

## BRIEF COMMUNICATION

**Irradiation Induced Changes in Flower Formation in  
*Cannabis sativa* L.**

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**Abstract.** Stimulation of flower formation was observed in the female plants of *Cannabis sativa* raised from seeds treated with gamma rays. These plants produced seeds, of smaller size. One of 195 plants formed sterile hermaphrodite flowers with reduced female structures and increased number of anthers.

Physical mutagens like X-rays and gamma rays are known to cause a number of morphological variations and mutations in plants, like delay in flowering, reduction of pollen and ovule fertility (CHOWTA and DNYANSAGAR 1974, RAGHUVANSHI and SINGH 1974, TYAGI and SINGH 1975). The present paper deals with the effect of ionizing radiations (gamma rays) on the female plants of *Cannabis sativa*.

Preliminary experiments showed that for the seeds of *Cannabis sativa* L. LD<sub>50</sub> dose of gamma rays from a Co<sup>60</sup> source was 200 Gy. Therefore, studies were made only on the progeny raised from this treatment. The plants were surveyed regularly to observe the change in the structure of female flowers. The rate (increase per day) of flower formation of ten female plants was observed till 42 days after sex determination. The size of 20 seeds was noted at the termination of the experiment (*i.e.* 42 days after sex determination).

Fig. 1 shows that the rate of female flower formation was promoted by 0.168 per day with irradiation. The total number of flowers (36.0) was increased as compared to the control (29.0). Seeds produced after gamma rays treatment were smaller in size (length 2.91 mm, width 2.21 mm) as compared to control seeds (3.04 mm and 2.48 mm, respectively). Out of the 195 female plants raised from the irradiated seeds one plant showed cytomorphological chimera. This mutant had varied male structures in the female flowers (Fig. 2). These hermaphrodite flowers developed only in the

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vicinity of the chimera and were sterile. There was a reduction in the number of stigmata to one and the ovary size was reduced (Fig. 2B, D). The male and female structures showed unusual arrangements. The early formed hermaphrodite flowers showed an anther lobe attached to the ovary by a stalk (Fig. 2A). The later formed flowers had 3—4 anther lobes in whorls around the ovary or on one side (Fig. 2B, C). In the more advanced stage

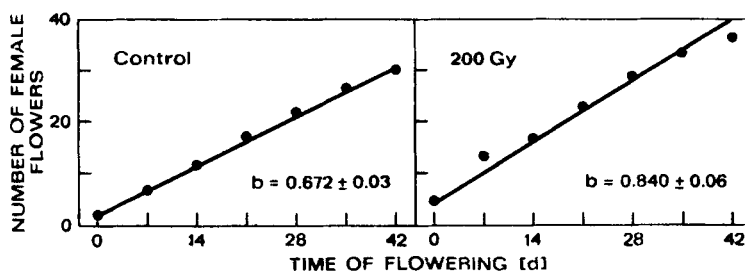


Fig. 1. Effect of irradiation on the number of female flowers.  $b$  — represents the rate of flower formation per day.

the hermaphrodite flowers showed a stalked anther-like structure bearing a central stigma (Fig. 2D). The last formed flowers had a globose shaped structure with a centrally placed stigma (Fig. 2E, F).

There are several reports where gamma rays increased the yield of barley, wheat, rice, oat, soybean and peanut as noticed in the present study. KAUSHIK *et al.* (1976) noted an increase in the female flower formation in *Luffa cylindrica*. It can be assumed that radiostimulation of flowering is mediated through changes in auxin level as suggested by KAMARA (1974). The inhibition in the size of seeds can be attributed to decreased cell division. KAUSHIK *et al.* (1976) also noticed decreased seed weight in *Luffa cylindrica*. Irradiation resulted in the production of some hermaphrodite flowers. The additional rudimentary anthers had sterile pollen grains. It can be presumed that irradiation produced some disturbance in the genetic mechanism, which resulted in local metabolic changes and also a shift in enzyme pattern leading to the formation of additional sex structures (FISHER and SYMKO 1973, OCHLEWSKA 1974, SINGH and MAHNA 1977).

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*Fig. 2 at the end of the issue.*

## BOOK REVIEW

RUBENSTEIN, I., PHILLIPS, R. L., GREEN, C. E., GENGEBACH, B. G. (ed.): *MOLECULAR BIOLOGY OF PLANTS*. — Academic Press, New York—London—Toronto—Sydney—San Francisco 1979. 343 pp., US \$ 27.50.

This proceedings' volume results from a symposium on plant molecular biology held at the University of Minnesota in 1976. It contains 12 contributions organized into three sections. The first topic is concerned with nuclear and chloroplast DNA (4 papers, 137 pp.). Particular attention is paid to the problem of origin, organization and functional and phenotypic significance of repeated sequences, and the methodology and original results of reassociation kinetics together with proposed models of some plant genomes are presented. Experimental evidence is provided supporting the idea that families of repeated sequences are created as clustered repeats which are subsequently dispersed throughout the genome. Discussion on DNA replication is based on autoradiographic studies of DNA fibers focused on structure, organization and functions of replicons. Chloroplast DNA is examined from the aspect of its physical properties, information content, and mechanism of replication.

