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Distant hybridization in green gram [*Vigna radiata* (L.) Wilczek]

Sanket R. Rabari[1], Dr. K. N. Chaudhari[1] and Dr. R. K. Kalaria[2]

[1] Dept. of Genetics and Plant Breeding, College of Agriculture, Navsari Agricultural University, Bharuch

[2] Bioinformatic section, Aspee Shakilam Biotechnology Institute, Navsari Agricultural University, Surat

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INTRODUCTION

Green gram is thought to have originated from the Indian subcontinent where it was domesticated as early as 1500 BC (Lambridges and Godwin, 2007). Cultivated mung beans were introduced to southern and eastern Asia, Africa, Austronesia, the Americas and the West Indies. Area, production and productivity of mungbean in India is about 55.46 lakh ha; 38.19 lakh tonnes and 685 kg/ha respectively (UPAg, 2024-25). Its per 100g seed has 56.7g carbohydrates, 1.2g fat and 24g protein. Vitamins B-complex and mineral elements including calcium, magnesium, phosphorus and potassium are also present in fair amount in the seeds. Flowers are cleistogamous and modeled on leguminous pattern. Stamens are diadelphous (9+1).

CASE STUDIES

Singh *et al.* (1996) studied interspecific hybrids involving four genotypes of mungbean as female and the three genotypes of urdbean as male. Genotypes influenced crossability, germination, survival and fertility of F_{1s} were partially fertile, late maturing and intermediate in morphology. Only 2 out of 6 hybrids, namely; BHUM 1 × Pant U 30 and T 44 × T 9 resulted in fertile F_{1s} which reached maturity. Fertility of the progenies improved from F_2 to F_3 generations.

Bhanu *et al.*(2018) attempted a total of 80 interspecific crosses *i.e.,* 36 each of *V. radiata* × *V. umbellate* (*V. radiata* as female) and *V. mungo* × *V. umbellata* (*V. mungo* as female) and 08 crosses of *V. radiata* × *V. mungo* (*V. radiata* as female) to study the crossability relationship among these three *Vigna* species. Among the crosses of *V. radiata* × *V. umbellate;* the crossability was observed highest in HUM 12 × RBL 9 (16.27%) followed by HUM 12 × RBL 9 (15.78%). In case of *V. mungo* × *V. umbellata*, the maximum crossability of 11.36% was noticed in cross, Mash 338 × RBL 9. For *V. radiata* × *V. mungo*, the highest crossability was visualized in hybrid, ML 1464 × Mash 338 (37.5%). The study indicated that different kinds of pre and post fertilization barriers are responsible for complete sterility to low fertility. RBL 1 and RBL 9 genotypes of ricebean showing substantially high percent of crossability and better seed set with different cultivars of mungbean and blackgram may be utilized for genetic improvement of the mungbean and blackgram.

Prithviraj and Murthy (2018) attempted twenty eight interspecific hybridization involving four mungbean (*V. radiata*) and seven rice bean (*V. umbellata*) varieties to study crossability and other related parameters. Among twenty eight interspecific crosses attempted, sixteen crosses were successful in setting pods. Of these sixteen interspecific crosses, KKM-3 × KBR-1 was found better with high crossability per cent, high hybrid pollen fertility, high seed germination percentage, lower hybrid lethality and lower hybrid breakdown was observed, suggesting that this cross combination is a potential source for obtaining new gene combinations.

Pandiyan *et al.* (2020) attempted the interspecific hybridization between mungbean (*V. radiata*) and *V. aconitifolia*. In direct and reciprocal crosses, the pod set percentages was high (13.27) in direct crosses when compared with reciprocal crosses which were recorded 8.97 only. The germination percentage was high (*i.e.* 98%) *V. radiata* when compared with *V. aconitifolia* with 45 percentage. The quantitative traits such as plant height, number of branches per plant, days to fifty percent flowering, length of branch, number of clusters per branch, number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, hundred seed weight, dry matter production and seed yield exhibited high *per se* performance in the direct cross *V. radiata x V. aconitifolia* which is like of parent *V. radiata* except for days to full maturity. Hence progenies of this direct cross may have wide variability and may generate transgressive segregants for yield/its components/biotic/abiotic stress.

Singh *et al.* (2020) attempted thirty interspecific crosses (including reciprocals) involving three genotypes/varieties of green gram (*V. radiata* (L) Wilczek) cv. HUM 1 HUM 2 & HUM 8 and five genotypes/varieties of blackgram [*V. mungo* (L.) Hepper] cv. T 9, Pant U 19, PDU 1, BHUU 1 & BHUU 91-346-1. Nine out of 30 crosses were successful only when green gram was used as seed parents. Germination, survival and pod bearing habit of the F_{1s} hybrids were much better in *Kharif* season as compared to spring/summer season. The F_{1s} showed positive heterosis for days to flowering and maturity, plant height, number of primary branches, pods per plant and cluster per plant while for pod length, number of seeds per pod, seed yield per plant and l00-seed weight, it exhibited negative heterosis. Further, the desirable transgressive segregants were observed in F_2 generation for most of the traits thus indicated that an elite population may be obtained through interspecific hybridization involving green gram and blackgram.

Sharma *et al.* (2022) performed interspecific hybridization between five genotypes of urdbean & three genotypes of mungbean to check the crossability relationship. Thirteen cross combinations of urdbean x mungbean were successfully developed. Interspecific seeds showed no germination under soil conditions so various growth media were used for germination. Interspecific seeds germinated only on the salt solution. F_1 seeds of cross UG-218 x Suketi exhibited highest crossability and showed maximum response on salt solution. The study put emphasis on the different kinds of fertilization barriers. In future genetic improvement studies should be carried out with the genotypes showing substantially high percent of crossability.

A. Mahalingam and N. Manivannan (2023) carried out an experiment on interspecific hybridization between *V. radiata* var. VBN (Gg)2, VBN (Gg) 3 (as females) and *V. mungo* var. Mash 114 (as male). The fertile F_1 had the shallow lobbed leaf of *V. radiata* var. VBN (Gg)2 and black colour seed of *V. mungo* var. Mash 114 with pollen fertility of 42.0 per cent and crossability of 12.50%. Most interestingly all the four interspecific F_1 plants were free from MYMV disease. In F_2 generation, only one healthy plant was survived. In F_3 generation, number of branches per plant, number of clusters per plant, number of pods per plant, pod length and seed yield per plant had high GCV, high PCV, high heritability coupled with high genetic advance as per cent of mean. Present study suggests that MYMV resistant cultivars of green gram can be explored through interspecific hybridization with *V. mungo* var. Mash 114 as a source of resistance and the hidden transgressive segregants can be recovered in F_3 generation.

CONCLUSION

Though Distant hybridization in mung bean provides opportunities for widening genetic diversity has some challenges like cross-incompatibility, sterility and low success rate. Genotype/s of species play important role in success of wide hybrids.

Successful interspecific hybrids provide scope for introgression of desirable genes from one species to the other species.

FUTURE THRUSTS OF WIDE HYBRIDIZATION

- Advancements in Genetic Exploration, Conservation, Characterization and Utilization
- Integration of Modern Technologies for high recovery of wide hybrids

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