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More reflections on the gnathosoma of the Mesostigmata

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Summary

A review is made on the subject of the gnathosoma of the Mesostigmata with special emphasis on the mouth parts, describing the 18 or more homologous structures of the feeding mechanism.

A synonymy of terms used in the literature for the gnathosoma and the mouth parts is presented.

A hypothesis is proposed on phylogenetic relationships between various cohorts of the Mesostigmata based on the comparison of the mouth parts.

An annex includes descriptions of the mouth parts of five species : *Sejus* sp., *Diarthrophallus quercus, Zercon* sp., *Polyaspis* sp. and *Antennurella* sp.

Key-words : Mesostigmata, epistome, tectum, corniculi, chelicerae, hypopharyngeal and salivary styli.

Résumé

Le sujet du gnathosoma des Mésostigmates et plus particulièrement des pièces buccales est ré-examiné.

Les quelques 18 structures homologues du mécanisme d'alimentation sont décrites, une synonymie des termes utilisés dans la littérature pour le gnathosome et les pièces buccales est présentée.

Une hypothèse est proposée au sujet des relations phylogénétiques entre les diverses cohortes de Mésostigmates sur la base d'une comparaison des pièces buccales.

En annexe sont présentées des descriptions des pièces buccales de 5 espèces : *Sejus* sp., *Diarthrophallus quercus, Zercon* sp., *Polyaspis* sp. and *Antennurella* sp.

Mots-clés : Mésostigmates, epistome, tectum, corniculi, chélicères, styles hypopharyngiens & salivaires.

Introduction

It has been more than thirty years since my series of publications on the mouth parts of the Mesostigmata first appeared (Gorirossi, 1950 ; Gorirossi and Wharton, 1953 ; Gorirossi, 1955 a, b, c, 1956). Those studies were part of a much larger work, my doctoral thesis, entitled "Comparative anatomical studies on the gnathosoma of the Mesostigmatid mites". Since then many publications have appeared on the gnathosoma. In this paper I shall review my work in light of those contributions as well as present some heretofore unpublished material. The basis for the gnathosomal study was a detailed investigation of species representing nine of the eleven cohorts proposed by Trägårdh in 1946. There were hundreds of other Mesostigmata drawn and studied during my year in Florence, Italy as a Fulbright Scholar at the Berlese Acaroteca.

The early publications used the then acceptable classification based on Trägårdh's work. This has long been supplanted and where Trägårdh's classification is no longer applicable, I have placed in parenthesis the classification as originally published. It should be noted, as well, that the species, *Megalolaelaps ornata* Keegan, 1946, is, now, in fact, *Megalolaelaps enceladus* Berl., 1910.

The following list gives the names of the species studied in detail. Where material has not already been published on the mouth parts of a species, a description is included in Annex I.

I. Cohort : **SEJINA** KRAMER, 1885 (*teste* VITZTHUM, 1941).
   1. *Sejus* sp. : Sejidae (? KRAMER, 1885) - see Annex I.

II. Cohort : **ZERCONINA** TRÄGÅRDH, 1944.
   1. *Zercon* sp. : Zerconidae BERLESE, 1892, see Annex I.

III. Cohort : **DERMANYSSINA** ATHIAS-HENRIOT, 1971 (GAMASIDES LEACH, 1915).
   1. *Megalolaelaps enceladus* BERLESE, 1910, Megalolaelapidae FONSECA, 1946, Gorirossi, 1956. (= *Megalolaelaps ornata* KEEGAN, 1946).

IV. Cohort : **PARASITINA** ATHIAS-HENRIOT, 1971. (GAMASIDES LEACH, 1915).
   1. *Pergamasus vargasi* GORIROSSI, 1955 : Parasitidae OUDEMANS, 1901, Gorirossi, 1955 c.

V. Cohort : **UROPODINA** KRAMER, 1881 (TRACHYTINA KRAMER, 1881).
   1. *Polyaspis* sp. : Polyaspididae BERLESE, 1917, see Annex I.
   2. *Uroactinia agitans* (BANKS) 1908 : Uroactiniidae JOHNSTON, 1968, (Uropodidae BERLESE, 1917), Gorirossi, 1955 a (= *Uropoda agitans* (BANKS) 1908).

VI. Cohort : **DIARTHROPHALLINA** TRÄGÅRDH, 1946
 1. *Diarthrophallus quercus* PEARSE and WHARTON, 1936 : DIARTHROPHALLIDAE TRÄGÅRDH, 1946, see Annex I

VII. Cohort : **ANTENNOPHORINA** CAMIN and GORIROSSI, 1955
 1. *Megisthanus floridanus* BANKS, 1904 : Megisthanidae, BERLESE, 1914, Gorirossi and Wharton, 1953. (MEGISTHANINA TRÄGÅRDH, 1945).
 2. *Euzercon latus* (BANKS), 1909 : Euzerconidae TRÄGÅRDH, 1938, Gorirossi, 1955 b. (CELAENOPSINA TRÄGÅRDH, 1938).
 3. *Passalacarus sylvestris* PEARSE and WHARTON, 1936 : Diplogyniidae TRÄGÅRDH, 1941, Gorirossi, 1955 b. (CELAENOPSINA TRÄGÅRDH, 1938).
 4. *Antennurella* sp. : Klinckowstroemiidae TRÄGÅRDH, 1946 (FEDRIZZIINA TRÄGÅRDH, 1938), see Annex I.

(Unfortunately, there were no representatives from the cohorts Microgynina or Thinozerconina available for study at that time.)

A detailed description of the mouth parts was originally given in the paper on *Megisthanus floridanus* (Gorirossi and Wharton, 1953) and Figs. I through VI from that paper are reproduced here. Also reproduced is the lateral view, Plate II, of the gnathosoma of *Megalolaelaps enceladus* from Gorirossi, 1956. Then, as now, to name and identify the many parts of the gnathosoma is not always evident and the decision is left more or less to the discretion of the author. For my study I chose a middle of the road sort of policy. When a structure seemed to agree in position, function and form with a structure already defined and named by an arachnologist, the same term was used to refer to that structure. An example was the use of the term epistome. Snodgrass (1948) used "epistome" to refer to the sclerotized plate from which some of the pharyngeal dilator muscles originate and from which the labrum (= epipharynx as used here) arises. The epistome, with reference to its position and function in the acarina, is identical with Snodgrass' interpretation and so the term epistome was maintained. In addition epistome, meaning 'over the mouth', describes well its position in the Mesostigmata.
When a term had to be coined for a structure, several principles were observed :

1. the structure in question was studied to detect any modifications within the different groups ;
2. its relative association to the other gnathosomal structures was noted ;
3. its possible function was interpreted if this function could be inferred by the presence of muscles or similar structures ;
4. if the preceding aids proved unsatisfactory, the structure was named simply to indicate its position with neighboring structures. For example the term protosternum immediately suggests its relative position to the deutosternum and the tritosternum.

Description of figures. Plate I.

Figure 1.

