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COMPARATIVE ANATOMICAL AND HISTOLOGICAL STUDY OF THE HEART OF FOUR SYRPHID SPECIES DIPTERA (SYRPHIDAE) IN IRAQ

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The paper deals with the anatomical and histological studies of the heart in larvae and adults of four syrphid species namely, *Lasiophthicus pyrastri* L., *Sphaerophoria scripat* L., *Syrphus corollae* F. and *Xanthogramma* sp. Structural differences of the dorsal vessel, particularly the heart chambers, ostia together with inner valves and the flap pads of the heart lumen have been described.

Key words: Syrphid, Taxonomy, Histology.

Introduction

It is evident from the literature that no work has been done on the anatomy and histology of heart in syrphid species. However, various workers have attempted similar studies in other insects including Diptera also such as on the larvae of Anopheles [1-3]. Ephemerid [4], *Chaoborus* [5,6] *Phormia regina* [7], *Stomoxys* [8], adults of *Drosiphila* [9], *Chironomus* [10] and *Musca* [11]. Thus the present study is the first attempt to provide a comparative account of the circulatory System of four species of the family Syrphidae.

Materials and Methods

Staining and dissecting techniques. (a) Larva. Third instar larvae were cleaned with tap water and placed on a block of ice or in a deep freezer for a few sec., then injected with methyleneblue into the haemocoel [12,13]. Ventrally in the posterior part of the abdomen with a microsyringe. The larvae were held between two fingers [14], while they were injected, then left for 30-45 mins. Some aphid were put in a petri-dish at 24 ± 1° and 65-68% R.H., for larval feeding. The larvae were dissected along the tergo-pleural junction [15] after which saline solution was added to the haemocoel [16]. The dorsal vessel was lifted up with very fine forceps after the removal of all tissues, and transferred to a drop of distilled water on a slide and examined.

Instant observation techniques. Uninjected individuals were used in this work [14]. Immediately after the removal of the sternum, a few drops of methylene blue diluted with an equal volume of saline solution were added to the haemocoel, then kept for 10 sec. and washed quickly with tap water and flooded with saline solution. This technique was found to be satisfactory for instant observation and for photography of the circulatory system and other tissues in their normal position inside the insect body. The same method was applied when the adults were dissected.

(b) Adult. The wings and legs of injected adults were taken off and the body was fixed on the tray with micropins under a binocular microscope. A ribbon of fine holes was made along the two sides of the abdominal sternum, then the sternum was removed. Few drops of saline solution [16] were added, after which the heart was picked up and immediately placed in a drop of distilled water on a slide for examination. Each side of the abdomen of a few individuals was out off, and the sternum peeled from posterior to anterior. The culture of flies were built up from the adults which were collected from aphid colonies on stone fruit trees and kept at 26±1° and 60-64% R.H. All measurements were taken with a graticule micrometer inserted in the eye piece of the microscope KYOWA x 40.

A cameralucida NMR-1 10x (Poland) was applied for drawing all figures. Dissection was carried out under a steroscopic binocular microscope type SEL-2 Ogawa Seiki (Japan). Identification of all specimens was done by British Museum (Asia 2342).

Results and Discussions

Structure of a circulatory system. (a) Larvae. The heart of *Lasiophthicus (Scaeva) pyrastri* has four pairs of ostia (Fig. 1, Asc.). The posterior dilated portion of the vessel forms a closed chamber. A constriction close to the ostia divides the heart cavity into four chambers. The valves are formed of two large lip-like shaped cells with prominant nuclei. The wall around wach opening is thick. Three pairs of flap pads were found in the heart lumen, which were in the wall of the 1st, 2nd and 3rd chambers and functioning as interventricular valves. The heart of *Syrphus corollae* is different from that of *L. pyrastri* as shown in Fig. 1 Asy.

