Examination of resistance to Sclerotinia stalk and head rot in sunflower (*Helianthus annuus* L.) hybrids

Viktor József Vojnich – Attila Hüvely – András Palkovics
Kecskemét College, Faculty of Horticulture, Department of Horticulture, Kecskemét, Hungary
vojnich.viktor@kfk.kefo.hu

SUMMARY

*Nowadays, phytopathogenic fungi cause the most serious yield loss in open field cultures, and sunflower (*Helianthus annuus*) is no exception to this phenomenon. Sclerotinia stalk and head rot (*Sclerotinia sclerotiorum*) is present in the whole area of Hungary, and can cause serious financial loss. In our experiment, sunflower hybrids were tested for resistance to* Sclerotinia sclerotiorum *infection. 16 sunflower hybrids were examined at the Experimental Breeding Site in Jászboldogháza. Pesticide treatment and also nutrient replacement were applied on the sunflower fields.*

Keywords: sunflower hybrids, *Helianthus annuus*, open field trial, *Sclerotinia sclerotiorum*

INTRODUCTION

The sunflower (*Helianthus annus*) gene center can be found in the west side of North America, but the first man who nationalized in Europe was a russian tsar Peter I. in the XVIII: century (Zhukovsky, 1950). Related to the extension of the arable farm area, oil mills have been spread and lots of local sunflower variety has occurred (Walter, 1974). When gene selection has been started here in the middle of the XIX century, it has immediately great success (Pustovojt, 1964). In Hungary the most significant habitats of sunflower were in the east-north counties (Szabolcs-Szatmár-Bereg, Borsod, Hajdú-Bihar) and in Transylvania. Thanks to the specific site and the orthodox religion (Kurnik, 1969) the first oil mill was established in 1812 in Ercsi, followed by many others.

Primarily sunflower was sown because of its high oil content (Antal, 1992; Bocz, 1992). It has been used in catering, animal feeding, and industrial purposes (colour stain, insecticide, cosmetics) (Vranceanu, 1977; Frank, 1999). Most of all: sunflower is a good honey plant and excellent to use like fuel substituted.

Today sunflower is a considerable plant among filed crops too. In the last decades crop area has grown in a huge rate worldwide (Antal, 2005), as long as the sunflower growing area in Hungary (2005-2014) is the same (*Table 1*). While sunflower crop yield might be 5-6 t/ha by applied suitable and effective production methods, then the Hungarian yield is approximately 2-3 t/ha.

Table 1

Sunflower production area, cumulated and mean yield (2005-2014) in Hungary

Year	Production area (1000 ha)	Cumulated (1000 t)	Mean (t/ha)
2005	511	1.108	2.170
2006	534	1.181	2.210
2007	513	1.060	2.070
2008	550	1.468	2.670
2009	535	1.256	2.350
2010	502	0.970	1.930
2011	580	1.375	2.370
2012	615	1.317	2.140
2013	597	1.484	2.490
2014	594	1.597	2.690

Source: KSH, 2015 (http)

The reason to lose crop yield is a phytopathogenic fungus, *Sclerotinia sclerotiorum*, which can be found everywhere in the country and may cause great economic losses. Water-soaked soft rot of sunflower can be affected to all parts of the plant, which can easily spread in vaporous, warm, rainy weather. In rare cases initial infestation can be found like flagging, necrosis (*Figure 1*). Later on tissues of stalks can be decayed and and heads can broken down (Antal, 2005).

