

PHYTOREMEDIATION POTENTIAL OF MILK THISTLE (*Silybum marianum*) – A SUSTAINABLE APPROACH TO MITIGATE SOIL CONTAMINATION WHILE SUPPORTING PHARMACEUTICAL APPLICATIONS

Ivana Cvetkovikj Karanfilova¹; Jovana Gjorgjievska¹; Marija Todorovska²; Filip Todorov¹; Veronika Stoilkovska Gjorgjievska¹; Marija Karapandzova¹; Mile Markoski²; Gjose Stefkov¹;

¹ Ss. Cyril and Methodius University in Skopje, Faculty of Pharmacy, Str. Mother Theresa 47, 1000 Skopje, Republic of North Macedonia.

² Ss. Cyril and Methodius University in Skopje, Faculty of Agricultural and Food Sciences, st. "16th Macedonian Brigade" No. 3, 1000 Skopje, Republic of North Macedonia

Corresponding author: ivanacvetkovikj@ff.ukim.edu.mk

Milk thistle (*Silybum marianum*) is recognized for its medicinal properties and potential as a phytoremediation agent. [1,2] This study assesses its ability to absorb heavy metals and decontaminate soils while preserving pharmacological efficacy. Soil and plant samples were collected from eight locations in North Macedonia during different vegetative phases. Mechanical and pedological soil analyses were conducted to characterize soil composition, while heavy metal concentrations in soil and plant material were evaluated using ICP-AES. Silymarin content in the plant and seeds was determined via high-performance liquid chromatography (HPLC).

The soils exhibited significant variability in heavy metal content. Lead (Pb) levels ranged from 25 to 107 mg/kg, cadmium (Cd) from 0.1 to 1.3 mg/kg, and zinc (Zn) from 14 to 203 mg/kg. Notably, lead and cadmium levels in plant material were below detection limits, confirming minimal accumulation, whereas zinc levels varied significantly, peaking in urban areas. Silymarin content ranged from 0.02% to 0.16% in plant material, with seeds exhibiting higher concentrations (1.14%), demonstrating the plant's resilience and pharmacological viability in contaminated environments.

These results highlight the adaptability of milk thistle to diverse soil conditions and its capacity to accumulate metals without compromising silymarin production. By combining phytoremediation with medicinal plant cultivation, milk thistle offers a sustainable approach to mitigating soil contamination while supporting pharmaceutical applications. This study provides critical insights for integrating environmental restoration with the production of high-value medicinal plants.

References:

1. Abenavoli L, Capasso R, Milic N, Capasso F. (2010) Milk thistle in liver diseases: past, present, future. *Phytother Res.*1423-32.
2. Violina R. Angelova, Mariana N. Perifanova-Nemska, Luzijan K. Krustev, Galina P. Uzunova (2018) Potential of *Silybum marianum* L. for phytoremediation of soil contaminated with heavy metals. *Journal of International Scientific Publications: Ecology & Safety* 12, 267-282