20th EUCARPIA General Congress

Abstracts

29 Aug – 1 Sep 2016
ETH Zurich, Switzerland

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Plant Breeding: the Art of Bringing Science to Life

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Introgressiomics: a new paradigm for crop improvement and adaptation to climate change

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The expected increasing demand of plant products in the coming decades and the environmental changes and associated stresses resulting from climate change represent a formidable challenge for plant breeders. Many crops have a narrow genetic base resulting from bottlenecks during domestication and modern breeding and this restricts the diversity available to breeders. Crop wild relatives (CWRs) represent a source of diversity of interest to breeders as they are frequently tolerant to biotic and abiotic stresses and display interesting features (e.g., quality traits). Although the use of CWRs in breeding has allowed dramatic improvements in a number of crops, their utilization has mostly been restricted to a limited number of specific traits. We propose a new approach, which we denominate "introgressiomics", which consists in the "mass scale development of multiple plant materials carrying introgressions of genomes from wild related species into the genetic background of crops that may allow developing new cultivars with dramatically improved properties, in particular adaptation to climate change". Introgressiomics is aimed at the massive generation of introgression materials for present and future (unforeseen) needs and therefore is a form of pre-emptive breeding. Introgressiomics begins with the identification of CWRs from different genepools encompassing a high genetic diversity and that represent sources of variation for traits of interest, in particular those related to climate change adaptation. This requires exploration of germplasm banks and identification of gaps in CWR collections in order to select and collect, when needed, CWRs for introgressiomics. Interspecific hybridization, in particular with CWRs from the secondary and tertiary genepools, and obtaining backcross generations to the cultivated species both potentially represent major obstacles for introgressiomics due to pre-zygotic and post-zygotic barriers. Different breeding techniques, however, can be used to increase the chances of obtaining plant materials with introgressions. The recurrent use of genomics tools, such as markers scattered over the entire genome and in target genomic areas, is essential for developing multiple collections of introgression lines (ILs) each from a different CWR donor, or the creation of mixed introgression populations in which individual genotypes may have introgressions from different CWRs. The ultimate aim of introgressiomics is to provide breeders with a dramatically enlarged genetic pool from which to obtain a new generation of cultivars adapted to the challenge of the sustainable increase in the quantity and quality of crop production in a climate change scenario. We exemplify the use of the introgressiomics approach with the work we are undertaking in broadening the genetic diversity of the cultivated eggplant (*Solanum melongena*).

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