

INTERNAL MORPHOLOGY AND HISTOLOGY OF THE POST EMBRYONIC
STAGES OF THE FISH MITE *LARDOGLYPHUS KONOI* (SASA AND ASANUMA)

ACARINA : ACARIDAE

3. DEUTONYMPH *

BY

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ABSTRACT

The internal anatomy and histology of the deutonymph of the fish mite *Lardoglyphus konoi* are described from paraffin sections viewed under immersion lens. The deutonymph has well developed body wall, muscular system, digestive system and nervous system. Sexes cannot be distinguished in the deutonymph because the genital organs are in their rudiments.

Mouth and anal opening and specialised cells in the epithelium of the stomach, caeca and rectum indicate a functional state of the alimentary canal. The epithelium of the anterior part of the caeca contains characteristic spherules.

The nervous system consists of the supra-oesophageal ganglion, circum-oesophageal connectives and a ventral cord. But for a faint demarcation into right and left lobes, separate lobes, centres or tracts are not discernable in the brain. The ventral cord has five separate clusters of cells on the ventral surface of which the anteriormost is the sub oesophageal ganglion and the rest the segmental ganglia.

A pair of cylindrical ridges formed of ground protoplasm containing rows of nuclei form the genital rudiments.

INTRODUCTION

In the two previous publications in the series, (VIJAYAMBIKA and JOHN ; in Press.), the internal morphology and histology of the larva and protonymph were described. The present paper deals with the internal morphology and histology of the last of the nymphal stages.

The descriptions are made from serial paraffin sections of healthy deutonymphs picked out from laboratory cultures of the adult. For details of fixation and staining methods, readers are referred to the previous publications in the series.

* Forms part of the Doctoral thesis of the senior author.

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OBSERVATIONS

Body wall and Musculature

They are essentially the same as in the larva and protonymph. The body wall is three layered as in the previous stages, but the outermost layer i.e., epiostracum is slightly broader in the deutonymph.

Alimentary canal

It is formed of the same components as in the larva and protonymph, an antero-ventral mouth opening, a pharyngeal tube, oesophagus, stomach and its caeca, colon, rectum and a postero-ventral anus.

The pharynx is mid-dorsal in position at the anterior end of the body. It is formed of two chitinous half tubes, and has a lumen, which opens into the oesophagus.

The oesophagus is dorso-median in position and runs obliquely backwards and upwards through a median foramen in the brain (fig. 4 OE). It is roughly triangular in cross-section and its wall is formed of an outer tunic and an inner chitinous intima. The outer tunic is a poorly staining syncytium with widely separated nuclei.

