

# Décryptage du signal cytokinine dans la formation haustoriale chez *Phelipanche ramosa*

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Université de Nantes

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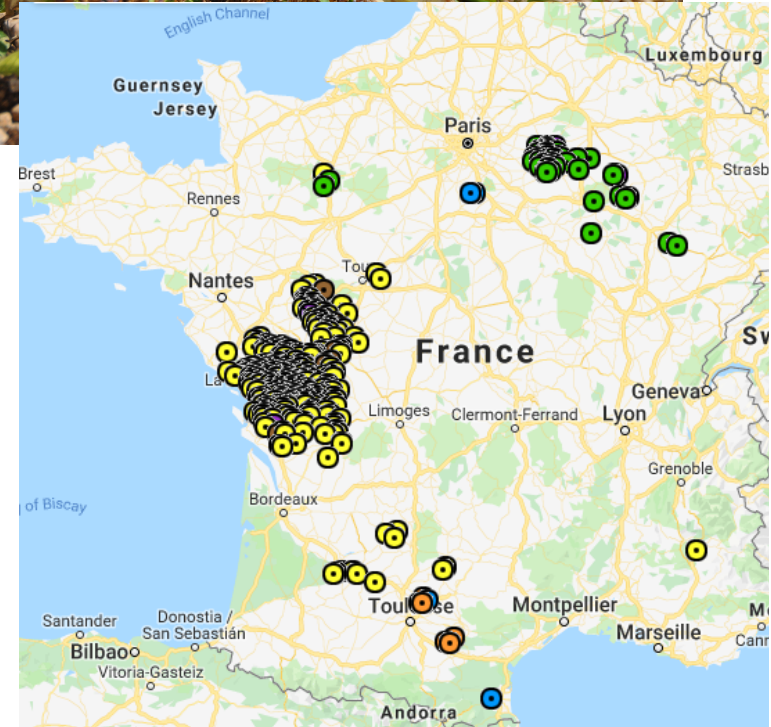
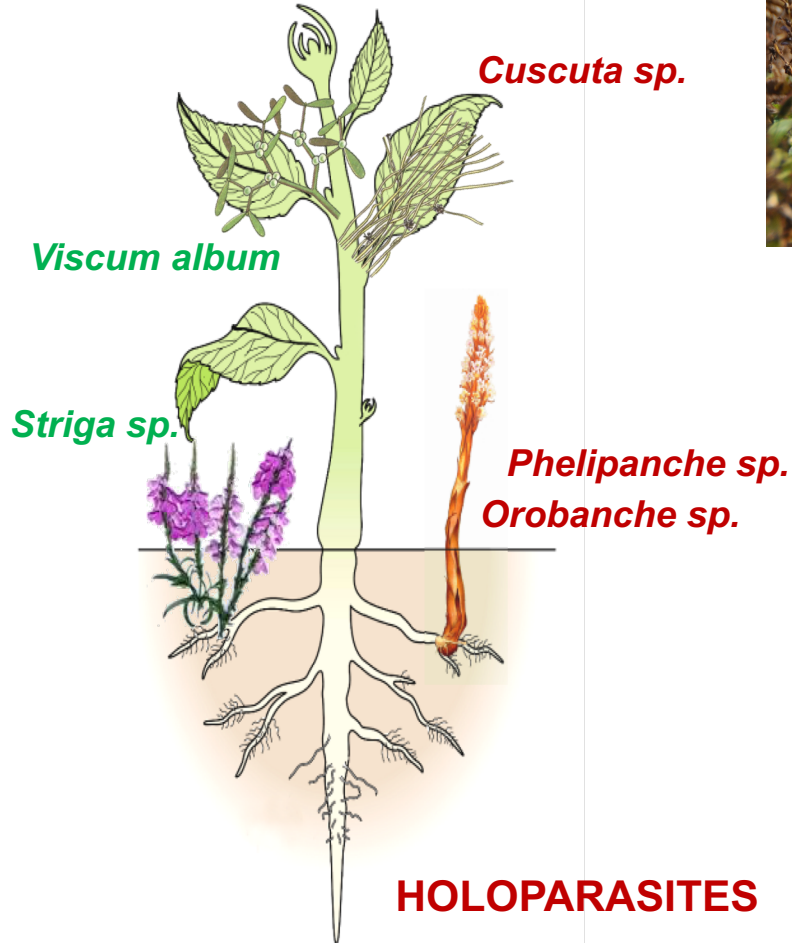
UNIVERSITÉ DE NANTES

# Plantes parasites

Epiphytes

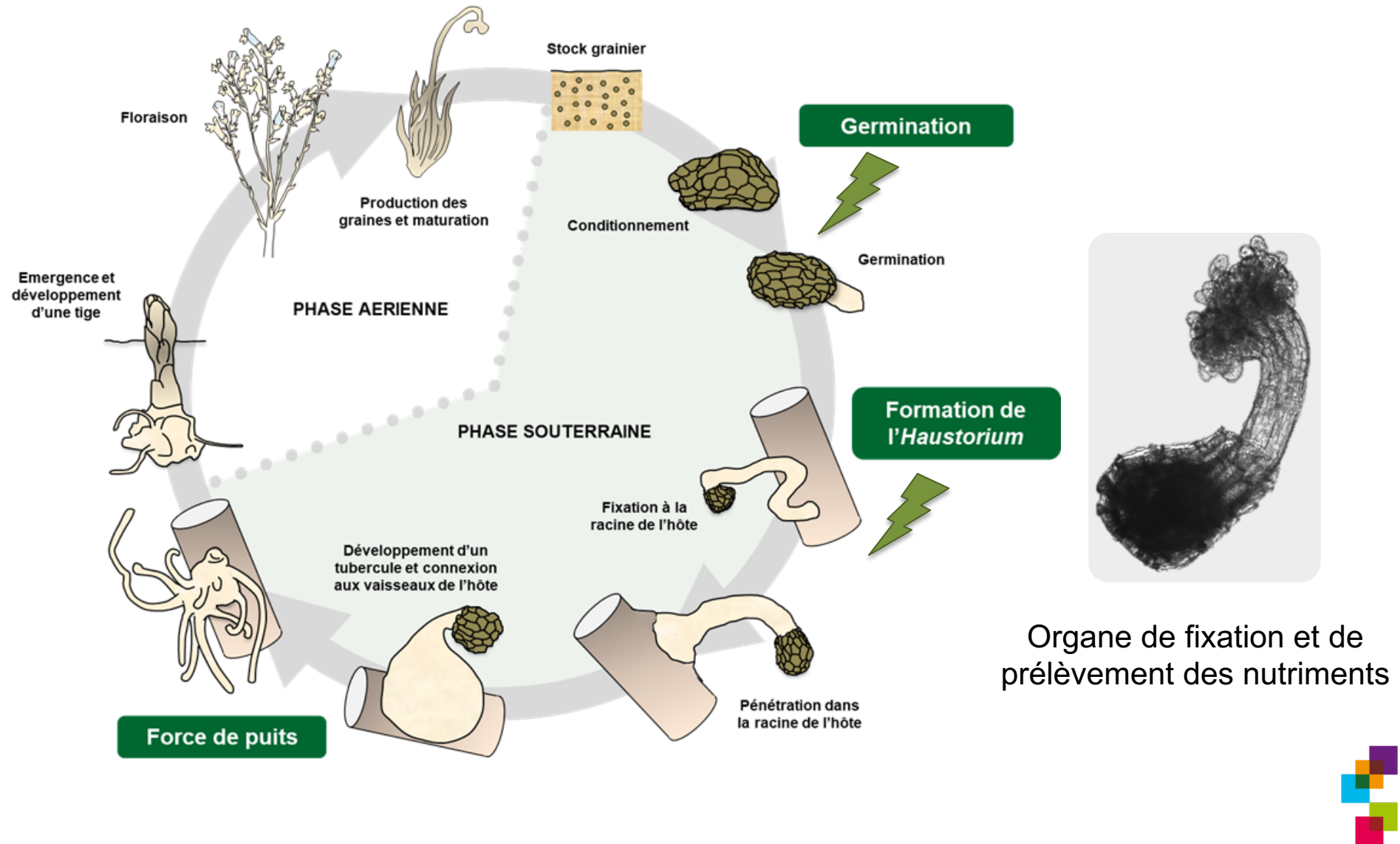
Epirhizes

## HEMIPARASITES



Pas de moyen de lutte efficace actuellement

# Cycle de vie de *P. ramosa*



# L'haustorium



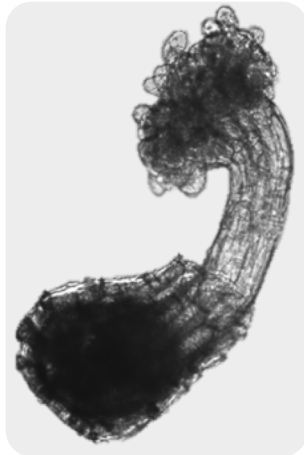
Organe de fixation et de prélèvement des nutriments

Hémiparasites



*S. hermonthica*

Holoparasites



*P. ramosa*

## Early Haustorial Structure (EHS)

- Arrêt de l'élongation de la radicule
- Gonflement de l'apex
- Différenciation des cellules épidermiques
  - Hémiparasites : poils haustoriaux
  - Holoparasites : papilles



# L'haustorium

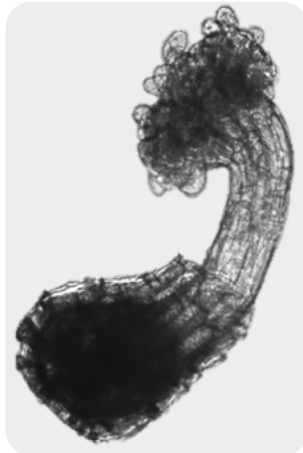
→ Organe de fixation et de prélèvement des nutriments

Hémiparasites

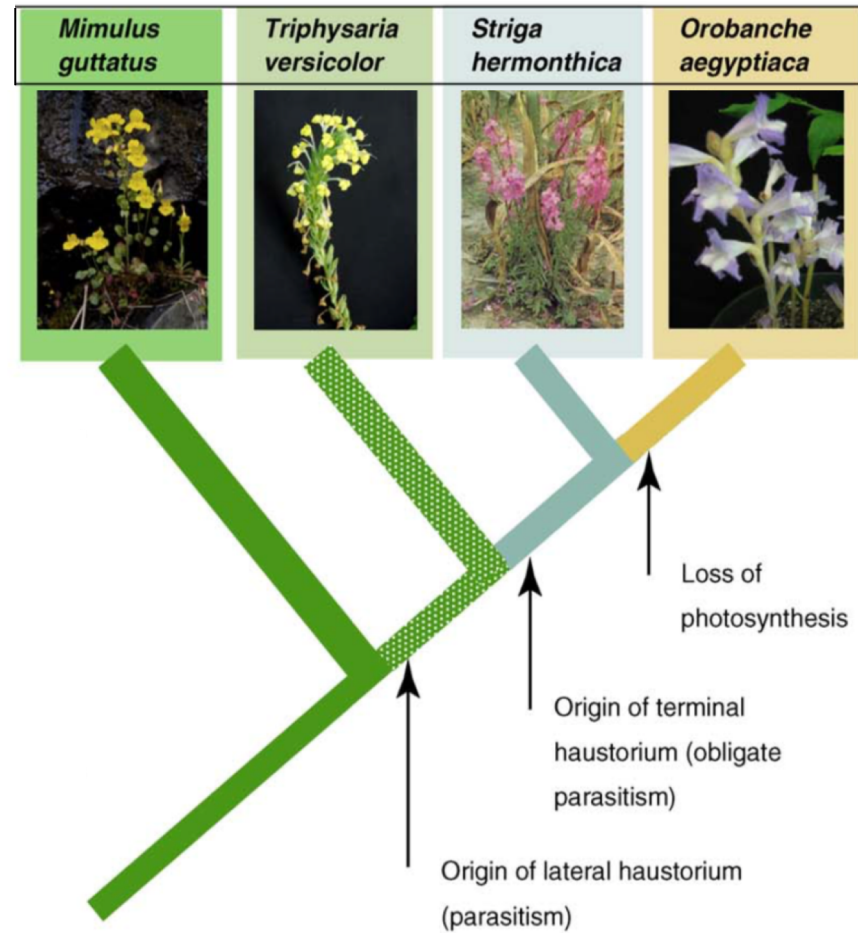


*S. hermonthica*

Holoparasites



*P. ramosa*



Westwood et al., 2010

# L'haustorium



Organe de fixation et de prélèvement des nutriments

Hémiparasites



*S. hermonthica*

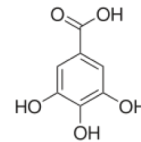
Holoparasites



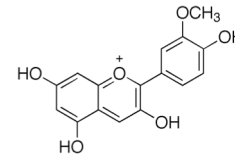
*P. ramosa*

## Hhaustorium Inducing Factors (HIF)

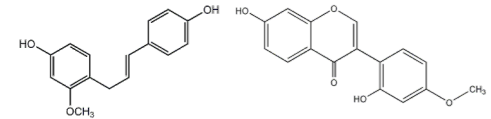
### Composés phénoliques



### Flavonoïdes

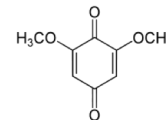


**Peonidin**



**Xenognosin A et B**

### Quinones



**DMBQ**

(2,6 dimethoxy-1,4-benzoquinone)

