ISSS/ ISTA Webinar on the Phenotypic Plasticity of Seed Traits

Dr. Eugenio Larios and Marie-Hélène Wagner have answered all the questions that were sent in during the session in detail below.

What are the effects on water stress on emergence?

MHW: *If severe stress: no germination so poor emergence. When water stress is moderate, germination occurs but delayed and emergence is also delayed because radicle growth is prior to shoot growth and seed reserves have to be sufficient until emergence.*

How did you calculate MGT? In literature, it is highly suggested to go with T50 value than MGT in terms of comparisons?

MHW: *They are very close when germination is 100% (all seeds germinate). MGT represent the mean time for all germinated seeds in a sample as T50 is the time to reach 50% of germination. You need to reach the plateau of the germination progress curve for MGT (full curve), that's why, in the ISTA Vigour Committee, we try to find an early count of germination correlated to it, fixing the best time for counting a radicle emergence.*

How about the phenotyping plasticity of crop plants under salt stress conditions?

MHW: *We don't work this stress in my lab, but in literature, you may find papers explaining how salt inhibits germination and suggestions to alleviate salt stress-induced inhibition of seed germination.*

2 reviews suggested below.

https://doi.org/10.1016/j.plaphy.2020.08.042

http://dx.doi.org/10.1016/j.jplph.2015.12.011

In case of the seed size controlled by recessive genes in some crops, if the effects of environmental conditions are at high level, so What is the role of phenotypic plasticity of plants in seed size for abiotic stress?

EL: *One important role of phenotypic plasticity under environmental heterogeneity is to maintain genetic variation and therefore the ability to respond to selection. The possibility to evolve is good if you think about adaptation under climate change. There is the advantage of being "adaptable" to a changing environment.*

Are all plant species have large seed better than small size?

EL: *Not necessarily. Selection on seed size is also environmentally mediated. From the offspring point of view, the bigger the seed the better. But from the mother point of view, it is a different story. The more seeds the better. And because there is a trade-off between seed size and seed number, having more seeds decreases seed size proportionally. Also, there is a conflict between mother and offspring. Selection would operate through all these processes.*

How to eliminate low vigour seeds from the seed lot?

MHW: *Avoid using low vigour seed lots in sub-optimal conditions. But if they are acceptable in favourable conditions, why eliminating part of them? Actually, seeds are produced in field and there is already a huge work to clean and process seed lots to get a good germination before commercialisation; vigour is not necessary for all situations but restricted to stressful ones.*

Tree seeds: often deep dormancy in these species, automated tools are dedicated to monitor germination rate not germinability. The imbibition conditions of Copenhagen incubator can also be a limit for large seeds.

If someone wants to try ScreenSeed on large sized species, how can you place the camera position in order to catch true size of radicles?

MHW: *Radicle size of large seeds: more space between seed, so less seeds per camera. Magnification is measured for each trial with a ruler in order that radicle length could be expressed in mm.*

Screenseed is another kind of imaging system (technology using machine learning) in 96 well-microplates mainly used with the model species Arabidopsis thaliana (https://doi.org/10.1038/s41598-020-79115-2) or for single seed analysis in different environments.