

Contents

I *Angelica sinensis* (Oliv.) Diels.: In Vitro Culture, Regeneration, and the Production of Medicinal Compounds ZHANG SHI-YU and CHENG KUO-CHANG (With 8 Figures)

1 Introduction	1
2 In Vitro Culture Approaches	6
3 Conclusions and Prospects	20
References	21

II *Anisodus acutangulus*: Production of Scopolamine and Hyoscyamine in Cell Cultures ZHENG GUANG-ZHI (With 20 Figures)

1 Introduction	23
2 In Vitro Approaches	25
3 Variants with Both Growth and Scopolamine Contents	38
4 Reduction of Cost of Cultures	40
5 Storage of Valuable Stock Cultures Through Cryopreservation	43
6 Conclusions	45
References	45

III *Basella alba* L.: In Vitro Culture and the Production of Betalains E. CYUNEL (With 14 Figures)

1 Introduction	47
2 In Vitro Approaches	50
3 Protocols	54
4 Results and Discussion	56
5 Conclusions and Prospects	62
References	66

IV *Bupleurum falcatum* L.: Embryogenesis and the Production of Saikosaponins N. HIRAOKA (With 5 Figures)

1 Introduction	69
2 In Vitro Approaches	72

3 Conclusions and Prospects	78
References	79
V <i>Camellia sinensis</i> L. (Tea): In Vitro Regeneration	
M. KATO (With 9 Figures)	
1 Introduction	82
2 In Vitro Culture Studies	86
3 Summary and Conclusion	96
References	97
VI <i>Coix lacryma-jobi</i> L. (Jobstears): In Vitro Regeneration	
SUN C.S. and WANG D.Y. (With 22 Figures)	
1 Introduction	99
2 In Vitro Approaches	101
3 Conclusion and Prospects	109
References	109
VII <i>Coptis</i> : In Vitro Regeneration of Plants and the	
Production of Berberine	
A. IKUTA and H. ITOKAWA (With 17 Figures)	
1 Introduction	110
2 In Vitro Approaches	111
3 Fundamental Conditions for Growth and Alkaloid Formation	113
4 Differentiation of <i>Coptis</i> Plants In Vitro from Callus	
Cultures and Comparison of Alkaloid Content of	
Regenerated Plants	119
5 Effects of Cloning and Mutagen	122
6 Immobilized Cell	126
7 Berberine Production by Suspension Culture	126
8 Conclusion	127
References	127
VIII <i>Cryptomeria japonica</i> Don (Japanese Cedar): In Vitro	
Production of Volatile Oils	
N. ISHIKURA (With 3 Figures)	
1 Introduction	129
2 In Vitro Approaches	130
3 Conclusion	134
References	134
IX <i>Datura</i> spp.: In Vitro Regeneration and the Production	
of Tropanes	
G. PETRI and Y.P.S. BAJAJ (With 10 Figures)	
1 Introduction	135
2 In Vitro Culture and Regeneration	135

3 Cryopreservation of Cell Cultures	142
4 Alkaloid Production in <i>Datura</i>	144
5 Summary and Conclusions	156
References	157

X *Dioscorea*: In Vitro Culture and the Micropropagation of Diosgenin-Containing Species

M. FURMANOWA and J. GUZEWSKA (With 5 Figures)

1 Introduction	162
2 In Vitro Approaches	165
3 Conclusions and Perspectives	179
References	180

XI *Foeniculum vulgare* Miller: Cell Culture, Regeneration, and the Production of Anethole

G. HUNAULT, P. DESMAREST, and J. DU MANOIR

(With 6 Figures)

1 Introduction	185
2 In Vitro Culture of Fennel	190
3 Somatic Embryogenesis and Fennel Breeding	202
4 Secondary Metabolites from Tissue Cultures	207
5 Protocols for In Vitro Culture of Fennel	208
6 Conclusion: In Vitro Culture Impact on Fennel Improvement	208
References	209

XII *Gardenia jasminoides* Ellis: In Vitro Propagation and the Formation of Iridoid Glucosides

H. MIZUKAMI (With 7 Figures)

1 Introduction	213
2 In Vitro Culture Studies	214
3 Summary	224
4 Protocol	224
References	225

XIII *Geigeria aspera* Harv.: In Vitro Culture and Medicinal Value of Sesquiterpene Lactones

H. J. MEYER and J. VAN STADEN (With 7 Figures)

1 Introduction	227
2 Morphology and Distribution of <i>Geigeria aspera</i> Harv.	227
3 Sesquiterpene Lactones	229
4 In Vitro Culture of <i>Geigeria aspera</i>	236
References	241

XIV *Heimia salicifolia*: In Vitro Culture and the Production of Phenyl- and Biphenylquinolizidines

A. ROTHER (With 7 Figures)

1 Introduction	246
2 In Vitro Approaches	250
3 Conclusions	261
4 Suggested Protocol	261
References	261

XV *Humulus lupulus* L. (Hop): In Vitro Culture; Attempted Production of Bittering Components and Novel Disease Resistance

