EFFECT OF *POA PRATENSIS* EXTRACTS ON GROWING AND DEVELOPMENT OF PERENNIAL GRASSES SEEDLINGS

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Abstract: *The scientific research carried out have underlined the effect of the allelopathic substances on the perennial graminaceae plants growth in the early stages of development after its germination. The proposed study intends to provide data on the mechanisms developed by plants (based on biochemical interactions) to survive.Many cultivated and spontaneous species produce allelochemic compounds that reduce the growth at the level of the plantlets. This phenomenon is mainly due to the direct interference with the cell division processes or with growth hormones. The biological material studied is represented by four species of perennial graminaceae: Dactylis glomerata L., Lolium perenne L., Poa pratensis L. and Festuca rubra L., studied in the laboratory. The plants were splashed with extracts obtained from the species Poa pratensis and were applied in three different doses. The extracts were applied in three different variants.The observations on the allelopathic interaction between plant species have a history of centuries, but the transition from observation to scientific certainty has been achieved relatively recently. The research that were made in the allelopathy field showed that the allelopathy substances may inhibit the germination of the seeds, but may also affect the growth and development of the receiver plant of such substances, so that the allelopathic phenomenon is a cause-effect relationship between the substances with allelopathic potential and physiological response of the target plant.The biochemical identification of these products and their effect on the growth and development of the plant is beneficial and should be of a great help concerning the growing of plants to obtain resistant fodders and to maintain the crops productive and profitable.The project aims to establish an interface between biochemical study essentially morphological and anatomical study of plants, emphasizing structural and functional changes that biochemical interactions, alelopatic type of plant may cause. The study will influence the broad base of knowledge on interactions alelopatic type of plant growth and development of vegetation cover and farming systems.*

***Key words*:** *perennial graminaes, allelopathy, growth and development*

INTRODUCTION

Secondary metabolites: phenolic acids, hydroxamic acids, flavonoids *etc*. appear frequently in the cultivated and wild grass varieties. (NEL & SMITH, 2009)

Many cultivated and spontaneous species produce allelopathic compounds that are reducing growth at the seedlings level. This phenomenon is due mainly to the direct interference with cell division processes or with the growing hormones. (EINHELLIG, 1995)

Researches from the allelopathy field have demonstrated that the allelopathic substances can inhibit seeds germination, and they can influence negatively the growing and development processes of the receptor plant for these substances, thus the allelopathic phenomenon is a cause-effect relationship between substances with allelopathic potential and the physiologic response of the target plant. (BLUM, 1995,2002; CHENG, 1995; KRUSE et al., 2000)

There is an increase interest in the field of development of new plants varieties with allelopathic potential for the weed control. The allelopathic varieties are able to control weeds

because of the natural production of bioactive allelochemicals, reducing in this way the synthetic herbicides use. (EINHELLIG, 2007)

Biological dosing represents an integrant part in all the allelopathy studies. These dosings are necessary for the evaluation of the allelopathic potential of the species and following the activity during the extraction, purification and identification time of the active biocompounds. In its most simple form, these biotests and the isolation and identification of the allelochemicals are techniques for the provision of the initial pieces of information. (OLIVEIRA, 2006)

The biotests techniques vary a lot and none researcher isn't using the same procedure. The greatest problem with the biotests is the lack of some standardised biotests. The incomplete pieces of information regarding the source of allelochemical substances, the extraction method, concentrations, fractions and the absence of some known compounds with demonstrated activity in biotests stopping their validity, frequently there cannot be set concordance relationships among the results of the biotest and the distinct vegetation models from field. (AKADÉMIAI KIADÓ, 2007)

MATERIAL AND METHODS

Biologicl material studied here is represented by for species of perennial grasses. From the species *Poa pratensis* was obtained the extract through specific biochemical methods, and the obtained extract was applied in three different concentrations to follow how the allelochemicals concentration increase inhibit seeds germination and the seedlings growth and development in the first growing stages.

