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Editorial

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Editorial

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The biennial conference of the International Society for Seed Science (ISSS) 'Challenge of Seed Science in a Changing World' was held at the Sorbonne University in Paris, France, July 3–7, 2023. This conference brought together 250 attendees from around the world who shared knowledge and discussions about the future of seed science.

This Special Issue of *Seed Science Research* compiles seven articles, including four research and three review articles, that were presented at the ISSS Conference, and which altogether cover various aspects of seed development, dormancy and germination regulation in the wider context of climate change.

A changing climate will significantly impact the productivity of agricultural systems and the dynamics of natural ecosystems. Indeed, patterns of seed development and germination timing will be dramatically affected by climate variations, especially drought and high temperature events. Here, for example, Seglias et al. show that alpine plant species are highly vulnerable to climate change, with early life stages being particularly sensitive. A study exposing seeds and seedlings of two rare alpine species to different temperature regimes found that they performed better under warmer conditions, suggesting that early stages may not be at high risk from warming temperatures. They suggest, however, that other climatic factors beyond temperature must be considered. Beveridge et al. have explored the effects of seed functional traits and environmental factors on germination responses in sub-tropical native Australian plant species, finding significant correlations between seed traits, environmental factors and germination outcomes. Their work shows that these interactions are crucial for predicting species' responses to changing climates and guiding seed-based land restoration efforts. Bezodis and Penfield reviewed the consequences of maternal effects, such as nitrogen status, temperature and photoperiod, on seed phenology, fitness and bet-hedging strategies. These effects influence seed dormancy, especially in species with coat-imposed dormancy or indehiscent fruits, and can involve direct environmental information acquisition, maternal-filial signalling and epigenetic inheritance.

Assessing seed quality and viability is crucial in seed production, crop breeding and adaptation to changing climate conditions. Sano et al. have investigated desiccation tolerance in tomato seeds, a model species for Solanaceae, holding a key strategic position for seed industry and commercial use in the world. They demonstrate the organ-specific loss and re-establishment of desiccation tolerance in different organs, with hypocotyls, showing a longer DT window than cotyledons and roots in post-germination seeds. Peng et al. have evaluated tetrazolium staining methods for six hard seeds. They show that staining conditions are more similar between closely related species, enabling rapid viability testing based on genetic proximity, which is vital for protecting germplasm resources and optimizing seed banks under climate change.

To aid the development of seed ecology into a truly global research discipline that benefits scientists irrespective of their geographic location and background, Silveira et al. identified ten major challenges that seed ecologists from developing countries face in relation to planning, designing, conducting and publishing their research. Several measures are proposed to overcome these challenges which can be implemented by seed ecologists and the broader scientific community including funding agencies, research directors, journal editors and the academic publishing industry. In a Technical Update, Pérez provides a critical overview of the use and interpretation of *P*-values and effect size indices, raising awareness of these important statistical tools for seed science research and providing additional resources useful for incorporating effect sizes in our seed discipline.

The studies compiled in this Special Issue underscore the importance of understanding the mechanisms governing seed germination, particularly in the context of climate change. Acquiring such knowledge will be essential in developing strategies to mitigate the impacts of climate change on seed germination and its associated regulatory processes and hence on crop productivity.

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