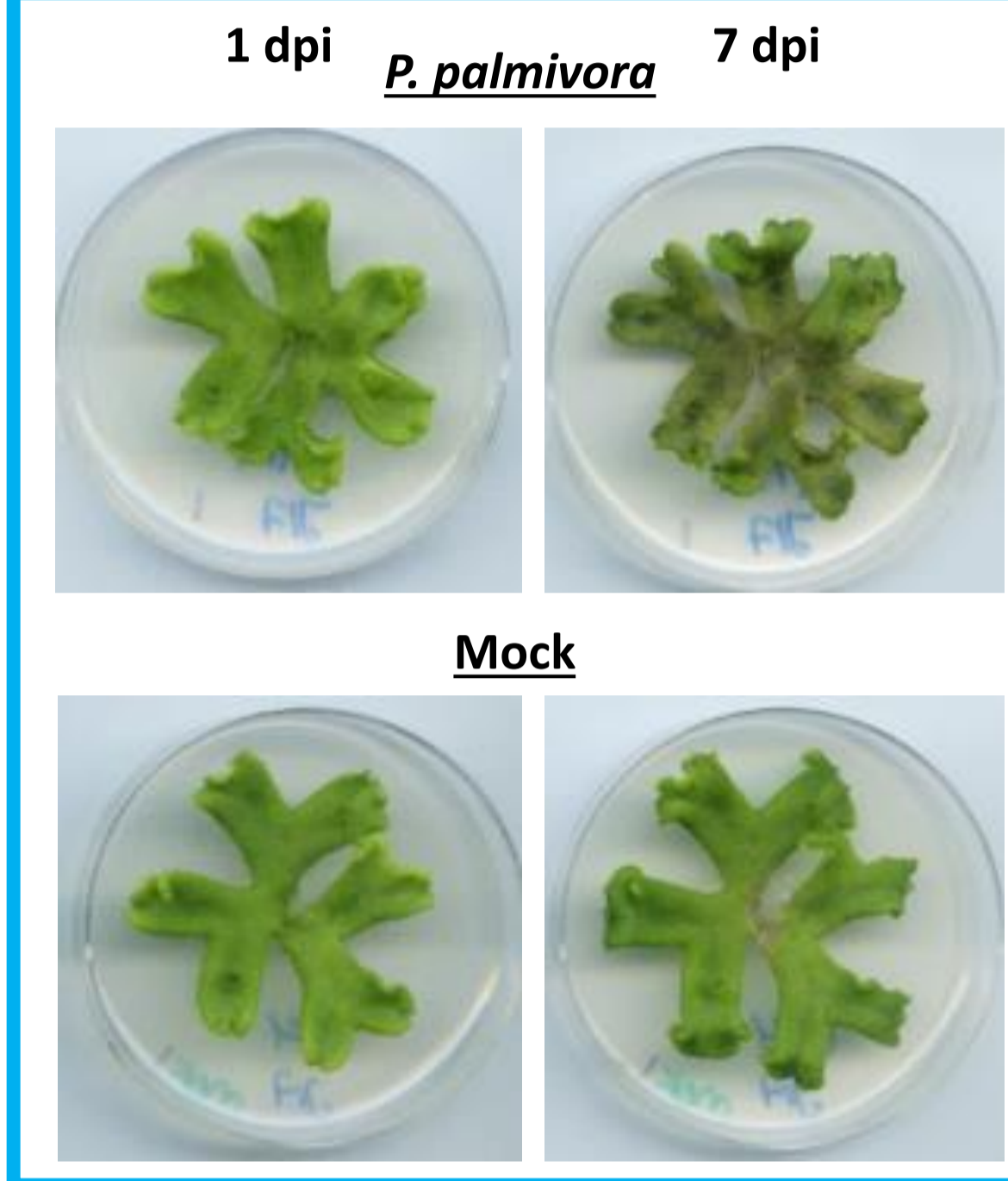


# Conserved Biochemical Defences Underpin Host Responses to Oomycete Infection in an Early Divergent Land Plant Lineage

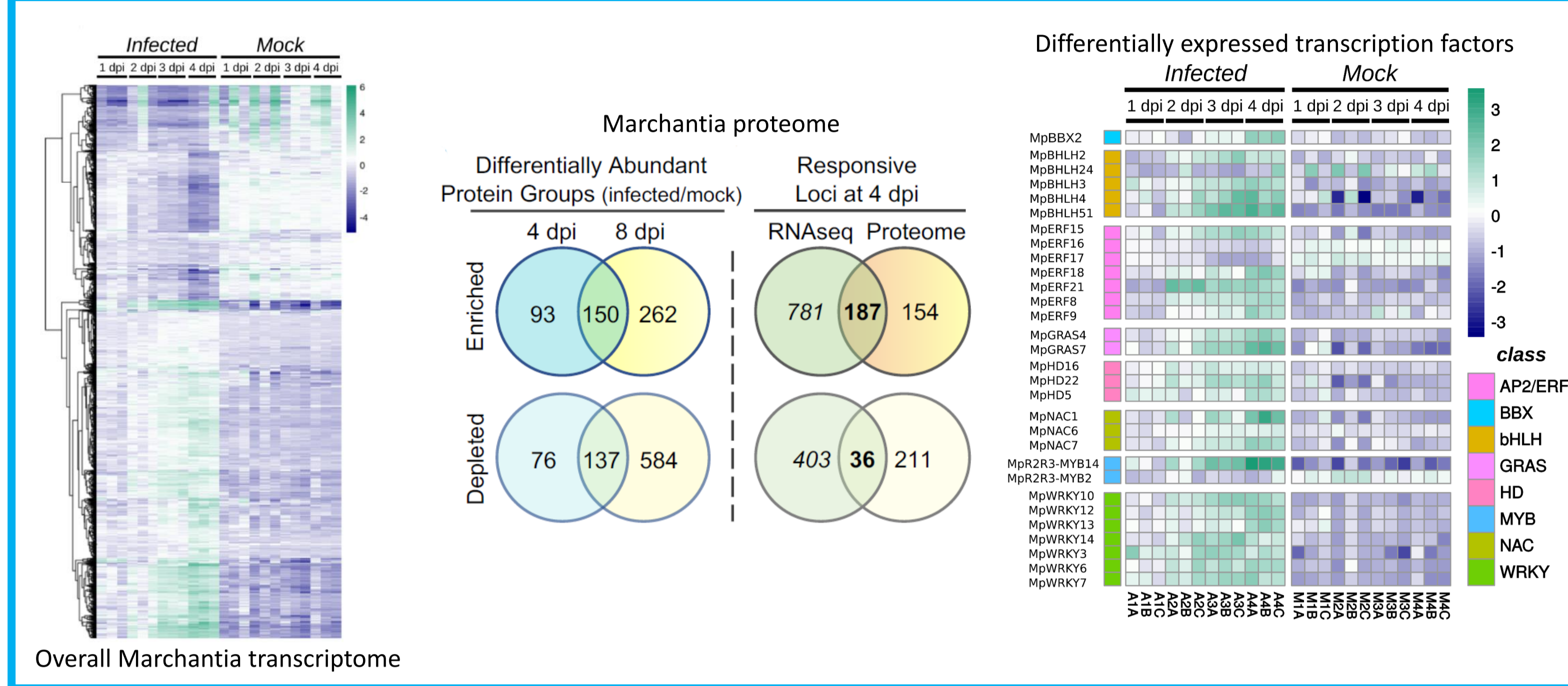
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 Sebastian.schornack@slcu.cam.ac.uk, twitter: @dromius; <sup>1</sup>University of Cambridge, Sainsbury Laboratory, Cambridge, United Kingdom; <sup>2</sup>Max-Planck-Institute for Plant Breeding Research, Cologne, Germany

