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GUIDE TO THE COMMON WATER MITE

GENERA OF FLORIDA

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INTRODUCTION

The water mites, or “Hydracarina” as they are often referred to, belong to the order Acariformes and the sub-order Parasitengona.

Parasitengona are characterized by species in which the larval forms differ greatly in habit and appearance from the adults. The sub-order also contains a small number of species which are terrestrial. This brings up a point of uncertainty as to whether water mites as a group are monophyletic or polyphyletic.

Water mites have received relatively little attention from people performing aquatic macroinvertebrate monitoring. However, in addition to the fact that they are encountered in all types of freshwater macroinvertebrate samples, there are other reasons why water mites warrant closer consideration.

Pieczynski (1976) states that “Due to their high abundance and mobility, predatory effects of their adults and nymphs, and the parasitic effects of their larvae, the water mites play an important role in the community of littoral fauna.” Independent studies by Schwoerbel (1964) and Young (1969) showed that water mite communities were very sensitive to the effects of domestic wastes in streams. In Young’s study he found that sewage effluent going into a stream in north central Colorado nearly eliminated the water mite fauna in the area. Even at a station eight miles downstream of the point of discharge where the dissolved oxygen had reached 100 percent saturation and other communities of organisms had recovered, the water mite community was still severely reduced. Finally, as with any group of aquatic macroinvertebrates encountered in samples, it is of value to identify them to the lowest possible taxonomic level since this enhances the value obtained for the various indices of diversity.

On the other hand, there are some problems involved in trying to identify water mites to the lowest possible taxonomic level (i.e., species). Prasad and Cook (1972) state that adult water mites often exhibit a great deal of intraspecific variation even among members of the same population. For this reason it is sometimes difficult even for the water mite taxonomist to tell with certainty whether he is dealing with a species complex or a single variable species. The most commonly used preservatives, ethanol and formalin, are the worst ones for mites since these tend to make the mites brittle and cause the appendages to curl up, thus obscuring taxonomic features. The recommended preservative is Koenike’s Fluid which is composed of 45 percent glycerine, 45 percent water and 10 percent glacial acetic acid. This preservative tends to cause appendages to become distended, thus facilitating identification of the-specimen. Another problem is that in many cases identification of water mites to species requires special slide preparation including dissection of the specimen. Finally, existing keys to species of water mites are few. Most known species are described in various papers but are not in keys.

From the aforementioned circumstances it may be concluded that the amount of available time will determine the level to which one can identify water mites. However, with a little extra effort and some initial patience on the part of the biologist, most mites can be easily identified to genus and several to sub-genus.

The purpose of this work is to familiarize the reader with some general information on water mites and also to present an artificial key to common water mite genera of Florida. The key is based on collections made from November 1976 through March 1984.

For a comprehensive work of worldwide scope, the reader is referred to Cook (1974). It is an excellent work containing keys to genera and sub-genera, descriptions and over 1900 figures.

I would like to thank Dr. Landon Ross and Russ Frydenborg for their comments, Dr. David Cook for verifying many of my specimens, Jim Hulbert for his guidance and support and Jan Murray for persevering through the typing of the original manuscript.

IDENTIFICATION METHODS

In writing this key the works of Cook (1974), Newell (1959), and Pennak (1953) were reviewed and emphasis was placed on the most easily visible characteristics. In many cases these characteristics can be observed by examining specimens under a dissecting microscope at high power (60X or greater). In other cases whole temporary slide mounts of cleared specimens in glycerine or “permanent” mounts in CMC-10 type media may have to be made for examination under a compound microscope.

In making slides it is important that the mite be mounted ventral side up and that the appendages (legs and palps) not be curled up over the venter.

As mentioned earlier, the ideal preservative for water mites is Koenike’s Fluid which tends to cause appendages to distend and also aids in clearing of internal contents. However, since most biologists preserve everything in either ethanol or formalin, clearing and mounting specimens is sometimes made more difficult.

Specimens preserved in ethanol can occasionally be made more suitable for mounting by first treating them in a solution of potassium hydroxide for a period of 12 to 24 hours. Soft bodied mites can be soaked in a 2 percent KOH solution while heavily sclerotized mites may be soaked in a 10 percent solution. After soaking, they should be rinsed briefly in water prior to mounting. Extremely hard bodied mites such as Arrenurus may not clear and therefore make poor quality whole mounts.

Life Histories

It has been estimated that there are approximately 10,000 species of water mites world wide and that North America has over 1,000 species. Of the known species the exact life cycles and developmental stages are known for a very few (on the order of 5 to 10 percent). However, there is a considerable amount of general knowledge on water mite life histories.

Adult water mites have four pairs of legs and in many species the males exhibit a sexual dimorphism of the third and fourth pairs of legs and the genital field. The leg modifications allow their use for grasping the female during copulation and also for spermatophore transfer. In these species the male grasps the female with the fourth pair of legs and transfers spermatophores to the genital pore of the female with the third pair of legs. Fertilization is then accomplished when the female releases eggs from her genital pore. The eggs are fertilized at this time by the sperm contained in the spermatophores previously placed there by the male.

Mullen (1977) states that in some species insemination is accomplished indirectly via stalked spermatophores which are attached to a substrate by the male and later picked up by a passing female. In these species the male leg modifications would be lacking.

Fertilized eggs are deposited in groups of up to two hundred on a suitable substrate. Within several days a six legged larva hatches from the egg.

The larvae lead a parasitic existence on aquatic and semi-aquatic organisms. According to Mullen (1977) the larvae of many species of water mites are associated with the surface film. Here they seek out their hosts which are usually newly emerging imagos of some aquatic insect but may also be an ovipositing female insect or some semi-aquatic organism. Simith and Oliver (1976) state that in other species the larva locates its potential host beneath the surface film either in the water column or in the substrate such that at ecdysis of the pupal or nymphal host the mite can climb onto the imago and attach at an appropriate site.

Following the parasitic larval stage is a sedentary stage known as nymphochrysalis. During this stage the larva metamorphoses into an active eight legged nymph. The nymph resembles the adult in habit and gross morphology but is sexually undifferentiated.

The nymphal stage is followed by another sedentary stage known as imagochrysalis. This is the transformation stage between the nymph and the adult (Prasad and Cook 1972).

There are cases in which the parasitic stage is bypassed. In such cases either the larval stage is passed within the egg and the predaceous nymph emerges or the larva emerges from the egg and transforms into a nymph without feeding (Prasad and Cook 1972).

Mitchell (1957) found that the eggs of many rheophilic species are extremely large and few in number. This is considered evidence that the young emerge at an advanced stage of development, the nymph.

