

Content

List of contributors	xiii
Foreword	xvii
PART ONE NOVEL PLANT BIORESOURCES: APPLICATIONS IN MEDICINE, COSMETICS, ETC.	
1 Plant Diversity in Addressing Food, Nutrition and Medicinal Needs	1
<i>M.E. Dulloo, D. Hunter and D. Leaman</i>	3
1.1 Introduction	3
1.2 Plant genetic resources for food and agriculture	7
1.3 Plant genetic diversity for nutrition	10
1.4 Plant diversity for medicines	14
Acknowledgements	16
References	16
2 World Health Organization Perspective for Traditional Medicine	23
<i>Ossy M. J. Kasilo and Jean-Baptiste Nikiema</i>	
2.1 Introduction	23
2.2 Policies on traditional medicine	24
2.3 Tools and guidelines	24
2.4 Implementation of the regional strategy on traditional medicine	35
2.5 The way forward	40
2.6 Conclusion	41
References	41
3 Cultivation of Novel Medicinal Plant Products and Associated Challenges	43
<i>Ulrich Feiter</i>	
3.1 Introduction	43
3.2 Basic principles of novel crop cultivation	43
3.3 Case study 1: <i>Pelargonium sidoides</i>	51
3.4 Case study 2: <i>Sutherlandia frutescens</i>	52
3.5 Case study 3: <i>Euphorbia resinifera</i>	54
3.6 Conclusion	55
References	55
Further reading	56
4 Enabling Technologies to Facilitate Natural Product-Based Drug Discovery from African Biodiversity	57
<i>Nyaradzo, T., L. Chigorimbo-Murefu, Grace Mugumbate and Kelly Chibale</i>	
4.1 Introduction	57
4.2 Enabling-technology platforms	59
4.3 Natural product diversification and drug metabolite generation platform	65
4.4 Conclusion	65
References	66
5 Assessing Biodiversity: A Molecular Approach Using DNA Sequencing	69
<i>Yasmina Jaufeerally-Fakim</i>	
5.1 Introduction	69
5.2 Taxonomy and evolution	69
5.3 Assessing diversity	70
5.4 DNA sequencing and barcoding	73
5.5 Plant genomics	75
5.6 Analysis of marker data	79
References	79

6 Conservation of Endangered Wild Harvested Medicinal Plants: Use of DNA Barcoding	81
<i>Sarina Veldman, Joseph Otieno, Barbara Gravendeel, Tinde van Andel and Hugo de Boer</i>	
6.1 Wild harvested medicinal plants: background and challenges	81
6.2 DNA barcoding general	82
6.3 DNA barcoding and species delimitation	82
6.4 DNA barcodes for plants	83
6.5 Examples of DNA barcoding of cryptic and prepared plant material	83
6.6 Plant DNA authentication, verification and certification	85
6.7 Future opportunities and challenges	85
Acknowledgements	85
References	86
7 Market Entry, Standards and Certification	86
<i>Susan A. Wren</i>	89
7.1 Sustainable utilization of indigenous plant products	89
7.2 Market entry	90
7.3 Certification	93
7.4 Developing indigenous plant-based enterprises as viable businesses with developing country communities	102
Acknowledgements	105
References	105
Further reading	105
8 European Union Market Access Categories and Regulatory Requirements for Novel Natural Products	105
<i>Thomas Brendler and L. Denzil Philipps</i>	107
8.1 Introduction	107
8.2 Raw materials	107
8.3 Finished products	111
8.4 Summary	122
Reference	123
Further reading	123
9 Nutrition, Health and Food Security: Evidence and Priority Actions	125
<i>L. J. Ferrão and T. H. Fernandes</i>	125
9.1 Introduction	125
9.2 Well-being and nutrition	125
9.3 Traditional food cultures	126
9.4 Nutrition in pregnancy and infancy	126
9.5 Health and nutrition education is central for development	127
9.6 Research and development	128
