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Dedicated to the memory
of Professor Dr. Georg Melchers
Preface

On planning this monograph, our intent was to examine first the current status of knowledge of the fundamental aspects of gametophyte-to-sporophyte development and, second, the haploidy progress in representative species where it is being used for plant improvement. Consequently, the monograph is divided arbitrarily into two sections.

The first section deals with the molecular, cytological and biochemical aspects of haploid embryogenesis. In this case, microspore embryogenesis is emphasized as this system still represents the primary route to haploid and doubled haploid embryo development in most species. Here, the authors have presented an up-to-date review of the regulation of microspore embryo induction and development.

The second section is devoted to the utilization of haploids in the improvement of specific crop species. Here, we have grouped them into families containing commercially important crops. Although the Fabaceae, Euphorbiaceae and Malvaceae families contain commercially important species, these were not included because of the scarcity of literature on the induction, development and use of haploids in these species. Nevertheless, as we gain more basic understanding of the induction and regulation of haploid embryogenesis, the use of this technology will be of great value in the improvement of these and other species.

The chapter on utilization of haploid cells and embryos (Chap. I.8) addresses their potential use in gene transformation, mutation, selection and artificial seed technology. Microspore-derived embryos offer a convenient system for studies of storage product accumulation and metabolism. In Chapter I.6 the use of such embryos and haploid cell cultures for storage lipid and protein metabolism is examined. The treatment is restricted to *Brassica* as there have been no reports of such studies with other species.

For the chapter on miscellaneous species (Chap. II.5), the intent was to provide coverage of those crop species that could not be conveniently included in the major families. Here, the authors have covered five families with emphasis on the use of gynogenesis for doubled haploid production. This method is quite successful in the Liliaceae and Cucurbitaceae and may be useful even in cases where androgenesis is applicable as novel genetic recombinations may be uncovered. At the National Research Council of Canada Plant Biotechnology Institute in Saskatoon, research is ongoing, aimed at the potential application of doubled haploids to the improvement of commer-
cially important members of the Umbelliferae, Labiatae and Caryophyllaceae. The results of those investigations will help in understanding species differences in haploid embryogenic response. Doubled haploid technology is of significant value in gene mapping and identification of quantitative trait loci (QTL), both of which are important for crop development.

With the current emphasis on a bioeconomy, renewable resources and sustainable development, existing crop species and emerging ones may have to be manipulated to produce biological molecules of commercial interest. There will be a need to improve crop adaptation to biotic and abiotic insults. Haploid technology is likely to be a valuable component of any strategy aimed at these improvements.

Bringing this material together as an overview should stimulate interest and the development of new concepts and mechanisms that will lead to further improvements and utilization of these very important haploid systems.

The editors greatly appreciate the cooperation of all the authors who contributed to this monograph, and we hope we have succeeded in highlighting the advances made in haploid embryo development and its potential uses. The editors wish to acknowledge the excellent technical assistance of Keith Pahl and Marie Mykytyshyn in editing this monograph. This work was performed as part of Genome Prairie’s Enhancing Canola through Genomics project.

C.E. Palmer, W.A. Keller, and K.J. Kasha

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List of Contributors

AIONESEI, T.
Max F. Perutz Laboratories, University Departments at the Vienna Biocenter, Institute of Microbiology and Genetics, Dr. Bohrgasse 9/4, 1030 Vienna, Austria

ANDERSEN, S.B.
Department of Agricultural Sciences, The Royal Veterinary and Agricultural University, Thorvaldsensvej 40, 1871 Frederiksberg C, Denmark

BOUTILIER, K.
Plant Research International. P.O. Box 16, 6700 AA Wageningen, The Netherlands

CLEMENT, C.
Université de Reims Champagne Ardenne, UFR Sciences, Biologie et Physiologie Végétales, BP 1039, 51687 Reims Cedex 2, France

DEVAUX, P.
Florimond Despres, Biotechnology Laboratory, 3 rue Florimond Despres, P.O.B. 41, 59242 Cappelle en Pévèle, France

FIERS, M.
Plant Research International. P.O. Box 16, 6700 AA Wageningen, The Netherlands

