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Short Communication

Study of induced amphidiploid derivatives of *Vigna radiata* × *Vigna mungo*

M. N. Singh and S. K. Singh

Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, BHU, Varanasi 221 005

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Greengram [*Vigna radiata* (L.) Wilczek] is one of the most important pulse crop of India with average production of only 300-400 kg/ha. The main reason of the poor productivity is narrow genetic base within the species besides biotic and abiotic factors. To widen the genetic base as well as for isolating the desirable recombinants, interspecific crosses of greengram with blackgram [*Vigna mungo* (L.) Hepper] hold great promise [1]. However, high degree of pollen sterility in interspecific F_1 hybrids [2] has been major hindrance to exploit the alien gene transfer. Induction of amphidiploids of such highly sterile F_1 hybrid observed to be fertile [3, 4] and reverted back to diploid in advanced generation resulting high yielding recombinants. However, Pandey *et al.* [3] reported that amphidiploid was high yielding and stable up to C_3 generation. In the present investigation an attempt has been made to observe the stability as well as relative performance of amphidiploid (C_1 to C_4) with their progenitors and interspecific F_1 hybrid involving mungbean and urdbean.

One cultivar of each of greengram cv. K 851 and blackgram cv. Pant U 30 were raised to make reciprocal crosses for obtaining interspecific hybrids. The hybrids seed and parents were grown in the pots for recording certain agronomic traits (Table 1). Further shoot tips of few 10-15 days old hybrid seedlings were treated with freshly prepared 0.25 per cent colchicine solution for 6 hours daily for three consecutive days to induce amphidiploids. The raw amphidiploid (C_1) was compared with parents and F_1 and was also advanced to obtain C_2, C_3 and C_4.

The final experiment comprising of parents F_1, C_2, C_3 and C_4 were grown in randomized block design with three replications during *kharif* 2003. Each plot consisted of 2 m length with row to row and plant to plant distances being 45 and 10 cm, respectively. Ten plants from each row were selected randomly for recording the observations for certain agronomic traits (Table 1). Data were subjected to statistical analysis (AM ± SE), 't' test and heterosis estimates.

Interspecific crosses could be obtained only when greengram was used as seed parents. The crossed (hybrid) seeds were shrivelled and F_1 hybrids were intermediate in morphology in respect to pod and stem hairiness, leaf shape and pod arrangement. However, it resembled the maternal parents for flower shape and cotyledon colour and for that of male parent for stem, leaf, calyx and mature pod colour.

Amphidiploid showed characteristics gigantism for various characters such as plant height, number of branches and flower per plant, size of leaf, stomata and pollen grain besides higher yield with improved seed size [3] as compared to F_1 and diploid progenitors. The significant differences of amphidiploids (C_1 to C_4) as compared to diploid F_1 and parents for leaf and pollen grain size, stomata size, number of stomata/unit area as well as test weight was evident through 't' test (Table 2). Besides, amphidipliod were indeterminate with prolonged reproductive phase bearing thick and dark green leaves. In respect of the pod length, number of seed per pod, pod arrangement, stem and seed colour, the amphidiploids resembled the male parent [3]. The fruiting habit of raw amphidiploid (C_1) was poor due to low pollen (78.0%) and ovule (75.7%) fertility due to meiotic irregularities [4]. The per cent pollen (85.8) and ovule (92.4) fertility followed by pods and cluster per plant, test weight and yield per plant was observed to be improved as generation advanced (C_4).

The extent of mid and better parents heterosis of F_1 and amphidiploids was positive for number of branches, flowers, clusters and pods per plant whereas for pod length and number of seeds per pod, it was negative. Further, the desirable yield heterosis over mid and better parents was noticed in C_2 and onward amphidiploids (Table 3). Similarly the per cent protein content of amphidiploids was observed to be 24.0, 27.6, 28.5 and 28.1 in C_1, C_2, C_3 and C_4 generations, respectively.

From the present study, it is quite obvious that further selection in advance generation (C_4 onwards) may brighten the prospects for isolating stable and high yielding amphidiploids coupled with improved quality traits in this important pulse crop.

Table 1. AM ± SE values of certain agronomic traits of *V. radiata* (K 851), *V. mungo* (Pant U-30), their F_1 hybrid and amphidiploids

