

Boosting European plant cryopreservation research

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Left: WG1/WG2 meeting participants of COST Action 871 at the University of Oulu, Finland (February 2008). Right: Cryopreservation of germplasm from the global banana collection at the Bioversity International Transit Centre, K.U. Leuven, Belgium. Photos: Bart Panis, K.U. Leuven, Belgium

“Cryopreservation” is the storage of biological material at ultralow temperature, generally the temperature of liquid nitrogen (-196°C). Its main advantage is that stored material does not undergo cellular divisions and moreover most physical processes are stopped at this low temperature. Therefore, plant material preserved under cryogenic storage can be maintained for very long, if not unlimited, periods of time and problems that are typical for storage in the active growth state, like genetic instability and the loss of accessions due to contamination, loss of vigour and totipotency and human error during continual subculturing are surmounted. So far, cryopreservation procedures have been developed for the *in vitro* tissues and non-orthodox seeds of about 200 plant species. Cryopreservation can thus be considered as a welcome, but necessary, long-term storage alternative for those plants that can not be stored by means of their seed (for example at the Svalbard Global Seed Vault).

There are, however, only a limited number of collections in Europe where cryopreservation is used routinely for plant germplasm conservation. A well known example is IPK (Leibniz Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany) that stores more than 1000 potato accessions in liquid nitrogen

together with a substantial number of mint and garlic accessions. Also tropical plant germplasm is stored in European institutes; e.g. 720 banana accessions are safely stored at the International Musa Germplasm Collection of Bioversity International (hosted at K.U. Leuven, Belgium).

Until 2002, cryopreservation research in Europe was rather scarce and dispersed. A first boost came in 2002 through the approval of a three-year EU FP5 research project entitled “CRYMCEPT: Establishing Cryopreservation Methods For Conserving European Plant Germplasm Collections” (Project QLK5 CT-2002-01279), Directorate-General Research - Quality of Life and Management of Living Resources Programme - see also www.biw.kuleuven.be/dtp/tro/crymcept/CRYMCEPT.htm. This project, coordinated by K.U. Leuven, Belgium was carried out in collaboration with partners from UK (University of Abertay Dundee, University of Derby), France (Institut de Recherche pour le Développement-IRD), Italy (Istituto Sperimentale per la Frutticoltura-ISF), Germany (Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH-DSMZ) and Bioversity International (formerly IPGRI), and aimed to develop more efficient and generally applicable plant cryopreservation protocols based on fundamental research.

To unravel cryoprotection, research was initiated on the analysis of sugars, polyamines, anti-oxidants, proteins and different membrane components, water thermal behaviour (using differential Scanning Calorimetry).

A second boost came again from the EU by the approval in 2006 of the EU COST (European Cooperation in Science and Technology) Action 871 “CRYOPLANET” (Cryopreservation of Crop species in Europe, www.agr.kuleuven.ac.be/dtp/tro/cost871/Home.htm). The aim of this COST Action is to create a network that brings together European scientists with an expertise and/or interest in plant cryopreservation, to develop efficient cryopreservation procedures. Emphasis is placed on using this approach as a complementary technique for the preservation of crops that are vegetatively propagated and/or produce non-orthodox seeds with a focus on underutilized crop species grown and/or conserved in Europe, and their wild relatives. The network, now counting 20 EU countries, will also alert and inform stakeholders in plant breeding and conservation practitioners who require cryopreservation to implement and underpin sustainable crop plant breeding programmes. One major event was the organization of the “First

International Symposium on Cryopreservation in Horticultural Species” Leuven, Belgium on 5-8 April 2009, co-organized by the COST Action together with ISHS (International Society for Horticultural Science). The organizers welcomed 149 registered participants from 43 countries from all parts of the world. The opening lecture, entitled “Why diversity Matters”, was presented by Emile Frison, Director General of Bioversity International, who emphasized the importance of preserving agricultural biodiversity for: i) source of traits for breeding; ii) resilience, stability and sustainability; iii) improved livelihoods; and iv) better nutrition and health.

The FP5 EU research project (2002-2005) as well as the EU COST Action (2006-2010) resulted in:

i) the availability of efficient and robust cryopreservation protocols applicable to many plant species and diverse germplasm types; ii) awareness of plant researchers previously unacquainted with recent developments in cryogenic storage methods; and iii) coordinated research on plant cryopreservation. Moreover, it has considerably improved the worldwide visibility of EU plant cryopreservation scientists. For further information on the Cost Action Action 871 “CRYOPLANET”, please contact the author (bart.panis@biw.kuleuven.be).