

USING SUNFLOWER WILD SPECIES TO IMPROVE RESISTANCE OF CULTIVATED SPECIE TO THE PARASITE BROOMRAPE (*OROBANCHE CUMANA* WALLR.)

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ABSTRACT

The parasitic plant *Orobanche cumana* (broomrape) is the most important biotic constraint to the production of sunflower, in all countries around the world. The aim of our study was evaluation of populations of some wild *Helianthus* species to broomrape populations that are highly virulent in Romania. All resistant interspecific population derived from crosses with annual specie *Helianthus debilis* and perennial specie *Helianthus maximiliani*. Testing of this interspecific populations indicate the possibility to obtain sources of resistance to broomrape populations present in Romania, but also in countries situated around Black Sea region.

INTRODUCTION

The most important parasitic weed in sunflower crop is broomrape (*Orobanche cumana* Wallr) who decreases seed yield production in fields infested in south, south east of Romania (Păcureanu-Joița, 2014; Risnoveanu et al., 2016).

Sunflower broomrape is present around the world with very aggressive races, especially in Black Sea region (Joița-Păcureanu, 2018; Masiliiov et al., 2018; Makliak et al., 2018; Encheva, 2018). It is very difficult to maintain genetic resistance of sunflower genotypes at broomrape attack in soil infested for a long period of time (Skoric et al., 2018).

The races of broomrape changes virulence in every year and that make difficult to have sunflower hybrids resistant for a long period of time.

Resources for resistance to broomrape useful is wild sunflower species (Seiler and Jan, 2014; Seiler, 2018; Jockovic et al., 2018).

MATERIAL AND METHOD

Our experiments have been made in two years, 2017 and 2018, in the artificial

infestation conditions, with broomrape seeds which was collected from infested fields with different races of broomrape parasite from Braila and Constanta area, in 2016 and 2017 years.

The most affected area by broomrape parasite cultivated with sunflower from Romania is Braila and Constanta area.

We evaluating 24 populations, derived from crosses of 4 wild *Helianthus* species with cultivated sunflower.

The experiments in the artificial infestation conditions have been made in the green house, using some pots of 10 l capacity, having inside a mixture of soil and sand (50% each) as well as broomrape seeds (2 g/pot). The broomrape attack was observed on the sunflower plants roots, taking out the plants from soil, after 40 days from the sunflower emergence, in the pots also, in flowering time.

RESULTS AND DISCUSSIONS

At NARDI Fundulea was obtained 24 interspecific populations of sunflower derived from crosses of 2 annual wild *Helianthus* species and 2 perennial wild *Helianthus* species (*Helianthus debilis*, *Helianthus petiolaris*, *Helianthus*

maximiliani and *Helianthus divaricatus*) with cultivated sunflower.

In figure 1 and 2, we present data of sunflower genotype tested for resistance to broomrape in year 2017 and 2018 from population collected in years 2016 and 2017 from area Constanta and area Braila.

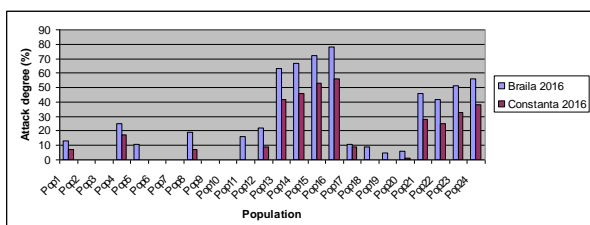


Figure 1 Attack degree of broomrape on interspecific population of sunflower tested in year 2017 in artificial condition (population of broomrape from Braila 2016 area and Constanta area 2016)

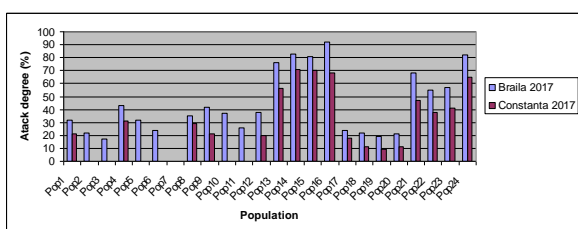


Figure 2 Attack degree of broomrape, on interspecific population of sunflower tested in year 2018 in artificial condition (population of

broomrape from Braila 2017 area and Constanta area 2017)

First was noted broomrape attack after 40 days from the sunflower emergence and some interspecific population of sunflower don't have broomrape attached by root, but in the flowering time the plant of *Orobancha cumana* get out from soil

Results of the experiment showed that 6 interspecific populations of sunflower (Pop 2, Pop 3, Pop 6, Pop 7, Pop 9, Pop 10) were resistant, in case of population of broomrape from area Braila 2016 and 10 interspecific populations of sunflower (Pop 2, Pop 3, Pop 5, Pop 6, Pop 7, Pop 9, Pop 10, Pop 11, Pop 18, Pop 19) were resistant in case of population of broomrape from area Constanta 2016.