The gnathosoma has been separated from the idiosoma. This dorsal view shows the outer sclerotized ring of the gnathosomal base, (C - C'), anteriorly, and, medially, the paired chelicerae, (A), and, laterally, the six-segmented pedipalps (E). The ends of the chelicerae protrude from the gnathosomal base as well as that portion of the subcheliceral plate, (D), which would project into the idiosoma. Medially and dorsally the gnathosomal base extends over the chelicerae to form the tectum, (B).
The gnathosoma can take many forms and shapes from the relatively large, heavily sclerotized structure of *Megisthanus floridanus*, which freely articulates with the distal end of the idiosoma, to that found in *Uroactinia agitans* where the gnathosoma is completely hidden behind the coxae of leg I and capable of being withdrawn within the camerostome.
Within the gnathosomal base are found the pharynx, the internal cheliceral sheaths, the epistome, part of the subcheliceral plate and the tentorium. While the subcheliceral plate can extend into the idiosoma, the pharynx is restricted to the base and most of its muscles originate from the walls of the gnathosomal base. In forms with a short gnathosomal base, as in *Uroactinia agitans* and *Polyaspis* sp., the mouth parts occupy more than half the length of the gnathosoma. In other forms, as *Megisthanus floridanus, Megalolaelaps enceladus* and *Passalacarus sylvestris*, the basal portion of the gnathosoma and, therefore, the length of the pharynx forms more than half of the length of the gnathosoma.

TECTUM

The tectum is always dorsal to the chelicerae and joined posteriorly to the gnathosomal base. In all the species studied here some differences exist between the tectum of the male and that of the female. The tectum of the male is usually larger and more heavily sclerotized. If denticles are present, they are more pronounced in the male than in the female.
In the present study the types of tecta could be separated into three main groups : (TABLE II)
1. In the Sejina, Epicriina, Zerconina and the Parasitina they are simple in shape and with little ornamentation.
2. In the Uropodina, (*Uroactinia agitans* and *Polyaspis* sp.) and the Diarthrophallina, (*Diarthrophallus quercus*) the tecta are very elaborate structures with many

processes and apophyses.

3. This third group, the cohort Antennophorina, now includes what was once three distinct cohorts, namely, the Megisthanina, the Celaenopsina and the Fedrizziina, (*Antennurella* sp.). In these the tecta have more or less smooth edges and always have a ventral keel. This keel may help in freeing the chelicerae of debris. Also in these forms, posterior to the keel, is a heavily sclerotized, mid-ventral plate which seems to reinforce the attachment for the internal cheliceral sheaths, (Gorirossi, 1955 b, Plate I, figs. F & F').

Figure 2.

The dorsal portion of the gnathosomal base and tectum have been removed. The chelicerae, the internal cheliceral sheaths, (A'), the external cheliceral sheaths, (A''), and the labrum, (H), are now visible.

CHELICERAE

The chelicerae are the most conspicuous of the mouth part elements. Of the groups studied here, the cohort Antennophorina can be distinctly differentiated from the others on the basis of their chelicerae. In this group the immovable and/or the movable digits of the chelicerae have large, elaborate, brush-like, billowing structures or excrescences extending from them. In most instances each of the excrescences is difficult to observe separately but as many as three such structures have been seen on a single digit (*Megisthanus floridanus*).

The chelicerae of the other groups lack these as such, however, in certain species the chelicerae of the male may have processes which differentiate them from the chelicerae of the female. In *Megalolaelaps enceladus*, (Dermanyssina), (Gorirossi, 1956) for example, the chelicerae of the male have a long, coiled proboscis-like structure which Keegan (1946) has said aids in sperm transfer. Chelicerae may also have excrescences which assist during feeding. In *Uroactinia agitans*, the immovable digit of the chelicerae of both sexes has an umbrella-shaped process which helps to draw material towards the mouth (Gorirossi, 1955 a.)

The internal cheliceral sheaths, just under the dorsal sclerotized portion of the gnathosoma and joined to it, form two sleeves in which the chelicerae glide. In cross section the sheaths can be seen attached to the tentorial and subcheliceral plates (the gnathothecum of Evans and Loots, 1975 ; and, where the proximal surfaces of the internal cheliceral sheaths meet or fuse they use the term gnathothecal septum ; van der Hammen, 1964, referred to these as the cheliceral frame, in part, and Hughes, 1949, as the cone sheaths).

The external cheliceral sheaths originate between the immovable and the distal segments of the chelicerae and are contiguous with the anterior edges (tubes) of the internal cheliceral sheaths. When one sees extended chelicerae of feeding mites, it is the external cheliceral sheaths encircling the distal segments which are visible. The relationship of these structures is clearly shown on the reconstructed lateral section of *Megalolaelaps enceladus*, Plate II.

Attached to the distal segment of each chelicera are the cheliceral muscles which originate from the dorsal wall of the idiosoma.

Figure 3.

Removal of the chelicerae and cheliceral sheaths exposes the framework on which the chelicerae glide : the subcheliceral plate, (D), the epistome, (I), and the tentorium, (M). Also visible are the labrum, (H), the epipharynx, (J), and the fan-shaped epipharyngeal muscles, (N), originating from the posterior margins of the subcheliceral plate and inserting within the epipharynx.

SUBCHELICERAL PLATE

The subcheliceral plate is usually U-shaped and can extend far into the idiosoma. The development of the subcheliceral plate is related to the type of chelicerae. If the chelicerae are long, slender structures as in *Uroactinia agitans*, the bars of the subcheliceral plate are correspondingly long and project to the metapodosomal region of the body. In predaceous forms, such as *Megisthanus floridanus*, in which the chelicerae are massive, heavily sclerotized structures, the bars of the plate are likewise heavily sclerotized, and broad ; in a parasitic form like *Diarthrophallus quercus*, in which the chelicerae are weakly sclerotized and relatively short, the subcheliceral plate is correspondingly short. Thus, from a knowledge of the type of chelicerae one can infer the degree of development of the subcheliceral plate. Also, from a knowledge of the feeding habits of a mite one should be able to deduce the type of chelicerae and thereby presume the development of the subcheliceral plate and tentorial region.

EPISTOME

The epistome forms the bridge connecting the medial, anterior arms of the subcheliceral plate. It continues forward to become the dorsal wall of the epipharynx, Plate II. From the ventral surface of the epistome originate dilator muscles which attach to the pharyngeal wall lying just beneath it. The entrance to the pharynx or mouth is just ventral to the epistome.

The epistome, for the most part, varies only in being narrow or wide. However in four cohorts, the Sejina, the Zerconina, the Parasitina and the Dermanyssina, there projects from the mid-posterior surface of the epistome an apodeme or epistomal process. It lies between and usually beyond and dorsal to the bars of the subcheliceral plate. In groups lacking the apodeme the bars of the subcheliceral plate are connected posteriorly by a lightly sclerotized bridge. In Sejina, Zerconina, Parasitina and the Dermanyssina the bridge is absent, the tips of the bars terminate separately and their medial surfaces tilt dorsally. The internal cheliceral sheaths, it would seem, in these forms have, thus, an additional support for their point of attachment, perhaps insuring greater resistance to any movement of the bars of the subcheliceral plate, Gorirossi, 1955c, Camin and Gorirossi, 1955, fig. 8. Börner (1903) regarded the presence of the epistomal process or "medial or labral apodeme", as he called it, highly significant in the 'Gamasides'. He felt that it represented a primitive condition since a comparable structure is found in the Uropygi. He felt that the only essential difference between the two groups is that in the Acarina the coxae of the palps fuse with the carapace, whereas in the Uropygi this degree of fusion is never reached. Another morphological bridge between the two groups is that in the Pedipalpida the coxae of the palps have moved dorsally and medially and eventually are contiguous with the lateral walls of the "labrum" (the epipharynx here). In the Acarina this association of the coxae with the epipharynx is retained by "coxal apodemes" (the subcheliceral plate here) and the coxae have fused with the "carapace" (the result of this fusion would be the gnathosomal ring). For these reasons Börner considered the 'Gamasides' primitive. It will be shown later that the Sejidae, the Zerconina, the Dermanyssina and the Parasitina have in common other gnathosomal features which separate them from the remaining groups, Table II.

