

Powdery Mildew on Soybean in Delaware

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ABSTRACT

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This is the first report on the occurrence of *Microsphaera diffusa* infection of soybeans in Delaware and the northeast region. Powdery mildew was observed on field-grown soybeans in September 1980; of 38 lines observed at four locations, nine were susceptible to natural infection by *M. diffusa*. Susceptible varieties were Ag DSR 232 and 532, AP 350, Essex, Falcon, and Md 71-583; Emerald, V76-438, and Ware were very susceptible.

Since 1974, there have been first-occurrence reports of *Microsphaera diffusa* Cke. and Pk. infection of soybeans (*Glycine max* (L.) Merr.) from Georgia (2), Illinois (10), Iowa (3), Minnesota (6), Virginia (11), and Wisconsin (1). Powdery mildew was first observed in Delaware on 23 September 1980 following a natural epiphytotic in two research fields at the University Substation, Georgetown. This observation prompted an evaluation of named and numbered lines at other locations in the state. Such evaluations can provide valuable information on field resistance of cultivars.

MATERIALS AND METHODS

Two fields of soybeans were evaluated for *M. diffusa* infections on 23 September. One field had been planted for another experiment with 10 cultivars in a randomized complete block design with four replications. All 10 cultivars had been inoculated on 20 June 1980 with an isolate of *Fusarium oxysporum* Schlecht. emend. Syd. and Hans. f. sp. *glycines* pathogenic to soybeans. The other field was planted with a total of 36 lines in a completely randomized block design with three replications. All plots consisted of four 6.8-m rows spaced 0.76 m apart. University research plots in the other

Delaware counties were observed for plants infected with *M. diffusa* on 30 September.

The presence of natural *M. diffusa* infections in the field plots were evaluated on 23 and 30 September. The frequency of diseased plants and intensity of disease were recorded. In questionable infections, leaves were observed with a $\times 10$ hand lens for the presence of *M. diffusa* mycelium. Leaves were also examined later under a dissecting microscope, and conidia and cleistothecia were viewed under a compound microscope. All soybean fields were at the early maturity or R7 stage (5) of development when observations were made.

RESULTS

Barrel-shaped conidia averaging $30.7 \times 15.2 \mu\text{m}$ occurred in chains on the surface of leaves. Cleistothecia were found on the surface of leaves of V76-438, Emerald, and Ware soybeans on 30 September. Crushed cleistothecia revealed the presence of several asci containing up to six ascospores. Appendages were dichotomously branched at the tips. The only cleistothecia found with unbranched appendages were immature. Therefore, we concluded that infection was due to *M. diffusa* and not *Erysiphe polygoni* DC.

Of the 38 lines evaluated at four locations in Delaware, nine were susceptible to *M. diffusa*. The susceptible cultivars were Ware, Falcon, and AP 350 in maturity group IV, V76-438 in group V, and the green-seeded vegetable soybean Emerald in group III. Moderately susceptible cultivars were Ag DSR 232 in group II, Ag DSR 532 in group III, and Md 71-583 and the widely adapted soybean Essex in group V. Resistant cultivars included A5618, AP 40, Bay,

Bedford, Clark 399, Clark 407, Clark 7550, FFR 559, Forrest, Gutwein 421, Gutwein 450, Kent, Max, Mid St 250, Mid St 452, Miles, N76-098, NAPB-505, Union, Verde, VR 8027, VR 9142677, Williams, Wilstar 365, Wilstar 430, Wilstar 550, XP5474, XP5934, and York. However, powdery mildew was observed at only the two Georgetown locations in Sussex County and not in Kent or New Castle counties.

On 23 September, the fungus was found covering 5-75% of the leaf surface of the susceptible lines. Infection was most severe on Ware, V76-438, and Emerald. Although infection was generally confined to leaves arising between the fourth and seventh nodes, all leaves of Ware appeared susceptible. Injury was usually more severe on lower leaves of the plants than on upper leaves. The fungus also severely damaged the stem and petiole of Ware soybeans. The group III and IV varieties, Williams and Union, showed no signs of infection; however, by 23 September they had begun to senesce and had few remaining leaves.

DISCUSSION

Although powdery mildew was first observed on 23 September, it may have been present as early as late August. The high mean daytime temperature for the first 3 wk of September at Georgetown was 29.6 C ($s = 3.2$ C). At this temperature, it takes weeks for soybean powdery mildew to develop significantly (8,9). After September 23 the temperature fell to 23.2 C ($s = 3.4$ C), and the disease developed rapidly.

The pathogen found in Delaware soybean fields fits the description of *M. diffusa* given by McLaughlin et al (7) and Paxton and Rogers (10). Paxton et al and others have suggested that *M. diffusa* can be mistaken for *E. polygoni* if identification is attempted before cleistothecia are fully mature (2,7,10). The earlier report (12) of *E. polygoni* causing powdery mildew of soybean in Delaware is not in agreement with our observations.

This is the first report of powdery mildew on field-grown Essex soybeans (2). Because this is the major variety grown in the northeast and Middle Atlantic region, and because infection

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may have occurred as early as late August, the potential of *M. diffusa* to become a serious pathogen of soybean is increased. Infections even occurred on petioles and stems of soybeans (Ware and Emerald), which contrasts with earlier reports that indicate only less damaging infections on the leaf surface (2-4,6). Infections were more severe on the lower leaves of infected plants. This is in agreement with results of adult-plant resistance studies in the growth chamber (8).

LITERATURE CITED

1. Arny, D. C., Hanson, E. W., Worf, G. L.,

Oplinger, E. S., and Hughes, W. H. 1975. Powdery mildew on soybean in Wisconsin. Plant Dis. Rep. 59:288-290.

2. Demski, J. W., and Phillips, D. V. 1974. Reaction of soybean cultivars to powdery mildew (*Microsphaera* sp.). Plant Dis. Rep. 58:723-726.

3. Dunleavy, J. M. 1976. A survey of powdery mildew of soybean in central Iowa. 1976. Plant Dis. Rep. 60:675-677.

4. Dunleavy, J. M. 1977. Comparison of the disease response of soybean cultivars to *Microsphaera diffusa* in the greenhouse and the field. Plant Dis. Rep. 61:32-34.

5. Fehr, W. R., and Caviness, C. E. 1977. Stages of soybean development. Iowa State Univ. Spec. Rep. 80.

6. Grau, C. R., and Laurence, J. A. 1975. Observations on resistance and heritability of resistance to powdery mildew of soybean. Plant

Dis. Rep. 59:458-460.

7. McLaughlin, M. R., Mignucci, J. S., and Milbrath, G. M. 1977. *Microsphaera diffusa*, the perfect stage of the soybean powdery mildew pathogen. Phytopathology 67:726-729.

8. Mignucci, J. S., and Lim, S. M. 1980. Powdery mildew development on soybeans with adult-plant resistance. Phytopathology 70:919-921.

9. Mignucci, J. S., Lim, S. M., and Hepperly, P. R. 1977. Effects of temperatures on reactions of soybean seedlings to powdery mildew. Plant Dis. Rep. 61:122-124.

10. Paxton, J. D., and Rogers, D. P. 1974. Powdery mildew of soybeans. Mycologia 66:894-896.

11. Roane, C. W., and Roane, M. K. 1976. *Erysiphe* and *Microsphaera* as dual causes of powdery mildew of soybeans. Plant Dis. Rep. 60:611-612.

12. U.S. Department of Agriculture. 1960. Index of Plant Diseases in the United States. Agric. Handb. 165. 531 pp.