While host responses to microbial colonization are extensively explored in evolutionarily young land plant lineages like angiosperms, we know relatively little about plant-pathogen interactions in earlier diverging land plants. We studied the response of the early divergent liverwort *Marchantia polymorpha* to infection with the oomycete pathogen *Phytophthora palmivora*. We uncovered a robust response to oomycete colonization in *Marchantia* that consists of conserved land plant gene families. Macroevolutionary comparisons of host infection responses in *Marchantia* and the angiosperm *Nicotiana benthamiana* revealed a shared set of orthologous microbe-responsive genes that include members of the phenylpropanoid pathway. The *Marchantia* transcription factor MpMyb14 activates the phenylpropanoid (flavonoid) biosynthesis during oomycete infection. MpMyb14 mediates the accumulation of anthocyanin-like pigments and enhanced resistance to infection.

## 1. *Phytophthora palmivora* infects *Marchantia polymorpha*

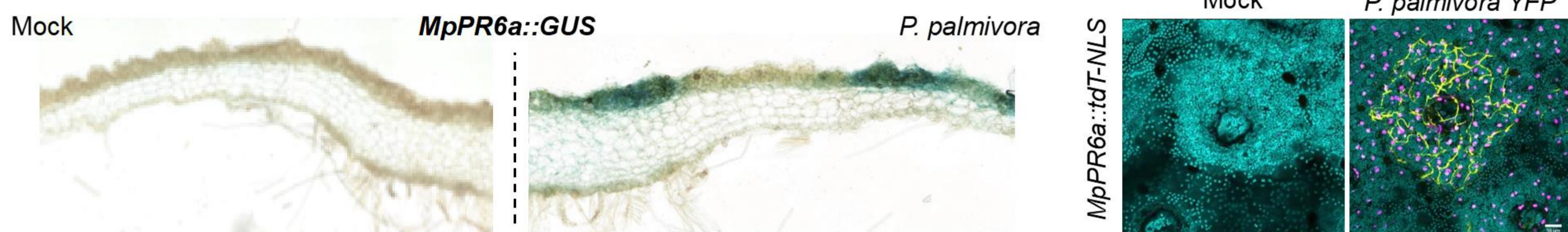


## 2. Transcriptional and proteomic response of *Marchantia polymorpha* to infection with the oomycete pathogen *Phytophthora palmivora*.

