

PATHOGENIC RACES OF SUNFLOWER DOWNY MILDEW IN EUROPE: PRESENT STATE, PROBLEMS AND PROSPECTS

F. Viranyi¹ and S. Maširević²

¹Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Pf. 102, 1525, Hungary

²Faculty of Agriculture, Institute of Field and Vegetable Crops, 21000 Novi Sad, M. Gorkog 30, Yugoslavia

SUMMARY

In the recent years, at least three sunflower downy mildew races other than race 1 have been reported from several European countries. To cope with this new situation, race identification on an international base is required.

Key words: Downy mildew, downy mildew races, sunflower diseases, race identification

Downy mildew (DM), incited by *Plasmopara halstedii* (Farlow) Berlese & de Toni, is considered one of the most serious diseases of sunflower worldwide. In Europe, it has been coincided with the introduction and spread of open-pollinated, oilseed cultivars in the 1960s. Although variable in inducing disease symptoms, the pathogen seemed to be uniform in its pathogenic character for many years. It was in 1972, that Zimmer reported of a local isolate of *P. halstedii* capable of attacking sunflowers known to be resistant to DM (Zimmer 1972). Since then the European race (race 1) and the Red River race (race 2) co-existed, the latter being confined to north America. Some years later, however, the appearance of DM isolates resembling race 2 were reported from the Soviet Union (Pogorletsky & Geshele 1975), Italy (D'Armini et al. 1975) and Romania (Vranceanu et al. 1978). Fortunately enough, neither of these records had further history afterwards and, in Europe, DM race 1 remained the only pathogenic form reported until 1988. Between the period of 1980-1988, three additional races of the fungus have been identified in the United States (Carson 1981; Gulya & Urs 1985; Ljubich et al 1988), with races 3 and 4 predominant.

In 1988 a new race of DM was found in the Indres region of France which was felt to be identical to the North American race 3 (Tourvieille et al. 1988). In the next year, a few field collections of DM from Hungary showed virulence on sunflower cultivars resistant to races 1 and 2. This observation has prompted us to start with a more defined international survey of the subject in collaboration with overseas scientists (Prof. W.E. Sackston and Dr. K.Y. Rashid, Canada; Dr. T.J. Gulya, U.S.A.). In the first step, DM isolates from Yugoslavia and Hungary were tested at both the Oilseed Crop Laboratory of the Institute of Field and Vegetable Crops, Novi Sad, and the Plant Pathology Laboratory of the Plant Protection Institute, Hungarian Academy of Sciences, Budapest. Based on a series of inoculations onto sunflower differentials it was found that some of

the Hungarian isolates in question were race 4 or alike (Virányi & Maširević 1990). Subsequently, race identification tests were expanded and carried out at the USDA laboratory in Fargo (U.S.A.) with isolates from different European and overseas countries. Due to the large number of USDA sunflower differentials available, a more precise race differentiation could be made resulting in the identification of two additional races (races 6 and 7) (Gulya et al. 1991). With the recent discovery of a new race in the United States (García & Gulya 1991), a total of eight DM races have been identified. As for Europe, there is a good reason to assume that, besides race 1, at least three additional races (3, 4 and 6) are existing (Tourvieille et al. 1988; Gulya et al. 1991; Vear, personal communication), while others may be verified subsequently (Gulya & Virányi, unpublished).

Considering the present state of knowledge on the occurrence and distribution of DM races in Europe, as well as the commercial sunflower cultivars grown, there is a large gap in the genetic control of *P. halstedii* in every sunflower producing country of the continent. What breeders have done with the release of a number of sunflower cultivars carrying DM resistance genes P1-1, P1-2, P1-3 or P1-4 was extremely successful for many years but it might be of risk to use such cultivars in areas where any of the new DM races are known to appear.

