Biotechnology in Agriculture and Forestry

Edited by T. Nagata
H. Lörz and J.M. Widholm

56 Haploids in Crop Improvement II

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

Springer

Haploids In Crop Improvement Ii Biotechnology In Agriculture And Forestry

Y. P. S. Bajaj

Haploids In Crop Improvement Ii Biotechnology In Agriculture And Forestry:

Haploids in Crop Improvement II Constantine E. Don Palmer,Wilfred A. Keller,Kenneth J. Kasha,2006-01-27 Doubled haploid technology is an important tool for plant breeding It allows for significant time reduction in the achievement of homozygous breeding lines of value in crop improvement This volume provides an excellent overview of haploid induction and the application of doubled haploids The authors emphasize advances made in the understanding of microspore embryogenesis but treat also advances in gynogenesis and the manipulation of parthenogenetic haploid development The text contains a thorough discussion of the application of haploidy to the improvement of a number of species from various families including Brassicaceae Poaceae and Solanaceae The various methods applicable to these species are described in detail Each chapter contains critical evaluation of the scientific literature and an extensive list of references This volume is ideally suited for plant breeders geneticists and plant cell biologists *Advances in Haploid Production in Higher Plants* Alisher Touraev,Brian P. Forster,Shri Mohan Jain,2008-12-18 The importance of haploids is well known to geneticists and plant breeders The discovery of anther derived haploid Datura plants in 1964 initiated great excitement in the plant breeding and genetics communities as it offered shortcuts in producing highly desirable homozygous plants Unfortunately the expected revolution was slow to materialise due to problems in extending methods to other species including genotypic dependence recalcitrance slow development of tissue culture technologies and a lack of knowledge of the underlying processes Recent years have witnessed great strides in the research and application of haploids in higher plants After a lull in activities drivers for the resurgence have been 1 development of effective tissue culture protocols 2 identification of genes c trolling embryogenesis and 3 large scale and wide spread commercial up take in plant breeding and plant biotechnology arenas The first major international symposium on Haploids in Higher Plants took place in Guelph Canada in 1974 At that time there was much excitement about the potential benefits but in his opening address Sir Ralph Riley offered the following words of caution I believe that it is quite likely that haploid research will contr ute cultivars to agriculture in several crops in the future However the more extreme claims of the enthusiasts for haploid breeding must be treated with proper caution Plant breeding is subject from time to time to sweeping claims from ent siastic proponents of new procedures *Haploids in Crop Improvement I* Y. P. S. Bajaj,2012-12-06 Haploid plants have the gametophytic number of chromosomes They are of great importance especially in studies on the induction of muta tions and also for the production of homozygous plants they are needed in large numbers The conventional methods employed by plant breeders for their production are cumbersome time consuming laborious and rather inefficient Sometimes it may take years to produce a pure line However with the introduction of in vitro techniques especially anther culture for the induction of androgenesis it has become increasingly evi dent that these methods considerably accelerate the production of haploids for plant breeding programs During the last decade in vitro produced haploids have been incor porated into breeding programs of many agricultural crops and positive

