CHAPTER VI-A

HISTOPATHOLOGICAL STUDIES OF MALE REPRODUCTIVE ORGANS OF P. FICTUS
OBSERVATIONS

HISTOLOGICAL OBSERVATIONS:

TESTIS: - Each testicular follicle is surrounded by a layer of compact fibrous connective tissue, the basement membrane which is the germ tissue. Every follicle is divided by a thin membrane into apical germanium and series of cyst containing developing germ cells. The germ cells are grouped together in a cyst. The earliest germ cells are the spermatogonia, which consist of a large nucleus surrounded by a thin layer of cytoplasm. The spermatogonia after mitotic division enlarge and transform into the primary spermatocytes, which are the largest cell types amongst the germ cell population. Secondary spermatocytes are obtained after meiotic division of the primary spermatocytes which resemble the primary spermatocytes except for their small size. The secondary spermatocytes divide mitotically and give rise to spermatids which are transformed into sperms. The posterior part of the follicle is full of maturing sperms and the developing spermatozoa and are grouped together to form a cyst (Fig. 34).

VAS DEPERENS: - The wall of the vas deferens is composed of the epithelium, the muscle layer, the adipose tissue layer, and the lumen cavity. The epithelium is quite thick and consists of laterally compressed cells, with broad free ends. Each of the epithelial cells contain a distinct nucleus with many nucleoli. The muscle layer is prominent but thin, and
layer of muscle fibres contain large elongated nuclei. Adipose tissue layer of fat bodies form a regular structure round the epithelial wall of the duct. The lumen of the duct is devoid of chitinous intima and contain spermatozoa (Fig.35).

**EPIDIDYMIS OR SPERM SAC**: Its structure is almost similar to that of the vas deferens. The epithelial layer is composed of a columnar cells containing distinct nuclei. The epithelial layer is surrounded on the outer side by a thick layer of striated cellular muscle, forming a strong coat in the wall of sperm sac. The adipose tissue layer is very well developed and forms on the outer most side a complete and thick covering round the wall of sac. In the cavity of the sac, large number of mature spermatozoa are scattered.(Fig.36).

**ACCESSORY GLANDS**: They are in total seven in number out of which four are similar and round gland like \((AG_1)\). Fifth is long gland like \((AG_2)\), sixth gland is having a two lumen \((AG_3)\) and seventh gland is having an anterior round structure and posterior tubular structure \((AG_4)\). Histologically all the accessory glands are covered by a thin connective envelop, a single muscle layered epithelium of varying thickness and a lumen. The wall of the tubules consists of a glandular epithelium set upon a basal lamina outside which is a thin layer of circular muscle. The epithelium became squamous or cuboidal in shape and lumen is filled with secretion (Fig.37). Proximal to the ejaculatory duct, the wall of each tubule is
modified to form a short muscular duct. The junction between this and glandular portion of the tubule is abrupt and can be distinguished externally by a constriction in the tubule wall. In the ductal region the muscle layer is greatly thickened, the epithelium is squamous or cuboidal and little secretion is visible in the lumen (Fig. 38).

**SEMINAL VESICLE** : Its structure is almost similar to that of the accessory glands. The seminal vesicle epithelium is composed of large cuboidal to columnar cells except that of the seminal vesicle, which contains spermatozoa in the lumen cavity (Fig. 37).

**HISTOPATHOLOGICAL OBSERVATIONS** :

The histopathological effects of the experimental concentration of alkylating chemosterilant apholate and non-alkylating chemosterilant hempa are described in this chapter. Observations were made in both the chemosterilants with different doses for the period of 35 days. The dose administered were .065 ml and .125 ml of both apholate and hempa given to different group of insects. The tissues selected for the present study are Testis, Vas deferens, Epididymis or Sperm sac, Accessory Glands and Seminal Vesicle and the necrotic effects seen are described in this chapter.
EFFECT OF .065 ml OF AHOLATE

AFTER 3 DAYS TREATMENT:

TESTIS: The basement membrane becomes irregular. Space formation was seen in the follicle and chromosomes became ring shaped. Spermatogonia, primary and secondary spermatocytes became pyknotic. Spermatogonia were reduced in size and the spermatids were also reduced and clumped and necrosis was seen in the sperm bundles (Figs. 39, 40).

VASC DEFERENS: There was no necrotic effect in the vas deferens.

SPERM SAC: There was no effect in the sperm sac.

ACCESSORY GLANDS: All the accessory glands were shrunken, their muscle layer became degenerated, basement membrane became thick, irregular, necrosis was seen in the epithelium and their nuclei became pyknotic having dense chromatin material (Fig. 41).

SEMINAL VESICLE: It was completely degenerated. Muscle layer and basement membrane became ruptured and there was no differentiation between secretory material and epithelium. Pyknotic nuclei of epithelium were scattered in the lumen (Fig. 41).

AFTER 7 DAYS TREATMENT:

TESTIS: Distorted shape of follicle was seen having vacuolization and space formation and basement membrane became irregular. Primary spermatocytes were big and loosely
packed and dense chromatin material was seen in the nuclei of spermatocytes. Spermatogonia were pycnotic and loosely packed. Necrosis and space formation was seen in the sperm bundles (Figs. 42, 43).

**VAS DEFERENS** :- No effect was seen.

**SPERM SAC** :- No necrotic changes were seen.

**ACCESSORY GLANDS** :- The necrotic effects were like that of 3 days.

**SEMINAL VESICLE** :- Further necrosis was seen at this stage and it became completely degenerated and nuclei of epithelium were less in number. Impairment of the secretory material was seen, and some necrotic spermatozoans were seen in the lumen out of which some were clumped (Fig. 44).

**AFTER 14 DAYS TREATMENT** :

**TESTIS** :- The basement membrane became thin and splitted. Primary and secondary spermatocytes became big and fragmented chromatin material was seen in their nuclei. Chromosomes of spermatogonia were clumped. Spermatids were also small and clumped and necrosis was seen in the sperm bundles (Fig.45).

**VAS DEFERENS** :- There was no change in Vas deferens.

**SPERM SAC** :- No change was observed.

**ACCESSORY GLANDS** :- At this stage, accessory glands were completely degenerated and their muscle layer and basement membrane were ruptured and splitting was seen in the basement membrane of some of the glands. Epithelial nuclei were
pycnotic having dense chromatin material. Vacuolization and cavity formation was seen in the secretory material of the lumen (Fig. 46).

**SEMINAL VESICLE**: It was shrunken and necrotic and small nuclei were seen in the muscle layer. Basement membrane became thick and the nucleus of epithelium have fragmented chromatin material and less secretion in the lumen was seen (Fig. 46).

**AFTER 21 DAYS TREATMENT**

**TESTIS**: The shape of follicle was distorted at this stage. Basement membrane became thin and irregular, cavity formation was seen in the follicle and pycnotic primary and secondary spermatocytes having fragmented chromatin material in their nuclei were also seen. Inactive sperm bundles were without tails and were smaller in size (Figs. 47, 48).

**VAS DEPERENS**: There was no change.

**SPERM SAC**: There was no effect.

**ACCESSORY GLANDS**: Further necrosis was observed in accessory glands. Their basement membrane was ruptured and pycnotic nuclei were seen in the epithelium. There was space formation between the epithelium and basement membrane and aggregation and accumulation of some nuclei was seen. Some accessory glands were completely filled with secretory material (Fig. 49).
**SEMINAL VESICLE** :- It was completely degenerated and basement membrane became thin and irregular. Nucleus of epithelium became small in size having dense chromatin material. Degenerated spermatozoa were seen in the lumen (Fig. 49).

**AFTER 28 TO 35 DAYS TREATMENT**

**TESTIS** :- There was further necrosis in the follicle and basement membrane became thin and was broken at some places. Primary spermatocytes have pycnotic nuclei having dense chromatin material. Secondary spermatocytes have dense thread like chromatin in their nuclei. There was necrosis in the cytoplasmic content of the follicle. Spermatogonia were reduced and became small and were thickly accumulated. Inactive sperm bundles were seen having weakly developed sperm head and there was space formation in the sperm bundles (Figs. 50, 51).

**VAS DEFERENS** :- There was no necrotic effect.

**SPERM SAC** :- There was no change.

**ACCESSORY GLANDS** :- Basement membrane became thin and was broken at some places. Nucleus of epithelium became small having dense chromatin material and they were arranged serially. There was space formation between the epithelium and secretory material and no change was seen in the secretory material of lumen in $AG_1$ glands. In $AG_2$ glands, basement membrane became degenerated and degenerated secretory material was seen in their lumen. In $AG_3$ glands, small vacuolizations and cavity formation was seen (Fig. 52).
SEMINAL VESICLE: Their muscle layer was degenerated and nuclei of muscle cells became pycnotic, splitting was seen in the basement membrane and vacuolization was seen in the nuclei of epithelium. Degenerated secretory material was seen (Fig. 52).

EFFECT OF .065 ml OF HEMPA

AFTER 3 DAYS TREATMENT:

TESTIS: The basement membrane was broken at some places. Apical germ cells were loosely packed and fragmented chromatin material was seen in their nuclei. Spermatogonia were reduced in size and their chromosomes became clumped. Clumped spermatids were also seen (Fig. 53).

VAS DEFERENS: There was no change.

FERM SAC: There was no effect.

ACCESSORY GLANDS: All the accessory glands were shrunked and their basement membrane became thin and space formation was seen in the epithelium. Nuclei of epithelium were small and cavity formation was seen in the secretory material (Fig. 54).

SEMINAL VESICLE: Necrosis was seen in the muscle layer and their nuclei were small having dense chromatin material. Basement membrane became thin, space formation and vacuolization was seen in the epithelium. Necrosis and less secretory material was seen in the lumen (Fig. 55).
AFTER 7 DAYS TREATMENT:

TESTIS: Irregular basement membrane and fragmented chromatin material was seen in the nuclei of secondary spermatocytes. Loose arrangement of spermatogonia and necrosis in the cytoplasmic content of follicle was seen. Clumping of spermatids and necrosis in the sperm bundles was seen (Figs. 56, 57).

VAS DEFERENS: There was no change in vas deferens.

SPERM SAC: There was no effect in sperm sac.

ACCESSORY GLANDS: They were reduced in size, their basement membrane became thin and broken at some places, pycnotic nuclei of epithelium were seen and necrosis was noticed in the secretory material of AG1 glands. AG2 glands, basement membrane became thin and less secretory material was seen in their lumen. AG4 glands became long, their basement membrane became thin and broken at some places, the epithelial nuclei became pycnotic and clumped nuclei were seen in the neck region of the gland. Necrosis and large secretory material was seen in the lumen (Figs. 58, 59).

SEMINAL VESICLE: Necrosis was seen in the muscle layer and nuclei became small. Splitting was seen in the basement membrane, vacuolization and necrosis was seen in the epithelium and fragmented chromatin material were seen in the nuclei of epithelium (Fig. 59).
AFTER 14 DAYS TREATMENT:

TESTIS: - Testicular follicle became long and space formation was seen. All the germ cells were degenerated. Primary and secondary spermatocytes became pycnotic. Spermatogonia were also pycnotic, sperm bundles became long and were inactive and space formation was seen in between them (Fig. 60).

VAS DEFERENS: - There was no change.

SPERM SAC: - No change in sperm sac was seen.

ACCESSORY GLANDS: - AG₁ glands became small, their basement membrane became thin and epithelial nuclei became small. AG₃ glands, both the lumen cavity were converted into a single cavity and nuclei of epithelium became small with dense chromatin material. Space formation and less secretory material was also seen (Fig. 61).

SEMINAL VESICLE: - It became degenerated and shrunked. Their muscle layer were ruptured and further necrosis was seen in the epithelium and their nuclei became pycnotic and dense chromatin material was seen in them. Very less secretory material was seen in the lumen (Fig. 61).

AFTER 21 DAYS TREATMENT:

TESTIS: - Follicles were distorted in shape, their basement membrane became thin and irregular and broken at some places. Fragmented chromatin material was seen in nuclei of
primary spermatocytes. Secondary spermatocytes became small. Spermatogonia were pycnotic and necrosis, space formation was seen in the sperm bundles (Fig. 62).

**VAS DEFERENS** :- There was no change in vas deferens.

**SPERM SAC** :- No effect was seen in sperm sac.

**ACCESSORY GLANDS** :- Shrinkage in all the accessory glands was seen at this stage. Basement membrane became thin, irregular and was broken at some places. Vacuolization was seen in the nuclei of epithelium and space formation was seen in between epithelium and secretory material. Cavity formation was also seen in secretory material (Fig. 63).

**SEMINAL VESICLE** :- It became reduced in size and space formation was seen in between the muscle layer and basement membrane. Vacuolization was seen in the muscle layer and their nuclei were small having dense chromatin material. Vacuolization was seen in the nuclous of epithelium and vacuolated nuclei were scattered in the lumen. There was space formation in the epithelium (Fig. 63).

**AFTER 28 DAYS TREATMENT:**

**TESTIS** :- The necrotic effects were like that of 21 days.

**VAS DEFERENS** :- There was no effect.

**SPERM SAC** :- There was no effect.

**ACCESSORY GLANDS** :- Further necrosis was seen in the accessory glands. They were distorted in shape, their basement membrane became thin, irregular and double layered. Nucleus of the
epithelium became very small having fragmented chromatin material and necrosis was seen in the secretory material (Fig. 64).

**SEMINAL VESICLE**: They were completely degenerated. Muscle layer became degenerated and basement membrane became thin and irregular. Degenerated secretory material was seen in the lumen (Fig. 64).

**AFTER 35 DAYS TREATMENT:**

**TESTIS**: Some recovery could be seen in the follicle, basement membrane became thick and was better developed and there was less deformity in the germ cells. Primary and secondary spermatocytes became pycnotic, spermatids became small and sperm bundles were better developed at this stage (Fig. 65).

**VAS DEPERENS**: No change was seen.

**SPERM SAC**: No change was seen.

**ACCESSORY GLANDS**: \( AG_1 \) glands, became normal and their basement membrane became thick. Epithelial nuclei have dense chromatin material. Compact secretory material was seen in the lumen. In \( AG_2 \) glands, splitting was seen in the basement membrane which looked like a double layered membrane. Vacuolated nuclei were accumulated in the lumen of the gland. In \( AG_3 \) gland, basement membrane became thick, irregular and fragmented chromatin material was seen in the nuclei of the epithelium. In \( AG_4 \) glands, basement membrane became thin and splitting was seen. Space formation was seen in between the basement membrane and epithelium. There was less secretory
material in the lumen (Figs. 66, 67). In ductal region of glands, there was no change except that the nuclei of epithelium became less deformed and vacuolated (Fig. 68).

**SEMINAL VESICLE**: No recovery could be seen and seminal vesicle was completely degenerated. The basement membrane became thin and irregular. Epithelial nuclei became pycnotic and fragmented chromatin material was seen and the epithelial layer lost its identity (Fig. 68).

**EFFECT OF 0.125 ml AHOolate**

**AFTER 3 DAYS TREATMENT**:

**TESTIS**: Follicles became long and thin and irregular basement membrane was observed and there was cavity formation in the follicle. Germ cells became degenerated and pycnotic. Necrosis was seen in the cytoplasmic content. Pycnotic primary and secondary spermatocytes were seen. Spermatids became small and long sperm bundles were observed (Fig. 69).

**VASC DEFERENS**: No change was seen.

**SPERM SAC**: There was no change.

**ACCESSORY GLANDS**: All the AG1 glands became shrunked and basement membrane became thin and irregular. Space formation was seen in between the epithelium and basement membrane. Accumulated nuclei of epithelium were also seen. In AG2 glands, nuclei of epithelium became pycnotic and were arranged serially and necrosis in the secretory material of the lumen was seen (Fig. 70).
**SEMINAL VESICLE** :- Splitting was seen in the muscle layer. Basement membrane became thick and irregular. Necrosis and space formation was seen in the epithelium and fragmented chromatin material was seen in the nuclei of epithelium (Fig. 70).

