4. Schneider, W. C., In *Enzymology*, (eds.) S. P. Colowick and N. O. Kaplan, Academic Press, Press, New York, 1957, p, 680.
5. Lowry, O. H., Rosenbrough, N. J., Farr, A. L. and Randall, R. J., *J. Biol. Chem.*, 1951, **193**, 265.
6. Spies, J. R., In *Methods in Enzymology*, (eds.) S. P. Colowick and N. O. Kaplan, Academic Press, New York, 1957, p. 468.
7. Nomura, T., Ogata, H. and Lucas, A., *Rev. Int. Oceanogr. Med.* 1979, **53–54**, 87.
8. Morse, D. E., Duncan, H. Hooker, N. and Morse, A., *Science*, 1977, **196**, 298.

EMBRYOLOGICAL STUDIES IN *PTEROTHECA FALCONERI* HOOK. F.

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

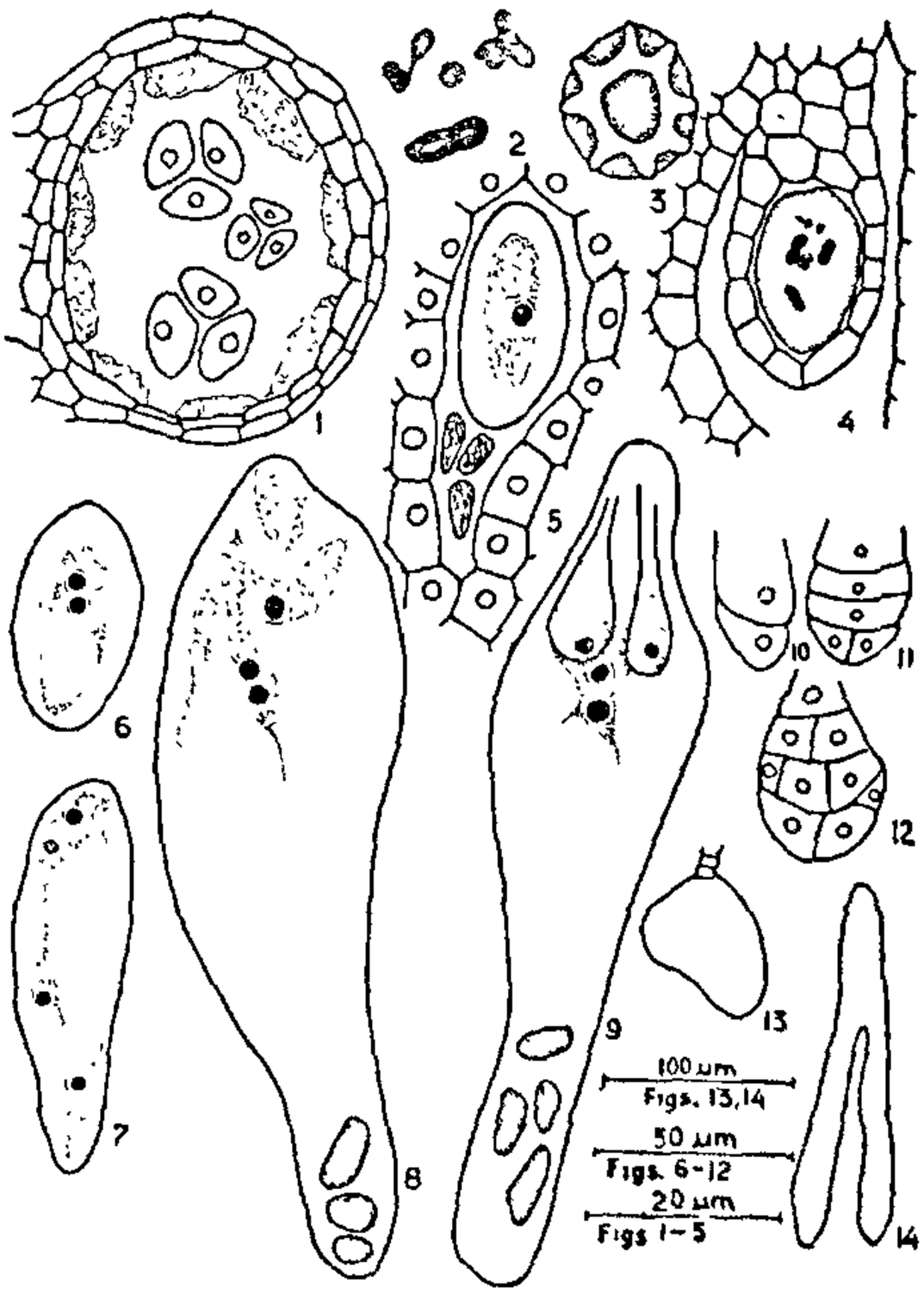
Pterotheca falconeri Hook. f., an annual herb of the tribe Cichorieae (Compositae), has restricted distribution in some regions of temperate Himalaya. The species has chromosome number, $2n = 6$[7,8] and 10[6,11] but $2n = 7$, 8, 9, 12 and 14 have also been noticed in some cases[5]. Besides, a variable 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.

