

NEW NOMENCLATURE OF DOWNY MILDEW RACES IN SUNFLOWER (*Plasmopara halstedii* Farl. Berlese et de Toni) IN BULGARIA (RACE COMPOSITION DURING 2000-2003)

Shindrova, P.*

Dobroudja Agricultural Institute, General Toshevo, Bulgaria

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SUMMARY

A new unified nomenclature system of downy mildew races was introduced in 2000 (Tourvieille *et al.*, 2000).

The present study has the aim to determine the distribution and race composition of sunflower downy mildew in Bulgaria according to this new nomenclature. During 2000-2003, 57 samples were collected from infected plants and their race affiliation was determined. According to the results obtained, three downy mildew races were isolated during this period: races 100, 300 and 700. Race 100 had the most limited distribution, 3.5% of the downy mildew population. It was detected only during the first year of the investigation. Race 300 was isolated during all years of study. Its percent in the pathogen population was 36.8% averaged for the period. It was distributed mainly in the southeastern, northwestern and central parts of Bulgaria. Race 700 had the widest distribution during the period of investigation. It was isolated from 34 out of a total of 57 samples analyzed, which was 59.7%. Its area of distribution was mainly in northeastern Bulgaria.

Key words: sunflower, downy mildew, races composition

INTRODUCTION

Not so long ago, various nomenclature systems have been used to determine the race composition of downy mildew in sunflower. In the United States, the races were designated with numbers (race 1, race 2, etc.). In France and several other European countries the so-called European nomenclature was adopted. According to this system, the races were denoted with Latin letters: race A, race B, etc. In Bulgaria, the downy mildew races were designated with consecutive Arab figures (race 1, race 2, etc.), but they did not correspond to the races from the American nomenclature system (Shindrova, 1995, 1998, 2000). In many cases differential lines used

* Corresponding author

for determination of the races were not the same. All this made both race determination and the exchange of information and breeding materials difficult. Therefore a new, uniform nomenclature of downy mildew races was suggested that would replace the old ones. According to this nomenclature system there are 10 downy mildew races currently existing in the world, as follows: 100, 300, 310, 330, 700, 703, 710, 711, 730 and 770 (Tourvieille *et al.*, 2000).

This study aims to determine the distribution and race composition of sunflower downy mildew in Bulgaria according to the new nomenclature system.

MATERIALS AND METHODS

With a view of determining the race composition of downy mildew in the major sunflower production regions in Bulgaria, expeditions have been annually undertaken to collect samples from infected plants. During the period of investigation, the samples were collected as follows:

- 2000 - southeastern Bulgaria (Bourgas, Rusocastro, Bolyarovo, Gorsky Izvor), northwestern Bulgaria (Chomakovtzy, Selanovtzy), central-northern Bulgaria (Pordim, Byala), northeastern Bulgaria (Sitovo, Dobrich, Isperih, Shumen, DAI-1, DAI-2);
- 2001 - southeastern Bulgaria (Bourgas, Topolovgrad, Radnevo), northwestern Bulgaria (Kapitanovtzy, Vidin, Selanovtzy), central-northern Bulgaria (Pordim, Russe-1, Russe-2, Brashlyan), northeastern Bulgaria (Targovishte-1, Targovishte-2, Popovo, Kardam, Isperih, Svetlen, Sitovo, DAI-1, DAI-2);
- 2002 - southeastern Bulgaria (Elhovo, Medven, Radnevo, Gorsky Izvor), northwestern Bulgaria (Selanovtzy, Kneja, Iskar-1, Iskar-2), northeastern Bulgaria (Silistra, Sredishte, Dobrich, DAI-infection field);
- 2003 - southeastern Bulgaria (Bourgas, Radnevo, Gorsky Izvor), northwestern Bulgaria (Selanovtzy, Kneja), central-northern Bulgaria (Pordim, Byala), northeastern Bulgaria (Tutrakan, Sitovo, Dobrich, DAI-1, DAI-2).

