HELIA, **14**, Nr. 15, p.p. 21-26 (1991)

DETERMINATION OF BROOMRAPE (Orobanche cumana Wallr.) RACES OF SUNFLOWER IN THE THRACE REGION OF TURKEY

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SUMMARY

Broomrape (*Orobanche cumana* Wallr.) is an obligate parasitic plant which feeds on sunflower roots and causes very high yield losses in sunflower. Due to broomrape problem, production area dropped down by as much as 50% in Turkey during 1956–62. This problem was solved with planting resistant varieties. However, broomrape became a problem again in 1980.

This study was conducted at the Thrace Agricultural Research Institute to determine the existing broomrape races in Thrace during 1983–90. Broomrape seeds collected from sunflower fields in the region and differentials obtained from Romania were used in this study. It was concluded that broomrape recently seen in the Thrace region was race "E".

Key words: Sunflower, broomrape races, resistant vericties

INTRODUCTION

Broomrape (*Orobanche cumana* Wallr.) is an obligate parasite plant which causes high yield losses of sunflower. Its very small and light seed makes it spread easily by wind and water at large distance. The seeds remain vital in the soil for 15–20 years (Pustovoit, 1975 and Škorić, 1988).

Broomrape control is primarily by host resistance. Resistant sunflowers were first developed in the USSR during 1912–17. Those were Kruglig–A–41, Kruglig–631 and Saratovsky–169, all resistant to race A of broomrape. When broomrape attack occured on resistant sunflowers in some parts of the USSR in the twenties, studies revealed that there developed a new race defined race B (Pustovoit, 1975). The newly discovere race B was more virulent and it was able to cause 7–9 fold seed yield reduction of susceptible sunflowers (Pustovojt, 1975).

Development of resistent sunflowers to race B took some time. Resistant sunflower cultivars developed for race B were Vniimk 1646, Vniimk 8931, Vniimk 6540, Smena, Peredovik, Armavirsky 3497 and Majak. However, it was noted that broomrape attack occured in some parts of the USSR on those cultivars in the '70s (Pustovoit, 1975).

Vranceanu et al. (1980) found that five physiological races exist within the broomrape population from Braila area in Romania. They also discovered differential hosts for those races. Studies on broomrape population collected from Vojvodina in Yugoslavia revealed that there were 7 races in that population (Aćimović, 1980). Broomrape is also a problem in Spain (Özhatay, 1973) and in Bulgaria (Bicvarova, 1978).

First problems with broomrape occurred Turkey in 1956. Following 1956, sunflower acreage and production has decreased tremendously in Turkey (Özhatay, 1973). After determination of resistant Vniimk cultivars in 1964, its production area increased again. Vniimk 8931 which was known to be resistant to broomrape races A and B predominated in all sunflower areas. However, it was attacked by broomrape races and resistance sources to them were initiated at the Thrace Agricultural Research Institute, Edirne in Turkey.

MATERIAL AND METHODS

Sunflower differentials were obtained from Romania to determine broomrape races of Thrace in 1983. Differentials and their reactions to broomrape races are given in Table 1.

Table 1. Sunflower broomrape–differential lines and their reaction to race complexes of *Orobanche cumana*.

DIFFERENTIAL AND GENE		RACE COMPLEX				
		A	B	C	D	E
AD–66	–	S	S	S	S	S
KRUGLIG–A–41	Or_1	R	S	S	S	S
JDANOV–8281	Or_2	R	R	S	S	S
VNIIMK–8931	Or_2	R	R	S	S	S
RECORD	Or_3	R	R	R	S	S
S–1358–A	Or_4	R	R	R	R	S
P–1380–A	Or_5	R	R	R	R	R
0043 B	Or_5	R	R	R	R	R

This study was carried out at the research field of the Thrace Agricultural Research Institute, Edirne, in the years of 1983, 1984 and 1986–1990. 0043 B, a maintainer line which was developed at Edirne, was added to differentials during 1986–90. Jdanov–8281 was replaced by Vniimk–8931 which is resistant to races A and B at the same years.

Inoculum was prepared with Orobanche seeds collected at maturity of broomrape shoots from sunflower fields in different parts of the Thrace region. Sunflower planting was made by hand. Prior to planting, rows one meter apart were marked and hills 30–35 cm apart within row were made. Approximately 500 mg of inoculum was put in each hill and little amount of water was given to promote the germination of sunflowers. Three sunflower seeds were put into each hill. After emergence plants were thinned to one plant in each hill. Two replications were used except 3 replications in 1984, 1986 and 1989. Number of rows per plot differed from year to year but it was generally two rows.

Total sunflower plants per plot, plants parasitized by broomrape per plot and total broomrape shoots above ground per plot were used for evaluation of sunflower differentials against Orobanche parasitism. Three indices of parasitism, as defined by Vrenceanu et al. (1986), were calculated. "Frequency" was calculated as the percent of sunflower plants attacked by broomrape. "Intensity" was the average number of broomrape shoots per parasitized sunflower plant. "Attacking rate" was the average number of broomrape shoots considering all sunflower plants for each differential. Sunflowers which show 10% or lower frequency and one or less attacking rate scores are considered resistant or highly

tolerant to broomrape in our conditions. The proportion of each broomrape race in the race complex was also estimated from the relative attacking rate scores.

RESULTS AND DISCUSSION

Broomrape parasitism results on sunflower differentials are given in Table 2. AD–66, Kruglig–A–41, Vniimk–8931 and Record were highly affected by broomrape attack. S–1358–A which is resistant to races A,B,C and D had lower frequency, intensity and attacking rate scores than sunflowers mentioned above. However, the scores obtained on S–1358–A are higher than the accepted scores for resistance to broomrape. P–130–Sa and 0043 B had the lowest parasitism scores in the study.

