BLACKBERRY LEAF AND FRUIT DISEASES IN WILD FLORA FROM SOUTH WESTERN PART OF ROMANIA

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Abstract. *Even if it could be considered a secondary crop from the agriculture economy point of view, blackberries could have an important role in the health balance of peoples who suffer of some anemias or of those who have different cardiovascular affections, some intestinal affections or even some intoxications. This is because blackberries contain important amounts of vitamins, microelements and very important, serious amounts of antioxidant substances but in the same time, this fruits have a very low caloric content. Dried fruits and leaves could be used for aromatic tea, with high content in antioxidant substances. Blackberry plantations pathogens have obviously their origins on blackberry plants from wild flora. This is the reason why we bring on attention the infectious pressure of some of the most important blackberry's pathogens, the fruits grey mold produced by fungus Botrytis cinerea and the leaf rust produced by fungus Phragmidium violaceum. Generaly speaking the Rubus species of blackberry from wild flora are very tolerant to this pathogens, but when we take in consideration the possibility of severe infections on blackberry plantation where are used varieties and hybrids of Rubus fructicosus L. It is in our interest to observe that this species have a lot of relatives in wild flora, as there are Rubus sulcatus, Rubus procerus, Rubus banaticus, Rubus thyrsanthus, Rubus argenteus, Rubus tomentosa, Rubus hirtus and Rubus caesius. From this point of view it is important that all these species could be infected by both fungi and so they contribute to the infectious pressure, which have effects also on cultivated blackberry from different plantations. In the present paper are presented data concerning both pathogen agents in the area of Nera Canyon National Park. Results of this analyze have extremely importance on the epidemiology model of some cultivated plants pathogens which have relative host species on wild flora.*

Key words: *blackberry, leaf diseases, fruit diseases*

INTRODUCTION

Blackberry (*Rubus sp*.) is a wide-spread shrub on the research area but it is well known mostly as a weed on pastures and as a component of stabilized flora from the area where we care to collect the data for the present paper. For the present time the farms with blackberry plantations are rare but the plant crop potential on the region may represent high attraction for people who want to start a farm in a low economic potential area. Any way this problem is analyzed the fact that blackberry plants have some diseases in the wild flora of the region is a real threat for any plantation on the area. At this point we take in consideration the high number of blackberry products because from blackberry there could be used the fruits for fresh consumption or dry fruits and leaves in teas, or the fruits could be prepared in different ways as jam, syrup or alcoholic preparations.

This is the reason why we try to see during the last three years the infectious potential of the diseases from the medicinal and aromatic plants of the area, including here the diseases of the plants meant to help on cure for some passing anemias or digestion disorders as there are blackberries. At this considerations we have to bring on the front the most important issue which is the necessity to use the lowest amount of pesticides in general for protecting medicinal plants against diseases, pests and weeds just for the reason to minimize the risk to bring some active substances molecules from the pesticides on the plants harvested for different medicinal preparations. For minimize the pesticide use it has to be known the natural

enemies from wild flora and to quantify their pressure on the cultivated plants from the same botanical genus or even same species but breeding improved varieties with less natural resistances but improved harvest potential.

The data regarding blackberry pathogens were collected during a period of three years, from 2013 till 2015 as a part of a larger study concerning pathogens of medicinal plants from wild flora of the region of National Park Cheile Nerei – Beusnita which is well known as a region with a wide diversity of vegetal species. The main prove of the diversity on the present paper is to say that it was clearly determined that on this region there are 6 species of what we call blackberry: *Rubus sulcatus, Rubus proceru., Rubus banaticus, Rubus thyrsanthus, Rubus tomentosa, Rubus hirtus and Rubus caesius.*

In the present paper we present the data of two pathogens monitoring data, both pathogens were observed in all three years when monitoring data were collected. One of the pathogens is a well know leaf pathogen, the blackberry rust (*Phragmidium violaceum)*, and the other is a fruits pathogen which produce the grey rot of the fruits (*Botrytis cinerea*).

MATERIAL AND METHOD

For a better quantification of pathogens attack frequency and intensity values on the reference area we preferred to define previously some representative populations for the plants which are the subject of the observations. This populations were named after the closest locality. To collect the data necessary for statistic calculation 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. Statistics was calculated after the method for bifactorial experiences with three repeats.

A number of 10 determinations for each variant we considered sufficient because specialized literature data indicate that errors in various measurements applied to samples or measurements are below the limit of significance, if the number of samples or measurements is greater than 10 according to the literature (ELZINGA C. L, ET AL, 1998). Locations where samples were carried out were relatively small in size, less than 2 hectares, which also led to the hint that 10 evaluation marks made on each point are sufficient to obtain relevant data and to avoid errors. Also we use as control for data comparing, the average of each factor.

RESULTS AND DISCUSSIONS

Blackberry rust was found in all the investigated areas with different values of frequency and intensity over the three years in which we perform the diseases threat assessment. As can be seen on a first assessment blackberry rust was present in all three locations with different values of frequency and intensity on blackberry plants.

In table 1 are notes for rust frequency of attack. The general idea of this values is that over the analyzed time period frequency values of the blackberry rust ranged between 45% and 85%. This show clearly that the pathogen is well adapted both to the climate conditions and parasitized species.

Statistical analysis indicates that there are not so obvious differences between the three populations. The only population in which the average frequency of attack was greater overall three experimental years, hovering at a significant difference from the control was population Potoc

Of the three years that have made determinations (Table 2), the most favorable to pathogen from attack frequency point of view was 2013. The attack frequency average on this

year is placed statistically at a significant difference from control (average of three experimental years).

