Research Note

Morphology of the female reproductive organ of the Oriental latrine fly, *Chrysomya megacephala* F. (Diptera, Calliphoridae)

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Abstract: The female reproductive organ of *Chrysomya megacephala* F. consists of paired ovaries, lateral oviducts, a common oviduct, 3 spermatosthecae and paired accessory glands. Each ovary is formed of about 100 to 110 polytrophic ovarioles. Externally, each ovariole is enclosed by a thin tunica propria. The common oviduct has syncytial epithelium lined by a thin intima. The duct has both longitudinal and circular muscles. The vagina is distinguishable into anterior and posterior portions. The posterior vagina has longitudinal as well as circular muscles but the anterior vagina has only circular muscle layer. Out of 3 rounded spermatosthecae 2 of one side are loosely bound together. Each spermatosteca is bounded with cuboidal epithelial layer. The cell has a prominent vacuole in the apical half which is filled with secretory material for the benefit of spermatozoa. The paired accessory glands open separately into the genital chamber. These glands show maximum activity during the breeding period.

Introduction

The family Calliphoridae is of considerable medical and veterinary importance, being responsible for severe traumatic myiasis. Only scattered records on the female reproductive system of Diptera are available (Graham-Smith, 1938; Clift and McDonald, 1973; Spradberry and Sands, 1976). Zaka-ur-Rab (1971), Klostermeyer and Anderson (1976) and Ansari and Murad (1981) have given some accounts of anatomical and histological structures of the reproductive organs of *Dacus cucurbitae, Tetanops myopaeformis* and *Hippobosca maculata*, respectively. In the present study an attempt has been made to describe the structural details of the reproductive organs of *Chrysomya megacephala* F. which is a major pest of carrion fauna.

Materials and Methods

The adult flies were reared under laboratory conditions. The females were dissected in Ringer's solution and whole mounts of female reproductive organs were prepared after staining with borax carmine. For histological studies, the material was fixed in alcoholic Bouin's fluid. Sections 5 to 7 μm thick were stained with Heidenhain's haematoxylin and counterstained with eosin. Photomicrographs were taken using appropriate magnifications.

Results

Anatomy of the female reproductive organ (Fig. 1). The internal genitalia of the female *C. megacephala* consists of paired ovaries, lateral oviducts, a single median oviduct, 3 spermatosthecae and 1 pair of accessory glands.

The whitish ovaries are placed dorsolateral to the alimentary canal, enclosed in a transparent peritoneal sheath. In a mature female the ovaries fill almost the entire abdominal cavity. Each ovary consists of about 100 to 110 polytrophic ovarioles. The short common oviduct opens into the dilated anterior vagina. The spermatosthecae and the accessory gland open dorsally into the anterior vagina. The vagina is provided with strong...
dilator muscles which facilitate the descent of eggs. Out of 3 spermatothecae 2 of one side are loosely bound together. Each spermatotheca is internally lined by a highly pigmented intima. The accessory glands are long and tubular whose distal half is much dilated. The accessory gland in the beginning is transparent which in mature females turns whitish due to copious secretion in the lumen.

**Histology of the female reproductive organ (Figs. 2–11).**

Ovary: The polytrophic ovarioles are covered over by a thin noncellular tunica propria. Each ovariole is divisible into 3 zones i.e., terminal filament, germarium and vitellarium. Terminal filament is a short thread like structure formed by the tunica propria. The germarium contains primary oogonia which later on develop into trophocytes and oocytes. The primary oogonia are surrounded by an epithelial layer formed of cuboidal cells. The vitellarium is divided into a number of follicles. Each follicle contains a few trophocytes and an oocyte enclosed within a capsule formed of cuboidal follicular epithelium. The trophocytes aggregate in the upper region of the ooblast and are differentiated into a compact mass of nutritive cells, the trophosome. The oocyte nourished by the trophosome develops at a much faster pace. There being no protoplasmic connections between the trophocytes and the oocytes, the transfer of nutritive material takes place through the rupture in the trophocyte cell membrane. As the ooblast develops further, the follicular epithelium begins to project into the ooblast between the trophosome and the oocyte, so as to completely isolate the 2 from each other at advanced stage of development. A few micropylar cells are found interpolated in the space between the trophocytes and the oocyte allowing the passage of the nutritive material from the nurse cells into the developing oocyte. The follicular epithelium enclosing the oocyte consists of columnar cells having oval nuclei and dense cytoplasm. The epithelium around the trophosome, however, undergoes gradual disintegration and ultimately looses its cellular nature. Each oocyte is more or less oval in shape. The fast growing oocyte is highly engorged with yolk granules. The outer margin of the oocyte becomes differentiated into a vitelline membrane. A structureless chorion is secreted by the follicular epithelium around the fully developed oocyte. With the development of the oocyte, the trophocytes are gradually utilized by the former.

