



Research review paper

## Influence of *rol* genes in floriculture

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### Abstract

Traditionally, new traits have been introduced into ornamental plants through classical breeding. However, genetic engineering now enables specific alterations of single traits in already successful varieties. New or improved varieties of floricultural crops can be obtained by acting on floral traits, such as color, shape or fragrance, on vase life in cut-flower species, and on rooting potential or overall plant morphology. Overexpression of the *rol* genes of the Ri plasmid of *Agrobacterium rhizogenes* in plants alters several of the plant's developmental processes and affects their architecture. Both *A. rhizogenes*- and *rol*-transgenic plants display the "hairy-root phenotype", although specific differences are found between species and between transgenic lines. In general, these plants show a dwarfed phenotype, reduced apical dominance, smaller, wrinkled leaves, increased rooting, altered flowering and reduced fertility. Among the *rol* genes, termed *rolA*, *B*, *C* and *D*, *rolC* has been the most widely studied because its effects are the most advantageous in terms of improving ornamental and horticultural traits. In addition to the dwarfness and the increase in lateral shoots that lead to a bushy phenotype, *rolC*-plants display more, smaller flowers, and advanced flowering; surprisingly, these plants may have better rooting capacity and they show almost no undesirable traits. *rolD*, the least studied among the *rol* genes, offers promising applications due to its promotion of flowering.

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Although the biochemical functions of *rol* genes remain poorly understood, they are useful tools for improving ornamental flowers, as their expression in transgenic plants yields many beneficial traits.

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*Keywords:* *Agrobacterium rhizogenes*; Hairy-root disease; Ornamental plants; Rhizogenesis; Transformation; *rol* genes

## Contents

1. Introduction . . . . .	4
2. Transformation in floricultural crops. . . . .	5
2.1. Flower development . . . . .	6
2.2. Flower color . . . . .	7
2.3. Flower fragrance . . . . .	8
2.4. Vase life . . . . .	8
2.5. Insect and disease resistance . . . . .	9
2.6. Plant morphology. . . . .	9
2.6.1. <i>ipt</i> gene . . . . .	10
2.6.2. <i>iaa</i> and <i>aux</i> genes . . . . .	11
2.6.3. <i>rol</i> genes . . . . .	11
3. Manipulation of plant characteristics using <i>A. rhizogenes</i> . . . . .	12
4. Effects of <i>rol</i> genes on plants in vitro . . . . .	17
5. Effects of <i>rol</i> genes on plants in vivo . . . . .	19
5.1. Transgenic plants with <i>rolA</i> , <i>B</i> and <i>C</i> . . . . .	19
5.2. Transgenic plants with <i>rolA</i> . . . . .	23
5.3. Transgenic plants with <i>rolB</i> . . . . .	23
5.4. Transgenic plants with <i>rolC</i> . . . . .	24
5.5. Transgenic plants with <i>rolD</i> . . . . .	27
6. Secondary metabolism of <i>rol</i> -transgenic plants . . . . .	28
7. Hormonal balance of <i>rol</i> -transgenic plants . . . . .	28
8. Applicability of <i>rol</i> genes in floriculture . . . . .	30
9. Future trends. . . . .	31
Acknowledgements . . . . .	32
References . . . . .	32

## 1. Introduction

New ornamental plant varieties are continuously being created by breeders in response to consumer demand for new products. Altered plant morphology and colors, better flower fragrance, and longer vase life in the case of cut flowers, are some of the desirable novel traits. Growers also look for plants with improved agronomic traits, such as increased production yield and resistance to plant pathogens or herbicides.

Traditionally, classical breeding has been used to introduce new traits and create new varieties in many species, including ornamentals. However, it is a tedious

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