The inoculum collected from the above regions was used to infect the set of differential lines. Standard methodology (Gulia *et al.*, 1991) was applied for this purpose. For determination of the race affiliation of downy mildew according to the new nomenclature system, nine lines were grouped as follows: first group - AD-66 (D-1), Rha-265 (D-2), Rha-274 (D-3); second group PM-13 (D-4), PM-17 (D-5), 803-1 (D-6); third group - HAR-4 (D-7), HAR-5 (D-8), HA-335 (D-9). Races were determined on the basis of the response of the lines from each group (Tourvieille *et al.*, 2000).

RESULTS AND DISCUSSION

The results of this investigation showed that during 2000 three races were isolated from the 14 samples - races 100, 300 and 700 (Table 1). Race 100 had the

most limited distribution, representing 14.3% of the pathogen population (Table 5). It was isolated from 2 samples originating from northwestern Bulgaria. Race 300 has a wider area of distribution. It was isolated from 5 samples, which makes 35.7% of the downy mildew population. This race is distributed in southeastern, northern and northeastern Bulgaria. The most common race in 2000 was race 700, isolated from 7 samples. Its share in the pathogen population was 50%. It was distributed in all sunflower production areas of the country - southeastern, northern and northeastern Bulgaria.

Table 1: Distribution and race composition of downy mildew in sunflower in 2000

Origin 2000	Set one			Set two			Set three			Race N.
	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	
	AD 66	Rha 265	Rha 274	PM 13	PM 17	803-1	HAR 4	HAR5	HA 335	
Southeastern Bulgaria										
Bourgas	S	S	S	R	R	R	R	R	R	700
Risocastro	S	S	S	R	R	R	R	R	R	700
Bolyarovo	S	S	R	R	R	R	R	R	R	300
Gorsky izvor	S	S	R	R	R	R	R	R	R	300
Northwestern Bulgaria										
Chomakovtzy	S	R	R	R	R	R	R	R	R	100
Selanovtzy	S	R	R	R	R	R	R	R	R	100
Northern Bulgaria										
Pordim	S	S	R	R	R	R	R	R	R	300
Byala	S	S	S	R	R	R	R	R	R	700
Northeastern Bulgaria										
Sitovo	S	S	S	R	R	R	R	R	R	700
Dobrich	S	S	S	R	R	R	R	R	R	700
Isperih	S	S	R	R	R	R	R	R	R	300
Shumen	S	S	R	R	R	R	R	R	R	300
DAI-1	S	S	S	R	R	R	R	R	R	700
DAI-2	S	S	S	R	R	R	R	R	R	700

In 2001, 19 samples of downy mildew were collected and two races were isolated from them - race 300 and race 700 (Table 2). Race 300 was identified in 6 samples, which is 31.6% of the pathogen population. It prevailed in southeastern Bulgaria, where 3 samples were isolated. Single samples from this race originated from the regions of Kapitanovtzy, Sitovo and DAI. Race 700 was predominant in 2001. It was isolated from 13 samples amounting to 68.4% of the downy mildew population. The distribution area of this race included northwestern, northern and northeastern Bulgaria.

Race 300 and 700 were again established in the total of 12 samples collected during the vegetation period of 2002 (Table 3). Race 300 was isolated from 5 samples, race 700 from 7 samples. The two races had different distribution areas. Race

300 was predominant in southeastern and northwestern Bulgaria, while race 700 was isolated mainly in northeast. It was also found in single samples originating from the regions of Medven and Iskar.

