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Inheritance of spontaneous male sterility in pigeonpea

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Abstract A male-sterile plant was observed in the UPAS-120 cultivar of pigeonpea (*Cajanus cajan*). The plant was about 5–7 days late-flowering and had white translucent anthers with complete pollen sterility. The inheritance of this spontaneous male sterility was studied in a cross involving the mutant and fertile UPAS-120, including their F_1, F_2, BC_1F_1 and BC_2F_1 generations. The results suggested that the male sterility was genetic and due to a recessive gene.

Key words Pigeonpea · *Cajanus cajan* · Male sterility · Inheritance

Introduction

Pigeonpea [*Cajanus cajan* (L.) Millspaugh] is an important and widely cultivated grain legume in India. Pigeonpea is normally self-fertilized; however, considerable natural crossing occurs mainly through bees and thrips (Rachie and Roberts 1974). The discovery of stable genetic male sterility (Reddy et al. 1978), coupled with its out-crossing nature, has opened the possibility of commercial utilization of the heterosis in pigeonpea. Singh (1991) reviewed the published literature and reported that both additive and non-additive gene actions were important for most of the yield and yield components.

UPAS-120 is an early maturing, indeterminate and high-yielding variety. It is also reported to be good general combiner for yield and important yield components (Singh 1991). We have observed an abnormal plant in this variety, which was about 5–7 days late in flowering, with a smaller number of pods, and which had white translucent anthers with 100% pollen sterility. This paper reports the inheritance pattern of this spontaneous mutant.

Materials and methods

The present investigation was carried out at the G. B. Pant University of Agriculture and Technology, Pantnagar. Seventy plants of the cultivar UPAS-120 were planted in a hybridization block in the wet season of 1994–95. One plant with abnormal appearance was detected in this cultivar. The flower had white translucent anthers which were devoid of pollen grains. We crossed this plant with the mother parent to study the inheritance of the mutant phenotype.

Results and discussion

The cross of the male-sterile UPAS-120 and its fertile counterpart was successful, suggesting that the plant with the mutant phenotype was male-sterile and female-fertile. In the F_1 generation seven plants were grown which were fertile and had a normal phenotype.

The segregation pattern of this cross was studied in the F_2 and back-cross generations (Table 1). The flowers of 371 F_2 plants were examined to record the anther morphology. Out of 371 plants, 290 had normal anthers while 81 had the white translucent anthers. The pattern of F_2 segregation indicated that male sterility was a genetic character and showed a segregation of 3 (normal): 1 (mutant) ratio. The F_1 plants were back-crossed with fertile UPAS-120. All 15 BC_1F_1 plants were fertile and normal. UPAS-120 sterile plants were also crossed with the F_1 plants and out of five BC_2F_1 plants two were male-sterile while three were male-fertile. These findings suggested that the male sterility was governed by a single recessive gene. Similar findings

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Table 1 Segregation for genetic male sterility in pigeonpea

Generation	Observed segregation		Expected ratio	χ^2	*P*
	Fertile	Sterile			
F_1	7	–	–	–	–
F_2	290	81	3 : 1	1.98	0.25–0.10
BC_1F_1	15	–	–	–	–
BC_2F_1	3	2	1 : 1	0.40	0.75–0.50

have been reported by Reddy et al. (1978) in pigeonpea and Singh and Singh (1995) in peas (*Pisum sativum* L.). The gene responsible for genetic male sterility is easily mutable under natural conditions and can be readily observed.

Male-sterile plants of UPAS-120 were grown in the wet season (July–November) and in the spring season (March–June). In both seasons the plants expressed male sterility, indicating that it is not influenced by the environment. Since UPAS-120 is a widely grown variety of pigeonpea in the north-west plains of India, the male-sterile gene in this background will be of great utility for the exploitation of heterosis at a commercial level.

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