Character		*V. radiata*	V. mungo	F_1 hybrid	Amphidiploid			
					C_1	C_2	C_3	C4
Plant height (cm)		77.0±0.98	33.6±0.75	93.0±0.85	110.0±1.24	97.0±1.10	96.7±1.40	94.2±1.36
Number of primary branches		3.0±0.43	3.2±0.27	4.0±0.40	5.4±0.81	5.3±0.87	5.5±0.90	5.8±0.88
Number of secondary branches		0.5±0.37	0.7±0.18	3.0±0.29	3.2±0.32	3.5±0.36	3.8±0.34	3.6±0.34
Number of cluster per plant		7.5±1.24	5.9±0.77	25.0±1.42	4.0±1.38	8.3±1.54	10.1±1.57	10.9±1.55
Number of pods per plant		29.0±1.30	23.6±0.80	51.0±1.25	14.0±1.62	32.0±1.40	41.1±1.56	45.7±1.48
Pod length (cm.)		6.9±0.96	4.8±0.67	1.9±0.86	5.6±1.20	5.3±1.36	5.2±1.31	5.3±1.29
Seeds per pod		11.0±0.62	6.0±0.46	1.5±0.35	5.8±0.58	5.6±0.60	5.5±0.61	5.6±0.59
100-seed weight (g)		4.0±0.44	3.9±0.28	2.9±0.57	5.0±0.93	5.2±1.42	5.4±1.12	5.4±1.30
Yield per plant (g)		8.0±0.22	7.1±0.14	2.1±0.10	5.6±0.40	8.9±0.52	11.8±0.62	12.4±0.58
Days to flowering		41.3±0.24	42.4±0.18	48.7±0.30	54.0±0.57	45.0±0.60	44.0±0.58	45.0±0.58
Days to maturity		81.2±0.18	83.8±0.13	113.8±0.24	102.0±0.47	98.0±0.53	98.0±0.50	95.0±0.52
Leaflet length (cm)		8.4±0.80	6.7±0.67	7.3±0.40	12.0±0.64	11.9±0.53	12.0±0.61	11.8±0.59
Leaflet width (cm)		6.6±0.35	3.4±0.19	5.9±0.36	8.3±0.48	8.2±0.51	8.2±0.49	8.3±0.50
Petiole length (cm)		10.2±0.97	7.6±0.64	6.8±0.73	11.3±0.80	11.6±0.92	11.8±0.89	11.5±0.88
Number of stomata per microscopic field		35.4±0.73	25.6±0.59	32.8±0.40	14.0±0.64	13.6±0.68	14.3±0.66	14.0±0.68
Size of stomata	L	25.1±0.75	18.3±0.64	25.7±1.10	32.4±1.25	36.6±1.30	34.5±1.36	34.8±1.34
	W	14.2±0.62	10.1±0.53	14.6±0.74	17.8±0.85	17.9±0.79	17.7±0.81	17.5±0.80
Size of pollen grains	L	74.6±0.71	50.7±0.54	64.7±0.44	126.0±0.88	127.4±0.91	125.0±0.85	126.2±0.86
	W	67.2±0.58	37.0±0.47	57.3±0.37	115.0±0.69	116.6±0.72	115.8±0.63	116.0±0.68
Pollen fertility (%)		96.5±0.39	95.3±0.26	18.4±0.41	78.0±2.10	81.4±1.76	83.9±1.81	85.8±1.85
Ovule fertility (%)		97.6±0.57	95.8±0.45	8.2±0.82	75.7±1.86	84.5±1.24	87.1±1.16	92.4±1.12
Protein content (%)		21.8	23.4	-	24.0	27.6	28.5	28.4

L = length, W = width

Table 2. Test of significance (t-test) for some traits in diploid parents, F_1 hybrid and amphidiploid of *V. radiata* × *V. mungo*

Source of variation	Leaflet length (cm)	Leaflet width (cm)	Stomata per microscopic field	Size of stomata (μ)		Size of pollen grains (μ)		100-seed weight (g)
				L	W	L	W	
Amphidiploid vs. *Vigna radiata*	7.80**	6.24**	5.72**	7.27**	6.74**	5.63**	6.90**	7.48**
Amphidiploid vs. *Vigna mungo*	6.74**	6.02**	5.90**	4.03**	5.68**	8.23**	6.28**	8.05**
Amphidiploid vs. F_1 hybrid	6.43**	5.55**	4.52**	6.37**	6.01**	7.61**	5.36**	3.93**

**P = 0.01

Table 3. Per cent heterosis of interspecific F_1 hybrid (*V. radiata* × *V. mungo*) and amphidiploids over better parent (BP) and mid parent (MP) for various quantitative traits

S.No.	Character	F_1 hybrid		Amphidiploid							
				C_1		C_2		C3		C4	
		BP	MP	BP	MP	BP	MP	BP	MP	BP	MP
1.	Plant height (cm)	20.8	68.2	42.9	98.9	26.0	75.5	25.6	74.9	22.3	70.3
2.	Number of primary branches	25.0	29.0	68.8	74.2	59.4	64.5	50.0	54.8	43.7	48.4
3.	Number of flowers per plant	132.7	138.5	164.7	171.3	202.9	210.4	221.0	229.2	233.8	242.1
4.	Number of cluster per plant	233.3	274.7	–46.7	–40.3	10.7	23.9	34.7	50.7	45.3	62.7
5.	Pods per plant	75.9	93.9	–51.7	–46.8	10.3	21.7	41.7	56.3	57.6	73.8
6.	Pod length (cm)	–72.5	–67.2	–18.8	–3.4	–23.2	–8.6	–24.6	–10.3	–23.2	–8.6
7.	Seeds per pod	–86.4	–82.4	–47.3	–31.8	–50.9	–36.5	–50.0	–35.3	–50.9	–36.5
8.	100-seed weight (g)	–27.5	–26.6	25.0	26.6	30.0	31.0	35.0	36.7	35.0	36.7
9.	Yield per plant (g)	–73.8	–72.1	–30.0	–26.3	11.3	18.7	47.5	57.3	55.0	65.3
10.	Days to flowering	17.9	16.5	30.8	21.2	8.9	7.7	6.5	5.3	11.4	10.1
11.	Days to maturity	40.1	37.9	25.6	23.6	20.7	18.8	20.7	18.8	17.0	15.2

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