This paper is the eighth of a series in which it is proposed to consider the external morphology of representatives of various insect groups. In an earlier paper in the series (Cope, 1942) a Mallophaga of the genus *Anthothallis* was considered, this being taken as representing the group designated by Kollong as the suborder Ichneumon. The object in considering the morphology of the insect at hand, which belongs to the genus *Tetrophthalmus*, representing the family Monoponidae of the subfamily *Amblycera*, is not only to point out the extreme diversity of form in the biting line but also to demonstrate the accomplishments that are possible through the strict application of the principles set forth in the first paper of this series (Cope and Rees, 1939, pages 80-83). Indeed, the Mallophaga with their wide diversity of specialized structure offer a splendid vehicle for the application and testing of these principles. As the work in comparative morphology has progressed it has become increasingly apparent that a strict adherence to these principles and to a rigid discipline is necessary and that any relaxation of the discipline will inevitably lead the worker into difficulties.

The line used as a basis for this study are referable to *Tetrophthalmus*, a group which, although showing certain special peculiarities, has appeared throughout these investigations to be more satisfactory as a representative of the Amblycera than any other that is readily available. The specific identification must be forborne at this time because of the uncertain status of the various species assigned to this genus. We do know, however, that the species at hand is that studied by Snodgrass (1939), his material and that here employed being part of the same lot. Snodgrass's paper on a species of *Tetrophthalmus* (by him called *Monopon tibicinis*) is the only study of any Monoponid that approaches completeness. However, the emphasis in his paper was on the mouthparts and the genitalia, while of extreme importance in an investigation of Mallophaga morphology, do not by any means exhaust the means of demonstrating homologies and relationships both within the order and in comparing the biting line with groups.

*Mr. G. R. M. Hopkins, Curator Entomologist at Bampala, Uganda, has kindly offered comments concerning the systematic status of the material used by the author in the previous study. The name *Anthothallis antimorphae* (Fabricius) was employed on the basis of the taxonomical data presented in Harrison's catalogue of the Mallophaga (1940). Mr. Hopkins, after examining material forwarded by the author, suggests that the species treated should be assigned to *Monopon tibicinis* (Coll.). In the present paper, however, the name *Anthothallis* will be used in order to avoid confusion in referring to the earlier paper.*
that are considered to be more generalized. Neuroptera with post-occipital suture points also discussed by Kollogl (1996), the scope of the investigation being rather limited.

**THE HEAD (Figures 27, 28)**

In considering this species of *Pterophthalmus* as a representative of the family Neuroptera and the suborder Neuroptera, we are confronted with an organism which, although retaining the primary ballyiophene head characters, is rather in contrast to the Ichneumonea head considered in an earlier paper. The reduction in size of the head and their position close to the anterior border of the head, the concomitant of the antenae in a cavity on the ventral side of the head, the extreme reduction of the so-called temporal lobes, and the retention of certain primary head sutures all represent differences between the heads of the two suborders. In general, the neuropteron head is considerably closer to what we consider to be a generalized insect head than is the Philopterus treated earlier in this series.

A statement of policy may well be presented at this point, since it is in the study of the head that its application is most likely to be made. The policy concerns the use of terminology which has no morphological foundation. There seem to be two distinct categories of these terms, the first being the widely used terms which are applied to all insects. They are encountered such words in wide usage as vertex, genal and postgena, which, it is true, are extremely convenient for reference in systematic work, but which, from the point of view here adopted, are essentially meaningless in morphological practice since they are areas that are not susceptible to definition by the limits of actual sutures. The second category contains terms designed for use within a particular group. Workers in the Ichneumonea have not been without imagination in the invention of such terms and we find literature sprinkled with such words as temporal lobes, forehead, ocellar lobes, suboccipital plate, and occipital plate. In this work, and in others to follow, attempts will be made to utilize terms which are less subject to the risk of more definite morphologies, significances. Reference will be made in many cases to the head segment to which an area may be assigned instead of using a topographical name that has no significance.

**The Head Capsule (Figures 27, 28)**

The identification of the more important landmarks on the head of *Pterophthalmus* indicates that everything on this highly modified head is reconcilable with the generalized insect head. The dorsal areas are for the most part fused into a single expanse, the temporal and post-frontal portions of the latter between the occipital-lateral and mandibular segments being obsolete. There are present, however, a transverse suture near the anterior border of the head and a weak suture on each side extending up, around the postero-lateral edges of the head on each side (Figure 27, A, B, C). The identity of the anterior margin of the head is established definitely by the fact that it bears the anter-rior articulations of the mandibles. This identifies the soleris as the clypeus and the suture which defines it posteriorly as the clypeo-frontal (epistomal) which marks the boundary between the occipital-antennal segment and the clypeus.