Identification of DM races is of increasing importance for two reasons. Firstly, breeders may want to know which races are more likely to be controlled by their cultivars and, secondly, epidemiologists/growers must know of the actual race distribution in a particular region before decision making of what cultivars could be grown there. Although race identification has become a routine work in some laboratories, with the recent increase in number of identified and postulated resistance genes, and the consequent increase in the number of races, a more informative and useful system of designating races is required (Sackston et al. 1990). The system described by Sackston and co-workers is said to be a flexible one. In fact, designation of races may be changed and, similarly, addition or substitution of differential lines of sunflower could be arranged on a continuing basis. In a proposal to the FAO Cooperative Research Network on Sunflower, the first author has outlined an international cooperation on monitoring and identifying *P. halstedii* populations throughout Europe. To start with, laboratories in France (INRA, Clermont-Ferrand), Hungary (PPI, Budapest) and Yugoslavia (IFVC, Novi Sad) were suggested to decide upon the materials and procedures to follow. Such a proposal is being prepared now (Gulya et al., unpublished) and be recommended for use after worldwide acceptance.

If DM races are continuing to arise as it could be, plant breeders are forced to discover and incorporate new resistance genes to match corresponding pathogen races. This "competition", however, will certainly be getting more difficult with time. As an alternative, sunflower breeding for horizontal/race non-specific resistance to DM would be of value.

REFERENCES

1. Carson, M.L. 1981. New race of *Plasmopara halstedii* virulent on resistant sunflowers in South Dakota. Plant Dis. rep. 5:842-843.
2. D'Armini, M., Monotti, M. and Zazzerini, A. 1975. Interventi agronomici e lotta chimica nel controllo della peronospora del girasole (*Plasmopara helianthi* Novot. f. *helianthi*). Atti Giornate Fitopatologiche 1975, 1-8.
3. Gulya, T.J., Sackston, W.E., Virányi, F., Maširević, S. and Rashid, K.Y. 1991. New races of the sunflower downy mildew pathogen (*Plasmopara halstedii*) in Europe and North and South America. J. Phytopathology (in press)
4. Gulya, T.J. and Urs, N.V.R.R. 1985. A new race of sunflower downy mildew. Phytopathology 75:1339.
5. Ljubich, A., Gulya, T.J. and Miller, J.F. 1988. A new race of sunflower downy mildew in North America. Phytopathology 78:1580.
6. Pogorletsky, B.K. and Geshele, E.E. 1975. Inheritance of resistance in sunflower to downy mildew. Genetika 11(3):21-28. (in Russian)
7. Sackston, W.E., Gulya, T.J. and Miller, J.F. 1990. A proposed international system for designating races of *Plasmopara halstedii*. Plant Disease 74:721-723.
8. Tourvieille, D., Champion, R., Vear, F., Mouzeyar, S. and Said, J. 1988. Une nouvelle race de mildiou en France. Identification, test et controle. Inf. Techn. (CETIOM) 104:3-7.
9. Virányi, F. and Maširević, S. 1990. A new sunflower downy mildew race in Hungary. Novényvédelem 26:274. (in Hungarian)
10. Vranceanu, A.V., Pirvu, N. and Iliescu, H. 1978. A new race of the fungus *Plasmopara helianthi* Novot. identified in Romania. Proc. 8th Intern. Sunflower Conf., Minneapolis, 328-333.
11. Zimmer, D.E. 1972. Field evaluation of sunflower for downy mildew resistance. Plant Dis. Rep. 56:428-431.

RAZAS PATOGENICAS DE MILDIU DE GIRASOL EN EUROPA: ESTADO ACTUAL, PROBLEMAS Y PERSPECTIVAS

RESUMEN

En los últimos años, se ha comunicado la presencia de al menos tres razas de mildiu de girasol diferentes de la raza 1 en varios países europeos. Para hacer frente a esta nueva situación, se requiere la identificación racial sobre una base internacional.

RACES PATHOGÈNES DU MILDIOU DU TOURNESOL EN EUROPE: CONSTATS, PROBLÈMES ET PERSPECTIVES.

RÉSUMÉ:

Au cours de ces dernières années, au moins trois races de mildiou du tournesol—autres que la race 1—ont été signalées dans plusieurs pays européens. Afin d'éclaircir cette nouvelle situation, l'identification de ces races selon une méthode reconnue internationalement est nécessaire.