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# **HORMONAL CONTROL OF BRANCHING AND FLOWERING IN *ZANTEDESCHIA* SPECIES**

A thesis presented in partial fulfillment of the requirements for the degree

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## Abstract

Calla lilies (*Zantedeschia* sp. Family: Araceae) are perennial herbaceous geophytes, gaining commercial importance as a cut flower and potted flowering plant. Stimulating branching in *Zantedeschia* would equate to higher floral productivity via increasing tuber size/weight and/or via triggering the sympodial flowering cascade. Bud outgrowth is however controlled by an autonomous developmental programme, executed via different degrees of para- (apical dominance) and/or endodormancy.

Based on visual clues that represent underlying changes in the shoot apical meristem, the growth cycle of *Zantedeschia* was demarcated into three phases, which coincide with the transition of buds from apical dominance to endodormancy. Application of 6-benzylaminopurine (BAP; an aromatic cytokinin) was successful in stimulating branching in phase 1. This equated to an increase in tuber size/weight, which in turn resulted in increased floral productivity in the next growth cycle. . Efficacy of BAP alone to stimulate branching declined from phase 1 to phase 3, and the need for a sequential application of gibberellin (GA<sub>3</sub>) increased concomitantly. GA<sub>3</sub> alone had no effect on branching. Efficacy of GA<sub>3</sub> alone to stimulate flowering declined from phase 1 to phase 3, and the need for a sequential application of BAP increased concomitantly. BAP alone had no effect on flowering. Stimulation of branching and enhanced flowering achieved by the reciprocal cross-talk between cytokinin and gibberellin may have major commercial implications.

When applied with unlabelled BAP, a significant decline in the uptake of [8-<sup>14</sup>C] BAP ([8-<sup>14</sup>C] BAP + BAP) was observed in phase 3, resulting in a decline in radioactivity available in the buds and upper region of the tuber. With unlabelled GA<sub>3</sub> ([8-<sup>14</sup>C] BAP + GA<sub>3</sub>) however, increased radioactivity was available in these parts in phase 3. *Meta*-topolin (mT) was identified as a metabolic product of BAP. Application of [8-<sup>14</sup>C] BAP + BAP resulted in a decline in the amount of mT from phase 1 to phase 3. However, application of [8-<sup>14</sup>C] BAP + GA<sub>3</sub> resulted in an increase in the amount of mT in phase 3. mT and 6-benzylaminopurine riboside (BAR) were also identified in natural plants.

Further studies on branching control in phase 1 involving topolins and strigolactones, elucidating the mechanisms of cross-talk between cytokinin and gibberellin in phase 3, reevaluating the relationship between branching and floral productivity, and corroborating the common mechanisms between dormancy and flowering are recommended.

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## List of Abbreviations

[ <sup>2</sup> H <sub>7</sub> ] BAP	Deuterated 6-benzylaminopurine
[ <sup>2</sup> H <sub>7</sub> ] BAR	Deuterated 6-benzylaminopurine riboside
[ <sup>3</sup> H]-iP	Tritiated isopentenyl adenine
[ <sup>3</sup> H]-Z	Tritiated zeatin
[8- <sup>14</sup> C] BAP	Radioactive 6-benzylaminopurine
ABA	Abscisic acid
Ade	Adenine
Ado	Adenosine
AMP	Adenosine monophosphate
<i>AP 1</i>	<i>APETALA 1</i>
ARCK	Aromatic cytokinin
ATI	Auxin transport inhibitors
BAP	6-benzylaminopurine
BAR/BARP/BA9G	6-benzylaminopurine riboside/6-benzylaminopurine ribotide/6-benzylaminopurine 9-glucoside
BSA	Bovine serum albumin
CK	Cytokinin
<i>CKX</i>	<i>CYTOKININ OXIDASE/DEHYDROGENASE</i>
<i>CO</i>	<i>CONSTANS</i>
DAP	Days after planting
DMRT	Duncan's multiple range test
DPM	Disintegrations per minute
<i>FLC</i>	<i>FLOWERING LOCUS C</i>
<i>FT</i>	<i>FLOWERING LOCUS T</i>
FW	Fresh weight
GA <sub>n</sub>	Gibberellin <sub>respective number</sub>
HFCA	9-hydroxyfluorene-9-carboxylic acid
HPLC	High performance liquid chromatography



iP	Isopentenyl adenine
<i>IPT</i>	<i>ISOPENTENYL TRANSFERASE</i>
ISCK	Isoprenoid cytokinin
LC-MS	Liquid chromatography-Mass spectrometry
LD	Long day
<i>LFY</i>	<i>LEAFY</i>
<i>LOG</i>	<i>LONELY GUY</i>
LSD	Least significant difference
Min	Minutes
MRI	Magnetic resonance imaging
MRM	Multiple reaction monitoring
mT/mTR	<i>Meta</i> -topolin/ <i>Meta</i> -topolin riboside
NPA	1-N-Naphthalphthalamic acid
NSB	Non specific binding
NZ	New Zealand
oT/oTR/ oMeoT/ oMeoTR	<i>Ortho</i> -topolin/ <i>Ortho</i> -topolin riboside/ methoxy <i>Ortho</i> -topolin/ methoxy <i>Ortho</i> -topolin riboside
PAT	Polar auxin transport
<i>PFT1</i>	<i>PHYTOCHROME AND FLOWERING TIME 1</i>
pT/pTR	<i>Para</i> -topolin/ <i>Para</i> -topolin riboside
SAM	Shoot apical meristem
<i>SOC1</i>	<i>SUPPRESSOR OF OVEREXPRESSION OF CONSTANS 1</i>
TBS	Tris buffered saline
TIBA	2, 3, 5-triiodobenzoic acid
Z/tZ	Zeatin/ <i>trans</i> -zeatin