Plant Genetics and Genomics: Crops and Models

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Genetics and Genomics of Pineapple

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Preface

During his second voyage to America, Christopher Columbus arrived in Guadeloupe in the West Indies on November 4, 1493. At a Carib village, he and his sailors encountered cultivated pineapple with its astonishing flavor and fragrance. When Columbus returned to Spain, he took plenty of pineapple fruit, and one fruit survived the trip, which he gave to the King. The fact that Columbus encountered pineapple on a Caribbean island indicated that pineapple had been domesticated and distributed from South America to the Caribbean islands, and now we know to Central America as well, at that time. This voyage started the distribution of pineapple to tropical and subtropical regions worldwide in a few hundred years. The success of industrial production of pineapple in Hawaii a century ago made pineapple a routine part of our diet and a pop culture fixture. Pineapple appeared in songs, movies, television shows, clothing, buildings, airplanes, and landmarks, besides numerous food products. As of 2016, pineapple is cultivated on 1.05 million hectares of land in 88 countries, producing 25.6 million metric tons of fruit with a gross production value of 14.9 billion US dollars.

Pineapple is self-incompatible (SI), and it remains to be investigated whether this SI is evolved by natural selection or selected through domestication. The SI in pineapple severely hindered pineapple improvement through traditional breeding via hybridization. Persistent vegetative propagation leads to accumulation of deleterious alleles. When homozygous, these recessive alleles could lead to declined viability or even be lethal. Selfing of self-compatible pineapple mutants resulted in severe decline of viability and even lethality in a few generations of inbreeding. With the exception of cultivar Queen, breeding through hybridization has been challenging in pineapple. Now that the pineapple genome was sequenced and many cultivars were re-sequenced, genetic transformation and genome editing of targeted traits provide opportunities for pineapple improvement. The release of a pink pineapple cultivar using genetic engineering by Del Monte is a good example of this new approach.

This book is intended to provide the most up-to-date knowledge of pineapple genetics and genomics, particularly the information on this heterozygous genome. We hope the sequencing and dissection of this genome will motivate graduate students and researchers to explore pineapple's fundamental biology and further improvement of this tasty and nutritious fruit.

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