Histopathological Effects of Thiourea on the Ovarian Development of *Calliphora erythrocephala*

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(Received September 10, 1977)

A study of the histopathological effects of thiourea on ovarian development of *Calliphora erythrocephala* was made by feeding their adults at 0.37% concentration for a period of first 48 hrs. The visible effects of chemosterilant were inhibition of development, irregular shape of follicle epithelial nuclei, clumping of chromatin material of follicle epithelial and nurse cell nuclei, vacuolation in the nurse cell and oocyte cytoplasm and delayed and poor synthesis of yolk in oocyte. The changes caused by thiourea have also been interpreted.

INTRODUCTION

The use of chemosterilants has now been well recognized throughout the world as a very effective method of controlling insect population. This normally aroused the curiosity of the researchers to know the histopathological effects of such chemosterilants on the development of gonads.

MORGAN and LABRECQUE (1962) and MORGAN (1967) used apholate and hempa respectively on *Musca domestica*. They reported that these chemosterilants inhibited the ovarian development, caused vacuolation of nurse cell cytoplasm and pycnosis of follicle epithelial cells. They also recorded the clumping of chromatin material in nurse cell nuclei. Recently CHAUDHRY and TRIPATHI (1976) have studied the histopathological effects of thiourea on the ovarian tissues of *Sarcophaga ruficornis*. Besides these changes they have also reported complete inhibition of the formation of yolk granules in the ooplasm and the transformation of follicle epithelium into a syncytial condition. In the present paper we have studied the histopathological effects of thiourea on the ovarian tissues of virgin females of *Calliphora erythrocephala*.

MATERIAL AND METHODS

Two groups of newly hatched virgin female *Calliphora erythrocephala* obtained from the culture maintained in laboratory kept in wire-meshed cages between 25–28°C temperature and 80–85 % relative humidity. For the first 48 hrs, one group was fed on a diet of bread soaked with milk containing 0.37 % thiourea, while the other group used as control, was fed on bread soaked with milk only. Thereafter both experimental as well as control flies were maintained on a diet of flesh and sugar solution. Ten flies from each group were then subsequently taken out at random every 24 hrs up to the age of 192 hrs and dissected in insect Ringer solution. Their ovaries were fixed in freshly prepared Bouin's fluid, dehydrated and embedded in paraf-

fin wax (m. p. 60°C) in the usual manner. Serial microtome sections of the ovaries at 6 μ were cut and stained with HEIDENHAIN'S-iron-alum-haematoxylin.

OBSERVATIONS

The ovariole of *Calliphora erythrocephala* is polytrophic type which is identified by the presence of a group of nurse cells and an oocyte surround by follicle cells. On comparison of the ovaries of the treated with untreated flies, up to 72 hrs after eclosion, no visible changes were recorded. However, differences began to appear beyond 72 hrs. It is noted that the relative size of the follicle, the nurse cells, and the oocyte in experimental insects are always smaller as compared to those in control animals. (Figs 1~9). Further the growth of the follicle in the experimental insects remains almost stationary beyond 144 hrs (Figs 7~9).

In control insects the follicle epithelial cells are more or less columnar in the beginning each with a large globular nucleus having dispersed chromatin material (Figs 1~2). But in 168 hrs these cells get transformed into squamous type (Fig. 4). In the ovariole of the treated forms though the follicle epithelial cells remain columnar throughout, nuclei become irregular and chromatin gets clumped in a solid mass. (Figs 7~9).

In the control flies the nurse cell nucleus shows a fine reticular net work of chromatin material on which irregularly distributed minute chromioles are present (Figs 1~2). But this chromatin, in experimental insects at 144 hrs, appear to be clumped in small grain like masses (Fig. 7). The cytoplasm of the nurse cells and oocyte also show vacuolation. With the advancement of time both these effects become more apparent (Figs 8~9).

The yolk deposition in ooplasm of the normal insects starts at 96 hrs. By 144 hrs the entire ooplasm is filled with large spherical darkly stained yolk bodies (Figs 1~3). On the contrary the formation of yolk in experimental insects is very slow. It starts appearing in the form of a few small granules at 120 hrs and even up to 192 hrs remains only sparsely distributed (Figs 5~9).

