Bright rufo-fulvous; tip of gaster light brown; clypeus, funiculus, clypeus and borders of mandibles brown.

Glenwood Springs, Colo., altitude 5,750 feet (Cockerell).

Superficially the ant resembles *Pogonomyrmex occidentalis* Cresson, but, as noted by Dr. Wheeler, the impressed thorax, shape of petiole, vestigial sting and non-pectinated posterior tibial spurs put it in the genus *Messor*. From the shape of the mandibles the ant evidently stores seeds. This ant differs from the other species of Messor in the fulvous red color and in having the peculiar apical lobe on the mandibles. The antennal scapes are more dilated at the base than in other species.

A COMPARATIVE STUDY OF THE MAXILLÆ OF THE ACRIDIIDÆ (ŒDIPODINÆ AND TETTIGINÆ), PHASMIDÆ AND PHYLLIIDÆ.[1]

By G. C. Crampton.

In attempting to determine the phylogeny and relationships of the Orthoptera-like insects, it has seemed advisable to make a comparative study of the various parts of the head (*i. e.*, the trophi, antennæ, etc.), of the thorax (*i. e.*, the sclerites, appendages, etc.), and of the abdomen (*i. e.*, the cerci, genitalia, etc.); and the present paper dealing with four of the types of maxillæ found in the Orthopteroid forms is offered as one of a series in which the trophi of these insects are discussed, in addition to the various other structures mentioned above. Since no detailed descriptions or figures of the maxillæ of the Phylliidæ, Phasmidæ, and Tettiginæ have been published (so far as I am aware), and since the general scheme of the maxillary structure is practically the same in all Orthopteroid insects, it has seemed preferable to begin the series of articles on the trophi, etc., of the Orthoptera-like forms, with the description of the maxillæ of the above mentioned insects.

The accompanying figures of the maxillæ are necessarily somewhat diagrammatic, since certain structures shown in the figures (*e. g.*, the basal portions of the cardo, etc.) would not be completely visible if sketched from the angle at which the remainder of the figure is drawn. Furthermore, lack of material preserved in al-

[1] Contribution from the Entomological Laboratory of the Massachusetts Agricultural College, Amherst, Mass.

cohol has made it necessary to draw the figures from dried specimens—which are always more or less distorted. In the main, however, it will be found that the relations of the parts are represented approximately correctly. Since the specimens were studied from various angles, it was found necessary to examine them submerged in a liquid medium (rather than mounted on slides) and a binocular was found much more satisfactory than the compound microscope, for this purpose.

In all of the figures, the insect's left maxilla has been depicted, and all views represent that surface of the maxilla which is normally directed posteriorly when the maxilla is "*in situ*"—or attached to the insect's head.

In Fig. 1 (Plate XI) is shown the maxilla of a species of the Phasmid *Anisomorpha* (probably *Anisomorpha buprestoides*), while that shown in Fig. 2 is of a species of Phyllium (probably *Phyllium scythe*). Fig. 4 is based upon the condition found in the maxilla of *Tettigidea parvipennis*, and that of a species of *Paratettix*. Fig. 3 represents the maxilla of *Dissosteira carolina*, and in this figure the outline of the distal segment of the galea is somewhat distorted, due to the fact that the specimen was flattened out to a greater extent than in the other insects figured.

As may be seen from the accompanying figures, the *cardo*, or basal portion of the maxilla (*co*, of all figures) is divided into two subdivisions in the Orthoptera-like insects. These two subdivisions are the *veracardo* (*vc*) and the *juxtacardo* (*jc*). The basal portion of the juxtacardo, *jc*, is not clearly visible until the maxilla is turned base upward, at a considerable angle. This region of the juxtacardo bears a prominent articulatory condyle, *ac*, to which there is usually attached a slender chitinous "muscle tendon." This maxillary condyle tendon is not shown in Figs. 1 and 2, but is colored black in Figs. 3 and 4. The juxtacardo of Phyllium and the Phasmids (Figs. 1 and 2, *jc*) is much broader in comparison with the veracardo (*vc*) than is the juxtacardo of the Acrididæ here figured.

The *stipes* (*st*, of all figures), like the cardo, is also divided into two principal subdivisions, the *juxtastipes* (*js*) and *verastipes* (*vs*),[1]

[1] The designations eucardo, eustipes, paracardo and parastipes would be somewhat briefer and more euphonious than veracardo, verastipes, juxtacardo and juxtastipes; but, since cardo and stipes are Latin terms, it is preferable to combine them with "vera" and "juxta" rather than with the Greek "eu" and "para."

which correspond in a general way to the two subdivisions of the cardo. The juxtastipes of Phyllium (Fig. 2, *js*) is much broader than in the other insects here figured, and the verastipes (*vs*) is divided into an upper and lower region in this insect. The lower region (*pf*) corresponds in a general way to the palpifer of the other insects, but is not strictly homologous with the palpifer.

