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СТРУКТУРНО-ФАУНІСТИЧНА ОРГАНІЗАЦІЯ ЛІТОРАЛЬНОГО ЗООПЛАНКТОНУ Р. УДАЙ НПП "ПИРЯТИНСЬКИЙ"

Представлено результати дослідження структурно-функціональної організації угруповань літорального зоопланктону р. Удай в межах Національного природного парку "Пирятинський", проведені влітку 2015 року. В результаті досліджень визначено 58 видів зоопланктону та проаналізовано їх щільність, біомасу, екологічний спектр угрупування, тип і спосіб живлення.

Ключові слова: зоопланктон, р. Удай, НПП "Пирятинський", Україна.

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СТРУКТУРНО-ФАУНИСТИЧЕСКАЯ ОРГАНИЗАЦИЯ ЛИТОРАЛЬНОГО ЗООПЛАНКТОНА Р. УДАЙ НПП "ПИРЯТИНСКИЙ"

Представлены результаты исследования структурно-функциональной организации сообществ литорального зоопланктона р. Удай в районе Национального природного парка "Пирятинский", проведенные летом 2015 года. В результате исследований определено 58 видов зоопланктона и проанализировано их плотность, биомассу, экологический спектр сообщества, тип и способ питания.

Ключевые слова: зоопланктон, р. Удай, НПП "Пирятинский", Украина.

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CHANGE IN THE CONTENT OF XANTHONES AND LIGNIN IN BUCKWHEAT AND WHEAT PLANTS UNDER SALICYLIC ACID AND CADMIUM IONS

Investigated the effect of cadmium and salicylic acid on phenols content (xanthones, lignin) in plants buckwheat (Fagopyrum esculentum Moench.) and wheat (Triticum aestivum L.). It is established that the action of cadmium ions increases the content of xanthone and produces lignin. To reduce the impact of stress factors it is expedient to use salicylic acid, which normalize the amount of xanthones and lignin in plants of buckwheat and wheat. With this stress regulator, phytohormons can significantly reduce the toxic effects of cadmium ions.

Key words: Fagopyrum esculentum Moench., Triticum aestivum L., cadmium chloride, salicylic acid, lignin, xanthones.

Introduction. Plants organism are extremely sensitive to the state of the environment and actively respond to change. The influence a different anthropogenic factors are seriously damaging for all plants. Plants resistance to stressful factors are controlled by the hormonal system. In recent years attention give hormonal compounds, especially for the induction of plants resistance to different stress factors. For this compounds include salicylic acid. Salicylic acid (SA) is considered as an endogenous plant growth regulator which has been found to generate a wide range of physiological and metabolic responses in plants [10]. The important role of plant protection under the action of stressors in necessary for life restored condition, belongs to the phenolic compounds. Polyphenols – secondary metabolites of the plant organism [6,12], which protect it from oxidative stress. The synthesis of polyphenols is enhanced under stressful conditions [8,13]. It is known that polyphenols counteract oxidative stress: neutralize active forms of oxygen, support the internal environment of cells and have a positive effect for activity of antioxidant enzymes [13].

In the present work, we made an attempt to explore whether external treatment of salicylic acid could mitigate the adverse effect of Cd toxicity on buckwheat and wheat plants and also investigate changes in the phenol contents under these conditions.

Matherials and methods. Seeds of wheat (*Triticum aestivum* L. cv. Podolianka) and buckwheat (*Fagopyrum esculentum* Moench. cv. Rubra) were sterilized and divided into two groups. First group of seeds were soaked in 0.05 μM SA respectively for 5 h, another group was soaked in distilled water (control). Then both groups were allowed to germinate on moist filter paper in the dark. Two-days-old seedlings were transported in pots filled with washed and inciderated sand artificially contaminated with Cd (25 mg/kg substrate). The concentration was chosen by comparing with the literature sources [5,7]. For our research were the plants are grown without Cd ions and SA (control), also plants, wich seed are soked SA, and plants are grown with Cd. The concentration of salicylic acid (0.05 μM) were chosen experimentally, basis of our previous studies. For investigation were used 14-days-old and 21-days-old plants.

