Agric. Res. J. Kerala 1988, 26 (1) 39 -44

CROSS COMPATIBILITY BETWEEN *ABELMOSCHUS MANIHOT* (L.) Medic. AND *ABELMOSCHUS ESCULENTUS* (L.) Moench.

Dalia Cherian and K. V. Peter

College of Horticulture, Vellanikkara 680 654, Trichur, India

Attention was recently shifted to other species of *Abelmoschus* possessing tolerance to yellow vein mosaic disease than *Abelmoschus esculentus* for use in inter-specific hybridisation. Arumugam *et al.* (1975) reported that *Abelmoschus manihot* accessions introduced from Africa and Japan were symptomless carriers of yellow vein mosaic virus. Reports regarding crossability of *Abelmoschus manihot* with *Abelmoschus esculentus* were not consistent. Devi (1932) confirmed symptomless carrier type of host reaction through grafting experiments in the two accessions of *Abelmoschus esculentus.* These two accessions are evaluated in the present study to find out cross compatibility for possible transfer of symptomless carrier type of host reaction to *Abelmoschus esculentus.*

Materials and Methods

There were three accessions of *Abelmoschus manihot* obtained from different sources (Table 1). Pusa Sawani *(Abelmoschus esculentus)* was the other parent used in the study. The four lines were grown during June-October, 1984. *Abelmoschus manihot* accessions were crossed with Pusa Sawani directly and reciprocally. *Abelmoschus man/hot* ssp. *tetraphyllus* (IIHR) x *A. esculentus* cross was not attempted. About 200 flowers in each of the cross combinations were emasculated and pollinated. Synchrony in flowering in Pusa Sawani and *A. manihot* was ensured by temporal sowing of Pusa Sawani. Observations were recorded on percentage of fruit set and number of seeds per fruit in F_0 and maternal parent. Percentages of fruit set, seed germination and seed forming efficiency were estimatad. Crossability index was calculated as per Rao (1979). Fertility of F_1 plant was estimated as percentage of fruit set in F, plants on salfing and as percentage of normal seeds. Pollen fertility of parents and F_1 plants was estimated by the acetocarmine test. Data on quantitative characters, collected from direct and reciprocal interspecific F, hybrids were analysed using student 't' test to estimate the maternal effect.

Results and Discussion

Crosses between three accessions of *Abelmoschus man/hot* and *Abelmoschus esculentus* showed that the percentage of fruit set did not differ widely in direct and reciprocal crosses (80.00%-94.80%) (Table 2). The percentage of seed forming efficiency was the highest for *Abelmoschus esculentus x Abelmoschus manihot* (KAU) (97.82%) and the lowest for *Abelmoschus manihot* (IARI) *x Abelmoschus esculentus* (63.38%). There was not much difference in the percentage of seed forming efficiency in direct and reciprocal crosses involving the above two species. The percentage of seed germination was less in hybrids, than in parents except in *Abelmoschus esculentus x Abelmoschus manihot* ssp.

Table 1

Source and morphological description of three accessions of *Abelmoschus manihot*

	Accession 1 *(Abelmoschus man/hot)*	Accession 2 *(Abelmoschus manihot)*	Accession 3 *(Abelmoschus man/hot* ssp. *tetraphyllus)*
Source	IARI, New	KAU, Vellanikkara	IIHR, Bangalore
Habit	Perennial shrub	Perennial shrub	Perennial shrub
Stem	Thick, slightly rough with red tinge	Thick, slightly rough, light green	Thin, rough, purple
Leaves	Alternate, long stalked, cordate base, acute apex	Alternate, long stalked, cordate base, acute apex	Alternate, long, stalked, cordate base, acute apex
Petiole	Long, red	Long, light green	Ventral side sparsely hairy green, dorsal side deep purple
Flower	Solitay, axillary, stalked, large buds avoid acute	Solitary, axillary stalked, large buds avoid acute	Solitary, axillary stalked, small buds avoid acute
Bracteoles	Large with appressed stiff hairs	Large with appressed stiff hairs	Large with appressed stiff hairs
Calyx	Companulate, obtusely dentate at apex with red tinge	Companulate, obtusely dentate at apex with red tinge	Spathaceous, green with purple tinge

