



Universiteit  
Leiden  
The Netherlands

## Metabolic changes in *Arabidopsis thaliana* plants overexpressing chalcone synthase

Dao, T.H.H.

### Citation

Dao, T. H. H. (2010, February 18). *Metabolic changes in Arabidopsis thaliana plants overexpressing chalcone synthase*. Retrieved from <https://hdl.handle.net/1887/14755>

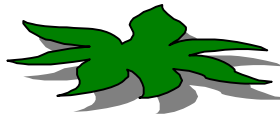
Version: Corrected Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/14755>

**Note:** To cite this publication please use the final published version (if applicable).

**Metabolic changes in *Arabidopsis thaliana*  
plants overexpressing chalcone synthase**



Thi Thanh Hien Dao

Metabolic changes in *Arabidopsis thaliana* plants overexpressing chalcone synthase

ISBN 978-90-9025134-9

Printed by Wöhrmann Print Service, Zutphen, The Netherlands.

Cover photo: *Arabidopsis thaliana*

Cover design: Hien Dao

# **Metabolic changes in *Arabidopsis thaliana* plants overexpressing chalcone synthase**

## **PROEFSCHRIFT**

ter verkrijging van  
de graad van Doctor aan de Universiteit Leiden,  
op gezag van Rector Magnificus prof. mr. P.F. van der Heijden  
volgens besluit van het College voor Promoties  
te verdedigen op donderdag 18 februari 2010  
klokke 13.45 uur

door

**Thi Thanh Hien Dao**  
geboren te Hanoi, Vietnam  
in 1976

## **Promotiecommissie**

Promotor            Prof. dr. R. Verpoorte

Co-promotors     Dr. H. J. M. Linthorst  
                         Dr. H. K. Kim

Overige Leden    Prof. dr. J.-L. Wolfender (University of Geneva, Switzerland)  
                         Prof. dr. P.J.J. Hooykaas (IBL, Leiden)  
                         Prof. dr. C.A.M.J.J. van den Hondel (IBL, Leiden)

This study was financially supported by the Vietnam Overseas Scholarship Program.

# Contents

	Page
List of Abbreviations	2
Chapter 1 General Introduction	3
Chapter 2 Chalcone synthase and its functions in plant pathogen resistance	7
Chapter 3 <i>Agrobacterium</i> -mediated transformation of <i>Arabidopsis thaliana</i> with <i>Cannabis sativa</i> cDNA encoding chalcone synthase	27
Chapter 4 Chalcone synthase protein expression in CHS transgenic <i>Arabidopsis</i>	38
Chapter 5 Identification of metabolites in <i>Arabidopsis thaliana</i> Col. 0	46
Chapter 6 Metabolic profiling of <i>Arabidopsis thaliana</i> transformed with a heterologous <i>chs</i> cDNA from <i>Cannabis sativa</i>	60
Chapter 7 <sup>1</sup> H-NMR analysis of metabolic changes in <i>Arabidopsis thaliana</i> Col. 0 and CHS transgenic plants upon treatment with UV-A/blue light	73
Chapter 8 Effect of benzothiadiazole on the metabolome of <i>Arabidopsis thaliana</i>	86
Chapter 9 Summary and general discussions	104
Samenvatting en algemene discussie	108
References	112
Curriculum Vitae	146
List of Publications	147
Acknowledgements	148

## List of Abbreviations

ACS	<i>Arabidopsis</i> chalcone synthase
BSA	bovine serum albumin
CHS	chalcone synthase
COSY	correlated spectroscopy
DW	dry weight
EDTA	ethylenediaminetetraacetic acid
EtOAc	ethyl acetate
GABA	$\gamma$ -amino butyric acid
HMBC	heteronuclear multiple bond correlation
HPLC	high performance liquid chromatography
MS	mass spectrometry
NMR	nuclear magnetic resonance spectroscopy
PCA	principal component analysis
PLS-DA	partial least square-discriminant analysis
PMSF	phenylmethanesulphonylfluoride
PVP	polyvinylpyrrolidone
SDS	sodium dodecyl sulfate
TTBS	Tween® / Tris-buffered salt solution
UV	ultra violet