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"PSEUDORESISTANCE" PHENOMENON TO HEAD ROT IN HUNGARY

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Summary

Three years observations and experiments on head rot caused by both Sclerotinia sclerotiorum and Botrytis cinerea in Hungary revealed that susceptibility of various sunflower varieties, hybrids and lines is basically influenced by ecological factors, and by weather conditions especially during ripening and pre-harvesting period. As a consequence of this susceptibility of a given sunflower depends fundamentally on the sowing time, under Hungarian or similar climatic conditions. In Hungary the medium or late harvesting period is often rainy. Even hybrids belonging to the same ripening group can be different slightly phenologically at the moment of the artificial or natural infection, which can give erroneous results. All sunflowers tested till now proved to be clearly susceptible to head rot, or the occasionally observed resistance, tolerance proved to be only "pseudoresistance".

Introduction

Head rot of sunflower, caused by Sclerotinia sclerotiorum and Botrytis cinerea is one of the most frequent and economically the most important diseases in Hungary. Many years of observations and literature data demonstrate that plants are the most susceptible between the end of flowering and the harvest. Especially tremendous losses and epidemic spread of the disease occurs, when this period is wet and rainy. This unfortunately happens quite often in Hungary, since temperatures drop, high humidity and rain are frequent in September.

Materials and Methods

Sunflowers/varieties, hybrids and lines/tested for head rot resistance are listed in Tables 1-4.

Artificial inoculations were carried out by means of the "toothpick" method.

Disease severity expressed generally in percentage of rotted capitula. After artificial inoculations, however, the following disease indices were used:

1: Healthy capitulum, or traces of rot around the wound
2: Less than half of the capitulum is rotted
3: More than half of the capitulum is rotted, or total damage.

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Results

During the last three years numerous sunflowers (cf. Tables 1-4) were tested for head rot (Sclerotinia sclerotiorum and Botrytis cinerea) resistance.

In 1975 experimental plots were sowed on May 4. Severity of head rot, caused by spontaneous infection of the two pathogens, was evaluated just before harvest (beginning of October). Results are summarized in Table 1.

TABLE 1. Head rot incidence in 1975.

Variety	Origin	Head Rot %
Peredovik	SU	20.3
Csakinszkij	SU	11.2
Airelle	F	3.5
Relax	F	6.3
Fransol	F	15.0
Romsun 52	R	19.6
Romsun 53	R	31.1
Romsum 59	R	20.0
Romsun 50	R	14.8
Sorem 80	R	18.2
Sorem 82	R	12.3
Sunbred 212	USA	20.6
Variety 891	USA	17.9
Variety 894	USA	6.1

Next year (1976) a similar experiment has been repeated with a larger number of sunflower varieties and hybrids. Sowing time was May 10, and results were read before harvest. Results are summarized in Table 2.

TABLE 2. Head rot incidence in 1976.

Variety	Origin	Head rot %	Variety	Origin	Head rot %
Peredovik	SU	15.00	Albino	I	25.34
VNIIMK 6540	SU	25.66	Romsun 52	R	12.08
Csakinszkij	SU	15.00	Romsun 53	R	20.37
HB-322	BG	22.76	Romsun 59	R	4.24
HB-14/219	BG	10.35	HS-90	R	14.86
YU-NS-65	YU	7.73	HS-305	R	14.78
Airelle	F	20.41	Sorem 80	R	10.56
Relax	F	11.26	Sorem 82	R	12.05
Remil	F	17.02	Sorem HT. 64	R	25.06
ABx41	F	3.66	Issanka	F	10.74
Fransol	F	10.05	Wielkopolski	PL	8.35
H.223	F	21.34	YU-NS-1	YU	9.09
H.465	F	8.11	H. 23	E	10.07
H.489	F	9.50	Romsun 18	R	10.21
Ala	I	17.01	Romsun 20	R	4.50
Argentario	I	30.30	Romsun 301	R	20.92

When comparing the disease severity of the same varieties and hybrids in the two years (Table 3) susceptibility of each sunflower tested seem to be considerably different, e.g., Airelle and Relax were resistant in 1975, but proved to be susceptible in 1976. It was supposed that susceptibility is fundamentally influenced by the weather conditions (especially temperature and relative humidity) during the ripening period.

TABLE 3. Comparison of head rot incidence in 1975 and 1976.

Variety	Origin	Head rot percent	
		1975	1976
Peredovik	SU	20.3	15.00
Csakinszkij	SU	11.2	15.00
Airelle	F	3.5	20.41
Relax	F	6.3	11.26
Fransol	F	15.0	10.05
Romsun 52	R	19.6	12.08
Romsun 53	R	31.1	20.37
Romsun 59	R	20.0	4.24
Sorem 80	R	18.2	10.56
Sorem 82	R	12.3	12.05

In order to explain this erroneous result next year (1977) the same sunflowers were sowed in two different times. Sowing times were May 12 (early) and June 18 (late). Severity of head rot (spontaneous infection) was estimated before harvest. Results are summarized in Table 4. Capitula of the early sowed sunflowers were almost free from rot, while in the late sowed plots severe head rot developed, e.g., in the early sowed plots Remil and UY-NS-65 were "resistant" (0 and 0.5% rot), but in the late sowed variety they were "susceptible" (92.3 and 62.5% rot).

