

VARIATIONS IN THE MOUTH PARTS OF SOME HYMENOPTERA.

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The group of the order Hymenoptera considered in the present paper is known as the Anthophila, a name signifying lover of flowers and indicative of their food habits. In order that they may procure their food they have mouth parts peculiarly adapted to the gathering of honey. This group is also characterized by having the basal joint of the posterior tarsi dilated into an oblong or sub-triangular plate which is generally hirsute on the inside and provided with instruments for collecting and carrying pollen.

In this group the jaws are strong, being varied in different species according to the work done by the particular species; the maxillae and labium are elongated and often transformed into a proboscis capable of being folded up several times beneath the head, the labium being pilose at the extremity.

This group Anthophila is divided into two families, Andrenidae and Apidae; the first family may be defined as the short tongued bees and the second as the long tongued bees.

In the Andrenidae the mentum is elongated and the labium at its extremity small and either spear shaped or cordate; with a small ear shaped lobe on each side, and being either straight or very slightly deflexed in some and reflexed in others; the labium and terminal maxillary lobes not forming an elongated proboscis. The palpi are jointed, the joints being cylindrical and longer than wide; the labial palpi are four jointed and are similar to the maxillary palpi which are six jointed. The mandibles are simple or terminated by one or two notches.

The insects composing the family Apidae have the mentum long, with the labium at its extremity forming an elongated, slender seta, reflexed when at rest, and as long or longer than the mentum, with two small lateral filaments, and forming with the maxillae, an elongated proboscis, capable of being protracted in front of the head when in action, or folded up beneath the head and breast when at rest, in the shape of a flattened . The palpi, attached at the base of the labium, form two slender flattened filaments often as long as the labium itself, the two



basal joints being very long, with the two apical joints minute, and obliquely affixed near the extremity of the second joint; the maxillary palpi vary in the number of joints from one to six.

The mouth parts of the larva of the Anthophila are very interesting. On the under side of the head is to be noticed a small transverse lip which answers quite well to the upper lip of the perfect insect; below this lip is a pair of horny jaws which have a transverse movement and which close under the upper lip; these jaws are kept in continual motion when the grub eats. The jaws of the grub are much like those of the perfect insect except in some species the number of notches may vary between the larva and the mature insect. Beneath the jaws, and reaching to the side of the head are a pair of fleshy organs which appear to be soldered to the head, having a fine style at the extremity of each. These evidently, from their situation and length, represent the maxillae of the future bee. The jaws in the larva are used as one of the means of locomotion.

In the family Andrenidae the two genera, *Halictus* and *Andrena* are very closely related, both in size, color and habits, but vary considerably as regards mouth parts. The labium of *Halictus* is practically the same size as that of *Andrena*. The labial palpi of *Halictus* are not so long as that of the *Andrena* and the joints are of a more uniform size and shape. The first joint of the labial palpi in the *Andrena* is considerably longer than the second joint and curved in slightly toward the tongue, the second joint being set on obliquely and the third joint small at the base but much enlarged at the apex, while the fourth joint is long and cylindrical.

The labial lobes of the *Halictus* are much larger than those of *Andrena*. In the *Halictus* the side of the lobe next to the tongue is almost straight, while the outside is considerably rounded and thickly set with fine short hairs, and the upper side sparsely set with bristly hairs. The labial lobes in the *Andrena* are much narrower and the same width the entire length, and are bent at right angles



about three fourths of the distance from the base and the under side of the curved part thickly set with short hairs.

The tongue of the Halictus is longer and broader than in Andrena and they are covered about equally with hairs.

The maxilla of Halictus is composed of three joints or lobes; the first lobe is a simple semi-cylindrical piece and attached to the second lobe at the two outer edges, forming an open joint. The second lobe is longer and wider than the first with one side slanted off until a point is formed and upon this slanted side is joined the third lobe which narrows and forms the tip upon which are a number of thickly set hairs. Upon this third lobe are borne the maxillary palpi, composed of six joints, the first one being about the same length of the other joints, but considerably larger in diameter.

The maxilla of Andrena is composed of three lobes, the same as in Halictus but vary considerably in shape. The first lobe, however, is very nearly the same shape but has a different joint. The second lobe is elliptically formed and is about three times as long as broad. One edge is thickly set with hairs and the surface set with short, stubby hairs. The outer lobe is long and narrow and curved at the outer end, the inside of the curve being covered with hairs. At the base of the outer lobe is a short club-shaped appendage, which has quite large spines scattered over it.