The tentorium, (M), is the chitinous extension from either side of the subcheliceral plate and the epistome. It forms the junction between these elements and the medial walls of the coxal segments of the palps. This lateral development of the tentorial region is relative, i.e., it depends upon the width of the gnathosoma. The forward extension of the tentorium becomes the dorsal wall of the hypostome (K).

CORNICULI

Articulating from the dorsal wall of the hypostome are usually found the heavily sclerotized corniculi, (L). The corniculi, if present, can arise from various positions from the hypostome, Table II, :

1. In the Epicriina, the Sejina, the Zerconina, the Parasitina, and the Dermanyssina they arise from the distal surface of the hypostome.
2. In the Uropoda and the Diarthrophallina they articulate with the dorsolateral surfaces of the hypostome.
3. In the Antennophorina they articulate with the mid-dorsal wall of the hypostome.

Although they assume various positions and shapes, their functions would seem to serve as an underlying support against which the palps may hold their prey (Wernz and Krantz, 1976), or, in some instances to guide the chelicerae and prevent excessive lateral movement.

The corniculi of the male and female may differ. The corniculi of the male of *Megalolaelaps enceladus*, for example, has three medial tooth-like structures while those of the female are smooth.

LABRUM

The labrum is an easily identifiable structure : unpaired, and dorsal to the epipharynx. It can project from the epistome as a sort of upper lip or it can be attached to the epipharynx as a sort of bulb. A variety of forms was found among the species studied here, from the smooth, forked labrum of *Megisthanus floridanus*, the spatulate, spiny labrum of *Euzercon latus*, the long, tapering labrum of *Megalolaelaps enceladus* and the spoon-shaped labrum of *Uroactinia agitans*.

While a study of the variations in morphology of the labrum of the different species gives little information concerning the similarities existing among the groups, this is not so if the labrum is studied in relationship to its attachment to the epipharynx.

If approached from this viewpoint, two groups are recognized :

1. those in which the base of the labrum projects from the epistome, as in *Megalaelaps enceladus, Megisthanus floridanus, Euzercon latus, Passalacarus sylvestris*, and *Antennurella* sp.
2. those in which the labrum is fused to the dorsal wall of the epipharynx as in *Sejus* sp., *Pergamasus* sp., *Uroactinia agitans, and Diarthrophallus quercus.* I would expect to find a similar relationship in Zerconina.

Oudemans (1928) and Börner (1903), have drawn a labrum in the forms they studied but have not mentioned it.

EPIPHARYNX

The epipharynx is the tongue-like structure which fits into the hypopharyngeal groove. It is seen rarely from the ventral surface being shorter usually than the hypostomal and hypopharyngeal processes which are ventral to it or surround it. Generally, the ventrolateral sides of the epipharynx are more heavily sclerotized and therefore more rigid than the dorsolateral sides. The ventrolateral sides are usually provided with ridges or teeth which fit into similar patterns to be found on the wall of the hypopharynx much as a lock and key arrangement. As stated above, depressor muscles which insert within the epipharynx originate from the subcheliceral plate. These muscles control the shape of the epipharynx and insure closure of the mouth when they contract and the epipharynx is depressed into the hypopharyngeal groove.

Figure 4.

If the epistome, labrum and epipharynx are removed, the hypopharynx, (Q), the hypopharyngeal styli, (V), and the hypopharyngeal processes, (O), are visible. The hypopharynx is the trough in which the epipharynx lies. It is the forward continuation of the ventrolateral walls of the pharynx. Dilator muscles which originate from the ventral walls of the hypostome insert on the hypopharyngeal walls.

HYPOPHARYNGEAL STYLI

The slender hypopharyngeal styli, (V), can be seen originating from the walls of the hypopharynx, where the hypopharynx begins. On the presence or absence of these styli, the mites studied here fall into two groups :

1. those with hypopharyngeal styli to which belong the Uropodina, Diarthrophallina and the Antennophorina;

2. those lacking hypopharyngeal styli or, if present, they are only rudimentarily formed. To this group belong the Sejina, the Parasitina, the Dermanyssina and the Zerconina.

Of those forms with hypopharyngeal styli the most interesting modification is that found in *Uroactinia agitans*. In this species, (Gorirossi, 1955), the styli are heavily sclerotized, blade-like structures with a deeply dentated, dorsal surface, so unlike the long slender styli of *Megisthanus floridanus* or the short spiny cones of *Euzercon latus*. As in other species, the styli of *Uroactinia agitans* project over the dorsal surface of the epipharynx. Instead, however, of lying parallel with each other, they lie obliquely toward each other so that their tips are between the chelicerae. Therefore, when the walls of the hypopharynx spread and the epipharynx is lifted by the epipharyngeal muscles, the styli would move laterally and perhaps influence the function of the chelicerae or they may simply function in removing debris that would accumulate on the chelicerae during feeding.

HYPOPHARYNGEAL PROCESSES

The hypopharyngeal processes, (O), are the anterior continuations of the walls of the hypophyarynx. These extensions of the hypopharyngeal wall usually project beyond the epipharynx or may envelop the epipharynx as in *Uroactinia agitans*, or, they can be simple, slender structures, as in *Megisthanus floridanus*, or, as described for *Euzercon latus* and *Passalacarus sylvestris*, they can possess many fringed edges.

Figure 5.

A detailed view of this region shows clearly the relationship of the above mentioned structures. In a personal letter from Dr. Snodgrass, dated 26 February, 1954, he wrote the following remarks concerning the pharynx, (S'), "There is one matter of homology between Arachnida and insects that is still undetermined. The question is as to the nature of the so-called pharynx. The sucking organ of insects has long been called the 'pharynx', but a true pharynx is a part of the stomodaeum. The sucking pump of liquid-feeding insects is derived from a preoral food pocket of generalized insects. I have named this pocket the *cibarium*, and the term is now coming into general use ... The dilator muscles of the cibarium always arise on the epistome (clypeus of entomology).

"The fact that the dilator muscles of the sucking organ of the arachnids arise on the epistome makes it suspicious that the 'pharynx' may not be a pharynx, but a secondary preoral pocket of the ectoderm analogous to the insect cibarium. I have not ventured to change the status of the arachnid 'pharynx' in print ... It has been said to be a part of the stomodaeum, but I do not believe the observation was based on a critical study.

"The matter can perhaps be settled only by a developmental study, but the question as to whether the arachnid 'pharynx' is a pharynx or not should be kept in mind. Some insects have a true pharyngeal pump in addition to the cibarial pump."

