

**ON THE HEAD CAPSULE, MOUTH-PARTS AND RELATED MUS-
CLES OF THE LARVA OF THE WOOLLY BEAR, *ANTHRENU S*
FASCIATUS HERBST (COLEOPTERA, DERMESTIDAE).**

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INTRODUCTION.

The investigation on the mouth parts of the larva of *Anthrenus fasciatus* Herbst. was taken up with a view to studying in detail the structure of these appendages and the glands, if any, associated with them that help in softening the food which is composed of highly resistant skeletal proteins (wool). Carpenter and Mac Dowell (1912) described the mouth-parts of some beetle larvae belonging to the families Dascillidae and Scarabaeidae. Anderson (1936) gave a comparative account of the labium of Coleopterous larvae and came to the conclusion that the prementum is very often subdivided into a first and a second prementum.

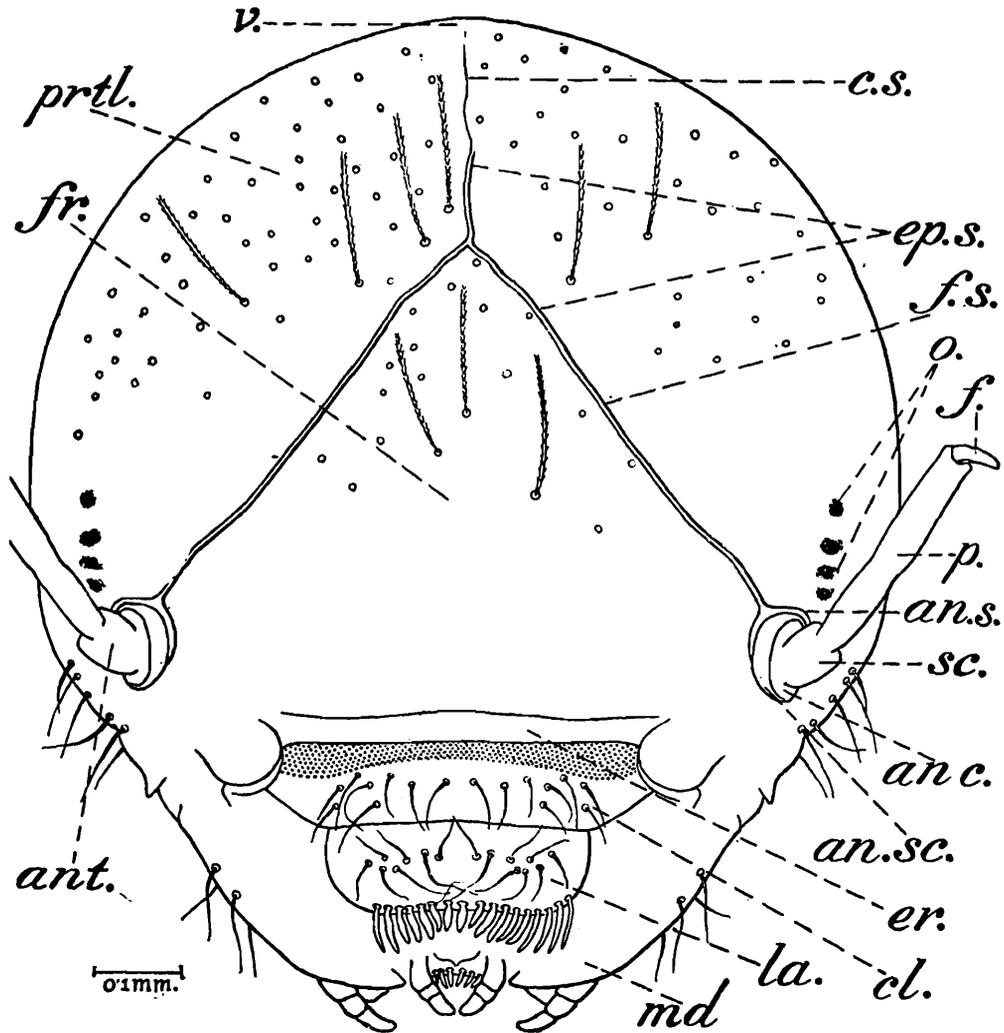
Das (1938) described the musculature of the mouth-parts of insect larvae belonging to various orders including Coleoptera and did not support the view advanced by Anderson. Although a number of papers have been published on the morphology of the mouth-parts of adult and larval insects there still exists difference of opinion in the interpretation of the sclerites of mouth-parts, especially of labium. Dorsey (1943) dealt with a comparative study of the musculature of the labrum, labium, and hypopharyngeal region of adult and immature Coleoptera. The present study on the larva of *Anthrenus fasciatus* has revealed that the prementum is a single, undivided plate and that there exist differences in the structure of mentum and the arrangement of labial muscles in the larvae of *A. fasciatus* and *Dermestes vulpinus*, the insects belonging to the same family Dermestidae.

MATERIAL AND METHODS.

The size of the larvae in different stages of growth varies from 0.7 to 4.5 mm. in length. For the present study nearly fully grown larvae, about 3.5 to 4 mm. were employed. For the study of the mouth-parts, the specimens were treated with 10 per cent. KOH overnight, then thoroughly washed in distilled water and finally stained with basic carbol fuchsin. For the study of musculature, material preserved in 90 per cent alcohol after a thoracic incision was found to be better than the fresh one. The head of the preserved larva was severed from the rest of the body and treated with acetone for a few days to dissolve the superfluous fat. Although the entire fat was not thus removed, the treatment proved useful and facilitated dissection to a considerable extent. After treating with acetone, the head was softened in distilled water for two days. Dissections were then made in 50 per cent. alcohol under a binocular microscope. The dissected mouth-parts along with the muscles were stained with a weak solution of eosin in 90 per cent. alcohol, cleared in Xylol and mounted in balsam. Some stained preparations were also made in glycerine. Microtome sections, 8-10 μ thick, of the head of the larva were cut in a vertical-longitudinal plane and were stained with iron haematoxylin and Orange G. The larvae employed for cutting sections were fixed in alcoholic Bouin's fluid immediately after they had cast off their skin, and preserved in 80 per cent. alcohol.

