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RESEARCH ARTICLE

IMPACT OF PYGIDIAL SECRETION ON HISTOLOGICAL CHANGES IN THE TESTIS OF ADULT MALE *Sphaerodema rusticum* (HETEROPTERA: BELOSTOMATIDAE) IN RELATION TO REPRODUCTION

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ABSTRACT

The male reproductive system of *Sphaerodema rusticum* consists of a pair of testis, seminal vesicle, vas deferentia, a common ejaculatory duct and then into aedeagus. The testis showed some remarkable changes in the insects treated with zoopesticide, pygidial secretion (25 ppm median lethal concentration). The testis of treated insects showed the presence of a ruptured testicular follicle, disintegrated spermatocytes, pynotic and necrotic spermatids. The toxicity impact of zoopesticide pygidial secretions was appropriate to be comparatively higher than other insects.

INTRODUCTION

Generally the reproductive system of insects is a complicated one. Spermatogenesis and testicular development has been studied in many insects (Numata and Hidaka, 1980 and Laifook, 1982). The tests are yellowish white organs lying at the posterior median end of the abdominal cavity. Each testis is composed of five testicular follicles and it is surrounded by a connective tissue which holds the testicular follicles together.

Each testis is supplied with tracheoles and fat body. Testis follicle is composed of several acinus. Each acinus of the follicle is externally connected with the peritropic membrane (Davey, 1958). Several authors have reported the structure and functions of the male reproductive organs in different species of insects Cantacuzene, 1967, Dufrancais, 1968; Odhiambo, 1966 and Leopold, 1976. This consideration led to investigate the effect of zoopesticide, pygidial secretion on the testis of adult male *Sphaerodema rusticum*.

MATERIAL AND METHODS

The adult control and treated *Sphaerodema rusticum* were kept separately after 48 hours; they were dissected under bionuclear microscope by using Ringer solution (Emphrussic and Beadle, 1936). The Ringers were subsequently removed and the tissue was fixed in Bouins fluid for 24 hours. Later, the tissue was processed by adopting standard histological techniques (Gurr, 1958).

RESULTS AND DISCUSSION

The male reproductive system of *Sphaerodema rusticum* consists of a pair of tests, seminal vesicle, vasa deferentia, a common ejaculatory duct, a pair of accessory glands and an aedeagus. The longitudinal section of testis in control insect shows that the follicle is composed of several acinus. Each acinus of the follicle is externally connected with thin perittrophic membrane.

Bordeas (1900) has observed the testicular tubules are enclosed in a peritoneal membrane. Davidson (1989) has reported that the testicular follicles are covered by a peritoneal membrane. Each testicular follicle was filled with germ cells which could be differentiated into different zones, depending upon various stages in their development. The zones of development can be organized as zone of spermatogonea which consist of apical cell complex and primordial; zone of growth where spermatocyes were formed; in zone of maturation, primary and secondary spermatocytes were produced, zone of transformation spermatids enclosed in a cyst and get converted into flagellated spermatozoa Satynarayana (1986) in *Odontophus varicornis.* The apical region contains numerous primaridial germ cells which are intensely stained with hamatoxylin. The lumen contains many primary spermatocytes and secondary spermatocytes which are deeply stained with eosin. The secondary spermatocyes are smaller than the primary spermatocytes due to mitotic and meiotic division. The secondary spermatocytes appear to be more in number than the primary spermatocytes (Figs. 1,2,3, and 4),

To the present study it has been mentioned earlier that the follicle of the testis of control insects contained many spermatocytes and secondary spermatocytes which are deeply stained with haematoxylin. The sperms were enlarged, hair like structures arranged in the form of bundles in the lumen of the follicle. But the testicular of the treated insects showed

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many histopathological architecture such as disintegrated apical cells, primary and secondary spermatocytes, reduced nuclear volumes of primary and secondary spermatocytes, weakly stained primardial germ cells, disorganized sperms with broken tails, necrotic spermatids and sperms and less packed spermatozoa with more space in lumen of the follicle (Figs. 5, 6, 7 and 8). These changes might be attributed to the effect of zoopesticide intoxication.

Nakayama *et al.* (1979) exposed metapa on *Mamestra brassicae* and reported that it inhibits the differentiation of spermatogonium into spermatocytes. Amirjit Kaur *et al.* (1983) are of the opinion that the hydroprene administration induced defective spermatozoa in *Zeptocoris coimbatorenesis.* Sperm production has been found to decrease in *Dysdercus cingulatus* due to tepa treatment (Ahmed, 1980). Jayakumar (1988) has reported that the clumping and inhibition of sperm differentiation in *Odontopus varicornis* when exposed to dimethoate. Balakrishnan (1990) and Nirmala Devi (1990) have reported similar observations in the case of *Pheropsophus lissoderous* and *Catacanthus incarnates* respectively when exposed to phosphamidon.