**AFTER 7 DAYS TREATMENT** :

**TESTIS** :- Their basement membrane became irregular, diffused chromatin material in the nuclei of primary spermatocytes was seen and fragmented chromatin material in the nuclei of secondary spermatocytes was observed. Chromosomes of secondary spermatocytes became accumulated and were tegoard in form. There was a change in the chromosomes position in spermatogonia and spermatogonia were loosely arranged. Necrosis and space formation was seen in the sperm bundles (Figs. 71, 72).

**VAG DEFERENS** :- There was no change.

**SPERM SAC** :- No change was seen.

**ACCESSORY GLANDS** :- All the accessory glands were degenerated, their basement membrane became thin and was broken at some places and nuclei of epithelium became pycnotic and were accumulated in the lumen. Necrosis was seen in the secretory material of lumen. (Fig. 73).

**SEMINAL VESICLE** :- It was completely degenerated. Necrosis was seen in the muscle layer, basement membrane became thick, vacuolization was seen in the nuclei of epithelium and
necrosis was seen in the secretory material of the lumen (Figs. 73, 74).

AFTER 14 DAYS TREATMENT:

TESTIS: - The basement membrane became irregular and vacuolization was seen in the apical germ cells. In the follicle, reduced cytoplasmic contents were seen. In the nuclei of primary and secondary spermatocytes diffuse chromatin material was seen. Spermatogonia became small and were pycnotic. Sperm heads were weakly formed and were accumulated at this stage (Fig. 75).

VAS DEPERENS: - There was no change.

SPERM SAC: - There was no change.

ACCESSORY GLANDS: - Distorted shape of accessory glands was seen. Muscle layer became degenerated and their nuclei became small. Nuclei of epithelium became small, secretory material became compact and lumen was completely empty at this stage (Fig. 76).

SEMINAL VESICLE: - Necrosis was seen in the muscle layer, basement membrane became thin and irregular and their nuclei became small having dense chromatin material. Secretory material became compact and lumen was completely empty at this stage (Fig. 77).

AFTER 21 DAYS TREATMENT:

TESTIS: - The basement membrane became thin, irregular and was broken at some places. Primary and secondary
spermatocytes became small having diffused chromatin material in their nuclei. Spermatids became pycnotic and were scattered in the region of sperm bundles. There was space formation in the sperm bundles (Figs. 78, 79).

VAS DEFERENS: - There was no effect.

SPERM SAC: - There was no effect.

ACCESSORY GLANDS: - All the accessory glands became degenerated, their epithelial layer was ruptured and lost their identity. There was space formation in accessory glands. Vacuolization and cavity formation was seen in the secretory material of the lumen (Fig. 80).

SEMINAL VESICLE: - Basement membrane became thin, irregular and vacuolization was seen in the nuclei of epithelium. Some accumulated spermatozoa were seen in the lumen (Fig. 80).

AFTER 28 DAYS TREATMENT:

TESTIS: - Further necrosis was seen at this stage. Shape of the follicle was distorted and the basement membrane became very thin. Degenerated and loose arrangement of germ cells was seen. Primary spermatocytes became pycnotic and secondary spermatocytes became small. Spermatids became small and were scattered in the follicle and space formation was seen in the follicle. Inactive sperm bundles became elongated (Figs. 81, 82, 83).

VAS DEFERENS: - No change was seen.

SPERM SAC: - No effect was seen.
ACCESSORY GLANDS: - Their basement membrane became disrupted. Epithelial nuclei became small sized having dense chromatin material and less secretory material was seen in the lumen (Fig. 84).

SEMINAL VESICLE: - Space formation and degenerated epithelium was seen and there was vacuolization in the secretory material (Fig. 84).

AFTER 35 DAYS TREATMENT

TESTIS: - The testicular follicle became long in shape and space formation was seen in the follicle. Primary spermatocytes became small and secondary spermatocytes were with diffused chromatin material in their nuclei. Pyknotic and accumulated spermatogonia was seen. Necrosis was seen in the sperm bundles (Fig. 85).

VASC DEFERENS: - No change was seen.

SPERM SAC: - No change was seen.

ACCESSORY GLANDS: - Their basement membrane became thin and irregular and the epithelium became necrotic and their nuclei became small having dense chromatin material. Vacuolization was seen in the secretory material (Fig. 86).

SEMINAL VESICLE: - The basement membrane became thin and vacuolization was seen in the nuclei of epithelium. Necrosis and cavity formation was seen in the secretory material of the lumen (Fig. 87).
EFFECT OF .125 ml HEMPA

AFTER 3 DAYS TREATMENT:

TESTIS: Testicular follicle became long and were distorted in shape and the basement membrane became irregular. Apical germ cells became degenerated. Primary spermatocytes became pyknotic. Secondary spermatocytes and spermatogonia became small and were packed with dense cytoplasmic material. Necrosis was seen in the sperm bundles and sperms were without tails (Fig. 88).

VAS DEFERENS: There was no change in vas deferens.

SPERM SAC: No change was seen.

ACCESSORY GLANDS: In AG1 glands, basement membrane became thick and nucleus of epithelium became small having dense chromatin material and cavity formation was also seen in the secretory material. In AG2 glands, basement membrane became thick and was broken at some places. Nuclei of epithelium had fragmented chromatin material. AG4 glands became shrunked in size. Basement membrane became irregular and necrosis was seen in the secretory material (Fig. 89).

SEMINAL VESICLE: Muscle layer became degenerated and basement membrane became thin and irregular. Fragmented chromatin material was seen in the nuclei of epithelium and necrosis was seen in the secretory material (Fig. 90).

AFTER 7 DAYS TREATMENT

TESTIS: The necrotic effects were seen like that of 3 days.
VAS DEFERENS: - No change was seen.

SPERM SAC: - No change was seen.

ACCESSORY GLANDS: - In AG₁ glands, basement membrane became thick and nuclei of epithelium became small having dense chromatin material. Compact secretory material was seen in the lumen. In AG₂ glands, basement membrane became irregular, pycnotic nuclei had dense chromatin material. Space formation was seen in the secretory material of the lumen. AG₄ glands were distorted in shape and their basement membrane became irregular. Small nuclei were accumulated at some places (Figs. 91, 92).

SEMINAL VESICLE: - Necrosis in the muscle layer and splitting in the basement membrane was seen. Fragmented chromatin threads were seen in the nuclei of epithelium. Necrosis was seen in the secretory material (Fig. 91).

AFTER 14 DAYS TREATMENT

TESTIS: - Degenerated apical germ cells were seen. Follicle became long and diffuse chromatin material was seen in the nuclei of primary spermatocytes. Necrosis was seen in the cytoplasm of follicle. Spermatogonia became pycnotic at this stage (Fig. 93).

VAS DEFERENS: - No change was seen.

SPERM SAC: - No effect was seen.
ACCESSORY GLANDS: Further necrosis was seen in the accessory glands at this stage. Muscle layer became degenerated. Basement membrane became thin and vacuolization was seen in the secretory materil of the lumen (Fig. 94).

SEMINAL VESICLE: There was further degeneration. Muscle layer became degenerated. Splitting was seen in basement membrane due to which it looked like double layer. Necrotic effects were seen in the nuclei and their chromatin material became fragmented. Necrosis was seen in the spermatozoans of the lumen (Fig. 94).

AFTER 21 DAYS TREATMENT

TESTIS: Further necrosis was seen at this stage. Follicles became degenerated and there was vacuolization in the apical germ cells. Spermatocytes were degenerated and spermatid became small. Necrosis and space formation was seen in the sperm bundles (Fig. 95).

VAS DEPERENS: No effect was seen.

SPERM SAC: No necrotic effect was seen.

ACCESSORY GLANDS: All the AG1 glands were degenerated and shrunked. Basement membrane became thin and broken at some places. Epithelial nuclei became small and scattered in the lumen. In AG2 glands, nucleus of epithelium became pycnotic having dense chromatin material and vacuolization
was seen in the secretory material (Figs. 96, 97).

**SEMINAL VESICLE**: It was completely ruptured. Muscle layer was disrupted, basement membrane became thin and broken, small nuclei were seen in the epithelium, and necrosis was seen in the secretory material (Fig. 96).

**AFTER 28 DAYS TREATMENT**

**TESTIS**: The necrotic effects were seen like that of 21 days.

**VAS DEFERENS**: There was no change.

**SPERM SAC**: There was no effect.

**ACCESSORY GLANDS**: All the accessory glands became distorted and basement membrane became thin and irregular. Nuclei of epithelium became small having dense chromatin material. Vacuolization and cavity formation was seen in the secretory material. Horse shoe shaped secretory material was seen in AG1 glands (Fig. 98).

**SEMINAL VESICLE**: There was shrinkage in the seminal vesicle and necrosis in the muscle layer. Basement membrane became thin and nuclei of epithelium became small having dense chromatin material. There was necrosis in the secretory material (Fig. 98).

**AFTER 35 DAYS TREATMENT**

**TESTIS**: Further shrinkage in the follicle and cavity formation was seen. Basement membrane became thin and
and irregular. Spermatids became pycnotic and clumped at this stage. Space formation was seen in the sperm bundles and sperms were without tail (Fig. 99).

**VAS DEPERENS** : There was no change.

**SPERM SAC** : There was no effect.

**ACCESSORY GLANDS** : All the accessory glands became distorted in shape. In AG₁ glands, basement membrane became thin, irregular and broken at some places. Fragmented chromatin material was seen in the nuclei of epithelium and necrosis was seen in the secretory material (Fig. 100). In AG₂ glands, nucleus of epithelium became small having dense chromatin material. Cavity formation and vacuolization was seen in the secretory material (Fig. 100).

**SEMINAL VESICLE** : Necrosis in the muscle layer and splitting in the basement membrane was seen. Apical nuclei became pycnotic at this stage and necrosis and space formation was seen in secretory material (Fig. 101).
DISCUSSION

The present chapter deals with the discussion of the histopathological changes induced in the male reproductive organs of *P. pictus*. By reviewing the literature it was noticed that very little work has been done on this aspect and whatsoever literature is available—deals with the necrotic effects on testes only. As such discussion has been done only with the work available on testes whereas rest of the male reproductive organs are so far not reported in relation to the effect of chemosterilants and as such can't be discussed. The present study reveals the histopathological effects induced by chemosterilant apholate and hempa on male reproductive organs. It is noticed that both the chemosterilants cause somewhat similar type of necrotic effects to the male reproductive organs in this insect.

The basement membrane became thin and irregular and the shrinkage of testis in *P. pictus* is like that of the reduction in size of testis of *M. domestica* treated with sodium azide as reported by Thakur and Mann (1982). The same has also been reported by Chamberlain (1962), Schwartz (1965), Lindquist and House (1967) in *Cochliomyia homintivorax* treated with apholate, *Hippelatus pusio* treated with tepa and metepa, *Anthonomus grandis* treated with apholate respectively.
The present findings are contrary to the findings of Rai (1964 ab), Outram and Campion (1967) who did not observe any change in the size of testes when they treated Aedes aegypti (L.) with apholate and Diparopsis castanea (Hmps) with tepa.

Distorted shape and cavity formation in testicular follicle of P. pictus are like that of P. pictus, sterilized with Hexachlorocyclo hexane (HCH) and aldrin as reported by Ahi (1988 a,b).

Vacuolization was seen in the apical germ cells of P. pictus, but fractionless apical germ cells were seen in B. mori on treatment with apholate as reported by Sugai and Mirumachi (1973). In L. migratoria, the apical germ cells are effected by apholate and tepa and these cells become pycnotic after treatment and are also displaced from their usual apical position to the middle of the follicle (Nath and Sharma, 1977). The entire testis including anterior and posterior region showed a great distortion of the germ cells and connective tissue, as reported by Maheshwari et al. (1981).

Primary and secondary spermatocytes have pycnotic nuclei and they are loosely packed in P. pictus like that of L. migratoria, treated with lower dose of apholate and hempa (Nath et al., 1976, 1978 b) whereas secondary spermatocytes became hypertrophied in L. migratoria on treatment with higher dose of apholate and hempa as reported by Nath et al. (1964, a,b).
The same has been reported by Rai (1964 a,b), Sugai and Hirano (1965), Saxena and Aditya (1969 a,b, 1971) in Aedes aegypti, Bombyx mori and P. pictus respectively. Spermatocytes became abnormal in O. fasciatus on treatment with tretamine as reported by Economopoulos and Gorden (1971 b). Cadmium chloride and 5-fluorouracil does not cause any testicular damage in L. migratoria as reported by Nath and Sharma (1977), Mittal et al. (1978). After tepa treatment, various histological catastrophies were observed in the testes viz the spermatogonia and spermatocytes were reduced in number and showed pycnotic nuclei as seen by Maheshwari et al. (1981). Saxena and Aditya (1969 a, b) observed similar results in Poekilocerus pictus after treatment with apholate and have also reported that chromatin material of the spermatocytes appeared as fragmented.

In the present study on P. pictus chromosomes became clumped, ring shaped and leggard in form and the same has been reported by Ahi (1988 a,b) in P. pictus after HCH and aldrin treatment. Chromosome damage in screw worm fly caused by alkylating agent was reported by Lachance and Riemann (1964). In B. mori (L.) weaken chromossome structure and breakage were seen after treatment with apholate by Sugai (1967 a). Spermatogonia were reduced in size and were loosely arranged in P. pictus, and tretamine was only half injurious to spermatogonia of Drosophila (Fahmy and Fahmy, 1964). Rienecke et al. (1969) has attributed the male sterility to the destruction of
spermatagonia in ball weevils. Necrotic spermatagonia of B. mori (L.) induced by aminopterin are reported by Sugai and Ashoush (1970). Nath et al. (1975) observed the interruption of spermatogenesis at spermatagonia level is significant, since, if all the spermatagonia are damaged, the initiation of a new wave of spermatogenesis is inhibited resulting in permanent sterility, and with hempa, pycnosis and degeneration in some of the spermatagonia of L. migratoria was seen by Nath et al. (1976) whereas in L. migratoria spermatagonia became pycnotic after treatment with apholate and tepa as reported by Nath and Sharma (1977).