results have been obtained especially with rice wheat potato barley maize asparagus sunflower brassica tobacco etc Among these rice and wheat are the best examples in which a number of improved varieties have been released In wheat the breeding cycle can be shortened by three or four generations when the pollen haploid breeding method is used instead of conventional cross breeding The release of the wheat varieties Jinghua 1 and Florin is a typical example of what can be achieved with other crops Taking these developments into considera tion the present volume Haploids in Crop Improvement I was compil ed Plant Breeding Reviews, Volume 34 Jules Janick,2011-01-04 Plant Breeding Reviews presents state of the art reviews on plant breeding and genetics covering horticultural agronomic and forestry crops incorporating both traditional and molecular methods The contributions are authored by world authorities anonymously reviewed and edited by Professor Jules Janick of Purdue University USA The series is an indispensible resource for crop breeders plant scientists and teachers involved in crop improvement and genetic resources **Genetics and Genomics of the Triticeae** Catherine Feuillet,Gary J. Muehlbauer,2009-06-10 Sequencing of the model plant genomes such as those of A thaliana and rice has revolutionized our understanding of plant biology but it has yet to translate into the improvement of major crop species such as maize wheat or barley Moreover the comparative genomic studies in cereals that have been performed in the past decade have revealed the limits of conservation between rice and the other cereal genomes This has necessitated the development of genomic resources and programs for maize sorghum wheat and barley to serve as the foundation for future genome sequencing and the acceleration of genomic based improvement of these critically important crops Cereals constitute over 50% of total crop production worldwide http www fao org and cereal seeds are one of the most important renewable resources for food feed and industrial raw materials Crop species of the Triticeae tribe that comprise wheat barley and rye are essential components of human and domestic animal nutrition With 17% of all crop area wheat is the staple food for 40% of the world s population while barley ranks fifth in the world production Their domestication in the Fertile Crescent 10 000 years ago ushered in the beginning of agriculture and signified an important breakthrough in the advancement of civilization Rye is second after wheat among grains most commonly used in the production of bread and is also very important for mixed animal feeds It can be cultivated in poor soils and climates that are generally not suitable for other cereals Extensive genetics and cytogenetics studies performed in the Triticeae species over the last 50 years have led to the characterization of their chromosomal composition and origins and have supported intensive work to create new genetic resources Cytogenetic studies in wheat have allowed the identification and characterization of the different homoeologous genomes and have demonstrated the utility of studying wheatgenome evolution as a model for the analysis of polyploidization a major force in the evolution of the eukaryotic genomes Barley with its diploid genome shows high collinearity with the other Triticeae genomes and therefore serves as a good template for supporting genomic analyses in the wheat and rye genomes The knowledge gained from genetic studies in the Triticeae has also been used to produce Triticale the first human made hybrid crop that results from a

cross between wheat and rye and combines the nutrition quality and productivity of wheat with the ruggedness of rye Despite the economic importance of the Triticeae species and the need for accelerated crop improvement based on genomics studies the size 1 7 Gb for the bread wheat genome i e 5x the human genome and 40 times the rice genome high repeat content 80% and complexity polyploidy in wheat of their genomes often have been considered too challenging for efficient molecular analysis and genetic improvement in these species Consequently Triticeae genomics has lagged behind the genomic advances of other cereal crops for many years Recently however the situation has changed dramatically and robust genomic programs can be established in the Triticeae as a result of the convergence of several technology developments that have led to new more efficient scientific capabilities and resources such as whole genome and chromosome specific BAC libraries extensive EST collections transformation systems wild germplasm and mutant collections as well as DNA chips Currently the Triticeae genomics toolbox is comprised of 9 publicly available BAC libraries from diploid 5 tetraploid 1 and hexaploid 3 wheat 3 publicly available BAC libraries from barley and one BAC library from rye 3 wheat chromosome specific BAC libraries DNA chips including commercially available first generation chips from AFFYMETRIX containing 55 000 wheat and22 000 barley genes A large number of wheat and barley genetic maps that are saturated by a significant number of markers The largest plant EST collection with 870 000 wheat ESTs 440 000 barley ESTs and about 10 000 rye ESTs Established protocols for stable transformation by biolistic and agrobacterium as well as a transient expression system using VIGS in wheat and barley and Large collections of well characterized cultivated and wild genetic resources International consortia such as the International Triticeae Mapping Initiative ITMI have advanced synergies in the Triticeae genetics community in the development of additional mapping populations and markers that have led to a dramatic improvement in the resolution of the genetic maps and the amount of molecular markers in the three species resulting in the accelerated utilization of molecular markers in selection programs Together with the development of the genomic resources the isolation of the first genes of agronomic interest by map based cloning has been enabled and has proven the feasibility of forging the link between genotype and phenotype in the Triticeae species Moreover the first analyses of BAC sequences from wheat and barley have allowed preliminary characterizations of their genome organization and composition as well as the first inter and intra specific comparative genomic studies These later have revealed important evolutionary mechanisms e g unequal crossing over illegitimate recombination that have shaped the wheat and barley genomes during their evolution These breakthroughs have demonstrated the feasibility of developing efficient genomic studies in the Triticeae and have led to the recent establishment of the International Wheat Genome Sequencing Consortium IWGSC http www wheatgenome org and the International Barley Sequencing Consortium www isbc org that aim to sequence respectively the hexaploid wheat and barleygenomes to accelerate gene discovery and crop improvement in the next decade Large projects aiming at the establishment of the physical maps as well as a better characterization of their composition and organization through large

