LEAF SPOT OF WILD PEPPERMINT SPECIES ON SOUTH -WESTERN PART OF ROMANIA

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Abstract. *On the evaluation process of the health status of the medicinal plants from spontaneous flora which was started in 2014 and continue even in present, there were a some pathogens which prove to require a closer attention. This attention is motivated by two reasons: first is the endemic character of those pathogens and the second reason is that the species of the plants affected by those pathogens have very well-known cultivated relative species. Also if we take in consideration that the breeding process in general reduce the plant resistence to diseases unless the breeder have a good source of resistance genes which could be conveniently imported in the new genotype. In the present paper is presented the situation of the plants from wild species of peppermint (Mentha longifolia, M. aquatica, M. arvensis and M. verticilliata) which have sufferd during the last five years by the attack of fungus Septoria menthae. This fungus affect mainly the leaves of the plants and it is well known in general that the main crop from peppermint plants are the leaves which must have a good quality. After the Septoria menthae attack, some parts of the affected leaves will be lost and so there will be quantity and quality lose of the peppermint crop. The general progress of this disease on the leaves start with a general chlorosis, than the leaf spots turn on necrosis with dark brown or black points which represent fungus fructification body, picnidia with picnospores. The data from the present paper was collected from populations of the wild peppermint species situated on a large area between Anina which is situated at an altitude of 710 m above the sea level and Moldova Nouă which is situated at an altitude of approximately 140 m above the sea level. The pathogen infectios potential was appreciated during the five years surveillance after attack degree calculated on the base of attack frequency and intensity collected from the field.*

Keywords*: Mentha sp., Septoria menthae*

INTRODUCTION

The area where the researches were carried out is very rich in medicinal and aromatic herbaceous species, as it is mentioned above that only the Mentha genus in this area is no less than four perennial mint species: *Mentha longifolia, M aquatica, M. arvensis and M. verticilliata* (BORCEAN A., IMBREA ILINCA, 2017, DĂNEȚ CARMEN ELENA, 2008).

One of the basic principles of plant protection prophylaxis requires the development of pathogens in spontaneous flora, especially plant species of the same botanical families with the crop plants (DOCEA E., SEVERIN V., 1990; POPESCU GH., 1993; POPESCU GH., 1998; DAVID GH., BORCEAN A., IMBREA F., 2003) . This principle is in the present situation (LAINE ANNA-LIISA, 2004)

As is natural, mint is a plant used both as a medicinal plant and as an aromatic plant, in very simple preparations such as teas or in extremely complex preparations such as some pharmaceutical products or confectionery recipes(TĂMAȘ M., MUNTEANU L., MUNTEAN S., DUDA M. VÂRBAN D., FLORIAN S., 2007). For an adequate extraction, both qualitative and especially quantitative of the active principles, the plants should not be affected by diseases or pests that affect the foliar surface and plant circulatory system(DAVID GH., BORCEAN A., IMBREA F., 2003; TĂMAȘ M., MUNTEANU L., MUNTEAN S., DUDA M. VÂRBAN D., FLORIAN S., 2007;).

Along the observations made on medicinal plants, we notice on the perennial peppermint species plants a pathogen which mainly affect the peppermint plant leaves. The

laboratory determinations point out that this pathogen is *Septoria menthae*. This pathogen produces, in the first phase small spots of the leaves (POPESCU GH., 1993; POPESCU GH., 1998., MARTIN B. ELLIS, PAMELA J. ELLIS, 1987). These spots are small, they have a maximum 3 mm diameter and inside these spots the fungus develop asexual fructification, picnids in which are developed multicellular spores (HATMAN M., BOBEȘ I., LAZĂR AL., PERJU T., SĂPUNARU T., 1986, POPESCU GH., 1993; POPESCU GH., 1998.).

The last phase of the attack of this fungus leads the leaves to a gradual drying, so it is very damaging if it installs in a mint culture. This is why evaluating this pathogen in spontaneous flora is welcome to know its epidemiological potential.

MATERIAL AND METHODS

Observations over the behavior of this pathogen have been performed for 3 years, between 2016-2018. Data concerning the pathogen attack parameters, collected from mint plants grouped in three populations located in the hilly and mountainous area of the south-west of Romania, between Anina and Cărbunari. Populations were named after the closest town, thus having the population of Anina, the population of Cărbunari and the population of Sasca.

During the three years data on the frequency and severity of attack of the Septoria menthae mushroom were collected. The data presented in this paper for each repetition is actually an average of three observations (one each month between June and August). These data were statistically calculated to observe the evolution of the pathogen in different soil and climate conditions because there are significant pedoclimatic differences between the three areas despite the apparent geographic proximity.

RESULTS AND DISCUSSIONS

The results on pathogen attack frequency recorded in the three populations (Table 1) indicate a significant difference in the plant response to infectious pathogenic pressure. depending on the influence of weather conditions on the relationship between plants and the pathogen. Thus, two of the three populations, namely the population of Anina and the population of Cărbunari, located in areas at higher altitudes, recorded lower and relatively near attack frequencies. This result is also confirmed by the statistical calculations that found the two populations to a significantly negative difference from the control. The third population, Sasca, with an average attack frequency at a significant difference from the control, was found to be the most sensitive to this pathogen among the populations analyzed.

