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Inheritance of Dwarfness in pigeon pea (*Cajanus cajan* (L.) Millsp.)

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Summary. A mutant pigeon pea, showing dwarf and bushy growth, very late maturity, poor yield and abnormal flowers was isolated from the tall variety, Brazil P/2. It is proposed that the mutant be called 'dwarf'.

A single recessive gene appears to be responsible for dwarfness and seems to have pleiotropic effect on maturation. The symbol proposed for the dwarfness gene is 'd'.

Abnormally dwarf off type plants were seen in a plot of pigeon pea at the State Agricultural Farm, Berhampore, West Bengal (India). Besides being very short in height, they were characterized by brittle stalks, smaller and lighter green leaves, delayed flowering and poor bearing of pods. The plants could be distinguished quite early, when they were about a foot tall, on account of their stunted growth and bushy nature, and they remained distinct from other pigeon pea plants throughout the rest of their lives (Figure 1).

Mutants in respect of plant habit have been isolated in pigeon pea by some other workers also. DESPANDE and JESWANI (1952) described a 'prostrate mutant', while CHAUDHARI and PATIL (1953) described a 'creeping mutant'. However, the dwarf mutant described here is a new one and can be regarded as an addition to the mutation spectrum of pigeon pea.

The present paper gives a description of the mutant and deals with the inheritance of dwarfness.

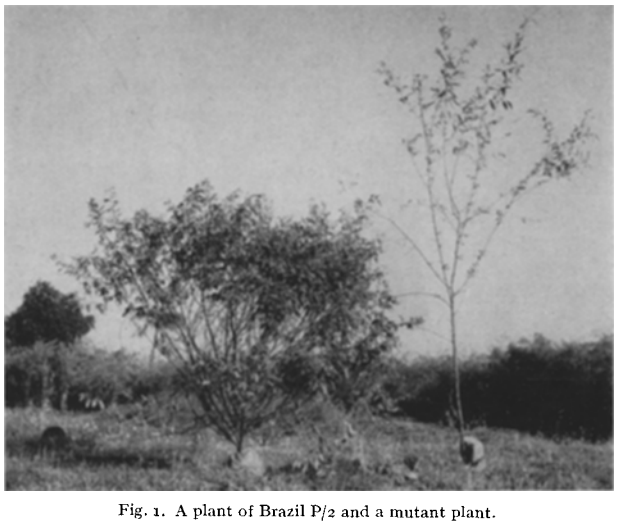

Fig. 1. A plant of Brazil P/2 and a mutant plant.

Procedure and Results

Two mutant plants of dwarf nature were observed in the maintenance plot of the variety, Brazil P/2, in 1959–60, at the State Agricultural Farm, Berhampore, West Bengal. These two plants were similar in growth habit and very different from the parental or any other existing variety. The possibility of the dwarf plants having arisen due to out-crossing can be ruled out since no dwarf plant ever existed in the collections maintained here. The distinguishing characters of the dwarf mutant and the parental variety, Brazil P/2, are presented in Table 1.

Table 1. *Distinguishing characters of the dwarf mutant and the parent.*

Characters	Brazil P/2	Dwarf mutant
Height	Tall (Av. 284.5 cm)	Dwarf (Av. 148.9 cm)
Habit	Spreading	Bushy
Stem hardiness	hard	brittle
Leaf	green	smaller and lighter green
Flowering	Late (162 days)	very late (193 days)
Average no. of main branches	11.5	10.0
Single plant yield	70 gm	32 gm
Style	more or less straight at tip	curved at tip

In 1960–61, open pollinated seeds obtained from the dwarf plants were grown in progeny rows. In both the progenies, a very large number of dwarf plants and a few tall ones were present. In 1961–62, selfed seeds were sown and most of the progenies bred

true. In certain cases a few off types were observed in otherwise true breeding cultures, and this could be attributed to natural crossing and mechanical mixture at one stage or the other.

In 1961—62, a few plants were selected from the true breeding dwarf mutant lines and also from the parental lines for hybridization work. Dwarf mutants were used as female parent, because, by the time these plants, which were quite late, got ready for hybridization, only a few flowers were available on the plants of Brazil P/2. Even if crosses were made on the latter, all the crossed flowers ultimately dropped. F_1 plants were raised in 1962—63. They were all of the same type and were tall and similar to the Brazil P/2 parent.