Table 2

Compatibility between *Abelmoschus escu/entus* (L) Moench cv. Pusa Sawani and three accessions of *Abelmoschus manihot* (L)

F_0	A[c]*	B[c]*	C[c]*	Crossability index % (CI)
Abelmoschus esculentus x *Abelmoschus manihot* (IARI)	91.42	52.30	72.00	53.88
Abelmoschus esculentus x *Abelmoschus manihot* (KAU)	94.80	77.20	72.00	82.47
Abelmoschus esculentus x *Abelmoschus manihot* ssp. *tetraphyllus (IIHR)*	96.00	68.00	93.33	95.36
Abelmoschusmanihot (IARI) x *Abelmoschus esculentus*	80.00	14.38	68.00	49.55
Abelmoschus manihot (KAU) x *Abelmoschus esculentus*	93.10	19.60	81.33	66.29
Maternal parent	A[s]**	B[s]**	C[s]**	
Abelmoschus esculentus Moench cv. 'Pusa Sawani'	92.00	78.92	88.00	
Abelmoschus manihot (IARI)	92.00	22.69	74.66	
Abelmoschusmanihot(KAU)	100.00	28.46	78.66	

C* crossed A = fruit set (%) C = germination (%)
s** = selfed B = average number of seeds/fruit of seeds

tetraphyllus (93.33%) and *Abelmoschus manihot* (KAU) x *Abelmoschus esculentus* (81.33%). The crossability index was the highest *tot Abelmoschus esculentus x Abelmoschus manihot* ssp. *tetraphyllus* (95.36%) and the lowest in *Abelmoschus manihot* (IARI) *x Abelmoschus esculentus* (49.55%). Seed forming efficiency (Table 3) at F_0 level was the highest for *Abelmoschus esculentus* x *Abelmoschus manihot* (KAU) (97.82%) and the lowest for *Abelmoschus manihot* (IARI) x *Abelmoschus esculentus* (63.38%). There wasnot much difference in seed forming efficiency in direct and reciprocal crosses involving *Abelmoschus esculentus* and *Abelmoschus manihot* (IARI) In *Abelmoschus esculentus x Abelmoschus manihot* (KAU), seed forming efficiency was 97.82%. In its reciprocal cross, it was only 86.38%. The efficiency of seed formation in *Abelmoschus esculentusx Abelmoschus manihot* ssp. *tetraphyllus* was 86.16%.

The fertility of F_1 hybrids was further evaluated by observing percentage of fruit set at F_1 level and seeds/F_1 fruit (Table 3). The fruit set (%) ranged from 15.79 to 82.35. It was the lowest in *Abelmoschus esculentus x Abelmoschus manihot* ssp. *tetraphyllus* (15.79%) and highest in *Abelmoschus esculentus* x

Table 3

Percentage of seed forming efficiency of the crosses and fertility of F_1 hybrids of *Abelmoschus esculentus* cv. 'Pusa Sawani' and three accessions of *Abelmoschus manihot*

Genotypes	Seeds in selfed maternal parent	Seeds in crosses (F_0)	Seed forming efficiency (%)	No. of selfing in F_1	Fruit set in F_1	Fruit set (%) in F_1	Seeds/ fruit in F_1
A .esculentus cv. 'Pusa Sawani'	76.92	—	—	—	—	—	—
A. manihot (IARI)	22.69	—	—	—	—	—	—
A. manihot (KAU)	28.46	—	—	—	—	—	—
A. esculentus x *A. manihot* (IARI)	—	52.30	66.27	18	12	66,67	4.20
A. manihot (IARI) x *A. esculentus*	—	14.38	63.38	20	12	60.00	5.20
A. esculentus x *A. manihot* (KAU)	—	77.20	97.82 .	17	14	82.35	4.70
A. manihot (KAU) x *A. esculentus*	—	19.60	86.38	15	10	66.67	5.90
A. esculentus x *A. manihot* ssp. *tetraphyllus* (IIHR)	—	68.00	86.16	19	3	15.79	2.10

