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INHERITANCE OF TWO INDUCED LETHAL CHLOROPHYLL MUTATIONS IN MUNGBEAN

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IN a mutation programme in mungbean (*Vigna radiata* (L.) Wilczek), two varieties (ML-5 and K-851) were subjected to treatment with *gamma rays* and EMS, separately and in combination. Two lethal chlorophyll mutations, *albina* and *chlorina* were observed in M_2 generation. The nature of inheritance of these chlorophyll mutations was studied up to M_4, with the help of heterozygous plants obtained in segregating rows and in each case monogenic recessive inheritance was observed[1]. The mutants *albina* and *chlorina* could be either due to two different alleles on the same locus or due to mutations at different loci; if located on different loci, they could be linked or independent. Due to their recessive lethal nature, the mutations will be available only in heterozygous plants, which cannot be distinguished phenotypically. The results of an experiment to study the inheritance of these two mutations are presented in this communication.

Albina and *chlorina* chlorophyll mutations in mungbean were maintained with the help of heterozygous plants in the segregating rows. Three random plants from a row segregating for *albina* were crossed in all combinations with three plants from a row segregating for *chlorina*. Six hybrids were obtained. F_1 hybrids were grown along with selfed progenies of the six parent plants. Segregation in the selfed progenies was studied to locate hybrids derived from heterozygous × heterozygous cross. Only one such hybrid was available amongst the six hybrids grown. F_2 generation from this hybrid was grown on plant to progeny basis and data on segregation were recorded.

In F_1 generation, derived from a cross between heterozygous *albina* and heterozygous *chlorina* one hybrid was represented by eight normal plants. In F_2 generation, four types of segregations were obtained (table 1). Type I was normal and no segregation was observed. Type II and type III segregated for *albina* and *chlorina* separately, whereas type IV segregated for both. The test of goodness of fit was applied and the results are given in table 1, which showed clear 3:1 segregation in type II and type III, and 9:3:4 in type IV. In type IV, recessive homozygotes for both loci were assumed to be included in *chlorina* seedlings. Gene symbols *aa* and *cc* were assigned for *albina* and

Table 1 *Segregation ratios of F_2 plants obtained from cross of heterozygous plants for albina and chlorina chlorophyll mutations.*

Type	No. of Row row*	Row no.	Segregation in F_2 Normal	Albina	Chlorina	*P* (3:1) in II & III and *P* (9:3:4) in IV
I	1	1	198	–	–	–
II	3	1	123	38	–	0.5–0.7
		2	66	17	–	0.3–0.5
		3	61	16	–	0.3–0.5
III	2	1	37	–	14	0.5–0.7
		2	140	–	48	0.8–0.9
IV	2	1	112	29	37	0.05–0.1
		2	59	14	24	0.2–0.3

* *P* (1:1:1:1) = 0.8–0.9.

