earlier from insect larvae[2], soils[3-7] and opium[8], but this is the first record from chickpea.

The authors are grateful to the authorities of Rajasthan Agriculture University for providing facilities and Director, CMI, Kew, UK, for identification of the pathogen.

25 September 1987; Revised 25 February 1988

1. Gaur, R. B., Bhanushally, T. B., Maheshwari, R. V., Singh, R. D. and Bhardwaj, R. P., *Int. Chickpea Newsl.*, 1983, **9**, 21.
2. Subramanian, C. V. and Ramakrishnan, K., *J. Madras Univ.*, 1958, **26**, 327.
3. Haware, M. P. and Pavgi, M. S., *Sydowia*, 1970, **24**, 126.
4. Haware, M. P., Joshi, L. K. and Sharma, N. D., *Sydowia*, 1974, **28**, 143.
5. Panwar, K. S. and Bohra, A., *Curr. Sci.*, 1974, **42**, 585.
6. Rao, A. S., *Curr. Sci.*, 1965, **34**, 490.
7. Saksena, R. K., Krishna Nand and Sarbhoy, A. K., *Proc. Nat. Inst. Sci. India*, 1967, **B33**, 144.
8. Roy, J. N. and Choudhary, H., *Proc. Indian. Sci. Congr.*, 1934, **21**, 246.

PARTHENOGENESIS UNDER MAGNETIC FIELD IN *MARSILEA* L.

C. WADHWANI and T. N. BHARDWAJA*

Biology Department, Jai Hind College, Bombay 400 020, India.

** Department of Botany, University of Rajasthan, Jaipur 302 004, India.*

The amphibious fern *Marsilea* L. is a fascinating experimental plant. This led us to study the effect of a magnetic field on parthenogenesis in this plant[1].

M. diffusa var. *approximata*, a Madagascar species, was taken up for the study of parthenogenetic embryo formation. The sporocarps were scarified and placed in tapwater for extrusion of sorophore and spore dispersal. The megaspores were picked up and transferred to another dish after ascertaining that no microspores accompanied any of the isolated megaspores.

The isolated megaspores kept in distilled water were subjected to a magnetic field between two poles of a magnet separated by a distance of 2.3 cm. A strong magnetic field of intensity 10.2 kG was provided by supplying a current of 2 amperes for different times (2.30, 3, 4.15, 4.45, 6, 12 and 24 h). Two batches of treated megaspores were kept under identical conditions of light and temperature along with controls for further observations.

Parthenogenetic embryo formation from these sets of isolated megaspores was found to occur and the data are given in table 1. It may be observed (table 1) that 2.30 h magnetic field of 10.2 kG did not lead to any significant effect on megaspore germination and parthenogenetic embryo formation since the control and experimental sets of megaspores contained almost the same number of embryos. However, magnetic field of 3 h duration markedly enhanced the percentage of embryo formation in treated megaspores (85.3) in comparison to control (50%).

Enhancement of the duration of magnetic field beyond 3 h up to 24 h showed, by and large, a continuing enhancement of percentage of embryo forma-

Table 1 *Effect of magnetic field on embryo formation in M. diffusa var. approximata*

	Duration of treatment													
	2.30 h		3 h		4.15 h		4.45 h		6 h		12 h		24 h	
	C	T	C	T	C	T	C	T	C	T	C	T	C	T
Number of megaspores	71	71	24	41	160	220	77	111	82	115	32	36	70	66
Number of embryos formed	67	64	12	35	102	183	34	81	63	108	25	33	44	53
Per cent embryos formed	94.3	90.1	50	85.3	63.7	83.1	44.1	72	76.8	93.9	78.1	91.6	62 8	80.3

C = Control; T = Treated.

tion in comparison to controls (table 1). The parthenogenetic embryos formed from such magnetically treated megaspores were always greater compared to their respective controls irrespective of the duration of magnetic field. The percentage of enhancement did not exactly correspond to the enhanced duration of the magnetic field.

It can therefore be stated, that magnetic field in regulated doses above 2.30 h time period does affect embryo formation and subsequent development of sporelings in varying degrees in *M. diffusa* var. *approximata*. It will be relevant to mention here that the effect of magnetic stimulus is known to change the growth and development in many angiosperms[2,3]. Such studies have so far been restricted to angiosperms and this is the first report of a fern material taken up for such studies.

The results indicate that a magnetic field of 10.2 kG enhances embryo formation in isolated megaspores of *M. diffusa* var. *approximata*. It is interesting to observe the magnetic effect on reproductive capacities of a plant. Study of the effect of magnetic field on various facets of sporeling growth is an interesting field of observation and is being continued.

7 October 1987

1. Wadhwani, C., Ph.D. thesis, University of Rajasthan, Jaipur, 1983.
2. Audus, L. J., *Nature (London)*, 1960, **185**, 132.
3. Chauhan, T. S., *Geobios*, 1979, **6**, 276.

