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RESEARCH ARTICLE

IMPACT OF HEAVY METAL ZINC ON HISTOLOGICAL CHANGES IN THE TESTIS OF ADULT MALE *Odontopus varicornis* (HETEROPTERA: PYRRHOCORIDAE) IN RELATION TO REPRODUCTION

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ABSTRACT

The male reproductive system of *Odontopus varicornis* 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 heavy metal zinc (25 ppm median lethal concentration). The testis of treated insects showed the presence of a ruptured testicular follicle, disintegrated spermatocytes, pycnotic and necrotic spermatids. The toxicity impact of heavy metal zinc on *Odontopus varicornis* was appropriate to be comparatively higher than other insects.

INTRODUCTION

Generally the reproductive system of insects is a complicated one spermatogenesis and testicular developments have been studied in many insects (Numata and Hidaka, 1980 and Lai-Fook, 1982). The testes 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 bodies testis follicle is composed of several acinus. Each acinus of the follicle is externally connected with the peritophic 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. These considerations led to investigate the effect of heavy metal zinc on the testis of adult male *Odontopus varicornis.*

MATERIALS AND METHODS

The adult control and treated *Odontopus varicornis* were kept separately after 48 hours, they were dissected under binocular microscope by using Ringer solution (Emphrussi and Beadle, 1936). The Ringer and subsequently removed and the tissue was fixed in Bouin's fluid for 24 hour. Later, the tissue was processed by adopting standard histological techniques (Gurr, 1958).

RESULTS AND DISCUSSION

The male reproductive system of *Odontopus varicornis* consists of a pair of testes, seminal vesicles, vasa deferentia, a common ejaculatory duct, a pair of tubulae accessory glands and an aedeagus. The longitudinal section of testis in control insects show that the follicle is composed of several *acinus.* Each *acinus* of the follicle is externally connected with thin peritrophic membrane. The apical region contains numerous primordial germ cells which are intensely stained with haematoxylin. The lumen contains many primary spermatocytes and secondary spermatocytes which are deeply stained with eosin. The secondary spermatocytes are smaller than the primary spermatocytes due to mitotic and meiotic divisions. The secondary spermatocytes appear to be more in number than the primary spermatocytes (Figs. 1, 2, 3 and 4).

The histopathological investigations on the reproductive system of insects treated with heavy metals provide an insight into the action of these toxic substances on the reproductive physiology of insects. In the present study it has been mentioned earlier that the follicle of the testis of control insects contained many primary spermatocytes and secondary spermatocytes which were deeply stained with haematoxylin. The sperms were elongated, hair like structures arranged in the form of bundles in the lumen of the follicle. But, the testicular follicle of the treated insects showed many histopathological architecture such as disintegrated apical cells, primary and secondary spermatocytes, reduced nuclear volumes of primary and secondary spermatocytes, weakly stained primordial germ cells, disorganized sperms with broken tails, reduced length of spermatids and sperms, necrotic spermatids and sperms and less packed spermatozoa with more space in the lumen of the follicle (Figs. 5, 6, 7 and 8). These changes might be attributed to the effect of heavy metal 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.*

