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report on
PLANT
DISEASE

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POWDERY MILDEW OF SOYBEANS

Powdery mildew of soybeans is caused by the fungus *Microsphaera diffusa*. Since 1972, the disease has changed from a greenhouse problem to a field disease of some concern in Illinois and other states. Yield losses ranging up to 14 percent have been attributed to the disease during certain years when cooler than normal temperatures prevail from flowering to maturity.

Figure 1. Young colonies of powdery mildew on soybean leaves.

Microsphaera diffusa infects other legumes such as garden beans (*Phaseolus vulgaris*) and peas *(Pisum sativum*), cowpeas (*Vigna unguiculata*), some *Crotalaria* and *Desmodium* species, scurf pea (*Psoralea* sp.), mungbeans (*Phaseolus aureus*), species of *Lespedeza*, lupines (*Lupinus* spp.), some species of wild soybeans, and American licorice (*Glycirriza lepidota*). Powdery mildew of soybeans also infects some members of two other plant families (Caprifoliaceae and Solanaceae).

Figure 2. Heavy coating of powdery mildew on a soybean leaf.

Symptoms

White, powdery, talcum-powder-like patches form on all plant parts, but primarily the leaves (Figure 1). These patches continue to enlarge and merge until plant parts are covered (Figure 2). Some varieties show chlorosis, or yellowing (Figure 3), scorching of the leaves, rusty patches on the underleaf surfaces, and premature defoliation.

Susceptibility on soybeans ranges from infections limited to the leaves on some varieties to infections that also include the stems and pods. Heavily infected pods usually contain shriveled, deformed, undeveloped, and flattened green seeds. A luxuriant growth of the mildew fungus develops on certain varieties, but no visible symptoms are produced.

Nevertheless, photosynthesis and transpiration are drastically reduced. Resistant soybean varieties usually develop chlorotic spots and vein necrosis on the upper leaf surface at infection sites. On such varieties,

the spread and reproduction of the fungus is limited to small patches, which may be invisible to the naked eye.

Figure 3. Soybean leaf severely infected with powdery mildew-showing chlorosis, or yellowing.

Disease Cycle

Infection occurs when microscopic asexual spores (conidia) land, germinate, and penetrate the epidermal cells. The conidia form several germ tubes, with the first attaching itself to the cells via an anchorage structure (appressorium). A thin filament (infection peg) forms under the appressorium and penetrates the host epidermis. This gives rise to the first feeding structure (haustorium), the only fungus structure found inside the host cells. The rest of the fungus body, or mycelium, grows superficially over the epidermal cells. Conidiophores (asexual fruiting structures) soon develop, giving rise to chains of conidia (Figure 4).

Wind-borne conidia start new infections and repeat the disease cycle continuously until soybean plants

