

Molecular Ecotoxicology of Plants

Bearbeitet von
Heinrich Sandermann

1. Auflage 2003. Buch. XIV, 243 S. Hardcover

ISBN 978 3 540 00952 8

Format (B x L): 15,5 x 23,5 cm

Gewicht: 555 g

[Weitere Fachgebiete > Chemie, Biowissenschaften, Agrarwissenschaften > Botanik > Pflanzenpathologie, Pflanzenkrankheiten](#)

Zu [Leseprobe](#)

schnell und portofrei erhältlich bei

The logo for beck-shop.de features the text 'beck-shop.de' in a bold, red, sans-serif font. Above the 'i' in 'shop' are three red dots of increasing size. Below the main text, 'DIE FACHBUCHHANDLUNG' is written in a smaller, red, all-caps, sans-serif font.

beck-shop.de
DIE FACHBUCHHANDLUNG

Die Online-Fachbuchhandlung beck-shop.de ist spezialisiert auf Fachbücher, insbesondere Recht, Steuern und Wirtschaft. Im Sortiment finden Sie alle Medien (Bücher, Zeitschriften, CDs, eBooks, etc.) aller Verlage. Ergänzt wird das Programm durch Services wie Neuerscheinungsdienst oder Zusammenstellungen von Büchern zu Sonderpreisen. Der Shop führt mehr als 8 Millionen Produkte.

Contents

1	Molecular Ecotoxicology: From Man-Made Pollutants to Multiple Environmental Stresses	1
	H. SANDERMANN	
1.1	Overview	1
1.2	Definitions of Ecotoxicology	2
1.3	Environmental Stress	5
1.4	The Unexpected Side of Ecotoxicology: Induced Resistance	9
1.5	Novel Techniques	11
1.6	Scope of the Present Book	12
	References	13
2	Metabolism of Natural and Xenobiotic Substrates by the Plant Glutathione S-Transferase Superfamily	17
	R. EDWARDS and D.P. DIXON	
2.1	Plant Glutathione Transferase (GST) Superfamily	17
2.1.1	Discovery	17
2.1.2	Organisation and Nomenclature of GST Gene Superfamily	19
2.1.3	Common Structural and Functional Characteristics of Plant GSTs	20
2.1.4	GSTs of <i>Arabidopsis thaliana</i> : a Blueprint for Studying Plant GSTs	22
2.2	Glutathione Transferases and Stress Responses	24
2.2.1	Roles for GSTs in Stress Tolerance in Animals	24
2.2.2	Regulation of GSTs in Plants by Biotic and Abiotic Stress	26
2.3	Roles for Plant GSTs in Endogenous Metabolism	29
2.3.1	Activities of GSTs in Detoxifying Metabolites of Oxidative Stress	29
2.3.1.1	Conjugation of Oxidation Products	29
2.3.1.2	Activity as Glutathione Peroxidases	30

2.3.2	GSTs and Plant Secondary Metabolism	31
2.3.2.1	Conjugation of Secondary Metabolites	31
2.3.2.2	Binding and Transport of Bioactive Metabolites	32
2.3.3	Alternative Functions for GSTs	
	as Glutathione-Dependent Enzymes	34
2.3.3.1	Activity as Isomerases	34
2.3.3.2	Redox Functions	35
2.3.3.3	Roles in Signalling	36
2.4	Roles for Plant GSTs in Xenobiotic Metabolism	37
2.4.1	Involvement of GSTs in Herbicide Metabolism	
	and Selectivity	38
2.4.2	Herbicide Safeners and GST Regulation	39
2.5	Future Goals in Understanding the Functions of Plant GSTs	40
2.5.1	GSTs in Transgenic Plants	41
2.5.2	GSTs as Targets for Functional Genomics	41
References		44

3

Activated Oxygen Species

in Multiple Stress Situations and Protective Systems

R. MITTLER and B.A. ZILINSKAS

51

3.1	The Chemistry of Activated Oxygen Species	51
3.2	Physiological Processes Contributing to AOS Production . .	51
3.2.1	Photosynthesis and Photorespiration	51
3.2.2	Respiration and Other Oxidases	52
3.3	Detoxification of AOS in Plants	53
3.3.1	Enzymatic Mechanisms	53
3.3.2	Nonenzymatic Mechanisms	57
3.4	Production of AOS During Environmental Stress	58
3.4.1	Drought Stress	58
3.4.2	Unfavorable Temperatures	59
3.4.3	Salt Stress	59
3.4.4	High Light	60
3.4.5	Ozone	60
3.4.6	UV-B Radiation	61
3.4.7	Heavy Metals	61
3.5	Production of AOS During Recovery from Stress	62
3.6	Natural Conditions Within the Ecosystem,	
	a Combination of Environmental Stresses	62
3.7	The Effect of Multiple Stresses on Plant Metabolism:	
	the Example of Desert Plants	63

3.8	Adaptive Plasticity as a Defense Strategy of Plants in the Field	67
3.9	Signalling Networks During Multiple Stress Conditions . . .	68
3.10	AOS as the Interface Between Biotic and Abiotic Stresses, a Possible Conflict During Multiple Stresses	69
References		70