scale random sequencing projects have been initiated already Concurrently a number of projects have been launched to develop high throughput functional genomics in wheat and barley Transcriptomics proteomics and metabolomics analyses of traits of agronomic importance such as quality disease resistance drought and salt tolerance are underway in both species Combined with the development of physical maps efficient gene isolation will be enabled and improved sequencing technologies and reduced sequencing costs will permit ultimately genome sequencing and access to the entire wheat and barley gene regulatory elements repertoire Because rye is closely related to wheat and barley in Triticeae evolution the latest developments in wheat and barley genomics will be of great use for developing rye genomics and for providing tools for rye improvement Finally a new model for temperate grasses has emerged in the past year with the development of the genetics and genomics including a 8x whole genome shotgun sequencing project of Brachypodium a member of the Poeae family that is more closely related to the Triticeae than rice and can provide valuable information for supporting Triticeae genomics in the near future These recent breakthroughs have yet to be reviewed in a single source of literature and current handbooks on wheat barley or rye are dedicated mainly to progress in genetics In Genetics and Genomics of the Triticeae we will aim to comprehensively review the recent progress in the development of structural and functional genomics tools in the Triticeae species and review the understanding of wheat barley and rye biology that has resulted from these new resources as well as to illuminate how this new found knowledge can be applied for the improvement of these essential species The book will be the seventh volume in the ambitious series of books Plant Genetics and Genomics Richard A Jorgensen series editor that will attempt to bring the field up to date on the genetics and genomics of important crop plants and genetic models It is our hope that the publication will be a useful and timely tool for researchers and students alike working with the Triticeae

Somaclonal Variation in Crop Improvement II Y. P. S. Bajaj,2012-12-06 In continuation of Somaclonal Variation and Crop Improvement I 1990 this volume is comprised of twenty four chapters dealing with somaclonal variants showing resistance to salt drought herbicides viruses Alternaria Fusarium Glomerella Verticillium Phytophthora fall armyworm etc in a number of plants of economic importance It is divided into two sections Section I Somaclonal Variation in Agricultural Crops wheat rice maize sorghum potato tomato Lotus Stylosanthes banana strawberry citrus colt cherry Section II Somaclonal Variation in Medicinal and Aromatic Plants Atropa Carthamus Hypericum Lavatera Nicotiana Primula Rauwolfia Scilla and Zinnia This book will be of great assistance to research workers teachers and advanced students of plant pathology tissue culture pharmacy horticulture and especially plant breeding Somatic Hybridization in Crop Improvement II Toshiyuki Nagata,Y.P.S. Bajaj,2012-12-06 This richly illustrated volume describes how somatic hybrids can contribute to the improvement of crops It comprises 24 chapters dealing with interspecific and intergeneric somatic hybridization and cybridization providing valuable tools for plant breeders *In Vitro Haploid Production in Higher Plants* S. Mohan Jain,S.K. Sopory,R.E. Veilleux,2013-03-09 Since the beginning of agricultural production there has been a continuous effort to grow

