OBSERVATIONS CONCERNING ST JOHN'S WORT (*HYPERICUM PERFORATUM*) BLIGHT (*DIPLOCERAS HYPERICUM)*

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Abstract. *On the last two years, the one target of this research carried out in the area of Nera river basin was to determine the main pathogens of the medicinal plants from the middle basin of Nera river because this location is situated almost all inside the natural reservation known as National Park of Nera Gorge. Regarding to the method of data collected, all observation data were collected during vegetation period of years 2013 and 2014. Those observations consist from four separate operations: first operation was to determine the areas with representative populations of* Hypericum *perforatum, the second operation was to determine pathogens which affect those plants (if there is any pathogen) and the third operation was to evaluate the attack parameters of the pathogen. The novelty is relatively high because present paper provides important data for both agricultural practice and for local environment authorities. Taking in consideration that* Hypericum *perforatum plants are used as healing agents due to their various medicinal properties, it is important to know the infection pressure of the plants pathogens from natural environment. It is well known that a part of fungus plant pathogens are mycotoxins producers which put under question any medicinal use of the infected plants and this is just one reason to know if these pathogens are not present on medicinal plants natural environment. Another main reason is that we appreciate the plants from wild flora as sources for diseases resistance genes in the plant breeding process. In the present work there were carried out researches concerning the possible reactions of the pathogens depending on local environment factors. Limits of the research are that data from the research are just from two years of observations. The originality of the work come out from the fact that all data presented are relevant for mapping the diseases of medicinal plants from wild flora. Importance of the paper became from bringing in front of the specialists a new topic concerning observations of pathogens behavior in relation with Saint John's wort (*Hypericum *perforatum) plants from wild flora.*

Key words: *Hypericum perforatum, wild flora, Diploceras hypericum*

INTRODUCTION

On the first place, the reason why we decide to present the present paper is that as it is well known, plants of spontaneous flora are equally exposed to the attack of pathogens as those from normal field crops (DAVID GH. ET AL., 2005; MUNTEAN L.S. ET AL., 2007). Also, as member of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) from 1994, Romania has to evaluate, as it is specified in the treaty by all CITES representatives, to evaluate the state of the world's wild fauna and flora at least once every 2 or 3 years.

In both years in which perform observations, Saint John's wort plants suffer attacks of blight which diminish very high the leaves number and also the quality of plants by affecting the stem and flowers integrity and aspect.

MATERIAL AND METHOD

In the area where we perform our observations over Saint John's wort (*Hypericum perforatum*) plants there are another three species from genus *Hypericum*: *Hypericum humifusum*, *Hypericum hirsutum* and *Hypericum maculatum*, but from our point of

view the main interest is on *Hypericum perforatum* because it's use as medicinal plant. On the research area we determine that Saint John's wort (*Hypericum perforatum*) plants are quiet frecvent on small groups with different densities. Most of all the plants prefer areas with intense sunlight exposer and prefer from this point of view the southern slopes exhibition even with poor in organic matter but very well drained soils. The flowering period and complete maturity of the plants take place on the research area on the second half of August. Pathogen attack symptoms became visible beginning with the second part of July, but the symptoms are obvious in August. Observations for initial data which stand on the base of the statistic analyse.

Observations for initial data which stand on the base of the statistic analyse from the present paper were collected during a two years period, in 2013 and 2014. We have tried to cover as well as we could the area of Nera river vicinity and for this reason we stablish that the most representative populations where we could analyse of fungus *Diploceras hypericum* on Saint John's wort (*Hypericum perforatum*) plants was on three populations placed near villages Potoc, Slatina Nera and Carbunari. All this location are in the 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 we perform 10 determinations of plant density on Saint John's wort and there were assessed the attack frequency and intensity of fungus *Diploceras hypericum*

Locations from where samples were carried out were relatively small in size, less than 1 hectare, which also led to the conclusion 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.

Also it has to be stablished from the very beginning that the populations were carefully selected on locations where plants have a representative density. Otherwise *Hypericum perforatum* plants are usually present on all meadows.

Comparing the experimental years, it is necessary to show that in 2014 there was much better from the point of view of environmental factors, because the rain periods distribution was better. Otherwise, the temperature averages were almost the same in both years and the soil conditions was the same because we didn't change the locations where we done the plants density determinations and the readings for blight (*Diploceras hypericum*) attack frequency and intensity.

RESULTS AND DISCUSSIONS

First operation was to evaluate the St. John's wort (*Hypericum perforatum*) plant densities to have a point in population's evaluations and also to make possible the evaluation of attack frequency and intensity of blight (*Diploceras hypericum*). Regarding population densities, averages of plants counted in 2013 and 2014 in for all three populations, as it is shown in table 1 point out that there is a very low variation just between 6 plants on Potoc population in 2013 and 9 plants on Slatina population in 2014.

Analyzing the three populations and taking in consideration the low variation on plant density, results of statistic analyze from table 2 show that if we take the average of the populations densities as witness, the highest difference was at significance level on populations from Slatina and Potoc. St. John's wort population from Sasca register an average of plants density too close from average which bring it under significance level.