4	Ethylene and Jasmonate as Regulators of Cell Death in Disease Resistance	75
	C. LANGEBARTELS and J. KANGASJÄRVI	
4.1	Introduction: Input Signals and Plant Responses in Ecotoxicology	75
4.2	Cell Death and Disease Resistance in Plants	76
4.3	Biosynthesis and Perception of Ethylene in Plants	78
4.3.1	Mechanism of Ethylene Biosynthesis	78
4.3.2	Ethylene Perception by Two-Component Systems, Sensors for Environmental Stress	81
4.3.3	Ethylene Signal Transduction	83
4.3.4	Regulation of Ethylene Biosynthesis and Perception	84
4.3.5	Ethylene Perception and Responses in Other Organisms . .	85
4.4	Biosynthesis and Perception of Jasmonate in Plants	86
4.4.1	Biosynthesis of Signals of the Jasmonate Family	88
4.4.2	Jasmonate Perception and Signalling	88
4.5	Roles of Ethylene under Oxidative and Pathogen Stress . . .	89
4.6	Roles of Signals of the Jasmonate Family Under Wounding as Well as Herbivore and Pathogen Attack	90
4.7	Interactions Between Ethylene and Jasmonate Pathways . .	92
4.7.1	Activation of Stress-Responsive Genes	92
4.7.2	Complementing Roles in Rhizobacteria-Mediated Resistance	92
4.8	Roles of Ethylene and Jasmonate in Programmed Cell Death	93
4.8.1	The "Oxidative Cell Death Cycle"	93
4.8.2	Cross-Talk with Other Signalling Molecules Coordinating Cell Death	95
4.8.3	A Model for the Control of Cell Death	97
4.9	Ecotoxicological Implications of Ethylene and Jasmonate Release from Plants	98
4.10	Concluding Remarks	100
References		101

5	The Role of Salicylic Acid and Nitric Oxide in Programmed Cell Death and Induced Resistance	111
	J.-P. MÉTRAUX and J. DURNER	
5.1	Plant Defense Responses	111
5.1.1	The Hypersensitive Response: A Form of Programmed Cell Death	111
5.1.2	Systemic Acquired Resistance (SAR)	115
5.2	Salicylic Acid (SA) as a Signal for SAR	116
5.2.1	SA and Its Biological Relevance for SAR	116
5.2.2	Biosynthesis and Metabolism of SA	120
5.2.3	The Activation of Defense Mechanisms by SA	122
5.3	The Oxidative Burst and Nitric Oxide (NO)	125
5.3.1	Biological Chemistry and Properties of NO	126
5.3.2	Biosynthesis of NO in Plants	128
5.3.3	NO Signalling in Plant Cells	130
5.3.4	Cross-Talk of NO with Reactive Oxygen Species and SA	133
5.4	Plant Responses to the Environment	136
5.4.1	Effects of Atmospheric and Soil-Borne NO on Plants	136
5.4.2	Abiotic Triggers of SA Production	137
5.5	Conclusions	138
	References	138
 6	 <i>Cis</i> Elements and Transcription Factors Regulating Gene Promoters in Response to Environmental Stress . . .	 151
	D. ERNST and M. AARTS	
6.1	Transcriptional Regulation	151
6.2	UV-B-Responsive Regulatory Sequences	155
6.3	Characterization of Heat-Shock Factors	156
6.4	Drought- and Cold-Responsive Gene Regulation	157
6.5	Ozone-Induced Gene Regulation	159
6.6	Xenobiotic-Responsive <i>cis</i> Elements	161
6.7	Activation of DNA Sequences by Heavy Metal Ions	162
6.8	Elicitor-Responsive Elements	163
6.9	Plant Hormone-Responsive DNA Sequences (Auxin, Cytokinin, and Ethylene)	165
6.10	Salicylic Acid and Jasmonate <i>cis</i> -Acting Elements	166
6.11	Concluding Remarks	167
	References	168

7	Increased Plant Fitness by Rhizobacteria	177
	L. C. VAN LOON and B. R. GLICK	
7.1	Introduction	177
7.2	Rhizobacterially Induced Growth Promotion	178
7.2.1	Ethylene	178
7.2.2	ACC Deaminase	179
7.2.3	A Model of Bacterial Lowering of Plant Ethylene Levels . . .	183
7.2.4	Treatment of Plants with ACC Deaminase Containing Bacteria	184
7.2.4.1	Flower Senescence	184
7.2.4.2	Flooding	185
7.2.4.3	Metal Stress	185
7.2.4.4	<i>Rhizobia</i> Infection	186
7.2.4.5	Pathogen Infection	186
7.3	Rhizobacteria-Mediated Induced Systemic Resistance	187
7.3.1	Disease Suppression by PGPR	187
7.3.2	Bacterial Signals Involved in Induction of Systemic Resistance	188
7.3.3	Induced Resistance Signalling in the Plant	191
7.3.4	Involvement of Ethylene and Jasmonic Acid in Induced Systemic Resistance	192
7.3.5	Differential Expression of Induced Systemic Resistance Against Different Pathogens	194
7.3.6	Interactions Between Induced Resistance Signalling Pathways	196
7.4	Concluding Remarks	197
	References	199
 8	 Scaling Up from Molecular to Ecological Processes	 207
	H. SANDERMANN and R. MATYSSEK	
8.1	Overview	207
8.2	Ecophysiology	210
8.3	Molecular Epidemiology	218
8.4	Connecting Laboratory to Field Experiments	221
	References	223
 Subject Index		 227
 Color Illustrations		 235