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ENVIRONMENTAL AND CLIMATIC FACTORS AFFECTING THE PARASITATION OF *Sclerotinia sclerotiorum* (Lib.) DE BARY ON SUNFLOWER

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SUMMARY

Ecological factors have been studied to reveal the effect of the conditions of soil on the development of apothecia of *Sclerotinia sclerotiorum*. The different genotypes of the soils determined the sporogenesis. Most apothecia were developed on the surface of soddy alluvial and sandy soils. Strong correlations have been found between the physical, chemical and microbiologycal features of soil and the intensity of apothecia development. The susceptibility of sunflower was studied in the field. NS–H–45, NS–H–43, S–2151 and U 55E, S–281, U 74 E were tolerant to Sclerotinia sclerotiorum caused by spontaneus infection and inoculation in the field.

Key words: *Sclerotinia sclerotiorum*, climatic conditions, susceptibility, sunflower hybrids

INTRODUCTION

Sclerotinia sclerotiorum has many host plants. In such case enormous vegetative schims accumulate in the soil. In order to work out sufficient control method against the disease, it becomes absolutely essential to know more about the biology of the fungus and to reveal the most important epidemic factors (1, 2, 3). As is known, *Sclerotinia sclerotiorum* owerwinters by means of sclerotia and it is able to infect host plants in two ways, either by vegetative mycelia in the soil, or by generative ascospores above the ground. In favourable conditions apothecia are formed from sclerotia on the open surface. Apothecia develop a large number of asci, each containing eight ascospores. In consequence to a change of environmental conditions, ascospores are emitted as the results of contraction and expansion of apothecia. In sufficient humidity, ascospores germinate and germ tubes penetrate host tissues which will be disintegrated by pectinase and cellulase enzymes produced by the pathogen (4, 5, 6, 7). Earlier, inoculation methods similar to natural infection have been worked out. Inoculation of various plants revealed that *Sclerotinia sclerotiorum* can infect young branches of locust–tree and swingle too (3). This paper aims to reveal what kind of environment and climatic conditions promote the development of apothecia and its sporulation in the field; on the other hand we would like to give some information about the epidemic potential of different sunflower hybrids.

MATERIAL AND METHOD

The experiments were carried out at the Research Centre of Seed Production and Trading Company in Nyiregyháza. The observations were carried out in continuity from 1985 to 1990. The sclerotia of *Sclerotinia sclerotiorum* were frozen in perlite or in composted soil at minus 15–20°C for 3–4 weeks, under diffuse light and 80–90% relative humidity. After this treatment apothecia developed through 3–4 weeks. After the appearence of apothecia, ascospores occured for 1–3 days. Discharged ascospores were collected by suitable spore traps and they were used for inoculation. *Trichoderma* ssp. content was tested in different genotypes of the soils by Martin medium. We studied the concentration and the species of population of hyperparasita organism. We determined the physical and chemical features of the soils (Table 1, 2). Early maturity and middle–maturity sunflower hybrids were tested by *Sclerotinia sclerotiorum* under provocation in the field (Table 3, 4).

Table 1. Tested soils

No.	Genotypes of soil	Origin	Date of examination			
1.	Soddy alluvial	Rakamaz	1986	1987	1988	1989
2.	Meadow soil	Tiszavasvári	1986	1987	1988	1989
3.	Forest earth	Mátészalka	–	1987	1988	1989
4.	Sandy soil	Nyiregyháza	–	1987	1988	1989
5.	Peaty soil	Tyukod	1986	1987	–	1989
6.	Common chernozem	Nagycserkesz	–	1987	1988	1989

Table 2. Influence of physical,chemical and microbiological parameters for sporogenesis of *Sclerotinia sclerotiorum* on different genotypes of soil