The dorsal vessel has four pairs of ostia with four chambers which looked slightly shorter and wider than those of *L. pyrastri*. The valves are formed of two large cells with filamentous ends and prominant nuclei (Fig. 2A 1,2,3). The heart proper in this species appeared triangular in shape with pairs of ostia at the narrow end. The dorsal vessel of the larvae of

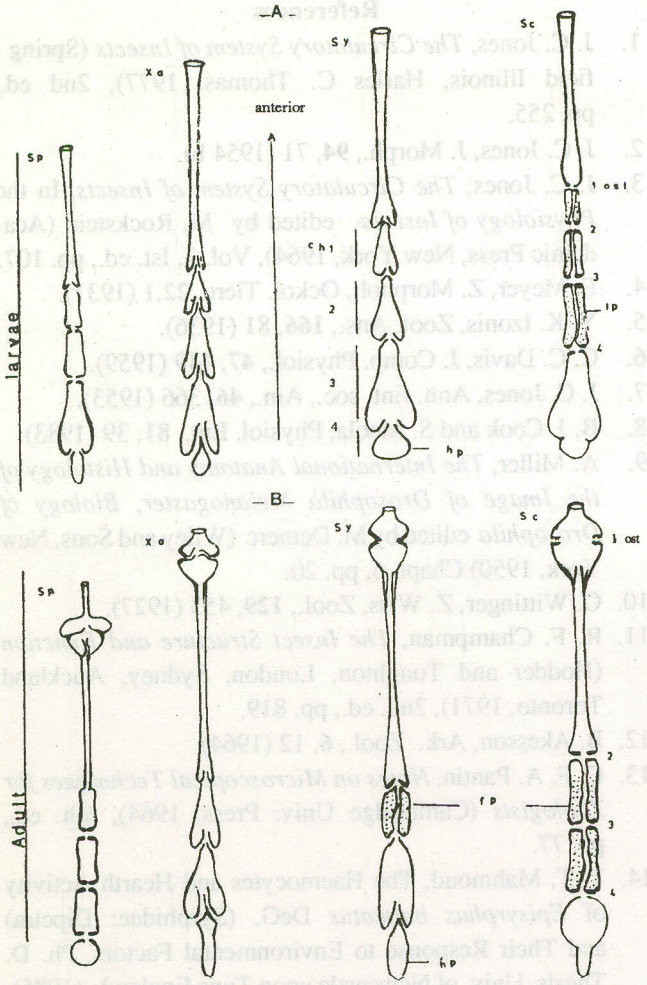

Fig. 1.

(A). The heart of 3rd instar larvae. (sp.). *Sphaerophoria scripta* L., (xa). *Xanthogramа* sp., (sy). *Syrphus corollae* F., (sc). *Lasiophthicus* (scaeva) *pyrastri* L.;

(B). The heart of adult for the above four species (fp). flap pad, (hp). heart proper, (ch). chamber, (ost). ostio

Xanthogramа is similar to that of *S. corollae*. The heart proper appears in pyriform shape. The structure of ostia was exactly like that of *S. corollae* but the filamentous ends join together forming an inner valve inside the heart lumen compared with the previous species (Fig. 1 Axa). *Sphaerophoria scripta* heart shows different appearance in general, the ostia without any filamentous (lip-like) ends exactly as that of the *L. pyrastri* ostia. The heart proper is characterized as finger-like. The heart has four ostia and consists of four chambers. The general form is like that of *S. corollae*, but very small in size and more confined. In all species tested the wall around each opening is thick. No inner valve was detected in the heart lumen, but the aorta included four single flap valves originating from the inner layer of the wall in *L. pyastri*, while two flaps were found in *S. scripta* and they were arranged in alternating positions half way between the first pairs of ostia and where the aorta passes through the cerebral ganglia.

