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Review of PhD thesis written by Msc Galin Gospodinov entitled
'Taxonomic and genetic investigation on sect. *Ricciella* genus *Riccia* in Europe with emphasis
on *R. fluitans* and *R. rhenana*'
done under the supervision of Dr hab. Katarzyna Buczkowska-Chmielewska, Prof. UAM and
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The genus *Riccia* is one of the most numerous genera among liverworts. It includes about 200 species and has an almost worldwide distribution. Many of them are still poorly known. For his research, the author selected primarily European species from the *Ricciella* section, with particular emphasis on two, i.e. *Riccia fluitans* and *R. rhenana*.

The main topic of the research was to elucidate the genetic relationships between *R. fluitans* and *R. rhenana*, with a specific focus on the diploidization process in *R. rhenana*. Additionally, he conducted research, among others, on the chromosome counts and the genome size of the haploid-diploid pairs *R. fluitans*–*R. rhenana* and *R. canaliculate*–*R. duplex* and the potential genetic relationship between the haploids and the diploids using isozyme analysis. The detailed objectives of the work are listed in section 1.3. The dissertation consists of few sections, titled 'Chapters'. Chapter 1 includes, among others, general introduction, aims and literature review. The remaining five chapters constitute the core of the work. They contain the results, conclusions, and discussion of the five main research topics. These chapters were prepared as drafts (without references) of papers that are to be, or have already been, submitted for publication. These chapters are briefly summarized, followed by a glossary of selected botanical terms, following Damsholt (2002). In my opinion, this glossary is unnecessary for a scholarly work; it has only educational value. The work ending with a brief summary and conclusions from the research conducted, a list of literature used in all chapters, information on the financing of the work, herbarium materials used, and supplementary materials.

Assessment of scientific achievements

Chapter 2 – ‘Difficult sex and how to avoid it: survival strategy as reproductive outcome in *Riccia*, with emphasis on *Riccia fluitans* and *Riccia rhenana*’, is based primarily on literature data. The author discusses survival strategies in the genus *Riccia* in relation to reproductive systems. He then applies this information to the two species he studies – *R. fluitans* and *R. rhenana*. The main conclusion is that *R. fluitans* and *R. rhenana* exhibit unique behavior, where a survival strategy benefits reproductive outcome. This is an interesting paper concerning the biology of the studied species.

Chapter 3 – ‘Distribution of *Riccia fluitans* and *Riccia rhenana* (Marchantiales) in Bulgaria – towards a conflict at a ploidy level’. The paper contains information on the current distribution of these two species in Bulgaria. Some localities have been confirmed cytologically. The author then compared the habitat preferences of *R. fluitans* and *R. rhenana*, based on habitat origin: natural, seminatural, and man-made. He concluded that *R. rhenana*, as a polyploid, is characterized by greater expansiveness and the ability to occupy human-made habitats. This is an interesting paper concerning the ecology and distribution of the studied species.

Chapter 4 – ‘Genome size and chromosome counts of some *Ricciella* species’. The genome size of the species from the section *Ricciella* is poorly known. This chapter provides data on the 1C value of some species, e.g., *R. canaliculata*, *R. duplex*, *R. fluitans*, and *R. rhenana*. This is the first time that 1C value has been established for these species. It has been shown that the 1C value can be used as a fast tool for species delimitation. A valuable genetics work. The title requires correction, as the nomenclature used in the work does not include '*Ricciella* species'.

Chapter 5 – ‘On the polyploidization of *Riccia rhenana*’. *R. rhenana* is a polyploid, but it is not fully known whether it is an autopolyploid or an allopolyploid. The author used three methods: isozyme analysis, chromosome counting, and DNA barcoding. Isozyme analysis confirms it is an allopolyploid, but the parental forms are unclear. The author suggests that one parent may be *R. fluitans* and the other *R. stenophylla*. It worth noting, that the correct name for *R. stenophylla*, according to the Code of Botanical Nomenclature, is *R. oerstediana* Lindenb. & Hampe. It is unclear on what basis the author claims it is the parent species of *R. rhenana*. *R. oerstediana* is likely a sterile form of *R. fluitans* and is not listed, for example, in the latest list of European bryophytes (Hodgetts et al. 2020).

Chapter 6 – ‘Preliminary taxonomic investigation on sect. *Ricciella*’.

Research was undertaken to determine the genetic relationship between the subgenus *Ricciella* and the section *Ricciella*. Data on approximately 30 species were used for the study (Table 6.1), of which 7 were originally studied. The preliminary results do not support the monophyly of subgenus *Ricciella* or its constituent section *Ricciella*. The taxonomic position of subgenus *Ricciella* was not supported, nor was the section *Ricciella* sensu Schuster and Jovet-Ast.

The results obtained may be subject to significant error due to the lack of many species included in the analysis. Section *Ricciella* comprises about 20 species and several lower taxa, while the entire subgenus *Ricciella* comprises about 100 species. Therefore, discrepancies may exist with obtained results and those of other authors.

In my opinion, this work is not about taxonomy; it is more of a phylogenetic reconstruction based on genetic studies. Plant taxonomy is the branch of botany that identifies, describes, classifies and names new plant taxa. It has developed a specific research methodology and utilizes tools, among others, from morphological, anatomical, and genetic analysis. However, these tools themselves do not belong to the field of taxonomy.

Final remarks

I am convinced that Msc G. Gospodinov has extensive knowledge of genetics, ecology and taxonomy of liverworts (Marchantiophyta). He is also familiar with the methods used in research on this group of plants and knows how to apply them. The results presented in his dissertation are original and contribute new information to the understanding of the biology of species from the *Ricciella* section.

In this context, I'm a bit surprised by the doctoral student's modest scientific output (only one work is cited, published in a local journal). This, of course, isn't a criterion for the price of a doctoral thesis, but it does indicate little scientific activity.

I evaluate Msc Galin Gospodinov's doctoral dissertation positively. In addition to the reservations mentioned above, several questions arose while reading the work:

1. What is unique about the behavior of *R. fluitans* and *R. rhenana*, in which their survival strategy favors reproductive outcomes?
2. How do natural habitats differ from man-made habitats for *R. fluitans* and *R. rhenana*?
3. What determines the size of the genome in polyploids?

4. On what basis does the author claim that *R. oerstediana* is the parent species of *R. rhenana*?
5. Why were more species not included in order to determine the genetic relationship between species within the *Ricciella* subgenus and *Ricciella* section?

Conclusions

Msc Galin Gospodinov's doctoral dissertation meets the requirements specified in art. 187 sec. 1-2 of the Act of 20 July 2018, the Law on Higher Education and Science (Journal of Laws of 2024, item 1571, as amended), therefore I hereby apply to the Council of the Faculty of Biology of the Adam Mickiewicz University in Poznań to allow Msc Galin Gospodinov to defend his doctoral dissertation.

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