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EFFECT OF CADMIUM CHLORIDE ON THE SPERMATOGENESIS OF *MUSCA DOMESTICA NEBULO* F. (DIPTERA : MUSCIDAE)

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Various concentrations of Cadmium chloride ranging from 0.01 to 5.00 % were given with food as a chemosterilant to the house fly, *Musca domestica*. Concentrations of 0.01 to 0.09 % affect only the general health of the individual but there occurs no sterility. Concentrations ranging from 0.1 to 2.0 % cause a temporary but complete sterility. The higher doses of 3.00 to 4.00 % concentrations induce permanent complete sterility. With 5.00% concentration, there is either no emergence of adult flies or, if any they die after few hours of emergence.

INTRODUCTION

A survey of literature reveals that there is no work on the effect of Cadmium chloride on *Musca domestica*. A good number of works are, however, there which deal with different chemicals on different insects (Schwartz, 1965; Das, 1967; Ezuch & Hoopingarner, 1967; Kappus & Corristan, 1967; Saito, 1967; Hamilton & Sutter, 1967; Parnell & Mettrick, 1969; Pillai & Grover, 1969; Henneberry *et al.*, 1972; Hsieh & Kowski, 1973; Nath *et al.*, 1975; Nath & Sharma, 1977; Chocholata, 1978).

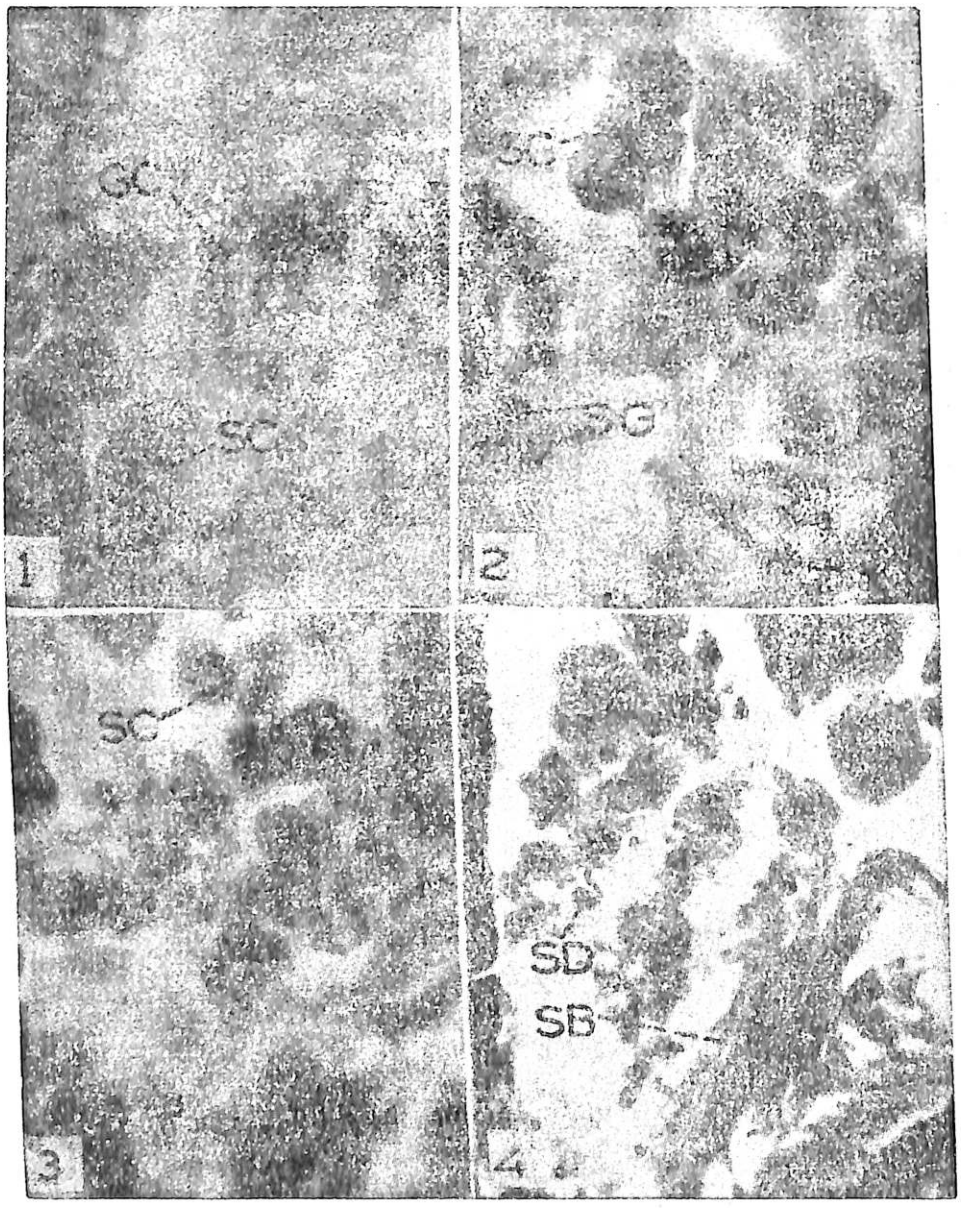
MATERIAL AND METHODS

The flies were reared in the laboratory at 28—30°C temperature and relative humidity 60—70%. Various concentrations T1—T9 of the chemosterilant, Cadmium chloride mixed with food were given to third instar larvae (last instar). For control, the food was without Cadmium chloride. The solvent used was water and the concentration of the compound was determined w/w with respect to food.

