

Contents

Acknowledgements	4
Introduction	5
Material and Methods	7
Field Studies	7
Herbarium Studies	7
Morphological Methods and Measurements	8
General Part	
Growth Habit, Root and Stem	11
Growth Habit	11
Rhizomatous Perennial Herbs	11
The Woody Species	11
The Root	17
The Stem	17
Wood Anatomy	20
Generic Description	20
Taxonomic and Ecological Implications	21
The Leaves	23
Stipules and Extrafloral Nectaries	32
Ecology of the Extrafloral Nectaries	33
Inflorescence and Flower	35
The Inflorescence	35
The Flower	38
Variation in the Number of Floral Organs	41
Pollen	42
The Ovary	43
Pollination Biology and Breeding System	44
Hypothesis	44
Observations and Pollination Experiments	44
Pollen Viability and Pollen Tube Growth	48
Conclusions	51
Hybrids and Cultivars	51
Fruit and Seed	52
Number of Loculi	53
Fertility	55
Dispersal and Distribution	57
Natural Dispersal	57
Dispersal by Man	59
Range Margins and Outposts	61
General Distribution and Comparison with other Genera	61
Life Cycle	64
Germination	64
The Seedling	66
Establishment of the Plantlet	66
The Fertile Phase	66
What Age Can an Elder Tree Reach?	67
Death	68

The Habitat	69
Chemical Constituents, Toxicity and Use	73
Toxicity: Are there Poisonous Species in <i>Sambucus</i> ?	73
The Cyanogenic Glycoside Sambunigrin as a Chemical Deterrent	75
Ecology of Cyanogenesis	76
Medical and Culinary Use	77
Fruit Anthocyanins	79
Material and Methods	79
Thin Layer Chromatography (TLC)	82
Results and Discussion	82
Conclusions	84
High Performance Liquid Chromatography (HPLC)	85
Results and Discussion	85
In Which Way Is Fruit Colour Determined?	94
Biosynthetic Pathway and Evolutionary Significance	95
Hypothetical Biosynthetic Pathway of <i>Sambucus</i> Anthocyanins	96
Genetic Background of <i>Sambucus</i> Anthocyanins: A Hypothesis	97
Evolutionary Interpretation of <i>Sambucus</i> Anthocyanin Data	99
Karyosystematics	101
Chromosome Numbers	101
Chromosome Morphology	104
Discussion	
Visualization of Evolution in the Genus	105
Evolutionary Significance of some Important Characters	105
Growth Habit	105
Inflorescence	106
Flower	106
Pollen Exine Sculpturing	107
Fruit Anthocyanins	108
Karyology	109
Character Combinations and Conflicting Characters	109
Earth History and Biogeography	113
An Old World Herbaceous Perennial as Ancestor of <i>Sambucus</i>	115
Place and Time of Origin	115
Scenario 1: Late Cretaceous Origin	116
Scenario 2: Oligocene Origin	119
Systematic Part	
The Family Sambucaceae	125
Where to Place <i>Sambucus</i> ?	125
<i>Sambucus</i> , <i>Viburnum</i> and <i>Adoxa</i>	126
The Genus <i>Sambucus</i>	129
<i>Sambucus</i> L.	129
Infrageneric Classifications	130
Taxonomic Species Concept	132
Subspecies and Species	133
Variety and Continuous Variation	133
Note 1: How to Collect <i>Sambucus</i> Specimens	134

Note 2: Citation of Types	134
Key to the Species and Subspecies	135
1. <i>Sambucus ebulus</i> L.	140
<i>S. ebulus ssp. ebulus</i>	143
<i>S. ebulus ssp. africana</i> (Engler) R. Bolli stat. nov.	144
2. <i>Sambucus wightiana</i> Wallich ex Wight et Arnott	146
3. <i>Sambucus adnata</i> DC.	149
4. <i>Sambucus gaudichaudiana</i> DC.	151
5. <i>Sambucus australasica</i> (Lindley) Fritsch	155
6. <i>Sambucus javanica</i> Blume	158
7. <i>Sambucus nigra</i> L.	161
<i>S. nigra ssp. nigra</i>	162
<i>S. nigra ssp. maderensis</i> (Lowe) R. Bolli stat. et comb. nov.	164
<i>S. nigra ssp. palmensis</i> (Link) R. Bolli stat. et comb. nov.	167
<i>S. nigra ssp. canadensis</i> (L.) R. Bolli stat. et comb. nov.	168
<i>S. nigra ssp. cerulea</i> (Rafin.) R. Bolli stat. et comb. nov.	174
<i>S. nigra ssp. peruviana</i> (H.B.K.) R. Bolli stat. et comb. nov.	177
8. <i>Sambucus australis</i> Cham. et Schlecht.	181
9. <i>Sambucus racemosa</i> L.	187
Preliminary Remarks on <i>Sambucus racemosa</i> L.	187
<i>S. racemosa</i> var. <i>racemosa</i>	195
<i>S. racemosa</i> var. <i>melanocarpa</i> (Gray) McMinn	195
Names of Taxa of Uncertain Application	198
Summary	199
Zusammenfassung	201
References	205

Appendix

Synoptic Key to the Species of <i>Sambucus</i>	223
Index of Taxa	224
Index of Plates	227