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(Hemiptera: Pentatomidae)**

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**Morphology Of the Head Capsule Of *Aelia rostrata* Boh.
(Hemiptera: Pentatomidae)**

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The cephalic exoskeleton, the endoskeleton of the head and the musculature related to the sucking mechanism of *Aelia rostrata* have been described.

The head capsule of *Ae. rostrata* is heavily sclerotized. It bears five segmented antennae, compound eyes, two ocelli and a four-segmented labium.

The labium encloses the mandibular and maxillary stylets. Mandibular stylets are lateral to the maxillary stylets in the labium. They become ventral in the head. Both stylets are provided with protractor and retractor muscles. The mandibular ones have a mandibular lever too.

The cibarium is the most conspicuous structure in the head. The hypopharynx, which is embedded into the tentorium, forms the floor of the cibarium. The epipharynx which constitutes the roof of the cibarium is membranous. Dilator muscles of the cibarium attach onto it. The salivary pump is ventral to the tentorium.

INTRODUCTION

Aelia rostrata is a phytophagous hemipteran and a serious pest to gramineous plants, especially to wheat in central Turkey.

A number of studies on the external and internal morphology of the hemiptera have been done in recent years [1,7]. Although some authors give general information on the morphology of the

head of hemiptera [8,10], there is no morphological study on the head capsule of *Aelia rostrata* [11,14]. A morphological study of the head capsule and sucking device of *Aelia rostrata* was felt to be useful, especially to those who deal with this insect as a pest.

MATERIAL AND METHODS

Specimens for the present study were collected from the hibernating quarters of *Aelia rostrata* in April 1965 in Ankara. The external morphology of the head capsule was determined by studying fresh, alcohol-preserved and dried specimens. The internal morphology was also studied by dissecting the fresh, fixed and alcohol-preserved specimens.

In order to cut serial sections, the whole insect was kept in hot 10 % potassium hydroxide (KOH) solution for two minutes, then transferred into glacial acetic acid . Next the head of the specimen was cut out and dehydrated in n-butyl alcohol, then imbedded in parafin with a 50°-60°c. melting point. The serial sections were cut at 25 micron intervals. Sections obtained from the specimens fixed in aqueous Bouin's solution were stained with Groat's hematoxyline and eosin and with Mann's methyl - blue - eosin.

The skeletal structure was also studied after the heads had been boiled in 10 % KOH solution for three minutes and rinsed in glacial acetic acid [18].

RESULT

External structure of the head:

The head capsule of *Aelia rostrata* is heavily sclerotized. Its dorsal surface consists of a vertex , a clypeal area and two gena which lie one on each side of the clypeus. There is no epistomal suture (Fig. 1).

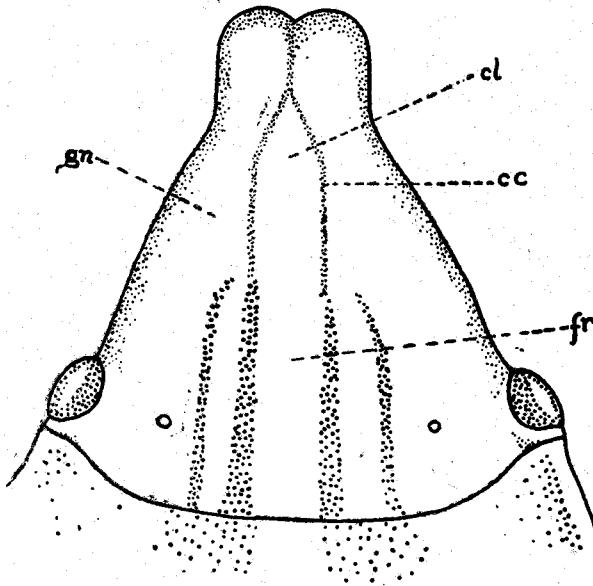


Fig. 1. Dorsal view of the head of *Aelia rostrata*. cc = clypeal cleft, cl = clypeus, fr = frons, gn = gena

The clypeal area is separated from the gena (mandibular plate) by a deep clypeal cleft which is formed by the inflections of the edges of the clypeus and the gena. The maxillary plate is separated from the mandibular plate by a suture which extends from the anterior part of the gena to the base of the antennal socket.