HEAD CAPSULE.

The head capsule of the larva of *Anthrenus fasciatus* (text-fig. 1) is of hypognathous type. The mid-dorsal region of the head, the epicranium, carries an inverted Y-shaped suture, the epicranial suture (*ep. s.*). The stem of the Y or the coronal suture (*c. s.*), also known as the metopic suture, extends medially on the top of the head. The two arms of the Y which diverge from the anterior end of the coronal suture and run anteriorly upto the antennal suture are called the frontal sutures (*f.s.*). The area bounded by the frontal sutures is the frons (*fr.*). The lateral areas of the cranium enclosed between the coronal and the frontal sutures are the parietals (*prtl.*). The dorsal surfaces of the two parietals forming the top of the head constitute the vertex (*v.*).



TEXT-FIG. 1.

Dorsal view of the head capsule of the larva of *Anthrenus fasciatus* Herbst.

an. s., antennal suture; *an. sc.*, antennal sclerite; *anc.*, antacorium; *ant.*, antenna; *c.s.*, coronal suture; *er.*, epistomal ridge; *ep. s.*, epicranial suture; *f.*, flagellum; *fr.*, frons; *f.s.*, frontal suture; *la.*, labrum; *md.*, mandible; *o.*, ocelli; *p.*, pedicel; *prt.*, parietal; *sc.*, scape; *v.*, vertex.

The frons is a well defined sclerite, limited dorsally and laterally by the frontal sutures (*f.s.*), and ventrally by the epistomal or fronto-clypeal suture. The epistomal suture is a deep inflection producing internally a strong chitinous ridge (*er.*) known as the epistomal ridge and this forms a brace in the region between the anterior mandibular articulations. The anterior arms of the tentorium (text-fig. 2*b*, *a. tent. a.*) arise from the epistomal ridge. The subgenal margins (text-fig. 2*a*, *sg. m.*) are connected in front with the epistomal suture running across the face and behind with the marginal rim of the epicranium called the peristome (fig. 2*a*, *pm.*) which is well developed.

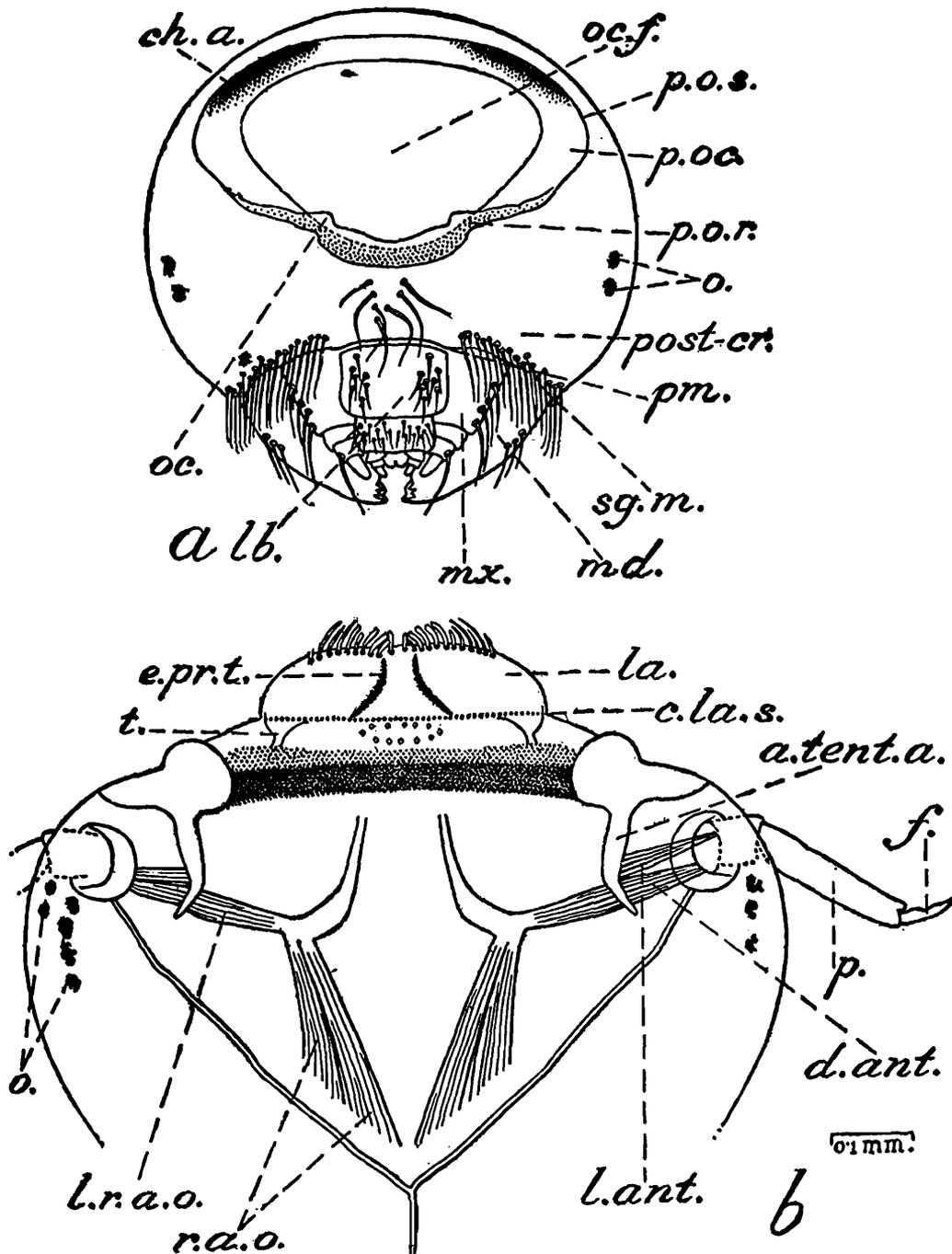
The antennae are situated laterally near the bases of the mandibles. The antennal sutures (text-fig. 1, *an. s.*) are closely approximated to the frontal sutures. Each antenna is lodged in a circular, lightly pigmented membranous area, the antacorium (*anc.*), and is surrounded by a deeply chitinised ring, the antennal sclerite (*an. sc.*). The antenna is composed of three segments, the scape (*sc.*), the pedicel (*p.*), and a short flagellum

