

## RESISTANCE OF SUNFLOWER HYBRIDS (*HELIANTHUS ANNUS* L) TO *SCLEROTINIA SCLEROTIURUM* (LIB.) DE BARY

Peter BOKOR, Kamil HUDEC

Department of Plant Protection, Slovak Agricultural University in Nitra, 949 76 Nitra, Slovakia; tel. 087 6508252, e-mail:  
peter.bokor@uniag.sk

### Summary

Commercial used sunflower hybrids were evaluated for their reaction to *Sclerotinia sclerotiorum* (Lib.) de Bary after artificial inoculation. The inoculation was realised before bud growth stage under field condition. In all hybrids used in trials germination fluctuated in interval 86 % to 100 %. Pathogen *Alternaria* spp. was obtained from non germinated seeds. Maximum infected seeds was recorded in hybrids S-277 and minimum in hybrid Pixel. Only 35 % plants infected by *S. sclerotiorum* were observed in hybrid S-277. Maximum of infected plants were in hybrid Bambo (80 %). The incidence of *Diaporthe helianthi* ranged from 80 to 95 %. Hybrids Apetil and Pixel show the ability to increase of same yield characteristics after inoculation by *S. sclerotiorum*.

**Key words:** *Helianthus annus*, *Sclerotinia sclerotiorum*, kernel weight, kernel density

### Introduction

*Sclerotinia sclerotiorum* (Lib.) De Bary is an important pathogen causing most important sunflower disease called white rot (Huang, Dueck, 1980). *Sclerotinia sclerotiorum* can produce three distinctly different diseases on sunflower; a basal stalk rot, which can appear at any plant growth stages, a mid-stalk rot on older plants, and a head rot on mature plants (Nelson, Lamey 1984). Rapid drying of the leaves and development of lesions on the tap roots and basal portion of the stem caused infected plants to die within a few days after the onset of wilting. Seed yield was significantly reduced when wilting occurred at early stage of plant development (Dorrell, Huang 1978). Under relatively low soil moisture conditions the overwintering sclerotia produce mycelia which infect the roots and cause basal stalk rot plant wilt (Huang, Dueck 1980, Huang 1985). Under high soil moisture conditions, sclerotia produce apothecia and ascospores infected floral parts and stems causing head rot (Ju, Maric 1988).

The development of resistant hybrids appears the most effective and economical approach to control this disease (Putt 1958, Dueck, Campbell 1978, Vear, Tourvielle 1984, Gulya et al. 1989).

The aim of this study was to evaluate the reaction of the commercial sunflower hybrids to sclerotinia wilt, to determine effects of this disease on yield, and to identify resistant hybrids for the purpose of crop recommendation.

### Material and methods

Evaluation of sunflower seeds germinative capacity used in field trials.

Non treated seeds were placed upon sterile cotton wool into Petri dishes. 100 seeds were used in two repetition. Germinative capacity power and germinative capacity of seeds were evaluated after three and seven days respectively. The number of germinate and non-germinate seeds were calculated, and health conditions of non-germinate seeds were determined. Infected seeds were placed on 2% PGA in 9-cm diameter Petri dishes to specify pathogens, which caused non-germinate seeds.

Preparation of *Sclerotinia sclerotiorum* inoculum

*Sclerotinia sclerotiorum* isolates (152, 154, 155) were obtained from sclerotia originated from locations Malanta, Chorvátsky Grob and Nové Zámky. *Sclerotinia* was originals harvested from sunflower plants after natural infection. The mixture all isolates in equal relation was used for inoculation. Inoculum was prepared according to Sedun and Brown (1989). *S. sclerotiorum* was grown 14 days at 25°C on sterilised wheat grain (press 100 kPa and temperature 120°C). Wheat grain was inoculated by seven days old cultures *S. sclerotiorum*, which was cultivated in dark at 25°C on PGA in 10-cm diameter Petri dishes.