9.7 Role of agricultural growth on reducing poverty, hunger and malnutrition	128
9.8 Concluding remarks	129
References	129
PART TWO MEDICINE (PLANTS AS MEDICINE: HUMANS AND ANIMAL HEALTH)	131
10 Anticancer Potential of African Plants: The Experience of the United States National Cancer Institute and National Institutes of Health	133
<i>John A. Beutler, Gordon M. Cragg, Maurice Iwu, David J. Newman and Christopher Okunji</i>	
10.1 Introduction	133
10.2 The United States National Cancer Institute programme	133
10.3 The International Cooperative Biodiversity Groups programme	139
10.4 Conclusions	145
Acknowledgements	145
References	145
11 Biodiversity as a Source of Potent and Selective Inhibitors of Chikungunya Virus Replication	151
<i>Pieter Leyssen, Jacqueline Smadja, Philippe Rasoanaivo, Ameenah Gurib-Fakim, Mohamad Fawzi Mahomoodally, Bruno Canard, Jean-Claude Guillemot, Marc Litaudon and Françoise Guéritte</i>	
11.1 The epidemiology of chikungunya virus	151
11.2 The PHYTOCHIK programme for the discovery of natural compounds active against chikungunya virus	154

11.3	Euphorbiaceae, abundant source of anti-chikungunya virus compounds	157
11.4	Conclusion	159
	Acknowledgements	159
	References	160
12	Using African Plant Biodiversity to Combat Microbial Infections	163
	<i>J. N. Eloff and L. J. McGaw</i>	
12.1	Introduction and problem statement	163
12.2	Commercial use of African medicinal plants in the herbal medicine industry	164
12.3	Why is there such a difference in product development for antimicrobials versus other medicinal applications?	164
12.4	Methods used in developing useful products	164
12.5	Results of random screening of large number of species	167
12.6	Our approach to random screening	168
12.7	Activity of compounds isolated against <i>Staphylococcus aureus</i>	168
12.8	Discovering antifungal compounds from natural products	169
12.9	Review papers focusing on antimicrobial activity of plants from Africa	169
12.10	Promising new approaches	169
12.11	The potential of using African medicinal plants as extracts	170
12.12	Conclusions	170
	Acknowledgements	171
	References	172
13	Plant Medicines Used in the Treatment of Malaria	175
	<i>John R.S. Tabuti, Antonia Nyamukuru and Mohammed Lamorde</i>	
13.1	Introduction	175
13.2	Approach used in the review	175
13.3	Plant species commonly used to treat malaria in Uganda	176
13.4	Conclusions and recommendations	177
	References	177
14	Multiple Anti-Infective Properties of Selected Plant Species from Zimbabwe	179
	<i>Rumbidzai Mangoyi, Tariro Chitemerere, Theresa Chimponda, Elaine Chirisa and Stanley Mukanganyama</i>	
14.1	Introduction	179
14.2	Preparation of plant extracts	181
14.3	Conclusions	188
	Acknowledgements	188
	References	188
15	Development of Phytodrugs from Indigenous Plants: The Mali Experience	191
	<i>Rokia Sanogo</i>	
15.1	Introduction	191
15.2	Development of new phytodrugs	198
15.3	Discussion	199
15.4	Conclusion	200
	References	200
16	Healing Aloes from the Mascarenes Islands	205
	<i>Joyce Govinden-Soulange</i>	
16.1	Introduction	205
16.2	The Asphodelaceae	205
16.3	Prospects and research avenues	211
	References	212
17	Pharmacological Activities of Some of the Neglected and Underutilized Tropical Plants in Malaysia	215
	<i>Z.A. Zakaria, F. Yahya, T. Balan, S.S. Mamat, R. Rodzi, F.H. Kamisan, C.A. Fatimah and A.L. Ibrahim</i>	
