Heredity (1983), **51** (1), 419–421

A NEW GENE FOR MALE STERILITY IN PIGEONPEA (*CAJANUS CAJAN* (L). MILLSP.)

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Received: 1.iii.83

SUMMARY

Several forms of female fertile and male sterile mutants in pigeonpea (*Cajanus cajan* (L). Millsp.) have been reported. A translucent anther type of male sterile characterised by non-separation of tetrads that is associated with a persistent tapetum is conditioned by a single recessive gene, ms_1 (Reddy *et al.*, 1977; Reddy *et al.*, 1978). By contrast, a male sterile plant identified in breeding line B15B by Wallis *et al.* (1981) has shrivelled, arrowhead-shaped, non-dehiscent, brown-coloured anthers, and the pollen mother cells degenerate at the early tetrad stage (Dundas *et al.*, 1981). This paper reports studies to determine the inheritance of the B15B male sterile character and its allelic relationship to the translucent anther type.

Male sterile plants of B15B were crossed with cultivars 3D8103, QPL-1, and Royes. The F_1 and F_2 generations and test cross progenies of fertile F_1 plants crossed to male sterile B15B were classified for male fertility. Segregation for fertility was also studied using self-pollinated progenies of random plants from F_5 lines of male sterile B15B × QPL-1. The allelic relationship between the B15B and translucent anther types of male steriles was studied using the F_1 and F_2 generations of the triple cross, male sterile B15B × F_1 progeny of MS-3A × QPL-1, where MS-3A possesses the gene conditioning translucent anthers.

(i) *Inheritance of B15B male sterility*

All F_1 progeny of crosses of the three cultivars to male sterile B15B plants were fertile. F_2 progenies of seven, six and two F_1 plants of crosses to 3D8103, QPL-1 and Royes, respectively, were studied. The results fitted a 3 fertile: 1 sterile ratio in all cases (all $P > 0{\cdot}01$, most $P > 0{\cdot}05$), as did the pooled results within and across the crosses (table 1). The test cross progenies were of limited size but each fitted a 1:1 ratio, although the pooled results did not do so (table 1). These results suggest that B15B male sterility is conditioned by a single recessive gene.

Of 25 F_6 progenies which segregated for male sterility, all but two statistically fitted a 3 fertile:1 sterile ratio. The test of heterogeneity indicated that these progenies could be pooled and the total over all the segregating progenies agreed with the expected ratio of 3:1 ($P > 0{\cdot}05$).

The F_2 population of the male sterile B15B (yellow flowered) × cv Royes (red flowered) cross included plants with red, yellow and streaked flowers. Most of the male sterile plants had streaked flowers and no male sterile,

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TABLE 1

Segregation for male sterility in F_2 and test cross generations in three crosses, and in triple cross F_2 progenies

Cross	F_2 plants			Test cross plants		
	Fertile	Sterile	Prob. (3:1)	Fertile	Sterile	Prob. (1:1)
B15B* × Royes	470	135	0·20–0·10	12	5	0·10–0·05
B15B* × 3D8103	650	209	0·70–0·50	7	5	0·70–0·50
B15B* × QPL-1	453	153	0·90–0·80	17	10	0·20–0·10
Pooled	1573	497	0·30–0·20	36	20	0·05–0·02

	Triple Cross F_2 Progenies				
	Fertile	Translucent Sterile	Sterile ^{B15B}	Expected ratio	Prob.
B15B* × (MS-3A × QPL-1)					
–18 progenies	2052	0	640	3:1	0·30–0·20
–11 progenies	927	270	398	9:3:4	0·20–0·10

* Male sterile.

red flowered plants were found. Only a very low frequency of male fertile, yellow flowered plants occurred. This suggests that the allele conditioning male sterility in B15B is closely linked with one or more of those conditioning yellow flower colour. Detailed linkage studies are in prgress.

(ii) *Allelic relationship of B15B and translucent characters*

All 23 triple-cross F_1 plants evaluated were male fertile, indicating that the translucent anther and B15B male sterile characters are conditioned by different genes. Of 29 triple-cross F_2 progenies, 18 segregated only for B15B sterility and 11 segregated for both the B15B and translucent anther types. This fitted a 1:1 ratio ($P > 0{\cdot}05$). With one marginal exception, in all the F_2's segregating only for B15B type male sterility a good fit to a 3 fertile:1 male sterile ratio was observed. The pooled values (table 1) also fitted to a 3:1 ratio. Eight of the 11 populations fitted well to a 9 fertile:3 translucent anther:4 B15B male sterile ratio ($P > 0{\cdot}05$). Of the other three populations, one was significant ($P < 0{\cdot}01$) while two had very small number of plants (8 and 22, respectively). The pooled values over all 11 F_2 populations fitted a 9:3:4 ratio (table 1).

These results indicate that the translucent anther and B15B male sterile characters are conditioned by different and independent gene systems. The gene symbol, ms_2, is proposed for B15B male sterility. Although the ms_1 and ms_2 genes segregate independently, the ms_2 gene acts to over-ride the expression of ms_1 since the $ms_1ms_1ms_2ms_2$ genotype exhibts the B15B male sterile phenotype. Presumably this is due to the earlier degeneration of pollen mother cells in the B15B type (Dundas *et al.*, 1981).

Acknowledgements. This project was supported financially by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and a Commonwealth of Australia Special Research Grant. Technical Assistance of Mr. C. Brauns was invaluable.

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