OBSERVATIONS CONCERNING THE BEHAVIOR OF RIBWORT PLANTAINS (*PLANTAGO LANCEOLATA*) UNDER POWDERY MILDEW (*PODOSPHAERA PLANTAGINIS)* ATTACK BETWEEN 2013 AND 2014.

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Abstract. *On the last two years, one of the target of our research work from the area of Nera river basin was to determine the diseases of plantains(Plantago sp.) species from Nera river basin. Also it is an attempt to see the dynamics of those pathogens. It is our duty to show from the very beginning that this paper contain data of just two years of research and this is the reason why data statistic interpretation could suffer dramatic changes in the near future, after we bring more observations data for statistic analyze. Regarding to the work method, all observation data were collected during vegetation period of years 2013 and 2014. In this paper there are presented only averages of data collected during the time period mentioned previously. Our observations consist from four separate operations. First operation was to determine in the year 2013 that form the three species of plantains Plantago major, P. minor, and P. lanceolata, the dominant species was Plantago lanceolata the areas with representative populations of Plantago sp.. The second operation was to determine the place and the density of the most representative populations of ribwort and third operation was to see if those plants are affected of some pathogens. The forth operation was to evaluate the attack parameters of each pathogen. The novelty is relatively high because this work provides important data for both agricultural practices (especially for breeding process) and also for local environment protection authorities. Taking in consideration that Plantago sp. plants are used on a relatively large scale for some pharmaceutical and cosmetic industry, it is important to know the infection pressure of the plants pathogens from natural environment. From this point of view we appreciate that the plants from wild flora are considered to be a consistent source for diseases resistance genes in the plant breeding process. Limits of the research are that data from the research are just from two years and greatly influenced by local climatic and soil factors.*

Key words: *Plantago lanceolata., wild flora, Podosphaera plantaginis*

INTRODUCTION

On the research area we determine that from genera *Plantago* there are three species: the common plantain (*Plantago major),* hoary plantain*(Plantago media)* and ribwort plantain*(Plantago lanceolata).* The most representative species as plant density and locations were we find it was ribwort plantain*(Plantago lanceolata)* and this is the reason why we report the powdery mildew attack just at this species. Ribworth plantains *(Plantago lanceolata),* together with the other plantains species are considered to be medicinal plants and could be used as remedy of a few medical affections (TĂMAȘ M., ET AL, 2007). Plants of *Plantago lanceolata* could be found in different plant associations and because of their reduced requirements to climate and soil, we can appreciate that they are very well adapted to local vegetation conditions. This explains why this species is quite common in the basin of the river Nera.

On the other hand, the fungus *Podosphaera plantaginis* has in turn limited variability because it is an obligate parasite and the dissemination distance of anamorphic form is quite limited(YARWOOD, C.E., 1978). The variability is assumed to be lower in both case of the plants *Plantago lanceolata* and of the fungus *Podosphaera plantaginis* because the area of each population has many natural barriers created by the relatively troubled and fragmented landscape.

During the evaluation of the health of plants from spontaneous flora including plantain plant, one of the pathogens which occure in all three populations evaluated on year 2013 was powdery mildew caused by the fungus *Podosphaera plantaginis* (DOCEA E., SEVERIN V., 1990). The fact that this fungus is a obligate parasite leads to a process of micro specialization and coevolution of the relationship between host plant and pathogen within limited local populations. This is because the ribworth plantain plants variability is quite small in the local populations (LAINE ANNA-LISA, 2004) and also because of the environment factors previously described.

MATERIAL AND METHOD

Observations for initial data which stand on the base of the statistic analyse from the presenet paper was collected during a two years period, in 2013 and 2014. Basically we try to cover as well as we could the area of Nera river vicinity inside of the National Park Cheile Nerei. As a result we determin that in this area there could be considered as entity three populations of ribworth (*Plantago lanceolata*), placed near villages Potoc, Slatina Nera and Sasca (both Romanian and Sasca Sasca Montana). All this location are in the middle basin of Nera river. Also all three locations have meadows typical vegetation for the middle of the river Nera basin (CARMEN ELENA DANET, 2008). In each of these locations were made by 10 determinations on ribwort (*Plantago lanceolata*) plant density and assessed the attack frequency and intensity of powdery mildew (*Podosphaera plantaginis*).