# L'haustorium



Organe de fixation et de prélèvement des nutriments

Hémiparasites



*S. hermonthica*

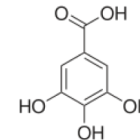
Holoparasites



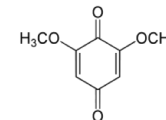
*P. ramosa*

## Haustorium Inducing Factors (HIF)

### Composés phénoliques



### Quinones

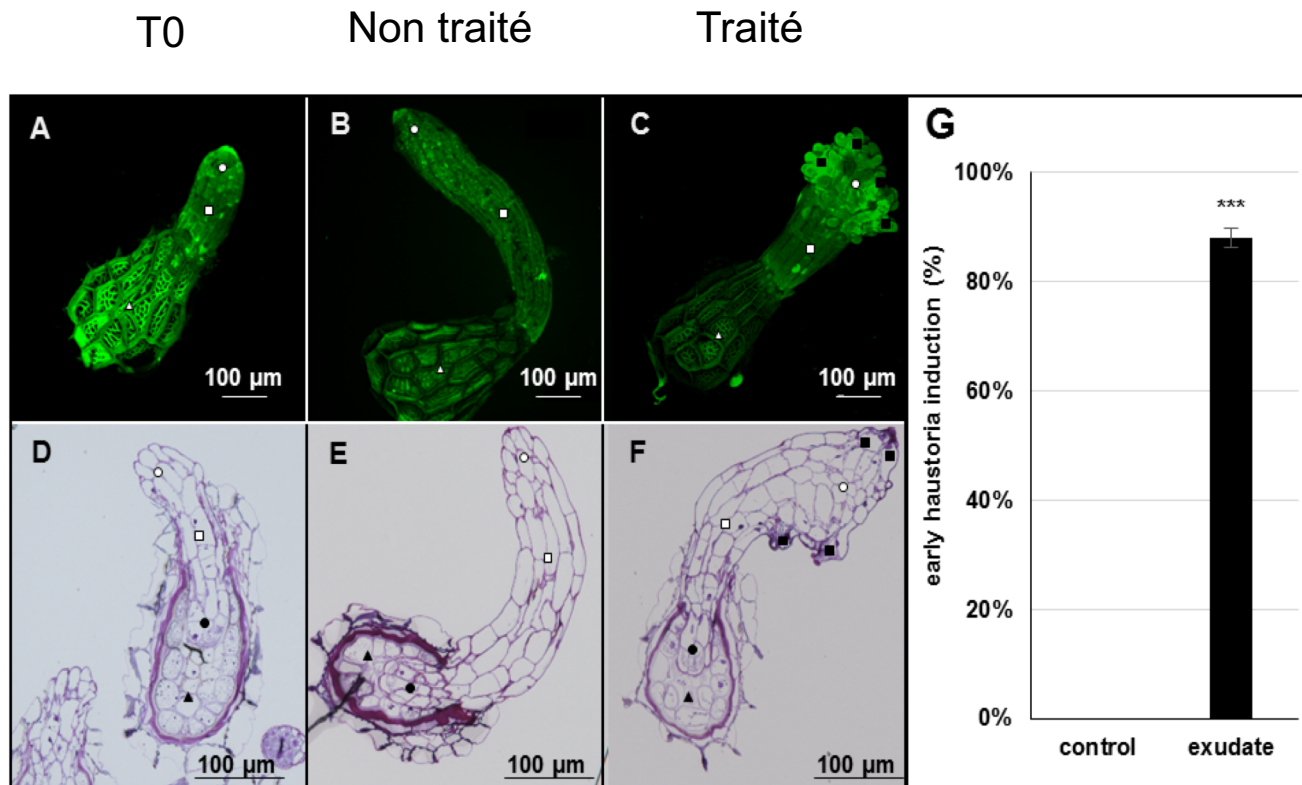


**DMBQ**

(2,6 dimethoxy-1,4-benzoquinone)

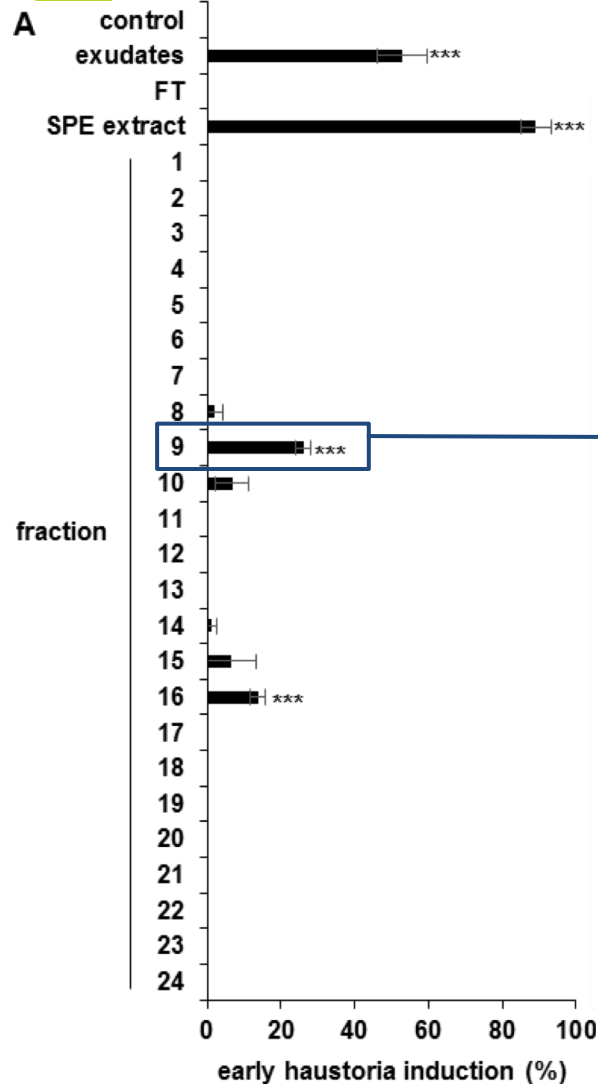
**Pas d'induction de l'haustorium**

# Induction de l'haustorium chez *P. ramosa*



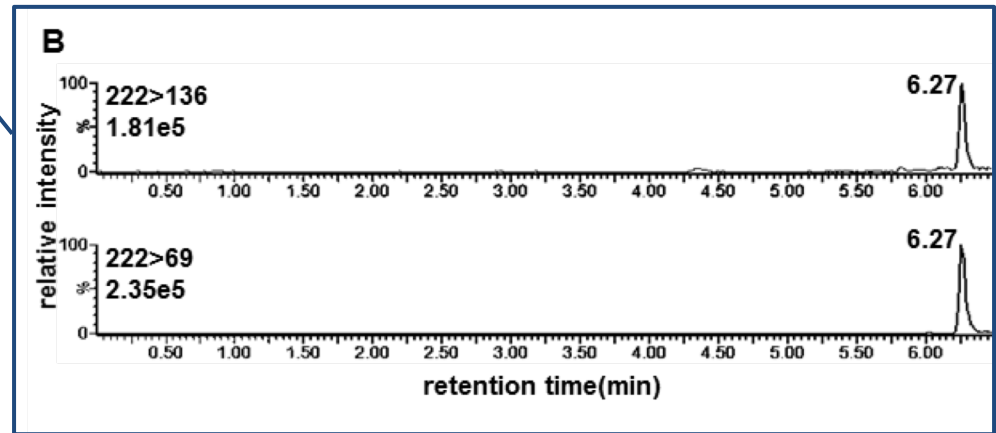
Les exsudats racinaires de Colza induisent la formation de l'haustorium

# Induction de l'haustorium chez *P. ramosa*



Extraction SPE → Fractionnement HPLC inverse  
Deux fractions induisent la formation de l'haustorium

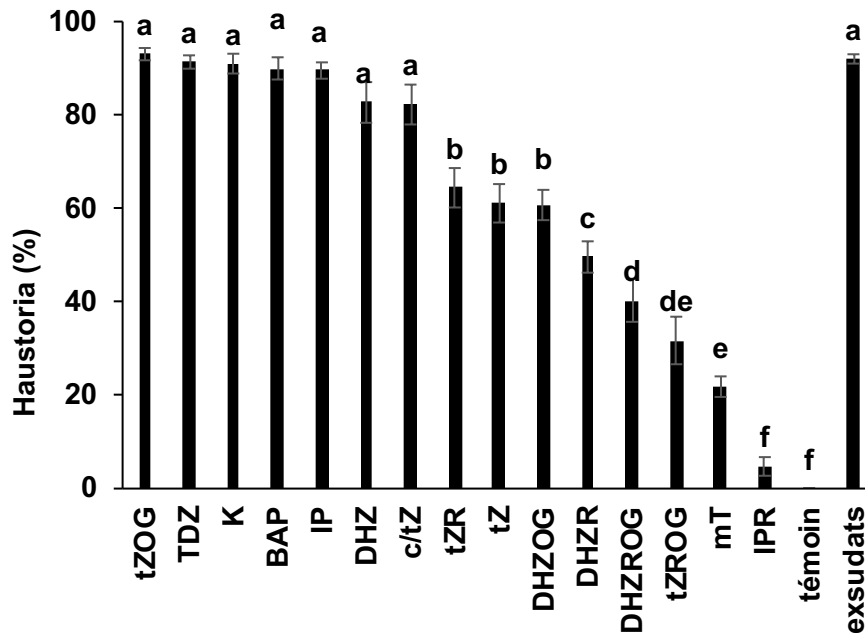
→ UPLC-ESI (+)– MS/MS



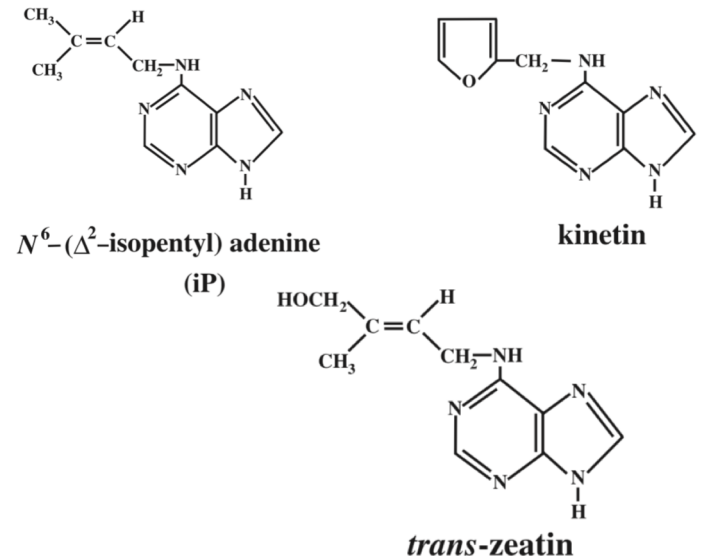
Molécules ayant les caractéristiques des cytokinines