J. B. HEALE, T. LEGG, and S. CONNELL (With 8 Figures)

1 Introduction	264
2 In Vitro Approaches	268
3 Conclusions and Prospects	282
4 Protocol	283
References	283

XVI *Hyoscyamus* spp.: In Vitro Culture and the Production of Tropane Alkaloids

A. STRAUSS (With 7 Figures)

1 Introduction	286
2 The Plant	286
3 In Vitro Approaches	296
4 Conclusions and Prospects	307
5 Protocol for Tropane Alkaloid Production by <i>H. muticus</i> Cell Culture	308
References	309

XVII *Jasminum* spp. (Jasmine): Micropropagation and the Production of Essential Oils

R. JONARD (With 11 Figures)

1 Introduction	315
2 In Vitro Cultivation	317
3 Essential Oils of Jasmine	326
4 Conclusions	327
References	330

XVIII *Macleaya* spp.: Morphogenesis and the Production of Secondary Metabolites

H. KOBLITZ (With 8 Figures)

1 Introduction	332
2 Developmental Investigations on Cell Cultures	333

3 Investigations on Alkaloid Formation, Enzymology, and Catabolic Processes in Cell Cultures	340
4 Summary and Concluding Remarks	343
5 Protocol	344
References	346

XIX *Mucuna pruriens*: In Vitro Production of L-DOPA
H. J. WICHERS, N. PRAS, and H. J. HUIZING (With 9 Figures)

1 Introduction	349
2 In Vitro Approaches	353
3 Conclusions and Prospects	363
References	365

**XX *Nicotiana tabacum* L. (Tobacco): In Vitro Production
of Nicotine**
S. OHTA and M. YATAZAWA (With 3 Figures)

1 Introduction	367
2 In Vivo Production of Nicotine	369
3 In Vitro Production of Nicotine	370
4 Summary	377
References	378

**XXI *Pimpinella anisum* L. (Anise): Cell Culture, Somatic
Embryogenesis, and the Production of Anise Oil**
D. ERNST (With 7 Figures)

1 Introduction	381
2 In Vitro Studies	383
3 Extraction and Structure of Compounds	391
4 Protocol	394
5 Conclusions	394
References	395

**XXII *Rauwolfia serpentina*: In Vitro Culture and the
Production of Ajmaline**
V. A. KUNAKH and E. G. ALKHIMOVA (With 14 Figures)

1 Introduction	398
2 In Vitro Approaches	398
3 Conclusions	415
References	415

**XXIII *Salvia miltiorrhiza*: In Vitro Production
of Cryptotanshinone and Ferruginol**
H. MIYASAKA, M. NASU, and K. YONEDA
(With 11 Figures)

1 Introduction	417
----------------------	-----

2 Materials and Methods	418
3 Results	418
4 Conclusions and Prospects	429
5 Protocol	429
References	430

XXIV *Saponaria officinalis* L.: In Vitro Culture and the
Production of Triterpenoidal Saponins

M. HENRY (With 7 Figures)

1 Introduction	431
2 In Vitro Approaches	436
3 Conclusion and Prospects	440
4 Protocol	441
References	441

XXV *Solanum aviculare* Forst., *Solanum laciniatum* Ait.

(Poroporo): In Vitro Culture and the Production of

Solasodine

T.E. MACEK (With 11 Figures)

1 Introduction	443
2 In Vitro Approaches	450
3 Conclusions and Prospects	462
4 Protocol	463
References	463

XXVI *Stevia rebaudiana* (Bert.) Bertoni: Production of
Natural Sweeteners

W. HANDRO and C.M. FERREIRA (With 3 Figures)

1 General Account	468
2 Tissue Culture of <i>Stevia rebaudiana</i>	474
3 Concluding Remarks	481
References	482

XXVII *Ruta graveolens*: In Vitro Production of Alkaloids
and Medicinal Compounds

G. PETIT-PALY, K.G. RAMAWAT, J.C. CHENIEUX,

and M. RIDEAU (With 2 Figures)

1 Introduction	488
2 In Vitro Approaches	494
3 Conclusions	501
References	502

XXVIII *Tabernaemontana* spp.: In Vitro Production of Indole and Biogenetically Related Alkaloids

R. VAN DER HEIJDEN, R. VERPOORTE, and P.A.A. HARKES
(With 5 Figures)

1 Introduction	506
2 Cell and Tissue Cultures of <i>Tabernaemontaneae</i> Species	509
3 Conclusions and Prospects	520
References	522

XXIX *Zingiber officinale* Roscoe (Ginger): In Vitro Propagation and the Production of Volatile Constituents

F. SAKAMURA and T. SUGA (With 5 Figures)

1 Introduction	524
2 In Vitro Approaches	528
3 Conclusions and Prospects	536
References	536

Subject Index	539
---------------------	-----

Dr.

Maréchal

Dr. Maxime

Maréchal-Ester

UNIST, Dr. Maxime

Federal Republic of ...

Dr. R. L. M. ...

CP 0460, 05499 São Paulo

Dr. ... M. Department ...

Academy, Brazil

ent of B

... ..