A number of 10 determinations 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 diagonally on each point are sufficient to obtain relevant data and to avoid errors. Based on the frequency and intensity of the fungus attack we calculated the degree of attack as synthetic index. Interpretation of results was done according to the methodology for two factor experiments where the first factor was the ribwort plants population and the second factor was the year when data was collected. Also we use as control for data comparing, the average of each factor.

RESULTS AND DISCUSSIONS

After the ribwort (*Plantago lanceolata*) plants was counted in the year 2014, at a first look even without any statistic analyze, if it is to compare experimental years, it was clear that in 2014 the plants density is higher than in 2013. This point out that for ribwort plants the local environmental conditions were better in 2014 than those from 2013 because this was the only variable on the experimental conditions between analyzed years. The variability of plant density inside the same population is high, even if on the average plant density seems to stay relatively constant. If we look on the table 1, the highest variation between plants density readings was on population from Sasca Montana and this phenomenon was in both years, in 2013 between 2 and 11 plants /m^2 and in 2014 between 5 and 14 plants /m^2. Placing the figures obtained on this context in statistic analyze there was obtained results from table 2.

Analyzing variation of plant density between the locations the average values between the two experimental years it is clear that the values are very close. This is confirmed statistically by the lack of any significance between averages of plant density

Regarding the differences between the experimental years, the average of plant density in the year 2014 have almost 2 plants / m^2 more than those in the year 2013, but this

difference is high for normal vegetation conditions. In the statistic analyze of this plant density differences (table 2), all figures point out a distinct significant difference between the years 2013 and 2014 comparing with the experimental average.

Taking in consideration that the differences of plant density are relative constant in all three locations it is easy to conclude that this is not a random phenomenon. The only significant differences between the years are the main weather conditions and for this reason, as a consequence we can conclude that weather conditions has a significant influence over the plant density of *Plantago lanceolata* populations in natural conditions.

Table1

Ribwort plant density distribution on experimental locations in 2013 and 2014

Repetition	Plant density						Average
	Sasca		Slatina		Potoc		
	2013	2014	2013	2014	2013	2014	
1	4	7	3	7	5	8	5.7
2	11	14	5	8	3	5	7.7
3	3	5	5	7	3	6	4.8
4	5	12	7	5	4	9	7.0
5	2	8	7	9	3	3	5.3
6	8	7	5	4	5	4	5.5
7	7	9	3	3	4	8	5.7
8	3	7	3	8	4	5	5.0
9	6	5	7	5	8	7	6.3
10	6	9	4	5	5	9	6.3
Averages	5.5	8.3	4.9	6.1	4.4	6.4	5.9
Difference	-0.4	2.4	-1.0	0.2	-1.5	0.5	0.0

Table 2

Ribwort plant density analysis on experimental locations

Population location	Plant density		Averages	Diff	Sig
	2013	2014			
Sasca	5.5	8.3	6.9	1.0	-
Slatina	4.9	6.1	5.5	-0.4	-
Potoc	4.4	6.4	5.4	-0.5	-
Average	4.9	6.9	5.9	witness	-

DL 5%= 0.6 DL 1%=1.4 DL 0.1% =2.3

Year	2013	2014	Average
Plants density	4.9	6.9	5.9
Difference	-1	1	witness
Significance	oo	**	-

DL 5%=0.6 DL 1%=0.9 DL 0.1% =1.5

Powdery mildew (*Podosphaera plantaginis*) is a fungus with constant apparition between the two experimental years. And the figures from table 3 show this constant presence

of the fungus on all three populations of ribwort. Analyze of fungus attack frequency point out that from the three populations, ribwort plants from Potoc population registered an average near the experimental average, placed from statistic point of view on a difference under the significance level. Sasca and Slatina populations of ribwort suffer a powdery mildew attack with a frequency level placed at a significant difference in case of Slatina population and at a significant negative difference in the case of Sasca population. From the second part of table 4 came clear out that the most favorable year for the fungus in relation with ribwort plants was 2014 because the average of fungus attack frequency was statistically placed at a distinct significant difference comparing with experimental witness. of fungus *Podosphaera plantaginis*.

