

THE GROSS ANATOMY OF THE ALIMENTARY
CANAL OF SOLUBEA PUGNAX (FAB.)
(HETEROPTERA, PENTATOMIDAE)

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At the present time the alimentary canal of the Heteroptera has been little studied. In view of this fact and because of the confusion which has arisen in the terminology and the inaccessibility of the more important papers to most students, a short paper dealing with the gross anatomy of the canal of one of the members of this order and bringing the more important facts together seems advisable.

The writer wishes to express his appreciation to Dr. C. H. Kennedy, of Ohio State University, for his advice during the course of this rather limited work and in the preparation of this paper, also for access to papers in his private library which otherwise would not have been available.

Stomodeum—The salivary pump opens into a long semi-transparent oesophagus (Fig. 1, OES) which extends from the anterior part of the head, passing between the rather large circum-oesophageal connectives and to about the middle of the prothorax.

Mesenteron—The oesophagus opens into a rather large first stomach (Fig. 1, 1ST. S), which extends posteriorly as far as the third abdominal segment. This was termed the crop by Malouf (1933), "premier poche de ventricule chylique ou stomac," by Dufour (1883) and the first stomach by Glasgow (1914). Malouf (1933) states that in *Nezara viridula* L. the oesophagus and crop have similar histological characters, there being "an innermost layer of folded epithelium composed of cubical cells and lined by a thin internal intima." However, he also states that "External to the epithelium is a layer of circular muscle fibers. External to these is a layer of longitudinal muscle fibers; while enveloping all is a nucleated peritoneal membrane." Malouf apparently has made an error in describing the muscles of this region because Harris, in an unpublished thesis, has shown that the longitudinal muscles in *Murgantia histrionica* are surrounded by a layer of circular muscles in the oesophagus. He also shows that in the "crop," as termed by Malouf, the longitudinal layer is external to the circular layer. Malouf has evidently interpreted some other structure as the intima in this organ. Ancona (1932) figures a long structure similar to this in *Alizires taxcoensis*, a Mexican species, which he divides into three parts—the "proventriculo," the "intestino medio" and "estomago." In the specimens of *Solubea pugnax* examined this organ varied considerably

in shape, apparently due to the varying food content. No structure was found which could be called a proventriculus. It is probable that

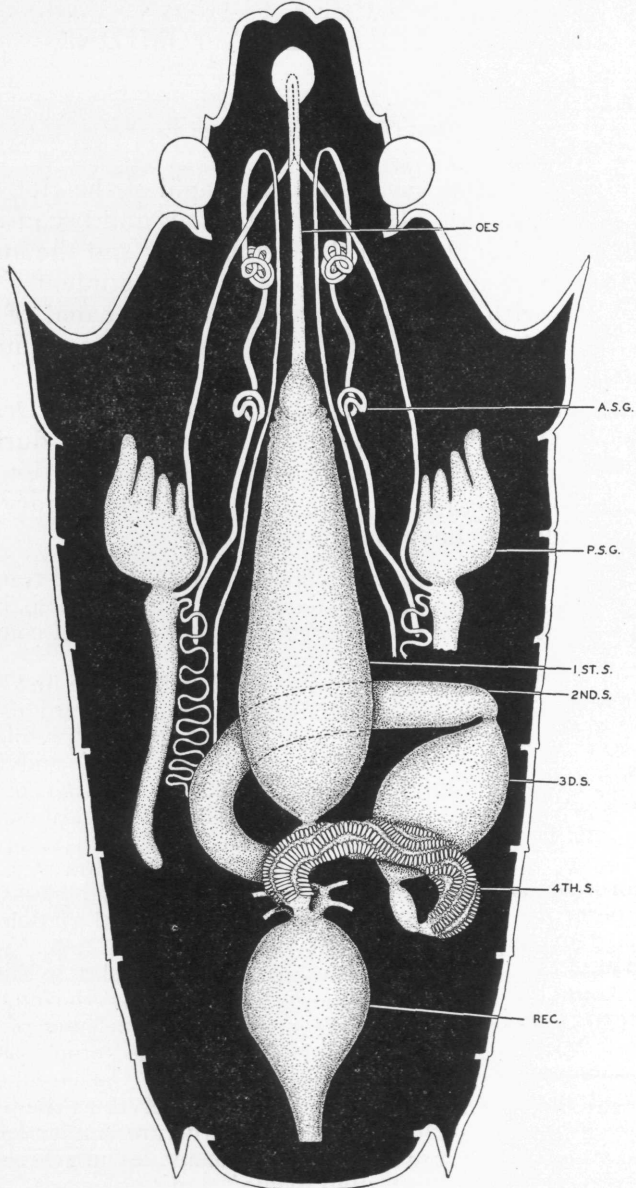


FIG. 1. The gross anatomy of the alimentary canal of *Solubea pugnax* (Fab.).

