Soybean phytophthora rot in southwestern Ontario

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Phytophthora megasperma var. *sojae* was isolated from dying soybean (*Glycine* max) plants and characterized as to race (1 to 6) using as differentials the cultivars Harosoy, Harosoy 63, Mack, Altona, and Sanga. Most of the 200 isolates obtained during 1973-76 were races 3 or 6 (90%) whereas 9% were races 4 or 5. Race 1 was obtained but race 2 was not found. Twelve of 71 fields contained more than one race. Additional testing of some of the race 6 isolates on the soybean lines PI 103.091 and PI 171.442 showed that races 7 and 8 are also present in southwestern Ontario,

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Phytophthora megasperma var. *sojae* a ete isolé de plants moribonds de soja (*Glycine* max) et des races (de 1 a 6) ont ete identifiées a l'aide de differents cultivars de soja (Harosoy, Harosoy 63, Mack, Altona et Sanga). Les races 3 et 6 ont ete retrouvees dans la plupart (90 %) des 200 isolats recueillis au cours de la periode 1974-1976, tandis que les races 4 et 5 n'etaient observees que dans 9 % d'entre eux. On a obtenu la race 1 mais pas la race 2. On a retrouve au moins 2 races dans quelques-uns des 71 champs. Les analyses supplementaires portant sur quelques isolats de la race 6 recueillis dans les parcelles de soja PI 103.091 et PI 171.442 ont montre que les races 7 et 8 étaient egalement presentes dans le sud-ouest de l'Ontario.

Phytophthora megasperma (Drechs.) var. ***sojae*** A.A. Hildebrand ***(Pms)*** incites a root and basal stem rot of soybeans (4). The disease was important in southwestern Ontario and in the major soybean growing region of the north central U.S.A. from about 1954, when it was first discovered, until shortly after 1963 when resistant isolines of agronomically acceptable cultivars were released to growers. These new cultivars contained the ***Rps,*** gene (1) which conferred resistance to what has been subsequently called race 1 of ***Pms.***

From about 1965 onward, essentially the entire soybean crop in Ontario was planted with cultivars resistant to race 1. We received occasional reports of plant killing but ***Pms*** was not isolated from the plants; ***Rhizoctonia*** sp. was recovered and presumed to be the incitant. In 1973, ***Pms*** was isolated from ***Rps,*** cultivars in Ontario. Further work showed that the isolates were different from race 1, race 2 (7), race 3 (8), and race 4 (9); and they have been reported as races 5 and 6 (3). By the latter part of the 1974 growing season about 50 reports had been received of diseased soybeans on the clay soils in southwestern Ontario. We have attempted to obtain an estimate of the prevalence of new pathotypes in this area; a portion of this work has been published (2).

Materials and methods

Soil was collected from around dead soybean plants in 33 fields in Essex, Kent, and Lambton counties (4 in 1973 and 29 in 1974). The soils were placed in 30-cim-diameter fibre pots in a greenhouse. Up to six repetitive plantings of each of four soybean strains (Amsoy, Altona, Harosoy, OX20-8) were made in each soil and isolations made from dying plants. From any strain grown in each soil no more than five ***Pms*** isolates were saved for testing; in many cases the number recovered was much less than five.

In 1975 a survey was made of the major soybean-producing areas in Essex (including Pelee Island) and Kent counties. Depending upon the frequency of soybean crops in an area, one field per 5 to 10 km of road travelled was checked. Where plant killing was found, dying plants were collected and isolations made from them. We tried to obtain one culture from each of two affected plants in each field. Diseased plants were olbtained from eight fields in 1976 in response to grower queries.

All isolations were made from stems of dying soybean plants. They were surface sterilized in 0.5% sodium hypochlorite; seedling hypocotyls were cross-sectioned at the margin of lesions, and woody stems were split and a sliver of stelar tissue removed. The plant pieces were placed on Difco corn meal agar (CMA) amended with 100 ppm pimaricin. Generally *Pms* was the only fungus which grew on the medium but bacterial contaminants were common. Pure cultures were obtained by inverting the agar 4 to 5 days after plating and removing mycelium which had grown through the agar layer.