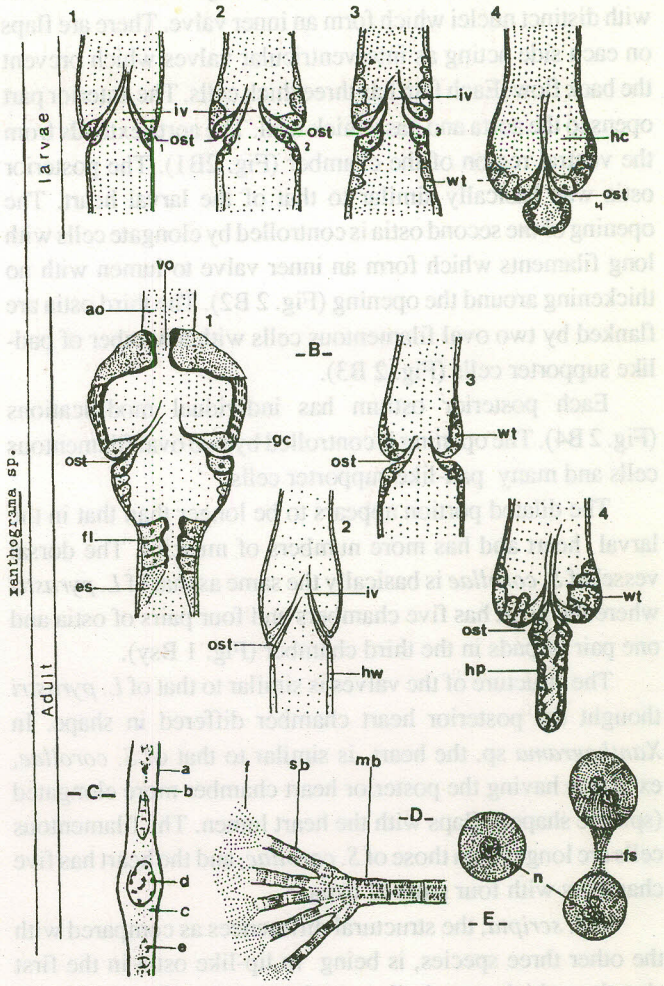

Fig. 2. Heart structure of syrphid group.

A. (1-4) Longitudinal section throughout the larval heart showing the structure of the ostia and inner valves; (hc). heart chamber; (ost). ostia; (iv). Inner valve; (wt). heart wall around the opening with thickening.

B-(1-4) Adult: Longitudinal section through the heart, showing the structure of the valves. (ao). aorta, (ost). ostia, (vo). valve to the aorta, (gc). filamen tous cell flanking the ostia, (fl). flaps acting as interventricular valves, (es). fine elastic strands, (hw). heart wall, (hp). posterior heart chamber with many fine suspensory muscles.

C. Longitudinal sectional through the wall of the heart, (a). wall, (b). connective tissue, (c). cytoplasm, (d). nucleus, (e). radial muscles.

D- Aliform muscles, (f). fine fibers, (sb). secondary branch, (mb). main branch.

E- Structure of pericardial cell; (n). nucleus, (fs). fine connecting strand of tissue.

The wall of the heart consists of a double layer of connective tissue. Between those two layer are circular muscle fibers extending around the heart (Fig. 2C). The alary muscles are connected to each other (Fig. 2D) by very fine fibrils inserted along the midline beneath the heart and connected to the heart wall ventrally by, fine strands.

(b) Adult. The dorsal vessel of *L. pyrastri* differ from that of the other three adult syrphids in having five functional chambers with four pairs of ostia (Fig. 1 Bsc). The first anterior

ostia has a large opening flanked by large filamentous cells with distinct nuclei which form an inner valve. There are flaps on each side acting as interventricular valves which prevent the back flow. Each flap has three thick cells. The anterior part opens to the aorta and has a thick wall. The aorta extends from the ventral region of the chamber (Fig. 2B1). The posterior ostia was basically similar to that of the larval heart. The opening of the second ostia is controlled by elongate cells with long filaments which form an inner valve to lumen with no thickening around the opening (Fig. 2 B2). The third ostia are flanked by two oval filamentous cells with a number of pad-like supporter cells (Fig. 2 B3).

Each posterior ostium has individual modifications (Fig. 2 B4). The opening is controlled by two oval filamentous cells and many pad-like supporter cells.

The dilated portion appears to be longer than that in the larval heart and has more numbers of muscles. The dorsal vessel of *S. corollae* is basically the same as that of *L. pyrastri* where the heart has five chambers and four pairs of ostia and one pair of pads in the third chamber (Fig. 1 Bsy).

The structure of the valves is similar to that of *L. pyrastri* thought the posterior heart chamber differed in shape. In *Xanthogramma* sp. the heart is similar to that of *S. corollae*, except in having the posterior heart chamber more elongated (spindle shaped) flaps with the heart lumen. The filamentous cells are longer than those of *S. corollae*, and the heart has five chambers with four pairs of ostia.

In *S. scripta*, the structural differences as compared with the other three species, is being in lip-like ostia in the first chamber which was similar to other species. The number of ostia and chambers were exactly as in the above mentioned species. The posterior heart was more flattened so as to appear round in comparison with other species.

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