The maxillary palpi is situated at the joint between the second and third lobes and is composed of six joints which are almost uniform in length and which diminish gradually in diameter toward the apex.

The mandible of the Halictus is about four times as long as broad, the basal end being much wider than the apical, and having two notches across the base. The outer edge is set with a few stiff bristles, and curves up toward the upper edge. There is one notch in the apical end, one lobe being quite large, the other



quite small. There is a small tuft of hairs toward the basal end on the upper side.

The mandible of *Andrena* is long and slim. The base is straight with the exception of a very small notch at the lower side. The lower side is quite thickly set with hairs and the apical end is divided by a very small notch, into two lobes, the upper of which is very small.

The labrum of *Halictus* appears to be composed of three parts. The basal part is semi-elliptically shaped, to which, on the rounded and under side is joined the second part which is parabolically shaped and which has attached to its upper surface, about one third of the distance from its base, a fleshy protuberance, something like an unjointed finger, which extends a little beyond the second part. The edges of the labrum are thickly set with broad, heavy spines and with an especially prominent one on each side of the finger.

The labrum of *Andrena* varies somewhat in that the basal part is more rectangular in shape and the second part seems to be missing, the long slender part being attached directly to the basal part. The edges of the long protuberance and the lower edge of the basal part are provided with heavy spines. The finger-like appendage here is broader at the base and diminishes to more of a point than does that of the *Halictus*.

In the genus *Nomia* of the family Andrenidae (see Plate II), the labium is somewhat larger than in *Halictus* or *Andrena*, but is of the same outline and shape. The two labial lobes are narrow and thick, set with hairs, and the labial palpi differ from those of *Halictus* in having the second joint longer than any of the rest. The maxilla is long and slender with maxillary palpi composed of six joints which are rounded in form. A small tuft of hairs is found on the tip of the terminal lobe.

The mandible is thick and short, becoming narrower about one third of the way from the base and then widening again. The lower edge slopes toward the upper forming a rounded point.



The labrum is about one third longer than broad, with the basal side almost straight and the apical edge rounded with a notch in the middle. The labrum is covered with hairs, those toward the outer margin considerably longer than those toward the basal margin. On each side of, and in close proximity to the notch is an especially long tuft of hairs.

The labium of *Melissodes mennacha* (Plate III), of the family Apidae, has the characteristic long tongue and palpi. The tongue, which is considerably the longest part, is cylindrical and thickly set with short hairs. The labial palpi are about two thirds as long as the tongue and go to help form the proboscis. The first two joints are long and flat; the first joint being about twice the length of the second. The third and fourth joints are very inferior compared with the other two and are cylindrical. The first and second joints have a few short stiff hairs scattered over the upper surface. Close to the base of the labial palpi are found two unjointed filaments covered with hairs and almost as long as the tongue. These no doubt help form a more complete proboscis.

The maxilla of their genus appears to have two lobes in the basal part which makes it quite broad. The second part of the maxilla is long and slender, tapering into a point and having a few hirsute appendages. The maxillary palpi are four jointed, the basal joint is large and globular at the base but narrows toward the apex; the three succeeding joints are decidedly smaller and thickly covered with hairs. On the basal part of the maxilla and close to the maxillary palpi are a row of sharp, short spines, which are broad at the base.

The mandible is broad at the base, but narrows rapidly for about one third its length and then remains the same width the rest of the way. It is slightly curved and has a bunch of hairs on each edge. The labium much resembles that of the genus *Nomia* except that it is larger in each dimension and has a heavy tuft of hairs at the point of the notch instead of a tuft on each side.



In *Agapostemon nigricornis* (Plate III) the labium is very much like that of *Andrena* as it belongs to the same family, but is without the labial lobes. The first joint of the labial palpi is about as long as the other three combined. The maxilla is very long and slender, having the basal part joined to the second part similarly to that of *Halictus*. The first three joints of the maxillary palpi are practically the same size, the fourth is considerably smaller, and to which the fifth joint is attached at right angles. The sixth is very small.

The mandible is broad at base curved and narrows to a sharp point, with the inner edge set with several short hairs and the outer edge with six long ones. The labium has the shape of a parabola set upon a straight, basal edge and with a single row of short hairs around the outer margin.