The seeds belonging to the other species (*Lolium perenne, Dactylis glomerata* and *Festuca rubra*) were set in Petri double disks. In every double disk was set a filter paper disk having the same dimension as the double disk bottom with the diameter of 12 cm, and then were set 100 seeds in three replicates. After the seeds setting these were covered with a filter paper disk and there was added 2 ml of extract in three replicates (V1 – concentrated, V2 dilution 1, V3 – dilution 2) or distilled water in the case of the tester every time when it was necessary to keep a constant humidity.

The lolinic alkaloids content in *Poa pratensis* extract was the following:

- Replicate 1 – concentrated = 0,08% alkaloids;
- Replicate 2 – dilution 1 =alkaloids;
- Replicate 3 – dilution 2 = 0,01% alkaloids.

RESULTS AND DISCUSSIONS

Through the measuring of the coleoptile and of the embrionary root they were looking to highlight the effect of the allelopathic substances on the seedlings growth in the first development stages after their germination.

Very suggestive in this way are the data presented in table 1. Where can be noticed the inhibitor effect of *Poa pratensis* extracts on *Lolium perenne* L. seedlings growth.

At replicate 1, where the concentration of the lolinic alkaloids is greater, the effect was totally inhibitor, thus the embrionary root and the coleoptile of *Lolium perenne* L. trated with weren't growing (fig. 1).

Replicate 2 with a lower concentration of lolinic alkaloids determinate a slightly growing of the embrionary root and coleoptile.

In the case that is applied the *Poa pratensis* extract in replicate 3 with a concentration of 0.01% there is noticing that treated *Lolium perenne* has a length of 1.85 cm and the coleoptile 2.6 cm.

The statistical analysis of the results show a highly significantly lower difference in the case of the plants treated in comparison with the tester (indifferent by the replicate of the extract applying).

If there is done a comparison between the tester and the tree replicates there was noticed that while the lolinic alkaloids are in a greater concentration the coleoptile and embrionary root growth is more reduced.

Table 1

The coleoptile and root length (cm) at *Lolium perenne L.*

Variant	**Tester *Lolium perenne***			
	$\bar{x} \pm sx$	$s\%$	**u**	**Significance**
Coleoptile	8.76±0.168	6.069		
Embrionary root	9.62±0.106	3.492		
***Lolium perenne* in *Poa pratensis* extract**				
Coleoptile				
V1	0±0	-	-52.103	000
V2	0.05±0	0	-49.129	000
V3	2.6±0.03	4.054	-35.939	000
Embrionary root				
V1	0±0	-	-90.541	000
V2	0.5±0	0	-85.836	000
V3	1.85±0.05	8.546	-66.169	000
	LSD 5%=2.26 (cm)	LSD 1%=3.25 (cm)	LSD 0.1%=4.78 (cm)	

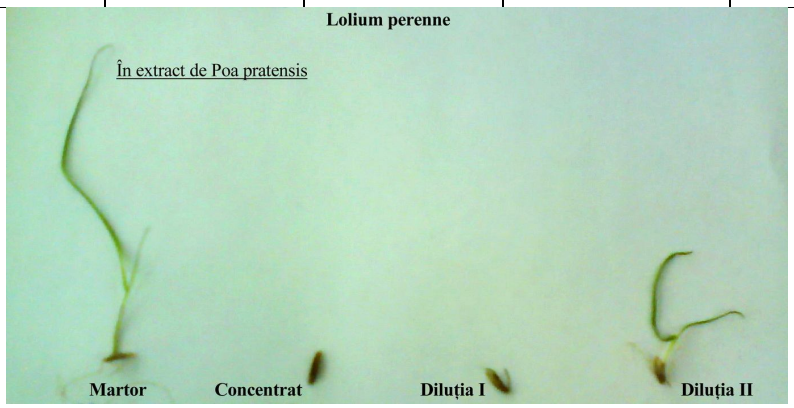

Figure 1: 14 days *Lolium perenne L.* seedlings grown on *Poa pratensis* extract neat to untreated tester

In *Dactylis glomerata* L. the phytotoxic effect of the extract obtained from *Poa pratensis* is manifesting through the inhibition of the seedlings growth, the treated plants being highly significantly smaller in comparison with the tester.

