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EFFECT OF CERTAIN ALKYLATING CHEMOSTERILANTS ON THE OVARIAN STRUCTURE AMERICAN COCKROACH (ORTHOPTERA: BLATTIDAE)

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IN the course of an investigation on the effect of apholate on corpora allata of *Periplaneta americana* (Bhargava and Tandon)[1], it was observed that corpora allata showclear signs of degeneration after the treatment. Since terminal oocytes in the ovaries of such cockroaches showed complete inhibition of growth and indication of resorption, it seemed of interest to see if the inhibition of oocyte development and resorption is due to inhibition of hormone release from corpora allata. The following experiment was, therefore, performed. Apholate, metepa and thiotepa were selected for the trials.

The cockroaches were bred in the laboratory on dried and powdered bread. Food of the experimental insects was saturated with 2% solution (in redistilled water) of one of the chemicals selected and dried. The ovaries were removed, fixed in Bouin's and sections were cut. Sections were stained with haematoxylin and eosin. Sections of treated cockroaches were compared with similar preparations from untreated ones (Fig. 1).

Results with Apholate

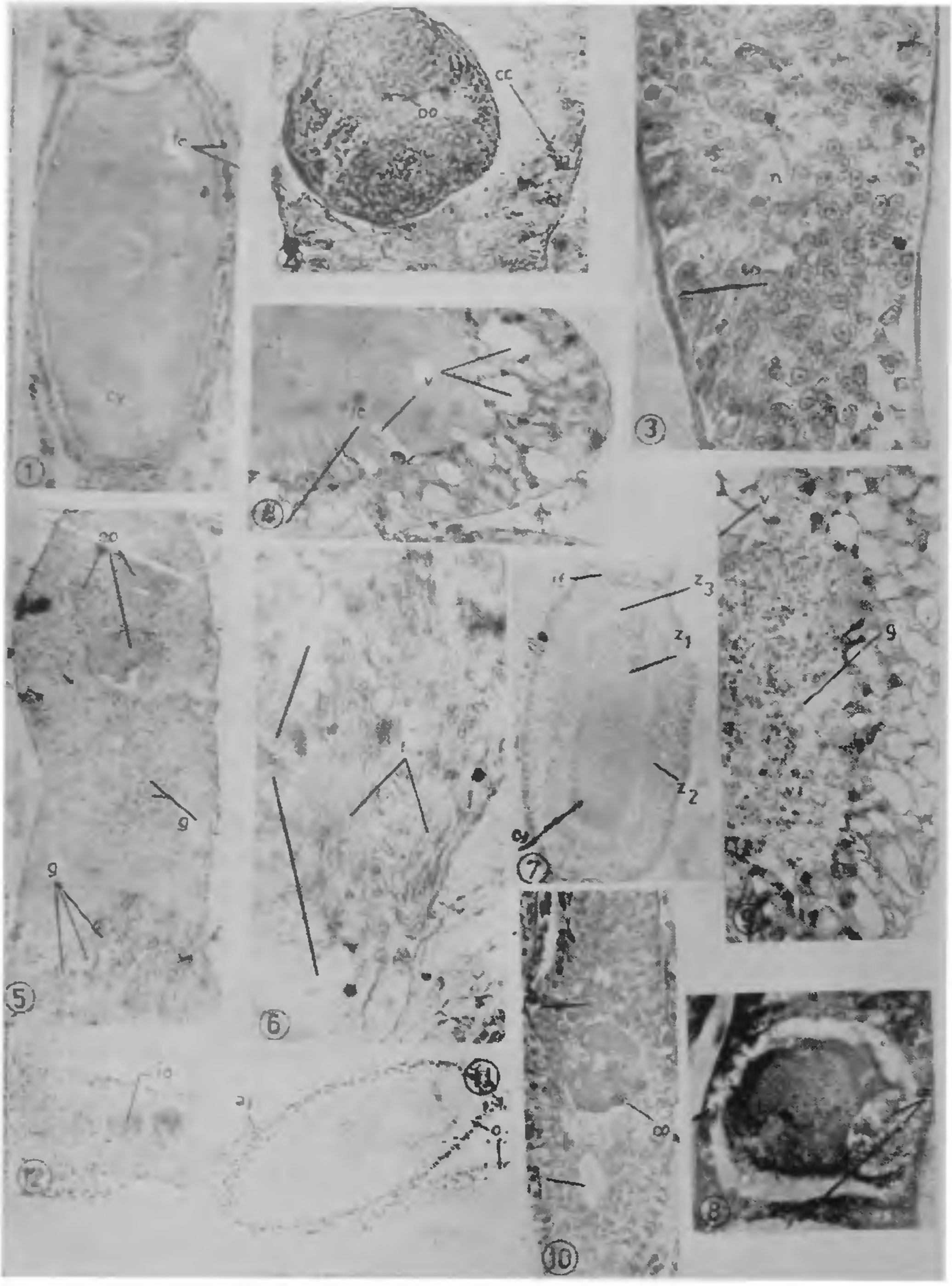
Within 24 hr a few small vacuoles appear in the peripheral cytoplasm of the mature oocytes and the follicular epithelial cells. The immature oocytes start shrinking away from the follicular epithelium (Fig. 2) and the interfollicular tissue becomes thin. After 72 hr, the interfollicular tissue degenerates completely and thus all the follicles of an ovariole become continuous (Fig. 4). The vacuoles increase in number as well as in size. The nuclei show clumped chromatin. The presence of a few small granules in the cytoplasm of the mature oocytes indicates the beginning of granular degeneration. After 120 hr the ovarioles start shrinking. This disturbs the linear arrangement of the oocytes which are now seen placed side by side at the distal end of the ovariole (Fig. 5). The external ovariole sheath does not shrink as rapidly and gets separated from the ovariole, and, therefore, can be seen projecting beyond the apex of the ovariole. The granules in the mature oocytes become larger and irregular in shape. After 144 hr here is notable reduction in the length and width of the ovariole. This makes the elastic tunica propria thick due to contraction. By 216 hr, the immature oocytes become completely degenerated leaving only the follicular tissue in the distal end of the ovariole. There is further reduction in the size and the intensity of staining. Proximally, the ovarioles show numerous irregular solid particles out of which some stain deeper (Fig. 5). A few ovarioles show fibres at their proximal ends indicating the beginning of fibrous degeneration (Fig. 6). Prolonged treatment further reduces the size of the ovarioles, causes the discharge of solid particles leaving empty spaces (Fig. 6) and increases the vacuolization and nuclei concentration.

