# EVALUATION OF RASPBERRY SPUR BLIGHT (*DIDYMELLA APPLANATA*) EPIDEMIOLOGIC POTENTIAL ON WILD RASPBERRY (*RUBUS IDAEUS*) POPULATIONS FROM SOUTHWESTERN PART OF ROMANIA.

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***Abstract.*** *In raspberry plantations it is well known that the blight of the raspberry stalk produced by the fungus Didymella applanata could bring sometime quite significant losses. It is necessary to consider that the attack results in complete raspberry stem necrosis of the infected plants in one to three years after infection. Once the attack has started, in the absence of a treatment, the stem dries out over a period of time which length varies depending on climatic conditions and the number of wounds on the stem, which occur accidentally or because of a pest attack. This paper is based on the results of assessments conducted between 2018-2021 on several populations of wild raspberries in the mountainous area located between the north of the city of Anina and the Cheile Nerei area. In the present paper we wanted to highlight the fact that the pathogen has natural resources and this practically explains the need for a permanent evaluation of it in raspberry plantations. Observations concerning the dynamics of the pathogen were carried out directly on the locations and point out a climatic dependence of the pathogen. They show that the years in which during the period April-October there were moderate temperatures and sufficient rainfall were those in which most infected plants where recorded. Results point out differences in behavior of host – pathogen relations for raspberry populations from different locations.*

***Keywords***: *Rubus idaeus, Didymella applanata, wild flora populations*

## INTRODUCTION

Spur blight produced by fungus *Didymella applanata* (Niessl) Sacc. (ERIKSSON O.E, 1981) is one of the most common raspberry pathogens in Romania. (KOCH 1931, LABRUYERE & ENGELS 1963, GJAERUM 1974, MISIC ET AL. 1975, WILLIAMSON & HARGREAVES 1981). On the other hand, the great damages considered to be caused by this fungus, may be partly produced by other pathogens (SEEMULLER 1974) as his presence was positive correctly determined (CORLETT M, 1981). At first sight spur blight simptoms are almost the same as frost injuries and these could bring some confusions (STADLER, 1965). Never the less, this fungus is a common presence on raspberry almost over all Europe and North America from last 50 years(CMI, 1977).

In the case of spur blight, fungus *Didymella applanata* (Niessl) Sacc. start the raspberry plants infections from the wounds produced by other factors such as *Resseliella theobaldi* midge, whose larvae produce such wounds on the base of the young stems (Nijveldt W.1963, Seemuller and Grunwald 1980). Other pests that cause both direct and indirect damage (such as superinfection of wounds caused by pathogens) to raspberry stalks and lead to an increase in *Didymella applanata* fungus attack are raspberry stingrays (*Lasioptera rubi* Heeg.) and mining fly (*Pegomyia rubivora* Coquillet) whose larvae cause significant damage to raspberry stems (RUOKOLA ANNA-LIISA, 1982), both of which are found in northern Europe.

Another important factor influencing the attack of this pathogen is mechanized harvesting (HARGREAVES AND WILLIAMSON, 1978) or the attack of insects that damage raspberry stalks.

The reason for conducting the epidemiological evaluation of the pathogen on the blackberry populations of the spontaneous flora was to practically evaluate the survival capacity and the infectious pressure of the fungal pathogen *Didymella applanata* (Niessl) Sacc

**MATERIAL AND METHODS**

Research on the attack dynamics of the pathogen has been carried out into an area where raspberries have naturally growing populations. There have been identified some local populations, some of them from natural protected areas or adjacent areas. That is why it should be said without exaggeration that these populations most correctly express the relationship between raspberry plants and the pathogen.

The number of local populations on which the observations where made was three and those populations have been named after the nearest and most representative locality or geographical form. Thus, the three populations where: the population of Poneasca, the population of Crivina and the population of Marghitaș.

Populations is distributed at relatively small distances, of less than 30 km from each other, which has made it possible to use a single set of climate data (total monthly rainfall and average monthly temperatures) for the entire four-year observation period. The climatic conditions (https://www.worldweatheronline.com ) existing during the four years in which the pathogen where monitored are those shown in Figure 1 for temperatures and Figure 2 for precipitation. Each year the fungus behavior where evaluated five month, between June and October. The final result of the evolution of the pathogen attack for the previous year were assessed in April of the following year. This strategy was chosen because the end result of the attack of this pathogen is the drying of the shoots and this final symptom can be seen best in spring, when viable shoots can be distinguished from those that have dried and also can be distinguished on shoots areas. Affected by the fungus *Didymella applanata* (Niessl) Sacc ..

For the correct evaluation of the evolution of the pathogen attack, including from a statistical point of view, each population where divided into three repetitions according to the spatial distribution of the populations. These populations where evaluated monthly in terms of frequency and intensity of attack of the pathogen.

