



Tropentag, September 16-18, 2026, hybrid conference

“Towards multi-functional agro-ecosystems
promoting climate resilient futures”

Salinity stress enhances secondary metabolite production in *Fagonia indica*: insights for climate-resilient medicinal plant resources in dryland ecosystems

MUHAMMAD UZAIR JAVED¹, BILAL HAIDER ABBASI², IVA VIEHMANNNOVA³

¹*Faculty of Tropical Agrisciences, Czech University of Life Sciences, Prague, Department of Crop Sciences and Agroforestry, Czech Republic*

²*Quaid-i-Azam University, Islamabad 45320, Pakistan, Department of Biotechnology,*

³*Faculty of Tropical Agrisciences, Czech University of Life Sciences, Prague, Department of Crop Sciences and Agroforestry,*

Abstract

Climate change and land degradation are accelerating soil salinisation in many arid and semi-arid regions, posing significant challenges for plant productivity and biodiversity in dryland agro-ecosystems. Understanding how stress-adapted plant species respond to saline conditions can provide insights into plant resilience while supporting sustainable utilisation of valuable plant bioresources. *Fagonia indica*, a medicinal plant naturally distributed in dry and saline environments, is known for its diverse pharmacologically active compounds; however, the production of these metabolites often varies depending on environmental conditions. This study investigated the effects of salinity stress on biomass production, antioxidant activity, and secondary metabolite accumulation in *F. indica* using controlled culture systems. Callus cultures were exposed to sodium chloride (NaCl) and sodium carbonate (Na₂CO₃) at concentrations of 1, 10, 50, 100, 250, and 500 mM over a 21-day elicitation period. NaCl at 250 mM significantly enhanced biomass production (54.8 g L⁻¹), total phenolic content (7.56 ± 0.144 μg mg⁻¹), and total flavonoid content (2.24 ± 0.059 μg mg⁻¹). Antioxidant activity was also highest under this treatment, with FRAP and ABTS values of 371.22 ± 9.52 and 422.79 ± 12.44 μmol TEAC mg⁻¹ DW, respectively. HPLC analysis revealed increased accumulation of key metabolites including caffeic acid, nahagenin, and betulinic acid. In contrast, moderate Na₂CO₃ treatments showed notable anti-inflammatory activity through inhibition of COX⁻¹ and LOX enzymes. These results demonstrate that salinity stress can stimulate the biosynthesis of valuable bioactive compounds in *F. indica*. Such findings contribute to understanding plant biochemical responses to environmental stress and highlight the potential of controlled production systems for sustainable metabolite production from climate-resilient medicinal plant species adapted to dryland ecosystems.

Keywords: Climate change adaptation, Dryland ecosystems, Medicinal plants, salinity stress, Secondary metabolites

Contact Address: Muhammad Uzair Javed, Faculty of Tropical Agrisciences, Czech University of Life Sciences, Prague, Department of Crop Sciences and Agroforestry, Kamycka 1281 praha-Suchdol, 16500 Prague, Czech Republic, e-mail: javed@ftz.czu.cz