(f.). The second segment is the longest and almost invariably presents a slight constriction a little before the middle of its length. The third segment is the smallest, and carries a small, conical sensory papilla at its tip. Each antenna is moved by two extrinsic muscles, one levator (text-fig. 2b, *l. ant.*) and the other depressor (*d. ant.*). The area of the cranium just below and behind the antenna is marked by six black dots or ocelli (text-figs. 1 & 2, *o*). These are located in two groups or rows. The anterior or dorsal row contains four ocelli, while the row posterior and ventral to the former contains only two. The two rows do not run parallel to each other but more or less converge anteriorly. The ocelli of the posterior row are clearly visible from the lateral or ventral side, but the view of the anterior row is obstructed by a number of hairs present between the two rows. The ocelli of both the rows are situated on a pale, lightly pigmented area. The facial region of the cranium is covered with a large number of hairs which are irregularly distributed and the exact boundaries of the various sutures can be clearly seen after removing them. The dorsal surfaces of the two parietals forming the top of the head are devoid of hairs. The posterior region of the head is not very hairy. There are a few hair on the ventral or posterior surface of the gnathal appendages and also near the subgenal and the peristomal margin.

The occipital suture is absent. The area of the cranium limited anteriorly by the frontal sutures, ventrally by the subgenal margins (text-fig. 2a, *sg. m.*) and peristome, and posteriorly by the post-occipital suture (*p.o.s.*) is the posterior region of the cranium (*post-cr.*) The post-occiput (*p. oc.*), which forms the margin of the occipital foramen (*oc. f.*), is a narrow band of the epicranium separated from the posterior region of the cranium by the post-occipital suture and to this is attached the neck membrane. The dorso-lateral region of the post-occiput bears a pair of somewhat deeply chitinised areas (*ch. a.*). Internally and ventrally the post-occipital suture forms a strongly chitinised post-occipital ridge (*p.o.r.*). At the base of the posterior tentorial arms, which arise from the post-occipital ridge, are situated narrow pits which lead into them. The posterior margin of the post-occiput bears ventro-laterally a pair of small processes, which by their position may be called the occipital condyle (text-fig. 2a, *oc.*).

MOUTH-PARTS.

The mouth-parts of the larva of *Anthrenus fasciatus* consist of : (1) an unpaired *labrum-epipharynx*, (2) a pair of *mandibles*, (3) a pair of *maxillae*, (4) an unpaired *labium*, and (5) an unpaired *hypopharynx*. The space enclosed by these appendages is the pre-oral or extra-oral cavity and it ends proximally at the opening of the mouth aperture. The roof of the pre-oral cavity is formed by the inner membranous region of the clypeo-labrum, while its floor is formed by the membranous tongue-like hypopharynx, which is continuous with the labium. Its lateral walls are formed by the inner sides of the mandibles and maxillae.



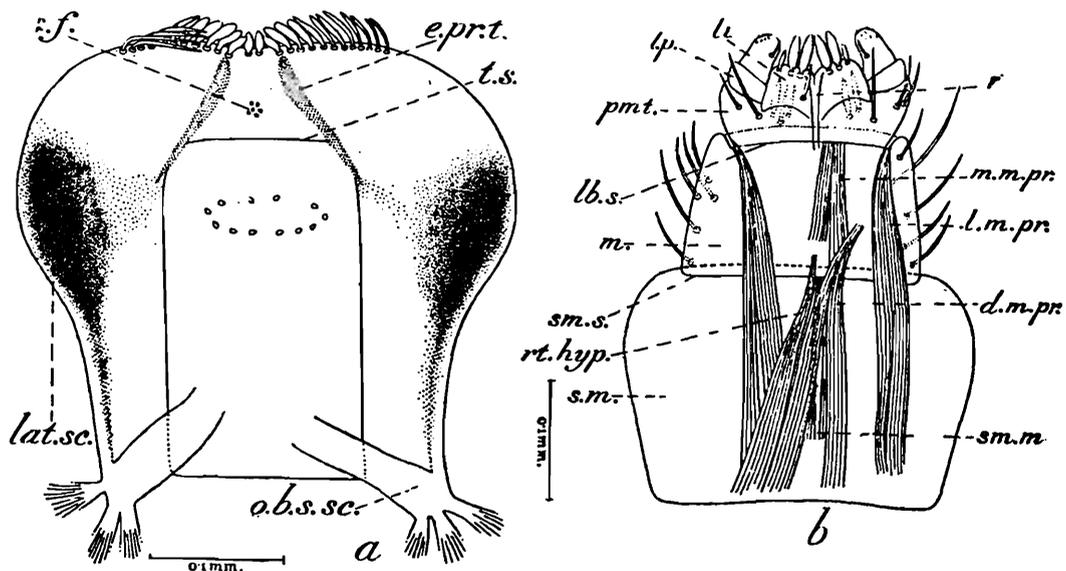
TEXT-FIG. 2.

