REVIEW OF DISSERTATION THESIS

Title: Exploring the Potential of *In-vitro* Polyploidization for Genetic Improvement of Medicinal Plants

Study programme: Tropical Agrobiology and Bioresource Management

Author: Rohit Bharati, M.Sc.

Supervisor: Prof. Ing. Eloy Fernández Cusimamani, Ph.D.

Reviewer: Ing. Jana Šedivá, Ph.D., Výzkumný ústav Silva Taroucy pro krajinu a okrasné zahradnictví, Průhonice

Introduction and Objectives

The dissertation thesis focuses on the breeding of four diverse medicinal plants using biotechnological methods, specifically induced polyploidization under *in vitro* conditions. It covers two well-known species, *Mentha spicata* and *Melissa officinalis*, and two lesser-known species, *Callisia fragrans* and *Melothria scabra*. Additionally, the author also examines the economically significant species Vitis.

The dissertation thesis included five objectives: the induction of polyploid genotypes in selected medicinal species and the evaluation of their new morphological, anatomical, biochemical, and physiological properties in comparison with diploid plants, including their genetic stability. For the genus *Vitis*, conditions for inducing chromosome doubling in this species were explored.

Results and Discussion

The dissertation thesis has broad scope. The results section is rich with excellent data showcasing the efficacy of *in vitro* polyploidization across the chosen medicinal plants. The demonstration of significant variations in morphological, biochemical, and physiological characteristics in polyploid plants compared to their progenitors is particularly noteworthy. The discussion integrates these findings with existing literature effectively, highlighting the innovative contributions of the research.

The conclusions drawn from the study are insightful, underscoring the potential of *in vitro* polyploidization in the genetic improvement of medicinal plants. The recommendations for future research, including the exploration of genomic selection integration for breeding, are well-justified.

Comments

I have minimal comments on the work, and they are of a formal nature:

- Page 13: Abstract (in Czech), the omission of italics for *Vitis* spp.
- Page 13, line 16: I would suggest this formulation: *In vitro* polyploidizace vybraných druhů rostlin zahrnovala ošetření nodálních segmentů rostlin různými koncentracemi oryzalinu (1–100 μM), s dobou působení 24 hod nebo 48 hod.
- Page 13, line 23: Indukované polyploidní rostliny vykazovaly významné rozdíly ve srovnání s diploidními genotypy…
- Page 14, line 12: omission of italics for *Taxus brevifolia.*

The overall evaluation of the dissertation work

Rohit Bharati's dissertation is a commendable piece of scholarly work that addresses a pivotal area of plant biotechnology with rigor and innovation. The research holds promise for not only

enhancing the genetic traits of medicinal plants but also for contributing to sustainable agriculture and pharmacology.
The submitted dissertation is a compilation of five articles by the author, focused on topics encompassed by the dissertation's assignment. The high quality of this work is ensured by research publications in professional journals with a high impact factor, which also led to the receipt of two prestigious awards: the Josef Hlávka Award for Outstanding Ph.D. Achievement (2023) and the Rector's Award for Excellence in Publication Output 2023.

The submitted work fully meets the requirements for a dissertation and therefore I recommend the dissertation for defense.

In Průhonice, April 19, 2024.