Ancona misinterpreted this organ when he divided it into a "pro-ventriculo," an "intestino medio" and "estomago."

The first stomach, after a distinct constriction, passes into a tubular organ, the second stomach (Fig. 1, 2ND. S.) which turns dorsally and then anteriorly and ventrally, passing in its normal position under the first stomach. This organ has been designated as the "true first stomach" by Malouf, the "portion filiforme" by Dufour, "intestino posterior" by Ancona, and the "second stomach" by Glasgow. After a distinct constriction it turns abruptly posteriorly and passes into a globular organ, the third stomach (3D. S.). This organ is the "second stomach" as termed by Malouf, the "second poche gastrique" by Dufour and the "third stomach" by Glasgow. This globular portion tapers posteriorly from the middle and passes into a very short organ which has been termed the "third stomach" by Malouf, "col de cette poche" by Dufour, while Glasgow combines it with the caecal part of the mesenteron into the "fourth stomach." In some of the specimens examined this was slightly swollen, while in others it appeared as a mere tube. Malouf states that the first, second and third stomachs, according to his terminology, have the same histological structure. He states that "the muscle fibers (as in the stomodeum) are spaced from one another. The circular layer is external to the internal layer." This arrangement is also the opposite to that usually found in the mesenteron of insects. Harris shows the longitudinal muscles external to the circular muscles in *Murgantia histrionica*.

The fourth stomach (Fig. 1, 4TH. S.) or caecal part turns dorsad from the third stomach of Malouf, makes somewhat of a loop and passes into the dorso-posterior region of the "ilium." It is apparently composed of four rows of plate-like structures surrounding a tube. Malouf states that "The lumen formed by the inner faces of the caecal discs is not lined by the epithelium. An inner membrane lines the lumen. Into the extreme posterior portion of the fourth stomach the circular and longitudinal muscles of the rectum extend." Harris states that epithelial cells are present in *Murgantia histrionica*.

Proctodeum—The fourth stomach passes into the "ilium" on the dorso-posterior side.

The "ilium" is a small knob-like structure on the anterior end of the rectum. A pair of rather large Malpighian tubules are inserted on each side of it. The Malpighian tubules are rather long and form an entangled mass in the dorsal part of the body cavity. They lie in the region of the second, third and fourth abdominal segments.

The rectum (Fig. 1, REC.) is a rather large membranous-like organ which extends forward to the posterior part of the third abdominal segment. It becomes narrower in the fifth segment and extends to the anus as a narrow tube.

Salivary Glands—There is a pair of principal salivary glands (Fig. 1, P.S.G.) which lie dorso-lateral to the "crop" of Malouf, one on each side. The anterior lobe is somewhat hand-shaped, having four distinct finger-like projections on the anterior end. The posterior lobe is tubular and may extend posteriorly to the anterior part of the third segment. At the juncture of the two lobes in each gland, there arise the salivary

ducts which extend forward and after passing around the commissure between the sub-oesophageal ganglion and the first thoracic ganglia come to lie beside each other, passing forward and emptying into the ventral side of the salivary pump. In one specimen these tubes, after passing around the commissure, converged and lay parallel to each other for a short distance after which they diverged and led to the principal salivary glands. From each gland just posterior to the salivary duct an accessory salivary gland (Fig. 1, A.S.G.) arises and extends posteriorly and somewhat ventrad reaching almost to the end of the posterior lobe of the principal gland. After folding upon itself several times it turns abruptly anteriorly. It runs forward to the posterior part of the head where it turns posteriorly and enlarges to about twice its size. It makes several convolutions in the anterior part of the prothorax and then runs posteriorly to approximately the juncture of the pro- and mesothorax where about two more convolutions are made, after which it runs more or less as a straight tube to the posterior part of the metathorax.

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