vines during March-April and shows conspicuous whitish disease spots and the infection spreads further.

Detailed studies on host range are in progress and would be reported in due course.

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REVERSAL OF EFFECTS OF ALKYLATING AGENTS THROUGH THE USE OF PROSTAGLANDIN E_1 IN THE OVOTESTIS OF THE SNAIL *LYMNAEA ACUMINATA*

RAVINDRA SINGH AND R. A. AGRAWAL

Department of Zoology
University of Gorakhpur
Gorakhpur 273 001, India

ALKYLATING agents, because of their property of, inhibiting protein synthesis, have been used successfully, as chemosterilants for insect pests[1], and chemotherapy of cancer[2]. The present authors[3] proposed the use of cyclophosphamide as a chemosterilant for snail pests and vectors as it adversely affected embryonic development and reduced the number of eggs in the snail *Lymnaea acuminata* the intermediate host for the liver flukes *Fasciola gigantica* and *Fasciola hepatica*. Similar results have now been found with busulfan.

Cyclophosphamide (21 μg) [2-oxo-2 (bis-β-chloroethylamino)-1-hydro-1,3,2-azoxaphosphoriane] and busulfan (15 μg) [1,4-dimethanesulfonyloxybutane] (divided in three equal doses) were injected in the foot of *Lymnaea acuminata* every 24 hr on three consecutive days. Fourth day onwards, one group of treated animals were injected 5 μg of prostaglandin E_1 (PGE_1)/animal/day for three days while another group (treated controls) was injected with saline only. DNA and RNA were estimated according to Schneider[4], protein by Lowry *et al.*[5] and total free amino acids according to the method of Spies[6]. Values have been expressed as μg/mg of ovotesis (mean $\pm$ SE) of six replicates. Students t-test was used to determine significant differences ($P < 0.05$ indicated by * in the text).

Following 21 μg cyclophosphamide or 15 μg busulfan treatment, DNA levels were reduced from 69.42 ± 1.12 μg/mg to 36.03 ± 1.36 μg/mg (52%)* and 43.57 ± 2.35 μg/mg (62%)* and RNA levels from 52.93 ± 0.81 μg/mg to 27.16 ± 0.74 μg/mg (52%)* and 30.60 ± 0.46 μg/mg (59%)* respectively. Similarly protein concentrations came down from 84.66 ± 1.42 μg/mg to 55.16 ± 1.30 μg/mg (65%)* and 60.66 ± 1.42 μg/mg (72%)* respectively, following cyclophosphamide and busulfan treatment. Free amino acid levels rose to 211%* and 212%* of controls following treatment with the same doses of the drugs.

Discontinuation of treatment with the alkylating agents for three days did not produce any significant recovery in any of the four constituents. However, when cyclophosphamide and busulfan-treated animals were administered PGE_1 for three days, there was remarkable recovery in the levels of DNA—87%* for cyclophosphamide and 84%* for busulfan; 99%* and 94%* respectively in case of RNA levels and 99%* in protein levels in animals treated with either drug. Relatively less, though significant, reduction in the free amino acid levels also took place.

The facts that, prostaglandin *E* and *F* like substances are present in molluscs[7], and activation of prostaglandin endoperoxide synthetase results in increased spermatogenesis in snails[8], indicate that prostaglandin may have a physiological role, in modulating fertility and synthesis of proteins in snails. The present experiments also give hopeful pointers towards the use of prostaglandins for countering the toxic effects of alkylating agents in cases where their use becomes essential for chemotherapy of neoplastic diseases.

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EMBRYOLOGICAL STUDIES IN *PTEROTHECA FALCONERI* HOOK. F.

