

# Metabolite-based resistance strategies of *Solanum bulbocastanum* against early and late blight



Julius Kühn Institute  
Federal Research Centre for  
Cultivated Plants



*Phytophthora infestans*



*Solanum  
tuberosum*



*Solanum  
bulbocastanum*

*Alternaria solani*



*Solanum  
tuberosum*



*Solanum  
bulbocastanum*

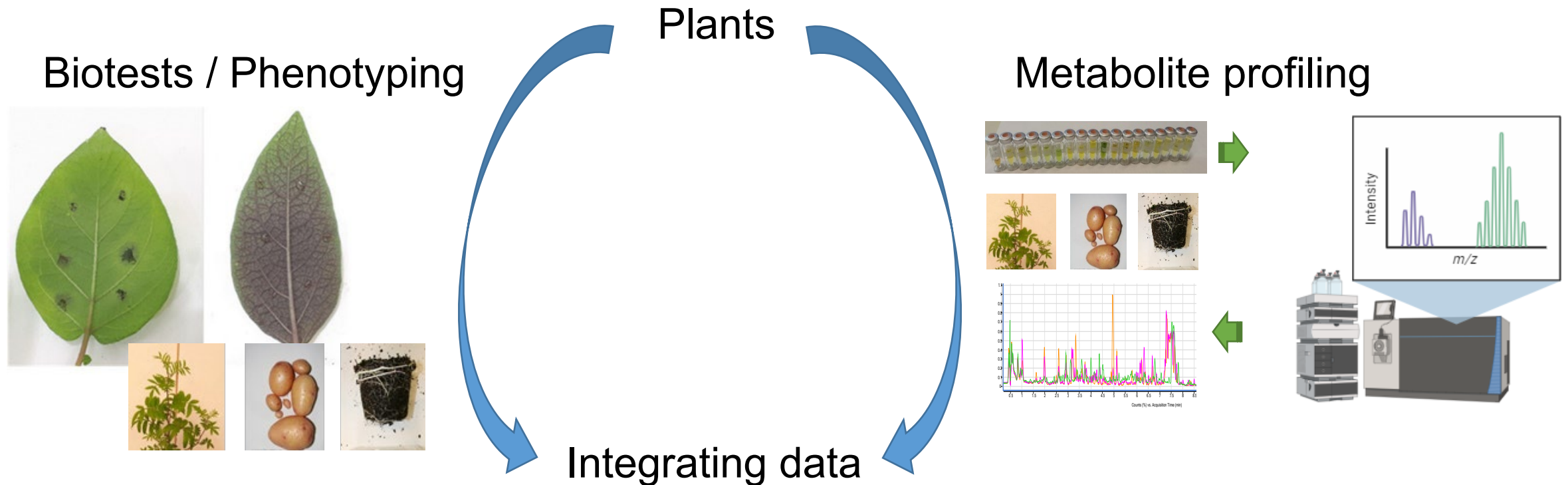
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<sup>3</sup> Leibniz-Institute for Plant Biochemistry (IPB), Halle, Germany.

# The approach: Metabolite profiling for resistance breeding



Selection of potential resistance-relevant compounds,  
identification, testing

**LC-MS** profiling of extracts from leaf, leaf surface, root, tuber

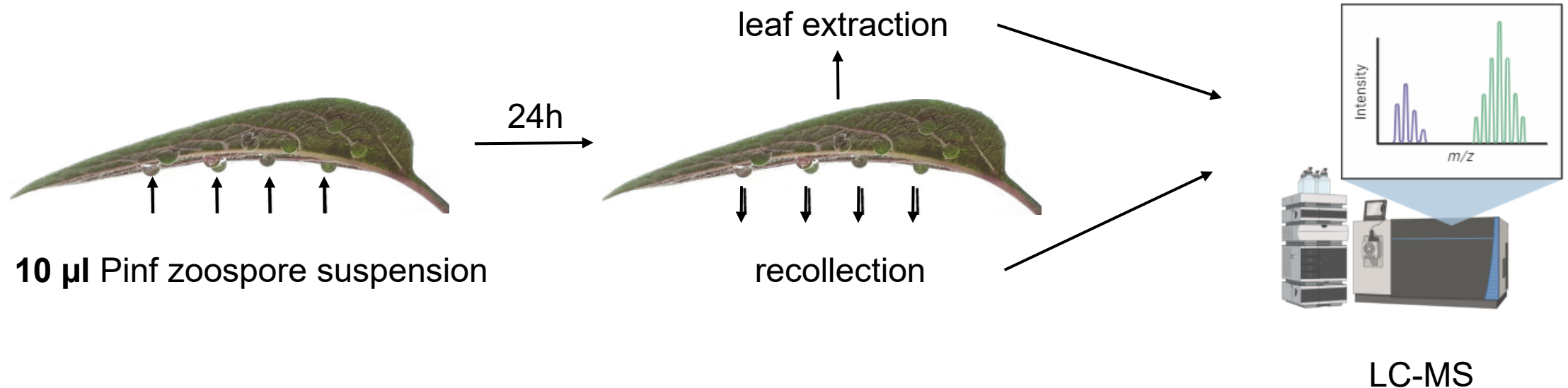
**GC-MS** profiling of extracts and volatiles

