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INTERSPECIFIC HYBRIDIZATION IN *FUCHSIA*



By

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DEDICATION

To my brother-in-law

Rajendra Prasad Mallavarapu

CONTENTS

Details of contents	Page
Acknowledgements	i
Tables	ii
Figures	iv
Abstract	vii
Chapter One - General introduction	1
1.1 Taxonomy and distribution of <i>Fuchsia</i>	1
1.1.1 <i>Fuchsia</i> species from Mexico, South & Central America	2
1.1.2 <i>Fuchsia</i> species from South Pacific region	4
1.2 Natural gene flow in plants	4
1.3 <i>Fuchsia</i> breeding	5
1.4 <i>Fuchsia procumbens</i> : a trailing fuchsia with unique characters!	6
Chapter Two- Interspecific hybridization in <u>Fuchsia</u>	7
2.1 Introduction	7
2.1.1 Floral morphology, flower size and style length, pollen volume in relation to interspecific hybridization	9
2.1.2 Hybridization in <i>Fuchsia</i>	11
2.1.3 Artificial hybridization in <i>Fuchsia</i>	13
2.2 Materials and methods	14
2.2.1 Plant material	14
2.2.2 Measuring style length	15
2.2.3 Estimation of pollen volume	15
2.2.4 Cross pollination for hybrid production	17
2.2.5 Morphology of species, cultivars and hybrids	17
2.3 Results	17
2.3.1 Relationship between style length and pollen volume	17
2.3.2 Hybridization studies	20
2.3.2.1 Crosses involving <i>F. arborescens</i> as the male parent	20
2.3.2.2 Crosses involving <i>F. boliviana</i> as the male parent	20
2.3.2.3 Crosses involving "Dr. Hammett" as the male parent	21
2.3.2.4 Crosses involving <i>F. encliandra</i> as the male parent	21
2.3.2.5 Crosses involving <i>F. excorticata</i> as the male parent	22
2.3.2.6 Crosses involving <i>F. fulgens</i> as the male parent	22
2.3.2.7 Crosses involving "Gartenmeister Bonstedt" as the male parent	23
2.3.2.8 Crosses involving <i>F. glazioviana</i> as the male parent	24
2.3.2.9 Crosses involving <i>F. hatschbachii</i> as the male parent	24
2.3.2.10 Crosses involving <i>F. magellanica</i> as the male parent	25
2.3.2.11 Crosses involving, <i>F. microphylla</i> , <i>F. minutiflora</i> , <i>F. reflexa</i> and "Timothy Hammett" as the male parents	25
2.3.2.12 Crosses involving <i>F. procumbens</i> as the male parent	27
2.3.2.13 Crosses involving <i>F. splendens</i> as the male parent	28
2.3.2.14 Crosses involving <i>F. triphylla</i> as the male parent	28

Details of contents	Page
2.3.2.15 Crosses involving <i>F. trumpetor</i> as the male parent	29
2.3.2.16 Crosses involving hybrids and <i>F. procumbens</i>	29
2.3.2.17 Back-crossings	29
2.3.3 Morphology of interspecific hybrids	30
2.3.3.1 Crosses involving <i>F. procumbens</i> as the male parent	30
2.3.3.1.1 <i>F. encliandra</i> X <i>F. procumbens</i>	30
2.3.3.1.2 <i>F. splendens</i> X <i>F. procumbens</i>	30
2.3.3.2 Crosses involving <i>F. arborescens</i> as the male parent	34
2.3.3.2.1 <i>F. triphylla</i> X <i>F. arborescens</i>	34
2.3.3.3 Crosses involving <i>F. boliviana</i> as the male parent	34
2.3.3.3.1 <i>F. fulgens</i> X <i>F. boliviana</i>	34
2.3.3.3.2 <i>F. hatschbachii</i> X <i>F. boliviana</i>	34
2.3.3.3.3 “Timothy Hammett” X <i>F. boliviana</i>	34
2.3.3.3.4 <i>F. triphylla</i> X <i>F. boliviana</i>	34
2.3.3.4 Crosses involving <i>F. glazioviana</i> as the male parent	36
2.3.3.4.1 <i>F. boliviana</i> X <i>F. glazioviana</i>	36
2.3.3.4.2 “Timothy Hammett” X <i>F. glazioviana</i>	36
2.3.3.4.3 <i>F. triphylla</i> X <i>F. glazioviana</i>	36
2.3.3.5 Crosses involving <i>F. magellanica</i> as the male parent	36
2.3.3.5.1 <i>F. boliviana</i> X <i>F. magellanica</i>	36
2.3.3.5.2 <i>F. fulgens</i> X <i>F. magellanica</i>	36
2.3.3.5.3 <i>F. glazioviana</i> X <i>F. magellanica</i>	36
2.3.3.6 Crosses involving <i>F. splendens</i> as the male parent	39
2.3.3.6.1 <i>F. fulgens</i> X <i>F. splendens</i>	39
2.3.3.6.2 <i>F. triphylla</i> X <i>F. splendens</i>	39
2.3.3.7 Crosses involving <i>F. trumpetor</i> as the male parent	39
2.3.3.7.1 <i>F. splendens</i> X <i>F. trumpetor</i>	39
2.3.4 Crossability of species based on taxonomic classification	42
2.4 Discussion	46
2.4.1 Hybridization in <i>Fuchsia</i>	46
2.4.2 Crossability in relation to taxonomic position	47
2.4.3 Variability in F ₁ progenies	50
2.5 Summary	52
Chapter Three -Pre-and Post-fertilization barriers in <u>Fuchsia</u>	53
3.1 Introduction	53
3.1.1 Pre-fertilization barriers	53
3.1.2 Post fertilization barriers	54
3.2 Materials and methods	56
3.2.1 Cross pollination for the analysis of pollen: stigma interactions & barriers to hybridization	56
3.2.2 Pollen germination and pollen tube growth	56
3.2.3 Ovule clearing	57
3.2.4 Hybrid inviability	57

