FACTS REGARDING *STIGMINA CARPOPHILA* IN *PRUNUS* SP. ORCHARDS FROM WESTERN PART OF ROMANIA

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Abstract. *During the last five years, one of the targets of our research work from the area of South-Western part of Romania was to determine the most important diseases sources for maintaining their infectious pressure the diseases of plum trees from a very favorable area as there are the western part of Romania. Also, it is an attempt to see the dynamics of those pathogens. It is our duty to show from the very beginning that this paper contain data from last five years of research and this is the reason why data statistic interpretation could suffer dramatic changes in the near future, after we bring more observations data for statistic analyze. On the plum orchards, Stigmina carpophila is one of the pathogens which take it's share from the leafs of plum trees and so it take a part of the plum crop. Never the less the pathogen produce a premature aging of the trees by reducing each ear the plum trees vigor. As an active measure to prevent this pathogen to produce damage to the trees and plum harvest it is necessary to apply some treatments after a premade plan of trees protection measure. But all these measures bring a higher cost to the harvest and also some pollution by using some fungicides. To reduce the number of treatments it is sometimes useful to know the infetios preasure of the pathogens which are the target of the phytosanitary plan of actions. Results point out that the best rain distribution and temepratures for fungus Stigmina carpophila were in those from 2020.*

Keywords*: Prunus sp. , Stigmina carpophila, weather influence*

INTRODUCTION

As it is clear at this moment, the pathogen name is *Stigmina carpophila* (Lév.) M.B. Ellis but it is known also in other research and literature materials as *Corineum beijerinkii* (www.mycobank.org). This pathogen produces the shot hole disease on the major species of stone fruit trees plum trees, cherry trees, apricot and peach trees (Hickman, G.W. 2001; Kirk, P.M. 1999; Kotte, W. 1941;). The disease is easy to be identified on the field (LARSEN, H., 1999; BOHAČENKO, I. ET AL, 2010; BUBICI G. ET AL, 2010) and in the laboratory (ADASKAVEG, J.E. 1995; ELLIS, M.B., ADASKAVEG, J.E., ET AL. 1990; ELLIS, J.P. 1997). The spore source of the infection is not just inside of the orchard but it comes also from isolated or groups of stone fruit trees, which are on different locations nearby the orchards (KAFI, A., RIZVI, M.K. 1971). In addition, it could come from some tree species from spontaneous areas, as there are the almond trees in the mountain regions because it proves that almond trees are an excellent host for *Stigmina carpophilla* fungus (ADASKAVEG, J.E. 1995: EVANS, K., ET AL. 2008; SHAW, D.A., 1990.)

The area where the data was collected for the present paper is in the lower mountain region from the south-west of Romania and due to this fat there are nice conditions for fungus *Stigmina carpophila* to develop at least 3 generations of conidial stages and perform the same number of secondary infections (GROVE, G.G. 2002). In the area there is a mix of plumtree orchards, some of them well maintained with nice productions for small farmers from the area. But, unfortunately there are some points where there are groups of plum trees which vegetate for free, the trees are not maintained at all and even the fruits are not harvested. It seems that those trees are really lost by theyr owners.

MATERIAL AND METHODS

The main idea for this work was the finding of a constant presence of leaf shot hole by the fungus *Stigmina carpophila*. For the present paper, the first important step was to identify larger or smaller plum populations that are present in the area of Sasca Montană and Sasca Română. It is very relevant to show from the beginig that there are clusters of plumtrees which are completely, or almost completely forgotten by their rightfull owners and due to this they are at all maintained. These populations are basically a source of not just for *Stigmina carpophila*, but for any pathogen which could produce infections to this trees.

There is also an aggravating factor which consists in the fact that the area has a very varied mountain relief. For reasons such as the ecological requirements of the plants grown on the few arable lands, fruit trees are almost every time placed on slopes, so they are not to occupy the arable meadow plots and to be able to provide them as much sun as possible for fruit ripening.

The trees are also placed on the slopes with the aim of fixing the soil and because between the trees that are placed in the style of classic plantations, a pasture or a hayfield is organized. This location allows pathogens such as *Stigmina carpophila* to develop significant amount of inoculum for secondary attacks under good natural conditions. This kind of secondary attacks are also stimulated by the fairly high atmospheric humidity on most days during the growing season. Another factor that favors the dissemination of spores of phytopathogenic fungi is the air currents that circulate quite intensively in the intramontane valleys and the Nera river valley.

The average temperatures and the amount of rain for the area of interest are those from figure 1 and 2.