Section II (4 papers, 103 pp.) deals with molecular aspects of genome expression. The biological problem of differential DNA replication and of its relation to phenotypic expression is discussed on plant rRNA genes. The number and efficiency of utilization of rRNA genes varies considerably between different species and there are examples of differential replication of rRNA genes in various plant systems. The association of production of genotrophs in *Linum usitatissimum* with a change in rRNA gene redundancy suggests that the level of rRNA genes influences phenotypic expression. The flow of genetic information from the DNA sequences into the RNA molecules results from the function of three separate systems for transcription indicated as RNA polymerase I, II and III and from metabolic processing of RNA polymerase transcripts. RNA polymerase II and poly A polymerase systems involved in mRNA formation are described in detail, and their physiological relationship during the maturation of maize grains is discussed in relation to understanding the regulatory mechanisms of gene expression. The problem of translation of the transcribed information is examined on wheat germ system using TMV-RNA with the focus on factor requirements for 40S and 80S complexes formation in protein chain initiation and on the function of the 5'—7-methylguanosine "cap" in the attachment of mRNA to the 40S ribosomal subunit. How the expression of genes in higher plants can be influenced by hormones is shown on hormonal control of enzyme formation in aleurone layers of germinating barley grains. Although the regulation of  $\alpha$ -amylase synthesis by gibberellin is well demonstrated and understood, the primary effect of the hormone remains unknown.

The third section is devoted to molecular biology of plant viruses and bacterial agents (4 contributions, 97 pp.). The virological topic discusses replication of viral RNA and the possible modes of synthesis of proteins coded for by the virus genome, and describes the properties and replication of viroids causing spindle tuber disease of potato. The recent finding that the oncogenic properties of *Agrobacterium tumefaciens* is associated with the presence of large bacterial plasmid increased the interest in this area of research. The problem of induction of crown-gall tumors by bacterial agents is surveyed critically with special emphasis on molecular biology of *Agrobacterium* plasmids.

The importance of the book consists in that it provides rapid information on the state of knowledge and on problems and perspectives of research in the principal areas of molecular plant biology.

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IRRADIATION INDUCED CHANGES IN FLOWER FORMATION

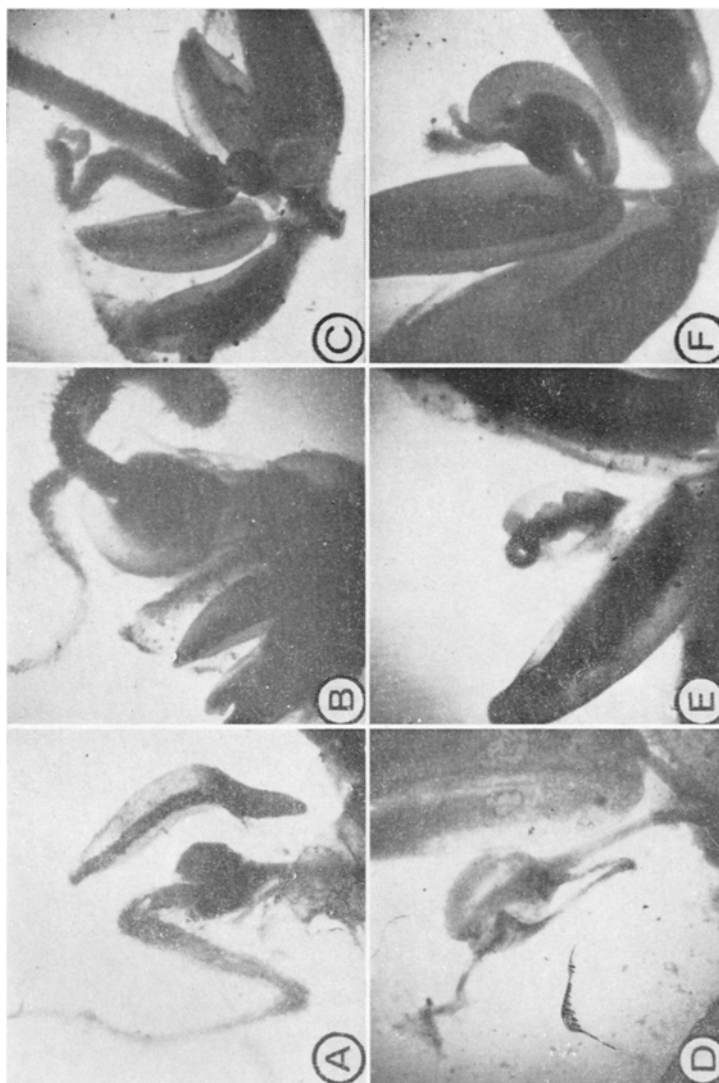


Fig. 2. Irradiation (200 Gy) induced hermaphrodite flowers on the female plants of *Cannabis sativa*. (Magnification  $150\times$ .)

A. An anther attached to the side of the ovary in the female flower. — B. Hermaphrodite flower with one style and three sterile anthers. — C. Hermaphrodite flower with four sterile anthers. Note the reduced size of the ovary. — D. One stigma arising from the centre of the anther like structure in the female flower. — E, F. Globose shaped structure with a centrally placed stigma in the female flower.