

Contents

| | | |
|-----------------------------------|-----|-----|
| Foreword by Dr. M. S. Swaminathan | ... | iii |
| Author's Preface to Third Edition | ... | v |

PAGE

CHAPTER I

| | | |
|---|-----|---|
| HISTORICAL RESUMÉ | ... | 1 |
| Introduction—Early period—Pre-mendelian—Mendelian Era—Recent Advances | | |

CHAPTER II

| | | |
|---|-----|---|
| REPRODUCTION | ... | 8 |
| Multiplication in plants—The flower—Self and cross-pollination—Development of stamens—Development of pistil—Fertilization—Asexual reproduction. | | |

CHAPTER III

| | | |
|---|-----|----|
| SEGREGATION AND INDEPENDENT ASSORTMENT | ... | 17 |
| Introduction—Mendel and his technique—Symbols—Monohybrids—Phenotype and Genotype—Segregation—Reciprocal cross—Laws of Mendel—Test-crosses—Calculation and testing of fit of Mendelian ratios—Segregation in populations—Incomplete dominance—Independent assortment of factors; dihybrid ratio—Third law of Mendel—Incomplete dominance—Dihybrid test cross—Trihybrid—Testing of goodness of fit—Kinds of inheritance—Practical applications. | | |

CHAPTER IV

| | | |
|---|-----|----|
| MODIFICATIONS OF F_2 RATIOS AND DOMINANCE | ... | 35 |
| Expression and interaction of factors—Interaction between dominant factors—Complementary factors—Supplementary factors—Epistasis—Inhibitory factors—Duplicate factors—Polymerism—Lethal factors—Modifiers—Cumulative factors. | | |

CHAPTER V

| | | |
|--|-----|----|
| ALLELISM | ... | 53 |
| Allelism — Dominance — Multiple alleles — Isoalleles — Pseudoalleles — Gene symbols. | | |

CHAPTER VI

| | | | | |
|--|-----|-----|-----|----|
| INHERITANCE OF QUANTITATIVE CHARACTERS | ... | ... | ... | 60 |
| Qualitative and Quantitative characters—Multiple factor hypothesis—Biometry—Types of F_1 and F_2 —Genetic variances—Effect and location of multiple factors. | | | | |

CHAPTER VII

| | | | | |
|---|-----|-----|-----|----|
| PHYSICAL BASIS OF HEREDITY | ... | ... | ... | 71 |
| The cell—Cell contents—Mitosis—Mitosis in animal cells—Chromosome—Meiosis—Differences between mitosis and meiosis—Syngamy—Parallelism between meiosis and Mendelian segregation—Chromosome theory of inheritance. | | | | |

CHAPTER VIII

| | | | | |
|--|-----|-----|-----|----|
| CHROMOSOME THEORY AND LINKAGE | ... | ... | ... | 97 |
| Introduction—Linkage—Calculation of linkage values—Gametic proportions—Testcross—Crossover and chiasmatype theory—Calculation of F_2 ratio—Linkage groups—Location of genes—Linkage maps—Importance in breeding. | | | | |

CHAPTER IX

| | | | | |
|---|-----|-----|-----|-----|
| SEX DETERMINATION AND SEX INHERITANCE | ... | ... | ... | 116 |
| Introduction—Sex determination—Sexuality and Dioecy—Sex in plants—Sex-determination in plants—Sex-inheritance and linkage—Sex reversal—Practical application. | | | | |

CHAPTER X

| | | | | |
|---|-----|-----|-----|-----|
| STRUCTURAL CHANGES IN CHROMOSOMES | ... | ... | ... | 134 |
| Genic arrangement—Types of structural changes—Deficiency—Duplication—Inversion—Translocation—Evolutionary significance. | | | | |

CHAPTER XI

| | | | | |
|--|-----|-----|-----|-----|
| MUTATIONS AND GENES | ... | ... | ... | 145 |
| Historical—Definition of mutation—Stage at which mutations occur—Nature of mutations—Types of mutations—Induced mutations—Mutations in plant breeding. | | | | |

CHAPTER XII

| | | | | |
|---|-----|-----|-----|-----|
| GENES, GENETICS OF MICRO-ORGANISMS AND STRUCTURE OF GENE | ... | ... | ... | 163 |
| Genes—Nature of gene—Gene action—Gene effect—Penetrance and expressivity—Genetics of micro-organisms. | | | | |

CHAPTER XIII

| | | | | |
|--|-----|-----|-----|-----|
| POLYPLOIDY | ... | ... | ... | 175 |
| Introduction — Polyploidy — Haploids — Diploids — Autopolyploids — Quantitative changes within a genome — Allopolyploids — Secondary polyploids — Induction of polyploidy — Change due to polyploidy — Polyploidy in evolution — Polyploidy in Breeding. | | | | |

