

Histopathological alteration in the ovaries of the desert locust *Schistocerca gregaria* (Forskal) induced by the IGR consult and Lufox

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ABSTRACT

Histopathological changes in the ovaries were tested in normal adult females and those developed from treated one day old of the fifth nymphal instar of the desert locust with (LC₅₀) of Consult and Lufox.

S. gregaria as well as other orthopterous insects has panoistic ovarioles, each ovariole is divided into a germarium and a vitellarium; the germarium contains the oogonia and the pre-follicular cells which surround the oocytes to form the ovarian follicles in the vitellarium; and is invested with non-cellular tunica propria and an outer cellular sheath (tunica externa).

In the ovarian follicles of those females developed from the treated nymphs with consult showed vacuolization of cytoplasm and degeneration of the cell components of follicular epithelium, oocytes were the most obvious signs of damage.

Damage was pronounced in the ovarioles of these females developed from the treated nymphs with Lufox. Ovariole growth was stunted and vitellogenesis and chorion formation were completely inhibited.

Keywords: Locust, *Schistocerca gregaria*, ovaries, Histopathology, IGR (Consult-Lufox).

INTRODUCTION

Plagues of desert locust, *Schistocerca gregaria* (Forskal) have been recognized as a threat to agricultural production in Africa and western Asia for thousands of years.

IGRs are diverse groups of chemical compounds that are highly active against immature stage of insects and have a good margin of safety to most non-target biota including invertebrates, fishes, birds and other wild life, they are also safe to man domestic animals, they will play an important role in control programs in the future (Mulla, 1995).

The main types of insect growth regulators used commercially are juvenile hormone analogues and chitin synthesis inhibitors (Parrella and Murphy, 1998).

Histological studies of gonads may provide morphological evidence for functions of gonial, extragonial tissues and cells.

The aim of the present study is to examine the histopathological changes occurred in the ovaries of the female *S. gregaria* developed from treated one day old of the 5th nymphal instar with sublethal concentration (LC₅₀) of two compounds of insect growth regulators; Consult (chitin synthesis inhibitor) and Lufox (mixture of juvenile hormone mimic and chitin synthesis inhibitor).

MATERIAL AND METHODS

1-Origin of population

The stock colony of *Schistocerca gregaria* was maintained for several years at the Luocst Research Division. Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza. The insects were reared and handled under the following technique described by Abbassi *et al.* (2003). Leaves of leguminous plant, *Medicago sativa* were daily placed as feeding material. The cages were incubated in a constant room temperature ($32\pm 2^{\circ}\text{C}$) and (30-50 RH).

2- Insect growth regulators used

Two analogues of insect growth regulators (IGRs) were used:

2-1. Hexaflumuron (10% EC) (Chitin synthesis inhibitor):

Consult (Hexaflumuron), [N(((3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy) phenyl)-amino) carbonyl)-2,6- difluoroben-zamide].

2-2. Lufox: mixture of juvenile hormone mimic (Fenoxycarb 7.5% EC), ethyl [2-(4-phenoxyphenoxy) ethyl] carbamate and Chitin Synthesis inhibitor (Lufenuron), (Axor 3% EC). N-[[[2,5-dichloro-4-(1,1,2,3,3,3-hexafluoropropoxy) phenyl] amino] carbonyl] -2,6-difluorobenzamide.

Consult and Lufox have proved to be toxic to one day old of the 5th nymphal instar *S. gregaria*. (Bakr *et al.*, 2009).

3- Experimental insects:

The First day of the 5th nymphal instar of *S. gregaria* was treated with the estimated LC_{50} of Consult and Lufox. The living individuals completed the development to be adults were studied as the treated generation. The ovaries of the tenth day of females were dissected.

These ovaries were used for histological study by the light microscope

4- Light microscop studies:

The adult females were dissected out in Ringer's solution. The female reproductive organs were isolated from the freshly dissected insects.

Bouin's fluid was used to fix the female reproductive organs. The latter were then dehydrated in series of ethanol. Then cleared in xylene and embedded in paraffin wax. Serial sections, 5-7 μm were stained with haematoxylin and eosin, then cleared mounted in DPX.

RESULTS AND DISCUSSION

A) Ovary of normal female:

The female reproductive system consists of a pair of ovaries, which connect with a pair of lateral oviducts. These joint to form a medium common oviduct opening into a genital chamber where a spermatheca is opening for the storage of sperms.