Differences between years on plant density, reported to the average, as it shown in table 2, are below the threshold of significance. This indicate a very good ecological plasticity

of plants from all three locations and also indicate that this populations are in those regions for a long time. If we collaborate this indications it is clear that *Hypericum perforatum* in this region is not an invasive species as it is in other regions where the plants of this species create problems and are considered to be weeds.

Taking in consideration the fact that plants are well adapted to regional environment, the pathogens must be very adapted to the plants to produce a significant attack. About the pathogen attack, first off all, if we look on table 3 and 5, the presence of this parasite fungus on plants each year and in all readings with low variance between readings done in the same year, indicate very clear a stabile relation between pathogen and it's host.

Attack frequency analyze(table 4) point out differences between populations. If Potoc population register a frequency average over the two experimental years very close to the witness and this bring a difference under significance threshold.

In the same period of time, population from Slatina Nera register a significant negative difference to witness and population from Carbunari register a distinct significant difference to witness. Regarding to attack frequency between the years 2013 and 2014, there are no significant differences.

Table1

Saint John's wort plant density distribution on experimental locations in 2013 and 2014

Repetition	Plant density						Average
	Carbunari		Slatina		Potoc		
	2013	2014	2013	2014	2013	2014	
1	12	9	6	15	3	8	8,8
2	5	14	14	11	5	4	8,8
3	9	6	8	12	6	7	8,0
4	9	8	11	9	8	5	8,3
5	14	7	4	7	5	8	7,5
6	6	9	9	9	5	9	7,8
7	8	11	7	11	7	9	8,8
8	5	5	8	5	9	7	6,5
9	7	5	11	6	6	8	7,2
10	12	7	7	9	6	7	8,0
Averages	8,7	8,1	8,5	9,4	6	7,2	8,0
Difference	0,7	0,1	0,5	1,4	-2,0	-0,8	0,0

Table 2

Saint John's wort plant density analysis on experimental locations

Population location	*Plant density*		*Averages*	*Diff*	*Sig*
	2013	*2014*			
Carbunari	*8,7*	*8,1*	*8,4*	*0,4*	-
Slatna	*8,5*	*9,4*	*8,95*	*1,0*	*
Potoc	*6*	*7,2*	*6,6*	*-1,4*	*o*
Average	*7,7*	*8,2*	*8,0*	*witness*	-

DL 5%= 0.6 DL 1%=1.7 DL 0.1% =2.3

Year	*2013*	*2014*	*Average*
Averages	*7,7*	*8,2*	*8,0*
Difference	*-0,3*	*0,2*	*witness*
Significance	-	-	-

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

Table 3

Saint John's wort blight frequency of attack (%) distribution values recorded in 2013 and 2014 on experimental locations

Repetition	*Frequency of Attack*						*Average*
	Carbunari		*Slatina*		*Potoc*		
	2013	*2014*	*2013*	*2014*	*2013*	*2014*	
1	*20*	*40*	*10*	*30*	*20*	*30*	*25,0*
2	*40*	*15*	*20*	*10*	*15*	*30*	*21,7*
3	*20*	*20*	*5*	*10*	*40*	*40*	*22,5*
4	*20*	*20*	*10*	*40*	*30*	*10*	*21,7*
5	*40*	*40*	*30*	*30*	*20*	*20*	*30,0*
6	*60*	*30*	*20*	*30*	*20*	*40*	*33,3*
7	*30*	*60*	*15*	*10*	*10*	*30*	*25,8*
8	*30*	*20*	*10*	*40*	*20*	*20*	*23,3*
9	*20*	*30*	*10*	*30*	*20*	*20*	*21,7*
10	*30*	*30*	*30*	*30*	*40*	*10*	*28,3*
Averages	*31*	*30,5*	*16*	*26*	*23,5*	*25*	*25,3*
Difference	*5,7*	*5,2*	*-9,3*	*0,7*	*-1,8*	*-0,3*	*0*

Table 4

Saint John's wort blight frequency of attack (%) analysis on experimental locations between 2013 and 2014

Population location	*Plant density*		*Averages*	*Diff*	*Sig*
	2013	*2014*			
Carbunari	*31*	*30,5*	*30,75*	*5,4*	**
Slatna	*16*	*26*	*21*	*-4,3*	*o*
Potoc	*23,5*	*25*	*24,25*	*-1,1*	-
Average	*23,5*	*27,2*	*25,3*	*witness*	

DL 5%=1.9 DL 1%=4.7 DL 0.1% =7.3

Year	*2013*	*2014*	*Average*
Averages	*23,5*	*27,2*	*25,3*
Difference	*-1,83*	*1,83*	*witness*
Significance	-	-	-

DL 5%=2.3 DL 1%=3.9 DL 0.1% =8.4

Blight attack intensity, as it was registered between the three populations, manifest the same patterns as pathogens attack frequency (table 6). Potoc population of *Hypericum perforatum* registered a low difference to witness which place the average of atack intensity of observation years values, under de significance threshold. The lowest difference to witness, with an value placed under the threshold limit with a significant difference was registered for Slatina population. The most sensitive population to blight attack over the observation period was registered at Carbunari population, with a distinct significant difference to witness.

