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***Research Article***

# MORPHOLOGY OF FEMALE REPRODUCTIVE ORGANS OF FLESHFLY, *SARCOPHAGA RUFICORNIS* FABR. (DIPTERA: SARCOPHAGIDAE)

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## ABSTRACT
The female reproductive organs of *Sarcophaga ruficornis* F. (Diptera: Sarcophagidae) consists of paired ovaries, lateral oviducts, a common oviduct, three spermathecae and paired accessory glands. Each ovary is formed of about 45-53 polytrophic ovarioles. The epithelium of lateral oviduct is formed of syncytial cells overlaid by longitudinal and circular muscle fibers. The common oviduct has syncytial epithelium lined by a thin cuticular intima and externally covered over by thin longitudinal and thick circular muscle fibres. The anterior region of genital chamber called uterus is divided into two chambers. The epithelium of genital chamber is syncytial in nature and is thrown into numerous folding. The genital chamber is internally lined with thin intima and has both longitudinal and circular muscle fibres. Each coiled spermatheca is bounded by cuboidal epithelial layer, of which apical region is double layered. Each spermatheca is internally lined with thick intima which forms annuli in the neck region. The paired globular accessory glands open separately into the uterus.

***Key Words*:** *Female Reproductive System, Sarcophaga Ruficornis, Ovary, Genital Chamber*

## INTRODUCTION
The family Sarcophagidae is of considerable medical and veterinary importance, being responsible for various types of myiasis (Dutto and Bertero, 2010; Gupta *et al.,* 2010; Sukontason *et al.,* 2010; Ahmed *et al.,* 2011; Zagool *et al.,* 2013). Our knowledge of the female reproductive organs of Diptera is very limited. The only notable work is those of Nayar (1965), Adams and Mulla (1967), Zaka-ur-Rab (1971), Clift and McDonald (1973), Spradbery and Sands (1976), Kumar (1978), Ansari and Murad (1981), Kokwaro (1983), Bansal and Murad (1987), Winterton *et al.,* (1999), Zacaro and Porter (2003). The present study was undertaken to describe the structural details of the female reproductive organs of *Sarcophaga ruficornis* F.

## MATERIALS AND METHODS
The adult flies of *S. ruficornis* were reared under laboratory condition. The females were dissected in Ringer's solution and the whole mount of female organs was prepared after staining with borax carmine. For histological studies, the female reproductive organs of freshly dissected flies were fixed in alcoholic Bouin's fluid. Wax blocks were prepared of each part after removing the Bouin's fluid and dehydration process. Then section of 5-7 µm thick was cut using Spencer type microtome. These sections were then stretched and dewaxed on slide and stained with Heidenhain's haemotoxylin and counterstained with 70% alcoholic Eosin. Figures were drawn using camera lucida.

## RESULTS AND DISCUSSION
The female reproductive system of *S. ruficornis* consists of paired ovarioles, paired oviducts, a median oviduct, three spermathecae, a pair of accessory glands and a genital chamber (Figure 1). The ovaries are placed dorso-lateral to the alimentary canal, enclosed in a peritoneal sheath. When fully grown, ovaries occupy major portion of visceral sinus. Each ovary is covered with a network of tracheoles which are more extensive in the basal region. Each ovary consists of about 45-53 ovarioles. Bansal and Murad (1987) in *Chrysomya megacephala* and Verma and Ishikawa (1984) in *Sarcophaga ruficornis* recorded