Results with Metepa

The effects of metepa also become distinctly visible within 24 hr. There is a general thickening of the follicular epithelium. However, the epithelium enveloping the mature oocytes becomes more thick and shows more or less three distinct zones—the outer showing vacuoles, the middle losing the staining intensity while the inner zone remains normal. After 48 hr, the number and the size of the vacuoles in the oocyte cytoplasm increase and the germinal vesicle contents become granular. The oocyte which starts shrinking away from the follicular epithelium shows distinct zones in its cytoplasm, the inner zone showing two or more lobes of dark staining clumped chromatin material. Within 72 hr of treatment the interfollicular cells first become flat and then degenerate making the follicles continuous. The nuclei show karyorrhexis. The mature oocytes show a complete picture of vacuolar and granular degeneration (Fig. 9). After 96 hr the ovarioles show only remnants of oocytes having round or ovoid granules in the cytoplasm enveloped in thick epithelium (Fig. 10). Prolonged treatment further reduces the width of the ovarioles.

Results with Thiotepa

The effects of thiotepa are more or less similar to those produced by metepa (Figs. 11 and 12). However, the interfollicular tissue degenerates within 48 hr and granular degeneration sets in within



FIGS. 1–12. Fig. 1. Section of normal ovary, 10 × 10. Fig. 2. 72 hr (alpholate treated) —showing reduced cytoplasm in follicular cells and shrinkage of the oocyte, 10 × 40. Fig. 3. 145 hr.

