INTERSPECIFIC HYBRIDIZATION IN *FUCHSIA*

By

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DEDICATION

To my brother-in-law

Rajendra Prasad Mallavarapu

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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 F_1 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. F_1 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.