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## DISEASES OF SUNFLOWERS IN SPAIN

### Downy Mildew:

Downy mildew (Plasmopara halstedii) was discovered in Spain for the first time in 1972 in Andalucia, in the south. This is the area in which sunflower cultivation for oil, which began on a very small scale in 1963, was concentrated until recently. Sunflowers are now grown widely in Spain, on an area exceeding 600,000 hectares in 1975. The crop was introduced into many parts of the central plateau and the north only in the last three or four years. Downy mildew has not yet been recognized in the center or north of Spain, and there is only one report of it from the southwest, in Extremadura. It now occurs in most parts of Andalucia where sunflowers are commonly grown, particularly where the crop has been sown in the same field two or three times since 1970.

Andalucia is an area of winter rainfall and dry, hot summers, with winter cereals the principal crop, and few alternatives to sunflowers as a summer crop on unirrigated land. For that reason, many farmers have repeated sunflowers in the same field every two years. In a few such fields, up to 80% of the plants showed symptoms of systemic infection with mildew. In most cases 10% or less of the plants were affected where the disease occurred. Although losses have been relatively slight on a regional scale, and less on a national basis, they have been unacceptably high for some individual growers, and many are worried that the disease may put an end to sunflower growing.

Mildew resistant hybrids were grown on a commercial scale for the first time in 1976. As only the "European" race of mildew has been identified in Spain, various sources of resistance can still be used in the production of mildew-resistant hybrids or varieties. Much effort is being expended in convincing growers to sow sunflowers no oftener than once in four years in a given field, even though they find it difficult to substitute other crops in such a long rotation.

### Charcoal Rot

Charcoal rot (Macrophomina phaseoli) (= Sclerotium bataticola) occurs in Spain, but its geographical distribution and the losses it may cause have not been determined.

Although it had not previously been determined on sunflowers in Spain, it was found on them in widely distributed fields, as well as on soybeans, as soon as it was looked for in 1972 and subsequent years.

It has been clearly demonstrated in the work of others, and in one our own works, that the presence of inoculum of this pathogen in the soil does not necessarily imply extensive infection and obvious injury to sunflower plants. Although it is an effective pathogen, this fungus rarely induces significant injury unless host plants are suffering from heat, and particularly from drought. Symptoms are not clear cut; the most usual result of infection is "premature ripening" of the plants. They may be somewhat shorter and the stalks are usually somewhat thinner than those of healthy plants. The leaves and stems dry out and turn brown while those of healthy plants are still green and the stalks straw-colored. The heads appear smaller and turn brown early. They tend to be soft and flexible whereas normally ripe heads are dry and stiff.

Seeds in heads of affected plants tend to be loose. The root system is much smaller than on healthy plants, and may appear gray inside because of the presence of vast numbers of micro-sclerotia of the pathogen in the internal tissues of roots and the basal part of the stem.

Because of the close association of the disease with high temperatures and drought, both of which affect yield adversely, it is difficult to separate the effects of the pathogen from those of adverse environmental factors.

### Sclerotinia Rot and Wilt

Wilt and root and stalk rot induced by Sclerotinia sclerotiorum have been observed in experimental plots, and on a few plants in farm fields. The disease is still not common, and possibly may not become a significant factor in sunflower production, because of the extremely dry conditions accompanying high temperatures in most parts of Spain. Neither S. minor nor Sclerotium rolfsii has yet been reported on sunflowers in Spain.

### Botrytis Rot

Seedling infection by Botrytis cinerea can pose serious problems in laboratory tests with downy mildew. It can also be severe on seedlings and older plants grown in plastic greenhouses during autumn and winter. Stalk rot and wilt symptoms identical with those induced by Sclerotinia sclerotiorum were caused by Botrytis on adult plants in November in experimental plots sown in July-August. It is not likely to be a factor on sunflowers grown during the normal season.

## Head Rot

Rot of sunflower heads, in other countries may be induced by Sclerotinia sclerotiorum, Botrytis spp., Rhizopus spp., and other fungi. The only organism found causing head rot in farm fields in Andalusia was Rhizopus, probably R. nigricans.

## Rust

Rust (Puccinia helianthi) occurs on the large, gray-striped or white seeded varieties sold for human food. This type of sunflower has been grown on one to two thousand hectares in Spain for many years. Heavy rust infection developed on oil-seed sunflower plants ripening in a plastic greenhouse during the winter, and rust was conspicuous on a winter generation of sunflowers in experimental plots in the field. Rust was scarce even under these conditions in the last two years, and is not normally seen on oilseed varieties in farm fields.

## Verticilliosis

Sunflowers infected by Verticillium dahliae were encountered in an experimental plot, but have not been seen in farm fields. Cotton has been grown widely in Andalusia for many years, and Verticillium has been isolated from diseased plants. Verticillium may become a factor where sunflowers are sown on old cotton fields.

## Bract necrosis

A bract necrosis of unknown origin causes considerable losses in farm fields and in experimental plots. It may appear on sunflowers at any stage from unopened green buds, newly opened heads 5 cm or less in diameter, to

heads which are physiologically mature and beginning to turn color. It first affects the tips of the bracts, which turn dark brown. The discoloration and death of the affected tissues progresses downward to the base of the bracts, and gradually involves the rest of the capitulum. When it appears late in capitulum development, it may not have any appreciable effect. When heads are affected while young and still small, the bract necrosis may be accompanied by the appearance of a dark, almost black necrotic area, 5 mm to 1 cm in diameter, in the center of the young capitulum. Heads affected while still young in many instances fail to open or develop further, turn a gray brown color and dry up. The condition on young, small heads is often associated with plants which are thinner and weaker than healthy neighbours. In one field where a significant proportion of plants showed the symptoms, the condition was associated with drought.

### Miscellaneous Diseases and Conditions

Fusarium spp. and other fungi have been isolated from sunflower plants with diseased roots, but their pathogenicity was not proved.

Patches up to 10 metres or more in diameter in sunflower fields have been killed by lightning.

Leaf distortion and malformation, with conspicuous venation and other symptoms of hormonal imbalance, occur commonly on sunflowers in the spring. The injury, attributable to spray drift from winter cereal fields treated with 2,4-D or similar herbicides, is often observed at a considerable distance from fields known to have been treated for weed control. Most herbicide applications are made by aircraft, and the danger of drift of even minute quantities of material is not adequately understood either by growers or aircraft operators. Some grow-

ers attribute the symptoms, which may occur at random on widely separated plants, to low temperatures.

Leaf and stalk pathogens such as Alternaria, Phoma, and Septoria have not yet been identified on sunflowers in Spain.