# *Solanum bulbocastanum* leaf surface metabolites and resistance to *Phytophthora infestans*

## **Metabolite Profiling of wild potato during interaction with *Phytophthora infestans***

Metabolite-based defense mechanisms, Leibniz-Institute for Plant Biochemistry, Halle

*Solanum tuberosum* secretes bioactive metabolites in early *Phytophthora* infestation.  
Are there similar mechanisms in highly resistant wild potato species?

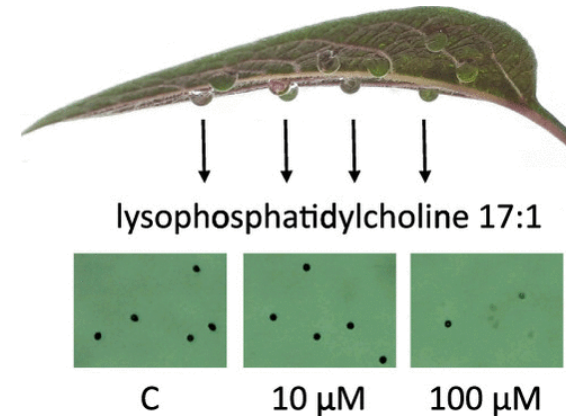


## Lysophosphatidylcholine 17:1 from the Leaf Surface of the Wild Potato Species *Solanum bulbocastanum* Inhibits *Phytophthora infestans*

Karin Gorzolka, Elvio Henrique Benatto Perino, Sarah Lederer, Ulrike Smolka, and Sabine Rosahl\*

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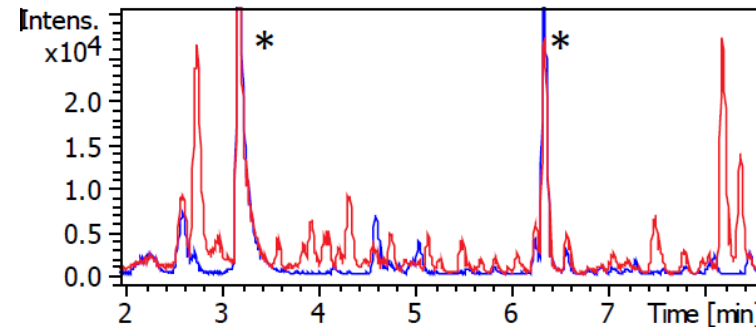
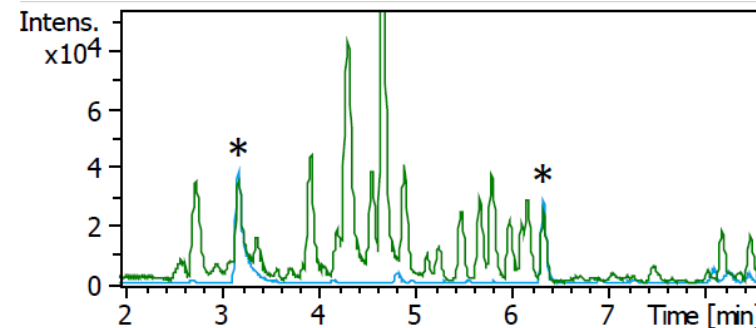
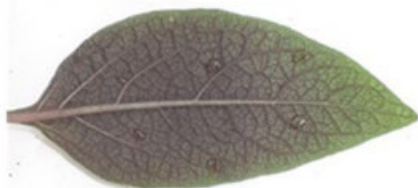
Read Online