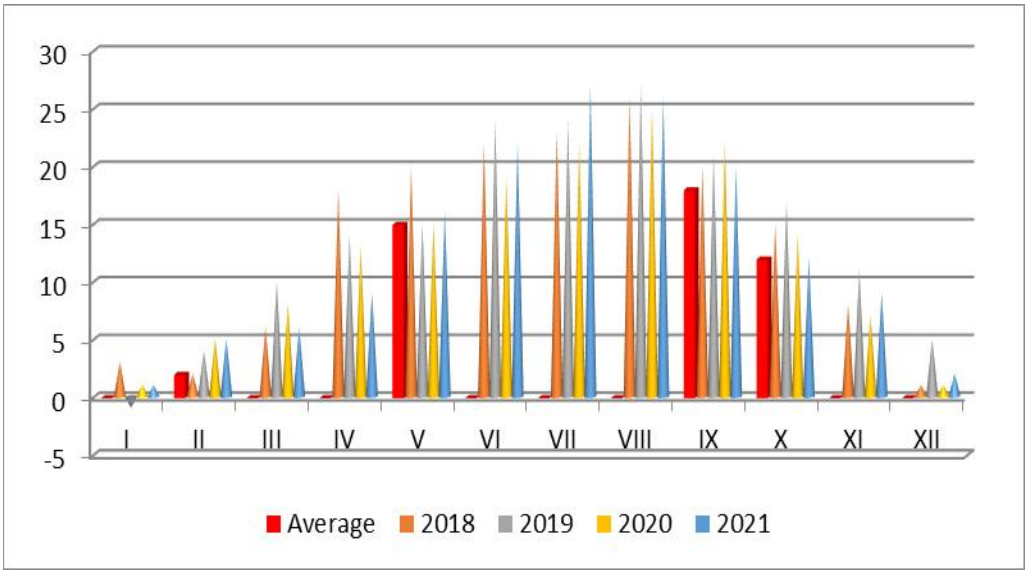


Fig. 1. Temperatures monthly averages evolution between 2018-2021 compared with 50 years average on the area of interest

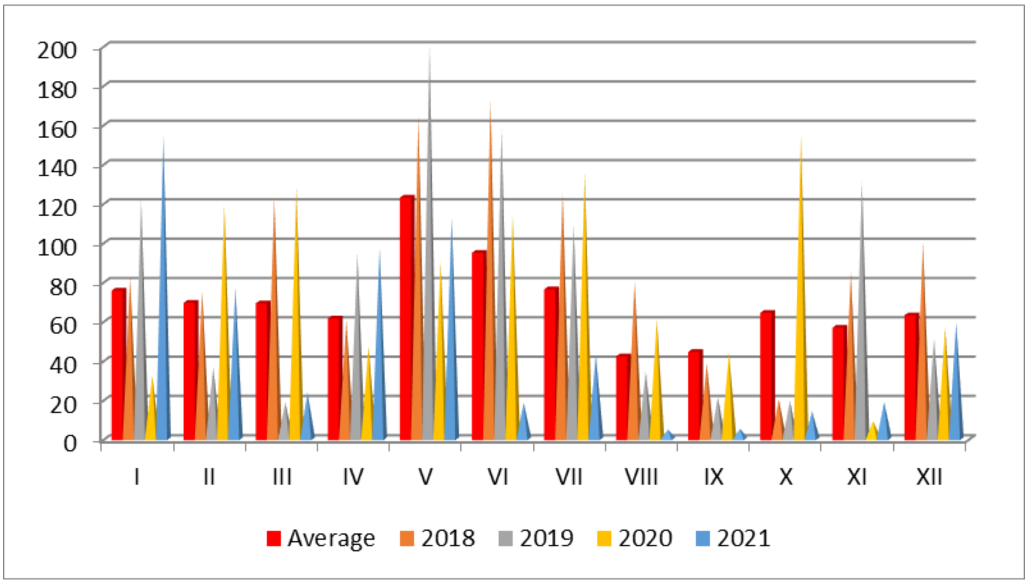


Fig. 2. Monthly rainfall amount evolution between 2018-2021 compared with 50 years average on the area of interest

Based on the monthly observations, each year an average of these observations was done for each repetition, these data being the basis for the statistical calculation of the differences between the experimental factors. Data collected where calculated, based on the two-factor experiment method. In this case, the two factors where the experimental year with four graduations (2018, 2019, 2020 and 2021) and the raspberry population evaluated with three graduations (Poneasca, Crivina and Marghitaș).

Analyzing the monthly temperature distribution over the four years (figure 1) compared to the average multiannual temperature, first observation is that most of the months of the year, in all four years, had much higher monthly averages than the multiannual average. This shows obvious and even aggressive warming.

The evolution of the amount of water from rains (figure 2) shows that there are quite pronounced differences between the four years. Thus, during the vegetation period the highest amounts of precipitation were recorded during the period April - July in 2018 and 2019. Between August and November the monthly amount of water from rain decreases progressively, reaching that in October and November the precipitation amounts are very low. The differences in the monthly precipitation amounts compared to the multiannual average show that during the vegetation period in all four years the precipitation amounts exceeded the multiannual average.

From the point of view of the pathogen's relationship with raspberry plants(WILLIAMSON B; PEPIN HS, 1987), the best climatic conditions were in 2018 and 2019 due to the relatively large amounts of water from rainfall during the growing season. The most unfavorable were those of 2021 due to the low amounts of rainfall recorded throughout the period from April to November.