Keeping in mind Dr. Snodgrass' comments, it is interesting to note the analogy between the cibarium (with muscles originating from the epistome) of the insects and the anterior portion of the so-called pharynx of the Mesostigmata where the most anterior dilator muscles do, indeed, also originate from the epistome. Could this most anterior region of the pharynx be homologous to the cibarial region of insects?

While the general shape of the pharynx in cross-section is that of an inverted triangle, that of *Megisthanus floridanus* is rectangular in shape, one surface of the narrow end adhering to the gnathosomal base by means of connective tissue. The arrangement of the constrictor and dilator muscles on the pharynx is not changed.

Figure 6.

A ventral view of the gnathosoma. To be noted are setae Z1, Z2, and Z3 outlining the ventral wall of the hypostome. The grouping of these setae set the limit for the region of the hypostome. For instance in *Megisthanus floridanus, Megalolaelaps enceladus* and *Passalacarus sylvestris* they form a triangle, the long side of which would connect the distal (Z1) and lateral (Z3) setae. In *Uroactinia agitans* the setae are in a straight line, parallel with the long axis of the body of the mite. The hypostomal setae of *Antennurella* sp. form an oblique line, the distal (Z1) of which is nearest the midline. (Hirschmann, 1959, labels these setae C1, C2 and C3 ; van der Hammen, 1964, as a, m1 and m2 and Evans and Loots, 1975, refer to them as the post-hypostomatic setae).

PROTOSTERNUM

The ventral surface of the hypostome is divided into right and left halves by the protosternum. The protosternum marks ventrally the floor of the hypopharynx. The protosternum is the anterior prolongation of the deutosternum but easily differentiated for it usually lacks any form of ornamentation. In most groups the walls of the protosternum are contiguous with those of the hypostome. This is not so in the Antennophorina, where the protosternal region projects more or less independently from the hypostomal region.

HYPOSTOMAL REGION

The hypostomal region of the two sexes may differ :
1. for example, in the male of *Pergamasus* sp. the hypostomal region, always clearly defined by the position of the hypostomal setae, is separated from the protosternal region.
2. In *Megalolaelaps enceladus* the ventral surface of the hypostomal region of the male possesses a pair of egg-shaped protuberances which are absent in the female.
3. In *Megisthanus floridanus* the lateral corners of the hypostomal region in the male curve anteriorly whereas in the female they do not.
4. In *Euzercon latus* the hypostomal region of the female is typically mesostigmatid in structure whereas that of the male is secondarily modified, probably for sexual purposes (Gorirossi, 1955).

The hypostomal processes, (P), are anterior continuations of the hypostome and are usually ventral to the hypopharyngeal processes or they may be fused with them entirely or partly.

DEUTOSTERNUM

The deutosternal plate, (U), divides the gnathosomal base into right and left halves. When one compares the ornamentation of the deutosternal region, three main groupings emerge :
1. those species having seven or more rows of ridges or denticles as *Sejus* sp., *Megalolaelaps enceladus* and *Pergamasus vargasi.*
2. those having crescent - shaped lobes as in *Uroactinia agitans* and *Polyaspis* sp.
3. the third group subdivides as follows :
a) those species having five or six rows of plates or denticles as in *Passalacarus sylvestris, Euzercon latus, Zercon* sp. and *Megisthanus floridanus* ;
b) *Antennurella sp.* which has four rows of denticles ;
c) *Diarthrophallus quercus*, which has three rows of denticles.

Hirschmann in his 1959 paper proposed using the deutosternal and protosternal regions (his hypostome) as "Gang" key characters which would permit species groupings in his Gangsystematik. He further suggested the possibility of establishing formulae for interpreting the transverse rows of denticles of the deutosternum (Querleisten) to be used in correlation with the dorsal setae maps in reflecting phylogenetic relationships. Hirschmann's exhaustive exploration of this ventral surface of the gnathosoma depicted in more than 91 drawings, representing 76 species, illustrates the rich diversity of forms and arrangements of the parts which can be exploited for classification.

GNATHOSOMAL SETAE

The gnathosomal setae, (W), lie on either side of the deutosternum (U). The position of the gnathosomal setae showed some consistency in the species studied here. For instance, in *Uroactinia agitans. Polyaspis* sp. and *Antennurella* sp., the setae are located laterally and between the first and second rows of teeth ; in *Sejus* sp., *Euzercon latus, Passalacarus sylvestris* and in *Megisthanus floridanus* they are opposite the fourth ridge. The most posterior ridge or row of teeth in each case was considered as number one, (Hirschmann, 1959, labels these C4 ; Evans and Loots. 1975, call these the palpcoxal setae and van der Hammen. 1964, the post infracapitular setae).

TRITOSTERNUM

This interesting structure, while not normally considered as part of the feeding mechanism, was demonstrated by Wernz and Krantz, (1975), to function 'in concert with the deutosternum (their capitular groove) of the gnathosoma as a fluid transport and grooming mechanism'. Excessive prey fluids are redirected towards the mouth between the tritosternal laciniae and the deutosternum, thus preventing loss of food material. They further showed that grooming of the deutosternum is accomplished through the combined raking action of the hypostomal processes (their lacinial pili) and the deutosternal denticles.

In the above review of the composition of the gnathosoma of the Mesostigmata, two structures have not been mentioned because they do not occur in *Megisthanus floridanus*. They are the salivary styli and the epipharyngeal styli.

SALIVARY STYLI

The salivary styli, when present, are usually found somewhere between the palps and epipharynx, projecting from the dorsal wall of the hypostome. They do not appear to be tubes but more like slender, solid structures which are grooved along their medial surfaces. Of the groups examined three lacked salivary styli. They are the Sejina, the Zerconina and Antennophorina.

Of the groups which possess them, i.e., the Parasitina, the Dermanyssina, Diarthrophallina and the Uropodina, the latter two seem to have styli which are situated more dorsally than the others, i.e., nearer the tectum.

EPIPHARYNGEAL STYLI

The epipharyngeal styli are very delicate, sclerotized projections attached to the base of the epipharynx. They have only been found in one species, *Euzercon latus*. Since they are absent in the other Celaenopsid studied (*Passalacarus sylvestris*), the question arose as to whether these were actual styli or just part of the labrum, with which they are closely associated. Only after careful dissection and study was the decision that they are structures independent of the labrum reached. First, the labrum of *Euzercon latus* is of a different texture ; it is lightly sclerotized and densely covered with tiny setules, whereas the styli are smooth structures with serrated edges. Second, the labrum projects from the epistome and the styli come off the epipharynx.

Observations

No fewer than 18 homologous structures have been described as forming part of the complex structure of the gnathosoma of the Mesostigmata. Table I summarizes the synonymy of terms of the gnathosoma used by various authors. These 18 homologous parts form a basic pattern that is consistent within the order. On the basis of their consistencies and differences with regard to morphology, presence or absence or position within the gnathosoma among the different groups, certain of these structures appear more significant than others in characterizing natural groupings among the cohorts. Indeed, they may reflect certain phylogenetic affinities. These have been identified as the EPISTOME, the TECTUM, the CORNICULI, the CHELICERAE, the HYPOPHARYNGEAL STYLI and, perhaps, the SALIVARY STYLI.
If the examples within the cohorts studies here are arranged with special regard to the above mentioned structures, three natural groupings emerge (see Table II) :

Group I. SEJINA - ZERCONINA - PARASITINA - DERMANYSSINA.
(The Parasitina and the Dermanyssina were formally included as part of the cohort GAMASIDES).
Epicrius mollis (Kramer, 1885) : Epicriidae Berlese, 1885 : Epicriina Vitzthum, 1941 was studied in detail (labelled *Epicrius geometricus*) as part of the Berlese collection. Dissections were not possible, but from what could be seen on the slide of the gnathosoma -chelicerae without brushes, a simple tectum without a keel, distal projecting corniculi and no salivary styli - it would seem that the cohort Epicriina would be part of Group I.

