IDENTIFICATION OF CYTO- AND GENOTOXIC EFFECTS OF LUNULARIC ACID IN *ALLIUM CEPA* L. ROOT TIP MERISTEM CELLS

D. ÇAVUŞOĞLU [1*], K. ÇAVUŞOĞLU [2], K. ÇAVUŞOĞLU [3], E. YALÇIN [3]

[1] Isparta University of Applied Sciences, Atabey Vocational High School, Department of Plant and Animal Production, 32670, Isparta-Turkiye
[2] Süleyman Demirel University, Faculty of Engineering and Natural Sciences, Department of Biology, 32260, Isparta-Turkiye
[3] Giresun University, Faculty of Arts and Sciences, Department of Biology, 28200, Giresun-Turkiye

E-mail: cavusoglu.dilek@gmail.com*, kursatcavusoglu@sdu.edu.tr, kultigin.cavusoglu@giresun.edu.tr, emine.yalcin@giresun.edu.tr

In this study, dose-dependent effects of lunularic acid (LA) on some physiological, cytogenetic, biochemical and anatomical parameters were investigated in Allium cepa L. bulbs. For this purpose, physiological parameters to be analyzed experimentally: germination percentage, root length, root number and fresh weight; cytogenetic parameters: micronucleus (MN) frequency, chromosomal aberrations (CAs) and mitotic index (MI); biochemical parameters were determined as catalase (CAT), superoxide dismutase (SOD) activities, malondialdehyde (MDA) level and free proline (Pr) content. In addition, cross-sections were taken from the roots and structural changes in meristem cells were examined. Onion bulbs were divided into four groups as one control and three treatments. The bulbs of the control group were kept in cuvettes containing tap water and the bulbs of the treatment group were kept in cuvettes containing 1 mM, 5 mM and 10 mM LA for 7 days. LA administrations caused a decrease in all investigated physiological parameter values, an increase in the frequency of MN and CAs, and reduce in MI compared to control group. In addition, LA application caused dose-related increases in CAT and SOD activities and MDA and Pr levels compared to control group. LA application promoted CAs such as sticky chromosome, spindle fiber damage, vagrant chromosome, reverse polarization in root meristem cells. After all LA applications, root anatomical structure changes such as epidermis cell deformations, flattened cell nucleus and unclear transmission tissue were observed and it was determined that these changes reached a maximum at 10 mM LA dose. As a result, it has been understood that high doses of LA promote multi-directional toxicity and the Allium test is a very reliable test in determining this toxicity.

Key words: *Allium cepa, Antioxidant defense system, Bulb germination, Genotoxicity, Lunularic acid, Meristematic cell damage.*

ВИЗНАЧЕННЯ ЦИТО- І ГЕНОТОКСИЧНОГО ВПЛИВУ ЛУНУЛЯРОВОЇ КИСЛОТИ В КЛІТИНАХ КОРЕНЕВОЇ ВЕРХІВКОВОЇ МЕРИСТЕМИ *ALLIUM CEPA* L.

У цьому дослідженні було вивчено дозозалежний вплив лунулярової кислоти (LA) на деякі фізіологічні, цитогенетичні, біохімічні та анатомічні параметри цибулин *Allium cepa* L. Експериментальним шляхом було проаналізовано такі фізіологічні параметри: відсоток проростання, довжина кореня, кількість коренів та свіжа маса; цитогенетичні параметри: частота мікроядер (MN), хромосомні аберації (CA) та мітотичний індекс (MI); біохімічні параметри визначали як рівні активності каталази (CAT), супероксиддисмутази (SOD), малондіальдегіду (MDA) та вміст вільного проліну (Pr). Крім того, було зроблено поперечні розрізи коренів і вивчено структурні зміни в клітинах меристеми. Цибулини розділили на чотири групи – контрольну та три групи для обробки. Цибулини з контрольної групи зберігали в кюветах, які містили водопровідну воду, цибулини груп обробки зберігали в кюветах, які містили 1 мМ, 5 мМ та 10 мМ LA, протягом 7 днів. Використання LA спричинило зниження всіх показників досліджуваних параметрів, збільшення частоти MN та CA і зниження мітотичного індексу порівняно з контрольною групою. Крім того, застосування LA спричинило дозозалежні підвищення активності CAT і SOD та рівнів MDA і Pr порівняно з контрольною групою. Застосування LA сприяло розвитку таких хромосомних аберацій, як «липка» хромосома, пошкодження ниток веретена, вагрантна хромосома, зворотна поляризація в клітинах кореневої меристеми. Після застосування LA спостерігали такі зміни анатомічної структури кореня, як деформація клітин епідермісу, сплюснуте ядро клітини та нечітка трансмісійна тканина; було встановлено, що ці зміни досягали свого максимуму при дозуванні LA в 10 мМ. Було визначено, що високі дози LA сприяють виникненню токсичності мультинаправленої дії і тест з використанням *Allium* дуже надійно визначає її токсичність.

Ключові слова: *Allium cepa*, система антиоксидантного захисту, проростання цибулин, генотоксичність, лунулярова кислота, пошкодження клітин меристеми.

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