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RESEARCH ON GENETIC AND BREEDING SUNFLOWER FOR RESISTANCE TO BROOMRAPE PARASITE (*Orobanche cumana*) IN ROMANIA

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Abstract

Theparasitic angiosperm broomrape (Orobanche cumana Wallr.) is currently regarded as one of the most important constraints in sunflower (Helianthus annuus L.) production Romania, but especially with highest frequency and intensity of the attack is found in the central and southern part of Moldova, Dobrogea and eastern Plain Baraganu. In the last 40 years, efforts to introduce genetic resistance to this parasite in sunflower hybrids were followed by the occurence of new virulent races that promptly overcame all known resistance genes. Due to this situation, most of the research efforts have focused on the development and characterization of new sources of genetic resistance to the most virulent races and also, on the genetic variability of Orobanche cumana populations. Different tests for sunflower resistance to the new races of the parasite, have showed that they are present now in different regions in Romania. Recommendations for reducing sunflower yield caused by broomrape are given.

Key words: *sunflower, Orobanche cumana, broomrape races, genetic resistance.*

INTRODUCTION

Broomrape (*Orobanche cumana* Wallr.) has more than forty years of parasitism on sunflower in Romania. For this period the malicious obligate parasite caused production losses of sunflower crop areas of central and southern part of Moldova, the eastern part of the Plain Baraganului and Dobrogea. The joint evolution of a broomrape and the host led to appearance of new races of the parasite, capable to overcome immunity of resistant varieties and hybrids. Last epiphytic conditions developed in the Romania at the beginning seventies when the biotype of broomrape which appeared for the first time in Moldova, named the Moldavian race, started to affect sunflower varieties and this new broomrape population seems to have spread and south-eastern Romania, the Big Island Braila and in Dobrogea, and the Eastern Bulgaria.

Research conducted in Romania by Pacureanu et al. (2009), identified as G race from experiences located in the south-east of the country using an assortment differentiator consists of inbred lines and commercial hybrids available on the market in Romania and presented resistant to Orobanche more aggressive races than race E.

Vrânceanu and Pacureanu (1995) studied a set of 84 hybrids international sunflower, noting that only 12% of them showed good resistance genetic attack *Orobanche cumana*, rest very sensitive. In the European countries cultivating sunflower new broomrape races, overcoming resistance of gene Or5 have appeared and have quickly extended much earlier on an extent 90th (Melero-Vara, et al., 2000; Molinero-Ruiz, Melero-Vara, 2004; Fernandez-Escobar et al, 2008). Resistance to them of sunflower wild species has been studied and resistant genotypes have been found out, lines and the hybrids resistant against race F, differentials for races have been developed (Dominguez, 1996; Fernandez-Martinez et al, 2000; Perez-Vich et al., 2002; Pãcureanu-Joita et al., 2004, 2008). Nevertheless Orobanche cumana is currently regarded as one of the most important constraints for sunflower production in Southern Europe, the Black Sea region, Ukraine and China (Parker, 1994). For the last fifteen years of effort of scientists and breeders

to present genetic sources of resistance to this parasite in sunflower hybrids were accomplished by occurrence of new virulent races which quickly have overcome all known genes of resistance (Fernandez-Martinez et al., 2008).
The purpose of our researches was to determine broomrape virulence from different locations of the east part area in Romania, with application of known sunflower differentials.

MATERIALS AND METHODS

Broomrape seeds were collected from four fields with natural broomrape infestation from four counties (Tulcea, Constanta, Ialomita and Calarasi) in the east part of Romania with one year before. The hybrids used in the natural infestation fields for isolation and collecting broomrape seeds were following: Performar, Sambro, Favorit, Sanluca, Sanay and ES Etnic.
Sunflower differentials (corresponding genes of resistance in brackets): lines AD 66 (susceptible), LC1002A (Or4), LC 1003A (Or5), LC1093A (Or6), KuglikA/41 (Or1), Jdanov 8281 (Or2), variety Record (Or3) and LG 5580 (Or7), have been used for studying broomrape virulence.
For differentiation of broomrape races seeds of sunflower differentials were sown in plastic boxes with the size 20:20:20 cm, filled with a soil-sandy mix (3:1), mixed with seeds of a parasite. Seeds of each broomrape population added in box from calculation of 200 mg on 1 kg of a soil mix. Plants were grown up in the natural condition and having watered carried out at drying of the top layer of soil. Through 30 days after seedlings appearance plants were dug out and roots were washed with water. Quantity of broomrape individuals (healthy tubercles and stems) were counted up. Average broomrape individuals on one affected plant were calculated on five plants of everyone differentials.

RESULTS AND DISCUSSIONS

In Romania, more than 60% of the sunflower cultivated area is infested with broomrape. There are four important areas, as the presence of the broomrape races and infestation degree, situated in Tulcea, Constanta, Ialomita and Calarasi locations.