Details of contents	Page
3.3 Results	58
3.3.1 Pollen-pistil interactions following crosses between <i>Fuchsia</i> species or cultivars	58
3.3.1.1 Pre-fertilization barriers	61
3.3.2 Post-fertilization barriers	61
3.3.2.1 Improper embryo/ endosperm development	62
3.3.2.2 Non germination of seeds	62
3.3.2.3 Hybrid inviability	62
3.3.2.3.1 Description of crosses that showed hybrid inviability	62
3.3.2.3.1.1 <i>F. boliviana</i> X <i>F. procumbens</i>	62
3.3.2.3.1.2 <i>F. procumbens</i> X <i>F. hatschbachii</i>	62
3.3.2.3.1.3 <i>F. reflexa</i> X <i>F. procumbens</i>	62
3.3.2.3.1.4 <i>F. triphylla</i> X <i>F. procumbens</i>	63
3.3.2.3.1.5 <i>F. glazioviana</i> X <i>F. magellanica</i>	63
3.3.2.3.1.6 <i>F. splendens</i> X <i>F. boliviana</i>	63
3.3.2.3.1.7 <i>F. splendens</i> X <i>F. fulgens</i>	63
3.3.2.3.1.8 <i>F. splendens</i> X <i>F. magellanica</i>	63
3.3.2.3.1.9 <i>F. triphylla</i> X <i>F. fulgens</i>	63
3.4 Discussion	65
3.5 Summary	71
Chapter Four-Chromosome number and genome size	72
4.1 Introduction	72
4.1.1 Mechanism of variation in nuclear DNA amount	75
4.1.2 Techniques for chromosome number and nuclear DNA amount	79
4.2 Materials and methods	84
4.2.1 Estimation of chromosome number by mitotic chromosome spreads	84
4.2.2 Preparation of mitotic spreads for karyotyping	84
4.2.2.1 Preparation of mitotic spreads by enzymatic digestion	84
4.2.2.2 The preparation of air-dried chromosome spreads	85
4.2.3 Silver staining nucleolus organizer regions	85
4.2.4 Plant material used to estimate the nuclear DNA amount	86
4.2.5 Isolation and staining of the nuclei	86
4.2.6 Nuclear DNA analysis by flow cytometry	87
4.2.7 Estimation of nuclear DNA content	87
4.2.8 Comparison of hybrid 2C DNA values with parental species	87
4.3 Results	88
4.3.1 Chromosome number in species and cultivars	88
4.3.2 Mitotic chromosome morphology and silver staining nucleolus organizer regions	88
4.3.3 C-value in <i>Fuchsia</i> species	88
4.3.4 C-value and geographical distribution of species	89
4.3.5 C-value, morphology, and phylogeny	89
4.3.6 C-value and ploidy level in the species	90
4.3.7 C-value in hybrids	90
4.4 Discussion	98
4.5 Summary	102