Table 4: Distribution and race composition of downy mildew in sunflower during 2003

Origin 2003	Set one			Set two			Set three			Race N.
	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	
	AD 66	Rha 265	Rha 274	PM 13	PM 17	803-1	HAR 4	HAR-5	HA-335	
Southeastern Bulgaria										
Bourgas	S	S	S	R	R	R	R	R	R	700
Gorsky izvor	S	S	R	R	R	R	R	R	R	300
Radnevo	S	S	R	R	R	R	R	R	R	300
Northwestern Bulgaria										
Kneja	S	S	R	R	R	R	R	R	R	300
Selanovtzy	S	S	R	R	R	R	R	R	R	300
Northern Bulgaria										
Pordim	S	S	S	R	R	R	R	R	R	700
Byala	S	S	S	R	R	R	R	R	R	700
Northeastern Bulgaria										
Tutrakan	S	S	S	R	R	R	R	R	R	700
Sitovo	S	S	S	R	R	R	R	R	R	700
Dobrich	S	S	R	R	R	R	R	R	R	700
DAI-1	S	S	R	R	R	R	R	R	R	300
DAI-2	S	S	S	R	R	R	R	R	R	700

In 2003, races 300 and 700 were again isolated from 12 analyzed samples (Table 4). Their shares in the downy mildew population were quite similar, with slight predominance of race 700 - 58.3% (Table 5).

Table 5: Percent of different races in the downy mildew population

Race	Period of study									
	2000		2001		2002		2003		2000-2003	
	Collected samples									
	No.	%	No.	%	No.	%	No.	%	No.	%
100	2	14.3	0	0	0	0	0	0	2	3.5
300	5	35.7	6	31.6	5	41.7	5	41.7	21	36.8
700	7	50.0	13	68.4	7	58.3	7	58.3	34	59.7
100+300+700	14	24.6	19	33.4	12	21.0	12	21.0	57	100

The results of the distribution areas were similar to those from the previous years: race 300 occurred mainly in the southwest, northwest and central-north of the country, while race 700 was detected in all samples collected from in northeast.

Table 2: Distribution and race composition of downy mildew in sunflower in 2001

Origin 2001	Set one			Set two			Set three			Race N
	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	
	AD 66	Rha 265	Rha 274	PM 13	PM 17	803-1	HAR 4	HAR-5	HA-335	
Southeastern Bulgaria										
Bourgas	S	S	R	R	R	R	R	R	R	300
Topolovgrad	S	S	R	R	R	R	R	R	R	300
Radnevo	S	S	R	R	R	R	R	R	R	300
Northwestern Bulgaria										
Kapitanovtzy	S	R	R	R	R	R	R	R	R	300
Vidin	S	S	S	R	R	R	R	R	R	700
Selanovtzy	S	S	S	R	R	R	R	R	R	700
Northern Bulgaria										
Pordim	S	S	S	R	R	R	R	R	R	700
Rousse-1	S	S	S	R	R	R	R	R	R	700
Rousse-2	S	S	S	R	R	R	R	R	R	700
Brashlyan	S	S	S	R	R	R	R	R	R	700
Northeastern Bulgaria										
Popovo	S	S	S	R	R	R	R	R	R	700
Kardam	S	S	S	R	R	R	R	R	R	700
Isperih	S	S	R	R	R	R	R	R	R	700
Targovishte-1	S	S	S	R	R	R	R	R	R	700
Targovishte-2	S	S	S	R	R	R	R	R	R	700
Svetlen	S	S	S	R	R	R	R	R	R	700
Sitovo	S	S	R	R	R	R	R	R	R	300
DAI-1	S	S	R	R	R	R	R	R	R	300
DAI-2	S	S	S	R	R	R	R	R	R	700

Table 3: Distribution and race composition of downy mildew in sunflower in 2002

Origin 2002	Set one			Set two			Set three			Race N
	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	
	AD 66	Rha 265	Rha 274	PM 13	PM 17	803-1	HAR 4	HAR-5	HA-335	
Southeastern Bulgaria										
Elhovo	S	S	R	R	R	R	R	R	R	300
Medven	S	S	S	R	R	R	R	R	R	700
Gorsky izvor	S	S	R	R	R	R	R	R	R	300
Radnevo	S	S	R	R	R	R	R	R	R	300
Northwestern Bulgaria										
Selanovtzy	S	S	R	R	R	R	R	R	R	300
Kneja	S	S	R	R	R	R	R	R	R	300
Iskar-1	S	S	S	R	R	R	R	R	R	700
Iskar-2	S	S	S	R	R	R	R	R	R	700
Northeastern Bulgaria										
Silistra	S	S	S	R	R	R	R	R	R	700
Sredishte	S	S	S	R	R	R	R	R	R	700
Dobrich	S	S	R	R	R	R	R	R	R	700
DAI	S	S	S	R	R	R	R	R	R	700