100-110 and 20-30 ovarioles respectively. Kokwaro (1983) in *Sarcophaga tibialis* and Kumar (1978) in *Sphyracephala hearseiana* reported 12-45 and 8-10 ovarioles. Spradbery and Sands (1976) in *Chrysomya bezziana* reported 75-115 ovarioles in wild flies and 50-91 ovarioles in laboratory reared flies. Clift and McDonald (1973) reported about 100 ovarioles in *Lucilia cuprina* and Zaka-ur-Rab (1971) recorded 11-35 ovarioles in *Dacus cucurbitae*. Adams and Mulla (1967) in *Hippelates collusor* and Nayar (1965) in *Syrphus balteatus* reported 10-20 and 35-45 ovarioles per ovary respectively. However, Ansari and Murad (1981) reported single ovarioles in *Hippobosca maculata*. Each ovarioles tapers at its apex to form a short terminal filament without forming a suspensory ligament in *S. ruficornis*, as recorded by Bansal and Murad (1987) in *C. megacephala* and Zaka-ur-Rab (1971) in *D. cucurbitae*. However Nayar (1965) in *S. balteatus* recorded definite suspensory ligament. Each ovary is formed of polytrophic ovarioles in which both the developing oocyte and trophocyte are enclosed by a single layered columnar follicle cells containing spherical nucleus (Figure 2). Polytrophic type of ovarioles is also recorded in *C. megacephala* (Bansal and Murad, 1987), *H. maculata* (Ansari and Murad, 1981) and *D. cucurbitae* (Zaka-ur-Rab, 1971). The role of follicular epithelium in providing lipid, carbohydrate and protein yolk bodies to the oocyte has been demonstrated by Bonhag (1956). The short lateral oviducts open into the common oviduct. The epithelium of the lateral oviduct is thin and syncytial in nature (Figure 3). The epithelium has small spherical nuclei and less granulated cytoplasm. The cellular wall of the duct is covered by a muscular sheath containing longitudinal and circular muscle fibre. The common oviduct takes a U-turn before opening into the genital chamber. The epithelium of common oviduct is syncytial in nature and consists of oval nuclei and densely granulated cytoplasm (Figure 4 & 5). The epithelium is thrown into folding which facilitates expansion during the passage of developing larva. Externally the epithelium rests on basement membrane and is internally lined with thin intima. The basement membrane is overlaid by a thin layer of longitudinal muscle fibres which in turn is covered by a thick layer of circular muscle fibres in present study as reported by Bansal and Murad (1987) in *C. megacephala.* In viviparous Diptera, anterior part of genital chamber forms a pouch known as uterus. The epithelium of uterus and genital chamber is syncytial in nature and is thrown into folds which are prominent in the apical region (Fig 6&7). Internally the epithelium is lined by a thin intima and externally by a thin layer of longitudinal and thick layer of circular muscle fibres. However, only circular muscle fibres have been reported in the anterior vagina by Bansal and Murad (1987) in *C. megacephala* and Ansari and Murad (1981) in *H. maculata*. The apical portion of uterus bifurcates into two chambers *S. ruficornis*, which receives the developing embryo from their respective side of the ovary, but Abasa (1972) does not describe any bifurcation in *Sarcophaga tibialis*. Extensive network of tracheoles over genital chamber and uterus provide the much needed oxygen to the developing embryo. The three spermatheca open independently on the dorsal side of the genital chamber in *S. ruficornis*. The presence of three spermatheca in also reported in *C. megacephala* (Bansal and Murad, 1987), *S. hearseiana* (Kumar, 1978), *L. cuprina* (Clift and McDonald, 1973) and *S. tibialis* (Abasa, 1972). But Benner and Curtis (1988) in *Megaselia scalaris* and Adams and Mulla (1967) in *H. collusor* reported one and two spermatheca respectively. Harterreiten-Souza and Pujol-Luz (2012) recorded four spermatheca in some individuals of *C. megacephala* and suggested that such events may be linked to genetic variation between populations and is also associated with change in environmental conditions. However, Ansari and Murad (1981) do not record the presence of spermatotheca in *H. maculata.* The epithelium of the spermatheca consists of cuboidal secretory cells. Externally the epithelium rests on basement membrane and internally, it is lined with thick layer of brown intima (Figure 8). The epithelium is vacuolated and double layer in the apical region which is visible from exterior, but Clements and Potter (1967) reported two types of cells in spermatheca of Aedes *aegypti*. The spermatheca is secretary in nature producing nutrients to the spermatozoa (Zaka-ur-Rab, 1971). One pair of accessory gland is found in the present study as in case of *C. megacephala* (Bansal and Murad, 1987). However, Ansari and Murad (1981) reported two pair of accessory glands in *H. maculata.* Each gland opens independently through a short narrow duct close to the opening of spermathecal ducts. The epithelium of accessory gland is cuboidal in nature with scattered nuclei (Figure 9).

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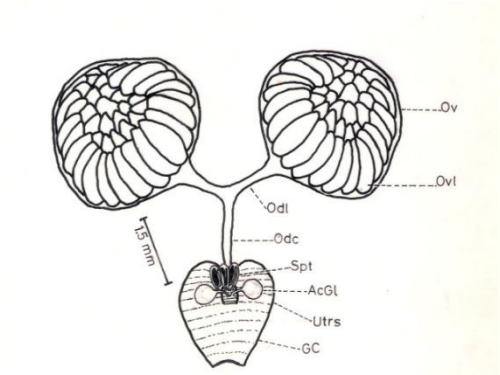


