Scientific Papers, UASVM Bucharest, Series A, Vol. LIV, 2011, ISSN 1222-5339

RESEARCH REGARDIG THE VIRULENCE OF BROOMRAPE PARASIT (*OROBANCHE CUMANA* WALLR.) IN SOUTHEASTERN OF ROMANIA

GEORGETA DICU, ELENA ANDREEA TEODORESCU, NICOLETA CLAUDIA DUMITRESCU, N. BOAGHE, MIHAELA IONITA

S.C. Procera Agrochemicals Romania S.R.L.

Keywords: *sunflower, Orobanche cumana, races, virulence*

Abstract

Broomrape (Orobanche cumana Wallr.) is becoming one of the most serious parasites for sunflower crop in Romania mainly in the south-eastern part of the country. During last two decades, the aggressivness of the parasite increased significantly the new physiological races appeared fast enough after a relative stable period of time on race E of broomrape. Research concerning races evolution carried out in different Institutes in Eastern Europe or Spain showed that the interaction host-parasite system the gene action was dominant type up to the level of race E beeing involved one single gene. Increasing the virulence of the parasite up to the race F or G, a new type of interaction was identified, being involved one or more genes for resistance dominant or recessive ones depending of the genetic material involved in the studies. This study carried out during 2009 and 2010 by Procera Agrochemicals in 5 location in South-eastern part of Romania identified the race G based on a differential set established on the characterization concerning the resistance of commercial hybrids available in commercial seeds catalog. It was included one hybrid without resistance genes (Performer), one race E resistant hybrid (PR64A89). The race F resistant hybrid was PRO229 (Procera) and the race G was PR64A71. This last one was characterized as „resistant against races more aggressive than E" in the Pioneer Hi-Bred-Seeds Agro.srl Romania" and as „resistant against race G" by Pacureanu [4].

Definitely the race G was identified in Tulcea and Constanta counties based on infestation values obtained after 2 years of trialing. In some locations (no 1, no 3, no 4 and no 5), virulence above race G was found because PR64A71 presented a very low number of strains. It seems to be a new race more aggressive than G and we named G+. The reason of infestation of PR64A71 could be the incomplete homozygocity of the hybrid compounds and in this situation broomrape shoots may appear. For the host spots infested with race G is not recommended to plant race E resistant hybrids because of the very high yield decrease. The hybrids race F resistant may register as well significant yield decreases in those areas.

INTRODUCTION

Broomrape parasite sunflower crops reduces significantly seed and oil production, depending on the population virulence and physiological races of parasite *Orobanche cumana*; production could decrease to 100%.

Because of the resistant genetic factors to broomrape in sunflower crops the first resistant hybrids were created. [8] noticed a form of resistance to broomrape of sunflower seeds with carbonogen protective coating.

During last two decades, the aggressiveness of the parasite increased significantly the new physiological races appeared fast enough after a relative stable period of time on race E of broomrape, especially around Black Sea, the virulence explosion have been identified in Trakia from Turkey, extending further in south-eastern part of Bulgaria and Romania, Moldova, Ukraine and Russia.

In Romania, research carried out by Procera Agrochemicals in 2009 and 2010 identified race G, during some experience in south-eastern part of the country, based on a differential set established on the characterization concerning the resistance over race E of commercial hybrids.

The objectives of this experiment is to establish the virulence of races for *Orobanche cumana* in south-eastern part of Romania based on a differential set established by Procera Agrochemicals.

MATERIAL AND METHODS

To determine the populations virulence of broomrape we used a differential set with commercial hybrids available in commercial seeds catalog:

- Performer-ICDA Fundulea-no resistance genes;
- PR64A89-Pioneer-race E resistance;
- PRO 229-Procera-race F resistance;
- PR64A71-Pioneer-race G resistance.

This study was carried out during 2009 and 2010 by Procera Agrochemicals in 5 location in Tulcea and Constanta county to identify the race more aggressive than E race.

