PLATYCNEMIDIDAE
- Premental setae arranged in 2 oblique rows ; palpal setae present ; distal margin of palps dentate ; labium short and flat ; caudal gills nodate, subnodate or entire, with secondary tracheae arising obliquely from main stems ; COENAGRIONIDAE
9. Labial palp zygopterous, flat, without setae ; labial palp narrow with long robust movable hook ; 10
- Labial mask broad, spoon-shaped (deeply concave), with numerous setae ; labial palps broad, with distal margin deeply incised, crenate or serrate ; palpal setae present ; median lobe of prementum entire ; fore and mid tarsi 3-segmented ; antennae 7-segmented ; 11
10. Fore and mid-tarsi 3-segmented ; antenna 7-segmented ; median lobe of prementum cleft apically ; palpal setae absent except in *Gynacantha* ; AESCHNIDAE
- Fore and mid-tarsi 2-segmented ; antenna 4-segmented ; median lobe of prementum entire ; palpal setae absent ; GOMPHIDAE
11. Abdominal length less than twice width ; long legged ; CORDULIIDAE
- Abdominal length greater than twice width ; larva stocky LIBELLULIDAE

The species recorded from Ceylon are as follows :

Sub-order—Zygoptera

Family—Chlorocyphidae

Libellago adami Fraser
Libellago finalis (Selys)

Libellago greeni (Laidlaw)
Libellago indica (Fraser)

Family—Epallagidae

Euphaea splendens Selys

Family—Calopterygidae (=Agrionidae)

Neurobasis chinensis chinensis (L).
Vestalis apicalis nigrescens Fraser

Family—Lestidae

Lestes divisa Selys
Lestes elata Selys
Lestes gracilis gracilis Selys

Lestes orientalis Selys
Lestes praemorsa decipens Kirby.

Family—Platystictidae

Drepanosticta adamsi (Fraser)
Drepanosticta austeni Lieftinck
Drepanosticta digna Selys
Drepanosticta fraseri Lieftinck
Drepanosticta hilaris (Selys)
Drepanosticta lankanensis (Fraser)
Drepanosticta montana (Selys)

Drepanosticta nietneri (Fraser)
Drepanosticta submontana (Fraser)
Drepanosticta sub-tropica (Fraser)
Drepanosticta tropica (Selys)
Drepanosticta walli (Fraser)
Platysticta apicalis Kirby
Platysticta maculata Selys

Family—Protoneuridae

Elattoneura caesia (Selys)
Elattoneura centralis (Selys)
Elattoneura leucostigma (Fraser)

Elattoneura tenax (Selys)
Prodasineura sita (Kirby)

Family—Platycnemididae

Copera marginipes (Ramb.)

Family—Coenagriidae

Aciagrion occidentale Laidlaw
Agriocnemis famina (Brauer)
Agriocnemis pygmaea (Ramb.)
Ceriagrion cerinorubellum (Brauer)
Ceriagrion coromandelianum (F.)
Coenagrion malayanum (Selys)
Enallagma parvum Selys

Ischnura aurora aurora Brauer
Ischnura senegalensis (Ramb.)
Onychagrion atrocyana Selys
Pseudagrion malabaricum Fraser
Pseudagrion microcephalum (Ramb.)
Pseudagrion rubiceps ceylonicum (Kirby)
Mortonagrion sp.

Sub-order—Anisoptera

Family—Libellulidae

- | | |
|--|--|
| <i>Acisoma panorpoides</i> (Ramb.) | <i>Orthetrum luzonicum</i> (Brauer) |
| <i>Aethriamanta brevipennis</i> (Ramb.) | <i>Orthetrum pruinatum neglectum</i> (Ramb.) |
| <i>Brachydiplax sobrina</i> (Ramb.) | <i>Orthetrum sabina sabina</i> (Drury) |
| <i>Brachythemis contaminata</i> (F.) | <i>Orthetrum triangulare triangulare</i> (Selys) |
| <i>Bradinyopyga geminata</i> (Ramb.) | <i>Onychothemis testacea ceylanica</i> Ris |
| <i>Cratilla lineata calverti</i> Forster | <i>Pantala flavescens</i> (F.) |
| <i>Crocothemis servilia</i> (Drury) | <i>Rhodothemis rufa</i> (Ramb.) |
| <i>Diplocodes nebulosa</i> (F.) | <i>Rhyothemis triangularis</i> Kirby |
| <i>Diplocodes trivialis</i> (Ramb.) | <i>Rhyothemis variagata variagata</i> (L.) |
| <i>Hydrobasilaris croceus</i> (Brauer) | <i>Sympetrum fonscolombei</i> (Selys) |
| <i>Hyaothemis frustorferi</i> (Korsh.) | <i>Tholymis tillarga</i> (F.) |
| <i>Indothemis caesia</i> (Ramb.) | <i>Tramea basilaris burmisteri</i> Kirby |
| <i>Indothemis limbata sita</i> Campion | <i>Tramea limbata simil ta</i> (Ramb.) |
| <i>Lathrecista asiatica asiatica</i> (F.) | <i>Trithemis aurora</i> (Brun.) |
| <i>Macrodiplax cora</i> (Brauer) | <i>Trithemis festiva</i> (Ramb.) |
| <i>Neurothemis intermedia intermedia</i> (Ramb.) | <i>Trithemis kirbyi</i> Selys |
| <i>Neurothemis tullia tullia</i> (Drury) | <i>Trithemis pallidinervis</i> (Kirby) |
| <i>Orthetrum chrysis</i> (Selys) | <i>Urothemis signata signata</i> (Ramb.) |
| <i>Orthetrum glaucum</i> (Brauer) | <i>Zygonyx iris ceylanici</i> (Kirby) |
| | <i>Zyxomma petiolatum</i> Ramb. |

Family—Corduliidae

- Epopthalmia vittata cyanocephala* (Hagen)
Macromia zeylanica Fraser

Family—Gomphidae

- | | |
|---|---|
| <i>Burmagomphus pyramidalis sinuatus</i> Fraser | <i>Ictinogomphus rapax</i> (Ramb.) |
| <i>Cyclogomphus gynostylus</i> Fraser | <i>Macrogomphus lankanensis</i> Fraser |
| <i>Gomphidia pearsoni</i> Fraser | <i>Macrogomphus annulatus keiseri</i> Lieftinck |
| <i>Heliogomphus ceylonicus</i> (Selys) | <i>Megalogomphus ceylonicus</i> (Laidlaw) |
| <i>Heliogomphus lyratus</i> Fraser | <i>Microgomphus wijaya</i> Lieftinck |
| <i>Heliogomphus nietneri</i> (Selys) | <i>Paragomphus henryi</i> (Laidlaw) |
| <i>Heliogomphus walli</i> Fraser | |

Family—Aeshnidae

- | | |
|-----------------------------------|------------------------------------|
| <i>Anax immaculifrons</i> (Ramb.) | <i>Gynacantha</i> sp. |
| <i>Anax guttatus</i> (Burm.) | <i>Hemianax ephippiger</i> (Burm.) |
| <i>Anax indicus</i> Lieftinck | |

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Order—Trichoptera

The Trichoptera are amongst the commonest larvae in large bodies of water. Many species also occur in fast flowing streams including torrents. The Ceylonese fauna is relatively well known (adults), thanks to the recent paper by Schmid (1958). The present list of species has been compiled by Mr. D. E. Kimmins of the British Museum (Nat. Hist.) and includes some from a paper by him in the press.

The Ceylonese species are as follows :—

Family—Rhyacophilidae

Agapetus anuragoda Schmid
Agapetus ayodhia Schmid
Agapetus hanumata Schmid
Agapetus ohiya Kimmins
Agapetus rama Schmid

Agapetus rawana Schmid
Agapetus rudis Hagen
Agapetus sita Schmid
Apsilochorema diffinis Banks
Rhyacophila castanea Hagen

Family—Hydroptilidae

Balioptilia guruluhela Schmid
Balioptilia hinipitigola Schmid
Balioptilia medipitigola Schmid
Balioptilia udawarama Schmid
Chrysotrichia aranuwa Schmid
Chrysotrichia dotalugola Schmid
Chrysotrichia hapitigola Schmid
Chrysotrichia hatuagola Schmid
Hydroptila dikirilagoda Schmid
Hydroptila kurukepetiya Schmid
Hydroptila mitirigalla Schmid
Macrostactobia elawalikanda Schmid
Microptila nikataruwa (Schmid)

Orthotrichia indica Martynov
Oxydroptila furcata Martynov
Oxydroptila kirilawela Schmid
Oxyethira bogambara Schmid
Oxyethira galekoluma Schmid
Parastactobia talakalahena Schmid
Plethus amogawarsa Schmid
Plethus bodhikatuwa Schmid
Plethus cilamegha Schmid
Plethus cursitans (Hagen)
Plethus udawasadena Schmid
Pseudoxythira asgirikanda Schmid
Stactobia fisheri Schmid

Family—Philopotamidae

Chimarra actinifera Schmid
Chimarra akarawitta Schmid
Chimarra auriceps Hagen
Chimarra auricoma Kimmins
Chimarra ceylanica Kimmins
Chimarra circularis Hagen
Chimarra confusa Ulmer
Chimarra godagama Schmid

