



Identification of salivary glands of Indian water scorpion *Laccotrephes maculatus* Fabr. (Hemiptera, Heteroptera: Nepidae)

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Abstract

Water scorpion, *Laccotrephes maculatus* Fabr. is unisexual and exhibits sexual dimorphism. The males are relatively smaller with conspicuous commexival spines and posses' distinct external genitalia. The male reproductive organs include a pair of testes, a pair of vasa deferentia, a pair of vesicula seminalis, two pairs of accessory glands and unpaired median ductus ejaculatorious. The female reproductive organs possess a pair of ovaries, a pair of lateral oviducts, a common oviductus communis, a vagina and he spermatheca. Water scorpion, *Laccotrephes maculatus* Fabr. possesses a pair of salivary reservoirs (SR) associated one, with each main salivary gland (MSG). Each salivary reservoir is a white, elongated sac like structure at the posterior end of which is produced into a narrow-closed tubule. The intimal cuticular lining of the reservoir is very thin. The reservoir often collapses on being empty due to the extreme thickness of its inner lining. The epithelial layer of the reservoir does not show any secretory activity which suggests that it is concerned with the storage of the saliva only. The epithelial layer of the reservoir, close to its junction with the duct consists of tall columnar cells, with distinctly visible nuclei.

Keywords: Salivary apparatus, main salivary gland, accessory salivary gland, salivary vesicle

Introduction

The salivary gland of *Hemiptera* has been described in a very large number of forms and their structure and disposition have first studied by Dufour (1833) ^[1]. Their physiology has been worked out by many workers (Nuorteva 1956 ^[6], Miles 1959 ^[5] and Saxena 1954 ^[8]). These studies show wide variation irrespective of the position, size and to some extent even in the histology, but the structure of salivary glands of *Hemiptera* are somewhat constant at infrafamilial levels (Southwood, 1955) ^[9] and *Heteroptera* falls in 2 types Pentatomomorpha and Cimicomorpha (Leston *et al.* 1954) ^[4]. In view of this *Laccotrephes maculatus* Fabr. common Indian water scorpion was selected for the present studies on salivary glands.

Material and methods

Large number of water scorpion, *Laccotrephes maculatus* Fabr. were collected from ditches, ponds etc. and kept in the laboratory. Freshly killed water scorpions were dissected out and salivary gland were fixed in Bouin's fluid fixative along with accessory duct to facilitate preparation of paraffin blocks. Staining with Ehrlich's hematoxylin and 2% alcoholic eosin proved to be fairly satisfactory. The diagrams have been drawn with the help of camera Lucida.

Observation and discussion

1. Salivary apparatus (Pl. I)

The salivary apparatus of water scorpion *Laccotrephes maculatus* Fabr. is situated below the hypopharynx in between the hypopharyngeal wings, it consists of a piston, piston roll, afferent duct, efferent duct and a two layered salivary pump. The salivary pump is a cylindrical vesicle like structure, consisting of an outer. The outer layer is folded on its inner side and forms the piston with which is attached a short piston rod. A pair of muscles arises from

the hypopharyngeal wings and become inserted on the piston. A pair of afferent ducts, extending one on each salivary duct opens into the cavity of salivary pump.

The efferent duct is formed by the anterior prolongation of the outer wall of the pump. The opening of the efferent duct is more complex than that of the afferent duct.

The alternate contraction and relaxation of the piston brings about the action of the salivary syringe. The pressure inside the pump decreases due to the withdrawal of the piston. It results in the collapse of the membranous roof of the efferent duct due to which the flow of the saliva in the backward direction is prevented. The salivary secretion is drawn into the pump through the afferent opening due to the lowering of the pressure at this time.

2. Main salivary gland

The main salivary gland (MSG) consists of a pair of a long glandular mulberry like elongated structured, found one on each side of the foregut in the region of the thorax and the first two abdominal segments. It is bounded by numerous highly branched trachea with the anterior region of the alimentary canal. Each gland consists of a large number of a small rounded lobes or acini (AC) which are arranged around a central axis. The acini are smaller towards the proximal and distal ends but larger in the middle giving a mulberry fruit like appearance to the gland. Each acinus is a hollow flask shaped structure that opens into the central canal of the gland by a short duct.