Each ovary consists of a number of panoistic ovariole, where the developed of the oocytes take place. Each ovariole has a wall, which is made up of two layers; an outer ovariole sheath or tunica externa (cellular network) and inner tunica propria (elastic membrane).

B) Structure of ovariol of normal female:

The ovarian follicle of previtellogenic female ovariol is composed of one oocyte and an outer follicular epithelial layer. The oocyte has large germinal vesicle Fig. 1(a). The ovarian follicle is enclosed by one layer of follicular epithelial cells Fig.1 (b).

C) Histopathological studies:

The histopathological investigation of ovarioles of female *S. gregaria* showed different deterioration effect after the treatment of 1- day old of the 5th nymphal instar by Consult and Lufox.

The structure of the previtellogenic ovarian follicles of adult female produced from treated nymphs with Consult has abnormal appearance Fig. (2). Wide spread cytolysis is observed in the follicle. The oocyte can not be identified. The cytoplasm degenerated and vacuolated Fig. (2).

The treatment of the 5th nymphal instar of *S. gregaria* with Lufox, showed malformed adult. The ovariole follicle are occupied by previtellogenic oocytes but no vitellogenic oocytes could be distinguished in any of the examined ovariole Fig. (3). The follicular epithelial cells are greatly malformed and lysis of cytoplasm are observed Fig. (3).

The present study has revealed many histopathological changes in ovaries of ten day old adult females produced of treated one day old of the 5th nymphal instar with Consult and Lufox each at LC₅₀ induced disturbance in protein synthesis of the ovary which reflect an inhibition of ovary maturation.

From the present observations, it is evident that, the follicular cells are suffering from degeneration and vacuolation. Follicular cells apparently regulate transfer of materials for oocyte growth. Histochemical studies on the telotrophic ovarioles of *Crynodes peregrinus* showed that follicle cells synthesize RNA which is exported to oocytes during its early stages of growth (Ray and Ramamurty, 1979).

These findings are similar to those observed by (Lim and Lee, 1982) who reported that diflubenzuron (DFB) retard the maturation of oocytes when applied against grasshopper, *Oxya japonica*. Also, Davey *et al.* (1993) recorded that the follicular epithelium surrounding the vitellogenic oocytes of *Locusta migratoria*, developed large spaces between the cells when ovary was exposed to methoprene.

Also, Tanaka *et al.* (1998). Applied juvenile hormone analogue, methoprene to *Locusta migratoria* and they found stimulated oocytes development in reproductively inactive females, while Zhang and Qi (2008) applied fenoxycarb against the newly emerged adults of *xenopsylla cheopis*, they found that the ovarian cells became atrophied.

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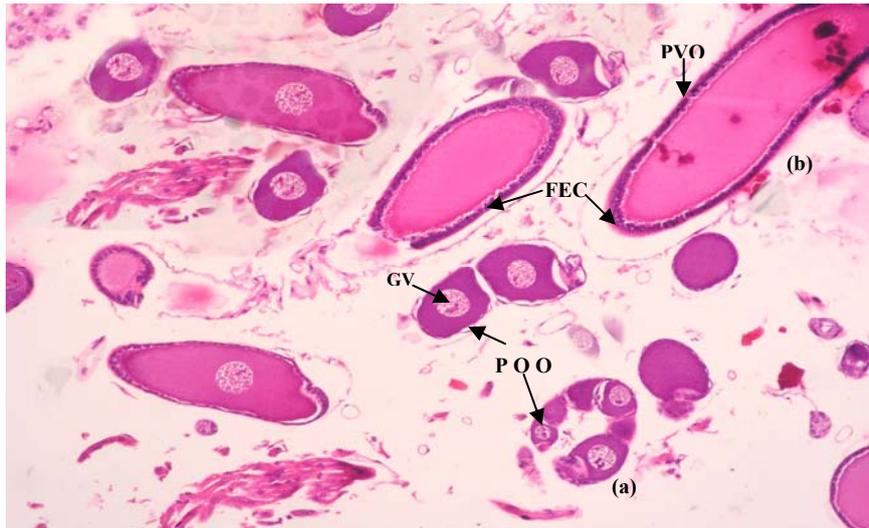


Fig. 1: Light micrograph of longitudinal section of ovary of normal female desert locust, *Schistocerca gregaria* shown different stages of immature oocytes. Notice primary oocyte (POO), previtellogenic oocyte (PVO), follicular epithelial cells (FEC), germinal vesicle (GV). (H&E, x100)