*Coelioxys deplanata* (Plate IV). The labium here is of the characteristic type of the *Apidae*. The tongue is thickly set with very short hairs and is not as long as that of *Melissodes nennacha*, but resembles this genus in having the first two joints of the labial palpi long and flat. In *Coelioxys deplanata* the second joint is considerably longer than the first and has a small tuft of hairs at the apex. The third and fourth joints are very small and cylindrical.

The basal part of the maxilla is considerably narrower at the base than at the apex. A small wedge shape part is found between the first and third parts to which the maxillary palpi is attached. The palpi is composed of three short cylindrical joints. The third part is narrow and curved and has a row of short, stubby hairs on the outer edge.

The basal edge of the mandible has two notches and the under edge has three notches and as many teeth. The middle tooth is smaller than the other two, the basal one being the largest. The upper edge is without notches and is gracefully curved, helping to form the third tooth.

The labium of this genus is very different from that of any genus we have yet noticed. It has a straight, basal edge as have the others, the sides make a



short curve outward and then narrow abruptly and then gradually widening again until the apex is as wide as the base. The surface is set with short hairs.

*Athidium maculifrons*. (Plate IV). The tongue of the labium is about as long as that of *Melissodes mennacha* but is not quite as broad and is covered with hairs which are longer than those of *Melissodes mennacha*. The first two joints of the labial palpi are the same length, the second one with a few hairs at the apex. The third joint is almost globular in shape and attached at right angles to the second joint. The fourth joint is much smaller than that of the third.

The upper margin of the basal part of the maxilla is set with short, heavy spines. The second part narrows in the opposite direction to that of *Coelioxys deplanata* and is considerably larger. The maxillary palpi are two jointed, the first joint being short and the second long and curved. The third part of the maxilla is very long and curved with the inner side set with very short hairs. The basal edge of the mandible has a long shallow notch. Like the *Coelioxys deplanata* the mandible here has three teeth. The first or apical one is much the larger and is symmetrically rounded to a point. The second tooth or middle one is much smaller but is shaped like the first. The third or basal tooth is much smaller and has a broad apical end.

The labium is much like that of *Coelioxys deplanata*; it narrows abruptly but also widens abruptly and is destitute of hairs except a small bunch on each side of the apical edge.

*Xylocopa*, or the Carpenter Bee (Plate V.). The basal part of the labium is much shorter than those previously noticed; the tongue and palpi are of the same length and the tongue is destitute of hairs. The labial palpi have all four joints cylindrical and the first two joints set with rows of short hairs. The first joint is longer than the other three combined and the second is longer than the third and fourth combined. The maxilla has a small appendage thickly set with hairs



like that in *Andrena*. The second part is joined at right angles to the basal part and is very broad in the middle part, narrowing abruptly to a point at the apex. The maxillary palpi is six pointed. The first and fourth joints are practically the same length as are the second and third, and fifth and sixth.

The mandible has two notches in the basal edge. The upper edge narrows abruptly and then runs out straight, turns downward at right angles, then presently makes an obtuse angle and joins the under side, which is practically straight. The under edge has a row of long hairs.

The labium is much longer than broad with a notch in the middle of the apical edge, which is set thickly with fine hairs.

*Apis mellifica* or Hive Bee (Plate V). As in *xylocopa*, the basal part of the labium is diminished in size. In the *Apis mellifica* the tongue is longer than the palpi and is covered with short hairs. The joints of the palpi average about the same in length as those of *xylocopa*. The first two joints are flat and covered with hairs. The third is club-shaped and the fourth much smaller.

The maxilla is long and narrow and on the basal parts are long hairs at the base which diminish in length toward the apex. On the second part are a few short hairs and a very inferiorly developed, two pointed palpi. The third part narrows into a point and the apical half is covered with hairs.

*Apis mellifica* has a mandible which is much narrowed in the middle, but with the ends about the same width. Toward the terminal end are a number of broad, heavy spines, and a number of hooked hairs on the apical edge. The under edge has a row of long hairs.

The labium is much longer than broad, the apical margin of which is set with short, heavy spines.