Common oviduct: The epithelium of the common oviduct is syncytial in nature. It has oval nuclei and densely granulated cytoplasm.Externally the epithelium rests on a basement membrane and internally it is lined by a thin intima. The epithelium is thrown into foldings which facilitates expansion during the passage of the egg. External to the basement membrane is a thin layer of longitudinal muscle fibres which is overlaid by a thick layer of circular muscle fibres.

Anterior vagina: The epithelium of the anterior vagina is thrown into folds. It is syncytial in nature and contains a number of vacuolated bodies with dense cytoplasm.

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**Fig. 1** Dorsal view of the female reproductive system.

AcGl, accessory gland; GC, genital chamber; Odc, common oviduct; Odl, lateral oviduct; Ov, ovary; Ovl, ovariole; Spt, spermatopheca.

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**Fig. 2** Longitudinal section of an ovariole. × 100.

**Fig. 3** Longitudinal section of the germarium. × 267.

**Fig. 4** Longitudinal section of a part of vitellarium. × 267.

**Fig. 5** Transverse section of the common oviduct. × 267.

**Fig. 6** Transverse section of the anterior vagina. × 267.
Fig. 7  Transverse section of the posterior vagina.  ×200.
Fig. 8  Longitudinal section of the spermatotheca.  ×267.
Fig. 9  Transverse section of the accessory gland (first portion).  ×267.
Fig. 10 Transverse section of the accessory gland (second portion).  ×267.
Fig. 11 Transverse section of the accessory gland (third portion).  ×287.  Ch, chorion;
Cmcl, circular muscle fibres; Epth, cellular epithelium; Epthf, follicular epithelium around
oocyte; Epthg, follicular epithelium around trophosome; Fol Epth, follicular epithelium;
Grm, germarium; In, Intima; lmCl, longitudinal muscle fibres; Lum, lumen; NrCl, nurse

cell; nu, nucleus; Obl, ooblast; Ooc, oocyte; Psh, peritoneal sheath; Secr, secretions; sEpth,
syncytial epithelium; spz, spermatozoa; TF, terminal filament; Tp, tunica propria; Troph,
trophosome; Vac, vacuole; Ylk, yolk.
and spherical nuclei, scattered under no definite plan. Internally the epithelium is lined by a thick intima and externally it is supported on a basement membrane which in turn is wrapped over by a peritoneal sheath. External to the latter is a thick layer of circular muscles. Longitudinal muscles are wanting.

Posterior vagina: In histological details the posterior vagina differs considerably from the anterior vagina. The syncytial epithelium encloses a very narrow lumen. Longitudinal muscles form a strong coating which is overlaid by a very thick layer of circular muscles.

Spermatotheca: The epithelium of the spermatotheca consists of cuboidal secretory cells. Externally the epithelium is supported on a basement membrane and internally, it is lined by a very thick layer of dark brown intima which sends out a number of very small processes projecting into the lumen. The epithelial cells contain densely granulated nuclei located in the basal half of the cell. The apical half of the cell contains vacuole having some secretory material which takes a comparatively lighter stain in the apical portion of the cells. This secretion is used as nutrition for the spermatozoa stored in the lumen of the spermatotheca.

The epithelium of the spermatothecal ducts is syncytial in nature having rounded nuclei. The cytoplasm is densely granulated. Externally the epithelium rests on a basement membrane which is overlaid by a thick layer of longitudinal muscle fibres and internally it is lined by a thick intima.

Accessory gland: The epithelium of the expanded region of the accessory gland is syncytial in nature having scattered nuclei. The cytoplasm is highly vacuolated. Externally the epithelium rests on a basement membrane. The lumen of the gland is filled with dense vacuolated secretion from the epithelium. The epithelium of the narrow portion of the accessory gland is comparatively thick. The histological plan is similar to that of the apical portion of the gland.