Beginning just anterior to the posterior articulation of the mandible on each side is the other suture mentioned, this extending posteriorly and ending out as it reaches the dorsal of the head. This, because of its relation to the posterior articulation of the mandible, may definitely be regarded as the pre-ocellar suture, marking a portion of the boundary between the median and occipital-antennal segments. The remainder of the "great suture" between these two segments is obsolete in this species, but is in some other Neuroptera the portion of it formed by the ventral part of the post-ocellar suture is present.

There is present one other feature of the head capsule which is very characteristic of the Neuroptera, Scorpionidae and Neuroptera. This is the deep, slit-like excrescence on each side of the head in the margin just anterior to the eye (Figure 27). There being no term available for the designation of those slits and their morphological origin being somewhat in doubt they are here referred to as the pre-ocular slits. In attempting to determine the origin of these slits we should, in accord with the discipline here followed, first attempt to relate them to some antecedent structure, rather than to assume immediately that they are entirely new structures.

In some of the Ichneumonea, especially in the Neuroptera genera *Culpophthalmus*, *Nemopon* and *Prionus*, and in the lamellobate genera *Lamellobothrya*, the post-ocellar sutures are clearly present, forming the characteristic inverted V with the arm on each side extending toward the pre-ocular slit, but in no observed instance actually reaching this slit. Taking into consideration the extent and position of these malaria as observed in insects of other orders it is not at all improbable that the slit on each side coincides with the line of this suture, where it passes across the margin of the head toward the base of the antennae. The slit would therefore be an invagination formed along a portion of the malar line between the pre-ocellar and mandibular segments. The obsolescence of the temporal portion of this suture makes it impossible to be certain in regard to this, but it seems to be an entirely tenable hypothesis. More investigation of similar forms and of a wider variety of adults will be necessary before the question can definitely be settled.

An outstanding feature of the head in many Ichneumonea is the presence of strengthening structures which take the form of sclerotized bars and bands forming thickenings of the body wall (Cope, 1898, page 110). These structures are especially well developed in the Ichneumonea and the Philopteridae, but among the Ichneumonea they are much less prominent. *Pterophthalmus* presents such buttresslike, sclerotized thickenings only in the region of the antennal fossa.

**The Tentorium (Figure 27b)**

The tentorium is not well developed in the species at hand. No trace of an anterior tentorial pit or anterior tentorial arm appears. There are, however, some neuropteron which retain the area and their corresponding pits, the pit being in the normal position just posterior to the clypeo-frontal suture closer to the anterior articulations of the mandibles. The genera *Nemopon* and *Culpophthalmus* all show the anterior pits in this position. It seems evident that in the species here treated the anterior arm has secondarily been lost. The posterior tentorial pit and arm are clearly developed. By facing one at each side of the guts, the arms extending forward and then curving posteriorly within the head capsule, but not being connected by a transverse bar.
The Antennae (Figures 27, 28)

The antennae are four-segmented and show no sexual dimorphism. Their position is that which is typical of all the Anephyrae, their foramina being situated on the apparent ventral side of the head, each at the base of a deep pit, the antennal fossa. The antennae can be almost entirely enclosed within the fossae and, because of the limitations imposed by the lips of the fossae, are apparently able to move only through a small arc. There are no setae near the antennal insertion and we must assume that the fossae have been formed secondarily by an invagination of the ventro-lateral surface of the antennal-sclerotic segment.

The Eyes (Figure 27)

The compound eyes are formed by double facets on the lateral margin of the head, just posterior to the antennal fossae (Figure 27). Ocelli are lacking.

The Labrum and Epipharynx (Figures 27, 28)

While in the Ethioptera previously studied the labrum is highly modified, large in size, and bent back upon itself, *Petroptilhaus* bears a much reduced labrum consisting of a narrow strip on the forward edge of the clypeus. The labrum is not a flap, but a flabellate structure which can only serve as a lip. Immediately posterior to the labrum is a thin transverse bar of sclerotized material which bears a row of setae on its surface. Due to its position and the presence of the setae, this sclerite can be nothing but the epipharynx. Cope (1910a) described a structure in Ethioptera which occupies somewhat the same position as does the epipharyngeal in this case. However, the structure in Ethioptera called the *palpus* is flabellate, lamellate, and much more in nature, and although the two structures obviously arise from the same place, the epipharyngeal region, the same term can hardly be applied to both.