As we review the large number of variations in the few genera here described it seems the variations of the mouth parts would furnish sufficient means of classification. For instance the length and shape of the tongue is a constant



character and is alone sufficient to separate this group, Anthophila, into the two families Andrenidae and Apidae. A good distinction between the two genera, Halictus and Andrena, would be the difference in size and shape of the labial lobes, while Agapostemon nigricornis would be separated from these two by the absence of labial lobes and an altogether differently shaped labium. The genus Nomia could be distinguished from all these just mentioned by an entirely differently shaped labium and by the fact that it has a five jointed labial palpi, while the others have four jointed palpi.

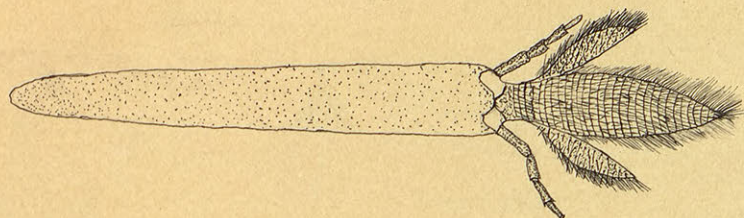
Melissodes could be separated from the other genera here described of the family Apidae by the presence of the unjointed filament found attached to the base of the palpi. The shape of the mandible, whether simple or toothed, the number of joints of the maxillary palpi, and form and size of the labium all serve as excellent points in the process of classification.



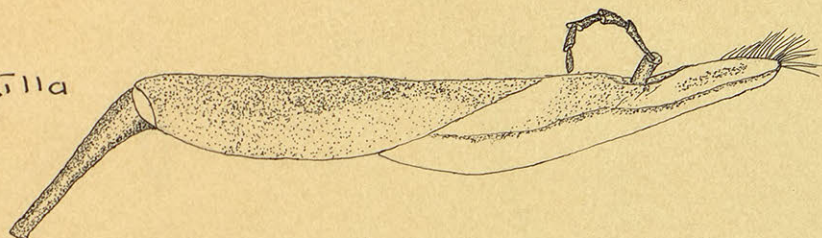
Halictus.

Plate I

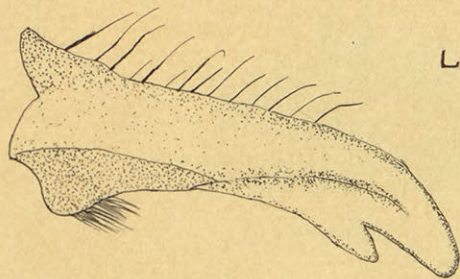
Labium



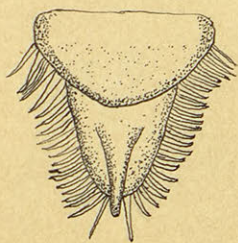
Maxilla



Mandible

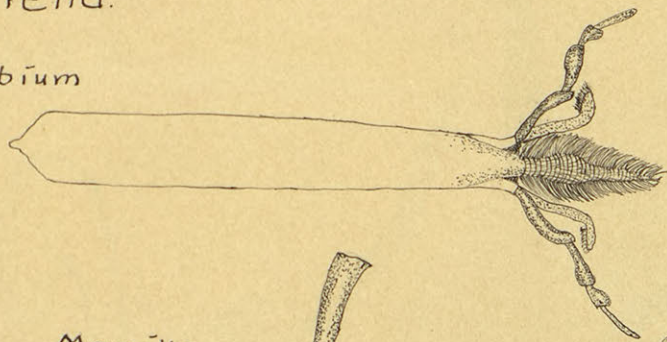


Labrum

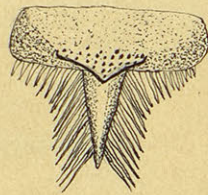


Andrena.

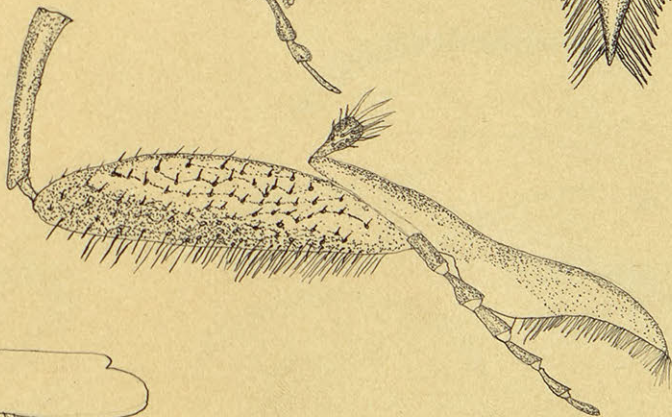
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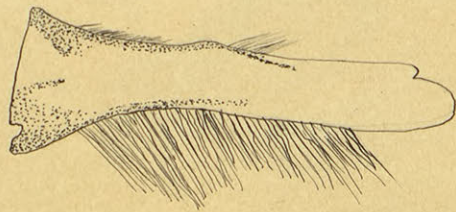
Labrum