Type of soil		Soddy alluvial	Sandy soil	Chernozem common	Forest earth	Meadow soil	Peaty soil
No. of *Sclerotinia* sc.		139	93	68	56	46	39
No. of *Trichoderma* ssp.		46	45	22	20	21	112
pH H_2O		6.7	7.4	7.6	7.4	5.7	6.5
Absorb. P_2O_5	mg/loog	27	9.2	21	8.1	21	14
Absorb. K_2O	mg/loog	6.1	21.5	39.5	15	15.2	21.5
NO_3–N	mg/loog	0.31	0.33	0.53	0.35	3.4	4.44
NH_4–N	mg/loog	0.23	0.32	1.28	2.33	3.89	4.75
Ca	mg/loog	70	125	196	280	480	990
Mg	mg/loog	11	7	23.5	28.7	38	49.5
Solubl. Zn		0.3	2.2	2.6	2.5	2.8	1.8
Solubl. Fe		33	34.5	28	21.5	14	4.0
Solubl. Cu		0.3	0.9	1.1	0.7	0.5	0.3
Solubl. Mn		125	67.5	42.6	27.0	20.0	11.5
Humus		0.56	1.0	1.15	2.8	3.15	7.8

+ No. of *Sclerotinia sclerotiorum*: $SzD_{5\%}$: 10.95

Table 3. Susceptibility of early maturity sunflower hybrids (basal stem, stem, head rot).

No.	Hybrid	Susceptibility to *Sclerotinia sclerotiorum*			
		Basal stem	Stem	Head	Average
1.	U–55 E	39.74	5.32	12.29	19.11
2.	S–281	43.44	11.45	15.17	23.35
3.	U–74 E	47.09	9.01	15.97	24.02
4.	Barbara	55.73	8.6	9.01	24.44
5.	J–550	43.02	13.11	26.63	27.58
6.	XP–4615	49.58	18.43	19.84	29.28
7.	IBH–168	51.63	20.48	21.3	31.13
8.	Clubsol	49.17	15.57	30.32	31.68
9.	NS–H–26	52.04	12.7	32.78	32.50
10.	Citosol 4	61.0	13.9	27.86	34.27
11.	Isobol	30.88	34.83	31.55	34.42
12.	Blumix	63.93	17.2	23.76	34.96
13.	Viki	56.96	12.7	35.65	35.10
14.	SH–13	57.37	18.44	34.41	36.74
15.	Festiv	52.04	24.17	34.83	37.01
16.	HB–1	70.08	18.85	36.05	41.66
17.	SH–55	57.78	27.45	40.15	41.79
18.	NK.285	85.65	27.86	26.22	46.57
19.	Florakis	68.86	30.32	44.25	47.81

Rate of susceptibility:		Infection of *Sc.sc.* %
1.	–	
2.	U–55E	10–20
3.	S–281, U–74 E, Barbara, S–550, XP–4315	20–30
4.	Blumix, Viki, SH–13, Festiv, Isobol, Lubsol, Citosol 4, IBH–166, NS–N–26	30–40
5.	NK–285, MB–1, Florakis, SH–55	40–50

Table 4. Susceptibility of middle–maturity sunflower hybrids (basal stem, stem, head rot).

No.	Hybrid	Susceptibility to *Sclerotinia sclerotiorum*			
		Basal stem	Stem	Head	Average
1.	NS–H–45	32.78	3.27	6.52	14.19
2.	NS–H–43	46.71	2.45	4.87	18.01
3.	S–2151	39.34	2.02	10.39	19.25
4.	Irampol	41.26	6.12	25.68	23.02
5.	S – 277	34.01	1.6	34.42	23.34
6.	Rempol	51.63	5.68	14.32	23.37
7.	NK–4	45.46	12.45	14.34	24.03
8.	S – 280	43.84	6.14	29.91	26.63
9.	NK – 265	44.66	5.58	30.73	27.02
10.	Union 309	51.63	9.42	24.58	28.54
11.	SH – 30	62.7	3.23	29.48	31.8
12.	Emil	63.68	6.09	27.04	32.30
13.	Antilla	60.24	4.87	31.95	32.35
14.	IH – 173	67.21	14.75	40.57	40.84
15.	IHNK–81	72.54	19.66	34.79	42.33
16.	NS–H–27	65.57	24.17	41.8	43.84
17.	Union 317	68.85	9.37	55.32	44.51