The Mandibles (Figures 27, 28)

One of the classic means of separating the members of the two suborders of the Mallophaga is the position of the mandibles. The mandibles of the Ichneumonea are said to be "vertical," while those in the Anephyrae are considered as "horizontal." In *Petroptilhaus* this condition is borne out characteristically, the articulations lying in a dorso-ventral line. The mandibles here are comparatively small and are placed forward. Both mandible branches have pointed processes which are intricately arranged so that there is no conflict as the left mandible overlaps the right beyond the median line of the head.

The Maxilla and Labium (Figures 27, 28)

The maxilla and labium here have become incorporated into what appears to be a single organ lying behind the mandibles and partially covering them in the region of the posterior articulations. It appears to have taken place in the fusion of the maxillae to the lateral margins of the labium, no setae remaining to show the origin of the various elements of the organ. The oral surface (Figure 28c) shows a pair of one-segmented labial papillae arising from a pre-mental area. Based from these there project laterally a pair of four-segmented auxiliary papillae.

The oral surface of the maxilla bears structures which seem to be closely allied with those seen in Ethioptera. Distally there is a pair of partially-

free lobes which bear on their oral surface a patch of spines, all pointing toward the stomodeum. Internally, the bases of these lobes receive the cranial epidermis of the lecania, which, however, cannot be traced more than halfway out to the spines of the lobes. Nevertheless, the presence of these spines and the spinous character of their surface appears to be basic enough for considering them to be the lecania, even though they be rather closely connected with the labium itself in this case. The cranial lecanial epidermis has been shown to be quite satisfactory and reliable in establishing homologies in other Mallophaga. The monopodial genus *Anistrotonia*, for example, can be used to illustrate the relationship between the cranial lecanial epidermis and the lecania itself. In *Anistrotonia*, the so-called auxiliary picks are present in the same form as in the Faccopoter (Cope, 1906a). In Ethioptera, in which the whole maxilla is reduced to a bulbous mass, the cranial epidermis of the lecania is present. These facts lend us to believe that wherever the epidermis is associated with a structure, that structure is auxiliary.

The salivary system exhibits a few minor departures from the condition as seen in the Faccopoter and the Ichneumonea, but the fundamental arrangement is of the type described earlier (Cope, 1910a, b). A pair of salivary reservoirs is pushed far forward within the cavity of the maxillae and labium, the ducts leading from the reservoirs uniting into a common duct, the salivary duct, which empties into the salivary region at the distal end of a reservoirized plate. This plate is regarded as being homologous with that seen in the Faccopoter and in the other Mallophaga studied, even though the actual orifice is not placed centrally within the salivary, as is the case in the more generalized situations. The orifice is therefore considered to be derived from the wall of the salivary, arising as a modification about the orifice of the delivery duct. Nothing similar to the so-called brush of the Faccopoter is present in *Petroptilhaus*, nor can any structure be found to correspond to the secondary lobe of the oral face of the labium, a prominent feature of the hypopharyngeal area of the Faccopoter and one certainly present in many biting lice.

The Gula (Figure 27)

Two gulae are present in *Petroptilhaus*. Set in the large membranous area behind the mouthparts on the ventral side of the head, the gulae bear the pair of posterior ventralial pits at its anterior lateral margins. Just anterior to the gula is a small area of membrane which is probably labial in nature (Figure 27b, c).

The Thorax (Figures 30-31)

The typical arrangement in the Mallophaga is exhibited here, the occipital region of the head being in contact with the pronotum, and confining the cervical region to the small area beneath the overlap of the cephalic and prothoracic parts. Only one pair of cervical sclerites is present, and that pair is found in quite the normal relations to the head and thorax, articulating with the occipital region and with the prothoracic episternum. A certain distortion has occurred, leaving the cervical sclerites extending dorso-ventrally instead of antero-posteriorly.