# Induction de l'haustorium chez *P. ramosa*



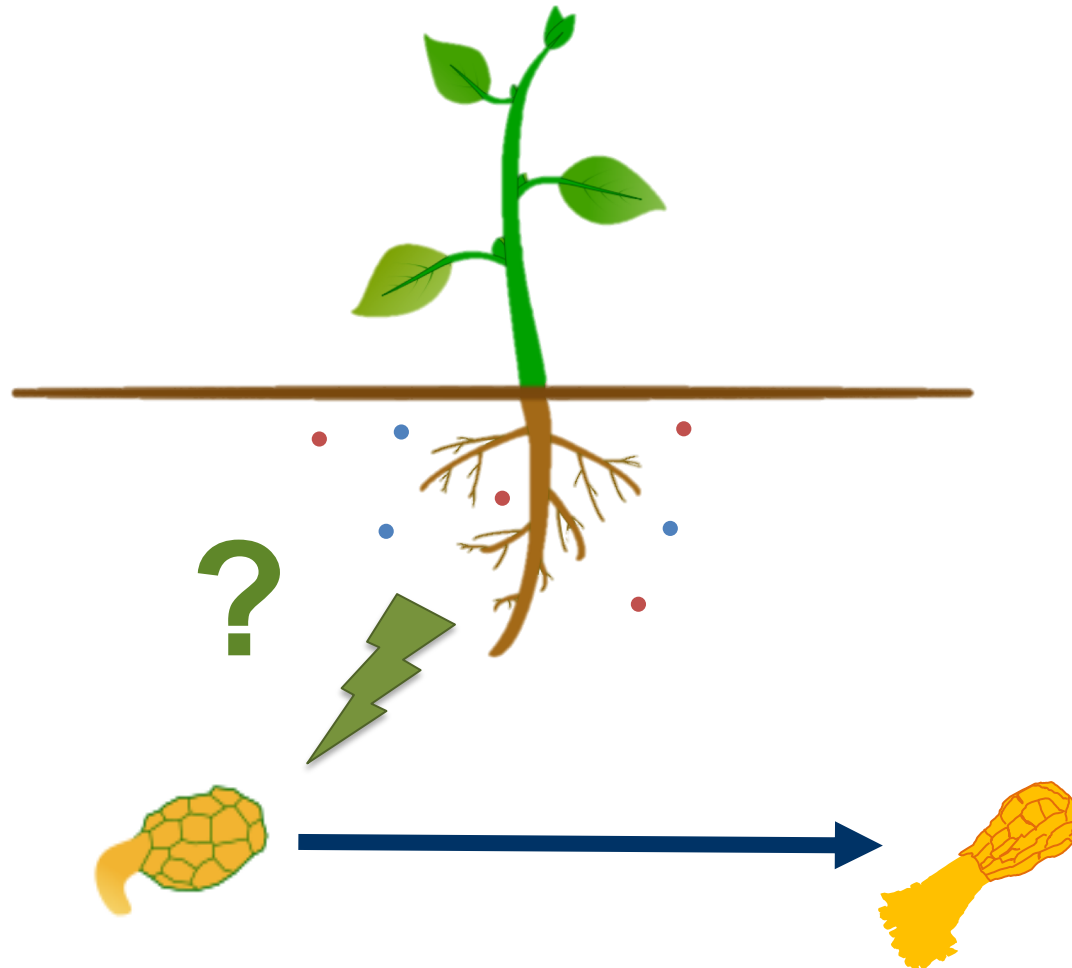
Les cytokinines induisent la formation de l'haustorium chez *P. ramosa*



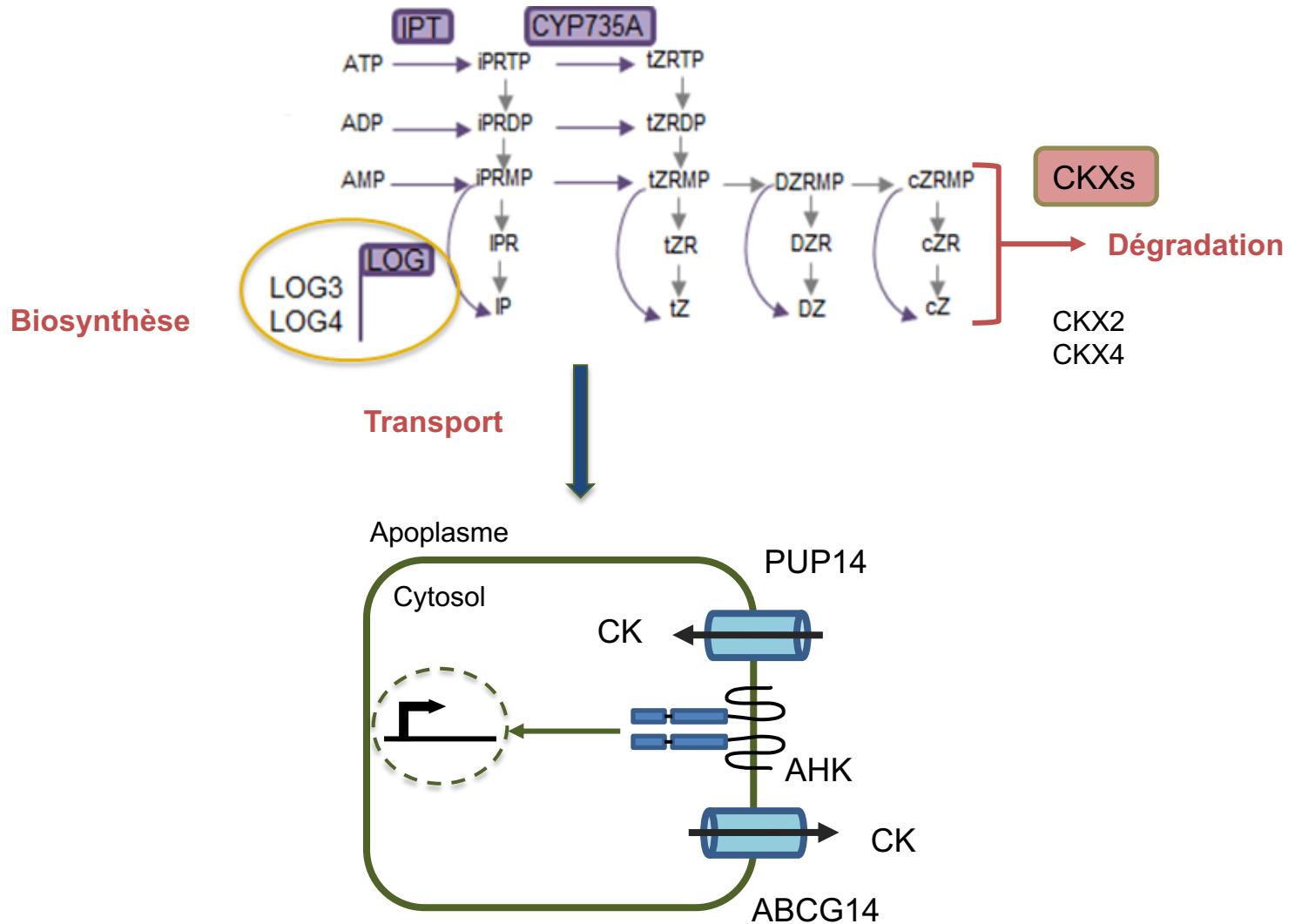
Phytohormones impliquées dans la division et différenciation cellulaire, développement racinaire, ...

Molécules très conservées dans le monde du vivant (plantes, bactéries, champignons, microalgues)

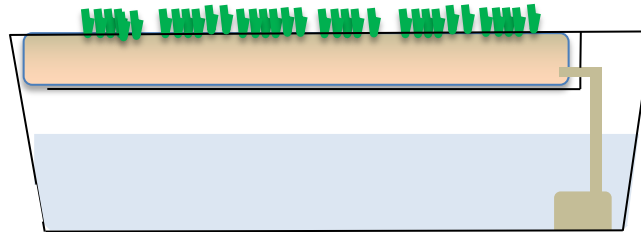
D'où proviennent les cytokinines présentes dans la rhizosphère de la plante hôte ?



# Caractérisation de mutants et plants transgéniques d'*Arabidopsis thaliana*



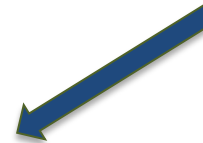
# Production des exsudats racinaires



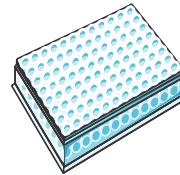
Culture hydroponique  
d'*Arabidopsis thaliana*