B. S. Gill and M. Iqbal
Department of Botany, Punjabi University
Patiala 147 002, India

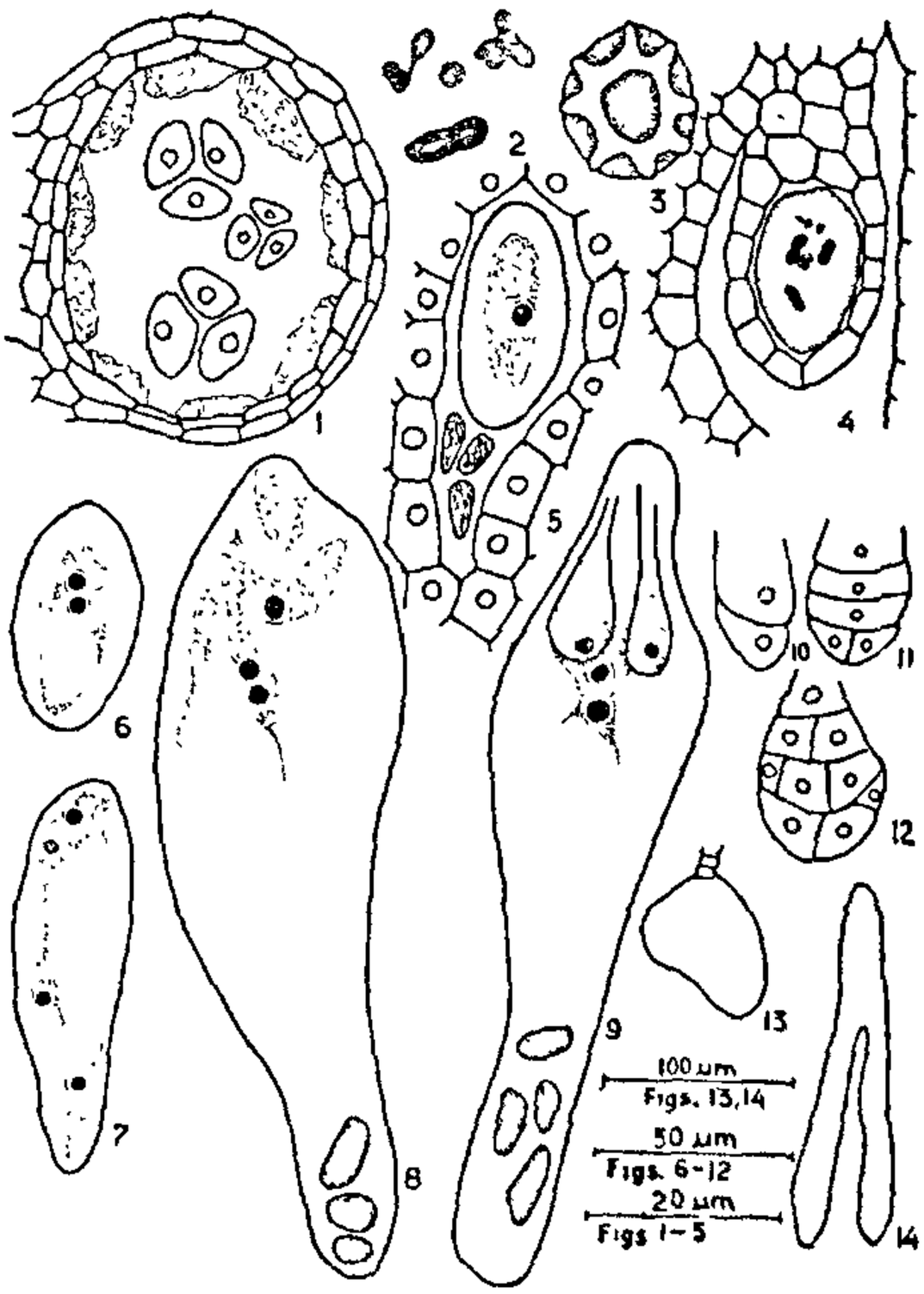
Pterotheca falconeri Hook. f., an annual herb of the tribe Cichorieae (Compositae), has restricted distribution in some regions of temperate Himalaya. The species has chromosome number, $2n = 6$[7,8] and 10[6,11] but $2n = 7$, 8, 9, 12 and 14 have also been noticed in some cases[5]. Besides, a variable number of B-chromosomes is also known to exist in the West Himalayan populations. Babcock[1] treats it as a minor variant of *Crepis sancta* sub-species *bifida* which has $2n = 10$. In view of its controversial taxonomic position coupled with the cytological and morphological variations, embryological studies were undertaken in the population of *Pterotheca falconeri* from the Simla Hills.

Anthers are tetrasporangiate, and the anther wall, which develops in a typical dicotyledonous type, consists of epidermis, hypodermis, ephemeral middle layer and tapetum (Fig. 1). As in most species of Compositae[2], anther tapetum is of periplasmodial type. Microsporogenesis including meiosis in PMCs with $n = 3$ (Fig. 2) is perfectly normal and the pollen fertility is cent per cent.

Megaspore mother cell, which is hypodermal in origin, undergoes normal meiosis with three bivalents constituted regularly. In some of the megaspore mother cells, one B-chromosome is also present (Fig. 4) which shows that B-chromosomes also exist through female line. Out of the four megaspores formed, only chalazal one is functional (Fig. 5). It enlarges lengthwise and its nucleus divides (Figs. 6 and 7), and ultimately a Polygonum type of embryo sac is formed (Figs. 8 and 9). In some of the embryo sacs, four antipodals are formed (Fig. 9) probably through the secondary division in one of the antipodals. Such divisions are also known to occur in genera like *Antennaria, Inula, Gnaphalium* and *Podolepis*[10]. Antipodals, in most of the cases, degenerate before fertilization.

As is the case with Cichorieae[3], the endosperm is cellular. During embryogenesis, the whole of the endosperm is consumed except for one or two layers which persist as jacket layers around the mature embryo. Existence of such jacket layers has also been recorded in other composites[4,9,10]. Their presence led Davis[2] to believe the seeds of Compositae to be endospermic in nature whereas they are considered to be non-endospermic.

Embryogenesis in this species conforms to the Asterad type with mature embryo being typically dicotyledonous (Figs. 10–14). Achene setting and germination is excellent. The present population of *Pterotheca falconeri* with $2n = 6$ thus has normal microsporogenesis, megasporogenesis, embryo sac development and embryogeny.



Figs. 1–14. Fig. 1. T.S. of anther. Fig. 2. Diakinesis showing three bivalents. Fig. 3. Pollen grain. Fig. 4. Megaspore mother cell with $3_{II} + 1B$. Fig. 5. Magaspore tetrad. Figs. 6–8. Stages of embryo sac development. Fig. 9. Mature embryo sac with four antipodals. Figs. 10–14. Stages of embryogeny.