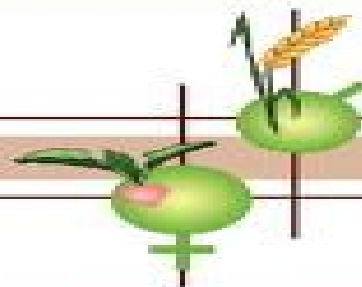


Alisher Touraev
Brian P. Forster
S. Mohan Jain
Editors

Advances in Haploid Production in Higher Plants



Springer

Advances In Haploid Production In Higher Plants

John W. Forster, Kevin F. Smith



Advances In Haploid Production In Higher Plants:

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 controlling embryogenesis and 3 large scale and wide spread commercial uptake 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 contribute 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 enthusiastic proponents of new procedures *In vitro Haploid Production in Higher Plants* S. Mohan Jain, S.K. Sopory, R.E. Veilleux, 2013-11-27

Since the beginning of agricultural production there has been a continuous effort to grow more and better quality food to feed ever increasing populations Both improved cultural practices and improved crop plants have allowed 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 **Progress and Opportunities of Doubled Haploid Production** Muhammad Asif, 2013-07-17 Deals with the historical perspectives and the current status of doubled haploid production along with its practical implications in basic and applied research It highlights various haploid production

methods with a comprehensive discussion on their pros and cons bottlenecks and embryogenic pathways The review also describes in detail the results of molecular and genomic studies conducted to investigate the underlying principles of this spectacular technique that has changed the status of many species from recalcitrant to responsive over the last ninety years

Doubled Haploids: Technological Advances and Role In Crop Improvement Zenu Jha, Satish B. Verulkar, Suprasanna Penna, 2025-03-05 This contributed volume covers the technology of double haploid production with special reference to anther culture and double haploid production in crop plants and applications for basic and applied research in crop improvement Globally plant breeders aim to achieve higher crop productivity by using different breeding techniques The double haploid genotypes have made this monotonous work easier and more efficient to a greater extent by achieving homozygosity and genetic fixation Haploids are genotype with a gametophytic chromosome number and a double haploid is a genotype developed when haploid cells undergo chromosome doubling Artificial production of double haploids can easily shorten the time required to create homozygous plants which is vital in plant breeding The book discusses how double haploids can help in accelerating conventional plant breeding programs and make early release of cultivars with superior and desirable traits along with greater utility in other research aspects of plant breeding genetics and genetic engineering It also explains the role of double haploids in complementing back cross breeding by transferring genes of interest from wild relatives thus breaking genetic barriers The book highlights the role of double haploids in genetic studies like inheritance of quantitative traits quantitative trait loci QTL mapping Genomics gene identification whole genome mapping and production of stable transgenic plants This book is essential for plant breeders geneticists researchers and students in agricultural and crop sciences offering insights into the transformative potential of double haploid technology in modern plant breeding

Plant Breeding Ibrokhim Y. Abdurakhmonov, 2012-01-11 Modern plant breeding is considered a discipline originating from the science of genetics It is a complex subject involving the use of many interdisciplinary modern sciences and technologies that became art science and business Revolutionary developments in plant genetics and genomics and coupling plant omics achievements with advances on computer science and informatics as well as laboratory robotics further resulted in unprecedented developments in modern plant breeding enriching the traditional breeding practices with precise fast efficient and cost effective breeding tools and approaches The objective of this Plant Breeding book is to present some of the recent advances of 21st century plant breeding exemplifying novel views approaches research efforts achievements challenges and perspectives in breeding of some crop species The book chapters have presented the latest advances and comprehensive information on selected topics that will enhance the reader's knowledge of contemporary plant breeding

Doubled Haploid Production in Crop Plants M. Maluszynski, Kenneth Kasha, B.P. Forster, I. Szarejko, 2013-06-29 The production of doubled haploids has become a necessary tool in advanced plant breeding institutes and commercial companies for breeding many crop species However the development of new more efficient and cheaper large scale production

protocols has meant that doubled haploids are also recently being applied in less advanced breeding programmes This Manual was prepared to stimulate the wider use of this technology for speeding and opening up new breeding possibilities for many crops including some woody tree species Since the construction of genetic maps using molecular markers requires the development of segregating doubled haploid populations in numerous crop species we hope that this Manual will also help molecular biologists in establishing such mapping populations For many years both the Food and Agriculture Organization of the United Nations FAO and the International Atomic Energy Agency IAEA have supported and coordinated research that focuses on development of more efficient doubled haploid production methods and their applications in breeding of new varieties and basic research through their Plant Breeding and Genetics Section of the Joint FAO IAEA Division of Nuclear Techniques in Food and Agriculture The first FAO IAEA scientific network Coordinated Research Programme CRP dealing with doubled haploids was initiated by the Plant Breeding and Genetics Section in 1986