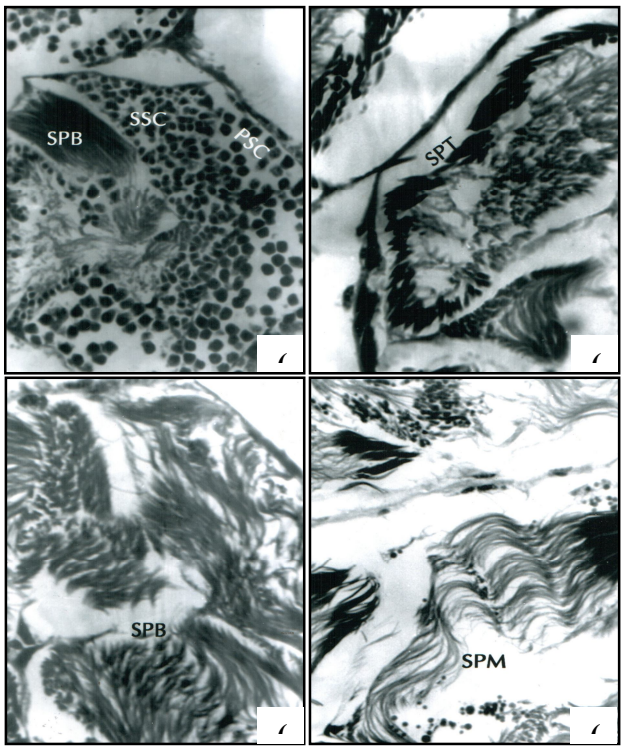

Fig. 1-4 Transverse section of testis follicle of control insect
SPB: Sperm Bundle; PSC – Primary spermatocytes; SSC – Secondary spermatocytes; SPT – Spermatids; SPM – Sperms

El-Ibrashy (1974) has investigated ecdyspne like substance in the leaves of *Podocarpus gracilior* which he termed as 'Ponasterones' and it brings a sterilizing effect on *Spodoptera uttoralis.* Kumudasukumar and Osmani (1981) have reported that the Catacanthus alkaloids cause sterility on *Dysdercus cingulatus.* When eucalyptus oil odour exposed to the nymphal stage or adult of *Dysdercus koeinigii* brought changes in its reproductive potentiality (Krishna, 1990). Similarly, Thiruvasagam (1994) has reported that the nimbecilin caused testicular deformities and affects the reproductive performance in *Aspongopusjanus.* Ramanathan (1995) has reported that *Pongamia glabra* leaf extract caused more disintegration of spermatocytes, spermatids and sperms and thus it affects the reproductive potentiality of *Periplaneta americana.*

It is inferred from the above findings that the heavy metal zinc, similar to that of several other toxicants and plant products, causes histopathological changes in the testis and affects the reproductive potential of *Laccotrephes ruber.*

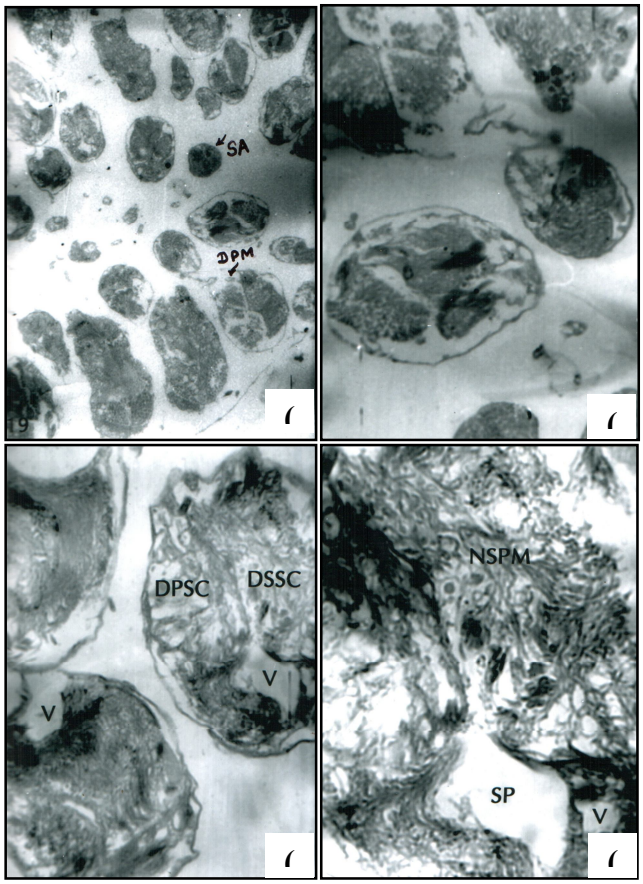

Fig. 5-8 Transverse section of testis follicle of treated insect

SA – Shrunken acini; DPM – Disintegrated peritrophic membrane; V – Vacuole; DPSC – Disintegrated primary spermatocytes; DSSC – Disintegrated secondary spermatocytes; NSPM – Necrotic sperms

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