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NMU-INDUCED POLYCARPELLARY MUTANTS IN REDGRAM

In recent years mutation breeding has been used as a valuable supplement to other methods of plant breeding for developing better varieties with new plant architecture, superior bio-chemical constitution and suitable growth and developmental rhythms. The effects of some physical and chemical mutagens were studied in the variety Pusa Ageti of redgram (*Cajanus cajan* (L.) Millsp.).

The breeder's seed of redgram was obtained from Division of Genetics, I.A.R.I., New Delhi. The dry seeds were irradiated with 10, 20 and 25 kR gamma-rays. Presoaked seeds (14 hours) in distilled water at room temperature) were treated with aqueous solutions of 0.01, 0.02 and 0.03% nitroso-methyl urea (NMU) and 0.1, 0.2 and 0.3% ethyl methane sulphonate (EMS) for six hours with intermittent shaking. The chemically treated seeds after a thorough washing in running water were sown in the field along with the irradiated as well as untreated ones to obtain M_1 generation. The seeds were collected on individual plant basis and were sown for M_2 generation. The normal looking plants of segregating progeny were grown to study the inheritance pattern of polycarpellary mutation in the M_3 .

Four polycarpellary mutants (PCM₁, PCM₂, PCM₃ and PCM₄) were screened from a single plant progeny of 0.03% NMU treated M_2 population. All the mutants forming viable seeds bred true in M_3 . These polycarpellary mutants exhibited various morphological abnormalities throughout their life span.

At 10–12 leaves stage, apical growth of the main shoot of the mutants was inhibited. The leaves on these shoot apices were arranged in a compact spiral manner (Fig. 1). After a few days, secondary branches appeared on stunted primary shoots. The growth of

the apices of these branches was also inhibited. The leaves on them were arranged in a similar manner as shown by the main shoot. However, when the vegetative growth culminated into reproductive growth, the ultimate branches grew normally. The flowering in these mutants was delayed as compared to those of control plants. However, the number and size of the floral buds on these branches was significantly high (Fig. 2). Most of these floral buds failed to mature as they turned black and abscised.



FIGS. 1–4. Fig. 1. A mutant showing growth inhibition at primary shoot apices. Fig. 2. Same showing stunted secondary branches and ultimate flowering branches. Fig. 3. a, b. Diadelphous and polyadelphous condition of stamens; c: Anther lobes on the petal. Fig. 4. 1–5. Carpellate gynoecium.

All the polycarpellary mutants had five types of flowers exhibiting some interesting features especially increase in the number of carpels. Most of the flowers were monocarpellary and were more or less normal in shape and size, while others were either bi-,

TABLE I

Number of pods/plant, seeds/pod, and pollen sterility in polycarpellary mutants in *Cajanus cajan* (L) Millsp.

Mutant	Pods/ plants	Seeds/ pod	Pollen sterility				
			Flowers				
			Mono- carpellary	Bi- carpellary	Tri- carpellary	Tetra- carpellary	Penta- carpellary
PCM ₁	44	1.95	28.15 ± 1.86	51.47 ± 2.40	23.07 ± 2.25	25.11 ± 3.31	35.93 ± 2.41
PCM ₂	13	1.62	30.46 ± 3.72	27.13 ± 4.36	24.98 ± 3.48	34.82 ± 2.13	36.51 ± 1.87
PCM ₃	Nil	Nil	69.75 ± 2.36	68.25 ± 1.29	71.37 ± 1.83	70.72 ± 1.74	69.76 ± 3.51
PCM ₄	10	3.00	39.30 ± 1.82	32.28 ± 2.41	31.36 ± 1.43	36.32 ± 1.34	33.66 ± 1.22
Control	135	3.55	5.54 ± 2.14

tri-, tetra- or penta-carpellary. The size of these flowers increased with the increase in the number of carpels. However, the number and size of the sepals in all polycarpellary flowers remained normal. On the other hand, the number of petals varied from five to nine. Flowers with increased number of petals lost their papilionaceous condition. There were ten to fourteen stamens which were either grouped in di- or polyadelphous manner (Figs. 3 a, b). These stamens also revealed morphological variations. Some of the anther lobes were seen attached to the petals (Fig. 3 c). Gynoecium consisted of one to five apocarpous pistils (Fig. 4). In a limited number of carpels, a longitudinal slit appeared on the ovary wall exposing the ovules. Such carpels generally failed to produce seeds.

The flowers exhibited variable degree of pollen and ovular sterility. Pollen sterility as tested by Alexander's method¹ in the flowers of polycarpellary mutants, ranged between 23 to 52% except in the mutant PCM₃ which showed an exceptionally higher degree of pollen sterility (Table I). Similarly, ovular sterility also varied as was evident by the number of mature seeds per pod. On account of higher sterility mutant PCM₃, failed to produce any fruit.

Increase in the number of carpel has also been recorded in several members of the family Leguminosae. Rao² in *Crotalaria* and Dutta³ in *Vigna*, have observed bicarpellary apocarpous condition. However, in *Cajanus*, multicarpellary apocarpous condition of pistil has been reported by Kajjari⁴, Joshi and Ramanujam⁵ and Venkateshwarlu *et al.*⁶.

The mutants obtained during the present investigation however, differed from multicarpellate mutants of Kajjari⁴, Joshi and Ramanujam⁵ and variant of Venkateshwarlu *et al.*⁶ in the respect that they had 1-5 carpellate flowers on the same plant. These mutant, exhibited variable degree of pollen and ovular sterility and various morphological abnormalities throughout their life span.

In M₃ generation, a normal plant of the mutated M₂-progeny segregated into 6 polycarpellary mutants and 26 normal plants ($\chi^2 0.666$; $P > 0.05$). The mode of segregation in M₃ generation, suggests that the polycarpellary character is monogenically recessive.

Our thanks are due to Mr. Sudhir Bhatnagar for his help in various ways. We are also grateful to Dr. Balram Sharma, I.A.R.I., New Delhi, for providing mutagens and Dr. Roshan Singh, Principal, R.B.S. College, Agra, for facilities.

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May 20, 1978.

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