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RESISTANCE EVALUATION OF SUNFLOWER GENOTYPES NATURALLY INFECTED BY SCLEROTINIA SCLEROTIORUM (LIB.) DE BARY

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INTRODUCTION

White rot (Sclerotinia sclerotiorum de Bary) is an important sunflower disease, especially from the point of sunflower resistance studies. The susceptibility of a large number of various plant species to S. sclerotiorum raises doubts as to the existance of specific genes of resistance to the disease in sunflowers. It is therefore important that differences in susceptibility have been found among naturally infected sunflower genotypes (Putt, 1958; Leclercq, 1973).

So far, different inoculation-based methods of white rot resistance evaluation of sunflower have not rendered satisfactory results. It is the reason why attempts have been made to evaluate breeding materials on the basis of natural infection.

In natural conditions of infection, test plants are seldom infected 100% which reduces the accuracy of evaluation. The efficiency of this method depends entirely on climatic conditions which may, in some years, render the method completely inapplicable. Nevertheless, the process of development of sunflower hybrids is sufficiently long as to allow the occurrence of epiphytotics of the disease, during which the resistance of breeding materials may be successfully evaluated.

MATERIALS AND METHOD

In this study, a large number of inbreds, hybrids, as well as the collection of wild sunflowers were used. Resistance was evaluated on

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the basis of the percentage of plants infected in conditions of natural infection in field. Individual forms of the disease were evaluated in different years, when the conditions were favorable for the occurrence of a specific disease form.

RESULTS AND DISCUSSION

Larger differences were found in the resistance to head and stem infection than the basal stem infection. It was probably due to different infection materials because the basal part of the stem is infected by the mycelia while the aboveground plant parts are infected by the ascospores.

The results of resistance evaluation on the basis of natural infection showed that the infections of head and stem are independent forms of the disease (Table 1). From the point of resistance, therefore, different forms should be viewed separately.

STEM INFECTION (INFECTION THROUGH LEAVES)

It has been observed earlier that sunflower genotypes differ in their reaction towards stem infection —some are highly susceptible and some are immune (Cuk, 1976). The studies conducted in the last five years turned out a number of genotypes which were infected in so small percentages that they could be included directly into the breeding for less susceptible hybrids.

Wild sunflower species are initial sources of disease resistance. A peculiarity of this disease form is that a higher susceptibility to it was incorporated from wild forms of H. annuus. One should be careful not to increase the susceptibility of cultured sunflowers when incorporating genes from wild into cultured sunflowers.

In some years, secondary infections may promote the distribution of the disease during the growing season. Such infections occur when healthy leaves touch the neighbouring infected leaves or when a part of an infected leaf falls on a healthy plant part. In favorable climatic conditions, an infected leaf part infects healthy plants regardless of their resistance to white rot. Reserve food in the infected leaf tissue enables the mycelia to penetrate the plant and start the pathological process. As there is no reserve food for ascospores, it could be concluded that they are incapable of infecting healthy plant tissue.

Table 1 - *Defferences in sunflower resistance to white rot. Independence between head and stem infection*

Cultivar	% of infected plants	
	Stem	Head
cms-9 x WPL-13	1,7	77,3
cms-9 x WPL-16	7,5	94,1
cms-9 x WPL-23	6,7	79,2
cms-9 x WPL-38	0	87,5
cms-9 x WPL-49	3	14,7
cms-9 x WPL-91	52,1	47,7

Leaf damages caused by other pathogens, e.g., Botrytis, heighten the sensitivity of sunflowers to white rot. Dead tissue may initially serve as reserve food to ascospores and enable their penetration into the plant. Damaged leaf cuticles and cellular epidermis may help the ascospores to penetrate the plant even without reserve food.

The commercial production of sunflower hybrids confirmed the reliability of resistance evaluation based on natural infection conducted during the process of breeding. Those hybrids which had been highly resistant during the breeding remained equally resistant in commercial production.

Head infection

Sunflower heads are infected by ascospores. As the fungus may use even pollen for initial reserve food, damages are not necessary to allow the ascospores to penetrate the plant. However, this assumption must be accepted with reasonable doubt because several foci of infection should occur in that case; besides, cms plants were not found to be more resistant although they are pollen-free if grown in isolation.

Shorter genotypes were found to be more susceptible, as reported by Leclercq (1973). This is connected with the conditions of infection because the concentration of ascospores is higher closer to the ground; also, air humidity promotes the occurrence of the disease.

The study showed considerable differences in resistance among genotypes of the same height. Also, some short genotypes were

Table 2 - *Field resistance of sunflower to white rot - head infection*

Cultivar	Plant height	% of infected plants
cms-10 x RHA-58	148	4,6
cms-10 x RHA-18	201	16,9
cms-12 x RHA-58	174	19,8
cms-12 x RHA-18	212	58,6
cms-39 x RHA-58	187	4,6
cms-39 x RHA-18	212	68,3
cms-45 x RHA-58	139	23,9
cms-45 x RHA-18	216	48,6
cms-53 x RHA-58	183	4,7
cms-53 x RHA-18	207	36,9

attacked less intensively while some tall genotypes were highly susceptible to white rot (Table 2). It was clear that the inbred RHA-58 generated shorter hybrids but higher white rot resistance than the inbred RHA-18.

CONCLUSIONS

As the available methods of inoculation are not reliable, the resistance of sunflower to white rot may be evaluated quite successfully on the basis of natural infection.

There are three independent forms of the disease (infection of basal stem, stem, and head) which should be viewed separately.

Larger differences were found in the resistance to stem and head infection than basal stem infection.

Wild forms of H. annuus include genotypes which are highly susceptible to stem infection.

Infected leaves promote the distribution of the disease through secondary infections.

Damaged leaf cuticles and epidermis enable the infection by ascospores.

Short sunflower genotypes are more susceptible to head infection although there are some short genotypes which are less susceptible.

Increased resistance in inbreds is transferred to F_1 generation. It is thus possible to produce less susceptible sunflower hybrids and reduce damages caused by white rot.

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