Reprints

Reprint from Brazilian Journal of Genetics Vol. 1, Nº 01 (1977)

Chromosome Number and Meiotic Behaviour of Some Wild *Manihot* Species Native to Central Brazil

By
Nagib M. A. Nassar

Instituto de Ciências Biológicas, Universidade Federal de Goiás
Goiânia, GO, Brasil.

ABSTRACT

Chromosome behaviour in meiosis was studied in seven wild Manihot (cassava, mandioca) species native to Central Brazil. These species are: M. tripartita Muell., M. anomaia Poh), M. zehntneri Ule, M. oligantha Pax, M. nana Muell, M. gracillis Pax, M. tomentosa Poh), M. zehntneriUle, M. oligantha Pax, M. nana Muell., M. gracilis Pax, M. tomentosa Pohl. The seven species had a regular meosis with haploid number n=18. No multi-associations, laggards or irregular distribution were observed. Pollen in the seven species has fair viability.

INTRODUCTION

The genus Manihot Adans is native to Tropical Central and South America. It contains about 98 species distributed from Mexico to South Brazil (Rogers and Appan 1973). Rogers and Appan divided the genus into 19 sections and considered Manihot esculenta means. Taxonomic entities laid by Rogers and Appan are based purely on morphological characters. Although this genus includes cassava, the notable important staple food all over the tropics, it has received little cytological attention. Among the limited studies reported in the literature, Graner (1935) determined somatic chromosome number in M. esculenta, Cruz (1968) reported somatic chromosome number of 8 wild species. Magoon et al. (1969, 1970) studied meiotic behaviour in M. esculenta and M glaziovii.

MATERIAL AND METHODS

Seven wild Manihot species were collected from different locations in the state of Goiás, Brazil. They are: M. tripartia Muell., M. anomala Pohl, M. zehntneri Ule, M. oligantha Paz, M. gracilis Pax, M, nana Muell, M. tomentosa Pohl, (see photo gallery). Seeds, or cuttings or whole plants were planted in the cassava germplasm collection at the "Instituto de Ciências Biológicas", Goiânia. When the plants flowered, inflorescences were fixed in a misture of three parts of absolute alcohol and one parte of propionic acid saturated with ferric acetate and kept in the refrigerator for 24 hours. The anthers were smeared with propionocarmine according to Swaminathan et al. (1954). Chomosome configurations in metaphase, chromosome distribution in anaphase I, and tetrad formation were studied. Pollen viability was determined by using acetocarmine and Iodine stain. Five hundred pollen grains per species were examined.

RESULTS

Chromosome associations showed extreme regularity in metaphase I in all seven species. Formation of 18 was seen in all the investigated species . Anaphase I was usually normal with na equal distribution of 18 chromosomes to each pole. No laggards, delayed separation of bivalents, restitution nuclei of polyads were observed in any of the 50 pollen mother cells examined for each species. Pollen viabilitty was found to be as follows: M. tripartita 90.6% M. anomala 92,4%, M. zehntneri 91,3%, M. oligantha 90.1% M. gracilis 94.7% M. nana 92.8%, M. tomentosa 90.4%.

DISCUSSION

Genetic number was found to be 18 in the seven wild species. Of these species, M. anomala, m. zehntneri, M. oligantha, M. nana and M. tomentosa had their chromosome number determined here for the first time. The chromosome number of M. tripartita and M. gracilis agrees with that reported by Cruz (1968) in somatic tissues. Cruz, studying somatic chromosome number in root tips of 8 wild species, found it to be 36 for all of them. Magoon et al. (1970), reported the same number in M. glaziovii. The known chromosome numbers in wild Manihot species can be tabulated as follows:

Table I – Chromosome number in wild *Manihot* species

Species	Habit of Growth	n	2n	author
M. handroana	Shrub	-	36	Cruz (1968)
M. jolyana	Shrub	-	36	Cruz (1968)
M. tripartita	Shrub	-	36	Cruz (1968)
M. tripartita	Shrub	18	-	Nassar (this paper)
M. tweedieana	Shrub	-	36	Cruz (1968)
M. pedicellaris	Shrub	-	36	Cruz (1968)
M. gracilis	Sub-Shrub	-	36	Cruz (1968)
M. gracilis	Sub-Shrub	18	-	Nassar (this paper)
M. dichotoma	Tree	-	36	Cruz (1968)
M. glaziovii	Tree	18	-	Magoon et al (1970)
M. glaziovii	Tree	-	36	Cruz (1968)
M. anomala	Shrub	18	-	Nassar (this paper)
M. zehntneri	Shrub	18	-	Nassar (this paper)
M. oligantha	Sub-Shrub	18	-	Nassar (this paper)
M. nana	Sub-Shrub	18	-	Nassar (this paper)
M. tomentosa	Sub-Shrub	18	-	Nassar (this paper)

