AMADEPA

Association Martiniquaise pour le Développement des Plantes Alimentaires

29ème
CONGRES ANNUEL
ANNUAL MEETING
REUNION ANNUAL

Agriculture Intensive dans les Iles de la Caraibe : enjeux, contraintes et perspectives
Intensive Agriculture in the Caribbean Islands : stakes, constraints and prospects
Agricultura Intensiva en la Islas del Caribe : posturas, coacciones y perspectivas

DONNÉES SUR LA REPRODUCTION SEXUÉE ET LES POSSIBILITÉS DE SÉLECTION CRÉATRICE CHEZ *D. ALATA* et D. *CAYENENSIS-ROTUNDATA*.

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RÉSUMÉ : Après une brève description des inflorescences, nous passerons en revue les différentes limites que nous avons pu recenser à la recombinaison sexuée. Enfin, nous envisagerons les solutions et les perspectives en matière de sélection créatrice.

ABSTRACT

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TITLE : DATA ON THE SEXUAL REPRODUCTION AND THE POSSIBILITIES OF BREEDING NEW VARIETIES IN *D.ALATA* AND D.
CAYENENSIS-ROTUNDATA.

ABSTRACT : After a brief description of the inflorescence, the different limitations found in sexual recombination will be reviewed. Finally, the solutions and prospects in the field of breeding will be considered.

DONNÉES SUR LA REPRODUCTION SEXUÉE ET LES POSSIBILITÉS DE SELECTION CRÉATRICE CHEZ *D. ALATA* ET D. *CAYENENSIS-ROTUNDATA.*

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INTRODUCTION

Plants the product of which is not the flower or the fruit but a part not directly linked to their sexual part, are less easily improved, from the fact that the organ used is different from the one acting in the breeding process. Moreover the prevalence of vegetative part in the value of the crop seems to reduce the developpement, even favours the deficiencies of the sexual parts.

Tough the last years have raised the hope of improving genetically the crops through somatic fusion, conventional breeding with sexual organs remains a necessary basis for a foreseenable improvement of most crops. So is with the yam, in spite of the recent advances in protoplast obtention and fusion resulting from the EEC project conducted by MANTELL and his team (1992) : the feasibility of gene transfert by protoplast fusion as well as by biobalistic, appears a valuable prospect at a fundamental research level, not at the practical breeding level up to now.

Wether the long past of vegetative propagation of the yam, has determined the problems of its sexual reproduction, or not, the precise knowledge of each level will open the ways for their solution.

Among the several species of yam cultivated in the W.I, we shall focus on two, ***D. alata*** and the species complex ***D. Cayenensis-Rotundata***, as the more important ones, and also because ***D. trifida*** (DEGRAS, 1978) and ***D. bulbifera*** have less sexual problems. As for

D.esculenta, its flowering is rather exceptional, a doubt even remaining on the observation of a single female flowering in its native country, Asia.

After short recalling of the characteristics of the flowers, we shall examine the successive barriers to overcome before arriving at seed germination, then our breeding objectives will be presented and the ways of building new varieties will be indicated.

FROM THE FLOWER TO THE SEED

The flower :

The figure 1 gives the main traits of the male and female flowers, the yam being dioic (with a low frequency of monoic).
To be noted is the small size of the flower, and the fact that at anthesis the female flowers of ***D.Cayenensis-Rotundata*** open their pieces only 2/10 - 3/10 of mm, while the flowers of ***D. alata*** become widely open. The yams flower only once in a year when they flower.

