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Estrogenic Effects of Aldrin and Quinalphos in Rats

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Aldrin and quinalphos are the two extensively used insecticides in agriculture in India. Previous investigations from this laboratory reported that the administration of aldrin and quinalphos to rats reduced the steroidogenic and spermatogenic functions of testis (Chatterjee et al 1988, 1988a; Ray et al 1988). The existing literature revealed that some insecticides adversely altered the male reproductive function due to their strong estrogenic property (Goldman et al 1986; Eroschenko 1978). In this context, we investigated whether the aforesaid insecticides have any estrogenic property which would be of value to correlate the inhibitory effects of these compounds on male reproduction.

The present studies were under taken to examine the estrogenic activity of aldrin and quinalphos in female rats.

MATERIALS AND METHODS

In the present experiments 24 sexually immature (22 day, weighing 29-32g) and 24 mature (90 day, weighing 120-140g) female Wister strain rats were used. They were housed at a constant lighting schedule of 12 hours per day and fed a standard rat's diet ad libitum. Immature rats were randomly divided into three groups (gr.I, II and III) consisting of eight rats in each group. Rats of first two groups (gr.I and II) were injected subcutaneously with aldrin and quinalphos respectively at a dose level of 1 mg/kg/day for 3 days and the remaining group (gr. III) was injected with sesame oil (0.1ml) to serve as vehicle-treated control. The mature rats were duly ovariectomized seven days prior to treatment with the insecticides. They were

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divided into three groups (gr. IV, V and VI) consisting of eight rats in each group. A similar experimental design was also applied to ovariectomized mature rats. Estrus cycles of ovariectomized rats was studied by examining vaginal smear three days after ectomy up to the date of cessation of treatment. All the rats were sacrificed 24h after the last injection. The uterus of each rat were dissected out, trimmed of fat, blotted and weighed. Carnoy-fixed paraffin sections of uteri (5μm thick) were used for histochemical localization of periodic acid-Schiff (PAS) positive substance by the method of Hotchkiss (1948) with saliva-treated control. They were also stained with routine haematoxylin and eosin for histological examination. Uterine weights were recorded and analyzed statistically, using the Dunnet test. The insecticides and their sources were as follows : Aldrin (1,2,3,4,10,10-hexachlor-1,4,4a,5,8,8a-hexahydro-1,4-endo-exo-5,8-dimethanonapthalene); Quinalphos (O,O-diethyl-O [quinoxalinyl (2)]- thionophosphate). Aldrin was obtained from National Organic Chemical Limited, Bombay, India and quinalphos was purchased from Sandoz (India) Limited, Bombay, India.

RESULTS AND DISCUSSION

The results of this experiments are shown in Table 1. Both the insecticides produced a significant increase in the weights of uteri in immature and ovariectomized mature rats in comparison to their corresponding vehicle-injected control. On histochemical studies, a remarkable increase periodic acid-Schiff (PAS) positive substance was observed in the uteri of both insecticide treated groups, as opposed to their corresponding controls. Aldrin and quinalphos treatment also produced a profound increase in the endometrial thickness and proliferation of endometrial glands of uterus (Figures 1 and 2). However, rats receiving vehicle showed atrophied endometrium and congestion of its glands (Figure 3). All the ovariectomized rats exhibited diestrus stage on vaginal smear examination before they were subjected for treatment. It was found that administration of aldrin and quinalphos induced a persistent vaginal estrus where as in vehicle-injected ovariectomized rats, a constant diestrus was noted.

Estrogen is important during the development and function of female reproductive organs of mammals. It is well established that estrogen is responsible for the estrus cycle and it helps to increase

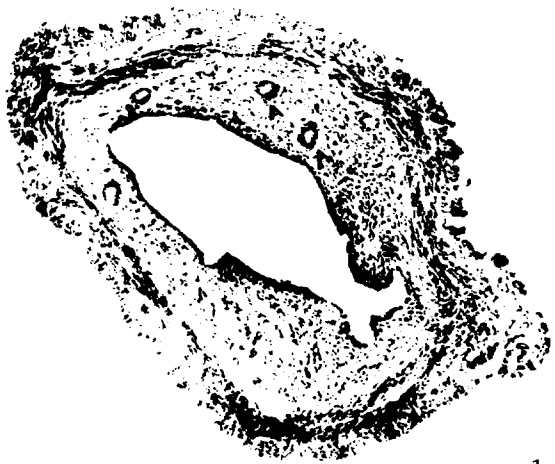

Figure 1. Uterus from a ovariectomized rat treated with aldrin (1mg/kg), showing enlargement of endometrium and proliferation of endometrial glands. PAS & H x 250.