A comparison of the maxillæ of certain immature Plecoptera, Ephemerida, and of certain Thysanura, with the first and second maxillæ of such centipedes as *Scutigera* and *Scolopendra*, would indicate that the maxillæ of an insect is compound, and probably represents a combination of the first and second maxillæ of *Scutigera*, etc. I am not yet prepared to say, however, that the line of demarcation between the juxtacardo and veracardo, which is continued upward between the juxtastipes and verastipes, represents the line of union of the basal portions of the two components of an insect's maxilla—although the possibility of such a condition would bear further investigation.

The *palpifer* (*pf*) or palpus-bearing sclerite, is rather indistinctly demarked in the insects under consideration. It is practically always bent backward, or folded around to the other side in such a fashion that the palpus (*pp*) is borne on the surface of the maxilla opposite to the one shown in the drawings.

The *palpus* (*pp*) is composed of five segments, and, in the insects under discussion, the two basal segments are subequal in size, but are much shorter than the three terminal ones. The three terminal segments of the palpus may be subequal in size, or the intermediate one may be shorter than the other two.

The segments of the maxillary palpus of *Phyllium* (Fig. 2, *pp*) are much flattened, or depressed, in conformity with the general flattened condition of the entire body of this insect. The two distalmost segments of the palpus of the Tettiginæ (Fig. 4, *pp*) are also considerably flattened, but this is apparent only after turning the palpus around to a much greater angle than that at which the remainder of the figure was drawn. The end segment of the palpus of *Dissosteira* (Fig. 3) bears a well marked terminal sensory area demarked by a dotted line in the drawing. This area is well provided with sensory setæ whose chief function is doubtless gustatory.

The *galea*, or external lobe of the maxilla, is composed of two segments—the *basigalea* (*bg*) or proximal segment being much shorter, and less distinctly demarked, than the *distigalea* (*dg*) or distal one. The distigalea may overtop the inner maxillary lobe, or lacinia (*la*), as is the case in three of the insects here figured (Figs. 1, 2 and 3), and this condition is characteristic of most of the insects related to the phasmids. The Tettiginæ, however (Fig. 4), seem to be an exception to the rule, and in this respect resemble certain Gryllidæ.

The distal segment of the galea (distigalea) of the Phasmids bears a well developed lobular process, the *galealobulus* (Fig. 1, *gl*) which may be homologous with the basal lobe of the bilobed galea of certain Hymenoptera. The lobule is poorly developed in Phyllium (Fig. 2, *gl*) and is absent in the Acrididæ here figured.