Maxilla



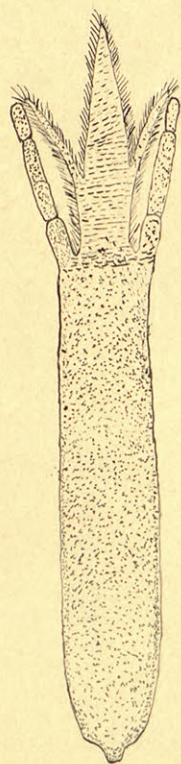
Mandible



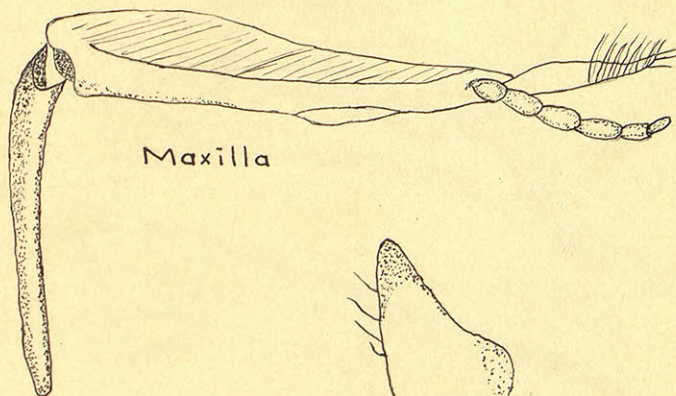


Nomia

Plate II



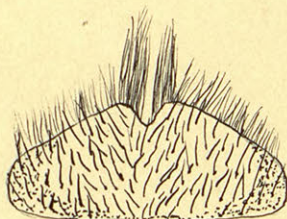
Labium



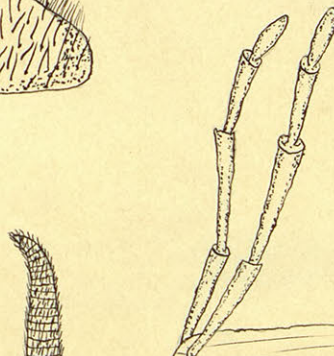
Maxilla



Mandible

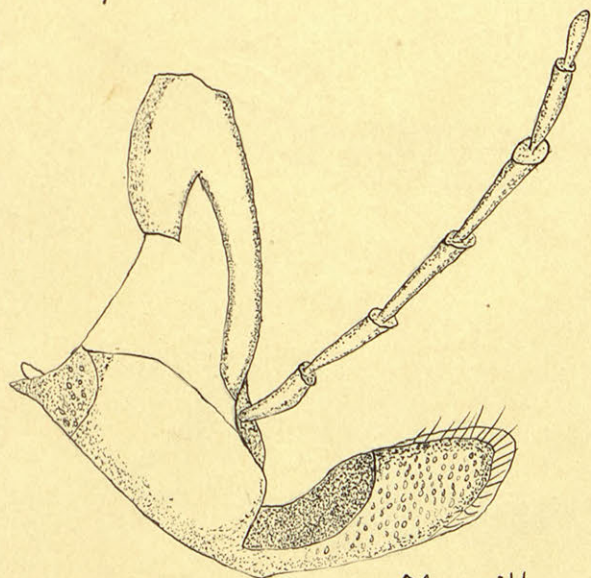


Labrum

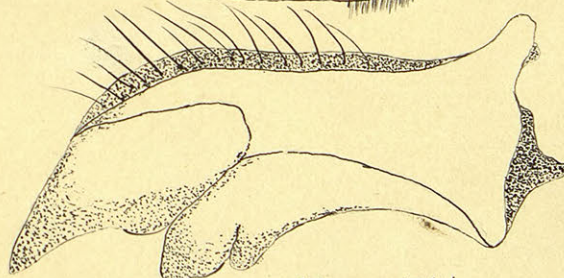


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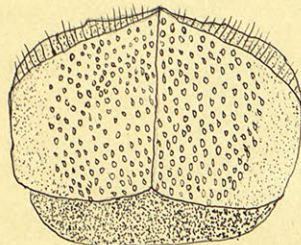
Sphe x