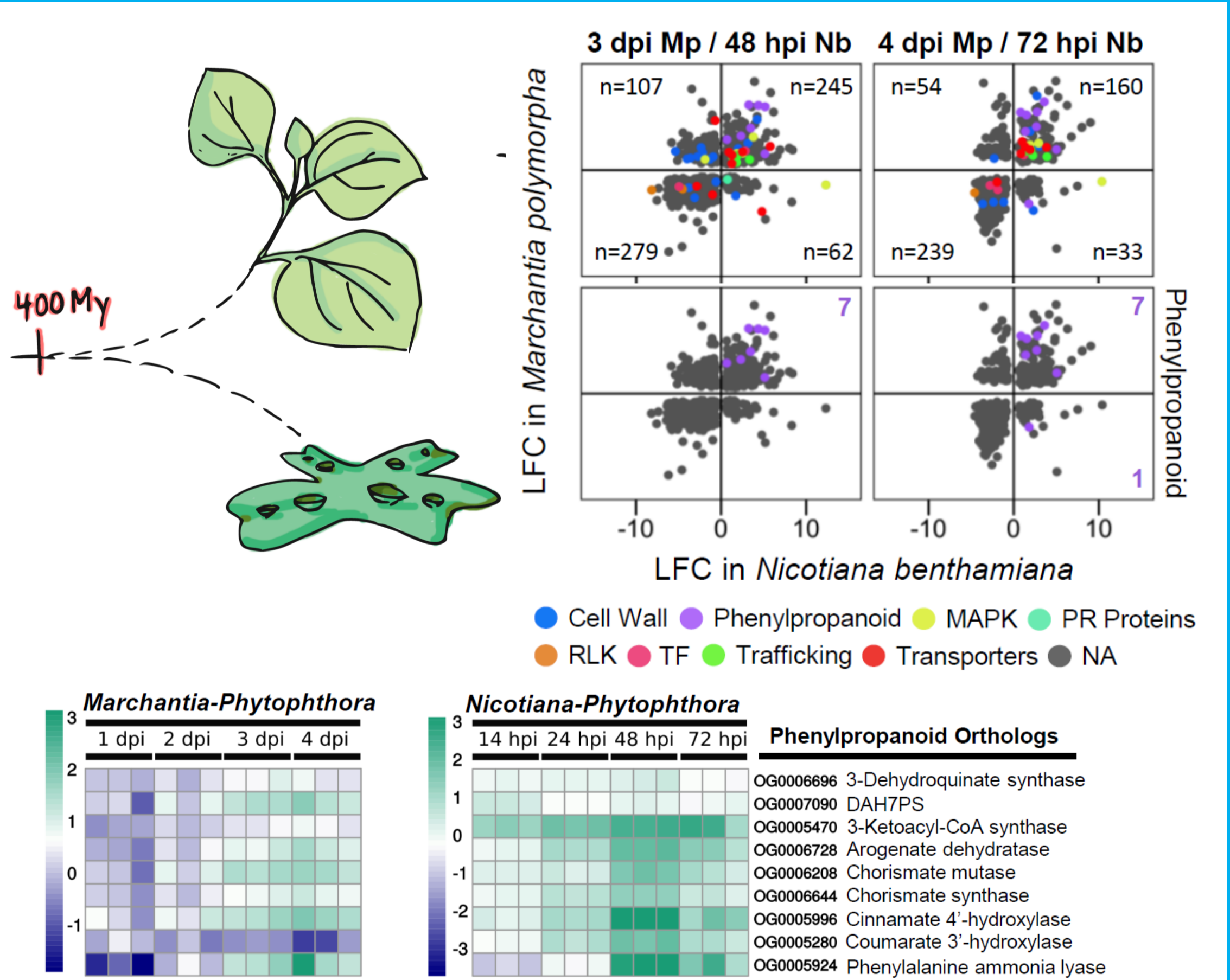


## 3. Activation of Pathogenicity-related genes is conserved in *Marchantia*

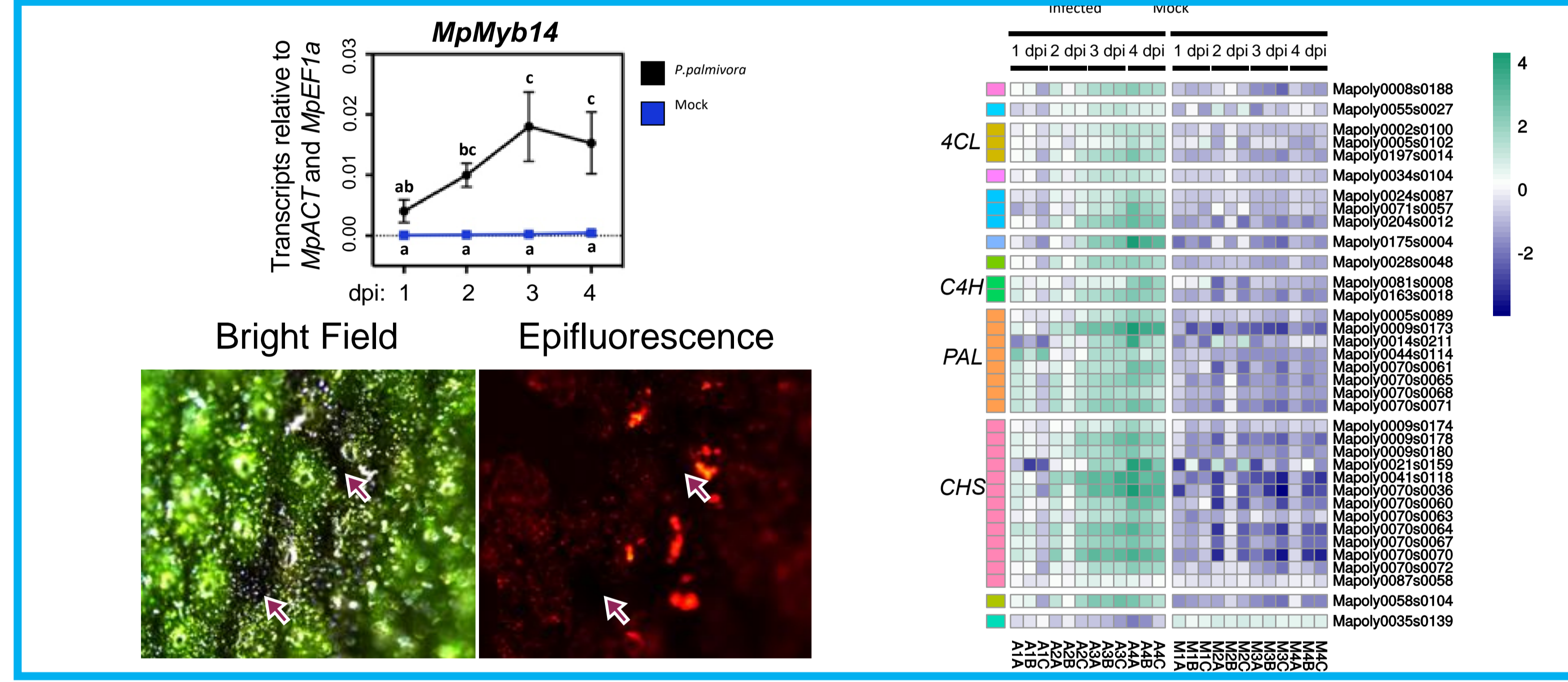
PR Family	Description	Induced by <i>P. palmivora</i>
PR1	Cysteine-rich secreted	1
PR2	β-Glucanase	5
PR3	Chitinase	1
PR6	Protease inhibitor	3
PR9	Peroxidase	14
PR15	Cupin	18