MATERIALS AND METHODS

Our small plot tests were made in an experimental station in Jászboldogháza (Jász-Nagykun-Szolnok county), where we checked 16 sunflower hybrid resistance against to *Sclerotinia sclerotiorum.* We sown the

hybrids in 70x30 cm of each other; one test field plot was 25.76 m^2. Sowing time was on 4-6th May in 2011 by 120 seeds per plot. The experimental design was a randomized blocks with 4 repetitions. The soil type was chernozem, with a 3.7 m/m% humus content, and 7.3 pH value. Nutrient supply were given in 2 periods: the first in the autumn (4th November 2010) with a multinutrient fertilizer 300 kg/ha, and the second in the spring (21th February 2011) with nitrogen fertilizer (NH_4-NO_3 34%) 200 kg/ha active substance. Chemical treatments were made two times during the season: on 4-5th May in 2011 with Force 1.5 G 7kg/ha, and on 11th in May with Racer 2.5 l/ha. There was no fungicide application on the area. The previous plants were rape in the year of 2008/2009 and winter wheat in 2007/2008.

Temperature and precipitation was an average of many years, which were advantageous for the sunflower hybrids from germination to the milk ripeness (15.5 mm in April, 30.6 mm in May, 45 mm in June, 91.2 in July and 39.2 in August).

Evaluation was made shortly after the symptoms have developed, on 15th in July.

RESULTS

Among the sunflower hybrids infestation were appeared in different values. Because rainy weather promoted the infection by ascospores, symptoms could be observed both on stalks and heads (*Table 2*).

Figure 1: ***Sclerotinia sclerotiorum*** **infection in sunflower head**

DISCUSSION

Today the number of certificated sunflower hybrids is more than 100. Our goal was to prove which hybrids process good resistance against Sclerotinia infections. In comparison of the tested hybrids the most resistant was ’Tamara’ (6 stalk and 66 head infections). There were high head infection at the following hybrids: ’Sorenzo’ (23 cases), ’Alibro’ (17 cases), ’Maestro’ (17 cases). The greatest stalk infection was occurred at the hybrid called ’Celia’ (9 cases). The most resistant sunflower hybrid against *Sclerotinia sclerotiorum* were ’Luleo’ and ’Neoma’ considering both infection types.

This evaluation test was given a general impression about the whole course of infection, which can be useful for breeders in the future.

Table 2

Sclerotinia stalk and head rot in sunflower (*Helianthus annuus* L.) hybrids

Name of hybrid	Infection type	I. repetition	II. repetition	III. repetition	IV. repetition	Total number
1. Neoma st.	Sclerotinia stalk rot	2	0	1	0	3
	head rot	0	0	1	0	1
2. Ferti st.	Sclerotinia stalk rot	5	0	1	1	7
	head rot	0	6	2	0	8
3. Brio st.	Sclerotinia stalk rot	2	0	1	1	4
	head rot	1	1	4	1	7
4. P 102 CL st.	Sclerotinia stalk rot	2	1	3	1	7
	head rot	4	2	0	5	11
5. Celia st.	Sclerotinia stalk rot	1	0	6	2	9
	head rot	3	1	2	1	7
6. Sunflora st.	Sclerotinia stalk rot	0	1	5	0	6
	head rot	2	0	2	0	4
7. Tamara st.	Sclerotinia stalk rot	3	0	1	2	6
	head rot	14	17	15	20	66
8. Kendo	Sclerotinia stalk rot	2	0	2	0	4
	head rot	0	2	3	0	5
9. Palomino	Sclerotinia stalk rot	2	0	3	0	5
	head rot	1	2	2	3	8
10. Alibro	Sclerotinia stalk rot	2	1	0	1	4
	head rot	3	5	3	6	17
11. Lisboa	Sclerotinia stalk rot	3	1	2	1	7
	head rot	8	1	0	1	10
12. Maestro	Sclerotinia stalk rot	2	0	1	1	4
	head rot	1	6	7	3	17
13. Oslo	Sclerotinia stalk	2	0	4	1	7
	head rot	0	0	1	5	6
14. Luleo	Sclerotinia stalk rot	0	0	0	1	1
	head rot	2	0	0	0	2
15. Sorenzo	Sclerotinia stalk rot	1	0	2	0	3
	head rot	8	3	7	5	23
16. Pan 31-101	Sclerotinia stalk	1	0	1	1	3
	head rot	2	1	2	4	9
Total		79	51	84	67	**281**

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