THE 9 th MEETING OF EUCARPIA,

MAIZE AND SORGHUM SECTION

USSR, Krasnodar

August 7 - 13, 1.977

ALLOTAXIS.- "DECUSATED" AND "GENOGEMINIC", TWO NEW CHARACTERS TO BREED PROLIFIC HYBRIDS".

By, Blanco M. ; Alvarez A. ; Bosch L. ; and Blanco J.L.

Departamento de Investigaciones Antropológicas y Genéticas
(C.S.I.C.)

ALLOTAXIS.- "DECUSATED" AND "GENOGEMINIC", TWO NEW CHARACTERS TO BREED PROLIFIC HYBRIDS".

By, Blanco M. ; Alvarez A. ; Bosch L. ; and Blanco J.L.

In 1.967, Blanco et al. reported the presence of several allotactic characters in one maize stock. Such allotactic variations affected the whole organography of the sporophyte, from seeds to stalks, leaves flowers, etc..

Throungh selection, decusated and genogeminic were segregated in different sublines.

Decusated character consist in duplication of leaves and ears per nodes: decusated plants have opposite leaves and ears. The leaves are in two crossed planes: the two leaves and ears of one node are in one direction while the leaves and ears of the two inmediate nodes are in cross directions.

In the process of isolation of decusated, it was segregated one subline in which the plants are "distic opposite": with two leaves and ears per node but all them in the same plane.

foto 1 = Decusated

foto 2 = "Distic - opposite"

Decusated character was introduced into seven different genetic backgrounds of inbred lines of two different groups: flint and dented.

In segregating populations of these stocks, the decusated plants, compared with their normal sister plants, had greater total leaf surface. The proportion in which decusated character increased the whole leaves surface of the plants, in relation to corresponding normal sister plants, was significantly different from one to other genetical backgrounds.

The smaller increase was 16 % while the greater increase was 114 % over the normal sister plants of the same genetical background.

Decusated character also affects other parts of the plant.

a) Reduces the surface of each leaf from 7'5 % to 23 %
" " length of the leaf from 1 % to 16 %
" " anchoria wide of the leaf from 2 % to 23 %
" " length of internodes from 2 % to 19 %
" " total height of the plant from 5 % to 22 %

b) duplicate the number of leaves.

Increases the number of ears from 17 % to 87 % and also increases very much the amount of pollen, because increases the number of branches of the tassel, the number of flowers and the number of anthers.

The incidence of Ustilago and Helminthosporium is higher in the decusated than in the normal sister plants.

Decusated does not looks to be the same character reported by Walden and Greyson with the name of ABPHYL. This one has leaves very narrow, while decusated character reduces the wide of the leaves, as mention before, but not so much as ABPHYL.

We are studying the genetics of this character and introducing it in several inbred lines to compare normal hybrids with their corresponding decusated versions.

Until now, we only know that this character is

a) Multifactorial

b) With some genes dominant and with some other recesive.

c) The frecuency of segregation is influenced by the genetical background and by cytoplasmic or maternal factors; for example:

Decusated plant were segregated in the 60'90 % in the progeny of one cross, while in the reciprocal cross progeny were segregated in the 23'13 %, only.

The diference being significative at the probability level of one in one thousand.

We suspect that the greater susceptibilities to Ustilago and Helminthosporium of decusated plants are the consequence of some change in the normal metabolism or in the translocation of sugars; for example : that the greater proportion of the surface of the leaves produces acumulation of metabolic substance in the leaves and stalk.

The incidences os Ustilago and Helminthosporium are different betwen decusated plants of different backgrounds.

We hope to be able to break such correlation and to adapt this character to the backgrounds of different stocks.

GENOGEMINIC.

This character is another one segregated from the original allotactic stocks reported in 1.967 by Blanco et al.

Genogeminic consist in embryos with more than one plumule. As a consequence of this, from each embryo germinate, at the same time, several twin plants: from two to five.

The genogeminic embryos looks different and biger tham the normal one.

foto 1 normal

" 2 } different shapes of genogeminic embryos
" 4 }

The twin plants born from the same embryos not ever are of the same phenotype; sometines can be identified as being of quite different genotypes.

The genogeminic seed character is quite different from the "two embryos seeds", several times reported (by Randolf L.F. in 1.936 and recently by Pesev N. and Petrovic, 1.976).

In the genogeminic seeds, there is only one embryo. In the other character, the "two embryos seeds" are the consequence of two seeds joined by the endospern.

foto 5 seed with two embryos

foto 6 seed with the genogeminic embryo

Through selection in one of the stocks the frecuency of geno-geminic seeds per ear arrived to 77 %.

We are studing the genetics of this character and introduccing it into several inbred lines with two purposes:

1st. To obtain genogeminic hybrid seed, to reduce the amount of seeds necessary per hectar.

2nd. To increase the proportion of oil and protein of the grain, and to insprove the quality of such protein.

Bibliography

1.- Blanco M.; Lorenzo - Andreu, A. ; Blanco, J.L.

1.967 Modificaciones filotáxicas en maíz: distiquia versus dispersión, espirodistiquia (dextro- levo) y decusación. Modificaciones semejantes en otras partes de las plantas. Gérmenes y embriones múltiples en maíces dísticos, espirodísticos y decusados . IV Jornadas de Genética Luso-Españolas. Programa y Resúmenes de las Comunicaciones. Centro de Biología, Instituto Gulbenkian de Ciencias, Oeiras, Portugal, pp 12 y 41 - 44.

2.- Blanco, M. ; Lorenzo-Andreu, A. ; and Blanco, J.L.

1.968 Modified phyllotaxis in maize. Dispersion, spirodistischy, decussation and similar alterations in other parts of maize plants. Multiple germination in distichous, spirodistichous an decussate plants . Maize Genetics Coop. News Letter 42: 35 - 36.

3.- Blanco, M. ; Lorenzo-Andreu, A. ; and Blanco, J.L.

1.968 Modificaciones filotáxicas en maíz: dispersión, espirodistiquia y decusación. Modificaciones similares en otras partes de la planta. Germinación múltiple en maíces dísticos y decusados. Portug. Acta Biolog. 10: 289 - 300.

4.- Blanco, M. ; Lorenzo- Andreu, A. ; and Blanco, J.L.

1.969 Modificaciones filotáxicas en maíz II. Anales Aula Dei 10: 716 - 723.

5.- Blanco, M. ; Lorenzo - Andreu, A. ; Blanco, J.L. ; and Alvarez, A.

1.975 "Allotaxis in maize", Maize Genetics Coop. News Letter 49: 33 - 34.

6.- Blanco, M. ; Lorenzo- Andreu, A. ; Blanco, J.L., and Alvarez, A.

1.975 Modificaciones alotácticas en maíz III. Algunas determinaciones biométricas. Anales Aula Dei 13: 98 - 110

7.- Greyson, R.I., and Walden, D.B.

1.972 The Abphyl syndrome in "Zea mays" L. Arrangement, number and size of leaves. Am. J. Botany 59: 466 - 472.