Maxilla



Mandible



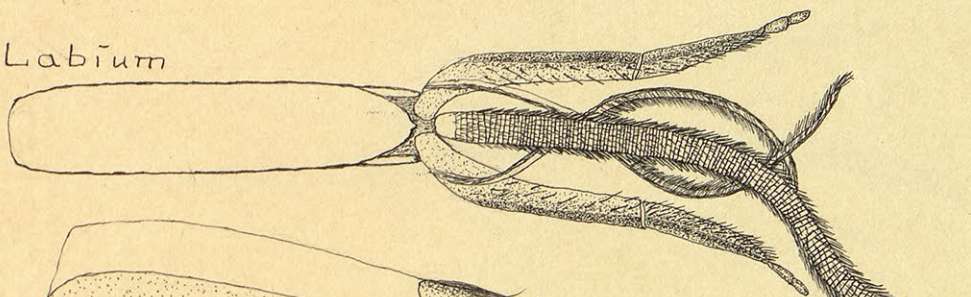
Labrum



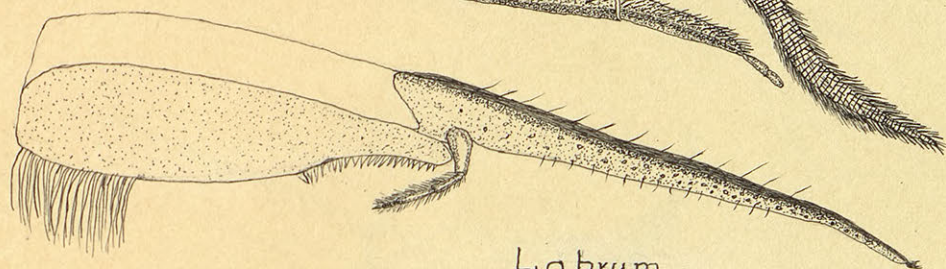
*Melissodes mennacha*

Plate III.