Pycnotic and displaced spermatids were seen in P. pictus as also reported by Nath et al. (1976) in L. migratoria. According to Sado (1961), Sugai and Hirano (1965), it is presumed that the effect of the chemical is more drastic on spermatogenic cells such as spermatids and young spermatozoa of silkworm Bombyx mori (L.). However, Schwartz (1965) showed no histological damages to the sperm when the chemosterilants were applied in the adult stage. As such it will not be a miss to point out that chemosterilant should be applied in the immature stages of insects because the mature sperms probably remain unaffected by these chemicals. Lachance (1966) reported inactive sperms in Habrobracon after treatment with tepa. Functionless abnormal sperms were seen in B. mori by Sado (1961), Sugai (1965), Sugai and Hirano (1965) and Sugai (1967 c). Sperms were affected after apholate treatment in
B. mori (L) as reported by Sugai and Suzuki (1971 a). Function-less abnormal spermatozoa were seen in B. mori (L) on treatment with apholate as reported by Sugai and Suzuki (1971 b) and Sugai and Mirumachi (1973). Necrosis and inactive sperm bundles were seen in P. pictus, but in L. migrotria when the post treatment period was increased, the spermatids and sperms were affected in that order. It implies that the cells inactive phase of proliferation are the most vulnerable to alkylating agents. This finding gets support from the works of Rai (1964 a,b), Sugai and Hirano (1965), Borkovec (1966), Campion (1972) and Davidson (1974). Degenerated spermatozoa of P. germanica treated with tepa and metepa are reported by LaBrecque and Fye (1978). The formation of mature sperms was greatly inhibited as seen by their absence in the posterior region of treated testis. Finally entire testis including the anterior and posterior region showed a great degree of distortion of the germ cell and connective tissue of D. koenigii with tepa as reported by Maheshwari et al. (1981). According to Thakur and Mann (1982), the number of spermatogonia, spermatocyte, spermatids and sperm bundles were a few as compared to normal testes indicating that the rate of sperm cell formation was less in treated flies. These results are very much in accordance with the results obtained by Haniotakis and Galachtiou (1973) while studying the effects of metepa on Dacus oleae. Lindquist et al. (1964), also observed desfunction of germ cells in testes of Anthonomus grandis with apholate. Mossimo
(1974) also sustained these results, reporting the effects of thiotepa on different spermatogenic stages in *Ceratitis capitata*, Wide. According to Haniotakis and Catsoulocos (1977), the testes became completely degenerated in *D. olae* when treated with a Hazno-aza-steroid ester \( R-(\text{bis(chloroethyl) amino}) \text{phenyl}) \) acetic acid and the same has been seen in the present work in *P. pictus*, after prolonged treatment with apholate and hempa. The other effects noticed in the present study in *P. pictus* are that the basement membrane became thin, irregular and broken at some places. Necrosis was seen in the cytoplasmic content of the follicle. Space formation was seen in the follicle. Degenerated germ cells were seen. Primary and secondary spermatocytes had diffused chromatin material in their nuclei. Spermatogonia and spermatids became reduced and clumped and were scattered in the follicle. Necrosis and space formation was seen in the sperm bundles. Sperm bundles were without tails and were smaller in size and were weakly developed. As far as the author is aware of, these necrotic changes are not reported so far. As far as the author is aware of, none has reported the effects of chemosterilant on the vas deferens and epididymis of insects. In the present study, no changes were seen in the vas deferens of *Beikelocerus pictus* and no necrotic effects were seen in the epididymis or sperm sac of *Beikelocerus pictus*.

Histologically, four type of accessory glands were seen in *P. pictus*. After apholate treatment all the four types of
Accessory glands became shrunked. Their basement membrane became thin and were broken at some places and nuclei of epithelium became pycnotic and were accumulated in the secretory material of the lumen. Necrosis was also seen in the secretory material of the lumen. As far as author is aware of, none has reported the effect of chemosterilants on the accessory glands in insects and as such it cannot be discussed further. After treatment with hempo, the $AG_1$ glands were reduced in size, their basement membrane became thin and broken at some places. Nuclei of epithelium were pycnotic and necrosis was seen in the secretory material. In $AG_2$ glands, splitting was seen in the basement membranes, which looked like a double layered membrane. Vacuolated nuclei were accumulated in the secretory material of the gland. In $AG_3$ glands, basement membrane became thick, irregular and fragmented chromatin material was seen in the nuclei of epithelium. In $AG_4$ glands, basement membrane became thin and splitting was seen. Space formation was seen in basement membrane and epithelium. Vacuolization was seen in the nuclei of epithelium and there was less secretory material in the lumen.

In the seminal vesicle of *P. pictus*, the muscle layer was degenerated and the nuclei of muscle layer became pycnotic. Splitting was seen in the basement membrane and vacuolization was also seen in the nuclei of epithelium. Degenerated secretory material was seen in the lumen. Since so far such type of work has not been reported in insect as such it cannot be discussed further.
It is concluded that both the doses of apholate and hempa cause similar type of necrotic effects in male *P. pictus* resulting sterility in them. The necrotic effects are more severe in testes and accessory gland and negligible in the remaining male reproductive organs.
EXPLANATION TO FIGURE

Fig. 34 : L.S. of Testis of control *Poekilocerus pictus*. Haematoxylin Eosin x 100

Fig. 35 : T.S. of Vas deferens of control *Poekilocerus pictus*. Haematoxylin Eosin X 100

Fig. 36 : Section of sperm sac (Epididymis) of control *Poekilocerus pictus*. Haematoxylin Eosin X 300

Fig. 37 : T.S. of Accessory gland of control *Poekilocerus pictus*. Haematoxylin Eosin X 90
EXPLANATION TO FIGURES

Fig. 38 : T.S. of distal part of Accessory gland of *Poekilocerus pictus*. Haematoxylin Eosin X 300

Fig. 39 : L.S. of Testis of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 40 : L.S. of Testis of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 300

Fig. 41 : T.S. of Accessory glands and seminal visicle of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 42 : L.S. of Testis of *Poekilocerus pictus* after 7 days of .065 ml apholate treatment.
Haematoxylin Eosin X 300

Fig. 43 : L.S. of sperm bundle of *Poekilocerus pictus* after 7 days of .065 ml apholate treatment.
Haematoxylin Eosin X 300

Fig. 44 : T.S. of Seminal vesicle of *Poekilocerus pictus* after 7 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 45 : L.S. of Testis of *Poekilocerus pictus* after 14 days of .065 ml apholate treatment.
Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 46 : T.S. of vas deferens of *Poekilocerus pictus* after 14 days of .065 ml apholate treatment. 
Haematoxylin Eosin X 200

Fig. 47 : Section of testis of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. 
Haematoxylin Eosin X 300

Fig. 48 : Section of testis of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. 
Haematoxylin Eosin X 100

Fig. 49 : T.S. of Accessory glands and seminal vesicle of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. Haematoxylin Eosin X 100.
EXPLANATION TO FIGURES

Fig. 50 : L.S. of Testis of *Rhekilocerus pictus* after 28 to 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 51 : L.S. of Testis of *Rhekilocerus pictus* after 28 to 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 200.

Fig. 52 : T.S. of Accessory glands and seminal vesicle of *Rhekilocerus pictus* after 28 to 35 days treatment. Haematoxylin Eosin X 100.

Fig. 53 : L.S. of Testis of *Rhekilocerus pictus* after 3 days of .065 ml hemoa treatment. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 54 : T.S. of Accessory gland of *Poekilocerus pictus* after 3 days of .065 ml hempa treatment.
Haematoxylin Eosin X 200.

Fig. 55 : T.S. of seminal vesicle of *Poekilocerus pictus* after 3 days of .065 ml hempa treatment.
Haematoxylin Eosin X 50.

Fig. 56 : L.S. of Testis of *Poekilocerus pictus* after 7 days of .065 ml hempa treatment.
Haematoxylin Eosin X 200

Fig. 57 : L.S. of Testis of *Poekilocerus pictus* after 7 days of .065 ml hempa treatment.
Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 58 : T.S. of Accessory gland and seminal vesicle of *Poekilocerus pictus* after 7 days of .065 ml hempa treatment. Haematoxylin Eosin X 50.

Fig. 59 : T.S. of AG4 Accessory gland and seminal vesicle of *Poekilocerus pictus* after 7 days of .065 ml hempa treatment. Haematoxylin Eosin X 50.

Fig. 60 : L.S. of Testis of *Poekilocerus pictus* after 14 days of .065 ml hempa treatment. Haematoxylin Eosin X 200.

Fig. 61 : T.S. of Accessory gland and seminal vesicle of *Poekilocerus pictus* after 14 days of .065 ml hempa treatment. Haematoxylin Eosin X 50.
EXPLANATION TO FIGURES

Fig. 62 : L.S. of Testis of *Poekilocerus pictus* after 21 days of .065 ml hempa treatment. Haematoxylin Eosin X 200.

Fig. 63 : T.S. of Accessory glands and seminal vesicle of *Poekilocerus pictus* after 21 days of .065 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 64 : T.S. of Accessory glands of *Poekilocerus pictus* after 28 days of .065 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 65 : L.S. of Testis of *Poekilocerus pictus* after 35 days of .065 ml hempa treatment. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 66 : T.S. of Accessory gland of *Poekilocerus pictus* after 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 100.

Fig. 67 : T.S. of AG3 Accessory gland of *Poekilocerus pictus* after 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 150.

Fig. 68 : T.S. of Distal accessory gland of *Poekilocerus pictus* after 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 200.

Fig. 69 : L.S. of Testis of *Poekilocerus pictus* after 3 days of .125 ml apholate treatment. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 70 : T.S. of Accessory gland of Poekilocerus pictus after 3 days of .125 ml apholate treatment. Haematoxylin Eosin X 100.

Fig. 71 : L.S. of Testis of Poekilocerus pictus after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 200.

Fig. 72 : L.S. of Sperm bundle of Poekilocerus pictus after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 100.

Fig. 73 : T.S. of Accessory glands of Poekilocerus pictus after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 74 : T.S. of Seminal vesicle of Poekilocerus pictus after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 300.

Fig. 75 : L.S. of Testis of Poekilocerus pictus after 14 days of .125 ml apholate treatment. Haematoxylin Eosin X 100.

Fig. 76 : T.S. of Accessory glands of Poekilocerus pictus after 14 days of .125 ml apholate treatment. Haematoxylin Eosin X 100.

Fig. 77 : T.S. of Seminal vesicle of Poekilocerus pictus after 14 days of .125 ml apholate treatment. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 78 : L.S. of Testis of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. Haematoxylin Eosin X 100.

Fig. 79 : Same as Fig. 78 showing sperm bundles and spermatids. Haematoxylin Eosin X 200.

Fig. 80 : T.S. of Accessory gland and seminal vesicle of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. Haematoxylin Eosin X 200.

Fig. 81 : L.S. of Testis of *Poekilocerus pictus* after 28 days of .125 ml apholate treatment. Haematoxylin Eosin X 100.
EXPLANATION TO FIGURES

Fig. 82 : L.S. of Spermatid and sperm bundle in Testis of *Roekilocerus pictus* after 28 days of .125 ml aphonolate treatment. Haematoxylin Eosin X 100.

Fig. 83 : Same as Fig. 82 (28 days of .125 ml aphonolate treatment). Haematoxylin Eosin X 100.

Fig. 84 : T.S. of Accessory glands of *Roekilocerus pictus* after 28 days of .125 ml aphonolate treatment. Haematoxylin Eosin X 100.

Fig. 85 : L.S. of Testis of *Roekilocerus pictus* after 35 days of .125 ml aphonolate treatment. Haematoxylin Eosin X 100.
EXPLANATION TO FIGURES

Fig. 86 : T.S. of Accessory glands of *Poekilocerus pictus* after 35 days of .125 ml apholate treatment. Haemotoxylin Eosin X 200

Fig. 87 : T.S. of Seminal vesicle of *Poekilocerus pictus* after 35 days of .125 ml apholate treatment. Haemotoxylin Eosin X 200.

Fig. 88 : L.S. of Testis of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 150.

Fig. 89 : T.S. of Accessory glands of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 100.
EXPLANATION TO FIGURES

Fig. 90 : T.S. of Seminal vesicle of Poekilocerus pictus after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 150.

Fig. 91 : T.S. of AG₁ Accessory glands and Seminal vesicle of Poekilocerus pictus after 7 days of .125 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 92 : T.S. of AG₂ and AG₄ Accessory glands of Poekilocerus pictus after 7 days of .125 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 93 : L.S. of Testis of Poekilocerus pictus after 14 days of .125 ml hempa treatment. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 94 : T. S. of Accessory glands and Seminal vesicle of *Poekilocerus pictus* after 14 days of .125 ml hempa treatment. Haematoxylin Eosin X 200.

Fig. 95 : L.S. of Testis of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 96 : T. S. of Accessory glands and Seminal vesicle of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 97 : T. S. of AG₁ glands of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 98 : T.S. of Accessory glands and seminal vesicle of *Rekilocerus pictus* after 28 days of 0.125 ml hempa treatment. Haematoxylin Eosin X 50.

Fig. 99 : Section of Testis of *Rekilocerus pictus* after 35 days of 0.125 hempa treatment. Haematoxylin Eosin X 100.

Fig. 100 : T.S. of Accessory glands of *Rekilocerus pictus* after 35 days of 0.125 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 101 : T.S. of Seminal vesicle of *Rekilocerus pictus* after 35 days of 0.125 ml hempa treatment. Haematoxylin Eosin X 200.
CHAPTER VI-B

HISTOPATHOLOGICAL STUDIES OF FEMALE REPRODUCTIVE ORGANS OF P. FLUCTUS
OBSERVATIONS

HISTOLOGICAL OBSERVATIONS:

OVARY: Each ovariole consists of number of oogonia and oocyte which are in different stages of maturity (cytomorphosis). The special feature of the oogonia or the oocytes is characterized due to the absence of any specialized nurse cells as the oogonia grow into oocytes, the follicle cell completely surround them from all sides and such ovarioles are said to be paroistic type. As such each ovariole in this insect has typical structure of a paroistic type of ovary.

On the basis of histological criteria and degree of maturation of oocyte, the ovarioles can be conveniently divided into four different zones viz. The Terminal filament, The Germanium, The Vitellanium and the Pedicel.

The ovariole sheath or the tunica propria is a constant feature in this insect. The follicular epithelium forms the covering of the ovarioles inside which different stages of oocyte differentiation and maturation can be seen. The ooplasm is a compact clear substance in an early oocyte, having a prominent nucleus, is situated at the distal end. A characteristic vacuole is found around the nucleus in this insect (Sahai, 1971). As the oocyte matures its ooplasm becomes thick and dense (Fig. 102).

OVIDUCTS: The histology of lateral and median oviduct is somewhat similar but the common oviduct (vagina) is different
in structure. The lateral and median oviducts are secretory in nature whereas the common oviduct (vagina) is non-secretory. The lateral and median oviducts are provided with a number of villi like infolding but in common oviduct there is a cellular mass like structure. The oviducts are provided with a thick layer of circular muscle fibres showing banding pattern and their cell lining is in single layer. These cells have scanty and loosely packed cytoplasm and are columnar in nature. The nucleus is basally placed and shows clear chromatin granules. In the lateral oviducts infoldings are small than those of the median oviducts whereas in median oviducts they are big and the nucleus has a definite chromatin granues and the cell cytoplasm is very compact. In between the circular muscle layer and villi, the longitudinal muscles are situated. The lumen of the lateral and median oviduct is filled with a secretory material having some droplets embedded in a homogenous matrix whereas in the lumen of the common oviduct no secretory material is seen (Figs. 103,104,105,106).

**SPERMATHECA AND SPERMATHECAL DUCT** :- Among the accessory sex glands, the spermathecae in female insects are the most important one from the point of sperm storage and viability. The spermatheca consist of an outer muscle layer which rests on a thick basement membrane and on inner side, a single layer of columnar epithelial cells with basally placed round nuclei can be seen. The lumen is surrounded by a chitinous coat and the outer muscle layer is appreciably thick. In spermathecal duct
the columnar epithelium is supported by a basement membrane and bears an inner lamellar chitinous intima and an outer layer of muscle fibres.

Spermathecal gland is surrounded by a multi layered coat of oval cells or secretory cells which pour their secretion into the lumen through very fine ductules. A well defined epithelium is absent (Fig. 107).

**SEMINAL VESICLE** :- The seminal vesicle is glandular in nature and this is made up of a muscle layer, basement membrane and epithelium. The histology of seminal vesicle reveals that the outer most layer is made up of very thin muscle layer. The epithelium of the tubules is cuboidal with rounded nuclei and is supported by a basement membrane. Internally it is composed with thick, compact secretory material.

**HISTOPATHOLOGICAL OBSERVATIONS**

The histopathological effect of apholate and hempa are described in this chapter. The observations were made with a dose of .065 ml and .125 ml of apholate as well as hempa for the period of 50 days. The tissue selected for the present study are ovary, lateral oviducts, common oviduct, spermatheca and spermathecal duct and seminal vesicle.

**EFFECT OF .065 ml OF APHOLATE**

The necrotic effects were not seen in the germanium and vitellarium at any stage of .065 ml of apholate treatment.
AFTER 3 DAYS TREATMENT:

OVARY/OOCYTE: In early oocytes follicular epithelial cells were pyknotic and their ooplasm became shrunked. In terminal oocyte, the tunica propria became very thin, irregular and vacuolization was seen in the ooplasm (Fig. 108).

