STUDYING THE INFLUENCE OF 2-((4-R-3-(MORFOLINOMETHYLEN)-4H-1,2,4-TRIAZOLE-5-YL)THIO)ACETIC ACID SALTS ON GROWTH AND PROGRESS OF CORN SPROUTS

Topicality. Agricultural industry urgently requires new and effective growth stimulating remedies. 1,2,4-triazole derivatives have had exhibited themselves as active fungicides and growth stimulators and the salts of 2-(4-R-3-R-1,2,4-triazole-5-ylthio)acetic acid are quite promising in this aspect.

Aim. To determine the impact on quality indicators of Galatea hybrid corn sprouts germination after the processing with solutions of 2-(4-R-3-(morfolinomethylen)-4H-1,2,4-triazole-5-ylthio) acetic acid salts. Further it was studied the impact of these compounds on the performance and germination of the “Galatea” hybrid corn seed in 2016 harvest. We have used auxin as the study comparison and distilled water was used as a control.

Results and discussion. The study had found that these compounds could differently influence on the growth and development of corn sprouts. It was mentioned that on the growth stimulating activity intensiveness can influence the replacement of amino group at the N4 nitrogen atom of 1,2,4-triazole cycle and the type of cation which is combined with acids.

Conclusions. In the result of our experiment it was determined the prospects of future investigations of synthesized compounds as a growth stimulators and noted appropriateness of “structure-action” dependences could be integrated into future research.

Key words: 1,2,4-triazole; corn sprouts; Galatea hybrid

R. O. Shcherbina, O. I. Panasenko, Ye. H. Knysh, N. A. Khromykh, Yu. V. Lykholat

1 Zaporizhzhya State Medical University
2 Dnipropetrovsk national university Oles Honchar

UDC 547.792'292-38:631.811.98:631.547.1/.2:633.15-047.37 DOI: 10.24959/ubphj.17.93
INTRODUCTION

Agricultural industry urgently requires new and effective growth stimulating remedies. These agents usually are natural or synthetic organic or inorganic compounds that in small concentrations can influence on the energy and speed of sprouts germination, length and weight of stems, germination which in turn affects the growth and development of plants helping to increase their productivity [1, 2]. As growth stimulating substances for cereals and crops there are widely used numerous biologically active compounds from different classes. 1,2,4-triazole derivatives have had to exhibited themselves as active fungicides and growth stimulators (tryadimefon, cyproconazol, propiconazol, penconazol, difenoconazol, tebuconazol, epoxyconazol etc.) [2-4]. Quite promising in this regard are the salts of 2-(4-R-3-(morfolinomethylen)-1,2,4-triazole-5-ylthio) acetic acid [5]. Thus our previous research experience along with labeled features the salts of 2-(4-R-3-(R1)-1,2,4-triazole-5-ylthio)acetic acid do not show high acute toxicity and are not accumulating in humans and animals organisms [2-4, 8].

The aim of these studies was to determine the impact on quality indicators of Galatea hybrid corn sprouts germination after the processing with solutions of 2-((4-R-3-(morfolinomethylen)-4H-1,2,4-triazole-5-yl)thio) acetic acid [5]. Thus in the result of the study we have marked compounds which are odorless, soluble in water and organic solvents (Fig.). Research of growth stimulating activity was conducted at the Department of Physiology and Plant Introduction of Oles’ Honchar Dnipro-Petrovsk National University under the direction of Doctor of Biological Sciences, Professor V. Lykholat and research staffer N. A. Khromykh.

Further it was studied the impact of these compounds on the performance and germination of the “Galatea” hybrid corn seed in 2016 harvest. For this study it was randomly counted 4 samples by 50 seeds and kept in a 0.01 % aqueous solution of these compounds for 6 hours. Then the seeds were washed three times with distilled water and then uniformly placed on moist filter paper in Petri dishes which were placed in a thermostatted cabinet in compliance with the temperature conditions of 20 ± 2 °C throughout the study period.

From the second day of the experiment we have counted the sprouted seeds referring to the fine grains those sprouts that have developed embryonic root not less than the length of a grain and formed germ which has at least half length of the seed. Sprouted seeds were placed in the box with filter paper are placed in cups of distilled water and kept in a thermostatically controlled cabinet.