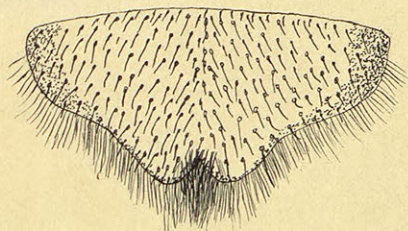
Labium



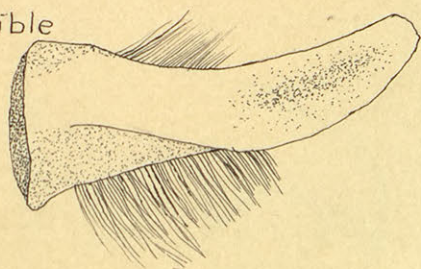
Maxilla



Labrum

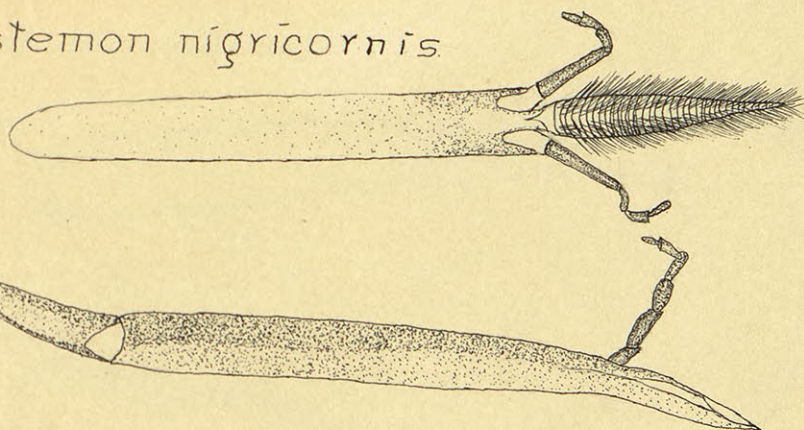


Mandible

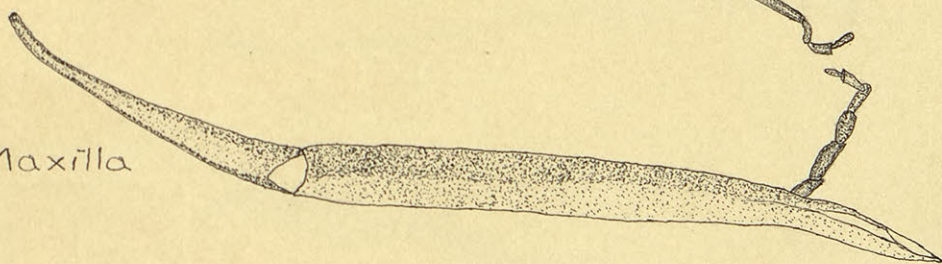


*Agapostemon nigricornis*

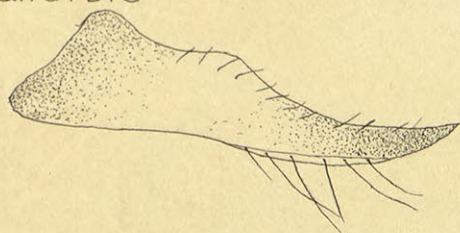
Labium



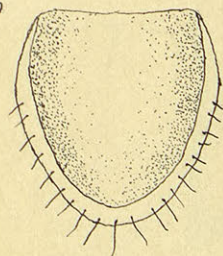
Maxilla



Mandible



Labrum

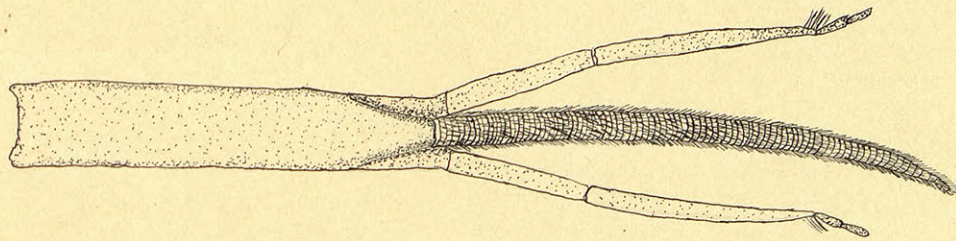




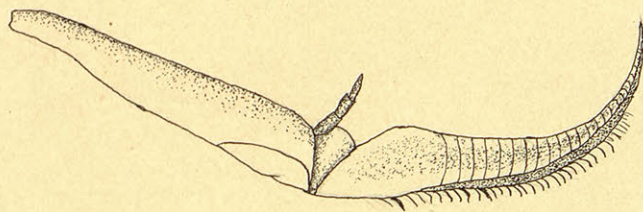
*Coelioxys deplanata*

Plate IV.

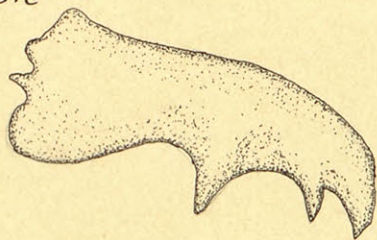
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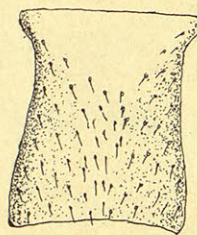
Maxilla



Mandible

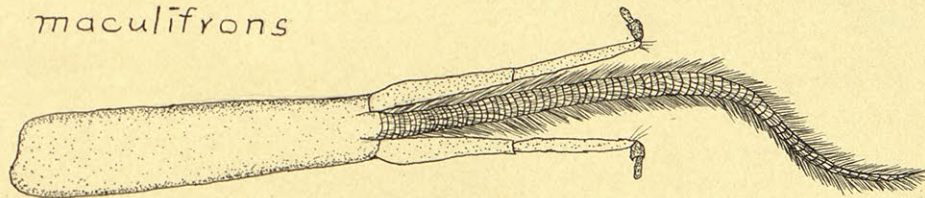


Labrum.

