DISTRIBUTION OF THE FUNGUS *ENTOMOSPORIUM MACULATUM* INFECTIOUS PRESSURE IN THE SUBMONTANE AND MOUNTAINOUS AREA OF SOUTHWESTERN ROMANIA

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Abstract. *Brown spot is a fairly common disease in quinces and pear trees in the area where the observations were made. As with other pathogens in fruit trees, in order to maintain the level of losses produced by this pathogen at an acceptable level, it is mandatory to know the level of its infectious load in the reference area. To achieve this goal, determinations of the attack parameters for fungus Entomosporium maculatum were performed. All measurements were performed on groups of trees located in locations located in significant areas as location both in distance in space and in terms of altitude. This makes possible an objective determination of the infectious pressure, taking into account the most common climatic and soil conditions in the reference area. All determinations regarding the pathogen were performed by successive evaluation through 4 determinations during the period between June and September of each year of the interval 2018-2020. The locations selected for those determinations to be carried out are grouped in terms of the dominant landforms for the reference area and they are as follows: the first location in Greoni commune, the second location around Răcășdia commune, the third location near Cărbunari commune and the fourth location near the town of Anina.*

Keywords*: Entomosporium maculatum, infectious pressure*

INTRODUCTION

Entomosporium maculatum known also as E. mespili is known as a pathogen with a numerous host species from *Rosaceae* genera particularly from subfamily Pomoideae. As it is known *Entomosporium* leaf spot fungus prefer as hosts the following genera: *Amelanchier, Aronia, Cotoneaster, Crataegus, Cydonia, Eriobotrya, Heteromeles, Malus, Mespilus, Photinia, Pyracantha, Pyrus, Rhaphiolepis,* and *Sorbus* (ALFIERI S. A.,1969; HORIE H., KOBAYASHI T., 1980; LAMBE R. C. ET AL, 1979; PAUL A. R. 1983; RAABE R. D., HANSEN H.N., 1955; SIVANESAN A., GIBSON I. A. S.. 1976; VAN DER ZWET T., STROO H. F.. 1985). This fungus is known also to have a worldwide distribution through the temperate zones. Also in the past 30 years it start to extand in tropical areas from Central America and from east and central Africa (COMMONWEALTH MYCOLOGICAL INSTITUTE. 1968; SIVANESAN, A., GIBSON I. A. S.. 1976, IMBREA, 2011)

In the South-West part of Romania quince leaf spot produced by the fungus *Entomosporium maculatum*, is a widespread and apparently endemic disease of quince (*Cydonia oblonga*) and some *Pyrus sp.* cultivars. This fungal disease is one of the most damaging to quince and pear trees in the landscape and nurseries during periods of cool, wet weather and when active growth is occurring. If there are just low levels of *Entomosporium* leaf spot than these have a purely aesthetic effect. On the other hand, severe infections on early vegetation stages could have as result an early and unwanted leaf drop. And those trees which suffer early leaf drop reduces their surviving chance during the winter if there will be long and cold periods of time. This disease could also compromise a part of the next year fruits harvest and the third effect, on long term it reduces the trees life time.

The wheather conditions necessary for infection are continuous leaf moisture combined with temperatures between 14-28°C, (BAUDOIN, A. 1986) for at least 8-12 hours.

MATERIAL AND METHODS

Observations concern the assessment of quince (*Cydonia oblonga*) diseases between 2018-2020 in the mountainous and pre-mountainous area between Nera River and the depression where the city of Anina and the Minis Valley are located. This is because in this area are a large number of quince trees which could be considered, from epidemiologic pint of view, as significant populations.

The evolution of quince pathogens, as in most pathogen cases, is strongly influenced by the evolution of climatic factors and this is the reason why we want to see how the attack parameters evolve on the different locations of the observations defined area. Under these circumstances the quince populations qualified for assessing the threat of fungus *Entomosporium maculatum (sin. E. mespili)* were those located in the area of the following locations: Anina, Răcăşdia, Cărbunari and Greoni. Climatic data are those given the city of Oravita which is in the middle of the area defined by the four populations. Even if the evolution of climatic conditions could be considered as normal over the three years there are important differences, specially to the quantities of rains water. So, it the temperatures have an almost same evolution between 2018 and 2020 (figure 1), the rains registered higher amount of water in 2018 and 2020 (figure 2). From climatic point of view we can appreciate that in case of fungus *Entomosporium maculatum* the highest temperatures during the period June-August, which were recorded between 2018 - 2020 (figure 1) have as effect the stop of fungus secondary infections.

