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ASSESSMENT OF HEAVY METAL TOLERANCE IN APRICOT VARIETIES GROWING ALONG HIGHWAYS IN THE TASHKENT REGION AND SELECTION OF RESISTANT VARIETIES

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Annotation: *This study investigates the accumulation of heavy metals, particularly lead ionium and cadmium ionium, in apricot varieties growing along highways in the Tashkent region and evaluates their physiological and biochemical tolerance levels. The research assessed the degree of metal absorption in leaves and fruits, as well as stress-related biochemical markers such as chlorophyll content and antioxidant activity. The results revealed several apricot genotypes with high resistance and low metal accumulation ability. The study provides a scientific basis for developing efficient selection and breeding strategies to obtain metal-tolerant and environmentally safe apricot varieties, which play an important role in ensuring food safety and promoting sustainable agricultural production in ecologically stressed regions.*

Key words: *apricot, heavy metals, tolerance, selection, food safety, Tashkent region.*

Introduction. Food safety and environmental sustainability have become key priorities in modern agriculture, especially in regions exposed to anthropogenic pollution. One of the critical environmental challenges is the accumulation of heavy metals such as lead (Pb) and cadmium (Cd) in agricultural soils and crops near highways and industrial areas. These metals enter the soil–plant system through vehicle emissions, industrial waste, and contaminated irrigation water. Once absorbed by plants, they can accumulate in edible parts, posing serious risks to human health through the food chain. Apricot (*Prunus armeniaca L.*), one of the most widely cultivated fruit crops in Uzbekistan, is highly valued for its nutritional and economic importance. However, apricot trees growing near busy highways are vulnerable to environmental contamination, which affects not only fruit quality but also the safety of food products.

In the Tashkent region, rapid urbanization and increased traffic density have intensified the deposition of heavy metals in agricultural areas. Heavy metals such as Pb and Cd are non-biodegradable and can persist in the soil for decades, gradually accumulating in plants. Long-term exposure to these metals leads to physiological stress in plants, resulting in reduced photosynthesis, altered enzyme activity, and impaired fruit development. Therefore, assessing the heavy metal

content in apricot fruits and identifying tolerant genotypes is of great scientific and practical importance. The study of physiological and biochemical responses of apricot plants under metal stress helps determine the mechanisms of resistance and supports the development of eco-safe and high-yielding varieties.

Modern plant selection (breeding) programs increasingly focus on creating varieties resistant to environmental stress factors, including heavy metals. Such an approach ensures the production of safe and high-quality fruits while maintaining ecological balance. Selection of tolerant genotypes requires detailed analysis of the plants’ physiological, biochemical, and morphological traits. In this study, several apricot varieties growing along highways in the Tashkent region were examined to evaluate their heavy metal accumulation potential and tolerance levels [1-5].

The outcomes of this study are expected to contribute to the improvement of environmental monitoring systems, support food safety initiatives, and provide a foundation for the breeding of ecologically stable apricot varieties. Furthermore, identifying low-accumulating genotypes will help minimize the entry of toxic elements into the human diet and promote the cultivation of apricot varieties that are both productive and environmentally safe.

Results and discussion. The study revealed notable differences in the accumulation of heavy metals (Pb and Cd) among apricot varieties collected from different environmental zones in the Tashkent region. Apricot fruits and leaves sampled from trees growing along busy highways (Yangi Hayot and Zangiota) contained significantly higher concentrations of heavy metals compared to samples from semi-urban (Chirchiq) and rural control (Kibray) areas. These differences were statistically significant ($p < 0.05$) and demonstrated a clear correlation between environmental pollution intensity and metal accumulation levels.

Apricot fruits collected from highway-adjacent zones contained up to 2.15 mg/kg of Pb and 0.41 mg/kg of Cd, while those from rural control sites contained only 0.58 mg/kg of Pb and 0.09 mg/kg of Cd. Similar trends were observed in leaf samples, confirming that atmospheric deposition and soil contamination from vehicle emissions are major sources of heavy metals.

Biochemical analyses revealed significant alterations in the physiological status of plants exposed to heavy metal stress. Chlorophyll *a* and *b* contents decreased by 20–35% in samples from polluted zones, indicating the inhibition of photosynthetic activity. In contrast, total soluble protein and antioxidant enzyme activity (especially catalase and peroxidase) increased, suggesting an adaptive defense mechanism against oxidative stress. Elevated malondialdehyde (MDA) levels (up to 2.4 times higher than control) further confirmed the occurrence of lipid peroxidation caused by Pb and Cd toxicity.

Table 1. Heavy metal content (Pb and Cd) in apricot fruits from different locations of Tashkent region

№	Sampling site (location)	Pb^{2+} (mg/kg)	Cd^{2+} (mg/kg)	Metal accumulation level	Plant response type
1	Highway zone (Yangi Hayot)	2.15	0.41	High	Sensitive
2	Near highway (Zangiota)	1.62	0.28	Moderate	Semi-tolerant
3	Semi-urban (Chirchiq)	1.09	0.19	Low	Tolerant
4	Rural control (Kibray)	0.58	0.09	Very low	Highly tolerant

Summary. The results of the research showed that apricot varieties grown in rural and semi-urban areas of the Tashkent region contained significantly lower levels of lead (Pb) and cadmium (Cd) compared to those cultivated along busy highways. The accumulation of heavy metals was directly related to the proximity of orchards to transport routes and industrial zones.

Based on these findings, tolerant and low-accumulating apricot genotypes were Based on the results, the Kibray and Chirchiq apricot genotypes can be recommended as parental forms in selection programs for developing metal-tolerant and ecologically safe apricot varieties. The integration of biochemical screening and heavy metal analysis provides an effective selection criterion for future breeding efforts aimed at sustainable fruit production and food safety in polluted environments.

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