2.1 Histology (Pl. II)

The transverse section of the main salivary gland reveals that it consists of a large number of irregularly shape acini (AC) arranged around a central canal (CC). All acini directly open into the central canal. Each acinus is bounded by a syncytial

epithelium having many nuclei. The nuclei are oval in appearance and contain few chromatin granules. The external basement membrane is very distinct. The musculature is totally absent. The lumens of the acini are filled with the salivary secretion (SS).

3. Accessory salivary gland

The accessory salivary gland (ASG) closely resembles the main salivary gland (MSG) in its shape and structure except for the relatively smaller size. Like the main salivary gland (MSG) it also bears a large number of similar lobes or acini (AC). A few of the anterior acini open directly into the central duct. The duct of the accessory salivary gland (DASG) joins with the central canal of the main salivary gland (DMSG) in between the two salivary vesicles (SV). The accessory salivary glands are relatively much smaller in size than the main salivary gland (MSG) and bears similar type of acini or lobes around the central axis. The acini give off very minute cuticular canals which open into the lumen of the central duct. The acini of the accessory salivary glands possess a thick layer of *syncytial epithelium* (AP) with a few oval nuclei and granular cytoplasm. The *epithelium* forming the inner lining of the duct of the accessory salivary gland is produced into numerous distinct longitudinal folds.

4. Salivary vesicle (Pl. I)

The central canal (CC) after emerging from main salivary gland anteriorly receives two small ducts from a pair of small thin walled, glistening white, bulbous structure, the salivary vesicles (SV). The salivary vesicles are situated just in front of the main salivary gland (MSG) and may be regarded highly specialized enlarged anterior most acini of the gland proper. The epithelial layer of the salivary vesicles exhibits secretory epithelial layer like that of acini. The lumen of the salivary vesicles is seen filled with milky white blue. A well developed valve is present at the opening of the salivary vesicles into the small duct which opens into the central canal of the main gland. The presence of a milky white secretion in the vesicle and a valve to regulate the flow of secretion

at its opening into the small duct suggest that these vesicles provide some special type of secretion that mixes with the saliva. Presswalla and George (1936)^[7], Hamilton (1931)^[2] and Kaushik (1971)^[3] have reported the presence of such type of vesicle in *Sphaerodema rusticum* Fabr., *Nepa cinerea* Linn. and *Belostoma indicum* Lep. and Serv. respectively.

4.1 Histology (Pl. II)

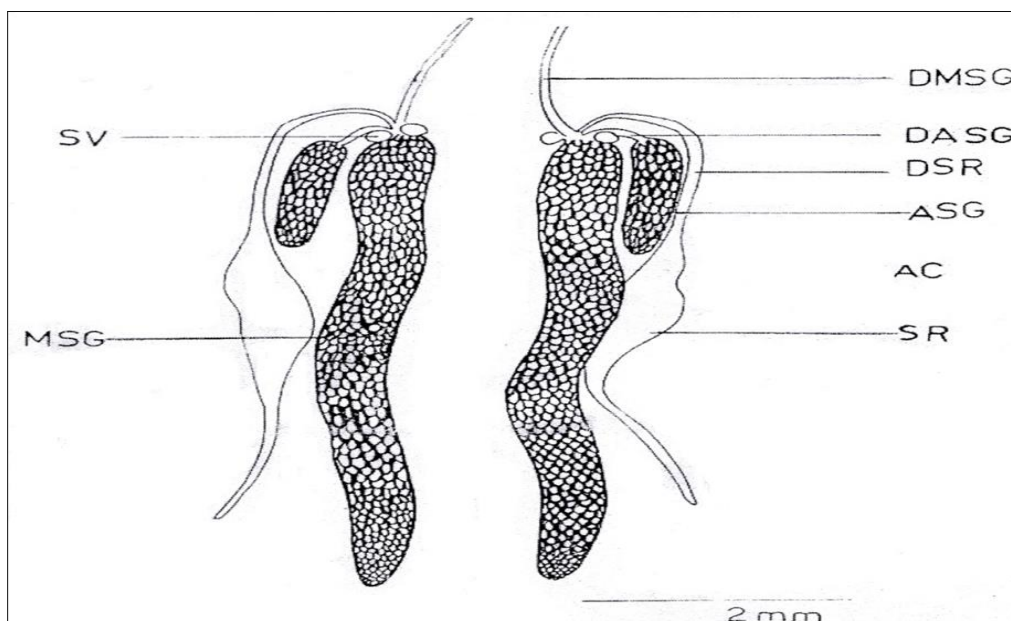
The histology studies of salivary vesicles of water scorpion *Laccotrephes maculatus* Fabr. reveals that it consists of a thin layer of *syncytial epithelium* (EP) which is produced into numerous small spherical localized vesicles like structures which have been attributed secretory epithelium. The cytoplasm is richly granulated with several small haphazardly distributed minute nuclei.