Chimarra lankana Kimmins
Chimarra lewisi Kimmins
Chimarra sandhamma Schmid
Chimarra sepulchralis Hagen
Chimarra uvana Kimmins
Chimarra wiharawela Schmid
Gunungiella madakumbura Schmid
Gunungiella nietneri Banks

Family—Polycentropidae

Dipseudopsis horni Ulmer
Dipseudopsis morosa Banks
Dipseudopsis stellata McLachlan
Nyctiophylax abaya Schmid
Nyctiophylax denanampriya Schmid
Nyctiophylax hittigama Schmid
Nyctiophylax vetulya Schmid
Pahamunaya layagammeda Schmid

Polyplectropus amarawathi Schmid
Polyplectropus matadapaya Schmid
Polyplectropus nubigens (Hagen)
Polyplectropus parakrama Schmid
Pseudoneureclipsis funesta Hagen
Pseudoneureclipsis nissanka Schmid
Pseudoneureclipsis thuparama Schmid
Pseudoneureclipsis watagoda Schmid

Family—Psychomyiidae

Abaria margaritifera Schmid
Ecnomus ceylanicus Mosely
Ecnomus duthagamini Schmid
Ecnomus helakanda Schmid
Ecnomus hinayana Schmid
Ecnomus indicus Martynov
Ecnomus lohapresada Schmid
Ecnomus pusanus Mosely
Ecnomus saddhatissa Schmid
Ecnomus tenellus (Rambur)
Ecnomus vaharika Schmid

Ecnomus vahasaba Schmid
Paduniella ceylanica Ulmer
Paduniella mahanawana Schmid
Paduniella mahindra Schmid
Panduniella pandya Schmid
Panduniella sangamitra Schmid
Panduniella subbakara Schmid
Panduniella vattagamani Schmid
Panduniella vikarmasinha Schmid
Tinodes mitis (Hagen)
Tinodes pullulans Navas

Family—Hydropsychidae

Aethaloptera sexpunctata (Kolenati)
Amphipsyche indica Martynov
Diplectrona kirimaduhela Schmid
Diplectrona maligna (Hagen)
Diplectrona papillonacea (Hagen)
Diplectronella taprobanes (Hagen)
Hydropsyche fryeri Ulmer
Hydropsyche katugahakanda Schmid
Hydropsyche malassanka Schmid
Hydropsychodes curvata (Martynov)
Hydropsychodes galahittigama Schmid
Hydropsychodes galapitikanda Schmid
Hydropsychodes kirimadawa Schmid

Macronema multifarium (Walker)
Macronema nebulosum Hagen
Macronema obliquum Hagen
Macronema pseudoneura Brauer
Macronema sepultum Hagen
Macronema splendidum Hagen
Oestropsyche vitrina (Hagen)
Polymorphanisus ocularis Ulmer
Pseudoleptonema ceylanicum Hagen
Pseudoleptonema godapitigama Schmid
Pseudoleptonema kalukandama Schmid
Synaptopsyche nikalandugola Schmid

Family Calamoceratidae

Anisocentropus annulicornis (Hagen)
Anisocentropus brevipennis (Ulmer)
Anisocentropus decipens (Ulmer)
Anisocentropus immunis McLachlan

Anisocentropus ittikulama Schmid
Ganonema elyakatuwa Schmid
Ganonema falcata (Banks)
Ganonema pallicorne McLachlan

Family—Odontoceridae

Marilia mixta (Hagen)

Family—Leptoceridae

Adicella agastya Schmid
Adicella biramosa Martynov
Adicella ino (Hagen)
Adicella najas (Hagen)
Athripsodes isurumuniya (Schmid)
Athripsodina martynovi (Forsslund)
Nietnerella hageni Kimmins
Oecetis biramosa Martynov
Oecetis ceylanica (Ulmer)
Oecetis dhatusena Schmid
Oecetis fahieni Schmid
Oecetis hamorta (Ulmer)
Oecetis lais (Hagen)
Oecetis lingua Schmid
Oecetis maligawa Schmid
Oecetis meghadonta Schmid
Oecetis naravitta Schmid
Oecetis nerviciliata (Schmid)

Oecetis nervisquamosa (Schmid)
Oecetis punctatissima (Schmid)
Oecetis sumanasara Schmid
Parasetodes maculata (Banks)
Setodes anuradha Schmid
Setodes argentoaurea Ulmer
Setodes argentonigra Ulmer
Setodes inlensis Martynov
Setodes iris Hagen
Setodes mahasena Schmid
Setodes mahawansa Schmid
Triaenodes cloe (Hagen)
Triaenodes gazella (Hagen)
Triaenodes lankarama Schmid
Triaenodes ornata Ulmer
Trichosetodes argentolineata Ulmer
Trichosetodes meghawanabaya Schmid
Tripletides ceylanicum Mosely

Family—Goeridae

Goera katugalkanda Schmid
Goera katugastota Schmid
Goera kirilagoda Schmid

Goera paragoda Schmid
Goera vulpina (Hagen)

Family—Lepidostomatidae

Goerodes fuscata (Navas)
Goerodes kanda Mosely
Goerodes mustellina (Hagen)

Goerodes piscina (Hagen)
Goerodes punda (Hagen)
Goerodes ursina (Hagen)

Family—Helicopsychoidea

Helicopsyche amarawathi Schmid
Helicopsyche rupawathi Schmid
Noleca asaka Mosely
Noleca hapugowala Schmid

Noleca kabaragola Schmid
Noleca koluandura Schmid
Noleca nittimaluna Schmid
Noleca watukaragoda Schmid

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Order—Coleoptera

Hardly any work is available of recent date on the taxonomy of the Ceylonese species. The literature given should serve to some extent in the diagnosis of genera and species although it deals with species from other countries or is considerably out of date as regards nomenclature.

A few changes to the names are as follows:—

Hydaticus has been wrongly spelt *Hydraticus* in the "Guide".

Clypeodytes bufo (Sharp)

Uvarus antennatus (Reg.)

Clypeodytes griseoguttatus (Reg.)

Uvarus flaviculus (Motsch.)

Guignotus inconstans (Reg.)

Uvarus genitalis (Sharp)

All these species have been given under the generic name *Bidessus* in the "Guide."

Copelatus tenebrosus Reg.

Copelatus irinus Reg.

Copelatus tenebrosus has been referred to as *Copelatus pusillus* and *C. irinus* as *C. horni* in the "Guide".

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Order—Diptera

This order includes families with aquatic and non-aquatic larvae. In some both truly aquatic and semi-aquatic or detritus inhabiting larvae are found. In the "Guide" no species list was given but the following families have been dealt with briefly, namely: Tipulidae, Culicidae, Corethridae, Chironomidae, Heleidae, Simulidae and Blepharoceridae (Nematocera) and Syrphidae (Brachycera). In this supplement the Corethridae are included in the Culicidae as a sub-family. Brief diagnoses with notes on biology are given for the Psychodidae, and Dixidae (Nematocera) and Stratiomyidae and Tabanidae (Brachycera). A few remarks are made on two other brachyceran families Rhagionidae and Sciomyzidae which have aquatic larvae.

A list of species recorded is included for all the families except the Stratiomyidae, Syrphidae, Tabanidae, Rhagionidae and Sciomyzidae. The references cover relevant literature in all the families mentioned.

Family—Tipulidae

They are common in the larval and pupal stages in moist habitats and many are truly aquatic. The adults are very characteristic, appearing like mosquitoes with enormously elongated legs. The larva has already been illustrated in the "Guide", Fig. 10, p. 95. The Ceylonese records though numerous probably represent only a fraction of the species found. The absence of a generic revision makes the placing of species rather difficult since so many changes have taken place at various times.