If there is made a comparison among the tester seedlings and the treated ones there can be noticed that the embrionary root and the coleoptile have a faster growing rate while the applied extracts have a lower concentration regarding the allelopathic substances (fig.2) this fact demonstrating that the extracts are becoming active at superior concentrations.

Coleoptile and embrionary root growing is inverse proportionally with the alleopathic substances concentration. The coleoptile length in *Dactylis glomerata* treated is 1.24 cm in replicate 2 and 3.84 in replicate 3 with a difference of 4.26 cm and respectively 2.02 cm in comparison with the tester. In the case of the embrionary root the difference is still greater. The tester *Dactylis glomerata* has developed a n embrionary root of 7.75 cm, with 7.55 cm longer then in the case of *Dactylis glomerata* treated with *Poa pratensis* extract in replicate 2 and 6.6 cm in comparison with the *Dactilis glomerata* from replicate 3.

Table 2

The coleoptile and root length (cm) at *Dactylis glomerata L.*

Variant	Tester *Dactylis glomerata*			
	$\bar{x} \pm sx$	$s\%$	u	Significance
Coleoptile	5.5±0.129	7.422		
Embrionary root	7.75±0.083	3.400		
***Dactylis glomerata* in *Poa pratensis* extract**				
Coleoptile				
V1	0±0	-	-42.602	000
V2	1.24±0.065	16.657	-29.443	000
V3	3.48±0.041	3.783	-14.891	000
Embrionary root				
V1	0±0	-	-93	000
V2	0.2±1.57	2.48	-90.6	000
V3	1.15±0.05	13.749	-67.713	000
	LSD 5%=2.26 (cm)	LSD 1%=3.25 (cm)	LSD 0.1%=4.78 (cm)	

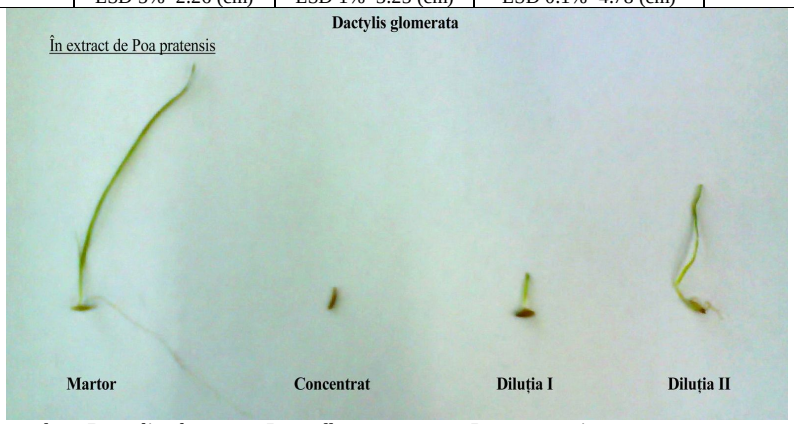

Figure 2: 14 days *Dactylis glomerata L.* seedlings grown on *Poa pratensis* extract neat to untreated tester

Statistical calculations are highlighting the fact that the embrionary root and the coleoptile at *Festuca rubra* are inhibited in growing when they are influenced by the effect of the allelopathic substances (existent in the extract of *Poa pratensis*), this being highly significantly lower in comparison with the tester. If there is analysed the average of the coleoptile and embrionary root length there is noticed the same aspect as in the case of the other grass species analysed, thus while the concentration of the allelopathic substances is growing there is decreasing the development of the seedlings.

