

ELEMENTS OF ANATOMY (NERVOUS SYSTEM) AT *MYZUS SPECIES* SULZ. SPECIES (HOMOPTERA: APHIDIDAE)

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Key words: *Myzus persicae*, sexuparae, nervous system, protocerebrum, deutocerebrum, tritocerebrum, optic lobes, subesophageal ganglion, ventral ganglionic chain

INTRODUCTION

The first anatomical study on aphids was carried out by Antonio van Leeuwenhoek (1696). Among those that carried out numerous dissections on aphids for to clarify some anatomical aspects we mention: Buckton, 1876; Mordvilko, 1895; Snodgrass, 1935; Börner, 1938, 1949, 1952; Svanvici, 1949; Ponsen, 1972; Dixon, 1975; Kunkel & Kloft, 1977, etc. The largest study of the kind was made by Roberti in 1946. He presented the morphology, the anatomy and the histology at *Aphis frangulae* Kalt. The illustration is done through black and white drawings. Ponsen (1987) presented the anatomy and physiology of the alimentary tract at some aphids.

Anatomically, aphids have very complicated organization if we consider the systematic position of these species.

By series of cross and longitudinal sections we managed to distinguish histo-anatomical elements that belong to the digestive apparatus, muscle, nervous, respiratory, glandular and reproduction systems and also of some structures like: dorsal vessel, adipose tissue, etc.

We present in this paper aspects of the nervous system at sexuparae of *Myzus persicae* Sulz.

MATERIAL AND METHOD

The sections necessary explaining some anatomical elements at aphids were obtained after sectioning some blocks of paraffin in which sexuparae of *Myzus persicae* Sulz. were previously included.

The biological material was placed in Bouin's fixative. Following fixation, aphids were washed in 70% ethanol, then dehydrated in an ethanol series (80%, 90%, 95% and absolute ethanol), transferred to xylene, and embedded in paraffin. Embedded aphids were sectioned on a rotary microtome at 10-12 μ m. Sections were mounted on Mayer's albumin-coated slides, dried, and deparaffinized. Mounted sections were clarified and deparaffinized in 3 changes of xylene, transferred through two changes of absolute ethanol and rehydrated through a series of ethanol solutions (95%, 80%, 70% and 50%). Sections were stained with Erlich's hematoxylin, eosin and Carazzi's hematoxylin and examined with a Nikon microscope.

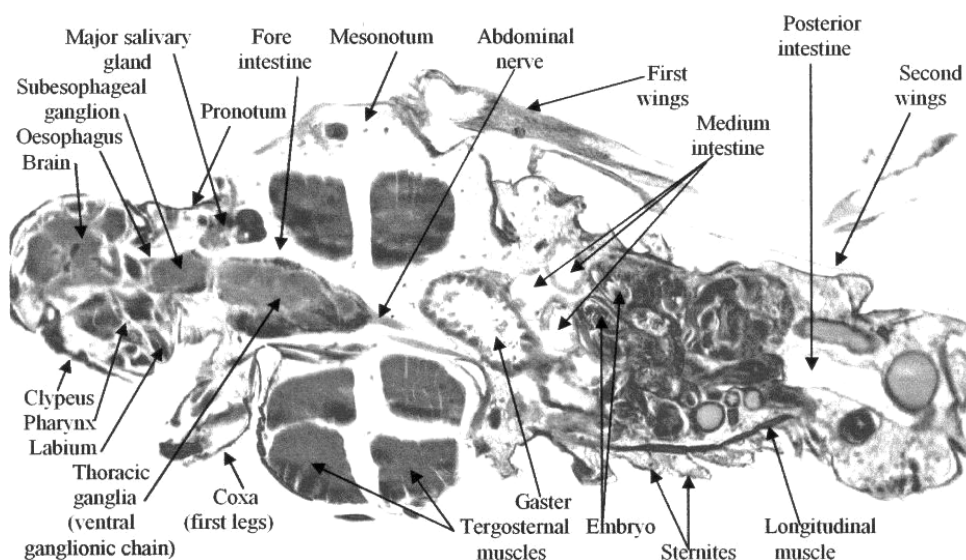


Fig. 1. Longitudinal section through the body of one sexuparae of *Myzus persicae* Sulz.