Infection of plants under field conditions

Field trials was carried out at Experimental base of Slovak Agricultural University in Dolná Malanta, near Nitra as a complete randomised block design with four replications. Six sunflower hybrids (Bambo, S – 277, Opera, Pixel, Arena and Apetil) were used in field trials. The sunflower hybrids were sown manually in April 1999 in two variants. The plants were inoculated in June, they had developed 4-6 pair of leaves, before bud growth stages. The plants were inoculated with 5 g of inoculum, inserted into a hole of the soil located 50 mm from the base of each stem, about 10 mm deep. The sunflower heads were harvested during September.

The number of infected plants were recorded, plant high and flower bud diameters were measured at beginning of flower growth stage (F 3.4). Before harvesting yield of sunflower (F 5.1.2) heads were counted number of health plants and number of plants infected by *S. sclerotiorum* and *Diaporthe helianthi*. Heads diameter, number of kernel in the heads, kernel weight

from the heads and one thousand seeds weight were also measured and compared among several hybrids. Acquired data were analysed by analysis of variance.

### Results and discussion

The number of germinate seeds was the highest hybrid Pixel and achieved 100 % (Table 1). Germination in all hybrids fluctuated in interval 86 % to 100 %. Only *Alternaria* spp. was determinate as pathogen obtained from non germinated seeds. Grey and rich cover of mycelium was presented on infected seeds and after microscopic analyses was pathogen *Alternaria* spp determinate. Maximum infected seeds (6) was recorded on seeds in hybrids S-277 (Table 1). Another hand from seeds of hybrid Pixel did not obtained pathogen *Alternaria* spp. and germination of this hybrid was 100 %.

The incidences of *Sclerotinia* wilt after artificial inoculation sunflower plants by *S. sclerotiorum* shows table 1.

Table 1. Germination, number of seeds infected by *Alternaria* spp., percentage of wilted sunflower after inoculation by *Sclerotinia sclerotiorum* and percentage of infected sunflower plants after natural infection by *Diaporthe helianthi*.

Hybrid	Germination [%]	Seeds infected by <i>Alternaria</i> spp. [%]	<i>Sclerotinia sclerotiorum</i> [%]	<i>Diaporthe helianthi</i> [%]
S-277	86	6	35	92.5
Bambo	88	4	80	97.5
Opera	96	3	55	95
Pixel	100	-	75	92.5
Arena	97	3	73	80
Apetil	99	1	70	87.5

Only 35 % plants infected by *S. sclerotiorum* were observed in hybrid S-277. Similar Ziman and Šrobárová (1996) observed the lowest infection by *S. sclerotiorum* in hybrid S-277 from all evaluated hybrids. Maximum of infected plants were in hybrid Bambo (80 %). Other hybrids such Opera, Pixel, Arena and Apetil showed level of infection ranking from 55 to 75 %. These results demonstrate that none of the tested hybrids was highly resistant to the pathogen *S. sclerotiorum*.

The number of sunflower plants were observed before harvesting. The incidence of *Diaporthe helianthi* ranged from 80 to 95 %.

Table 2. Reaction of sunflower hybrids to *Sclerotinia sclerotiorum* and effects on plant hight, heads diameter, yield and one thousand seeds weight

Hybrid	Plant hight [cm]	Heads diameter		Number of kernel in the heads [ks]	Kernel Weight from the heads [g]	One thousand seeds weight [g]
		Flowering [mm]	Harvest [mm]			
S-277	108.1 <sup>a</sup>	50.0 <sup>a</sup>	157.0 <sup>a</sup>	1647 <sup>a</sup>	74.0 <sup>ab</sup>	44.5 <sup>a</sup>
Bambo	90.2 <sup>a</sup>	45.6 <sup>a</sup>	148.0 <sup>a</sup>	1330 <sup>a</sup>	66.5 <sup>a</sup>	50.9 <sup>ab</sup>
Opera	122.2 <sup>a</sup>	61.5 <sup>a</sup>	166.8 <sup>ab</sup>	1676 <sup>a</sup>	78.2 <sup>ab</sup>	46.8 <sup>a</sup>
Pixel	114.2 <sup>a</sup>	43.0 <sup>a</sup>	190.0 <sup>ab</sup>	1384 <sup>a</sup>	91.3 <sup>ab</sup>	67.7 <sup>c</sup>
Arena	95.2 <sup>a</sup>	51.6 <sup>a</sup>	176.8 <sup>ab</sup>	1824 <sup>a</sup>	87.0 <sup>ab</sup>	47.2 <sup>ab</sup>
Apetil	87.7 <sup>a</sup>	51.4 <sup>a</sup>	221.0 <sup>b</sup>	1376 <sup>a</sup>	142.6 <sup>b</sup>	101.3 <sup>d</sup>