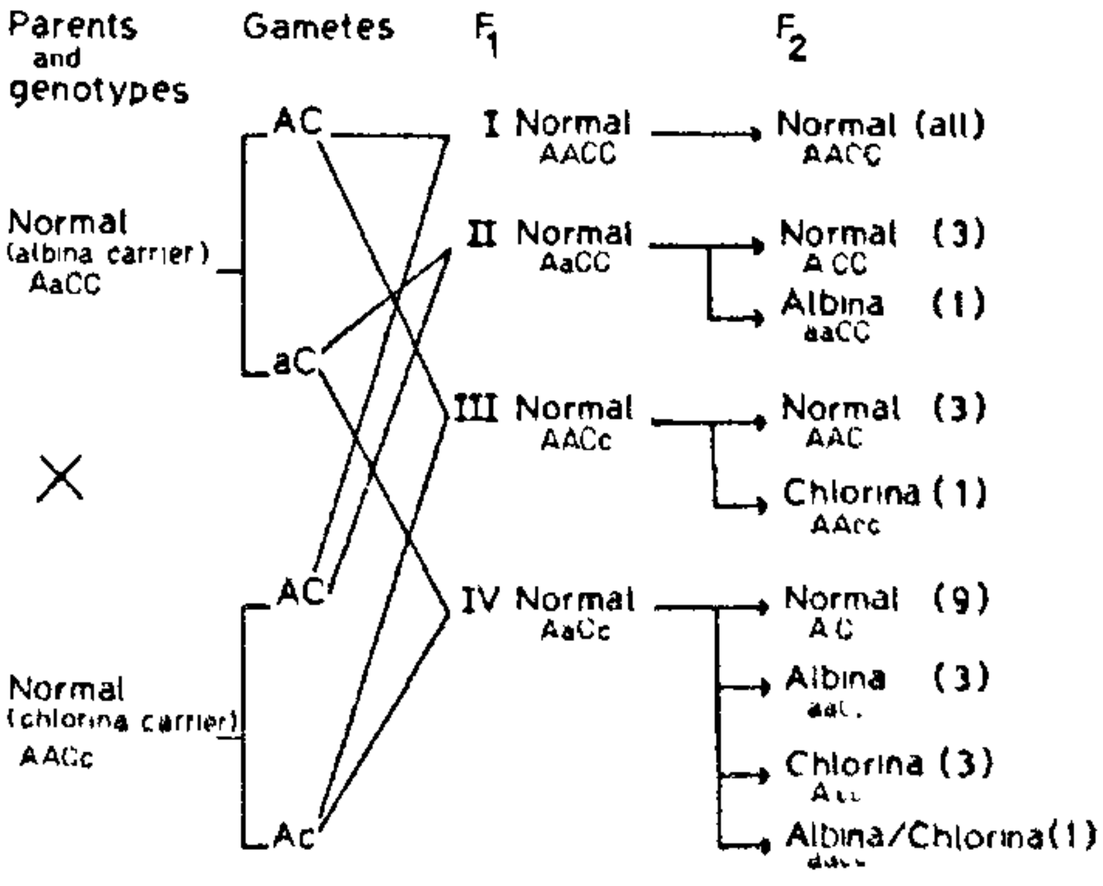

Figure 1. Segregation pattern in the progeny of a cross between heterozygous plants for *albina* and *chlorina* chlorophyll mutations in mungbean.

chlorina, respectively. The results are explained accordingly in figure 1. The results clearly indicate that independent single recessive genes are responsible for *albina* and *chlorina* lethal chlorophyll mutations. Our results agree with similar results earlier obtained with six lethal chlorophyll mutations in pearl millet[2] and two non-lethal chlorophyll mutations in soybeans and pearl millet.[3,4]

28 June 1983; Revised 13 September 1983.

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PROMOTORY EFFECT OF GLUTAMINE ON ROOT REGENERATION FROM CALLUS CULTURES OF MUNG

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CALLUS cultures of legumes generally require organic supplements[1] for profuse growth and, sometimes, bean seed extract[2], or glutamine[3] for growth and maintenance. Growth regulator combination with sugar concentrations is reported to determine bud and root regeneration from callus cultures[4], and absence of reduced nitrogen favours root regeneration while the presence favours embryo regeneration[5]. The present study reports the promotory effect of glutamine, a source of reduced nitrogen, on root regeneration from callus cultures of mungbean (*Vigna radiata* L. Wilczek).

Mungbean calli were initiated from shoot explants from 3-day old seedlings on B_5 medium[6] containing 0.1 μg ml^{-1} kinetin and 0.5 μg ml^{-1} 2,4-D. The calli were transferred to B_5 medium containing 0.05 and 0.1 μg ml^{-1} 2,4-D, 0.01 and 0.1 μg ml^{-1} kinetin and 0, 0.5, 1, 2 and 4 g l^{-1} glutamine in all possible combinations. Fresh and dry weights of calli, and the number of roots regenerated were recorded after 30 and 40 days, respectively. Data were analyzed according to the completely randomized design and means were compared using CD[7].

Glutamine significantly promoted fresh and dry weights of mungbean calli; interaction of glutamine with kinetin and or 2,4-D was significant. The promotory effect of glutamine was more pronounced at 0.1 μg ml^{-1} each of 2,4-D and kinetin. The glutamine containing media showed 17–77% more fresh and dry weights (table 1). A similar result has been reported in soybean[8]. Generally amino acids are inhibitory to the growth of callus and cell cultures in the presence of nitrate and ammonium salts[9]. But glutamine enhanced callus growth in mungbean in the presence of nitrate and ammonium salts of B_5 medium. In fact, calli of *Cajanus cajan* require glutamine for maintenance on B_5 medium[3].

The presence of glutamine in B_5 medium at low 2,4-D and kinetin concentrations promoted root regeneration; the promotory effect was evident particularly at 1, 2 and 4 g l^{-1} glutamine (table 1). These observations do not agree with those of Halperin[5], who reported that reduced nitrogen in the form of ammonium chloride or amino acids including glutamine

Table 1. *Effect of glutamine on callus fresh and dry weights of, and root regeneration from mungbean calli. Each value is mean of six replicates.*

Growth regulator (μg ml^{-1})		Glutamine	Fresh weight	Dry weight	Number of roots/ culture tube
2,4-D	Kinetin	(g l^{-1})	(mg)	(mg)	
0.05	0.01	0	889 6	87.8	2.3
		0.5	1189.6	112.0	2.7
		1 0	1295.0	124.6	3 5
		2.0	1307.8	126.6	6.1
		4.0	1361.2	131.4	7.3
0.05	0.1	0	904.8	89.0	1.5
		0.5	1389.4	134.0	2.7
		1.0	1429.2	142.4	6 0
		2.0	1478.9	144.6	10 0
		4 0	1599.2	148.6	6.3
0.1	0.01	0	877.0	84.0	2.5
		0.5	1234.4	120.4	2.7
		1 0	1289.0	126.0	8.0
		2 0	1357.6	131.0	7.6
		4.0	1370 8	133.6	7.0
0.1	0.1	0	1158.4	117.0	1.7
		0.5	1436 6	137.4	3 3
		1.0	1537.0	150.6	5.5
		2.0	1558 1	151.6	8.7
		4.0	1667 2	163 0	6.7
CD ($P = 0.05$)			108 2	9.1	0.5