



Europäische Gesellschaft für Herbologie
European Weed Research Society
Société Européenne de Malherbologie

**EWRS Soil Seed Bank, Germination
& Early Growth**
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**Minutes from the workshop of Soil Seed Bank, Germination and Early Growth
Working Group of the EWRS**

Working Group meeting

Università degli studi de Perugia, Perugia, Italy, 13-15 June 2023

Participants:

Jackline Abu-Nassar (Israel), Nahema Venceslai (UK), Jonathan Binder (UK), María Arias (Spain), Jordi Izquierdo (Spain), Aritz Royo Esnal (Spain), Jevgenija Nečajeva (Latvia), Valentina Šoštarčić (Croatia), Nebojša Nikolić (Italy), Andrea Onofri (Italy), Euro Panacci (Italy), Francesco Tei (Italy), Theresa Piskáčková (Czech Republic), Myriem Chtourou (Tunisia).

Conected online for the discussion sessions: Alireza Taab (deputy) (Iran), Agnieszka Synowiec (Poland), Isabel Calha (Portugal).

Final programme

Tuesday 13 June

13:30-15:00. Registration and Meeting opening (Aritz-Royo Esnal).

15:00-15:45. MODELING WORKSHOP. Getting started. Introduction to the workshop. Introduction to R and levelling of participants. Installing and attaching the required packages. Hands-on: exercises. (Andrea Onofri)

15:45-16:00. Coffee break

16:00-18:30. MODELING WORKSHOP. Introduction to time-to-event methods and comparing with nonlinear regression methods. The time to event curve: estimating the curve by maximum likelihood, deriving information from the time-to-event curve (quantiles and predictions), comparing time-to-event curves (Andrea Onofri).

19:00. Welcome cocktail

Wednesday 14 June

8:45-10:45. MODELING WORKSHOP. Hydro-time (HT), thermal-time (TT) and hydrothermal-time (HTT) models: theoretical foundations, deriving the models, meaning of model parameters (Andrea Onofri).

10:45-11:00. Coffee break

11:00-13:00. MODELING WORKSHOP. Casting HT, TT and HTT in the time-to-event framework. Fitting HT, TT and HTT models with R. Hands-on exercises (Andrea Onofri).

13:00-14:00. Lunch

14:00-15:00. Oral presentations

- Timing post-emergence weed control measures by using the differential form of a function (Jordi Izquierdo)
- Effect of temperature on blackgrass (*Alopecurus myosuroides*) seed dormancy and germination (Nahema Venceslai)
- Effect of herbicide timing on emergence pattern of *Echinochloa crus-galli* (Barnyardgrass) in maize (Theresa Piskáčková)
- Emergence pattern of annual monocot species from artificial soil seed bank (Valentina Šoštarčić)

15:00-15:15. Coffee break

15:15-16:45. Oral presentations (continuation)

- An approximation to model the emergence of *Sinapis arvensis* in two Mediterranean climatic conditions (Myriem Chtourou)
- Characteristics of seed physiological dormancy state and seed decay in soil in *Avena fatua* (Jevgenina Nečajeva)
- Importance of modelling the weed emergence for the efficient use of stale seedbed in rice (Nebojša Nikolić)
- Estimation of biological parameters for *Panicum capillare* L. seed germination (Valentina Šoštarčić)
- Description and modeling of the emergence of *Lolium rigidum* populations in the Iberian Peninsula (Aritz Royo-Esna)
- Modelling *Ridolfia segetum* emergence under rain-fed conditions across Spain (Aritz Royo-Esna)

16:45-17:30. Discussions about oral presentations

Thursday 15 June

9:00-10:45. Discussion of the old experiment carried out between 2016 and 2018, with data of *Avena fatua* and *A. barbata*. Focus on the potential publication.

10:45-11:00. Coffee break

11:00-12:30. Ultimate the protocol for *Echinochloa crus-galli* germination assays.

12:30-13:30. Lunch

13:30-15:45. Brainstorming, possibility for applying for a European call project. Needs, pros and cons.

15:45-16:00. Coffee break

16:00-18:30. Field trip to the experimental station of the organizing institution.

19:00. Meeting dinner

Comments on programme: Because of personal reasons, Mohsen Mesgaran had not been able to come to Perugia, thus Andrea Onofri was the professor in charge of all lectures on modelling with R statistics. This also slightly altered the initial timetable. In the oral presentations, the initial time for presentations (12 min + 3 min for questions) was changed for a question (and discussion) section at the end of all presentations.

Start of workshop

On behalf of the working group of soil seed bank, germination and early growth, Aritz Royo-Esnal welcomed the participants to the workshop. Participant introduced themselves. 14 participants joined the workshop and came from 8 different countries. Aritz explained the general objectives of the working group and the objectives of the workshop.

R course for modelling seed germination and seedling emergence

Before starting with the course, Andrea gave a short presentation about the University of Perugia and of their department. Regarding the course itself, Andrea explained the particular problem of the germination (and emergence) experiments, which are the censored data, and how to overcome this problem, using alternative analysis, such as the time-to-event methods. He also explained how to obtain information on germination (and emergence) capability, speed and uniformity, as well as how to compare different lots, populations and treatments, and also how to investigate the effect of external covariates, such as temperature and humidity.

