
EVALUATING OF WILD HELIANTHUS SPECIES OF SUNFLOWER AND INTERSPECIFIC HYBRIDIZATION FOR RESISTANCE TO BROOMRAPE (*OROBANCHE CUMANA* WALLR.)

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ABSTRACT

Broomrape become in the last years very dangerous for sunflower crop in Romania and new races appears in every year. *Orobancha cumana* Wallr (broomrape) is present in more than half of areas cultivated with sunflower in our country. Broomrape causes important losses to sunflower seed yield. The better method to control this parasite is genetic resistance. Breeding for resistance of broomrape can be done by transferring genes from wild species of *Helianthus*. By testing different sunflower genotypes, resistant to the most virulent races of the parasite, in artificial condition from different infested areas, year by year is study of the relationship between the parasite and the host plant. Resistant genotypes at broomrape in one year lose resistance next year and become tolerant.

INTRODUCTION

For broomrape parasite (*Orobancha cumana* Wallr), resistance genes have been identified in wild sunflower species. Thus, the first sources of resistance were created by crossing the species of *Helianthus tuberosus* with the cultivated sunflower (Pustovoit, 1976). Ruso *et al.* (1996) tested 26 perennial wild species and 12 annual wild species and Terzić *et al.* (2016) tested 7 annual wild species and 182 accessions, most of which showed good resistance to the attack of the respective broomrape population.

Annual wild species *Helianthus debilis* subsp. *tardiflorus* poses resistance to race G (Velasco *et al.* 2012) Perennial wild species have more resistance than annual species to Race F (Seiler and Marek, 2011).

Wild *Helianthus* species represent a valuable genetic resource for new broomrape races who are more virulence in every year (Pacureanu-Joita M. *et al.*, 2015; Anton F.G. *et al.*, 2016; Risnoveanu L. *et al.*, 2016 a.; Risnoveanu L. *et al.*, 2016 b).

MATERIALS AND METHODS

The testing, for some broomrape populations, has been done in the artificial infestation, in 10 liter buckets with mixture of soil and sand and 2g of broomrape seed in greenhouse at NARDI Fundulea after Panchenko (1975) method. I was evaluate the resistance to attack of broomrape after 40 days of 12 interspecific hybrids and set of differential lines for races of broomrape belonging NARDI Fundulea in 2 years, in 2016 and 2017 (figure 1).



Figure 1. Screening the resistance to broomrape in the pots in greenhouse

The population of broomrape was collected from, Braila 2015, and was tested to identify the genotype of sunflower resistant to this races of *Orobancha cumna* Wallr in year 2016, in greenhouse. In 2017 tested in greenhouse the same genotype for resistance with population of broomrape from Braila 2016 where is present very virulent races. Check resistant is hybrid PR64LE20 and check sensitive is hybrid Performer.

13 accessions of five annual *Helianthus* species and was tested for resistance to broomrape in 2016 and 2017 in greenhouse.

RESEARCH RESULTS

Sunflower differential line for race Fof broomrape, LC 1093B controlled by a single dominant gene *Or6*, was sensible in both years of testing at race G of broomrape (table 1).

Table 1.

Results from the sunflower differentials set for resistance to broomrape population (*Orobancha cumana* Wallr.) from Braila 2015 and 2016

Differentials lines	Races of broomrape				
	Race C	Race D	Race E	Race F	Race G
173B - Record	R	S	S	S	S
LC1002 B	R	R	S	S	S
LC1003 B	R	R	R	S	S
LC1093 B	R	R	R	R	S

All accessions of *Helianthus praecox* and *Helianthus petiolaris* and two accessions of *Helianthus debilis* is full resistant to population of broomrape from Braila 2015 area (table 2).

Table 2

Resistance of annual *Helianthus* species in year 2016, in greenhouse

Annual <i>Helianthus</i> wilde species		Intensity of broomrape atack(%) (population of broomrape from Braila 2015 area)
A1Ne	<i>Helianthus neglectus</i>	1
A2De	<i>Helianthus debilis</i>	1
A3De	<i>Helianthus debilis</i>	0
A4De	<i>Helianthus debilis</i>	0
A5Pe	<i>Helianthus petiolaris</i>	0
A6Pe	<i>Helianthus petiolaris</i>	0
A7Pe	<i>Helianthus petiolaris</i>	0
A8Pe	<i>Helianthus petiolaris</i>	0
A9Pr	<i>Helianthus praecox</i>	0
A10Pr	<i>Helianthus praecox</i>	0
A11Pr	<i>Helianthus praecox</i>	0
A12Pr	<i>Helianthus praecox</i>	0
A13Arg	<i>Helianthus argophyllus</i>	8

Two accesions of *Helianthus debilis*, *Helianthus petiolaris* and *Helianthus praecoxis* resistant to population of broomrape from Braila 2016 area (table 3).

