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## Histomorphology of the ventral nervous system of *Spodoptera litura*

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### Abstract

In the present study an investigational work was performed to find out the presence of neurosecretory cells in the ventral nerve cord of *Spodoptera litura*. The Insect Ringer solution was used for dissection. Specimens were kept in ringer solution and dissected out. A diluted solution of methylene blue was used for staining. Aqueous Bouin's fixative was used for fixing specimens heads. After fixation heads were cut into sections ranges from 6  $\mu$  to 10  $\mu$  and stained by stained aldehyde fuchsin. 'B' and 'C' type of neurosecretory cells was observed in the ventral nerve cord of *Spodoptera litura* but 'A' and 'D' type of cells were absent in the ventral nerve cord of *Spodoptera litura*. Information regarding the size, shape and distribution of 'B' and 'C' type of cells is provided in detail.

**Keywords:** *Spodoptera litura*, Nervous System, Neurosecretory Cells.

### 1. Introduction

The presence of neurosecretory cell in ventral ganglia of a Caterpillar of moth, *Eacles imperialis* was observed. The presence of secretory products in the neurosecretory cells of suboesophageal ganglion of *Ephestia Kuehniella* was also reported. The presence of neurosecretory cells in other suboesophageal ganglion has also been observed in silkworm moth. Arvy *et al* <sup>[1]</sup> and Hasegawa <sup>[2]</sup> showed the presence of neurosecretory cells in the suboesophageal ganglion of silkworm moth *Bombyx mori*. The possible functions and histology of the neurosecretory cells in the Ventral ganglia was studied by Delphin <sup>[3]</sup> in *Schistocerca gregaria*. The presence of neurosecretory cells of the ventral ganglia have also been studied in different insects species such as *Locusta migratoria*, <sup>[4]</sup> *Schizodactylus monstrosus* <sup>[5]</sup>.

Histologically thirteen different types of neurosecretory cells have been observed in the ventral ganglia of the beetle *Blaps mucronata* <sup>[6]</sup>. This is an example of the largest number of neurosecretory cells so far reported from an insect.

The presence of hormonal system in the ventral nerve cord tissue and ganglia have been noted by Gersch <sup>[7]</sup> in various insects. Geldiay <sup>[8]</sup> had observed the secretory products of neurosecretory cells in ventral ganglia of *Blaberus craniifer*.

The presence of neurosecretory cells of the ventral ganglia have also been studied by Chalaya <sup>[4]</sup> in *Locusta migratoria*. Awad <sup>[9]</sup> in *Heliothis armigera* and Gandal <sup>[10]</sup> in *Achoea janata* have reported the histochemical nature of neurosecretory cells in ventral ganglia.

In the present study an attempt has been made to make out the presence of neurosecretory cells in the ventral nerve cord of *Spodoptera litura*.

### 2. Material and Methods

Specimens were dissected out in insect Ringer solution and stained in a diluted solution of methylene blue. Heads were fixed in aqueous Bouin's fixative. Sections were cut at 6  $\mu$  to 10  $\mu$  and stained by stained aldehyde fuchsin.

### 3. Observations

**3.1 Histomorphology of ventral nerve cords:** The presence of 'B' and 'C' types of neurosecretory cells has been noted in the different ganglia of the ventral nerve cord. They have been described in detail, with their distribution and measurements.

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### 3.2 Neurosecretory cells in suboesophageal ganglion

'A' and 'D' type of cells are absent, in the suboesophageal ganglion, however 'B' and 'C' cells are observed, 'B' cells are elliptical in shape, the cytoplasmic inclusions stained bluish green with aldehyde fuchsin (AF). They measure  $12 \pm 0.5 \mu$  in cellular diameter, located anterior medially and then their nuclear diameter is  $4.5 \pm 0.5 \mu$ , 'B' cells are 3 to 4 in number, 'C' cells vary in number and position, measuring  $9.0 \pm 1.5 \mu$  in cellular diameter and  $2.5 \pm 1.5$  in nuclear diameter. They are 2 to 3 in number, smaller than 'B' cells and generally seen in the corners of the ganglia.

### 3.3 Neurosecretory cells in Prothoracic ganglia

The Prothoracic ganglion has no 'A' and 'D' types of cells, only 'B' and 'C' types of cells are present. They are spherical in shape and their cytoplasmic inclusions purple with aldehyde fuchsin, 'B' cells measures about  $11 \pm 1.5 \mu$  and in nuclear diameter  $4.0 \pm 0.6 \mu$  in nuclear diameter. 'C' cells measures in cellular diameter  $8.0 \pm 0.5 \mu$  and in nuclear diameter  $2.5 \pm 1.0 \mu$ . The number of 'B' cells is 1 to 2 and 3 to 4 'C' cells are noted.

