

STUDY OF THE REACTION OF HELIANTHUS DEBILIS ACCESSIONS TO PHOMOPSIS HELIANTHI MUNT.-CVET.



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ABSTRACT

Phomopsis/Diaporthe helianthi Munt.-Cvet. et al. is a pathogen causing gray spots on sunflower (*Helianthus annuus* L.) and leads to considerable yield decrease.

The reaction of some annual wild sunflower species of genus *Helianthus* to the cause of the agent of grey spots on sunflower was studied. The content of the seed oil and vegetation period of investigated accessions were determined.

It was established that in the collection of DAI - General Toshevo accessions were maintained, which could be used as donors for resistance. Eight annual wild accessions (E-011, E-012, E-137, E-089, E-138, E-139, E-014, E-141) were with the immune type of reaction to the pathogen *Phomopsis helianthi* and the other three (E-010, E-013, E-136) showed resistance to it. Only one of the accession (E-082) was with medium resistance type of reaction to the pathogen.

INTRODUCTION

The gray spots on sunflower caused by the pathogen *Phomopsis/Diaporthe helianthi* Munt. Cvet.et al appeared to be one of the more serious problem nowadays. As a result of severe attacks the plant core has been destructed and the broken plants have fallen to the ground. The main measure for overcoming such problems are connected to pesticides use and applying of good agricultural technics. There is another way for effective protection against gray spots attacks. Increasing of genetic resistance nowadays is the important factor for successful breeding work.

The best way to control fungal diseases is the development of resistance hybrids. Including resistance accessions in future hybrid combinations could be used to obtain of a new and varied genetic material, resistant to economically important diseases of sunflower.

MATERIALS AND METHODS

The research was carried out 2020 in Dobrudzha agricultural institute under artificial infection conditions, which were annually maintained.

Plant material

Helianthus debilis includes five subspecies (Schilling and Heiser, 1981). In the present study are includes *H. debilis*, ssp. *cucumerifolius* (accessions E-012 and E-137), *H. debilis*, ssp. *silvestris* (accessions E-013, E-089, E-138 and E-139), *H. debilis*, ssp. *tardiflorus* (accessions E-014 and E-141), *H. debilis*, ssp. *vestitus* (E-010), *H. debilis*, ssp. *debilis* (E-011), *H. debilis* (accessions E-082 and E-136).

Infection background and determination of accessions reaction.

The plants were inoculated at the buttoning stage according to the method of Encheva and Kiryakov (2002). The petiole of a leaf was cut from the middle of the plant by a scalpel 3 cm from the stem. A plastic straw containing an agar disc of 5-day old culture of PH 20.1.1 isolate was inserted into the core of the leaf petiole. The *Ph. helianthi* isolate used for inoculation was isolated the previous year from infected sunflower crops in the region of DAI. Six plants of all the accessions were inoculated. The reaction of the accessions were read 10 days after inoculation according to the following five-degree scale: 1-no symptoms; 2-spots on the stem up to 5 cm long; 3-spots on the stem larger than 5 cm; 7-spots covering the next internode; 9-stem breaking at the place of inoculation. The ranking of the accessions is based on the middle disease index (MDI), calculated by the following formula: $MDI = \sum (n \times ds) \times N$ (n- number of plants; n- point of attack (1-9), N-total number of plants) as follow: Immune – 1.0 (I); Resistance – 1.1-3.0 (R); Middle resistance – 3.1-5.0 (MR); Susceptible – 5.1 – 7.0 (S); Very susceptible - up 7.1 (VS). (Pic.1)

Breeding characters observed.

The seed oil content and vegetation period of investigated *H. debilis* accessions were determined. Seed oil content was observed using nuclear magnetic resonance (Tab.2).

Pic.1 Five-degree scale



RESULTS AND DISCUSSION

Results

The reaction of the studied *Helianthus debilis* accessions to *Phomopsis helianthi* isolate included in the investigation varied in the ranges- from immune to the middle resistance (tab.1). Immune type of a reaction was established for the accessions- E-011, E-012, E-137, E-089, E-138, E-139, E-014, E-141. Resistance was reported for the accessions- E-136, E-013, E-136. The accession E-082 reacted with middle resistance type of reaction.