Adult water mites are predaceous feeding upon crustacea, protozoa, insect larvae and, in fact, any aquatic organism they can overpower (Wolcott, 1905). According to Barr (1978) observers of water mite activity have witnessed a group of adult water mites collectively attacking insect larvae many times the size of the individual mites.

Respiration

Respiration is accomplished by means of a closed tracheal system. On the dorsal surface of the capitulum are two stigma which are covered by thin membranes. These stigma open into a pair of air tubes which eventually lead to a system of tracheal tubes running throughout the body (Wolcott 1905).

In the heavily sclerotized mites, these tracheal tubes come in close proximity to the integument where there are “body pores” or openings in the sclerotization thus acting somewhat as tracheal gills.

Distribution and Habitat

Water mites have been found on every continent except Antarctica (Cook 1974). They successfully inhabit all types of habitats from thermal springs to lakes, ponds, streams, sloughs and even water filled tree holes.

They can-be found primarily in vegetated waters either lotic or lentic and while the overwhelming majority occur in fresh water, a few occur in brackish and marine environments (Wolcott 1905).

Crowell (1961) published a paper containing ranges and habitat types for over 450 species. This publication also contains an extensive bibliography with 123 references.

Glossary of Taxonomic Terms

Acetabular Plates: Sclerotized plates flanking the gonopore which bear the genital acetabula. These plates are generally stationary but in females of the genus *Limnesia* they are movable and act in a similar fashion to genital flaps (see definition of genital acetabula, gonopore and genital flaps). See Figs. 2, 6, and 31.

Capitulum: Sclerite which contains the mouthparts and to which the palps are attached.

Chelate: Condition of the palp in which the fourth segment has a dorsal projection beyond the point of insertion of the fifth segment. The fifth segment is able to articulate upward against this projection in a claw-like manner. There are varying degrees of this condition. See Figs. 1 and 3. (This should not be confused with the uncate condition - see definition).

Coxae: The most proximal leg segments which more or less resemble expanded sclerites attached to the ventral side of the body.

Dorsal Shield: A single large or two or more smaller close fitting sclerites which occupy the dorsum. Fig. 16 is an example of the latter.

Genital Acetabula: Small disk-like or cup-like structures which are associated with the genital field. They may be borne on acetabular plates or they may lie within the gonopore. See Figs. 2, 7, 25, and 31.

Genital Field: The entire genital area including the gonopore, genital flaps and acetabular plates, if present.

Genital Flaps: Movable sclerotized plates which can cover the gonopore when closed. They usually do not bear acetabula but when closed can cover acetabula which may be located in the gonopore. See Figs. 15 and 19.

Glandularia: Paired glands each having an associated seta. The seta is often difficult to see.

Gonopore: Opening of the reproductive system.

Peg-like Setae: Short stout setae located on the ventral side of palpal segments in certain genera of water mites.

PI -PII - PIII - PIV - PV: Method of numbering palpal segments where PI is most proximal segment (first segment) and PV is most distal (fifth segment).

Palps: First easily visible pair of appendages other than legs. These are attached to the capitulum.

Uncate: A condition of the palp in which the fourth segment is greatly enlarged ventrally and the fifth segment is able to articulate downward against this ventral enlargement. See Fig. 5.

Ventral Shield: Term used to describe the entire venter when the coxae and genital field are united by secondary sclerotization to form a large ventral sclerite.

AN ARTIFICIAL KEY
TO THE COMMON WATER MITE GENERA OF FLORIDA

1. Palps chelate (Figs. 1, 3..................2

   Palps not chelate. Either simple (Figs. 23, 30, 32) or uncate (Figs. 5, 8)............ 3

2. P-IV longer than P-III; dorsodistal portion of P-IV extending well beyond the point of insertion of P-V (Fig. 1); numerous genital acetabula borne on a pair of well developed genital flaps which flank the gonopore (Fig. 2); no dorsal sclerotization................ ....Hydrodromidae: Hydrodroma

   P-IV shorter than P-III; dorsodistal portion of P-IV extending only slightly beyond point of insertion of P-V (Fig. 3); genital field roughly heart-shaped with most of the acetabula anterior to the gonopore (Fig. 4); sclerotization of dorsum varying from very slight in the region of the eyes to a large dorsal shield........Hydrachnidae: Hydrachna

3. Palps uncate (Fig. 5); hard bodied mites with completely sclerotized dorsal and ventral shields 4

   Palps not uncate; mites may be hard bodied or soft bodied 6

4. With numerous pairs of genital acetabula borne on wing-like acetabular plates which generally extend well laterally from the gonopore (Fig. 6) (males of this genus are highly variable in body shape, especially in the caudal region). (See Figs. 39, 40, 41.) ....Arrenuridae: _Arrenurus_

With three to nine pairs of genital acetabula all located within the gonopore (Fig. 7) ....Krendowskiidae 5

5. Length of capitulum two to three times its width; capitulum protrusible, attached to a tube of soft integument (Fig. 8)..... _Geayia_

Length of capitulum less than twice its width; capitulum not protrusible........... ...._Krendowskia_

6. Eyes occupying a common anterior, median dorsal sclerotized plate (Fig. 9, 10); opening of mouth surrounded by a circular membranous fringe (Fig. 11); typically soft bodied, red mites..........................7

Eyes not as above; mouth opening not surrounded by a circular membranous fringe... 9

7. Length of sclerotized eye plate less than or equal to width (Fig. 9).....Eylaidae: _Eylais_

Length of sclerotized eye plate much greater than width (Fig. 10)........Limnocharidae 8

8. Capitulum protrusible on a tube of soft integument (Fig. 13); palps three segmented or appearing two segmented (third segment reduced to a sub-terminal spine like process) (Fig. 14) ...._Rhyncholimnochares_

Capitulum not protrusible; palp five segmented (Fig. 12) ...._Limnochares_

9. Genital acetabula lying very close to each other in two medial rows which either meet or very nearly meet on the midline of the gonopore (Figs. 15, 19, 20, 24); typically these are or can be covered by movable genital flaps. (These flaps sometimes make the acetabula difficult to see in _Torrenticola_) (Fig. 15) 10

Genital acetabula lying on acetabular plates or flaps on either side of the gonopore _or_ if acetabula are in rows in the gonopore, then the rows are shifted to either side and do not meet at the midline and there are no moveable genital flaps (Fig. 25)...................15

10. Dorsal and ventral shields present, the dorsal shield consisting of a large plate and two or four smaller anterior plates (Fig. 16) ....Torrenticolidae: _Torrenticola_