Anthrenus fasciatus Herbst.—a. Ventral view of the head capsule. b. ventral view of a portion of the dorsal wall of the head capsule.

a. tent. a., anterior tentorial arm; *c. la. s.*, clypeolabral suture; *ch. a.*, chitinised area; *d. ant.*, depressor muscle of antenna; *e. pr. t.*, strong rod-like sclerite; *la.*, labrum; *lb.*, labium; *md.*, mandible; *mx.*, maxilla; *o.*, ocelli; *oc.*, occipital condyle; *oc. f.*, occipital foramen; *pm.*, peristome; *p. oc.*, post occiput; *p. o. r.*, post occipital ridge; *p. o. s.*, post occipital suture; *post-cr.*, posterior region of the cranium; *r. a. o.*, retractor muscle of the mouth angle; *sg. m.*, subgenal margin; *t.*, torva.

Labrum-epipharynx (text-figs. 2b & 3a).—The labrum-epipharynx is a broad transversely elongate plate. It overlies the mandibles and, when cleared in 5 per cent. KOH solution, looks like a hollow bag. Its anterior or dorsal surface, which forms the labrum proper, is slightly convex and deeply chitinised, and is connected proximally to the lower margin of the clypeus by the

clypeo-labral suture (text-fig. 2b, c. la. s.). From the dorso-lateral corners of the labrum, close to the clypeo-labral suture are given off a pair of strongly chitinised short curved rods known as tormae. Each torma (t.) bends inwards and downwards, and then fuses with the lateral sclerite (text-fig. 3a, lat. sc.) situated on the epipharyngeal surface of the labrum close to its lateral margin. The fusion of tormae with the lateral sclerites evidently gives greater rigidity and support to the labrum but it has led to the suppression of lateral labral muscles or ventral (posterior) muscles of the labrum, which have been stated by Das (1938) and Dorsey (1943) to be inserted on the torma in the larvae of other Coleopterous insects e.g. *Dermestes vulpinus* F., *Tenebroides mauritanicus* L. and *Tenebriodes* sp. The posterior wall of labrum is thin and membranous and forms the epipharynx. It bears a pair of somewhat rod-like sclerites (*e. pr. t.*), which are inclined towards each other at the distal end. Between the two rod-like sclerites, runs a transverse suture (text-fig. 3a, *t.s.*), which separates the epipharyngeal surface of the labrum from the membranous inner surface of the clypeus; and the two together form the epipharyngeal wall of the pre-oral cavity.



TEXT-FIG 3.

Anthrenus fasciatus Hebrst.—a. Epipharyngeal surface of the labrum and clypeus as seen from below. b. Dorsal view of labium showing various muscles.

a., part of the apodeme; d. m. pr., dorsal muscles of prementum; e. pr. t., strong rod-like sclerite; l. m. pr., lateral muscles of prementum; l. p., labial palp; lat. sc., lateral sclerite; lb. s., labial suture; li., ligulia; m., mentum; m. m. pr., median muscles of prementum; o. b. s. sc., a portion of the oral branch of suspensorial sclerite; pmt., prementum; rt. hyp., retractor muscles of hypopharynx; s. f., sensory papillae; s. m., submentum; sm. m., submentomental muscles; sm. s., submentomental suture.

