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Histological investigation on the neurosecretory cells in Brain, Thoracic and abdominal ganglia of a grasshopper *Hieroglyphus banian* (Orthoptera: acrididae)

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Abstract : Grasshopper (*Hieroglyphus banian*), an orthopteran species is considered to be a serious pest of rice plant in India. The biology an life cycle of this pest is largely goverened by the type of neuroendocrine system as well as the neurosecretory cells responsible for secretion of important neurosecretory materials & hormones.

In the present investigations 3 types of NSC have been found to exist in different ganglionic mass & the brain. These types I,II and III have been identified on the basis of their specific staining reactions and cellular morphology.

Key words: Neurosecretory cells, subtypes, staining reactions, grasshopper (*Hieroglyphus banian*).

INTRODUCTION

The neurosecretory cells (NSC) of insect were 1st described in the pars intercerebralis of the honeybee *Apis mellifera* Weyer in 1935[1]. However, the study of insect neurosecretion progressed slowly during the years 1930-1950,[2] intensified only after the introduction of Gomori's methods in 1950[3] i.e., Gomori's chrome hematoxylin stain by Bargman (1949). A paraldehyde fuchsin by Gabe (1953,)[4]. NSC have been described in many groups of insects, but most of the observation have been made on the brain, sub-oesophageal and frontal ganglia and corpora cardiaca.

The neurosecretory cells (NCS) of the ventral nerve cord ganglia consisting of the NSCS of the suboesophageal (SOG), thoracic (TG) and abdominal ganglia (AG). A brain form are rich and diversified system and widely dispersed than brain cells. The nerve cells with secretory activities shown by specific staining techniques Gomori (1950)[3]; Dogra & Tandon (1964)[5], Delphin, (1965)[6] are called "neurosecretion cells". Neurosecretory cells are identified in various parts of the central nervous system Arvy and Gabe (1962)[7]. The NSCs are in 2 distinct groups – the 1st group is the median neurosecretory cells. The axons of the cells leave the median group together as 2 axons clusters, they pass the brain transversely cross each other in it & leave the brain as nervi corporis cardiac & enter the anterior corpora cardiaca (Strong, 1965[8]; Dogra, 1967[9]; Peacock & Anstee, 1977[10]; Khan *et.al.*, 1984[11]). The other group is called lateral NSCs.

Bodenstein (1953)[12] in his work on *Periplaneta* suggested the existence of a specific interaction of the corpora cardiaca with the prothoracic gland causing the maintenance and activity of the latter. He showed that removal of the corpora allata and the retention of the corpora cardiaca would help to maintain the prothoracic glands in the adult insect. But Wigglesworth (1954)[13], in

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his study of the breakdown of the thoracic glands in adult *Rhodnius,* showed that transplantation of the corpus cardiacum will not help to prevent the breakdown of the glands.

The suboesophageal ganglia is located in the ventro-posterior part of the brain & connected to the brain by a pair of connectives. Corpora cardiaca are located ventro posterior to the brain and the hypocereberal ganglia. Another endocrine gland corpora allata are connected to the corpora cardiaca by a pair of nerves nervi corporis allati-I and to the suboesophageal ganglia by another pair (Hoffman, 1970[14]; Peacock & Anstee, 1977[10]; Ozluk, 1991[15]) has pointed out that the corpora cardiaca consistof nervous and osmiophil cells.

MATERIALS AND METHOS

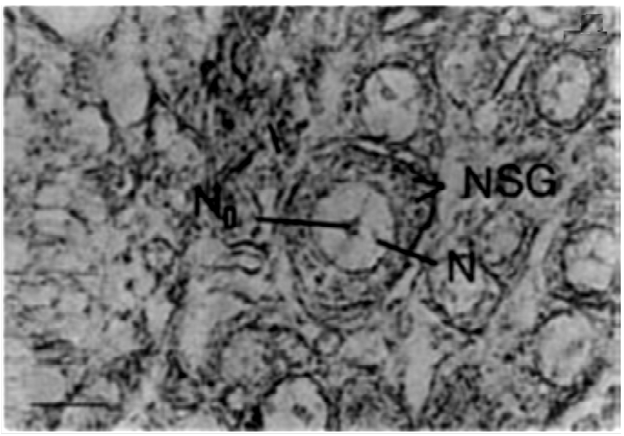
Hieroglyphus was collected from the field. The brain was fixed in a solution of 4% formaldehyde in insect saline solution (Ephrussi & Beadle, 1939). Brain, thoracic and abdominal ganglia were dissected out from adult animals into physiological saline solution and fixed in Bouin's solution & embedded in paraffin and sectioned at 7 m. Serial sections were stained with paraldehyde fuchsin (Gomori, 1950)[3], as modified by Halmi (1952) and Daveson (1953). The dissecting sections were examined by M.S.Z. stereoscopic binocular microscope.

