Scientific Papers. Series A. Agronomy, Vol. LVII, 2014
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

PRELIMINARY RESULTS ON CREATING NEW SUNFLOWER (*Helianthus annuus* L.) WITH RESISTANCE TO DROUGHT BASED ON INTERSPECIFIC HYBRIDATION WITH WILD SILVERLEAF SUNFLOWER (*Helianthus argophyllus* TORR. & A. GRAY)

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Abstract

In the period 2008-2013 at NARDI Fundulea research have been carried out in order to introduce drought-resistant gene/genes from wild to Helianthus annuus L. cultivated species. Interspecific hybridisation, backcross (six generations) and self-pollination (two generations), and a rigorous selection (after each generation, under the water stress conditions and minimum inputs) for productivity, MMB and oil content were performed. Drought resistance and yield quality improvement under organic farm conditions is a difficult goal due to polygenic determinism of these characters. Progress has been obtained for genetic characters studied (production, oil content and MMB) for all inbreeded lines presented. One of these lines presented improved values for all characters as compared with maternal lines. Four from seven inbreeded lines were improved achenes production and the other 3 improved lines have better capacity of oil production in drought conditions and in the organic farms technology. The results from 2013 confirmed the improvement trends reported from the previous selection years.

Key words: *backcross, Helianthus annuus L., Helianthus argophyllus Torr. & A. Gray, interspecific hybridization.*

INTRODUCTION

First interspecific hybridization was performed in 1916 in Russia by Satziperov. These and other later investigations showed that as a result of crossing of different Helianthus species with cultivated sunflower. New forms resistant to different diseases and the broomrape parasite could be obtained by Pustovoit (1960), Putt and Sackson (1957), Cristov, (1996).

Sunflower forms with higher seed oil content and drought tolerant were obtained by interspecific hybridization with *H. argophyllus* Torrey. & Grey (Iouraş and Voinescu, 1984; Saucă, 2010).

The wild species *Helianthus argophyllus* possess considerable variability for resistance to drought, diseases and parasitic plant which can be utilized for the improvement of cultivated sunflower (Jan et al., 2008).

This report presents the results of interspecific hybridization between cultivated sunflower (*Helianthus annuus* L) and wild species (*Helianthus argophyllus*) and their potential for developing lines with economically important characters suitable as parental lines for developing new sunflower hybrids.

MATERIALS AND METHODS

The results presented in this paper were obtained during the period 2012-2013 only, at the NARDI Fundulea - Călăraşi (a typical location for Bărăgan plain area) and Stupina-Constanţa (a very dry location). The weather conditions for these locations are presented in Figure 2. The investigation included 8 interspecific hybrids of sunflower (2n=34) in the 6 backcross generation. Methods of interspecific hybridization and selection, self-pollination, backcrossing with pollen from *Helianthus argophyllus* species and pollination with pollen cultivated sunflower were used (Figure 1).