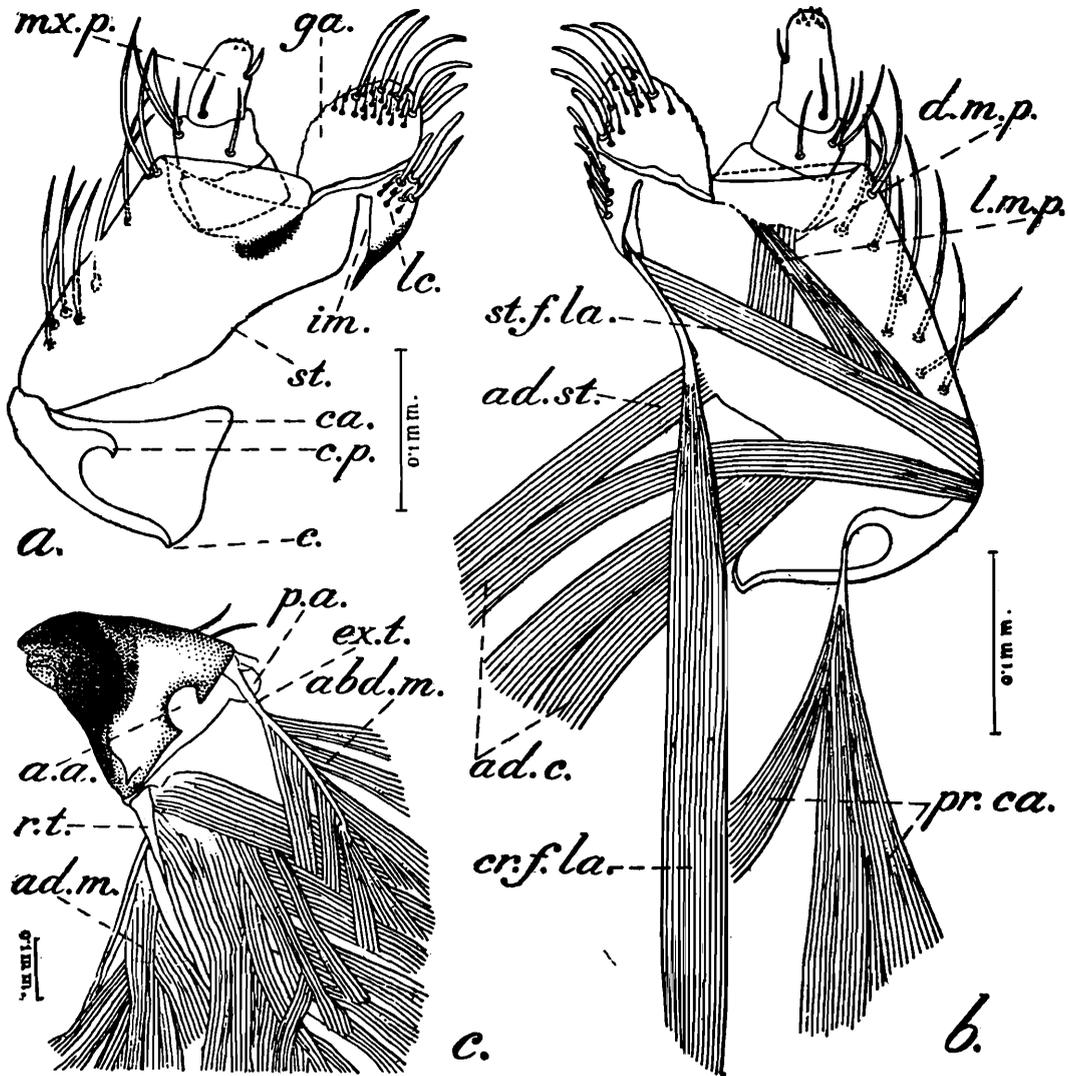
The dorsal surface of the labrum is covered with a large number of irregularly distributed hairs. In preparing a permanent mount of the labrum after treatment with KOH, most of these hairs fall off and the labrum presents a deeply fenestrated appearance. The epipharyngeal surface of the labrum (text-fig. 3a.) bears thick, short stumpy setae which are regularly arranged in a single row along its distal margin. It also bears a group of six extremely minute, conical sensory papillae (*s. f.*) which are located in front of and slightly away from the transverse

suture. The membranous surface of the clypeus also bears a number of sensory papillae arranged in an elliptical, ring-like pattern. They are, however, bigger in size than those borne by the epipharyngeal surface of the labrum.

Mandibles (text-fig. 4c).—The mandibles are the strongest of the mouth-parts and are situated laterally, immediately below and behind the labrum and clypeus. The outer surface of each mandible is convex and the basal portion roughly triangular. It is attached to the *pleurostomal*¹ margin of the cranium by the outer edge of the triangular base. Of the three angles at the basal portion of the mandible one points inwards and projects into the intergnathal pre-oral cavity, while the other two are directed outwards. The proximal region of the mandible is hollow while the brownish-black distal region is very hard and compact. The mesial surface of the distal region of the mandible is deeply notched ; it may be called the incisor area since it bears chitinous ridges or teeth, which are, however, not clearly seen in all preparations. In suitable mounts one can see three tooth-like ridges separated by two grooves. Each mandible is hinged to the head capsule by an anterior and a posterior articulation. The anterior or dorsal articulatory point (*a.a.*) consists of a notch or socket in the proximal or dorsal margin of the mandible into which fits a convex knob-like structure situated in the dorsal margin of the head capsule, close to the base of the anterior tentorial arms. The posterior or ventral articulatory point (*p.a.*) consists of a strongly developed condyle which fits into a socket in the ventral margin of the posterior region of the cranium. A pair of apodemes or tendons are associated with the mandibles for the attachment of muscles. Of these, the inner or mesial one—the recto-tendon (*r. t.*)—arises proximally from the inner angle of the basal portion, while the outer one or extenso-tendon (*ex. t.*) arises between the anterior and posterior articulatory surfaces and is situated slightly anterior to the posterior articulation. The proximal region of the mandible on its outer or convex surface is covered with a few hairs.

Maxillae (text-fig. 4a).—The two maxillae are situated posterior to the mandibles one on either side of the medially placed labium. Each maxilla consists of a small proximal sclerite, the cardo (*ca.*) and a long distal sclerite the stipes (*st.*). The stipes bears a short palpus (*mx. p.*) and two lobes, the galea (*ga.*) and the lacinia (*lc.*). A distinct suture between the cardo and the stipes permits considerable flexibility to both. The cardo is attached to the head by the pleural membrane and articulated to the hypostomal margin of the cranium by a small basal condyle (*c.*), which fits into a groove in the ventral margin or the hypostomal margin. The outer surface of the cardo is somewhat convex and presents a cup-shaped structure when seen from inside, *i.e.*, anterodorsally. The proximal rim of the cardo at its outer angle on the inner side is inflected to form a stout, slightly curved, tooth-like process (*c.p.*) known as the cardo process, to which is attached the promotor muscle of the cardo. Distally the cardo articulates with the stipes forming an angle with the latter. The membranous area bounded by the margins

¹ For descriptive purposes the part of the subgenal suture lying above the mandible is sometimes distinguished as the pleurostomal suture.



TEXT-FIG. 4.