The Ceylonese records are as follows:—

- | | |
|---|---|
| <i>Antocha salikensis</i> Alex. | <i>Hexatoma tuberculifera</i> (Edw.) |
| <i>Conosia irrorata</i> (Wied.) | <i>Geranomyia fletcheri</i> Edw. |
| <i>Conosia minuscula</i> Alex. | <i>Geranomyia genitaloides</i> Senior White |
| <i>Cryptolabis pollicis</i> Alex. | <i>Gonomyia conchiformis</i> Alex. |
| <i>Cryptolabis triquestra</i> Alex. | <i>Gonomyia hedys</i> Alex. |
| <i>Ctenascroscelis ochripes</i> (Brun.) | <i>Gonomyia lanka</i> Alex. |
| <i>Dicranomyia absens</i> Brun. | <i>Gonomyia persimilis</i> Alex. |
| <i>Dicranomyia columbina</i> Brun. | <i>Gonomyia pictalis</i> Alex. |
| <i>Dicranomyia fascipennis</i> Brun. | <i>Gonomyia pollicis</i> Alex. |
| <i>Dicranomyia subtesselata</i> Brun. | <i>Gonomyia rohuna</i> Alex. |
| <i>Dolichozeza guttunalis</i> Alex. | <i>Gonomyia serendibensis</i> Alex. |
| <i>Dolichozeza palifera</i> Alex. | <i>Gymnastes cyanea</i> (Edw.) |
| <i>Dolichozeza sinhalica</i> Alex. | <i>Gymnastes kandyana</i> Alex. |
| <i>Epiphragma kempfi</i> Brun. | <i>Gymnastes maya</i> Alex. |
| <i>Erioptera ornatipes</i> Edw. | <i>Gymnastes simhale</i> Alex. |
| <i>Eupilaria sinhalica</i> Alex. | <i>Libnotes rotata</i> (Van der Wulp) |
| <i>Eupilaria taprobatica</i> Alex. | <i>Libnotes notatinervis</i> Brun. |
| <i>Eupilaria thysantos</i> Alex. | <i>Libnotes poeciloptera</i> Ost. Sack. |
| <i>Hexatoma albonotata</i> (Loew) | <i>Libnotes punctipennis</i> Brun. |
| <i>Hexatoma badia badia</i> (Brun.) | <i>Libnotes thwaitesiana</i> West. |
| <i>Hexatoma crystalloptera</i> (Ost. Sack.) | <i>Limnobia albipes</i> Senior White |
| <i>Hexatoma ctenophorides</i> (Edw.) | <i>Limnophila simplex</i> Brun. |
| <i>Hexatoma fusca</i> (Edw.) | <i>Longurio errans</i> (Edw.) |
| <i>Hexatoma greeni</i> (Edw.) | <i>Longurio zeylanica</i> Alex. |
| <i>Hexatoma humberti</i> (Ost. Sack.) | <i>Mitopeza flavicans</i> Edw. |
| <i>Hexatoma meleagris</i> (Ost. Sack.) | <i>Molophilus kandyensis</i> Alex. |
| <i>Hexatoma ochripleuris</i> (Edw.) | <i>Molophilus rachus</i> Alex. |
| <i>Hexatoma pachyrrhina</i> (Ost. Sack.) | <i>Molophilus veddah</i> Alex. |
| <i>Hexatoma pachyrrhinoides</i> (Edw.) | <i>Molophilus wejaya</i> Alex. |
| <i>Hexatoma seredib</i> Alex. | <i>Molophilus yakko</i> Alex. |
| <i>Hexatoma rufithorax</i> (Brun.) | <i>Nephrotoma pleurinotata</i> (Brun.) |
| <i>Hexatoma scullata</i> (Edw.) | <i>Olbiogaster orientalis</i> Edw. |
| <i>Hexatoma subnitens</i> (Edw.) | <i>Orimarga asignata</i> Senior White |
| <i>Hexatoma subpaenulata</i> (Edw.) | |

Family—Tipulidae—Contd.

Pachyrhina javensis (Dol.)
Paradelphomyia indulcata Alex.
Polymera zeylanica Alex.
Pselliophora elongata Edw.
Pselliophora henryi Edw.
Pselliophora laeta (F.)
Pselliophora taprobanes (Walk.)
Pseudolimnophila zeylanica Alex.
Rhabdomastix schmidiana Alex.
Styringomyia ceylonica Brun.
Styringomyia crassicosta (Spies.)
Styringomyia fryeri Brun.
Styringomyia marmorata Senior White

Teucholabis fenestra Ost. Sack.
Teucholabis ornata Brun.
Thrypticomys longineva Edw.
Thrypticomys saltens (Dol.)
Tipula brunettiella Alex.
Tipula ceylonica Edw.
Tipula flavescens Brun.
Tipula gracillina Brun.
Tipula hampsoni Edw.
Trentepholia nigriapicalis (Brun.)
Trentepholia pennipes Ost. Sack.
Trentepholia spieseri Edw.
Trentepholia trentepholi Wied.

Family—Psychodidae

Although usually found in moist habitats, some species have truly aquatic larvae and pupae. The larva has already been illustrated in the "Guide", Fig. 15, p. 95. The larvae are somewhat flattened, lack prolegs and the body segments are divided into annuli. The head is small and the terminal end of the abdomen usually bears a circle of hairs.

The Ceylonese records are —

Psychoda geniculata Brun
Psychoda albopicta Brun.
Parabrunetiella albohumentalis Brun.

Parabrunetiella flavicollis Brun.
Pericoma proxima Brun.

Some species are found in highly polluted habitats like catch pits of latrines. A very common species in this habitat is a Pan-tropical species *Telmatoscopus albipunctatus* Say.

Family—Culicidae

This family includes the mosquitoes, phantom midges and some "gnats". The mosquitoes belong to the sub-family Culicinae and the phantom midges and gnats to the sub-family Corethrinae.

The Corethrinae are represented by two genera *Chaoborus*, which is truly planktonic and abundant in the larger lakes, and *Corethrella* found in a variety of habitats including marshes and pitcher plants (*Nepenthes*). They are characterised by the prehensile antennae.

The Ceylonese records are —

Chaoborus asiaticus Giles
Corethrella inepta (Annandale) (Fig. F 2, 3.)

Chaoborus asiaticus has already been illustrated in the "Guide" (Fig. 4., p. 95)

The mosquitoes are all characterised by the paired mouth brushes. They do not have prehensile antennae. In the anophelines the hairs of the head and thorax numbered in Fig. H 1. are used in specific diagnosis together with the palmate hairs which vary in shape and size. In the culicines the structure of the terminal segments of the abdomen including the siphon are of prime importance in specific diagnosis (Fig. G 1.). The comb teeth, pecten teeth, hair tufts and the distribution of various setae in this region serve in diagnosis both in the culicines proper and most other non-anophelines too.

Mosquito larvae and pupae are essentially inhabitants of shallow, still waters. They live amongst vegetation and removal of this protection often means their elimination. A few species, e.g., *Anopheles fluviatilis* are found in streams, but even here they live in the relatively calm backwaters. Some live in collections of water in leaf axils or fallen leaves, others are exclusively found in pitcher plants. A number of species of Culicines are found in polluted waters.

FIG. G

The mosquitoes are the best known group of insects because of their importance as transmitters of diseases. In groups known to transmit diseases like the Anophelines and Culicines much work has been devoted to the taxonomy and in recent years to the biology. The freshwater biologist often comes across mosquito larvae and should be able to identify them at least to the major groups. There are keys available for the diagnosis of the Ceylonese larvae in Carter (1925) and Senior White (1925, 1927). The features used in the diagnosis of larvae are illustrated in Fig. G 1. for Culicines and Fig. H 1. for Anophelines. Also the larvae of a few species are shown in Figs. G and H.

The mosquitoes recorded from Ceylon have been taken from the world compilation of Stone, Knight and Starcker (1959).