CONCLUSION

According to this investigation, three downy mildew races were isolated in Bulgaria during the period 2000-2003: race 100, race 300 and race 700. The distribution area and share in the pathogen population of each of them varied over the years, which is related to the rapid change in the variety structure of the sunflower crop. Race 100 had the most limited occurrence, 3.5%. It was detected only in the first year of the study, which can be explained with the mass introduction of resistant sunflower hybrids. Race 300 was isolated in all years of the investigation. Its share in the pathogen population, averaged for the whole period of study, was 36.8%. This race was distributed mainly in southeastern, northwestern and central northern Bulgaria. During 2000-2003 race 700 was most common. It was isolated in 34 out of a total of 57 samples analyzed, which makes a mean of 59.7% of the overall downy mildew population in sunflower. The distribution area of race 700 was mainly northeastern Bulgaria, but it was also detected in single samples from other regions.

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NUEVA RECLASIFICACIÓN DE RAZAS DEL TIZÓN DE GIRASOL (*Plasmopara halstedii* Farl. Berlese et de Toni) EN BULGARIA (COMPOSICIÓN DE RAZAS DURANTE EL PERÍODO DE 2000-2003)

RESUMEN

El nuevo sistema unificado de nomenclatura de razas del tizón fue introducido en el año 2000 (Tourvieille *et al.* 2000).

El objetivo de este estudio fue determinar la distribución y la composición de razas del tizón en Bulgaria, de conformidad con la nueva nomenclatura. Durante el período comprendido entre los años 2000 y 2003, fueron recolectadas 57 muestras de las plantas infectadas, que fueron analizadas para el tipo de la raza. Según los resultados obtenidos, tres razas fueron aisladas durante el período de investigación, las razas 100, 300 y 700. La raza 100

tuvo la distribución más estrecha, 3,5% de la población total del tizón. Ésta fue determinada solamente durante el primer año de la investigación. La raza 300 fue determinada en todos los años, con la aportación promedia en la población de 36,8%. Ésta fue divulgada prevalentemente en las partes de sudeste, nordeste y central de Bulgaria. La raza 700 tuvo la mayor distribución durante el periodo de investigación. Ella fue aislada de 34 del total de 57 muestras analizadas, lo que hace 59,7%. El areal de distribución de esta raza fue prevalentemente el noreste de Bulgaria.

**NOUVELLE NOMENCLATURE DES RACES DE ROUILLE DU
TOURNESOL (*Plasmopara halstedii* Farl. Berlese et de
Toni) EN BULGARIE (COMPOSITION DE RACE EN 2000-
2003)**

RÉSUMÉ

Un nouveau système unifié de nomenclature des races de rouille a été présenté en 2000 (Tourvieille *et al.* 2000).

Le but de cette étude est de déterminer la distribution et la composition de la race de rouille du tournesol en Bulgarie selon cette nouvelle nomenclature. En 2000 et 2003, cinquante-sept échantillons ont été recueillis des plantes infectées et leur affiliation à une race a été déterminée. Les résultats obtenus ont montré que trois races avaient été isolées au cours de la période de recherche, les races 100, 300 et 700. La race 100 avait la distribution la plus limitée, 3,5% de la population de rouille. Elle n'a été détectée que durant la première année de la recherche. La race 300 a été isolée pendant toutes les années de la recherche. Le pourcentage de sa population pathogène était de 36,8% en moyenne pour cette période. Elle était distribuée surtout dans le sud-est, le nord-ouest et les régions centrales de la Bulgarie. Pendant la période de recherche, c'est la race 700 qui était le plus largement distribuée. Elle a été isolée dans 34 des 57 échantillons analysés, ce qui représente 59,7%. Sa zone de distribution était surtout le nord-est de la Bulgarie.