The Prothorax (Figures 29-34)

The prothorax of this species, when considered in connection with the structures seen in other Monopodines and some Boophilidae, offers the answer to a
question that should have been asked by workers in the Mallophaga long ago, but which seems nevertheless never to have been formulated. It seems to the au-
thor strange that so little curiosity has ever been expressed concerning the na-
ture of the strikingly distinctive suture which extends transversely across the
middle of the large sclerite that has always been regarded as the pronotum. In
spite of the fact that no suture is known to divide the pronotum in any
other insect group there seems to have been no attempt to explain its significance
in the Mallophaga or even to apply a name to it. Its presence throughout the
whole suborder Mallophaga, is, all the recognized families, would seem to give it
a status that demands its explanation. The suture in question, Figure 29) is but
the surface manifestation of a well-developed phragma that extends nearly across
the dorso-prothoracic area.

Let us remember our principles and adhere to our discipline in attempting
to explain this structure, the principle that every structure must be morphologi-
ically accounted for and the discipline that in accounting for it we shall not
accept the alscenly expedient of immediately assuming that the structure is merely
some little secondary development that need not be seriously considered.

Let us examine the other structures of the prothorax. A lateral view of
this segment (Figure 30) shows that the pleural fold is present and extends up-
ward and posteriorly from the notal articulation, thus setting off an anterior
portion of the pleurite (morphologically the subeox) which is the conventional
episternum and a posterior portion which is the conventional epipeneron. In
this fold, just dorsal of the notal articulation is that great landmark, the ger-
eral epiphenal pit. The epipeneron is expanded laterally to produce the peculiar lateral
expansion of the prothorax, the "wing" of authors, which is a conspicuous feature
of many of the Mallophaga. The mesothoracic epipeneron has migrated forward and has
become involved with the epipeneron.

The most noteworthy fact is that the pleural elements, the episternum and epipeneron, are expanded upward in an arcuate manner and are
fixed to the notal elements of the segment in the transverse sulcus and its
accompanying phragma. It should be noted that the median dorso-
longitudinal furrow which is present does not cross this transverse sulcus and is
confined to the area posterior to it.

Taking into consideration the situation which appears in the meconotous
and will be described, it seems evident that the subeoxal elements—the
pleurite—of the prothorax have expanded dorso-laterally behind the pronotum until they
have met each other along the median line of the body. The transverse sulcus
and phragma forms along the line between these elements and the true pro-
notum, which are the areas lying anterior to this structure. This sulcus and its phrag-
ma will be designated as the transverse noto-pleural sulcus and phragma of the
prothorax.

Along the pleural fold there is a well defined phragma, which is viewed
in microscopy preparations of the type used for systemic purposes shows as
a dark, somewhat diagonal band on each side of the thorax, defining the "wing"
or epiphenal extension that in some forms is extraordinarily developed.

The ventral portions of the prothorax are not unusual. A pair of sternal
sphyngeal pits is situated at the posterior-lateral boundaries of the gaster
median swelling which can scarcely be called sternite. The sternal appendages
unite each the corresponding pleural sphyngeus. So precoxal or postcoxal portions
of the subeoxal remain, the entire region about the coxal fommes being unbran-
ched.
of a precoxal area, to the ventral side of the body, but shows no postcoxal sclerotization. The metathoracic subcoxae also send downward a similar precoxal arm, which, however, is detached from the episternum. Posteriorly to the metathoracic episternum is a small, sclerotized area which seems to be a fragment of the postcoxal arm of the subcoxae.

On the ventral side of the metathorax there is centrally a median, un sclerotized elevation of the derm. The texture of the derm is different from the surrounding membrane and it might possibly be regarded as representing a sternal area. The precoxal arms of the subcoxae come down each to the sternal sphenodite of its corresponding side, the epophyseal pits being widely separated. The arm bears an articulation with the corax. This is here considered to be the ventral articulation, rather than the trochantin. The trochantin is lacking.

On the ventral side of the metathorax the detached, precoxal arm of the subcoxae proceeds downward in the same fashion, surrounding the corresponding sternal sphenodite pit and continuing for a short distance posteriorly. The ventral sternal articulation is developed as in the preceding segment. Here also the epophyseal pits are widely separated. Anterior to the tergosternal pits is a median sclerite that may be regarded as an actual sternite.

**The Internal Skeleton (Figures 31, 35)**

The sternal sphenodites of the pterygosternum deserve mention. The metathoracic sternal sphenodites extend up into the body cavity and are compressed by a bridge (Figure 32), a condition that seems to be somewhat unusual. The sternal sphenodites of the metathorax are quite short and are not connected.