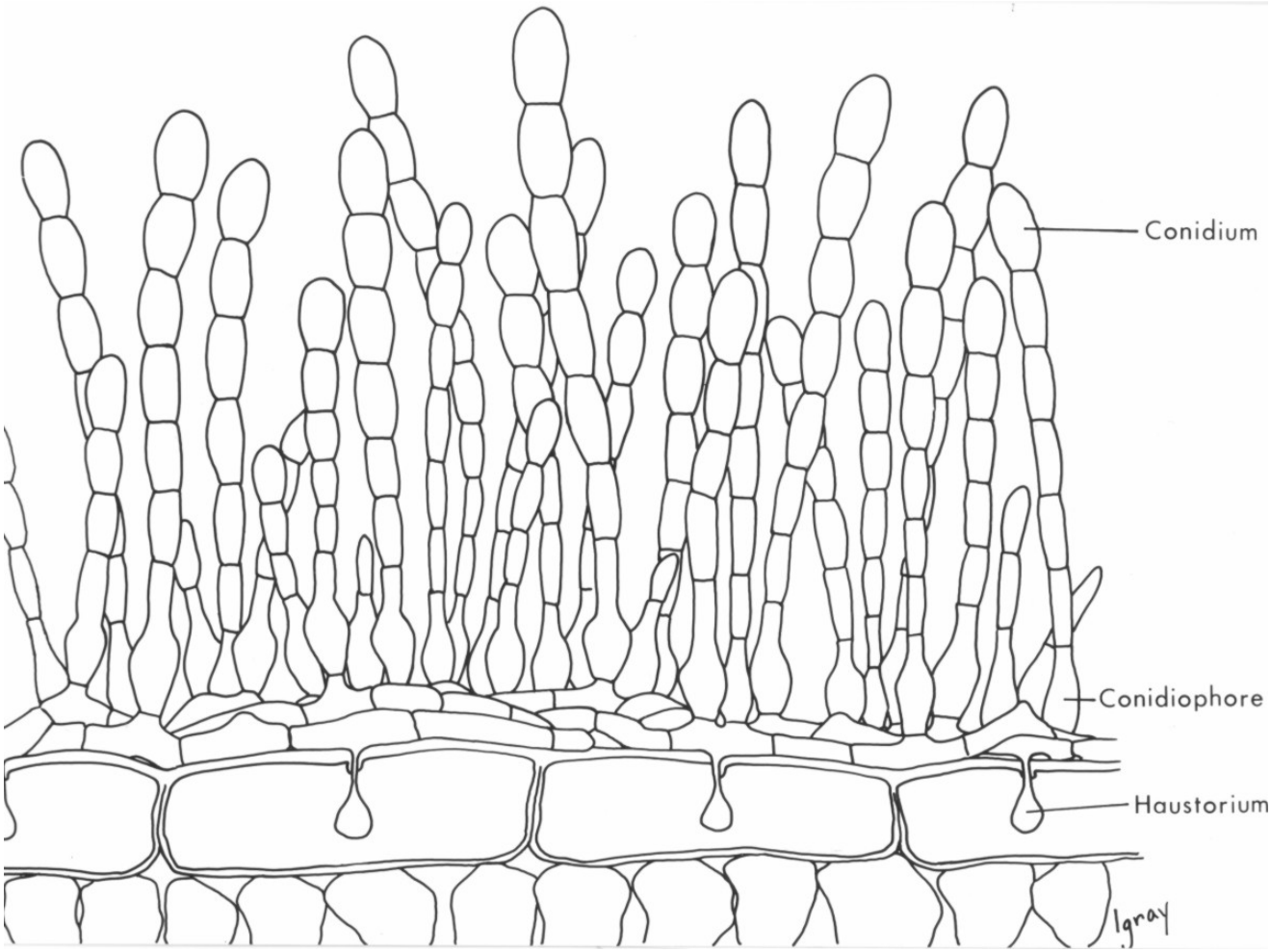

Figure 4. Mycelia growing over a soybean leaf surface with erect conidiophores, chains of conidia, and haustoria within the epidermal cells (drawing by L. Gray).

mature.

Cool weather of 65° to 76°F (18° to 24°C) favors disease development, while temperatures above 86°F (30°C) arrest the growth and reproduction of the fungus. During rainy periods, conidia are washed away, temporarily delaying the secondary spread of the fungus.

Speck-sized, black fruiting bodies (cleistothecia) sometimes are produced in mildew colonies late in the fall (Figure 5). Inside the cleistothecia, yellow ascospores (sexual spores) are produced in saclike structures called asci (Figure 5). It is believed that ascospores are released in the spring and serve as primary inoculum.

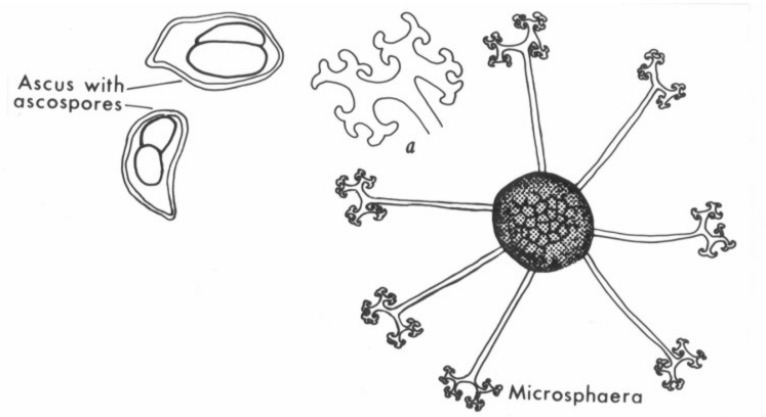

Figure 5. Right, Cleistothecium of microsphaera with (a) showing details of the tip of an appendage; and left, two asci with ascospores (drawing by L. Gray).

In Illinois, cleistothecia have not always been observed on soybeans infected with powdery mildew. Cleistothecia usually are limited to certain sites and years. At present, the relative importance of the sexual and asexual stages in the overwintering of the fungus is not fully understood. Since *Microsphaera diffusa* infects many other plant species, including some perennials, the possibility exists that these or still other plant species may be involved in the overwintering of the pathogen.

Control

The only control is to plant resistant soybean varieties. Certain varieties are susceptible in the seedling stage and express resistance about flowering time while others are resistant throughout their lifetime. For the latest information on the relative resistance and susceptibility of soybean varieties recommended by University of Illinois Extension Specialists and county Extension advisers, read Illinois Agronomy Handbook which is revised annually. This publication is available at your nearest Extension office or from University of Illinois Ag Services, P345, 1917 S. Wright St., Champaign, IL 61820 (1-800-345-6087).