Climate-Smart Rice Breeding Akansha Singh, Shravan Kumar Singh, Jiban Shrestha, 2024-11-15 This book covers all aspects of smart breeding technologies in creating novel crop architecture to meet future rice demand Several advanced crop breeding technologies like marker assisted backcross breeding marker assisted recurrent selection genomic assisted breeding haplotype breeding and genome editing technologies have been introduced and employed for rice productivity improvement Use of artificial intelligence and machine learning in crop phenotype prediction is paving the way for climate smart breeding Chapters in this volume cover all these relevant topics The global rice demand is estimated to rise to 555 and 827.86 million tons in 2035 for milled rice and paddy respectively Enhancing high nutrition rice production under the pressure of global climate change conditions is a hard task for breeders Changing climatic scenarios and extreme weather conditions have increased the incidence of various biotic and abiotic stresses Also every degree rise in global mean temperature causes 3.2 % reduction in rice yield globally This creates an urgent need for developing high yielding rice varieties to tackle the aggravated issue of food security This book is meant for scientists professionals researchers and students working on enhancing rice production through advanced plant breeding technologies *Advances in Plant Breeding Strategies: Breeding, Biotechnology and Molecular Tools* Jameel M. Al-Khayri, Shri Mohan Jain, Dennis V. Johnson, 2016-02-02 The basic concept of this book is to examine the use of innovative methods augmenting traditional plant breeding towards the development of new crop varieties under different environmental conditions to achieve sustainable food production This book consists of two volumes Volume 1 subtitled Breeding Biotechnology and Molecular Tools and Volume 2 subtitled Agronomic Abiotic and Biotic Stress Traits This is Volume 1 which consists of 21 chapters covering domestication and germplasm utilization conventional breeding techniques and the role of biotechnology In addition to various biotechnological applications in plant breeding it includes functional genomics mutations and methods of detection and molecular markers In vitro techniques and their applications in plant breeding are discussed with an emphasis on

embryo rescue somatic cell hybridization and somaclonal variation Other chapters cover haploid breeding transgenics cryogenics and bioinformatics 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 Genetics and Breeding for Productivity Traits in Forage and Bioenergy Grasses John W. Forster, Kevin F. Smith, 2018-03-20 This book is a printed edition of the Special Issue Genetics and Breeding for Productivity Traits in Forage and Bioenergy Grasses that was published in *Agronomy*

Agricultural Biotechnology: Latest Research and Trends Dinesh Kumar Srivastava, Ajay Kumar Thakur, Pankaj Kumar, 2022-01-08 This book caters to the need of researchers working in the ever evolving field of agricultural biotechnology It discusses and provides in depth information about latest advancements happening in this field The book discusses evolution of plant tissue culture techniques development of doubled haploids technology role of recombinant DNA technology in crop improvement It also provides an insight into the global status of genetically modified crops use of RNAi technology and mi RNAs in plant improvement Chapters are also dedicated for different branches of omics science including genomics bioinformatics proteomics metabolomics and phenomics along with the use of molecular markers in tagging and mapping of various genes QTLs of agronomic importance This book also covers the role of enzymes and microbes in agriculture in productivity enhancement It is of interest to teachers researchers of biotechnology and agriculture scientists Also the book serves as additional reading material for undergraduate and postgraduate students of biotechnology agriculture horticulture forestry ecology soil science and environmental sciences National and international biotechnologists and agricultural scientists will also find this to be a useful read

Biotechnologies of Crop Improvement, Volume 1 Satbir Singh Gosal, Shabir Hussain Wani, 2018-06-22 During the past 15 years cellular and molecular approaches have emerged as valuable adjuncts to supplement and complement conventional breeding methods for a wide variety of crop plants Biotechnology increasingly plays a role in the creation conservation characterization and utilization of genetic variability for germplasm enhancement For instance anther microspore culture somaclonal variation embryo culture and somatic hybridization are being exploited for obtaining incremental improvement in the existing cultivars In addition genes that confer insect and disease resistance abiotic stress tolerance herbicide tolerance and quality traits have been isolated and re introduced into otherwise sensitive or susceptible species by a variety of transgenic techniques Together these transformative methodologies grant access to a greater repertoire of genetic diversity as the genes may come from viruses bacteria fungi insects animals human beings unrelated plants or even be artificially derived Remarkable achievements have been made in the production characterization field evaluation and commercialization of transgenic crop varieties worldwide

