

Preface

Transfer of alien genes into crop plants from wild and exotic plant genetic resources has invoked tremendous interest of crop scientists globally. Wild species are a rich reservoir of useful alien genes hitherto not available in the cultivated gene pool. These include resistance to diseases and insect-pests, tolerance to drought, salinity, temperature extremities and other abiotic stresses as well as genes for several quality traits. While most of the alien gene introgressions of practical importance in crop plants have been achieved through vertical gene transfer, horizontal gene transfer through transgenesis (for cross incompatible species), somatic hybridization and most recently, intragenesis and cisgenesis, has offered great promise in broadening the genetic base of cultivated crop species. These techniques, lately aided by molecular markers and in situ hybridization have led to introgression of hundreds of genes of interest in cultivated background, thereby improving their genetic potential. The gains through alien gene transfer are significant, nevertheless also raising some issues regarding their possible impacts on human and animal health as well as on environment. Even though, such gene transfers have been successfully accomplished across many crop species and technologies required for these transfers have been refined, which significantly improved the success rate of alien introgression events. Consequently, besides development of several plant products, ample literature has been generated over the years on different aspects of alien gene transfer which needed to be brought under a single book cover so as to provide the readers a comprehensive exposition on this important aspect. Realizing it, we developed this theme with an objective to provide an overview about the importance of alien gene transfer, how it is accomplished, detection of introgressions, the associated advantages and risks, and the significant achievements made from alien gene transfers. Keeping in view the scope of the subject, we have covered this topic in two volumes; the first volume deals with the innovations, methods and risk assessment while the second volume deals more with the practical aspects and covers achievements and impacts of alien gene transfer.

The first volume is already in your hands and covers more of the theoretical aspects of alien gene transfer in crop plants. The first chapter introduces the topic and discusses various techniques of alien introgression followed by a chapter on

distant hybridization, which is a prerequisite for vertical gene transfer. The subsequent two chapters deal with the important aspects of tissue culture and embryo rescue followed by a chapter on techniques of horizontal gene transfer through genetic transformation. Distant hybridization has also led to the discovery of newer techniques immensely useful to plants breeders, and Chap. 6 explains one such technique—doubled haploidy breeding. The following two chapters cover the modern aspects of molecular techniques helping in introgression as well as detection of alien chromatin in cultivated background. Chapter 9 elaborates some of the significant agronomically relevant traits transferred into crop plants. Of late, bioinformatics has witnessed tremendous developments and finds great uses in many spheres of agricultural research, including the detection of alien genes, and this aspect has been covered in Chap. 10. The subsequent two chapters summarize the theme specially focussing on the possible human and ecological impacts of alien gene transfers as well the challenges and risks involved.

The authors of various chapters of this book are all renowned experts in their fields and deserve heartfelt thanks for writing their chapters meticulously and with great responsibility. We are extremely thankful to Dr. S. Ayyappan, Secretary, Department Agricultural Research and Education, Government of India and Director General, Indian Council of Agricultural Research (ICAR), New Delhi, for providing overall support and guidance in furthering our research and academic pursuits. Prof. Swapan Kumar Datta, Deputy Director General (Crop Science), ICAR and Dr. B.B. Singh, Additional Director General (Oilseeds and Pulses), ICAR deserve special mention for their constant encouragement for taking up this endeavour. With profound gratitude we also wish to mention the name of Dr. N. Nadarajan, himself an accomplished plant breeder and Director, Indian Institute of Pulses Research Kanpur, who has a special interest in the subject of distant hybridization and alien gene transfer in crop plants. He was a key force in motivating us to undertake this endeavour and deserves our appreciations. We are also grateful to our colleague Debjyoti Sen Gupta and research scholars working with us: Nupur Malviya, Rakhi Tomar, Ekta Srivastava and Mrityunjaya Singh for compilation of references and searching voluminous literature related to the topic. At Springer, Hannah Smith, Mellissa Higgs and Kenneth Teng, the commissioning editors; Daniel Dominguez the developmental editor and the entire production team have been instrumental in developing our idea of a book on such an important subject to its present form and deserve our appreciations. Our lovely kids Puranjay, Neha and Gun always helped to keep the atmosphere lively while Dr. Rakhi Gupta and Mrs. Renu Rani, our better halves, allowed us to work overtime and gave us all emotional support for which they deserve our genuine appreciation.

We hope that this book will be successful in achieving what we actually desired from it—providing the readers an updated and comprehensive reference on alien gene transfer in crop plants and a ready reckoner for the researchers and scholars who have an interest in this field.

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