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CONSIDERATIONS ABOUT *HELIANTHUS TUBEROSUS* AS SECONDARY HOST FOR *ALTERNARIA HELIANTHI*

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Abstract. *Present paper came after five years of nine years of surveillance on some well know populations of Jerusalem artichoke* (*Helianthus tuberosus). This species is a close relative of sunflower (Helianthus annus) and for this reason they have some common diseases and pests. In the present paper we bring the analyze of Alternaria helianthi fungus presence on the plants of Helianthus tuberosus populations. It is notorious that Alternaria helianthin is one of the most present diseases on the sunflower. Present paper present one way of natural preservation of fungus Alternaria helianthi on the spontaneous flora which means that this pathogen will come back on the sunflower fields every year whatever the combat strategy will be taken by the farmers. Since 2017 there were conducted surveillance on Jerusalem artichoke* (*Helianthus tuberosus*) and one of the funguses which was almost constant on the surveilled populations was *Alternaria helianthi. These means that the fungus has a constant presence in the area and for this reason it is a constant treat for sunflower areas from Sout Western part of Romania*. *Data revealed in the present paper about virulence (frequency of attack) and aggressivity (intensity of attack) of the fungus were collected between 2022 and 2025. We have previous data, starting from 2017 but there were some years like 2017,2018 and 2020 when the fungus was almost absent on the surveilled populations. The populations of Jerusalem artichoke* (*Helianthus tuberosus*) situated on the middle basin of Nera River.

Keywords*: Helianthus tuberosus, Alternaria helianthi*

INTRODUCTION

Jerusalem artichoke (Helianthus tuberosus) is adapted to a wide range of environments (PIMSAEN, W. et.al., 2010) and has a wide range of uses. The tubers are fairly large, up to 10cm long and 6 cm in diameter [HUXLEY. A., *1992*]. Initially, the tubers were used as feed for pigs. Everything changed after it was discovered that inulin, which is found in large quantities in Jerusalem artichoke tubers, naturally and directly transforms into fructose and also can be used on a number of culinary recipes (KAYS, S.J ,2008; MA, X.Y.; ZHANG, L.H., et. al. 2011; VOLK G.M., RICHARDS K., 2006). This discovery led to a simple technique for preserving fresh tubers in storage, and then, after the inulin transforms into fructose, it is extracted from the tubers and specially used as a sweetener for people suffering from diabetes (UPHOF. J. C. TH., 1959). The roasted tubers are a coffee substitute (FACCIOLA. S., 1990).

The issue we bring before the scientific community is that Jerusalem artichoke belongs to the genus Helianthus, just like the sunflower (*Helianthus annuus*), one of the main crops grown in Romania. The attack of alternaria leaf spot (*Alternaria helianthi*), a common disease for Jerusalem artichoke but especially for sunflower, leads to substantial losses for both plants, the main reason being the drying of the leaves. This phenomenon is quite rapid in years when there are intervals of rainy days followed by periods of high temperatures that lead to increased atmospheric humidity. This is relatively simple for the Jerusalem artichoke populations analyzed, which are practically located in the Nera river basin, directly leading to higher humidity and sun exposer in the summertime.

For sunflower crops, especially where the density is close to the maximum recommended limit, plants that have reached the floral bud formation stage and after this phenophase, they have leaves large enough to cover the space between rows, thus creating a

humid microclimate in the lower third of the stems. Direct result is a rapid necrosis of the leaves in the lower half of the stem due to attack by foliar pathogens, especially alternariosis and powdery mildew (figure 1).



Figure 1. Aspects of *Alternaria helianthi* attack on *Helianthus tuberosus* plants on the middle basin of Nera River meadow (original photography's)

MATERIAL AND METHODS

Between 2022 and 2025, data were collected regarding the frequency and intensity of alternaria leaf spot (*Alternaria helianthi*) attacks, and based on these, the degree of attack was calculated. The data were collected from five populations of Helianthus tuberosus located in the middle basin of the Nera River between the localities of Sasca Română and Bogodinți

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(figure 2), as follows: The population from Slatina Nera (P1), the population from the Nera Monastery area (P2), the population from the Sasca Montană locality area (P3), the population from the Sasca Română locality area (P4), and the last population, somewhat isolated from those on the Nera River, is the population from the Șușara stream (P5), after entering the valley leading to the waterfall.

