

Fourth Edition

Plant Roots

The Hidden Half

Edited by

Amram Eshel • Tom Beeckman



CRC Press

Taylor & Francis Group

Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an *informa* business

Contents

Preface to the Fourth Edition	ix
Editors.....	xi
Contributors	xiii

PART I The Evolution and Genomics of Roots

1 The Origin of Roots.....	1-1
<i>Paul Kenrick</i>	
2 <i>Arabidopsis</i> Root	2-1
<i>Jaimie M. Van Norman, Louisa M. Liberman, and Philip N. Benfey</i>	

PART II Root Structure

3 Cellular Patterning of the Root Meristem.....	3-1
<i>Kimberly L. Gallagher</i>	
4 Cellular Patterning in the Root Epidermis.....	4-1
<i>Yana M. Wieckowski and John Schiefelbein</i>	
5 Structure and Function of Three Suberized Cell Layers	5-1
<i>Chris J. Meyer and Carol A. Peterson</i>	
6 Lateral Root Development	6-1
<i>Leentje Jansen, Marlies Demeulenaere, and Tom Beeckman</i>	
7 Vascular Development in <i>Arabidopsis</i> Roots.....	7-1
<i>Anthony Bishopp, Sedeer El-Showk, and Ykä Helariutta</i>	
8 Secondary Growth of Tree Roots.....	8-1
<i>Nigel Chaffey</i>	
9 Rice.....	9-1
<i>Yoan Coudert, Van Anh Le Thi, and Pascal Gantet</i>	
10 Genetic Analysis of Maize Root Development.....	10-1
<i>Frank Hochholdinger and Guenter Feix</i>	
11 Molecular Mechanisms Involved in Adventitious Root Formation.....	11-1
<i>Joseph Riov, David Szwerdszarf, Mohamad Abu-Abied, and Einat Sadot</i>	

PART III Regulation of Root Growth

12	Auxin Signaling in Primary Roots.....	12-1
	<i>Catherine Perrot-Rechenmann</i>	
13	Role of Gibberellins in Root Growth.....	13-1
	<i>Eiichi Tanimoto and Ko Hirano</i>	
14	Molecular Basis of Cytokinin Action during Root Development.....	14-1
	<i>Serena Perilli, Laila Moubayidin, and Sabrina Sabatini</i>	
15	Ethylene Regulates Root Growth and Development.....	15-1
	<i>Daniel R. Lewis and Gloria K. Muday</i>	
16	Absciscic Acid in Root Growth and Development.....	16-1
	<i>Ive De Smet and Hanma Zhang</i>	
17	Brassinosteroid Signaling in Root Development.....	17-1
	<i>Josep Vilarrasa-Blasi, Mary-Paz González-García, and Ana I. Caño-Delgado</i>	
18	Role of Strigolactones in Root Development and Communication.....	18-1
	<i>Hinanit Koltai</i>	
19	Root Gravitropism.....	19-1
	<i>Ranjan Swarup, Darren M. Wells, and Malcolm J. Bennett</i>	
20	Calcium.....	20-1
	<i>Sarah Swanson and Simon Gilroy</i>	

PART IV Soil Resource Acquisition

21	Root-Based Solutions to Increasing Crop Productivity.....	21-1
	<i>Michelle Watt, Anton P. Wasson, and Vincent Chochois</i>	
22	Root Architecture and Resource Acquisition.....	22-1
	<i>Ahmad M. Manschadi, Günther G.B. Manske, and Paul L.G. Vlek</i>	
23	Root pH Regulation.....	23-1
	<i>Jóska Gerendás and R. George Ratcliffe</i>	
24	Root Water Uptake and Water Flow in the Soil–Root Domain.....	24-1
	<i>Guillaume Lobet, Charles Hachez, François Chaumont, Mathieu Javaux, and Xavier Draye</i>	
25	Inorganic Nitrogen Acquisition and Signaling.....	25-1
	<i>Alain Gojon</i>	
26	Nutrient Uptake and Root System Architecture Modeling.....	26-1
	<i>Moshe Silberbush, Amram Eshel, and Jonathan P. Lynch</i>	
27	Global Change and Root Lifespan.....	27-1
	<i>David M. Eissenstat, M. Luke McCormack, and Quanying Du</i>	
28	Developmental Adaptations in Roots of Desert Plants with Special Emphasis on Cacti.....	28-1
	<i>Joseph G. Dubrovsky and Svetlana Shishkova</i>	
29	Root Systems of Woody Plants.....	29-1
	<i>Frédéric Danjon, Alexia Stokes, and Mark R. Bakker</i>	
30	Roots as a Source of Food.....	30-1
	<i>Daniel F. Austin and Robert Jarret</i>	

PART V Root Response to Stress

- 31 Temperature Effects on Root Growth..... 31-1
Marc Faget, Stephan Blossfeld, Siegfried Jahnke, Gregor Huber, Ulrich Schurr, and Kerstin A. Nagel
- 32 Flooding Tolerance Mechanisms in Roots 32-1
Kurt V. Fagerstedt, Olga B. Blokhina, Chiara Pucciariello, and Pierdomenico Perata
- 33 Plant Roots under Aluminum Stress 33-1
Hideaki Matsumoto and Yoko Yamamoto
- 34 Root Responses to Trace Metallic Elements 34-1
Nathalie Verbruggen and Christian Hermans
- 35 Maintaining Root Growth in Drying Soil 35-1
Eric S. Ober and Robert E. Sharp
- 36 Effects of Salinity on Root Growth 36-1
Nirit Bernstein
- 37 Soil Mechanical Resistance and Root Growth and Function..... 37-1
W. Richard Whalley and A. Glyn Bengough

PART VI Root–Rhizosphere Interactions

- 38 Fungal Root Endophytes 38-1
Thomas N. Sieber and Christoph R. Grünig
- 39 Molecular Physiology of Tree Ectomycorrhizal Interactions..... 39-1
Mohammad Tanbir Habib, Till Heller, and Andrea Polle
- 40 Mycorrhizae—Rhizosphere Determinants of Plant Communities..... 40-1
Ingrid Kottke and Gábor M. Kovács
- 41 Response of Soybean Roots to Soybean Cyst Nematode at the Molecular Level..... 41-1
Benjamin F. Matthews, Heba M.M. Ibrahim, Parsa Hosseini, Nadim Alkharouf, and Savithiry S. Natarajan

PART VII Modern Research Techniques

- 42 Minirhizotron Techniques..... 42-1
Boris Rewald and Jhonathan E. Ephrath
- 43 Noninvasive Tools for Measuring Metabolism and Biophysical Analyte Transport at the Root–Rhizosphere Interface 43-1
Eric S. McLamore and D. Marshall Porterfield

Genes and Mutants Index Genes and Mutants Index-1

Organism Index Organism Index-1

Terms Index Terms Index-1