RESULTS AND DISCUSSIONS

The nervous system at aphids is organized in a very complex way and we can describe a central nervous system and a visceral nervous system. The central nervous system includes the brain, the subesophageal ganglion and the ventral ganglionic chain (Fig. 1). The visceral nervous system or stomatogastric nervous system is simpler, consisting in the frontal ganglion, the recurrent nerve and the hypocerebral ganglion. Short and thin nerves go out

from different places of the visceral nervous system and send their terminations to the dilatatory muscle of the pharynx and the fore intestine.

The brain. It is composed of protocerebrum, deutocerebrum and tritocerebrum (Fig. 2). It is very developed and occupies almost entire cavity of the head. It has oblong-globular shape and it stretches from a part to the other of the head, between the eyes and downward, in the oral cavity.

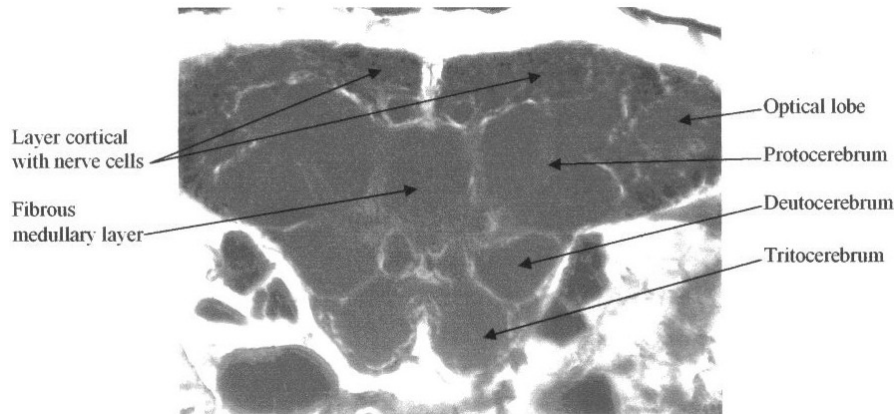


Fig. 2. Detail at the level of the brain

The protocerebrum is the most voluminous region and lies in the uppermost part of the brain (Fig. 2). It has on lateral sides two optic lobes (Fig. 3). The central part has a little sinuous margin with a median invagination. The protocerebrum also has three small lobes on which are inserted the short

nerves of the lateral ocelli and the nerve of the median ocellus. The optic lobes are two big latero-posterior prolongs from the central part of the protocerebrum. From the lateral part of each lobe depart the short optic nerve (Fig. 3) which is divided into numerous elements that form the compound eye.

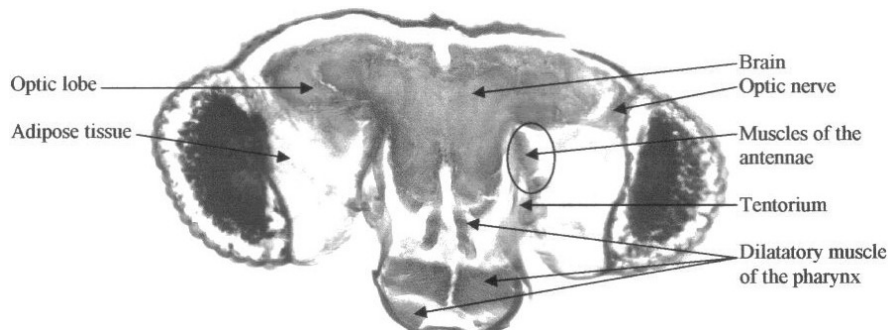


Fig. 3. Cross section at the level of the clypeus

The deutocerebrum lies under the protocerebrum (Fig. 2). It is more developed in the anterior part and narrower in the lower-rear part neighboring tritocerebrum. Anterior margin is a little sinuous. From the deutocerebrum departs the antennal nerve that goes forwards to the lateral sides of the head; it comes into the antennae and is divided into numerous secondary branches which innervate the muscle of the antennae. The main branch continues into the second article and sends its endings to the sensillae.

