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Plant pathology

Sunflower resistance to French races of downy mildew *(Plasmopara halstedii)*

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Summary — Three races of downy mildew (1, A, B) have been observed on sunflowers in France. Until recently, all genotypes resistant to race A were resistant to the less virulent races 1 and B. Some genotypes have now been identified as resistant to races 1 and A but susceptible to race B.

***Helianthus annuus* = sunflower / *Plasmopara halstedii* = downy mildew / sélection**

Résumé — Résistance du tournesol aux races françaises de mildiou *(Plasmopara halstedii).* *Il existe en France 3 races de* Plasmopara halstedii, *agent du mildiou du tournesol,* Helianthus annuus *L : la race 1, la race B et la race A. Tous les génotypes résistants à la race A étaient également résistants aux 2 autres races. Cette possibilité pouvait être exploitée par les sélectionneurs en utilisant uniquement la race A pour sélectionner pour la résistance simultanée aux autres races françaises. Cependant, la mise en évidence du comportement de la lignée QHP1 et de 2 populations, HAR4 et HAR5, qui sont résistantes à la race A mais sensibles à la race B, remet en question cette stratégie de sélection et imposerait l'utilisation de 2, voire des 3 races françaises.*

Helianthus annuus = *tournesol* / Plasmopara halstedii = mildiou / *sélection*

Downy mildew of sunflower (*Helianthus annuus* L) is caused by *Plasmopara halstedii* (Farl) Berl and de Toni. It is an obligate parasite with physiological races that are capable of attacking a variable range of sunflower genotypes. Resistance is controlled by major genes denoted *Pl.* At present, 7 races and 16 *Pl* genes have been reported (Gulya *et al,* 1991a, 1991b).

In France, 3 different races have been found (Tourvieille *et al,* 1989): race 1, which was identified in 1966 (Louvet and Kermoal, 1966); race A, which is similar to the American race 4 and was identified in 1988; and race B which is similar to the American race 3 and was identified in 1989.

Table I presents the interactions of these 3 races with a range of differential sunflower genotypes. The contamination of differentials and assessment of resistance were made according to the method described by Mouzeyar *et al* (1993, 1994), by observation of both fungal sporulation and microscopic development of resistance reactions. Until recently, race A was considered as the most virulent and all genotypes resistant to this race were also resistant to the less virulent races. This meant that breeders could only carry out selection programmes using the most virulent race in order to breed for resistance to all 3 races.

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Table I. Reaction of sunflower differentials to French races of downy mildew pathogen, *Plasmopara halstedii.*

Sunflower genotypes	*Origin*	P halstedii *races**		
		1	*B*	*A*
HA89	USDA inbred line	S	S	S
RHA266	USDA inbred line	R	S	S
RHA274	USDA inbred line	R	S	S
HIR34	INRA inbred line, a selection from *H tuberosus*	R	S	S
PMI3	INRA inbred line, a selection from DM2 (synthetic, USDA)	R	R	S
XP	INRA inbred line, a selection from Russian Novinka population	R	R	R
DM3	USDA, synthetic	R	R	R
QHP1	INRA inbred line, a selection from HAR5	R	S	R
HAR4	USDA population	R	S	R
HAR5	USDA population	R	S	R
HA338	USDA inbred line, a selection from *Helianthus praecox*	R	R	R

* R: resistant; S: susceptible. Lines are maintained by self-pollination under paper bags at INRA, Clermont-Ferrand.

However, it has now been observed that the inbred line QHP1 and the populations HAR4 and HAR5 are resistant to race A but susceptible to race B (less virulent). This means that it will be necessary to check that resistance sources are effective against all French races in breeding programmes.

In addition, since this result is different from that obtained with American races 3 and 4 (Gulya, personal communication), more detailed studies of the identification of French races are necessary.

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