INFECTIOUS PRESSURE ANALYSIS OF *PHLOEOSPORELLA PADI* FUNGUS IN THE SOUTHWESTERN PART OF ROMANIA

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Abstract. *Cherry leaf spot (Blumeriella jaapi f.c. Phloeosporella padi) is one of the most harmful diseases present in the cherry orchards in Romania because it leads to the early drying of the leaves and even to the deformation of the cherries. This leads to a decrease of the crop quality. On the other hand, due to the early loss of a large number of leaves too early, the resistance of the trees to winter frost is reduced. This pathogen, along with the brown rot of cherries (Monilinia laxa fc Monilia laxa) is one of the well-founded reasons for two treatments, and in some years with warmer and wet spring even three treatments, in the first third of the vegetation period in the orchards cherry and cherry from the southwestern part of Romania. One of the main causes of the annual occurrence of this pathogen in the cherry orchards located in the sub-mountain area in the mentioned area is the existence of a large quantity of the inoculum from the spontaneous flora. The problem of existence in the forests of the mountain and sub-mountain areas of the wild cherry or of the cherry or bitter cherry (Cerasium avium var.silvestris) is well known, as they are known popular language in the reference area. These cherry trees in the spontaneous flora generally have the same pathogens as those of the varieties in the cherry plantations in this area. Therefore, the spread of pathogens is very easy and the transmission through air currents from the forests near the plantations is only a matter of microclimate and time. Knowing the infectious pressure of these pathogens is an advantage of farmers who have cherry plantations because in this way they can appreciate the need to apply treatments. Based on the properties of the pathogenesis and the epidemiology of these pathogens, it is possible to assess the exact moment of the intervention with a treatment and also, very economically important, a protection strategy in the orchard can be carried out, including the phytosanitary products with which it is used will intervene.*

Key words: *Cerasium avium var.silvestris, Phloeosporella padi infectious preassure*

INTRODUCTION

From the definition of the basic principles of the production of any epidemic, it became clear that the reserve of the pathogen existing in the spontaneous flora is a key factor in determining the damage caused by the respective pathogen (TARR S.A.J., 1972). This is because the amount of the inoculum is the one that underlies the formation of the infectious load of any pathogen. The moment of initiation and the evolution during any season of any disease at all, depends not only on the pedoclimatic conditions and sensitivity of the host plants for a pathogen, but also on the pathogen's reserve and its evolution in time(ANNESI T., MOTTA E., FORTI E., 1997). The present work proves once again the validity of these principles of epidemiology by analyzing the infectious pressure of *Phloeosporella padi* fungus at the wild cherry in the mountain area from the southwestern part of Romania.

The importance of this theme is given by the constant losses of cherry harvest and the premature aging of the cherry trees from the plantations, especially due to pathogens which have as final result a massive defoliation too early in the summer, as *Phloeosporella padi* do. Also, harvest losses are quantitative through degradation of the fruits infected by the pathogen and also by reducing the quality of the fruits due to pulp deformations (BORCEAN A., 2003). A more important effect, however, is the premature loss of the leaves that dry up and fall prematurely (SIMERIA GH.,1995) as a result of the numerous fructifications produced by the pathogen on the leaf tongue

The existence of *Phloeosporella padi* fungus inside the wild cherry populations from spontaneous flora draws attention to the protection strategy of the cherries in the orchards from this area. And this came from the necessity to start those protection strategy from the undoubted existence of a quantity of the inoculum that would pose the problem of applying a number of treatments every year (IMRE J. HOLB, 2013). The number of treatments from the disease control strategy depend mainly on the evolution of the existing pedoclimatic conditions (KRANZ J., ROTEN J., 1988).

a b c d

Figure 1. Aspects of *Phloeosporella padi* attack on Cerasus avium trees (a, b, c) and leaves completely dried after pathogen attack

It is known that this fungus has the biological threshold of only 10° C and the beginning of a massive attack occurs in June (AGRIOS G., 2005), when the biological threshold is no longer a problem and the rains in the high hills and mountain areas, are possible quite often. So, it is assumed that there are excellent conditions for *Phloeosporella padi* fungus infections, especially if the plantations which are in the area of high and pre-montane hills, where the air currents are strong enough to bring the inoculum from the wild cherry trees which are on spontaneous flora to the cherry tree varieties from plantations. Looking at the disease evolution during last 10 years it is clear that there is no resistance to fungus *Phloeosporella padi* (ANDERSEN K. L. ET. AL., 2018) on the cherry varieties, we can consider just the tolerance to this pathogen.

