STUDY OF THE ACTION OF *POA PRATENSIS* L. VEGETAL EXTRACT ON THE CHEMICAL COMPOSITION OF SOME PERENNIAL GRASSES

Cristian BOSTAN, Alexandru MOISUC, Florina RADU, Luminița COJOCARIU,Veronica SĂRĂȚEANU

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Timisoara, Aradului Street, no. 119, RO-300645, Romania
Corresponding author: bostancristian2000@yahoo.com

Abstract: *The purpose of the researches is represented of determination of allopathic effect realized of Poa pratensis L. on perennial graminaes Festuca rubra L., Dactylis glomerata L. and Lolium perenne L.Given the complexity of the mechanisms by which perennial graminaes interact, we considered in this study the hypothesis of the allelopathic properties at the four perennial graminaes in laboratory conditions, from the point of view of the type of chemical compounds, secondary metabolites.The secondary plant metabolites and their degradation products are important in all agroecosystems, including fodder crops. Many fodder species have indicated that present an heterotoxicity character, both between fodder species and for weed species. The symptoms range from the germination capacity, which is the most obvious, to the size and number of organs reduction.The biological material that was studied, is represented by four perennial graminaceae species as: Dactylis glomerata L., Lolium perenne L., Poa pratensis L. and Festuca rubra L.. The studies were made in the laboratory. The plants were splashed with low alcoholic extracts of the pirolizidinici and ergotic alkaloids respectively, that were obtained from the air part of the plant of the species Poa pratensis L.. The estract have been applied in three different shots.There is a worldwide effort in agriculture, to eliminate the amount of chemical compounds used in the agricultural production technology, by introducing organic and biological substances. One of the possible solutions is allelopathy, using the chemical interactions between plants. The literature indicates that the active substances of the plant present allelopathic properties.The chemical composition of forage plants is one of the main characteristics in terms of forage quality, the degree of digestibility and consumption depending on the chemical composition. Many plants remove substances with toxic properties, leading to biochemical changes of the environment (habitat). Thus, the alkaloids and glicozizii secreted by the plants have toxic effects on plants.The importance of this paper lies in the fact that the spraying with extracts leads to changes in the chemical composition of plants, changes that vary with the applied dose. Therefore the value of the NFL, NAL, EGV concentrations increases with the increasing of the dose of extract.*

Key words: *perennial graminaes, allelopathy, lolinici acizi, crude protein,*

INTRODUCTION

Forage plants chemical composition is one of the features determined regarding forage quality, by chemical composition depending the digestibility and consumability degree (MOISUC, 2002).

Testing the influence given by the extracts obtained from grasses can draw in future the opportunity of the obtaining of a natural herbicide that can be successfully used in the highlighting of the sustainable farming idea.

Allelopathy derive from the Greek word *allelon* meaning "*one in the front of the other*" and *patos* meaning "*to suffer*"" (RIZVI, HAQUE, SINGH & RIZVI, 2006).

In agriculture is present an effort at world level for the elimination of the amount of chemicals used in the farming technology, through the introduction of some biological and ecological substances. One of the possible solutions is allelopathy, the use of a chemical

interaction among plants. Literature indicates the fact that the active substances from plants have allelopathic features. (GARCIA, 2008)

Allelopathy represents "*the damaging effect exercised by a plant on other plant through the production of some chemical compounds that are released and diffused in the environment*". *Allelopathic substances* are chemical compounds that participate into the allelopathic type biochemical interactions among plants and are generally represented by compounds with small molecular mass as are the terpenoid type (mono and sesquiterpene) and phenolic compounds (phenols, phenolic acids, hydroxiquinone, cinamic acids). (VALTERE EVANGELISTA et al. 2008)

Most of these substances are found initially in plants in an inactive form and are serving as defending substances against pests. After some hydrolysis, oxidizing-reduction, metilation or demetilation processes are obtaining new compounds with allelopathic features. The allelopathic processes appear among different plants species and among the individuals of the same species. The allelopathic effects among the individuals of the same species are named *autotoxicity*. (CHENG, 2009)

