THE CRUMENA OF THE COCCIDAE AND THE ADELGES

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The crumena is a tubular pocket or pouch, which acts as a receptacle for the long stylets which occur in several families of the Homoptera. In the majority of sucking insects the labium is as long as the stylets reposing in it, but the Coccidae, Adelges, Aleyrodidae, and the Psyllidae, all have stylets considerably longer than the labium, and until such time as the stylets are inserted into the host plant, their excess length has to be accommodated elsewhere.

The Psyllidae manage to do this by projecting the stylets forward from the base of the labium in a loop outside the body. In the other families the long stylets are doubled back into the tube-like crumena, which often extends to the posterior end of the abdomen, or in cases where the stylets are several times the length of the body, the crumena may be required to resolve itself into several loops.

This peculiar pocket was mentioned and named by Mark in 1876, but it is difficult to find anything in recent literature that gives a clue to its origin. It was described in 1928 by the Japanese author Kitao in "Notes on the Anatomy of **Warajicoccus,**" as a tubular passage having three walls or layers; an inner, weakly chitinized layer, a thinner middle hypodermal layer, and an outer layer consisting of an inconspicuous basal membrane. The only section of the scale crumena obtained in the laboratory at Vernon agrees with the above description. Unless, however, this organ is sectioned directly through the centre, the inner walls will be cut at more of a tangent than the outer wall, thus giving an impression of varying thickness. When the crumena is seen in dissection it appears to be composed of thin membranes of equal thickness.

In the present paper it is suggested that the crumena consists of the basal membranes or linings of the epithelial invaginations, which build up the stylets; that these membranes are brought down with the stylets to form a receptacle in the body for them. A difference between the crumena of the scale and that of the Adelges and mealy bugs seems to be correlated to a difference in the manner of bestowing the stylets in the crumena.

The main difference between the scale crumena and that of the Adelges and mealy bugs, is due to the fact that the latter insects cast away the inner tube or layer.

A brief description of the eclosion from the egg of **Adelges abietis** Kalt. shows how this is accomplished.

The eggs of this **Chermes** are deposited on the needles of Norway spruce, each egg being anchored by a pedicel. When the egg is in an advanced stage of incubation, the nymph within is observable with its long stylets rolled up on either side of the supporting frame of the mouth parts. As the nymph breaks out of the egg envelope and extricates itself, the stylets are then seen protruding from the labium, their tips being attached to the membrane of the egg envelope.

The stylets of the nymph are more than five times the length of its body. Hence it takes about half an hour for the long stylets to be entirely unrolled in the head and extruded through the labium. Until the stylets are fully extended and their proximal retorts clamped into the framework of the mouthparts no muscular action at their base seems possible, and the stylets are probably propelled forward by movements which must be attributed to the joint action of the labium and labrum.

The nymph, after straightening out its stylets, is some distance from the empty egg, but is still connected with this by the stylets. After a short pause of ten minutes duration the nymph walks away, leaving a membraneous tube attached to the empty egg.

During this pause the insect has retracted the stylets by means of the muscles at their base. Under the microscope first one mandible is seen to be retracted a short distance, then the other, the compound maxillae following suit. But whereas the mandibles are free, the maxillae are enclosed in a thin membrane which is broken off as the tips of the stylets disappear into the labium. This membrane is continuous with the egg membrane and cannot conceivably be anything else than the basal membrane of the maxillary invaginations. If these accompany the maxillary stylets it would be expected that the basal membranes of the mandibles should also accompany them. Dissection of the mealy bug during the moult, at a time when the stylets are fully extruded, indicates that the mandibular membranes are brought away from their invagination but do not pass out of the body. They appear to be crumpled up at the base of the labium ready to receive the stylets when they are retracted, thus forming the crumena.

The scale insect on the other hand does not extrude and retract the stylets through the labium. The stylets pass directly from their rolled position in the head into the labium and are then doubled back into the crumena, the maxillary membranes forming the inner tube of the scale crumena, while the mandibular membranes form the outer tube.

There is thus strong evidence that the crumena is derived from the same epithelial cells that build up the stylets. Increase in length of the stylets at each instar is therefore accompanied by a similar increase in the length of the material which forms the crumena. That this delicate organ is so seldom seen in section may be due to its degeneration and disappearance after it is emptied of the stylets.

It will probably be found that the new stylets of fresh instars of sucking insects are all enclosed in their respective membranes when leaving the maxillary and mandibular invaginations. There is some evidence that this is the case with the **Aphididae.** For instance, it is not uncommon in aphis-punctured tissue to find short projections which have hitherto been supposed to belong to the stylet sheath that the plant deposits around the stylet. It is more likely that these projections are the basal membranes which are sloughed off during penetration. Micro-photographs by other authors are indicative of this.

The basal membranes can only be used as a crumena in those insects in which the mouth parts are entognathous. In most of the species of the Homoptera the stylets issue out between the labium and labrum before entering the latter. In the Coccidae and Adelges the labrum and labium are so intimately in conjunction, as in the **Thysanoptera,** that they entirely enclose the stylets until these pass out at the tip of the labium.