**Figure 1: Female reproductive system**

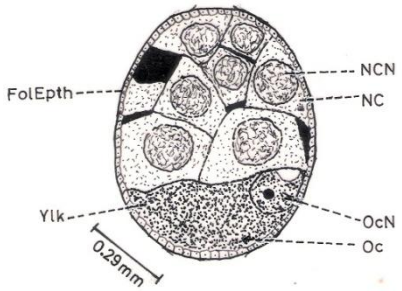


**Figure 2: Cross section of an ovariole**

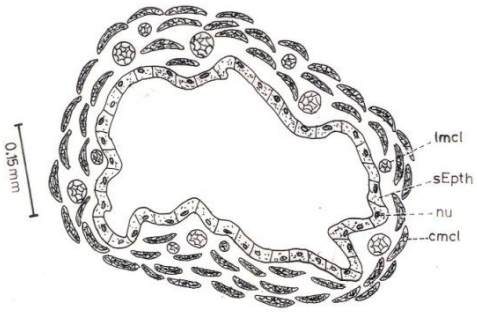


**Figure 3: T. S. of lateral oviduct**

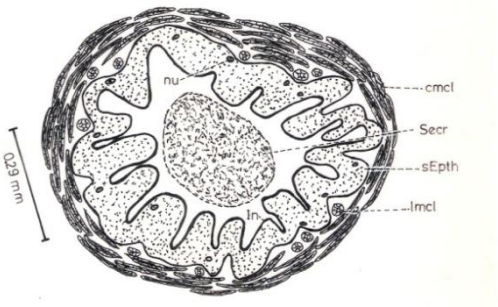


**Figure 4: T. S. of common oviduct (Anterior region)**

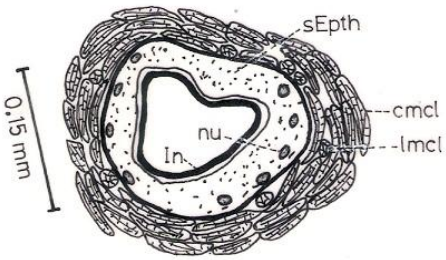


**Figure 5: T. S. of common oviduct (Posterior region)**

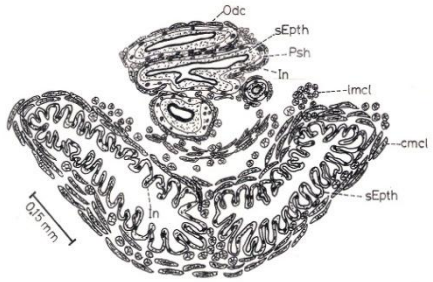


**Figure 6: T. S. of uterus (Anterior region)**

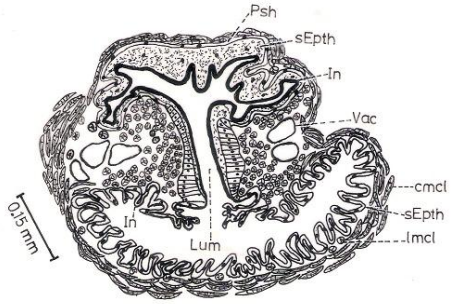


**Figure 7: T. S. of uterus (Posterior region)**

**Abbreviations of Figures 1-8:** *AcGl-accessory gland, cmcl-circular muscle fibres, Epth-cellular epithelium, FolEpth-columnar follicle cells, GC-genital chamber, In-intima, lmcl-longitudinal muscle fibres, Lum-lumen, NC-nurse cell, NCN-nurse cell nucleus, nu-nucleus, Oc-developing oocyte, OcN- oocyte nucleus, Odc- common oniduct, Odl-lateral oviduct, Ov-ovary, Ovl-ovariole, Psh-peritoneal sheath, Secr-secretion, sEpth-syncytial epithelium, Spt-spermatheca, Spz-spermatozoa, Utrs-uterus, vac-vacuole, Ylk-yolk granules*

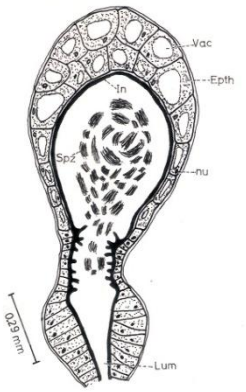


**Figure 8: L. S. of spermatheca**

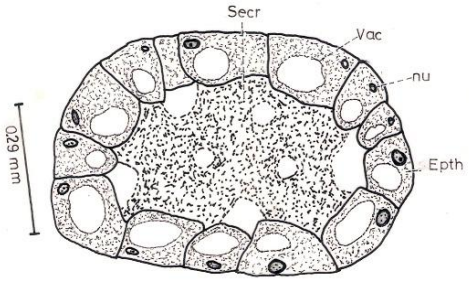


**Figure 9: T. S. of accessory gland**

**Abbreviations of Figure 8 and 9:** *Vac-vacuole, sEpth-syncytial epithelium, nu-nucleus, Lum-lumen, Spz-spermatozoa, In-intima; Secr-secretion, Vac-vacuole, nu-nucleus, sEpth-syncytial epithelium*

The cytoplasm of the epithelium is highly vacuolated which is in conformity with the findings in *C. megacephala* (Bansal and Murad, 1987) and *H. maculata* (Ansari and Murad, 1981) and epithelium rests on basement membrane. The vacuoles in the posterior region of accessory gland are comparatively larger than those of anterior region. Two pairs of milk gland which are modified accessory gland are reported in *H. maculata* (Ansari and Murad, 1981).

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