EVALUATION OF BIOLOGICALLY ACTIVE ORGANIC EXOMETABOLITE CONTENT IN RHIZOSPHERE OF MEADOW AGROCENOSES OF DIFFERENT SPECIES COMPOSITION

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ABSTRACT

The organic products of plant exometabolites and vital activity of plant-attendant microflora in rhizosphere of meadow agrocenoses were studied. It was revealed that more of phenolcompounds (by a factor of 1.5-3) and nitrogenous ones (by a factor of 1.5-2) were involved in a small biological turnover through a soil medium under 2-fold mowing of herbage than under 4-fold one.
KEYWORDS: meadow plants, rhizosphere, root exometabolites, content

INTRODUCTION

A plant produces a specific biochemical (allelopathic) medium in a rhizosphere by extracting exometabolites of organic origin with roots into soil (Rhice,1978; Grodzinsky, 1991). Study on allelopathic conditions of the rhizosphere is very important during formation of polycomponent herbages under derno-podzolic soil conditions. Soils of this type have a weak absorbing capacity and owing to this fact, plant exometabolites and organic products of vital activity of plant-attendant microflora desorb into soil solution and affect acceptor plants via rhizosphere (Ellanskaya, Golovko,2004). In the first place, phenolcompounds (PHC) and free amino acides (FAA) are attributed to exometabolites with the highest biological activity.

METHODS

The qualitative and quantitative composition of FAA and the total content of PHC in a rhizosphere of monocultures of grass species (*Medicago sativa* L.,*Trifolium repens* L., *Trifolium pratense* L., *Lotus corniculatus* L., *Bromopsis inermis* L., *Phleum pratense* L., *Festuca pratensis* Huds., *Festuca rubra* L.) and their mixtures under 2-fold and 4-fold mowing of herbage were studied in field trials on meliorated derno-podzolic sandy-loam soil. The soil allelopathic effect on the nitrogen-fixing activity (NFA) of root nodules in leguminous grasses being analysed. The content of FAA in soil was determined using aminoanalyzer, PHC was analised with Folin-Ciocalteu's Reagent, NFA by acetylene method.

RESULTS AND DISCUSSIONS

The total PHC content in the rhizosphere of the agrocenoses amounts to 58-88 mg $\cdot$ kg^{-1} and 33-45 mg $\cdot$ kg^{-1} of air dry soil, respectively; the total content of FAA makes up 23-28 mg $\cdot$ kg^{-1} and 12-28 mg $\cdot$ kg^{-1} (Table 1 and 2). The monocultures and grass mixtures under study differ substantially in the content of soil phenols extracted by different solvents. The rhizosphere of *Bromopsis inermis* and *Lotus corniculatus* is characterized by the highest PHC concentration of ethanol fraction while rhizosphere of *Phleum pratense* – by a high content of phenols desorbed with aqueous acetone. Alanine, glutamic acid, valine and isoleucine prevailed in the composition of FAA extracted from soil. *Dactylis glomerata* and *Bromopsis inermis* belong to grass species intensively accumulating phenols and FAA in the rhizosphere that causes a high allelopathic activity of soil in their rhizosphere and affect to a certain extent the nitrogen-fixing capacity of

legume components when these crops are involved in grass mixtures. A rise in the nitrogen fixation activity of root nodules in legume-grass mixture as compared with monocultures in *Trifolium pratense* is connected by an inverse relationship with phenolic status of the rhizosphere, but in *Trifolium repens* – with concentration of FAA.

Table 1. The total content of phenolic compounds (mg · kg^{-1}) in rhizosphere of meadow agrocenoses. The 3-rd year of vegetation

Two-movings use			Four-movings use		
Species Composition	Ethanol fraction	Acetone fraction	Species composition	Ethanol fraction	Acetone fraction
Bromopsis inermis	22.3± 1.6	30.5± 6.5	*Dactylis glomerata*	12.4± 0.3	32.9± 1.8
Phleum pratense	17.7± 1.2	70.0± 5.5	*Festuca pratense*	8.3± 0.7	25.0± 2.8
Lotus corniculatus	21.6± 1.1	59.0± 4.9	*Festuca rubra*	7.5± 0.6	29.1± 5.3
Trifolium pratense	11.9± 0.9	46.2± 6.8	*Trifolium repens*	8.8± 0.4	24.3± 0.4
Medicago sativa	21.0± 1.1	66.5± 5.3	*Medicago sativa*	11.8± 0.5	24.1± 1.3
Tr.pratense+Ph.pratense	18.1± 1.3	49.0± 3.3	*D.glomer.+F.rubra+M.sat.*	12.5± 0.5	27.4± 0.5
L.corniculatus+Ph.pratense	16.8± 0.1	65.6± 3.3	*D.glomer.+F.rubra+Tr.rep.*	9.2± 0.4	33.7± 1.5
M.sativa+Br.inermis	20.6± 1.8	65.6± 6.4	*F.prat.+F.rubra+Tr.rep.*	10.4± 0.1	35.4± 2.1

Table 2. The content of free amino acids (mg · kg^{-1}) in rhizosphere of meadow agrocenoses. The 3-rd year of vegetation

Cenosis of two-movings use			Senosis of four-movings use		
Bromopsis inermis	*Phleum pratense*	*Medicago sativa*	*Dactylis glomerata*	*Festuca rubra*	*Medicago sativa*
28.32	23.55	28.27	28.91	12.50	18.0

FAA dissolved in water in concentrations of 0.0001 – 0.01 % are known, as a rule, to stimulate growth and development of plants (Stefansky,1992), with each amino acid having own concentration interval of the stimulating effect. FAA act as inhibitors at concentration being higher than the above-stated. According to our data, concentration of FAA in soil under legume grasses and cereals did not fall outside the limits of the stimulating effect (0.0001 – 0.0006 %). It should be noted, however, that combination of such species as *Medicago sativa*, *Dactylis glomerata* and *Bromopsis inermis* in grass mixture can introduce a high total content of exogenous FAA in rhizosphere and their inhibiting effect on plants.

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