MATERIAL AND METHODS

The experiment was carried out in the period 2017-2019 in the southwestern part of Romania, in the premontane and mountain area, where the wild cherry finds a very good development climate. In order to have an overview on the evolution of the pathogen that produces the cherry anthracnose, we chose three different areas as altitude, and with a relatively linear north-south layout, with a distance of about 70 km between the most northern point and the most northern point. southern.

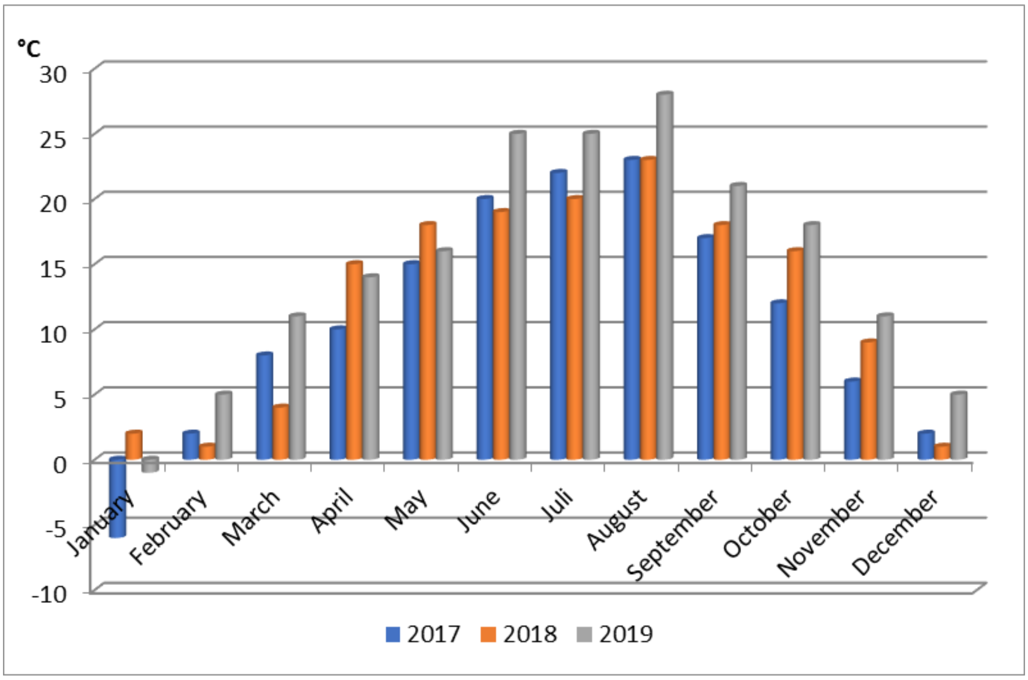

Figure 2. The evolution of temperatures monthly averages between 2017 and 2019

As expected, the evolution of the pathogen over time is strongly influenced by the climatic conditions. In order to track the evolution of the climatic conditions, we have chosen the data provided by the Oravita meteorological station, a station located relatively in the center of the area where the observations were made. The data are those shown in figure 2 regarding the evolution of temperatures and in figure 3 regarding the evolution of precipitation

The evolution of the temperatures was a relatively normal one, but it should be noted that the warmest year (the highest monthly average temperatures) especially during the summer period, were recorded in 2019, the year in which the only negative monthly average was in January and the temperatures have grown steadily, with no syncope’s and plateaus, until August and fell sharply in September. The other years show relatively normal evolution curves of monthly average temperatures.

