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Studying Of 2-((5-R-4-R_1-4H-1,2,4-Triazole-3-Yl)Thio)Acetic Acid Salts Influence On Growth And Progress Of Blackberries (*KIOWA Variety*) Propagules.

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ABSTRACT

Blackberry is very useful and promising culture and by the level of taste contains a significant amount of nutrients - vitamins (A, B_1, B_2 B_3 B_5, B_6, B_9, C, E), micronutrients (manganese, iron, zinc, selenium, copper, calcium, potassium, phosphorus, magnesium, sodium) etc. Due to the presence of these components blackberry is actively used in medical practice and it is well-known for its inherent antioxidant, wound healing, anti-inflammatory, diaphoretic, diuretic properties. Despite the fact that blackberry is a fairly hardy culture the need for treatment by active and non-toxic growth stimulators is appropriate. The purpose of this work is to study the impact of 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts on the cuttings growth and development of Kiowa variety blackberries. The objects of our research are 12 substances which are water soluble 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts. In further it was conducted the study of compounds effect on the cuttings growth and development of Kiowa variety blackberries. As the standard of comparison it was used the growth stimulator Charcor®. By the study results it was found that compounds have different impact on cuttings growth and development of Kiowa variety blackberries. It was found that the most active in stimulating growth of blackberry cuttings on the 17th day was the compound PKR-135, and on the 40th day – PKR 144, PKR-145 and DKP-21. As a result of the experiment it was found promising to conduct further research of synthesized substances as growth stimulants and marked patterns of dependence between structure and action could be integrated into future research.

Keywords: 1.2.4- тріазол, growth and progress, blackberries propagules, Kiowa varieties.

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INTRODUCTION

Blackberry is very useful and promising culture [1]. In this way, the leaders of this crop cultivation are North America (over 65 ths. tons, 35 ths. tons of which are grown in the United States), Europe (47 ths. tons of blackberries, including Serbia – 27,5 ths. tons and Hungary - 13 ths. tons). This berry by the level of taste contains a significant amount of nutrients - vitamins (A, B_1, B_2 B_3 B_5, B_6, B_9, C, E), micronutrients (manganese, iron, zinc, selenium, copper, calcium, potassium, phosphorus, magnesium, sodium) etc. [1, 2]. Due to the presence of these components blackberry is actively used in medical practice [3]. So it is well-known for its inherent antioxidant, wound healing, anti-inflammatory, diaphoretic, diuretic properties [4-6]. Despite the fact that blackberry is a fairly hardy culture the need for treatment by active and non-toxic growth stimulators is appropriate [1]. In this aspect there are very interesting and promising Nitrogen-containing heterocycles which are derivatives of the 1,2,4-triazole. Derivatives of this heterocyclic system are actively used in medicine, veterinary and agronomy [7-8]. Despite the previous success in research of growthstimulating activity of the derivatives of 1,2,4-triazoles in cultures of sunflower and wheat [10, 11] the purpose of this work is to study the impact of 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts on the cuttings growth and development of Kiowa variety blackberries.

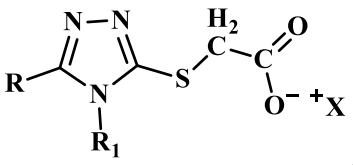
EXPERIMENTAL

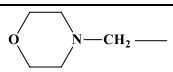
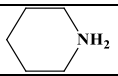
The objects of our research are 12 substances [12, 13] which are water soluble 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts (table1). In further it was conducted the study of compounds effect on the cuttings growth and development of **Kiowa** variety blackberries. As the standard of comparison it was used the growth stimulator Charcor® ("Agrobiotech", Ukraine) [14] at the rate of 1 ampoule per 1 litre of water. Studies of the synthesized compounds were carried out at the Department of plants physiology and introduction of Oles Honchar Dnipropetrovsk National University under the leadership of Doctor of biological Sciences, Professor Yu. V. Lyholat and responsible Candidate of biological Sciences, senior researcher N. O. Hromyh. As the research model object it were selected blackberries of North American **Kiowa** variety which was grown in the University of Arkansas, USA. Parental forms were experimental plants of Arkansas Selection 791 and Arkansas Selection 1058 that stand outby the power and size of the fruit.