Mass hybridization in pigeon pea is a very difficult task since the percentage of success is as low as 2—3%. Therefore, test crossing could not be attempted in the present study and genetic observations were recorded on the segregating population in F_2, and the confirmation was done in F_3 and F_4.

Table 2. *F_2 and F_3 segregation of the cross, Dwarf mutant × Brazil P/2.*

Generation	No. of plants Tall	Dwarf	Ratio	χ^2	p
F_2	2430	828	3:1	0.298	0.70—0.50
F_3	4239	1381	3:1	0.546	0.50—0.30

In F_3, numbers of progenies available for recording pure tall and segregating tall were not large enough to give a good fitness to 1:2 ratio. Hence additional numbers of cultures were grown in F_4. When F_3 and F_4 data were pooled together, there were 35 true breeding talls and 60 segregating talls. Hence χ^2 was 0.525 and p = 0.50 — 0.30, indicating a good fitness to 1:2 ratio.

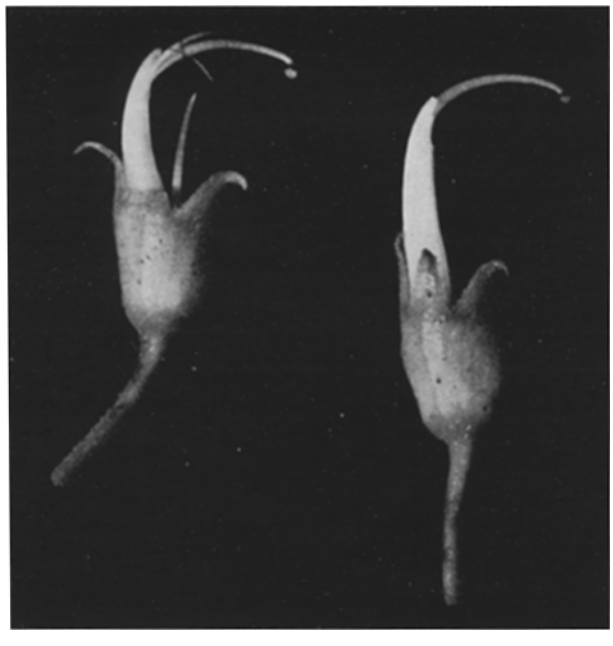

Fig. 2. The abnormal tip of the style in the mutant and the normal tip in Brazil P/2.

Cytological examination of flower buds of the dwarf plants failed to show any chromosomal aberration, but it was observed that all the anthers in a flower were not well developed and the tip of the style was curved (Figure 2). Pollen fertility was 70% and the female fertility was found to be normal.

Discussion

The occurrence of dwarf plants which differed a good deal from the parental plants and bred true to the type was not due to out-crossing, because a similar variety did not exist in the locality. It could, however, be attributed to spontaneous gene mutation as chromosomal aberrations could not be traced with dwarfness. The mutant type was dwarf in growth habit and was a poor yielder as compared to the parent. Besides the abnormality in growth habit, the plants were very late in maturity and had one or two undeveloped anthers and an abnormal stylar tip. Though pollen fertility of the mutant plants was observed to be quite high and female fertility was normal, the general appearance of the flowers was unhealthy. It appears that the mutant gene is also responsible for very late maturity, poor bearing of pods and flower abnormality.

Original tallness of the Brazil P/2 parent was completely dominant to dwarfness, and very late maturity was completely linked with dwarfness since no dwarf and late or tall and very late plant was found to occur in the three segregating generations. Monogenic segregation was observed in F_2 and that was confirmed in F_3 and F_4. Hence dwarfness should be regarded as monogenic recessive to tallness. 'd' gene is proposed for dwarfness as against 'D' allele for tallness. The non-occurrence of recombination of growth habit and maturity period suggests that the gene 'd' probably has pleiotropic effect. Other characters, like flower abnormality and pod bearing were not studied in segregating generations.

Zusammenfassung

Aus einer hochwüchsigen Straucherbse (*Cajanus cajan* (L.) Millsp.) der Sorte Brazil P/2 wurde eine Mutante mit verzwergtem und buschigem Wuchstyp, sehr später Reife, geringer Ertragsfähigkeit und abweichender Blütenform isoliert, für die der Name „dwarf" vorgeschlagen wird.

Nur ein rezessives Gen scheint für den Zwergwuchs verantwortlich zu sein, das einen pleiotropen Effekt auf die Reife ausübt. Für dieses Gen wird das Symbol „d" vorgeschlagen.

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