Determination of xanthons was based on the determination the main and most common glucoside – mangiferin. For investigation were used spectrofotometric assays. The results of mangiferin was expressed in % of dry weight (DW) [2,3].

Determination of lignin in stem was based on color reaction with floroglucine [4]. For investigation were used optical microscope and program Image Tool. The size was obtained using the formula A=P/0,8, де A-size of aperture (micrometers), P- size of aperture (pixels), 0,8 – the conversion factor. The conversion factor was determined by photographing a ruler and then determined the number of pixels in 1 micrometers.

Results and discussion. Plants are frequently exposed to stress factors, that greatly influence growth, development, survival, crop productivity, and species distribution. Many plants can acquire tolerance in response to this factors. In this article all attention is for secondary metabolites of the plant organism – phenolic compounds, exactly xanthones. Many plants for stressful reaction including changes in physiological and biochemical processes [3]. Information about the change of xanthones contents under influence of heavy metals doesn't find. Known that xanthones as a phenolic compounds and secondary metabolites of plant organism has a protective role under stressful condition and oxidative stress, and their synthesis increase under this conditions [8,12,13]. The most common C-glucoside – mangiferin. Mangiferin was isolated from mango (*Mangifera indica* L.), but known that it is common

in other flower plants. This substance is known for their biological activiti.

Changes of xanthons content are represented in Figure 1. Analyzing the xanthons content of plants under influence of SA and Cd, we can see increase in 14-days-old wheat plants and decrease in shoots 21-days-old wheat plants in all variants, except non-stressed plants (control). (Fig. 1, A). Pre-treatment with 0.05 μM salicylic acid stimulated xanthons accumulation, this is due to the common synthesis of phenolic compounds. Salicylic acid is known as the compound which may play a protective role in stressful conditions. The difference in buckwheat plants in the content of investigated compounds was not detected, possibly due to the high total content of phenolic compounds and insignificant xanthon contents in these plants.We observed increase of this parameters in 21-days-old buckwheat plants with Cd treatment (Fig.1,B), because phenolic compounds are a natural stress metabolite of plants. Also, it can be a variental characteristic.

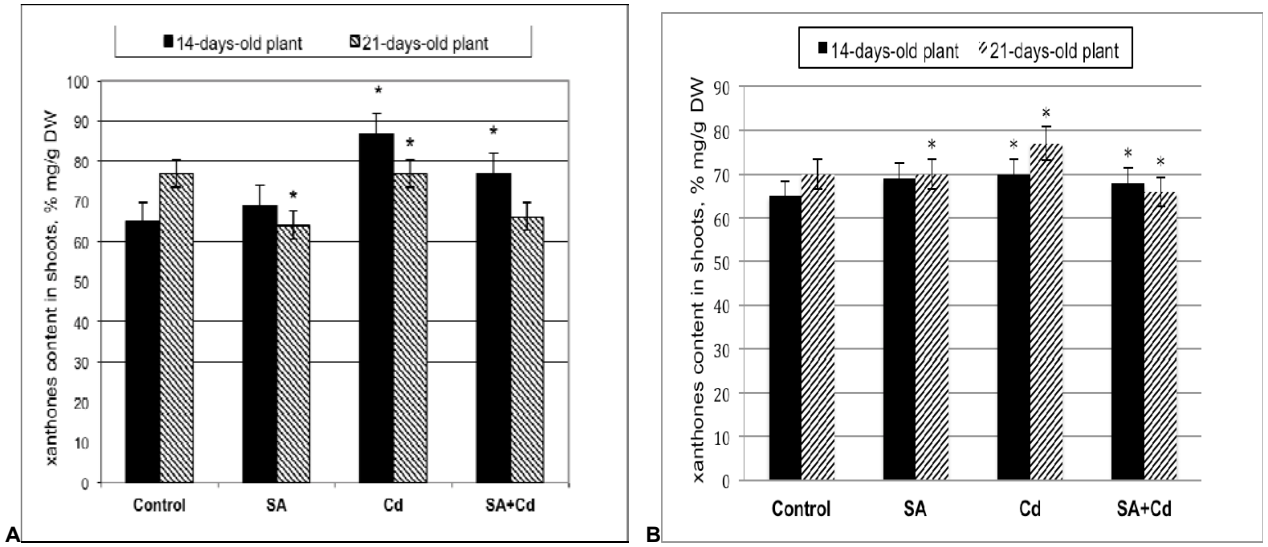

Fig.1. Effect of Cd and salicylic acid treatments on xanthone contents in wheat (A) and buckwheat (B) plants, %