<sup>abcd</sup> - values followed by the same letter in each column are not significantly different from each to other at the significant level 0.05 (Tuckey's test)

The reduction in yield of sunflower on the infested fields (Table 2) was primarily due to the effect of *Sclerotinia* wilt in comparison with control variants (Table 3). Only hybrids Apetil and Pixel showed the ability to increase of same measured values after inoculation by *S. sclerotiorum*. The difference was detected after harvest in heads diameter, kernel weight from the heads and weights of one thousand seeds. The increase of one thousand seeds weights after inoculation by *S. sclerotiorum* also observed Rashid, Dedio (1992) and Ziman, Šrobárová (1996) at the same tested hybrids. It is possible to assume that some hybrids are able to reduce negative influence of pathogen enlarges size and weight of kernels.

The influence of infection by *S. sclerotiorum* on sunflower plants was not manifested in growth stage beginning of flower, where was acquired value of the plant high and diameter of head. The non-significant differences among the hybrids were found in the plant hight, heads diameter and number of kernel in the heads.

Variability was found for morphological and harvests characteristics. The largest heads were recorded in hybrid Apetil, 221 mm in diameter (Table 2) and on the other hand the smallest heads were recorded in the hybrid Bambo (148 mm) and S-277

(157 mm). There were observed significant differences among tested hybrids (Table 2). Similar results determined assessment of kernel weight from the heads.

Table 3. Control - Non infected variants.

Hybrid	Plant height [cm]	Heads diameter		Number of kernel in the heads [ks]	Kernel Weight from the heads [g]	One thousand seeds weight [g]
		Flowering [mm]	Harvest [mm]			
S-277	122.5a	51.3 <sup>a</sup>	168.0 <sup>a</sup>	1936 <sup>a</sup>	95.0 <sup>a</sup>	49.3 <sup>a</sup>
Bambo	104.4a	52.8 <sup>a</sup>	180.5 <sup>a</sup>	1660 <sup>a</sup>	106.7 <sup>a</sup>	63.1 <sup>a</sup>
Opera	129.2a	64.0 <sup>a</sup>	189.8 <sup>a</sup>	1862 <sup>a</sup>	112.2 <sup>a</sup>	59.7 <sup>a</sup>
Pixel	116.4a	59.1 <sup>a</sup>	166.3 <sup>a</sup>	1578 <sup>a</sup>	84.9 <sup>a</sup>	55.4 <sup>a</sup>
Arena	122.6a	63.7 <sup>a</sup>	189.0 <sup>a</sup>	2008 <sup>a</sup>	107.3 <sup>a</sup>	54.1 <sup>a</sup>
Apetil	108.3a	62.2 <sup>a</sup>	218.5 <sup>a</sup>	1427 <sup>a</sup>	142.1 <sup>a</sup>	99.1 <sup>b</sup>

<sup>ab</sup> - values followed by the same letter in each column are not significantly different from each other at the significant level 0.05 (Tuckey's tests)

Significant differences among the hybrids were found as for as the weight of one thousand seeds (Table 2). The maximum of one thousand seeds weight was recorded by hybrid Apetil (101.3 g), followed by hybrid Pixel (67.7 g) and minimum weight was recorded by hybrid S-277 (77.5 g).

These results demonstrated that hybrids vary not only in their susceptibility to infection of *S. sclerotiorum*, but also in their ability to yield well under similar disease situation. The assessment of yielding ability under disease severity is essential for the identification of genotypes with tolerance (Buddenhagen 1981).

The hybrids Pixel, Arena, Apetil showed susceptibility to *Sclerotinia* on approximately equal level (70-75%) however only Apetil showed the ability to produce well under disease conditions and appeared to have tolerance to the disease. Tolerant hybrids could be recommended to complement crop rotation practices in areas where the disease is a limiting factor.

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