Dorsal and ventral shields absent........ 11

11. All legs crowded together at anterior end of body; all coxae fused and laterally expanded sometimes resulting in a laterally compressed body form (Fig. 17, 18)...........Oxidae 12

Legs and coxae not as above...............13

12. Body compressed laterally; coxae greatly expanded laterally and extending up onto the dorsum leaving only a narrow unsclerotized strip (Fig. 17)...................._Frontipoda_

Body not compressed laterally; coxae not as greatly expanded as above although they usually extend up the sides of the body (Fig. 13) ...._Oxus_

13. A Y-shaped coxal suture line extending from the anterior end of the genital field to the tips of the first coxae (Fig. 19, 20)...... ....Lebertiidae: _Lebertia_

No Y-shaped coxal suture line as above .... Sperchontidae 14

14. Glandularia large, raised and with numerous papillae (Fig. 21, 22); P-IV lacking small ventral peg-like setae.........Sperchonopsis

Glandularia various but lacking numerous papillae; P-IV with two very small ventral peg-like setae (Fig. 23, 24)........Sperchon

15. Hard bodied mites having completely sclerotized dorsal and ventral shields; often dorso-ventrally flattened mites.......... 16

Soft bodied mites lacking dorsal and ventral shields but may have numerous reticulate plates on dorsal and ventral body surfaces 18

16. Three pairs of genital acetabula lying in a single row on each side of the gonopore (Fig. 25) ....Mideopsidae: Mideopsis

Genital acetabula numerous, lying on acetabular plates on either side of the gonopore (Fig. 26, 27)....................17

17. First through third pairs of legs inserted near front of ventral shield; no lateral projections of the coxae in the area of insertion of fourth pair of legs (Fig. 26). ....Aturidae: <u>Albia</u>

First through third pairs of legs not inserted near front of ventral shield (Fig. 27); lateral projections of coxae present in area of insertion of fourth pair of legs (Fig. 27, 28) ....Unionicolidae: <u>Koenikea</u>

18. Soft bodied mites having numerous reticulate plates on dorsal and ventral body surfaces; capitulum protrusible on a tube of soft integument; numerous genital acetabula on movable flaps flanking the gonopore (Fig. 29) ....Rhynchohydracaridae: <u>Clathrosperchon</u>

Not with the above combination of characters 19

19. P-II with a peg-like seta ventrally which may be located on a tubercle of varying length (Fig. 30); fourth pair of legs each lacking a terminal claw but may have a terminal seta; typically with three pairs of genital

acetabula on plates flanking the gonopore (Fig. 31) ....Limnesiidae: Limnesia

Not with the above combination of characters 20

20. Fourth coxae with a pair of glandularia near the suture line between the third and fourth coxae. (This may be difficult to distinguish from glandularia on the dorsal surface of the body in cleared, mounted specimens. However, careful focusing of the microscope should help); first coxae fused medially (Figs. 33, 34) ....Hygrobatidae 21

Fourth coxae lacking glandularia; first coxae not fused medially (Figs. 35, 36, 37, 38).. 22

21. Capitulum fused with first coxae (Fig. 33) . ...Hygrobates

Capitulum not fused with first coxae (Fig. 34) ....Atractides

22. Suture line between third and fourth coxae incomplete, present only near lateral margin (Fig. 35); typically with five or six pairs of genital acetabula.......................... ....Unionicolidae: Unionicola

Suture line between third and fourth coxae complete or nearly so; typically with seven to many pairs of genital acetabula.......... 23

23. Hind margin of fourth coxae more or less transverse or truncate (Fig. 36)........... ....Unionicolidae: <u>Neumania</u>

Hind margin of fourth coxae noticeably angular (Figs. 37, 38)...............Pionidae: <u>Piona</u>

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FIGURES

Figure 1. Hydrodroma, Palp

Figure 2. Hydrodroma, Ventral view including genital field

Figure 3. Hydrachna, Palp

Figure 4. Hydrachna, Ventral view including genital field

FIG. 1

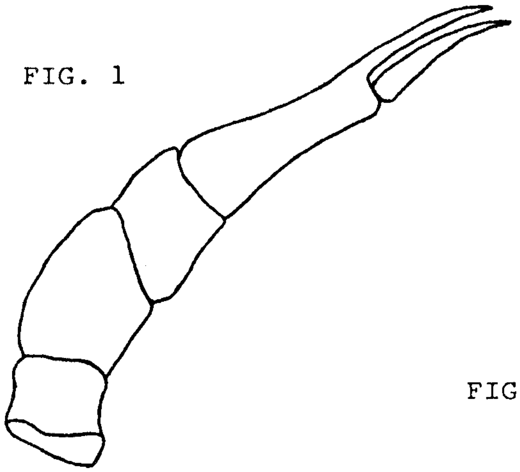
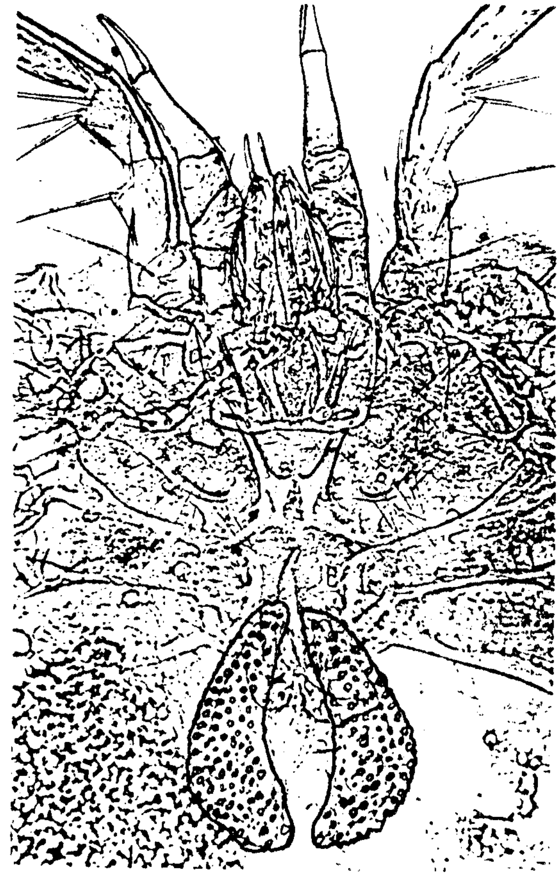


FIG. 2



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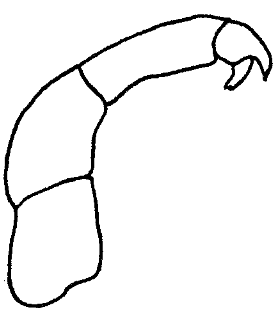