Secondary metabolites with allelopathic potential have a great chemical diversity and are implied in many metabolic and ecologic processes. (AIRES et al. 2005) These substances can belong to different categories of secondary metabolites: phenols, terpenes and alkaloids that can be detected in different organs: leaves, flowers, fruits and the roots of some plants species. (MARASCHIN – SILVA & AQÜILA, 2006)

In the organs of some plants can accumulate distinct metabolites with allelopathic potential, this metabolic feature can be used for the purpose of producing biologic crops. The need of reducing chemicals in farming systems has renewed the interest for the use of allelochemicals from plants against weeds. (MARCO & BARBERA, 2005)

Similar chemical composition and the coexistence of different plant species can be powerful affected by the interactions among them. (INDERJIT and CALLAWAY, 2003)

Chemical studies done on perennial grasses and other plants have shown that the substances that are on the base of the allelopathy are secondary metabolites with vegetal origin that belong to alkaloids, isoprenoids, flavonoids, phenols, terpenes and glucosinolates. (BOUTON, 2005)

There is important to be identified mainly the classes of allelopathic compounds implied and their concentrations respectively the mechanisms through that those are getting into the environment, thus to be able to draw a more accurate image of the function they are having.

When those alkaloids are found in enough high concentrations they are inducing negative effects on the plants' development. (PÉREZ et al. 1991, TSANUO et al. 2003, FERGUSON ET AL. 2003)

MATERIAL AND METHODS

The main goal of our research was to set the capacity of the determined substances to influence the quality of studied grasses.

Biological material studied is represented by four perennial grasses species: *Dactylis glomerata L., Lolium perenne L., Poa pratensis L.* and *Festuca rubra L.*, studied in laboratory conditions and in pots.

The experience was set in three replicates. Excepting the tester that was watered only with distilled water, the other plants from pots were watered with low alcoholic extracts of pyrolizidinic alkaloids, respectively ergotic alkaloids obtained from the aerial part of *Poa pratensis* L. species. The extract was applied in three different doses, respectively 10 ml/pot, 40 ml/pot and 80 ml/pot.

After the treatment of the plants the material obtained from every species of grass (entire plant) was cleaned of soil and dried at 60°C for 24 hours. The dried material was milled with a mill until the milled material was passed through a sieve with the 1 mm holes.

This biological material was analysed for different chemical features.

RESULTS AND DISCUSSIONS

Researches done and the results presented in this scientific paper have the purpose of improving the understanding the action of some allelopathic chemicals with direct effects on the perennial grasses (*Lolium perenne, Dactylis glomerata*, *Festuca rubra* şi *Poa pratensis*).

In the last years the number of publications in the field of allelopathy increased exponential when the physiologists, biologists, pratologists and biochemists were continued to study this challenging domain. These studied have in view: chemical structure, respectively the action site and the target species (in this case – grasses from grassland).

This work approaches agricultural concepts, respectively agronomic features regarding grasses and their quality under the influence of the studied factors and also, specific biochemical concepts for the obtaining of the extracts and the material testing.

Table 1

Chemical composition of Lolium perenne plants after the watering with Poa pratensis extract

	Ash %			**CP %**		
Variant	**Mean**	**%**	**Dif./Semnif**	**Mean**	**%**	**Dif./Semnif**
Tester L.p.	11.10	100.00	-	17.78	100.00	-
D1	11.10	100.00	0.00	17.58	98.88	-0.20
D2	11.11	100.09	0.01	17.29	97.24	-0.49
D3	11.00	99.10	-0.10	16.97	95.44	-0.81
	$LSD_{5\%}$=0.37(%) $LSD_{1\%}$=0.56(%) $LSD_{0.1\%}$=0.89(%)			$LSD_{5\%}$=1.42(%) $LSD_{1\%}$=2.15(%) $LSD_{0.1\%}$=3.46(%)		
	NDF %			**ADF %**		
Tester L.p.	69.35	100.00	-	29.75	100.00	-
D1	69.21	99.80	-0.14	29.35	98.66	-0.40
D2	69.00	99.50	-0.35	29.02	97.55	-0.73
D3	68.54	98.83	-0.81	28.47	95.70	-1.28
	$LSD_{5\%}$=3.97(%) $LSD_{1\%}$=6.01(%) $LSD_{0.1\%}$=9.66(%)			$LSD_{5\%}$=3.31(%) $LSD_{1\%}$=5.01(%) $LSD_{0.1\%}$=8.05(%)		
	NFL µg/g			**NAL µg/g**		
Tester L.p.	541.00	100.00	-	127.00	100.00	-
D1	541.00	100.00	0.00	127.00	100.00	0.00
D2	541.00	100.00	0.00	127.00	100.00	0.00
D3	541.00	100.00	0.00	127.00	100.00	0.00
	$LSD_{5\%}$= 8.13(µg/g) $LSD_{1\%}$=12.32(µg/g) $LSD_{0.1\%}$=19.79(µg/g)			$LSD_{5\%}$= 4.26(µg/g) $LSD_{1\%}$= 6.46(µg/g) $LSD_{0.1\%}$= 10.37(µg/g)		

