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The Role of Plastome-Genome Incompatibility and Biparental Plastid Inheritance in Interspecific Hybridization in the Genus *Zantedeschia* (Araceae)

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ABSTRACT

In most genera combinations of plastomes and genomes function to form normal plants, irrespective of the taxonomical distances between the plastidial genome and the nuclear genome. In some genera plastomes and genomes have co-evolved to such a degree that they can only function within specific combinations. Our aim was to determine plastid inheritance and plastome-genome incompatibility (PGI) among species of *Zantedeschia* from the section *Aestivae*. To this end, plastomes and genomes of five taxa (*Z. albomaculata* subsp. *albomaculata*, *Z. albomaculata* subsp. *macrocarpa*, *Z. elliotiana*, *Z. pentlandii* and *Z. rehmannii*) were combined by interspecific hybridisation. Plastomes were differentiated using plastome specific CAPS-markers. Degrees of plastome-genome incompatibility existed between the hybrid genomes of *Z. rehmannii* and *Z. albomaculata*, *Z. rehmannii* and *Z. elliotiana*, *Z. rehmannii* and *Z. pentlandii* and the plastomes of *Z. albomaculata*, *Z. elliotiana* and *Z. pentlandii*, respectively. The plastome of *Z. rehmannii* appeared compatible to all tested hybrid genomes in section *Aestivae*. It was only fully incompatible with the hybrid genome with *Z. aethiopica* (section *Zantedeschia*). The plastomes of *Z. albomaculata* and *Z. elliotiana* appeared compatible to the hybrid genome of *Z. albomaculata* and *Z. elliotiana*. Four plastomes were differentiated among the section *Aestivae*. Biparental plastid inheritance (3 to 90%) was observed among all crossing combinations, which produced more than 1600 interspecific offspring. Biparental inheritance of plastids thus appeared to be a general phenomenon among interspecific hybrids within the section *Aestivae*. A literature review shows that biparental plastid inheritance is not uncommon in interspecific hybrids. The genus *Zantedeschia* shows an unusual wide range of degrees of biparental plastid inheritance that is only recorded in genera that also show plastome-genome incompatibility.

Keywords: Aestivae, arum lily, calla lily, cpDNA, cytoplasmic, hybrid variegation

INTRODUCTION

As a member of the *Araceae* family, the genus *Zantedeschia* is endemic to southern Africa and consists of two sections (Letty 1973; Singh 1996). Cultivars have been bred for ornamental value of either the flowers or the entire plants mainly from *Z. rehmannii*, *Z. albomaculata*, *Z. elliotiana* and *Z. pentlandii*. Most cultivars are propagated vegetatively, although some are F_1 hybrid cultivars, thus propagated by seeds.

Zantedeschia spp. (**Fig. 1**) have a tuberous (section *Aestivae*) or rhizomatomous (section *Zantedeschia*) storage organ (Singh 1996), are frost tender and, except for *Z. aethiopica*, require a period of dormancy. *Z. aethiopica* is an evergreen, but will become dormant if its environment limits growth. Therefore, storage organs of all *Zantedeschia* spp. are lifted after onset of dormancy and are stored in a growth-limiting environment. The genus *Zantedeschia* con-

Fig. 1 *Zantedeschia* spp. used in this study. (**A**) *Z. aethiopica*; (**B**) *Z. rehmannii*; (**C**) *Z. albomaculata* subsp. *albomaculata*; (**D**) *Z. elliotiana*.

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