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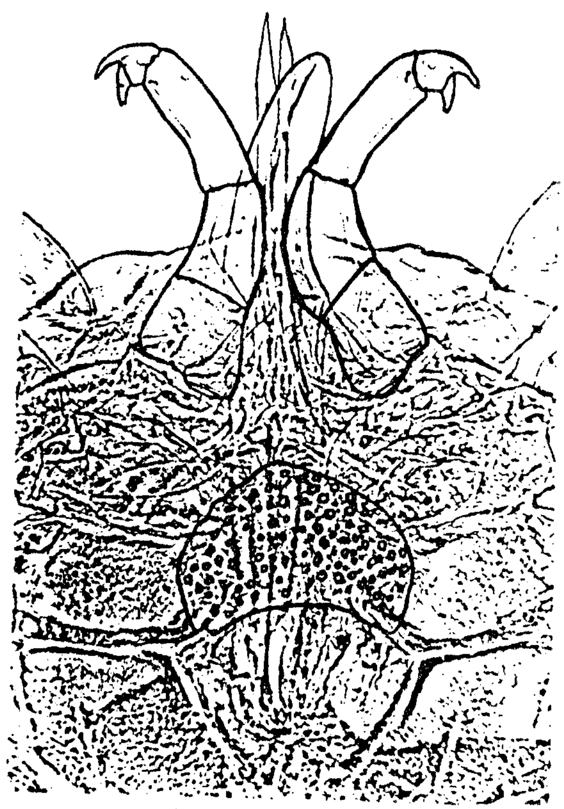


Figure 5. Arrenurus, Palp

Figure 6. Arrenurus, Genital field

Figure 7. Krendowskia,. Genital field

Figure 8. Geayia, Protruded capitulum (ventral view), palps and tips of first coxae

Figure 9. Eylais, Eye plate

Figure 10. Limnochares, Eye plate

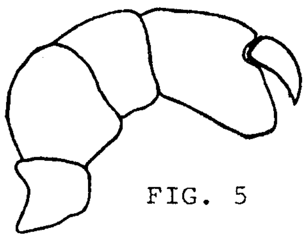
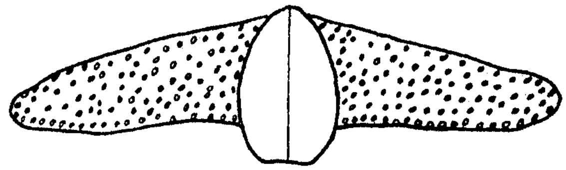


FIG. 5



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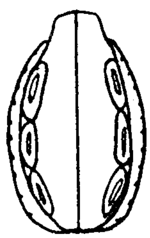

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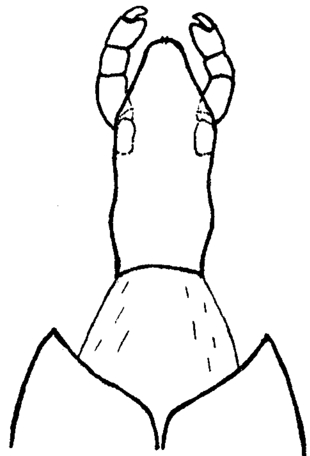

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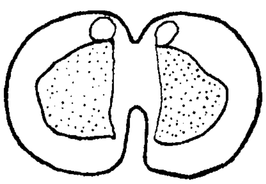

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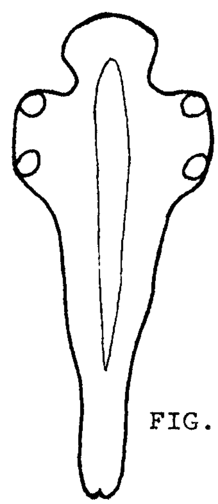


FIG. 10

Figure 11. Limnochares, Capitulum, mouth opening and palps

Figure 12. Limnochares, Palp

Figure 13. Rhyncholimnochares, Dorsal view showing eye plate and protruded capitulum

Figure 14. Rhyncholimnochares, Palp

Figure 15. Torrenticola, Genital field (genital flaps closed over acetabula)

Figure 16. Torrenticola, Dorsal shield

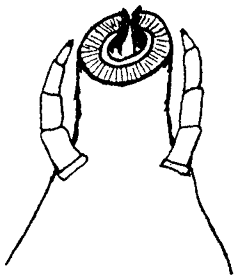


FIG. 11

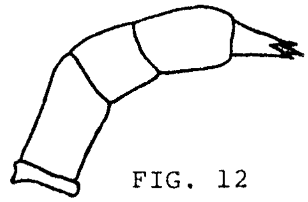


FIG. 12

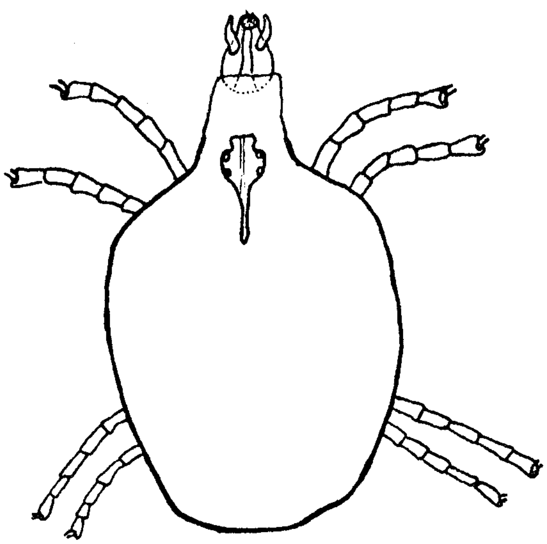
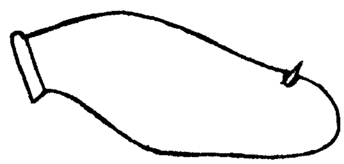


