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Reproductive morphology in mycophagous thrips *Elaphrothrips procer* (Thysanoptera: Phlaeothripidae)

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ABSTRACT:
The order Thysanoptera encompasses minute insects called Thrips which are usually a few millimetres long. The thrips shows many peculiarities in their reproductive morphology. Sexual polymorphism plays an important role in mating behaviour. In the present paper observation reproductive morphology on mycophagous thrips Elaphrothrips sp are discussed. The female reproductive system of investigated Elaphrothrips species consist a pair of ovaries which connect with a pair of lateral oviducts. They join to form a common oviduct and vagina. The female examined in this study possess one spermatheca and no accessory gland. Vagina is open exterior on IXth sternite by a median gonopore.The entire male reproductive system occupies the abdominal region from III to IX segments. It is consist of, a pair of testes, a pair of vasa deferentia, a pair of seminal vesicle, two pairs of accessory glands and an ejaculatory duct

Key words: *Elaphrothrips sp*, Ovary, Testis, Spermathica, Accesory glands,

INTRODUCTION:

Elaphrothrips sp. is a mycophagous thrips feeds on fungal spores and generally occur on the fungus infected dry leaves of *Butea monosperma* plant during humid seasons of the year. Comparatively to the other thrips, the size of adults *Elaphrothrips sp* is large. Sexes easily differentiates due to male is larger than female. Male having tarsal tooth on foreleg, while in female absent. Larvae are red in colour with black terminal tubes, occurs in colony and eggs are dull white in colour glued vertically on the leaf surface and in group. This species are mostly available during month of September to November.

The Thysanoptera insects offer unique opportunities to study the other variables of social behaviour due to exhibits a wide variety of life histories and social interaction. Order Thysanoptera divided into two suborders i.e. Terebrantia and Tubulifera. Thrips belonging to Terebrantia posses a distinct saw like ovipositor while Tubulifera consist 10th abdominal segment which is drawn into a tube and the ovipositor is internal and flexible structure. The purpose of this paper is to analyse the reproductive morphology of mycophagous type *of Elaphrothrips* species.

MATERIAL AND METHODS:

Collection and Resproductive Morphology study:

The thrips were collected from their host plant *Butea monosperma* dry fungal infected leave during the humid periods of the year when they mostly occur. The eggs, larvae, pupae and adults of *Elaphrothrips sp* were collected and carried to the laboratory along with leaf fold and fungal infected dry leaves of *Butea monosperma* for rearing.

The collected specimens of *Elaphrothrips* adult male, female, larvae and eggs were kept in large plastic bowls along with fungus infected dry leaves. Then they transfer to the separate plastic rearing bowl to avoid overcrowding and food limitation. For protection bowls were covered by muslin cloth. Light 12:12 and temperature (25±1°C) were maintained. Relative humidity maintained at 80% by keeping wet filter paper in the rearing bowl.

For reproductive morphology studies adults were dissected out in insect Ringer's solution under stereo zoom microscope (Magnus).

The testes and ovaries were dissected out by picking both ends of the body and pulled out an abdominal tube with the help of fine forceps results into break up at IX abdominal tube and reproductive organs stretched out easily. The organs were observed under compound microscope without staining and photographed.

Fixed the organ in Bouin's fluid and dehydrated in the alcohol series cleared in xylene, stained with Haematoxylin and Eosin and mounted in DPX. Whole-mounts of ovaries, testes and spermatheca were studied under compound microscope (Magnus). Photographs were made using a digital camera (Olympus: SP550UZ) and image projection system (MIPS). Measurements were made using the image analysis software (Olympus).

RESULTS AND DISCUSSION:

FEMALE REPRODUCTIVE ORGANS:

The female reproductive system of investigated species *Elaphrothrips procer* (Schmutz) consist a pair of ovaries which connect with a pair of lateral oviducts. They join to form a common

oviduct and vagina. The female examined in this study possess one spermatheca and no accessory gland (Fig. 1). Vagina open exterior on IX th sternite by a median gonopore.

The Ovary:

In the observed thrips, there is one pair of panoistic ovary showing all oogonia develop into oocyte and follicle cells. Each ovary contains four ovarioles (Fig. 1). In mature female, ovariole almost fills the entire abdominal cavity. Ovaries are situated underneath the midgut and in the oviposition phase the ovarioles enlarges and reach the first abdominal segment. Each ovary is bounded by a peritoneal sheath and the ligament is formed by the terminal filament of the ovarioles.

Morphologically five different regions termed as zones are observed in one ovarioles. Depending on the ages and ovulation stage, each zone develops differently.