Collecte hebdomadaire  
des exsudats

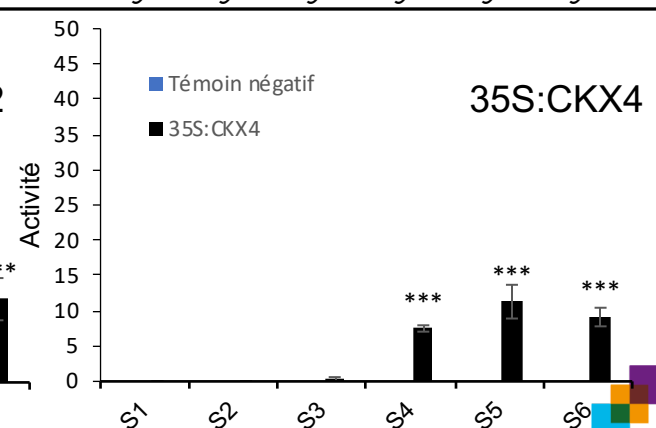
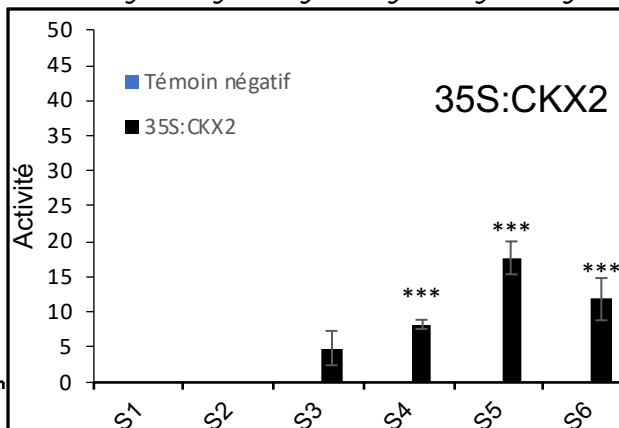
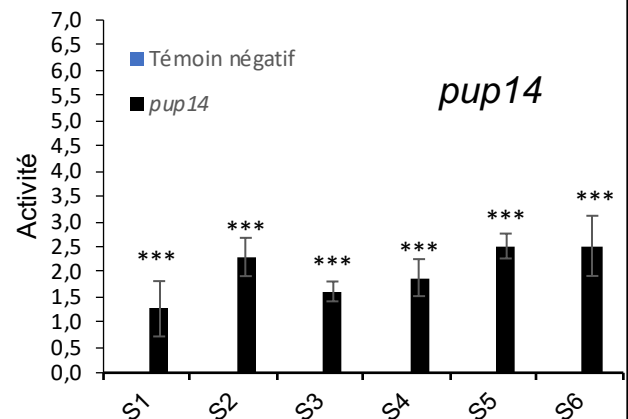
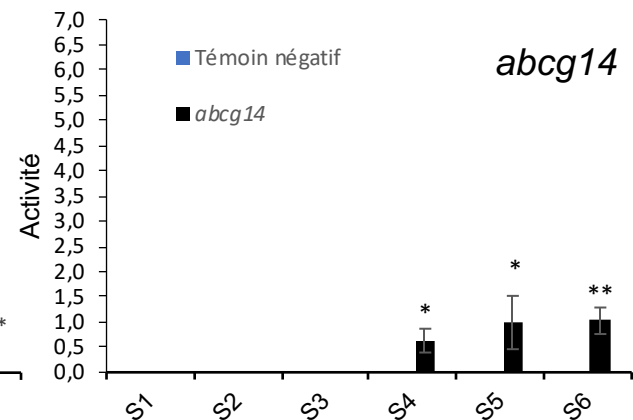
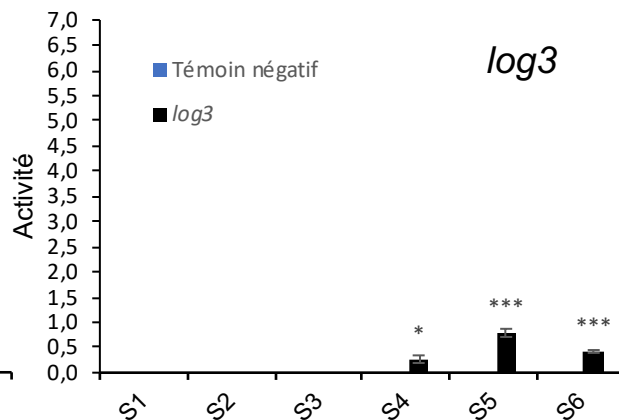
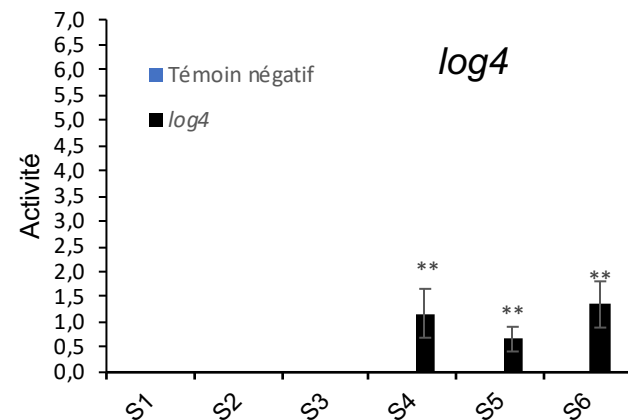
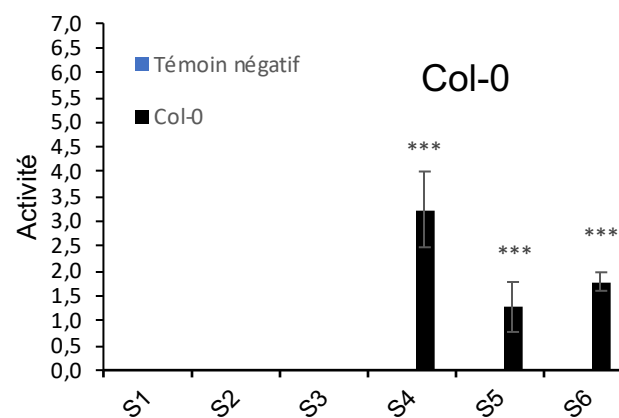


Test d'activité  
haustoriale



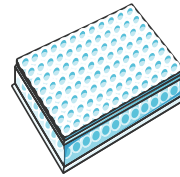
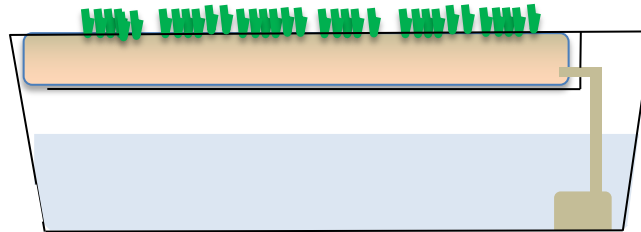
# Activité des exsudats bruts

Activité (Haustoriums / g MS / L)