The mandibular and maxillary plates continue ventrally as plate-like structures, called buccala (kehlplatte of Stichel) [10].

The short gula which has a groove along its midline extends from the posterior margin of the basal segment of the labium to the margin of the occipital foramen. Its lateral parts are prolonged into the buccalas (Fig. 2).

The occiput forms the lateral wall of the occipital foramen which is highly sclerotized and constitutes a ring-like apodem. The muscles which originate from this apodem continue into the thorax and connect with the apodems of the prothorax.

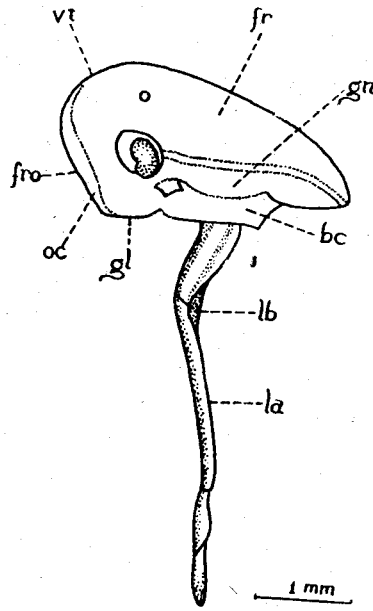


Fig. 2. Lateral view of the head of *Aelia rostrata*. bc = buccala, fr = fronz, gl = gula, gn = gena, la = labium, lb = labrum, Oc = occiput, vt = vertex.

The eyes are located laterally on the head with two ocelli between them. The antennae are segmented into five parts.

Labium and stylets:

The rostrum consists of four segments (Fig.2). The ventral and lateral walls of the rostrum are formed by the labium. The basal segment of the labium is a short conical sclerotized structure. It continues posteriorly, and lies between the buccalas when the insect is at rest. The anterior surface of the first segment of the labium is slightly invaginated. The mandibular and maxillary stylets fit this groove which is covered dorsally by a long triangular labium. The first segment is attached to the anteroventral margin of the tentorium by a bundle of muscle. Another muscle, levator labii primus, which raises the labium, originates from the apodem on the anterior margin of the first labial segment and runs into the lumen of this segment reaching the anterior

margin of the second labial segment. The depressor labii primus, which depresses the labium, originates from the anteroventral surface of the tentorium lateral to the salivary pump which is attached to the base of the second segment. The long second labial segment is followed by shorter third and fourth labial segments, and the last three segments of the labium lie in a groove along the median line of the thoracic sterna, extending a little behind the coxae of the third thoracic legs.

There are two mandibular and two maxillary stylets both of which are enclosed by the labium forming the rostrum. The mandibular stylets are lateral to the maxillary stylets in the labium and ventral in the head (Fig.3). Their proximal ends are somewhat flat, with indentations, and the distal ends curved inward. The mandibular stylets lie in the mandibular sac, and are provided with mandibular levers which are triangular, distally forked plates

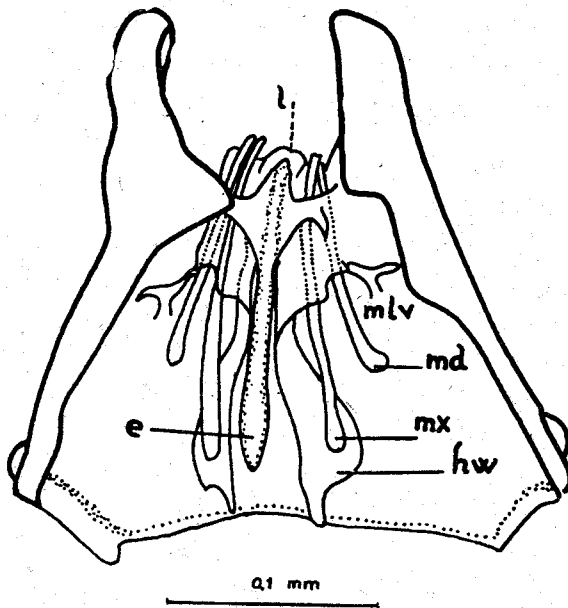


Fig. 3. Dorsal view of the endoskeleton of the head of *Aelia rostrata*. e = epipharynx, hw = hypopharyngeal wing, L = lorum, md = mandibula, mlv = mandibular lever, mx = maxilla.