Chapter Five-Meiotic analysis of species and hybrids	103
Introduction	103
5.1.1 Genome analysis	103
5.1.2 Sterility and meiosis	104
5.1.3 Gametes with the somatic chromosome number (2n gametes)	106
Materials and methods	109
5.2.1 Estimation of viable and malformed pollen grains	109
5.2.2 Observation on meiotic metaphase I	109
5.2.3 Detection of gametes with somatic chromosome number	109
5.2.3.1 Studies related to pollen diameter to identify haploid & diploid gametes	109
5.2.3.2 Progeny analysis of diploid-diploid and diploid-tetraploid crosses	109
Results	110
5.3.1 Pollen viability	110
5.3.1.1 Pollen viability in the species and cultivars	110
5.3.1.2 Pollen viability in F ₁ hybrids	110
5.3.2 Frequency of malformed pollen	111
5.3.3 Chromosomal pairing and fertility in species and F ₁ hybrids	112
5.3.4 Frequency of production of unreduced chromosome number in pollen of species, cultivars and hybrids	120
5.3.4.1 Morphological screening of gametes with somatic chromosome number by measuring the pollen size	120
5.3.5 Presence of different pollen morphs	124
Discussion	125
Summary	131
Chapter Six-Molecular phylogeny of the genus <u>Fuchsia</u>	132
Introduction	132
6.1.1 The nrDNA- use of ITS region in phylogenetic studies	134
6.1.2 The cpDNA- use of trnL-F spacer in phylogenetic studies	136
6.1.3 Phylogenetic trees- study of species relationships	137
6.1.4 Role and selection of outgroups	140
Materials and methods	141
6.2.1 Genomic DNA extraction	141
6.2.2 DNA quantification	142
6.2.3 Amplification of the <i>Fuchsia</i> ITS and <i>trnL-F</i> region	142
6.2.4 Sequencing	143
6.2.5 Phylogenetic analysis	143
6.2.5.1 DNA sequence alignment and analysis	143
Results	144
6.3.1 Phylogenetic inference using neighbor joining	145
6.3.2 Comparison of nuclear rDNA and chloroplast DNA phylogenies	152
6.3.2.1 Clades that are consistent in both phylogenetic analyses-topological congruence	152
6.3.2.2 Clades that are distinct in both phylogenetic analyses-topological incongruence	152
6.3.3 The strongest clades	153
6.3.3 Hybrids produced and phylogenetic position	153

Details of contents	Page
6.3.3 Hybrids produced and phylogenetic position	153
6.4 Discussion	154
6.5 Summary	157
Chapter Seven-General discussion	158
Literature cited	164
Appendices	
Appendix- I Species and cultivars of <i>Fuchsia</i> used in this study	199
Appendix- II Chemicals and materials	200
Appendix- III (1) Morphological characterization of hybrids with <i>F. arborescens</i> as the male parent	202
Appendix- III (2) Morphological characterization of hybrids with <i>F. boliviana</i> as the male parent	203
Appendix- III (3) Morphological characterization of hybrids with <i>F. glazioviana</i> as the male parent	204
Appendix- III (4) Morphological characterization of hybrids with <i>F. magellanica</i> as the male parent	205
Appendix- III (5) Morphological characterization of hybrids with <i>F. splendens</i> as the male parent	206
Appendix- III (6) Morphological characterization of hybrids with <i>F. trumpetor</i> as the male parent	207
Appendix- III (7) Floral characterization of Mexico, South-Central American <i>Fuchsia</i> species and cultivars used in the hybridization	208
Appendix- III (8) Leaf characterization of <i>Fuchsia</i> species, cultivars & hybrids	210
Appendix- IV Abbreviations	211
Appendix- V(1) Multiple sequence alignment of <i>Fuchsia</i> species analyzed from ITS region of nrDNA	212
Appendix- V(2) Multiple sequence alignment of <i>Fuchsia</i> species analyzed from <i>trnL-trnF</i> region of cpDNA	214