They are as follows —

- | | |
|---|--|
| <i>Aedes aegypti</i> (L.) (Fig. H 7.) | <i>Anopheles gigas</i> var <i>simlensis</i> (James) |
| <i>Aedes albolateralis</i> (Theo.) | <i>Anopheles hyrcanus</i> (Pallas) |
| <i>Aedes alboscuteclatus</i> (Theo.) | <i>Anopheles insulaeflorum</i> (Swell. and Swell.) |
| <i>Aedes albotaeniatus</i> (Leicester) | <i>Anopheles jamesi</i> Theo. (Fig. H 2.) |
| <i>Aedes aureostriatus</i> var <i>greeni</i> (Theo.) | <i>Anopheles kawari</i> James |
| <i>Aedes aureostriatus</i> var <i>kanaranus</i> (Barr.) | <i>Anopheles maculatus</i> Theo. |
| <i>Aedes butleri</i> Theo. | <i>Anopheles nigerrimus</i> Giles |
| <i>Aedes chrysolineatus</i> (Theo.) | <i>Anopheles pallidus</i> Theo. |
| <i>Aedes gubernatoris</i> (Giles) | <i>Anopheles pediotaeniatus</i> (Leicester) |
| <i>Aedes harveyi</i> (Barr.) | <i>Anopheles pseudobarbistrostris</i> Theo. |
| <i>Aedes indicus</i> (Theo.) | <i>Anopheles ramseyi</i> Covell |
| <i>Aedes jamesi</i> (Edw.) | <i>Anopheles subpictus</i> Grassi |
| <i>Aedes laniger</i> (Wied.) | <i>Anopheles tessellatus</i> Theo. |
| <i>Aedes lankaensis</i> Stone and Knight | <i>Anopheles vagus</i> Donitz |
| <i>Aedes longirostris</i> (Leicester) | <i>Anopheles varuna</i> Iyenger |
| <i>Aedes macdougalli</i> Edw. | <i>Armigeres aureolineatus</i> (Leicester) (Fig. G 5.) |
| <i>Aedes medipunctatus</i> (Theo.) | <i>Armigeres magnus</i> (Theo.) |
| <i>Aedes niveus</i> Ludlow | <i>Armigeres omissus</i> (Edw.) |
| <i>Aedes novalbopictus</i> Barr. | <i>Armigeres subalbatus</i> (Coq.) |
| <i>Aedes ostentatio</i> (Leicester) | <i>Culex bahri</i> (Edw.) |
| <i>Aedes pallidostriatus</i> (Theo.) | <i>Culex bairlyi</i> (Barr.) |
| <i>Aedes pipersalatus</i> (Giles) | <i>Culex barraudi</i> Edw. |
| <i>Aedes pseudomediofasciatus</i> (Theo.) | <i>Culex bitaeniorhynchus</i> Giles |
| <i>Aedes pseudotaeniatus</i> Giles | <i>Culex brevipalpis</i> Giles |
| <i>Aedes reginae</i> Edw. | <i>Culex campilunati</i> Carter and Wijesundera |
| <i>Aedes scatophogoides</i> (Theo.) | <i>Culex castrensis</i> Edw. |
| <i>Aedes seculatus</i> Menon | <i>Culex cinctellus</i> Edw. |
| <i>Aedes simplex</i> (Theo.) | <i>Culex edwardsi</i> Barr. |
| <i>Aedes spermathecus</i> Wijesundera | <i>Culex epidesmus</i> (Theo.) |
| <i>Aedes stenoestrus</i> (Theo.) | <i>Culex fragilis</i> Ludlow |
| <i>Aedes taeniorhynchoides</i> (Christophers) | <i>Culex fuscanus</i> Wied. (Fig. G 4.) |
| <i>Aedes thomasi</i> (Theo.) | <i>Culex fuscifurcatus</i> Edw. |
| <i>Aedes vexans</i> (Meigan) | <i>Culex fuscocephalus</i> Theo. |
| <i>Aedes vittatus</i> (Bigot) | <i>Culex gelidus</i> Theo. |
| <i>Aedes w-albus</i> (Theo.) | <i>Culex halifaxi</i> Theo. |
| <i>Aedes yerburyi</i> Edw. | <i>Culex infantulus</i> Edw. |
| <i>Anopheles aconitus</i> Donitz | <i>Culex malayi</i> (Leicester) |
| <i>Anopheles aitkenii aitkenii</i> James | <i>Culex mammalifer</i> (Leicester) |
| <i>Anopheles annandalei interruptus</i> Puri | <i>Culex mimulus</i> Edw. |
| <i>Anopheles annularis</i> Van der Wulp | <i>Culex minor</i> (Leicester) |
| <i>Anopheles barbistrostris</i> Van der Wulp | <i>Culex minutissimus</i> (Theo.) |
| <i>Anopheles culicifacies</i> Giles | <i>Culex nigropunctatus</i> Edw. |
| <i>Anopheles elegans</i> James | <i>Culex pallidothorax</i> Theo. |
| <i>Anopheles fluviatilis</i> James | <i>Culex pipiens quinquefasciatus</i> Say |
| <i>Anopheles gigas</i> Giles | <i>Culex fatigans</i> (Figs. G 2, 3.) |
| <i>Anopheles gigas</i> var <i>refutans</i> Alcock | <i>Culex raptor</i> (Edw.) |

Culex rubithoracis (Leicester)
Culex shebbearei Barr.
Culex spathifurca (Edw.)
Culex sinensis Theo.
Culex tritaeniorhynchus Giles (Fig. G 1.)
Culex uniformis Theo
Culex vorax (Edw.)
Ficalbia chamberlaini chamberlaini Ludlow
Ficalbia chamberlaini clavipapus (Theo.)
Ficalbia hybrida (Leicester)
Ficalbia intermedia (Barr.)
Ficalbia luzonensis (Ludlow) (Fig. H 5.)
Ficalbia minima (Theo.)
Heizmannia greeni (Theo.)
Hodgesia bailyi Barr.

Hodgesia malayi Leicester.
Malaya genuirostris Leicester
Mansonia annulifera (Theo.)
Mansonia crassipes (Van der Wulp)
Mansonia indiana Edw.
Mansonia uniformis (Theo.) (Fig. G 6.)
Orthopodomyia anopheloides anopheloides (Giles)
Orthopodomyia anopheloides maculata (Theo.)
Orthopodomyia flavithorax Barr.
Toxorhynchites minimus (Theo.)
Toxorhynchites splendens (Wied.) (Fig. H 4.)
Tripteroides affinis (Edw.)
Tripteroides aranoides (Theo.)
Tripteroides doffeiri (Gunther)

Family—Dixidae

They resemble mosquito larvae superficially but can usually be recognised in life by their characteristic U Shape. They differ from mosquito larvae in having discrete thoracic segments and two pairs of prolegs on abdominal segments 1 and 2. They are rare. One species has been recorded in Ceylon namely *Dixa zeylanica* Senior White. *Dixa* is illustrated in Figs. F 4–7.

Family—Chironomidae

The larvae are common in habitats with decaying organic matter. They often reach enormous numbers in suitable habitats. Many species occur in paddy fields in the moist soil. They form an important constituent of the bottom fauna of tanks and ponds. Some species are red in colour and are referred to as bloodworms. They are used to feed fish in aquaria. Many species are pale yellow or greenish in colour.

The records from Ceylon are only a small fraction of the number certainly found in aquatic habitats. They are as follows :—

<i>Cardiocladius ceylanicus</i> Kieff.	<i>Chironomus superbis</i> Kieff.
<i>Chironomus allothrix</i> Kieff.	<i>Chironomus variicornis</i> Kieff.
<i>Chironomus elatus</i> Kieff.	<i>Chironomus</i> sp.
<i>Chironomus fuscitarsus</i> Kieff.	<i>Dactylocladius ceylanicus</i> Kieff.
<i>Chironomus gloriosus</i> Kieff.	<i>Pentaneura</i> sp.
<i>Chironomus heptatomus</i> Kieff.	<i>Polypedilum nubifer</i> (Skuse)
<i>Chironomus nigromarginatus</i> Kieff.	<i>Procladius</i> sp.
<i>Chironomus perichlorus</i> Kieff.	<i>Spaniotoma</i> sp.
<i>Chironomus praetiosus</i> Kieff.	<i>Tanypus annulatipes</i> (Kieff.)
<i>Chironomus stratipennis</i> Kieff.	<i>Tanypus pallidipes</i> (Kieff.)
<i>Chironomus sumptuosus</i> Kieff.	<i>Tanytarsus</i> sp.

Family—Heliidae

The larvae occur in a variety of habitats. Some are found in moist soil, amongst moss and decaying vegetation. Some are truly aquatic. These forms swim with an eel-like movement and are often slender and live amongst vegetation. The adults of some species bite man and may be of nuisance value or even transmit parasitic diseases to domestic animals and man.

The Ceylonese records are—

Bezzia indecora Kieff.
Calyptopogon gibbosa Wied.
Culicoides anophelis Edw.
Culicoides bilobatus Kieff.
Culicoides ceylanicus Kieff.
Culicoides flaviscutatus Wirth and Hubert
Culicoides paraflavescens Wirth and Hubert
Dibezzia ceylonica Kieff.
Forcipomyia calcarata Kieff.
Forcipomyia hirtipes Meij.
Forcipomyia jacobsoni Meij.

Forcipomyia longicalcar Kieff.
Forcipomyia noctivaga Kieff.
Forcipomyia ornatiscrus Kieff.
Forcipomyia semipilosus Kieff.
Forcipomyia simulans Edw.
Forcipomyia tetraclada Kieff.
Forcipomyia theobromae Kieff.
Palpomyia sp.
Probezzia sp.
Stilobezzia festiva Kieff.
Stilobezzia inermipes Kieff.

Family—Simulidae

There has been only two species recorded from Ceylon so far. The larvae inhabit flowing water and the adults are bloodsucking. Some species are known to transmit parasitic diseases to man and domestic animals and in these cases have been intensively studied. The larvae have been recorded in the branchial chambers of potamonid crabs in Africa.

The Ceylonese records are :—

Simulium atratum Meij.

Simulium striatum Brun.

Family—Blepharoceridae

Only two species are known from Ceylon at present, namely, *Hammatorhina bella* Loew and *Hammatorhina pulcra* Edw. The Indian fauna has been better studied and larvae and pupae and adults of a number of genera are known.

Family—Stratiomyiidae

These larvae are flattened dorso-ventrally and appear like leeches at first sight. They are characterised by the circlet of bristles at the posterior end which may be in one or two groups (Fig. F 8.) These bristles when spread out on the surface act as a float. There is an opaque deposit of calcium carbonate in the integument. These larvae are easily missed in collections because they are apparently lifeless. They are rare in freshwater collections. Only a few stratiomyid species occur in water; the rest are found in terrestrial habitats, hence no list of species is included.

Family—Tabanidae

The larvae of most species are semi aquatic whilst only a few are truly aquatic in the immature stages. The adults are very common and some species bite man and other mammals.

The larva which has already been illustrated ("Guide" page 95, Fig. 1.) is elongate and tapers towards both ends. The body consists of a reduced head, three thoracic segments and eight abdominal segments of which the first seven bear small prolegs which are often greatly reduced. The terminal end of the abdomen has a respiratory siphon.

Many species have been recorded from Ceylon. The larvae are poorly known.

Family—Rhagionidae (Leptidae)

The larvae have a reduced head and each abdominal segment bears a pair of pseudopods with terminal spines. The last abdominal segment (anal) carries two hairy processes. The genus *Atherix* has aquatic larvae (Fig. F 9.) and a single species has been recorded from Ceylon, namely, *Atherix labiata* Bigot.