The tritocerebrum is the part inferior of the brain and it is positioned under the deutocerebrum (Fig. 2). It is divided into two lobes that get into the oral cavity, extending on the lateral sides of the double series of dilatatory muscle of the pharynx. The lobes of the tritocerebrum are separated except

the bottom where they are connected into a short and transversal commissure which prolongs upwards into the frontal ganglion. Two nerves (the labral nerves) depart from the inferior extremity of the tritocerebrum, one on each lobe and finish in the labral or oral ganglion within a short distance.

The oral ganglion is positioned under the anterior and median part of the clypeus and it is divided in two small lateral lobes which are positioned externally to the dilatatory muscle of the pharynx in its superior part and they are connected into a single aggregation in the superior part.

The subesophageal ganglion (Fig. 1, 4). It is connected to the brain through two anterior extensions (connectives). It has an anterior part a little narrower than the posterior one and it is as long as its maximum width. It is positioned in the cephalic

capsule and in the pronotum under the oesophagus and the anterior part of the salivary glands. The ganglion has two medial-longitudinal light

concavities, one dorsal and one ventral. In the dorsal concavity is the oesophagus and in the ventral concavity is the salivary canal.

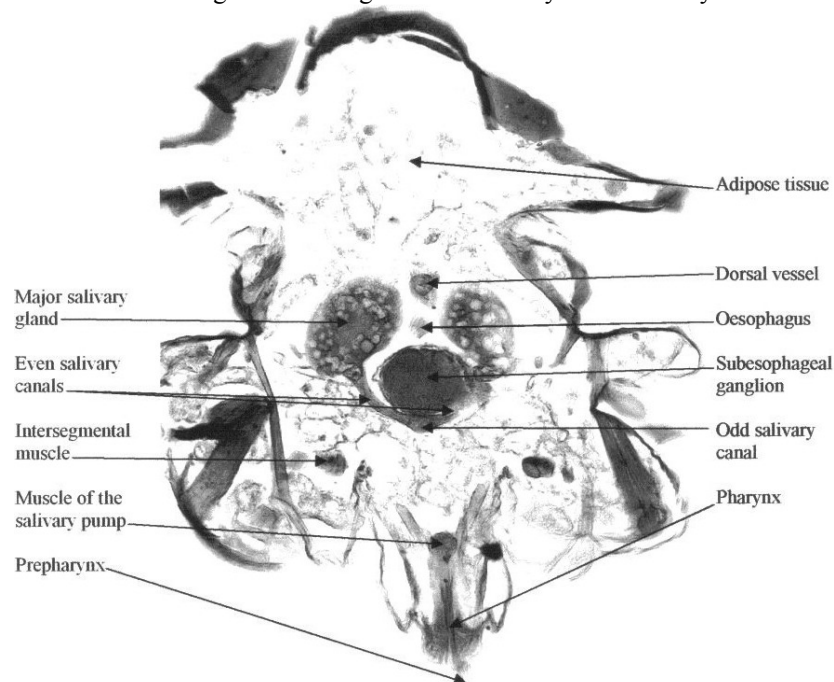


Fig. 4. Cross section at the level of the inferior part of the maxilla

The ventral ganglionic chain (the thoracic ganglia) (Fig. 1, 5). It is composed from ganglia that are merged into a single aggregation. It is positioned in pronotum and mesonotum, under the salivary glands and the oesophagus and it ends before mesothorax. The ventral ganglionic chain is connected through a fascicle of connective nervous fibers to the subesophageal ganglion. The two canals of the salivary glands pass through the narrow space that exists on both sides of this connective and they connect under the subesophageal ganglion into a small canal. The ventral ganglionic chain is wider

and higher in the anterior part and it decreases gradually at the rear part. It is prolonged posteriorly into the abdominal nerve (Fig. 1) which goes under the intestine and arrives at the extremity of the gaster. The abdominal nerve is very long and grows thin towards its final part and it sends numerous and very thin branches to the lateral sides of the gaster and finishes into several nervous branches that innervate vagina. Various nerves like pedal and alar nerves depart from the ventral ganglionic chain and go to the muscle of legs and wings. The nerves are finished into a terminal nervous plate at the level of the muscle (Fig. 6).

