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EDITORIAL

Preface from the Editor-in-Chief

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The 68th UN General Assembly declared 2016 the International Year of Pulses (IYP), to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production for food security and a balanced nutrition. To mark and contribute to this IYP, PCTOC publishes this special issue devoted specifically to the recent advances in the plant cell, tissue and organ culture as in biotechnology for the breeding of leguminous pulses. I would like to sincerely thank Dr. Teodardo Calles, Agricultural Officer in charge of Legumes at the Plant Production and Protection Division Food and Agriculture Organization of the United Nations (FAO), who kindly accepted to also preface this special issue of our journal, and Prof. Traud Winkelmann for editorial handling of some submissions.

The family Leguminosae, third largest family of flowering plants, includes about 650 genera and 18,000 species. Second only to cereals in worldwide importance and production, legumes are characterized not only by their typical flower structure and seed anatomy but also, importantly, by their unique ability to fix and use atmospheric nitrogen through a symbiotic relationship with rhizobia bacteria, whereby they can survive even in conditions of poor nitrogen availability and produce abundant proteins in absence of any supplementary nitrogen fertilization. Used in rotation, legumes reduce both energy consumption and greenhouse gas emissions, ameliorate soil structure by increasing its organic matter content and also improve air/water relations coupled with a lower input of fertilizers. Moreover, by associating with endomycorrhiza forming fungi legumes can establish symbiotic relationships that greatly impact plant nutrition via an enhanced water uptake and nutrient intake.

Taken together, these traits explain the high interest in legumes for a sustainable agriculture, as the last decades have witnessed a significantly increasing demographic pressure that, added to a drastic increase in energy consumption, is dramatically affecting the global climate. Not surprisingly, this has resulted in an increased demand for agronomic resources at a time when most land left available for agriculture is marginal, being submitted to various forms of stress both abiotic and of biotic origin (pests and diseases) that provoke several physiological and metabolic disorders and, in fine, drastically reduce yield when most needed. Therefore, resolving and understanding the impact of such stresses on yield is a major scientific and agronomic challenge of this century, and biotechnology-based breeding offers viable alternatives to conventional approaches for the generation of novel genotypes with a better resistance to both biotic and abiotic stresses and with an improved yield.

Up until now, leguminous pulses in general have been considered as recalcitrant to biotechnological breeding strategies mainly because of the large difficulties found in regenerating plants de novo from isolated cells, tissues and even organs. Indeed, a large genotype dependence of in vitro response has been frequently observed in legume species hindering the application of various strategies for in vitro selection and/or gene transfer. These could significantly accelerate breeding, which otherwise requires a number of successive generations to fix in the genome any novel resistance trait acquired, ensuring its heritability in the progeny. However, developments in this domain during the last decade show that, in terms of biotechnology tools, leguminous pulse crops are leaving its infancy.

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This Special Issue of Plant Cell Tissue and Organ Culture features several articles where the in vitro based biotechnology breeding approaches have been developed and exploited. They appear according to the strategies developed and are preceded by two review articles summarizing recent advances in the area (Gatti et al. 2016; Jacob et al. 2016). The fixation of a genetic novelty takes several generation cycles and this problem has been countered through the induction of flowering and seed set in vitro (Croser et al. 2016; Bermejo et al. 2016). One of the major drawbacks in terms of the exploitation of biotechnology for legume pulses has been and remains for a number of species their recalcitrance for propagation and de novo regeneration and the four following articles treat this subject with a range of species (Silué et al. 2016; Ogunsola et al. 2016; Nguyen et al. 2016; Ochatt et al. 2016). Subsequently, these strategies and methods have been exploited to optimize gene transfer in general by using both marker genes (Nguyen et al. 2016; Mekala et al. 2016) and genes of interest for the understanding and acquisition of tolerance to abiotic stress (Araújo et al. 2016; Duque et al. 2016; Yao et al. 2016) as to insect pests (Das et al. 2016; Kaur et al. 2016), and also to validate gene function for physiological and metabolism studies (Luo et al. 2016).

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