During the ripening period of the early sowed sunflowers weather was unfavorable to the head rot; temperature was high, relative humidity was low. During the maturation of the late sowed plots, however, weather supported the epidemic spread of the head rot pathogens: low temperature with high humidity. This correlation is demonstrated in Table 5.

In the same year 25 FAO hybrids and 150 Hungarian experimental hybrids, together with standard varieties were sowed in two different times (early: May 12; late: June 18), in three repitition. Capitula of the experimental plants were artificially inoculated with Sclerotinia sclerotiorum by means of the "toothpick" method. Severity of head rot was estimated on the basis of infection indices. All the tested sunflowers proved to be clearly susceptible (infection index: 2,8-3), except H CMS-3/H3 (index: 1,9); H CMS-3/H2 (index: 2,4); VNIIMK 6540 (index: 2,5); H CMS-3/H1 (index: 2,6); H 23 (Spain) (index: 2,7); H CMS-5/H2 (index: 2,7); and H CMS-3/H2 (index: 2,7), in the late sowed plots. The same sunflowers, however, behaved clearly susceptible in the early sowed plots. It is necessary to underline, that at the time of the artificial inoculation only these "pseudoresistant" sunflowers in the late sowed plots had green or pale yellow-green capitula, while all the rest were yellow or near mature.

Figure 1
Artificial inoculations with the "toothpick" method.
Green/left/ and yellow/right/ capitula

Figure 2
Remil, French hybrid, sowed early/ May 12/ in 1977, free from rot

Figure 3
Remil, whoed late /June 18/ in 1977, serious head rot

TABLE 4. Head rot incidence in early and late sowed sunflowers in 1977.

Variety	Origin	Head rot percent	
		Sowing-Time May 12	Sowing-Time June 18
Peredovik	SU	0.73	78.95
VNIIMK 6540	SU	0.58	93.33
Csakinszkij	SU		88.89
HB. 322	BG	15.90	80.00
HB-14/219	BG	2.30	88.2
YU-NS-65	YU	5.50	62.5
YU-NS-28	YU		57.1
Airelle	F	2.8	70.0
Relax	F		58.3
Remil	F	0	92.3
Sorem HT.58	R	0.57	82.3
Romsun 52	R	1.2	100.0
Romsun 53	R	6.9	93.3
Romsun 59	R	2.3	76.5
Sorem 80	R	2.24	83.3
Sorem 82	R	1.67	88.2
Sorem HT.64	R	1.68	88.9
Issanka	F	0.5	64.29
H5-C3	F		84.21
Flambeau	F	0.6	100.00
Wielkopolski	PL	0.5	60.00
YU-NS-1	YU	3.3	100.00
H-23	E		100.00
Romsun 18	R		89.5
Romsun 20	R		100.00
Romsun 301	R	3.91	94.7

Figure 4
YU-NS-65, Yugoslavian hybrid, sowed early/
May 12/ in 1977, free from rot

Figure 5
YU-NS-65, sowed late/June 18/ in 1977, serious head rot

TABLE 5. Temperature and Relative humidity in 1977 and the physiologically/full mature stage of early (May 12) and late (June 18) sowed sunflowers.

Month	Temperature C°	% Relative Humidity	Physiologically mature		Full Mature	
			Early sowed	Late sowed	Early sowed	Late Sowed
July	21.2	65.8				
August	20.5	71.45	August 15			
September	14.7	70.9		Sept. 15	Sept. 15-30	
October	11.9	81.7				Sept.30-Oct.15
November	5.9	84.0				

Discussion

All sunflowers (varieties, hybrids, lines) tested till now in Hungary proved to be susceptible to head rot. The occasionally observed resistance (tolerance) proved to be only "pseudoresistance". For dependable testing of head rot resistance it is highly advisable to test sunflowers on the basis of careful phenological analysis. In this respect serial sowing combined with artificial inoculations, carried out exactly at the same phenophase would be necessary. Even in this case weather conditions (temperature, relative humidity, and precipitation) can fundamentally influence the disease severity.

These observations and experimental results seem to be valid to all geographical and climatic areas similar to Hungary.

In addition we have to cope with a somewhat similar situation in the case of downy mildew, too. In a variety test carried out at the Institute for Research on Forage Crops, Iregszemsce, all of the early and medium ripening FAO hybrids were resistant in 1977. This year, however, when weather was extremely favorable to Plasmopara infection, near 100% infection was found on the following hybrids: Remil, Marianne, Relax, NSH 26. Mild or medium infection developed on NSH 63, HS 53 and Fransol. This means, unfortunately, that even in case of downy mildew neither reliably tolerant, nor resistant hybrids or breeding materials are available at present.