Likewise significant advances have been made towards increasing crop yields improving nutritional quality enabling crops to be raised under adverse conditions and developing resistance to pests and diseases for sustaining global food and nutritional security The overarching purpose of this 3 volume work is to summarize the history of crop improvement from a technological perspective but to do so with a forward outlook on further advancement and adaptability to a changing world Our carefully chosen case studies of important plant crops intend to serve a diverse spectrum of audience looking for the right tools to tackle complicated local and global issues

Triticale François Eudes, 2015-09-10 Triticale crop species has received substantial research support since the mid 20th century making it a commercial success in many countries in diverse value propositions However no recent book captures the new knowledge and progresses made in more than 2 decades The purpose of this work is to review and collate the new knowledge of triticale plant biology and agronomy while considering the contribution of biotechnology enablers such as molecular markers doubled haploid technology and genetic engineering in breeding for traits important for crop production feed food and industrial end uses

The Gentianaceae - Volume 2: Biotechnology and Applications Jan J. Rybczyński, Michael R. Davey, Anna Mikula, 2015-06-17 This book the second of two volumes on the Gentianaceae is devoted to aspects of biotechnology and their applications It consists of 18 chapters and covers micropropagation by means of organogenesis or somatic embryogenesis and single cell manipulation of various species belonging to the horticultural genera *Blakstonia* *Centaureum* *Gentiana* *Gentianella* and *Swertia* Furthermore the application of somatic cell hybridization haploidization and genetic variation arising from tissue and organ culture for the production of plants with new horticultural traits such as new flower colors or sizes or with special pharmaceutical values is treated in detail Also discussed are molecular markers that facilitate breeding and cultivar identification the preservation of genetic resources by cryopreservation the postharvest physiology of cut Gentian flowers and potted plants and different analytical methods for the evaluation of Gentians as sources of secondary metabolites such as xanthones and flavonoids secoiridoids and C glucoflavonoids and their positive impacts on human health This volume as well as the companion book *The Gentianaceae Volume 1 Characterization and Ecology* will serve as key reference works for scientists and students in the fields of botany plant breeding biotechnology and horticulture as well as professional gardeners

Biotechnology for Medicinal Plants Suman Chandra, Hemant Lata, Ajit Varma, 2012-08-10 Plant based medicines play an important role in all cultures and have been indispensable in maintaining health and combating diseases The identification of active principles and their molecular targets from traditional medicine provides an enormous opportunity for drug development Using modern biotechnology plants with specific chemical compositions can be mass propagated and genetically improved for the extraction of bulk active pharmaceuticals Although there has been significant progress in the use of biotechnology using tissue cultures and genetic transformation to investigate and alter pathways for the biosynthesis of target metabolites there are many challenges involved in bringing plants from the laboratory to successful commercial cultivation This book presents

the latest advances in the development of medicinal drugs including topics such as plant tissue cultures secondary metabolite production metabolomics metabolic engineering bioinformatics and future biotechnological directions *Progress in Botany Vol. 81* Francisco M. Cánovas, Ulrich Lüttge, Christoph Leuschner, María-Carmen Risueño, 2020-01-23 With one volume each year this series keeps scientists and advanced students informed of the latest developments and results in all areas of the plant sciences The present volume includes reviews on plant physiology biochemistry genetics and genomics forests and ecosystems

Doubled Haploidy in Model and Recalcitrant Species Jose M. Seguí-Simarro, 2016-03-14 Doubled haploids DHs are powerful tools to reduce the time and costs needed to produce pure lines to be used in breeding programs DHs are also useful for genetic mapping of complex qualitative traits to avoid transgenic hemizygotes for studies of linkage and estimation of recombination fractions for screening of recessive mutants These are just some of the advantages that make DH technology one of the most exciting fields of present and future plant biotechnology All of the DH methods have model species where these technologies have been developed or that respond very efficiently to their corresponding induction treatment However not all the species of economical agronomical interest respond to these methodologies as they should be in order to obtain DHs on a routine basis Indeed many of them are still considered as low responding or recalcitrant to these treatments including many of the most important crops worldwide Although many groups are making significant progresses in the understanding of these intriguing experimental pathways little is known about the origin causes and ways to overcome recalcitrancy It would be very important to shed light on the particularities of recalcitrant species and the special conditions they need to be induced In parallel the knowledge gained from the study of basic aspects in model species could also be beneficial to overcome recalcitrancy In this e book we present a compilation of different approaches leading to the generation of DHs in model and in recalcitrant species and different studies on new and relevant aspects of this process useful to extract common traits and features to know better these processes and eventually to elucidate how to make DH technology more efficient

