

Contents

Section I Oils and Fibers

I.1	Soybean	3
	P.M. OLHOFT and D.A. SOMERS	
1	Introduction	3
2	Somatic Embryogenesis	4
3	Organogenesis	14
4	Other Regeneration and Transformation Methods	20
5	Conclusions	23
	References	24
I.2	Canola	29
	V. CARDOZA and C.N. STEWART	
1	Introduction	29
2	Economic Importance of Canola	29
3	Molecular Genetics of Rapeseed	30
4	Tissue Culture of Canola	30
5	Transformation of Canola	31
6	Transgenic Traits	32
7	Impact of Transgenic Plants	34
8	Conclusions	34
	References	34
I.3	Sunflower	39
	G. LU, X. HU, and D.L. BIDNEY	
1	Introduction	39
2	Tissue Culture and Transformation	40
3	Genomics and Molecular Biology	42
4	Transgenic Improved Input Agronomic Traits	45
5	Transgenic Output Quality Traits	48
6	Gene Flow and Biosafety	50
7	Concluding Remarks	50
	References	51

I.4	Oil Palm	59
	A. RIVAL	
1	Introduction	59
2	Economic Importance	59
3	The Impact of Biotechnology in Breeding Strategies	61
4	Advances in Tissue Culture	66
5	Genetic Transformation Technologies	70
6	Transgenic Plants for Oil Palm Improvement	71
7	Conclusion and Perspectives	74
	References	75
I.5	Peanut	81
	P. OZIAS-AKINS	
1	Introduction	81
2	Applications of Molecular Markers	81
3	Peanut Transformation	90
4	Conclusions	99
	References	99
I.6	Cotton	107
	K.S. RATHORE	
1	Introduction	107
2	Importance of Genetic Engineering in Cotton	107
3	Modification of Cotton via Genetic Transformation	108
4	Transformation Methods	108
5	Alternative Methods Used to Transform Cotton	118
6	Selectable Marker Genes Used for Generating Transgenic Cotton	119
7	Reporter Genes Used in Cotton	119
8	Traits Introduced into Cotton Through Genetic Transformation	120
9	New Technological Advances and Their Role in Cotton Improvement	122
10	Future Perspective	123
	References	124
I.7	Flax	129
	A. PREŤOVÁ, B. OBERT, and Z. BARTOŠOVÁ	
1	Introduction	129
2	Tissue and Organ Culture	129
3	Somatic Embryogenesis	131
4	Protoplast and Cell Suspension Cultures	134
5	Anther, Microspore and Ovary Cultures	135
6	Gene Transfer in Flax	136

7	Potential Applications of Transgenic Flax	137
8	Molecular Markers	138
9	Concluding Remarks and Further Prospects	138
	References	139

Section II Medicinal Crops

II.1	Ginseng.....	149
	Y.E. CHOI	
1	Introduction	149
2	Cell Culture of <i>P. ginseng</i>	150
3	Hairy Root Culture of <i>P. ginseng</i>	152
4	Adventitious Root Culture in <i>P. ginseng</i>	153
5	Plant Regeneration of <i>P. ginseng</i> via Organogenesis and Somatic Embryogenesis	155
6	Genetic Transformation and Metabolic Engineering	158
7	Genomics in <i>P. ginseng</i>	161
8	Concluding Remarks.....	163
	References	164
II.2	Opium Poppy	169
	J.M. HAGEL, B.P. MACLEOD, and P.J. FACCHINI	
1	Introduction	169
2	Origins and History	170
3	Modern Cultivation.....	171
4	Classic Breeding	177
5	Biochemistry and Molecular Biology	178
6	Biotechnology	181
7	Future Prospects	184
	References	185
II.3	Henbane, Belladonna, Datura and Duboisia	189
	R. ARROO, J. WOOLLEY, and K.-M. OKSMAN-CALDENTEY	
1	Introduction	189
2	Tropane Alkaloids, Uses and Outlook	189
3	Economic Importance of Tropane Alkaloid-Containing Crops	192
4	Tropane Alkaloid Biosynthetic Pathway	193
5	Current Research and Development in Transgenic Technology	195
6	Use of Hairy Root Cultures for Tropane Alkaloid Production	198
7	Novel Developments and Future Challenges	200
	References	201