The authors are thankful to Professor S. S. Bir, F.N.A., Head, Department of Botany, Punjabi University, Patiala, for providing adequate laboratory facilities. Grateful thanks are also due to CSIR, New Delhi, for financial assistance to the second author.

May 25, 1981.

1. Babcock, E. B., *Univ. Calif. Pub. Bot.*, 1947, **21**, 1.
2. Davis, G. L., *Systematic Embryology of the Angiosperms*, John Wiley and Sons, Inc., New York, 1966.
3. Deshpande, R. K., *Curr. Sci.*, 1962, **31**, 133.
4. Kapil, R. N. and Sethi, S. B., *Phytomorphology*, 1962, **12**, 222.
5. Kaushal, P. S. and Mehra, P. N., *Nucleus*, 1976, **19**, 47.
6. Koul, A. K. and Gohil, R. N., *Phyton (Horn.)*, 1973, **15**, 57.
7. Mehra, P. N., Gill, B. S., Mehta, J. K. and Sidhu, S. S., *Caryologia*, 1965, **18**, 35.
8. Mehra, P. N. and Mann, S. K., *Nucleus*, 1972, **15**, 123.
9. Padmanabhan, D., *Phytomorphology*, 1962, **12**, 356.
10. Pullaiah, T., *Am. J. Bot.*, 1979, **66**, 1119.
11. Shetty, B. V., *Taxon*, 1967, **16**, 552.

LEPIDIUM SATIVUM LINN.— AN UNRECORDED HOST FOR *ALBUGO CANDIDA* (PERS. EX CHEV.) KUNTZE.

N. P. Melkania and G. B. Upreti*
Department of Botany
Kumaun University Campus
Almora 263 601, India

* Department of Botany
Government P.G. College, Pithoragarh, India

During a survey of vegetable diseases in Pithoragarh District of Kumaun Himalaya in December 1979, a severe infection by white rust was observed on the leaves of *Lepidium sativum* Linn. (Halim). The pathogen of the infected leaves was identified as *Albugo candida* (Pers. ex Chev.) Kuntze. [=*Cystopus candidus* (Pers.) Lev..] A survey of literature[1] indicated that *Lepidium sativum* was an unrecorded host for *A. candida*.

The fungus is an obligate endoparasite. Mycelium intercellular, non-septate which produces knob-like haustoria inside the host cells. Conidiophores are short, erect, and club-shaped forming a palisade tissue underneath the host epidermis. Conidia are formed in chains in basipetal succession, arising from the conidiophores at the base of the cavity. Conidia spherical, thick-walled, hyaline, and interconnected by isthmus. The conidia measure 15·00 to 17·22 μ in diameter.

The authors are grateful to the Head, Department of Botany, Kumaun University Campus, Almora, for research facilities.

December 22, 1980.

1. Bilgrami, K. S., Jamaluddin and Rizwi, M. A. *Fungi of India*, Pt. 1, Today and Tomorrow's Printers and Publishers, New Delhi, 1979.

NOTE ON INHERITANCE OF RESISTANCE TO POWDERY MILDEW AND DAYS TO FLOWERING IN PEAS

Hari Har Ram, R. D. Singh and Y. V. Singh
Department of Plant Breeding,
G.B. Pant University of Agriculture and Technology
Pantnagar, 263 145, India

Powdery mildew (*Erysiphe polygoni* DC) is a serious disease of pea (*Pisum sativum* L.). All the cultivated pea varieties are severely damaged by this disease. For a stable solution of this problem, breeding of early maturing, powdery mildew resistant varieties is, therefore, imperative. A late maturing, tall type, powdery mildew resistant line (T–10) was crossed with Arkel (early maturing, susceptible to powdery mildew and a famous vegetable type variety) and New Line Perfection, *i.e.*, NLP (early-medium maturing, susceptible to powdery mildew and good for vegetable type). The performance of parental lines, F_1, F_2, BC_1 and BC_2 generations in Arkel × T–10 and that of parents, F_1 and F_2 generations in NLP × T–10 observed during 1976–77 and 1977–78 are given in Table I.

Based on the distribution of days to flowering in parental lines and F_1, the flowering duration of 55 or more days was considered as late and the lower duration as early. The F_1 was late in both the crosses indicating lateness as dominant. The F_2 generation followed a segregation ratio of 3 late : 1 early. Back cross with late dominant parent (T–10) did not segregate as expected. Back cross with the recessive parent (Arkel) fitted to an expected ratio of 1 : 1. The F_2 of NLP × T–10 also gave a segregation pattern of 3 late : 1 early. These results clearly demonstrate