

CONTENTS

CONTRIBUTORS TO VOLUME 6	v
PREFACE	vii

Ecological Aspects of Nitrogen Assimilation

J. A. LEE AND G. R. STEWART

I. Introduction	2
II. Nitrogen Uptake and Assimilation	2
A. The Uptake of Nitrate and Ammonia	2
B. Nitrogen Fixation	4
C. Nitrate Reduction	5
D. Ammonia Assimilation	6
E. Sites of Nitrogen Assimilation	8
F. Control of Nitrogen Assimilation	10
III. Nitrogen in the Environment	12
A. The Acquisition of Nitrogen by Ecosystems	12
B. Mineralization and Nitrification	14
C. Nitrogen Source: Nitrate or Ammonium Ions?	18
IV. Characteristics and Behaviour of Nitrogen Assimilating Enzymes in Different Species	24
A. Nitrate Reductase	24
B. Enzymes of Ammonia Assimilation in Different Species	26
C. Kinetic Characteristics of Ammonia Assimilating Enzymes in Different Species	32
V. Ecological Adaptation in the Assimilation of Nitrogen	35
Acknowledgements	39
References	39

Physical Aspects of Water Relations of Plant Cells

U. ZIMMERMANN AND E. STEUDLE

I. Introduction	46
II. Description of Membrane Transport	47

III. Transport Equations	48
A. Homogeneous Planar Membranes	48
B. Use of Terms	54
C. Planar Composite Membranes	57
D. Folded Membranes	59
E. Active Water Transport	62
F. Energy Conversion	66
G. Half-time of Water Exchange in Single Cells	69
IV. Elasticity of Plant Cells	71
A. Definition of the Volumetric Elastic Modulus, ϵ	71
B. The Determination of ϵ in Single Cells with the Pressure Probe	73
C. The Determination of ϵ in Single Cells by Indirect Methods	83
D. The Determination of Bulk Elastic Moduli in Tissues	84
V. Hydraulic Conductivity	88
A. Giant Algal Cells	88
B. Higher Plant Cells	95
C. Cell Suspensions	99
VI. Turgor-dependent Processes	104
VII. Conclusions	111
Acknowledgements	112
References	112

Aspects of Chromosome Evolution in Higher Plants

KEITH JONES

I. Introduction	120
II. The Modern Approach to Chromosome Evolution	120
A. The Modern Methods	121
B. The Quality of DNA	123
III. The Nature and Direction of Chromosome Change	128
A. Structural Mutations	128
B. Size Differences	130
C. The Direction of Chromosome Change	132
IV. The Centromere and its Influences	133
A. Centromere Structure and Position	133
B. Centromere Evolution	136
C. The Telocentric Chromosome	138
V. Structural Change	140
A. Centric Fission	140
B. The Isochromosome	145
C. Pseudo-isochromosomes	149
D. Isochromosome Derivatives	149
E. The Evolutionary Significance of Isochromosomes	151
F. Centric Fusion	152

VI.	The Origin of B Chromosomes	156
VII.	Nombre Fondimental	159
VIII.	The Significance of Centric Fusion in the Evolution of Higher Plants	159
A.	The Genus <i>Gibasis</i>	160
B.	The Genus <i>Cymbispatha</i>	161
C.	<i>Zebrina</i>	168
D.	The Cycads	171
E.	The Podocarpaceae	173
F.	<i>Lycoris</i>	176
G.	<i>Nothoscordum</i>	177
H.	<i>Haplopappus</i>	179
I.	<i>Luzula</i>	179
J.	Miscellaneous Cases	181
IX.	The Implications of Polyploidy	182
A.	The Buffering Influence of Polyploidy	182
B.	The Interaction of Polyploidy and Centric Fusion	183
X.	Finale	186
A.	The Chromosome Method	186
B.	The Dimensions of Chromosomes	188
C.	The Primitive Angiosperms	189
References		191

Cytogenetics, Biosystematics and Evolution in the Bryophyta

A. J. E. SMITH

I.	Introduction	196
II.	Cytogenetics	196
A.	Cytological Techniques	196
B.	Chromosome Numbers	199
C.	Polyploidy (Euploidy)	208
D.	Aneuploidy	219
E.	Meiotic Irregularities	221
F.	Accessory and Micro-chromosomes	224
G.	Sex Chromosomes	230
H.	Heterochromatin	236
I.	Karyotype Analysis	238
J.	Cytotaxonomy	242
III.	Biosystematics	244
A.	Genetics	245
B.	Breeding Systems	245
C.	Population Differentiation	248
D.	Hybridity	250
E.	Apogamy, Apospory and Diplospory	252
F.	Cultivation Experiments	253
G.	Phytochemistry	259
H.	Biometric Methods	260

IV. Evolution	261
A. Micro-evolution	262
B. Macro-evolution	266
V. Summary	269
Acknowledgement	270
References	270

Plant Resins—Their Formation, Secretion and Possible Functions

B. DELL AND A. J. McCOMB

I. General Introduction	278
II. Definitions of Resins and Related Plant Products	278
A. Resins	279
B. Latex	279
C. Essential Oils	279
D. Gum and Mucilage	280
E. Wax	280
F. Overlap Between Categories	280
III. Chemistry of Resins	281
A. Terpenoids	281
B. Flavonoids	284
C. Other Chemicals	285
IV. Chemotaxonomy	286
A. Flavonoids	286
B. Terpenoids	286
C. Surface Resins	287
V. The Occurrence and Yields of Surface Resins	288
VI. The Structure of Resin-Secreting Glands	291
A. Glands which Secrete Surface Resins	291
B. Glands which Secrete Internal Resins	300
C. Common Features of Gland Cells which Secrete Resins	301
D. Intracellular Accumulation of Resin Components	302
E. Extracellular Secretion of Resins	303
VII. Sites of Resin Synthesis	304
A. Glandular Hairs	305
B. Internal Secretory Structures	305
C. Synthesis in Tissue Cultures	306
VIII. The Function of Resins	307
A. Surface Resins	307
B. Internal Resins	309
C. General Comments	310
IX. Concluding Remarks	311
Acknowledgements	311
References	312