Zone I is the terminal filament. The germarium zone II, is located just below the terminal filament and above the vitellarium zone III. The germarium contains somatic prefollicular cells, oogonia, and early oocytes. Because of the smaller amount of oocyte within the ovarioles, only two different zones were distinguishable within the vitellarium (zone IIIa and zone IIIb). Zone IIIa contains small oocyte. In zone IIIb the oocytes are recognizable on the vitellogenic growth.

The ovarioles of *Elaphrothrips procer* (Schmutz) contains on average 5-7 oocytes.

All the ovarioles fuse with each other at the end of terminal filament and form a thick ligament which provides joining with the salivary gland at their base.

Due to the gradual maturation of ova from anterior to posterior direction, the ovarioles gradually increase in their size. The ovarioles of each ovary open posterioly into the lateral oviduct.

The Oviduct:

There are two types of oviducts observed, the lateral oviduct and common oviduct.

The lateral oviducts are tubular and long. They are in pair, run obliquely in mid-posterior direction and fused to form a common oviduct. The lateral oviducts are highly dilated measuring about 286 µm, for the accumulation of the mature ova. In adult mature female, it elongates and became highly distensible.

The common oviduct opens into the external genitalia. The spermatheca consist a spermathecal duct which is connected with the vagina.

The Spermatheca:

The spermatheca is an oval shaped capsule and single in number. The spermatheca is situated in abdominal segments VI and VII. The spermatozoa within spermatheca are mixed with granular materials.

The accessory glands are absent.

MALE REPRODUCTIVE ORGANS:

The entire male reproductive system occupies the abdominal region from III to IX segments. It is consist of, a pair of testes, a pair of vasa deferentia, a pair of seminal vesicle, two pairs of accessory glands and an ejaculatory duct **(Fig. 2)**.

The Testis:

The adult testis is reddish in coloured and is pointed at both the end. (Fig. 5.6). The two testes situated in the segments III and IV of the abdomen. Each testis measures about 482 µm in length and maximum width is 73 µm in the middle region. Posteriorly testis opens into a long narrow tube of vas deferens.

The vasa deferentia:

Each vas deferens is a long tubular duct. It lies in the abdominal segment IV to segments VII **(Fig. 2)**. It measures about 2892 to 3100 µm in length.

The seminal vesicle:

The vas deference terminates into a slightly dilated sac like seminal vesicle. It has a reddish pigment on its dilated margin **(Fig. 2)**.The seminal vesicle united with each other and opens into an ejaculatory duct. It measures about 420-440 µm in length.

The ejaculatory duct:

It is a short duct and opens externally into the male genitalia. It is present between the segments IX and X. Along with seminal vesicle it also receives two pairs of accessory glands.

Accessory glands:

There are two pairs of accessory glands occur.

i) First pair of accessory glands: The first pair of accessory glands is tube like but shorter in length. The length of each tube is about 650µm. They are open into the ejaculatory duct near the opening of second pair on the lateral side. This gland is composed of glandular epithelial cells surrounded by a thin peritoneal membrane. The lumen of the accessory glands is filled with homogeneous material secreted by the epithelial cells (Fig.3).

ii) Second pair of accessory glands: The second pair is long, tube like and slightly expanded. It opens into the ejaculatory duct. Each accessory gland measures about 850 µm length. This gland is composed of cuboidal cells and externally

covered by the peritoneal membrane (Fig 3). The secretary material is present in the form of granules.

The number of ovarioles in an ovary [illegible] insect as well as its taxonomic position.

Cary (1902) first described five ovarioles in each ovary of *Anaphothrips striata* whereas other workers have repeatedly found only four ovarioles within ovary including *Elaphrothrips* [illegible] **1953; Davies, 1961; Heming, 1970b and Haga, 1975).** All examined thrips species possess four ovarioles on each ovary and this is believed to be a common feature of the Thysanoptera **(Moritz, 1997).**

The reproducing tract of female insects typically includes paired accessory glands, whose function varies **(Hoshen and Ward, 1999).** Accessory reproductive glands produce oviposition pheromone secretions which coat and fasten eggs to laying substrates and provide lubrication and egg protection.