(Fig.6). Its long anterior part is attached by ligament to the mandibular stylets near the base. A bundle of muscle (protractor of mandibular stylets) originating from the posterior digit of the lever runs ventro-dorsally and is attached to the edge of the clypeal cleft.

The maxillary stylets extend more posteriorly than the mandibular stylets. They have flat proximal ends for muscle attachment and lancet-shaped distal ends with no maxillary lever (Fig. 3,4,7). Each maxillary stylet lies in a maxillary sac formed by the hypopharyngeal wing and the membrane attached to the two edges of the wings (Fig. 6). The maxillary stylets placed opposite each other from a food canal and salivary duct in the rostrum. The food canal is dorsal to the salivary canal (Fig.5) and the efferent salivary duct originating from the salivary pump enters the salivary canal of the rostrum.

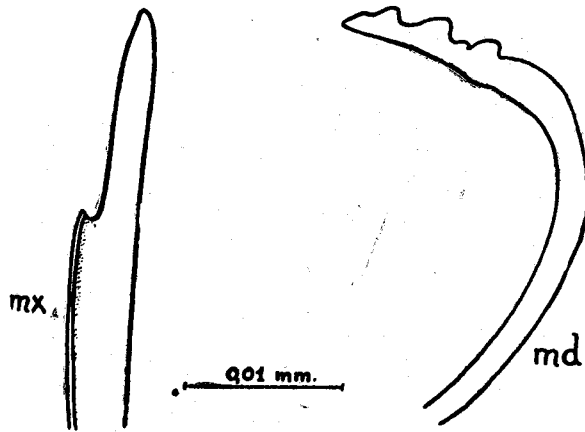


Fig. 4. Distal end of the mandibular and maxillary stylets of *Ae. rostrata*.
md = mandibular stylet, mx = maxillary stylet

The retractor muscle of the mandibula originates from the lateral wall of the cranium and is attached to the base of the mandibular stylet. The protractor muscle of the maxillary stylet originates from the anterior surface of the tentorium and is attached

the maxillary stylet. The function of this muscle is to extend the maxillary stylet (Fig.7).

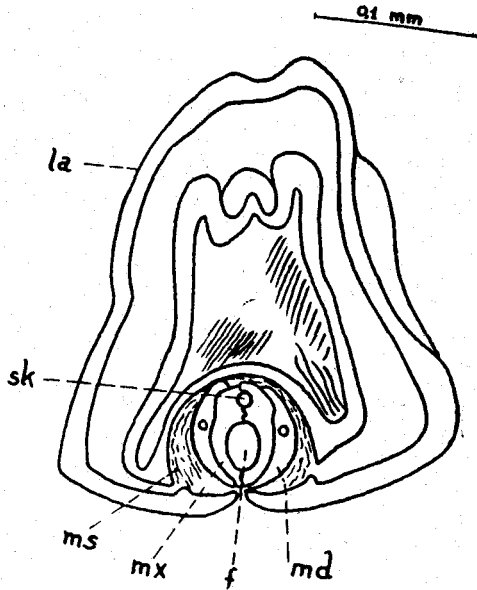


Fig. 5. Cross section of the labium of *Aelia rostrata*. f= food canal, la= labium
md= mandibular stylet, mx= maxillary stylet ms= muscle,
sk= salivary canal

Cibarium:

The most conspicuous feature of the head capsule's attachment to the hypopharynx is the cibarium or food pump, which lies along the median line of the head capsule, with its ventral wall formed by a highly sclerotized hypopharynx. This has a v-shaped groove on the dorsal surface and is embedded in the tentorium. The anterior arms and the main body of the tentorium are fused to form a compact structure with a v-shaped groove on the dorsal surface in which the hypopharyngeal wall of the cybarium fits. The posterior arms of the tentorium are well developed and go back to the wall of the head capsule. The roof of the cibarium is formed by the epipharynx, which is a membranous and flexible wall.

when the insect is not taking in food, it invaginates into the lumen of the cibarium. Posteriorly, the hypopharyngeal wall becomes less sclerotized and membranous. There are two sets of dilator muscles attaching the dorsal wall to the cibarium; the anterior group originates from the clypeal area as two separate groups at either side of the amedian line of the head, while the posterior group follows the anterior muscles extending to the occipital foramen. The muscle insertions are also lateral to the median line of the head capsule (Fig. 6). Contraction of the dilator muscle lifts the dorsal wall of the cibarium upwards widening the lumen in order for food to be taken. If these muscles relax, the dorsal wall invaginates into the hypopharyngeal lumen and the lumen of the cibarium narrows. Continual movement of these muscles keeps the sap flowing into the alimentary canal.