Group II. DIARTHROPHALLINA - UROPODINA (to which TRACHYTINA has now been incorporated).

Group III. MEGISTHANINA - CELAENOPSINA - FEDRIZZIINA
(Now all members of the single cohort ANTENNOPHORINA).

Discussion

Using Börner's reasoning, since it is conceivable that the persistence of the epistomal apodeme represents a primitive condition stemming from the Arthropoda :

Group I. SEJINA - ZERCONINA - PARASITINA - DERMANYSSINA, would represent the most primitive group characterized by :
1) an epistomal apodeme (Epicriina ?),
2) simple tecta without keel,
3) corniculi which extend from the distal wall of the hypostome,
4) simple chelicerae without brushes, or, if present, not elaborate,
5) slightly developed or no hypopharyngeal styli,
6) with or without salivary styli).

Group II. DIARTHROPHALLINA - UROPODINA, differs from Group I because of having no epistomal apodeme, and, from groups I and III because of :
   a. their elaborately developed tecta without a keel,
   b. the corniculi which articulate laterally from the dorsal wall of the hypostome,
   c. having both salivary and hypopharyngeal styli.

The cohorts comprising Group III differ from Groups I and II in the above scheme, in view of :
1) their simple tecta with a mid-ventral keel,
2) corniculi articulating from the mid-dorsal surface of the hypostome,
3) chelicerae possessing very elaborate brushes,
4) having only hypopharyngeal styli.
They have in common with Group II the absence of the epistomal apodeme and the presence of hypopharyngeal styli.

Remarks

Using mouth parts as a basis for indicating a possible phylogenetic relationship among the groups of the Mesostigmata intrigued me over thirty years ago. Many authors have recognized the fairly uniform recurrence of certain mouth part structures in the groups they have studied. Kramer, 1876, mentions the tectum (his Randfigur) as being a structure easily discernable through the developmental stages, the hypostome (his Unterlippe) and the hypopharyngeal processes (his Fahne, in part) as structures which might change in appearance but always recognizable. Trägårdh, 1950, listed the tectum (his epistome), the chelicerae (his mandibles) the hypostome (his maxillary plate) and the hypostomal processes (his appendages of the maxillary lobes) as being such structures. Baker, et. al. in their 1958 GUIDE TO THE FAMILIES OF MITES did incorporate the chelicerae, corniculi, hypopharyngeal styli, salivary styli, tectum and the epistomal apodeme as vital components of their keys.

Hirschmann and Zirngiebl-Nicol (1964), as quoted in Hirschmann 1971, presented a new classification (Gangsystematik) of the Uropodidae based on postembryonic development. They considered the chelicerae, the hypopharyngeal processes with possibly the hypostomal processes, (their laciniae), the protosternum, (their anterior hypostomal groove), and the deutosternum, (their posterior hypostomal region, part), as important diagnostic characters among structures of the gnathosoma for their Gangsystematik.

Gnathosomal structures have long been an acarologist's tool in taxonomy. The author hopes that the material presented here further justifies the reliability of using mouth parts as key characters to reflect major affinities and diversities at all levels of classification.

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Legend for tables and figures :

TABLE I.

Synonymy of Terms.

TABLE II.

The occurrence of certain mouth part structures among the cohorts of the Mesostigmata.

PLATE I. Megisthanus floridanus : *Female.*
Fig. 1. - *The dorsal view of the gnathosoma.*
Fig. 2. - *The tectum and dorsal wall of the gnathosoma have been removed.*
Fig. 3. - *The chelicerae and the cheliceral sheaths have been removed.*
Fig. 4. - *The epipharyngeal muscles, epistome, labrum and epipharynx have been removed.*
Fig. 5. - *Detail of hypopharyngeal region.*
Fig. 6. - *Ventral view of the gnathosoma.*

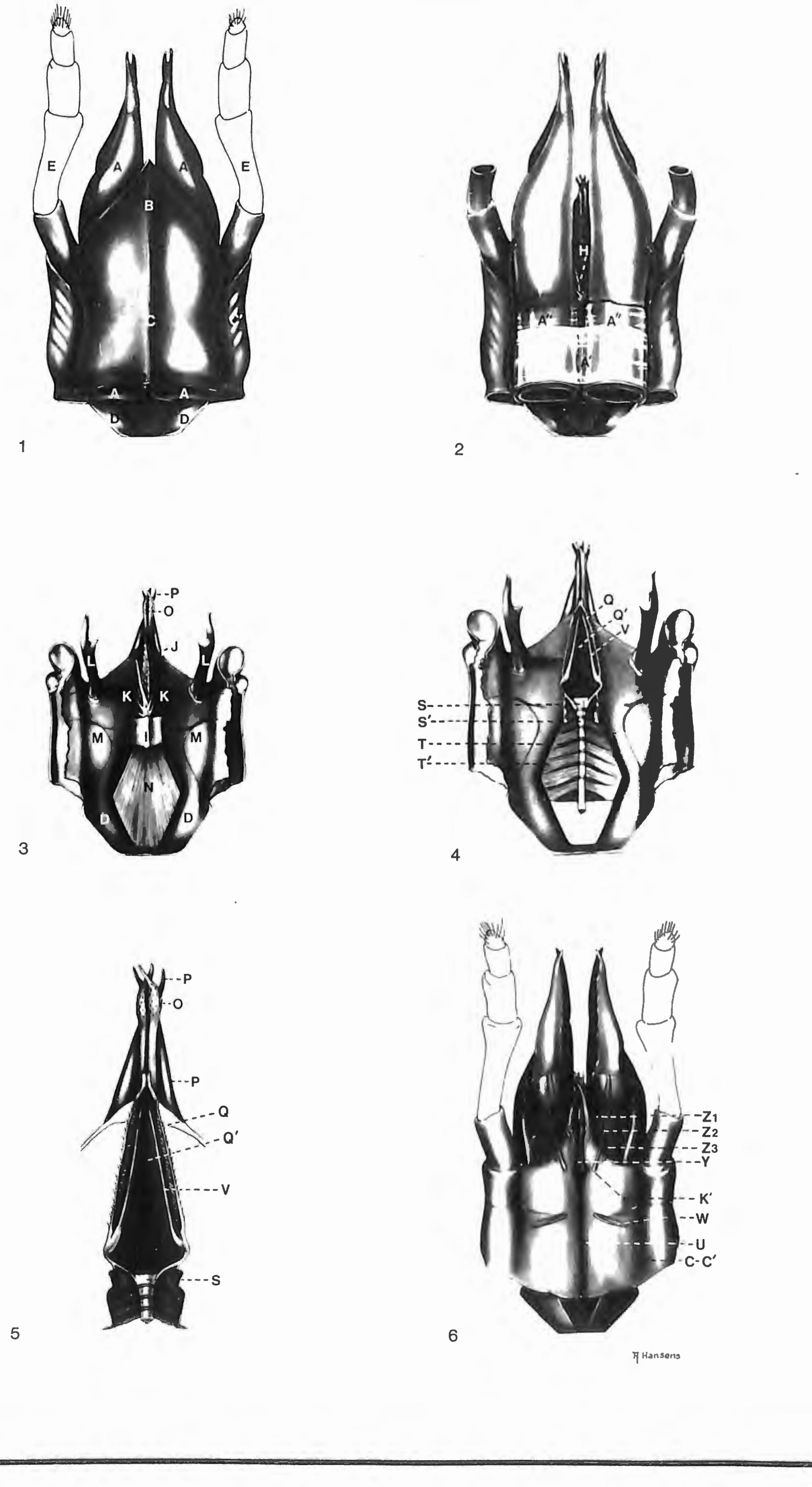
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PLATE I.