Oral presentations

There had been 10 oral presentations related to the topics of the working group. These presentations varied from using the differential form of a function to predict the best moment for a weed control method application (Jordi Izquierdo), to the study of germination and emergence characteristics of several weed species, like *Alopecurus myosuroides* (Nahema Venceslai), herbicide resistant *Echinochloa crus-galli* (Theresa Piskáčková), *Setaria pumila*, *E. crus-galli* and *Panicum capillare* (Valentina Šoštarčić), *Sinapis arvensis* (Myriem Chtourou), *Avena fatua* (Jevgenija Nečajeva), and *Lolium rigidum* and *Ridolfia segetum* (Aritz Royo-Esnal), and also the use of emergence models for establishing the best date for stale seedbed in rice in order to better control wild rice (*Oryza sativa*) and banyardgrass (*E. crus-galli*) (Nebojša Nikolić).

After the presentations, a question session was organized for questions to the presentations and to start some discussion that was further deepen in the discussion sections of the following day, being one of the main topics the practical use of these already developed and published models in different platforms.

Discussion of the old experiment carried out between 2016 and 2018, with data of *Avena fatua* and *A. barbata*. Focus on the potential publication

This study started one year later than that of *Echinochloa crus-galli*. The experiment was established in different locations throughout Europe and the Middle East, and data on emergence and growth (in BBCH scale) was periodically recorded. To date, only one poster has been presented in Chios 2017 (Tørresen et al., 2017). The discussion started focussing on the objectives that would have a new manuscript about these *Avena* species: would it be a comparison between common and local populations? A comparison and application of already developed models to our data? Include emergence and early growth data in a single manuscript or consider them as separate?

We also considered the possibility of repeating the experiment so that we could complete the data obtained in the period 2016-2018.

Despite all these discussion, there are still some participants that did not send the data to the person that was in charge of compiling them. Thus, it was decided that Aritz would write to these participants in order to receive as much data as possible before looking at the results and finally decide the objectives that can be

accomplished with them. For this same reason, the decision to establish the experiment again or not was delayed.

It was also agreed that those participants in the workshop that did not participate in the experiment 2016-2018, but that can work on the data and collaborate in the new manuscript would be included as coauthors of the future publication.

Ultimate the protocol for *Echinochloa crus-galli* germination assays and discussion of a new common experiment

After the results obtained in the previous *Echinochloa* experiment, published in Weed Research (Royo-Esnal et al., 2022a and 2022b) and Agronomy journal (Nečajeva et al., 2022), we decided to establish a germination assay to complete the information obtained in there. Basically, the objective is to obtain the base temperatures and base water potentials of the common and local populations coming from maize fields used in the previous experiment, completed with other new locations in the UK, France and Germany, among other countries. The seeds of these populations will be sent to the University of Lleida (Aritz Royo-Esnal) for the base temperature assays, and to the University of Padua (Nebojša Nikolić) where the base water potential will be studied, together with the University of Zagreb (Valentina Šoštarčić).

The protocol was agreed and finished, and will be sent to the participants in few days.

Brainstorming, possibility for applying for a European call project. Needs, pros and cons

One of the limitations we have, as a working group, is that all the research we do is done from our own spare time. The common experiments that have been carried out until now have not been financed directly by a project, although sometimes it could be included within particular projects that participants could have on their own. In order to improve the quality of the data, and to look for a practical application of the already developed models, a discussion session about a common project to apply for was organized.

In this session, a main problem was visualized, which is the lack of practical use of most models that have been published. Francesco Tei, in the oral presentation discussion, pointed out that the validation of these models in other regions different from that where they had been developed should be done. Moreover, under the climate change scenario, some of these already published models could need to be recalibrated, because they had been developed more than 10 years ago. The lack of a practical use is usually due to a lack of a platform where these models could be integrated and be consulted. The program AlertInf, which was firstly developed to predict the emergence of six summer weeds in maize crops in the Veneto region (Italy), has already been calibrated to be used in soybean fields and also to be used, for *E. crus-galli*, in a continental region of Croatia.

Under this scenario, it was proposed to start working on a draft that would be based on the platform AlertInf. This potential project would require:

- The validation of the included models in several other countries and climatic regions across Europe.
- The inclusion of new models, already developed, for species that were not included in this program, and their validation, similar to the first point
- Consider other species for which no model has been yet developed, either annual or perennial.

This points would help decide when to apply weed management strategies within the critical periods for weed control, contributing to more effective use of managements methods, including more rational use of herbicide, and to reduce the risk of herbicide resistant biotypes selection.

Although AlertInf was developed for its use in summer crops, Nebojša said that the ampliation of the platform to winter crops was feasible.

It was commented that, in order to have a good platform, access to meteorological stations, evenly and well distributed throughout Europe, is needed.

Other ideas arose for completing this platform, for example, the possibility of developing a section which could include suggestions of crop rotations under certain problematic situations (troublesome weed populations or communities).

Nebojša offered himself for starting to write a draft of a project memory that will be further discussed by participants of the WG.

End of workshop

The workshop ended with an excursion organized by the local organizers, who showed the participants the experimental fields they work on, and with a dinner afterwards.

Next meeting is still to be established and will be online. It is expected also to have a meeting during the IWSC in 2024.

Thank you very much to Andrea, Francesco and Euro for hosting the workshop!

Aritz Royo-Esnal (Chairman of meeting and writing the minutes)