

EDITORIAL

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Tomato molecular biology – special collection of papers for molecular horticulture

Graham B. Seymour^{1*} and Jocelyn K. C. Rose²

Tomato (*Solanum lycopersicum*) is the second most important vegetable crop globally, after potato, with about 100 million tons fresh fruit being grown on 3.7 million hectares (FAO 2021), and is of great importance in the human diet due to the large amount of fruit consumed. The fruit are eaten both fresh and, equally importantly, as a processed product in puree, soups and canned products. They provide an important dietary source of vitamins and minerals, such as K, Fe and Ca, and are known for the large number of health promoting secondary metabolites, including the carotenoid and flavonoid pigments that give the fruit a spectrum of yellow, red and orange colours.

Tomato commercial production and breeding is supported by a long history of research that has led to the identification of regions of the tomato genome that control a host of important traits including disease resistance, yield and fruit quality. The first tomato genome was sequenced a decade ago and the sequence is now in its fifth iteration with 100's of genome sequences from a wide spectrum of wild species crop relatives and cultivated varieties. The diploid nature of tomato, genomic resources and a wide range of single gene mutants make it an excellent model plant to study dicot crop species and especially those with fleshy fruits.

In this special collection, we bring together a range of papers to explore the latest developments and scientific insights in tomato molecular biology. This brief editorial summarises the key features of the papers

that collectively set the scientific discovery in the context of plant development and highlight relevance to horticulture.

Plant architecture is a critical determinant of crop productivity and influences, among other factors, the number of reproductive shoots. The hormonal control of plant architecture has been the subject of studies for well over 100 years, but recent advances in genomics have accelerated our understanding of its molecular basis. Tomato is an especially useful model to investigate the association between plant architectural features and their impact on crop performance. Side branching in tomato is undesirable and results in unwanted labour and management costs. Three main phytohormone classes are known to influence side branching: auxins, cytokinins (CKs) and strigolactones. Auxin inhibits the outgrowth of axillary buds and maintains apical dominance. CKs act antagonistically to auxin, suppressing apical dominance and allowing release of axillary buds from dormancy. Auxin modulates CK concentration by repressing its levels, while strigolactones affect bud inhibition by modulating auxin transport. In addition, there seems to be some interplay between CK and strigolactone levels, and the overall picture highly complex. In this special issue, Pino et al. (2022) report that tomato plants overexpressing the cytokinin-deactivating gene *CYTOKININ OXIDASE 2* (*CKOX2*) showed excessive growth of axillary shoots, which is opposite to the phenotype expected of plants with reduced CK content. The authors suggest that CKs cause their paradoxical effects on branching by disturbing auxin status, and by altering the expression of genes associated with branching and CK homeostasis. The study highlights the intricacy of

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Molecular Biology Of Tomato

John I. Yoder



Molecular Biology Of Tomato:

Molecular Biology of the Tomato John I. Yoder, 1993-07-15 The ideal fresh market tomato Sunseeds the challenge of breeding processing tomatoes Specialised requirements for producing transgenic glasshouse tomatoes Development and application of a molecular linkage map in tomato Integration of the classical and molecular linkage maps of tomato chromosome Recombinant inbred populations for high resolution mapping in tomato Mapping quantitative genes involved in a trait assessed on an ordinal scale a case study with bacterial canker in *Lycopersicon peruvianum* Studies towards a genetic and molecular analysis of paramutation at the Sulfurea locus of *Lycopersicon esculentum* Mill Evaluation the prospects of transposon tagging in tomato by the use of endogenous genetic markers Transposon induced chromosomal rearrangements The role of HMGR reductase in tomato fruit development Plant hormone and photomorphogenic mutants of tomato Auxin perception and the regulation of tomato growth and development Self incompatibility in the solanaceae Molecular analysis of gene regulation and function during pollen development Tissue specific gene expression in tomato pistils Molecular mapping of flower development in tomato Genetic control of ethylene and carotenoid production in transgenic tomatoes Inhibition of ripening in transgenic tomato plants expressing ACC deaminase Regulation and function of the E8 fruit ripening gene from tomato Inhibition of fruit senescence Molecular biology of tomato yellow leaf curl virus TYLCV and potential ways to control disease International Conference, Molecular Biology of Tomato, Berkeley, 1996 Molecular Biology of Tomato, International Conference, 1996 The Molecular Biology and Biochemistry of Fruit Ripening Graham Seymour, Gregory A. Tucker, Mervin Poole, James Giovannoni, 2013-03-18 A comprehensive and mechanistic perspective on fruit ripening emphasizing commonalities and differences between fruit groups and ripening processes Fruits are an essential part of the human diet and contain important phytochemicals that provide protection against heart disease and cancers Fruit ripening is of importance for human health and for industry based strategies to harness natural variation or genetic modification for crop improvement This book covers recent advances in the field of plant genomics and how these discoveries can be exploited to understand evolutionary processes and the complex network of hormonal and genetic control of ripening The book explains the physiochemical and molecular changes in fruit that impact its quality and recent developments in understanding of the genetic molecular and biochemical basis for colour flavour and texture It is a valuable resource for plant and crop researchers and professionals agricultural engineers horticulturists and food scientists Summary Reviews the physiochemical and molecular changes in fruit which impact flavour texture and colour Covers recent advances in genomics on the genetic molecular and biochemical basis of fruit quality Integrates information on both hormonal and genetic control of ripening Relevant for basic researchers and applied scientists **Tomato Yellow Leaf Curl Virus Disease** Henryk Czosnek, 2007-09-23 Ideally suited to horticulturalists and plant virologists this highly useful text offers a multidisciplinary view on one of the major diseases of tomato crops the tomato yellow leaf curl disease It deals with