Family—Sciomyzidae

The head of the larva is rudimentary. The segments bear paired lateral projections in each segment. The last abdominal segment has a two pairs of flattened structures. The commonest genus is *Sepedon* (Fig. F 10.) and although it has not been recorded from Ceylon it is probably found. Other species, e.g., *Saltisella* are parasitic in snails and attempts have been made to use them to control snails which act as intermediate hosts to trematodes by introducing suitable sciomyzids.

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Order—Hydracarina

Diplodontus silvestri (Daday)

Piona dadayi Piersig

Piona sp.

DELETE *Piona conglobata* and *Lamienia falcipes*

Diplodontus silvestri has been referred to as

Hydraphantis silvestri and *Eupatsa silvestri* in the Guide and in Suppl. I respectively.

Two references which will be of use in determining Ceylonese species are given.

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Appendix

This includes references of a general nature or which do not come under the groups dealt with in this supplement.

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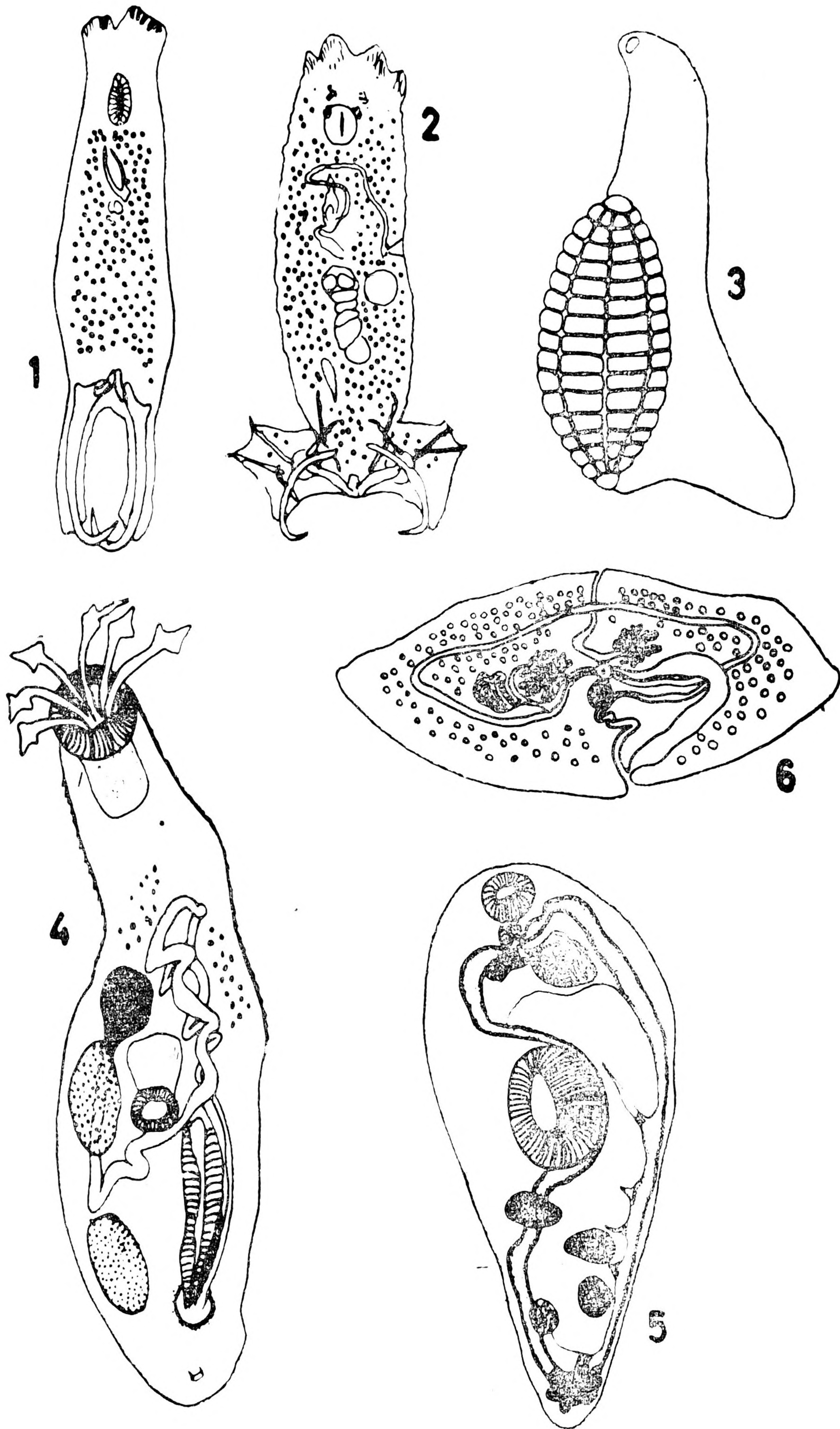


Fig. A. (1) *Dactylogyrus longicirrus* Tripathi. After Tripathi (1957). (2) *Dactylogyroides macracanthus*. After Gussev (1963). (3) *Aspidogaster indicus* Dayal, After Chauhan (1953). (4) *Bucephalus tridenticularia* Verma, After Chauhan (1953). (5) *Ophichorchis lobatum* Srivastava, After Chauhan (1953). (6) *Transversotrema*. From Hymen : Invertebrata Vol. 2.

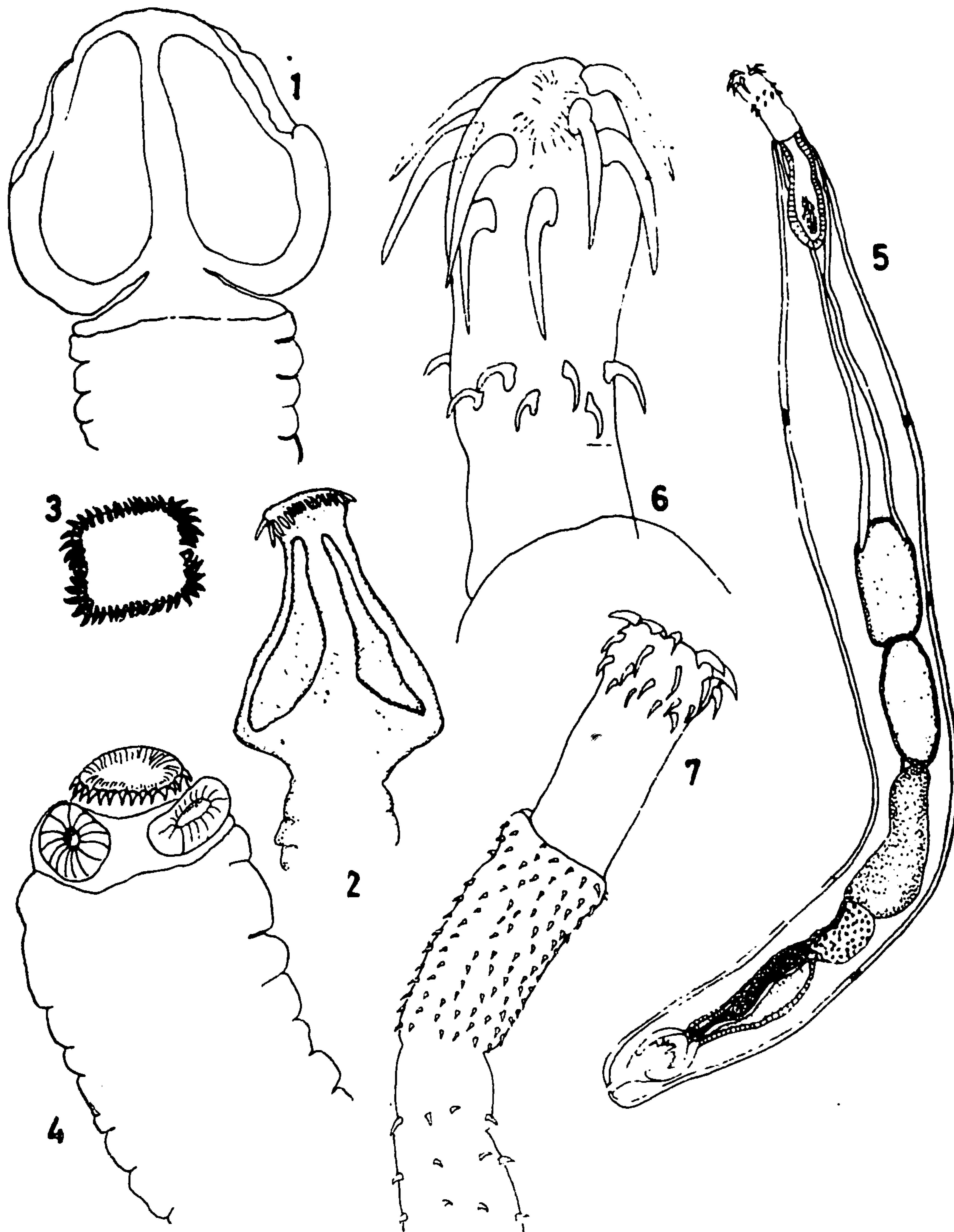


Fig. B. (1) *Bothriocephalus gowkongensis*; Scolex. (2) *Senga lucknowensis*; Scolex. (3) En face view of apical disc of *Senga lucknowensis*. (4) *Gangesia bengalensis*; scolex and anterior end of body. (5) *Zeylanchinorhynchus longinuchalis*. (6) Proboscis of *Z. longinuchalis*. (7) Proboscis and anterior portion of body of *Pallisentis nagpurensis*. All figures after Fernando and Furtado (1963b)