ASTEROCOCCUS, UNDER HIGH ALTITUDE COSMIC-RADIATIONS

PUSHPA SRIVASTAVA and JAFAR NIZAM*

Department of Botany, University of Rajasthan, Jaipur 302 004, India.
** Department of Botany, Osmania University, Hyderabad 500 007, India.*

The present communication is in continuation of our work on Chlorococcales[1]. *Asterococcus*, a Volvocalean genus (Culture Collection of Algae, Bloomington), has been subjected to high altitude cosmic radiation for the first time in four different flights. The first exposure at altitudes of 37410 and 36582.9 m for 9 and 6 h respectively did not result in lethal impacts on the cultures. However, damaging effects were quite evident on chloroplasts which turned into fragments and granules. Growth, monitored by optical density measurement, was also retarded (figure 1). The second exposure for 7 and 5 h, at altitudes of 36600 and 35564 m respectively proved lethal to the alga.

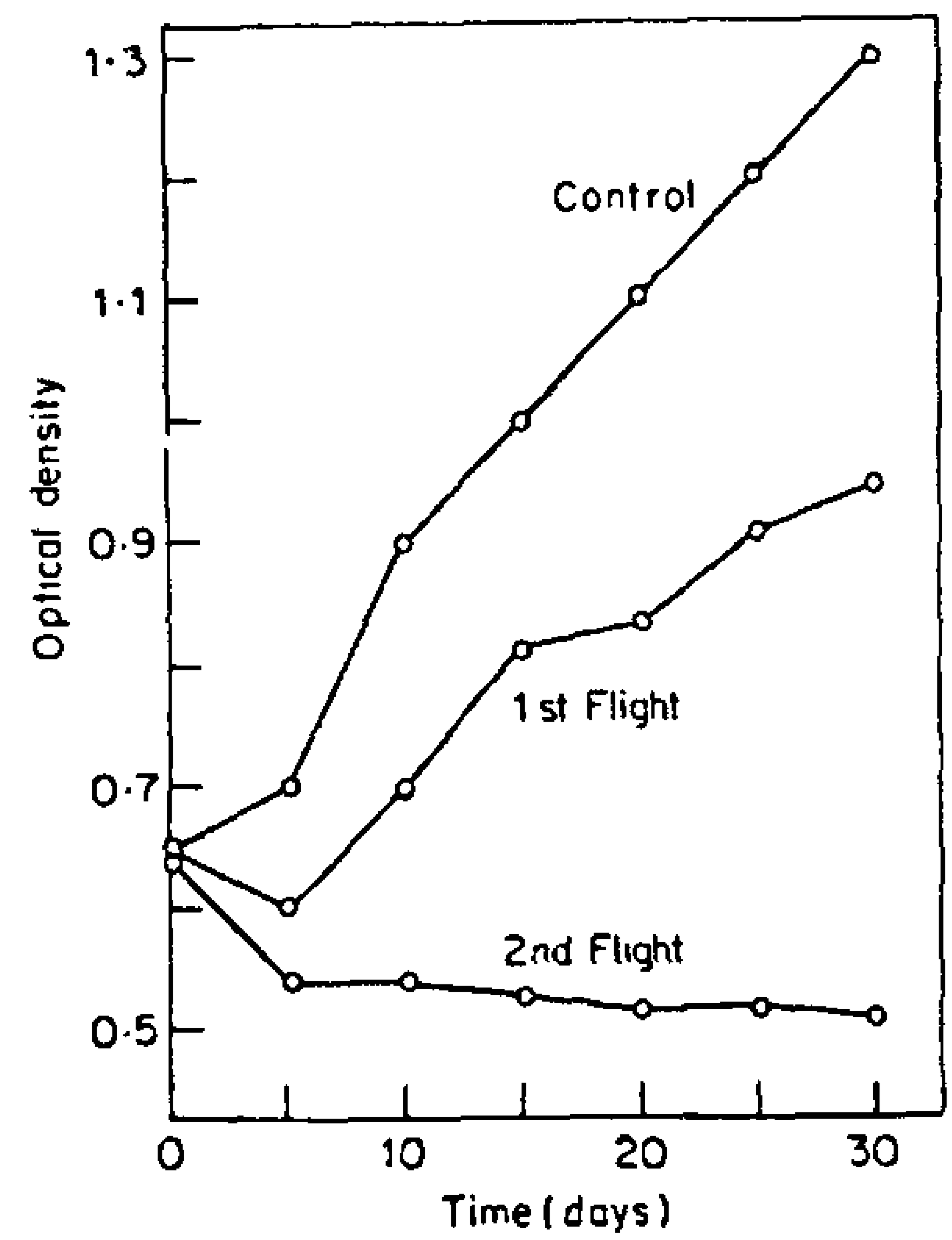

Figure 1. Growth pattern of *Asterococcus* after cosmic irradiation at 37140 and 36600 m altitudes.

One of the pronounced effects of irradiation was enlargement of cell dimensions (figure 2B, C). This may be attributed to delayed cell division and defective metabolic processes. The formation of large vacuoles (figure 2C) may be an effort on the part of the cell to cope up with the expanded cell walls. Another significant consequence of cosmic irradiation was the disintegration of colonies (figure 2D) accompanied by irregularity in cell shape and cell size.

Volvocalean genera, such as desmids[2], were shown to be quite sensitive to high altitude cosmic radiation compared to Chlorococcalean genera[1]. The present study further supports the view that Chlorococcalean algae with their high resistance to cosmic radiation are best suited for the support of life of man in space.

The authors are grateful to Dr A. Stiller, Coordinator of joint Indo-US IQSY-EQEX program of balloon flights, for extending flight facilities.