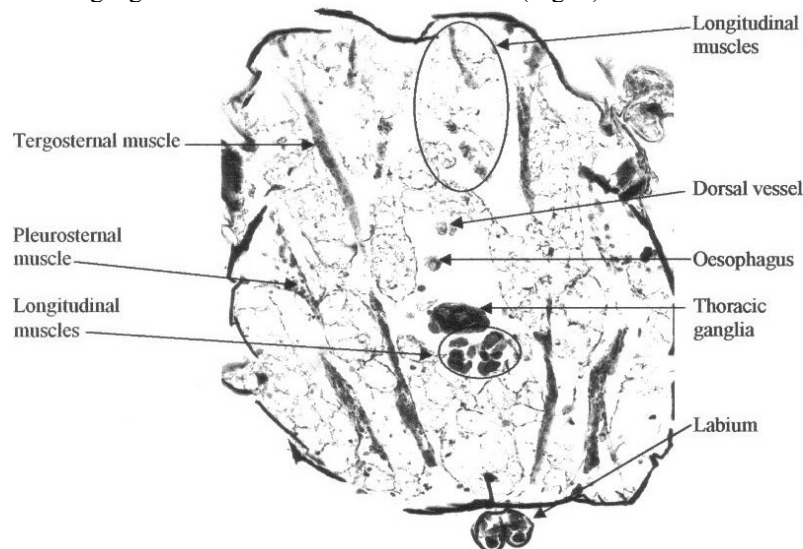


Fig. 5. Cross section at the level of the mesonot

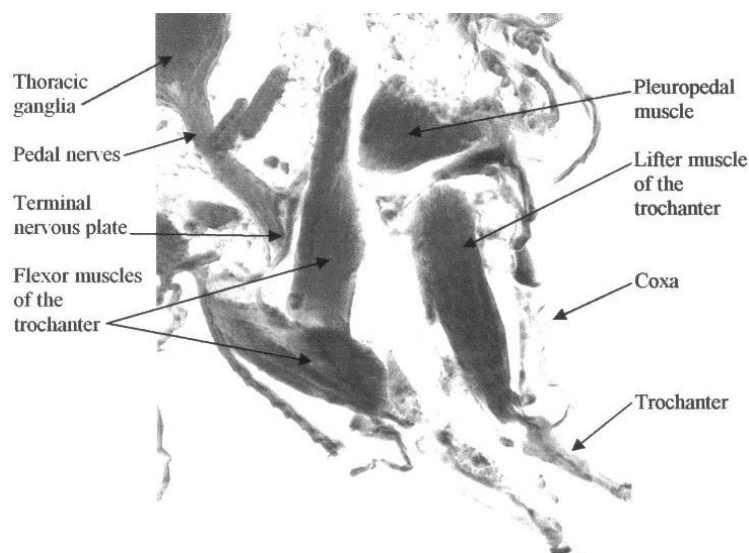


Fig. 6. Detail at the level of the first leg

CONCLUSIONS

The central nervous system of aphids appears in the sections we have done like a very well developed system. The brain and the subesophageal ganglion are the most voluminous organs in the cephalic cavity and pronotum. The ventral ganglionic chain is a voluminous organ, too and it occupies a large space in the anterior part of the mesonot.

We identified, located, described and illustrated the following nervous structures at sexuparae of *Myzus persicae* Sulz.: protocerebrum, deutocerebrum, tritocerebrum, optic lobes, oral ganglion, subesophageal ganglion, ventral ganglionic chain, nerves and nervous plates.

REZUMAT

Prin serii de secțiuni transversale și longitudinale, realizate pe sexupare de *Myzus persicae* Sulz. am reușit să evidențiem elemente histo-anatomice care aparțin sistemului muscular, sistemului nervos, aparatului digestiv, sistemului respirator, sistemului glandular și sistemului reproducător, dar și anumitor structuri ca: vasul dorsal, țesutul adipos, etc.

În această lucrare prezentăm câteva aspecte ale sistemului nervos. Am identificat, localizat, descris și

ilustrat creierul (protocerebrum, deutocerebrum, tritocerebrum, lobii optici), ganglionul bucal, ganglionul subesofagian, catena ganglionară ventrală și diferiți nervi.

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