more and better quality food to feed ever increasing popula tions Both improved cultural practices and improved crop plants have al lowed us to divert more human resources to non agricultural activities while still increasing agricultural production Malthusian population predictions continue to alarm agricultural researchers especially plant breeders to seek new technologies that will continue to allow us to produce more and better food by fewer people on less land Both improvement of existing cultivars and development of new high yielding cultivars are common goals for breeders of all crops In vitro haploid production is among the new technologies that show great promise toward the goal of increasing crop yields by making similar germplasm available for many crops that was used to implement one of the greatest plant breeding success stories of this century i e the development of hybrid maize by crosses of inbred lines One of the main applications of anther culture has been to produce diploid homozygous pure lines in a single generation thus saving many generations of backcrossing to reach homozygosity by traditional means or in crops where self pollination is not possible Because doubled haploids are equivalent to inbred lines their value has been appreciated by plant breeders for decades The search for natural haploids and methods to induce them has been ongoing since the beginning of the 20th century *Rice* Y. P. S. Bajaj,2012-12-06 Rice is the most important cereal crop which feeds more than half the population of the world It is being grown in more than 144 641 million ha with a production of over 468 275 million tons in 1988 Rice is attacked by a large number of pests and diseases which cause an enormous loss in its yield Therefore the major objectives in rice breeding are the development of disease resistance tolerance to insects adverse soil water and drought and improvement of quality including increased protein content Tremendous efforts being made at the International Rice Research Institute have resulted in the release of improved varieties It is estimated that the world s annual rice production must increase from 460 million tons in 1987 to 560 million tons by the year 2000 and to 760 million tons by 2020 a 65% increase in order to keep up with the population growth IRRI Rice Facts 1988 To achieve this gigantic goal new strategies have to be evolved Since the success of any crop improvement program de pends on the extent of genetic variability in the base population new techniques need to be developed not only to generate the much needed variability but also for its conservation In this regard the progress made in the biotechnology of rice during the last 5 years has amply demonstrated the immense value of innovative approaches for further improvement of this crop **Molecular Plant Breeding** Yunbi Xu,2010 Recent advances in plant genomics and molecular biology have revolutionized our understanding of plant genetics providing new opportunities for more efficient and controllable plant breeding Successful techniques require a solid understanding of the underlying molecular biology as well as experience in applied plant breeding Bridging the gap between developments in biotechnology and its applications in plant improvement Molecular Plant Breeding provides an integrative overview of issues from basic theories to their applications to crop improvement including molecular marker technology gene mapping genetic transformation quantitative genetics and breeding methodology **Androgenesis and Haploid Plants** Yves Chupeau,1998-05-20 Jointly published with INRA Paris

The use of haploid plants is of increasing importance in plant biology and plant breeding This book illustrates how the advances in plant molecular and cell biology provide an exciting means for the analysis of androgenesis in terms of pollen development and the initiation of embryogenesis It provides both an appraisal of techniques and their practical application and is the most up to date source of information about the biology of gametophytes Reproductive Biology and Plant Breeding Yvette Dattee,Christian Dumas,Andre Gallais,2012-12-06 This volume has been produced for the XI 11th EUCARPIA Congress EUCARPIA the European Association for Plant breeding currently has 1 200 members including scientists and staff of both publ ic and private organizations Its aim is to promote scientific and technical research and cooperation In the field of plant breeding and thereby to contribute to the development of agriculture Every three years EUCARPIA organizes a scientific congress In 1992 the Xilith EUCARPIA Congress will be held In ANGERS Fran ce and the theme Is Reproductive biology and plant breeding Reproduction of plant material Is central to selection The geneti cist the plant breeder and the seed grower all use sexual and ve getative reproduction during the various stages of plant breeding and creation of variety The possibility of unlimited interspecific reproduction the use of gametogenesis dysfunction the creation of auto and allogamy and the cloning of the best genotypes are the challenges before the plant breeder To understand how the reproductive system conditions the genetic structure of a population and to Investigate the relation ships between the reproductive mode and the organization of varia bility Is a central key to genetic progress The articles presented In this book review the current state of knowledge of reproductive biology and Its impact on variety crea tion **Transgenic Crops I** Y.P.S. Bajaj,2012-12-06 Recently there has been tremendous progress in the genetic transformation of agricultural crops and plants resistant to insects herbicides and diseases have been produced field tested and patented Transgenic Crops I compiles this information on cereals grasses legumes and oilseed crops It comprises 25 chapters and is divided into two sections I Cereals and Grasses wheat rice maize barley sorghum pearl millet triticale Agrostis spp Cenchrus ciliaris Dactylis glomerata Festuca arundinacea Lolium spp and sugarcane II Legumes and Oilseed Crops Arachis hypogaea Brassica juncea Brassica napus Cicer arietinum Glycine max Gossypium hirsutum Helianthus annuus Lens culinaris Linum usitatissimum Sinapis alba Trifolium and Vicis narbonensis This book is of special interest to advanced students teachers and research workers in the field of plant breeding genetics molecular biology plant tissue culture and plant biotechnology in general *Medicinal and Aromatic Plants III* Y. P. S. Bajaj,2012-12-06 After the 1988 and 1989 volumes this is the third volume on Medicinal and Aromatic Plants Each of the 29 chapters contributed by international scientists deals with one individual plant genus namely Atropa Ageratina Ailanthus Aconitum Apium Aloe Akebia Bidens Carthamus Chamomilla Carum Citrus Cymbopogon Dysosma Euphorbia Fritillaria Glycyrrhiza Lavandula Nigella Pelargonium Perilla Podophyllum Rosa Scutellaria Securinega Solanum Swertia Symphytum Syringa Their distribution economic importance conventional propagation in vitro propagation and production of metabolites through tissue culture are treated in detail Special emphasis is laid on the potential of industrial in