LATERAL OVIDUCT: It was distorted in shape, muscle layer became thin, irregular and their nuclei were pyknotic having dense chromatin material. Circular muscles became thin. Scattered nuclei were seen in longitudinal muscles. Space formation and vacuolization was seen in the epithelium and their nuclei were reduced in size having dense chromatin material (Fig. 109).

MEDIAN OVIDUCT: Necrosis was seen in the muscle layer, circular muscles became thin, irregular and broken at some places. Enlargement of villi like folds was seen as such lumen was reduced. Nuclei of longitudinal muscles became clumped and nuclei of epithelium became pyknotic having dense chromatin material (Fig. 110).

COMMON OVIDUCT: It was distorted in shape and shrinkage in common oviduct was seen. Outer muscle layer and circular muscle layer were ruptured and there was no differentiation between them. The cellular mass became degenerated (Fig. 111).

SPERMATHECA: Basement membrane became thin and space formation was seen in the epithelium and their nuclei became pyknotic
having dense chromatin material and necrosis was seen in the secretory material (Fig. 112).

**Spermathecal Duct**: Muscle layer became degenerated, basement membrane became thick, irregular, space formation was seen in the epithelium and their nuclei were vacuolated (Fig. 113).

**Seminal Vesicle**: Vacuolization was seen in the nuclei of muscle layer. Cytoplasm and nuclei of epithelium became vacuolated (Fig. 113).

**After 7 Days Treatment**:

**Ovary/Oocyte**: Pycnotic follicular epithelial cells were seen. In the fully matured oocytes, necrosis and space formation was seen in the ooplasm (Fig. 114).

**Lateral Oviduct**: Necrotic effects were similar to that of 3 days.

**Median Oviduct**: Splitting was seen in the circular muscles, and it was broken at some places. Circular and longitudinal muscles were degenerated. Villi like folds were shrunked and nuclei of epithelium became vacuolated and clumped. Necrotic and less secretory material was seen in the lumen (Fig. 115).

**Common Oviduct**: The necrotic effects were seen and were similar to that of 3 days.

**Spermatheca**: It was degenerated and basement membrane became thin. Nuclei of epithelium were pycnotic having dense chromatin. Degenerated secretory material was observed in the lumen (Fig. 116).
SPERMATHECAL DUCT: - Nuclei of epithelium became small and had dense chromatin material. There was necrosis in the secretory material (Fig. 116).

SEMINAL VESICLE: - Splitting was seen in the basement membrane and their nuclei became pycnotic having fragmented chromatin material. Space formation and vacuolization was seen in the cytoplasm of epithelium and the lumen was without secretory material (Fig. 117).

AFTER 14 DAYS TREATMENT:

OVARY/OOCYTE: - Pycnotic nuclei of follicular epithelium was seen and necrosis was seen in the ooplasm of fully matured oocytes (Fig. 118).

LATERAL OVIDUCT: - It was distorted in shape, muscle layer became thin, irregular and was broken at some places. Nuclei of longitudinal muscles were scattered and villi like folds became shrunken. Space formation was seen in the epithelium and the size of their nuclei became small and had dense chromatin material. Large vacuolization were seen in the secretory material (Fig. 118).

MEDIAN OVIDUCT: - It was degenerated, muscle layer became thin, irregular and space formation was seen in the folds. Vacuolization was seen in the nuclei of epithelium (Fig. 119).

COMMON OVIDUCT: - It was completely degenerated and necrosis was seen in the cytoplasm of epithelium. The nuclei of epithelium became pycnotic and had dense chromatin material (Fig. 120).
SPERMATHECA: They were degenerated. Muscle layer became ruptured and space formation was seen in between the basement membrane and epithelium. Necrosis was seen in the epithelium and nuclei of epithelium became pyknotic having fragmented chromatin material. The lumen was without any secretion (Fig. 121).

SPERMATHECAL DUCT: Necrosis was seen in the duct and nuclei of epithelium became pyknotic. Necrosis and space formation was seen in the secretory material of lumen (Fig. 121).

SEMINAL VESICLE: Necrotic effects were similar as seen in 7 days treatment.

AFTER 21 DAYS TREATMENT:

OVARY/OOCYTE: Tunica propria became thin and space formation and splitting of follicular epithelium was noticed. Nuclei of follicular epithelium became small. Binucleate condition was seen in the oocytes and there was vacuolization in the nuclei (Fig. 122).

LATERAL OVIDUCT: Circular muscles became very thin and there was more shrinkage in villi like folds giving it an appearance to that of a single layered structure. Their nuclei became pyknotic. Large vacuolization was seen in the secretory material of the lumen (Fig. 123).

MEDIAN OVIDUCT: Muscle layer was thin, irregular and circular muscles became thin. Space formation was seen in the villi
like folds. Compact structure of epithelium was seen and their nuclei became small in size. Large vacuoles were seen in the secretory material. Distortion of secretory material was also noticed (Fig. 124).

**COMMON OVIDUCT** :- It was completely degenerated. Circular muscles and epithelium became ruptured and cellular mass became distorted in shape and lost their identity (Fig. 125).

**SPERMATHECA** :- Necrosis was seen in the muscle layer and their nuclei became vacuolated. Basement membrane became thin and space formation was seen in the epithelium and their nuclei became vacuolated. Vacuolization was seen in glandular portion of spermaphenga and their nuclei became small (Fig. 126).

**SPERMATHECAL DUCT** :- Effects were like that of 14 days.

**SEMINAL VESICLE** :- Basement membrane became thin, irregular and nuclei of epithelium were vacuolated. No change was seen in the meshwork fibril (Fig. 127).

**AFTER 28 DAYS TREATMENT** :

**OVARY/OOCYTE** :- There was impairment in the terminal oocytes, their nuclei were migrated to the central part and there was vacuolation and space formation in the ooplasm. Splitting of follicular epithelium and tunica propria was also seen (Fig. 128).
LATERAL OVIDUCT: They were distorted in shape. Muscle layer became thin and their nuclei became very small, shrinkage was seen in the villi like folds. Vacuoles were formed in the secretory material (Fig. 129).

MEDIAN OVIDUCT: Outer muscle layer became thin and irregular. Epithelium was completely damaged and degenerated, their nuclei became pycnotic and have dense chromatin material. Villi like folds were scattered in the lumen. Vacuolization was also seen in the lumen (Fig. 130).

COMMON OVIDUCT: It was completely degenerated. Epithelium and cellular mass became ruptured and space formation was seen in between them (Fig. 131).

SPERMATHECA: Their basement membrane became thin and was broken at some places. Necrosis was seen in cytoplasm of epithelium and their nuclei became pycnotic. Necrosis and space formation was seen in secretory material (Fig. 132).

SPERMATHECAL DUCT: Vacuolization was seen in the nuclei of epithelium and vacuolization and space formation was also seen in the secretory material (Fig. 133).

SEMINAL VESICLE: Effects were like that of 21 days stage.

AFTER 35 DAYS TREATMENT:

OVARY/OOCYTE: Oocytes became long, slender and follicular epithelium became thin. Highly vacuolated ooplasm was also seen (Fig. 134).
**LATERAL OVIDUCT** :- Their muscle layer became thin and irregular and shrinkage was seen in villi like folds. Vacuolization and space formation was seen in the epithelium. Nuclei of epithelium became pycnotic having dense chromatin material (Fig. 135).

**MEDIAN OVIDUCT** :- It was completely degenerated. Muscle layer and circular muscles became degenerated. Space formation was seen in the epithelium. Nuclei of epithelium became pycnotic having dense chromatin material (Fig. 136).

**COMMON OVIDUCT** :- It was completely ruptured and there was no differentiation between the epithelium and cellular mass. Cellular mass became ruptured at this stage (Fig. 137).

**SPERMATHECA** :- Necrosis was seen in the muscle layer and their nuclei became pycnotic. Basement membrane became thin. Necrosis was seen in the epithelium and their nuclei became small having dense chromatin material. Necrosis was also seen in the secretory material (Fig. 138).

**SPERMATHECAL DUCT** :- Basement membrane became thin, space formation was seen in the epithelium and their nuclei became pycnotic having dense chromatin material and compact secretory material was seen (Fig. 139).

**SEMINAL VESICLE** :- It was completely normal. Basement membrane became thick, nuclei have dense chromatin material and compact meshwork fibril was seen (Fig. 139).
EFFECT OF .065 ml OF HEMPA

No change was seen in the germanium and vitellarium of any stage of .065 ml of hempa.

AFTER 3 DAYS TREATMENT:

OVARY/OOCYTE: In the terminal oocyte, the follicular epithelium was degenerated and the nucleus was centrally situated. There was necrosis in the ooplasm (Fig. 140).

LATERAL OVIDUCT: Its shape was distorted and outer muscle layer and circular muscles were degenerated. Space formation was seen in the villi-like folds and there was distortion in their shape. Nuclei of epithelium became pyknotic. There was space formation in the lumen (Fig. 141).

MEDIAN OVIDUCT: Necrosis and space formation was seen in the outer muscle layer and their nuclei were of small size. Space formation was seen in between the circular muscles and epithelium. Necrosis was seen in the cytoplasm of epithelium and their nuclei became pyknotic having fragmented chromatin material (Fig. 142).

COMMON OVIDUCT: Outer muscle layer became degenerated, splitting was seen in the circular muscles, necrosis and vacuolization was seen in the epithelium and their nuclei became pyknotic. Intima of cellular mass was distorted in shape (Fig. 143).

SPERMATHECA: Necrosis was seen in the outer muscle layer. Basement membrane became thin. Space formation was seen in
the epithelium and their nuclei were pycnotic having fragmented chromatin material (Fig. 144).

SPERMATHECAL DUCT: Basement membrane became thin and was broken at some places. Necrosis was seen in the cytoplasm of epithelium and their nuclei became pycnotic (Fig. 144).

SEMINAL VESICLE: It was almost normal. Basement membrane became thick and cytoplasm of epithelium was compact and compact meshwork fibril was also seen (Fig. 144).

AFTER 7 DAYS TREATMENT:

OVARY/OOCYTE: Nuclei of follicular epithelial cells became pycnotic. Vacuolization was seen in the ooplasm of fully matured oocytes (Fig. 145).

LATERAL OVIDUCT: Outer muscle layer and circular muscles became degenerated and were broken at some places. Nuclei of longitudinal muscles were vacuolated and nuclei of epithelium were small in size having dense chromatin material (Fig. 145).

MEDIAN OVIDUCT: Basement membrane became thin and less number of villi like folds were seen as they were shrunk and their nuclei became pycnotic. Vacuolated secretory material was seen in the lumen (Fig. 146).

COMMON OVIDUCT: Necrosis was seen in the outer muscle layer and there was splitting in the circular muscles. Nuclei of epithelium became small in size having dense scattered chromatin material. Cellular mass became shrunked and their intima became very thin (Fig. 147).
SPERMATHECA: Basement membrane became thin and splitted. Space formation was seen in the epithelium and their nuclei became pycnotic. Necrosis was seen in the secretory material and spermathecal gland. There was necrosis in the epithelium and their nuclei became small. Aggregation of epithelial nuclei was noticed in the spermathecal gland (Figs. 148, 149).

SPERMATHECAL DUCT: Basement membrane became thin and splitted and space formation was seen in the epithelium. Nuclei of epithelium became pyknocytic having dense chromatin material. Space formation and necrosis was seen in the secretory material (Fig. 148).

SEMINAL VESICLE: Nuclei of muscle layer became vacuolated and basement membrane became thick. Space formation in the epithelial cells and necrosis in meshwork fibril was seen (Fig. 149).

AFTER 14 DAYS TREATMENT:

OVARY/OOCYTE: Nuclei of follicular epithelium became pyknocytic and ovarian sheath was broken at places. In the terminal oocyte, nuclei were centrally located and ooplasm was compactly filled (Fig. 150).

LATERAL OVIDUCT: It was distorted in shape. Necrosis was seen in the muscle layer and circular muscles became thin, irregular and were broken at some places. Necrosis was seen in the longitudinal muscles and their nuclei were vacuolated. Shrinkage and space formation was seen in the villi like folds,
and nuclei of epithelium became vacuolated. Vacuolization was seen in the secretory material (Fig. 151).

**MEDIAN OVIDUCT**: Split circular muscles and necrosis in longitudinal muscles was seen. Villi like folds became separated from each other. Nuclei became prominent having dense chromatin material. A big vacuole in the centre and some vacuoles of varying sizes were seen in the secretory material of the lumen (Fig. 152).

**COMMON OVIDUCT**: Degenerated muscle layer was seen and their nuclei became pycnotic. There was splitting of the circular muscle. Distorted shape of cellular mass was seen and their intima became shrunked (Fig. 153).

**SPERMATHECA**: Basement membrane became thin and irregular. Space formation was seen in the epithelium and nuclei of epithelium became pycnotic having dense chromatin material. Space formation was also seen in the secretory material (Fig. 154).

**SPERMATHECAL DUCT**: There was degeneration of muscle layer. The basement membrane became thin and irregular and nuclei of epithelium became pycnotic. Necrosis in the secretory material was also observed (Fig. 155).

**SEMINAL VESICLE**: Basement membrane became thin. Epithelial cell nuclei became small and necrosis was seen in the meshwork fibril (Fig. 155).

**AFTER 21 DAYS TREATMENT:**

**OVARY/OOCYTE**: Tunica propria of penultimate oocyte became thin and two oocytes have a common ovarioler sheath. Invading
of follicular epithelium was also seen. The nucleus was somewhat centrally located in the ooplasm and follicular epithelium became thin. Space formation was seen in between follicular epithelium and the ooplasm (Fig. 156).

**LATERAL OVIDUCT** :- Outer muscle layer became irregular, their nuclei became pycnotic and vacuolization was also seen. The circular muscles became thick. Vacuolization was seen in longitudinal muscles and their nuclei and chromatin material was fragmented. Vacuolization and space formation was seen in the epithelium and villi like folds became distorted. Nuclei of epithelium became vacuolated and no secretory material was seen in the lumen (Fig. 157).

**MEDIAN OVIDUCT** :- Villi like folds became branched and space formation was seen. Nuclei became pycnotic having fragmented chromat in material. Nuclei of intima became small having dense chromat in material and were arranged serially (Fig. 158).

**COMMON OVIDUCT** :- Muscle layer became degenerated and space formation was seen in the epithelium. Their nuclei became pycnotic having dense chromat in material. Cellular mass became degenerated (Fig. 159).

**SPERMATHECA** :- Space formation was seen in between the basement membrane and epithelium. Nuclei of epithelium was reduced in size. No secretory material was noticed in the lumen (Fig. 160).

**SPERMATHECAL DUCT** :- Basement membrane became thin and irregular. Space formation was seen in the epithelium. Nuclei
of epithelium became pyknotic and big vacuole was seen in the secretory material and secretory material was very less (Fig. 160).

**SEMINAL VESICLE** :- Basement membrane became thin and irregular and necrosis was seen in the epithelium. Nuclei of epithelium became vacuolated. No change was seen in the meshwork fibrile (Fig. 161).

**AFTER 28 DAYS TREATMENT**

**OVARY/OOCYTE** :- Tunica propria became thin, irregular and was broken at some places. Nuclei of follicular epithelial cells became pyknotic and were less in number in fully matured oocytes. Ooplasm was vacuolated and degenerated (Fig. 162).

**LATERAL OVIDUCT** :- Nuclei of outer muscle layer became vacuolated. Space formation was seen in between the epithelium and circular muscles. Nuclei of epithelium were vacuolated, and vacuolization was also seen in the secretory material (Fig. 162).