Charkor is the rooting stimulator with auxin-cytokinin action developed at the Institute of Bioorganic Chemistry and Petrochemicals of National Academy of Science (NAS) of Ukraine and made by the State enterprise «Interdepartmental Scientific and Technological Center "Agrobiotech"» NAS and Ministry of Education and Science of Ukraine. It is a composition of natural growth regulators and synthetic analogues of phytohormones. Clear, bright yellow water-alcohol solution, the active substance of which is a complex of 2,6-dimethylpyridine-1-oxide from naphthyl acetic acid and Emistim C. It is recommended for acceleration of root creation in green and lignified cuttings, and rooting and survival of fruit seedlings and ornamental trees, shrubs, flowers, medicinal plants.

In the experiment there were used blackberry cuttings 4-5 cm in length with one bud in the upper third of cutting. Cuttings were immersed in aqueous solutions of studied compounds (100 mg/ml) to the level of the bud and kept for 20 hours at room temperature. Control cuttings were kept in distilled water. In further the cuttings were washed with distilled water and planted in containers filled with moist sand that was previously calcined (3 hours at 100 °C). Above the cuttings there was put a wet moss to prevent drying [15-17].

Table 1: Structural formulas of the 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts (1-12)



№	Comound	R	R_1	^+X
1.	PKR-134		$-C_6H_5$	

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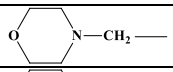
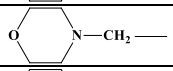
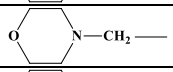
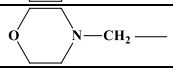
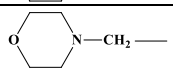
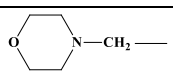
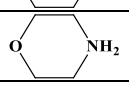
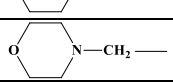
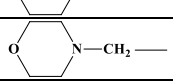
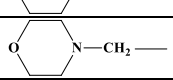
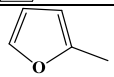
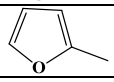
2.	**PKR-135**		$-C_6H_5$	K
3.	**PKR-136**		$-C_6H_5$	Na
4.	**PKR-137**		$-C_6H_5$	NH_3-CH_2-CH_2-OH
5.	**PKR-139**		$-C_6H_5$	NH_4
6.	**PKR-144**		$-C_2H_5$	
7.	**PKR-145**		$-CH_3$	
8.	**PKR-177**		$-NH_2$	NH_4
9.	**PKR-182**		H	NH_4
10.	**PKR-234**		$-NH_2$	NH_3-CH_3
11.	**DKP-21**		$-NH_2$	K
12.	**DKP-22**		$-NH_2$	Na

RESULTS AND DISCUSSION

By the study results it was found that compounds of 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts (1-12) have different impact on cuttings growth and development of **Kiowa** variety blackberries. Observations and measurements were made on 10th, 14th, 17th and 40th day of the experiment. So on the **10th day** after the cuttings planting there were observed the bud swelling and growth of samples, the most intensive were ***PKR-135, PKR-137, PKR-139, PKR-144, DKP-22*** and **Charkor**. On the **14th day** after planting it was observed the appearance of roots in cuttings samples of **PKR-135, 139-PKR, PKR-177, DKP-22, Charkor and distilled water**. On the **17th day** after planting there were root growth, the appearance of roots in cuttings samples of **PKR-144, PKR-145** (table 2).

Table 2: The measurements results of the roots length made at the 17th day of the experiment

№	Substance cipher	The number of roots (on 1 cutting)	The average length of root, mm	% to the control
2	**PKR-135**	7	28,3±9,5	250,4
4	**PKR-137**	3	5,2±1,4	46,0
5	**PKR-139**	3	16,0±6,1	141,6
6	**PKR-144**	2	14,5±0,5	128,3
7	**PKR-145**	4	9,3±5,1	82,3
8	**PKR-177**	5	18,2±2,6	161,1
12	**DKP-22**	7	16,4±6,4	145,1
13	**Charkor**	9	22,0±2,6	194,7
14	**Distilled water**	3	11,3±8,0	-

In the future continuation of the experiment there were planted 4 cuttings for each of the treatment options. At the time of measurement (04.01.2017) the age of seedling was 40 days (table. 3, figure 1, 2).