Pleural sphenodites are lacking on both metathorax and metathorax, but a distinct pleural phragm is present along the entire length of the pleural fold on each segment.

**The Legs (Figure 34)**

The prothoracic legs are not much different from those of the other segments. They are shorter and are carried, as Halophyges, forelegs usually are, turned forward beneath the head. The prothoracic coxae are elongated transversely to their longitudinal axis. The coxal of the other legs are somewhat conical. The trochantin and femur present nothing unusual, while the tibiae of all the legs bear a spinous process near the apex. The tarsi are two-segmented, the first segment in each bearing a spur-like, bifurcate process which is quite distinctive in appearance (Figure 34A, B).

The tarsus, as in all the bird-insecting lice, are paired. No pubalculus or capulum is present.

**The Abdomen (Figures 35, 36)**

The abdomen of both the male and female of *Petrophylax* bears a complete complement of segments from the first to the tenth, the eleventh being vestigial. No particular proboscis arises in connection with the segmentation; the segment standing out clearly and the spiracles, where present, serving as reliable landmarks.

The formation of intersternites has been made on some segments and there is a strong tendency in that direction on others. The first two segments actually bear intersternites (Figure 35) which are completely split off from their tergites, while in the third to eighth segments, the splitting off has not become complete. No buttress occurs on the abdomen of this species. Definite sternites are clearly visible on the first to seventh segments, but in most cases do not involve much territory.

**Tergites of the Female (Figure 35)**

Extreme simplification has occurred in the cases of the tergosternal structures in the female of *Petrophylax*. Only two segments beyond the eighth are recognizable, the tergites being present as single plates in no unusual manner.

Ventrally, posterior to the seventh sternite, we find a pair of simple gonopods lying side-by-side medially and fused at their tips to form the only element of the ovipositor that is left in this species. The gonopods are bound on each side by a fragment of what must be the eighth sternite (Figure 35A). The gonopods are bound quite fast dorsal and undercovered upon the ventral areas to some extent, but there is no ventral sclerite.

The anal opening has moved forward to the anterior part of the terminal segment on the ventral side.

**The Male Terminalia (Figure 35B, 36)**

Ten segments are found on the male abdomen as well. The tergites are large plates which cover the dorsal areas completely, the eighth being recognizable by the last abdominal spiracle, and the ninth and tenth being almost completely fused.

Ventrally, there has occurred a fragmentation of the eighth sternite into two parts which have moved slightly laterally.

The ninth sternite strengthens the anterior tip of the genital opening and is easily distinguishable.

There are no testicular tracts.

The copulatory apparatus of the male is considerably more simplified than in most Halophyges, and bears a close relationship to the condition found in *Ethioptrus* (Ope, 1908). Gonopods and styles are lacking, and we see nothing to be considered parameres. The phallosome is carried retroverted into the abdomen, within a phallosome and its sheath walls, the copulatory tube is another folding posteriorly, forming a tube which is continuous with the ejaculatory sac and its duct. The secretion of the phallosome is accomplished in the customary way, by muscle control through the long basal sperm which is attached to the endophallus on the apex of the phallosome.

The anal opening in the male is closely associated with the genital structures, opening into a cleft, in common with the gonopore. This condition is known to occur in other insects but its frequency among the Halophyges has not been thoroughly studied.

There is in this species a large filiform-like phragm arising as an infolding from the membrane on the ventral side between the eighth and ninth segments (Figure 35B, D). This phragm, termed here the subventral phragm (basal plate), forms an extender forward to the exterior edge of the seventh segment and seems to form a cleft on which the genital structures rest, in addition to serving as an origin for visceral muscles.
The spiracles on the prothorax, which are of mesothoracic origin, are involved in the epimeron. It is impossible to determine from this species alone whether there has been a fusion of the spiracular plate with the epimeron, or whether the spiracular plate has been lost, with the consequent migration of the spiracle over onto the epimeron. These mesothoracic spiracles are not especially typical of mesothoracic spiracles in general, the usual form being rather slit-like in character. In Petrophysalus (Figure 3A) there is rather a rigid support arranged around a large opening which leads into a box-like crypt below the surface. This crypt is joined by the large tracheae coming off the lateral trunk. The triangle of large tracheae known to be common in the xenoponids is shown in Figure 3A, and agrees essentially with that figured by Harrison (1937, Figure 1) for Myricopsis annulatus, another Xenoponid.

No mesothoracic spiracles are present.