epidemiological aspects of the disease as well as integrated pest management in the field Coverage discusses the efforts aimed at breeding tomato plants resistant to the virus by classical breeding by marker assisted breeding and by genetic engineering

Genetic Improvement of Tomato G. Kalloo, 2012-12-06 The esculent *Lycopersicon esculentum* long thought to be poisonous has become a major U S food crop and source of vitamins and minerals thanks largely to genetic modification and new production technology Rick 1978 Tomato *Lycopersicon esculentum* Mill is one of the most important solana ceous vegetable crops grown worldwide under outdoor and indoor conditions It has become an important commercial crop so far as the area production industrial values and its contribution to human nutrition is concerned During the past few decades tremendous developments have contributed to the knowledge and understanding of various areas of genetics breeding and biotechnology and voluminous literature has been generated The purpose of preparing this monograph is to give a comprehensive up to date treatment to the various aspects of genetic improvement of tomato The emphasis has been placed on cytology classical and molecular genetics reproductive biology germplasm resources hybrid seed production use of wild taxa selection breeding methods breeding for abiotic and biotic stresses processing and quality breeding improvement for mechanical harvesting and biotechnology tissue culture protoplast fusion and genetic transformation These topics are presented in 22 different chapters However a few aspects have been discussed in more than one chapter For example seed production is treated in chapters 1 4 and 8 molecular biology genetic engineering in chapters 3 and 22 and heterosis in chapters 8 and 16

Grapevine Viruses: Molecular Biology, Diagnostics and Management Baozhong Meng, Giovanni P. Martelli, Deborah A. Golino, Marc Fuchs, 2017-07-05 The domestication of grapes dates back five thousand years ago and has spread to nearly all continents In recent years grape acreage has increased dramatically in new regions including the United States of America Chile Asia China and India and Turkey A major limiting factor to the sustained production of premium grapes and wines is infections by viruses The advent of powerful molecular and metagenomics technologies such as molecular cloning and next generation sequencing allowed the discovery of new viruses from grapes To date grapevine is susceptible to 64 viruses that belong to highly diverse taxonomic groups The most damaging diseases include 1 infectious degeneration 2 leafroll disease complex and 3 rugose wood complex Recently two new disease syndromes have been recognized Syrah decline and red blotch Losses due to fanleaf degeneration are estimated at 1 billion annually in France alone Other diseases including leafroll rugose wood Syrah de cline and red blotch can result in total crop loss several years post infection This situation is further exacerbated by mixed infections with multiple viruses and other biotic as well as adverse abiotic environmental conditions such as drought and winter damage causing even greater destruction The book builds upon the last handbook written over twenty years ago on the part of diagnostics and extensively expands its scope by inclusion of molecular biology aspects of select viruses that are widespread and economically most important This includes most current information on the biology transmission genome replication transcription subcellular localization as well as

virus host interactions It also touches on several novel areas of scientific inquiry It also contains suggested directions for future research in the field of grapevine virology

Genetics, Genomics, and Breeding of Tomato Barbara E.

Liedl, Joanne A. Labate, John R. Stommel, Ann Slade, Chittaranjan Kole, 2013-01-17 This volume covers the advances in the study of tomato diversity and taxonomy It examines the mapping of simple and complex traits classical genetics and breeding association studies molecular breeding positional cloning and structural and comparative genomics The contributors also discuss transcriptomics proteomics metabolomics and bioinformatics The information in this book will be useful to researchers working on other Solanaceous crops as well as those interested in using the tomato as a model crop species

Molecular Biology of the Biological Control of Pests and Diseases of Plants Muthukumaran Gunasekaran, Darrell

Jack Weber, 2020-01-29 While many books are available on biological control this is the only book to detail the application of molecular biology to control of pests and diseases Each chapter deals with a different pathogen and the application of new molecular biological techniques to the biocontrol of the pathogen This new reference presents the most comprehensive list of organisms available Internationally respected experts discuss viruses bacteria fungi nematodes protozoa weeds and insects Types of control methods are described and techniques commonly used in molecular biology to identify the etiological agents diagnose diseases and develop control methods are reviewed

Transgenic Plant Research Alan R. Lindsey, 1998-11-26

This text is split into four main sections gene transfer techniques transgenic approaches to gene isolation manipulation of plant development biochemistry and physiology and predictability of transgene expression

Molecular Biology J.