In 2014 due to less favorable climate conditions for the pathogen development, the frequency of attack has developed a very negative significant difference to control. The situation has changed in 2015 when the average of attack frequency from the three populations was very close to average, which make the difference to witness below the significance threshold.

Blackberry rust attack intensity at studied populations (table 3) had a reduced variation amplitude, ranging from 27,78% at Potoc population, to a value of 31,67 % at Sasca population. This is the explanation for the low differences between populations and environments area average (experience witness), also ensured as under significance values after we performed statistical calculations.

Table 1

Values of blackberry rust (*Phragmidium violaceum*) 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	2013	80	85	70	76.11	7.04	x
	2014	65	60	75			
	2015	85	85	80			
Population of Bogodinti	2013	65	70	70	65.00	-4.07	-
	2014	60	45	70			
	2015	75	60	70			
Population of Sasca	2013	75	75	80	66.11	-2.96	-
	2014	45	60	70			
	2015	65	55	70			
Area averages	2013	73.33	76.67	73.33	69.07	Control	-
	2014	56.67	55.00	71.67			
	2015	75.00	66.67	73.33			

DL 5% = 5,24 DL 1% = 7,52 DL 0,1% = 12,16

Table 2

Blackberry rust (*Phragmidium violaceum*) attack frequency over the research period

Factor B -year	2013	2014	2015	Average
Averages	75.44	61.11	71.66	69.4
Difference	6.04	-8.29	2.26	Control
Significance	xx	ooo	-	-

DL 5% = 3,36 DL 1% = 5.28 DL 0,1% = 7.83

As regards the differences between the observations were made, even if at first sight the differences are not high, the statistical calculation indicates that there is a distinctly significant difference between multiannual average of the surveillance area and the average of

the year 2013 and also a a significant negative difference between control and the average of year 2014. In 2015 the average intensity of attack on all three studied populations the difference was too close to the multiannual average of attack intensity to have a difference at the significance level

Table 3

Attack intensity of *Phragmidium violaceum)* on different mallow local populations

Factor A Population	Factor B - year	First repeat	Second repeat	Third repeat	Averages of factor A	Differences	Significance
Population of Potoc	2013	40	30	30	30,56	0.56	-
	2014	25	40	30			
	2015	40	20	20			
Population of Bogodinti	2013	30	40	20	27,78	-2.22	-
	2014	20	20	20			
	2015	30	40	30			
Population of Sasca	2013	25	30	30	31,67	1.67	-
	2014	30	30	35			
	2015	40	30	35			
Area averages	2013	31,67	33,33	26,67	30,00	control	-
	2014	25,00	30,00	28,33			
	2015	36,67	30,00	28,33			

DL 5%= 3,12 DL 1% = 5,23 DL 0,1% = 8,22

Table 4

Attack intensity of *Phragmidium violaceum)* over the research period

Factor B -year	2013	2014	2015	Average
Averages	33.89	27,77	31,66	30,1
Difference	3,79	-2,33	1,56	control
Significance	xx	0	-	

DL 5%= 2,24 DL 1% = 3,16 DL 0,1% = 4,43

Gray mold of blackberry fruits (Botrytis cinerea) was present in all of the years in which the observations were carried out at all blackberry the populations under study. Due to fact that fruits once infected are finally completely rotten, we considered that attack intensity is 100 % and therefore the attack intensity at this disease was no longer object for statistical calculations.

Attack frequency of blackberries grey mold on all three populations (table 5) record values situated between 16.33 % at population of Sasca and 26 % at population of Bogodinti. Statistical analyze of frequency data point out that the differences between populations are relatively low and this is the reason why only the Bogodinti population has been situated at a statistically significant difference from witness.

Between the three years of observation, on the assembly of the observed blackberry populations (table 6) the highest average value of attack frequency was registered on 2015 with

a value of 22.33 % since the lowest value was registered in 2014 with 18.44 %. Statistic analyzes point out that the differences between attack frequency averages of the grey mold are all under the limit of significance for entire period of three years when observations were carried out..

Table 5

Attack frequency of *Botrytis cinerea)* on different local populations

Factor A - population	Factor B - year	First repeat	Second repeat	Third repeat	Averages of factor A	Differences	Significance
Population of Cărbunari	2013	10	22	17	18.44	-1.81	-
	2014	15	12	21			
	2015	23	21	25			
Population of Potoc	2013	27	21	33	26.00	5.74	x
	2014	22	28	19			
	2015	24	32	28			
Population of Sasca	2013	16	11	23	16.33	-3.93	-
	2014	17	18	14			
	2015	19	14	15			
Averages	2013	17.67	18.00	24.33	20.26	Control	-
	2014	18.00	19.33	18.00			
	2015	22.00	22.33	22.67			

DL 5%= 4,16 DL 1% = 6,42 DL 0,1% = 10,54

Table 6

Attack frequency of *Phragmidium violaceum)* over the research period

Factor B	2013	2014	2015	Area average
Average	20	18.44	22.33	20.25
Difference	0.25	-1.81	2.08	control
Significance	-	-	-	-

DL 5%= 3,82 DL 1% = 5,72 DL 0,1% = 9,36

CONCLUSIONS

Both, leaf rust *(Phragmidium violaceum)* and fruits gray mold *(Botrytis cinerea)* affected blackberry plants in all three years analyzed but the differences between the three years are relatively low for both pathogens which means that these pathogens are already endemic and could create problems on any blackberry plantations in these area.

Leaf rust can lead to premature foliation of plants which void correct hardening of wood before entering the winter and so it could result the loss of a large

number of shoots if winter has strong frosts.

As endemic pathogen gray mold can produce attacks that would have the effect of compromising the blackberry plants from plantations and premature aging of the plants where the attack would start in early spring by affect the buds or later affecting the flowers and finally affecting the fruits.

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