Analyzing the data concerning fungus *Diploceras hypericum* attack intensity obtained from both years across all three populations, it is obvious that the most favorable year for fungus was 2013 when the average of attack intensity was over the threshold with a distinct significant difference. As compensation, in the next year attack intensity average value was under the witness threshold with a distinct significant negative difference.

Table5

Saint John's wort blight intensity of attack intensity of attack (%) distribution values recorded in 2013 and 2014 on experimental locations

Repetition	*Intensity of attack*						*Average*
	Carbunari		*Slatina*		*Potoc*		
	2013	*2014*	*2013*	*2014*	*2013*	*2014*	
1	*40*	*20*	*5*	*30*	*15*	*20*	*17,5*
2	*20*	*20*	*15*	*10*	*15*	*10*	*12,5*
3	*15*	*40*	*15*	*15*	*40*	*30*	*25,0*
4	*15*	*30*	*10*	*30*	*10*	*20*	*17,5*
5	*20*	*60*	*15*	*20*	*20*	*20*	*18,8*
6	*15*	*40*	*20*	*20*	*10*	*15*	*16,3*
7	*30*	*30*	*10*	*30*	*10*	*30*	*20,0*
8	*15*	*40*	*10*	*20*	*30*	*25*	*21,3*
9	*20*	*20*	*15*	*40*	*15*	*20*	*22,5*
10	*15*	*30*	*10*	*15*	*10*	*10*	*11,3*
Averages	*20,5*	*33*	*12,5*	*23*	*17,5*	*20*	*18,3*
Difference	*2,3*	*14,8*	*-5,8*	*4,8*	*-0,8*	*1,8*	*0,0*

Table 6

Saint John's wort blight intensity of attack (%) analysis on experimental locations between 2013 and 2014

Population location	*Plant density*		*Averages*	*Diff*	*Sig*
	2013	*2014*			
Carbunari	*20,5*	*33*	*26,75*	*5,7*	**
Slatna	*12,5*	*23*	*17,75*	*-3,3*	*o*
Potoc	*17,5*	*20*	*18,75*	*-2,3*	-
Average	*16,8*	*25,3*	*21,1*	*witness*	-

DL 5%= 2.7 DL 1%=4.9 DL 0.1% =7.4

Year	*2013*	*2014*	*Average*
Averages	*16,8*	*25,3*	*21,1*
Difference	*-4,3*	*4,3*	*witness*
Significance	*oo*	**	-

DL 5%= 1.8 DL 1%=3.6 DL 0.1% = 5.7

CONCLUSIONS

After just two years of observations there are just a few conclusions.

1. Saint John's wort (*Hypericum perforatum*) have relatively stale populations because there was registered no differences between the two experiment years on the values of populations cross averages.
2. Fungus *Diploceras hypericum* attack manifest highest values of attack frequency and intensity on Carbunari population and the lowest values on Slatina population which mean that the main factors of influence of the fungus attack paramenters are the local environment conditions.
3. Because attack frequency manifest almost no differences on the experimental years (differences were under threshold limit), but the attack intensity values of the experimental years averages registered a distinct significant difference ot witness, this show that the main sensitive parameter to measure the fungus evolution is attack intensity.

BIBLIOGRAPHY

ELZINGA C. L., SALZER D. W., WILLOUGHBY J. W., 1998, Measuring and monitoring plant populations, Bureau of Land Management, U.S. Department of the Interior.

CIRAK C., AKSOY H. M., AYAN A. K., SAĞLAM B., KEVSEROĞLU K. (2005), Enhanced hypericin production in *Hypericum perforatum* and *Hypericum pruinatum* in response to inoculation with two fungal pathogens. Plant Protect. Sci., 41: 109–114.

DĂNEŢ CARMEN ELENA, 2008, Teză de doctorat, Bibiloteca Universităţii de Ştiinţe Agricole şi Medicină Veterinară a Banatului Timişoara.

DIAS A..C..P.., FRANCISCO A., BARBERAN T., FERRERIA F., FERRERES F. (1998): Unusual flavanoids produced by callus of *Hypericum perforatum.* Phytochemistry, 48: 1165–1168

DOCEA E., SEVERIN V., 1990, Ghid pentru recunoaşterea şi combaterea bolilor plantelor agricole, Ed. Ceres, Bucureşti,.

LAINE ANNA-LIISA, 2004, Resistance variation within and among host populations in a plant-pathogen metapopulation: implications for regional pathogen dynamics, Journal of Ecology, vol. 92, nr.6, pag. 990-1000

MUNTEANU L.,.TĂMAŞ M., , MUNTEAN S., DUDA M. VÂRBAN D., FLORIAN S., Tratat de plante medicinale, 928 pag.., Ed. Risoprint, Cluj Napoca, 2007

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