Bryant, 1993-01-01 Methods in Plant Biochemistry Volume 10 Molecular Biology covers techniques for working with plant genes specific techniques for modifying the genetic contents of plant cells and applications of molecular biology techniques to understanding how plants work The book discusses RNA extraction and fractionation in vitro translation of plant messenger RNA and cDNA cloning and screening The text also describes nucleic acid blotting and hybridization applications of protein blotting in plant biochemistry and molecular biology and the applications of polymerase chain reaction Non radioactive in situ RNA hybridization using digoxigenin and an application for co localization studies with radioisotopes are also considered The book further tackles the immunolocalization of antigens in plants with light and transmission electron microscopy protoplast fusion and the import of in vitro synthesized proteins into intact chloroplasts and isolated thylakoids from higher plants The text also looks into seed development and the molecular and genetic analysis of tomato fruit development and ripening Molecular biologists geneticists and people involved in plant genetic manipulation horticulture and agriculture will find the book invaluable

The Biology of Nematodes Donald L Lee, 2002-01-10 The Biology of Nematodes

synthesizes literature on free living plant parasitic and animal parasitic nematodes Topics covered include systematics and phylogeny neuromuscular physiology locomotion sense organs behavior aging the nematode genome survival strategies immunology structure and organization gametes and fertilization and feeding and metabolism This volume the most

authoritative available includes contributions from researchers working on groundbreaking molecular techniques leading to new approaches in the study of nematode worms It provides an important resource for research scientists working in a number of agricultural medical and biological fields

Plant Nutrition — Molecular Biology and Genetics G.

Gissel-Nielsen,A. Jensen,2013-06-29 The sixth International Symposium on Genetics and Molecular Biology of Plant Nutrition was held in Elsinore Denmark from August 17 21 1998 and organised by the RiSO National Laboratory in the year of its 40 anniversary The 98 participants represented 23 countries and 80 scientific contributions with 43 oral and 37 poster presentations The symposium addressed the molecular mechanisms physiology and genetic regulation of plant nutrition The Symposium brought together scientists from a range of different disciplines to exchange information and ideas on the molecular biology of mineral nutrition of plants The symposium emphasised Bridging the gap between molecular biology applied genetics plant nutrition and plant breeding The development of methodologies to improve the efficiency and effectiveness of nutrition of plants Quality of plant products With sessions on Nitrogen Phosphorous Micronutrients Symbiosis Membranes Stress Heavy Metals and Plant Breeding In comparison with the previous conferences in this series more emphasis was placed on use of molecular techniques to clarify physiological mechanisms and processes gene expression and regulation as well as genetic marker assisted analysis Significant of molecular genetic markers and other progress was reported in exploitation biotechnologies in breeding programmes

Sustainable Management of Arthropod Pests of Tomato

Waqas Wakil,Gerald E Brust,Thomas Perring,2017-11-19 Sustainable Management of Arthropod Pests of Tomato provides insight into the proper and appropriate application of pesticides and the integration of alternative pest management methods The basis of good crop management decisions is a better understanding of the crop ecosystem including the pests their natural enemies and the crop itself This book provides a global overview of the biology and management of key arthropod pests of tomatoes including arthropod vectored diseases It includes information that places tomatoes in terms of global food production and food security with each pest chapter including the predators and parasitoids that have specifically been found to have the greatest impact on reducing that particular pest In depth coverage of the development of resistance in tomato plants and the biotic and abiotic elicitors of resistance and detailed information about the sustainable management of tomato pests is also presented Provides basic biological and management information for arthropod pests of tomato from a global perspective encompassing all production types field protected organic Includes chapters on integrated management of tomato pests and specific aspects of tomato pest management including within protected structures and in organic production Presents management systems that have been tested in the real world by the authors of each chapter Fully illustrated throughout with line drawings and color plates that illustrate key pest and beneficial arthropods associated with tomato production around the world

Achieving sustainable cultivation of tomatoes

Dr A. K. Mattoo,Prof. A. K. Handa,2017-03-31 Discusses developments in good agricultural practice from crop growth models to

improved water and nutrition management Reviews advances in understanding plant physiology and genetic diversity as well as their contribution to improvements in breeding Summarises recent research on diseases and pests as well as their control through developing disease resistant varieties or integrated weed management **10 Years Plant Molecular Biology** R.A.

