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Cross compatibility in five species of *Capsicum*

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Abstract

Evaluation of 160 accessions of *Capsicum* which included five species and their inter specific hybrids at Chalode (Kerala, India) indicated that *C. chinense* (110.3 ASTA unit colour and 186.2 g per plant yield) and the hybrid *C. annuum* x *C. chinense* (58.6 ASTA unit colour and 190.3 g per plant yield) were the most promising and can be used as sources of colour for improving the present day chilli cultivars.

Key words: capsanthin, *Capsicum,* chilli, evaluation, fruit colour.

Natural fruit colour is one of the most important attributes of chillies (*Capsicum* spp.) used in processed foods in place of synthetic colours. One of the obvious ways to improve quality of visual and extractable red colour in chilli is to improve the quality of ripe fruits from which colour is derived. More than 20 carotenoids contribute to colour in chillies (Bosland 1993) and capsanthin, the major carotenoid in ripe fruits, contributes up to 60 per cent of the total carotenoids and imparts the major red colour and is present as its dilaurate. Though the colour contents of some of the varieities and lines of chilli are known, information on their specific species values is lacking.

Based on the morphological characters and by adopting the key proposed by IBPGR (1983), the following typical accessions under five *Capsicum* spp. were selected for hybridization at TxD Pollination Unit, Chalode (Kerala, India) during 1995-96.

CA 33 (Manjari) - *C. annuum* L., CA 89 (White Kanthari) - *C. frutescens* L., CA 484 (Source: NBPGR, Vellanikkara) - *C. chinense* Jacq., CA 302 (Source: Beltsville, USA) - *C. baccatum* L. and CA 470 (Source: IIHR, Bangalore) - *C. chacoense* Hunz.

Cross Compatibility Index (CCI) was calculated as suggested by Rao (1979). Well developed flower buds, which would open the next day morning were emasculated during previous day evening. Pollination was performed between 7.00 and 8.30 am the next day morning using pollen from covered male flowers. The bags were removed after 3 days. Red ripe chillies were harvested, dried and the stalk and seeds were removed before powdering. Total extractable colour

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was estimated as per ASTA methods (Hort & Fisher 1971).

Absorbivity (a) of standard colour solution =

$$\frac{\text{Absorbance of standard colour solution at 450 nm}}{\text{Cell length (cm) x Concentration (mg/ml)}}$$

Extractable colour (ASTA Units) =

$$\frac{\text{Absorbance of extract at 450 nm x 200}}{\text{Cell length (cm) x a x Concentration of solution (mg/ml)}}$$

Relative heterosis and heterobeltiosis were also worked out.

Significant positive heterosis for yield was recored only in *C. annuum* x *C. chinense* with a maximum mean yield of 190.31 g per plant. Significant positive heterosis for colour was recorded in *C. frutescens* x *C. baccatum* and *C. annuum* x *C. chacoense,* but their mean performances was low. Maximum mean extractable colour was observed in *C. annuum* x *C. chinense* (58.62 ASTA units). But *C. chinense* recorded high extractable colour (110.34 ASTA units) along with high yield (186.2 g/plant). *C. annuum* recorded medium extractable colour with medium yield (152.59 g/plant). All other species and hybrids registered low colour and yield. The mean values of hybrids with respect to total extractable colour was higher when compared with the mean values of parents. But, hybrids registered mean low yields in comparison to their parents (Table 1).

Table 1. Performance of *Capsicum* spp. and F_1 hybrids, cross compatibility index and extent of relative heterosis and heterobeltiosis for yield and colour

Species/F1 hybrids	CCI	Yield/plant (fresh weight)			Total extractable colour		
		Mean performance (g)	RH (%)	HB (%)	Mean performance (ASTA units)	RH (%)	HB (%)
C. annuum		152.590			82.31		
C. frutescens		48.795			29.36		
C. chinense		186.198			110.34		
C. baccatum		40.561			16.31		
C. chacoense		39.562			10.26		
C. annuum x *C. frutescens*	6.67	7.383	-92.66**	-95.16**	52.36	-6.2*	-36.4**
C. annuum x *C. chinense*	30.21	190.310	4.61**	2.22**	58.62	-39.1**	-46.9**
C. annuum x *C. chacoense*	17.60	11.828	-87.68**	-92.24**	51.20	10.6**	-37.8**
C. frutescens x *C. chinense*	22.23	48.964	-58.35**	-73.72**	50.31	-28.0**	-54.4**
C. frutescens x *C. baccatum*	39.53	0.265	-99.41**	-99.44**	48.52	112.5**	65.3**
C. chinense x *C. baccatum*	1.81	0.890	-99.21**	-99.51**	56.36	-28.4**	-58.9**
Mean of parents		93.541			49.72		
Mean of hybrids		43.273			51.06		

CCI = Cross Compatibility Index; RH = Relative heterosis; HB = Heterobeltiosis

* P = 0.05; ** P = 0.01

The present investigation revealed cross compatbility between the six cross combinations of *Capsicum* spp. Pillai *et al.* (1977) and Sundaresan and Chandrasekaran (1979) reported one way incompatibility between *C. annuum* and *C. frutescens,* where the cross failed when *C. annuum* was used as the female parent. According to Smith and Heiser (1957), about 2 per cent of viable seeds were obtained when *C. frutescens* was used as the female parent in the above cross. In this study, when *C. annuum* lines were used as the female parent, cross compatibility index values averaged 6.67% after hand pollination. This indicated that *C. annuum* and *C. frutescens* were comparatively crossable. Keshavram & Saini (1971) found that *C. annuum* and *C. frutescens* lines were successfully intercrossed in all directions. The cross *C. chinense* and *C. baccatum* were classified as often compatible since their cross compatibility index value was less than 5%. Crosses involving *C. annuum* and *C. chinense* and *C. frutescens* and *C. baccatum* were found to be highly crossable.

Complete cross incompatibility was observed in four interspecific cross combinations of *Capsicum* studied. Hybrid inviability in *C. frutescens* x *C. chacoense* and *C. baccatum* x *C. chacoense* might be due to post fertilisation barriers in the form of defective endosperm or embryo or due to abnormal development of endosperm. Post fertilisation barriers were observed in the cross *C. chinense* x *C. chacoense,* resulting in the collapse of F_1 seedlings at sixth leaf stage. However, Kumar *et al.* (1988) could get sterile F_1 plants from the above cross. The hybrid inviability in crosses involving *C. annuum* and *C. baccatum* might be due to wide genetic distance between the parents. Cross compatibility index, being a multiplicative function of components like percentage of fruits set, viable seeds per fruit, percentage germination and percentage of seedling survival, higher cross compatibility index in a few crosses might be due to higher values of any of these components.

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