II.4	Taxus	205
	M.T. PIÑOL, R.M. CUSIDÓ, J. PALAZÓN, and M. BONFILL	
1	Introduction	205
2	Biosynthesis of Taxol	207
3	In Vitro Culture	209
4	Conclusions and Prospects	220
	References	221

Section III Ornamental Crops

III.1	Roses	227
	S.S. KORBAN	
1	Introduction	227
2	Advances in Molecular Markers for Genetic Studies and Breeding	227
3	Cloning and Characterization of Genes of Economic Value	230
4	Advances in Genetic Transformation and Recovery of Transgenic Plants	232
5	Conclusions	235
	References	236
III.2	Carnation	241
	M. MOYAL-BEN ZVI and A. VAINSTEIN	
1	Introduction	241
2	Recent Developments in Carnation Biotechnology	242
3	Conclusions	250
	References	250
III.3	Chrysanthemum	253
	P.B. VISSER, R.A. DE MAAGD, and M.A. JONGSMA	
1	Introduction	253
2	Chrysanthemum Transformation	255
3	Future Outlook	268
	References	269
III.4	Orchids	273
	H. YU and Y. XU	
1	Introduction	273
2	Genetic Transformation of Orchids	274
3	Potential Genes for Genetic Engineering of Orchids	284
	References	286

III.5	Gladiolus	289
	K. KAMO and Y.H. JOUNG	
1	Introduction	289
2	Tissue Culture	289
3	Genetic Transformation	291
4	Promoters and Gene Expression	292
5	Resistance to Bean Yellow Mosaic Virus	294
6	Resistance to Cucumber Mosaic Virus	295
7	Future Studies	295
	References	296
III.6	Forsythia	299
	C. ROSATI, A. CADIC, M. DURON, and P. SIMONEAU	
1	Botanical Origin and Genetic Information	299
2	Genetic Resources and Breeding Programs	305
3	In Vitro Culture	307
4	<i>Forsythia</i> Biotechnology Research	310
5	Conclusions	316
	References	316

Section IV Forages and Grains

IV.1	Alfalfa	321
	C. SENGUPTA-GOPALAN	
1	Introduction and Economic Importance	321
2	Breeding	322
3	Genomics	323
4	Genetic Engineering	323
5	Conclusions	331
	References	331
IV.2	Clover	337
	A. MOURADOV, S. PANTER, M. EMMERLING, M. LABANDERA, E. LUDLOW, J. SIMMONDS, and G. SPANGENBERG	
1	Introduction	337
2	Improvement of Forage Quality by Modification of Secondary Metabolism	338
3	Improvement of Tolerance to Abiotic and Biotic Stresses	342
4	Functional Genomics and Metabolomics as Key Technologies for Characterisation and Modification of Natural Product Biosynthesis	345
5	Conclusions, Challenges and Future Developments	347
	References	349

IV.3	Tall Fescue	357
	Z-Y. WANG and G. SPANGENBERG	
1	Introduction	357
2	Economic Importance	358
3	Current Research and Development	359
4	Practical Applications of Transgenic Plants	364
5	Conclusions and Future Challenges	367
	References	368
IV.4	Ryegrasses	373
	Y. RAN, C. RAMAGE, S. FELITTI, M. EMMERLING, J. CHALMERS, N. CUMMINGS, N. PETROVSKA, A. MOURADOV, and G. SPANGENBERG	
1	Introduction	373
2	Economic Importance	373
3	Current Research and Development	374
4	Practical Applications of Transgenic Plants	380
5	Conclusions and Future Challenges	386
	References	387
IV.5	Lupins	397
	L.M. TABE and L. MOLVIG	
1	Introduction	397
2	Genetic Transformation of Lupins	399
3	Lupin Improvement Through Biotechnology	402
	References	407

Section V Regulatory and Intellectual Property of GM Plants

V.1	Freedom to Commercialize Transgenic Plant Products: Regulatory and Intellectual Property Issues	411
	S. CHANDLER and J. ROSENTHAL	
1	Introduction	411
2	Intellectual Property	412
3	Regulatory Approval	419
4	Conclusion	428
	References	428
	Index	431