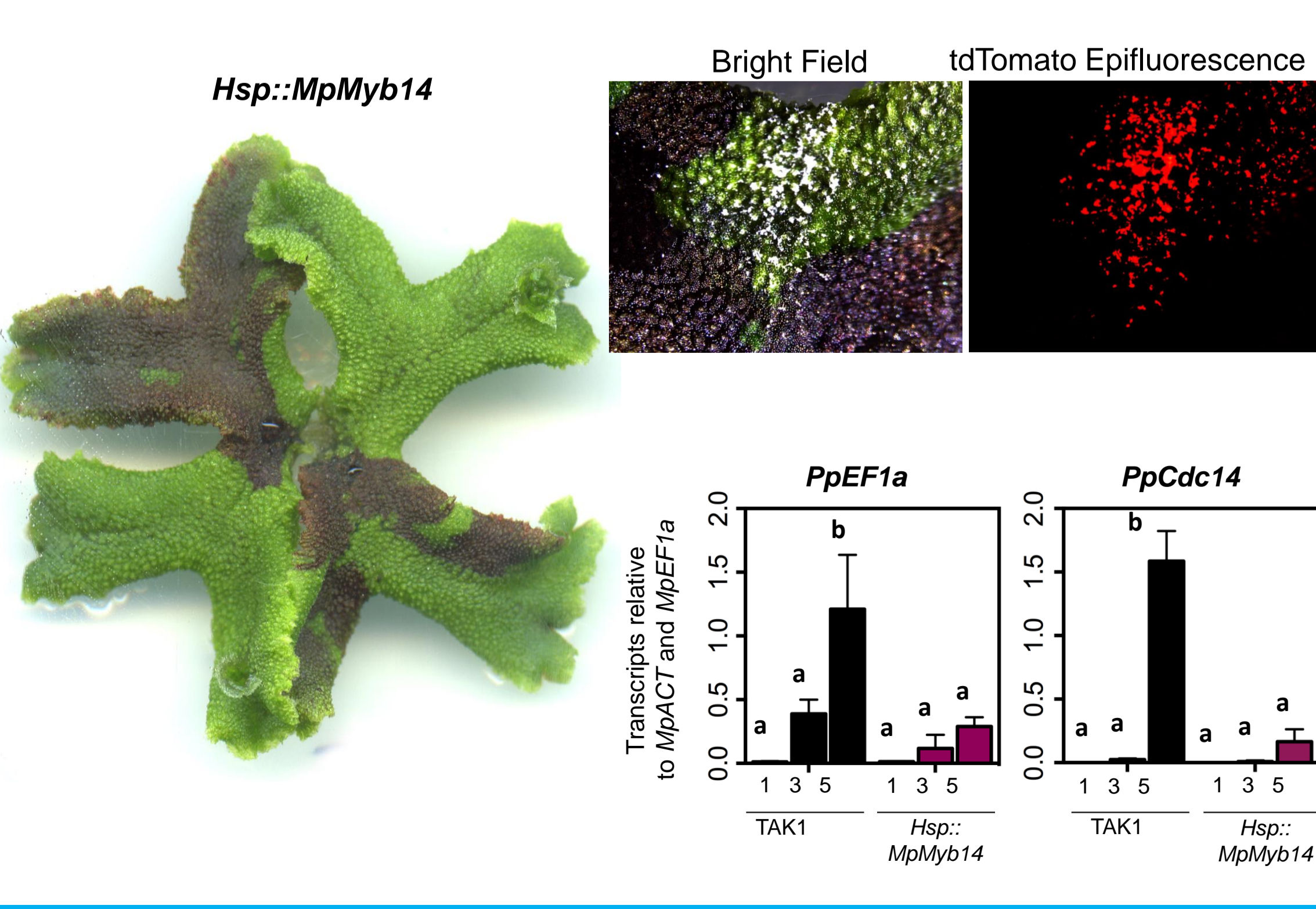
## 4. Orthologous phenylpropanoid pathway genes are similarly induced in *Nicotiana benthamiana* and *Marchantia*