*Solanum tuberosum*



*Solanum bulbocastanum*

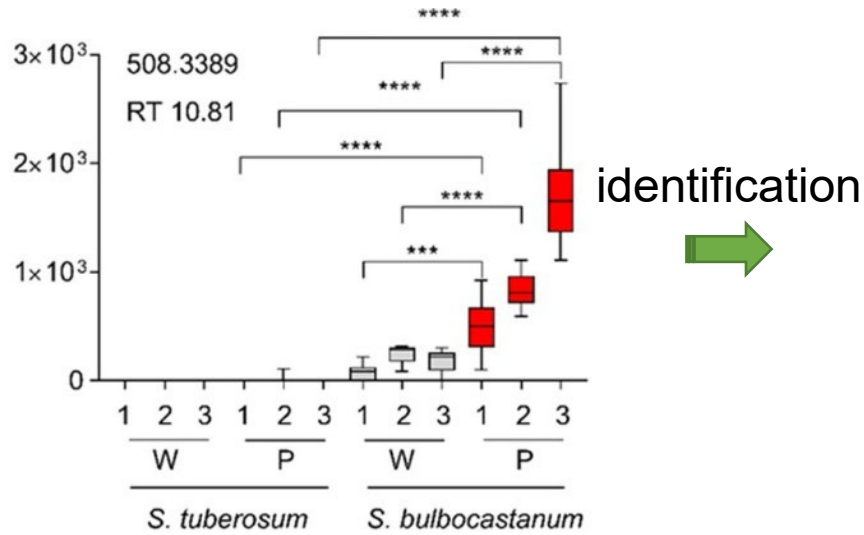


Many trichome-specific compounds  
(e.g. rutin)

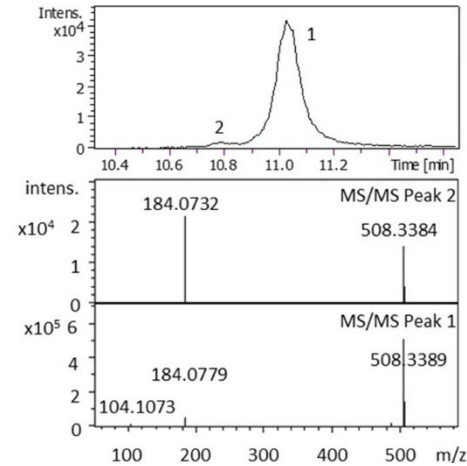
Leaf compounds were very distinct!

Leaf surface metabolites:  
5 signals higher on *S. bulbocastanum*  
than in *S. tuberosum* after *P. inf*  
inoculation

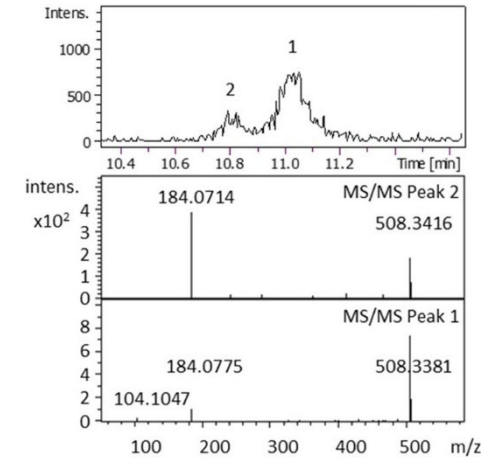
# *Solanum bulbocastanum* leaf surface metabolites and resistance to *Phytophthora infestans*