DISCUSSION

DEEPAK and CHAUDHRY have established that a minimum concentration of 0.37 % of thiourea brings about sterility in the female *Calliphora erythrocephala* which on being mated to normal male produce only nonviable eggs (unpublished). In all the experiments in the present work, therefore, the same concentration of thiourea has been used.

BIER (1962) in *Calliphora* has shown by radioisotope labelling technique that H³-histidine is found in follicle epithelial cells within a short time after injection and later in the ooplasm. This according to him suggests participation of the follicle epithelium in yolk formation. By labelling techniques the follicle epithelial cells of a variety of species have been found to be rich in RNA (BIER, 1963; RAMAMURTY, 1963). It is thus possible that high rate of RNA synthesis in these cells is associated with yolk protein synthesis. In the present experiment the nucleus of each follicle cell of *Calliphora erythrocephala* treated with thiourea becomes irregular and its chromatin becomes clumped, which shows a pathological state of follicle cells. The poor synthesis of yolk

Figs 1~9. Sections of ovaries of *Calliphora erythrocephala* untreated (Figs 1~4) and treated with thiourea (Figs 5~9). Hours after eclosion : (1), 96; (2), 120; (3), 144; (4), 168; (5), 96; (6), 120; (7), 144; (8), 118; (9), 192. F, Follicle; NC, Nurse cell; NCN, Nurse cell nucleus; OC, Oocyte; OCN, Oocyte nucleus; V, Vacuole. All photomicrographs are of same magnification except for Fig. 4, which is just half of the magnification of other cases.

in the oocyte may therefore be due to the pathogenicity of thiourea.

It is well known that the nurse cells of polytrophic ovariole break-down at certain stages of egg maturation. The break-down products are incorporated into the oocyte and thus form an additional source of protein and RNA. KLUG (1968) has demonstrated that in the eggs of sterile mutant *Drosophila* the cessation of growth of oocytes is associated with abnormal clumping of chromosome in the nurse cells. Thus a hypothesis has been advanced by him that ribosomal biogenesis is impaired and that consequently little RNA enters the oocyte where yolk synthesis normally occurs. Based on this hypothesis it may be assumed that in *Calliphora erythrocephala* the clumping of chromatin material of the nurse cell nuclei after 144 hrs in the treated flies may be responsible in arresting the growth of the oocyte. The vacuolation of the nurse cell cytoplasm in *Calliphora erythrocephala* likewise may also impair the nutrition of the eggs. The vacuolation in the ooplasm of the treated flies may be either due to improper nourishment from the nurse cells or it may be due to direct interaction of the thiourea with the oocyte. The consequent result of thiourea in *Calliphora erythrocephala* is that the ovarian follicle not only remains under developed but also shows pathological condition.

REFERENCES

- BIER, K. (1962) Autoradiographische Untersuchungen zur Dotterbildung. *Naturwiss.* **49**: 332-333.
- BIER, K. (1963) Autoradiographische Untersuchungen über die Leistungen des Follikelepithels und der Nahrzellen bei der Dotterbildung und Eiweissynthese im Fliegenovar. *Arch. Entwicklungsmech. Organ.* **154**: 552-575.
- CHAUDHRY H.S. and C.P.M. TRIPATHI (1976) Histopathological effect of thiourea on the ovarian tissues of *Sarcophaga ruficornis* (FABR.). *Experientia.* **32**: 103-104.
- KLUG, W.S. (1968) Oogenesis in the Su²-Hw mutant of *Drosophila melanogaster*. *Ph. D. Thesis, Northwestern University, Evanston.*
- MORGAN, P.B. (1967) Effects of hempa on the ovarian development of house fly, *Musca domestica* (Diptera: Muscidae). *Ann. ent. Soc. Amer.* **60**: 812-818.
- MORGAN, P.B. and G.C. LABRECQUE (1962) The effect of apholate on the ovarian development of house flies. *J. econ. Entomol.* **55**: 626-628.
- RAMAMURTY, P.S. (1963) Über die Herkunft der Ribonukleinsäure in den wachsenden Eizellen der Skorpionsfliege *Panorpa communis* (Insecta, Mecoptera). *Naturwiss.* **50**: 383-384.