# Production des exsudats racinaires



Test d'activité  
haustoriale

Culture hydroponique  
d'*Arabidopsis thaliana*

Collecte hebdomadaire  
des exsudats

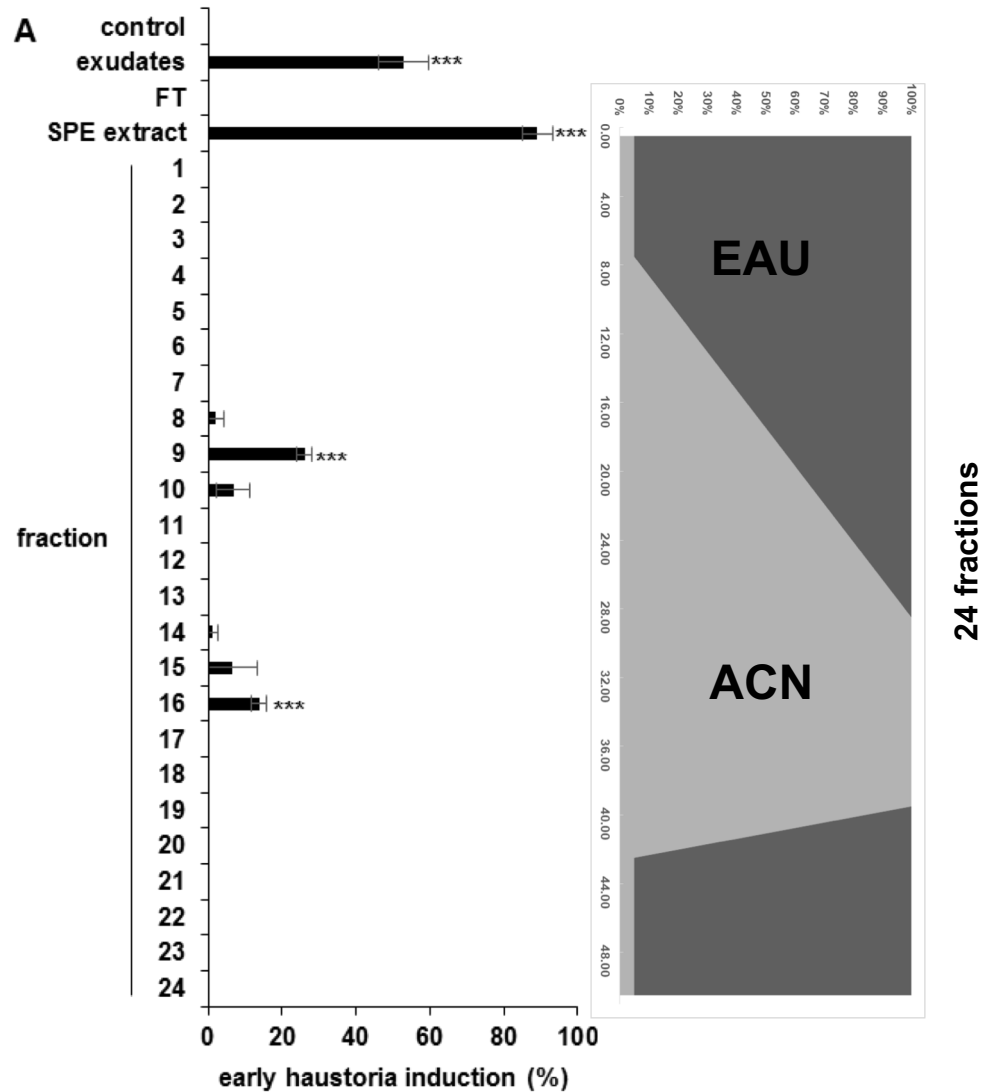
Extraction SPE

Fractionnement HPLC  
inverse

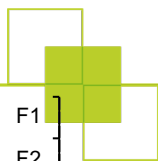


# Activité des fractions

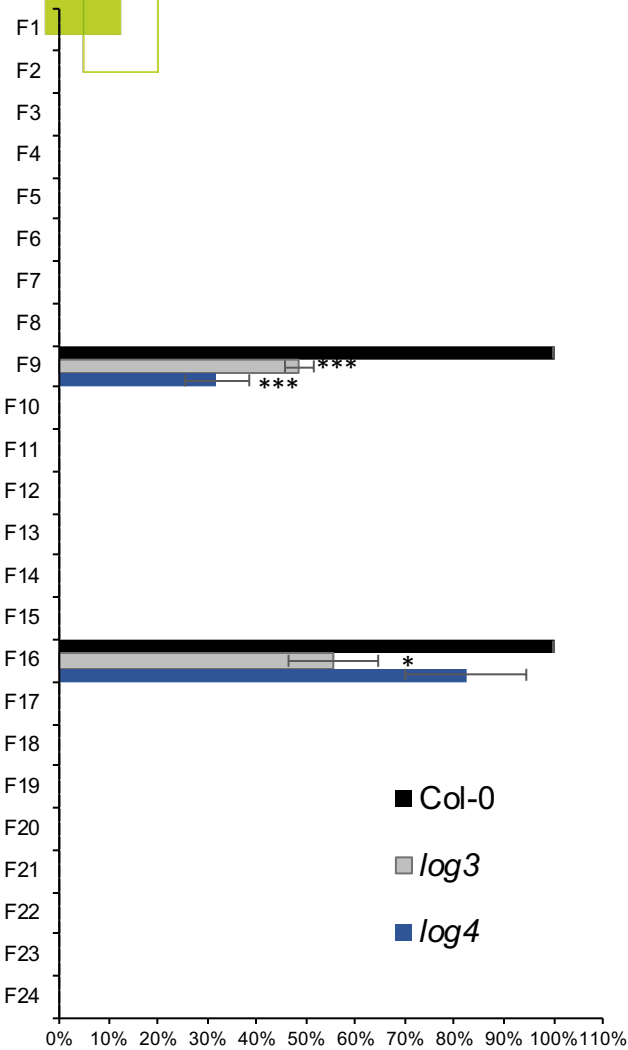
*B. napus*



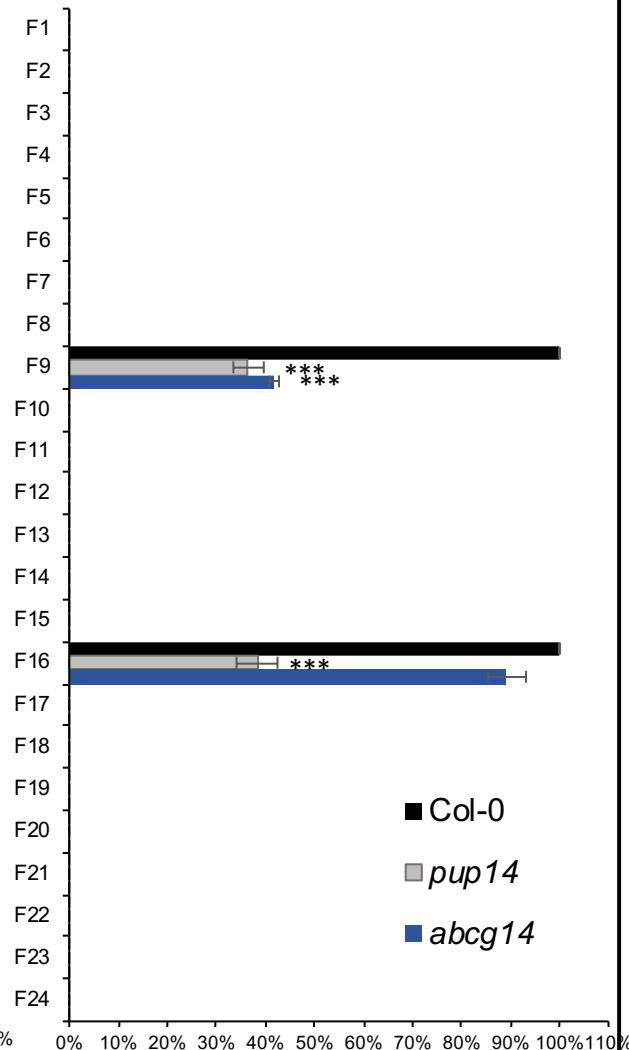
# Activité des fractions



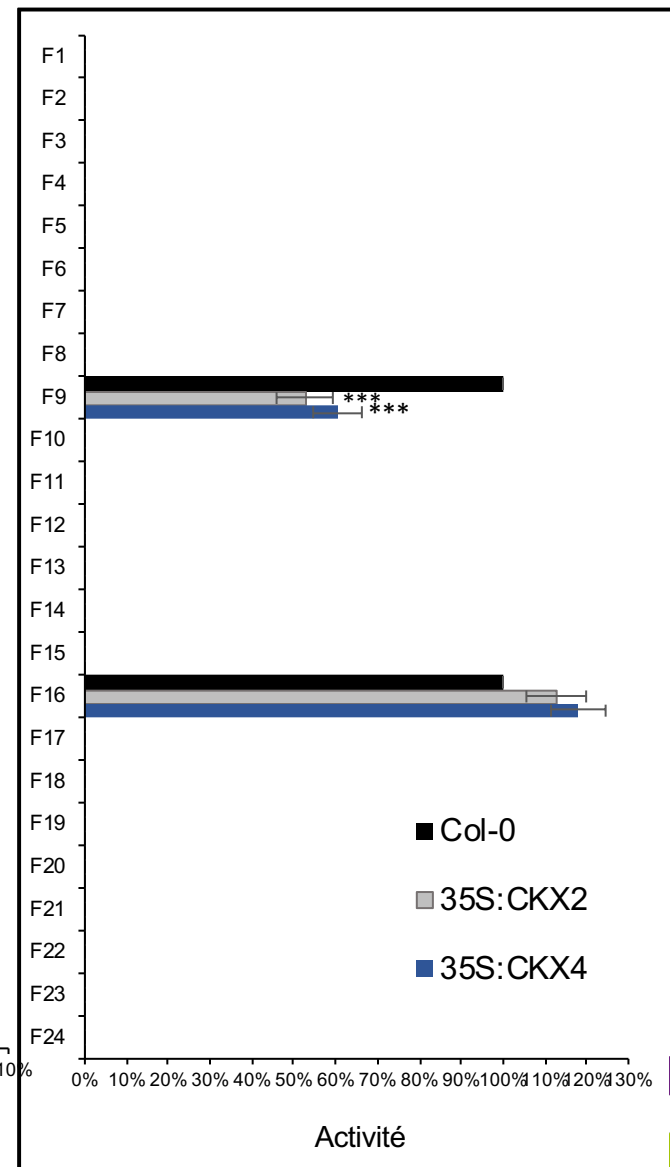
*A. thaliana*



Activité

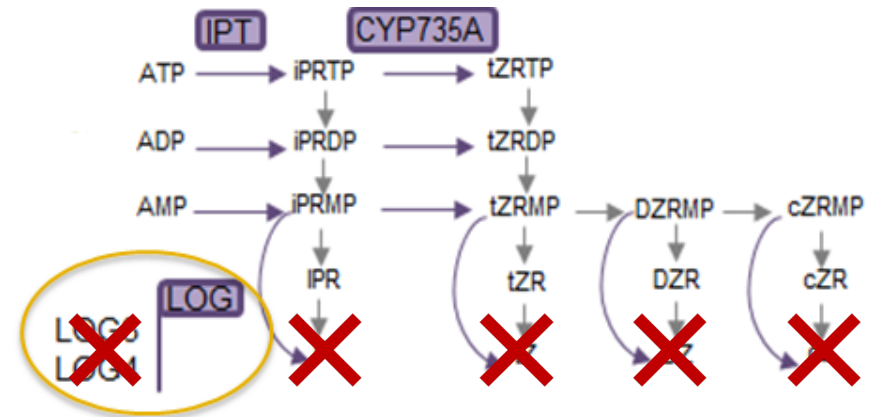
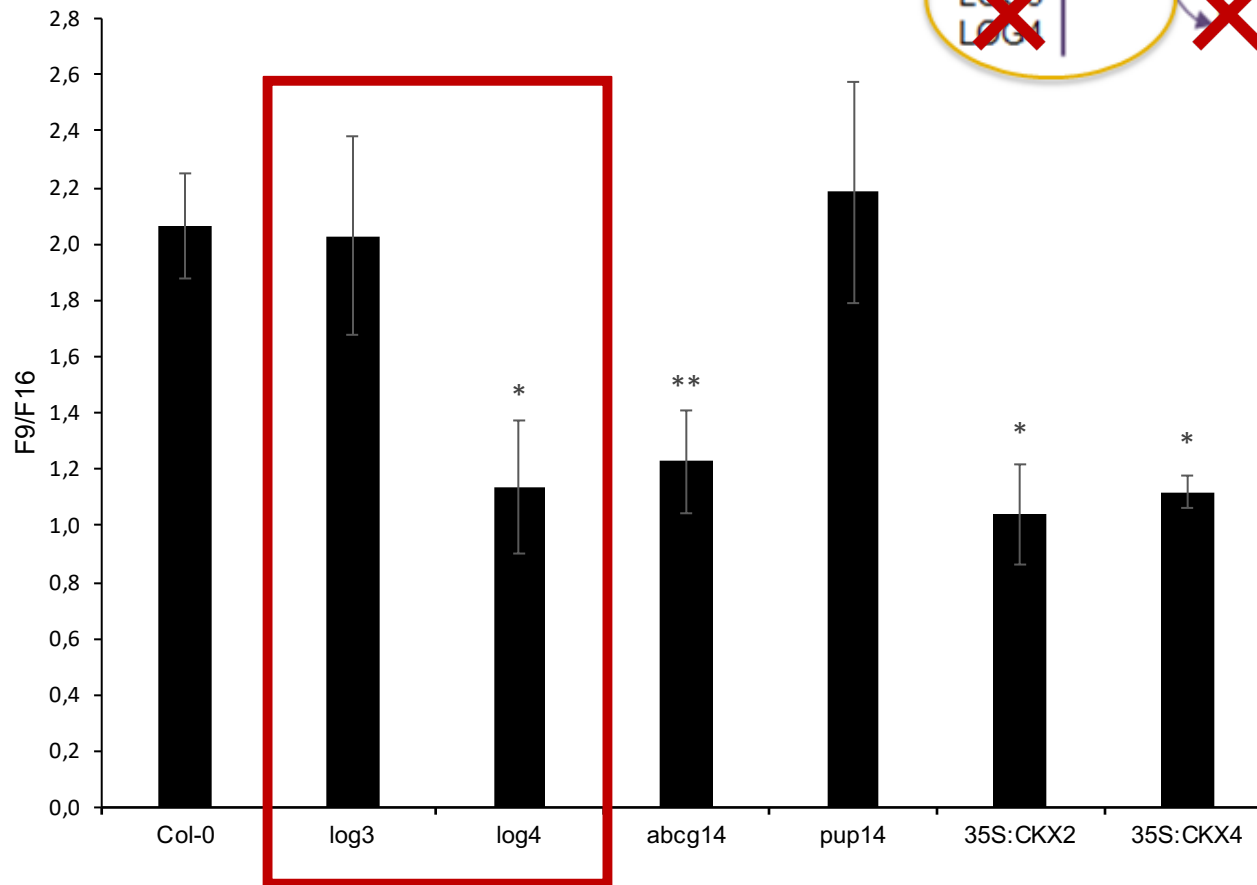


Activité

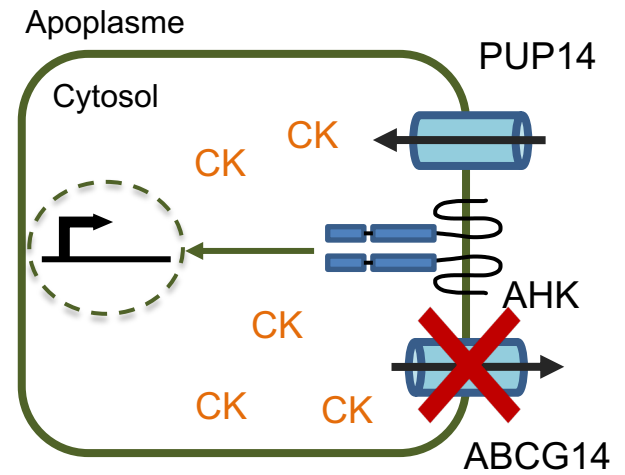
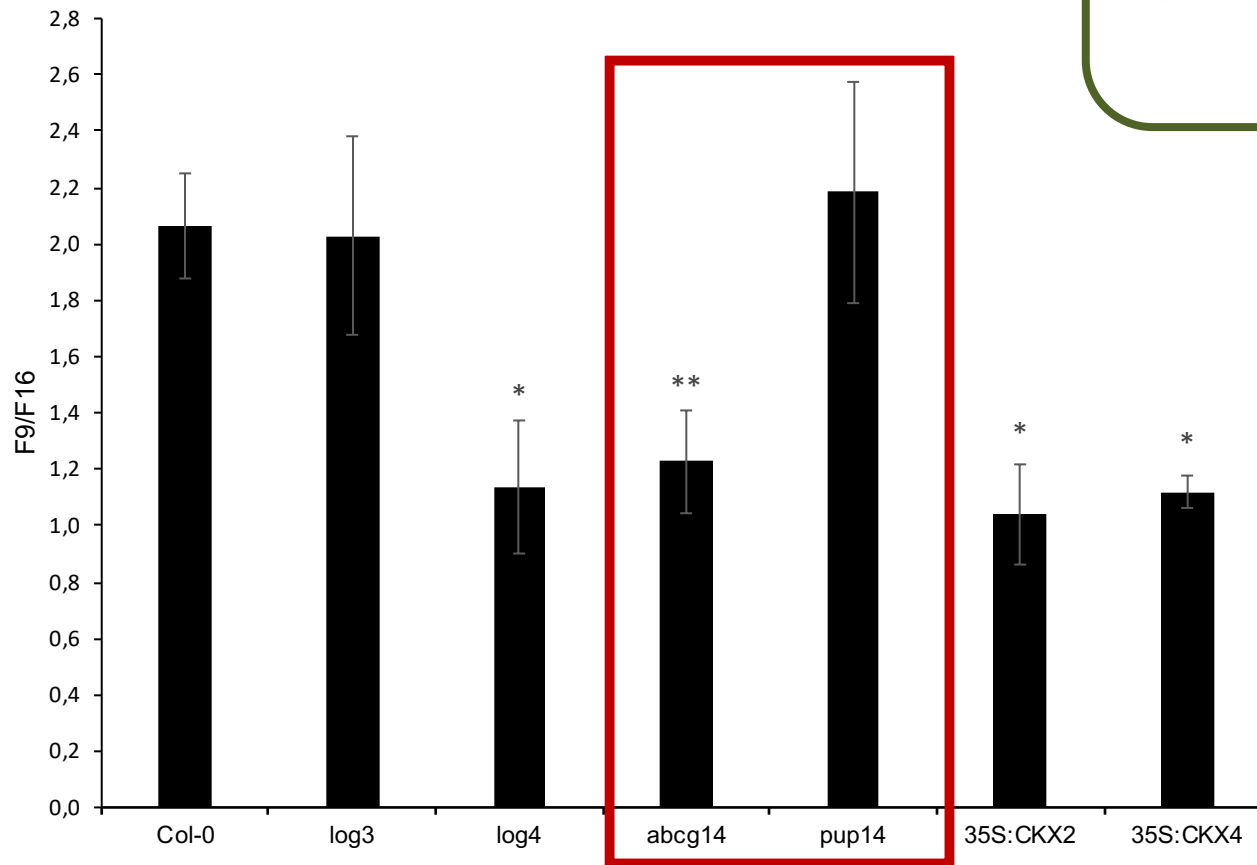