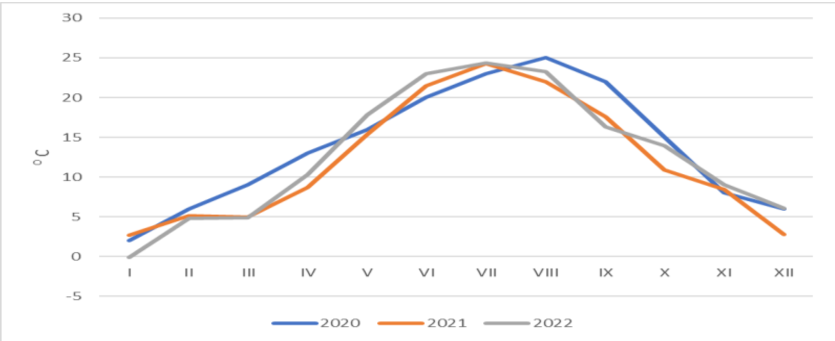

Figure 1. Monthly average temperature in the research area between 2020-2023

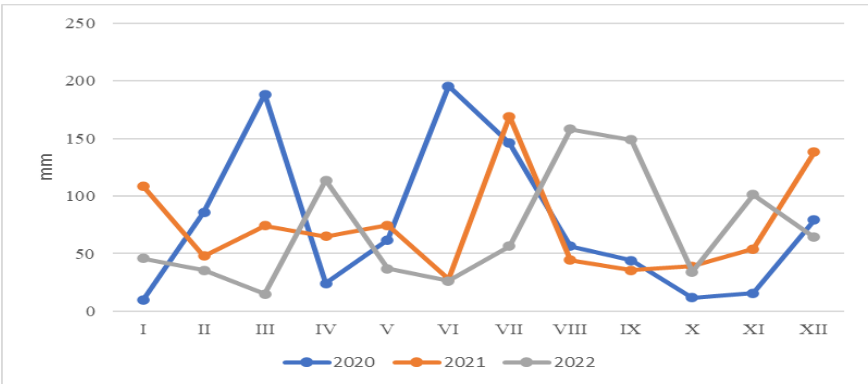

Figure 2. Monthly amount of water from the rain in the research area between 2020-2023

To evaluate the infection capacity of the fungus *Stigmina carpophila* we performed measurements of the frequency and intensity of the pathogen in the identified plum populations. Based on the measurements, the degree of attack of the pathogen was calculated as a synthetic indicator of the evolution of the infectious capacity. It is also easy to see which are the sensitive points of the agent's resistance.

RESULTS AND DISCUSSIONS

Data on the frequency and intensity of attack by the fungus Stigmina carpophila were subjected to statistical calculation. The results of the attack frequency calculation show that the Tunele population was the one that recorded the highest attack frequencies on average in the three years of observations (table 1). This was followed by the population of Sasca. The lowest attack frequency was in the plum population in the Nera Monastery area. This indicates that plums located in the Tunnels area may have been more exposed to higher atmospheric humidity from the Nera River which is very close in spatial distance.

Table 1

Fungus *Stigmina carpophila* attack frequency on observed populations

Factor A Populations	Factor B Year	Repetition 1	Repetition 2	Repetition 3	Average of factor A	Differences	Significance
Population of Sasca	2020	45	55	65	37.8	0.2	-
	2021	30	35	40			
	2022	20	25	25			
Population of Tunels	2020	50	55	70	42.2	4.6	**
	2021	30	35	55			
	2022	20	30	35			
Population of Monastery Nera	2020	40	50	55	32.8	-4.8	○○
	2021	25	30	35			
	2022	15	20	25			
Populations averages	2020	45.0	53.3	63.3	37.6	Control	-
	2021	28.3	33.3	43.3			
	2022	18.3	25.0	28.3			

DL 5% = 2.2 DL 1% = 4.3 DL 0.1% = 7.2

Table 2

Fungus *Stigmina carpophila* attack frequency between 2020-2022

Factorul B - year	2020	2021	2022	Average
Averages	53.9	35.0	23.9	37.6
Differences	16.3	-2.6	-13.7	Control
Significance	***	-	○○	-

DL 5% = 8.7 DL 1% = 11.6 DL 0.1% = 14.3

This is fundamentally different from the population in the Nera Monastery area which consists of small groups of plum trees located at a distance of several hundred meters from the river and on an east-facing slope, being exposed to solar radiation all day during the summer. This is the explanation for the lowest attack frequency among the three populations observed.

Sasca population had an average attack frequency close to the average (witness statistical interpretation). All plum tree groups being in small individual orchards (with up to 20 trees) and having full-day sun exposure, just like the population in area of the Nera Monastery.