Rate of susceptibility:		Infection of *Sc.sc.* %
1.	–	0 – 10
2.	NS–H–45, NS–H–43, S–2151	10–20
3.	Irampol, Rempol, S–277, S–280, Union 309, NK–4, NK–265, SH–30	20–30
4.	Antilla, Emil	30–40
5.	Union 317, IHNK–81, S–246, NS–H–27, IH–173	40–50

RESULTS

The most suitable climatic parameters for the sporogenesis of *Sclerotinia sclerotiorum* were the following:

temperature of air: 20 – 25 °C
temperature of soil: 15 – 18 °C
relative humidity: 80 – 90 °C
wetness of soil: min 30 %
intensity of light: min 1500 max 6000 Lux

Under such conditions of environment, the most intensive sporogenesis of white mould occurred on the surface of soddy alluvial and sandy soils. The concentration of apothecia was less on the surface of the forest earth, meadow and peaty soils (Table 2).

We found negative correlations between *Trichoderma* ssp. concentration, NO_3–N, NH_4–N mg/100g. soil content, humus content and the number of apothecia of *Sclerotinia sclerotiorum* (Table 2).

Different sunflower hybrids were examined in the field under provocation. The basal stem, stem and head rot values and average susceptibility showed field tolerance of sunflower (Table 3, 4).

DISCUSSION

We have obtained new information for the epidemic of *Sclerotinia sclerotiorum* (Lib.) de Bary. The climatic conditions (temperature, wetness, light), the different genotypes of soil and the susceptibility of sunflower hybrids have an important role in the development of epidemic of white mould on sunflower in Hungary. There is a strong correlation between organic matter in the soils and the number of apothecia on soil surface. The susceptibility of sunflower is an important character for plant production. The early maturity U 55 E, S – 281, U 74 E, the middle–maturity NS–H–45, NS–H–43, S–2151 were less susceptible in the field under provocation circumstances.

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FACTORES AMBIENTALES Y CLIMATICOS QUE AFECTAN LA PARASITACION DE *Sclerotinia Sclerotiorum* (Lib.) DE BARY EN GIRASOL

RESUMEN

Los factores ecológicos ha demostrado un estudio que revelan el efecto de las condiciones del suelo en el desarrollo de apotecios de *Sclerotinia Sclerotiorum*. Los diferentes tipos de suelos determinaron la esporogénesis. La mayor parte de los apotecios se desarrollaron sobre la superficie de los suelos aluviales y arenosos. Scencontró una fuerte correlación entre la características físicas, químicas y microbiológicas del suelo y la intensidad de formación de apotecios. La susceptibilidad del girasol fué estudíada en el campo NS–H–45, NS–H–43, S–2151 y U 55E, S–281, U 74 E fueron tolerantes a *Sclerotinia Sclerotiorum* por infección espontánea y bajo el ataque en el campo.

FACTEURS DÉPENDANTS DES CONDITIONS ENVIRONEMENTALES ET CLIMATIQUES LORS DE L'INFECTION DU TOURNESOL PAR *Sclerotinia Sclerotiorum* (Lib.) DE BARY.

RÉSUMÉ:

Une étude des facteurs écologiques a été effectuée afin de déterminer leurs effets sur le développement des apothécies de *Sclerotinia sclerotiorum* . Les différents types de sols ont permis la sporogenèse. Le plus grand nombre d'apothécies a été formé sur des sols sodés alluviaux et sur des sols sableux. Une forte corrélation a été trouvée entre les faciès physiques, chimiques, microbiologiques des sols et le niveau de développement des apothécies. La sensibilité du tournesol a été testée en champ. NS11-45, NSH-43, S-2151 et U-55E, S-281, U74E étaient tolérants à *Sclerotinia sclerotiorum* tant en infection naturelle qu'en infection renforcée en champ.