



UNIWERSYTET KAZIMIERZA WIELKIEGO
W BYDGOSZCZY

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Review of doctoral thesis

MSc Danielle Cecchetti

Entitled: „The impact of electromagnetic fields (EMF) on the germination, morphology and physiological responses of *Triticum aestivum* seeds”

The assessment of the doctoral dissertation was made based on resolution No. 79 of the Council of the Discipline of Biological Sciences, at the Faculty of Biological and Veterinary Sciences, Nicolaus Copernicus University in Toruń, submitted in a letter dated October 28, 2024, by Prof. Dr. Hab. Justyna Rogalska, Dean of the Faculty.

The doctoral dissertation of Mr. Danielle Cecchetti, submitted for review, was prepared under the supervision of Prof. Dr. Hab. Adriana Szmidt-Jaworska in the field of Exact and Natural Sciences, Discipline of Biological Sciences. The co-supervisor was Dr. Agnieszka Pawełek. The work was performed at the Faculty of Biological and Veterinary Sciences Nicolaus Copernicus University in Toruń.

The doctoral dissertation is a scientific monograph, written in English, based on two scientific publications, one published in the journal *Agronomy* (IF 3.7) in 2022, and the other one was prepared for publication in the *Plant Growth Regulation* journal (IF 3.5, currently under review). In both publications, MSc Danielle Cecchetti is the first author, and his contribution to the creation of both works is significant. The PhD Student was responsible for: methodology, investigation, statistical analysis, original draft preparation, visualization, and additionally, in the second work, conceptualization, preliminary draft preparation, review, and editing. The monograph is additionally provided with an abstract in English and Polish and a list of

abbreviations. The assessed doctoral dissertation consists of 6 chapters: Introduction, Hypothesis and aim of the study, Discussion of obtained results, Summary and conclusions, Laboratory skills acquired during the completion of the doctoral dissertation, and Bibliography covering 67 items of literature. At the end are attached 2 works constituting the basis of the Monograph.

In addition, Mr. Danielle Cecchetti is a co-author of two more publications from 2022 published in Agronomy (IF 3.7) and Environmental Evidence (IF 2.9). All publications are thematically related and concern the influence of the electromagnetic field on the physiological response of plants. The doctoral thesis submitted for assessment meets the formal and substantive requirements for this type of study and is consistent with the Act of 20 July 2018 - Law on Higher Education and Science (Journal of Laws 2023, item 742, as amended).

The topic of the dissertation accurately defines and connects the series of publications regarding the morphological, biochemical, and physiological response of *Triticum aestivum* seeds after treatment with the electromagnetic field. The application of electromagnetic fields (EMFs) in agriculture has garnered increasing attention in recent years, primarily due to its potential to enhance plant growth parameters and improve the physiological responses of plants to environmental stress factors. Despite this growing interest, the precise mechanisms through which EMFs influence plant processes remain widely unexplored, particularly concerning how they interact with seed size and quality. The doctoral dissertation provided an in-depth investigation into the physiological changes experienced by wheat seeds of varying sizes, specifically small and big, over the initial 72 hours after sowing. The study concentrated on young and naturally aged seeds and assessed the impact of electromagnetic field (EMF) treatment.

The doctoral thesis's main hypothesis is that electromagnetic fields act as a stimulus for the germination process and enhance the quality of seed material.

The specific objectives of the experimental procedures are as follows:

- identifying an effective method for seed classification based on seed size,
- investigating the impact of light conditions on germination parameters of freshly harvested seeds treated with electromagnetic fields (50 Hz, 7 mT),
- comparing phytohormone profile alterations induced by electromagnetic field exposure,
- examining changes in germination parameters of aging seeds,
- assessing the potential of electromagnetic fields to enhance seed condition and their role in the priming procedure.

All hypotheses and research goals were presented in detail and verified in two attached publications.

The most important achievements of Mr. Danielle Cecchetti's doctoral dissertation include:

1. Electromagnetic field exposure was found to accelerate both germination and early growth processes, particularly in big seeds. Big seeds exposed to EMFs exhibited faster germination rates and more vigorous early growth compared to their non-EMF-exposed counterparts, especially when germinated in darkness.
2. The findings confirm that electromagnetic field treatment can effectively mitigate some negative effects of seed aging, enhancing seed resilience and overall performance.
3. Research shows that EMF treatment can be valuable for enhancing seed quality and survival. This approach can potentially improve seed outcomes on a broader scale, ensuring that seeds, whether small or big, can achieve their maximum potential and contribute effectively to agricultural productivity and sustainability.

In summary, I would like to state that the monograph submitted for evaluation entitled: "The impact of electromagnetic fields (EMF) on the germination, morphology and physiological responses of *Triticum aestivum* seeds" is a good basis for applying for a doctoral degree in the scientific discipline of biological sciences. The published article and the work prepared for publication demonstrate the good preparation of the PhD student to conduct important scientific research in the world.

However, while reading the work, I had a few questions and comments.

Questions and comments:

1. There is an error on the title page about discipline. It should be: biological sciences.
2. The dissertation lacks a description of the Materials and methods. Why?
3. The order of the author names cited in the text "Introduction" is incorrect. It should be in the first place chronologically, and in the second place alphabetically.
4. The dissertation contains punctuation errors and typos, e.g. p. 7 line 16, p. 8 line 4, p. 9 lines 7 and 26, in References.
5. In the first publication, the name of the cultivar was defined as a variety **var. Owacja**. This is a cultivated **cultivar**, not a botanical one, so it should be correctly marked as a cultivar

with a single upper apostrophe '**Owacja**'. This can be corrected in the second paper, which is in the review.

6. In the Materials and methods described in the first publication and in the manuscript of the second paper, there is no detailed information about the IHAR Group headquarters and the full name. The work provides only an abbreviation, which will not be obvious to all recipients in the world...
7. Why did you choose the electromagnetic field at the frequency of 50 Hz and an intensity of 7 mT? Did you perform preliminary tests to select the appropriate field values? Did you base it on literature data? Please explain.

I would like to point out that the above comments are minor inaccuracies, mainly editorial, which do not affect the substantive assessment of the work.

Summary

In summary, I hereby declare that the submitted doctoral dissertation by MSc Danielle Cecchetti entitled “The impact of electromagnetic fields (EMF) on the germination, morphology and physiological responses of *Triticum aestivum* seeds” meets all the requirements for doctoral dissertations specified **in the Act of 20 July 2018 - Law on Higher Education and Science (Journal of Laws 2023, item 742, as amended)**. For this reason, I am applying to the High Discipline Council of Biological Sciences of Nicolaus Copernicus University in Toruń to admit Mr. Danielle Cecchetti to further stages of the doctoral proceedings.

Bydgoszcz, 27.12.2024 r.

