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SELECTION FOR MONOCEPHALOUS AND RECESSIVE BRANCHING IN AN ORNAMENTAL SUNFLOWER POPULATION (*Helianthus annuus* L.)

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Abstract

The objetive of this work was to obtain an improved population of sunflower with plants possessing recessive branching and/or monocephaly.

Plants selected at random from this population were selfed and simultaneously were crossed to two cytoplasmic male sterile inbred lines.

Three hundred and twenty seven S1 families were grown in the field and twenty two of them that showed 81 % or more unbranches plants were selected.

Fifty three percent of the progeny of the selected families S1 was branched (most with recessive branching) and 47 % was unbranched while in the self-pollinated plants (S0) of the original population, 96 % of the phenotypes were branched (dominant and recessive).

Introduction

The inheritance of character for branching in sunflower is controlled by dominant and recesive genes.

In 1960, Putt determined that branching character was controlled by a recessive gen (b). Hockett and Knowles (1970) found four different genes, two dominant and two recessive, that govern the expression of the branched phenotype. They were simbolized as Br2, Br3 (dominant) and b2, b3 (recessive).

The ornamental population used in this work is composed of monocephalic and branched plants with or without a central capitulum larger than secondary heads. The objetive of this work was to obtain a recessive policephalic and/or monocephalic population, that could be used to obtain branched and/or monocephalic restorer lines whose origin is completely different to the pure lines used in commercial hybrids. This certainly poses great expectances in their combining ability.

Materials and Methods

In the present work two cms monocephalic inbred lines and S_0 plants taken at random from the ornamental population were used.

To fix the characters on plants taken at random, they were selfpollinated and at the same time were crossed with cms inbred lines. This last procedure was carried out to detect dominant and recessive genes for branching and/or monocephaly in selfpollinated plants. Hybrids and selfpollinated were identified for each crossing. The presence of dominant genes was suggested when the descendant plants studied were branched and the presence of recessive genes for branching or genes for monocephaly when monocephalic plants were present.

The materials were conducted as follow:

Cycle 1988/89:

Basic material was obtained from 180 half sib families. From each family, two or three plants were self-pollinated and crossed with two male steryle lines, one of which was of a longer cycle (pure line 19 A) than the other (pure line 55 A).

All the 327 crossing were divided in groups according to the following characters: branching (with a predominant central capitulum,CC, or without a predominant central capitulum,WC,) or monocephaly of the ornamental plants and also according to which male sterile line was used.(Table 1)

Cycle 1989/90:

The Hibrid seeds were sown one month before selfpollinated seeds to be able to see the expression of the character in hybrids and to work afterwards on the families S_1 selected through the crossings.

To determine whether male steryle lines 19 A and 55 A modified the proportion of the branching or monocephalic character in the crossings, Chi Square Test for independence in contingency tables was applied.

The selected families S_1 were manually crossed among themselves with a pollen mixture to diminish dominant gene frequency for branching. Some of these families were self-pollinated(10) and others sib crossed(8) to fix genotype.

To increase genetic variability in the population,S1, families that present betwen 48 and 78% monocephalic plants in the crossings were selected; 37 families from selfpollination and 8 from sibbing.

Cycle 1990/91:

Progeny from the selected families was sown in an isolated plot where free intercrossing was posible. And also, those families which showed monocephalic plants were selfpollinated and sibbed to fix this character.

The percentage of branched and monocephalic phenotypes were determined.

Three or four capitulums per family were harvested and oil content was determined by NMR analyser.

Table 1. Classification and number of crossings.

GROUP	ORNAMENTAL PLANT	X LINE	Nº of CROSSINGS
1	Branched ,CC,	19 A	107
2	Branched ,WC,	19 A	111
3	Monocephalic	19 A	6
4	Branched ,CC,	55 A	52
5	Branched ,WC,	55 A	41
6	Monocephalic	55 A	6
7*			4
TOTAL			327

* Group 7: Comprises 4 crossings, in two of which there is no information registered on the branching character of the ornamemtal plants and of the other two crossings there is no information neither on the branching character of the ornamental plants nor on the male sterile line with which they were crossed.

Results and discussion

From the original population, 96 % of the selfpollinated plants used in the crossings were branched and 4 % were monocephalic. (Table 2)

Twenty two families S_1 with 81 % or more monocephalic plants in their crossings were selected. This percentage was chosen as a basis because there were few crossings with 100 % of monocephalic plants. After selection and controlled crossings were carried out,

Table 2. Number of crossings carried out with pure lines 19 A and 55 A classified by the type of branching or monocephaly and the phenotypical frequencies of the character.

PURE MALESTERILE LINE	Nº of CROSSINGS				
	BRANCHED CC	BRANCHED SC	MONOCEPHALIC M	TOTAL	%
19 A	107	111	6	224	68.9
55 A	52**	41**	6	99/101 **	31.1
TOTAL	159	152	12	323/325	
PHENOTYPIC FRECUENCY	49.2	47.1	3.7	327*	100

* Total of plants self-pollinated and crossed with malesterile lines was 327. From 2 of the crossingns branched character of ornamental plants and of the malesterile line used is unknown.
**Two crossings were not added in the phenotypical frequency since records for branching were lacking.

Table 3. Number of plants, totals and phenotypical frequencies of the select families S1 descendants.

GROUP*	NUMBER of PLANTS		TOTAL
	MONOCEPHALIC	BRANCHED	
1	53	129	182
2	27	23	50
3	26	44	70
4	24	60	84
5	22	21	43
6	88	6	94
7	12	3	15
TOTAL	252	286	538
PHENOTYPICAL FREQUENCY	46.8	53.2	100

progenies of the selected families had lower percentage of branched phenotypes (53 %) and a higher percentage of unbranched phenotypes (47 %). (Table 3)

Ninety-six percent of branched plants in the original population, probably had a high percentage of dominant genes for branching, while 53 % of branched plants from the selected progenies would be composed by a high percentage of branched plants governed by recessive genes.

Thirty-nine percent of F1 crossings belonged to the monocephalic phenotype and sixty-one percent to the branched one.

A total of 10291 plants were analized and from the analysis of Chi-Square test for independence betwen groups 1 and 4; 2 and 5; 3 and 6 (table 1) it was inferred that lines 19 A and 55 A did not modify ($P > 0.05$) the proportions of the character : branched or monocephalic in the progeny obtained from crossings.

Oil mean percentage of the progenies from the selected families S_1 was 37 percent (range 26,3-48,2), its variance 23,8 and standard deviation 4,9. As heredability for this character is quite high (Fick,1975) it is thought that it would not be difficult to reach a higher mean than that used as a basis for marketing in Argentina (44 %)

Conclusion

The original percentage of 96 % of branched plants (mostly dominant) was decreased to 53 % (mostly recessive branching). Monocephalic percentage of plants was increased from 4 % to 47 %.

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