Anthrenus fasciatus Herbst.—a. Left maxilla. b. Right maxilla with muscles. c. Right mandible with muscles.

a. a., anterior articular point; abd. m., abductor muscle; ad. c., adductor of cardo; ad. m., adductor muscle; ad. st., adductor of stipes; c., condyle; c. p., cardo process; ca., cardo; cr. f. la., cranial flexor of lacinia; d. m. p., depressor muscle of palp; ex. t., extenso-tendon; ga., galea; i. m., membranous area; l. m. p. levator muscle of palp; lc., lacinia; mx. p., maxillary palp; p. a., posterior articular point; pr. ca., promotor of cardo; r. t., recto-tendon; st., stipes; st. f. la., stipital flexor of lacinia.

of the stipes, cardo, and labium is the basimaxillary membrane. It is devoid of any sclerites. The stipes is narrow proximally and wider distally. At its proximal end it is articulated with the cardo at two points. Das (1938) also states that except in the larval Diptera such a condition exists in most larval insects. From the distal end of the stipes arises the three segmented maxillary palpus (*mx. p.*). The two proximal segments of the palp are broader than long, while the third one is longer than broad and unlike the other segments carries a number of minute sensory papillae at its rounded tip. The galea (*ga.*) has the form of a flattened lobe narrow at the base and broad distally. Its outer margin is slightly convex and serrated. The distal half of the galea, which carries a large number of thick setae, is less chitinised than the proximal half which stains deeply with fuchsin. The lacinia (*lc.*) is situated

behind the galea and has the form of a triangular lobe. A small membranous area (*i.m.*) intervenes between the main portion of the stipes and the lacinia. The inner angle of lacinia is sharply inflected and directed backwards forming a strong apodeme for the attachment of the cranial flexor of lacinia. The posterior or the ventral surface of the maxilla is covered with a number of bristles or hairs.

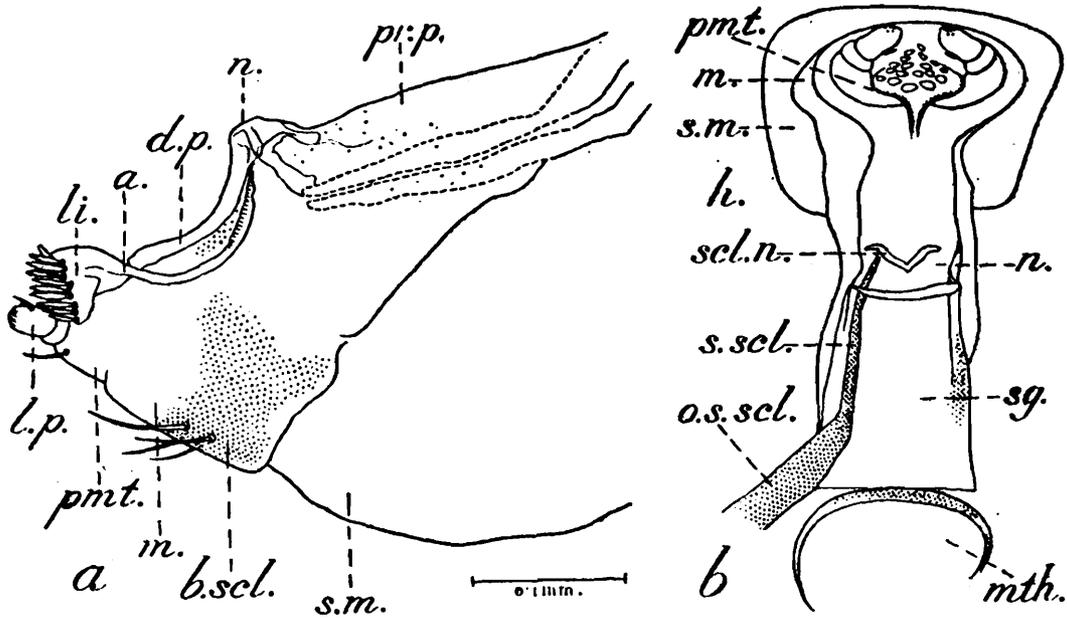
Labium (text-fig. 3*b.*).—The labium is attached to the ventral margin of the head and consists of two main segments, the distal one being the prelabium or prementum (*pmt.*) and the proximal, the postlabium or postmentum. The suture between the two is the labial suture (*lb. s.*). The postlabium is further divided by the submentomental suture (*sm. s.*) into two portions, the proximal submentum (*s. m.*) and the distal mentum (*m.*).

The prementum is always smaller than the mentum and submentum. It bears a pair of labial palps and a pair of lobes fused with each other constituting the ligula (*li.*); there is no separate glossa or paraglossa. There is, however, a distal cleft between the two lobes which constitute the ligula and each lobe bears distally a number of thick stumpy setae. The labial palpus (*l. p.*) is smaller than the maxillary palpus and consists of two segments. The proximal segment is broader than long while the distal is longer than broad and bears at its rounded tip a number of minute sensory papillae. An apodeme (*a*) runs backwards and slightly upwards along the mid-dorsal line from the proximal end of the ligula, and in a lateral view looks like a curved U-shaped rod with the two arms of the U being wide apart (fig. 5*a.*). It extends into the distal region of the mentum and is fused with the hypopharynx for the greater part of its length. The anterior half of this apodeme, as compared with the posterior portion, is deeply chitinised and the anterior or dorsal muscle of the labium is inserted on it at a place where the deeply chitinised portion ends.

The mentum is smaller than the submentum and movable on it to a considerable extent in the vertical plane. It is fused with the basal sclerite of the hypopharynx (text-fig. 5*a,b. scl.*) and this fusion apparently gives the mentum a slightly folded appearance at its lateral margins.

The submentum is the largest of the three plates constituting the labium. It is narrower in its proximal region and is rigidly attached to the ventral margin of the cranium. It gradually becomes wider distally where its lateral margins are more or less rounded. The ventral or posterior surface of the labium is covered with bristles. In the larva of *Dermestes* (Das, 1938) the mentum is larger than the submentum as well as the prementum.