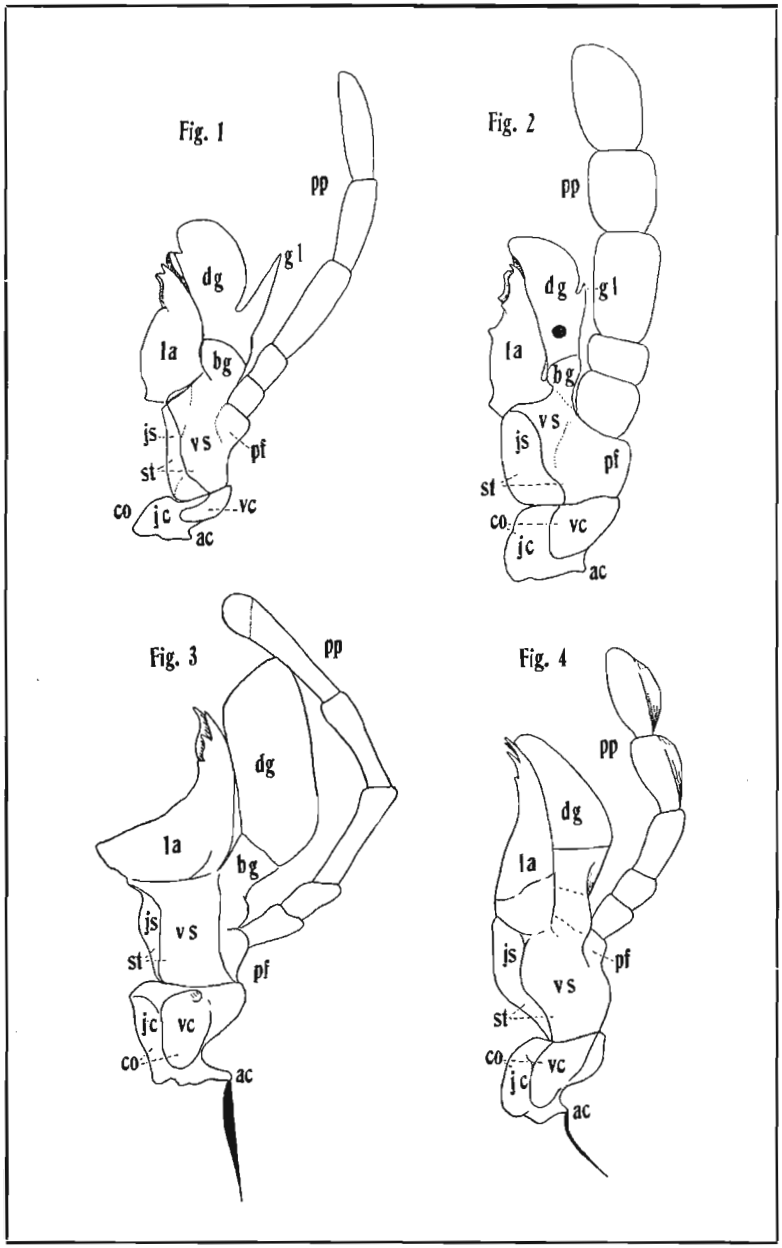
The *lacinia* (*la*) or inner maxillary lobe is more nearly vertical in outline in the Tettiginæ, Phylliidæ, and Phasmidæ (Figs. 4, 2, and 1), while in *Dissosteira* (Fig. 3) the inner margin of the lacinia sweeps downward in a broad curve to the projecting inner basal angle, thereby making the lacinia of this insect much broader at the base than is the case with the other insects under discussion. The inner basal angle of the lacinia of the Phylliidæ and Phasmidæ (Figs. 2 and 1) is much more protuberant than in the maxilla of the Tettiginæ (Fig. 4), although in the latter insects also a projecting basal portion is to be seen if the maxilla is turned much further around than in the view shown in the drawing. In *Dissosteira*, the surface of the inner basal angle of the lacinia is densely beset with rounded microscopic scales.

Along the inner margin of the distal portion of the lacinia, there occur several tooth-like projections, or *laciniadentes*. The function of these "teeth" is apparently that of holding, and possibly of assisting in comminuting the food. In the insects related to the Phasmids, these laciniadentes are arranged in two rows, or are separated by a vertical groove into two sets, although there is usually but one terminal "tooth."

The principal conclusions here reached, concerning the maxillæ of the Acridiidæ, Phylliidæ and Phasmidæ, may be briefly summarized as follows:

The cardo is composed of two subdivisions, the juxtacardo and veracardo.

The stipes is composed of two principal subdivisions, the juxtastipes and verastipes.



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The basal two of the five segments of the palpus are subequal, and are much shorter than the three distal ones, which are usually subequal in length.

All of the segments of the palpus are greatly flattened in the Phylliidæ, while in the Tettiginæ, the distal two are somewhat flattened.

The galea is composed of two segments, and the distal one overtops the lacinia, save in the Tettiginæ.

The distal segment of the galea of the Phasmidæ bears a well developed lobular process (galealobulus) which may represent the basal lobe of the bilobed galea of certain Hymenoptera. It is but feebly developed in the Phylliidæ, and is absent in the Acridiidæ.

The tooth-like processes of the lacinia (laciniadentes) occur in two rows, thus differing from those of many other Orthopteroid insects in which they occur in a single row.

The maxilla of the Phylliidæ resembles that of the Phasmidæ rather more than it resembles that of the Acridiidæ.

The maxilla of an insect is possibly compound, and may represent the combined first and second maxillæ of *Scutigera*, and other centipedes.

Explanation of Plate XI.

Fig. 1. Posterior view of the left maxilla of a Phasmid.
Fig. 2. Posterior view of the left maxilla of *Phyllium*.
Fig. 3. Posterior view of the left maxilla of *Dissosteira*.
Fig. 4. Posterior view of the left maxilla of a Tettigid.

Abbreviations.

ac = articulatory condyle of cardo.
bg = basal segment of galea (basigalea).
co = cardo.
dg = distal segment of galea (distigalea).
gl = lobular process of galea (galealobulus).
jc = proximal subdivision of cardo (juxtacardo).
js = lesser subdivision of stipes (juxtastipes).
la = lacinia.
pf = palpifer.
pp = maxillary palpus.
st = stipes.
vc = distal subdivision of cardo (veracardo).
vs = principal subdivision of stipes (verastipes).