

Preface

The Rosaceae Family is represented by approximately 3,000 species of diverse plants, primarily confined to temperate climates. The family has a rich variety of architectural forms and contains herbaceous, tree and shrub species. Many family members are readily recognizable because of their edible seasonal fruits that are prized for their unique flavors, colors and nutritious properties (e.g. apple, strawberry, raspberry, pear, cherry, plum, apricot, pear), as well as familiar ornamentals (e.g. roses) and nuts (e.g. almonds).

Today's rosaceous cultivars have been derived from centuries of careful selection and breeding, using a palette of some of evolution's most curious creations. The careful sculpting that has transformed the germplasm was not trivial, as several of the most coveted fruit species maintain complicated genomes—in some cases among the most complex of cultivated plants (e.g. strawberry). Other species in the family are represented by large perennial tree crops that exhibit substantial juvenility phases, posing a barrier to standard breeding and genetic analyses. Yet, today's superior cultivars feature robust growth, substantial yields and resistance to common biotic and abiotic stresses; traits fostered by human intervention. When the hurdles to efficient cultivation, breeding and selection are considered, the quality and quantity of rosaceous plant products derived from traditional breeding techniques is little short of amazing.

Surprisingly, the breeding practices that have yielded today's finest cultivars have remained almost unchanged for the last 50 years. While selection and cultivation practices have moved forward with only minor revisions, the world has changed significantly, posing new challenges to sustained and profitable, yet environmentally compatible production. Changes in public policy have limited access to water, power, labor and land. Effective fumigants and fungicides have fallen from favor and are now restricted from traditional uses. The pest and pathogen landscape continually changes, remodeled by variations in climate and spreading human populations. Meanwhile, consumer demand increases annually for flawless fruit with superior flavor and health attributes, and for perfect flowers with a long vase life—all the time at lower cost and in a short time-frame.

This means that new tools and strategies are needed to assist efficient development of future generations of innovative cultivars across the Rosaceae. Recent advances in genome-level analyses have proven a valuable route to deriving an

understanding of the molecular events that govern plant responses in model systems. Applying these proven techniques to questions within the Rosaceae will make it possible to provide new tools to aid selection and enhance production. However, the Rosaceae research community overall has experienced a dearth of plant and molecular resources in the public domain, a trend that has only recently been reversed. Today the important crops of the Rosaceae are beginning to enjoy the same benefits once confined to model plant systems. It is possible to quickly assess linkage relationships between genes, test the relevance of a gene or genes to traits of interest, and develop molecular markers to assist traditional selection. Although these concepts have come a long way in the last decade, genomics-level studies in the Rosaceae still are in their infancy.

Unlike other genomics texts that feature the products of a decade of high-throughput molecular and genome-level analyses, our work in Rosaceae is much more the end of the beginning, rather than the beginning of the end. In the last two years significant EST datasets have been developed for *Malus* and *Prunus* (~260,000 and 85,000 ESTs respectively in public databases.) Genomics-level investigations into the structure of genomes, the physical associations between genes, and specific roles of given genes in physiological functions of importance are now emerging. The 3rd International Rosaceae Genomics Conference in New Zealand in March 2006 initiated broad scale interactions among researchers in the Rosaceae internationally. These were further developed further at the 4th International Rosaceae Genomics Conference in Chile in March 2008, with new research investigations crossing international lines. This reality makes the timing of this volume even more appropriate, as it marks a starting point for an explosion of genomics investigations in the Rosaceae. Complete curated genome sequence is expected for apple, peach and strawberry within the realistic range of finite calendar pages. These sequences will accelerate the next wave of studies exploring and comparing the form and function of the many genomes that define the striking differences in form within the Rosaceae e.g., a herbaceous plant vs. a tree, or a fleshy rather than a dehiscent fruit. Among the many dividends of this research will be the development of superior products for consumers, a better understanding of the genetic elements that contribute to agronomic traits of interest, an enhanced vision of Rosaceae evolution, as well as answers to some of the fundamental questions of plant biology, particularly around the specification of plant architecture, that may be best answered by species within this family.

This book covers recent progress in genomic research among the Rosaceae family of crops, grounding recent findings firmly in a historical context of genetic studies. The current status of the application of genomics technologies for crop development is examined. A general introduction precedes summaries of genomics research and applications on a crop by crop basis, each authored by a panel of active researchers on that particular species. This volume will be of considerable value as a resource for workers in the Rosaceae operating at all levels, from research scientists in genetics, genomics and breeding, to graduate and undergraduate students.

Palmerston North, New Zealand
Gainesville, Florida

Susan E. Gardiner
Kevin M. Folta



<http://www.springer.com/978-0-387-77490-9>

Genetics and Genomics of Rosaceae

Folta, K.M.; Gardiner, S.E. (Eds.)

2009, XVII, 636 p., Hardcover

ISBN: 978-0-387-77490-9