Authentic standard  
LPC17:1



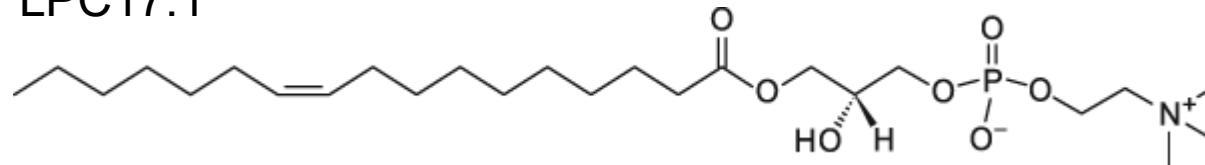
*blb2G* leaf  
surface droplet



- ✓ Retention time
- ✓ MSMS



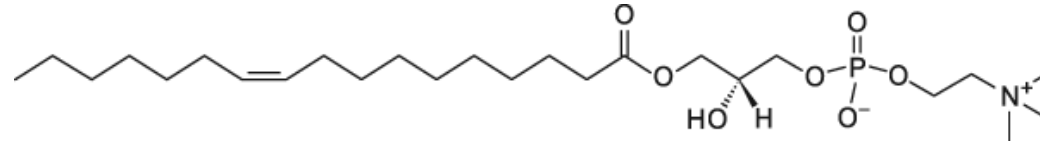
LPC17:1



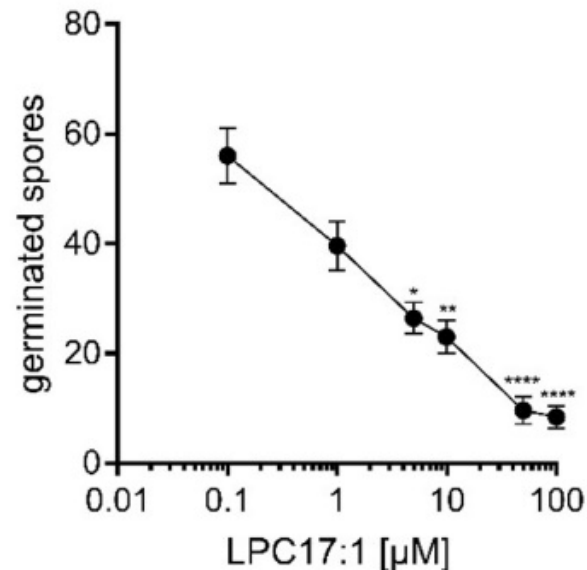
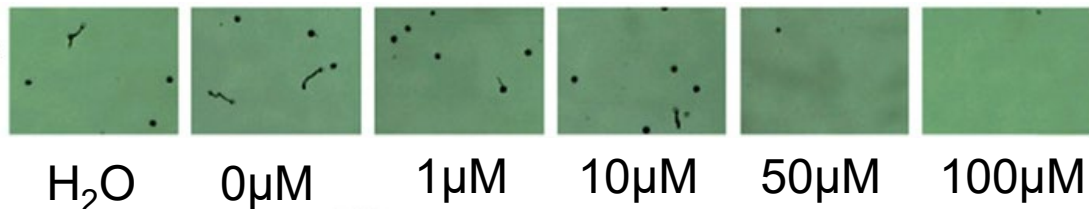
picture: (AVANTI polar lipids)

# *Solanum bulbocastanum* leaf surface metabolites and resistance to *Phytophthora infestans*

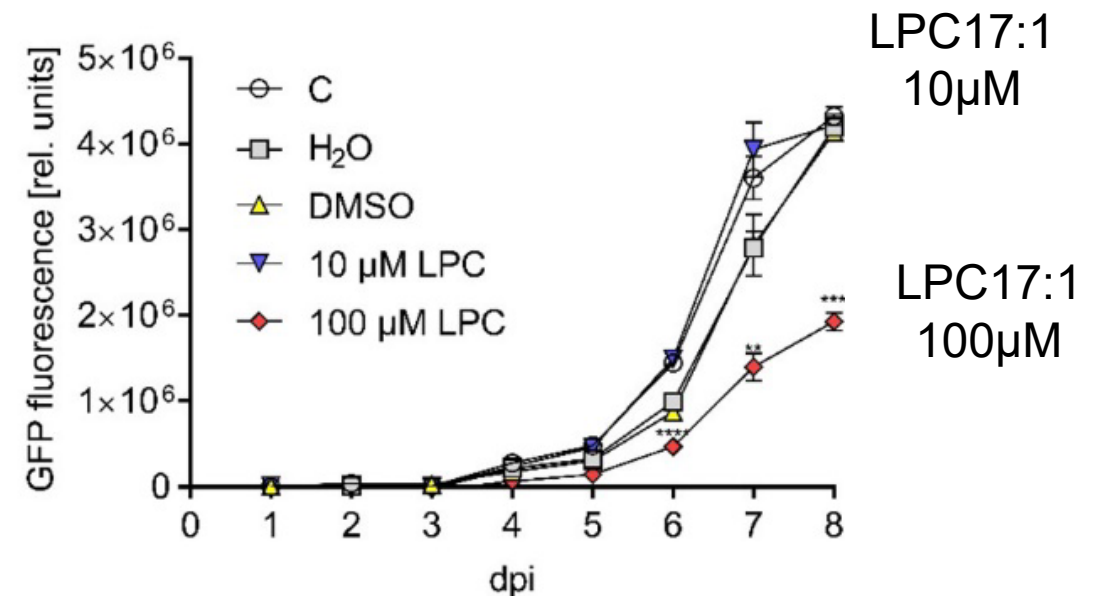
Biotests with *Phytophthora infestans* and LPC17:1