Table I. Data on duration and mortality of third instar larva and pupa and of mating bouts with respect to spermatogenesis of adults obtained from control and treated larvae of *Musca domestica nebulo*.

Experiments	Duration of 3rd instar larva (hrs)	Duration of pupa (hrs)	Mortality of 3rd instar (%)	Mortality of pupa (%)	Number of mating bouts to regain normalcy.
	72 3	101 8	5.2	8 6	Normal from birth
(T1) 0.01 % to 0.09 % concentration	75.3	104 6	10.8	11 6	Normal from birth
(T2) 0.1 % to 0.4 % concentration	80 2	107 5	13.6	13.7	2 to 3 with 0.1% 5 to 6 with 0 2% to 0.4%
(T3) 0.5 % concentration	83.4	112.8	16.6	19 2	6 to 7
(T4) 0 6 % to 0.7 % concentration	87.7	114.1	19.8	25.8	7 to 8
(T5) 0.8 % to 0.9 % concentration	90.5	118.3	23.4	32.7	8 to 9
(T6) 1.0 % to 2.0 % concentration	92 2	122.0	28.3	40.0	10 to 11
(T7) 3.0 % concentration	96.5	127.0	40.5	49 9	Complete sterility
(T8) 4.0 % concentration	99.4	130.6	56.1	60 3	Complete sterility
(T9) 5.0 % concentration	101.3	138.9	75 8	90 8	No mating

Adult flies were dissected in the physiological saline (0.7% aqueous NaCl). Sections of testis fixed in Zenker and Bouin's fixatives, were stained with Hematoxylin–Eosin stain. To see the extent of sterility the treated males were



Figs. 1–4. 1. 0.1% $CdCl_2$ effect on germ cells. 2. 0.2 to 0.4% $CdCl_2$ concentration effect on spermatogonia and spermatocytes. 3 Starting of necrosis with 0.5% to 0.7% $CdCl_2$ concentration similar effects are with 0.8% and 0.9% But effects are severe with 0.8% and 0.9% 4. Spermatids show beaded appearance with 1.0% $CdCl_2$. Similar effects are with 2.00% to 4.00% $CdCl_2$ (Abbreviations–GC, Germ cell, S. spermatozoa; SB, sperm bundle; SC, spermatocyte; SD, spermatid; SG, spermatogonia).

mated with untreated females and subsequently observations were made on spermatogenesis in relation to mating through histological preparations

RESULTS AND DISCUSSION

Lower doses of this chemosterilant (0 01 to 0.09 %) do not have any notable effect on the process of spermatogenesis in *Musca domestica nebulo* (Table I). However, the doses of 0 1 to 2.00 % concentration induce a complete but temporary sterility. The dose of 0 1 % shows slight effect due to loosening and clumping of the germ cells (Fig. 1). With this concentration the other stages of spermatogenesis remain uneffected morphologically but the number of cysts become quite less as compared to the control ones. Similar studies have also been made by Schwartz (1965); Rai (1964) with different chemosterilants. Saini *et al.* (1984) found that when newly emerged treated males were mated with untreated virgin females, the eggs laid by latter did not hatch. However, when untreated virgin females were mated with 2–3 days old treated males or with treated males having already the experience of 2–3 matings with other untreated virgin females, the eggs were laid but the rate of hatching was only 60–80 %. Rate of hatching become, cent percent when untreated virgin females were mated with 8-9 days old treated males. The authors thus conclude that when entire Cadmium chloride is excreted out, normalcy is regained. As the excretion is stepwise, so is the regaining of normalcy. With 0 2 % and 0 4 % doses the period of complete but temporary sterility is extended. Only the spermatogonial cysts are effected (Fig. 2). The newly emerged treated male starts producing normal healthy sperms after 5-6 matings with different untreated virgin females. Extent and duration of sterility are directly related with the amount of Cadmium chloride in the body. Doses of 0 5 to 0.7 % cause necrosis of spermatocytes (Fig. 3) and consequently their number in the following stages is reduced (Cline, 1968). Still higher doses 0.8 % and 0.9 % cause similar but more severe effects (Fig. 3). Sterility period is also considerably extended, *i. e.* upto 8 to 9 matings in 0.8 to 0.9 % concentrations (Table I). With the still higher doses, *i. e.* 1.0 % and 2.0 %, the spermatids give beaded appearance and are less in number as compared to normal ones (Fig. 4), sterility period lasts from 10—11 matings. Doses of 3.0 % and 4.0 % cause inactivity and reduction in the number of spermatozoa (Fig. 4). The adult life span is considerably shortened. This dose is sufficient for complete and permanent sterility. To confirm it further a dose of 5.0 % concentration was given. This dose effects the physiology of the individual to such an extent that the adult life span becomes very much shortened. It has been observed that either there is no emergence of adult flies with this dose or if there is any, the latter dies after 4-6 hours of emergence.

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