Figure1. Some aspects from breeding field of NARDI - Fundulea

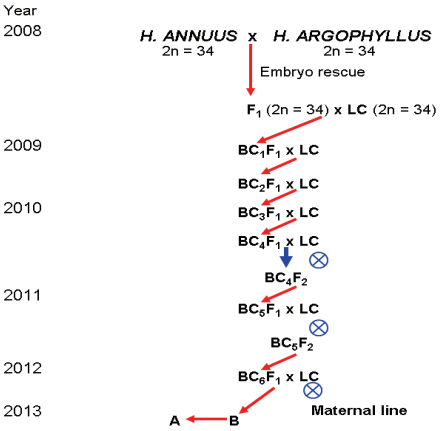

Figure 2. The breeding procedure

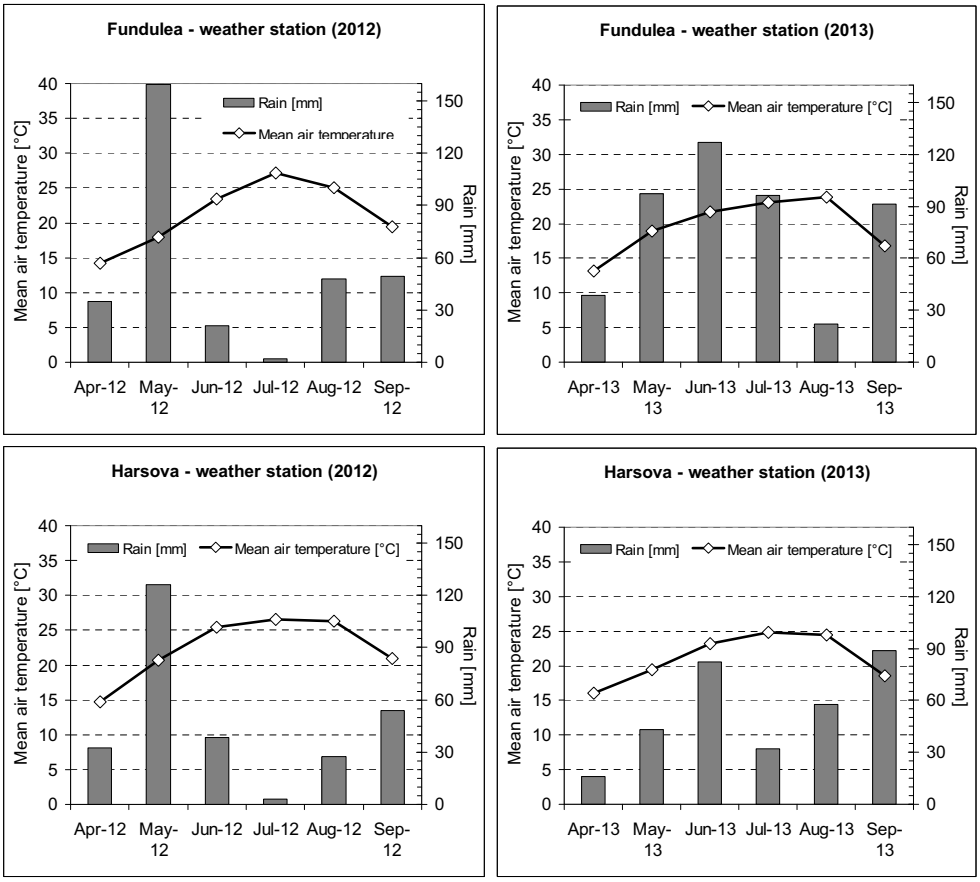

Figure 3. Weather conditions during sunflower vegetation at Fundulea and Stupina (Hârşova weather station) in 2012 and 2013

RESULTS AND DISCUSSIONS

As a result of interspecific hybridization between cultivated sunflower (*Helianthus annuus* L.) and wild species *Helianthus argophyllus*, hybrid plants from the different combinations produced a great diversity regarding the inflorescence dry weight, thousand kernels weight and oil content, both from the point of view of the line used as

mother and the location were has carried out the experiment (Table 1).

The values for the studied characteristics Inflorescence dry weight, one thousand kernel weight and oil content were much lower for the drier location (Stupina), but in the most cases the values for the improved lines were higher than values of the maternal lines. The ratios (in %) between improved lines and maternal lines are shown in Table 2. In the drier conditions of Stupina, in the year 2013, the improved lines exceeded the maternal lines with up to 147% for inflorescence dry weight, with about 67% for TKW and one improved line presented an oil content with 3.8% higher than initial line, meanwhile other two lines were at the levels of maternal lines. One improved line (Bio.3) had a lower performance in Stupina conditions, but it had better results than maternal line under Fundulea conditions.

Table 1. Main target parameters

Code	Inflorescence dry weight (netto) [g]		Thousand kernels weight [g]		Oil content [%]	
	Fundulea	Stupina	Fundulea	Stupina	Fundulea	Stupina
Bio.1	**61.4**	**19.1**	**59.6**	**41.2**	**42.9**	**39.2**
M.2	58.6	7.7	52.0	35.8	42.8	37.8
Bio.3	**100.3**	**44.1**	**89.4**	**75.1**	**43.3**	**39.5**
M.5	71.1	44.8	82.6	84.2	42.7	39.6
Bio.5	**82.8**	**45.4**	**49.1**	**40.8**	**43.3**	**39.8**
M.6	53.8		49.7		42.7	
Bio.7	**98.0**	**43.0**	**59.0**	**55.9**	**43.8**	**39.7**
M.7	50.4	38.4	50.2	48.2	44.3	40.0
Bio.9	**53.8**	**32.7**	**59.2**	**45.2**	**44.5**	**39.8**
M.10	51.0	19.1	59.1	33.4	42.7	39.7
Bio.11	**75.2**	**37.4**	**66.0**	**51.8**	**43.0**	**39.8**
M.12	72.0	27.0	71.1	46.3	43.6	39.8
Bio.13	**102.6**	**33.5**	**80.5**	**58.7**	**42.8**	**40.3**
M.12	52.7	14.4	68.3	35.2	43.2	40.5
Bio.17	**79.9**	**32.7**	**78.1**	**52.0**	**43.0**	**39.7**
M.11	72.0	27.0	71.1	46.3	43.6	39.8

Table 2. Percentage from value of initial line grown in the same conditions (%)

Code	Inflorescence dry weight (netto)		Thousand kernels weight		Oil content	
	Fundulea	Stupina	Fundulea	Stupina	Fundulea	Stupina
Bio.1	**104.8**	**247.2**	**114.5**	**115.2**	**100.2**	**103.8**
Bio.3	**141.1**	98.5	**108.2**	89.3	**101.5**	99.7
Bio.5	**153.8**		98.9		**101.3**	
Bio.7	**194.5**	**111.8**	**117.4**	**115.9**	99.0	99.3
Bio.9	**105.5**	**170.9**	**100.2**	**135.5**	**104.4**	**100.1**
Bio.11	**104.5**	**138.6**	92.9	**112.0**	98.6	**100.1**
Bio.13	**194.6**	**232.0**	**117.8**	**166.9**	99.0	99.5
Bio.17	**111.0**	**121.2**	**109.8**	**112.3**	98.5	99.8

CONCLUSIONS

The results of this investigation showed that successful interspecific hybridization between cultivated sunflower (*Helianthus annuus* L) and wild species *Helianthus argophyllus* and the transfer of new genetic material into cultivated sunflower was possible.

Improved lines with valuable characters were obtained.

Lines developed from these crosses can be used in developing high quality sunflower hybrids, increases the genetic diversity for drought resistance.

ACKNOWLEDGEMENTS

This research was supported by the Word Bank- MAKIS- Modernizing Agricultural Knowledge Information System and the NARDI Fundulea. The skilled technical assistance of Dr. Stanciu Danil and Dr. Maria Stanciu is gratefully acknowledged.

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