FRIEDT, W.
Institute of Crop Science and Plant Breeding I, Justus-Liebig-University of Giessen, Heinrich-Buff-Ring 26–32, 35392 Giessen, Germany

FUJUKO, H.
National Institute of Vegetable and Tea Science, Mie 514-2392, Japan

HEBERLE-BORS, E.
Max F. Perutz Laboratories, University Departments at the Vienna Biocenter, Institute of Microbiology and Genetics, Dr. Bohrgasse 9/4, 1030 Vienna, Austria
HORN, R.
Department of Genetics and Biochemistry, Clemson University,
100 Jordan Hall, Box 340324, Clemson, South Carolina 29634-0324, USA

JAKÄE, M.
Agronomy Department, Biotechnical Faculty, University in Ljubljana,
Jamnikarjeva 101, 1000 Ljubljana, Slovenia

JUHÁSZ, A.G.
Vegetable Crops Research Institute, Budapest, 1775 Pf 95, Hungary

KASHA, K.J.
Department of Plant Agriculture, University of Guelph, Guelph, Ontario,
N1G 2W1, Canada

KELLER, W.A.
NRC – Plant Biotechnology Institute, 110 Gymnasium Place, Saskatoon,
Saskatchewan, S7N 0W9, Canada

LIU, C.-M.
Plant Research International. P.O. Box 16, 6700 AA Wageningen,
The Netherlands

NICHTERLEIN, K.
Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture,
Vienna, Austria. Present address: FAO, Regional Office for Europe,
Viale delle Terme di Caracalla, Rome, Italy

PALMER, C.E.
NRC – Plant Biotechnology Institute, 110 Gymnasium Place, Saskatoon,
Saskatchewan, S7N 0W9, Canada

PICKERING, R.
New Zealand Institute for Crop and Food Research Limited,
Private Bag 4704, Christchurch, New Zealand

SANGWAN, R.S.
Université de Picardie Jules Verne, Androgenèse et Biotechnologies, 33,
rue Saint-Leu, 80039 Amiens, France

SANGWAN-NORREEL, B.
Université de Picardie Jules Verne, Androgenèse et Biotechnologies, 33,
rue Saint-Leu, 80039 Amiens, France
TAI, G.C.C.
Potato Research Centre, Agriculture and Agri-Food Canada, P.O. Box 20280,
Fredericton, New Brunswick, E3B 4Z7, Canada

Takahata, Y.
Faculty of Agriculture, Iwate University, Morioka 020-8550, Japan

Tashpulatov, A.S.
Max F. Perutz Laboratories, University Departments at the Vienna
Biocenter, Institute of Microbiology and Genetics, Dr. Bohrgasse 9/4,
1030 Vienna, Austria

Touraev, A.
Max F. Perutz Laboratories, University Departments at the Vienna
Biocenter, Institute of Microbiology and Genetics, Dr. Bohrgasse 9/4,
1030 Vienna, Austria

van der Geest, A. (Lonneke) H.M.
Plant Research International. P.O. Box 16, 6700 AA Wageningen,
The Netherlands

Wakui, K.
Junior College, Tokyo University of Agriculture, Setagaya 156-8502, Japan

Weselake, R.J.
Department of Chemistry and Biochemistry, University of Lethbridge,
4401 University Dr, Lethbridge, Alberta, T1K 3M4, Canada. Present address:
Department of Agriculture, Food and Nutritional Science, 410 Agriculture/
Forestry Centre, University of Alberta, Edmonton, Alberta, T6G 2P5,
Canada

Zarhloul, M.K.
Institute of Crop Science and Plant Breeding I, Justus-Liebig-University
of Giessen, Heinrich-Buff-Ring 26–32, 35392 Giessen, Germany

Zoriniants, S.
Max F. Perutz Laboratories, University Departments at the Vienna
Biocenter, Institute of Microbiology and Genetics, Dr. Bohrgasse 9/4,
1030 Vienna, Austria
Section I Molecular, Cytological, and Biochemical Aspects of Haploid Embryogenesis