The sunflower differentiators have been performed in these areas to have the information about the parasite races spreading.
In the Table 1, it can be observed that in Tulcea area all differentiators are attack with a very high degree of infestation, so even the differentiator for race G is hybrid and the biological purity is not like for the lines, this present high level of infestation. In this area were identification races A,B,C,D,E,F and G.

Table 1. Affection degree of sunflower differentials by broomrape from different populations, 2011 in Tulcea location

No	Hybrid, variety, on which broomrape was collected	AD 66	KuglikA/41	Jdanov 8281	Record	LC1002A	LC1003A	LC1093A	LG5580
1	Performar	83	72	64	41	27	10	9	14
2	Sambro	16	10	12	8	14	17	7	12
3	Favorit	12	8	14	18	13	14	6	10
4	Sanluca	24	18	15	11	13	12	8	10
5	Sanay	7	5	4	6	10	16	4	8
6	ES Ethic	4	3	4	6	5	17	3	6

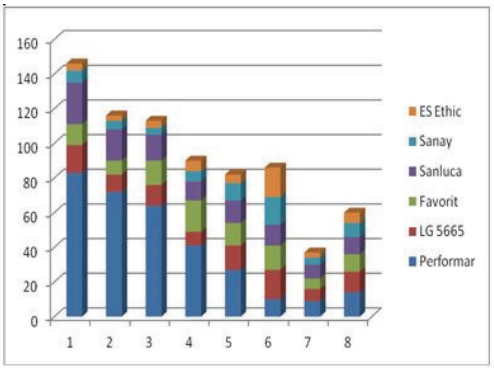

Figure 1. Chart data Tulcea

All differentiators which have been infested in Tulcea are infested in Constanta area too,but the infestation degree being smaller comparing with the results obtained in Tulcea (Tables 2); degree of infestation is high on inferior races, and decrease to the superior races. The same like in Tulcea, in this area were identification races A, B, C, D, E, F and G, but the level of infestation is different.

Table 2. Affection degree of sunflower differentials by broomrape from different populations, 2011 in Constanta location

No	Hybrid, variety, on which broomrape was collected	AD 66	KuglikA / 41	Jdanov 8281	Record	LC1002A	LC1003A	LC1093A	LG 5580
1	Performar	94	85	77	64	50	36	8	16
2	Sambro	84	80	76	36	24	8	4	14
3	Favorit	78	72	71	33	22	8	3	10
4	Sanluca	87	73	64	32	23	6	3	12
5	Sanay	72	68	58	38	26	7	5	8
6	ES Ethic	67	60	47	41	29	5	4	5

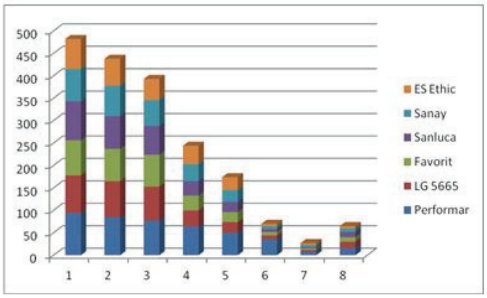

Figure 2. Chart data Constanta

In Ialomita aria (Table 3) are affected differentiator for race A,B,C,D,E and F so this means that race F was spread in this area. Degree of infestation is high on inferior races, and decrease to the superior races.

In Calarasi aria (Table 4) are affected differentiator for race A,B,C,D and E so this means that race E was spread in this area. Degree of infestation is high on inferior races, and decrease to the superior races, so in this area means that the race F is superior race for this area.

Table 3. Affection degree of sunflower differentials by broomrape from different populations, 2011 in Ialomita location

No	Hybrid, variety, on which broomrape was collected	AD 66	Kuglik A / 41	Jdanov 8281	Record	LC1002 A	LC1003 A	LC1093 A	LG 5580
1	Performar	114	92	44	32	27	6	8	0
2	Sambro	84	64	38	27	18	5	4	0
3	Favorit	71	60	34	24	14	8	3	0
4	Sanluca	82	61	33	22	20	11	5	0
5	Sanay	0	0	0	0	0	0	0	0
6	ES Ethic	0	0	0	0	0	0	0	0

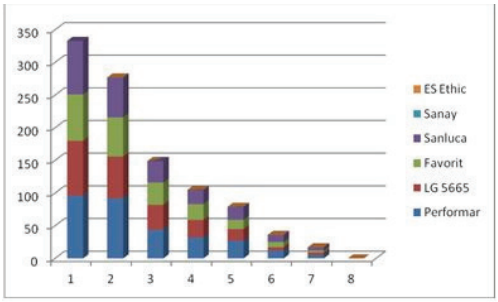

Figure 3. Chart data Ialomita

Table 4. Affection degree of sunflower differentials by broomrape from different populations, 2011 in Calarasi location