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TABLES

List of Tables	Page
Chapter Two - Interspecific hybridization in <u>Fuchsia</u>	
2.1 Examples of sympatric occurrence and natural interspecific hybridization in <i>Fuchsia</i> .	12
2.2 Artificial hybrids from interspecific hybridization of South Pacific sections of <i>Fuchsia</i> (Godley & Berry, 1995).	13
2.3 Relationship between style length and pollen volume of <i>Fuchsia</i> species.	18
2.4 Summary of the results of artificial hybridization with <i>F. arborescens</i> .	20
2.5 Summary of the results of artificial hybridization with <i>F. boliviana</i> .	21
2.6 Summary of the results of artificial hybridization with <i>F. encliandra</i> .	22
2.7 Summary of the results of artificial hybridization with <i>F. fulgens</i> .	23
2.8 Summary of the results of artificial hybridization with "Gartenmeister Bonstedt".	23
2.9 Summary of the results of artificial hybridization with <i>F. glazioviana</i>	24
2.10 Summary of the results of artificial hybridization with <i>F. hatschbachii</i> .	24
2.11 Summary of the results of artificial hybridization with <i>F. magellanica</i> .	25
2.12 Summary of the results of artificial hybridization with <i>F. microphylla</i> .	25
2.13 Summary of the results of artificial hybridization with <i>F. minutiflora</i> .	26
2.14 Summary of the results of artificial hybridization with <i>F. reflexa</i> .	26
2.15 Summary of the results of artificial hybridization with "Timothy Hammett".	26
2.16 Summary of the results of artificial hybridization with <i>F. procumbens</i> .	27
2.17 Summary of the results of artificial hybridization with <i>F. splendens</i> .	28
2.18 Summary of the results of artificial hybridization with <i>F. triphylla</i> .	28
2.19 Summary of the results of artificial hybridization with <i>F. trumpetor</i> .	29
2.20 Hybrids produced in this study and percentage fruit set in relation to taxonomic position (Berry <i>et al.</i> , 2004).	42

List of Tables	Page
2.21 Crossability of species/cultivars (excluding crosses involving hybrids as one of the parents) indicating total number of crosses attempted and percentage fruit set in each cross combination.	43
 Chapter Three - Pre-and post-fertilization barriers	
3.1 Pollen germination and pollen tube growth in interspecific crosses involving <i>Fuchsia</i> species and cultivars.	59
3.2 Hybrid combinations between <i>Fuchsia</i> species or cultivars where there was a failure of the cross due to different post-fertilization barriers.	60
 Chapter Four - Chromosome number and genome size	
4.1 Published nuclear DNA amounts of Onagraceae (Bennett & Leitch, 2005a).	83
4.2 Nuclear DNA amount in <i>Fuchsia</i> species, 2C-values in pg DNA using barley as internal standard, genome size was calculated as 2C- value divided by ploidy level (number of chromosome sets) (Leitch & Bennett, 2004).	91
4.3 Nuclear DNA amount in five artificial interspecific hybrids, 2C-values in pg DNA using barley as internal standard.	92
 Chapter Five - Meiotic analysis of species and hybrids	
5.1 Mean meiotic configurations per pollen mother cell and pollen viability (%) in <i>Fuchsia</i> .	118
5.2 Studies related to pollen morphology to detect unreduced gametes in <i>Fuchsia</i> .	121
5.3 Studies related to pollen morphology to detect unreduced gametes in <i>Fuchsia</i> cultivars/ hybrids.	122
 Chapter Six - Molecular phylogeny of the genus <u>Fuchsia</u>	
6.1 Nucleotide frequencies of nrDNA for 44 taxa analyzed by neighbor joining analysis.	147
6.2 Nucleotide frequencies of cpDNA for 31 taxa analyzed by neighbor joining analysis.	148

FIGURES

List of Figures	Page
Chapter Two - Interspecific hybridization	
2.1 Estimation of pollen diameter	16
(a) A three aperturate pollen grain of <i>F. glazioviana</i> showing the single measurement that was made.	
(b) A two aperturate pollen grain of <i>F. minutiflora</i> showing the two measurements that were made.	
2.2 Style length & pollen volume of <i>Fuchsia</i> species	19
(a) Relationship between style length & pollen volume in diploid species of <i>Fuchsia</i>	
(b) Relationship between style length & pollen volume in tetraploid species of <i>Fuchsia</i>	
2.3 Floral morphology of yellow fuchsia and parental species	31
(a) <i>F. encliandra</i>	
(b) <i>F. procumbens</i>	
(c) F ₁ hybrid	
(d) Comparative floral morphology	
2.4 Yellow hybrid fuchsia	32
F ₁ hybrid : <i>F. encliandra</i> X <i>F. procumbens</i>	
2.5 F ₁ hybrid: <i>F. splendens</i> X <i>F. procumbens</i>	33
(a) <i>F. splendens</i>	
(b) <i>F. procumbens</i>	
(c) F ₁ hybrid	
2.6 F ₁ hybrid: <i>F. triphylla</i> X <i>F. arborescens</i>	35
(a) F ₁ hybrid	
(b) Staminoid flower	
2.7 Male sterile flowers of hybrid: <i>F. triphylla</i> X <i>F. boliviana</i>	35
(a) Floral morphology	
(b) Anthers	
2.8 Variation in F ₁ hybrid: “Timothy Hammett” X <i>F. glazioviana</i>	37
2.9 F ₁ hybrid: <i>F. fulgens</i> X <i>F. magellanica</i>	38
2.10 Variation in the F ₁ hybrid progeny: <i>F. triphylla</i> X <i>F. splendens</i>	40
2.11 Variation in F ₁ hybrid: <i>F. splendens</i> X <i>F. trumpetor</i>	41

