



Universiteit  
Leiden  
The Netherlands

## **Molecular engineering of plant development using *Agrobacterium*-mediated protein translocation**

Khan, M.

### **Citation**

Khan, M. (2017, March 22). *Molecular engineering of plant development using Agrobacterium-mediated protein translocation*. Retrieved from <https://hdl.handle.net/1887/47374>

Version: Not Applicable (or Unknown)

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

Downloaded from: <https://hdl.handle.net/1887/47374>

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

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/47374> holds various files of this Leiden University dissertation

**Author:** Khan, M.

**Title:** Molecular engineering of plant development using Agrobacterium-mediated protein translocation

**Issue Date:** 2017-03-22

**Majid Khan**

Molecular engineering of plant development using *Agrobacterium*-mediated protein translocation

Thesis, Leiden University 2017

ISBN: 978-94-6182-776-0

The research presented in this thesis was performed in the Molecular and Developmental Genetics department at the Sylvius Laboratory, Institute of Biology Leiden (IBL) of the Leiden University, the Netherlands and was supported by a fellowship of the Institute of Biotechnology & Genetic Engineering (IBGE) at the Agricultural University of Peshawar with financial support by the Higher Education Commission (HEC) of Pakistan.

**Cover:** The upper panel shows the generic split-GFP system in which *Agrobacterium tumefaciens* simultaneously transfers a GFP1-10 expressing T-DNA and a GFP11-tagged fusion protein to a wild-type plant cell. The lower panel shows the syringe infiltration of *Capsicum annuum* (sweet pepper) cotyledons with an *Agrobacterium* strain carrying the generic split-GFP system, and a confocal image of green fluorescent stomatal guard cell as a result of successful DNA and protein co-translocation.

**Cover designed by Majid Khan**

**Layout & Printing by: Off Page, Amsterdam**

Copyright © 2017 by Majid Khan. All rights reserved. No part of this book may be reproduced, stored in a retrieval system or transmitted in any form or by any means, without prior written permission of the author.

**Molecular engineering of plant development using *Agrobacterium*-  
mediated protein translocation**

Proefschrift

Ter verkrijging van  
de graad van Doctor aan de Universiteit Leiden,  
op gezag van de Rector Magnificus Prof. mr. C. J. J. M. Stolker,  
volgens besluit van het College voor Promoties  
te verdedigen op woensdag 22 maart 2017  
klokke 15.00 uur

door

Majid Khan  
geboren te Charsadda, Pakistan  
20th August 1981

## **PROMOTIECOMMISSIE**

**Promotor:** Prof. Dr. P.J.J. Hooykaas

**Co-promotor:** Dr. R. Offringa

**Overige leden:** Prof. Dr. H. Spaink  
Prof. Dr. J. Memelink  
Prof. Dr. ir. R. G. H. Immink (Wageningen University)  
Dr. F. A. Krens (Wageningen University)  
Dr. B. S. de Pater

## TABLE OF CONTENTS

<b>Chapter 1</b>	General introduction Contribution of the <i>Agrobacterium</i> transformation machinery to plant developmental studies	9
<b>Chapter 2</b>	<i>Arabidopsis</i> AHL15-induced rejuvenation promotes longevity and polycarpy in <i>Nicotiana tabacum</i>	39
<b>Chapter 3</b>	<i>Agrobacterium</i> -mediated translocation of plant developmental regulators to plant cells	67
<b>Chapter 4</b>	A generic split-GFP-based reporter system for <i>Agrobacterium</i> -mediated protein translocation in plants	91
<b>Chapter 5</b>	Summary and Samenvatting	117
	Acknowledgments	127
	Curriculum vitae	129



**To**

***The richest poor man,***

**Abdul Sattar Edhi**

No religion is higher than humanity  
(Abdul Sattar Edhi)