FIG. 13

FIG. 14



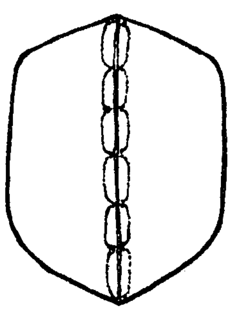


FIG. 15

FIG. 16

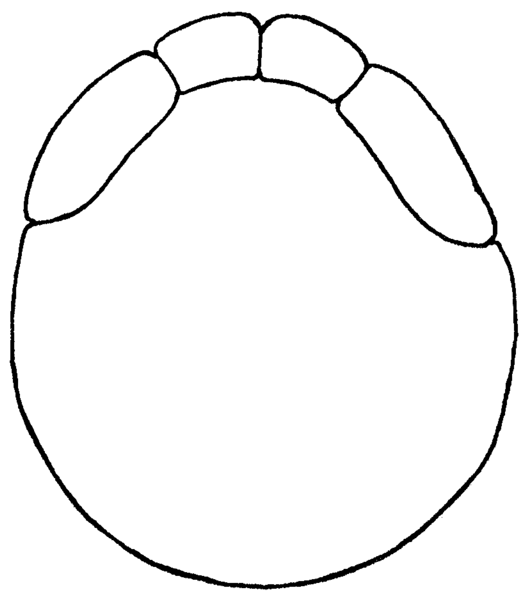


Figure 17. Frontipoda, Lateral view

Figure 18. Oxus, Ventro-lateral view

Figure 19. Lebertia, Coxae and genital field

Figure 20. Lebertia, Ventral view

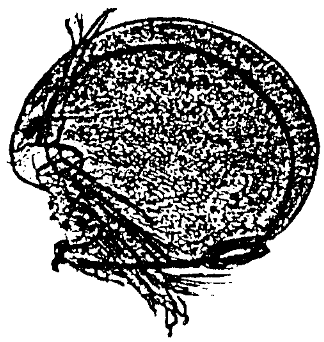


FIG. 17

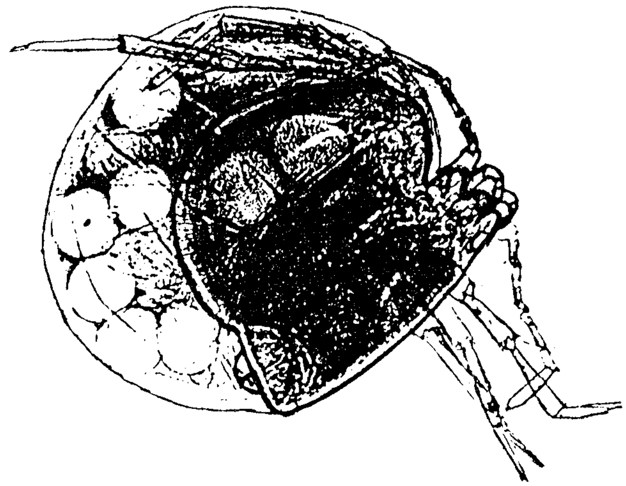


FIG. 18

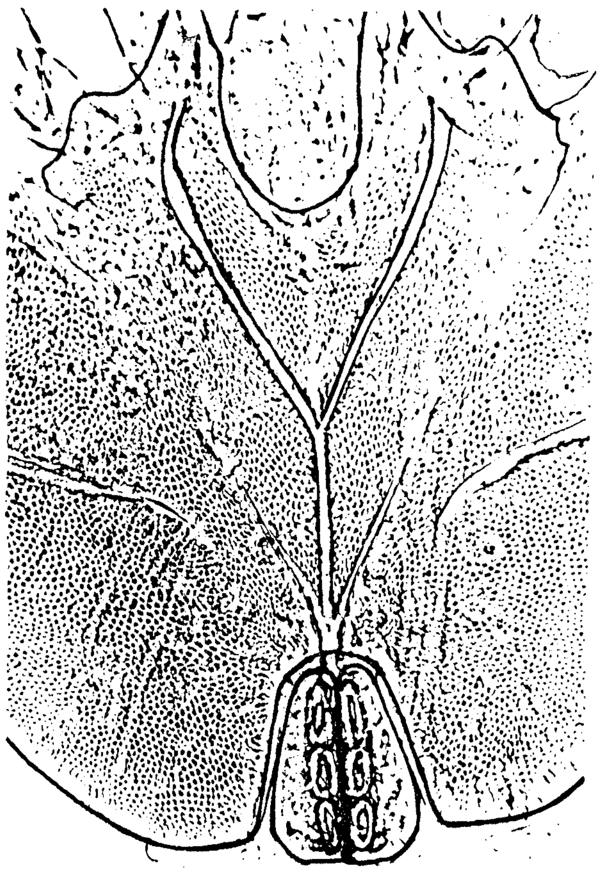


FIG. 19

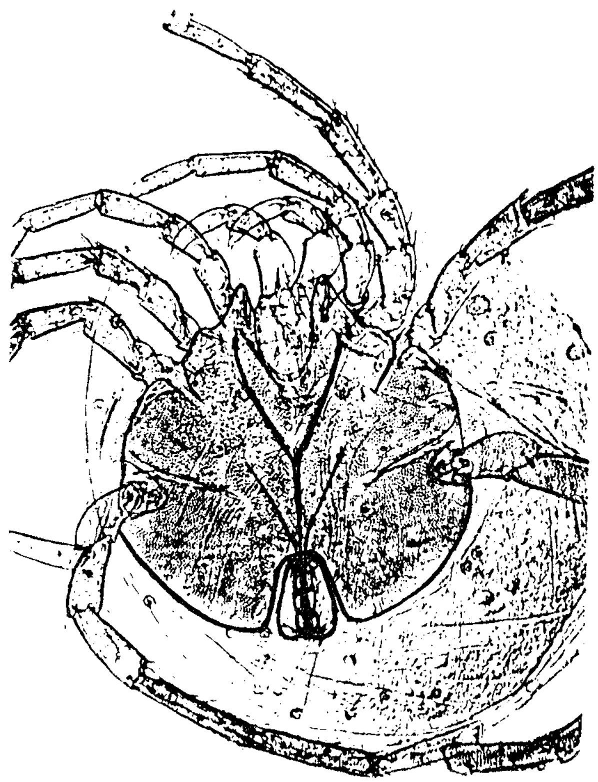


FIG. 20

Figure 21. _Sperchonopsis_, Dorsal view

Figure 22. _Sperchonopsis_, One of a pair of glandularia

Figure 23. _Sperchon_, Palp (note small peg-like setae on P-IV)

