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BROADENING THE GENETIC BASE OF CASSAVA, *Manihot esculenta* Crantz, BY INTERSPECIFIC HYBRIDIZATION

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Controlled crosses by vector insects resulted in the production of interspecific hybrids of cassava (*Manihot esculenta* Crantz) and *Manihot* species, while manual crosses failed. Marker genes for hairy stem, red disk, unribbed fruit, and foliaceous brackteoles proved efficient in recognizing interspecific hybridization between *Manihot* species and cassava.

Key words: wild cassava. *Manihot neusana*, *Manihot anomala*, interspecific hybridization, marker genes.

[Amélioration du fonds génétique du manioc (*Manihot esculenta* Crantz) par hybridization interspécifique]

Titre abrégé: Hybridation interspécifique du manioc.

Des croisements dirigés à l'aide d'insectes vecteurs nous ont permis d'obtenir des hybrides interspécifiques du manioc (*Manihot esculenta* Crantz) et d'autres espèces du genre *Manihot* là ou des croisements manuels avaient échoué. Les gènes marqueurs déterminant la tige poilue, le disque rouge, les fruits non côtelés et les bractéoles foliacées se sont avérés efficaces pour reconnaître l'hybridation interspécifique du manioc et d'autres espèces du genre *Manihot*.

Mots clés: Manioc sauvage. *Manihot neusana*, *Manihot anomala*, hybridation interspécifique, genes marqueurs.

Cassava cultivars are deficient in many economic characters such as resistance to insects , diseases , and drought, and have low protein content (Nassar and Dorea 1982; Nassar and Grattapaglia l986). This can be attributed to the mode of evolution in the species and modifications of the al1ogamy system of the plant (Nassar and O'Hair l985). Lost genes can be restored to the gene pool of the cultigen by interspecific hybridization with wild relatives, which possess these genes (Nassar et al. l985). Wild species of cu1tivated crops have been frequently used as an important source of genetic diversity and have been employed effectively in a variety of breeding programs (Stalker l980). Controlled introgression of genes could alleviate stress problems in cassava given the availability of wild relatives which exhibit diversity in adaptations and attributes (Nassar 1985).There are interspecific barriers to hybridization (Nassar et al. l985), but these can be broken by the use of a diversity of pol1inator gametes.

This work reports production of interspecific hybrids of two *Manihot* species namely *M. neusana* Nassar and *M. anomala* Pax with cassava through controlled crosses by vector insects.

Two wild *Manihot* species, *M. anomala* and *M. neusana* maintained in the living collection at the Experimental Biology Station, Universidade de Brasilia, were used for this experiment.

In October l982 the species were each planted in three rows alternated with cassava. In June 1983, 200 seeds were collected from each species and replanted in October 1984 for identification of possible natural hybridization. The following marker genes were used to identify interspecific hybrids: variegated color of fruit dominant to smooth, red color of flower disk dominant to yellow, setaceous bracteole dominant to foliaceous, and noded stem dominant to smooth. Observations of growth habit, height, stem texture, and tuber formation were also recorded. In addition to the open pollination for the above mentioned species, 400 manual crosses with pollen of cassava cultivar Catelo were realized.

Of 200 seeds of *M. neusana*, only 43 seedlings emerged of which two hybrids were identified. Interspecific hybrids were identified by dominant markers from cassava; noded stem, setaceous bracteoles, ribbed fruit, and tuberculated root (Table l). Other characters provided indirect evidence of hybridization.

The 200 seeds collected from *M. anomala* gave rise to 1l2 seedlings. Of these,

three seedlings showed characteristics of interspecific hybridization. Only one seedling survived to maturity. This hybrid plant exhibited dominant phenotypes from cassava, namely ribbed fruit, red color of the flower disk, noded stem, and tuberous roots (Table 2).

Table 1. Comparison of morphological characters for *M. neusana*, cassava and their hybrid.

Character	***M. neusana***	**Cassava**	**Hybrid**
Growth habit	Procumbent shrub 1.5-2 m	Erect shrub 1.5-2 m	Erect shrub 1.5-2 m
Young stem texture	Hairy	Glabrous	Hairy
Bracteoles	Foliaceous	Setaceous	Setaceous
Fruits	Globose, without ribs, variegated	Ovoid, ribbed, green	Ovoid, ribbed, variegated
Tuber formation	None	Forms tubers	Forms tubers

Table 2. Comparison of morphological characters for *M. anomala*, cassava and their hybrid.

Character	***M. anomala***	**Cassava**	**Hybrid**
Growth habit	Erect shrub2-2.5 m	Erect shrub 1.5-2 m	Erect shrub 1.5-2 m
Young stem texture	Hairy	Glabrous	Hairy
Bracteoles	Semi-foliaceous	Setaceous	Setaceous
Flower disk color	Creamy	Red	Red
Leaf form	Anomala	Lobed; 5 lobes	Anomala
Fruits	Globose, without ribs	Ovoid, ribbed	Ovoid, ribbed
Tuber formation	Scarcely forms tubers	Forms tubers	Forms tubers

These results show that glabrous stem, setaceous-folicaceous bracteoles, red-creamy color of flower disks, variegated-green color of fruit, and ribbed-nonribbed fruit are simple marker genes that can be used to recognize interspecific hybridization. It is evident that interspecific barriers between *Manihot* species can be broken by the use of an abundant diversity of pollinator gametes transmitted by insect vectors. Interspecific crosses were difficult to fertilize manually in this work and wild previous crosses (Nassar et al. l985). The evidence suggests that barriers between cassava and other *Manihot* species are weak and recently evolved. It seems they have arisen not as a primary isolating event, but secondarily after geographic isolation. Nassar (l978) postulated cassava itself is an interspecific hybrid that appeared by domestication some 2000 years ago or less.

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