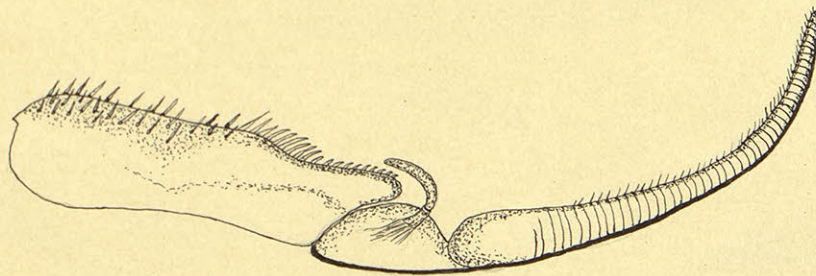


*Anthidium maculifrons*

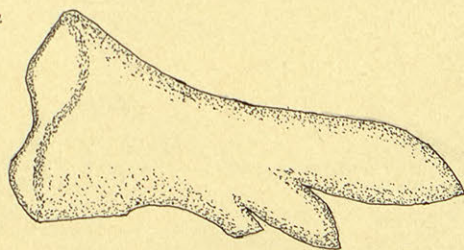
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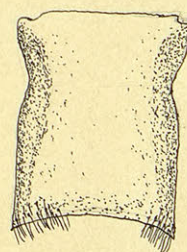
Maxilla



Mandible



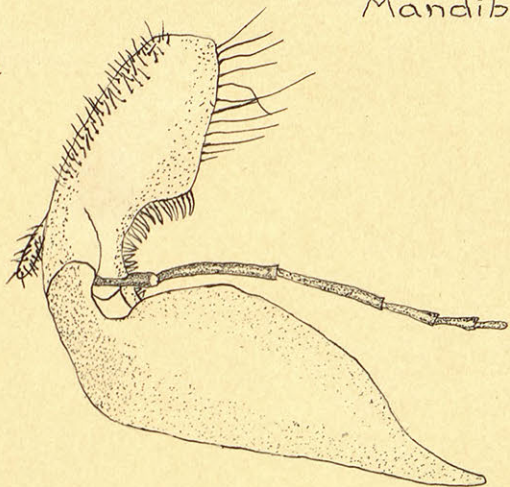
Labrum



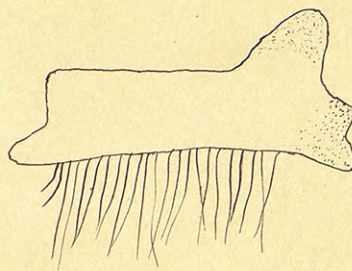


*Xylocopa*

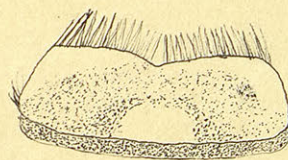
Maxilla



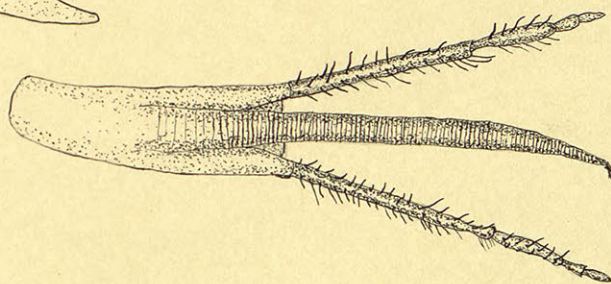
Mandible



Labrum

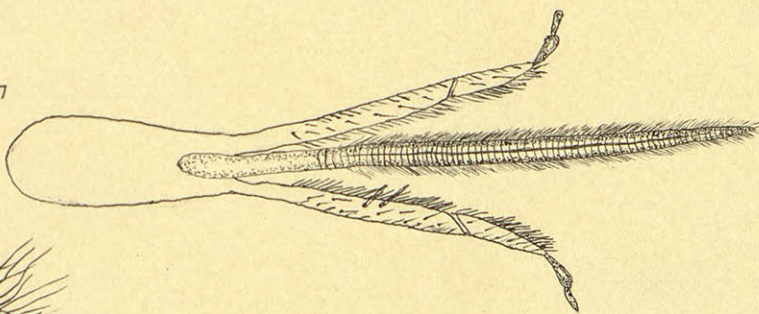


Labium



*Apis mellifica*

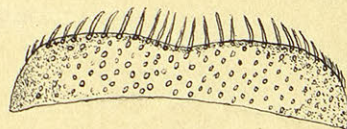
Labium



Maxilla



Labrum



Mandible