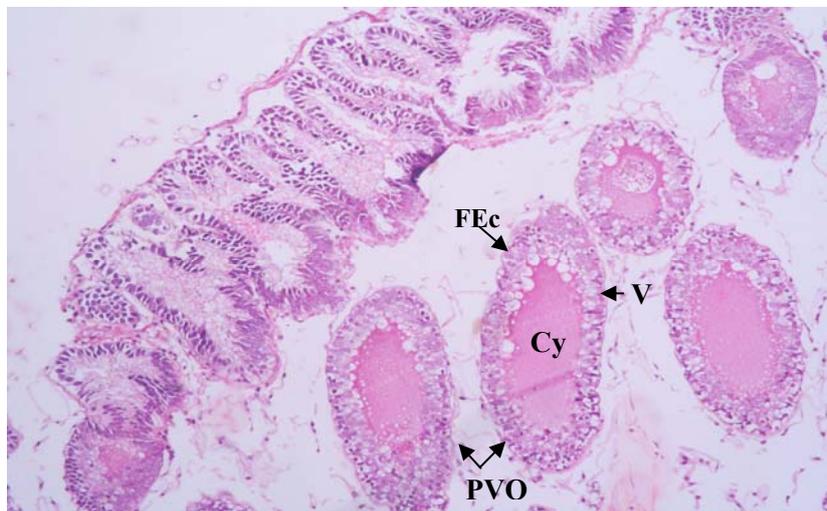


Fig. 2: Light micrograph of longitudinal section of ovary of normal female desert locust, *Schistocerca gregaria* developed from treated 1 day old of the 5th nymphal instar with LC₅₀ of consult shown previtellogenic oocytes (PVO), vacuoles (V) in follicular epithelial cells (FEC) and cytoplasm. (H&E, X 200).

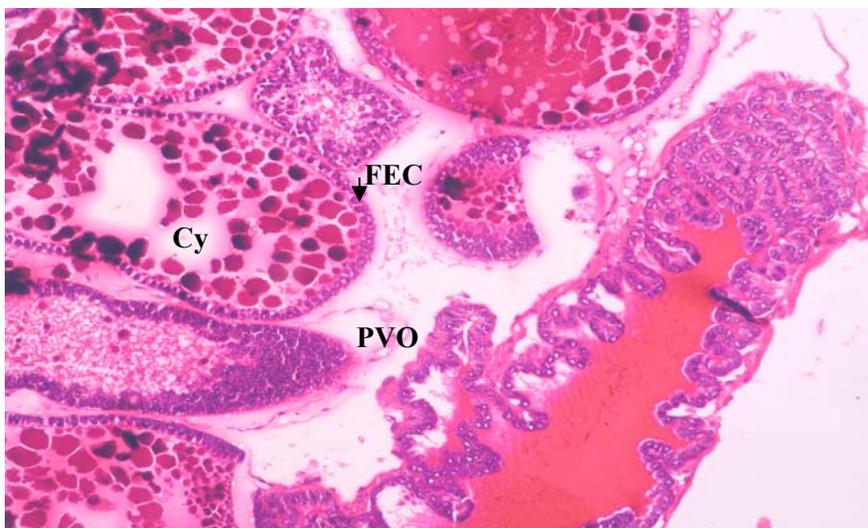


Fig. 3: Light micrograph of longitudinal section of ovary of normal female desert locust, *Schistocerca gregaria* developed from treated 1 day old of the 5th nymphal instar with LC₉₀ of lufox shown malformed previtellogenic oocytes (PVO), follicular epithelial cells (FEC) and cytoplasm (CY).

ARABIC SUMMARY

التغيرات النسيجية فى مبيض الجراد الصحراوى شيستوسيركا جريجاريا الناتجة من منظمات النمو الحشرية الكونصلت واللوفكس

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تم دراسة التغيرات النسيجية فى مبايض الطور اليافع للجراد الصحراوى بعد عشر أيام من انسلاخها من العمر الخامس المعامل أول يوم بالكونصلت واللوفكس. وأوضح الفحص النسيجي للمبيض المعامل بالكونصلت ظهور فجوات فى الخلايا الطلائية المحيطة بالبويضة وكذلك فى السيتوبلازم بينما المبيض المعامل باللوفكس أظهر تشوهات فى البويضات حيث أصبحت ممثلة بنشقات من السيتوبلازم وكذلك نشوه فى الخلايا الطلائية المحيطة بها حيث أصبحت مدمج خلوي.