vitro production of plant compounds of medical and pharmaceutical relevance using tissue culture Molecular Marker Systems in Plant Breeding and Crop Improvement Horst Lörz,Gerhard Wenzel,2008-11-01 Successful release of new and better crop varieties increasingly requires genomics and molecular biology This volume presents basic information on plant molecular marker techniques from marker location up to gene cloning The text includes a description of technical approaches in genome analysis such as comparison of marker systems positional cloning and array techniques in 19 crop plants A special section focuses on converting this knowledge into general and specific breeding strategies particularly in relation to biotic stress Theory and practice of marker assisted selection for QTL gene pyramiding and the future of MAS are summarized and discussed for maize wheat and soybean Furthermore approaches in silviculture on the examples of Fagus Populus Eucalyptus Picea and Abies are presented The volume ends with a comprehensive review of the patents relevant for using molecular markers and marker assisted selection **Transgenic Trees** Y.P.S. Bajaj,2012-12-06 Annotation This volume on Transgenic Trees comprising 22 chapters deals with the genetic transformation of fruit and forest trees It is of special interest to advanced students teachers and research workers in the field of forestry horticulture molecular biology plant tissue culture botany and plant biotechnology in general BOOK JACKET Title Summary field provided by Blackwell North America Inc All Rights Reserved Advances in Molecular Breeding Toward Drought and Salt Tolerant Crops Matthew A. Jenks,Paul M. Hasegawa,Shri Mohan Jain,2009-05-07 With near comprehensive coverage of new advances in crop breeding for drought and salinity stress tolerance this timely work seeks to integrate the most recent findings about key biological determinants of plant stress tolerance with modern crop improvement strategies This volume is unique because is provides exceptionally wide coverage of current knowledge and expertise being applied in drought and salt tolerance research **Medicinal and Aromatic Plants VII** Professor Dr. Y. P. S. Bajaj,2013-11-11 27 chapters cover the distribution economic importance conventional propagation micropropagation tissue culture studies and in vitro production of important medicinal and other pharmaceutical compounds in various species of Anchusa Brucea Catharanthus Chrysanthemum Coleus Corydalis Coreopsis Emilia Ginkgo Gloriosa Hypericum Inonotus Leucosceptrum Lilium Linum Mosses Nandina Penstemon Prunus Pteridium Quassia Ribes Senecio Taraxacum Thermopsis Vanilla and Vitiveria Like the previous five volumes on medicinal and aromatic plants Volumes 4 7 15 21 and 24 this book contains a wealth of useful information for advanced students and researchers in the field of plant biotechnology and chemical engineering pharmacy botany and tissue culture

Advances in breeding techniques for cereal crops Prof Frank Ordon,Prof. Wolfgang Friedt,2019-06-28 Assesses performance of conventional techniques such as backcross and hybrid breeding in introducing new traits Maps current progress in methods to identify quantitative trait loci QTL linking phenotypic traits with genetic information for selection Shows comparative strengths and weaknesses of marker assisted selection MAS techniques such as genome wide association studies GWAS and nested association mapping NAM Cotton Y.P.S. Bajaj,2012-12-06 Cotton is a multipurpose crop and

produces lint the most important source of fiber used in the textile industry oil seed meal and hulls Twenty three chapters on various aspects of in vitro manipulation and other biotechnological approaches to the improvement of cotton are arranged in six sections Special emphasis is placed on interspecific hybridization somaclonal variation transgenic cotton resistant to insects and herbicides and re engineering of fiber This book is of special interest to advanced students teachers and research workers in the field of cotton breeding genetics tissue culture molecular biology and plant biotechnology in general

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