Barriers in the sexual reproduction

They can be found at the following stages, in :

- the opening of the flowers (good or bad synchronization)
- the quality of the gametes
- the growth of the pollen tube
- the development of the embryon and/or the endosperm
- the seed setting and germination.

a) The problem of synchronization can be exemplified by the observation done among our collection of clones of ***D.Cayenensis-Rotundata*** last year (figure 2). If for this specific complex, at least to some extent, it can be tried some staggered plantation, in view of a convergent switch of the male and female time of anthesis, this solution is less valuable for ***D. alata.*** The flowering of this species seems more linked to the annual variation of the photoperiod.

b) The quality of the gametes, as defined by the viability of the pollen and its aptitude to germinate either in vitro or/and on the stigma (Table 1). Wide variation are observed within species. It should be defined also refering to the female gamete. But this is uneasy, considering the difficult access to the ovary and the lack of simple standards.

c) The growth of the pollen tube can be observed. Its stopping at various level (style, ovary, ovule) is possible.
One case of sticking (figure 3) in a tentative interspecific crossing is a figure of what could happen within the species having several level of ploidy like ***D. alata*** or the complex ***D.Cayenensis-Rotundata.***

The level of ploidy appears a serious factor of sterility at least in ***D. alata***, (ABRAHAM and NAIR, 1991). A recent investigation among hexaploid females in Guadeloupe shows no more than 2% seeds with normal size (figure 4) and only 1/10 of them in total presented an embryo. Conversely, reasonable level of seed set is obtained from tetraploid female, a result also reached in India.

d) Lack of seed germination. Though a definitive evaluation is still wanted on this point, no germination is known from hexaploid. Questionable seedlings only have been saved through in vitro culture in Guadeloupe. Chlorophyllian abnormalities in some progenies from uncontrolled pollination may represent the visible part of a wider spectrum resulting also in letal issues from genetically incompatible backgrounds.

BREEDING OBJECTIVES AT INRA

In both species ***D. alata*** and ***D.Cayenensis-Rotundata***, we aim at a mechanizable croping system. It means no-staking, tuber weighing no more than 2 kilogrammes and exhibiting a regular shape, a high culinary grade.

In the case of ***D. Cayenensis-Rotundata*** no staking gives rise to higher fungal pressure (***Rhizoctonia solani, Sclerotium rolfsii***). In the case of ***D. alata***, anthracnose (***Colletotrichum gloesporioides***) appears more or less endemic among high quality cultivars if it is possible to grow a number of tolerant cultivars of medium or low culinary quality.

Breeding for genetic resistance to disease is thus at high priority in combination with high culinary grade.

TOWARDS SOLUTIONS AND PROSPECTS

They rest on the genetic resources and the methodologies available.

1. The genetic resources

Their value are not only from their direct agronomical interest, but over all from their flowering ability and their combining aptitudes, two factors wich cover many problems as has been seen.

D.Cayenensis-Rotundata

Our collection hold about forty clones among which a half flowers regulary. Their diversity could surely be extended refering to the variability known in West Africa (HAMON 1987, ZOUNDJIHEKPON et al, 1990). Some relatively original clones could be held however, considering the oldness of the introduction of the specific complex in the West Indies where its primary description led to a confusion about its true origin. Why not a genetic drift or an area of secundary diversification there ? A study is needed. HAMON et al (1992) admit that barriers for the intrafecundity are linked to the structure of the gene pool. We tried to evaluate the variability within our flowering collection regarding the fungus ***Rhizoctonia solani***.

D. alata

We have 90 clones, among which about thirty are flowering more or less regularity. Considering the morphological and carylogical

description published by some research teams of India, a country closed to the area of primary diversification of the species, our collection seems to cover a good part of the variability described. Studies are in progress among it for an approach of its structure and the explanation of the barriers of interfecondity. The species can be also understood as a genetic pool.

2. The methods for breeding new varieties. The case of ***D.alata.***

It has been established that the tetraploid could be the basis of the breeding work. But tetraploid females are among the most susceptible to anthracnose. Hopefully some tetraploid males are more or less tolerant. A screening among their progenies could bring interesting steps in the improvment of the species . Another path is the tentavive crossing of hexaploid females, that exhibit bad-shaped and rough-tasted tuber, with improving male, and clonal selection among their possible progenies. A set of hexaploid compatible females could be thus determined.

CONCLUSIONS

A sufficient knowledge is available to enter in a rational approach of the breeding of the yams, enven if more remains to be understood and controlled in their floral biology. New cultivars can be expected with some improved adaptation to the field and the market. However the final success for the yam industry depends from a steady institutional research effort and a better organization of the producers.