Schilperoort, Leon Dure, 2012-12-06 It is very clear nowadays that plants offer several opportunities for basic studies e.g. on development and embryogenesis and that the fundamental principles laid open contribute to the development of new tools for plant breeding Within the scope of the present publication the editors have had to make a difficult choice from the many important subjects that have contributed to the remarkable progress of our molecular biological understanding of complex biological problems This has resulted in review papers showing the present state of the art in genetic engineering gene expression and its manipulation microbe and insect interactions with plants transposable elements and gene tagging plant and organ development the function and structure of the genome chloroplasts and lipid biosynthesis All papers have been written in such a way that they are also useful for non experts interested in a particular field as well as for students following courses in plant molecular biology Besides presenting the state of the art each paper gives some historical background to the developments in the field as well as perspectives for further basic research and applications Because of the latter scientists and students engaged in plant breeding will also profit from this publication *Fruit Quality and Its Biological Basis*

Michael Knee, 2002 Fruit technology draws on biology and engineering to maintain quality during storage distribution and marketing This book focuses on the biological processes that determine appearance texture taste nutritional value and flavor of fleshy fruits It also focuses on the ways by which these biological processes can be manipulated to maximize quality for the consumer It discusses the advances in the understanding of these procedures at the molecular level and the mode of action and limitations of current technology for postharvest handling of fruits A concluding chapter examines prospects for the genetic control of fruit development composition and quality **Plant Biotechnology and Agriculture** Arie Altman, Paul

Michael Hasegawa, 2012 As the oldest and largest human intervention in nature the science of agriculture is one of the most intensely studied practices From manipulation of plant gene structure to the use of plants for bioenergy biotechnology interventions in plant and agricultural science have been rapidly developing over the past ten years with immense forward leaps on an annual basis This book begins by laying the foundations for plant biotechnology by outlining the biological aspects including gene structure and expression and the basic procedures in plant biotechnology of genomics metabolomics transcriptomics and proteomics It then focuses on a discussion of the impacts of biotechnology on plant breeding technologies and germplasm sustainability The role of biotechnology in the improvement of agricultural traits production of industrial products and pharmaceuticals as well as biomaterials and biomass provide a historical perspective and a look to the future Sections addressing intellectual property rights and sociological and food safety issues round out the holistic discussion of this important topic Includes specific emphasis on the inter relationships between basic plant biotechnologies

and applied agricultural applications and the way they contribute to each other Provides an updated review of the major plant biotechnology procedures and techniques their impact on novel agricultural development and crop plant improvement Takes a broad view of the topic with discussions of practices in many countries

Advances in Molecular Genetics of Plant-Microbe Interactions, Vol.1 H. Hennecke, Desh Pal S. Verma, 2013-06-29 Research on the interaction between plants and microbes has attracted considerable attention in recent years The use of modern genetic techniques has now made possible a detailed analysis both of plant and of microbial genes involved in phytopathogenic and beneficial interactions At the biochemical level signal molecules and their receptors either of plant or of microbial origins have been detected which act in signal transduction pathways or as co regulators of gene expression We begin to understand the molecular basis of classical concepts such as gene for gene relationships hypersensitive response induced resistance to name just a few We realize and will soon exploit the tremendous potential of the results of this research for practical application in particular to protect crop plants against diseases and to increase crop yield and quality This exciting field of research which is also of truly interdisciplinary nature is expanding rapidly A Symposium series has been devoted to it which began in 1982 Recently the 5th International Symposium on the Molecular Genetics of Plant Microbe Interactions was held in Interlaken Switzerland It brought together 640 scientists from almost 30 different countries who reported their latest research progress in 47 lectures 10 short oral presentations and on over 400 high quality posters This book presents a collection of papers that comprehensively reflect the major areas under study explain novel experimental approaches currently in use highlight significant advances made over the last one or two years but also emphasize the obstacles still ahead of us

Progress in Nucleic Acid Research and Molecular Biology Kivie Moldave, 2002-08-06 Progress in Nucleic Acid Research and Molecular Biology provides a forum for discussion of new discoveries approaches and ideas in molecular biology It contains contributions from leaders in their fields and abundant references

The Just Economy Richard Winfield, 2022-01-26 First Published in 1988 Richard Dien Winfield's The Just Economy investigates what the economy should be undertaking a normative inquiry ignored by contemporary economists Drawing upon Hegel's Philosophy of Right Winfield's book shows how justice lies in self determination how the economy can realize social freedom and how economic relations must be regulated to uphold family welfare equal economic opportunity and political autonomy Exposing the pitfalls in past attempts to conceive economic justice including those of ancient Greek philosophers social contract thinkers the classical political economists and Marx The Just Economy settles the controversy between capitalism socialism and communism It is crucial reading for thinkers and citizens the world over

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