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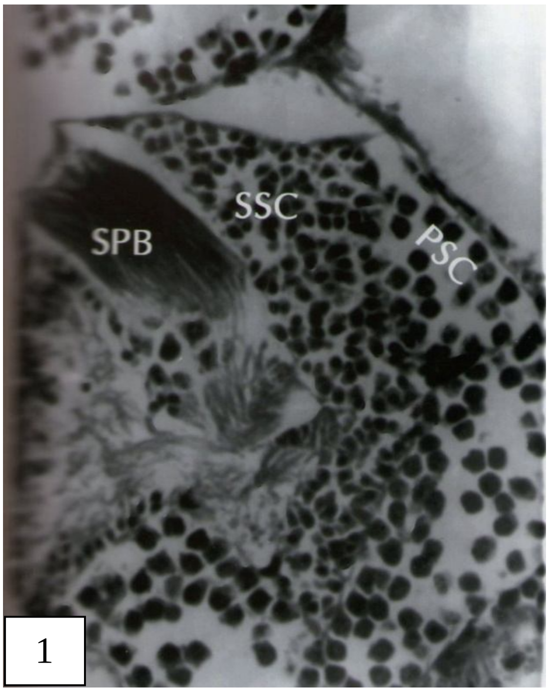
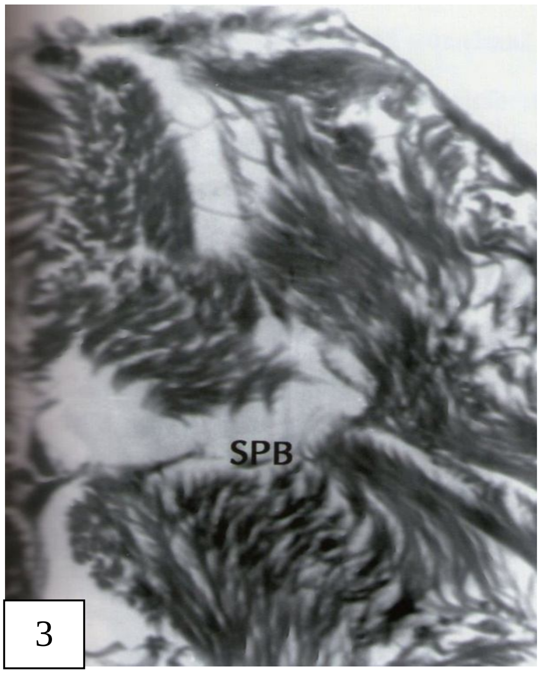


