

Races of *Phytophthora megasperma* f. sp. *glycinea* on Soybeans in Eastern Nebraska

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ABSTRACT

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Soil samples were collected in 1980 from soybean fields in 39 counties in eastern Nebraska to identify races of *Phytophthora megasperma* f. sp. *glycinea* (*Pmg*) in the state. In 1981, 300 fields were sampled in three counties. Race 1 was isolated from Seward and Butler counties, races 1 and 3 from Richardson County, races 9 and 14 from Nemaha County, and races 1 and 18 from Saunders County. A new physiologic race distinct from the 22 known races of *Pmg* was isolated from Saunders, Otoe, Nemaha, and Richardson counties. It is proposed as race 23.

The eastern third of Nebraska lies on the western edge of the soybean belt of the United States. The hectareage of soybeans (*Glycine max* (L.) Merr.) in Nebraska has increased from about 0.46 million in 1977 to about 0.85 million in 1981. During the same period, the irrigated soybean hectareage approximately tripled.

Phytophthora megasperma Drechs. f.

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sp. *glycinea* Kuan & Erwin (2) (*Pmg*) (syn. *P. megasperma* Drechs. var. *sojae* Hildeb.) has not been considered an economic problem in Nebraska, where the climatic conditions are generally less favorable than in states to the east and south, where the fungus has been relatively more devastating. However, an increasing number of soybean fields with diseased plants possibly infected with *Phytophthora* sp. have been found.

Race 1 of *Pmg* was thought to be present in Nebraska and race 3 was isolated from diseased plant tissue collected in Douglas County (4). Race 13 was reported by J. E. Partridge (*unpublished*) in Otoe, Nemaha, and Richardson counties. However, the

incidence and distribution of *Pmg* and the races present in Nebraska were not fully known.

MATERIALS AND METHODS

During July and August 1980, 860 soil samples were collected at random from soybean fields in 39 Nebraska counties and screened to determine the incidence and distribution of *Pmg*. The total soybean hectareage per county determined the number of fields sampled within that county. Soil samples were taken from within the soybean rows at a depth of 10–13 cm at five sites in each field. From each site, five soil probes were made and bulked.

In 1981, 100 fields in three counties, Butler, Gage, and Saunders, were sampled for *Pmg* in a similar manner as in 1980 except all soil probes from a field were composited. The soil samples, used as obtained from the field, were screened for *Pmg* in the greenhouse by planting the cultivar Harosoy as the susceptible host although Harosoy was resistant to races 12 and 16 of the 16 races that had been identified. Temperature was maintained at about 25 C. At the first primary leaf stage, pots of soil containing Harosoy

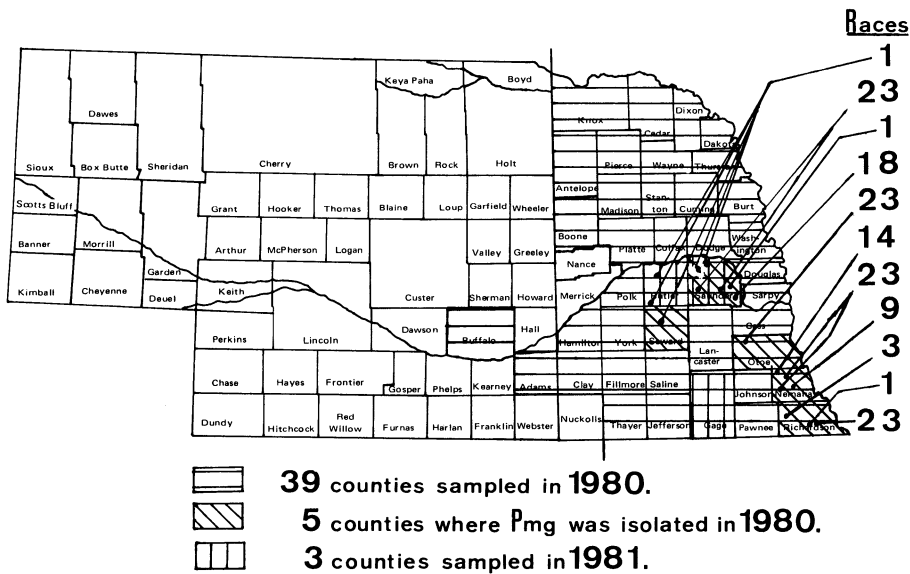


Fig. 1. Results of Nebraska surveys for *Phytophthora megasperma* f. sp. *glycinea* in 1980 and 1981.

