STEMPHYLIUM SP. - THE AGENT OF REDDISH-BROWN SPOT IN SUNFLOWER

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SUMMARY

Reddish-brown spots may frequently be observed on leaves and stems of sunflower plants. Isolating pure cultures from these spots and inoculating sunflowers in field and in greenhouse, we found that the agent of these spots is a parasitic fungus Stemphyllium sp. In pure culture and on PDA medium, the fungus forms a medium rank carmine red mycelial film. The mycelium is septate, red, and it stains the PDA medium carmine red. On the tips of the hyphae there develop cylindrical and terminally rounded brown conidia which are septated longitudinally and transversally. Their size is 11.08-63.71 x 3.31-36.01 µm. The optimum temperature for the development of the fungus on PDA is around 25°C, the minimum about 5°C, the maximum between 30 and 35°C. The conidium germinates in a water drop in one hour producing several hyphae. At inoculation in field and greenhouse, the incubation lasts 4-5 days. When 12 plant species were incolated with the fungus, the infection occurred only on the sunflower (Helianthus annuus). Thus we propose a new name for the fungus - Stemphylium helianthi.

INTRODUCTION

Spots on sunflowers are caused by a number of fungi belonging to various genera. However, the majority of the described agents of spots on sunflower belongs to Alternaria genus. The symptoms caused by these fungi are easily recognized. However, the isolations of characteristic and conspicuous reddish-brown spots that occur frequently on sunflower stem, petioles, and laminae have regularly indicated a fungus from Stemphylium genus. This finding has been reported earlier (Aćimović and Štraser, 1982; Aćimović, 1987). This paper describes in more detail the symptoms of the disease and some characters of the fungus.

MATERIALS AND METHODS

Infected sunflower parts have been collected in several locations in Vojvodina Province (northeastern Yugoslavia) and pure cultures of the fungus were isolated on potato-dextrose agar (PDA).

We studied the isolate obtained from the material collected in the vicinity of Novi Sad (NS). All laboratory tests were conducted on PDA: the effect of temperature (0, 5, 10, 15, 20, 25, 30, and 35°C) on the development of the fungus, the growth of mycelia, the presence of air-borne mycelia, their compaction, changes in color, and the occurrence of the reproductive organs, the conidia. A morphological study was conducted on 100 microscopically measured conidia sampled from the lot reproduced at the optimum temperature for fungus development. In greenhouse, young sunflower plants were inoculated with a suspension of conidia; in field, sunflower plants were inoculated at the beginning of flower by teh toothpick method, inserting toothpicks in the middle of the stem.

The virulence of the fungus was tested on 12 plant species which were inoculated 20 days after the emergence in a greenhouse.

RESULTS

Disease symptoms

The fungus forms ellipsoidal reddish-brown spots on sunflower stems and leaves. After the stage of flower, the spots are 2-5 cm long and 2-3 cm wide. From the

surface of the stem, the fungus penetrates the lignified and the medullar parts of the stem. The attacked part rots and is prone to breaking. The infection starts along the stem, at the base of the petiole, and in the zone of nerves of the lamina. Spot size depends on the age of the attacked plant at the time of infection. Large spots have been observed on young plants, small and narrow spots on oil plants. When the base of the petiole is inoculated, a reddish-brown spot spreads along the petiole causing a partial or complete drying of the lamina. When the stem is inoculated at the time of flower, in field conditions, the infection spreads slowly through the lignified part and rapidly through the medullar part reaching the length of 5, 10 or even 100 cm. The external symptom of the disease is a slight chlorosis. Infected plants are somewhat earlier to mature and their seeds are not is filled as those of healthy plants.

When young plants are infected in a greenhouse, the first symptoms occur on the cotyledons and then on stems and leaves, in the form of oval reddish-brown spots. Consequently, the cotyledons and the leaves dry up and the stem breaks at the site of infection.

Some characteristics of the fungus

The fungus develops slowly on PDA. Regardless of the temperature, the fungus does not cover the entire surface of a 9-cm Petri dish in the period of 30 days.