Activité

# Activité inductrice de l'haustorium

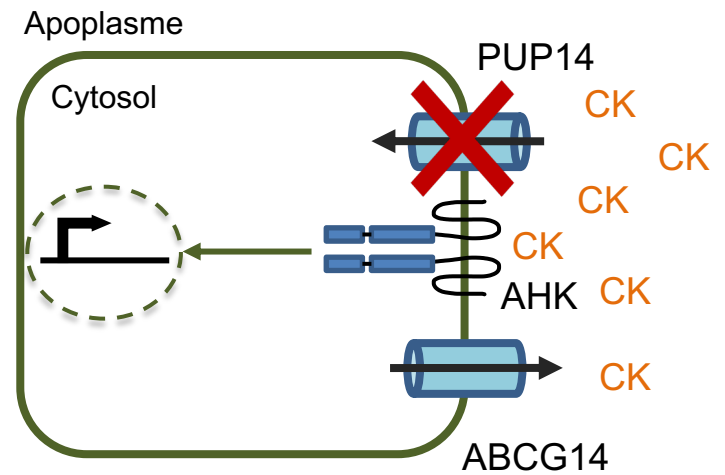
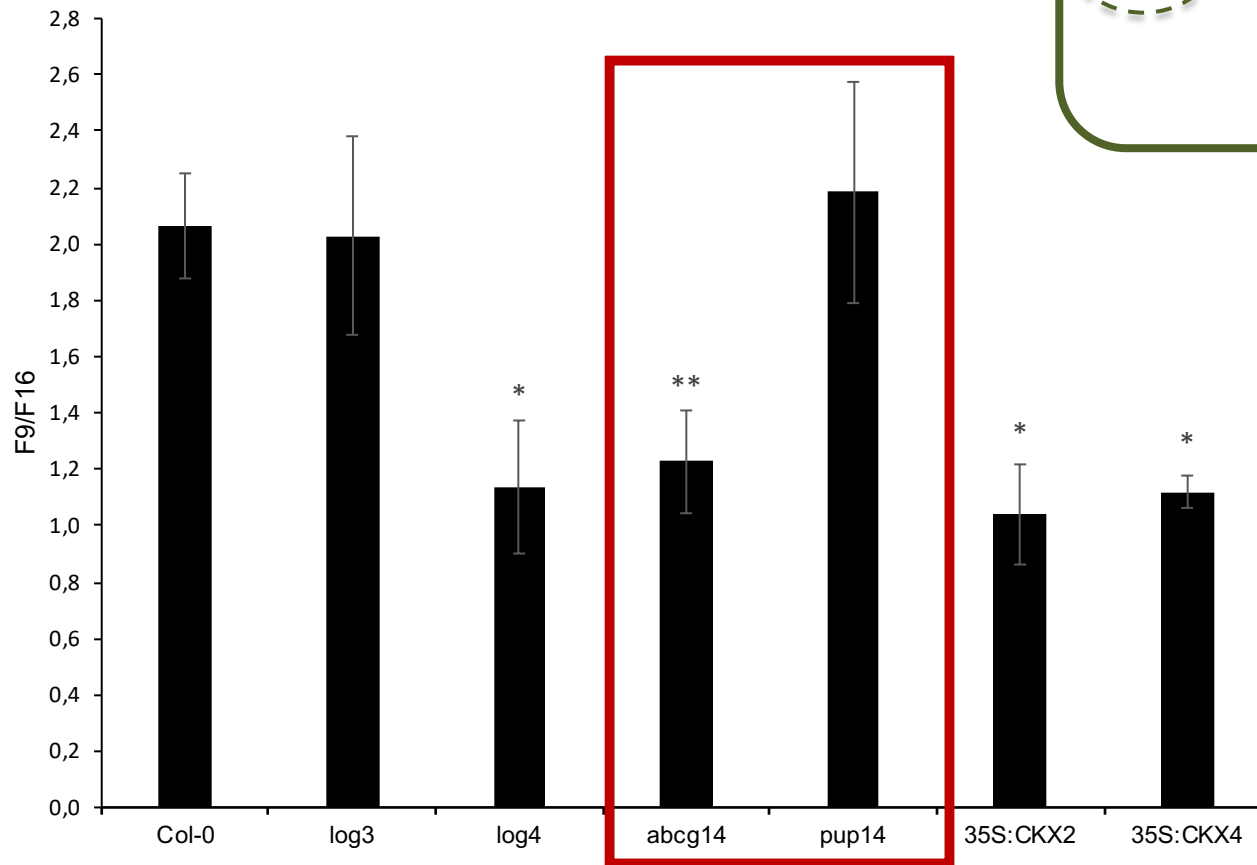