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Figure1: Image of cuttings samples Kiowa variety blackberry №1-7, 14 made on the 40th day of the experiment.

Figure2: Image of cuttings samples Kiowa variety blackberry №8-14 made on the 40th day of the experiment.

Table 3: The results of the 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts impact to the root cuttings in Kiowa variety blackberry after 40 days of experiment.

№	Substance cipher	Sprouted, only	Length of roots (M±SD)	% to control	Length of shoots (M±SD)	% to control
1	**PKR-134**	3	27,0±9,7	85,7	20,3±1,2	109,7
2	**PKR-135**	4	33,1±10,8	105,1	19,8±8,7	107,0
3	**PKR-136**	4	25,6±7,9	81,3	15,0±4,2	81,1
4	**PKR-137**	4	23,0±11,7	73,0	15,5±5,3	83,8
5	**PKR-139**	4	28,6±12,0	90,8	20,8±6,7	112,4
6	**PKR-144**	4	51,0±11,1	161,9	32,5±12,5	175,7
7	**PKR-145**	4	44,6±9,1	141,6	21,8±3,3	117,8
8	**PKR-177**	3	39,1±12,7	124,1	19,3±9,0	104,3
9	**PKR-182**	4	38,6±12,5	122,5	20,5±7,7	110,8
10	**PKR-234**	3	29,7±8,0	94,3	19,0±1,0	102,7
11	**DKP-21**	2	43,2±12,1	137,1	21,5±7,8	116,2
12	**DKP-22**	3	38,6±8,5	122,5	27,0±4,0	146,0
13	**«Charkor»**	1	34,1±12,2	108,3	shoot dried up	-
14	**Distilled water**	4	31,5±12,7	-	18,5±6,3	-

According to the study (table 3) it should be noted the compound PKR-135 (potassium 2-((5-(morpholinomethyl)-4-phenyl-4H-1,2,4-triazole-3-yl)thio)acetate) which has the most pronounced effect on the cuttings root length of blackberries. And on the seventeenth day of the experiment this figure exceeded the result of Charkor at 55,7%. It was noted that further replacement of potassium cation (PKR-135) with organic cations - monoetanolammonium (PKR-137) and piperidine (PKR-134) and with the inorganic - sodium (PKR-136) and ammonium (PKR-139) significantly reduces stimulating growth impact of compounds. Analyzing the data of the experiment it should be noted the substance PKR-144 (morpholinium 2-((4-ethyl-5-(morpholinomethyl)-4H-1,2,4-triazole-3-yl)thio)acetate). So on the 40th day of the experiment the blackberries length of roots and shoots after treatment exceeded the control at 61,9 and 75,7% respectively. It should be noted that replacing of ethyl group (PKR-144) on methyl (PKR-145) at the N_4 atom nucleus of 1,2,4-triazole leads to the reduction in the growth of roots and shoots of blackberries. It is interesting to note the fact that the appearance of free amino groups in the molecules of 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salts has different influences on blackberry root cuttings performance. In this way the replacement of the phenyl radical (PKR-139) on free $–NH_2$ group at the N_4 nitrogen atom of the 1,2,4-triazole ring increases the length of the roots to the level of 124,1%, while the length of shoots decreased at 8,1% respectively. Also there is the influence of substituents on the carbon atom C_5 of tryazole cycle. Thus the replacement of morpholinomethyl radical (PKR-135, PKR-136) to furan nucleus (DKP-21, DKP-22) slightly improves the length of roots and shoots of blackberry cuttings and it exceeded the results of Charkor.

CONCLUSION

- It was conducted the study of 2-((5-R-4-R_1-4H-1,2,4-triazole-3-yl)thio)acetic acid salt influence on the cuttings growth and development of Kiowa variety blackberries in the laboratory.
- It was found that the most active in stimulating growth of blackberry cuttings on the 17th day was the compound PKR-135, and on the 40th day – PKR 144, PKR-145 and DKP-21.
- As a result of the experiment it was found promising to conduct further research of synthesized substances as growth stimulants and marked patterns of dependence between structure and action could be integrated into future research.

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