### 3.4 Neurosecretory Cells in Meso and Metathoracic ganglion:

The neurosecretory cells in the thoracic ganglion never been noticed in the central part. The location and distribution of neurosecretory cells are the same as the prothoracic ganglion. 'A' and 'D' cells are also absent and cell group comprises only 'B' and 'C'. The 'B' cell  $9 \pm 0.7 \mu$  in diameter and nuclear diameter is  $4.0 \pm 0.6 \mu$  and for 'C' cells  $9.5 \pm 1.5 \mu$  and  $2.0 \pm 0.5 \mu$ . The numbers of 'B' and 'C' cells are 1 to 2. They stained purple with AF.

### 3.5 Neurosecretory cells in abdominal ganglion

The distribution and arrangement of neurosecretory cells in nervous regions are similar in all the abdominal ganglion. In the last abdominal ganglia the number of cells is more 'A' and 'D' type of cells are absent in abdominal ganglia. 'B' and 'C' type of cells are found in all the abdominal ganglia. These cells are identical to the cells of thoracic ganglia. 'B' cells measure  $9.0 \pm 0.6 \mu$  in diameter. The 'C' cells measure  $4.0 \pm 1.6 \mu$  in diameter and nuclear diameter  $2.5 \pm 1.3 \mu$ . 'B' cells are more in number than 'C' (B cells 3-4, C cells 1-2). They stain purple with aldehyde fuchsin. The last abdominal ganglion is situated in the 7th segment of the abdomen. The 'A' and 'D' type of cells are also absent in this ganglion, but 'B' and 'C' type of neurosecretory cells is similar as seen in other anterior abdominal ganglion.

## 4. Discussion

The ventral nervous system in *Spodoptera litura* consists of the post oral series of segmental ganglia and their connectives. The ventral nerve cord starts with the tritocerebral part of the brain and includes the ganglia of mandibular, maxillary and labial segments which are fused to form suboesophageal ganglion. The ventral nerve cord comes out from the head capsule and runs posteriorly in midventral line with ganglionic swellings in the thoracic and abdominal segments. Although the ganglia are segmentally arranged, they are found to be fused in some segments of the moth, to form a compound ganglionic mass which is comparable with the higher lepidopterons.

In *Spodoptera litura* there are only two thoracic ganglia, one prothoracic ganglia and other mesometathoracic ganglia,

which is compound thoracic ganglion formed by the fusion of ganglia of meso and meta thoracic segments keeping their own identity. In adult moth *Spodoptera litura* in abdomen there are four ganglia, first three situated in 2nd, and 5th abdominal segments, while the last abdominal ganglion is situated in the 7th abdominal segment. This type of arrangement has also been reported in other lepidopteran insects like Bombyx mori and *Hyalophora cecropia* [12].

The histological details of ventral nervous system in *Spodoptera litura* shows the same basic units as seen in higher pterygote insects 13-14. The neuropile which is the central core is ultimately covered by thin glial cells. The perilemma forms the outer covering of the ventral nerve cord and is made up of fibrous neural lamella and cellular perineum.

Day 15 reported for the first time, the presence of neurosecretory cells in the ventral nerve cord of ganglia of insects and could be called pioneers in this field. Since then a number of workers have studied the histological aspects of the ventral nerve cord Hinks 16 during his observations on lepidopteran insects did not find any neurosecretory cell in the sub-oesophageal and thoracic ganglia.

In moth *Spodoptera litura* a large number of neurosecretory cells are observed in the sub-oesophageal and ventral ganglia. In this moth only 'B' and 'C' type of neurosecretory cells are present in the sub-oesophageal ganglion, thoracic ganglion and abdominal ganglion.

The study of diversity of cell types in Lepidoptera given by Delphin 3 and Hinks 16 were taken into consideration while studying the neurosecretory cells in *Spodoptera litura*. The 'A' cells are not found in any other ganglia, except brain in *Spodoptera litura*. The 'B' and 'C' cells are observed in this moth and no consistency in number and position has been observed. Similar results have been observed by Fraser 17 in *Lucilia caesar*, Delphin 3 in *Schistocerca gregaria* and Fletcher 6 in *Blaps mucronata*. The cells of ventral ganglia 1 of *Spodoptera litura* are largest neurosecretory cells among all the groups. The staining reactions of 'B' and 'C' cells are similar but, they can easily be detected and differentiated on the basis of their cell size. The 'C' cells can be compared with those described by Johanson 18 in *oncopeletus*, Fuller 19 in *Blattiden*, Raabe 20 in *Clitellus extradenctatus* and Fletcher 6 in *Blaps mucronata*. During the present study of histology it is noted that the cell types in the various parts of ventral ganglia are identical.

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