Figure 24. _Sperchon_, Ventral view

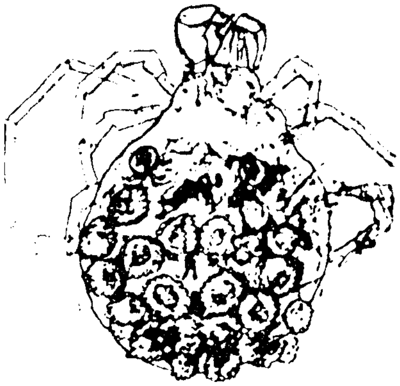


FIG. 21

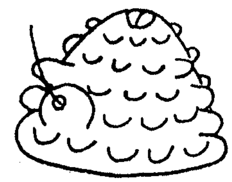


FIG. 22

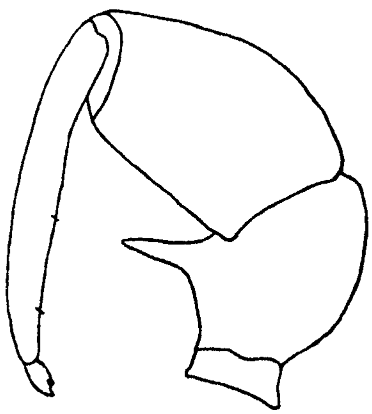


FIG. 23

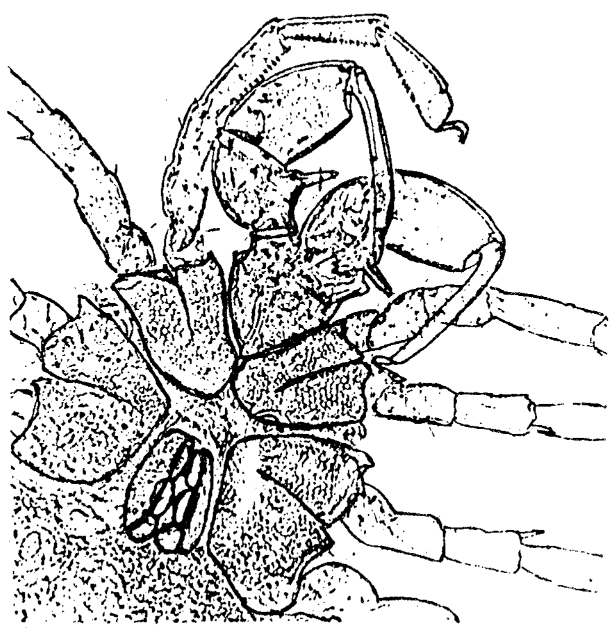


FIG. 24

Figure 25. Mideopsis, Genital field

Figure 26. Albia, Ventral view

Figure 27. Koenikea, Ventral view

Figure 28. Koenikea, Ventral view (legs removed)

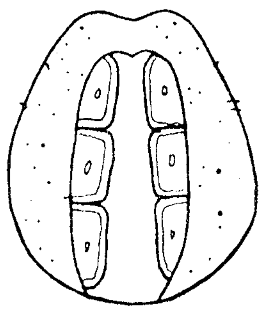


FIG. 25

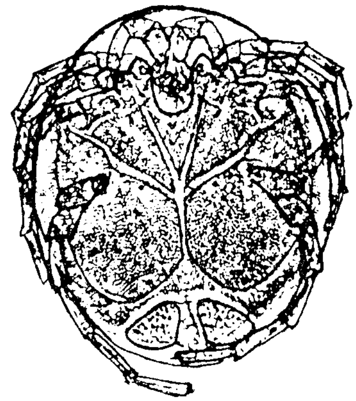


FIG. 26

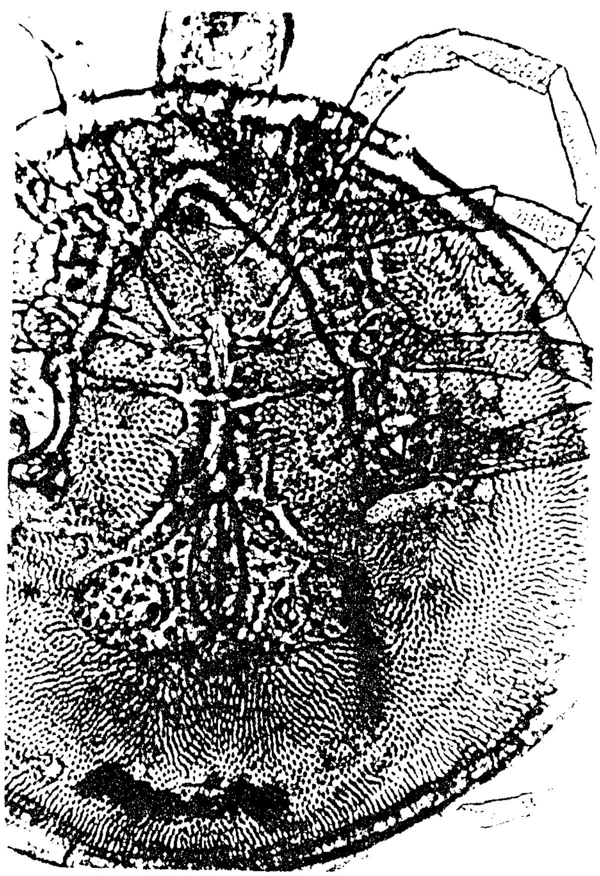


FIG. 27

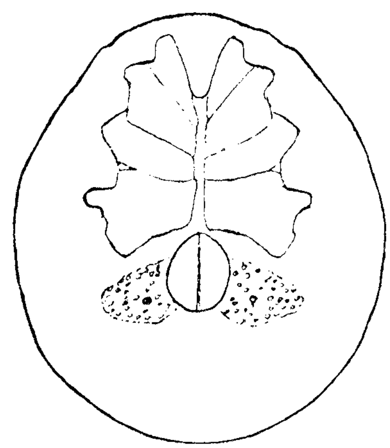


FIG. 28

Figure 29. Clathrosperchon, Ventral view showing reticulate plates, genital field, protruded capitulum and palps