Table 3

Ribwort powdery mildew frequency of attack (%) distribution values recorded in 2013 and 2014 on experimental locations

Repetition	Frequency of attack (%)						Average
	Sasca		Slatina		Potoc		
	2013	2014	2013	2014	2013	2014	
1	25	40	20	35	60	60	40.0
2	30	40	40	40	30	60	40.0
3	30	20	30	60	20	30	31.7
4	20	35	30	70	30	70	42.5
5	50	40	60	60	30	40	46.7
6	20	25	50	40	30	60	37.5
7	40	60	30	60	60	40	48.3
8	50	40	70	50	20	70	50.0
9	30	40	40	70	40	30	41.7
10	50	60	40	60	30	60	50.0
Averages	34.5	40	41	54.5	35	52	42.8
Difference	-8.3	-2.8	-1.8	11.7	-7.8	9.2	0

Table 4

Ribwort powdery mildew frequency of attack (%) analysis on experimental locations between 2013 and 2014

Population location	Frequency of attack (%)		Averages	Diff	Sig
	2013	2014			
Sasca	34.5	40	37.25	-5.6	o
Slatna	41	54.5	47.75	4.9	*
Potoc	35	52	43.5	0.7	-
Average	36.8	48.8	42.8	witness	-

DL 5%=2.9 DL 1%=5.9 DL 0.1% =8.3

Year	2013	2014	Average
Frequency of attack (%)	36.8	48.8	42.8
Difference	-6	6	witness
Significance	00	**	-

DL 5%=2.6 DL 1%=5.7 DL 0.1% =9.4

Also we can't ignore that in 2013 the average of fungus attack frequency was statistically placed at a negative distinct significant difference comparing with experimental witness. This distribution of the attack frequency distribution point out that climatic conditions from the year 2013 stimulate ribwort plants to manifest a better tolerance at powdery mildew attack.

Table5

Ribwort powdery mildew intensity of attack intensity of attack (%) distribution values recorded in 2013 and 2014 on experimental locations

Repetition	Intensity of attack (%)						Average
	Sasca		Slatina		Potoc		
	2013	2014	2013	2014	2013	2014	
1	10	15	40	20	10	30	25.0
2	40	35	30	60	30	30	37.5
3	15	15	10	45	10	60	31.3
4	30	40	10	40	30	20	25.0
5	20	30	20	30	40	60	37.5
6	50	60	30	30	20	30	27.5
7	30	45	30	60	20	45	38.8
8	20	40	20	40	30	40	32.5
9	20	40	40	20	50	40	37.5
10	20	40	30	60	30	60	45.0
Averages	25.5	36	26	40.5	27	41.5	33.8
Difference	-8.3	2.3	-7.8	6.8	-6.8	7.8	0.0

Table 6

Ribwort powdery mildew intensity of attack (%) analysis on experimental locations between 2013 and 2014

Population location	Intensity of attack (%)		Averages	Diff	Sig
	2013	2014			
Sasca	25.5	36	30.75	-2.0	o
Slatina	26	40.5	33.25	0.5	-
Potoc	27	41.5	34.25	1.5	-
Average	26.2	39.3	32.8	witness	-

DL 5%= 1.7 DL 1%=2.9 DL 0.1% =5.4

Year	2013	2014	Average
Intensity of attack (%)	26.2	39.3	32.8
Difference	-6.6	6.6	witness
Significance	oo	**	-

DL 5%= 1.8 DL 1%=2.8 DL 0.1% = 4.5

Ribwort powdery mildew intensity of attack suffer an increase of values, in 2014 comparing with those from 2013, as they are shown in table 5. This increase of values is not at the same level on all three populations on which we record fungus attack parameters. Averages of fungus *Podosphaera plantaginis* attack intensity have registered values between 25.5 % in 2013 on Sasca ribwort population and 41.5 % on Potoc ribwort population. Even if this values seems to indicate high amplitude of variation, statistic analyze from table 6 show that if we report at average, the attack intensity amplitude of variation is below the significance on Slatina and Potoc populations and lower value than the average, situated at a significant negative difference to witness, on Sasca ribwort population. Also, statistic analyze from table 6 show clear the difference between years which is at a distinct significant level comparing with the average of attack intensity. We have a hint on this direction after the values from table 5 but is definitely demonstrated by statistics.

CONCLUSIONS

After just two years of observations there are not many conclusions.

1. Weather conditions have a very important influence on ribwort (*Plantago lanceolata*) population density taking in consideration the variations between 2013 and 2014 on the same populations, with same soil conditions.
2. Fungus *Podosphaera plantaginis* is also influenced by weather conditions taking in consideration the increase of both attack frequency and intensity on all three monitored locations.
3. Taking in consideration that on Sasca ribwort population both attack frequency and intensity was at significant negative difference level to witness, this is the only population which show a tolerance to fungus attack.

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