In order to evaluate the anthracnose attack and the inoculum reserve of the pathogen (A.BORCEAN, CASIANA MIHUT. OKROS A., 2020), the virulence (the intensity of the attack) and the aggressiveness of the pathogen (the frequency of the attack) were analyzed(A.BORCEAN, CASIANA MIHUT. OKROS A., 2020). 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(A.BORCEAN, CASIANA MIHUT. OKROS A., 2020). 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 2018-2020 for the comparison between the experimental years.

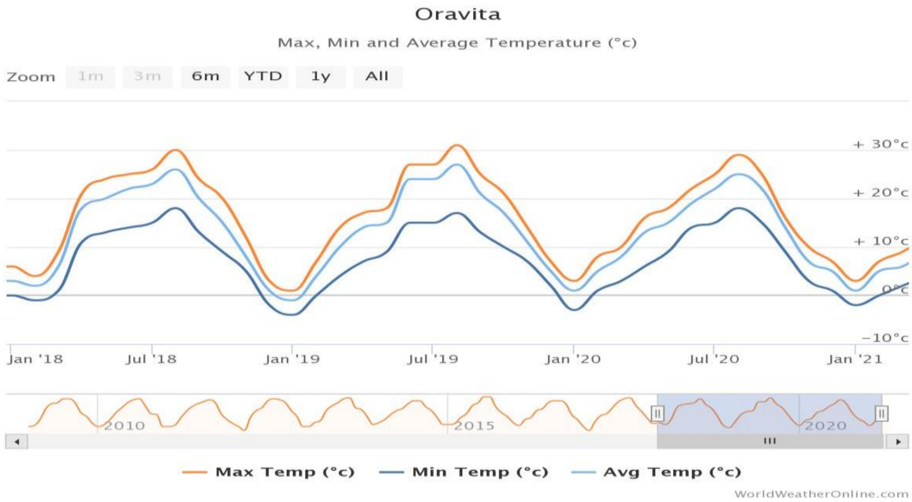

Figure 1. Average temperatures on Oravita betveen 2018-2020 (source www.WorldWeatherOnline.com)

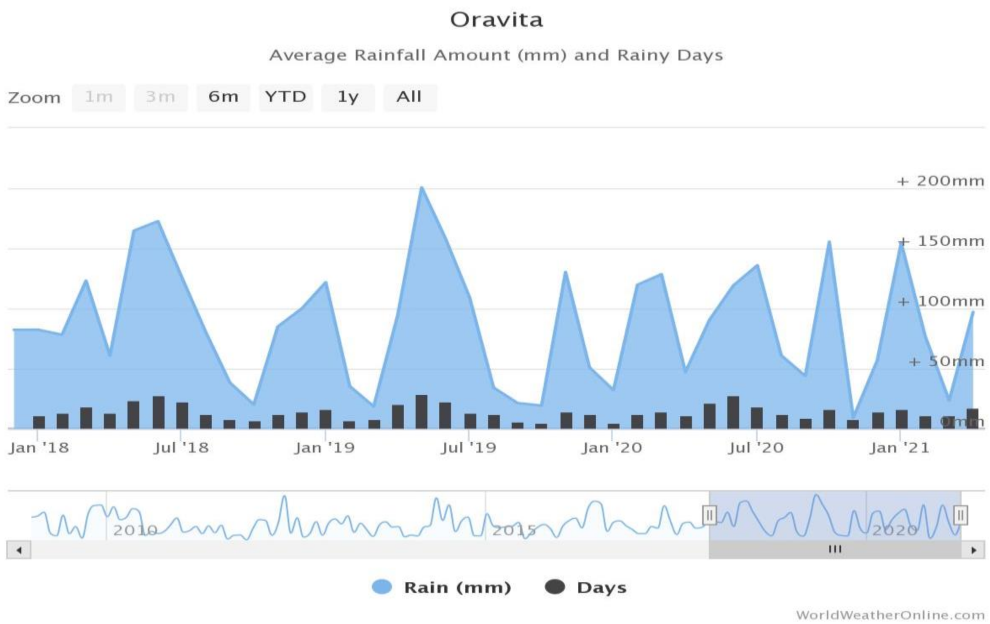

Figure 2. Rain amount registered on Oravita betveen 2018-2020 (source www.WorldWeatherOnline.com)

During the three years in which the evolution of the fungus Entomosporium maculatum was followed, it had quite large variations. In order to highlight this evolution, data were collected on the frequency and intensity of attack of the pathogen, considering that these data show most accurately the aggressiveness of a pathogen (frequency of attack) and its virulence (intensity of attack). The statistical analysis was for experiments with two factors: factor A was the population of Cydonia oblonga from the area where data was collected and factor B was the year in which the observations were made. Thus, for factor A, we had 4 graduations, the populations from the territories of Cărbunari, Răcășdia, Greoni and Anina localities. For factor B we had only 3 graduations, respectively the 3 years from 2018-2020.