(apholate treated)—Distal end of the ovariole showing follicular epthelium of two sides coming closer because of reduced size of oocyte. Note the presence of vacuoles and cellular degeneration in follicular tissue and thick tunica propria, 10 × 40. Fig. 4. 72 hr (apholate treated) follicles have become continuous due to degeneration of interfollicular tissue, 10 × 40. Fig. 5. 216 hr. (apholate treated)—showing distal end of ovariole with three clumped oocytes two of them placed side by side. Note the aggregation of nuclei in the centre. The proximal end of ovariole shows dark stained granules of large size, 10 × 10. Fig. 6. 216 hr (apholate treated)— proximal end of the ovariole showing fibrous degeneration. Note that the granules have been discharged leaving empty speces, 10 × 40. Fig. 7. 24 hr. (metepa treated)—The cytoplasm of the oocyte showing three different zones. Also note the vacuoles in cytoplasm. 10 × 10. Fig. 8. 48 hr (metepa treated)—Oocyte showing the bursting of the germinal visicle. Note the granulation of the material of germinal vesicle, 10 × 40. Fig. 9. 72 hr (metepa treated)—Mature oocyte showing increased thickness of the follicular epithelium and large vacuoles. Note also the granulation of cytoplasm, 10 × 40. Fig. 10. 96 hr (metepa treated)—Note the enlarged follicular tissue and only remnants of cytoplasm and granules, 10 × 40. Fig. 11. 24 hr (thiotepa treated)—Oocyte cytoplasm showing three distinct zones. The follicular epithelium has thickened, 10 × 40. Fig. 12. (Thiotepa treated) —showing continuation of the follicles. Note clumping of the chromatin, 10 × 10.

cc—Clumped chromatin; *cv*—Cytoplasm; *f*—Fibres; *fe*—Follicular epithelium; *g*—Granules; *gv*—Germinal vesicle; *if*—Interfollicular tissue; *io*—Immature oocyte; *n*—Nuclei; *o*—Ovariole; *oo*—Oocyte; *s*—Space; *tp*—Tunica propria; *v*—Vacuoles; *z-1* to *z-3*—Zones of damaged oocyte.

72 hr. The size of the ovariole remains uneffected. Prolonged treatment produces fibrous degeneration.

Morgan[2] expressed his doubt that the affected cells may be able to overcome the effect of chemosterilants. The formation of fibrous tissue after the treatment with apholate, metepa and thiotepa clearly indicates that the damage is a permanent one. Though the nature of the damage in the ovarioles caused by all the three chemicals is more or less same, it is interesting to note that apholate affects the length and width both (as was also reported by Burden and Smittle[3]) metepa only the width while thiotepa does not affect the size of the ovariole at all.

La Brecque and Smith[4] raised a question whether chemosterilants affect fecundity and oviposition through inhibition of neuroendocrine system in insects. Bhargava and Tandon[1] report that apholate causes atrophy in corpora allata and thus inhibits hormone release in *P. americana*. Apholate has been known to affect fecundity and oviposition in many insects[5-7]. The present investigation clearly shows that oocytes are damaged beyond repair after treatment with apholate, metepa and thiotepa. As the control of oocyte maturation by corpora allata is well known[8], it is reasonable to assume that apholate damages the oocytes *via* corpora allata in *P. americana*. As the two other alkylating agents are showing almost similar effects on the oocytes, the mode of action of all the three compounds might be the same.

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DARSHAK SEA MOUNT IN THE NORTH-EASTERN ARABIAN SEA

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ABSTRACT

The Darshak Sea Mount is situated just south of the Indus Canyon. It rises upwards from a depth of about 1,500 m to approximately 450 m towards the surface. Similar submarine hills and sea mounts are seen in the profiles and physiographic maps of that region. These sea mounts and submarine hills possibly mark the site of earlier volcanic activity probably related to Deccan Traps.

THE topography of the sea floor to a large extent reflects its geology and structure. Geomorphological maps based on the analyses of echograms thus provide useful basic information on the geology and structure of the sea bed. As a part of the Institute's project on regional geology of the