Many workers confused the spermatheca for accessory glands and vice-versa. **Buffa (1898)** reported the presence of a spermatheca but absence of the accessory sex glands in *Helothrips haemorrhoidalis* while **Cary (1902)** reported the absence of the spermatheca and accessory female sex glands in *Anaphothrips striata.* **Sharga (1933b)** confirmed the presence of functional spermatheca in a large number of species of thrips. **Davies (1961)** in *Limothrips cerealium* clearly pointed out the distinction between the spermatheca and the accessory gland. The spermatheca is a brown body and the accessory glands are differing histologically from one another. **Heming (1970a)** in *Frankliniella fusa* has confirmed the presence of spermatheca and accessory glands. There are other species where accessory glands have been reported as absent whereas a spermatheca is present, *Haplothrips verbasci* **(Heming, 1970a),** *Bactridothrips brevitubus* **(Haga, 1975)** and *Elaphrothrips greeni* **(Watane, 1985).**

The present investigation of *Elaphrothrips* species confirms the observation of earlier workersin *Haplothrips simplex* and *Haplothrips verbasci,* **(Davies, 1961)** in *Limothrips Cerealium* and **(Watane, 1985)** in *Elaphrothrips greeni.*

The ovarioles of thrips are of panoistic type like those of majority of exopterygote insects, with exceptions in Hemiptera and Psocoptera **(Imms, 1963),** but their delayed development recalls endopterygote morphogenesis or Remetabolous metamorphosis.

Dhileepan and Ananthakrishnan (1987) studied five species of sporophagous [illegible] oogonial cells and the previtellogrnic oocytes does not differ among polymorphic ovaries.

This is further evidence that the number of oocytes per ovariole (vitellarium) depends on the reproduction ecology of the insect. Five different [illegible] were examined and considerable differences in their number of oocytes were determined **(Dhileepan and Ananthakrishnan, 1987).**

Elaphrothripsprocer (Schmutz) had the low number of oocytes (5-7 oocyte/ ovalioles) and [illegible] reducing the mortality this may be the reason for reduced oocyte number.

The basic general structural organisation of male reproductive organs of *Elaphrothrips procer* (Schmutz) is similar to that of other thrips studied by early workers in *Haplothrips distinguendens* and other nine species **(Sharga, 1933);** *Arrhenothrips ramakrishnae* and *Cerothrips tibialis* **(Ananthakrishnan, 1953);** in *Frankliniella fusca* and *Haplorthrips verbasci* **(Heming, 1970b);** *Elaphrothrips greeni* **(Watane, 1985).** *Sarcothrips longis* **(Kumm, 2002).** The male reproductive system consists of a pair of elongated tests a pair of thin long tubular vasa deferentia dilating posteriorly into the seminal vesicles an ejaculatory duct and two pairs of accessory glands.

In the adult of *Elaphrothrips procer* (Schmutz)the testis shows all the stages of spermatogenesis from spermatogonia to the spermatozoa suggesting the development of germs cells in their respective zones divides the testis into zone of germarium, maturation, transformation and spermatozoa and thus conforms to the general concept of earlier workers **(Snodgrass, 1935; Wigglesworth, 1965; Watane, 1985; Kumm, 2002).**

In insects each vasa deferentia consists of a narrow tube which enlarges into the seminal vesicle **(Snodgrass, 1935; Imms, 1963; Wigglesworth, 1965).** in *Elaphrothrips greeni* **(Watane, 1985)** and in Phlaeothripidae thrips **(Kumm, 2002)** same type of the long tubular vasa deferentia and seminal vesicle are reported.In *Elaphrothrips procer* (Schmutz) the vasa deferentia is a long tubular duct which [illegible] observations are in support with the view of earlier workers.

CONCLUSION:

The present work explores some aspects of the reproductive organs of *Elaphrothrips procer* (Schmutz). In *Elaphrothrips procer* (Schmutz) the formation of spermatophore is not observed, and supported to the observation of *Elaphrothrips greeni* though there is a presence of two pairs of accessory glands which is in accordance with the *Haplothrips verbasci* and other thrips.In all that respect Female reproductive system of *Elaphrothrips procer* (Schmutz) possess four ovarioles, single spermathica and absence of accessory gland fallows the above study.

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FIGURES:

Fig 1. Female Reproductive Organ of *Elaphrothrips procer*
OV-Ovarioles, LOV-Lateral Oviduct
CO-Common Oviduct, SP-Spermatheca

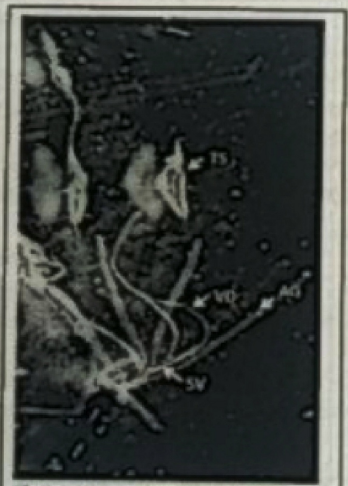

Fig 2. Male Reproductive Organ of *Elaphrothrips procer*
TS-Testis, VD-Vasa Deferentia
SV-Seminal Vesicles, AG-Accessory Gland

Fig 3 Accessory Glands of *Elaphrothrips procer*
AG-Accessory Gland (AG1 and AG2)