Table 3

Resistance of annual *Helianthus* species in year 2017, in greenhouse

Annual <i>Helianthus</i> wilde species		Intensity of broomrape atack(%) (population of broomrape from Braila 2016 area)
A1Ne	<i>Helianthus neglectus</i>	5
A2De	<i>Helianthus debilis</i>	6
A3De	<i>Helianthus debilis</i>	0
A4De	<i>Helianthus debilis</i>	0
A5Pe	<i>Helianthus petiolaris</i>	0
A6Pe	<i>Helianthus petiolaris</i>	1
A7Pe	<i>Helianthus petiolaris</i>	0
A8Pe	<i>Helianthus petiolaris</i>	2
A9Pr	<i>Helianthus praecox</i>	1
A10Pr	<i>Helianthus praecox</i>	2
A11Pr	<i>Helianthus praecox</i>	0
A12Pr	<i>Helianthus praecox</i>	0
A13Arg	<i>Helianthus argophyllus</i>	20

Three interspecific hybrids LC 1068Cx *Helianthus maximiliani*, LC1093B x *Helianthus argophyllus* and LC 1093B x *Helianthus maximiliani* was resistant to population from Braila 2015 (figure 2). The check resistant (hybrid PR64LE20) was

resistant to these population of broomrape and check sensitive (hybrid Performer) was susceptible.

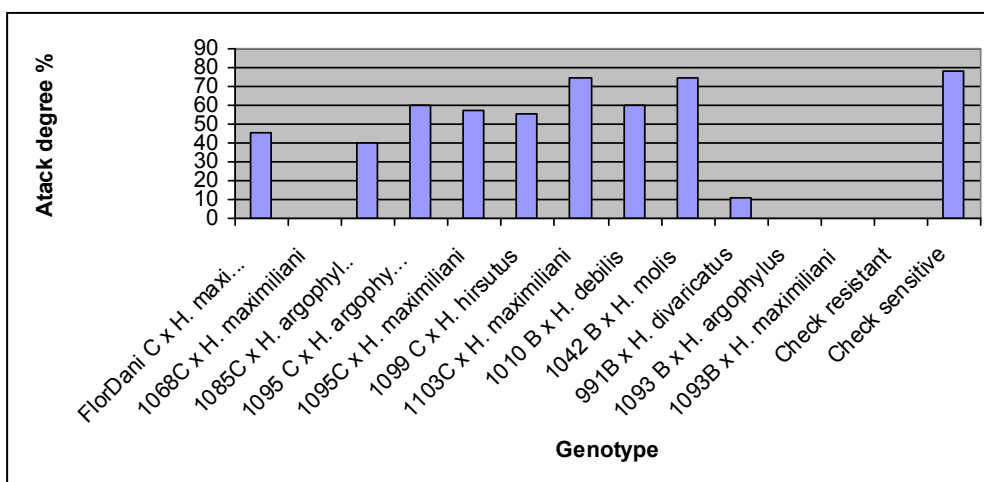


Figure 2. Attack degree of broomrape in greenhouse, in 2016

Only one interspecific hybrids, LC1093B x *Helianthus argophyllus*, present tolerance to population of broomrape from Braila 2016 area (figure 3).

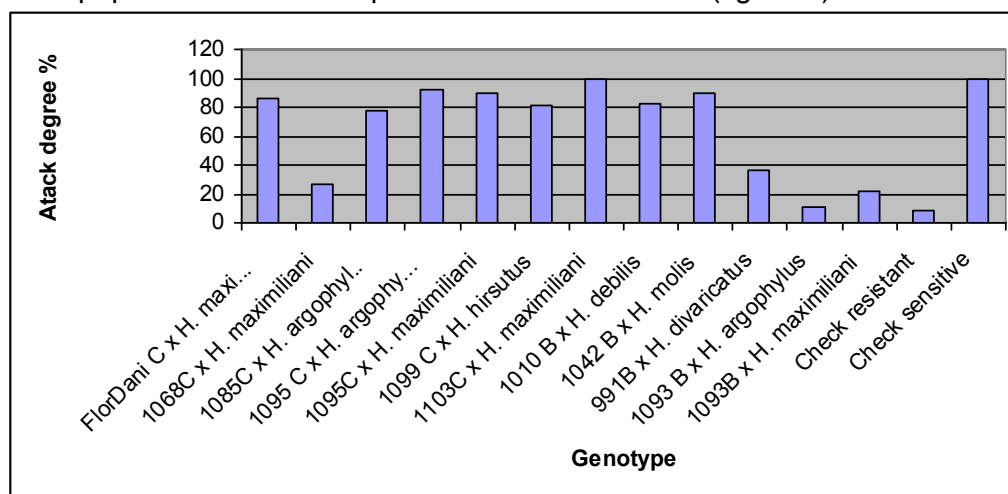


Figure 3. Attack degree of broomrape in greenhouse, in 2017

The check resistant (hybrid PR64LE20) was tolerant to this population of broomrape from Braila 2016 and check sensitive (hybrid Performer) was susceptible (figure 4).



Figure 4. Screening for resistance to broomrape after 40 days after sowing

CONCLUSION

Annual wild species can be used in breeding program for resistance to broomrape. Some accessions of *Helianthus praecox*, *Helianthus debilis*, *Helianthus petiolaris* is full resistance to races of broomrape present in Romania. There is difference in the parasite attack degree, depending on year and location of broomrape population.

In area Braila 2015 was present more than race F of broomrape and interspecific hybrids LC 1093 B x *Helianthus argophyllus*, LC 1093B x *Helianthus maximiliani* and LC 1068C x *Helianthus maximiliani* have 0% infestation with *Orobanche cummna* Wallr.

Interspecific hybrids LC 1093 B x *Helianthus argophyllus*, LC 1093B x *Helianthus maximiliani* and LC 1068C x *Helianthus maximiliani* have a good tolerance to more of race F of broomrape who was present in Braila 2016.

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