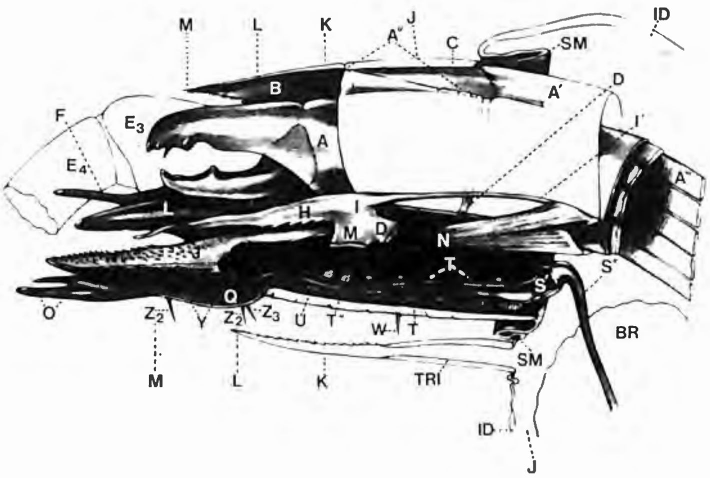

PLATE II.

Reconstructed lateral view of the gnathosoma of Megalolaelaps enceladus.

Explanation of symbols. PLATE II.

A : Chelicerae
A' : Internal cheliceral sheaths
A" : External cheliceral sheaths
B : Tectum
C, C' : Gnathosomal base
D : Subcheliceral plate
E : Palps
H : Labrum
I : Epistome
J : Epipharynx
K : Dorsal wall of hypostome
K' : Ventral wall of hypostome
L : Corniculi
M : Tentorium
N : Epipharyngeal muscles
O : Hypopharyngeal processes
P : Hypostomal processes
Q : Hypopharyngeal wall
Q' : Floor of hypopharynx
S : Dorsal wall of pharynx
S' : Pharynx
T : Pharyngeal constrictor muscles
T' : Pharyngeal dilator muscles
U : Deutosternum, details not shown.
V : Hypopharyngeal stylus
Y : Protosternum
Z1, Z2, Z3 : Distal, medial, lateral hypostomal setae.

TABLE I. SYNONYMY OF TERMS

Present study	Gnathosomal base	Deutosternum	Protosternum	Hypostome (v. side)	Hypostomal processes	Hypopharyngeal processes	Hypopharynx	Hypopharyngeal styli	Epipharynx	Labrum	Tectum	Epistome/sub-cheliceral plate
Winkler, 1888	capitulum	-	Mittleren Lappen	ausseren Laden der Maxillen	-	-	-	-	epipharynx (Zunge)	-	epistome	intermaxillar gerüst (part)
Börner, 1903	ventral Wand der Coxa Carapace	-	-	dorsalen Wand der Coxa	-	-	-	lappiger Anhang der Coxa der 2 Extr., die Mund-hohle von oben teilweise bedeckend	labrum	-	epistome	labral apodeme/ coxal apodemes (parts)
Oudemans, 1914	maxillary coxa	Rima	hypopharynx (?)	hypostome (part)	-	-	-	-	labrum	-	epistome	-
Oudemans 1928	maxillary coxa	Rima	hypostome	-	-	-	-	-	epipharynx	-	epistome	-
Stanley, 1931	capitulum	-	hypostome (part)	hypostome (part)	-	-	-	-	lingula	vomer	epistome	-
Vitzthum, 1931	coxae maxillares	Rima hypopharynx	hypostome (part)	maxillae (part)	-	lacinae malarum internum	-	paralabra interna	labrum	-	epistome	subcheliceral part (part)
Snodgrass, 1948	basis capituli	-	hypostome	hypostome (part)	hypostomal processes (part)	-	hypostome (part)	stylus (?)	labrum (part)	labrum (part)	tectum, tectum capituli	epistome
Hughes, 1949	basis capituli	hypostome, deutosternum	ant. pro-longation of hypostome	rostrum	malae internae	malae internae (part)	ant. v.l. walls of pharynx	paralabra externa	epipharynx	labrum	epistome	subcheliceral plate (part)
Evans, 1957	basis capituli	ventral or capitular groove	-	rostrum	-	internal malae	-	-	ligula	-	tectum	-
Hirschmann, 1959	gnathosomal base	hypostome		Mundfort-satz	-	lacinae	-	paralacinae	labrum	paralabra (part)	tectum	epistome styli (part)
van der Hammen, 1964	mentum	subcapitular groove		genae	-	laciniae	labial gutter	labelli,	labrum	-	cheliceral tectum	cervix (part)
Evans, 1968	basis capituli	deutosternum	-	hypostome	laciniae (ventral)	fibrillae (dorsal)	pro-oral groove	-	labrum	-	tectum capituli	-
Evans and Loots, 1975	basis gnathosomatica	hypognathal groove		external mala(part)	-	hypostomatic processes	pre-oral trough	paralabra	labrum	supra-labral process	gnatho-tectum	subcheli-ceral plate (part)
Karg, 1986	gnathosoma	hypostome	-	hypostome (part)	paralaciniae	laciniae	-	-	-	-	tectum	
Akimov, et al. 1988	gnathosomal base	hypostomal groove	-	hypostome	laciniae	laciniae (part)	hypopharynx	-	epipharynx	labrum	tectum	epistome, subcheli-ceral plate

TABLE II.

		EPISTOME		TECTUM			CORNICULI			CHELICERAE		HYPOPHARYNGEAL STYLI		SALIVARY STYLI		HYPOPHARYNGEAL & SALIVARY STYLI			
		apodeme		keel			project from hypostomal wall			brushes									
		present	absent	simple without	elaborate without	simple with	distally	laterally	dorsally	less elab.	elaborate	without or simple	with	without	with	both lacking	with both	only hypoph.	only saliv.
	SEJINA	x		x			x			x		x		x		x			
	ZERCONINA	x		x			x			x		x		x		x			
	DERMANYSSINA	x		x			x			x		x			x				x
	PARASITINA	x		x			x			x		x			x				x
	UROPODINA		x		x			x		x			x		x		x		
	DIARTHROPHALLINA		x		x			x		x			x		x		x		
ANTENNOPHORINA	MEGISTHANINA		x			x			x		x		x	x				x	
	CELAENOPSINA		x			x			x		x		x	x				x	
	FEDRIZZIINA		x			x			x		x		x	x				x	

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ANNEX I

Cohort : SEJINA KRAMER, 1885 (*teste* VITZTHUM, 1941)
Family : Sejidae (?KRAMER, 1885)
Species : *Sejus* sp.