Comments: * – significant at P≤0.05, (M±SD, n=3)

Except to many internal changes (the contents of important metabolites, activity of enzymes etc.), the plant organism can be resistand due to external changes. In recent years, research on the metabolism of lignin and plant resistance hasn't been plentiful.

Cellulose, hemicellulose, and lignin comprise the main composition of cell walls of plants and are important components of natural lignocellulosic materials. Lignin is one of the most abundant organic polymers in plants, just behind cellulose. In the cell wall lignification process, lignin penetrates into the cell walls and fills in their framework, which increases the hardness of the cell wall, enhancing the mechanical and the compressive strengths, promoting the formation of mechanical tissues, and consolidating the plant body and water conduction. Lignin, as a secondary metabolite in plant growth and development, has important biological functions in the growth and development and disease resistance of plants. Lignin metabolism in plants has physiological significance, which was mainly present as the close relationship between changes of its enzyme activity, the increase of intermediate and lignin contents and cell differentiation, the resistance to pathogen infection, and other physiological activities in plant development [4]. Many studies have shown that, when the plant is infected or resistance is induced, the activity of enzymes related to lignin synthesis and the content of lignin would both increase, thereby enhancing the resistance of plants. Lignin biosynthesis can be regulated by changing external factors, such as the action of drought [11]. Heavy metals also influence the formation of lignin. Different plant tissue would have a different lignin content, because lignin biosynthesis regulated by changing the activities of different enzymes [9].

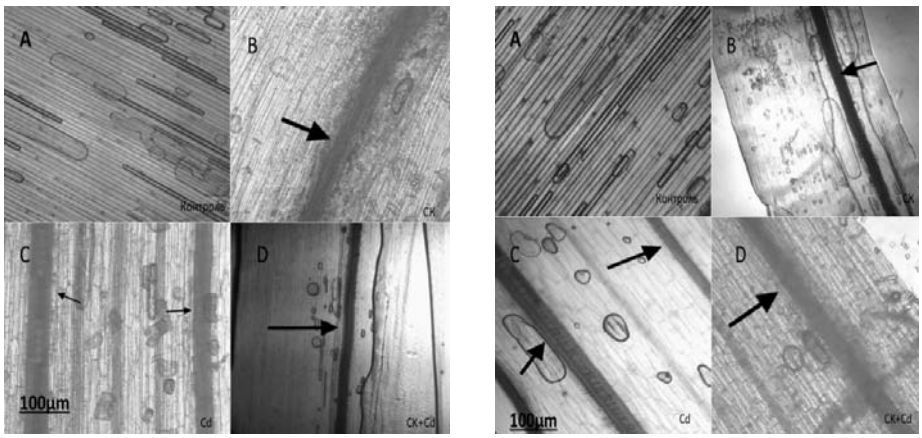

Fig.2. Effect of Cd and salicylic acid treatments on localization and the formation of lignin in shoots 14-days-old and 21-days-old wheat plants (A-Control, B-SA, C-Cd, D-SA+Cd)

In our case, for detection of lignin we chose different parts of plant (leaf, stem, node and internode). All research plants were on the second (14-days-old) or third (21-days-old) leaf. Presents results (photo) the part of stem, close to the node, where it was best seen accumulation of lignin (for 14 and 21 days-old) compared to other parts of the plant. Different parts of plants would have a different lignin content and composition. For example, the lignin content and structure are significantly different in the node and internode of reed (*Arundo donax*); the node has a higher density than the internode because of the high content of phenolic acids (p-coumaric acid and ferulic acid) [1,4,9]. The reasons for this difference are varied. For instance, methyl jasmonate can significantly improve the POD activity of seedlings and the lignin content. Both jasmonic acid and gaseous methyl jasmonic acid could induce the expression of chalcone synthase, thereby increasing the lignin content [9,13]. Our results show differences accumulation in plants, depending on the conditions of growth [13]. Discovered species differences, with a predominance of lignin in plants of buckwheat in comparison with wheat plants (Fig. 2,3). Also considered, that salicylic acid consumed increased formation of lignin, through phenolic composition (Fig. 3).