**MEDIAN OVIDUCT** :- Circular muscles became thin and irregular. Necrosis was seen in longitudinal muscle. Some of the nuclei became pyknotic, clumped and have dense chromatin material. Distorted villi like folds were seen. Nuclei of intima became small having dense chromatin material and nuclei were arranged serially. Vacuolization was seen in the cytoplasm of epithelium. Space formation and vacuolization was also seen in the secretory material (Fig. 163).
COMMON OVIDUCT :- Shrinkage was seen in the common oviduct. Muscle layer became thin and pycnotic. Splitting was seen in the circular muscles and their nuclei have dense chromatin material. Nuclei of epithelium became small and distorted shape of cellular mass was seen (Fig. 164).

SPERMATHECA :- Basement membrane became thin, irregular and space formation was seen in the epithelium. The epithelial nuclei became pycnotic having dense chromatin material. There was necrosis in the secretory material (Fig. 165).

SPERMATHECAL DUCT :- Basement membrane became thin and space formation was seen in the epithelium. There was vacuolization in their nuclei and necrosis was seen in the secretory material (Fig. 166).

SEMINAL VESICLE :- Muscle layer became thin, and basement membrane became thick. Nuclei of epithelium were reduced in size and were vacuolated. Compact structure of fibrillar meshwork was noticed (Fig. 167).

AFTER 35 DAYS TREATMENT :

OVARY/OOCYTE :- Tunica propria became thin and oocyte became binucleated. Follicular epithelium was reduced and space formation was seen in these oocytes. Some vacuoles were also seen in the ooplasm (Fig. 168).

LATERAL OVIDUCT :- Outer muscle and circullar muscles became thin and irregular. Villi like folds became more shrunken and nuclei of epithelium became vacuolated. Vacuolization was also seen in secretory material (Fig. 169).
**MEDIAN OVIDUCT** :- Muscle layer became thin, irregular and their nuclei became pycnotic. 'Villi like folds became shrunked and were distorted in shape. Vacuolization was seen in the nuclei of epithelium and they were loosely packed. Space formation was seen in the secretory material (Fig. 170).

**COMMON OVIDUCT** :- Shrinkage was seen in the common oviduct. Muscle layer became thin, irregular and their nuclei became small. Circular muscles became thick. Vacuolization was seen in the cytoplasm of epithelium and their nuclei became pycnotic and distorted cellular mass was also seen (Fig. 171).

**SPERMATHECA** :- Necrosis and vacuolization was seen in the muscle layer and basement membrane became thin. Space formation was seen in the epithelium and vacuolization was seen in the nuclei of epithelium. Necrosis and space formation was seen in the secretory material of the lumen (Fig. 172).

**SPERMATHECAL DUCT** :- Vacuolization was seen in the muscle layer. Basement membrane became thin and irregular. Vacuolization was seen in the nucleus of epithelium and space formation was seen in the epithelium. Vacuole formation was seen in the secretory material (Fig. 173).

**SEMINAL VESICLE** :- They were completely degenerated. There was no differentiation between the muscle layer and epithelium. Muscle layer became vacuolated and vacuolization was also observed in the fibrillar meshwork (Fig. 173).
AFTER 42 DAYS TREATMENT:

OVARY/OOCYTE: - Tunica propria became thin, irregular and separated from follicular epithelium and was broken at some places in nearly oocytes. Vacuolization was seen in the ooplasm (Fig. 174).

LATERAL OVIDUCT: - Necrosis was seen in the outer muscle layer. Circular muscles became thin and irregular. Longitudinal muscles became thin. Shrinkage, distorted shape and space formation was seen in the villi like folds. Vacuolization was seen in the nuclei of epithelium. Compact secretory material was seen (Fig. 174).

MEDIAN OVIDUCT: - Space formation was seen in between the circular muscle and villi like folds. Villi like folds became distorted and were somewhat scattered. There was space formation in the folds. Pyknotic nuclei of epithelium have fragmented and scattered chromatin material in the epithelium (Fig. 175).

COMMON OVIDUCT: - The necrotic effects were like that of 35 days.

SPERMATHECA: - Spermatheca was shrunked. Outer muscle layer became necrotic and basement membrane became thin and irregular. Space formation was seen in the epithelium. Large vacuoles were seen in the glandular portion of spermatheca (Figs. 176, 177).

SPERMATHECAL DUCT: - Space formation was seen in between the outer muscle layer and basement membrane. Vacuolization was
seen in the cytoplasm of epithelium. There was necrosis in the secretory material (Fig. 176).

**SEMINAL VESICLE** :- The necrotic effects were like that of 35 days.

**AFTER 50 DAYS TREATMENT**:

**OVARY/OOCYTE** :- Degenerated and pycnotic follicular epithelial cells were seen in the oocytes and oocyte nucleus was centrally located. Less vacuolization was seen in the ooplasm (Fig. 178).

**LATERAL OVIDUCT** :- The necrotic effects were like that of 42 days.

**MEDIAN OVIDUCT** :- Outer muscle layer became thin, irregular and vacuolization was seen. Circular muscle became thin and their nuclei became pycnotic. Villi like folds became distorted in shape. Necrosis and space formation was seen in the epithelium. Nuclei of epithelium became pycnotic and have dense chromatin material and were loosely arranged (Fig. 179).

**COMMON OVIDUCT** :- The necrotic effects were like that of 35 days.

**SPERMATHECA** :- Outer muscle layer became pycnotic and their nuclei were reduced in size having fragmented chromatin material. Basement membrane became thin and nuclei of epithelium became small. Necrosis and space formation was seen in the secretory material (Fig. 180).
SPERMATHECAL DUCT: - Vacuolization was seen in the muscle layer and splitting in the basement membrane was seen. There was vacuolization in the epithelium and nuclei of epithelium were vacuolated. There was necrosis in the secretory material (Fig. 180).

SEMINAL VESICLE: - There was necrosis in the muscle layer and basement membrane became thin. Space formation was seen in the epithelium and their nuclei have fragmented chromatin material (181).

EFFECT OF .125 ml OF AHOLATE;

AFTER 3 DAYS TREATMENT:

OVARY/OOCYTE: - It was distorted in shape and outer sheath became thin and nuclei of germanium became vacuolated. Tunica propria became thin and irregular. Follicular epithelial cells became pycnotic. Vacuoles were seen in the ooplasm and it was shrunked in the terminal oocytes. Space and compartment like formation of multinucleated oocyte was evident at this stage (Figs. 182, 183).

LATERAL OVIDUCT: - Outer muscle layer became thin and irregular. Nuclei of longitudinal muscle became small clumped and vacuolated. Shrinkage was seen in the villi like folds. Big space formation was seen between the epithelium and secretory material. Necrosis was also seen in the secretory material (Fig. 184).
**MEDIAN OVIDUCT**: Necrosis was seen in the circular muscles and longitudinal muscles. Nuclei of circular muscles became pyknotic and were vacuolated in longitudinal muscles. Space formation was seen in the epithelium and vacuolization was seen in their nuclei. Nuclei of intima were small having dense chromatin material and were arranged serially. Vacuolization was seen in the secretory material (Fig. 185).

**COMMON OVIDUCT**: Outer muscle layer became irregular and their nuclei became pyknotic. Circular muscles were splitted and their nuclei were vacuolated. Small fragmented nuclei of epithelium were seen, having shrunked chromatin material and the central cellular mass was distorted (Fig. 186).

**SPERMATHECA**: Outer muscle layer became thin and was broken at some places. Space formation was seen in the epithelium and secretory material was compact and thick (Fig. 187).

**SPERMATHECAL DUCT**: Necrosis was seen in the outer muscle layer. Basement membrane became thin and splitted. Degenerated nuclei of epithelium were also seen (Fig. 187).

**SEMINAL VESICLE**: Muscle layer became degenerated. Basement membrane became thin and nuclei of epithelium became very small. Space formation or vacuole was seen in meshwork fibrils.

**AFTER 7 DAYS TREATMENT:**

**OVARY/OOCYTE**: Degenerated germanium was seen at this stage. Ooplasm of early oocytes became shrunked and space formation
was seen. In the vitellarium, tunica propria became thin and follicular epithelium became shrunked. Follicular epithelium became very thin and tunica propria was separated from the oocyte. The nuclei of follicular epithelium were very small and vacuolated. Vacuoles were also seen in the ooplasm (Figs. 188, 189).

**LATERAL OVIDUCT** :- The recortic effects were like that of 3 days.

**MEDIAN OVIDUCT** :- Necrosis was seen in the circular muscles and their nuclei became pycnotic. Space formation was seen in between the circular muscles and epithelium. Necrosis was also seen in the longitudinal muscles. Shrinkage and space formation was seen in the villi like folds. Nuclei of epithelium became small having dense chromatin material. Necrosis and less secretory material was seen in the lumen (Fig. 190).

**COMMON OVIDUCT** :- It was distorted in shape. Outer muscle layer became irregular and was broken at some places. Nuclei of epithelium were shrunked and aggregated and vacuolization was also seen. There was shrinkage in the cellular mass (Fig. 191).

**SPERMATHECA** :- Degenerated muscle layer was seen and their nuclei became small. Basement membrane became thin and irregular. Nuclei of epithelium became small having dense chromatin material. Necrosis was seen in the secretory material (Fig. 192).
SPERMATHECAL DUCT: Splitting was seen in the basement membrane. Vacuolization was seen in the cytoplasm of epithelium and their nuclei became small (Fig. 192).

SEMINAL VESICLE: Basement membrane became thin and irregular. Nuclei of epithelium became small and meshwork fibril became compact in structure.

AFTER 14 DAYS TREATMENT:

OVARY/OOCYTE: There was same effect on germarium and vitellarium like that of 7 days. Tunica propria became thin and irregular. Thin pycnotic follicular epithelial cells were seen and scattered nucleoli were seen in the nucleus. Binucleated oocyte were also seen and vacuolization was intense in the ooplasm (Fig. 193).

LATERAL OVIDUCT: It was distorted in shape, outer muscle layer became irregular and their nuclei were of small size. Circular muscles became thin and space formation was seen in longitudinal muscles and their nuclei became pycnotic. Space formation was also seen in the epithelium and their nuclei were pycnotic (Fig. 194).

MEDIAN OVIDUCT: Further necrosis was seen in the median oviduct. Necrosis and space formation was seen in the epithelium and their nuclei became small having dense chromatin material and were accumulated in intimal part. Large vacuolization was seen in the secretory material (Fig. 195).
COMMON OVIDUCT: - Outer muscle layer became thin, irregular and circular muscles were splitted. Fragmented nuclei were seen in the circular muscle. Vacuolization was seen in the nuclei of epithelium and shrinkage was seen in the cellular mass (Fig. 196).

SPERMATHECA: - Distorted shape of spermatheca was seen. Outer muscle layer was completely degenerated and basement membrane was broken at some places. Nuclei of epithelium became very small and space formation was seen in the secretory material (Fig. 197).

SPERMATHECAL DUCT: - Nuclei of epithelium became pyknotic and space formation was seen in the secretory material.

SEMINAL VESICLE: - It was shrunked. Outer muscle layer and basement membrane was completely ruptured. Nuclei of epithelium were small and narrow lumen cavity was seen (Fig. 197).

AFTER 21 DAYS TREATMENT:

OVARY/OOCYTE: - The necrotic effect of germarium and vitellarium was same as in 7 days treatment. Tunica propria became thick. The follicular epithelial cells were distinctly pyknotic and most of them have lost contact among themselves. Vacuolization was seen in the ooplasm. Nuclei of ooplasm was shifted to a side and was not in the centre and was distorted also. Invading of follicular epithelium near oocyte nucleus was seen. The ooplasm was divided by a differentiating layer into two portions, the inner showing vacuoles while the other portion had clear ooplasm (Figs. 198, 199).
LATERAL OVIDUCT: - Outer muscle layer and circular muscles became thin and nuclei of outer muscle layer were vacuolated. Longitudinal muscles became thin, and their nuclei were accumulated. Shrinkage and space formation was seen in the villi like folds and vacuolated nuclei were seen in the epithelium (Fig. 200).

MEDIAN OVIDUCT: - Outer muscle layer became thin, irregular and splitted. Circular muscles became thick and their nuclei became small having dense chromatin material. Longitudinal muscles became thin and their nuclei were vacuolated. Space formation was seen in the villi like folds and nuclei of epithelium became small and necrosis was seen in the secretory material (Fig. 201).

COMMON OVIDUCT: - The necrotic effects were like that of 14 days.

SPERMATHECA: - Outer muscle layer became degenerated. Nuclei of epithelium became small and have dense chromatin material. Necrosis was seen in the secretory material (Fig. 202).

SPERMATHECAL DUCT: - The necrotic effects were like that of 14 days.

SEMINAL VESICLE: - Basement membrane became thin, irregular and was broken at some places. Space formation was seen in the epithelial cells and nuclei became small and have dense chromatin material. Necrosis was seen in the meshwork fibril. (Fig. 203).
AFTER 28 DAYS TREATMENT:

OVARY/OOCYTE: The germanium became irregular and shrunken and their nuclei were small sized. Nuclei of vitellarium became pycnotic and their follicular epithelium became thin, irregular and compact solid ooplasm was seen. Further degeneration was seen at this stage. The follicular epithelium became thin and their nuclei became pycnotic in fully matured oocyte. Ooplasm was degenerated. Tri nucleated oocytes were also seen. At this stage chromatin material was clumped. (Figs. 204, 205, 206).

LATERAL OVIDUCT: Further shrinkage was seen. Circular muscles became thin, irregular and shrinkage was seen in the villi like folds. Some pycnotic nuclei were accumulated in the intima of folds and villi like folds were decreased. Large vacuolizations were seen in the secretory material (Fig. 207).

MEDIAN OVIDUCT: It was completely degenerated. Outer muscle layer became thin, irregular, circular muscles became splitted and villi like folds were completely distorted in shape. Space formation was seen in the epithelium and nuclei of epithelium became pycnotic or necrotic having fragmented chromation material and they have lost their identity. Further necrosis was seen in the secretory material (Fig. 208).

COMMON OVIDUCT: Outer muscle layer was ruptured and splitting was seen in the epithelium and nuclei of epithelium became small having dense chromatin material. Degenerated cellular mass was seen (Fig. 209).
SPERMATHECA: Necrosis was seen in the muscle layer. Basement membrane became thin. Nuclei of epithelium became small and necrosis was seen in the secretory material (Fig. 210).

SPERMATHECAL DUCT: Nuclei of epithelium became small having dense chromatin material and compact secretory material was seen in the lumen (Fig. 210).

AFTER 35 DAYS TREATMENT:

OVARY/OOCYTE: Degeneration of germanium was seen. Space formation was seen in the follicular epithelium and their nuclei became pycnotic. Nuclei of vitellarium became distorted in shape and were accumulated. Tunica propria became thin, irregular and was broken at places. Vacuolization and space formation was seen in the ooplasm. Oocyte became distorted in shape and it looked like a oostorbed oocyte (Figs. 211, 212, 213).

LATERAL OVIDUCT: Outer muscle layer became irregular and was broken at some places and their nuclei became very small. Circular muscles became very thin and split. Space formation was seen in the longitudinal muscles and their nuclei became pycnotic. Vacuolization was seen in the epithelium and shrinkage in villi like folds was seen. Nuclei of epithelium became pycnotic and secretory material was vacuolated (Fig. 214).

MEDIAN OVIDUCT: Outer muscle layer became completely degenerated and their nuclei became small and have dense chromatin material. Splitting was seen in the circular muscles and
necrosis was seen in the longitudinal muscles. Space formation was seen in between circular muscles and villi like folds. Space formation was also seen in the epithelium and their nuclei became pycnotic having fragmented chromatin material (Fig. 215).

**Spermatheca**: Basement membrane became thick. Space formation was seen in the epithelium and their nuclei became pycnotic. Space formation was seen in the secretory material (Fig. 216).