Plant Biology and Biotechnology Bir Bahadur, Manchikarla Venkat Rajam, Leela Sahijram, K. V. Krishnamurthy, 2015-06-19 Plant genomics and biotechnology have recently made enormous strides and hold the potential to benefit agriculture the environment and various other dimensions of the human endeavor It is no exaggeration to claim that the twenty first century belongs to biotechnology Knowledge generation in this field is growing at a frenetic pace and keeping abreast of the latest advances and calls on us to double our efforts Volume II of this two part series addresses cutting edge aspects of plant genomics and biotechnology It includes 37 chapters contributed by over 70 researchers each of which is an expert in his/her own field of research Biotechnology has helped to solve many conundrums of plant life that had long remained a mystery to mankind This volume opens with an exhaustive chapter on the role played by thale cress *Arabidopsis thaliana* which is believed to be the *Drosophila* of the plant kingdom and an invaluable model plant for understanding basic concepts in plant biology This is followed by chapters on bioremediation biofuels and biofertilizers

through microalgal manipulation making it a commercializable prospect discerning finer details of biotic stress with plant fungal interactions and the dynamics of abiotic and biotic stresses which also figure elsewhere in the book Breeding crop plants for desirable traits has long been an endeavor of biotechnologists The significance of molecular markers marker assisted selection and techniques are covered in a dedicated chapter as are comprehensive reviews on plant molecular biology DNA fingerprinting techniques genomic structure and functional genomics A chapter dedicated to organellar genomes provides extensive information on this important aspect Elsewhere in the book the newly emerging area of epigenetics is presented as seen through the lens of biotechnology showcasing the pivotal role of DNA methylation in effecting permanent and transient changes to the genome Exclusive chapters deal with bioinformatics and systems biology Handy tools for practical applications such as somatic embryogenesis and micropropagation are included to provide frontline information to entrepreneurs as is a chapter on somaclonal variation Overcoming barriers to sexual incompatibility has also long been a focus of biotechnology and is addressed in chapters on wide hybridization and hybrid embryo rescue Another area of accomplishing triploids through endosperm culture is included as a non conventional breeding strategy Secondary metabolite production through tissue cultures which is of importance to industrial scientists is also covered Worldwide exchange of plant genetic material is currently an essential topic as is conserving natural resources in situ Chapters on in vitro conservation of extant threatened and other valuable germplasms gene banking and related issues are included along with an extensive account of the biotechnology of spices the low volume high value crops Metabolic engineering is another emerging field that provides commercial opportunities As is well known there is widespread concern over genetically modified crops among the public GM crops are covered as are genetic engineering strategies for combating biotic and abiotic stresses where no other solutions are in sight RNAi and micro RNA based strategies for crop improvement have proved to offer novel alternatives to the existing non conventional techniques and detailed information on these aspects is also included The book s last five chapters are devoted to presenting the various aspects of environmental marine desert and rural biotechnology The state of the art coverage on a wide range of plant genomics and biotechnology topics will be of great interest to post graduate students and researchers including the employees of seed and biotechnology companies and to instructors in the fields of plant genetics breeding and biotechnology

The Brassica juncea Genome Chittaranjan Kole, Trilochan Mohapatra, 2022-03-08 This book is the first comprehensive compilation of deliberations on elucidation and augmentation of the genome of Brassica juncea one of the leading oilseed crops of the world popularly called as brown mustard Indian mustard Chinese mustard or Oriental mustard It includes discussions on genepools genetic diversity and its characterization classical genetic and traditional breeding basics and application of heteroploidy techniques and applications of introgressive hybridization in vitro culture for micro propagation somatic mutation somatic embryogenesis and somatic hybridization genetic engineering including genetic transformation and gene silencing and molecular genetic mapping and

mapping of genes and comprehensive delineations on genome sequencing and comparative genomics resequencing for elucidation of origin and diversity large scale genome analysis plastid genome sequence transcriptomics metabolomics proteomics evolutionary genomics role of regulatory genes in development and adaptation and their utilization in trait improvement precise breeding for yield quality and resistance to biotic and abiotic stresses and prospects of genome editing

The Genus Citrus Manuel Talon,Marco Caruso,Fred G. Gmitter jr.,2020-01-21 The Genus Citrus presents the enormous amount of new knowledge that has been generated in recent years on nearly all topics related to citrus Beginning with an overview of the fundamental principles and understanding of citrus biology and behavior the book provides a comprehensive view from Citrus evolution to current market importance Reporting on new insights supported by the elucidation of the citrus genome sequence it presents groundbreaking theories and fills in previous knowledge gaps Because citrus is among the most difficult plants to improve through traditional breeding citrus researchers institutions and industries must quickly learn to adapt to new developments knowledge and technologies to address the biological constraints of a unique fruit tree such as citrus Despite the challenges of working with citrus tremendous progress has been made mostly through advances in molecular biology and genomics This book is valuable for all those involved with researching and advancing producing processing and delivering citrus products

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