List of Figures	Page
2.12 Diagrammatic representation of crossability of species in relation to their taxonomic position.	44
2.13 Pigmentation in the vegetative parts of the hybrid plants involving <i>F. glazioviana</i> and <i>F. magellanica</i> as the parental species	45
(a) <i>F. boliviana</i> X <i>F. glazioviana</i>	
(b) <i>F. boliviana</i> X <i>F. magellanica</i>	
(c) <i>F. glazioviana</i> X <i>F. magellanica</i>	
(d) <i>F. triphylla</i> X <i>F. glazioviana</i>	
(e) "Timothy Hammett" X <i>F. glazioviana</i>	
 Chapter Three - Pre- and post-fertilization barriers	
3.1 Seedlings of <i>Fuchsia</i> hybrids showing a variety of abnormalities during early development.	64
(a) <i>F. boliviana</i> X <i>F. procumbens</i>	
(b) <i>F. glazioviana</i> X <i>F. magellanica</i>	
(c) <i>F. splendens</i> X <i>F. boliviana</i>	
(d) <i>F. splendens</i> X <i>F. fulgens</i>	
(e) <i>F. splendens</i> X <i>F. magellanica</i>	
(f) <i>F. triphylla</i> X <i>F. fulgens</i>	
(g) <i>F. triphylla</i> X <i>F. fulgens</i>	
(h) <i>F. triphylla</i> X <i>F. Procumbens</i>	
 Chapter Four- Chromosome number and genome size	
4.1 Orcein stained mitotic spreads obtained by root tip squash technique.	93
(a) <i>F. glazioviana</i> (2n=44)	
(b) "Dr. Hammett" (2n=99)	
4.2 Frequency histogram of nuclear DNA amounts of some of the <i>Fuchsia</i> species and hybrids produced by flow cytometric measurement of propidium iodide stained nuclei, isolated from young leaves.	94
4.3 Bar graph showing nuclear DNA amount in New Zealand and South-Central American species	95
4.4 Bar graph showing DNA amount in <i>Fuchsia</i> species and hybrids.	96
4.5 Nucleolar dominance in the hybrid: <i>F. triphylla</i> X <i>F. arborescens</i> .	97
 Chapter Five - Meiotic analysis of species and hybrids	
5.1 Meiotic metaphase I cells of parental species used in the interspecific hybridization showing normal bivalent formation.	114
(a) <i>F. splendens</i> (2n=22)	