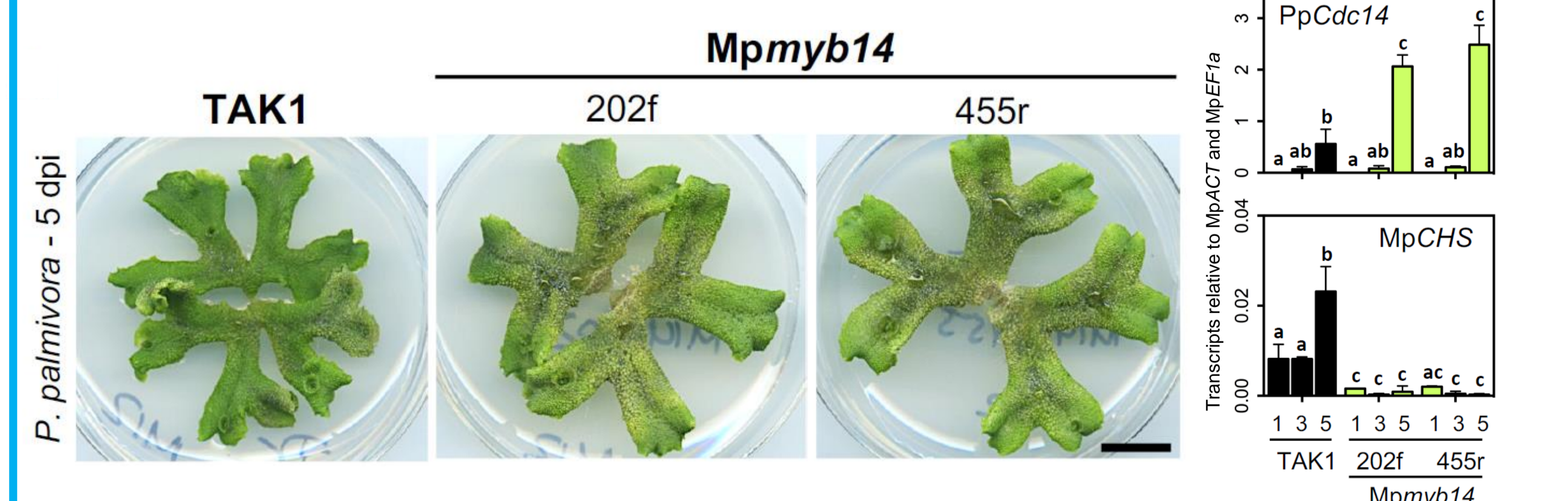
## 5. MpMyb14 upregulation coincides with the induction of flavonoid biosynthesis genes and pigment accumulation in *P. palmivora*-colonized *Marchantia* thalli