were kept saturated for 1 wk to allow any organism present to flourish, then the plants were stressed to wilting. This procedure was repeated two or three times. Isolations were made from stem tissue and transferred to dilute V-8 juice agar medium (200 ml clarified V-8 juice per 800 ml distilled water and 15 g agar) containing 10 mg of streptomycin and 100 mg/L of benomyl 50 WP.

When an isolate was determined to be a *P. megasperma* type, pure cultures were obtained from hyphal tip sections. The isolate was kept at 25 C for 2-3 wk in dilute V-8 juice agar in petri plates.

Differential cultivars were inoculated by the hypocotyl method, by placing a piece of inoculum in a small inverted V-shaped slit made about 1 cm below the cotyledons (1). The wound was covered with petroleum jelly and inoculated plants were placed in a dew chamber at 100% relative humidity for 48 hr to prevent desiccation of the inoculum and host tissue. Inoculated plants were transferred to the greenhouse and maintained at 25-28 C. Six to 7 days after inoculation, the seedlings were classified as resistant (no external symptoms) or susceptible (60% of plants dead). This procedure was replicated three times for each isolate.

RESULTS

Of 39 counties surveyed in 1980, *P. megasperma* was isolated from five—Seward, Saunders, Otoe, Nemaha, and Richardson (Fig. 1). In 1981, *Pmg* was isolated from fields in Butler and Saunders counties. These counties are located in the eastern and extreme southeastern corner of the state, where the average annual precipitation is 76.2-86.4 cm/yr. In Seward, Saunders and Butler counties, the average irrigated soybean hectareage is 39, 24, and 9%, respectively, whereas the other three counties average less than 1% irrigated soybeans.

In 1980, race 1 was found in Seward County, races 1 and 3 in Richardson County, and races 9 and 14 in Nemaha County. Two isolates from Saunders, one from Otoe, two from Nemaha, and one from Richardson counties gave reaction patterns identical to the eight differential cultivars. These isolates appear to be a race distinct from the 22 known races of *P. megasperma* because it was avirulent on Mack, PI 103.091, PI 171.442, and Tracy and virulent on Harosoy, Sanga, Harosoy 63, and Altona (3).

In 1981, no isolates of *Pmg* were found in the 100 soil samples from Gage County, race 1 was isolated from two and

eight fields, respectively, in Butler and Saunders counties, and race 18 was isolated from one location in Saunders County.

DISCUSSION

Although *P. megasperma* has not been considered an economic problem to soybean growers in Nebraska, there has been a growing concern about the potential problem as both the total and irrigated soybean hectareage has increased. *Pmg* was isolated from soil from 22 of the 468 fields sampled in 1980 and 1981. Seven of the 22 fields were irrigated and were in Butler, Seward, and Saunders counties, where irrigated soybeans average 18% of the total of the three-county area. The other 15 isolates of *Pmg* were found in unirrigated fields in the southeastern counties. Because of the small number of samples, definite conclusions about the relationship of irrigation per se to the incidence of *Pmg* are speculative but it appears that *Pmg* is probably no more of a problem for irrigated soybeans than for unirrigated soybeans in areas of higher rainfall.

The predominant race in Nebraska is race 1; however, races other than 1, 3, and 13 are present in the state. Races 9 and 14 were isolated from Nemaha County and race 18 was isolated in Saunders County.

A distinct new race of *Pmg* was also isolated from areas extending over four counties (Fig. 1). The eight differential cultivars reacted to this new race in a pattern that differed from those of the 22 known races of *Pmg*. This new physiologic race is proposed as race 23.

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