# Activité inductrice de l'haustorium



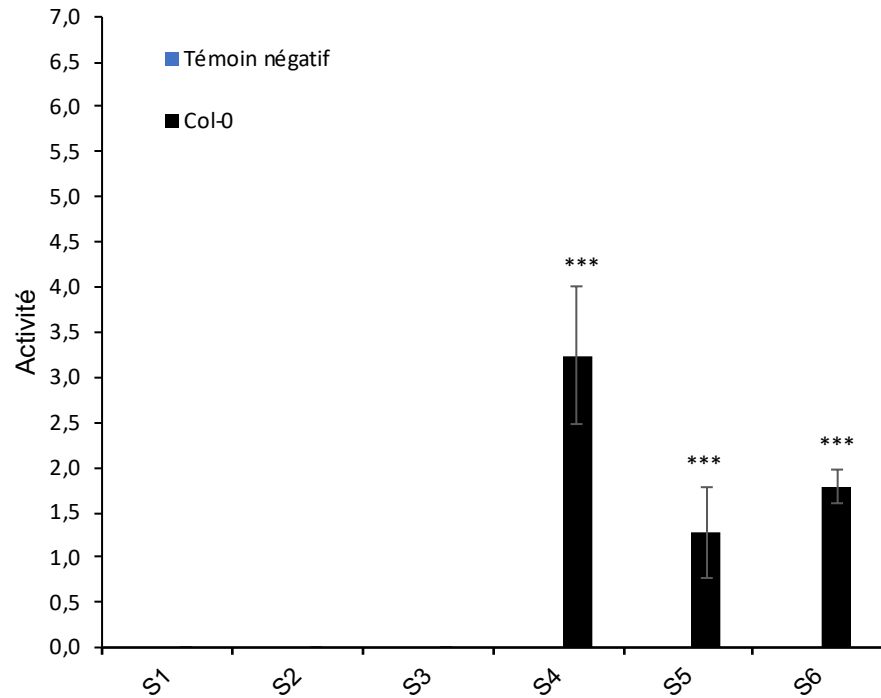


# Activité inductrice de l'haustorium

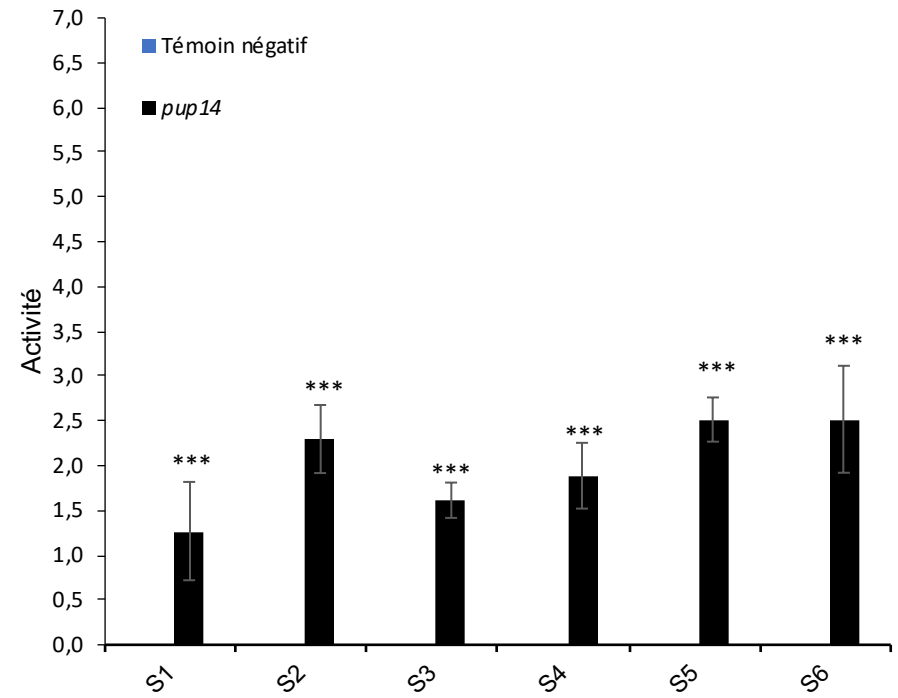


# Activité des exsudats racinaires bruts

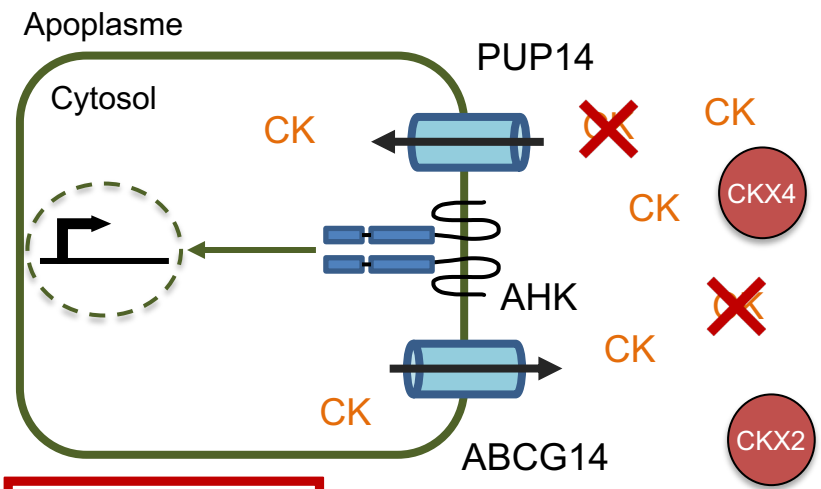
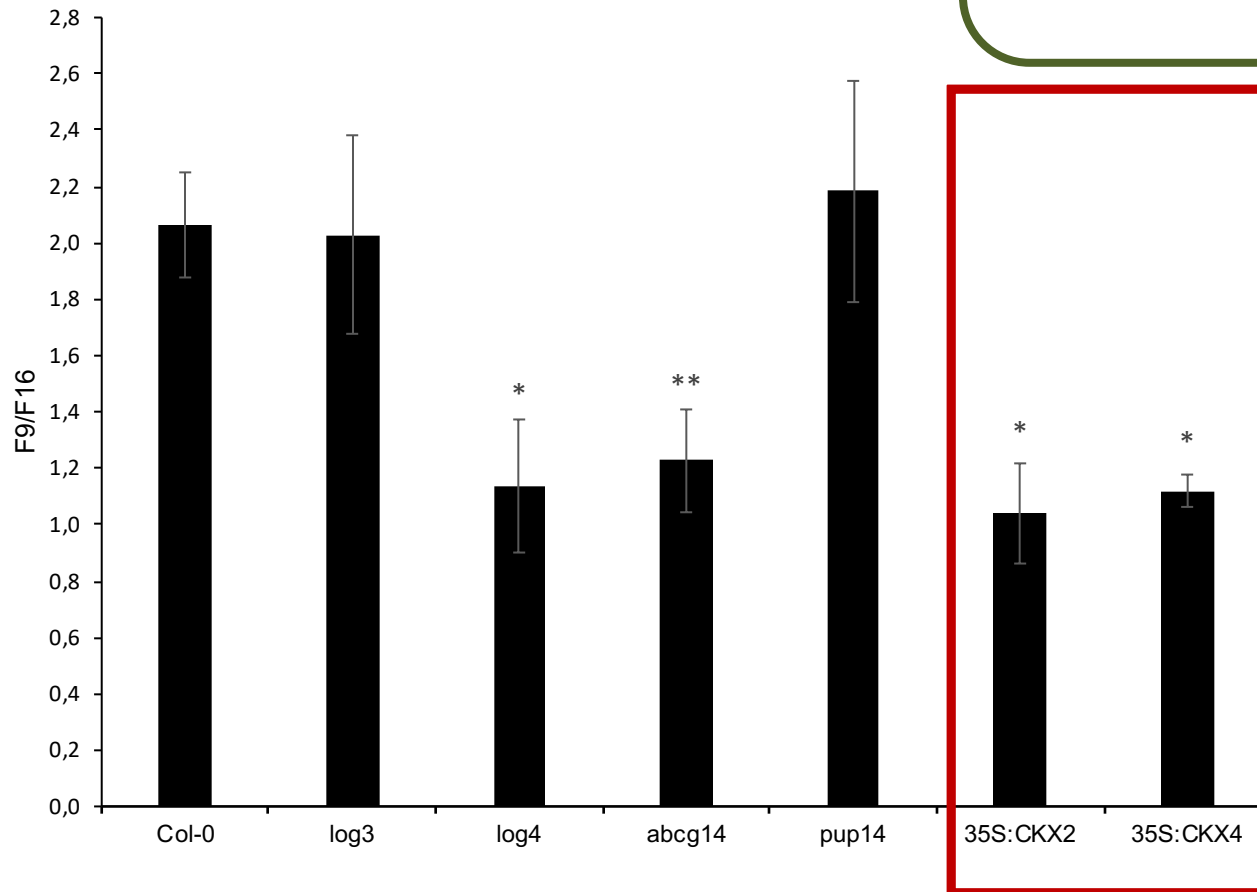
Col-0

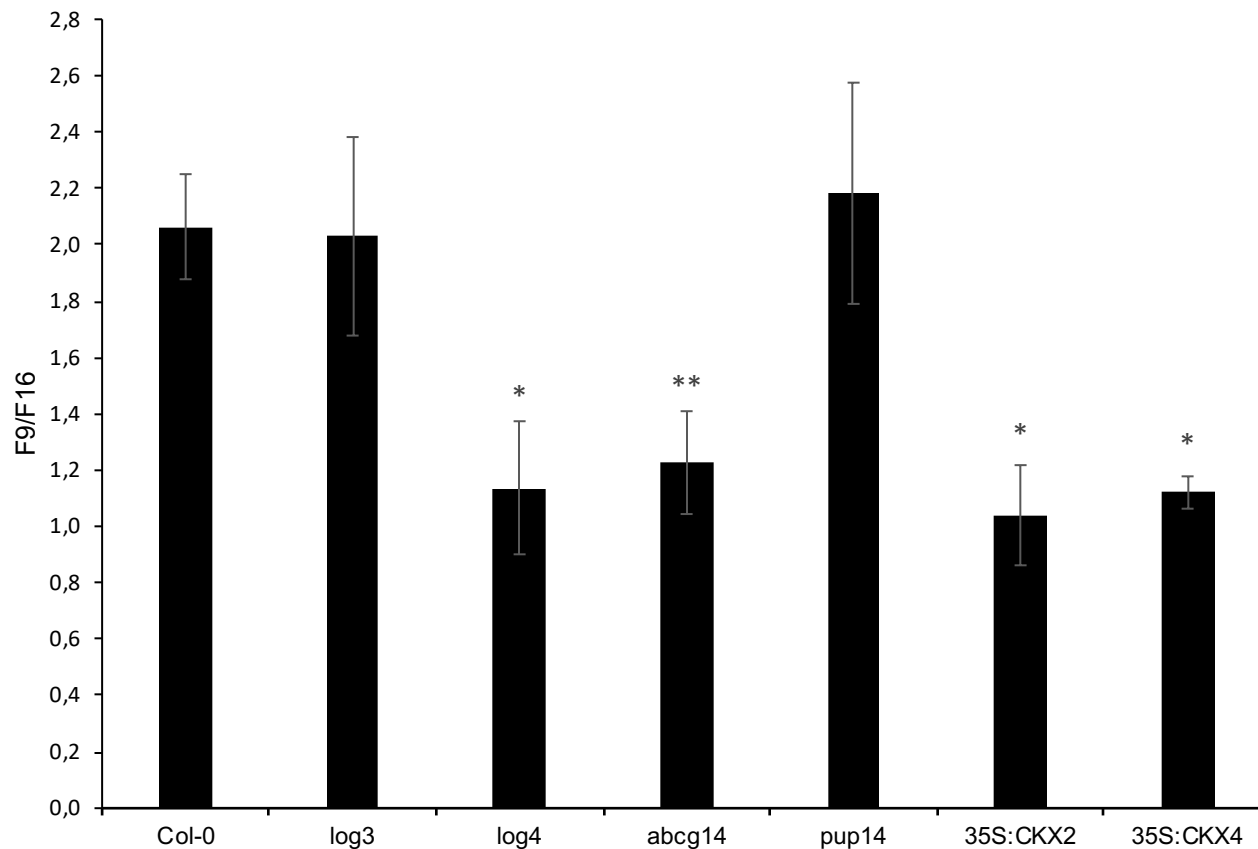


*pup14*



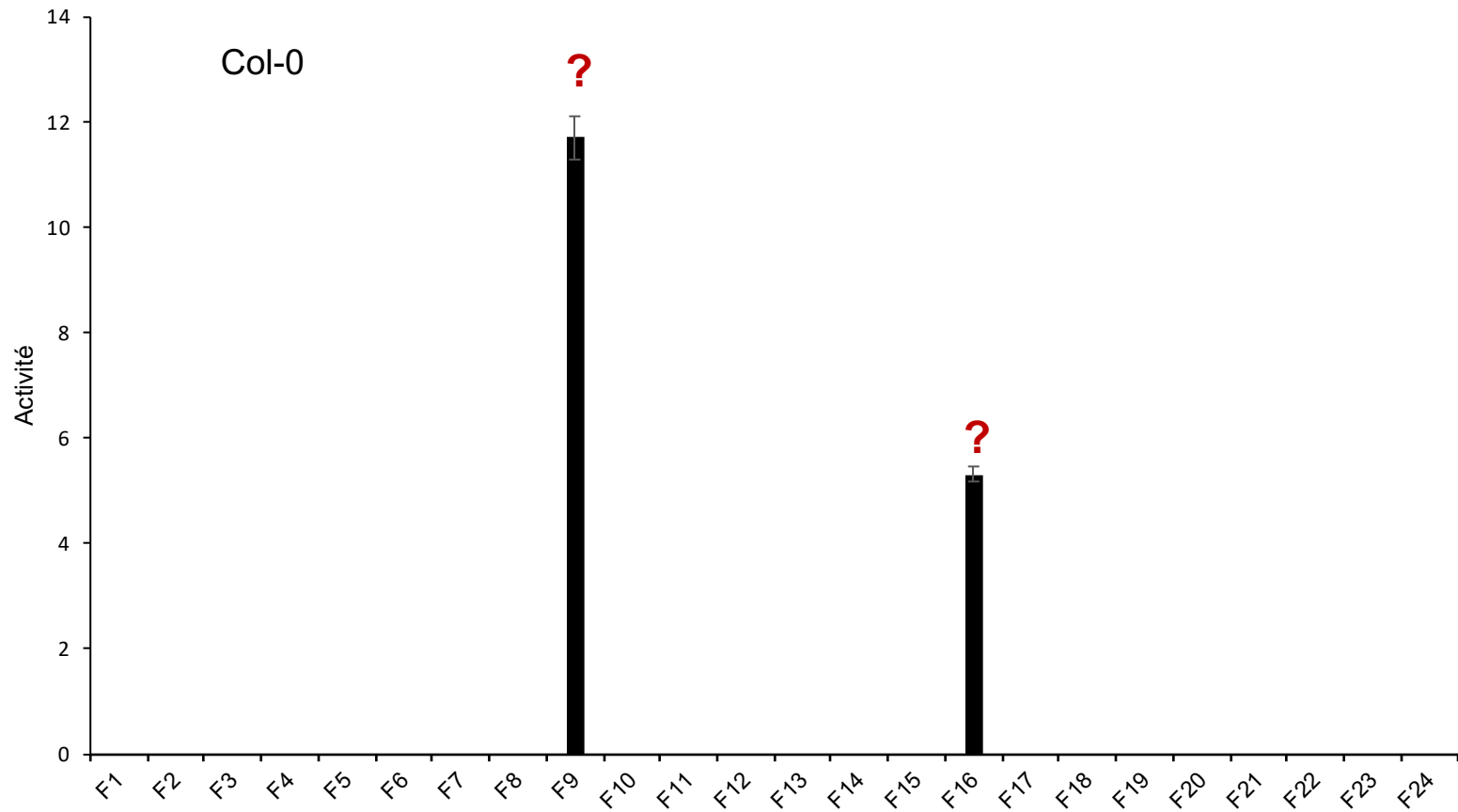
# Activité inductrice de l'haustorium





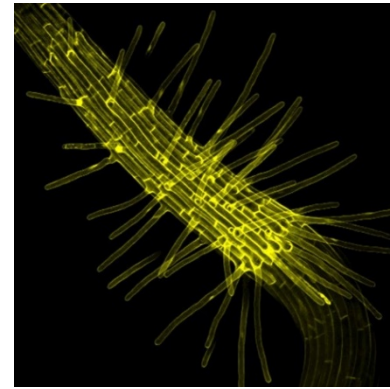
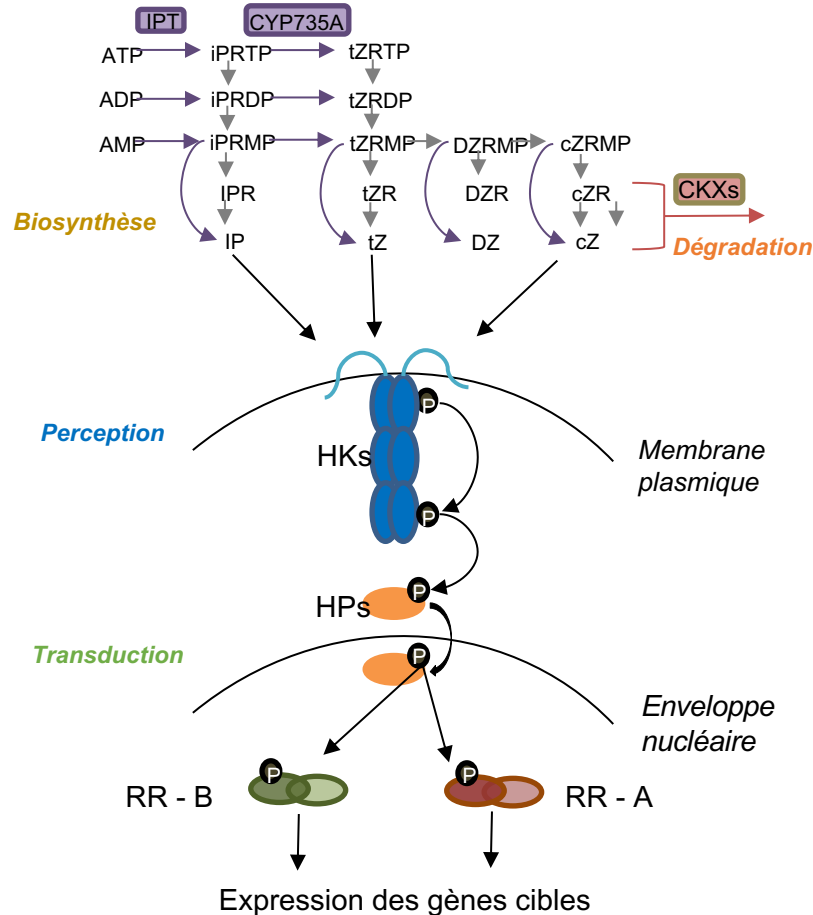
L'altération de la voie des cytokinines induit une modification de l'activité inductrice de l'haustorium des exsudats racinaires

