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EDITORIAL

HIGHLIGHTS OF THE SPECIAL ISSUE ON "HORTICULTURE RESEARCH FOR GREEN AND SUSTAINABLE DEVELOPMENT"

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Horticulture is the science and technology of intensively cultivating plants for food, comfort and beautification purposes. Horticulture comprises a wide range of plants and crops including fruit and nut trees, vegetables, edible fungi, and ornamental plants, as well as tea plants also categorized as horticultural crops in some countries including China. Horticultural products are of great value and serve as important dietary sources of antioxidants, vitamins and mineral nutrients for human nutrition and health. Development of a green and sustainable horticulture, producing more and safer fruit and vegetables, is a prerequisite for meeting the ever-increasing demand of the growing human population.

In contrast to other field crops or model plants, horticulture comprises a diverse group of plants ranging from annual to perennial crops that are primarily grown for fresh consumption, which means their cultivation and breeding methods are quite different from other plants, in particular, in somatic variation or bud-sport, grafting propagation, flowering regulation, organogenetic development and postharvest storage systems. Horticultural research mainly focuses on breeding, cultivation and postharvest production related biological questions, to generate knowledge beneficial for cultivar improvement for better quality and year-round supply, to understand biological basis and regulation of quality formation and maintenance. However, owing to the long juvenile period, polyembryony (such as in citrus), large canopy of perennial horticultural plants, especially for fruit crops, basic and applied research has progressed slowly over the years.

Recently, with the rapid development of high-throughput sequencing technology, research in horticulture has entered

the new 'omics' era. A large number of datasets for horticultural plants obtained through multi-omics including genomics, epigenomics, transcriptomics, proteomics and metabolomics, are now available, which provides many clues for understanding the molecular basis of agronomically important traits. To date, high-quality draft genome sequences have been accomplished for more than 30 horticultural plant species. Based on these reference genomes, resequencing data and newly developed molecular markers, numerous key candidate loci/genes controlling major agronomical traits of perennial horticultural plants have been identified through BSA and GWAS analysis of genetic populations, using these strategies that have been successfully and widely applied to field crops and model plants. One prime example is the genetic locus responsible for citrus polyembryony, which was recently narrowed to an 80-kb region containing 11 candidate genes by comparative genomic analysis of natural citrus populations, identifying *CitRWP* as the key candidate gene controlling polyembryony. This approach was also applied to QTL mapping and candidate gene mining for fruit quality (including sugar, acid, TSS and carotenoid), fruit shape, fruit size, fruit weight traits in perennial horticultural plants, such as apple, citrus, grape, peach and pear. Also, recent research on the exploitation and utilization of short-juvenile germplasm, like mini-citrus as a model plant, has facilitated functional genomics of fruit crops. A number of functional genes and their molecular mechanisms were successively identified, thereby accelerating the breeding and genetic improvement of main cultivars.

Considering the rapid progress of horticulture research and its indispensable contribution to human health, *Frontiers of Agricultural Science and Engineering* (*FASE*) is launching a special issue "Horticulture Research for Green and Sustainable Development". We invited experts with rich experience in studies of fruit crops, vegetables, ornamentals and tea plants to share their new research achievements and perspectives. A total of 11 articles are included in this special issue. Its research findings cover QTL mapping and key gene mining for maesil weeping traits (https://doi.org/10.15302/J-FASE-2020379) and tea flavonoid metabolism (https://doi.org/10.15302/J-FASE-2021382), functional identification of apple anthocyanin biosynthetic regulator MdMYB1 in controlling ascorbic acid accumulation (https://doi.org/10.15302/J-FASE-2020367), trifoliate orange PtLEA7 protein (https://doi.org/10.15302/J-FASE-2020368) and apple SUMO E3 Ligase MdSIZ1 (https://doi.org/10.15302/J-FASE-2021388) in modulating drought tolerance, tomato D1 protein turnover in photoprotection under sub-high temperature and high light conditions (https://doi.org/10.15302/J-FASE-2021383), and tomato *FNC* gene in determining the fruit netted-cracking phenotype (https://doi.org/10.15302/J-FASE-2020374). Electrical signals have been reported to be widely generated in response to various environmental changes and are recognized as vital for plant defense, Hu et al. investigated the characteristics of herbivory/wound-elicited electrical signal transduction in tomato, found GLR3.3 and GLR3.5 function as key regulators in leaflet-to-leaflet electrical signal transduction and JA accumulation (https://doi.org/10.15302/J-FASE-2021395). Ploidy manipulation via diploid by tetraploid interploidy crosses is widely used for breeding triploid seedless cultivars. Xia et al. (https://doi.org/10.15302/J-FASE-2021385) produced 182 triploid and 36 tetraploid plants between the diploid Orah mandarin and three allotetraploid somatic hybrids, and further revealed the mechanism of tetraploid hybrids formation by the fertilization of 2n megagametophytes via second division restitution. Two reviews are also included in this special issue. Ji et al. reviewed the recent advances in the regulation of climacteric fruit ripening in terms of phytohormones, transcription factors and epigenetic modifications (https://doi.org/10.15302/J-FASE-2021386). Makkumrai et al. compared the planting locations, climates, cultivation systems, orchard managements, fruit characteristics, and main metabolites between Chinese and Thailand pummelos, highlighted the potential resources for pummelo breeding and genetic improvement (https://doi.org/10.15302/J-FASE-2021391).