Situation changes in case of population of broomrape from area Braila 2017 when only one interspecific population of sunflower (Pop 7) was resistant. In case of population of broomrape from area Constanta 2017, 7 interspecific populations of sunflower (Pop 2, Pop 3, Pop 5, Pop 6, Pop 7, Pop 10, Pop 11) were resistant

In table 1, we present phenotypic data of interspecific population created at our institute (NARDI Fundulea) who tested for resistant to broomrape in artificial condition.

Table 1

Agronomic traits of interspecific population studied

Interspecific population	Crosses of 4 wild <i>Helianthus</i> specie with cultivated sunflower	Height of plants (cm)	Days to flowering	Days to maturity	Head diameter (cm)	Seed yield /plant (g)	Branching/ Non branching
Pop 1	ANT10B x <i>H. petiolaris</i>	170 cm	84 days	130 days	19 cm	33.13g	non branching
Pop 2	ANT10B x <i>H. debilis</i>	175 cm	85 days	130 days	25 cm	26.52g	non branching
Pop 3	ANT10B x <i>H. maximiliani</i>	171cm	83 days	130 days	22 cm	27.47g	non branching
Pop 4	ANT10B x <i>H. divaricatus</i>	163 cm	86 days	130 days	20 cm	37.90g	non branching

Pop 5	ANT68C x <i>H. petiolaris</i>	128 cm	75 days	123 days	10 cm	9.01g	branching anthocianin coloration
Pop 6	ANT68C x <i>H. debilis</i>	126 cm	76 days	123 days	11 cm	20.57g	branching anthocianin coloration
Pop 7	ANT68C x <i>H. maximiliani</i>	130 cm	74 days	123 days	11 cm	12.69g	branching
Pop 8	ANT68C x <i>H. divaricatus</i>	133 cm	75 days	123 days	11 cm	11.70g	branching
Pop 9	ANT85C x <i>H. petiolaris</i>	126 cm	86 days	135 days	21cm	27.95g	non branching
Pop 10	ANT85C x <i>H. debilis</i>	143cm	87 days	135 days	18 cm	19.14g	one branching basal
Pop 11	ANT85C x <i>H. maximiliani</i>	144 cm	86 days	135 days	22 cm	55.86g	non branching
Pop 12	ANT85C x <i>H. divaricatus</i>	128 cm	87 days	135 days	21 cm	21.39g	two branching basal
Pop 13	ANT95C x <i>H. petiolaris</i>	106 cm	77 days	123 days	14 cm	12.35g	branching
Pop 14	ANT95C x <i>H. debilis</i>	104 cm	75 days	123 days	13 cm	12.71g	branching
Pop 15	ANT95C x <i>H. maximiliani</i>	119 cm	78 days	123 days	13 cm	14.02g	branching
Pop 16	ANT95C x <i>H. divaricatus</i>	112 cm	76 days	123 days	14 cm	13.52g	branching
Pop 17	ANT98C x <i>H. petiolaris</i>	129 cm	74 days	123 days	9 cm	4.12g	branching anthocianin coloration
Pop 18	ANT98C x <i>H. debilis</i>	144 cm	76 days	123 days	8 cm	1.66g	branching anthocianin coloration
Pop 19	ANT98C x <i>H. maximiliani</i>	142 cm	73 days	123 days	10 cm	4.71g	branching anthocianin coloration
Pop 20	ANT98C x <i>H. divaricatus</i>	128 cm	77 days	123 days	7 cm	3.66g	branching anthocianin coloration
Pop 21	ANT99C x <i>H. petiolaris</i>	103 cm	77 days	123 days	15 cm	2.15g	branching anthocianin coloration
Pop 22	ANT99C x <i>H. debilis</i>	96 cm	75 days	123 days	12 cm	3.41g	branching anthocianin coloration
Pop 23	ANT99C x <i>H. maximiliani</i>	104 cm	78 days	123 days	15 cm	0.29g	branching anthocianin coloration
Pop 24	ANT99C x <i>H. divaricatus</i>	106 cm	76 days	123 days	14 cm	1.08g	branching anthocianin coloration

CONCLUSIONS

Some interspecific populations of sunflower derived from crosses of wild *Helianthus* with cultivated sunflower have a good resistance to broomrape attack.

The attack of broomrape in year 2017 in area Braila was more virulent then year 2016 and genotypes who was resistant in 2016 lost resistance in next year. In area Constanta is present race G of broomrape and all resistant interspecific populations in this area can

be used to obtain the sources of resistance.

In area Braila is present race H or more and interspecific population Pop 7 is very important for sunflower breeding to developed new hybrids resistant at this new races.

Testing of population indicate the possibility to obtain source of resistance to broomrape population present in Romania, but also in countries situated around Black Sea region.

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