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USING OF BRIDGING SPECIES IN INTERSPECIFIC HYBRIDISATION IN GENUS *CARICA*

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THERE are numerous examples where species hybrids offer a great reservoir of variability for improvement of cultivated species. Incorporation of genes for disease resistance is normally one of the common objectives in breeding programme while utilising an alien species. In the genus *Carica*, to which the papaya (*Carica papaya*) belongs, interspecific hybridisation offers enormous possibilities for obtaining disease resistance, though the methods to obtain certain interspecific hybrids are fraught with obstacles. In the present paper the use of a bridging species to overcome the crossability barrier between two *Carica* species has been demonstrated which has enormous significance in papaya breeding especially for resistance to the papaya mosaic virus which is taking a very heavy toll

Table 1 *Morphological features of interspecific and complex-hybrids*

Characters	*C. monoica*	*C. cauliflora*	*C. papaya*	F_1 *C. monoica* × *C. cauliflora*	F_1(*C. monoica* × *C. cauliflora*) × *C. papaya*
Stem					
Shape	Cylindrical upright	Cylindrical upright	Cylindrical woody	Cylindrical upright	Cylindrical
Colour	Green, turns brown when old	Brown	Brown	Green	Brown
Branching	Branching in leaf axil	Branching absent	Branching in leaf axil	Branching in leaf axil	No branching
Leaves					
Colour	Thick green	Dark, dull green	Green	Green	Thick green
Shape	lobed, 3–5 pointings	Broad, Entire and small lobes	Broad, Entire lobed (5–8)	Lobed (3–6)	Broad, Lobed (7–9)
Petiole	Medium & Slender	Long and cylindrical	Long and cylindrical	Medium and cylindrical	Short and cylindrical
Plant sex	Monoecious	Dioecious	Dioecious	Only one male plant was obtained	Dioecious
Panicle Shape	Born on short stalk or clustered	Born on long stalk or clustered	Born on long stalk or clustered	Born on long stalk and clustered	Short stalk clustered
Position	Axillary	Cauliflorous	Axillary	Axillary & Cauliflorous	Axillary
Flower					
Type	Slender	Broad & thick	Slender	Slender	Slender
Colour	Yellow	White	White	White	Yellow
Pollen-fertility	Highly fertile (95.71%)	Highly fertile (97.01%)	Highly fertile (95.60%)	Partially fertile (74.75%)	Highly fertile (93.08%)
Seed set	High	High	High	—	Medium

of the crop in many papaya growing regions in the world.

All the cultivars of papaya (*Carica papaya*) are known to be susceptible to the papaya mosaic virus. However, the wild species *C. cauliflora* has been reported to be resistant to this virus[1]. Attempts to hybridise these two species have failed in the past[2] owing to the abortion of the hybrid embryo. Work on interspecific hybridisation is in progress at this Institute for the last seven years. Out of the innumerable pollinations that were made between *C. papaya* and *C. cauliflora* only one hybrid was obtained. Even this limited success was achieved only by pollinating on stigma smeared with 5% sucrose[3]. This F_1 was subsequently used to backcross with the parental species to generate sufficient population for screening against Mosaic Virus. At the National Chemical Laboratory interspecific hybrids could be obtained by embryo culture[4].

During interspecific hybridisation in the genus *Carica*, it was possible to obtain hybrids of *C. cauliflora* × *C. monoica* without any difficulty. Previous studies have also shown that these two species are easily crossable[5,6]. Further studies showed that this F_1 interspecific hybrid is crossable with *C. papaya* and fertile hybrids can be obtained involving the genomes of *C. papaya, C. cauliflora* and *C. monoica*. The hybrids have mainly the characteristics of *C. papaya* and the plants are vigorous and detailed studies on their variability pattern and reaction to the Mosaic virus are underway.

The distinguishing morphological features of the three species, interspecific hybrid (*C. monoica* × *C. cauliflora*) and the complex hybrid (*C. monoica* × *C. cauliflora* × *C. papaya*) are presented in table 1. It was observed that the complex hybrid showed an assortment of parental species characteristics indicating that they are true hybrids. The pollen fertility however, was very high in the parental species as well as the complex hybrid indicating the close affinity among the species, though there are crossability barriers at certain levels.

It is interesting to note that this is a typical example of interspecific hybridisation where two species which are individually incompatible to a third species do not pose any crossability barriers in their hybrid form. That is, *C. monoica* and *C. cauliflora* are incompatible with *C. papaya* but the present studies have shown that *C. cauliflora* × *C. monoica* hybrid is compatible with *C. papaya*. The new complex species hybrid is expected to be an interesting breeding material not only for the possibility of introducing resistance to Mosaic virus into the papaya cultivars but also to study the monoecious characteristics in the background of *C. papaya* which is dioecious. Further studies on the reaction of these interspecific hybrids to the PMV and the nature of inheritance to sex are in progress.

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A NOTE ON THE NUCLEOLAR STAINING IN *CHARA* SP.

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IN the study of cytology of Characeae, the size and number of nucleolus per cell is not of much importance, yet their dimension and variation in number are generally taken into consideration[1-3]. During the cytological investigations of Characeae of West Bengal, the authors have observed that the nucleolus very often could not be distinctly differentiated within the nucleus and to determine their number by the usual aceto-carmine staining following the iron-alum method[4] present difficulties. A suitable methodology to stain the nucleolus in *Chara* very prominently was keenly felt. The main objective was to see how far the $AgNO_3$ staining method for nucleolus[5] which works excellently in angiospermic material could be employed in case of *Chara* sp., with modifications if any, specially in the staining of the nucleolus of vegetative cells which have high chlorophyll content. The follow-