There were nine females and two males of *Sejus* sp. which had been collected from the basal three hole of a beech tree thirteen miles west of Nahma Junction, Delta County in Michigan. These mites are medium in size, not heavily sclerotized, with unusually large, strong chelicerae that seem far out of proportion with the remainder of the gnathosomal elements, even the palps seem small in comparison. The chelicerae of the male and female are essentially the same. The chela of the chelicerae are about as long as the first and second segments and armed with teeth.

The deutosternum of the male and female is similar. It has eight to ten rows of four to seven small denticles. These denticles are larger and more conspicuous in the male than in the female. The ventral surface of the gnathosoma of the male has additional denticles which encroach upon the second, third and fourth rows fo deutosternal denticles (the most posterior row of denticles being row one). These denticles on the gnathosoma extend anteriorly to the base of the medial hypostomal setae. In the female a similar row of gnathosomal denticles flanks either side of the fourth row of deutosternal denticles.

The gnathosomal setae in both male and female are slightly shorter than the lateral hypostomal setae and have setules. They lie lateral to the third row of deutosternal denticles.

The tectum in both sexes is mucro in shape. It is distinctly differentiated from the gnathosomal base by its smooth surface. The dorsal wall of the gnathosomal base in both sexes is moderately covered with denticles. There is present an epistomal apodeme. The bars of the subcheliceral plate are broad and flat. The epipharynx is a slender, delicate structure, the ventrolateral walls of which are covered with tiny denticles. The anterior tip of the epipharynx can be seen from the ventral surface. The labrum extends from the dorsal wall of the epipharynx as a "bulb" and is not a separate structure. The hypopharyngeal groove is slightly formed. Anteriorly, the paired hypopharyngeal processes extend independently from each half of the groove. Laterally, are very fine, finger-like extensions of the hypopharyngeal processes. Hypopharyngeal styli and salivary styli are lacking in these mites.

The ventral surface of the hypostome is characterized by the three hypostomal setae lying on either side of the protosternum. In the male, the medial setae are approximately two and one-half times longer than the lateral setae and approximately five times longer than the distal setae. They are the most robust of the three setae and densely covered with setules. The lateral setae are about three times longer than the distal setae and nude; the distal setae are very thin, straight setae without setules. In the female the setae are of the same relative size but not as long as in the male and all lack setules. In both the male and female the medial setae lie in the same perpendicular plane as the distal setae while the lateral setae, a little to the side of this plane, are nearer the distal than the medial setae.

The hypostomal processes extend distally as delicate, membranous structures which envelope the distal tip of the epipharynx.

The region of the protosternum lies anterior to the medial hypostomal setae and extends to slightly beyond the base of the lateral hypostomal setae. Its walls appear rigid and terminate distally in two pointed processes. The epipharynx can usually be seen between its distal tips. The corniculi are relatively small, tusk-like structures.

The specialized seta on the tarsal segment of the palps has three tines, one of which is minute.

* Camin and Gorirossi, 1955, p. 31, fig. 8b.

Cohort : UROPODINA KRAMER, 1881
Family : Polyaspididae BERLESE, 1913
Species : *Polyaspis* n. sp.

Ten females and five males of the species *Polyaspis* sp. were collected from the basal tree hole in an oak tree at Gongales, Ascension Parish, Louisiana. These mites are unusual in that they have their larval skins attached to their bodies. With their moderately large chelicerae, they could act as predatory mites.

The gnathosomal base is short and broad and void of ornamentation. The deutosternum is made up of three combs of deutosternal denticles with approximately ten per row. The gnathosomal setae are short, branched and spinose. They lie opposite and between the first and second row of deutosternal denticles and are posterior and slightly lateral to the lateral hypostomal setae.

The region of the hypostome is restricted to a comparatively small area. The hypostomal setae lie closely together; the medial setae are nearer the lateral than the distal setae. The lateral setae are the longest of the setae and are approximately one and one-half times longer than the distal setae and approximately four times longer than the medial hypostomal setae. They are sparsely covered with setules. The distal hypostomal setae lie medial and posterior to the corniculi. They are almost three times longer than the medial setae and lack setules. The medial hypostomal setae are the shortest of the setae and have prominent spines on their surfaces.

The hypostomal processes are long and slender and extend to the middle of the palpal genu. They are covered with small spines on their distal third.

The tectum consists of a long, slender, median, tongue-like structure which is covered with minute denticles and a pair of spinose projections laterally. It is a conspicuous structure and can be seen from a ventral view when the chelicerae are retracted.

The epistome does not have an epistomal apodeme and is narrow; the bars of the cheliceral plate are relatively long and about two-thirds of their length extends into the idiosoma.

The epipharynx is about three-fourths the length of the corniculi and short when compared with the epipharyngeal development of the other Mesostigmata. It is covered with tiny denticles.

The labrum is a small, cone-shaped structure about one-fourth the length of the epipharynx.

The hypopharynx is covered with tiny denticles and is corresponding short to accommodate the short epipharynx. No hypopharyngeal processes were observed.

The hypopharyngeal styli are very well developed; they are slender, spinous structures, slightly shorter than the epipharynx.

Salivary styli are present. They are extremely long, smooth structures, almost as long as the palps.

The protosternal area is very short, corresponding to the short epipharynx and the short hypopharynx.

The corniculi are very long, blade-like and heavily sclerotized structures which reach beyond the base of the palpal tibia, almost to the base of the two-tined tarsal seta.

The chelicerae lack excrescences and the first segment is the longest of the three segments. The cheliceral digits are large, strong and subequal in length.

The palps are only four segmented. The palpal tibiae and tarsi are fused, their line of fusion being marked by the position of the two-tined tarsal seta.

Cohort : ANTENNOPHORINA CAMIN & GORIROSSI, 1955. (FEDRIZZIINA)
Family : Antennophoridae BERLESE, 1892
Species : *Antennurella* sp.

Only the female of the species of *Antenurella* sp. was available for dissection.

The gnathosoma is moderately large and projects from the anteroventral surface of the idiosoma. The gnathosomal base forms the greater part of the gnathosoma. The deutosternum is clearly delineated and has four rows of weakly developed denticles. The small, pointed gnathosomal setae have setules and are located laterally between the first and second row of deutosternal denticles. The gnathosomal base is marked by three ridges. They extend from either side of the deutosternum. The most posterior of these is slightly anterior to the first row of deutosternal denticles and curve anteriorly to the base of the gnathosomal setae. The middle ridge begins at the level of the third row of deutosternal denticles and are directed anteriorly. The most anterior ridge is at the upper limit of the deutosternum and begins just anterior to the fourth row of deutosternal denticles.