The germination energy was calculated as a percentage of sprouted seeds on the third day of the experiment, seed germination was calculated on the seventh day.

Germination speed was calculated as the conventional index which indicates the number of days required for germination of 1 seed [1, 9]. As the study comparison we have used β-indolyl acetic acid (Auxin) and distilled water was used as a control.

RESULTS AND DISCUSSION

The study had found that the 2-((4-R-3-(morfolinomethylen)-4H-1,2,4-triazole-5-yl)thio) acetic acid salts in different ways can influence on the growth and development of Galatea hybrid corn sprouts (Table). It was noted that on the intensity of the growth stimulating activity can affect substituted at N4 nitrogen atom of 1,2,4-triazole cycle and the nature of the cation which is bound with 2-((4-R-3-(morfolinomethylen)-4H-1,2,4-triazole-5-yl)thio) acetic acid.

Thus in the result of the study we have marked compounds PKR-135, PKR-136 and PKR-177 which are virtually by all indicators of the growth stimulating activity excess comparison standard auxin. In the study of growth
stimulating activity it was found that the salts of 2-[((4-R-3-(morfolinomethylen)-4H-1,2,4-triazole-5-yl)thio)acetic acid with inorganic cations have more pronounced impact on germination indicators quality. Thus the replacement of ammonium cation (PKR-234) into organic methyl ammonium cation (PKR-234) as a replacement of PKR-177 into organic acetic acid with inorganic cations have more pronounced stimulating activity on germination indicators quality. Thus the replacement of ammonium cation (PKR-177) into organic methyl ammonium cation (PKR-234) as a replacement of free amino group at the N4 nitrogen atom of 1,2,4-triazole PKR-234 methyl ammonium cation (PKR-177) into phenyl radical (PKR-139) and sodium (PKR-136) cations in the molecule of 2-((4-phenyl-3-(morfolinomethylen)-4H-1,2,4-triazole-5-yl)thio) acetic acid significantly improves the speed of germination and sprouting speed of corn. Interesting fact is that the introduction of piperydin cation (PKR-134) in the molecule leads to a significant increase of germination energy to the level of 50.4 % that exceeds the standard auxin at 7.2 % respectively (Table).

### CONCLUSIONS

1. We have conducted the studying of influence of 2-((4-R-3-(morfolinomethylen)-4H-1,2,4-triazole-5-yl)thio)acetic acid salts on the growth and development of corn sprouts (Galatea hybrid) in laboratory conditions.

2. It was established that at the most significant growth stimulating activity in corn sprouts showed inorganic salts (sodium PKR-136, potassium PKR-135 and ammionium PKR-177) of 2-((4-R-3-(morfolinomethylen)-4H-1,2,4-triazole-5-yl)thio) acetic acid.

3. In the result of our experiment it was determined the prospects of further investigations of synthesized compounds as a growth stimulators and noted appropriateness of "structure-action" dependences could be integrated into future research.

### Conflicts of Interest: authors have no conflict of interest to declare.

### REFERENCES

1. Шишов, А. Д. Определение ростстимулирующих концентраций новых регуляторов роста и индукторов устойчивости растений / А. Д. Шишов, Г. Л. Матевосян // Фундаментальные исследования. - 2005. - № 9. - С. 46-47.

2. Щербина, Р. О. Анализ фармакологической активности походных 1,2,4-триазолу / Р. О. Щербина // Фармация, часопис. – 2014. – № 4. – С. 145-150.

3. Біологічні властивості сполук, що утворені поєднанням 1,2,4-триазолу, фурану та інших функціональних замісників / Д. М. Даниленко, В. В. Парченко, О. І. Панасенко, Є. Г. Книш // Актуальні питання фармац. і мед. науки та практики. – 2015. – № 3. – С. 93-97.

4. Парченко, В. В. Нові S-похідні 1,2,4-триазолу як потенційні оригінальні вітчизняні ветеринарні лікарські засоби / В. В. Парченко, О. І. Панасенко, Є. Г. Книш // Актуальні питання фармац. і мед. науки та практики. – 2015. – № 3. – С. 93-97.

5. Щербина, Р. О. Аналіз фармакологічної активності похідних 1,2,4-триазолу / Р. О. Щербина // Фармац. часопис. – 2014. – № 4. – С. 145-150.