## RESULTS AND DISCUSSIONS

Results concerning the assessment of *Didymella applanata* attack frequency and intensity during the four years, after processing the raw data and the statistical calculation are shown in the following tables. Thus, Table 1 shows the statistical results on the assessment of the frequency of attack of the fungus *Didymella applanata* on the three raspberry populations.

It can be observed that the lowest averages of the frequency of attack were in the population of Poneasca, this being a significantly negative difference compared to the average for the four years of the populations. The highest average was recorded in the population of the Marghitaș Lake area, which in terms of value was a distinctly significant difference from the control.

Of the four years, only in 2019 and 2021 the averages on the three populations of the frequency of attack exceeded the limits of significance but in opposite directions. Thus, if in 2019 the average frequency of attack was at a very distinctly significant difference from the control, in 2021 the average frequency of attack was at a distinctly significant negative difference from the control. All these differences between the years of observations are the result of climate differences between the 4 years and among the climatic factors the one that most influenced the evolution of the attack frequency was the amount of precipitation.

*Table 1*

Evolution of *Didymella applanata* attack frequency between 2018-2021 on the evaluated populations

| Nr. crt. | Factor A Population | Factor B - Year | | | | Populations averages | Differences | Significance |
|---|---|---|---|---|---|---|---|---|
| | | 2018 | 2019 | 2020 | 2021 | | | |
| 1 | Poneasca | 18,3 | 20,0 | 11,7 | 6,7 | 14,2 | -2,2 | o |
| 2 | Crivina | 16,7 | 25,0 | 13,3 | 8,3 | 15,8 | -0,6 | - |
| 3 | Lacul Marghitaș | 21,7 | 28,3 | 15,0 | 11,7 | 19,2 | 2,8 | xx |
| 4 | Populations averages | 18,9 | 24,4 | 13,3 | 8,9 | 16,4 | Control | - |

DL 5%= 1.6 DL 1%= 2.7 DL 0,1% = 4.4

| Factor B Year | 2018 | 2019 | 2020 | 2021 | Years average |
|---|---|---|---|---|---|
| Years averages | 18,9 | 24,4 | 13,3 | 8,9 | 16,4 |
| Differences | 2,5 | 8,1 | -3,1 | -7,5 | Control |
| Semnificance | - | xx | - | o o | - |

DL 5%= 4.2 DL 1%= 6.6 DL 0,1% = 8.4

The intensity of the attack (Table 2) had lower values compared to the frequency of attack but the evolution over the four years was relatively similar to that of the frequency of attack. The only population in which the values of the intensity of the attack exceeded the witness with a significant difference was the one located in the area of Lake Marghitaș.

*Table 2*

Evolution of *Didymella applanata* attack intensity between 2018-2021 on the evaluated populations

| Nr. crt. | Factor A Population | Factor B - Year | | | | Populations averages | Differences | Significance |
|---|---|---|---|---|---|---|---|---|
| | | 2018 | 2019 | 2020 | 2021 | | | |
| 1 | Poneasca | 6,7 | 11,7 | 6,7 | 2,3 | 6,8 | -1,6 | - |
| 2 | Crivina | 8,3 | 10,0 | 5,0 | 3,7 | 6,8 | -1,7 | - |
| 3 | Lacul Marghitaș | 13,3 | 18,3 | 8,3 | 6,7 | 11,7 | 3,3 | x |
| 4 | Populations averages | 9,4 | 13,3 | 6,7 | 4,2 | 8,4 | Control | - |

DL 5%= 2.1 DL 1%= 3.6 DL 0,1% = 4.7

| Factor B Year | 2018 | 2019 | 2020 | 2021 | Years average |
|---|---|---|---|---|---|
| Years averages | 9,4 | 13,3 | 6,7 | 4,2 | 8.4 |
| Differences | 1,0 | 4,9 | -1,8 | -4,2 | Control |
| Semnificance | - | xx | - | oo | - |

DL 5%= 2.8 DL 1%= 4.1 DL 0,1% = 6.2

Between the four years, there were quite marked differences in the intensity of the attack, their averages for all three populations being above the limits of significance in two of the four years. But, if in 2019 the average attack intensity of the fungus *Didymella applanata* was statistically significantly different from the average of the four years, in 2021 the value of the attack intensity decreased to a distinctly negative difference to the witness.

## CONCLUSIONS

1. Fungus *Didymella applanata* was present in all locations where raspberry populations were found to be large enough in density to be able to assess the attack parameters of the fungus (frequency and intensity of attack) and to be able to perform appropriate statistics.
2. During the four years of the assessment, the relationship between the fungus *Didymella applanata* and the raspberry plants had a rather high dynamic, largely influenced by climatic conditions.
3. Frequency of attack had higher values than the intensity of the attack and also the dynamics was higher, having values located from a statistical point of view both in the positive and in the negative part of the limits of the variation range.
4. The attack intensity of the fungus had both, lower values and the variation of the intensity of the populations was also very low, only in the case of the population located near Lake Marghitaș.

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