**Discussion**

*Chrysomya megacephala* F. has paired ovaries and each one is composed of approximately 100 to 110 ovarioles. Spradbery and Sands (1976) in *C. beziana* have recorded 75 to 115 ovarioles in wild flies and 50 to 91 ovarioles in laboratory reared flies, while Clift and McDonald (1973) put their number as approximately 100 in *Lucilia cuprina*. However, a number of larviparous Diptera have only 1 ovariole in each ovary. The ovariole tapers at its apex as terminal filament without forming a suspensory ligament. The presence of suspensory ligament, however, has been reported in *Calliphora erythrocephala* (Graham-Smith, 1938). Each ovariole of *C. megacephala* is of the polytrophic type and is covered over by a thin transparent tunica propria as in *Dacus cucurbitae* (Zaka-ur-Rab, 1971) and *Hippobosca maculata* (Ansari and Murad, 1981). The nutritive material is mainly contributed by the trophocytes which disintegrate as the developing oocyte derives nutrition from them (Gerber et al., 1971). The discharge of the nutritive material from the trophosome into the oocyte takes place by the rupture of trophocyte cell, there being no protoplasmic connections between the trophocytes and the oocyte as also reported by Zaka-ur-Rab (1971) in *D. cucurbitae*. However, the role of the follicular epithelium in providing lipids, carbohydrates and protein yolk bodies to the oocyte has also been demonstrated by Bonhag (1956). The developing oocyte in *C. megacephala* is accompanied by 7 trophocytes. In *Glossina austeni* (Huebner et al., 1975) and *Sarcophaga tibialis* (Kokwaro, 1983) 15 nurse cells are reported, while in *H. maculata* (Ansari and Murad, 1981) there are only 2 trophocytes. The musculature of the common oviduct consists of an inner longitudinal and outer circular muscles but in *C. erythrocephala* (Graham-Smith, 1938) this arrangement is found to be reversed. The musculature of the anterior vagina consists only of circular muscles. The posterior vagina consists of an inner layer of longitudinal muscles and an outer layer of circular muscles while only longitudinal muscles have been observed by Graham-Smith (1938) in *C. erythrocephala*.

Rounded spermatotheca have been observed by the present authors in *C. megacephala*. The number and form of spermatotheca is, however, subject to great variation. The presence of 3 spermatotheca has also
been recorded in *L. cuprina* (Clift and McDonald, 1973), *C. bezziana* (Spradbery and Sands, 1976), and *Physiphora aenea* (Sareen and Kaur, 1982), while in *H. maculata* (Ansari and Murad, 1981) these are reported as wanting. Two types of cells surrounding the spermathecae have been recorded in *P. aenea* (Sareen and Kaur, 1982), while in *C. megacephala*, *D. cucurbitae* (Zaka-ur-Rab, 1971) and *T. myopaeformis* (Klostermeyer and Anderson, 1976) only one type of cells has been recorded. The spermathecae are for the reception and storage of spermatozoa. The spermathecae are secretory in nature producing nutrients for the spermatozoa (Gerber et al., 1971; Zaka-ur-Rab, 1971).

The accessory glands are usually present in Dipterous insects. Their number, size, shape vary from species to species. A single pair of long tubular accessory glands has been recorded in various Dipterous insects and is also present in *C. megacephala*. In viviparous Diptera *H. maculata* (Ansari and Murad, 1981) two pairs of accessory glands have been recorded. The vacuolated cytoplasm of the accessory glands has been reported by various workers (Klostermeyer and Anderson, 1976; Ansari and Murad, 1981) suggesting secretory nature of the epithelial cells. Zaka-ur-Rab (1971) in *D. cucurbitae* shows the presence of an intima but it is wanting in *C. megacephala*. The secretion is viscid, granular and highly coagulable suggesting colletorial function (Zaka-ur-Rab, 1971). In viviparous Diptera, the accessory glands are modified to such an extent that they secrete a milky fluid for the nourishment of the developing larva within the uterine cavity (Ansari and Murad, 1981).

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**References**


**摘要**

オビキンパエ雌生殖器官の形態

オビキンパエ雌の生殖器官の形態を組織学的に研究した。生殖器官の切片をハイデンハイムのヘマトキシンとエオジンで二重染色して観察し、内部形態を顕微鏡写真をそえて記述した。