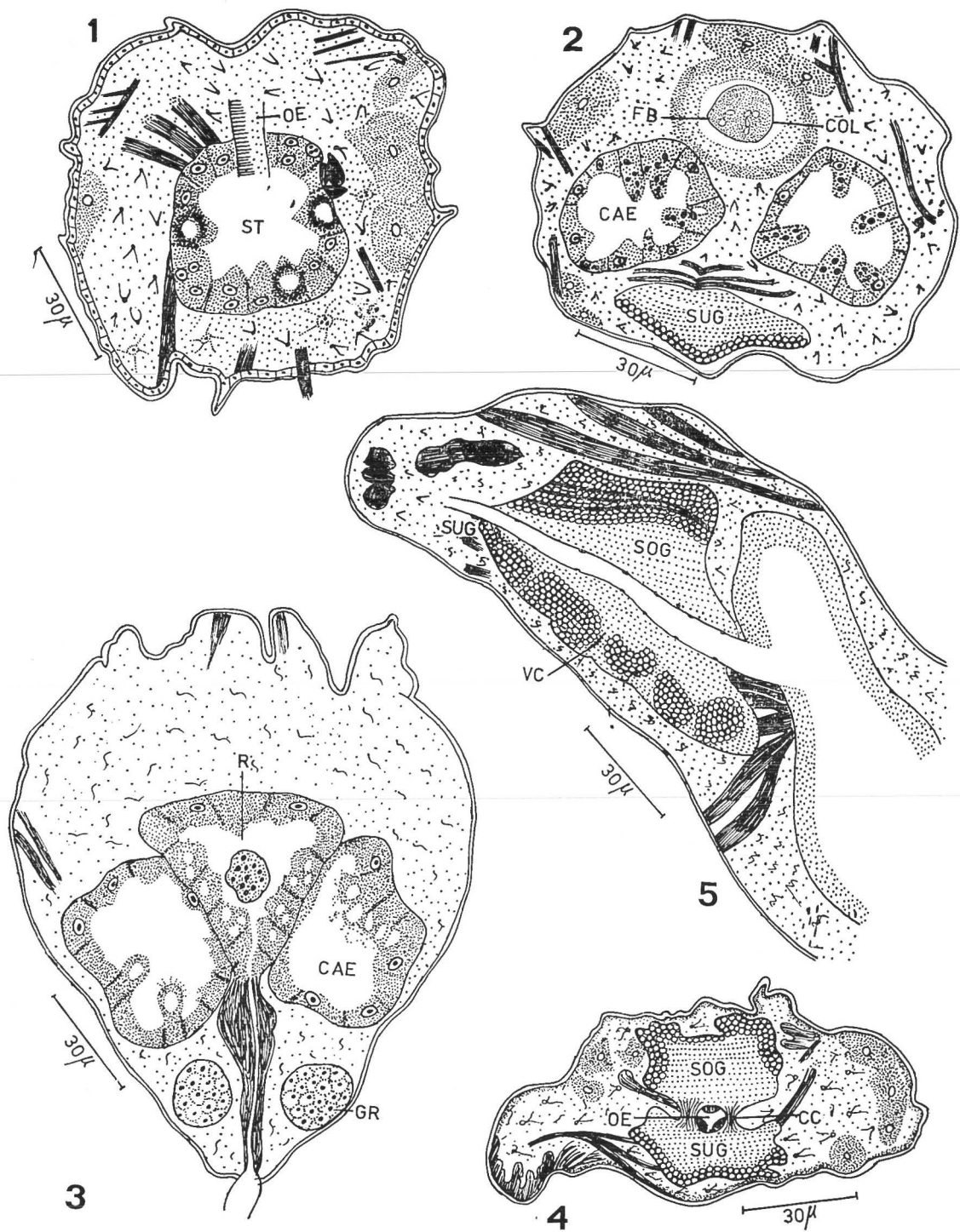
The stomach (fig. 1 ST) in the deutonymph is roughly a rectangular sac situated more or less in the middle of the anterior end of the body. It is about 30 to 32 microns in length. The wall of the stomach is formed of an outer basement membrane and an inner epithelium. The epithelium on the roof is formed of short squamous cells (Please see fig. 1).

The epithelium on the sides and floor is made up of slightly elongated, pyramidal cells. Among the pyramidal cells two types are visible; one in which nuclei are prominently present towards the centre and the other in which the centre of the cell is occupied by a large vacuole (Please see fig. 1). In the latter type of cells nuclei are not distinct, but a diffused basophilic zone is present around the vacuoles.

The caeca are situated one on either side of the stomach and open by wide opening on the postero-lateral walls of the stomach. The caeca are roughly 70 microns in length of which nearly 30 microns extend anteriorwards, from the point of opening into the stomach, and the rest, backwards. They are blunt at both ends.

The wall of the caecum (fig. 2 CAE) has also an outer envelope of basement membrane. The basement membrane carries a simple epithelium towards the innerside. For the major part, this epithelium is flat and formed of squamous cells, but especially on the lateral walls and to a lesser extent on the roof and floor, some epithelial cells project into the lumen. These cells are two types mainly. Those in the anterior half of the caecum are club-shaped (Please see fig. 2) and contain characteristic spherules and a prominent nucleus. Those in the posterior half are also club-shaped and some pyramidal, but the centre of these cells is occupied by a large vacuole (fig. 3 CAE). In these cells the cytoplasm is reduced to a rim around the vacuole and the nuclei are also not visible. In some of the cells carrying the vacuole, the distal edge is disrupted, and protoplasmic strands projecting from the disrupted edges into the lumen are present.

The posterior end of the stomach is obliquely directed upwards and opens into the colon. The colon (fig. 2 COL) is a dorso-ventrally flattened sac 20 to 25 microns in length and 24 to 30 microns in width. The wall of the colon is built up of an outer lamella which is rather broad and structureless. Inner to this there is a pavement layer of undifferentiated protoplasm which forms the epithelium. Neither cellular limits nor nuclei are visible in this layer. The colon contains a food bolus (fig. 2 FB) which is spherical in shape, and about 20 to 24 microns in diameter.



FIGS. 1 à 5 : 1) Oblique transverse section through the stomach. OE ; oesophagus, ST ; stomach ; 2) Transverse section through the colon and anterior end of caeca. COL ; colon, CAE ; caeca, FB ; food bolus, SUG ; sub-oesophageal ganglion ; 3) Transverse section through the rectum and the posterior caeca. CAE ; caeca, GR ; genital rudiments, R ; rectum ; 4) Transverse section through the brain. SOG ; supra-oesophageal ganglion, CC ; circumoesophageal connective, OE ; oesophagus, SUG ; sub-oesophageal ganglion ; 5) Vertical longitudinal section. SOG ; supra-oesophageal ganglion, SUG ; sub-oesophageal ganglion, VC ; ventral cord.