17.1	Introduction	215
17.2	<i>Muntingia calabura</i>	215
17.3	<i>Dicranopteris linearis</i>	218
17.4	<i>Bauhinia purpurea</i>	219

17.5	Melastoma malabathricum	222
17.6	Conclusion	224
	References	224
18	Multiple Applications of Endophytic <i>Colletotrichum</i> Species Occurring in Medicinal Plants	227
	<i>Mahendra Rai, Gauravi Agarkar and Dnyaneshwar Rathod</i>	
18.1	Introduction	227
18.2	Diversity of endophytic <i>Colletotrichum</i> sp. in medicinal plants	228
18.3	Biomedical applications	228
18.4	Agriculture applications	228
18.5	Industrial applications	231
18.6	Perspectives	233
18.7	Conclusion	234
	References	234
19	African Plants with Potential for Development into Ethnoveterinary Products	237
	<i>L.J. McGaw and J.N. Eloff</i>	
19.1	Introduction	237
19.2	What is ethnoveterinary medicine?	237
19.3	Ethnoveterinary medicine in Africa	238
19.4	African plants as sources of commercial remedies	238
19.5	Examples of African medicinal plants used for ethnoveterinary purposes with scope for commercialization	255
19.6	Toxicity	256
19.7	Conclusions	258
	References	258
20	African Plant Biodiversity in Pest Management	263
	<i>S. N'Danikou, D.A. Tchokponhoue, C.A. Houdegbe and E.G. Achigan-Dako</i>	
20.1	Introduction	263
20.2	History of humans' use of plant biodiversity in pest management	264
20.3	Methods and approaches in pest management	264
20.4	Research on plant use in pest management	266
20.5	Biodiversity of African plants used in pest management	267
20.6	Benefits of the use of plants in crop pest management	270
20.7	Limits of the study	270
20.8	Conclusion	270
	References	270
	Appendices	275
21	Commercialization of Ethnoveterinary Botanical Products	285
	<i>David R. Katerere</i>	
21.1	Introduction	285
21.2	Therapeutic areas for ethnoveterinary applications	287
21.3	Conclusion	290
	Acknowledgements	290
	References	290
22	Plants Used for Pest Management in Malawi	295
	<i>Cecilia Maliwichi-Nyirenda, Lucy Lynn Maliwichi and John F. Kamanula</i>	
22.1	Introduction	295
22.2	Merits and demerits of pest management systems in Malawi	296
22.3	Plant species used in pest management	297
	References	301
	PART THREE FOOD (SPICES, FRUIT AND VEGETABLES, ETC.)	303
23	Aromatic Plants: Use and Nutraceutical Properties	305
	<i>Lucia Guidi and Marco Landi</i>	
23.1	Introduction	305
23.2	Mediterranean aromatic plants	307
23.3	Concluding remarks	325
	References	325

24 'Let Your Food Be Your Medicine': Exotic Fruits and Vegetables as Therapeutic Components for Obesity and Other Metabolic Syndromes	347
<i>Mohamad Fawzi Mahomoodally</i>	
24.1 Introduction	347
24.2 Obesity, diabetes and metabolic syndromes	347
24.3 Medicinal food plants against metabolic diseases	348
24.4 Conclusion	355
References	356
25 Strategic Repositioning African Indigenous Vegetables and Fruits with Nutrition, Economic and Climate Change Resilience Potential	361
<i>M.O. Abukutsa-Onyango</i>	
25.1 Introduction	361
25.2 African indigenous vegetables and fruits	362
25.3 Strategic repositioning of indigenous vegetables and fruits in the horticulture	364
25.4 Concluding remarks	367
References	367
26 Hepatoprotective, Antiulcerogenic, Cytotoxic and Antioxidant Activities of <i>Musa acuminata</i> Peel and Pulp	371
<i>Fatimah Corazon Abdullah, Lida Rahimi, Zainul Amiruddin Zakaria and Abdul Latif Ibrahim</i>	
26.1 Introduction	371
