STEM ROT ON WILD PEPPERMINT SPECIES ON SOUTH-WESTERN PART OF ROMANIA

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Abstract. *During the diseases surveil conducted on the medicinal plants from south western part of Romania, on the Nera river canyon there are some significant populations of wild peppermint. The idea of the disease surveillance in medicinal plants came from the necessity to determine the pathogens in wild flora as potential threat to the crops and also because it is well known as general principal that the plant of the species from the wild flora are more resistant to pathogens than their relatives from the crop plants because on the breeding process the crop plants lose a lot of diseases resistance genes. From this point of view, if a pathogen is present on plants from the wild flora than it could be expected to be at least present on the crop plants. Also the area where the observations were performed is proper for growing medicinal herbs as intensive crops. At the time when this surveillance take place it was well known that the area is populated with four different species of wild peppermint (Mentha longifolia, M. aquatica, M. arvensis and M. verticilliata). One of the affections found on some of the wild peppermint plants consists on necrotic lesions on the stem. Also, the leaves placed over the lesions shown a start of necrosis which has a progress to the complete leaf necrosis. Populations were noted and since the first encounter was noted this populations was taken under a careful surveillance of the disorder evolution. Observations performed in laboratory show clear picnidia formed on the stem lesions and all data point to Phoma strasseri as pathogen which cause the stem necrosis. Peppermint populations on which we perform the measurements of pathogen virulence and aggressively has as common point that they are situated in the vicinity of Nera stream, but on higher ground and on meadow sandy soil. Plant density on these populations was between 6 and 41 so the results are relevant for the situation.*

Key words: *Mentha sp., Phoma strasseri*

INTRODUCTION

Anybody who work on the kitchen and cook or make cakes, or special drinks, or a simple mint tea, know how important is peppermint for modern society. If we take a look as agricultural specialists at peppermint crops there is clear that never the less those crops are based on special cultivars or on some special selected local populations and also as any other field crop, peppermint have certain diseases. Also it's not a point to deny that this kind of crops made for medicinal purpose or special for cooking some deserts, anybody want to be organic crops or ecological crops, with none or lesser quantities of pesticides and here the fungicides are included. If we need to reduce or renounce to fungicides than we need to have a certain strategy to avoid diseases and for this we have to know wherefrom came the pathogens and one of the most undesirable answer is that the pathogens has a natural reservoir on wild peppermint species. Present papers propose is to bring on attention only one of the peppermint pathogens and this pathogen incidence analyze for Mentha sp. plants, on natural environment conditions. On the area where the observations were carried out there are four different species of wild peppermint (*Mentha longifolia*, *M. aquatica*, *M. arvensis* and *M. verticilliata)*(DĂNEȚ C. ELENA, 2008). Descrioption of these species was done extensively in Romanian literature (TĂMAȘ M., MUNTEANU L., MUNTEAN S., DUDA M. VÂRBAN D., FLORIAN S., 2007). The present paper is not a study about these species tolerance at fungus *Phoma strasseri* incidence

but it is about the pathogen incidence on peppermint wild flora populations from the described area.

After laboratory examination, the pathogen identification was easy to do and our data collate to data from literature (and BEATA ZIMOWSKA, ZOFIA MACHOWICZ-STEFANIAK, 2005). First there were some plants which present necrotic lesions located at the base part of the stem. Then, after a careful examination with a magnifier glass there ware dark points inside area of the necrotic lesions. We collect those samples and in the laboratory, after a microscopic examination it was clear that the dark points were real pycnidia with single cell hyaline spores inside the pycnidia which were a high similitude with the literature (MELOUK H., HORNER C. E., 1967).

MATERIAL AND METHOD

For a better quantification of pathogens attack frequency and intensity values on the reference area we prefer to define previously some regions with representative populations for the peppermint plants which are the subject of the observations. These populations were named after the closest locality where they are located. All the data for the present paper were collected between 2014 and 2016.

To collect the data necessary for statistic calculation and to respect the statistical accuracy (ELZINGA C. L., SALZER D. W., WILLOUGHBY J. W., 1998), the defined populations were divided in three parts, each part represent an experimental repeat. The values of the attack frequency and intensity for each repeat are in fact an average of ten determinations, both for attack frequency and intensity. Values of those readings, for each repeat and for both, attack frequency and intensity, are in the tables 1 and 3. Statistics was calculated after the method for two factors experiences, each factor have for statistic relevance three repeats. The control for statistic analyze was the experimental averages because we didn't have one more reliable point of reference.

The area where the research was carried out is a natural protected are from south-western part of Romania, placed in Caras - Severin district on the meadow and ravens of Nera River and tributaries, between settlements Potoc and Sasca Română. On this region soil has a good drainage but in the same time, if exposed to sun for long period become hot on the first 10 cm from surface and this have a very high importance because the root physiology is disturbed and as consequence plants became sensitive to root and stem base pathogens.

RESULTS AND DISCUSSIONS

Phoma necrotic lesions on wild peppermint plants stem base and rhizomes surveillance carried out between 2014 and 2016 bring us the attack frequency figures from the table 1. It is obvious that the lowest number of infected plants was registered on Sasca population. On statistical analyze this population has situated a significant negative difference to control.