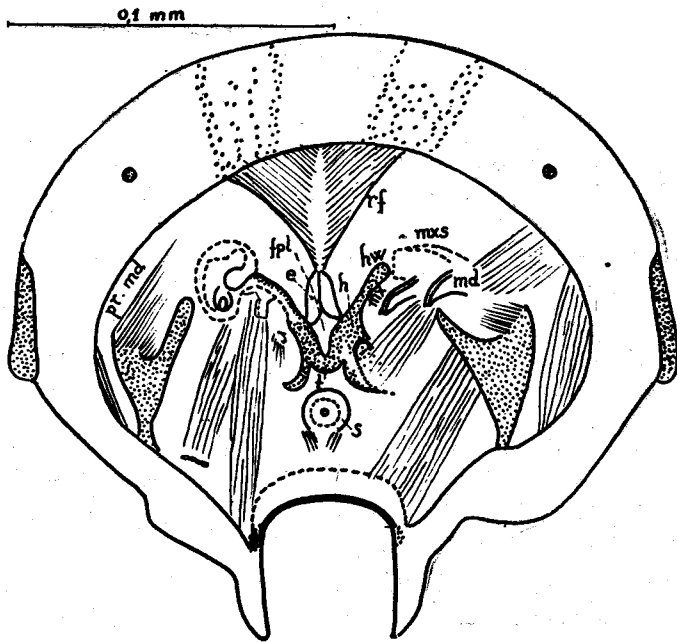


Fig. 6. Cross section of the head capsul of *Aelia rostrata* e= epipharynx, flp= lumen of the food pump, h= hypopharynx, hw= hypopharyngeal wing, md= mandibula, mlv= mandibular lever, mx= maxilla, mxs = maxillary sac, prmd = protractor muscle of the mandibula, rf= retractor muscle of the food pump, s= salivary pump, t= tentorium

Salivary syringe:

The salivary syringe lies ventrally to the anterior part of the cibarium, between the hypopharyngeal wings. It is cup-shaped and consists of two layers, the inner layer of which is membrannous and invaginated, bearing an apodem, or piston, for muscle attachment. The retractor muscle of the salivary syringe originates from the occipital area of the head capsule and is attached by a tendon to the piston of the inner layer (Fig. 7). The two efferent salivary ducts which run anteriorly merge into a single duct just before entering the salivary syringe ventrally.

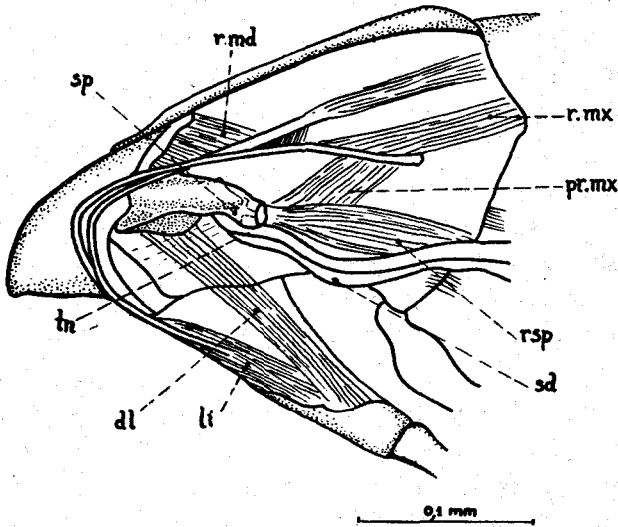


Fig. 7. Sagittal section through the head capsule of *Aelia rostrata* dl= depressor labii, li= levator labii, prmx= protractor muscle of the maxilla, rmx= retractor muscle of the maxilla, rsp= retractor muscle of the salivary pumpsd= salivary duct, sp= salivary pump, tn= tendon.