Table 1.

Evolution of *Septoria menthae* attack frequency (%) on some peppermint populations between 2016-2018

Factor A - populations	Factor B - year	Repetition 1	Repetition 2	Repetition 3	Average of factor A	Differences	Significance
Population of Cărbunari	anul 2016	35	20	15	19.4	-4.4	○
	anul 2017	10	15	10			
	anul 2018	20	30	20			
Population of Sasca	anul 2016	45	55	40	34.4	10.6	* *
	anul 2017	15	15	20			
	anul 2018	40	35	45			
Population of Anina	anul 2016	10	15	15	17.8	-6.1	○
	anul 2017	25	15	30			
	anul 2018	15	15	20			
Populations averages	anul 2016	30.0	30.0	23.3	23.9	Martor	-
	anul 2017	16.7	15.0	20.0			
	anul 2018	25.0	26.7	28.3			

DL 5% = 3.2 DL 1% = 7.6 DL 0.1% = 12.3

Table 2.

Evolution of *Septoria menthae* attack frequency (%) during the period between 2016-2018

Factorul B - year	2016	2017	2018	Average
Averages	27.8	17.2	26.7	23.9
Differences	3.9	-6.7	2.8	Control
Significance	*	○○	*	-

DL 5% = 2.4 DL 1% = 6.2 DL 0.1% = 9.3

The distribution of the frequency of attack per year (table 2) indicates that among the three populations in the years 2016 and 2017 the wild mint plants were affected in a higher number than in 2017. Statistically, in the years 2016 and 2017, the mean attack frequencies s - were significantly different from the control. Instead, in 2017, the mean of the attack frequency was attributed to a significantly different negative difference from the witness.

Intensity of attack, which shows the natural resistance of plants to the pathogen, shows a very varied behavior of the three populations (table 3). Anina population record the lowest average of attack intensity over the three years of observations. On statistic calculations, the average of attack intensity in this case was placed on a significantly difference from the witness (mean of the three populations).

The highest susceptibility to the infectious pressure of the fungus *Septoria menthae* was recorded in the Sasca population(table 3). This is proved by a three years average of attack intensity placed at a significantly difference from the control.

Table 3.

Evolution of *Septoria menthae* attack intensity (%) on some peppermint populations between 2016-2018

Factorul A - populations	Factorul B - year	Repetition 1	Repetition 2	Repetition 3	Average of factor A	Differences	Significance
Population of Cărbunari	2016	15	20	20	15.0	0.4	-
	2017	10	5	5			
	2018	25	20	15			
Population of Sasca	2016	20	35	15	19.4	4.8	*
	2017	10	10	15			
	2018	35	15	20			
Population of Anina	2016	10	5	10	9.4	-5.2	○
	2017	5	5	15			
	2018	10	15	10			
Populations averages	2016	15.0	20.0	15.0	14.6	Control	-
	2017	8.3	6.7	11.7			
	2018	23.3	16.7	15.0			

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

Analyzing the behavior of wild peppermint plants during the three years of observations by the evolution of *Septoria menthae* intensity of attack (table 4), it can be concluded that among the three populations, the differences in behavior was significant. These differences are both due the climatic conditions of the years and the plants natural resistance

Table 4.

Evolution of *Septoria menthae* attack intensity (%) during the period between 2016-2018

Factorul B - year	2016	2017	2018	Average
Averages	16.7	8.9	18.3	14.6
Differences	2.0	-5.7	3.7	Control
Significance	-	○○	*	-

DL 5% = 2.6 DL 1% = 5.3 DL 0.1% = 8.7'

Thus are the reasons why the statistical calculation indicates the most favorable conditions for the attack of the *Septoria menthae* fungus in 2018, when the intensity of attack against the average of the three years was significant(table 4). The lowest attack intensity of the pathogen was registered in 2017, the year in which the attack actually stopped in the last decade of July. Statistically, in 2017, the average of the intensity of attack among the three populations was significantly different from the average of the years (table 4).

CONCLUSIONS

1. Climate conditions influence the frequency of attack of the *Septoria menthae* fungus because the lowest number of mint plants affected by the pathogen was recorded on the population of Anina and on the population of Cărbunari, both locations has been characterized by a significant difference in altitude and therefore on thise areas was another thermal regime.
2. The most sensitive to the attack of the Septoria menthae pathogen was the Sasca population, the latter registering over the three years of average observations of frequency and intensity of attack above the significance limit.
3. The year with the most favorable conditions for the development of the pathogen was the year 2018, when both the frequency and the intensity of the attack register averages with significant differences from the control.
4. The most favorable conditions for increasing plants tolerance to the pathogen was in 2017, when the average of the three populations in both the frequency and the intensity of the attack recorded distinctly significantly negative differences compared to the control

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