26.2 Hepatoprotective activity	373
26.3 Antiulcerogenic activity	377
26.4 Cytotoxic activity	379
26.5 Antioxidant activity	380
26.6 Conclusion	381
References	381
27 Plant Bioresources and their Nutrigenomic Implications on Health	383
<i>Maznah Ismail and Mustapha Umar Imam</i>	
27.1 Introduction	383
27.2 Plant bioresources for health uses: beyond traditional uses	384
27.3 Bioactivity of plant bioresources: nutrigenomic implications	384
27.4 Potential implications of the rising trend in the use of plant bioresources for remedies	390
27.5 Conclusions	390
Acknowledgements	391
References	391
28 Safety of Botanical Ingredients in Personal Healthcare: Focus on Africa	395
<i>R. Vihotogbé, C.N.A. Sossa-Vihotogbé and G.E. Achigan-Dako</i>	
28.1 Introduction	395
28.2 Safety in healthcare via food consumption	395
28.3 Medicinal plants in healthcare	396
References	405
PART FOUR COSMETICS (INCLUDING DYES, AROMAS)	409
29 Aromatic and Medicinal Plants in North Africa: Opportunities, Constraints and Prospects	411
<i>Mohamed Ghanmi, Abderrahman Aafi, Badr Satrani, Mohamed Aberchane, Abderrahim Khia and Salah Eddine Bakkali Yakhlef</i>	
29.1 Introduction	411
29.2 Aromatic and medicinal plants in North Africa: a snapshot on the countries of the Maghreb (Morocco, Algeria and Tunisia)	411
29.3 Aromatic and medicinal plants in North Africa: overview and prospects	413
29.4 Aromatic and medicinal plants in Morocco: opportunities, constraints and prospects	413
29.5 Development of the aromatic and medicinal plants sector in Morocco: the strategy adopted	415
29.6 Research conducted in the field of aromatic and medicinal plants: achievements and prospects	415

29.7	Medicinal and aromatic plants in Algeria	417
29.8	Medicinal and aromatic plants in Tunisia	418
29.9	Molecular techniques as tools for conservation and valorization of aromatic and medicinal plants	418
29.10	Sector of aromatic and medicinal plants in North Africa: prospects	421
	References	421
30	Development of Natural Cosmeceuticals: Harnessing Asia's Biodiversity	425
	<i>Azila Abdul-Aziz, Mariani Abdul Hamid, Norhayati Mohammad Noor, Harisun Yaakob, Rosnani Hasham and Mohamad Roji Sarmidi</i>	
30.1	Introduction	425
30.2	<i>Mangosteen</i> : a 'fruity' depigmenting agent	425
30.3	<i>Ficus deltoidea</i> : the 'golden' treasure from nature	426
30.4	<i>Labisia pumila</i> : Malaysia's queen of herbs	427
30.5	<i>Andrographis paniculata</i> : a 'bitter' therapy for the skin	428
30.6	<i>Centella asiatica</i> : herbs' jack of all trades	429
30.7	Future trends	429
	References	430
31	Unique Bioresources from Ethiopia for Food, Medicine and Cosmetics	433
	<i>E. Dagne</i>	
31.1	Introduction	433
31.2	<i>Boswellia</i> species (Burseraceae), <i>etan</i> (Amharic)	433
31.3	<i>Catha edulis</i> (Celastraceae), <i>khat</i>	433
31.4	<i>Coffea arabica</i> (Rubiaceae), <i>buna</i> (Amharic)	434
31.5	<i>Commiphora myrrha</i> (Burseraceae), <i>kerbe</i> (Amharic)	435
31.6	<i>Croton macrostachyus</i> (Euphorbiaceae), <i>bissana</i> (Amharic)	435
31.7	<i>Echinops kebericho</i> (Asteraceae), <i>kebericho</i> (Amharic)	435
31.8	<i>Ensete ventricosum</i> (Musaceae), <i>enset</i> (Amharic)	436
31.9	<i>Eragrostis tef</i> (Poaceae), <i>tef</i> (Amharic)	436
31.10	<i>Hagenia abyssinica</i> (Rosaceae), <i>koso</i> (Amharic)	438