6. Шишов, А. Д. Определение ростстимулирующих концентраций новых регуляторов роста и индукторов устойчивости растений / А. Д. Шишов, Г. Л. Матевосян // Фундаментальные исследования. - 2005. - № 9. - С. 46-47.

7. Щербина, Р. О. Анализ фармакологической активности походных 1,2,4-триазолу / Р. О. Щербина // Фармация, часопис. – 2014. – № 4. – С. 145-150.

8. Біологічні властивості сполук, що утворені поєднанням 1,2,4-триазолу, фурану та інших функціональних замісників / Д. М. Даниленко, В. В. Парченко, О. І. Панасенко, Є. Г. Книш // Актуальні питання фармац. і мед. науки та практики. – 2015. – № 3. – С. 93-97.

9. Дослідження рістстимулюючої активності походних 1,2,4-триазолу на прикладі насіння зоніонка простого / І. І. Аксінова, Р. О. Щербина, О. І. Панасенко та ін. // УФЭФК. – 2014. – № 6. – С. 78-82.

10. Шишов, А. Д. Определение ростстимулирующих концентраций новых регуляторов роста и индукторов устойчивости растений / А. Д. Шишов, Г. Л. Матевосян // Фундаментальные исследования. - 2005. - № 9. - С. 46-47.

11. Щербина, Р. О. Анализ фармакологической активности походных 1,2,4-триазолу / Р. О. Щербина // Фармация, часопис. – 2014. – № 4. – С. 145-150.

12. Біологічні властивості сполук, що утворені поєднанням 1,2,4-триазолу, фурану та інших функціональних замісників / Д. М. Даниленко, В. В. Парченко, О. І. Панасенко, Є. Г. Книш // Актуальні питання фармац. і мед. науки та практики. – 2015. – № 3. – С. 93-97.
REFERENCES

1. Shchykov, A. D., Matvevsian, L. I. (2005). Fundamentalnyie isledovaniia – Basic Research, 9, 46–47.
2. Shcherbyna, R. O. (2014). Farmatseyaftchnyi chasopys – Pharmaceutical review, 4, 145–150.
3. Danilenko, D., Parchenko, V., Panasenko, O., Knysh, Y. (2015). Biological properties of the compounds formed by the combination of the 1,2,4-triazoles, furans and other functional substitutes. Current Issues In Pharmacy And Medicine: Science And Practice, 3 (19), 93–97. doi: 10.14739/2409-0541.2015.3.52627.
4. Parchenko, V. V. (2012). Farmatseyaftchnyi Zhurnal – Pharmaceutical journal, 3, 43–48.
5. Aksonova, I. I., Shcherbyna, R. O., Panasenko, O. I., Knysh, Y. H., Aksonov, I. V. (2014). Ukrainskyi biofarmatseyaftchnyi zhurnal. – Ukraininian biofarmaceutical journal, 6, 76–82.
6. Knysh, Y. H., Panasenko, O. I., Shcherbyna, R. O., Aksonova, I. I., Aksonov, I. V. (2014). Soli S-polishidrykh 1,2,4–tryazol, zhcho stimuluiut rist nasinnia soniashnyku [Salts of S-1,2,4-triazole derivatives that stimulate the growth of sunflower]. Patent 109099 Ukraine C 07 D 249/00, C 07 D 249/12, C 07 D 413/06, A 01 N 43/653; declared 27.10.2014; published 10.07.2015, № 13.
7. Knysh, Y. H., Panasenko, O. I., Safonov, A. A., Kravchenko, T. V., Susak, O. A., Danilenko, D. M. (2016). Polishidni 1,2,4–tryazol, zhcho stimuluiut rist soniashnyku [1,2,4-Triazole derivatives that stimulate the growth of sunflower]. Patent 110453 Ukraine A 61 K 31/00 C 07 D 249/00; declared 05.04.2016; published 10.10.2016, № 19.
8. Rakesh, K., Mehd, S. Y., Saurabh, C., Atul, S. (2013). Triazole as Pharmaceuticals Potentials. International Journal of PharmTech Research, 5 (4), 1844–1869.
9. Seeds of agricultural crops. Methods for determining the quality. Section 2.2. Methods of analysis of seed germination and vigor. (2003). HOST 4138–2002 from 2003. Kyiv: Derzhspozhyvchstandart–Ukraine.