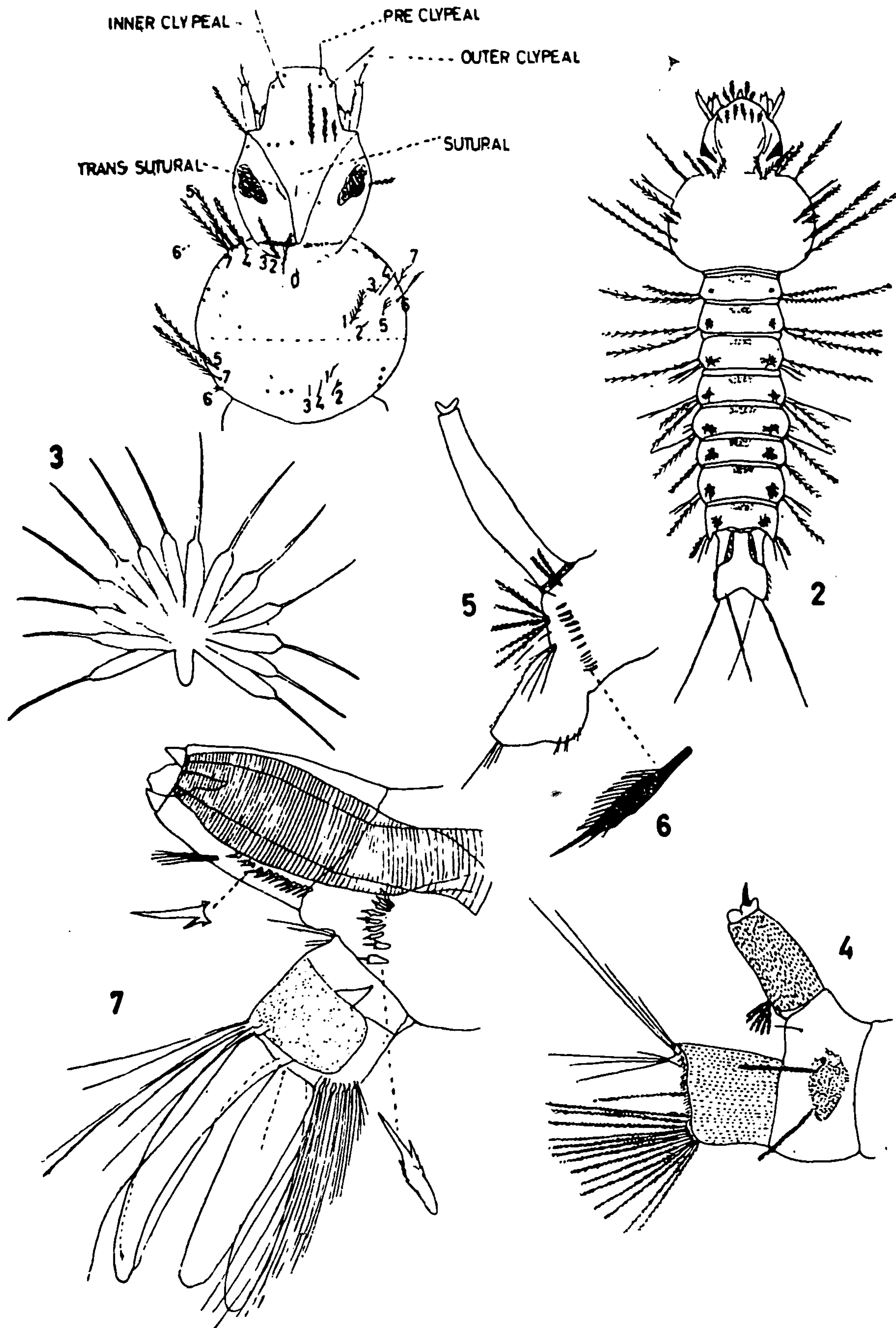


Fig. H. (1) Diagram of *Anopheles* head and thorax. The taxonomically important hairs are named or numbered. (2) Larva of *Anopheles jamesi*. (3) Palmate hairs of sixth abd. segment of *Anopheles jamesi*. (4) *Toxorhynchites splendens*; terminal portion of larva. (5) *Ficalbia luzonensis*; terminal portion of larva. 6. Comb scale, (7) *Aedes aegypti*; terminal portion of larva.

Figs. 2-5 After Senior White 1925 b, 1927.

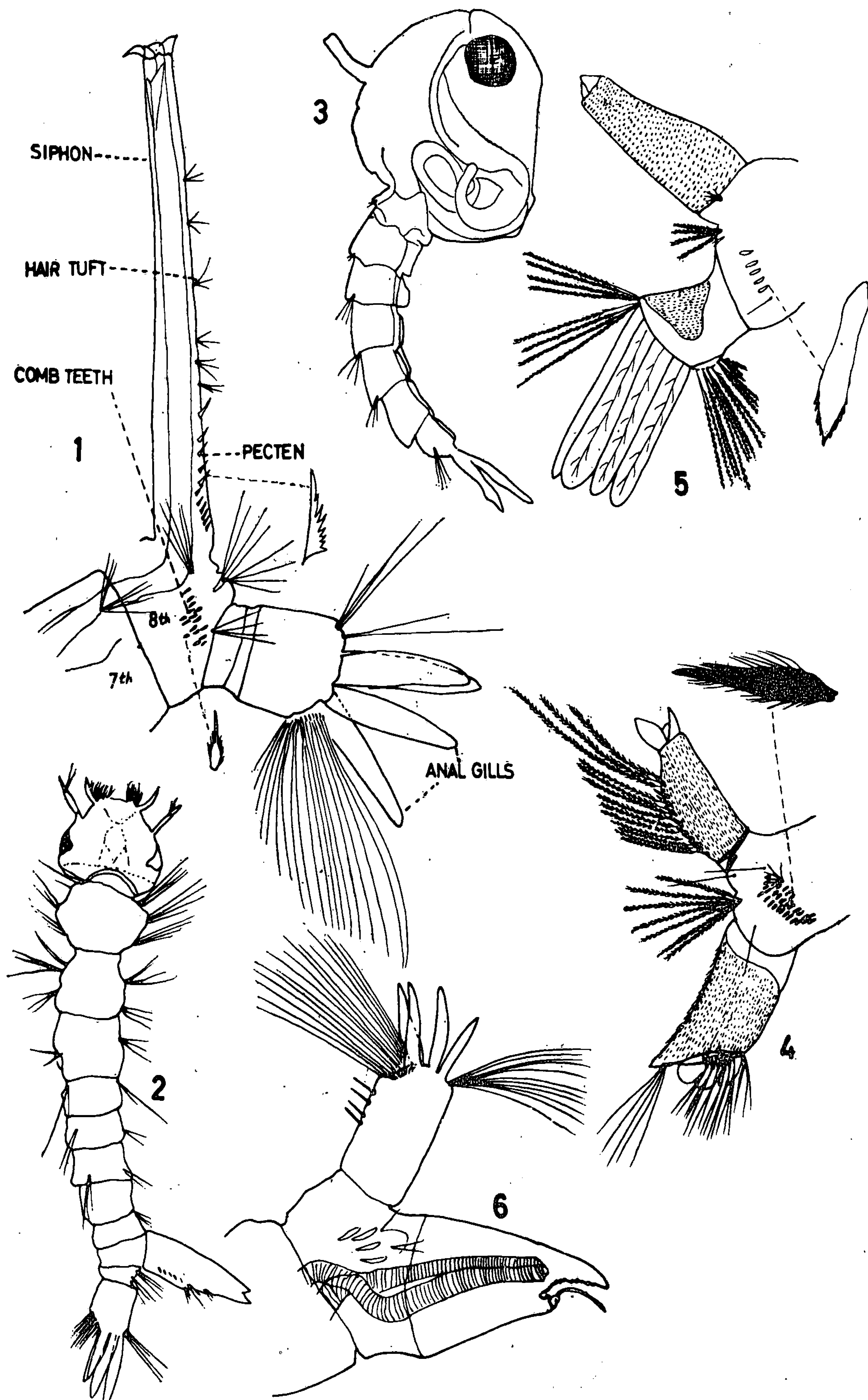


Fig. G. (1) Siphon and terminal segments of *Culex tritaeniorhynchus* larva. (2) Larva of *Culex fatigans*. (3) Pupa of *Culex fatigans*. (4) Terminal portion of *Culex fuscans*. (5) Terminal portion of *Armigeres aureolineatus*. (6) Terminal segments of *Mansonia*.

