

## Review of Doctoral Thesis "Orchid Diversity" by Iva Schödelbauerová

The doctoral thesis by Iva Schödelbauerová on orchid diversity is based on five international publications of which one is a submitted manuscript and all others published or accepted papers or chapters in books. To the published material the author has added a general introduction, scope of the thesis, summary of results and discussion, conclusions and conservation implications.

In this general part the author shows that she is skillful in using the main theoretical findings in ecology.

Orchids as the largest plant family with up to 35000 species is quite unevenly distributed throughout the world and many species are rare or threatened. Therefore it serves as a good example for diversity studies.

As the topic of the thesis is really broad the thesis covers some general geographical and local trends of diversity. However, clearly defined objectives of the thesis in the general part would have done reading easier.

### Specific questions:

On page 1 in general introduction you count different factors that determine the number of species. Among them there are factors as available energy and productivity. How they are related?

On page 10 you say that greater population stability should allow narrower niches. Does your *Lepanthes* case study prove that?

On page 13 you state that one orchid individual gives rise to only one offspring individual that achieves reproduction age. From where comes this result?

What about correlation in between biomass and species richness? Do you think it is positive for orchids?

The significant positive correlation of orchid diversity with the size of protected area – isn't it a question of a hen and a chicken? I.e., cannot it also be that the protected areas are established predominantly in the areas of higher diversity?

On page 18 you state that more species are expected to be found in a forest than a meadow at the same latitude. From where have you got this information and do you think it holds?

Epiphytic orchids in paper IV: in Chitwan the epiphytic orchids are not associated with particular species of trees. Lichens are associated with tree groups depending on pH of the bark – some live on deciduous others on coniferous trees - may be you could find something similar here?

On page 23 you speak about predicting population growth rates as far as 13 years ahead, which is about eight times the life span of the species. I guess you meant the life span of individuals?

Still one of the main constraints of our understanding of the diversity patterns is our inadequate knowledge of species distribution. Could contemporary tools as NDVI from satellite images help in that?

Throughout the work the author has demonstrated her ability to exploit contemporary research methods and analyses. All discussion parts are well covered with available literature in the particular field.

It should also be appreciated that in the end of the work the author has outlined more practical tasks and guidelines for conservation.

Reading of the thesis was a difficult but rewarding job as the extensive work is well written and the author deserves PhD in ecology.



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## *Orchid diversity*

This Ph.D. thesis represents very nice contribution to the field of determinants of orchid species richness on the global scale, evaluating factors such as area of the country or size of protected areas within the country, available energy presented as normalized difference vegetation index, latitude or metapopulation interactions within a species. The thesis is based on five scientific papers, from which one (Paper III) was already published as a book chapter in *Scaling Biodiversity* (Cambridge University Press), another one (Paper IV) is accepted for a book *Himalayan Biodiversity* (Springer). Three papers were submitted to scientific journals, Paper I already appeared in *Lankesteriana*, Paper II is in press in *Biological Conservation* (IF 3.56) and Paper V is still under evaluation in *Biodiversity and Conservation*. These papers are in the thesis supplemented with chapters as General Introduction, General Conclusions or Conservation Implications, which altogether create highly readable text.

Despite the undoubtedly excellent grade of this thesis, I have some comments to Iva; I suppose she will respond to them.

- The title of the thesis is too simplified, a more descriptive would be better, I think. There are many aspects from which orchids are a plant group featuring a unique diversity, e.g. flowers morphology, types of fertilization, outcome of mycorrhizal symbiosis and corresponding gain of carbon compounds. Could Iva give us an alternative title of her thesis?
- In the key article of the thesis the authors claim an idea which is expressed in the title of the article: *Size of protected areas is the main determinant of species diversity in orchids*. I think that the dependent and independent variable (determinant) in this case should be arranged vice versa, i.e. the independent variable in this case should be orchid species richness and the size of protected areas is dependent on it. My substantiation is simple: national authorities have to create protected areas in order to save the biodiversity and thus also the orchids. The higher orchid species richness, the more protected areas they have to declare. If there is low orchid species richness, lower count of restricted areas is needed. Please, could Iva discuss these two opinions?
- In the same paper, the authors discuss the lack of the correlation described above as at least partial result of the fact that “many European orchids thrive in unprotected agricultural meadows and are maintained by regular moving”. As I am not familiar with mechanisms of orchid protection across Europe, I will ask the situation in the Czech Republic specifically. Does Iva know the manner our local authorities contribute to the maintenance of orchid populations on these agricultural, regularly moved meadows?

Finally, I state that the dissertation of Iva Schödelbauerová meets all the prerequisites and I recommend it for defense.



18th June 2009

## **Review of the PhD Thesis “Orchid diversity” by Mgr. Iva Schödelbauerová, submitted to the Faculty of Sciences, University of South Bohemia**

During the last decade, the study of biodiversity has become a priority for the scientific community in the context of a rapidly changing world climate. Accurate records of present biodiversity, together with understanding the factors influencing its dynamics are expected to indicate how the living world will be affected by climate change, habitat fragmentation and other effects of over-increasing of human population. The PhD thesis of Mgr. Schödelbauerová integrates very well in this timely context: the Orchidaceae family is a prime candidate for such studies, given that (i) it is arguably the second-largest extant plant family, (ii) its main distribution range coincides with areas potentially most threatened by climate change, and (iii) many of its species are locally distributed and generally rare.

The PhD thesis includes a general introduction, a summary, conclusions and conservation implications and it is based on five papers, at present in various stages in the publication process. The structure of the PhD thesis as papers published in journals and books is very positive, ensuring an easy, effective and fast dissemination of the results. Paper I and II analyze the relationship between species richness and (i) area (as total area, but also as size of protected areas), (ii) energy available and (iii) latitude. These papers show that latitude influences species richness more than the energy available to an assemblage and that orchid biodiversity significantly decreases with increasing latitude. Further, size of area considered when studying orchid species richness is an important predictor in most cases, and the size of protected areas for a region influences directly biodiversity.



Paper III discusses inverse latitudinal gradient in species diversity, but, even if it is still investigating living biodiversity, it is arguable if it is cohesive enough with the rest of the PhD Thesis. The fourth paper is an interesting case study of orchid diversity in the lowlands of Nepal. The main conclusion of the latter study indicates that epiphytic orchids in the analyzed area are not associated with particular species of trees.

In the fifth paper, the authors undertake a difficult task of making a long-term prediction of the growth rate of *Lepanthes rubripetala* populations, and test their prediction using demographic data over a 13 years period. The predictive model proves to be successful and it is potentially useful for exploring the effects of new management regimes.

Therefore, the PhD Thesis by Mgr. Schödelbauerová presents interesting results and draws sound conclusions. A future addition to this research might be represented by studying the relationships between orchid species diversity and genetic diversity, as fundamental components of biodiversity. In conclusion, I recommend Mgr. Schödelbauerová to be awarded with the tile PhD.

Yours sincerely,



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