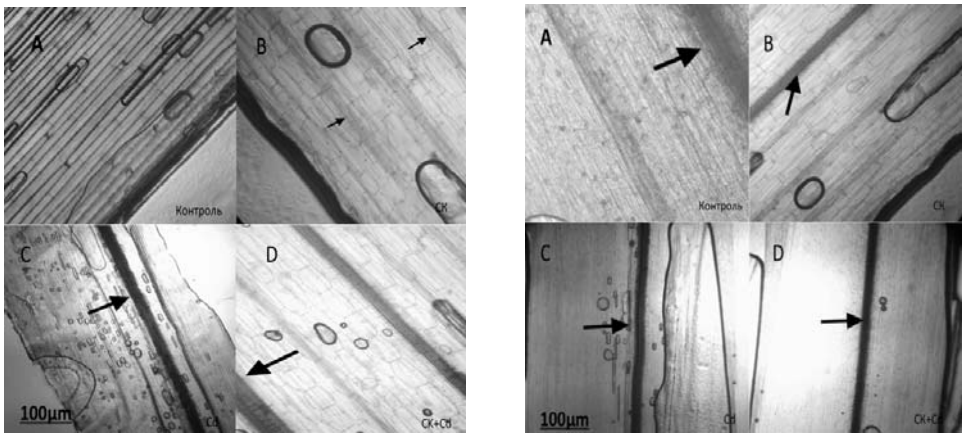

Fig.3. Effect of Cd and salicylic acid treatments on localization and the formation of lignin in shoots 14-days-old and 21-days-old buckwheat plants (A-Control, B-SA, C-Cd, D-SA+Cd)

Summary. Our results confirm stress protectiv role of phenolic compounds by the heavy metals action. We can talk about the involvement of different mechanisms of protection, as external (the process of lignification) and internal (changes in the content of xanthons) for the actions of cadmium chloride. Salicylic acid under these conditions reduced education (accumulation) of xanthons and stimulated lignification in buckwheat and wheat plants. Comparing data on different plants in species composition, more visible changes can be observed in the identification of lignin in plants of buckwheat, in our opinion is associated species and varietal characteristics, a high content of phenolic compounds in this culture. Also, through the high content of phenolic compounds was observed a low level xanthons. The influence of salicylate is the reason that it is a substance of phenolic origin, has a common way of synthesis with phenols, activated in stress conditions and salicylic acid is an active growth regulator in plants.

The use of external treatment salicylic acid in a concentration of 0.05 Mm can serve as an important regulator of the formation of phenolic compounds by the action of stressors, especially in the variant with the combined effect of two factors (SA+Cd), and indirect impact on plants growth and development.

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ЗМІНА ВМІСТУ КСАНТОНІВ ТА НАГРОМАДЖЕННЯ ЛІГНІНУ В РОСЛИНАХ ГРЕЧКИ ТА ПШЕНИЦІ ЗА ДІЇ САЛІЦИЛОВОЇ КИСЛОТИ ТА ІОНІВ КАДМІЮ

Досліджено сумісний вплив іонів кадмію та саліцилової кислоти на вміст поліфенолів у рослинах гречки (Fagopyrum esculentum Moench.) і пшениці (Triticum aestivum L.). Встановлено, що за дії іонів кадмію зростає вміст ксантонів та посилено утворюється лігнін. Для зниження впливу стресового чинника доцільно використовувати саліцилову кислоту, яка нормалізує нагромадження фенольних сполук – вміст ксантонів та лігніфікацію у рослин гречки та пшениці. За допомогою цього регулятора росту можна певною мірою зменшити токсичний вплив іонів кадмію.