At the posterior end, the colon bends downwards and opens into the rectum. The rectum is an elongated triangular sac (fig. 3 R) roughly 18 microns in length. It is roughly 14 microns in width at its dorsal, widest part. The rectal wall also has an outer envelope of thin, structureless basement membrane. Inner to it there is a simple epithelium. The epithelium is flat and pavement like for the major part. Nuclei wherever present are large and basally situated. On the sides this epithelium is formed of pyramidal cells which project into the lumen (Please see fig. 3). These cells lack separate nuclei but contain several large vacuoles.

Reproductive system

The gonads still remain in the rudimentary stage and sexes cannot be distinguished in the deutonymph. The gonadal rudiments (fig. 3 GR) are paired and are situated ventrally, to the posterior end of the caeca, on either side of the rectum. The genital rudiments are bounded by a limiting membrane which is very thin and structureless. Within the limiting membrane is a cylindrical ridge, which is the germinal zone. This ridge consists of ground protoplasm and several rows of nuclei piled upon each other (Please see fig. 3). Each nucleus is surrounded by a narrow rim of homogeneous cytoplasm.

Nervous system

As in the larva, protonymph and adult, the nervous system in the deutonymph also consists of the brain (fig. 4 SOG) a pair of circum oesophageal connective (fig. 4 CC) and a ventral cord (fig. 5 VC).

The brain (fig. 5 SOG) is anteriormost in position and dorsal to the oesophagus. It is wedge-shaped with the narrow end directed forwards. A median shallow longitudinal furrow is present on the dorsal side of the brain, facilitating the vague delineation of two lateral halves of the brain (Please see fig. 4). The brain has a cell rind of several layers thick on the dorsal and dorso-lateral sides. The cells are of uniform characters, closely packed, poor in cytoplasm and rich in chromatin. The medulla is uniform without any differentiation into neuropiles or tracts. The transverse fusion is however complete in the medulla.

The brain is connected to the antero-dorsal tip of the ventral cord by the circum-oesophageal connectives. The connections are formed by parallel fibers bounded together into a bundle, and lack in the ganglionic cells on the surface (Please see fig. 4 CC).

The ventral cord (fig. 5 VC) is also wedge-shaped, unpaired, and median in position. In sections five separate groups of cells are visible on the ventral surface of the ventral cord. Of these the one at the antero-dorsal tip belongs to the sub-oesophageal ganglion and the others to the segmental ganglia. The segmental ganglia are separated from each other by faint transverse depressions, and short lengths of nervous matter which are bare on the outer surface (Please see fig. 5). These short lengths of the ventral cord constitute the connectives between the segmental ganglia. In the segmental ganglia, the ventral surface is capped by a cell rind of several cells deep. The cells are small, tightly packed and poor in cytoplasm. Transverse fusion is complete for the entire length of the ventral cord.

The ventral cord elongates into a rat-tail nerve as in the protonymph. During the course of this slender nerve backward, it gives out pairs of branches to the stomach and rectum. In addition, the following nerves are also visible in sections as arising from the brain and the ventral cord. (1) a pair of nerves from the distal tip of the supraoesophageal ganglion (2) a pair of nerves from the suboesophageal ganglion to the chelicera (3) a pair from the ventral cord to each pair of legs.

DISCUSSION

There appears to be no dedifferentiation of the tissues in the deutonymphal stage also. But it would appear that a further concentration has taken place in the nervous system. The ganglionic cell groups which are six in number on the ventral cord of the protonymph have been reduced to five in the deutonymph, as in the adults. Obviously the ganglion of the cheliceral segment might have advanced forward and fused with the sub-oesophageal ganglion.

Among the three post-embryonic stages, only the nervous system of the deutonymph approaches maximum to that of the adult. A dorsal longitudinal furrow, partially separating the brain into two lateral halves as in the adult is present in the deutonymph. The number of segmental ganglia in the deutonymph is the same as in the adult. Among the peripheral nerves, all except those which arise from the tritocerebral region (a pair to the caeca and a median nerve to the pharyngeal tube) are present in the deutonymph.

Similar to the other nymphal stages, deutonymph also appears to be an actively feeding stage, because, a food bolus is present in the colon and glandular cells are present in the epithelium of the caeca. The basophilic zone within the vacuolated cells of the stomach wall is also suggestive, that some kind of active synthesis is taking place in the epithelium of the stomach.

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