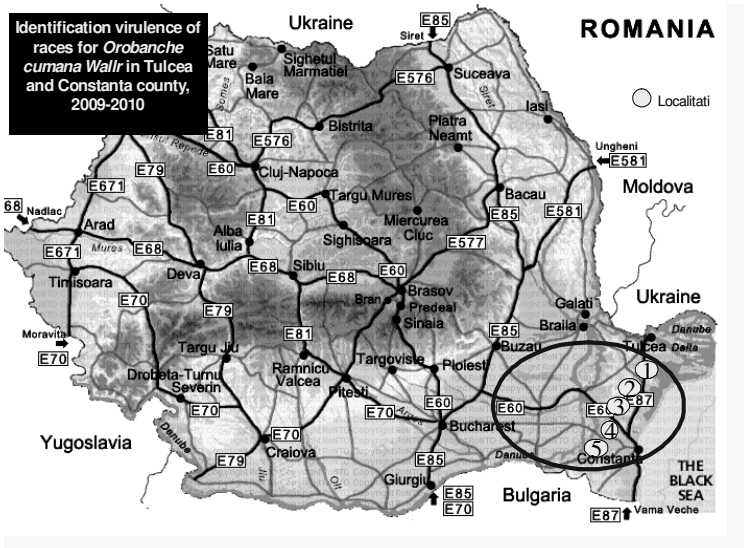
The susceptible control and the resistant one planted on the borders and in the middle of the field for a better tracking of field infestation. Two reps were planted for each differential in each location.

To establish the virulence of races for *Orobanche cumana,* it the following indicators were calculated:

- infestation frequency (F): number of infested plants with Orobanche on row/ total number of plants on row * 100

- infestation intensity (I): total number of Orobanche strains/total number of infested plants with *Orobanche* on row

- attack degree (GA): F*I/100



RESULTS AND DISCUSSION

In table 1 we can see that the resistant genes are different, depending by experiment and differential set established to analysis genetic determinism for *Orobanche cumana*.

Genetic conditioning of resistance to race A-E is made through only one dominant gene Or5, and for populations or physiological races more aggressive than race E genetic conditioning of resistance is more complicated, because must be used additivity or complementarity effects.

During research for race determination of *Orobanche cumana Wallr.* or resistance genes were used genetics systems for differentiation specifically every country or institution with specific.

In table 2 we can see accounted values for attack frequency, intensity and degree of attack for those 4 used differentiators hybrids.

PRO 229 hybrid registered values of attack degree between 0.1 and 0.44, the strongest infestation was in the first location. The hybrid could register in this location low productions because of the parasite. Based on frequency values, intensity and attack degree we could confirm the existence of race G in those five locations.

PR64A71 hybrid recorded the lowest infestation. Attack frequency was between 0 and 2.2% and degree attack was 0 in 4 locations and 2.2 in the first location. In locations 1,3,4,5 we found 1-2 parasites on the hybrid and we confirm the virulence populations of broomrape is over G.

Table 1

Genetic determinism of resistance/tolerance for *Orobanche cumana*

Resistance source	Race *Orobanche*	Resistance gene	Gene resistance type	Bibliographic reference
Krugklik-A-41	A-E	Or1	one dominant gene	Vranceanu and collaborators (1980)
Jdanov 8281	A-E	Or2	one dominant gene	Vranceanu and collaborators (1980)
Record	A-E	Or3	one dominant gene	Vranceanu and collaborators (1980)
S-1358	A-E	Or4	one dominant gene	Vranceanu and collaborators (1980)
P-1380	A-E	Or5	one dominant gene	Vranceanu and collaborators (1980)
SW501	unknown	unknown	one dominant gene	Ish-Shalom_Gordon and collaborator (1993)
NR-5	E	Or5	one dominant gene	Sukno and collaborators (1999)
R-41	E	unknown	one dominant gene	Dominguez (1996)
P-96	F (Mencia-Spania)	Or6, Or7	two recessive genes	Akhtouch and collaborators (2002)
P-96	E	unknown	one dominant gene	Perez-Vich and collaborators (2002)
KI-534	E	Or6, Or7	two recessive genes	Rodriguez-Odeja and collaborators (2001)
KI-534	F (EK23), Spania	Or6, Or8	two recessive genes	Rodriguez-Odeja and collaborators (2002)
J1 (BR4)	F (Mencia-Spania)	Or6	one dominant gene	Perez-Vich and collaborators (2002)
LC1093	F(Romania)	Or6	one dominant gene	Pacureanu and collaborators (2004)
J1 (BR4)	F (Mencia-Spania)	Or6, Or7	two partially dominant genes	Velasco and collaborators (2006)
	G (Spania)	unknown		Molinero,Ruiz and Melero-Vara (2005)
Commercial hybrid 6471	G (Romania)	unknown		Pacureanu and collaborators (2009)