The maxillary gland:

A glandular structure laterodorsal to the food pump, and close to the stylets of the *Ae. rostrata*, may be considered as the maxillary gland which has been observed in other hemiptera be-

fore. This structure consists of a number of small cuboid cells containing spherical nuclei which stain darkly with hematoxiline.

DISCUSSION

The head capsule of *Aelia rostrata* is heavily sclerotized and does not have any suture between the sclerites with the exception of the suture which separates the mandibular and maxillary plates.

In the adult *Gerris remigis* the only distinct division between the sclerites is the dorsal suture [2]. An epistomal and epicranial suture is obvious in the fifth instar nymphs and only an epistomal sulcus is found in the adults of *Saldula*. [4]

Aelia rostrata has a long, four - segmented labium. Homology may be established in its structure with other hemipteran species [1, 2, 4, 9]. However *Ae. rostrata* differs from *Gerris remigis* [2] in not having an intersegmental sclerite between the third and fourth segments.

Mandibular and maxillary stylets are enclosed by the labium. Their location in the labium and in the head is homologous with the other hemiptera [1, 2, 3, 4, 5, 6].

The tips of the mandibular stylets have indentations on the margins. The same morphology is encountered among the aquatic and terrestrial hemiptera [1,2, 9]. However *Saldula pallipes* is asymmetrical between the left and right mandibular stylets. The tip of each maxillary stylet of *Ae. rostrata* is lancet-shaped with a cut edge and has no indentations. It differs in this respect from other hemipteran species [2,4,9], while it shows a similarity to *Lygus pabilinus* [1]

Ae. rostrata is provided with a mandibular lever. Because maxillary stylets do not have this lever, it shows a close similarity to *G. remigis*. [2].

As in other hemipteran species [1-9] the cibarium is constituted of a hypopharynx and an epipharynx. The true pharynx which is provided by the dorsal muscles is a relatively short

tube and devoid of cuticular teeth. It differs from *Saldula* and *C. janus* in this respect [5,7].

Ae. rostrata has a well developed tentorium which supports the cibarium, the salivary pump and the muscles. The same structure exists in other land bugs [1,7], while the authors do not describe such tentorial structure in any other hemiptera [2,4,5]. Their "hypopharyngeal wings" may be homologous with "posterior arms of tentorium". Therefore the "body of hypopharynx" referred to by the authors may include tentorial structure too.

The cephalic musculature is well developed and homology can be established with other hemipteran species [1,4,5].

In the head of the *Ae. rostrata*, a glandular structure consisting of small, cuboid cells was found. A similar structure, the so-called maxillary gland or cephalic gland, was also recorded in other terrestrial phytophagous bugs, such as *Lygus pabilinus* [1], *Oncopeltus fasciatus* [3] and in *Coridius janus* [7].

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ÖZET

Bu çalışmada *Aelia rostrata* Boh.'nın baş morfolojisi ve iç anatomisi incelenmiştir.

Baş kapsülü kuvvetle kitinleşmiştir. Labium dört halkalı olup dorsal kısmında bulunan oluk gibi teşekkül içine mandibula ve maxilla iğneleri yerleşmiştir. Labium içinde mandibula iğneleri maxilla iğnelere nazaran lateral, baş içinde ise ventral durumdadır. Her iki tip iğnenin proximal uçları yassılaştırmış olup buraya kaslar bağlanır. Mandibula iğneleri aynı zamanda birer levye ile teşhiz edilmiştir. Maxilla iğneleri karşılıklı gelecek besin ve tükrük kanahını meydana getirirler.

Cibarium (besin pompası), baş içerisinde bulunan önemli bir organdır. Ventral kısmı çok sertleşmiş bulunan hypopharynx'ten dorsal kısmı membran yapısındaki epipharynx'ten meydana gelmiştir. Cibarium'un dorsal yüzüne, bu kısmın dorso-ventral istikamette hareket etmesini sağlayan kaslar bağlıdır.

Tükrük sıvı pompası, tentoriuma nazaran ventral olarak yer alır. Piston kısmına, başın occipital kısmından çıkan retraktor bir kas bağlıdır.

Baş morfolojisi bakımından *Aelia rostrata* ile *Antocoryzae* ve diğer *Gaeocoryzae* arasında homoloji mevcuttur.

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