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Effect of bridging groups in phenyl derivatives of benzotriazole on genotoxicity for *Allium fistulosum* L.

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Abstract

1*H*-Benzylbenzotriazole and 1-(phenylsulfonyl)-1*H*-benzotriazole differ only in the nature of the functional group connecting the benzotriazole with the phenyl fragment. When we studying the genotoxicity of the compounds, we used their alcohol solutions at concentrations of 0.1 mg/ml and 0.0001 mg/ml. Served as control seeds of *Allium fistulosum L.*, germinated in 0.5% isopropyl alcohol. As a test object, we chose the "Aprelsky" variety, which is characterized by high germination, resistance to temperature fluctuations. The seeds were germinated for 5 days in a thermostat at a temperature of +22 °C. On the last day of the experiment, measurements of root length and germination of seeds were made, according to which toxicity was assessed. On crushed preparations prepared by the standard method and stained with acetocarmine, the effect of the compounds on the proliferative activity of the cells of the root meristem in the experiment and control, the mitosis-modifying effect of 1*H*-benzylbenzotriazole and 1-(phenylsulfonyl)-1*H*-benzotriazole, as well as their ability to induce chromosomal aberrations in cells was calculated root meristem. Evaluating seed germination and root length in the experiment and control, we found that both compounds are significantly toxic to *Allium fistulosum* L. At the same time, with an increase in the concentration of compounds, their inhibiting properties decreased. 1-(Phenylsulfonyl)-1*H*-benzotriazole had the maximum toxicity at a concentration of 0.001 mg/ml. The study of the effect of the compounds on the value of the mitotic index revealed a significant effect of 1*H*-benzylbenzotriazole. The mitosis-modifying effect of both compounds manifested itself in stopping cell division at the prophase stage. However, the size of prophase blocks was significantly higher in 1*H*-benzylbenzotriazole. The method of anatelophase analysis showed that both compounds showed mutagenicity, causing significantly more chromosomal

aberrations than in the control. The number of aberrant anatelophases did not depend on the concentration; however, 1*H*-benzylbenzotriazole exhibited greater mutagenicity than 1-(phenylsulfonyl)-1*H*-benzotriazole. The reason for the differences in the biological activity of the compounds and the observed paradoxical responses are discussed.

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References

[1] M.C. Becerra, N. Guinazu, L.Y. Hergert, A. Pellegrini, M.R. Mazzieri, S. Gea, I. Albesa. *In vitro* activity of *N*-benzenesulfonyl benzotriazole on Trypanosoma cruzi epimastigote and trypomastigote forms. *Exp. Parasitol.* **2012**. Vol.131. P.57-62. DOI: 10.1016/j.exppara.2012.02.028

[2] H. Nagayoshi, K. Kakimoto, S. Takagi, Y. Konishi, K. Kajimura, T. Matsuda. Benzotriazole ultraviolet stabilizers show potent activities as human aryl hydrocarbon receptor ligands. *Environ. Sci. Technol.* **2014**. Vol.49. P.578-587. DOI: 10.1021/es503926w

[3] S.A. Dzhabieva, D.B. Tagiev, N.A. Zeinalov, and S.V. Kurbatova. Thermodynamics of benzotriazole derivatives sorption from water-organic eluents. *Butlerov Communications.* **2018**. Vol.56. No.12. P.1-9. DOI: 10.37952/ROI-jbc-01/18-56-12-1 (Russian)

[4] A. Seeland, M. Oetken, A. Kiss et al. Acute and chronic toxicity of benzotriazoles to aquatic organisms. *Environ. Sci. Pollut. Res.* **2012.** Vol.19. P.1781-1790. DOI: 10.1007/s11356-011-0705z

[5] V. Beltoft, E. Nielsen, O. Ladefoged. Evaluation of health hazards and proposal of health based quality criteria for soil and drinking water. *Environmental Project.* **2013**. Vol.1526. 28p.

[6] P. Borowski, J. Deinert, S. Schalinski et al. Halogenated benzimidazoles and benzotriazoles as inhibitors of the NTPase helicase activities of hepatitis C and related viruses. *Eur. J. Biochem.* **2003**. Vol.270. P.1125-1653. DOI: 10.1046/j.1432-1033.2003.03540.x

[7] F. Sparatore, M. I. La Rotonda, E. Ramundo et al. Effect of benzotriazole derivatives on plant growth. *J. Farmaco; Edizione Scientifica*. **1978**. Vol.33. P.924-944.

[8] E.S. Selezneva, E.A. Valieva, E.I. Ten'gaev. The role of xenobiotic structure in the development of a biological response on the example of benzotriazole derivatives. *SamSU Bulletin – Natural Science Series*. **2012**. No.3/1(94). P.219-225. (Russian)

[9] P.R. Ortiz de Montellano, B.A. Mico, J.M. Mathews, K.L. Kunze, G.T. Miwa, A.Y. Lu. Selective inactivation of cytochrome P-450 isozymes by suicide. *Archives of Biochemistry and Biophysics*. **1981**. Vol.210. No.2. P.717-728. DOI: 10.1016/0003-9861(81)90239-3

[10] Guidelines for short-term tests for the detection of mutagenic and carcinogenic chemicals. *Hygienic criteria for the state of the environment. World Health Organization. Geneva*. **1989**. No.51. 212p.

[11] G.F. Lakin. Biometrics. *Moscow: Higher School*. **1990**. 352p. (Russian)

[12] E.B. Burlakova, A.A. Konradov, E.L. Maltseva. The action of ultra-low doses of biologically active substances and low-intensity physical factors. Regulation problems in biological systems; under total. ed. A.B. Rubin. *Moscow: Izhevsk. Research Center "Regular and Chaotic Dynamics"*. **2006**. 480p. (Russian)

[13] A.S. Davydov. Biology and Quantum Mechanics. *Kiev: Naukova Dumka.* **1979**. 296p.

[14] S.A. Gostimsky. Workshop on cytogenetics. *Moscow: Moscow State University*. **1974**. 47p. (Russian)

[15] I.A. Alov, A.I. Braude, M.E. Aspiz. Fundamentals of functional cell morphology, ed. prof. Alova I.A. 2nd ed. *Moscow: Medicine.* **1969**. 343p. (Russian)

[16] L.D. Prusakova, V.I. Kefeli, S.L. Belopukhov. The role of phenolic compounds in plants. *Agrochemistry.* **2008**. No.7. P.86-96. (Russian)
[17] Zoya P. Belousova, Ekaterina S. Selezneva, Veronika A. Ilyina. Effect of bridging groups in phenyl derivatives of benzotriazole on genotoxicity for *Allium fistulosum* L. *Butlerov Communications.* **2021**. Vol.67. No.7. P.99-104. DOI: 10.37952/ROI-jbc-01/21-67-7-99 (Russian)