**Spermathecal Duct**: Space formation was seen in the epithelium. There was less secretory material in the lumen (Fig. 217).

**Seminal Vesicle**: Necrosis was seen in the muscle layer and their nuclei became small. Space formation was seen in the epithelium and there was necrosis in the secretory material (Fig. 217).

**Effect of 0.125 ml of Hempa**:

**After 3 Days Treatment**:

**Ovary/Oocyte**: There was no change in germarium and vitellarium. Nuclei of follicular epithelium were reduced in size. Necrosis and vacuolization was seen in the ooplasm. In early oocytes, tunica propria became thin and large vacuoles were seen around nucleus. Big space was formed in between follicular epithelium and ooplasm (Figs. 218, 219).
LATERAL OVIDENT: Outer muscle layer and circular muscles became thin and nuclei of longitudinal muscles became vacuolated. Vacuolization was seen in the cytoplasm of epithelium and villi like folds became shrunken. Nuclei became small and were accumulated in intimal portion and necrosis was also seen in secretory material (Fig. 219).

MEDIAN OVIDENT: Outer muscle layer became thin, irregular and separation of outer membrane was noticed. Nuclei of circular muscles became pycnotic. Longitudinal muscles became thin and their nuclei were vacuolated. Necrosis and distorted shape of villi like folds were seen. Space formation was seen in the epithelium. Nuclei of epithelium became pycnotic having fragmented chromatin material (Fig. 220).

COMMON OVIDENT: There was no differentiation in between the circular muscles and epithelium. Nuclei of epithelium became small. Cellular mass became distorted and their nuclei became pycnotic (Fig. 221).

SPERMATHECA: Necrosis was seen in the muscle layer and their nuclei became small in size. Basement membrane became thin and irregular. Space formation was seen in the epithelium and their nuclei became vacuolated. Spermathecal gland became very small. Pycnotic and vacuolated nuclei was seen (Fig. 222).

SEMINAL VESICLE: Basement membrane became thin and vacuolization was seen in the cytoplasm of epithelium and their nuclei became small and have dense chromatin material. Necrosis was also seen in meshwork fibril (Fig. 223).
AFTER 7 DAYS TREATMENT:

OVARY/OOCYTE: The follicular cells of germarium lost their smoothness and were crumpled. Nuclei became vacuolated and necrosis in the cytoplasmic content of the germarium was seen. No change was seen in the vitellarium. Complete degenerated or resorbed oocytes were seen. Follicular epithelium became thin and was broken at some places. Space formation was seen and ooplasm was vacuolated (Figs. 224, 225).

LATERAL OVIDUCT: It was shrunked and distorted in shape. Nuclei of muscle layer became small and shrinkage was seen in villi like folds. Small and accumulated nuclei were seen in the epithelium. Necrosis was also seen in the secretory material (Fig. 225).

MEDIAN OVIDUCT: Further necrosis was seen in the median oviduct. Outer muscle layer and circular muscles became degenerated and space formation was seen in the villi like folds and there was no differentiation in the epithelium and villi like folds. Nuclei of epithelium became pycnnotic and were scattered and had dense chromatin material (Fig. 226).

COMMON OVIDUCT: The effects were seen like that of 3 days.

SERMATHECA: Necrosis was seen in muscle layer and their nuclei became pycnnotic having fragmented chromatin threads. Basement membrane became thin, irregular and vacuolization was seen in the cytoplasm of epithelium. Nuclei became pycnnotic having fragmented chromatin material. Less secretory material
was seen in the lumen. Necrosis was also seen in the secretory material of lumen (Fig. 227).

SPERMATHECAL DUCT: - Basement membrane became thick and nuclei of epithelium became pyknotic having fragmented chromatin material. Necrosis was seen in the secretory material (Fig. 227).

SEMINAL VESICLE: - Basement membrane became thin, irregular and nucleus of epithelium became small having dense chromatin material. No change was seen in meshwork fibril. Empty lumen was observed.

AFTER 14 DAYS TREATMENT:

OVARY/OOCYTE: - Germarium and vitellarium were same like that of 7 days. The follicular epithelium of mature oocytes became distinctly pyknotic and was broken at some places and degenerated ooplasm was seen. Space formation was also noticed in the ooplasm and big vacuoles were seen in the ooplasm (Fig. 228).

LATERAL OVIDUCT: - Outer muscle layer became degenerated and their nuclei were very small having dense chromatin material. Circular muscles became very thin and were broken at some places. Shrinkage was seen in the villi like folds. Two types of secretory material was seen. Half of the secretory material became sparsely scattered and the other was vacuolated and compact (Fig. 229).

MEDIAN OVIDUCT: - Further necrosis was seen in the villi like folds. Space formation was seen in the epithelium and nuclei of epithelium became pyknotic having dense chromatin material.
Big vacuoles were seen in the secretory material (Fig. 230).

**COMMON OVIDUCT** :- Outer muscle layer was irregular and nuclei of circular muscle became pycnotic having dense chromatin material and were loosely packed. Further necrosis was seen in the cellular mass and their intima was degenerated (Fig. 231).

**SPERMATHECA** :- Basement membrane became thin, irregular and was broken at some places. Vacuolization was seen in the epithelium and their nuclei became small, having dense chromatin material. Compact secretory material was seen (Fig. 232).

**SPERMATHECAL DUCT** :- Outer muscle layer became degenerated. Basement membrane became thin, irregular and necrosis was seen in the secretory material (Fig. 233).

**SEMINAL VESICLE** :- Necrosis was seen in the muscle layer and their nuclei became pycnotic. Basement membrane became thin and irregular. Vacuolated nuclei of epithelium were seen and space formation was seen in the meshwork fibril (Fig. 233).

**AFTER 21 DAYS TREATMENT** :

**OVARY/OOCYTE** :- Early oocytes of germarium were degenerated and chromatin material of their nuclei became shrunked. Follicular epithelium of vitellarium became thin, irregular and broken at some places. Tunica propria became thin and irregular. Tetra nucleated oocytes were seen and their nucleoli were prominent and densely stained. Nuclei of follicular epithelium were pycnotic and degenerated ooplasm was seen (Figs. 234, 235).
LATERAL OVIDUCT: Outer muscle layer was degenerated and their nuclei were pyknotic. Circular and longitudinal muscles became thin. Space formation was seen in the villi like folds. Vacuolization was seen in the cytoplasm of epithelium and their nuclei became pyknotic (Fig. 236).

MEDIAN OVIDUCT: Circular muscles and longitudinal muscles became thin and irregular. Necrosis was seen in the epithelium and nuclei of epithelium have fragmented chromatin material and they were scattered all over. Necrosis was seen in the secretory material (Fig. 237).

COMMON OVIDUCT: It became distorted in shape. Outer muscle layer was ruptured. Circular muscle became thin and splitted. Cellular mass became shrunked and distorted in shape and their intima became thin and lost their identity (Fig. 238).

SPERMATHECA: Outer muscle layer was degenerated. Basement membrane became thin and irregular. Space formation was seen in the epithelium and their nuclei were pyknotic. Space formation was seen in the lumen and necrosis was seen in the secretory material (Fig. 239).

SPERMATHECAL DUCT: Basement membrane became thin. Space formation was seen in the epithelium and necrosis was seen in the secretory material.

SEMINAL VESICLE: The necrotic effects were like that of 14 days (Fig. 239).
AFTER 28 DAYS TREATMENT:

OVARY/OOCYTE: The follicular epithelium of germarium became thin and their nuclei became prominent. Vacuolization was seen in the cytoplasmic contents of germarium. Separation was seen in tunica propria of early oocytes. Nuclei of follicular epithelium became pycnotic. Binucleated oocytes were seen. Vacuolization and space formation was seen in the ooplasm (Figs. 240, 241).

LATERAL OVIDUCT: It was distorted in shape, outer muscle layer became thin, irregular and their nuclei became pycnotic. Space formation was seen in the cytoplasm of epithelium and it was shrunked and their nuclei were pycnotic (Fig. 242).

MEDIAN OVIDUCT: Circular muscles became thin, irregular, splitted and separated from epithelium. Vacuolization was seen in the epithelium and nuclei of epithelium became vacuolated and clumped. Necrosis was seen in the secretory material (Fig. 243).

COMMON OVIDUCT: The effects were same as in 21 days.

SPERMATHECA: It was completely degenerated. Its epithelium was also degenerated and the nuclei of epithelium became small having dense chromatin material and the nuclei were scattered all over (Fig. 244).

SPERMATHECAL DUCT: Basement membrane was splitted and space formation was seen in the epithelium. Their nuclei were pycnotic and have dense chromatin material. Degenerated secretory material was seen (Fig. 244).
**SEMINAL VESICLE** :- The effects were seen like that of 21 days.

**AFTER 35 DAYS TREATMENT**:

**OVARY/OCYTE** :- There was same effect in germarium like that of 28 days. The necrotic effects were same in oocytes also as in 28 days.

**LATERAL OVIDENT** :- Lateral oviducts became distorted in shape. Outer muscle layer was degenerated and circular muscles were thin, irregular and broken at some places. Necrosis was seen in longitudinal muscles and their nuclei were scattered, villi like folds were also shrunken. Space formation was seen in the epithelium and nuclei of epithelium became pycnotic. Degenerated secretory material was also seen (Fig. 245).

**MEDIAN OVIDENT** :- It was distorted in shape. Outer muscle layer became thin, irregular and nuclei of epithelium were vacuolated and clumped. Shrinkage was seen in the folds, large number of small vacuoles or droplets were seen in the secretory material. Big space formation between folds and secretory material was seen (Fig. 246).

**COMMON OVIDENT** :- It was completely degenerated. Outer muscle layer and epithelium was ruptured. Splitting was seen in the circular muscles and cellular mass was also disrupted (Fig. 247).

**SPERMATHECA** :- Necrosis was seen in the outer muscle layer and shrunken chromatin material was seen in the nuclei. Basement membrane became thin and irregular. Vacuolization was
seen in the cytoplasm of epithelium and their nuclei were vacuolated. Degenerated secretory material was seen (Fig. 248).

**SPERMATHECAL DUCT**: Basement membrane became thin, irregular and was broken at some places. Vacuolization was seen in the cytoplasm and nucleus of epithelium. Necrosis was seen in secretory material (Fig. 248).

**SEMINAL VESICLE**: Necrosis was seen in the outer muscle layer and basement membrane became thin, irregular and space formation was seen in the epithelium. Nuclei of epithelium were vacuolated. Degeneration and space formation was seen in the meshwork fibril (Fig. 249).

**AFTER 42 DAYS TREATMENT**:

**OVARY/OOCYTE**: Nuclei of early oocytes were centrally located and their ooplasm was compact. Tunica propria of terminal oocyte became very thin. Ooplasm was shrunked and space formation was seen. Binucleated oocyte were seen and their nucleoli were not very prominent. Necrosis and vacuolization was seen in the ooplasm (Figs. 250, 251).

**LATERAL OVIDUCT**: Necrosis was seen in the outer muscle layer. Circular muscles were very thin and nuclei of longitudinal muscles were clumped. Further shrinkage was seen in the villi like folds and their nuclei were very small, having dense chromatin material. Degenerated secretory material was seen (Fig. 252).
**M**E**D**I**A**N O**V**I**D**U**C**T:** Outer muscle layer was ruptured and splitting was seen in the circular muscles, nuclei of longitudinal muscles became pycnotic. Space formation was seen in the epithelium and their nuclei were big and were loosely packed (Fig. 253).

**C**O**M**O**N O**V**I**D**U**C**T:** Shrinkage was seen in the common oviduct. Muscle layer was degenerated and circular muscles were splitted. Necrosis was seen in the epithelium, cellular mass was also shrunked (Fig. 254).

**S**P**E**R**M**A**T**H**E**C**A:** There was space formation in the muscle layer and basement membrane became thin, irregular, splitted and broken at some places. Epithelium was vacuolated and their nuclei were small. There was space formation in the secretory material (Fig. 255).

**S**P**E**R**M**A**T**H**E**C**A**L D**U**C**T:** Basement membrane became thin and irregular. Space formation was seen in the epithelium and secretory material of the lumen was having a big vacuole (Fig. 256).

**S**E**M**I**N**A**L V**E**S**I**C**L**E:** The effects were same as seen in 35 days.

'*AFTER 50 DAYS TREATMENT'*

**O**V**A**R**Y/O**O**C**Y**T**E:** There was no change in germarium and vitellarium. In this stage, flower like arrangement of vacuoles were seen in the ooplasm of terminal oocyte and ooplasm was shrunked and compact. Nucleus was normal and vacuolar arrangement of ooplasm was near the nucleus (Fig. 257).
LATERAL OVIDUCT: It was distorted in shape and was completely degenerated. Outer muscle layer and circular muscles were ruptured. Shrinkage was seen in the villi like folds and their nuclei were pycnotic. Necrosis and space formation was seen in the secretory material (Fig. 258).

MEDIAN OVIDUCT: Necrosis was seen in the outer muscle layer. Circular muscle became thin and split. Longitudinal muscles were thin and their nuclei have fragmented chromatin material. Villi like folds became long and they invaded the lumen completely. Space formation was seen in the villi like folds and the nuclei of epithelium were pycnotic and vacuolated. Very less secretory material was seen (Fig. 259).

COMMON OVIDUCT: Necrosis was noticed in outer muscle layer and circular muscles were split. Cellular mass and their intimal portion were somewhat normal in structure and nuclei of epithelium were pycnotic (Fig. 260).

SPERMATHECA: It was somewhat normal. Basement membrane was thick and irregular. Nuclei were normal having dense chromatin material. Vacuolization and necrosis was seen in the secretory material (Fig. 261).

SPERMATHECAL DUCT: It was completely normal. Basement membrane became thick. Cytoplasm of epithelium became compact. Nuclei have dense chromatin material.

SEMINAL VESICLE: Completely normal structure was seen. Outer muscle layer and basement membrane became thick and irregular. Nuclei of epithelium were small and had dense chromatin material.
DISCUSSION

In the present investigation, it was noticed that apholate and hempa causes histopathological changes to the female reproductive organs of \textit{P. pictus}. The histopathological effects caused by these chemosterilants were somewhat similar and the necrotic effects are discussed in this chapter.

There was necrosis in the gerarium, and more degeneration was seen in the posterior region of gerarium. The oocytes of gerarium became small and have shrunked chromatin material in their nuclei. In the vitellarium, follicular epithelium became thin, irregular and the ooplasm became shrunked in \textit{P. pictus}. Landa and Režábova (1965) indicated the destruction of the gerarium and follicle cells of house flies. The gerarium was much reduced in size and few oocytes were developed in \textit{Tertranychus urticae} Koch, after treatment with 5-fluorouracil as reported by Jalil and Morrison (1969). Ondracek and Matolin (1977) showed that there was no yolk deposition in the vitellarium of \textit{A. obtectus} treated with tepa. No disintegration of gerarium and follicular epithelium was recorded by Jalaja and Prabhu (1976) in case of \textit{D.cingulatus} after treatment with metepa and apholate. The reduced vitellarium and the gerarium, however, remains normal in \textit{C.chinensis} after treatment with \textit{Acorus calamus} L. oil vapours as seen by Tikku \textit{et al.} (1978). Inhibition of gerarium was seen in \textit{A. aegypti} after treatment with chemosterilant as reported by
LaBrecque and Fye (1978). The vitellarium region of the ovariole is more susceptible to chemosterilant than the germarium region and their follicles are severely damaged in P. americana (L.), treated with hempo, thiotepa and Bis (Dimethylamino) Dithiazolium chloride as reported by Saxena and Bhatnagar (1980). These findings are in accordance with Morgan and LaBrecque (1962, 1964) and Combiesco et al. (1967) in M. domestica. Treatment with tepa, brought about histological changes in both germarium and vitellarium as compared to those in the normal insects. The follicular epithelium lost its smoothness and became crumpled and the vacuolization was seen in the germarium in P. koenigii by Maheshwari et al., (1981).

