

Posudek na bakalářskou práci

- školitelský posudek
 oponentský posudek

Jméno posuzovatele: Paolo Bartolić

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Název práce: Polyploidization and hybridization as evolutionary drivers in the *Medicago sativa* group

- Práce je literární rešerší ve smyslu zveřejněných požadavků (pravidel).
 Práce obsahuje navíc i vlastní výsledky.

Cíle práce (předmět rešerše, pracovní hypotéza...)

The objective of this thesis is to synthesize current knowledge on the *M. sativa* species complex, wild relatives of an important forage crop alfalfa, focusing on whole genome duplication and its impact on evolutionary processes. Specifically, to examine the pre- and postzygotic barriers between congeneric species and the genetic differentiation among them. Additionally, trying to identify gaps in the existing research and proposes new directions for future studies to address these gaps.

Struktura (členění) práce:

There are four major sections of the thesis and the literature section.

Introduction is a brief and concise overview of the thesis. The reader is introduced with the topic which is the effect of polyploidy on the evolutionary complex of *M. sativa*.

The second part, titled "POLYPLOIDY IN PLANT EVOLUTION," presents polyploidy in a broader context, addressing various aspects of its role in plant evolution and speciation processes. This section provides all the necessary information for the reader to fully understand the subsequent parts.

The third part titled "MEDICAGO SATIVA COMPLEX" is separated in multiple subsections, all of which go in more detail about a specific part of the topic of this thesis. It starts with taxonomical and morphological overview of the *M. sativa* complex introducing the classification which will be followed since there are different taxonomical interpretations of this relatively complicated group. It follows with distribution, ecology of the taxa, and the pre- and postzygotic reproductive barriers between them. After that, the origin and the evolution of the complex is discussed. This is the part of the thesis which sums up the known research on the speciation and the genetic differentiation of the complex and their hybrids. It is concluded with two subsections on the origin of the tetraploid *M. sativa* and *M. falcata*, as well as the origin and population structure of other complex members and *M. prostrata*.

The fourth part is the conclusion which sums up the previous two sections and highlights the potential avenues of research which are lacking at this moment. Current research gaps include understanding the mechanisms behind triploid seed non-viability, the ecological and genetic factors driving prezygotic reproductive barriers, and the coexistence dynamics of different ploidy levels in natural populations. Additionally, comprehensive molecular analyses and evaluations of less

studied members' ecological preferences and genetic lineages are needed to clarify their roles in the complex's origin and diversification. Addressing these gaps will enhance our understanding of evolutionary processes and inform breeding strategies.

Jsou použité literární zdroje dostatečné a jsou v práci správně citovány?
Použil(a) autor(ka) v rešerši relevantní údaje z literárních zdrojů?

The literary sources are used sufficiently. There are over 70 references to various research articles and books relevant to this topic. There are some minor inconsistencies in the citing.

Pokud práce obsahuje (nadstandardně) i vlastní výsledky, jsou tyto výsledky adekvátním způsobem získány, zhodnoceny a diskutovány?

It doesn't contain any results.

Formální úroveň práce (obrazová dokumentace, grafika, text, jazyková úroveň):

The quality of the thesis is very good. The text is well-written and informative, the command of the English language is good, and the text is supplemented with multiple tables and figures that effectively illustrate key points and enhance understanding.

Minor grammatical mistakes and awkward sentences exist, as well as inconsistencies in the usage of abbreviations. Furthermore, some figures are not completely explained.

Splnění cílů práce a celkové hodnocení:

The objectives outlined in this thesis have been successfully accomplished. This work provides a comprehensive synthesis of the current knowledge on the *M. sativa* species complex, which is essential for understanding the evolutionary dynamics of the important forage crop, alfalfa. The thesis thoroughly examines the role of whole genome duplication and its significant impact on evolutionary processes within this species complex.

A detailed literature review of pre- and postzygotic barriers between congeneric species has been conducted, revealing the intricate genetic mechanisms that contribute to reproductive isolation and speciation. Furthermore, the thesis brings forward current knowledge of genetic differentiation among these species, offering new insights into their evolutionary relationships and divergence.

In addition to summarizing existing research, this thesis identifies several gaps in the current body of knowledge and proposes innovative directions for future studies. These proposed directions are designed to address the identified gaps, ensuring that future research can build upon the findings presented here.

Overall, this thesis achieves its goals by providing a thorough and insightful examination of the *M. sativa* species complex, contributing valuable knowledge to the field of evolutionary biology and agricultural science.

Otázky a připomínky oponenta:

1. Considering that the *M. sativa* complex exhibits a clear triploid block and all the putative gene flow occurs through unreduced gametes, is anything known about the frequency of these gametes?
2. In cases where the triploid block is strong and the production of unreduced gametes is low, what is the biggest problem for the newly formed, fit polyploid? What are some reproductive strategies that plants employ to overcome this challenge?
3. Knowing their respective distributions, how might the overlap of tetraploid *M. falcata* and *M. prostrata* in certain regions influence the evolutionary dynamics between these taxa?
4. In your thesis you mention how "the southern populations adapted to better pollinator attraction by change of yellow flower colour to purple". Could you elaborate on why would that be the case?

Návrh hodnocení školitele nebo oponenta

výborně velmi dobře dobře nevyhověl(a)

Podpis školitele/opponenta:

Instrukce pro vyplnění:

- Prosíme oponenty i školitele o co nejstručnější a nejvýstižnější komentáře k jednotlivým bodům (dodržujte rozsah), tučně vyznačené rubriky jsou povinnou součástí posudku.
- Při posuzování je nutno zohlednit požadavky stanovené pro vypracování bakalářských prací – plná verze viz <https://www.natur.cuni.cz/biologie/studium/2018-pravidla.pdf>
- Posudek **nahrajte do SISu** nejpozději do **28. 5. 2024**. **Podepsaný předejte osobně mně při obhajobě**, nebo před obhajobou dejte do **kastlíku s mým jménem u sekretářky**, nebo pošlete na adresu: Jana Kulichová, Katedra botaniky, UK PŘF, Benátská 2, Praha 2, 128 01.