Ключові слова: Fagopyrum esculentum Moench., Triticum aestivum L., кадмію хлорид, саліцилова кислота, лігнін, ксантони.

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ИЗМЕНЕНИЕ СОДЕРЖАНИЯ КСАНТОНОВ И НАКОПЛЕНИЕ ЛИГНИНА В РАСТЕНИЯХ ГРЕЧИХИ И ПШЕНИЦЫ ПРИ ДЕЙСТВИИ САЛИЦИЛОВОЙ КИСЛОТЫ И ИОНОВ КАДМИЯ

Исследовано совместное влияние ионов кадмия и салициловой кислоты на содержание фенолов (ксантонів, лигнина) в растениях гречихи (Fagopyrum esculentum Moench.) и пшеницы (Triticum aestivum L.). Установлено, что за действия ионов кадмия возрастает содержание ксантонов и усиленно образуется лигнин. Для снижения влияния стрессового фактора целесообразно использовать салициловую кислоту, которая нормализует содержание и снижает содержание ксантонов и лигнификацию в растениях гречихи и пшеницы. С помощью этого регулятора роста можно значительно уменьшить токсическое влияние ионов кадмия.

Ключевые слова: Fagopyrum esculentum Moench., Triticum aestivum L., кадмия хлорид, салициловая кислота, лигнин, ксантоны.

UDC 598.288.7 : 591.555.1

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DIFFERENCES IN AGGRESSIVE BEHAVIOR OF RELATED SPECIES OF FLYCATCHERS (MUSCICAPIDAE) FAMILY

The article is devoted to the observation of differences in relation between aggressive behavior of related species of Flycatchers (Muscicapidae) family and behavior acts in naturally watering places. Observations have reviled the timing separation between presence and engagement of Flycatchers in morning hours and relation with acts of aggression. Each representative of Flycatchers family is using the watering place in different ways. The correlation between intraspecific and interspecific contacts with the predominance of interspecific and highly aggressive interactions has been analyzed. The rating of successfulness of the acts of aggression has been established for every particular group of Flycatchers. It demonstrates the energetic justification of aggressive behavior for spotter, red-breasted and pied flycatchers but energetic overspend and failure for collared flycatcher.

Keywords: behavior, aggression, Muscicapidae, watering place.

Introduction. Over the last decade, interest to the flycatcher's ecology significantly increased due to their synanthropic opportunities, habitat area expansion and population increasing in the southern Europe, as well as their relationships with the other species. For the social bird's interaction study, flycatchers are ideal species because some knowledge regarding the use of non-specific and cone-specific information in their choice of nesting place has already been partially disclosed. Besides these species are flexibly used an intraspecific and especially interspecific social information (for example, neighborhood with the great and the blue tits) [26].

Numerous publications of European authors, the question of the aggression's reasons and consequences among the animals are actively appeared. Especially essential attention is spared to behavior's differences investigation on different territories, its significance for biology, ecology and social relationships closed and competitive species. Much attention is paid to aggression study in intraspecific competition [14], but its significance and consequence in interspecific competition or other relationships of the closed species are the newer and not enough learnt issue so far [27, 36], but its mechanisms and consequences are still not clear.

Interspecific competition is an important factor which regulates niche overlapping in the resources use by the closed spices and relative density of the bird's population [38, 33]. Under natural conditions specimens of many spices are involved to this competition that certainly increases competition level and aggressive behavior as one of expression of competition [29].

Interspecific aggression has also an important consequence for ecological processes and provides with answers about the reasons of evolutional strategies behavior change. For today, there are still exist difficulties in understanding how exactly the behavior will influence on the structure, functions and stability of the ecosystem, interaction difficulties which exist between species and environment. Information exchange between specimens of the other species in relation to resources is extremely important and its mechanism may have impact to consistent patterns and consequences of species coexistence [21].

For forest and steppe zones of Ukraine breeding is spotted flycatcher (Muscicapa striata) and pied flycatcher (Ficedula hytoleuca) which are under protection of Bonn and Berne conventions and coralled flycatcher (Ficedula albicollis) and red-breasted flycatcher (Ficedula parva)