Figs. 4 and 5 after Senior-Whi

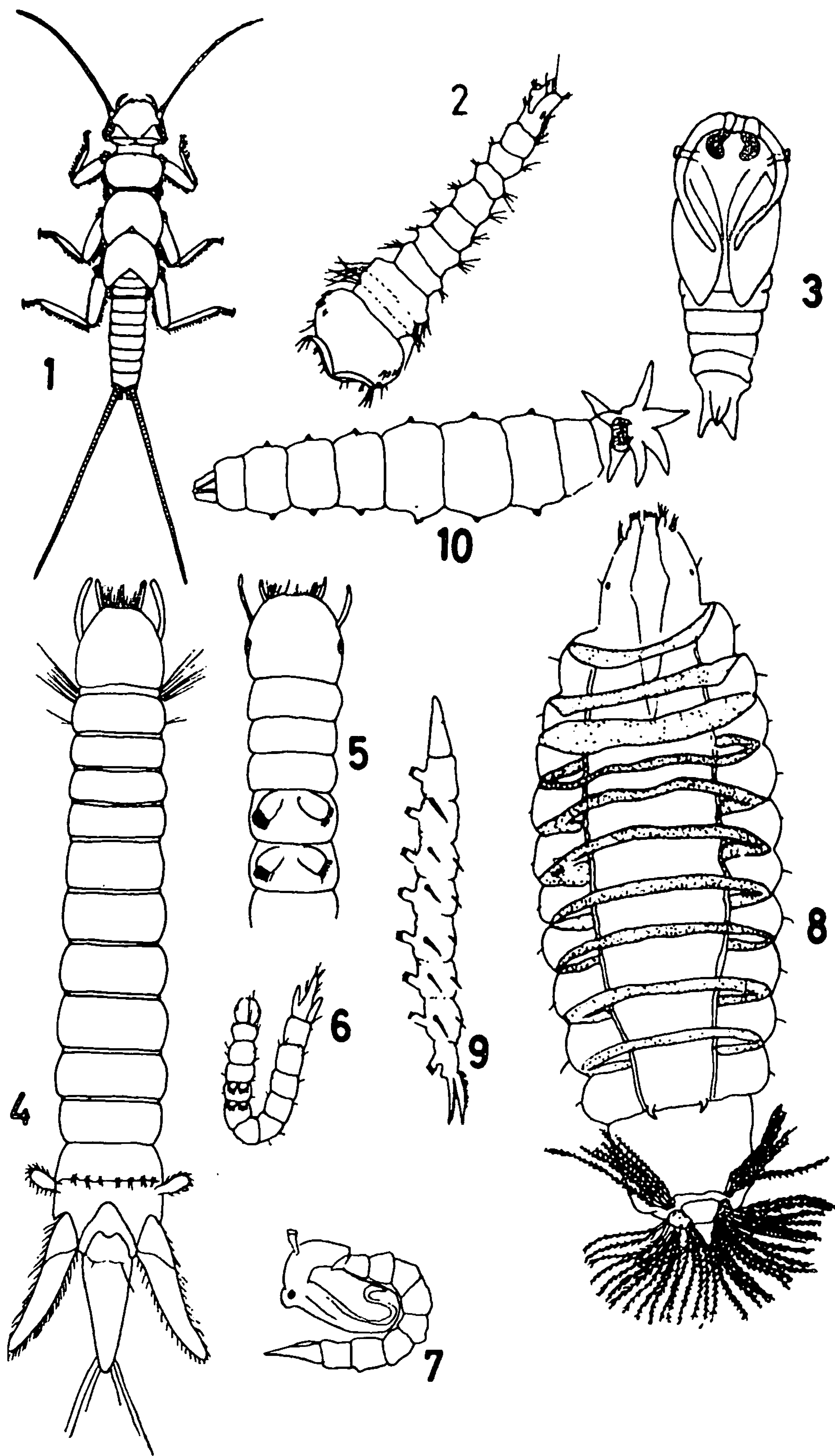


Fig. F. (1) *Neoperla* sp.; larva. (2) Larva of *Corethrella*. (3) Pupa of *Corethrella*. (4) *Dixa* larva; dorsal view. (5) *Dixa* larva; anterior segments showing prolegs. (6) *Dixa* larva in position assumed in life. (7) Pupa of *Dixa*. (8) Stratiomyid larva; dorsal view. (9) Larva of *Atherix*. (10) Larva of *Sepedon*.

Fig. 1. From a drawing by Mr. Khoo Soo Ghee, Zoology Department, University of Singapore. 4, 5, and 7. after Prasad (1918). 6. Semidiagrammatic. 9. After Wesenberg—Lund (1953).

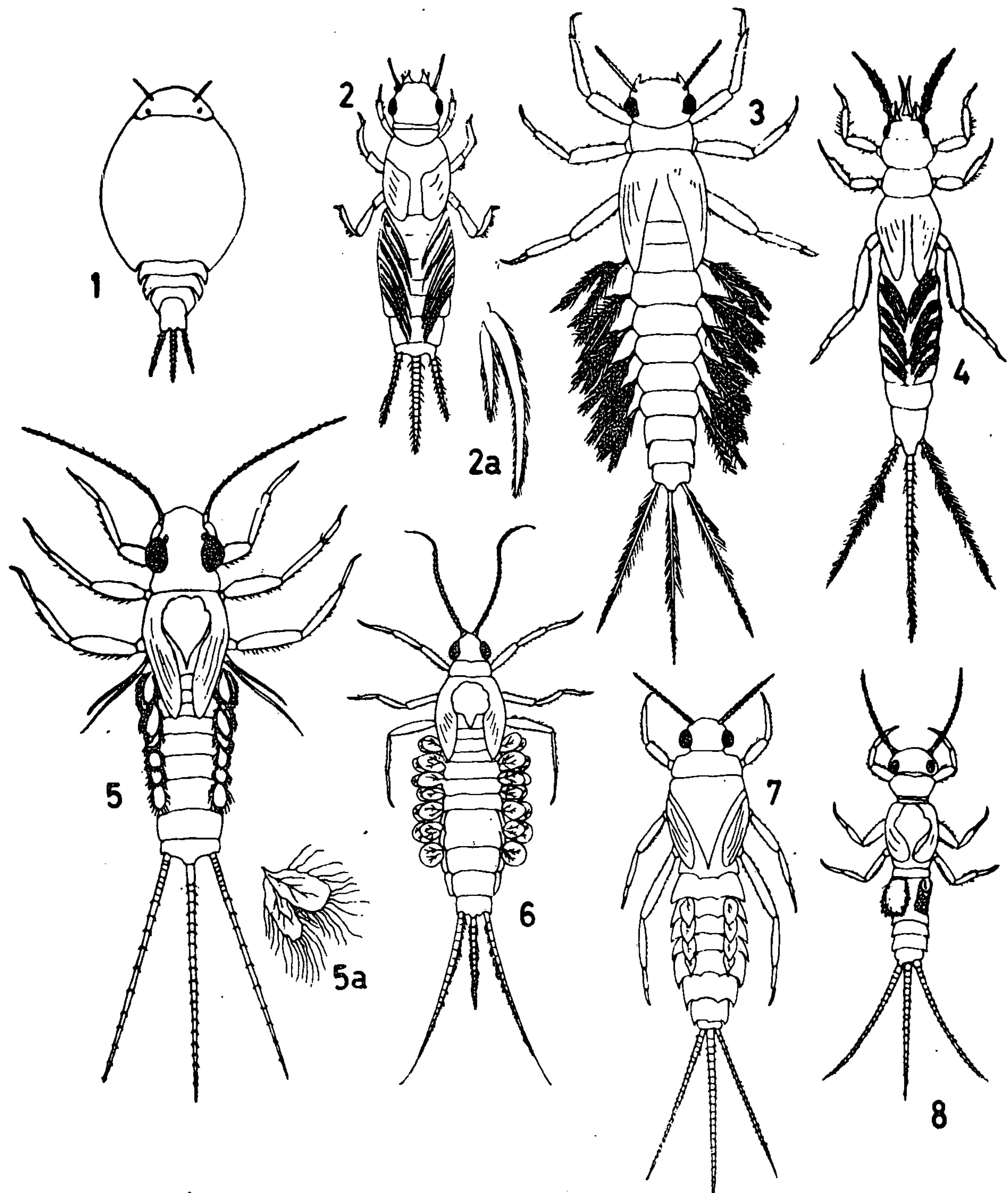


Fig. E. (1) *Prosopistoma*. (2) *Povilla corporaali*. (3) *Potamanthus luteus* L. (4) *Ephemera vulgata* L. (5) *Thraulius*. (6) *Cloeon*. (7) *Ephemerella ignita* Poda. (8) *Caenis*.

Fig. 3 after Ulmer (1937); 1-4 and 7 after Eaton (1884-1888). 5, 6 and 8 from unpublished thesis of Mrs. S. Karunakaren, Zoology Department, University of Singapore.