Among the three years, the highest frequency of attack on the whole of the three populations was recorded in 2020 (table 2). The lowest attack frequency was recorded in the year 2022. The evolution over the three years of observations was strongly influenced by the amount of precipitation and atmospheric humidity, and the results suggest exactly this.

The attack intensity over the three years recorded the highest values in the population of Tunele and the lowest in the population of Sasca. The population around the Nera Monastery was below the significance limit with the values closest to the average of the area.

Among the three years, the highest attack intensity was recorded in 2020, and the lowest in 2022. Both differences are statistically distinctly significant, the one in 2020 positive, the one in 2022 negative.

Table 3

Fungus *Stigmina carpophila* attack intensity on observed populations

Factorul A - Populations	Factorul B Year	Repetition 1	Repetition 2	Repetition 3	Average of factor A	Differences	Significance
Population of Sasca	2020	5	10	15	6.8	-2.0	○
	2021	5	5	10			
	2022	1	5	5			
Population of Tunels	2020	10	15	25	11.1	2.3	*
	2021	5	10	15			
	2022	5	5	10			
Population of Monastery Nera	2020	5	15	15	8.4	-0.3	-
	2021	5	10	15			
	2022	1	5	5			
Populations averages	2020	6.7	13.3	18.3	8.8	Control	-
	2021	5.0	8.3	13.3			
	2022	2.3	5.0	6.7			

DL 5% = 1.8 DL 1% = 3.3 DL 0.1% = 4.7

Table 4

Fungus *Stigmina carpophila* attack intensity between 2020-2022

Factorul B - year	2020	2021	2022	Average
Averages	12.8	8.9	4.7	8.8
Differences	4.0	0.1	-4.1	Control
Significance	**	-	○○	-

DL 5% = 2.6 DL 1% = 3.7 DL 0.1% = 5.6

The attack rate has very low values due exclusively to the low values of the attack intensity. It can also be observed that in combination, attack frequency and intensity have the effect of reducing the differences between populations (table 5). This can also be seen from the lack of differences that exceed the significance limit in the case of populations.

Table 5

Fungus *Stigmina carpophila* attack degree on observed populations

Factorul A Populations	Factorul B Year	Repetition 1	Repetition 2	Repetition 3	Average of factor A	Differences	Significance
Population of Carasova	2020	2.3	5.5	9.8	3.1	-0.9	-
	2021	1.5	1.8	4.0			
	2022	0.2	1.3	1.3			
Population of Anina	2020	5.0	8.3	17.5	5.6	1.6	-
	2021	1.5	3.5	8.3			
	2022	1.0	1.5	3.5			
Population of Sasca	2020	2.0	7.5	8.3	3.3	-0.7	-
	2021	1.3	3.0	5.3			
	2022	0.2	1.0	1.3			
Populations averages	2020	3.1	7.1	11.8	4.0	Control	-
	2021	1.4	2.8	5.8			
	2022	0.5	1.3	2.0			

DL 5% = 2.2 DL 1% = 6.3 DL 0.1% = 9.8

Table 6

Fungus *Stigmina carpophila* attack degree between 2020-2022

Factorul B - year	2020	2021	2022	Average
Averages	7.3	3.3	1.2	4.0
Differences	3.4	-0.6	-2.7	Control
Significance	*	-	○	-

DL 5% = 2.6 DL 1% = 4.3 DL 0.1% = 6.7

Instead, at the level of the three years of observations, the differences recorded in the degree of attack showed, definitively this time, what were the most favorable conditions for the development of the attack of the pathogen. Thus, the most favorable year was 2020, the year that was definitely the best from the point of view of both the amount of precipitation recorded in the April - September interval. Also, 2020 was the best of the three years of observations, from the point of view of the distribution of precipitation throughout the vegetation period.

The lowest degree of attack resulting from the calculations was that of 2022 (table 6), the year with the lowest amount of precipitation and with a distribution of days with rain absolutely limited for the development of phytopathogenic fungi.

CONCLUSIONS

The lowest values of the attack frequency of the fungus Stigmina carpophila are recorded by the population located around the Nera Monastery, and the highest values by the population located around the area called Tunnele.

The attack intensity of the pathogen had values much lower than those of the attack frequency and the highest average value was that of the population of the Tunnels area and the lowest in the population of Sasca.

The degree of attack, as a synthetic index of the frequency and intensity of the attack, shows after statistical calculation the fact that there really is no specific population with sensitivity to the pathogen

Among the three years, the best for the development of the pathogen attack was 2020, and the most unfavorable was 2020, this being due exclusively to the rainfall regime of the three years.

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