OCCURRENCE OF STERILITY AND REDUCED FERTILITY IN F_1 AND BC_1F_1 HYBRIDS BETWEEN PERENNIAL WILD SPECIES AND CULTIVATED SUNFLOWER

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Helianthus genus is a polyploid complex consisting of diploid and hexaploid species with the basic chromosome number of n=17 (Schilling and Heiser, 1981). The genus comprises annual (diploid) and perennial species (diploid, tetraploid, and hexaploid) (Heiser, 1969).

It has been found that the annual wild species are genetically closer to the cultivated sunflower than the perennial species (Georgieva, 1974). Studying possibilities of crossing annual wild species between themselves and with the cultivated sunflower, Chandler (1979) found a genetic distance among the species of the section Annui by testing their crossability, pollen fertility of F_1 hybrids, and analysis of meiosis of the species and the F_1 hybrids. The objective of this study was to conduct a similar analysis on the perennial species which are potential sources of resistance to pathogens.

It is difficult and often impossible to cross the cultivated sunflower with perennial species (of various ploidy levels) by conventional hybridization methods, Having conducted a number of crossings with different populations of perennial species, F_1 hybrids with 15 species and BC_1F_1 hybrids with eight species were produced.

Sterility in BC_1F_1 hybrids was encountered in this round of interspecific hybridization. Its presence was established by visual inspections in field and microscopic checks of anthers. The percentages of sterility in F_1 and BC_1F_1 hybrids ranged from 0 to 39.3% and from 31.3% to 100%, respectively (Table 1).

Another problem was a reduced pollen fertility in interspecific hybrids. Pollen fertility was assessed in the wild species, F_1, and BC_1 hybrids after the method of Alexander (1969). The tested species varied in this trait; also, all F_1 and BC_1F_1 hybrids had lower pollen fertility in relation to their parents (Table 2).

TABLE 1 STERILITY IN F_1 AND BC_1F_1 INTERSPECIFIC HYBRIDS

SPECIES	CHROMOSOME NO.	F_1 HYBRIDS					BC_1F_1 HYBRIDS				
		NO. OF HYBRID COMBIN.	TOTAL NO.OF PLANTS	STERILE	FERTILE	% OF STERI-LITY	NO.OF HYBRID COMBIN.	TOTAL NO.OF PLANTS	STERILE	FERTILE	% OF STERI-LITY
H. RIGIDUS	n=51	10	105	39	66	37,1	91	292	179	113	61,30
H. TUBEROSUS	n=51	5	90	23	67	25,6	19	56	50	6	89,28
H. RESINOSUS	n=51	6	89	4	85	4,5	3	3	2	1	66,66
H. EGGERTII	n=51	1	5	0	5	0	6	29	10	19	34,48
H. LAEVIGATUS	n=34	7	51	12	39	23,5	55	136	93	43	68,38
H. STRUMOSUS	n=34;51	2	13	0	13	0	2	3	3	0	100,00
H. HIRSUTUS	n=34	8	66	24	42	36,4	9	10	5	5	50,00
H. DECAPETALUS	n=17;34	3	28	11	17	39,3	1	1	1	0	100,00
H. DIVARICATUS	n=17	1	1	0	1	0	-	-	-	-	-
H. NUTTALLII	n=17	1	9	0	9	0	13	19	6	13	32,57
H. OCCIDENTALIS	n=17	1	8	0	8	0	1	1	0	1	100,00
H. MAXIMILIANI	n=17	2	10	0	10	0	-	-	-	-	-
H. SMITHI	n=17	4	27	0	27	0	5	6	4	2	66,66
H. MOLLIS	n=17	2	10	0	10	25,0	-	-	-	-	-
H. SALICIFOLIUS	n=17	1	7	0	7	0	-	-	-	-	-

TABLE 2 POLLEN FERTILITY IN PERENNIAL SPECIES, F_1 AND BC_1F_1 INTERSPECIFIC HYBRIDS

SPECIES	CHROMOSOME NO.	NO.OF TESTED POPUL.	% POLLEN FERTILITY	NO.OF TESTED F_1 HYBRIDS	% POLLEN FERTILITY	NO.OF TESTED BC_1F_1 HYBRIDS	% POLLEN FERTILITY
H. RIGIDUS	n=51	4	61.3-98.9	5	41.7-55-4	18	2.7-72.6
H. TUBEROSUS	n=52	19	46.6-98.9	4	26.6-72.6	-	-
H. RESINOSUS	n=51	2	98.6-98.7	4	64.9-80.2	-	-
H. EGGERTII	n=51	1	98.5	1	50.8	4	10.4-84.9
H. LAEVIGATUS	n=51	5	96.0-99.0	5	61.1-69.9	7	9.6-84.9
H. STRUMOSUS	n=34;51	9	76.8-98.6	2	42.6-62.9	2	0
H. HIRSUTUS	n=34	2	36.7-99.0	7	15.8-20.2	1	27.3
H. DECAPETALUS	n=17;34	1	97.9	4	15.2-22.9	1	0
H. DIVARICATUS	n=17	6	80.6-99.4	1	10.4	-	-
H. NUTTALLII	n=17	3	70.2-96.6	1	40.4	1	4.9
H. OCIDENTALIS	n=17	3	74.9-97.7	1	9.6	1	0
H. MAXIMILIANI	n=17	12	74.9-96.0	2	6.1-29.5	-	-
H. SMITHI	n=17	3	77.4-98.6	2	3.7-88.7	-	-
H. MOLLIS	n=17	3	77.4-98.6	2	3.7-88.7	-	-
H. SALICIFOLIUS	n=17	1	92.7	1	50.79	-	-

To explain the occurrence of sterility and reduced pollen fertility, the meiosis of the wild species, F_1, and BC_1F_1 hybrids was analysed by the acetocarmine method. The analysis included diakinesis, metaphase I and II, anaphase I and II, telophase II, and tetrads. The obtained results were presented as the percentage of deviation from the normal meiotic cycle.