	EGV µg/g		
Tester L.p.	0.071	100.00	-
D1	0.069	97.18	-0.002
D2	0.064	90.14	-0.007
D3	0.067	94.37	-0.004
	$LSD_{5\%}$=0.011(µg/g)$LSD_{1\%}$=0.016(µg/g) $LSD_{0.1\%}$=0.026(µg/g)		

Experimental results obtained (table 1) show that the *Poa pratensis* L. extract hasn't significant influence on *Lolium perenne* L. plants. The values of NFL (N-formil loline), NAL

(N-acetil loline) and EGV (ergovaline) determined in the plants watered with *Poa pratensis* L. extract aren't increasing with the increase of the applied dosis of extract. In comparison with the tester, the plants watered with extract aren't presenting significant differences; in this case the lolinic alkaloids and ergovaline influences the quality of treated plants. Even isn't statistically supported, there is noticed a low decrease of the crude protein with the increase of the applied doses of extract. Thus, the tester *Lolium perenne* L. has an average of the crude protein of 18.78, the plants treated with extract in D1 (10 ml/pot) have a mean of the crude protein of 17.58, in D2 (40 ml/pot) 17.29, and in D3 (80 ml/pot) 16.97.

Table 2

Chemical composition of Dactylis glomerata plants after the watering with Poa pratensis extract

	Ash %			**CP %**		
Variant	Mean	%	Dif./Semnif	Mean	%	Dif./Semnif
Tester D.g.	10.80	100.00	-	18.78	100.00	-
D1	9.80	90.74	-1.00	16.38	87.22	-2.40^{0}
D2	10.12	93.70	-0.68	16.38	87.22	-2.40^{0}
D3	10.02	92.78	-0.78^{0}	16.31	86.85	-2.47^{00}
	$LSD_{5\%}$=0.74(%) $LSD_{1\%}$=1.11(%) $LSD_{0.1\%}$=1.79(%)			$LSD_{5\%}$=1.59(%) $LSD_{1\%}$=2.41(%) $LSD_{0.1\%}$=3.87(%)		
	NDF %			**ADF %**		
Tester D.g.	74.89	100.00	-	31.45	100.00	-
D1	73.00	97.48	-1.89	31.37	99.75	-0.08
D2	72.87	97.30	-2.02	31.00	98.57	-0.45
D3	70.80	94.54	-4.09	30.12	95.77	-1.33
	$LSD_{5\%}$=4.85(%) $LSD_{1\%}$=7.35(%) $LSD_{0.1\%}$=11.80(%)			$LSD_{5\%}$=2.74(%) $LSD_{1\%}$=4.16(%) $LSD_{0.1\%}$=6.68(%)		
	NFL µg/g			**NAL µg/g**		
Tester D.g.	0.090	100.00	-	0.050	100.00	-
D1	0.090	100.00	0.000	0.050	100.00	0.000
D2	0.090	100.00	0.000	0.050	100.00	0.000
D3	0.089	98.89	-0.001	0.055	110.00	0.005
	$LSD_{5\%}$=0.022(µg/g)$LSD_{1\%}$=0.033(µg/g) $LSD_{0.1\%}$=0.054(µg/g)			$LSD_{5\%}$=0.017(µg/g) $LSD_{1\%}$=0.026(µg/g) $LSD_{0.1\%}$=0.042(µg/g)		

Another species studied here is *Dactylis glomerata.*

From the analysis of the experimental data presented in table 2 there can be noticed that the watering of the plants with *Poa pratensis* L. extract leads to the change of the chemical composition of the *Dactylis glomerata* L. plants, changes that differ with the applied dose.