The central canal of the main salivary gland receives a pair of ducts (DSV) from the salivary vesicles, a duct (DASG) from the accessory salivary gland and a duct (DSR) from the salivary reservoir and then extends as the main duct (MSGD) of the salivary gland which extends anteriorly and opens into a salivary syringe. The main salivary duct consists of a layer of multinucleated syncytial epithelium having granular cytoplasm with scattered distinct nuclei. The basement membrane and intimal lining are quite thick.

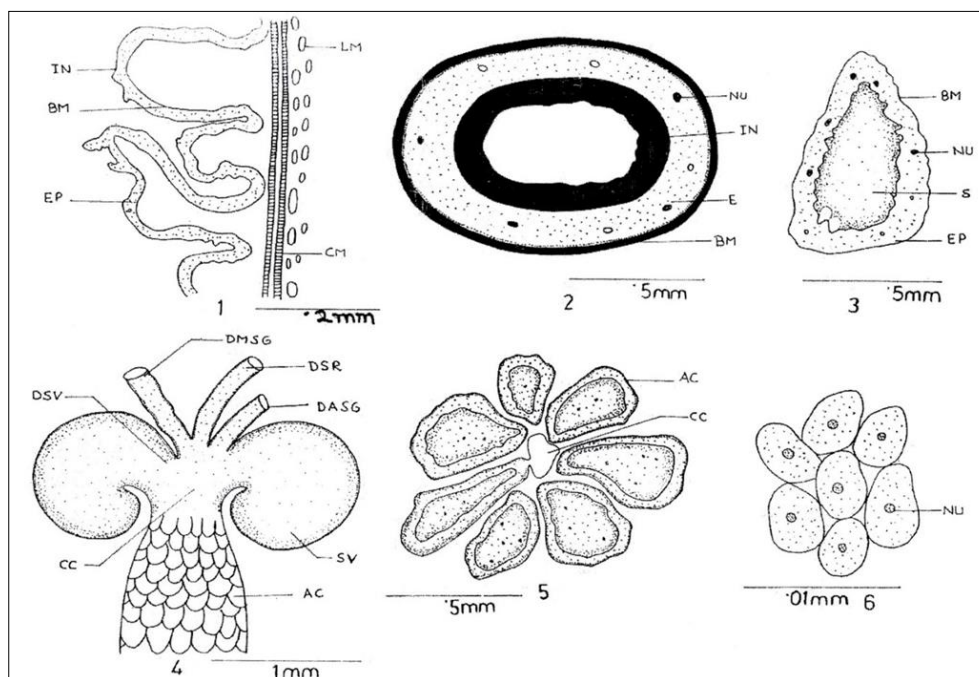
5. Salivary reservoir (Pl. II)

The water scorpion, *Laccotrephes maculatus* Fabr. possesses a pair of salivary reservoirs (SR) associated one, with each main salivary gland (MSG). Each salivary reservoir is a white, elongated sac like structure at the posterior end of which is produced into a narrow-closed tubule. The intimal cuticular lining of the reservoir is very thin.

The reservoir often collapses on being empty due to the extreme thickness of its inner lining. The epithelial layer of the reservoir does not show any secretory activity which suggests that it is concerned with the storage of the saliva only. The epithelial layer of the reservoir, close to its junction with the duct consists of tall columnar cells, with distinctly visible nuclei.



Salivary apparatus (Pl. I)



Histology of salivary gland (Pl. I I)

Abbreviation: AC - Acini; CC - Central canal; SS - Salivary secretion; ASG - Accessory salivary gland; MSG - Main salivary gland; DASG - Duct of the accessory salivary gland; SV - Salivary vesicles; DMSG - Central canal of the main salivary gland; DSV - Duct from the salivary vesicles; DSR - Duct from the salivary reservoir; MSGD - Main duct of the salivary gland; SR - salivary reservoir.

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