31.11	<i>Moringa stenopetala</i> (Moringaceae), <i>shiferaw</i> (Amharic)	438
31.12	<i>Nigella sativa</i> (Ranunculaceae), <i>tikur azmud</i> (Amharic)	439
31.13	<i>Phytolacca dodecandra</i> (Phytolaccaceae), <i>endod</i> (Amharic)	439
31.14	<i>Sorghum bicolor</i> (Poaceae), <i>mashla</i> (Amharic)	439
31.15	<i>Taverniera abyssinica</i> (Leguminosae), <i>dingetegna</i> (Amharic)	440
31.16	<i>Civettictis civetta</i> : source of civet zebad (Amharic)	440
31.17	Conclusion	440
	References	440
32	Aromatic Plants from Reunion Island (France)	443
	<i>Anne Bialecki and Jacqueline Smadja</i>	
32.1	Introduction	443
32.2	Aromatic plant production: economic data	443
32.3	Extraction techniques used in Reunion Island	444
32.4	Analysis of essential oils and plant headspace in the Chemistry Laboratory of Natural Substances and Food Sciences	445
32.5	Identification of volatile compounds at the Chemistry Laboratory of Natural Substances and Food Sciences	446
32.6	Conclusion	451
	Acknowledgements	452
	References	452
33	Anti-Parasitic Activity of Essential Oils and their Active Constituents against <i>Plasmodium</i>, <i>Trypanosoma</i> and <i>Leishmania</i>	455
	<i>Joanne Bero, Salomé Kpoviessi and Joëlle Quetin-Leclercq</i>	
33.1	Introduction	455
33.2	Essential oils	455
33.3	Compounds isolated from essential oils	460
33.4	Discussion and conclusion	460
	References	467

34 Metabolomic Analysis of a Commercially Important Aromatic Plant from the Indian Ocean: <i>Vanilla planifolia</i>	471
<i>Tony L. Palama</i>	
34.1 Introduction	471
34.2 Vanilla description	471
34.3 Vanilla metabolomics	473
34.4 Other future prospects	475
34.5 Conclusions	476
References	477
35 Natural Dyes for Photonics Applications	479
<i>M. Maaza</i>	
35.1 Introduction	479
35.2 Nonlinear optical properties of natural dyes: $\chi^{(3)}$ and optical limiting applications	479
35.3 Linear optical properties of natural dyes: Grätzel dye solar cells	485
35.4 Conclusion	491
Acknowledgements	491
References	492
36 The Host Innate Immune Response to <i>Propionibacterium acnes</i> and the Potential of Natural Products as Cosmeceutical Agents	495
<i>Marco Nuno de Canha, Smeetha Singh and Namrita Lall</i>	
36.1 The skin and its function	495
36.2 The impact of skin disorders with focus on acne	495
36.3 <i>Propionibacterium acnes</i> : is it the culprit?	495
36.4 Acne vulgaris (acne)	496
36.5 The activation of innate and adaptive immune system	497
36.6 The host immune response to infection by <i>Propionibacterium acnes</i>	498
36.7 Conventional treatments available for acne vulgaris	499
36.8 Potential of natural products to treat acne vulgaris	500
36.9 The importance of the emergence of plant life on Earth	501
36.10 A proposed stepwise approach from plant extract to cosmeceutical product	501
References	505
37 New Natural Aromatic Products: Search, Evaluation and the Development Issues	507
<i>Murray Hunter</i>	
37.1 Introduction	507
37.2 The family of natural aromatic extracts	507
37.3 The search and screening process	508
37.4 Sources of potential plant opportunity identification	509
37.5 The characteristics and classification of natural aromatic materials	510
37.6 Evaluating the characteristic strengths and weaknesses of natural aromatic materials	512
37.7 The development issues	512
37.8 Conclusion	522
References	523
Further reading	524
Index	525