In the acse of *Dactylis glomerata,* when it is watered with *Poa pratensis* L. extract the crude protein content decreases indifferent by the dose of the extract applied. At the applying of a dose of 10 ml (D1) and 40 ml (D2) of extract the crude protein content in the *Dactylsi glomerata* L. plants is significantly lower in comparison with the tester and highly significantly lower at the 80 ml (D3) dose (table 2).

A third important species that enters in the grassland and forage crops composition is *Festuca rubra*. The applying of *Poa pratensis* L. extract on *Festuca rubra* shows that the extract doesn't influences significantly the chemical composition of *Festuca rubra* plants, the allelopathic substances and the crude protein doesn't represent significant differences in the plants treated in comparison with the tester *Festuca rubra*, but as in the case of *Lolium perenne* there takes place a slightly decrease of the crude protein, decrease that is manifesting during the increase of the applied dose of extract.

Table 3

Chemical composition of Festuca rubra plants after the watering with Poa pratensis extract

	Ash %			CP %		
Variant	**Mean**	**%**	**Dif./Semnif**	**Mean**	**%**	**Dif./Semnif**
Tester F.r.	11.37	100.00	-	17.98	100.00	-
D1	11.32	99.56	-0.05	17.87	99.39	-0.11
D2	11.30	99.38	-0.07	17.68	98.33	-0.30
D3	11.20	98.50	-0.17	17.48	97.22	-0.50
	$LSD_{5\%}$=0.54(%) $LSD_{1\%}$=0.82(%) $LSD_{0.1\%}$=1.31(%)			$LSD_{5\%}$=1.25(%) $LSD_{1\%}$=1.89(%) $LSD_{0.1\%}$=2.04(%)		
	NDF %			**ADF %**		
Tester F.r.	70.78	100.00	-	28.45	100.00	-
D1	70.45	99.53	-0.33	28.32	99.54	-0.13
D2	70.28	99.29	-0.50	28.00	98.42	-0.45
D3	69.87	98.71	-0.91	27.62	97.08	-0.83
	$LSD_{5\%}$=3.68(%) $LSD_{1\%}$=5.57(%) $LSD_{0.1\%}$=8.94(%)			$LSD_{5\%}$=4.31(%) $LSD_{1\%}$=6.53(%) $LSD_{0.1\%}$=10.49(%)		
	NFL µg/g			**NAL µg/g**		
Tester F.r.	1550.00	100.00	-	771.00	100.00	-
D1	1550.00	100.00	0.00	771.00	100.00	0.00
D2	1550.00	100.00	0.00	771.00	100.00	0.00
D3	1550.00	100.00	0.00	771.00	102.46	0.00
	$LSD_{5\%}$=23.94(µg/g) $LSD_{1\%}$=36.25(µg/g) $LSD_{0.1\%}$=58.23(µg/g)			$LSD_{5\%}$=14.71(µg/g) $LSD_{1\%}$=22.26(µg/g) $LSD_{0.1\%}$=35.76(µg/g)		

	EGV µg/g		
Tester F.r.	0.129	100.00	-
D1	0.127	98.45	-0.002
D2	0.129	100.00	0.000
D3	0.129	100.00	0.000
	$LSD_{5\%}$=0.005(µg/g) $LSD_{1\%}$=0.007(µg/g) $LSD_{0.1\%}$=0.012(µg/g)		

CONCLUSIONS

1. In *Poa pratensis* extract were found allelopathic compounds;
2. From the multitude of alkaloids known in literature there were identified the following: NFL- N-formil loline; NAL-N-acetil loline, EGV- ergovaline;
3. The influence of the alkaloids on the change of the quality index in the first developing phenophases was reflected through a slightly decrease of the crude protein content.

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