SPB - Sperm Bundle, PSC - Primary Spermatocytes, SSC - Secondary Spermatocytes

Fig. 1 Transverse section of testis follicle of the control insect XCa 40

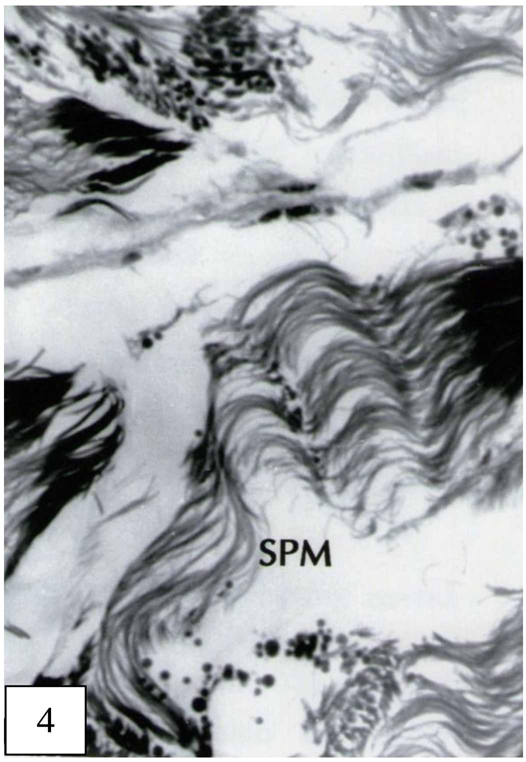
SPT – Spermatids

Fig. 2 Transverse section of testis follicle of the control insect XCa 40



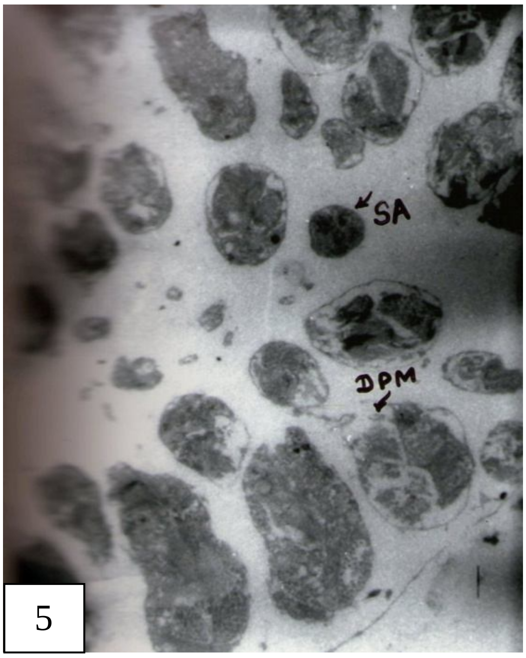
SPB - Sperm Bundle

Fig. 3 Transverse section of testis follicle of the control insect XCa 40



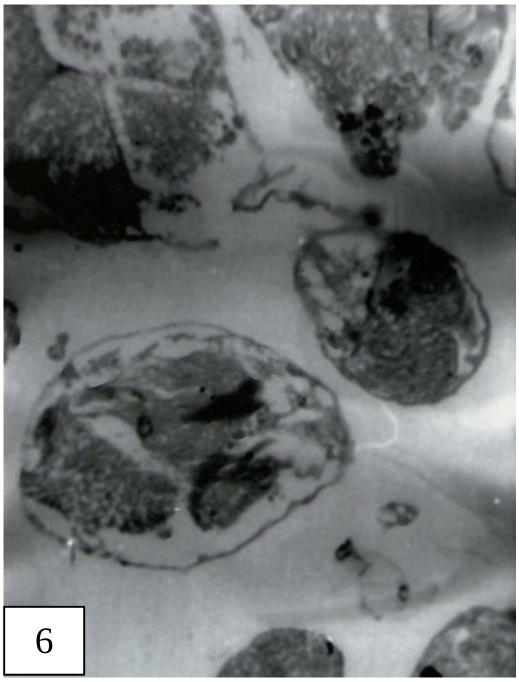
SPM - Sperms

Fig. 4 Transverse section of testis follicle of the control insect XCa 40



SA - Shrunken acini, DPM - Disintegrated peritoneal membrane

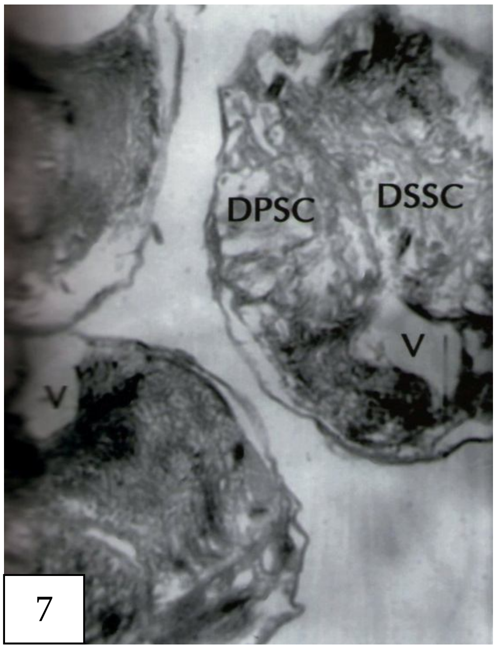
Fig. 5 Transverse section of testis follicle of the treated insect XCa 10



DPM - Disintegrated peritoneal membrane

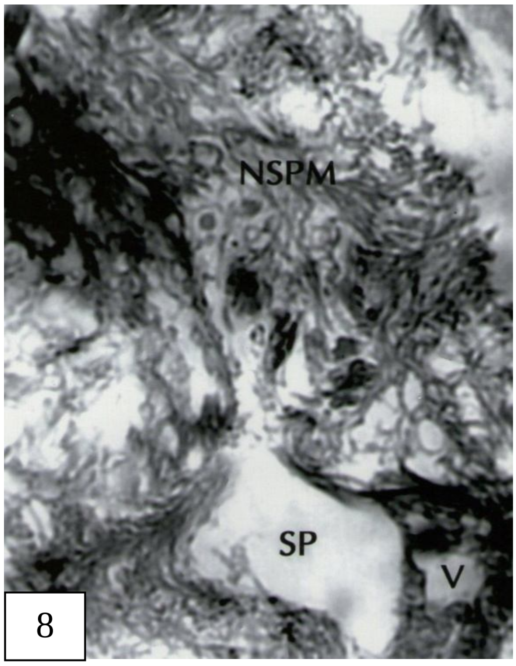
Fig. 6 Transverse section of testis follicle of the treated insect XCa 20

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.



V- Vacuole , DPSC - Disintegrated primary spermatocytes, DSSC- Disintegrated secondary spermatocytes

Fig. 7 Transverse section of testis follicle of the treated insect XCa 40



V – Vacuole, NSPM - Necurotic sperms,SP – Space

Fig. 8 Transverse section of testis follicle of the treated insect XCa 100

EI-Ibrashy (1974) has investigated ecdys.one like substance in the leaves of *Podocarpus gracilior* which he termed as 'Ponasterones' and it brings a sterilizing effect on *Spodoptera littoralis.* 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 *Aspongopus janus.* 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 *Odontopus varicornis.*

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