African Crop Science Journal, Vol. 2, No. 2, pp. 169–171, 1994
Printed in Kenya.

1021-9730/94 $ 10.00 + 0.00

INTRA- AND INTERSPECIFIC HYBRIDIZATION IN THE GENUS 'CAPSICUM'

O.A. FALUSI and J.A. MORAKINYO
National Cereals and Research Institute,
P.M.B. 8, Bida, Niger State, Nigeria.

(*Received* 27 *December* 1993; *accepted* 14 *March* 1994)

ABSTRACT

Several crosses were made within and between *Capsicum annuum* L. and *C. frutescens* L., and intra- and inter-specific hybrids were produced. Five successful hybrids were obtained. Pollen viability was drastically reduced in the hybrids particularly in the inter-specific hybrids. It is suggested that there had been enough gene flow within and between the species under consideration to account for the occurrence of many strains of pepper in cultivation.

***Key Words*: *Capsicum annuum* L.; *C. frutescens* L.; intra- and inter-specific hybrids, pollen viability**

RÉSUMÉ

Plusieurs croisements inter et intra-spécifiques entre *Capiscum annuum* L et *C. frutescens* L. et leurs hybrides ont été produits. Cinq hybrides ont été sélectionnés avec succès. Il a été observé une réduction drastique de la viabilité du pollen des hybrides et plus spécialement de celui des hybrides inter spécifiques. Il a été conclu que le flow de gènes entre les deux espèces parentes et à lintérieur des espèces souches elles mêmes a été suffisant et pourrait expliquer l'apparition de plusieurs souches de culture de piment.

***Mots Clés: Capsicum annuum*; *C. frutescens* L., hybrides intra et inter-spécifiques, viabilité du pollen.**

INTRODUCTION

Peppers (*Capsicum* Spp.) belong to the family solanaceae and genus *Capsicum*, Linn. The genus consists of 20 to 30 wild species and five domesticated taxa, all of which originated from the New World (Mcleod *et al.*, 1982). These domesticated taxa include *Capsicum annuum*, *C. baccatum*, *C. frutescens C. chinense and C. pubescens*, out of which the two commonly recognized are *C. annuum* L. and *C. frutescens* L. (Heiser and Pickersgill, 1969).

Nwankiti (1981) carried out hybridization between a mild variety ("Tatase") and an extremely pungent variety ("Nsukka yellow" accession number OS/UN/60) of *Capsicum annuum* and found that the hybrid had lower fruit set than the parents. In an earlier work, Nwankiti (1976) indicated that most of the present day strains of *Capsicum* are likely to be of intra-specific hybrid origin. The aim of this study was therefore to carry out intra-and inter-specific hybridization and pollen viability studies in *Capsicum annuum* L. and *C. frutescens* L. collections so as to determine

the case of gene exchange and give an insight to the breeding behaviour and evolution within the genus.

MATERIALS AND METHODS

The experimental materials were obtained from a local market in Ilorin, Nigeria. Their identities are summarised in Table 1. Seeds were extracted from each variety, air dried and sown in different seed trays. The seedlings were later transferred into plastic pails in four replicates. At maturity, the four varieties were crossed in all possible combinations. This was done by carefully opening and emasculating flower buds one day before anthesis. These flower buds were recognized by their characteristic size and tension along the seems of the petals.

At that stage, the anthers had not dehisced. Pollen grains from desired sources were then dusted on the stigma of the emasculated flower, tagged and bagged.

Parental and F_1 seedlings were raised to maturity in plastic pails. Pollen grain viability was estimated by staining in cotton blue-in-lactophenol and pollen diameter was measured at x 400 microscope magnification. Pollen grains that were deeply stained and were spherical in shape were considered viable.

RESULTS AND DISCUSSION

The result of the intra-specific and inter-specific crosses are summarized in Table 2. Percentage successes observed in the crosses were low and comparable in both intra - and interspecific crosses. The low fertilization success coupled with the poor viability of some of the F_1 seeds (Table 2) indicate the difficultities of crossing within and between the species. This corroborates the report of Heiser and Smith (1953).

The poor viability observed in the F_1 seeds might be due to abnormality in chromosome complement. The data, however, do not provide enough evidence to conclude that the collections are not biologically related or that they are reproductively isolated. On the other hand, the five successful crosses recorded coupled with F_1 viability and fertility in some of them show that hybridization is possible in nature and is most probably responsible for the existence of many varieties of peppers that are in cultivation.