The populations had a number of plants ranging between 58 and 243 according to Table 1. As can be seen, the number of plants is sufficiently large to support a relevant statistical calculation. For the statistical calculation, each population was divided into 3 repetitions.



Figure 2. Distribution of *Helianthus tuberosus* populations inside the research area.

Table 1

Number of plants in the analyzed populations of *Helianthus tuberosus* during the period 2023 2025

Nr. crt	Population	Year		
		2023	2024	2025
1	Slatina Nera	182	152	174
2	Mănăstirea Nera	126	154	168
3	Sasca Montană	156	58	87
4	Sasca Română	146	188	243
5	Șușara	122	184	226

The statistical calculation was performed only for the virulence and aggressiveness of the pathogen. The data subjected to the statistical calculation were collected throughout the July - September interval throughout the entire evaluation period, practically each repetition

being the data collected in one of the three evaluation months in each of the three years of evaluation.

RESULTS AND DISCUSSIONS

The results regarding the evolution of the virulence of the pathogen *Alternaria helianthi* in the five Jerusalem artichoke populations evaluated during the period 2023-2025 are shown in Table 1. The highest virulence values were recorded in the population located near the Nera monastery with a very significant difference from the control, followed by the population at the entrance to the Șușara stream valley with a significant difference from the control. The lowest virulence values were recorded in the population in the meadow of the Sasca Montană locality with a distinctly significant negative difference.

The repetition data indicate that of the three years, the most favorable for the development of the pathogen was 2025 followed by 2023 and 2024 had the most unfavorable conditions. This can be best seen in Table 2, namely the fact that in 2023 the average of the populations is very close to the average of the populations for all three years, the difference being statistically insignificant. On the other hand, the average of the five populations in 2025 was the highest compared to the average, compared to those in 2023 and 2024, the difference from the control being significant. It is also worth noting the year 2024, which recorded an average of the virulence of the five populations with a distinctly significant negative difference due to the lowest average between the averages of the three years.

Table 2

Virulence of fungus *Alternaria helianthi* on the *Helianthus tuberosus* over the populations between 2023 and 2025

Factor A Local populations	Factor B Year	Virulence			Factor A Local populations statistic		
		First repeat	Second repeat	Third repeat	Averages	Differences	Significance
Slatina Nera	2023	35	25	20	25.6	-2.4	o
	2024	25	15	10			
	2025	40	40	20			
De Mănăstirea Nera	2023	45	40	35	33.3	5.3	***
	2024	30	35	25			
	2025	30	35	25			
De Sasca Montană	2023	25	20	25	24.4	-3.6	oo
	2024	20	25	15			
	2025	30	35	25			
De Sasca Română	2023	30	35	25	25.6	-2.4	o
	2024	20	25	15			
	2025	30	25	25			
De Șușara	2023	25	30	30	31.1	3.1	*
	2024	30	25	25			
	2025	40	45	30			
Populations average	2023	32	30	27	28.0	Control	-
	2024	25	25	18			
	2025	34	36	25			

DL5% = 2.31 DL1% = 3.36 DL0.1% = 5.04

Table 3

Virulence of fungus *Alternaria helianthi* evolution on *Helianthus tuberosus* over the years, between 2023 and 2025

Factor B Year	2023	2024	2025	Average
Averages	29.7	22.7	31.7	28.0
Differences	1.7	-5.3	3.7	Control
Significace	-	oo	*	-

DL5% = 3.16 DL1% = 4.30 DL0.1% = 5.83

The aggressiveness of the fungus Alternaria helianthi, the second parameter measured in the interval 2023-2025 in the Jerusalem artichoke populations monitored for attack. The variation of the data recorded in the three years was quite large, ranging between 5-35%, the lowest values being recorded in 2024 and the highest in 2025, as can be seen in table 3.

Regarding the five populations, it can be observed that by far the one affected by the attack of the pathogen was the Jerusalem artichoke population from the Șușara valley with a distinctly significant difference compared to the control. The least affected was the population from Slatina Nera with a distinctly significant negative difference compared to the control. The populations from Sasca Montană and Sasca Română suffered relatively small losses, the pathogen registering close values of aggressiveness which, from a statistical point of view, were below the level of significance.