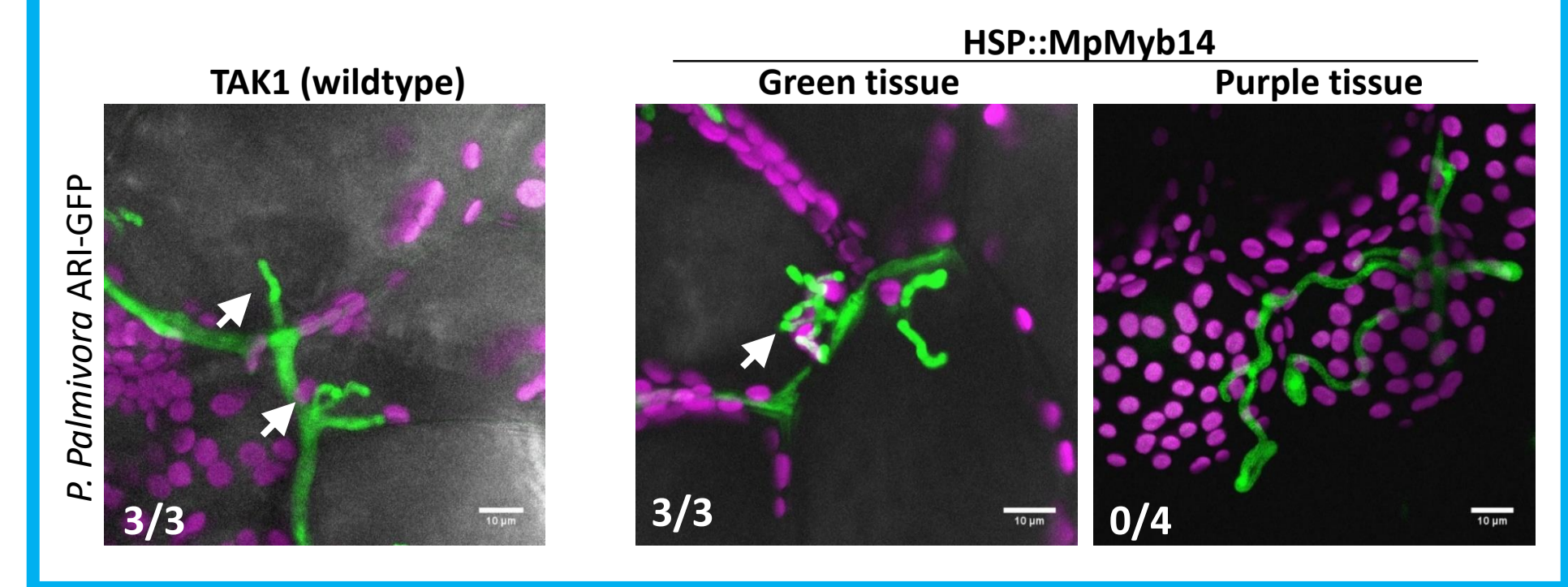
## 7. Over-accumulation of MpMyb14-regulated phenylpropanoids enhance resistance to *Phytophthora palmivora*



## 6. MpMyb14-dependent regulation of flavonoid biosynthesis genes is required for liverwort resistance to oomycete infection



## 8. MpMyb14 activation impairs *Phytophthora* cell entry and formation of intracellular haustoria



**Conclusion:**  
 The *Marchantia* response to oomycete infection displays evolutionarily conserved features indicative of an ancestral pathogen deterrence strategy centered on phenylpropanoid-mediated biochemical defenses.