Rain distribution on each month of the time interval between 2017 and 2019 shows that in general the accumulated water is on a relatively low quantity in most years, with small exceptions. Thus, from the graph it can be noted that the year 2017 was relatively dry with the entire interval only an amount of 242.4 mm of rainfall. There were 1069.6 mm of water from rain accumulated in 2019, when there were months like May with 93.1 mm of rain water and June with 274.4 mm of rain water records. At this situation we can add the amount of snowfall in January with 146.5 mm of water and the autumn rains of November with a total of 118 mm of water. This has greatly influenced the overall development of the pathogen reserve, especially that of the phytopathogenic fungi.

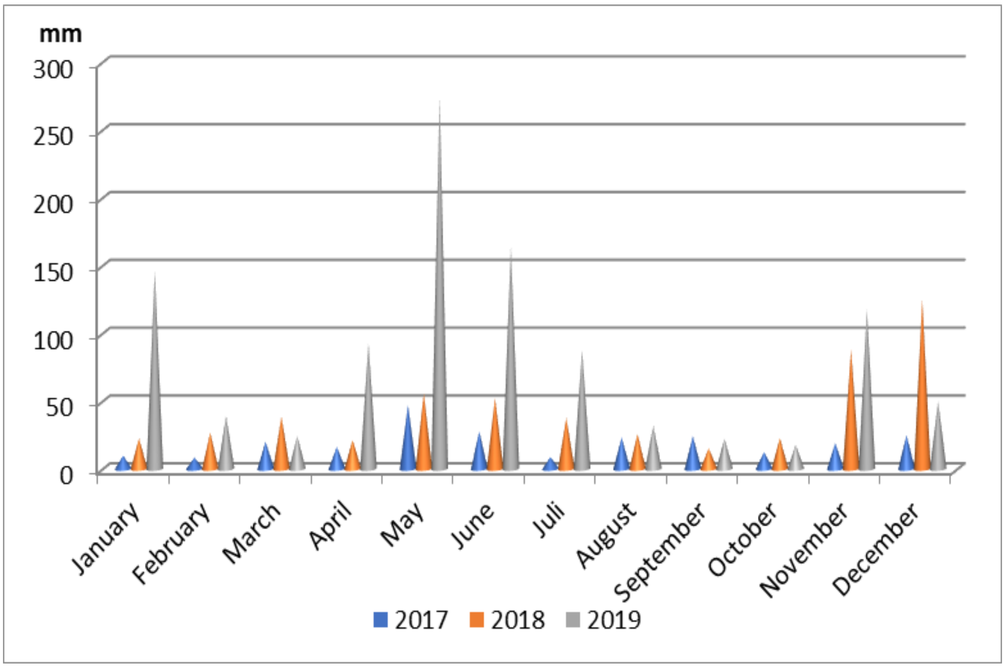

Figure 3. The evolution of monthly total rain water between 2017 and 2019

In order to evaluate the anthracnose attack and the inoculum reserve of the pathogen, the virulence (the intensity of the attack) and the aggressiveness of the pathogen (the frequency of the attack) were analyzed. The statistical calculation of the differences between years was performed by the method of calculating the bifactorial experiences in which the first factor is the area in which the data were collected and the second factor is the experimental year. In order to have a common basis of comparison we used as a control the average of the locations for the first factor and the average of the period 2017-2019 for the comparison between the experimental years.

According to the norms of phytosanitary control in force, the data were collected from three trees located in the same area on a distance of maximum 1 km between them, each tree constituting a repetition. In each of the three trees, the leaves of three snakes located in different positions to the axis of the tree were analyzed, the frequency and intensity of the attack being noted. Thus, in the tables in this paper, the frequency and intensity of each repetition is an average of the three trees observed.

RESULTS AND DISCUSSIONS

As shown in table 1, the frequency of attack that signifies the aggressiveness of the pathogen had values of over 30% in most of the populations followed during the entire analysis interval. However, it should be noted that in 2017 all populations recorded attack frequency values between 26.7% and 29%. In these conditions, it is observed that the highest frequency of attack was registered in the population around the towns of Sasca Montană and Sasca Română and the least affected is the one located around the locality of Șopotul Nou

Table 1.

Results regarding the frequency of attack of the Phloeosporella fadi padi in the populations evaluated during the period 2017-2019.

