similar ones present in non-variant sectors. In white sectors, the chloroplasts were absent both in bundle sheath and mesophyll cells. The variant was partially fertile. Seed germination was 30 to 40%, and despite the unknown portion of apomictic seeds, 65 produced white, 20 green and 34 variegated seedlings out of a sample of 119 germinated seeds. Analysis of segregation of these green and variegated plants of the next generation is in progress.

In monocot species, leaves are divided lengthwise by three types of veins: midvein, lateral and small veins. The vascular system is established in a hierarchial fashion as the leaf develops. The midvein is established first in an acropetal direction towards the tip and basipetally into the sheath. Lateral veins develop acropetally in the leaf lamina, while small veins are initiated in this organ basipetally. The mutants in *P. maximum* demonstrate, that the complete process of vein initiation and development is apparently under complex genetic control [2].

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*(Contributed by **FLADUNG, M.**, Federala Research Centre for Forestry and Forest Products, Institute of Forest Genetics, Sieker Landstrasse 2, 22927 Grosshansdorf, Germany)*

INDUCED MUTATIONS IN CASTOR

Castor (*Ricinus communis* L.) is an important oilseed crop in India. To create variability mutations were induced in two cultivars 'TMV5' (maturing in 130-140 days) and 'CO1' (perennial type). Gamma rays and diethyl sulphate and ethidium bromide were used for seed treatment. Ten doses, from 100 to 1000 Gy were employed. For chemical mutagenesis five concentrations of mutagenes from 10 to 50 mM were tried. No economic mutants could be isolated after treatment with the chemical mutagens. The following economic mutants were identified in the dose 300 Gy of gamma rays.

Annual types from perennial CO 1 castor

CO 1 is a perennial variety (8-10 years) with bold seeds (100 seed weight 90 g) and high oil content (57%). Twenty-one lines were isolated with annual types (160-180 days) with high yield potential as well as bold seeds and high oil content. These mutants, identified in M_3 generation were bred true in subsequent generations up to M_8 generation. Critical evaluation of the mutants in yield evaluation trials is in progress.

Parental lines for development of hybrids

The inflorescence of castor is monoecious type with bottom 30-35% male flowers and top 65-70% female flowers. Four mutants were identified from the variety TMV 5 with higher proportions of female flowers ranging from 80-90%. These mutants in M_7 generation were identified as good combiners in the development of hybrid combinations. The yield of the hybrid combinations are presented in Table 1. Present investigations have clearly shown that there is a great potentiality in improving castor productivity and production by mutation induction.

Table 1. Performance of hybrid combinations

Combinations	Seed yield (kg/ha)	Increase over standard hybrid GCH 4 (%)
LRES 17 x TMV 5 – Mutant No.1	1333	13.6
LRES 17 x TMV 5 – Mutant No.4	1396	11.9
LRES 17 x TMV 5 – Mutant No.2	1529	30.3
LRES 17 x TMV 5 – Mutant No.3	1513	28.9
SKP 24 x TMV 5 – Mutant No. 1	1349	15.0
SKP 24 x TMV 5 – Mutant No. 2	1451	23.7
SKP 24 x TMV 5 – Mutant No. 3	1481	26.3
SKP 24 x TMV 5 – Mutant No. 4	1420	21.1
GCH 4 Hybrid (Check) (VP 1 x 48-1)	1173	-

*(Contributed by **GANESAN, K., H.S. JAVAD HUSSAIN** and **P. VINDHIYAVARMAN**, Oilseeds Research Station, Tindivanam 604 002, Tamil Nadu, India)*

MUTAGENESIS AS A BREEDING METHOD IN LENTIL

Mutagenesis was used to develop cultivars with good adaptability to exogenous factors and with increased productivity [1; 5]. By means of this alternative breeding procedure, increases in biological and nutritive value of the seeds were studied [2; 3]. To increase genetic variability in lentil (*Lens culinaris* Medic.) breeding material, experimental mutagenesis was applied parallel to conventional breeding methods. The aim was to characterize the mutant lines as well as determine whether some of them could be directly registered as cultivars or as gene donors in breeding programme.

Within the period 1993-1996, eight mutant lentil lines were studied under field conditions. They were obtained as a result of gamma rays (^{60}Co) and ethyl methanesulfonate (EMS) treatment of the small seeded cultivar 'Tadjikskaya 95'. Air-dried seeds were treated. During the vegetative stage, phenological observation was made. The structural elements of productivity were established by biometrical analysis of 25-30 plants from each of the variants. Phytopathological evaluations were made using the scoring procedure established by ICARDA. Protein content was determined by the Kiejdhal method. The technological qualities of the seeds were determined using the method of Tretyakova and Ustinova [4].

The mutant lines differed considerably in their biological traits from the parent cultivar. The vegetative period ranged from 84 to 89 days (Table 1). The mutant lines were later-maturing than parent variety Tadjikskaya 95 by 1-5 days. As a result of mutagen treatment, the range in plant height was expanded from 1 to 8.3 cm. Line 96-8, obtained after irradiation with gamma rays, was the tallest (40.3 cm). Lodging of the mutant lines was greater than that of the initial cultivar and ranged from 20.0 to 66.7%. The trait varied to a great extent depending on environmental conditions. Mutagenic treatments also caused changes in seed size and seed coat colour. Development of resistance to important diseases of lentil in Bulgaria is of considerable interest. In comparison to the parent variety, mutant lines 96-8 and 96-14 proved to have better resistance to Fusarium and Anthracnose. The highest resistance to Anthracnose was found in M 96-7 (candidate cultivar 'Elitsa'). Data for characters related to productivity are presented in Table 2. As a result of the mutagenic treatments, changes occurred for branching of the 1st as well as the 2nd type. The number of branches was greatly reduced in mutant line