The abdominal spiracles are a bit more conventional, exhibiting no peculiarities.

**GENERAL OBSERVATIONS**

As in Euthysopus, there has been much in the way of secondary modification through the loss, migration, and fusion of parts in Petrophysalus. With all this, however, no situations are encountered which are not explainable through the application of logical morphological principles. Here, as in Euthysopus, the most interesting changes have taken place on the head and thorax, but, in the main, in entirely different ways. Leaving aside the features which are obviously common to all Mallophanes, the extreme dorso-ventral compression, the fusion of head segments, the reduction of the mouthparts, and the loss of wings, we find that the tendencies in evolution have led the Asphymines along quite different paths from those of the Ichneumonidae. On the whole, tracing these paths is perhaps a bit less difficult in any insect at hand than in Euthysopus, but in a few cases, although the Xenoponids do appear to be a less specialized group than the families of the Ichneumonidae, there have been situations to require explanation.

The retention of the elytra-frontal (epistomal) suture and the proanabdominal suture are features, not found in the Ichneumonidae, which have proven invaluable in explaining this head. Divergent trends among special lines of the antennae, antennaloss, and the anellus and elytra have appeared as unusual occurrences but have not been inapparent problems. The condition of such Paucopteran and Mallophanes characters as found in the salivary system with the calypter and in the elytra has lent itself weight to the pattern more consistent.

The way in which the problems concerning the thorax of Petrophysalus have unfolded has been gratifying in view of the apparent difficulties as these problems are first approached. As has been pointed out already, the three segments have quite evidently evolved independently of each other and along three different lines. The type of thorax which has been attained seems to exist throughout the Asphymines with but slight modifications. In summary, the processes involved have been as follows. On the prothorax the subcoxal elements forming the pleurites have extended upward, crowding around the posterior border of the notum until they meet at the midline of the body and have pushed the notum forward. Between the notum and this upward extension of the subcoxae there has been formed the conspicuous transverse suture and phragma that are such conspicuous features of the prothorax of this suborder.

On the notum the same process has proceeded with an even greater reduction of the notum, which remains merely as a little sclerotized plate crowded to the anterior border of the segment, while the subcozaal elements have in size and position undergone the normal appearance of the notum.

On the metathorax apparently this process has not been initiated and the metasternum and the subcoxal elements retain their normal relations.

The subcoxal and sternal elements of the thoracic segments present no special problems. The ventral articulations of the coxa and subcoxae have been retained while the trochanters and the trochantellus articulations have been lost. One peculiar feature, which, however, is occasion perhaps to all Mallophanes, is the fact that the sternal apophyses have become involved in the corresponding subcoxal elements. The reduction of the ventral subcoxal elements and the lateral migration of the apophyses has opened a median space in which a true sternite has appeared or is definitely suggested on each segment.

The abdominal components seem to be all in place and, although there has been much loss of parts, the identity of the various structures can still be determined. In the male the ovipositor is reduced to the paired bases of the gnathosoma. The genitalia of the male are quite simple, and unfortunately throw no special light on such problems as the nature of the 'parameres,' which are present in some Mallophanes. In the male the structure called the 'subgenital phragma' is quite well developed. Its occurrence in other Mallophanes should be watched for.

It is still not possible to determine the origin of the Mallophanes, or what relationship they bear to the Paucopteridae, but now that we have some understanding of the morphological developments in both the Asphymines and Ichneumonidae we can begin to expand and perhaps in time secure enough knowledge of the Mallophanes to permit some definite conclusions.

**BIBLIOGRAPHY**


Tetraphthalmus sp., details of head structures

Figure 28

Figure 29

Tetraphthalmus sp., dorsal aspect of thorax
Tetraphthalmus sp., ventral aspect of thorax

Tetraphthalmus sp., internal skeleton, dorsum removed

Figure 32

Figure 33
Tetrophthalmus sp., tracheal system and legs

Figure 34

Tetrophthalmus sp., terminalia of male and female

Figure 35
basal apodeme, ejaculatory sac, endotheca, aedeagus, phalloproct

A. lateral aspect

endotheca, phalloproct, subgenital phragma, anus, choica

segments 6, 7, 8, 9, 10

B. median section through genitalia

basal apodeme, ejaculatory sac, segments 6, 7, 8, 9, endotheca, subgenital phragma

C. dorsal aspect

Tetrophthalmus sp., male genitalia

Figure 36