No	Hybrid, variety, on which broomrape was collected	AD 66	Kuglik A / 41	Jdanov 8281	Record	LC1002 A	LC1003 A	LC1093 A	LG 5580
1	Performar	114	92	44	32	27	6	8	0
2	Sambro	84	64	38	27	18	5	4	0
3	Favorit	71	60	34	24	14	8	3	0
4	Sanluca	82	61	33	22	20	11	5	0
5	Sanay	0	0	0	0	0	0	0	0
6	ES Ethic	0	0	0	0	0	0	0	0

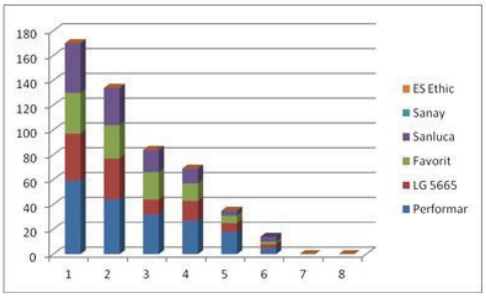

Figure 4. Chart data Calarasi

CONCLUSIONS

Parasite *Orobanche cumana* Wallr. evolved in the virulence of populations in recent two decades in southeastern Romania with especially in Tulcea and Constanta.

To achieve the research is essential establish a differentiator assortment created of inbred lines and hybrids with reaction known to the pathogen, with the participation of private companies and research institutes.

Expanding research in all areas with *Orobanche cumana* and monitoring these areas.

Zoning sunflower hybrids depending on the resistance and tolerance to *Orobanche cumana*.

REFERENCES

Antonova T.S., Araslanova N.M., Guchetl S.Z., Trembak E.N., Tchelyustnikova T.A., Ramazanova S.A., 2009. Virulence of broomrape populations on sunflower in regions of Northern Caucasus. Vestnik of Rosselhosacademy, No 3, p. 66-69 (in Russian).

Kaya Y., Demirci Y, Evci G., 2004. Sunflower (*Helianthus annuus* L.) breeding in Turkey for broomrape (*Orobanche cernua* Loeffl) and herbicide resistance. Helia 27. Nr 40, p. 199-210.

Molinero-Ruiz M., Melero-Vara, Jose M., 2004. Virulence and aggressiveness of sunflower broomrape (*Orobanche cumana*) populations overcoming the Or5 gene. Proc. 16th International Sunflower Conference, Fargo, ND USA.

Pacureanu Joita M.,Raranciuc S., Sava E., Stanciu D., Nastase D., 2009. Virulence and aggressiveness of sun-flower broomrape (*Orobanche cumana* Wallr.) population in Romania. Helia. 32. Nr 51 p. 111-118.

Pustovoit G.V., 1966. Mejvidovaia ghibridizatia kak metod selectii podsolnecinika na grupovnoi imunitet Ghenetika, 1, p. 59-69.

Rojkova V.T., Koseleva R.M., 1987. Izucenie na reaktii obraztov podsolnecinika mirovoi kolectii VIR na razlicinie populatii zarazihi. In Selektiia I Ghenetika Tehniceskih Kultur. Sb. Naucinih Trudov po Prikl. Bot., Ghen. I Sel., VIR Leningrad 113, p. 41-46.

Fernandez-Escobar J., Rodriguez-Ojeda M.I., Alonso L.C., 2008. Distribution and dissemination of sunflower broomrape (*Orobanche cumana* Wallr.) race F in Southern Spain. Proc. 17th International Sunflower Conference. Cordoba, Spain, V.1, p. 231-236.

Satâperov F.A., 1913. Opiti s podsolnecinikom. Trudi Biuro Prikl. Bot., 6 (4), p. 251-258.

Vasile T.A., 1981. Studiul rezistentei florii-soarelui la atacul de lupoaie (*Orobanche* spp.). Rezumat al tezei pentru obtinerea titlului stiintific de " Doctor in agronomie" Institutlul Agronomic "N. Balcescu" Bucuresti.

Vranceanu A., Tudor V., Stoenescum F., Parvu, N., 1981. Evolutii ale virulentei parazitului *O. cumana* Wallr. si gene corespunzatoare de rezistenta la floarea-soarelui. Analele ICCPT Fundulea Vol XLVIII, p. 37-43.

Vranceanu A., Pacureanu J., 1995. Evaluation of an international set of sunflower hybrids in relation to broomrape (*O. cumana* Wallr.) resistance. Helia 3, p. 19-24.

Vranceanu A.V., 2000. Floarea-soarelui hibrida. Editura Ceres Bucuresti, p. 1445.