| | PAGE |
|---|------|
| CHAPTER XIV | |
| STERILITY AND INCOMPATIBILITY | 234 |
| Introduction—Environmental causes of sterility—Genetic sterility—Hybrid sterility—Zygotic and endospermal sterility—Morphological sterility—Meiotic—Incompatibility—Genetic association of sterility—Cytological basis for sterility—Evolutionary significance. | |
| CHAPTER XV | |
| CYTOPLASMIC INHERITANCE | 255 |
| Introduction—Predetermination—Dauermutations—Cytoplasmic effects—Plastid inheritance—Plasma inheritance—Nature of the plasmon particles—Cytoplasmic inheritance in some crop plants—Practical applications. | |
| CHAPTER XVI | |
| VARIATION | 271 |
| Variation—Taxonomical categories and biotypes—Environment and variation—Factors influencing variation—Intraspecific variations (Agro-ecotypic)—Autogenous variation—Graft hybrids and chimeras—Xenia, metaxenia and merogony—Parallel variation—General. | |
| CHAPTER XVII | |
| SELECTION | 294 |
| Selection—Population constituents—Effects of selection on population—Artificial selection—Selection methods—Plant survey—Acclimatization. | |
| CHAPTER XVIII | |
| PURE LINE SELECTION | 304 |
| Introduction—Johannsen's experiments—Genetic significance—Effect of selfing cross-pollinated crops—Primary and secondary selections—Bulk for selection—Field technique—Limitations. | |
| CHAPTER XIX | |
| CLONES AND CLONAL SELECTION | 313 |
| Clones—Clonal variation—Bud mutation—Improvement in clones—Selection technique in clones—Other kinds of vegetatively propagated sporophytes—Parthenocarpy—Practical application. | |
| CHAPTER XX | |
| HYBRIDISATION TECHNIQUE | 328 |
| Early work—Object of hybridisation—Technique of hybridisation—Anthesis—Emasculation—Artificial pollination—Natural crossing—Culture of parents. | |
| CHAPTER XXI | |
| HETEROSIS OR HYBRID VIGOUR | 350 |
| Introduction—Historical—Effects of inbreeding—Theories on causes of heterosis—Heterosis in general—Heterosis and its practical application in some crop plants—Special techniques for the large-scale production of hybrid seeds. | |
| CHAPTER XXII | |
| EVOLUTION OF NEW VARIETIES THROUGH HYBRIDISATION | 367 |
| Introduction—Choice of parents—Cross-pollinated crops—Clones—Inter-specific hybrids in Agriculture and Forestry—Back-crossing—Selection in hybrid progenies—Introgressive hybridisation—Limitation—Achievements. | |

CHAPTER XXIII

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| PLANT BREEDING METHODS | ... | ... | ... | ... | ... | 399 |
| Introduction—Historical—Mass selection—Pedigree method—Single plant or pure line method—Breeding new varieties by hybridisation—Breeding in cross-fertilized plants—Breeding methods in some crops—Fodder and forage crops—Svalof system. | | | | | | |

CHAPTER XXIV

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| BREEDING FOR DISEASE, PEST AND DROUGHT RESISTANCE | ... | ... | ... | ... | ... | 410 |
| Importance of the problem—Nature of damage caused by pests and diseases—Nature of disease resistance in plants—Variations in disease resistance—Acquired immunity—Inheritance of disease resistance—Breeding for disease resistance—Breeding for disease resistance: general method—Nature of pest resistance—Drought resistance. | | | | | | |

CHAPTER XXV

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| PHASIC DEVELOPMENT IN PLANTS | ... | ... | ... | ... | ... | 433 |
| Introduction—Lysenko's theory—First phase—Second phase—Third phase—Physiology of vernalization—The technique—Vernalization in some crops—Genetic concept. | | | | | | |

CHAPTER XXVI

| | | | | | | |
|--|-----|-----|-----|-----|-----|-----|
| SEED PRODUCTION AND CROP DETERIORATION... | ... | ... | ... | ... | ... | 445 |
| Seed purity—Mechanical admixture—Roguing—Genetic causes of deterioration—Prevention. | | | | | | |

CHAPTER XXVII

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| EVOLUTION AND NATURAL SELECTION | ... | ... | ... | ... | ... | 451 |
| Evolution—Species formation—Genetic analysis—Natural selection—Origin of cultivated plants. | | | | | | |

CHAPTER XXVIII

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| STATISTICS IN RELATION TO PLANT BREEDING | ... | ... | ... | ... | ... | 468 |
| Introduction—Sampling—Statistical constants—Tests of significance—Chi-square (χ^2) test. | | | | | | |

CHAPTER XXIX

| | | | | | | |
|----------------------------|-----|-----|-----|-----|-----|-----|
| CORRELATION AND REGRESSION | ... | ... | ... | ... | ... | 476 |
| Correlation—Regression. | | | | | | |

CHAPTER XXX

| | | | | | | |
|--|-----|-----|-----|-----|-----|-----|
| FIELD TRIALS | ... | ... | ... | ... | ... | 481 |
| Object of field trials—Soil heterogeneity—Choice of site—Size and shape of plots—Variant (treatment)—Layout—Replication and randomization—Sowing, planting and harvesting of experimental plots—Duration of experiment—Record of details for field experiments—Paired plots or Beaven's half-drill method—Randomized block—Latin square—Split plot design—Lattice design—Covariance. | | | | | | |

APPENDICIES

| | |
|--|-----|
| I. Distribution of 't'; II. Distribution of χ^2 ; III. Distribution of F; IV. Gene symbols for paddy, sorghum and cotton; V. Linkage values in some crop plants; VI. List of some monoecious and dioecious plants; VII. List of some inter-specific and intergeneric crosses and amphidiploids; VIII. List of cultivated plants classified under primary centres of origin; IX. Chromosome numbers (2x); X. Glossary; XI. Bibliography. | 513 |
|--|-----|