In the present study, the tunica propria became thin, splitted, irregular and there was space formation in P. pictus as also reported by Banerjee and Sahai (1986, 1987a), Sahai and Banerjee (1986), after treatment with tepa, metepa, apholate and hempo and Ahi (1987) in P. pictus treated with hexachloro cyclohexene (HCH).

Follicular epithelium became pycnotic, degenerated and space formation was seen in between the epithelium and ooplasm. The ooplasm of mature oocytes was invaded by follicular epithelium and on prolonged treatment of apholate and hempo, the follicular epithelial cells became distinctly pycnotic and most of them have lost their contact among themselves. Invading of follicular epithelium was seen near the
oocyte nucleus in *P. pictus*. Degeneration of follicular epithelium was reported in *L. migratoria* by Nath et al. (1975) after tepa administration. Whereas in *P. americana*, the follicular epithelium of mature oocytes became thick and wavy and their nuclei became prominent and dumbbell shaped after hemepa treatment as reported by Bhargava et al. (1977). The follicular epithelium of immature oocytes of *P. americana* became shrunked after apholate treatment as reported by Tandon and Bhargava (1977) and there is a general thickening of the follicular epithelium of *P. americana* treated with metepa as reported by Tandon and Bhargava (1977). According to Nath and Sharma (1977), nuclei of follicular epithelial cells tended to become pycnotic and the ooplasm was contracted and vacuolated after treatment of apholate. The yolk in mature oocytes was damaged in *L. migratoria* and such observations were also recorded by Morgan (1967) and Wilson and Hays (1969) with derivatives of hemepa viz. P, bis (1-aziridinyl -N- methyl phosphoric amide and P, P-bis (1- aziridinyl) -N- (3 methoxy propyl) phosphinothionic amide in house-flies.

According to Nath and Sharma (1977), 5-fluorouracil appears to be quite effective on ovarian tissue since it causes contraction of ooplasm and degeneration of the follicular epithelium accomplished through pycnosis and loss of the follicular epithelial cell cytoplasm. Since the follicular epithelium is damaged, the maturation of the oocyte is affected and the number of mature oocytes in the ovary
decreases. These observations on Locust ovary are in conformity with the work of various authors who had reported vacuolization and degeneration of nurse cell which subsequently led to the degeneration of the ovaries of various insects treated with antimetabolites such as Morgan (1967), Rezabova and Landa (1967) and Rezabova (1968). They also noticed a proliferation of follicular epithelium of the egg chamber, and subsequent degeneration of nuclei and cell membrane in 6-azaridine treated houseflies. Follicular epithelial layer lost its contact with the underlying ooplasm and the degeneration of ooplasm after apholate treatment in L. migratoria was reported by Nath et al. (1978 a,b). It is similar as seen in P. pictus in the present study. This observation was also reported by Morgan and LaBrecque (1962), Landa and Rezabova (1965) and Combiesco et al. (1967) in house flies. Morgan and LaBrecque (1962, 1964) and Combesico et al. (1967) reported pycnosis of nuclei, vacuolization of cytoplasm and general atrophy of the follicular epithelium in the ovary of M. domestica after treatment with tepa, thiotepa and apholate and the same has been seen in the present study in P. pictus. Follicular epithelium of oocytes of M. domestica looses its contact with ooplasm and degeneration of ooplasm was noticed by Thakur and Mann (1982) after sodium azide treatment. This finds support by the findings of Nath and Sharma (1977). Thakur and Mann (1982) also reported degeneration of follicular epithelial
cells, loss of cytoplasmic fluid and contraction of ooplasm which give rise to finger like projections and these projections later on break-up the ooplasm into bits. Similar degeneration of follicular epithelial cells has been reported by Nath et al. (1975) in L. migratoria after tepa administration.

Some of the follicle cells were found empty and irregular in shape in M. domestica treated with sodium azide as reported by Thakur and Mann (1982). The present findings are very much in accordance with the findings of Langen Scheidt (1973) who studied the effects of apholate in spider mite Tetranynchus urticae (Koch). No histopathological deformities were observed in later treatment by sodium azide in M. domestica as reported by Thakur and Mann (1982). Similar results were also obtained by Langenscheidt (1973) after treatment of spider mites with apholate. Vacuolization of ooplasm, pycnosis and degeneration of nuclei of nurse cell were observed in higher concentration which sustaintiated the result of Sakuria (1974) who reported it in M. domestica with hempa treatment.

The nuclei of the follicular epithelial cells became pycnotic and the ooplasm of the terminal and penultimate oocytes was highly vacuolated as noticed by Banerjee and Sahai (1986) after treatment with tepa and metera. Resorption of mature oocytes in tepa- metepa treated P. pictus is evident from the progressive increase in their vacuolation. Similar observations were made by Bulygin Sakaya et al. (1967) in thiotepa and tretamine treated Cydia pomonella, Heliothis
armigeru and Agrotis segetum. Degeneration of follicular epithelium owing to pycnosis, impairment of its function and subsequent arrest of growth of oocyte of P. pictus has been reported by Sahai and Banerjee (1986) after treatment with hempo. The nuclei of follicular epithelium were also crumpled and dense, the immature oocytes started shrinking away from the follicular epithelium, tunica propria was thicker than normal and more intact with the follicular epithelium in P. pictus as reported by Banerjee and Sahai (1987) after treatment with apholate. According to Mittal et al. (1978) the finger-like projections of the follicular epithelium invading the shrinking ooplasm are formed due to pressure exerted on the epithelial cytoplasm by fragmentation of the chromatin material. Fragmentation of such kind could not be traced in P. pictus by Banerjee and Sahai (1987) after apholate treatment. The invasion of follicular epithelium into the ooplasm by fingerlike process has not been reported by Saxena and Aditya (1974) and Tandon and Bhargava (1977) whereas these have been shown by Morgan and LaBrecque (1962) in house flies, Nath et al. (1975, 1976, 1978 a,b) in L. migratoria and the similar invading of follicular epithelium into ooplasm has been seen in the present study in P. pictus.

In the present study, ooplasm became shrunked and necrosis, degeneration and highly vacuolated ooplasm was seen. Flower like vacuolization was seen in the ooplasm and the division of ooplasm by a differentiating layer into two portions,
the inner showing vacuoles while the other had a clear ooplasm is reported first time. Necrosis in the ooplasm of A. mellifera (L.) treated with tepa is reported by Taber and Borkovec (1969). Few vacuoles appear in peripheral cytoplasm in P. americana, which increase in number and size with lapse of time as reported by Bhargava et al. (1977) after hempo treatment. Slight shrinkage of ooplasm after treatment with aholate in L. migratoria was reported by Nath et al. (1978) and compact, solid undifferentiated mass of ooplasm was seen in D. koenigii after sodium azide treatment by Maheshwari et al. (1981). The oocyte appeared to be a compact, solid, undifferentiated mass of ooplasm as compared to the normal, was seen in D. koenigii after sodium azide treatment by Maheshwari et al. (1981). Nath et al. (1976) are of same opinion regarding the space formation in Locusta migratoria. Formation of such gaps has also been reported in D. cingulatus after the application of Paper factor by Judson et al. (1978b). However, such a change was not observed in D. koenigii by Taneja et al. (1979) after aholate treatment. It would, therefore, not be unreasonable to presume that different chemosterilants have different effects at histological level. Vacuoles, shrinkage and central accumulation of yolk was seen in the ooplasm of C. stolli Wolff after juvenoid treatment by Mukhopadhyay et al. (1988).

In the present study, binucleated, trinucleated and tetranucleated oocytes were seen in P. pictus. The migration of oocyte nucleus to the central part of the ooplasm was also
seen. Two oocytes having a single ovarian sheath was also noticed. Compartment like formation was seen in the multinucleated oocyte and these oocytes became distorted in shape as seen in the present study. The inhibition of oocyte of tepa and metepa treated ovaries of *M. domestica* began degenerating at 48 to 72 hrs respectively as reported by Morgan and Labrecque (1964). The immature oocytes were not visibly damaged, indicating that after a time, the effect of hempa may be overcome. Labrecque *et al.* (1965), Morgan (1967) and Bhargava *et al.* (1977) also made the similar suggestion. Eggs were not altered by any of the treatment of tepa in *A. mellifera* (L.) as reported by Taber and Borkovec (1969). The damage caused by alkylating agent is irreversible in oocytes, has been reported by Campion and Lewis (1970), Nath *et al.* (1976) and Banerjee and Sahai (1986). Small abnormal oocytes were seen in *O. fasciatus* treated with tretamine by Economopoulos (1971). Oocytes became smaller in *Achoea janata* (L.) after treatment with tepa and metepa as reported by Sukumar and Naidu (1977). Tandon and Bhargava (1977) reported in *P. americana* after anholate treatment that terminal oocytes in the ovaries showed complete inhibition of growth and indication of resorption and appearance of small vacuoles in the cytoplasm of the mature oocytes. They also reported that Hempa damages mature oocytes more than immature oocytes of *P. americana* and the same has been confirmed by Sahai and Banerjee (1986) in *P. pictus* which is in agreement with the views of Morgan (1967), Wilson and Hays (1969) and Nath *et al.*
(1976) who obtained similar results with hempa derivatives. Oocytes of *L. migratoria* became small after treatment with azadirachtin (Rembold and Sieber, 1981). Complete degeneration of inter oocyte bridges at this stage resulted in binucleated or even trinucleated oocytes has been reported by Banerjee and Sahai (1987) after treatment with apholate. Binucleated oocytes and trinucleated oocytes were also observed in *P. pictus* after Hexachlorocyclohexane treatment by Ahi (1987) and the same has been in the present study in *P. pictus* with apholate and hempa treatment. Resorption of the oocytes and other ovarian dysfunctions were observed with azasteroids in *D. similis* by Kaur *et al.* (1986 a,b) and in *D. similis* after *chrysanthemum indicum* treatment by Kaur *et al.* (1989). Painter and Kilgore (1965) reported inhibited ovarian development in house flies after treatment with various antimetabolites inducing 5-fluorouracil and aminopterin. Metwally and Landa (1972) reported abnormalities in follicular cells of *Trogoderma granarium* Everts, after treatment with two juvenile hormone analogue. They also reported that effects of these hormone analogue on oogenesis were noticeable in various degrees of degeneration, partial or complete atrophy of ovarioles. 5-fluorouracil acid causes eventually complete degeneration of the ovary of *L. migratoria* as reported by Nath and Sharma (1977). The effective dose of hempa, thiotepa and Bis (Dimethylamino) Di thioazalium chloride caused severe histopathological damage to panoistic
ovary such as degeneration and dissolution of ovariole, cytoplasm pycnosis and fragmentation of chromatin material in oogonia and of follicular cells which resulted in complete degeneration of all cellular material of *P. americana* as reported by Saxena and Bhatnagar (1980). The ovarioles are sometimes found to be smaller and the oocyte, narrow than normal in *P. pictus* after tepa, metepa treatment as reported by Banerjee and Sahai (1986). According to Stark et al. (1990), azadirachtin had no significant effect on growth and development of female progeny in *C. capitata*.

After treatment with apholate and hempa the lateral oviducts of *P. pictus* became distorted in shape, their muscle layer became thin, irregular and the nuclei became pycnotic. Circular muscle and longitudinal muscle became thin, irregular and splitting was also observed. Vacuolization and space formation was seen in the epithelium and distorted shape of villi like folds were seen. Necrosis and space formation and large vacuoles were seen in the secretory material. Deformation of the genital chamber in *P. pictus* has been reported by Banerjee and Sahai (1986) similar to the findings in *A. obtectus* by Ondracek and Matalin (1971) and in locusts by Nath et al. (1975). Shrinkage in the genital chamber (lateral oviduct) was seen and its infolding in *P. pictus* were slightly increased with prologged post-treatment period, suggests its inactivity and degeneration, after apholate treatment as reported by Banerjee and Sahai (1987). Nuclei of epithelium
of genital chamber (lateral oviduct) became pycnotic in *P. pictus* after treatment with HCH as reported by Ahi (1987). The same has been seen in the present study in *P. pictus*, after treatment with acetolate and hempa, muscle layer became thin and was broken at some places and circular muscles also became thin. Clumped nuclei were seen in the epithelium of median oviduct which were vacuolated. Small vacuoles were also seen in the secretory material. Further discussion is not possible as, so far, no references are available in this tissue.

The common oviduct of *P. pictus* after treatment with both the chemosterilants show that outer muscle layer and circular muscle layer became degenerated. Nuclei of epithelium became small and pycnotic. Distorted shape of cellular mass was also seen. After prolonged treatment, it was further degenerated and no differentiation could be seen in the epithelium and the cellular mass. As far as author is aware of, no references are available on this tissue as such it can't be discussed further.

In spermatheca, outer muscle layer became ruptured, basement membrane became thin and nuclei of epithelium became vacuolated and vacuolization was also seen in the glandular part of spermatheca in which their nuclei also became small. In spermathecal duct, necrosis was seen in the outer muscle layer, and their nuclei became pycnotic, vacuolization was
seen in the nuclei of epithelium. Space formation and
vacuolization was also seen in the secretory material. Since
no references are available on this tissue also, further
discussion cannot be made. In seminal vesicle, nuclei of
outer muscle layer became vacuolated and basement membrane
became thick and irregular. Space formation was seen in the
epithelium and their nuclei became vacuolated. Necrosis in
meshwork fibril was also seen. So far, no work has been done
on this tissue also as such it cannot be discussed further.