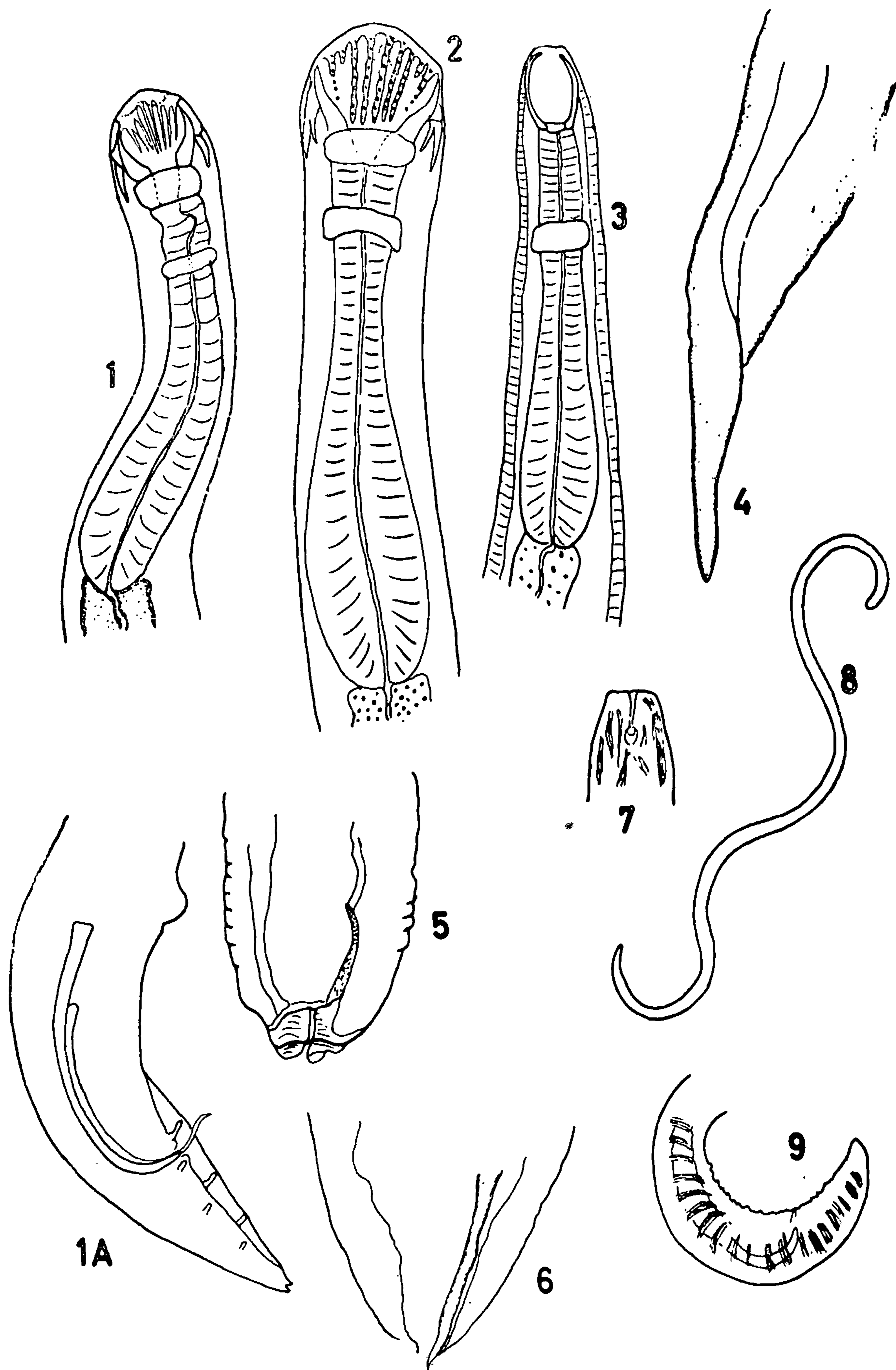


Fig. D. (1) *Camallanus ceylanicus*; fore part of body. 1A. Posterior portion of male, *C. ceylanicus*. 2) *Zeylanema anabantis*; fore part of body. (3) *Procamallanus*; fore part of body. (4) Tail of *Procamallanus* female. (5) Terminal portion of *Hedruris* larva (female). (6) Terminal portion of *Eustrongylides* larva (female). (7) Anterior end of *Hydromermis*. (8) *Hydromermis*. (9) Terminal portion of *Hydromermis* male.

Figs. 1-4 after Fernando and Furtado (1963a). 7-9 after Schurmanns-Stekhoven (1954). All figures redrawn.

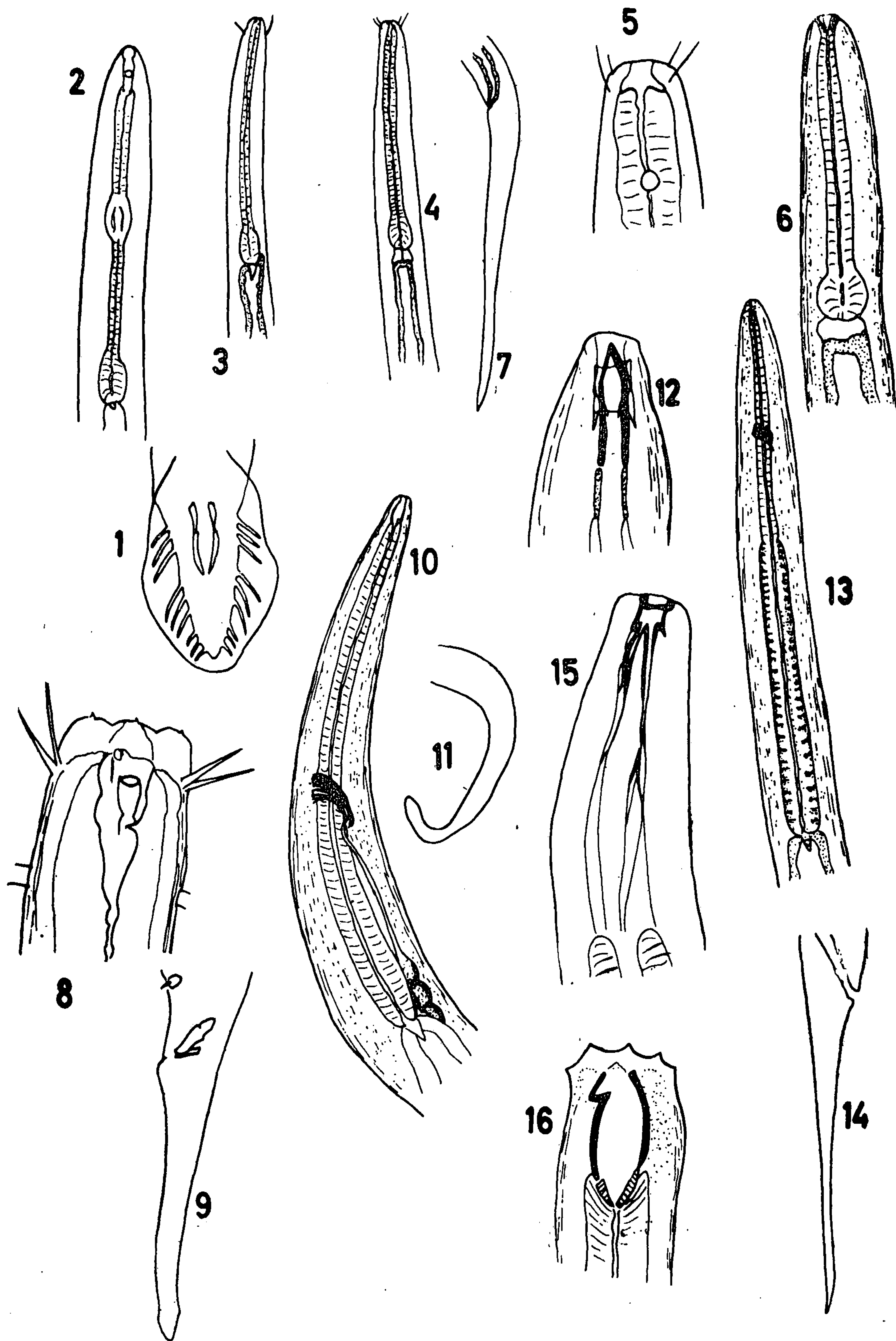


Fig. C. (1) Terminal portion of *Rhabditis* male. (2) *Diplogasteroides*; fore part of body. (3) *Plectus*; fore part of body. (4) *Monohystera*; fore part of body. (5) *Monohystera*; anterior end. (6) *Monochromodora vulgaris*; anterior portion. (7) Tail of *Monochromodora vulgaris*. (8) Cephalic region of *Tobrilus gracilis* (Bastian). (9) Male tail of *Tobrilus gracilis*. (10) *Bathyonchus indicus*, Kreis; anterior portion. (11) *Bathyonchus indicus*; tail. (12) *Dorylaimus stagnalis*; cephalic portion. (13) *Dorylaimus stagnalis*; fore part of body. (14) *Dorylaimus stagnalis*; tail of female. (15) *Actinolaimus*; anterior end. (16) *Mononchus*; anterior end.

Figs. 10, 11 and 15 after Kreis (1936); others after Goodey (1963). All figures redrawn.