As the guest editors, we thank all the authors and reviewers for their great contributions to this special issue on "Horticulture Research for Green and Sustainable Development", and the *FASE* editorial team for their great support. We hope the research findings in this issue represent the main concerns of horticulture researchers and producers, and will be beneficial to quality promotion and cultivar improvement of horticultural crops and ensure a green and sustainable development of horticultural industry.

Dr. Xiuxin Deng, Professor of Horticulture at Huazhong Agricultural University, Academician of the Chinese Academy of Engineering. He has mainly been engaged in citrus germplasm discovery, innovation and utilization for genetic improvement and genomics research. His recent work focused on the exploitation of wild kumquat as the model plant of citrus genetic studies, and the formation mechanism of citrus flesh color and polyembryony traits. He successively held the president of Chinese Society for Citriculture, the eleventh chairman of International Society of Citriculture and chief scientist of China National Technology System for Citrus Industry. He is the author of more than 300 research papers in peer reviewed journals including *Nature Genetics*, *Molecular Plant*, *Plant Physiology*, etc. He has received national and international awards including the 2011 Outstanding International Horticulturist award by the American Society of Horticultural Science, the Chinese Agricultural Excellence Award, and International Society of Citriculture Fellow Member, etc.

Dr. Yujin Hao, Professor of college of Horticultural Science and Engineering, Shandong Agricultural University. He obtained his PhD degree in Pomology from Huazhong Agricultural University in 2000. His research mainly focused on exploring the key genes and its regulation mechanisms of apple fruit quality (color, acid, etc.) and resistance traits, aiming at facilitating the genetic improvement of apple. He has published more than 160 peer-reviewed papers in international academic journals.

Dr. Jingquan Yu, Chair Professor at Horticultural Department of Zhejiang University. His research focused on plant growth, development, and the crosstalk of reactive oxygen species (ROS) and hormones (especially brassinosteroids) in plant adaptation to environmental changes using tomato and cucumber as the experimental materials. Until now, he published more than 200 papers in international journals including *Nature Plants*, *Current Biology*, *Plant Cell*, *New Phytologist*, and *Plant Physiology*, etc. He currently has an H-Index of 60 and has been on the Thomson Reuters official list of Highly Cited Researcher, earning a mark of Exceptional Impact, focusing particularly on plant stress response and regulation. He received the National Prize for Natural Science in 2007 and National Prize for Progress in Science and Technology in 2016, respectively.

Dr. Qixiang Zhang, Professor of Beijing Forestry University. He serves as Director of National Engineering Research Center for Floriculture, Chair of Working Group Ornamental Genetic Resources, ISHS. He has been engaged in flower teaching and research for more than 30 years and has been conducting continuous and systematic studies on germplasm exploitation, breeding, and industrialized technology of important flowers such as Mei (*Prunus mume*), Roses, and Chrysanthemum. He has won three second prizes of National Science and Technology Progress Awards, created more 100 new flower varieties, obtained 50 National Invention Patents; made 16 National and Industry Standards; published more than 90 research papers in peer reviewed journals including *Nature communication*, etc.

Dr. Zhonghua Liu, Professor of Tea Science at Hunan Agricultural University, Academician of the Chinese Academy of Engineering. He has mainly been engaged in theory and technology of tea processing, tea comprehensive processing and resource utilization, tea and health. His recent work focused on mechanism of tea quality and flavor formation, molecular biology and germplasm innovation of tea plants. He successively held the vice president of China Society for Tea Science, vice president of International Tea Culture Institute and chief scientist for tea processing of China National Technology System for Tea Industry. He is the author of more than 300 research papers in peer reviewed journals including *Redox Biology*, *Food Chemistry*, and *Journal of Agricultural and Food Chemisty*, etc. He has received national and international awards including the 2017 Outstanding Innovation Award of International Tea Science and Technology by International Tea Committee, and the Chinese Science and Technology Progressive Award, etc.