Hypopharynx (text-figs. 5*a. & b.*).—The hypopharynx is fused with the prelabium and also with the lateral margins of the mentum. It is composed of three parts, namely, a curved distal portion (*d. p.*), a small rectangular portion in the middle (*n.*), and a long proximal portion (*pr. p.*) extending upto the base of the mouth opening.



TEXT-FIG. 5.

Anthrenus fasciatus Herbst.—*a.* Lateral view of labium and hypopharynx. *b.* Surface view of labium and hypopharynx.

a., apodeme; *b. scl.*, basal sclerite; *d. p.*, distal portion of hypopharynx; *l. p.*, labial palp; *li.*, ligula; *m.*, mentum; *mth.*, mouth; *n.*, neck of hypopharynx; *o. s. scl.*, oral branch of suspensorial sclerite of the hypopharynx; *pmt.*, prementum; *pr. p.*, proximal portion of hypopharynx; *s. scl.*, suspensorial sclerite; *scl. n.*, sclerite in neck region; *sg.*, subgusta.

The distal portion is the hypopharynx proper. It runs backwards and upwards and looks very much like a tongue. It is fused anteriorly with the prelabium and laterally with the lateral margins of the mentum forming a pocket-like structure. The lateral walls of the hypopharynx bear a pair of basal sclerites (*b. scl.*) which are fused with the mentum. The dorsal surface of the hypopharynx is deeply grooved.

The rectangular middle portion of the hypopharynx, which may be called the neck (*n.*), is bounded by transverse sutures at its proximal and distal limits, and is supported by an approximately U-shaped sclerite (*scl. n.*). This sclerite serves for the attachment of retractor muscle of the hypopharynx.

The long proximal portion is comparatively narrow in its distal region. It is supported by a pair of strong chitinous rods, the suspensorial sclerites (*s. scl.*), which run laterally. Each suspensorial sclerite near the opening of the mouth bends upwards and runs closely applied to the sides of the oral aperture (*mth.*). In this region it is not deeply pigmented and is called the oral branch of the suspensorial sclerite (*o.s. scl.*), which serves for the attachment of the retractor muscle of the mouth-angle. The hypopharynx is covered with a number of irregularly distributed minute sensory papillae which are present in a fairly large number on the sides of the subgusta.

MUSCULATURE OF THE MOUTH-PARTS.

Labral muscles.—The musculature of the labrum consists of a single group of muscle fibres known as *compressor of the labrum*. It is made up

of a group of small thin fibres running across and between the anterior and posterior walls of the labrum. No other muscles are directly inserted on the walls of the labrum. The fusion of tormae with the lateral sclerites has led to the suppression of *lateral labral muscles* described by Das (1938) in several insect larvae.

Mandibular muscles (text-fig. 4c).—Each mandible is moved by a strong adductor and a much smaller abductor muscle.

Adductor of the mandible : The fibres of the adductor muscle (*ad. m.*) are spread out fan-wise and take their origin from the dorsal and posterior walls of the cranium. They are inserted on a large apodeme, the recto-tendon (*r. t.*), at the inner angle of the mandibular base.

Abductor of the mandible : The fibres of the abductor muscle (*abd. m.*) take their origin from the lateral wall of the cranium and arise a little anterior to the adductor muscle. They are inserted on a small apodeme, the extenso-tendon (*ex. t.*), situated on the outer margin at the base of the mandible between the anterior and posterior articulatory points.

The ventral set of muscles present in certain insects (Snodgrass, 1935) is absent in the larva of *Anthrenus fasciatus*.

Maxillary muscles (text-fig. 4b).—The musculature of each maxilla comprises one paired and six unpaired muscles as follows :—

Promotor of the cardo : This is a branched muscle (*pr. ca.*) having its fibres arranged in three bundles which take their origin from the posterior region of the cranium close to the rim of the foramen magnum, and are inserted through a tendinous cord on the cardo-process.

Adductor of the cardo : There is a pair of this muscle (*ad. c.*) for each maxilla. One member of the pair is short and stout. Its fibres are arranged in two bundles which take their origin on the posterior tentorial arm and get inserted on the mesal side of the cardo. The other member of the pair is comparatively long and slender. Its fibres are arranged in one bundle which take their origin on the posterior tentorial arm and are inserted on the lateral side of the cardo, externally to the cardo-process.

Adductor of the stipes : This is a stout muscle (*ad. st.*) and its fibres are arranged in one bundle. It takes its origin on the posterior tentorial arm and is inserted on a blunt process situated about the middle of the inner or mesal margin of the stipes. This muscle is important in determining the mesal limit of the stipes.

Cranial flexor of the lacinia : This muscle (*cr. f. la.*) is the longest of all the muscles of maxilla and lies dorsally to the adductors of the cardo and stipes. It takes its origin on the posterior region of the cranium slightly dorsal to that of the promotor of the cardo and is inserted through a tendinous cord on the inflected edge of the lacinia.

Stipital flexor of the lacinia : The fibres of this muscle (*st. f. la.*) are arranged in one bundle. It takes its origin on the outer angle of the stipital base and runs dorsally to the muscles of the palpus. Some fibres of this muscle are directly inserted on the inner base of the lacinia, while others have their insertion through the tendinous cord of the cranial flexor of lacinia.

Levator muscle of the maxillary palpus : This muscle (*l.m.p.*) is longer than the depressor muscle. It has its origin on the basal part of the stipes close to the origin of the stipital flexor of lacinia and gets inserted on the dorsal margin of the basal segment of the palpus.