RESULTS AND DISCUSSIONS

Data on the frequency of attack indicate a depression in the aggressiveness of the fungus Entomosporium maculatum in 2019 compared to the other two years (2018 and 2020) in the period in which the observations were made. Over the three years, the least attacked by the pathogen was the quince population from Răcășdia, followed by a relatively small difference from the quince population from Greoni.

The biggest losses of the foliar apparatus affected by the spot (Entomosporium maculatum) was the population of Cărbunari. During the three years, the highest average frequency of attack of the pathogen on all four populations was recorded in 2018 and the lowest average frequency of attack was recorded in 2019.

All these data show that the aggressiveness of the fungus Entomosporium maculatum is mainly influenced by climatic conditions, especially by the amount and distribution of precipitation.

Table 1.

Evolution of fungus *Entomosporium maculatum* attack frequency on evaluated apple populations

Nr.	Factor A Populations	Factor B - Experimental year			Factor A averages	Differeces	Significance
		2018	2019	2020			
1	Population of Cărbunari	22.6	15.6	25.0	21.1	2.9	* *
2	Population of Răcășdia	16.6	12.3	16.0	15.0	-3.2	○ ○
3	Population of Greoni	18.0	12.6	20.3	17.0	-1.2	-
4	Population of Anina	23.3	19.6	16.6	19.8	1.6	*
5	Average	20.1	15.0	19.5	18.2	Control	-

DL 5% =1.9 DL1%= 3.3 DL 0.1%= 5.4

Table 2

Evolution of fungus *Entomosporium maculatum* attack frequency between 2018 and 2020

Factor B- Year	2018	2019	2020	Average
Averages	20.1	15.0	19.5	18.2
Differences	1.9	-3.2	1.3	Control
Significance	*	○ ○	-	-

DL 5% =1.6 DL1%= 2.8 DL 0.1%= 4.1

The intensity of the attack results on statistic analyze of the four populations it show a relatively similar evolution to the frequency of the attack. Thus, the highest value of attack intensity was recorded in Răcășdia followed by a lower value by the population of Anina. The lowest figures for attack intensity were recorded in the population from the Greoni area.

Table 3

Evolution of fungus *Entomosporium maculatum* attack intensity on evaluated apple populations

Nr.	Factor A Populations	Factor B - Experimental year			Factor A averages	Differeces	Significance
		2018	2019	2020			
1	Population of Cărbunari	18.6	13.3	20.3	17.4	4.1	* *
2	Population of Răcășdia	12.3	9.6	14.0	12.0	-1.4	-
3	Population of Greoni	8.3	5.6	9.6	7.8	-5.5	○ ○
4	Population of Anina	16.3	12.6	19.3	16.1	2.7	*
5	Average	13.9	10.3	15.8	13.3	Control	-

DL 5% =2,1 DL1%= 4.0 DL 0.1%= 6,3

Table 4

Evolution of fungus *Entomosporium maculatum* attack intensity between 2018 and 2020

Factor B- Year	2018	2019	2020	Average
Averages	13.9	10.3	15.8	13.3
Differences	0.6	-3.0	2.5	Control
Significance	-	○ ○	*	-

DL 5% =1.1 DL1%= 2,8 DL 0.1%= 4.2

Of the three years of observations, the lowest intensity of attack was recorded in 2019 so that in the following year the highest value of intensity of attack on all four populations was recorded. All these variations are not accidental but are due to variations in climatic factors.

Among the best monitored climatic factors are temperatures and rainfall regime. Thus, it can be seen that in the reference area, the quince populations, in the case of the brown spot produced by the fungus Entomospoium maculatum, the different values of frequency and intensity of attack are due almost exclusively to the variation of the amount of precipitation. This is because the average temperature was maintained throughout the period June - September between values that are higher than the temperature required for the development and maturation of the pathogen, which is 20 ° C.

CONCLUSIONS

1. The fungus Entomosporium maculatum was present during the 3 years of evaluation in all four evaluated populations, which shows that this pathogen is endemic, with a very high degree of adaptation to climatic conditions in the area of the four evaluated populations.
2. The aggressiveness of the fungus Entomosporium maculatum (frequency of attack) is very high given that the water supply from precipitation is close to the multiannual average because the thermal regime of the area is the one that is permanently observed.
3. Fungus *Entomosporium maculatum* virulence, which represent the attack intensity, is greatly influenced by the humidity recorded in the leaves of quinces, which actually depends on the precipitation recorded. That is the reason why practically the intensity of the attack varies relatively similar to the frequency of attack.

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