# Réponse transcriptomique des fractions actives (9 et 16)

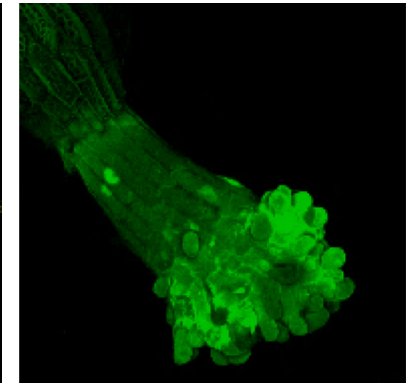




# Réponse transcriptomique des fractions actives (9 et 16)



Dr. J. Lucas



V. Goyet

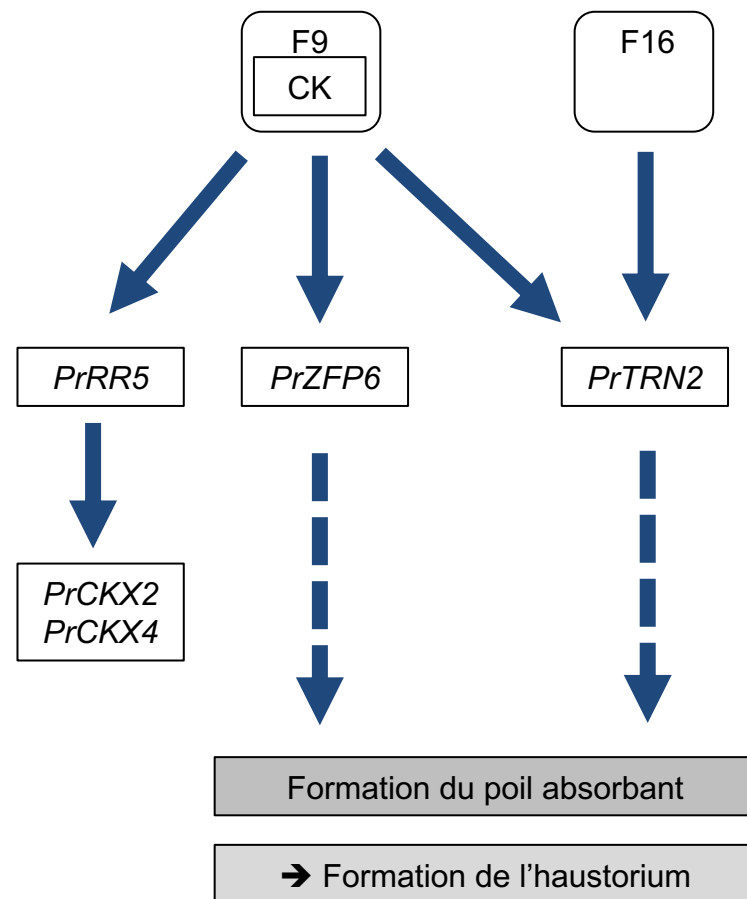
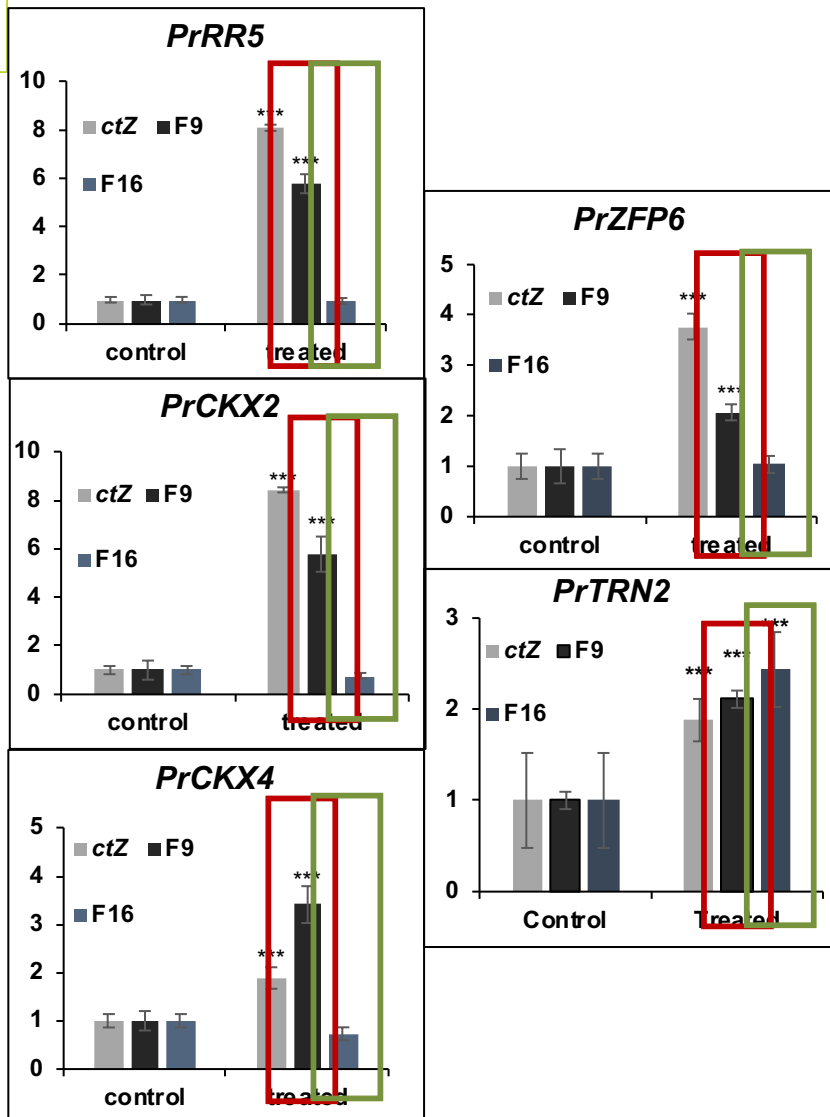
*PrRR5* : marqueur de la voie de CK

*PrCKX2* et *PrCKX4* : dégradation des CK

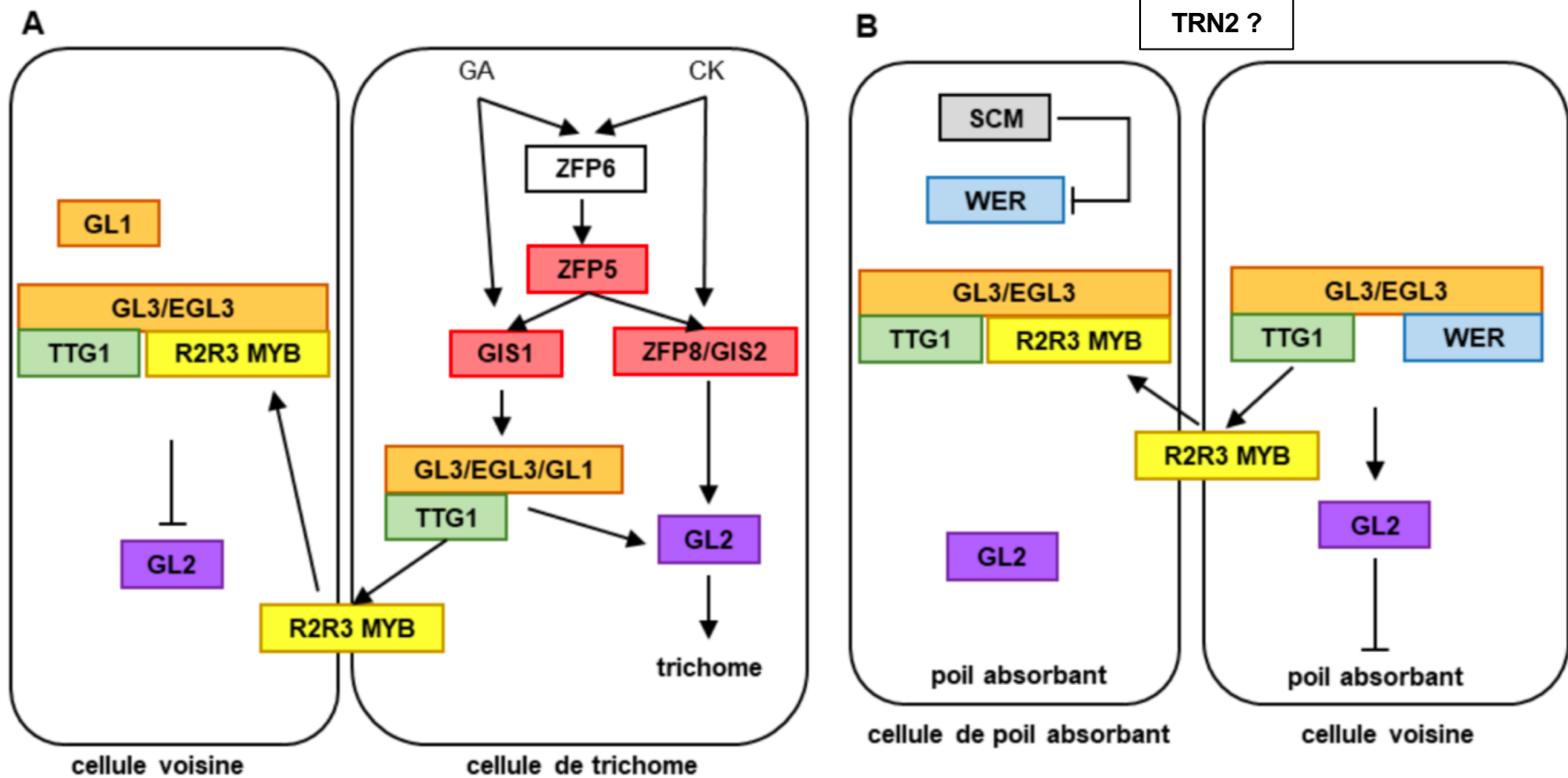
*PrZFP6* : formation des poils absorbant en réponse aux CK

*PrTRN2* : formation des poils absorbant

# Réponse transcriptomique des fractions actives (9 et 16)



# Réponse transcriptomique des fractions actives (9 et 16)





Les cytokinines induisant la formation de l'haustorium sont exsudées par la plante hôte

## Perspectives

Contribution de la fraction 16 à l'agressivité de la plante parasite

- Tests d'agressivité avec traitement par la fraction 16
- Identification des composés inducteurs de l'haustorium
  - Exploration de la voie de signalisation induite

Comparaison entre les plantes holoparasites et hémiparasites





**Merci de votre attention**