Table 3

The coleoptile and root length (cm) at *Festuca rubra L.*

Varianta	Tester *Festuca rubra*			
	$\bar{x} \pm sx$	$s\%$	u	Significance
Coleoptile	7.01±0.125	5.644		
Embrionary root	8.63±0.112	4.125		
***Festuca rubra* in *Poa pratensis* extract**				
Coleoptile				
V1	0±0	-	-56.025	000
V2	1.62±0.032	6.375	-41.681	000
V3	4.6±0.033	2.291	-18.612	000
Embrionary root				
V1	0±0	-	-76.646	000
V2	0.2±1.57	2.48	-74.869	000
V3	0.5±0	0	-72.205	000
	LSD 5%=2.26 (cm)	LSD 1%=3.25 (cm)	LSD 0.1%=4.78 (cm)	

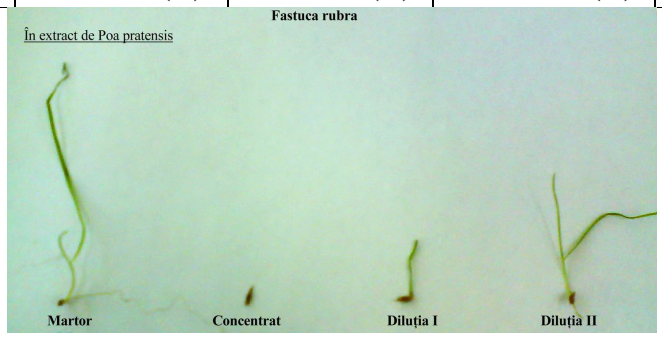

Figure 3: 14 days *Festuca rubra L.* seedlings grown on *Poa pratensis* extract neat to untreated tester

CONCLUSIONS

- Growth of the seedlings kept on an environment treated with extracts is more reduced in comparison with the tester and the effect is maximal at the higher concentration;
- Following the obtained results these researches have shown that the species used for the obtaining of the extracts have presented in their composition alkaloids, the identified ones having an inhibitor effect on the growth of the perennial grasses;
- The inhibiting of the seedlings growth by the allelopathic substances demonstrates that these substances confer competitiveness and superiority meanwhile to the allelopathic species in relationship with the other species.

BIBLIOGRAPHY

1. BLUM U., 1995 - The value of model plant-microbe-soil system for understanding processes associated with allelopathic interactions. *In* Allelopathy, Organisms, Processes and Applications, eds. Inderjit, Dakshini and Einhellig. ACS Symposium Series 582.Washington DC.

2. BLUM U., 2002 - Soil solution concentrations of phenolic acids as influenced by evapotranspiration. Abstracts of the Third World Congress on Allelopathy.

3. EINHELLIG, F.A., 1995. Allelopathy: current status and future goals. *In* "Allelopathy: Organisms, Processes, and Applications" (Inderjit, K.M.M. Dakshini and F.A. Einhellig, Eds.); ACS Symposium Series 582, American Chemical Society, Washington, DC, 1–25.

4. CASTELLS M., PENUELAS A., AND VALENTINE G.J., 2004 - Are phenolic compounds released from the Mediterranean shrub *Cistus albidus* responsible for changes in N cycling in siliceous and calcareous soils? New Phytologist, 162: 187-195.

5. DAVIES, E.; LANE, G. A.; LATCH, G. C. M.; TAPPER, B. A.; GARTHWAITE, I.; TOWERS, N. R.; FLETCHER, L. R.; POWNALL D. B. 1993 - Alkaloid concentrations infield-grown synthetic perennial ryegrass endophyte associations. Proceedings of the Second International Symposium on *Acremonium/Grass* Interactions. Pp. 72-76.

6. DJURDJEVIĆ, L., MITROVIĆ, M., PAVLOVIĆ, P., PERIŠIĆ, S. MAČUKANOVIĆ-JOCIĆ M., 2005 - Total phenolics and phenolic acids content in low (*Chrysopogon gryllus*) and mediocre quality (*Festuca vallesiaca*) forage grasses of Deliblato Sands meadow-pasture communities in Serbia. *Czech J. Anim. Sci., 50, (2): 54–59.*

7. FERGUSON, J.J., AND RATHINASABATHI. H., 2003 - Experimental design for the study of allelopathy. *Plant and Soil* 256 : 1-11.