The higher number of infected plants was found on Potoc population. Average of fungus *Phoma strasseri* attack frequency over the three years surveillance was at a distinctly significant difference to control(table 1).

Regarding to the results concerning attack frequency on the third population analyzed on present surveillance, the average value was between the other two populations. But because this value was very close to control value and from satistic point of view it was situated under the significance level.

If we look at the attack frequency figures evolution during the three years period (table 2), comparing to the average of experimental period, it is obvious that the if in 2014 we have a value of 10.22 %, very close to the experimental period average, in 2015 the attack frequency registered the lowest value for the analyzed time period with 7.89 %.

It remain to show that in with 13 % of attack frequency average registered in 2015 this was the highest value of populations from our surveillance. This value, from statistic point of view is at a significant difference to control.

Table 1

Values of *Phoma strasseri* attack frequency at various local populations

Factor A - population	Factor B - year	First repeat	Second repeat	Third repeat	Averages of factor A	Differences	Significance
Population of Potoc	anul 2014	15	25	15	17.78	7.41	**
	anul 2015	15	5	20			
	anul 2016	20	15	30			
Population of Bogodinți	anul 2014	2	5	10	8.78	-1.59	-
	anul 2015	15	2	5			
	anul 2016	10	25	5			
Population of Sasca	anul 2014	10	5	5	4.56	-5.81	o
	anul 2015	2	2	5			
	anul 2016	2	5	5			
Averages	anul 2014	9.00	11.67	10.00	10.37	control	-
	anul 2015	10.67	3.00	10.00			
	anul 2016	10.67	15.00	13.33			

DL 5% = 3.58 DL 1% = 6.32 DL 0,1% = 9.16

Table 2

Phoma strasseri attack frequency over the research period

Factor B -year	2014	2015	2016	Average
Averages	10.22	7.89	13.00	10.37
Difference	-0.15	-2.48	2.63	control
Significance	-	o	*	-

DL 5% = 2.18 DL 1% = 3.26 DL 0,1% = 5.23

Attack intensity at this disease show only how sensitive is the plants on fungus *Phoma strasseri* attack on some well-known environment conditions. From the analyzed populations, the plants from Potoc population show the highest sensitiveness to pathogen because with an average of 43.89 % it was situated at a distinctly significant difference to control (table 3).

The lowest value of fungus *Phoma strasseri* attack intensity, with only 19.44 % was registered at Sasca wild peppermint population. At this rate of attack the difference to control

was very significant negative. As it happened on the attack frequency, also on the case of fungus attack intensity for a value of 39.89 %, the difference to control was under the limit of significance.

It is obvious that after this analyze, the best tolerance to fungus *Phoma strasseri* was at Sasca wild peppermint population. On the other side, the most sensitive peppermint population to fungus attack was Potoc population.

Regarding to the time period when the surveillance take place (table 4), the lowest average value of attack intensity was registered on the year 2016. At an average of 28.33 % the attack intensity was under control average with a significant difference. On the other side, the year 2015, with a value of 41.11 % this was the highest value of attack intensity from the three years of surveillance and from statistic point of view this value was situated at a distinctly difference from control.

The year 2014 brings an intensity value situated near the control and from this point of view it was under the limit of significance. It is important to observe that even at the lowest value, the attack intensity was over 10 % which point out the most important way of fungus to create reserve for the next year, and on this case it is obvious because in the next year the attack intensity was at the highest level from the analyzed period.

Table 3

Values of *Phoma strasseri* attack intensity at various local populations

Factor A - population	Factor B - year	First repeat	Second repeat	Third repeat	Averages of factor A	Differences	Significance
Population of Potoc	anul 2014	40	35	55	43.89	9.81	**
	anul 2015	35	60	40			
	anul 2016	65	30	35			
Population of Bogodinți	anul 2014	25	35	45	38.89	4.81	-
	anul 2015	35	60	70			
	anul 2016	20	30	30			
Population of Sasca	anul 2014	20	15	25	19.44	-14.63	000
	anul 2015	15	30	25			
	anul 2016	20	10	15			
Averages	anul 2014	28.33	28.33	41.67	34.07	control	-
	anul 2015	28.33	50.00	45.00			
	anul 2016	35.00	23.33	26.67			

DL 5% = 5.33 DL 1% = 8.26 DL 0,1% = 12.42

Table 4

Phoma strasseri attack intensity over the research period

Factor B -year	2014	2015	2016	Average
Averages	32.78	41.11	28.33	34.07
Difference	-1.30	7.04	-5.74	control
Significance	-	**	o	-

DL 5% = 1.84 DL 1% = 4.63 DL 0,1% = 7.16

CONCLUSIONS

1. On the values of both attack frequency and attack intensity obtained over the three years of surveillance period it is clear that fungus *Phoma strasseri* survive with no problem on wild peppermint population under climatic conditions from this part of Romania.
2. For the crop of peppermint from this area it is recomanded to rotate the crop after 2-3 years because this is the only biologic way to reduce the fungus *Phoma strasseri* incidence. On local populations it is impossible to perform rotation and this is one way of the pathogen to maintain the infectious pressure inside of these populations.
3. For fungus *Phoma strasseri* there is a very different behavior for attack frequency an attack intensity. As example ve have the highest value of attack intensity average in the year 2015 but the attack frequency highest average value was registered in the year 2016.

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