Table 4

Aggressivity of fungus *Alternaria helianthi* on the *Helianthus tuberosus* populations between 2023 and 2025

Factor A Local populations	Factor B Year	Agresivity			Factor A Local populations statistic		
		First repeat	Second repeat	Third repeat	Averages	Differences	Significance
Slatina Nera	2023	15	10	20	12.8	-4.4	oo
	2024	5	5	10			
	2025	20	15	15			
De Mănăstirea Nera	2023	10	15	10	13.9	-3.3	-
	2024	10	15	10			
	2025	15	20	20			
De Sasca Montană	2023	15	20	15	15.6	-1.7	-
	2024	10	15	10			
	2025	15	20	20			
De Sasca Română	2023	20	15	10	17.2	0.0	-
	2024	15	10	10			
	2025	25	30	20			
De Șușara	2023	25	30	25	26.7	9.4	**
	2024	20	25	20			
	2025	35	30	30			
Populations average	2023	17	18	16	17.2	Control	-
	2024	12	14	12			
	2025	22	23	21			

DL5% = 4.08 DL1%= 6.39 DL0.1%= 9,89

Table 5

Aggressivity of fungus *Alternaria helianthi* evolution on *Helianthus tuberosus*

Factor B Year	2023	2024	2025	Average
Averages	17.0	12.7	22.0	17.2
Differences	-0.2	-4.6	4.8	Control
Significace	-	ooo	***	-

DL5% =2,05 DL1%=2,78 DL0.1%=3,77

The evolution of the pathogen's aggressiveness over the three years of evaluation (table 4) had a high dynamic considering that unlike 2023, in 2024 the average aggressiveness decreased by 4.6%, the statistical difference from the average aggressiveness being at a very significant negative difference. In 2025, the aggressiveness increased by an average of 4.8% compared to the control. The difference in the behavior of the pathogen between the three years is thus visible.

CONCLUSIONS

The evolution of the pathogen's aggressiveness over the three years of evaluation (table 4) had a high dynamic considering that unlike 2023, in 2024 the average aggressiveness decreased by 4.6%, the statistical difference from the average aggressiveness being at a very significant negative difference. In 2025, the aggressiveness increased by an average of 4.8% compared to the control. The difference in the behavior of the pathogen between the three years is thus visible.

BIBLIOGRAPHY

BORCEAN A , DAVID GH, ARSENE G. G., 2020, Spontaneous populations of Jerusalem artichoke's (*Helianthus tuberosus* L.) disease in S-W Romania, Research Journal of Agricultural Science, 52 (2), 2020

CARRUTHERS. S.P., 1986, Alternative Enterprises for Agriculture in the UK. Centre for Agricultural Strategy, Univ. of Reading

CHITTENDON F., 1951, RHS Dictionary of Plants plus Supplement, 1956 Oxford University Press

DUKE. J., 1983, Handbook of Energy Crops

FACCIOLA. S., 1990, Cornucopia - A Source Book of Edible Plants., Kampong Publications

HEDRICK. U. P., 1972, Sturtevant's Edible Plants of the World, Dover Publications

HILL. A. F., 1952, Economic Botany, The Maple Press

HUXLEY. A., 1992, The New RHS Dictionary of Gardening, MacMillan Press

KAYS, S.J., 2008, Biology and Chemistry of Jerusalem Artichoke: *Helianthus tuberosus* L.; Nottingham, S.F., CRC Press/Taylor & Francis Group: London, UK,

MA, X.Y.; ZHANG, L.H.; SHAO, H.B.; XU, G.; ZHANG, F.; NI, F.T.; BRESTIC, M., 2011, Jerusalem artichoke (*Helianthus tuberosus*), a medicinal salt-resistant plant has high adaptability and multiple-use values. J. Med. Plants Res.

PIMSAEN, W.; JOGLOY, S.; SURIHARN, B.; KESMALA, T.; PENSUK, V.; PATANOTHAI, A, 2010, Genotype by Environment (GxE) Interactions for Yield Components of Jerusalem Artichoke (Helianthus tuberosus L.). Asian J. Plant Sci., nr. 9, pag. 11-19

SIMONS A. J., 1977, New Vegetable Growers Handbook, Penguin

SIMMONS A. E., 1978, Simmons' Manual of Fruit, David & Charles

UPHOF. J. C. TH., 1959, Dictionary of Economic Plants., Weinheim

VOLK G.M., RICHARDS K., 2006, Preservation methods for Jerusalem artichoke cultivars, Hort. Science, nr. 41, pag. 80–83