List of Figures	Page
(b) <i>F. triphylla</i> (2n=22)	
5.2 Meiotic metaphase I cells of some of the hybrids produced in this study.	115
(a) Meiocyte showing bivalents and univalents in the hybrid <i>F. triphylla</i> X <i>F. boliviana</i> (2n=33)	
(b) Meiocyte showing bivalents in the hybrid <i>F. triphylla</i> X <i>F. splendens</i> (2n=22)	
(c) Meiocyte showing bivalents and univalents in the hybrid <i>F. triphylla</i> X <i>F. arborescens</i> (2n=33)	
(d) Meiocyte showing bivalents in the hybrid <i>F. boliviana</i> X <i>F. magellanica</i> (2n=44)	
5.3 (a) Anaphase I showing univalents lagging behind on the equatorial plate in the hybrid between <i>F. triphylla</i> and <i>F. splendens</i>	116
(b) Anaphase I in the hybrid between <i>F. hatschbachii</i> and <i>F. boliviana</i> showing many univalents without any orientation on an equatorial plate at metaphase I.	
(c) Anaphase I and telphase I of the hybrid between "Timothy Hammett" and <i>F. boliviana</i> .	
(d) Cells at different stages of meiosis with univalents in one cell in "Timothy Hammett" and <i>F. boliviana</i> .	
5.4 Fresh pollen under photomicroscope (Fluorescein di-acetate method), 2n viable pollen identified by arrows among viable, non-viable and shriveled 1n pollen (a-c) and completely sterile pollen (d).	117
(a) <i>F. triphylla</i> X <i>F. splendens</i> hybrid	
(b) "Timothy Hammett" X <i>F. boliviana</i> hybrid	
(c) <i>F. fulgens</i> X <i>F. splendens</i> hybrid	
(d) <i>F. splendens</i> X <i>F. trumpetor</i> hybrid	
 Chapter Six - Molecular phylogeny of the genus <i>Fuchsia</i>	
6.1 (a) Diagrammatic representation of tandemly repeated nrDNA region showing the ribosomal genes and the spacer regions between them.	135
(b) Diagrammatic representation of positions of three non-coding regions of cpDNA.	137
6.2 Phylogenetic analysis of nrDNA of 44 taxa analyzed by neighbor joining method using PAUP 4.1b.	149
6.3 Phylogenetic analysis of cpDNA of 31 taxa analyzed by neighbor joining method using PAUP 4.1b.	150
6.4 Phylogenetic analysis of combined sequences of nrDNA & cpDNA of 26 taxa analyzed by neighbor joining method using PAUP 4.1b.	151

ABSTRACT

Fuchsia is a large and distinctive genus in the family Onagraceae comprising over 110 species, classified into 12 sections. The tropical Andes, Mexico-Central America, Hispaniola, southeastern Brazil, southern Andes and South Pacific region (New Zealand and Tahiti) are the biodiversity hotspots for this genus. It is also an important floricultural genus of trees and shrubs. *Fuchsia procumbens*, a New Zealand endemic species is unique with upright yellow flowers, unusual blue pollen and procumbent plant growth characters, characters that are absent from existing cultivars. One goal of this research was to investigate whether these characters could be transferred between species by artificial hybridization.

An extensive hybridization programme both between the American species and between them and the New Zealand one resulted in the production of many new hybrids. The morphological features and parentage of these new hybrids were documented in this study. A significant first has been the production of a yellow flowered hybrid from a cross between *F. encliandra* and *F. procumbens*. It combines the plant growth character of *F. encliandra* and the flower colour and form of *F. procumbens*. The procumbent plant growth character has also been transferred in a cross with *F. splendens* but this hybrid has yet to flower. Many other interesting hybrids have also been produced with interesting variation in both floral and vegetative characters.

Not all cross combinations were successful and a variety of pre- and post-fertilization barriers to hybridization were observed, some of which were investigated in more detail. Once hybrids were produced in the crosses between American species most of the plants were vigorous, unlike most of hybrids produced between New Zealand and American species. An exception amongst the crosses between American species produced sub-viable plants that showed a virus-like syndrome.

To investigate whether chromosome number, ploidy level and nuclear DNA amount affected the success of hybridization these features were investigated in a range of species from most sections of the genus. No obvious relationship was observed. Meiotic analysis of F₁ hybrids showed a wide range of pairing during metaphase I but most of the hybrids showed univalents and low pollen fertility. Several hybrid combinations showed unexpected chromosome numbers that were shown to have arisen from the formation of unreduced gametes in some of the parents. These parental plants produced a proportion of large pollen grains, the result of meiotic nuclear restitution.

Nuclear DNA amounts and genome sizes were determined for the first time in this genus using flow cytometry. Large interspecific differences were found (>2-fold) but interestingly this was not related to ploidy as the genome size (DNA C-value/ploidy level) was significantly smaller in polyploids compared to most diploids. The exception amongst the diploids was *F. procumbens*, which had the smallest diploid C-value. F₁ hybrids, as expected, had C-values that were not significantly different from the calculated mid-parental values.

Phylogenetic analysis using sequences from nuclear rDNA (ITS) and chloroplast DNA produced trees with different topologies. The ITS tree was used to show that genome size has changed during the evolution of the genus but *F. splendens*, the most basal species is one of the diploids with a large C-value.

Overall, this study has shown that in *Fuchsia* crossability is not necessarily related to chromosome number, ploidy level, genome size or phylogenetic position of the parental species as the crosses between both closely and distantly related species produced successful hybrids.