Table 2

Differential sort for *Orobanche cumana* Wallr. races identification

Differential sort	Characterization	F (%)	I (%)	GA (%)
Performer	no resistance	79 -100	1.75-4	1.7- 4
PR 64A89	E, Or5	24 -79	0.7 - 2.33	0.2 - 1.59
PR0229	F, Or6	14 - 39	0.4 - 1.9	0.1 - 0.44
PR64A71	G, Or7	0 - 2.2	0 - 1	0 - 0.02

F=infestation frequency; I=infestation intensity; GA=attack degree

CONCLUSIONS

1. During the last two decades, the aggressivity of the parasite increased significantly the new physiological races in the southeastern part of Romania, especially in Tulcea and Constanta county and proximity of Black Sea from Turkey, Bulgaria, Ukraine and Russia
2. Research concerning races evolution is necessary establishment of a differentiating sort created with inbred lines or hybrids with resistance for broomrape parasite.
3. Based on frequency values, intensity and attack degree registered, we can establish the physiologically races of *Orobanche Cumana* Wallr. in those five locations.
4. In 2009 and 2010 in our locations we identified race G and in locations 1,3,4,5 virulence more aggressive than race G, because we found broomrape strains on the hybrid resistant for race G.
5. Broomrape reduced significantly seed and oil production. It is not recommended to cultivate sunflower hybrids with resistance genes for race E or F in locations infested with race G or G+.

REFERENCES

1. Buherovici P.G., 1967. *Viivalenie rasovogo sostava podsolnecinicoi zarazihi moldavskovo proishojdeniia.* Sb. Rabot Masl. Kult., Vip. 2, Krasnodar (pp. 68).
2. Kaya Y., Y. Demirci, G. Evci, 2004. *Sunflower (Helianthus annuus L.) breeding in Turkey for broomrape (Orobanche cernua Loeffl) and herbicide resistance*. Helia 27, Nr. 40 (pp. 199-210).
3. Molinero-Ruiz M., Melero-Vara, M. Jose, 2004. *Virulence and aggressiveness of sunflower broomrape (Orobanche Cumana) populations overcoming the Or5 gene.* Proc. 16th International Sunflower Conference, Fargo, ND USA.
4. Pacureanu Joita, M. Raranciuc, S. Sava, E. Stanciu, D. Nastase, 2009. *Virulence and aggressiveness of sunflower broomrape (Orobanche Cumana Wallr.) population in Romania*. Helia 32, Nr. 51 (pp. 111-118).
5. Pustovoit G.V., 1966. *Mejvidovaia ghibridizatia kak metod selectii podsolnecinika na grupovnoi imunitet Ghenetika*. 1 (pp. 59-69).
6. Rojkova V.T., R.M. Koseleva, 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 (pp. 41-46).
7. Rotarenco V., 2010. *Unele aspecte morfo-fiziologice si genetice de interactiune gazda-parazit (Helianthus anuus L. - Orobanche Cumana Wallr.).* Autoreferatul tezei de doctorat, Universitatea de Stat din Moldova, Chisinau.

8. Satâperov F.A., 1913. *Opiti s podsolnecinikom*. Trudi Biuro Prikl. Bot., 6(4) (pp. 251-258).
9. 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" Institutul Agronomic "N. Balcescu" Bucuresti.
10. Vranceanu A.V., V.A. Tudor, F.M. Stoenescu, N. Parvu, 1981. *Evolutii ale virulentei parazitului Orobanche Cumana Wallr. si gene corespunzatoare de rezistenta la floarea-soarelui.* Analele ICCPT Fundulea Vol. XLVIII (pp. 37-43).
11. Vranceanu A.V., J.M. Pacureanu, 1995. *Evaluation of an international set of sunflower hybrids in relation to broomrape (Orobanche Cumana Wallr.) resistance*. Helia 3 (pp. 19-24).
12. Vranceanu A.V., 2000. *Floarea - soarelui hibrida*. Ed. Ceres, Bucuresti (pp. 1445).
13. xxx, 2010. Pioneer Hi-Bred Seeds Agro. SRL Romania, commercial catalog.