Figure 30. Limnesia, Palp

Figure 31. Limnesia, Ventral view

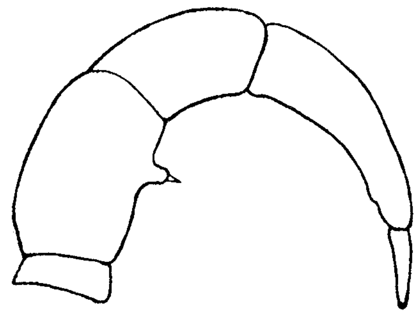


FIG. 30

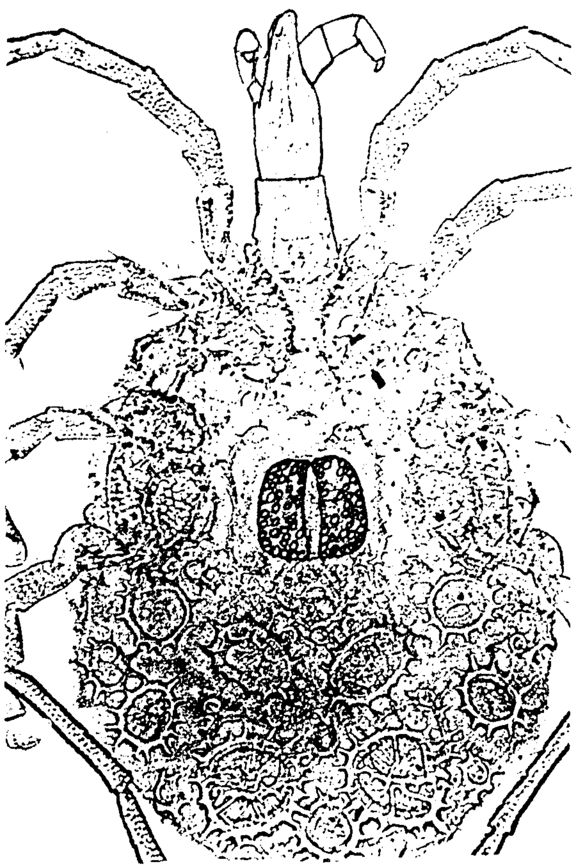


FIG. 29

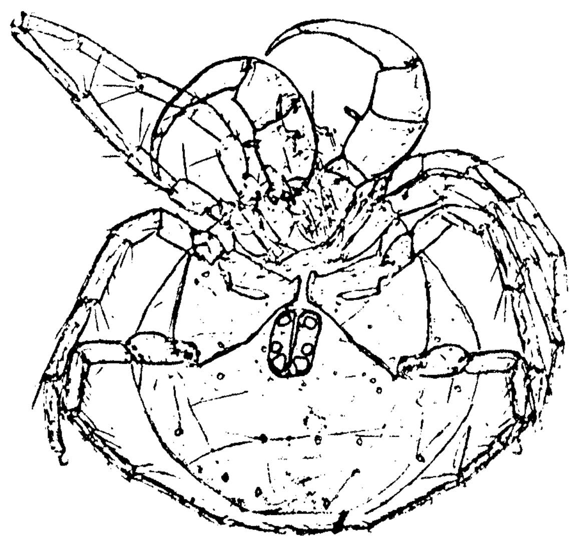


FIG. 31

Figure 32. *Hygrobates*, Palp

Figure 33. *Hygrobates*, Capitulum, coxae and genital field

Figure 34. *Atractides*, Capitulum, coxae and genital field

Figure 35. *Unionicola*, Ventral view (note incomplete, curved suture line between third and fourth coxae)