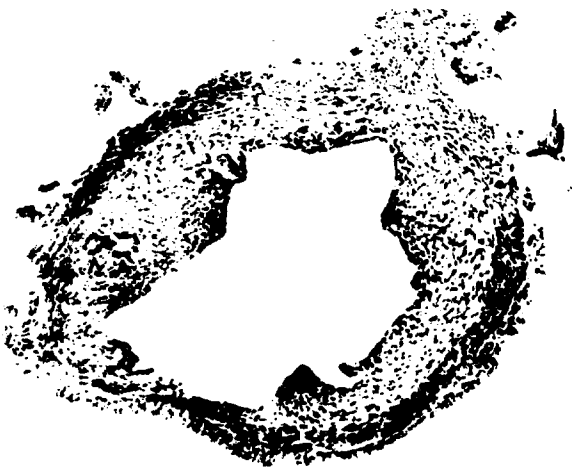

Figure 2. Uterus from a overiectomized rat treated with quinalphos (1mg/kg), showing enlargement of endometrium and proliferation of endometrial glands. PAS & H x 250.

uterine weight and glycogen content along with endometrial proliferation (Best and Taylor 1955). In the present study, the administration of aldrin and quinalphos produced a significant increase in the weight of uteri, uterine glycogen content,

Table 1. Effect of Aldrin and Quinalphos (1mg/kg/day, s.c.) on Estrus cycle, uterine weights and glycogen content in immature and ovariectomized mature rats. (Mean±SEM, n=8).

Group	Condition	Treatment	Uterine wt.(mg/ 100g)	Uterine Glycogen content	Estrus Cycle
I.	Immature	Aldrin	94.30[a] ±1.99	3+	-
II.	"	Quinalphos	72.24[a] ±1.05	3+	-
III.	"	Vehicle	60.71 ±1.60	2+	-
IV.	Mature (Ovariecto-mized)	Aldrin	108.18[a] ±2.50	4+	Estrus
V.	"	Quinalphos	94.45[a] ±1.95	4+	Estrus
V.	"	Vehicle	80.61 ±2.10	2+	Diestrus

'a' = $P < 0.001$, when compared with corresponding vehicle-injected controls.

'+' = Indicate the intensity of colour reaction.

proliferation of endometrium and its glands both in immature and ovariectomized mature rats, indicating estrogen like action of the compounds. The induction of persistent vaginal estrus following the treatment of both aldrin and quinalphos to ovariectomized mature rats further suggested their estrogenic nature. These insecticides appear to have produced such an effect directly on the uterine endometrium and not by liberating estrogen from ovaries since the animals were either devoid of their ovaries (ovariectomized) or had undeveloped ovaries (immature).

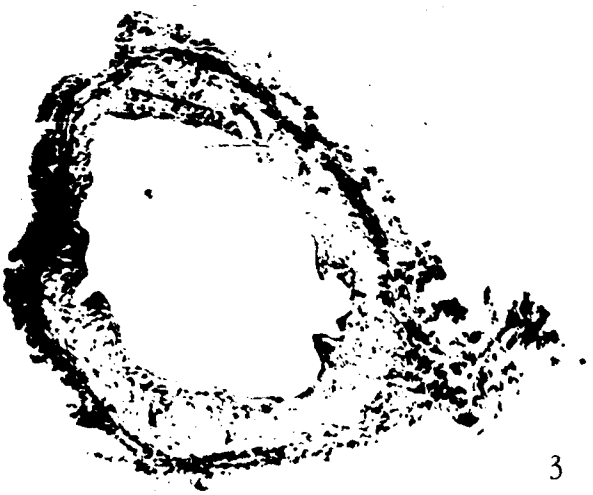

Figure 3. Uterus from a ovariectomized rat treated with vehicle, showing atrophied endometrium and congesion of endometrial glands. PAS & H x 250.

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