The hypostomal region resembles that described for the female of *Euzercon latus* (Gorirossi, 1955 b), in that, the region is distinctly separated from the protosternum. The hypostomal setae are arranged in a straight line that runs obliquely across the hypostome. The long, tapering distal hypostomal setae are smooth and bend slightly medially. They are approximately twice as long as the medial setae. The medial setae, nearer the lateral setae, are the only hypostomal setae with setules and are about two and one-half times longer than the lateral setae. The lateral setae are short and needle-like. The hypostomal processes could not be differentiated from the hypopharyngeal processes.

The protosternal region resembles that described for the female of *Euzercon latus.*

The corniculi project sharply inward from their point of articulation with the hypostome. They are short structures divided on their inner surfaces.

The tectum of *Antennurella* sp. is short and broad. It has rows of tiny denticles dorsally and has a serrated edge. On its ventral surface is a well-developed, darkly-sclerotized, keel-like structure which extends into the idiosoma.

The epistome is a narrow, heavily-sclerotized bar. The tentorium and subcheliceral plate are similar to that described and shown for the Celaenopsina (Gorirossi, 1955b). About one-half of the length of the bars of the subcheliceral plate projects into the idiosoma.

The epiharynx is delicately sclerotized and covered with denticles.

The labrum is spatulate, lightly sclerotized and covered with denticles.

The hypopharynx is long, well developed and provided with tiny denticles. The hypopharyngeal processes are elaborately developed and envelope the epiharynx. The hypopharyngeal styli are about one-third as long as the epipharynx; they are slender, tapering structures and covered with denticles.

The chelicerae are moderately long, rather robust structures, with long, filamentous excrescenes on the ventral surface of the movable digit.

The palpal tarsus has a two-tined seta.

Cohort : DIARTHROPHALLINA TRÄGÅRDH, 1946
Family : Diarthrophallidae TRÄGÅRDH, 1946
Species : *Diarthrophallus quercus*, PEARSE & WHARTON, 1936

Diarthrophallus quercus was studied from dissections and whole mounts. It is a small, oval, opalescent-colored mite which inhabits the antennal sockets of *Popilius disjunctus.* All stages of the mite can be found on the beetles at any one time. It is well adapted for its preferred locality by unusually long setae scattered over its surface and an unusually long first pair of legs. Trägårdh, 1946*, refers to these as 'adaptive, ecological characters' and writes :

'The long bristles of the dorsal side of both nymphae and adults are undoubtedly very powerful defensive weapons. Such bristles occur in many otherwise defenseless acarina ... The development of the first pair of legs as a kind of antennae, devoid of ambulacres but provided with numerous tactile or sensorial hairs ... This specialization has been rendered possible because the ambulacres of the other legs are so powerful that they are sufficient for the mite to cling to the polished surface of the beetle'.

D. quercus is an extremely tiny mite. The adult male and female are about 480 microns long and 350 microns wide. The minute gnathosoma is compactly arranged possessing all structures except for the epipharyngeal styli. The male, unlike the female, has a pair of small spur-like structures which project from the hypostomal region lateral to the distal hypostomal setae.

The gnathosomal base is void of ornamentation. In one female specimen examined, the deutosternum had three widely-separated rows of denticles, two denticles per row. The gnathosomal setae in the male are extremely small and located posteriorly to the medial hypostomal setae. In the female they are on the dorsal surface of the gnathosomal base, lateral to the tectum and posterior to the palpal trochanter.

The hypostomal portion of the gnathosoma forms the greater part of the ventral surface - approximately two-thirds of it. Except for the hypostomal setae it is without ornamentation. The distal hypostomal setae are the longest of the setae, approximately two and one-half times longer than the lateral and about three and one-half times longer than the medial setae, these latter are next to the corniculi. The three setae are arranged in a straight line that runs obliquely across the hypostome. The hypostomal setae are without setules.

The hypostomal processes are conspicuous structures. They are long and tapering and reach the middle of the tibial segment of the palps.

The protosternal region is well developed and on one specimen examined appeared to be covered with small denticles.

The corniculi are large, tusk-like structures, and project laterally from the hypostome.

The chelicerae are of moderate size, the second segment of which is the longest of the segments. From the immovable digit extends a long, slender excrescence, one surface of which has barb-like projections.

The tectum of both species is by far the most elaborately developed of any of the forms studied. It is similar in both sexes and readily seen from a ventral view. It has a broad base which tapers and subdivides distally into four processes. Two lateral processes curve medially as the curved palm of a hand ; medially are two other processes, one of which is the continuation and the termination of the dorsal surface of the tectum and one of which projects from the ventral surface. This process is a bifid, 'fleshy-looking' structure and is the longest part of the tectum. The tips of all the processes are covered with tiny 'bristles'.

The epistome lacks the epistomal apodeme and the subcheliceral plate projects slightly beyond the gnathosomal base into the idiosoma. It appears lightly sclerotized.

The epipharynx resembles that described for *Sejus* sp. but cannot be seen from the ventral surface.

The labrum can be distinguished only as a flap-like structure extending dorsally from the epipharynx.

The hypopharynx is covered with tiny denticles. The hypopharyngeal processes are fused with the hypostomal processes laterally. They are free at their tips as two, filamentous structures and are about three-fourths the length of the hypostomal processes.

The hypopharyngeal styli are minute, tusk-like structures and void of ornamentation.

The salivary styli can easily been seen without dissection. They lie medial to the palps and are long, slender processes which reach to the tibial segment of the palps.

The tarsal segments of the palps lack the specialized setae so characteristic of the Mesostigmata.

Cohort : ZERCONINA TRÄGÅRDH, 1944
Family : Zerconidae BERLESE, 1892
Species : *Zercon* sp.

Zercon sp. was studied from specimens in the Acaroteca at the U. S. National Museum. According to the locality labels on the slides, four males and two females were collected at Logan Canyon, Utah and two females from Sartine Canyon, Wellsville, Utah. The following observations were made from whole mounts.

The gnathosomal base is simple. The deutosternum of both sexes is the same. It has five to six rows of denticles, the number of denticles per row varied from two to seven. Ridges extend on either side of the first, third, fourth and fifth rows of denticles. The gnathosomal setae occur between the second and third row of deutosternal denticles.

The hypostomal region is the same in the male and female. The distal hypostomal setae are the longest and are about one and one-half times as long as the medial hypostomal setae. The medial setae are about one and one-half times as long as the lateral hypostomal setae. The lateral hypostomal setae are the shortest and are nearer the medial hypostomal setae. All hypostomal setae have some setules.

The hypostomal processes resemble those described for *D. quercus* but are shorter. The details of the protosternum were impossible to study.

The corniculi are relatively small and short and shaped like small tusks. They extend from the distal wall of the hypostome.

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* Trägårdh, I, 1946. Diarthrophallina, a new group of Mesostigmata found on passalid beetles. *Entomologi Meddelelser* 24 : 369-394.

The epipharynx and labrum could not be seen from the ventral surface.

The hypopharynx is provided with tiny denticles. Finger-like processes extending laterally from the hypostomal processes were probably the hypopharyngeal processes.

No salivary styli or hypopharyngeal styli are present (Camin and Gorirossi, 1955).

The tectum of both sexes terminates in three peaks, the center one is the longest. All three have jagged edges.

The chelicerae lack excrescences but have a seta at the base of the immovable digit. The second segment is the longest.

The specialized seta of the tarsal segment of the palps is two-tined.