Reports in the literature are in agreement that 2n=36 for m. esculenta, cassava (Graner, 1935; Abraham, 1944; Cruz, 1968). Also there is agreement on regular 18 bivalent formation in diferrent cultivars of cassava (Abraham, 1944, Magoon et al., 1969, Sohmer, 1968). Bolhuis (1953), Jennings (1959), Lanjouw (1939), and Magoon et al. (1970) reported easy and sucessful crossability between cassava and a number of wild manihot species. Moreover, Jennings (1963), reported higlher fertility for hybrids of cassava and some sild Manihot species. Rogers and Appan (1973), considering frequent hybridity between cassava and local wild relatives, assumed that natural hybridization must have p;ayed a large role in evolving different species in this genus. They were guided in this idea by the hyp. Hesis of harion (1961) that a number of wild species may have developed as a results of change hybridization between crops cultivars and local wild species. Attempts at crossing cssava with the wild species mentioned here are under way. Preliminary results are in agreement with previous reports. A review of the literature, combined with regular meiosis seen in the investigated species, indicates the cytological barriers have not yet been establisched in this biological group.

The seven wild species showed fair pollen fertility compared to varyng degrees of sterility in cassava cultivars reviewed in the literature (Cours 1951; Sohmer 1968; Magoon et al., 1968). Low fertility of cassava cultivars in comparison to the wild species may be atributed to maintenance of those cultivars for many centuries by means of vegetative reproduction. This would to accumulation of spontaneous mutations. As plants nerver passed through a sexual reproduction cycle, most of these mutations had no chance of being eliminated.

ACKNOWLEDGMENTS

This Work was carried out with the help of a grant from the International Development Research Centre, Ottawa, Canada.

REFERENCES

Abraham, A. (1944). Natural and artificial polyploids in tapioca (Manihot esculenta Crantz). Proc. Ind. Sci. Cong. 32: part III.

Bolhuis, G.G. (1953). A survey of some attempts to breed cassava varieties with a high content of protein in the roots. euphytica 2: 107-112.

Cours, G. (1951). Le manioc à Madgascar. Men, Inst. Rech. Sci. Madgarcar Sr. Biol. Veg. 3: 203-400.

Cruz, N.D. da, (1968). Citologia do gênero Manihot Adans. 1. Determinação do número de cromossomos em algumas espécies. Na. Acad. Brasil. Cien. 40: 91-95.

Graner, E.A. (1935). Contribuição para o estudo citológico da mandioca. Escola superior de agricultura Luiz de Queiroz, USP, Piracicaba. 28.

Herlan, J. (1961). Geographic origin of plants useful to agriculture, In AAAs Symposium on germplasm resources. AAAs, Washington, D.C.

Jennings, D.L. (1959). Manihot melanobasis, Mull Arg. A useful parent for cassava breeding. Euphytica 8: 157-162.

Jennings, D.L. (1963). Variation in pollen and ovule fertility in varieties of cassava and the effect of interspecific crossing on fertility. Euphytica 12: 69-76.

Lanjouw, J. (1939). Two interesting especies of Manihot L. from Surinam. Recueil des travaux Botaniques Néerlandais 36: 542-549.

Magoon, M.L., Joss, J.S., Vasudevan, K.N. (1968). Male sterile cassava. The Nucleus 11:1-6.

Magoon, M.L., Krishnan, R. and Vijaybai, K. (1969). Morphology of pachytene chromosomes and meoisis in manihot esculanta Crantz. Cytologia 34: 612-618.

Magoon, M.L., Krishnan, R. And Vijayabai, K. (1970). Cytogenetcs of the F. hybrid between cassava and ceara rubber and its back crosses. Genetica 41: 3-12.

Rogers, D.J. and Appan, S.G. (1973). Manihot, Manihotoides. Flora neotropica, monograph No 12, Hafner Press, New York.

Sohmer, S.H. (1968). Microsporogenesis in Manihot esculenta. Cytologia 33: 97-99.

Swaminathan, M.S., Magoon, M.L. and Mehra, K.L. (1954). A simple propionocarmine technique for plants with small chromosomes, Indian J. Genet. Pl. Breed. 14: 87-88.

(Received Dec 31, 1977)