Data on the rate of development of the fungus at different temperatures are presented in Table 1.

TAB. 1: Effect of temperature on the growth of the Stemphylium sp. mycelium

DAYS	TEMPERATURE IN °C						
	5	10	15	20	25	30	35
2	–	–	0,7	1,0	1,6	1,0	–
4	0,3	0,8	1,7	2,2	3,1	2,0	–
7	0,7	1,6	2,3	2,7	4,5	3,4	–
9	1,0	1,8	2,6	3,1	5,2	4,0	–
11	1,6	2,0	2,9	3,3	5,9	4,5	–
14	2,2	2,3	3,3	3,6	6,5	5,1	–
16	2,4	2,5	3,5	3,8	6,7	5,1	–
21	2,6	2,9	3,9	4,4	7,2	5,2	–
25	2,7	3,2	4,4	4,9	7,6	5,3	–
30	3,0	3,6	4,8	6,1	8,1	5,5	–

The minimum temperature for the development of the fungus was between 0 and 5°C, the optimum about 25°C, and the maximum between 30 and 35°C. After 30 days, the mycelia were most luxuriant and compact at 15, 20, and 30°C. The largest number of conidia was recorded at 25°C. The fructification did not take place at 5 and 30°C.

The mycelial film is white for the first four days to acquire a reddish-brown color later on. The film is grayish-brown at the surface and reddish-brown on the medium, with gold-violet reflections. The fungus stais the medium carmine red.

A 30 day old microscopic mycelium is light brown, septate and branched, with a brown membrane.

The conidium is dark brown, located on the tips of the septate conidiophore. It consists of several cells, and it is partitioned by longitudinal (1-2) and transversal (1-6) septa. Its size is 11.08-63.71 x 8.31-36.01 µm.

Virulence of the fungus

The virulence of the fungus was examined on 12 plant species in a greenhouses. The results are presented in Table 2.

TAB. 2: Virulence of Stemphylium sp. on different plant species

No.	PLANT SPECIES	Degree of virulence
1.	Allium cepa	-
2.	Beta vulgaris	-
3.	Brassica oleracea	-
4.	Datura stramonium	-
5.	Dancus carota	-
6.	Helianthus annuus	***
7.	Helianthus tuberosus	-
8.	Medicago sativa	-
9.	Pisum sativum	-
10.	Ricinus communis	-
11.	Solanum lycopersicum	-
12.	Zinnia elegans	-

\- uninfacted
* low virulence
** medium virulence
*** high virulence

The incubation period after inoculation in field and in greenhouse lasts 4-5 days.

DISCUSSION

Stemphylium sp. is a new parasite of the sunflower in Yugoslavia. According to the temperatures favorable for its development, it may be present on sunflowers in all countries with a moderately continental climate. Our research results indicate that the fungus is specialized for sunflowers, causing distinct symptoms which differ from those caused by other parasitic fungi. The fungus differs morphologically and biologically from the other species from Stemphylium genus, and we propose a new name for it - Stemphylium helianthi.

CONCLUSION

A fungus Stemphylium sp. is a new parasite of the sunflower. It causes reddish-brown spots on the above-ground parts of sunflower plants.
In a pure culture on PDA, the fungus develops slowly, producing a medium compact, reddish-brown mycelia.
The conidium consists of several celis which are reddish-brown and partitioned by longitudinal and transversal septa. Its size is 11.08-63.71 x 8.31-36.01 μm.
The optimum temperature for the development of the fungus is about 25°C, the minimum between 0 and 5°C, and the maximum between 30 and 35°C.
Of the 12 plant species tested, the pathogen was virulent only on the sunflower.
The incubation period of the fungus on inoculated sunflower plants is 4-5 days.

LITERATURE

Aćimović M., Štraser N., 1982, Stemphylium sp., the agent of reddish-brown spot on sunflower stem, 10th Int.Sunf.Conference: 157.

Aćimović M., 1987: Sunflower diseases mapping in Europe and some Countries outside Europe in the period 1984-1986: 1-18.