Table.1 Reaction of *Helianthus debilis* to isolate PH 20.1.1 of *Phomopsis helianthi*

Code	Accession	MDI	Variability		Type of resistance
			Min.	Max.	
E-010	<i>Helianthus debilis</i> , ssp. <i>vestitus</i>	2,0	1	3	R
E-082	<i>Helianthus debilis</i>	5,7	3	7	MR
E-011	<i>Helianthus debilis</i> , ssp. <i>debilis</i>	1,0	1	1	I
E-012	<i>Helianthus debilis</i> , ssp. <i>cucumerifolius</i>	1,0	1	1	I
E-137	<i>Helianthus debilis</i> , ssp. <i>cucumerifolius</i>	1,0	1	1	I
E-013	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	1,7	1	3	R
E-089	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	1,0	1	1	I
E-136	<i>Helianthus debilis</i>	2,0	1	5	R
E-138	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	1,0	1	1	I
E-139	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	1,0	1	1	I
E-014	<i>Helianthus debilis</i> , ssp. <i>tardiflorus</i>	1,0	1	1	I
E-141	<i>Helianthus debilis</i> , ssp. <i>tardiflorus</i>	1,0	1	1	I

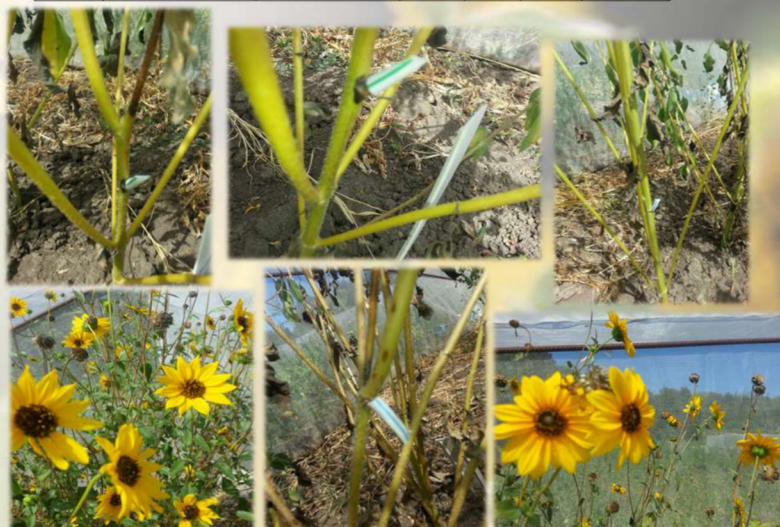


Table 2. Seed oil content, % and vegetation period, days of investigated *H. debilis* accessions.

No	Accession	Vegetation period, days	Seed oil content, %
E-010	<i>Helianthus debilis</i> , ssp. <i>vestitus</i>	165	29,6
E-082	<i>Helianthus debilis</i>	170	28,4
E-011	<i>Helianthus debilis</i> , ssp. <i>debilis</i>	170	27
E-012	<i>Helianthus debilis</i> , ssp. <i>cucumerifolius</i>	170	28
E-137	<i>Helianthus debilis</i> , ssp. <i>cucumerifolius</i>	170	28,5
E-013	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	165	27,4
E-089	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	165	29
E-136	<i>Helianthus debilis</i>	155	31,5
E-138	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	170	29
E-139	<i>Helianthus debilis</i> , ssp. <i>silvestris</i>	170	29
E-014	<i>Helianthus debilis</i> , ssp. <i>tardiflorus</i>	170	30,5
E-141	<i>Helianthus debilis</i> , ssp. <i>tardiflorus</i>	170	30

Discussion

Studying the resistance of annual and perennial accessions of the genus *Helianthus*, Encheva et al. (2014) found that accessions E-137 and E-138 of the species *Helianthus debilis* showed resistance to the isolate used in the study, while E-012, E-089 and E-082 were middle resistant.

In the present investigation E-012, E-137, E-089 and E-138 showed an immune type of reaction and E-082 retains its response. The reasons for this may be due to climatic conditions (Maserevic, 2000) and the aggressiveness of the isolates (Encheva, 2002). Studying the response to eight isolates on nine sunflower hybrids of *Phomopsis helianthi*, Encheva (2002) found significant differences in resistance, depending on the aggressiveness of the isolates.

CONCLUSION

The presented results showed that the collection of wild *Helianthus* species, located on the territory of DAI own wild annual sunflower species, which could be included in the breeding programs as initial material for developing new hybrids. The results of this research showed it may be possible that the studied accessions carry genes for resistance to *Phomopsis helianthi* Munt. Cvet.et al.