The results with differentials in our study were somewhat consistent with the results obtained in Romania. Vranceanu et al. (1975), noted that AD–66 which was susceptible to all races of broomrape was highly attacked by Orobanche. Although high frequency and attacking rate scores were observed on AD–66 in the early years of the test, they were lower in the following test years. Since AD–66 was very susceptible to broomrape, it was highly affected by Orobanche attack at the early growth stage. It was observed that plant development of AD–66 was retarded and some plants died after broomrape attack. Therefore, the number of plants of AD–66 evaluated was low almost in all years. Higher broomrape nodulation on roots and poor plant development of AD–66 lessened Orobanche shoot growth above ground. Hence, intensity was low for AD–66 when compared with the results obtained by Vranceany et al. (1975).

According to Pustovoit (1975), Jdanov–8281 is resistant to races A and B. It was tested in 1983 and 1984. When the results of Jdanov–9291 were compared with the results of Record and S–1358–A which are resistant to 3 and 4 races of broomrape, respectively, it showed lower frequency and attacking rate scores. The parasitism results were also lower than the results of Vranceanu et al. (1975). Jdanov–8281 then may be considered to have some tolerance to the new race. Since we had encountered complications with Jdanov–8281, it was replaced by Vniimk–8931 which was also resistant to races A and B.

According to Vranceanu et al. (1975), P–1380–2A is resistant to broomrape races A,B,C,D and E. Broomrape frequency scores obtained on P–1380–2A averaged 4.9%. Few broomrape occuring on P–1380–2A can be explained by seed mixture or presence of a new race different from race E in the Thrace region. If the latter assumption is accepted, it can be said that the new race is not very harmful because many Orobanche shoots observed on P–1380–2A are poor and inable to set seed.

Broomrape resistance of 0043 B which has been used extensively in sunflower breeding programs shows that it is still resistant to the Orobanche races in the region.

The estimation of the proportion of each broomrape race within the broomrape population showed that races A, B, C and D were evenly represented (Table 2). Race E was in the lowest proportion.

This study showed that five race complexes of broomrape exist within *O. cumana* population in Thrace region of Turkey and lines P–1380–2A and 0043 B, developed by Romania and Turkey, respectively, were resistant to those races.

Table 2. Combined data of broomrape parasitism results on sunflower differentials in Thrace during 1983–90.

Sunflower differential	Total plants	Plants parasitized by broom rape	Total broom rape shoots	Frequency %	Intensity	Attacking rate	RACE COMPLEX				
							A	B	C	D	E
AD–66	791	721	7584	91.1	10.5	9.6	S	S	S	S	S
KRUGLIG–A–41	1098	987	13700	89.9	13.9	12.5	R	S	S	S	S
JDANOV–8281*	295	100	587	33.9	5.9	2.0	R	R	S	S	S
V.–8931**	829	721	7625	87.0	10.6	9.2	R	R	S	S	S
RECORD***	1112	991	11382	89.1	11.5	10.2	R	R	R	S	S
S–1358–A	1142	745	4192	65.2	5.6	3.7	R	R	R	R	S
P–1380–2A	1138	56	74	4.9	1.3	0.06	R	R	R	R	R
0043 B**	355	0	0	0.0	0.0	0.0	R	R	R	R	R
				Race Frequency:			20	26	24	22	8

* Tested 2 years
** Tested 5 years
*** Tested 6 years

ACKNOWLEDGEMENTS

The authors wish to thank Dr.A.V. Vranceanu and his colleagues in Romania for providing sunflower broomrape differentials for this study.

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DETERMINACION DE RAZAS DE JOPO (*Orobanche cumana* Wallr.) DE GIRASOL EN LA REGION TURCA DE TRACIA.

RESUMEN

Jopo (*Orobanche cumana* Wallr.) es una planta parásita obligada que se alimenta en raíces de girasol y causa pérdidas de rendimiento de girasol muy elevadas. Debido al problema de jopo, el área de producción se redujo al 50% en Turquía durante 1956–62. Este problema se resolvió mediante la siembra de variedados resistentes. Sin embargo, el jopo volvió a ser un problema de nuevo en 1980.

Este estudio se realizó en el Instituto de Investigación Agrícola de Tracia con el objeto de determinar las razas de jopo existentes en Tracia durante 1983–90. En este estudio se utilizaron semillas de jopo recolectadas de campos de girasol en la región y diferenciales obtendidos de Rumanía. So concluyó que el jopo recientemente observado en la región de Tracia era de la raza "E".

DÉTERMINATION DE RACES D'*Orobanche cumana* Wallr., PARASITE DU TOURNESOL DANS LA RÉGION DE THRACE EN TURQUIE.

RÉSUMÉ:

Orobanche cumana Wallr. est un parasite obligatoire qui se développe sur les racines de tournesol provoquant de très importantes pertes de rendement. En raison de ce probléme la culture du tournesol a régressé en Turquie de 50% entre 1956 et 1962. Une solution avait été trouvée grâce à l'introduction d'hybrides résistants. Cependant ce parasite constitue de nouveau un probléme depuis 1980. Cet étude, réalisée entre 19883 et 1990, a été menée à l'Institut de Recherches Agricole de Thrace afin de déterminer l'existence de races d'-*Orobanche* dans cette région. Les graines de ce parasite ont été récoltées sur des parcelles infectées de tournesol et différentes races en provenance de Roumanie ont été utilisées. Il a été conclu que la race observée récemment en Thrace est la race "E".