A COLLECTION OF WILD SUNFLOWER SPECIES AND ITS USE IN A BREEDING PROGRAM

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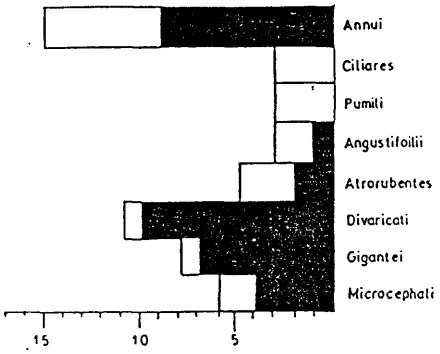
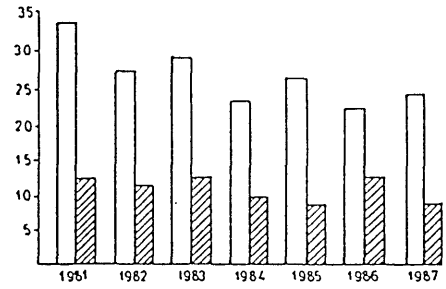
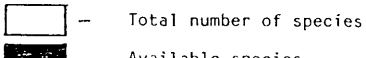
Helianthus genus (Compositae) includes 50 North American Sunflower species (Schilling and Heiser, 1981). A high genetic variability of the genus is tried to be used by introducing methods of interspecific hybridization and sunflower breeding.
The objective of this paper is to expose basic problems in the maintenance of a collection of wild sunflower species and in their use in breeding programs. The presented results are a portion of a seven-year investigation (1981-1987), which covers several directions of use of wild species (sources of disease resistance, sources of CMS and Rf genes, new ideotypes, etc.).
The Novi Sad collection of wild sunflower includes about 700 entries. Histogram 1 shows the available species given in series, according to the well-known systematization of Helianthus genus. Histogram 2 shows the available species in the period 1981-1987.

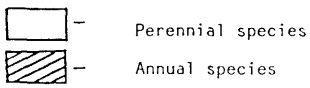
His. 1: NUMBER OF AVAILABLE SPECIES IN RELATION TO THE TOTAL NUMBER



His. 2: NUMBER OF ANNUAL AND PERENNIAL SPECIES IN THE PERIOD 1981/1987







The species from Ciliares series have not been collected (His. 1)since they are known as noxious weeds. Only one species from Pumuli series has been collected but it has been lost in a couple of years.
A certain number of species (different populations) has been grown each year so that the entire collection has been covered in the period of seven years (most collection numbers) (His. 2).
The maintenance of the collection, i.e., the production of seed poses a serious problem. Most wild species have low autofertility and some are autosterile. Seed germination is low. Some species cannot complete the vegetation period in the offered climatic conditions. Seed production figures for the seven-year period are given in Tables 1a and 1b.

A crossing program included all species grown in the period from 1981 to 1987 (the species were represented by different populations). The success of crossing and the list of species which were included in the process of breeding and selection are given in Tables 2a and 2b.

The success of crossing was low, indicating the following problems of exploitation of the high variability present in Helianthus genus:
- it is difficult to cross wild species and the cultivated sunflower. Conventional cross methods cannot be used with some species;
- there occur embryo abortiveness and reduced fertility or complete sterility in F-1 and later generations;
- a complete autosterility in F-1 generation precluding the production of F-2 generation.

CONCLUSION

The further collecting of wild sunflower species should include the variability within series or species.
Autosterility should be overcome by suitable methods.
Species estimated as prospective sources of disease resistance, sources of CMS and Rf genes, and important agronomic traits should be grown.
The causes of reduced fertility and autosterility should be determined by cytogenetic studies.
Up-to-date methods of "in vitro" growing should be put in practice (embryo culture, anther culture, protoplast fusion).

Tab. 1a: Seed production of annual species

Species	Total No. of population	No.of populat. grown	No.of populat. with produc. seed
H. ANNUUS	257	156	95
H. ANOMALUS	4	4	1
H. ARGOPHYLLUS	21	10	10
H. DEBILIS	24	23	20
H. DESERTICOLA	7	7	-
H. EXILIS	3	3	1
H. NEGLECTUS	9	9	3
H. NIVEUS	9	9	1
H. PARADOXUS	2	2	1
H. PETIOLARIS	46	44	14
H. PRAECOX	30	27	20

Tab. 1b: Seed production of perennial species

Species	Total No. of population	No.of populat. grown	No.of populat. with produc. seed
H. PUMILUS	2	1	1
H. ANGUSTIFOLIUS	13	1	-
H. FLORIDANUS	2	2	-
H. ATRORUBENS	12	7	5
H. CARNOSUS	1	1	-
H. HETEROPHYLLUS	2	-	-
H. RADULA	9	2	-
H. SILPHIOIDES	0	1	1
H. DECAPETALUS	1	1	1
H. MULTIFLORUS	1	1	1
H. DIVARICATUS	14	11	5
H. EGGERTII	2	2	1
H. HIRSUTUS	2	1	1
H. MOLLIS	8	8	8
H. OCCIDENTALIS	12	6	4
H. RIGIDUS	25	16	5
H. STRUMOSUS	28	21	8
H. TUBEROSUS	39	31	23
H. GIGANTEUS	19	18	15
H. GROSSESERRATUS	17	16	13
H. MAXIMILIANI	22	22	21
H. NUTTALLII	7	7	4
H. RESINOSUS	3	2	2
H. SALICIFOLIUS	1	1	1
H. GLAUCOPHYLLUS	1	1	1
H. LAEVIGATUS	12	10	5
H. MICROCEPHALUS	7	2	0
H. SMITHI	3	2	2

Tab. 2a: Success of crossing annual species

Species	No.of hybrid combin. in F_1	No.of hybrid combin. in BC_1	No.of hybrid combin. in BC_2
H. ARGOPHYLLUS	10	18	11
H. DEBILIS	10	2	4
H. PETIOLARIS	12	24	-
H. PRAECOX	7	10	9
H. NEGLECTUS	7	12	-
H. EXILIS	2	4	-

Tab. 2b: Success of crossing perennial species

Species	No.of hybrid combin. in F_1	No.of hybrid combin. in BC_1	No.of hybrid combin. in BC_2
H. TUBEROSUS	23	16	-
H. RIGIDUS	10	72	5
H. GIGANTEUS	3	-	-
H. OCCIDENTALIS	2	1	-
H. EGGERTII	1	9	-
H. STRUMOSUS	4	2	8
H. RESINOSUS	4	1	-
H. LAEVIGATUS	4	31	4
H. MAXIMILIANI	1	1	-
H. SALICIFOLIUS	3	1	4
H. HIRSUTUS	7	9	4
H. MOLLIS	1	1	1
H. DECAPETALUS	3	1	-
H. SCABERIMUS	1	2	-
H. NUTTALLII	1	10	2
H. SMITHII	1	3	-