All cultures were stored on CMA slants under mineral oil at 18-22° C. A set of differential soybean cultivars, Harosoy, Harosoy 63, Mack, Altona, and Sanga, were inoculated by the hypocotyl-puncture method of testing virulence of ***Pms*** (5). Mycelium grown in agar (3) was used for testing the 1973-74 isolates and mycelium grown in broth was used for the 1975-76 isolates. The pots containing inoculated plants were covered with

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Table 1. Number of isolates (N=200) of *Phytophthora megasperma* var. *sojae* classified into races 1 to 6 in southwestern Ontario during 1973 through 1976

	No. of isolates of races					
Year	1	2	3	4	5	6
1973	0	0	1	0	4	15
1974	0	0	2	10	0	134
1975	2	0	13	3	0	51
1976	0	0	4	1	0	10
Total	2	0	20	14	4	160

polyethylene bags, placed in subdued light for 3 to 4 days and then uncovered. Two to 16 hours after uncovering, plants with rotted hypocotyls and wilted leaves were considered susceptible. A minimum of eight plants per differential strain were tested. If more than 20% of the seedlings gave an anomalous reaction, the testing was repeated.

Results and discussion

Five soybean differential varieties, Harosoy, Harosoy 63, Mack, Altona, and Sanga, are used in distinguishing races 1 to 6 (3); and the additional use of the soybean lines PI 103.091 and PI 171.442 will distinguish races 7, 8, and 9 (6). Inoculation of the full set of differential strains with some of our race 6 isolates indicated that races 7 and 8 are present in southwestern Ontario. Inoculation tests comparing those isolates with type cultures of races 7 and 8 confirmed this. However, Mack is resistant to races 1, 2, 3, 6, 7, 8, and 9, but is susceptible to races 4 and 5. Since the Mack type of resistance is being used in breeding projects, races 4 and 5 are of significance. And since races 7, 8, and 9 behave similarly to race 6 on Mack, they are not of immediate concern and need not be classified separately.

During the period 1973 through 1976, 200 *Pms* isolates were classified into races 1 to 6 (Table 1). Ninety percent of the isolates were races 3 or 6, and 9% were races 4 or 5. Race 1 was found in only one field, and race 2 was not found.

Races 3 and/or 6 were obtained in the majority (86%) of the 71 fields, but races 4 or 5 were obtained from 11% of the fields (Table 2). Only races 1, 3, and 6 were obtained from Kent and Lambton counties; however, more extensive sampling is required in those counties. As a conservative estimate, races 4 or 5 were present in 16% of the fields tested in Essex county; this variability in *Pms* will be of significance when cultivars resistant to races 3 and 6 are brought into production.

Table 2. Distribution of *Phytophfhora megasperma* var. *sojae* races by fields (N=71) in counties and townships of southwestern Ontario, 1973–76

	No. of fields with races						
Township	1	3	4	5	6	3 & 6	4 & 6
Essex County							
Anderdon	0	0	1	0	2	0	0
Sandwich W.	0	0	0	0	1	0	0
Sandwich S.	0	0	0	0	1	0	0
Maidstone	0	1	1	0	3	1	2
Colchester N.	0	0	0	0	9	1	0
Colchester S.	0	1	0	1	5	0	1
Gosfield S.	0	0	1	0	1	0	0
Gosfield N.	0	0	0	0	2	1	0
Rochester	0	0	0	0	4	0	0
Tilbury N.	0	1	0	0	1	0	0
Tilbury W.	0	0	0	0	3	0	0
Mersea	0	1	0	0	3	0	1
Pelee Island	0	1	0	0	1	0	0
County total	0	5	3	1	3 6	3	4
Kent Counry							
Romney	0	0	0	0	1	0	0
Tilbury E.	1	1	0	0	3	4	0
Raleigh	0	1	0	0	2	0	0
Howard	0	0	0	0	1	0	0
Orford	0	0	0	0	1	0	0
County total	1	2	0	0	8	4	0
Lambron County							
Sombra	0	0	0	0	1	0	0
Enniskillen	0	0	0	0	1	1	0
Brooke	0	0	0	0	1	0	0
County total	0	0	0	0	3	1	0
Total	1	7	3	1	4 7	8	4

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