Table 4

Pollen fertility in parents and interspecific hybrids

Pusa *Sawani*	*Abelmoschus manihot* (IARI)	*Abelmoschus manihot* (KAU)	*Abelmoschus manihot* ssp. *tetraphyllus* (IIHR)	*Abelmoschus esculentus* x *Abelmoschus manihot* (IARI)	*Abelmoschus manihot* (IARI) X *Abs/moschus esculentus*	*Abelmoschus esculentus* x *Abelmoschus manihot* (KAU)	*Abelmoschus manihot* (KAU) x *Abelmoschus esculentus*	*Abelmoschus esculentus* x *Abelmoschus manihot* ssp. *tetraphyllus* (IIHR)
87.50	91.69	94.50	99.51	24.07	14.68 .	13.39	19.81	69.12
78.90	89.48	94.68	98.95	16.29	9.70	11.36	18.51	70.33
92.89	90.11	96.70	99.33	15.09	15.88	14.75	15.38	78.52
93.37	89.43	97.30	99.22	14.20	14.06	18.09	10.55	72.90
95.48	92.00	93.33	99.42	18.98	11.80	19·14	15.59	76.80
96.74	89.08	95.57	97.12	17.61	14.28	17.85	13.74	78.18
93.54	95.87	90.08	97.91	17.46	21.25	16.16	15.17	72.41
94.59	90.54	96.23	96.04	19.21	17.80	14.13	16.59	75.40
95.83	92.40	95.18	97.55	20.00	16.10	14.20	20.80	73.08
95.53	91.44	91.59	99.00	26.57	14.60	12.35	17.97	72.92
Mean	93.44±	94.52±	98.41±	18.95 ±	15.02±	15.14±	16.41 ±	93.97 ±
SE	5.41	2.27	1.19	3.86	3.14	2.58	3.03	3.17

Abelmoschus manihot (KAU) (82.35%). Eventhough hybrids exhibited high percentage of fruit set, seed set/fruit was very poor in all hybrids. It ranged from 2.1 to 5.9 seeds/F_1 fruit. The seeds, if at all formed, were shrivelled and were very small. In all the cross combinations, percentage of normal seeds was low (0.5 to 1.0%).

Acetocarmine test of pollen fertility of parents and interspecific F_1 hybrids provided useful information (Table 4). Pollen fertility in the parental species *Abelmoschus manihot* ssp. *tetraphyllus* was very high (98.41%). In the case of *Abelmoschus manihot* (IARI), *Abelmoschus manihot* (KAU) and *Abelmoschus esculentus* pollen fertility was 91.2%, 94.52% and 93.44% respectively. In *Abelmoschus esculentus* x *Abelmoschus manihot* (IARI), the fertility was around 19.0% in the direct cross and 15.0% in reciprocal cross. Unlike other inter-specific hybrids, pollen fertility of the hybrid *Abelmoschus esculentus* x *Abelmoschus manihot* ssp, *tetraphyllus* was very high (74%). The F_1 plants did not possess normal seeds and F_1 generations could not be raised. The F_1 plant sterility observed in all the interspecific hybrids indicated absence of perfect homology between genomes constituting the species.

Summary

The three accessions of *Abelmoschus manihot* were crossable with *Abelmoschus esculentus* cv. Pusa Sawani. *Abelmoschus esculentus* crossed well with *Abelmoschus manihot* ssp. *tetraphyllus* at F_1 level (CI = 95%). This was evident from F_1 fruit set, F_1 seed set and germination of F_1 seeds. But the F_1 plants did not bear normal seeds and F_2 germination could not be raised, indicating chromosomal nonhomology between the two species. The symptomless carrier type of host reaction cannot be transferred by conventional methods.

Acknowledgements

This paper forms a part of the M. Sc. (Hort) thesis of the senior author submitted to the Kerala Agricultural University. The senior author acknowledges Indian Council of Agricultural Research, New Delhi for the award of Junior Research Fellowship.

References

Arumugam, R., Chelliah, S. and Muthukrishnan, C. R. 1975. *Abelmoschus manihot*, a source of resistance to yellow vein mosaic. *Madras agric. J. 62:* 310-312

Devi, S.N. 1982. Induction of variability in *Abelmoschus manihot* var. *Ghana* by irradiation. M. Sc. thesis, Kerala Agricultural University, Vellanikkara, Trichur.

Rao, N.N. 1979. Barriers to hybridisation between *Solanum melongena* and some other species of *Solanum.* (In) Hawker, J. G., R. N. Lester and A. D. Skelding (Ed). *The Biology and Taxonomy of the Solanaceae.* Linneaen Society of London, 605-615