

Contents

Preface

Acknowledgements

A List of Plates

I Hybrido-embryology in *Populus*

1	Development of Sex Organs.....	2
1.1	Flowers and inflorescences	2
1.2	Floral morphology	3
1.3	Development of pollen	3
1.4	Development of embryo sac.....	5
1.5	Summary	7
2	The Secretory Stigma	17
2.1	Light microscopy and cytochemistry	17
2.2	Scanning electron microscopy.....	18
2.3	Transmission electron microscopy	18
2.4	ATPase activities in stigma cells of <i>P. lasiocarpa</i>	19
2.5	Summary	19
3	Pollen-stigma Interaction	39
3.1	Germinated pollen grains and their wall sculptures	40
3.2	Pollen tube behaviour on stigmas.....	40
3.3	Discussion	42
4	The Progamic Phase	51
4.1	Conspecific matings	51
4.2	Intersectional crosses.....	52
4.3	Intergeneric cross: <i>P. simonii</i> × <i>Salix matsudana</i>	54
4.4	Summary	55
5	Double Fertilization.....	65
5.1	Conspecific matings	65
5.2	Intersectional crosses.....	66
5.3	Intergeneric cross: <i>P. simonii</i> × <i>Salix matsudana</i>	68
5.4	Summary	68
6	Development of Embryo and Endosperm	79
6.1	Conspecific matings	79
6.2	Intersectional crosses.....	81
6.3	Intergeneric cross: <i>P. simonii</i> × <i>Salix matsudana</i>	82
6.4	Summary	82

II Sexual Reproductive Biology of Distant

Hybridization in *Cunninghamia*

7	Intergeneric Cross Between <i>Cunninghamia</i> and <i>Cryptomeria</i>	90
7.1	Controlled pollination and hybrid seed production.....	90
7.2	Soft X-ray detection of hybrid seeds.....	90
7.3	Seed germination and hybrid seedlings.....	91
7.4	PCR and RFLP analyses.....	91
7.5	Summary.....	92
8	Interfamilial Cross Between <i>Cunninghamia lanceolata</i> and <i>Platycladus orientalis</i>	96
8.1	Controlled pollination and sample preparation.....	96
8.2	Pollen germination and pollen tube growth.....	96
8.3	Fertilization and postfertilization.....	97
8.4	Summary.....	97

III Application of Cytobiological Techniques for

Overcoming Barriers to Hybridization

9	<i>In ovulo</i> Embryo Culture in <i>Populus</i>	100
9.1	<i>In ovulo</i> embryo culture for <i>Populus euphratica</i>	100
9.2	<i>In ovulo</i> embryo culture for intersectional crosses.....	101
9.3	Intergeneric cross: <i>P. simonii</i> × <i>S. matsudana</i>	102
9.4	Summary.....	103
10	Isolation of Viable Gametes: Towards <i>in vitro</i> Fertilization.....	117
10.1	Angiosperms.....	117
10.2	Gymnosperms.....	122
10.3	Summary.....	124