It is concluded that the apholate and hempa (both the
doses) cause somewhat similar histopathological changes in
the ovarian system of this insect, which result in causing
impairment of the insect and the female incapable of repro-
duction.
EXPLANATION TO FIGURES

Fig. 102: L.S. of Ovary of control *Pbekilocerus pectus*
Haematoxylin Eosin X 100

Fig. 103: T.S. of Lateral oviduct of control
*Pbekilocerus pictus*. Haematoxylin Eosin X 100

Fig. 104: T.S. of Median oviduct of control
*Pbekilocerus pictus*. Haematoxylin Eosin X 100

Fig. 105: Same as Fig. 104. Haematoxylin Eosin X 200.
EXPLANATION TO FIGURES

Fig. 106 : T.S. of Common oviduct of control *Poekilocerus pictus*. Haematoxylin Eosin X 100

Fig. 107 : T.S. of Spermatheca, spermathecal duct and seminal vesicle of control *Poekilocerus Pictus*. Haematoxylin Eosin X 60

Fig. 108 : L.S. of Oocyte of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 109 : T.S. of Lateral oviduct of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 150
EXPLANATION TO FIGURE

Fig. 110 : T.S. of Median oviduct of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 111 : T.S. of Common oviduct of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 112 : Section of Spermatheca of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 113 : T.S. of Spermathecal duct and seminal vesicle of *Poekilocerus pictus* after 3 days of .065 ml apholate treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 114 : L.S. of Oocyte and Lateral Oviduct of *Poekilocerus pictus* after 7 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 115 : T.S. of Median Oviduct of *Poekilocerus pictus* after 7 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 116 : Section of Spermatheca and T.S. of Spermathecal duct of *Poekilocerus pictus* after 7 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 117 : T.S. of Seminal Vesicle of *Poekilocerus pictus* after 7 days of .065 ml apholate treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 118: T.S. of Oocyte and Lateral Oviduct of *Poekilocerus pictus* after 14 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 119: T.S. of Median Oviduct of *Poekilocerus pictus* after 14 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 120: T.S. of Common Oviduct of *Poekilocerus pictus* after 14 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 121: T.S. of Spermatheca and Spermathecal duct of *Poekilocerus pictus* after 14 days of .065 ml apholate treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 122 : L.S. of Oocyte of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 123 : T.S. of Lateral Oviduct of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 124 : T.S. of Median Oviduct of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 125 : T.S. of Common Oviduct of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. Haematoxylin Eosin X 200
Fig. 126: T.S. of Spermatheca of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 127: T.S. of Seminal Vesicle of *Poekilocerus pictus* after 21 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 128: L.S. of Oocyte of *Poekilocerus pictus* after 28 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 129: L.S. of Oocyte and T.S. of Lateral Oviduct of *Poekilocerus pictus* after 28 days of .065 ml apholate treatment. Haematoxylin Eosin X 60
EXPLANATION TO FIGURES

Fig. 130 : T.S. of Median Oviduct of *Poekilocerus pictus* after 28 days of .065 ml apholate treatment. Haematoxylin Eosin X 300

Fig. 131 : T.S. of Median Oviduct of *Poekilocerus pictus* after 28 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 132 : T.S. of Spermatheca of *Poekilocerus pictus* after 28 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 133 : T.S. of Spermathecal duct of *Poekilocerus pictus* after 28 days of .065 ml apholate treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 134 : L.S. of oocyte of *Poekilocerus pictus* after 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 60

Fig. 135 : T.S. of Lateral oviduct of *Poekilocerus pictus* after 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 136 : T.S. of Median Oviduct of *Poekilocerus pictus* after 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 137 : T.S. of Common Oviduct of *Poekilocerus pictus* after 35 days of .065 ml apholate treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 138: L.S. of Spermatheca of *Poekilocerus pictus* after 35 days of 0.065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 139: T.S. of Spermathecal duct of *poekilocerus pictus* after 35 days of 0.065 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 140: L.S. of oocyte of *Poekilocerus pictus* after 3 days of 0.065 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 141: T.S. of lateral oviduct of *Poekilocerus pictus* after 3 days of 0.065 ml hempa treatment. Haematoxylin Eosin X 150.
EXPLANATION TO FIGURES

Fig. 142 : T.S. of median oviduct of _Roekilocerus pictus_ after 3 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 143 : T.S. of common oviduct of _Roekilocerus pictus_ after 3 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 144 : T.S. of spermatheca and spermathecal duct of _Roekilocerus pictus_ after 3 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 145 : T.S. of oocyte and lateral oviduct of _Roekilocerus pictus_ after 7 days of .065 ml hempa treatment. Haematoxylin Eosin X 60
EXPLANATION TO FIGURES

Fig. 146 : T.S. of median oviduct of *Poekilocerus pictus* after 7 days of .065 hempa treatment. Haematoxylin Eosin X 100

Fig. 147 : T.S. of common oviduct of *Poekilocerus pictus* after 7 days of .065 hempa treatment. Haematoxylin Eosin X 200

Fig. 148 : T.S. of spermatheca and spermathecal duct of *Poekilocerus pictus* after 7 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 149 : T.S. of spermathecal gland and seminal vesicle of *Poekilocerus pictus* after 7 days of .065 ml hempa treatment. Haematoxylin Eosin X 100
EXPLANATION TO FIGURES

Fig. 150 : L.S. of oocyte of *Poekilocerus pictus* after 14 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 151 : T.S. of lateral oviduct of *Poekilocerus pictus* after 14 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 152 : T.S. of median oviduct of *Poekilocerus pictus* after 14 days of .065 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 153 : T.S. of common oviduct of *Poekilocerus pictus* after 14 days of .065 ml hempa treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 154 : Section of spermatheca of *Roekilocerus pictus* after 14 days of .065 ml hempa treatment. **Haematoxylin Eosin X 200**

Fig. 155 : T.S. of Spermathecal duct and seminal vesicle of *Roekilocerus pictus* after 14 days of .065 ml hempa treatment. **Haematoxylin Eosin X 200**

Fig. 156 : L.S. of oocyte of *Roekilocerus pictus* after 21 days of .065 ml hempa treatment. **Haematoxylin Eosin X 100**

Fig. 157 : T.S. of lateral oviduct of *Roekilocerus pictus* after 21 days of .065 ml hempa treatment. **Haematoxylin Eosin X 100**
EXPLANATION TO FIGURES

Fig. 158: T.S. of median oviduct of *Poekilocerus pictus* after 21 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 159: T.S. of common oviduct of *Poekilocerus pictus* after 21 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 160: T.S. of spermatheca and spermathecal duct of *Poekilocerus pictus* after 21 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 161: T.S. of seminal vesicle of *Poekilocerus pictus* after 21 days of .065 ml hempa treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 162 : L.S. of oocyte and lateral oviduct of *Poekilocerus pictus* after 28 days of .065 ml hempla treatment. Haematoxylin Eosin X 60

Fig. 163 : T.S. of median oviduct of *Poekilocerus pictus* after 28 days of .065 ml hempla treatment. Haematoxylin Eosin X 100

Fig. 164 : T.S. of common oviduct of *Poekilocerus pictus* after 28 days of .065 ml hempla treatment. Haematoxylin Eosin X 200

Fig. 165 Section of spermatheca of *Poekilocerus pictus* after 28 days of .065 ml hempla treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 166 : T.S. of spermathecal duct of *Poekilocerus pictus* after 28 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 167 : T.S. of seminal vesicle of *Poekilocerus pictus* after 28 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 168 : L.S. of oocyte of *Poekilocerus pictus* after 35 days of .065 ml hempa treatment. Haematoxylin Eosin X 150

Fig. 169 : T.S. of lateral oviduct of *Poekilocerus pictus* after 35 days of .065 ml hempa treatment. Haematoxylin Eosin X 100
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Fig. 170 : T.S. of median oviduct of *Ptekilocerus pictus* after 35 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 171 : T.S. of common oviduct of *Ptekilocerus pictus* after 35 days of .065 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 172 : Section of spermatheca of *Ptekilocerus pictus* after 35 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 173 : T.S. of spermathecal duct and seminal vesicle of *Ptekilocerus pictus* after 35 days of .065 ml hempa treatment. Haematoxylin Eosin X 200
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Fig. 174 : T.S. of oocyte and lateral oviduct of *Poekilocerus pictus* after 42 days of .065 ml hempa treatment. Haematoxylin Eosin X 60

Fig. 175 : T.S. of median oviduct of *Poekilocerus pictus* after 42 days of .065 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 176 : T.S. of spermatheca, spermathecal gland and seminal vesicle of *Poekilocerus pictus* after 42 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 177 : T.S. of (spermathecal gland) after 42 days of .065 ml hempa treatment. Haematoxylin Eosin X 300
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Fig. 178: L.S. of oocyte of *Pbekilocerus pictus* after 50 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 179: T.S. of median oviduct of *Pbekilocerus pictus* after 50 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 180: T.S. of spermatheca and spermathecal duct of *Pbekilocerus pictus* after 50 days of .065 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 181: T.S. of seminal vesicle of *Pbekilocerus pictus* after 50 days of .065 ml hempa treatment. Haematoxylin Eosin X 200
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Fig. 182 : L.S. of germarium and vitellarium of Poekilocerus pictus after 3 days of 0.125 ml of apholate treatment. Haematoxylin Eosin X 100

Fig. 183 : L.S. of oocyte of Poekilocerus pictus after 3 days of 0.125 ml of apholate treatment. Haematoxylin Eosin X 200

Fig. 184 : T.S. of lateral oviduct of Poekilocerus pictus after 3 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 150

Fig. 185 : T.S. of median oviduct of Poekilocerus pictus after 3 days of 0.125 ml of apholate treatment. Haematoxylin Eosin X 200
Fig. 194: T.S. of lateral oviduct of *Poekilocerus pictus* after 14 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 150

Fig. 195: T.S. of median oviduct of *Poekilocerus pictus* after 14 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 196: T.S. of common oviduct of *Poekilocerus pictus* after 14 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 197: T.S. of spermatheca, spermathecal duct and seminal vesicle of *Poekilocerus pictus* after 14 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 100
EXPLANATION TO FIGURES

Fig. 190:  T.S. of median oviduct of *Poekilocerus pictus* after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 191:  T.S. of common oviduct of *Poekilocerus pictus* after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 192:  T.S. of spermatheca and spermathecal duct of *Poekilocerus pictus* after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 193:  L.S. of oocyte of *Poekilocerus pictus* after 14 days of .125 ml apholate treatment. Haematoxylin Eosin X 150
EXPLANATION TO FIGURES

Fig. 186 : T.S. of common oviduct of *Poekilocerus pictus* after 3 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 187 : T.S. of spermatheca of *Poekilocerus pictus* after 3 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 188 : L.S. of germarium and vitellarium of *Poekilocerus pictus* after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 189 : L.S. of oocyte of *Poekilocerus pictus* after 7 days of .125 ml apholate treatment. Haematoxylin Eosin X 100
EXPLANATION TO FIGURES

Fig. 198 : L.S. of ovary of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. *Haematoxylin Eosin X 150*

Fig. 199 : L.S. of oocyte of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. *Haematoxylin Eosin X 300*

Fig. 200 : T.S. of lateral oviduct of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. *Haematoxylin Eosin X 150*

Fig. 201 : T.S. of median oviduct of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. *Haematoxylin Eosin X 200*
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Fig. 202 : Section of spermatheca of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 203 : T.S. of spermathecal duct and seminal vesicle of *Poekilocerus pictus* after 21 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 204 : L.S. of germarium and vitellarium of *Poekilocerus pictus* after 28 days of .125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 205 : L.S. of oocyte of *Poekilocerus pictus* after 28 days of .125 ml apholate treatment. Haematoxylin Eosin X 90
EXPLANATION TO FIGURES

Fig. 206 : T.S. of oocyte of *Poekilocerus pictus* after 28 days of .125 ml apoholate treatment. Haematoxylin Eosin X 300

Fig. 207 : T.S. of lateral oviducts of *Poekilocerus pictus* after 28 days of .125 ml apoholate treatment. Haematoxylin Eosin X 90

Fig. 208 : T.S. of median oviduct of *Poekilocerus pictus* after 28 days of .125 ml apoholate treatment. Haematoxylin Eosin X 200

Fig. 209 : T.S. of common oviduct of *Poekilocerus pictus* after 28 days of .125 ml apoholate treatment. Haematoxylin Eosin X 200
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Fig. 210 : Section of spermatheca and spermathecal duct of *Poekilocerus pictus* after 28 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 200.

Fig. 211 : L.S. of germarium and vitellarium of *Poekilocerus pictus* after 35 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 212 : L.S. of oocyte of *Poekilocerus pictus* after 35 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 160

Fig. 213 : T.S. of oocyte after 35 days of 0.125 ml apholate treatment. Haematoxylin Eosin X 100
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Fig. 214: T.S. of lateral oviduct of *Poekilocerus pictus* after 35 days of 1.125 ml apholate treatment. Haematoxylin Eosin X 100

Fig. 215: T.S. of median oviduct of *Poekilocerus Pictus* after 35 days of 1.125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 216: T.S. of spermatheca of *Poekilocerus pictus* after 35 days of 1.125 ml apholate treatment. Haematoxylin Eosin X 200

Fig. 217: T.S. of spermathecal duct and seminal vesicle of *Poekilocerus pictus* after treatment. Haematoxylin Eosin X 200
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Fig. 218 : L.S. of oocyte of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 300

Fig. 219 : L.S. of oocyte and lateral oviduct of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 150

Fig. 220 : T.S. of median oviduct of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 221 : T.S. of common oviduct of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 200
EXPLANATION TO FIGURES

Fig. 222 : Section of spermatheca and spermathecal duct of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 223 : T.S. of seminal vesicle of *Poekilocerus pictus* after 3 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 224 : L.S. of germarium and vittelarium of *Poekilocerus pictus* after 7 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 225 : L.S. of oocyte and lateral oviduct of *Poekilocerus pictus* after 7 days of .125 ml hempa treatment. Haematoxylin Eosin X 60
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Fig. 226 : T.S. of median oviduct of *P. b. pictus* after 7 days of .125 ml of hempa treatment. Haematoxylin Eosin X 200

Fig. 227 : T.S. of spermatheca and spermathecal duct of *P. b. pictus* after 7 days of .125 ml of hempa treatment. Haematoxylin Eosin X 200

Fig. 228 : L.S. of oocyte of *P. b. pictus* after 14 days of .125 ml of hempa treatment. Haematoxylin Eosin X 60

Fig. 229 : T.S. of lateral oviduct of *P. b. pictus* after 14 days of .125 ml of hempa treatment. Haematoxylin Eosin X 100
EXPLANATION TO FIGURES

Fig. 230 : T.S. of median oviduct of *Poekilocerus pictus* after 14 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 231 : T.S. of common oviduct of *Poekilocerus pictus* after 14 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 232 : T.S. of spermatheca of *Poekilocerus pictus* after 14 days of .125 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 233 : T.S. of spermathecal duct and seminal vesicle of *Poekilocerus pictus* after 14 days of .125 ml hempa treatment. Haematoxylin Eosin X 200
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Fig. 234 : L.S. of germarium, vitellarium and early oocyte of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 235 : L.S. of oocyte of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 236 : T.S. of oocyte and lateral oviduct of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 100.

Fig. 237 : T.S. of median oviduct of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 200
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Fig. 238: T.S. common oviduct of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 239: T.S. of spermatheca and spermathecal duct of *Poekilocerus pictus* after 21 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 240: L.S. of germarium of *Poekilocerus pictus* after 28 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 241: L.S. of oocyte of *Poekilocerus pictus* after 28 days of .125 ml of hempa treatment. Haematoxylin Eosin X 200
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Fig. 242: T.S. of lateral oviduct of *Poekilocerus pictus* after 28 days of .125 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 243: T.S. of median oviduct of *Poekilocerus pictus* after 28 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 244: T.S. of spermatheca and spermathecal duct of *Poekilocerus pictus* after 28 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 245: T.S. of lateral oviduct of *Poekilocerus pictus* after 35 days of .125 ml hempa treatment. Haematoxylin Eosin X 60
EXPLANATION TO FIGURES

Fig. 246 : T.S. of median oviduct of *Poekilocerus pictus* after 35 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 247 : T.S. of common oviduct of *Poekilocerus pictus* after 35 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 248 : T.S. of spermatheca and spermathecal duct of *Poekilocerus pictus* after 35 days of .125 ml of hempa treatment. Haematoxylin Eosin X 200

Fig. 249 : T.S. of seminal vesicle of *Poekilocerus pictus* after 35 days of .125 ml of hempa treatment. Haematoxylin Eosin X 200
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Fig. 250 : L.S. of oocytes of *Poekilocerus pictus* after 42 days of .125 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 251 : Same as Fig. 250. Haematoxylin Eosin X 200

Fig. 252 : T.S. of lateral oviduct of *Poekilocerus pictus* after 42 days of .125 ml hempa treatment. Haematoxylin Eosin X 60

Fig. 253 : T.S. of median oviduct of *Poekilocerus pictus* after 42 days of .125 ml hempa treatment. Haematoxylin Eosin X 200
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Fig. 254: T.S. of common oviduct of *Poekilocerus pictus* after 42 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 255: T.S. of spermatheca of *Poekilocerus pictus* after 42 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 256: T.S. of spermathecal duct and seminal vesicle of *Poekilocerus pictus* after 42 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 257: L.S. of oocyte of *Poekilocerus pictus* after 50 days of .125 ml hempa treatment. Haematoxylin Eosin X 300
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Fig. 258: T.S. of lateral oviduct of *Poekilocerus pictus* after 50 days of .125 ml hempa treatment. Haematoxylin Eosin X 100

Fig. 259: T.S. of median oviduct of *Poekilocerus pictus* after 50 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 260: T.S. of common oviduct of *Poekilocerus pictus* after 50 days of .125 ml hempa treatment. Haematoxylin Eosin X 200

Fig. 261: Section of spermatheca of *Poekilocerus pictus* after 50 days of .125 ml hempa treatment. Haematoxylin Eosin X 200