Depressor muscle of the maxillary palp : This is a short and stout muscle (*d.m.p.*) having its origin on the mesal side of the stipes and insertion on the basal segment of the maxillary palp.

It will thus be seen that all the lobes of the maxilla, excepting the galea, are provided with muscles. The absence of the flexor of galea in the larva of *Anthrenus fasciatus* is not a unique feature, for such a condition has been met with in various other Coleopterous larvae (*Agriotes*, *Carabus* etc.) described by Das (1938). Snodgrass (1928) is of the opinion that the inner lobe apparently borne by the basal segment of the palpus in *Sialis* (Neuroptera-Megaloptera), called the galea by Crampton (1922), cannot be given this name, as it lacks muscles. Das (1938), however, does not agree with Snodgrass and points out that the galea in many larval insects has been found to be without muscles. The absence of muscles on the galea in the larva of *Anthrenus fasciatus* supports Das's opinion.

Labial muscles (text-fig. 3b).—The musculature of the labium comprises the following paired muscles:—

Median or ventral muscles of the prementum (*m.m. pr.*) : These take their origin on the submentum ventral to the retractor muscles of the hypopharynx and are inserted on the middle of the proximal border of the prementum.

Lateral muscles of the prementum (*l.m.pr.*) : The fibres of each member of the pair are arranged in two bundles which take their origin on the submentum ventral to the retractor muscles of the hypopharynx and are inserted on the sides of the proximal border of the prementum.

Dorsal muscles of the prementum (*d.m.pr.*) : These muscles take their origin on the submentum internally to the retractor muscles of the hypopharynx and are inserted on the apodeme (*a*) already described.

Submentomental muscles (*sm.m.*) : These are very small and slender median muscles which take their origin on the submentum ventral to the median or ventral muscles of the prementum, and are inserted on the middle of the proximal border of the mentum.

Snodgrass (1935) does not distinguish the median muscles from the submentomental muscles and calls the latter the 'median muscles' in many Coleopterous larvae. He states that in many larval Coleoptera the prementum is composed of two principal plates, on the proximal one of which are inserted the 'median muscles' and on the distal one the tentorial adductors. Anderson (1936) supports Snodgrass's view and states that the prementum in Coleopterous larvae is very often subdivided into a first and a second prementum, and the latter serves as the area on which the retractors of the prementum are inserted. He (1936, p. 4) further states: "That the mentum, a subdivision of the postmentum, contains no muscle insertions is shown by examples: *Periplaneta* (pl. I, B) and the labium of adult *Harpalus* (pl. I, C). It is

necessary to accept this interpretation if we are to gain the consistency essential to a comprehensive understanding of the labial structure." Das (1938), however, states that the prementum is never subdivided into a proximal and a distal plate though it may have lateral sclerites. He is of the opinion that when the postmentum is a single plate no muscle is inserted upon it, but when it has two plates, the submentum and the mentum, the latter has the insertion of the submentomental muscle. My observations on the larval labium of *Anthrenus fasciatus* fully support Das's view. The prementum in this insect is undivided. The postmentum consists of two plates, the submentum and mentum, and the submentomental muscles are inserted on the middle of the proximal border of the mentum. Snodgrass maintains that the median muscles of the labium extending from the postmentum to the prementum are the only muscles which have their origin upon the postmentum. But in the larva of *A. fasciatus* besides the median muscles of the prementum, the lateral and dorsal muscles of the prementum, the submentomental muscles and the retractor muscles of the hypopharynx have their origin upon the submentum.

I have not been able to observe distinctly the muscles of the labial palp on account of the small size of the latter. Das (1938) writes "In most larval insects the labial palpus is not provided with antagonistic muscles." The same author has described that in the larva of *Dermestes* the median muscles are absent and the submentomental muscles are inserted on the middle of the mental plate (Das 1938, pl. 6, fig. 36). In the larva of *A. fasciatus* unlike that of *Dermestes vulpinus*, median muscles of the prementum are fully developed and the submentomental muscles are inserted on the middle of the proximal border of the mentum as is the case in most primitive insects.

Hypopharyngeal muscles.—The musculature of the hypopharynx consists of the following paired muscles:—

Retractor of the hypopharynx (text-fig. 3b, *rt. hyp.*): The fibres of this muscle are arranged in one bundle. It takes its origin on the proximal region of the submentum (externally to the dorsal premental muscles) and runs forwards and upwards to be inserted in the neck region of the hypopharynx. Its contraction depresses the hypopharynx and thus serves to increase the intergnathal pre-oral cavity.

Retractor of the mouth angle (text-fig. 2b, *r. a.o.*): It is a branched muscle and its fibres are arranged in three bundles. One of these which runs in a horizontal plane has its origin on the anterior tentorial arm and insertion on the oral branch of the suspensorial sclerite. Of the remaining two, the inner one is longer than the outer. Both these have their origin on the frons and insertion on the oral branch of the suspensorial sclerite. The contraction of this portion of the muscle probably serves to elevate the posterior region of the hypopharynx.

Microtome sections showed that neither of the gnathal appendages is provided with a glandular tissue.

SUMMARY.

The structure of the head capsule and the associated muscles of the larva of *Anthrenus fasciatus* has been described. The mouth-parts consist of an unpaired labrum-epipharynx, a pair of strong mandibles, a pair of maxillae, and an unpaired labium and hypopharynx. The presence of any gland associated with these appendages has not been detected.

ACKNOWLEDGMENTS.

I am highly grateful to Professor K. N. Bahl, under whose guidance this work was conducted at the Lucknow University Zoological Research Laboratory. My sincere thanks are also due to Dr. M. L. Roonwal for going through the manuscript which has, however, been prepared at the Zoological Survey of India, Banaras Cantt.

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