Pollen viability was high in the parent plants ranging between 64% and 87% (Table 3). This

TABLE 1. Identity of the pepper plants that were used in this study

S/No.	Code number	Local name	Botanical name	Description
1	TA1	"Tatase"	*Capsicum annum var. grossum L.* Sendt.	Has very large bell-shaped fruits with mild taste, plants with one pedicel per node.
2.	TA2	"Tatase"	*Capsicum annum var. grossum L.* Sendt.	Has large bell-shaped fruits with mild taste. Plants with one pedicel per node.
3.	TA3	"Tatase"	*Capsicum annum var. grossum L.* Sendt.	Has medium size bell-shaped fruits with mild taste. Plants with one pedicel per node.
4.	RO1	"Atarodo"	*Capsicum annum var. abbreviatum* Fingerh.	Has small round wrinkled fruits with hot taste. Plant has one pedicel per node.
5.	RO2	"Atarodo"	*Capsicum annum var. abbreviatum* Fingerh.	Has small oblong and wrinkled fruits with hot taste. Plants with one pedicel per node.
6.	SO1	"Atasombo"	*Capsicum annum var. accuminatum* Fingerh.	Has long pointed fruits with hot taste Plants with one pedicel per node.
7.	WE1	"Atawewe"	*Capsicum frutescens var. baccatum* L.	Has small pointed fruits with very hot tase. Plants with 2–4 pedicels per node.

TABLE 2. Pollination success and germination percentage of intra- and inter-specific hybrids of *Capsicum annum* and *C. frutescens*

Cross combination	No. of flowers	Pollination success (%)	Germination of F_1 seeds (%)
Intra-specific:			
TA2 x SO1	30	10.0	20
SO1 x TA2	35	5.7	0
SO1 x RO2	35	6.5	20
RO2 x SO1	30	0	0
SO1 x TA3	32	9.0	15
TA3 x SO1	40	0	0
TA1 x SO1	45	0	0
Inter-specific:			
TA2 x WE1	35	11.4	5
WE1 x TA1	40	0	0
WE2 x RO2	35	8.5	25

implies that microsporogenesis has probably been stabilized in them over time by the screening out of meiotic irregularities as reported in advanced generations of induced autotetraploid *Capsicum* by Singh and Roy (1987) and in intra-specific hybrids of *Capsicum annuum* by Nwankiti (1981). On the other hand, pollen viability was low in all the hybrids except in SO1 x TA3 where 65.2% was recorded and variation in pollen size was higher as shown by the coefficient of variation. Pollen grain in the hybrids except those of SO1 x TA3 were deformed and shrunken. Pollen viability in the interspecific hybrids WE1 x RO2 and TA2 x WE1, were particularly low at 39.9% and 35.79%, respectively.

The percentage pollen viability is inversely proportional to the effectiveness of the barrier to gene exchange. This barrier is the impaired sporogenesis in the hybrids. As was expected, the barrier was more effective between species than within species. This explains why the inter-specific hybrids recorded the lowest pollen grain viability. Although pollen grain viability was also low in the intra-specific hybrids compared with parents, it can be said that there had been enough gene flow within and between the species under consideration to account for the occurrence of many strains of pepper as indicated by Nwankiti (1979).

REFERENCES

Heiser, C.B. and Smith, P.G. 1953. The cultivated *Capsicum* peppers. *Economic Botany* 1: 214–227.

Heiser, C.B. and Pickersgill, B. 1969. Names for the cultivated *Capsicum* species (Solanaceae). *Taxonomy* 18: 277–283.

Mcleod, M.J., Sheidon, I.G. and Eshbaugh, W.H. 1982. Early evolution of chilli peppers. *Economic Botany* 36(4): 361–368.

Nwankiti, O.C. 1976. Cytogenetics of some Nigerian peppers. Genus *Capsicum* L. cytology aspects. *Nigerian Journal of Science* 10: 47–60.

Nwankiti, O.C. 1981. Sterility in intra-specific hybrids of *Capsicum*. *Indian Journal of Genetics* 41: 200–204.

Singh, R.N. and Roy, S.K. 1987. Meiotic abnormalities and pollen fertility in C_2 and C_3 generations of autotetraploids *Capsicum*. *Genetica Agrarian* 41: 337–348.

TABLE 3. Pollen viabiltiy and size in parents and hybrids of *Capsicum annum* and *C. frutescens*

Plant	Pollen viability (%)	N	Pollen size x ± sd	CV (%)
TA1	85.6	932	28.2 ± 2.85	10.12
TA2	87.0	866	28.2 ± 2.11	7.48
TA3	71.2	960	26.8 ± 2.51	9.44
RO1	65.0	727	26.6 ± 2.49	9.36
RO2	68.3	753	26.2 ± 2.51	9.58
SO1	64.0	825	29.5 ± 2.26	7.66
WE1	84.0	769	29.3 ± 2.40	8.18
WE1 x RO2	39.9	703	26.3 ± 4.01	15.20
TA2 x SO1	50.2	920	21.8 ± 2.51	11.50
SO1 x RO2	42.0	702	25.0 ± 4.13	16.50
TA2 x WE1	35.7	600	21.9 ± 4.38	20.00
SO1 x TA3	65.2	725	25.9 ± 2.40	9.26