RESULTS AND DISCUSSION

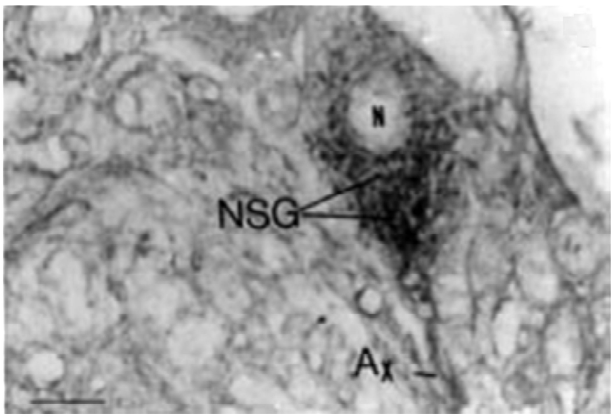
The brain of *H.banian* consists of 3 parts- Protocerebrum, deutocerebrum and tritocerebrum, corpora cardiaca and corpora allata are present in the part where oesophagus enters the brain. The corpora cardiaca are elongated structure lying ventral to the brain and dorsal to the oesophagus. 3 types of neurosecretory cells has been

Table 1: Histological properties of neurosecretory cells found in the thoracic and abdominal ganglion of *H.banian*.

Type of NSCs	Cell dia. (µm)	Nuclear dia (µm)	Staining affinity	Cell shape
A	24.6 – 20.8	11.1 – 8.7	Deep purple	
B	29.7 – 24.7	14.6 – 11.9	Light pink	
C	39.1 – 28.7	14.6 – 11.5	Deep purple	



Photograph . 2. Section of the mesothoracic ganglion, showing B-type neurosecretory cell (oblong), stained with PAF. Nucleus (N), Nucleolus (No), Neurosecretory granules (NSG). Bar:10µm.



Photograph . 1. Section of the third abdominal ganglion, showing A-type (oval) neurosecretory cell, stained with PAF. Nucleus (N), Neurosecretory granules (NSG), Axon (Ax). Bar: 10µm.

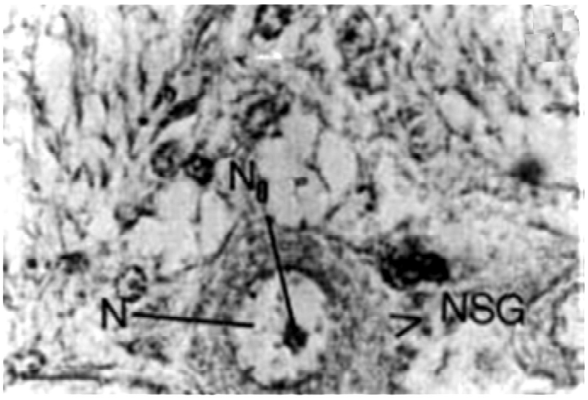


Fig. 3. Section of the fourth abdominal ganglion, showing B-type (oblong) neurosecretory cell, stained with Azan. Nucleus (N), Nucleolus (No), Neurosecretory granules (NSG). Bar: 10µm.

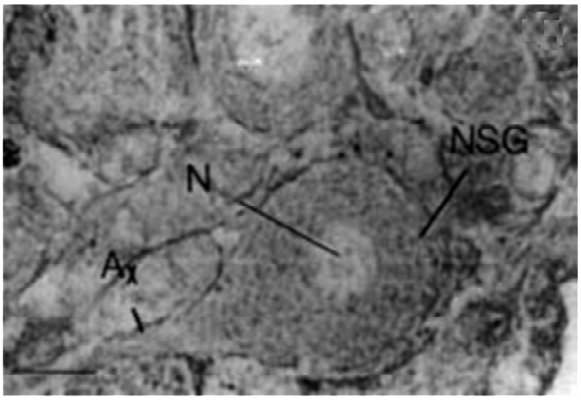


Fig. 4. Section of the last abdominal ganglion, showing C-type (spherical) neurosecretory cell, stained with PAF. Nucleus (N), Neurosecretory granules (NSG), Axon (Ax). Bar: 10µm.

found. These are as per their staining property (Table).

Type-A Neurosecretory cells

Secretory granules in the cytoplasm of the Type-I NSC stained deep purple with PAF and also observed the granules along the axons. Neurosecretory cells were found in pairs in metathoracic and in all abdominal ganglia except in the last abdominal ganglion of *H.banian.* The average cell and nuclear diameter of this type of cells were measured to be 24.6-20.8 µm, 11.1-8.7 µm respectively.

Type-B Neurosecretory cells

Type-B NSC in the ganglia of *H.banian* were PAF (-)ve and stained light pink granules. These cells were present in peripheral regions in the all thoracic and abdominal ganglia of Hieroglyphus. Diameter of these cells were measured to the 29.7-24.7 µ m and the nuclear diameter were 14.6-11.9 µ m.

Type-C Neurosecretory cells

These NSC have very small granules distributed uniformly within the cell body which stained deep purple with PAF. The cell bodies of this type of NSC were measured in their avg. diameter to be 39.1-28.7 µm & nuclear diameter 14.6-11.5 µ m. These were the most common large NSC and were observed in the all thoracic and abdominal ganglia and were distributed throughout the periphery of each ganglia.

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