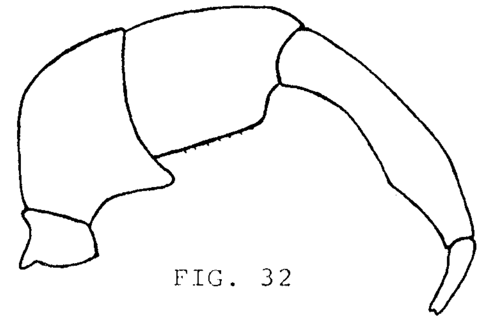


FIG. 32

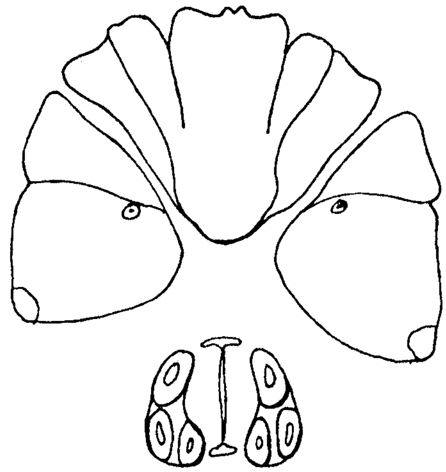


FIG. 33

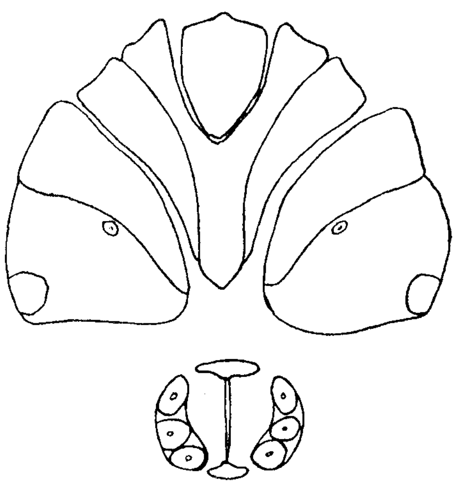


FIG. 34

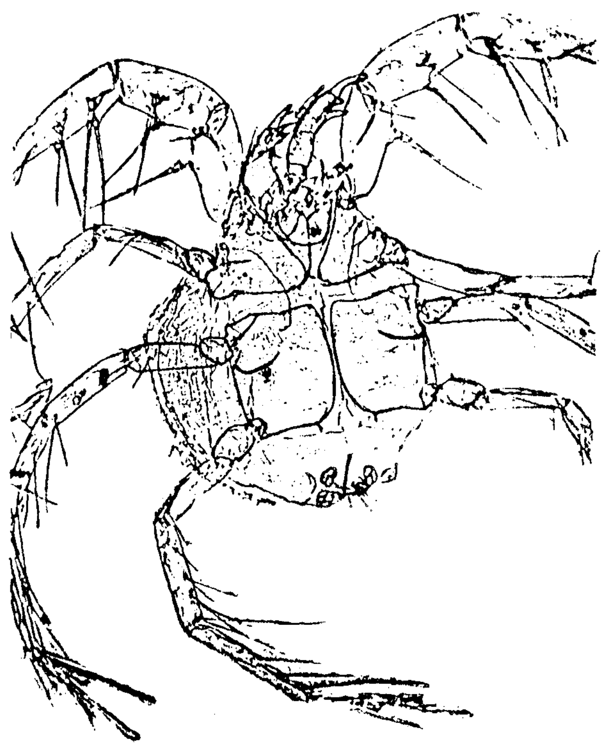


FIG. 35

Figure 36. Neumania, Ventral view

Figure 37. Piona, Ventral view

Figure 38. Piona, Ventral view

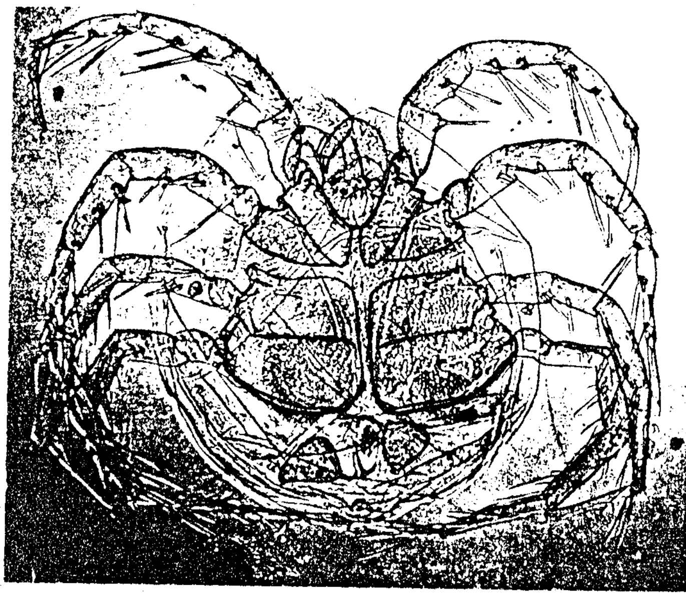
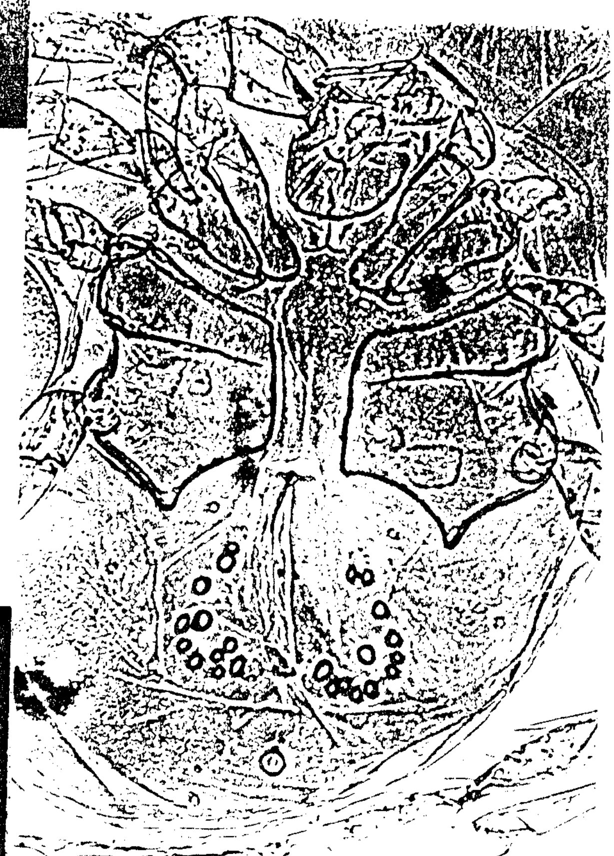


FIG. 36

FIG. 37



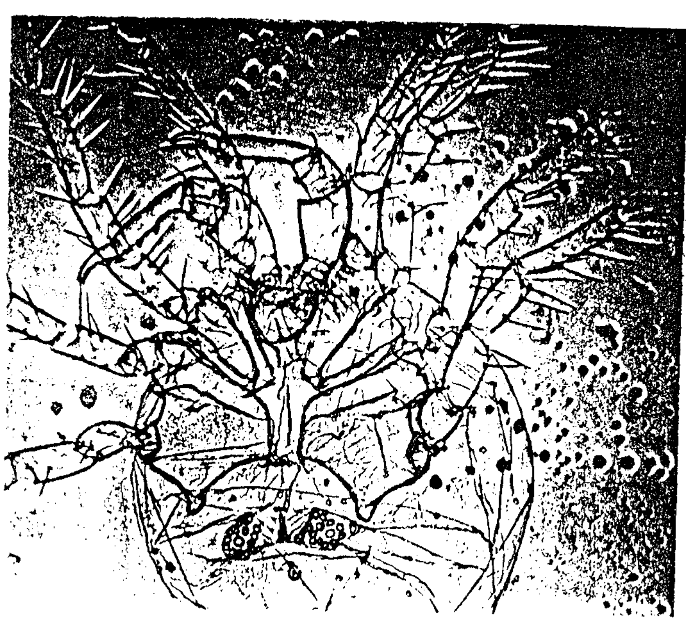


FIG. 38

Figure 39. *Arrenurus apopkensis*, Dorsal view, male (redrawn from Cook, 1976)

Figure 40. *Arrenurus zorus*, Dorsal view, male (redrawn from Cook, 1976)

Figure 41. *Arrenurus problecornis*, Dorsal view, male (redrawn from Cook, 1976)

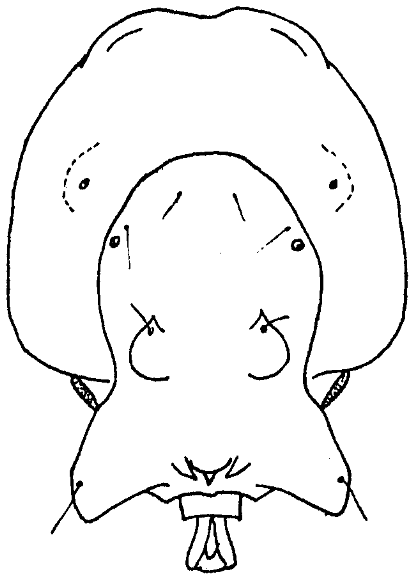


FIG. 39

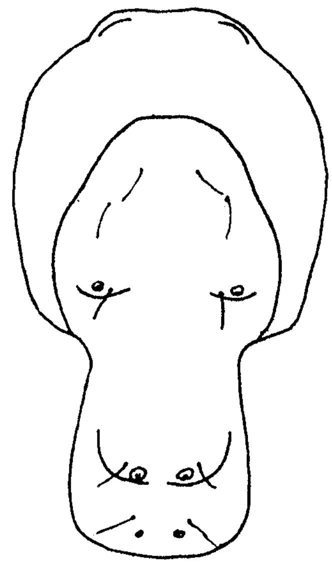


FIG. 40

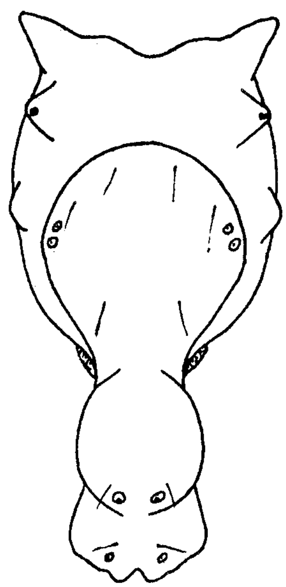


FIG. 41

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