First factor Evaluated population	**Second factor - Year of evaluation**			**Populations averages**	**Differences**	**Significance**
	2017	**2018**	**2019**			
Marghitas population	27.7	29.7	35.0	30.8	-0.6	-
Marila population	29.0	30.7	34.7	31.4	0.1	-
Sasca population	28.0	31.7	38.3	32.7	1.3	*
Șopot population	26.7	30.7	34.0	30.4	-0.9	o
Populations Averages	27.8	30.7	35.5	31.3	Control	-

DL 5% = 0.7 DL 1% = 1.6 DL 0.1%= 2.5

Table 2

Results regarding the frequency of attack during the period 2017-2019

Second factor experimental years	**2017**	**2018**	**2019**	**Years average**
Years averages	27.8	30.7	35.5	31.3
Differences	-3.5	-0.7	4.2	Control
Significance	o	-	**	-

DL 5% = 3.1 DL 1% = 3.9 DL 0.1%= 5.3

The analysis of the evolution frequency of anthracnose attack in the entire population of wild cherry blossoms in 2017-2019 shows that the lowest value of the attack frequency was recorded in 2017 (table 2), with a significantly negative difference from the control (average three years). The high frequency of attack, with a difference value from the statistically assured control as distinctly significant, was recorded in 2019. Analyzing the trends of the attack intensity of the Phloeosporella padi fungus, it can be said that the virulence of this pathogen is relatively constant, in the three years, there is a rather small variation, the averages varying between the studied populations between 19.7% and 29.3% (Table 3).

At the same time, the variation over the three years was between 20.2% and 28.6%, which is also a rather restricted variation of virulence (Table 4). From a statistical point of view, the average of the year 2019 for all four populations to which observations were made, stands at a very significant difference of witness. The average intensity of attack in 2018 was at a difference below the significance limit, being very close to the average of the three years (table 4). The lowest value of the intensity of attack, which means the lowest virulence of the pathogen was recorded in 2017, when the average of the intensities of attack of the four populations was at a distinctly significantly negative difference from the witness (table 4).

Table 3.

Results regarding the intensity of attack of the Phloeosporella padi in the populations evaluated during the period 2017-2019.

First factor Evaluated population	**Second factor - Year of evaluation**			**Populations averages**	**Differences**	**Significance**
	2017	**2018**	**2019**			
Marghitas population	19.3	22.0	27.7	23.0	-1.0	o
Marila population	21.3	22.7	29.0	24.3	0.4	-
Sasca population	19.7	23.0	29.3	24.0	0.0	-
Șopot population	20.3	25.0	28.3	24.6	0.6	-
Populations Averages	20.2	23.2	28.6	24.0	Control	-

DL 5% = 0.7 DL 1% = 1.2 DL 0.1%= 2.0

Table 4

Results regarding fungus Phloeosporella padi frequency of attack during the period 2017-2019

Second factor experimental years	**2017**	**2018**	**2019**	**Years average**
Years averages	20.2	23.2	28.6	24.0
Differences	-3.8	-0.8	4.6	Control
Significance	oo	-	***	-

DL 5% = 2.9 DL 1% = 3.8 DL 0.1%= 4.2

The variations in the values of both the aggressiveness and the virulence seem to be due exclusively to the climatic differences between the three years, especially to the differences of precipitation that fall in each of the three years of observations. It can be easily seen from Figure 2 that between April and August the highest precipitation amount was recorded in 2019 and the lowest was in 2017.

CONCLUSIONS

1. In view of the frequency of attack of Phloeosporella padi fungus in wild cherry populations evaluated, it can be seen that there is a sufficiently large amount of this pathogen to cause significant damage to any cherry plantation in this area. .

2. Increased aggressiveness of the pathogen is registered especially in the years with large amounts of precipitation falling in the summer months.

3. It is recommended that when setting up any cherry plantation in this area, biological material with demonstrated resistance to the attack of cherry anthracnose should be used.

4. Treatments against this pathogen are obligatory to be performed when the PED is performed and in compliance with the principle of rotation of the plant protection products used.

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