## Zoospore germination



## Mycelial growth in liquid media





# Inner values also count: **inner leaf metabolites**

## Isolation of a bioactive metabolite from leaves of *Solanum bulbocastanum*

Metabolite profiling of wild potato species for resistance against potato pest insects

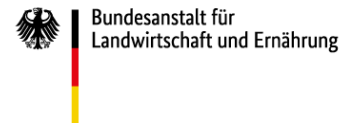


Gefördert durch



aufgrund eines Beschlusses  
des Deutschen Bundestages

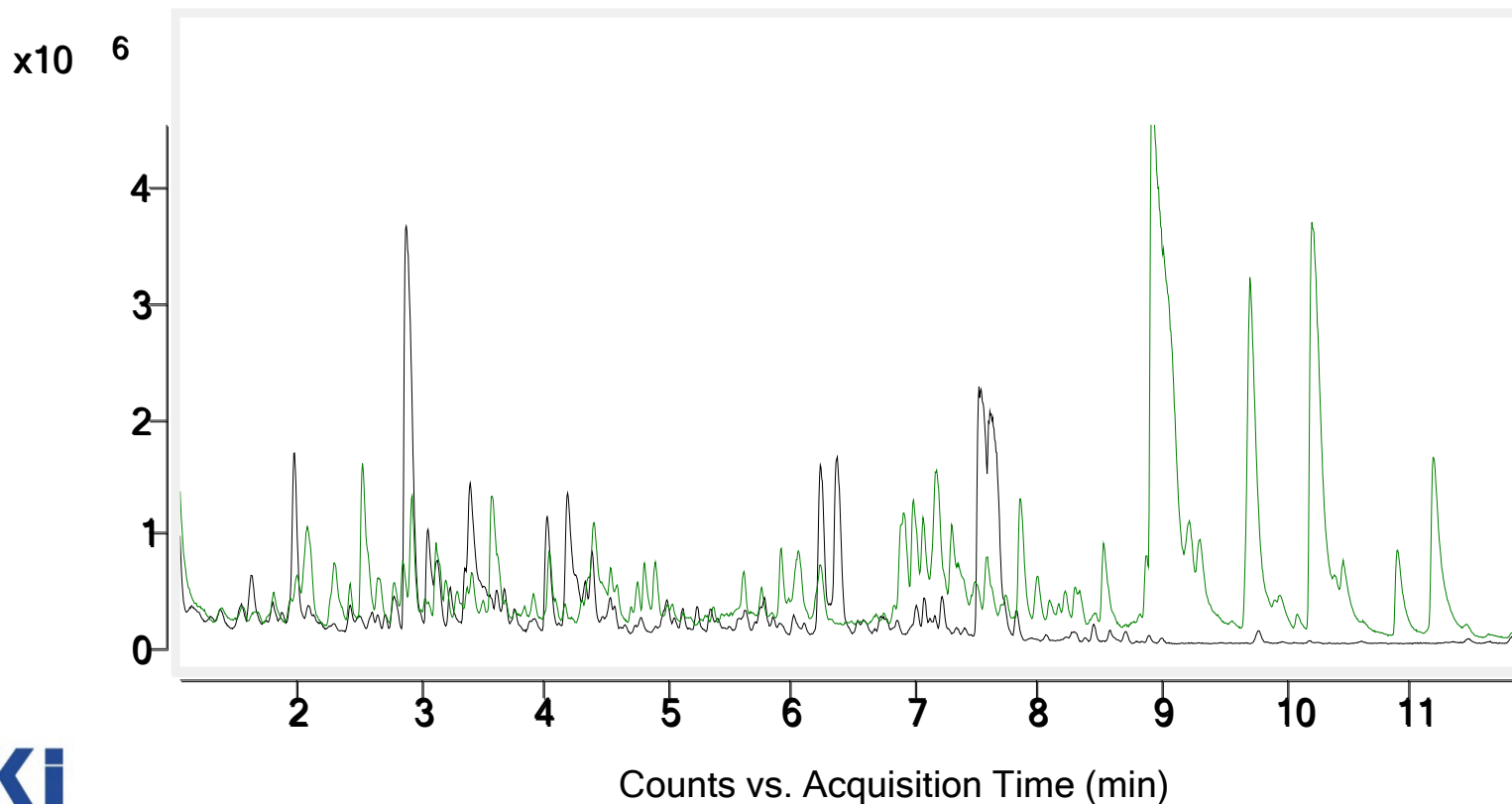
Projektträger



**FKZ 28A8706A-C19**

*S. tuberosum*

*S. bulbocastanum*



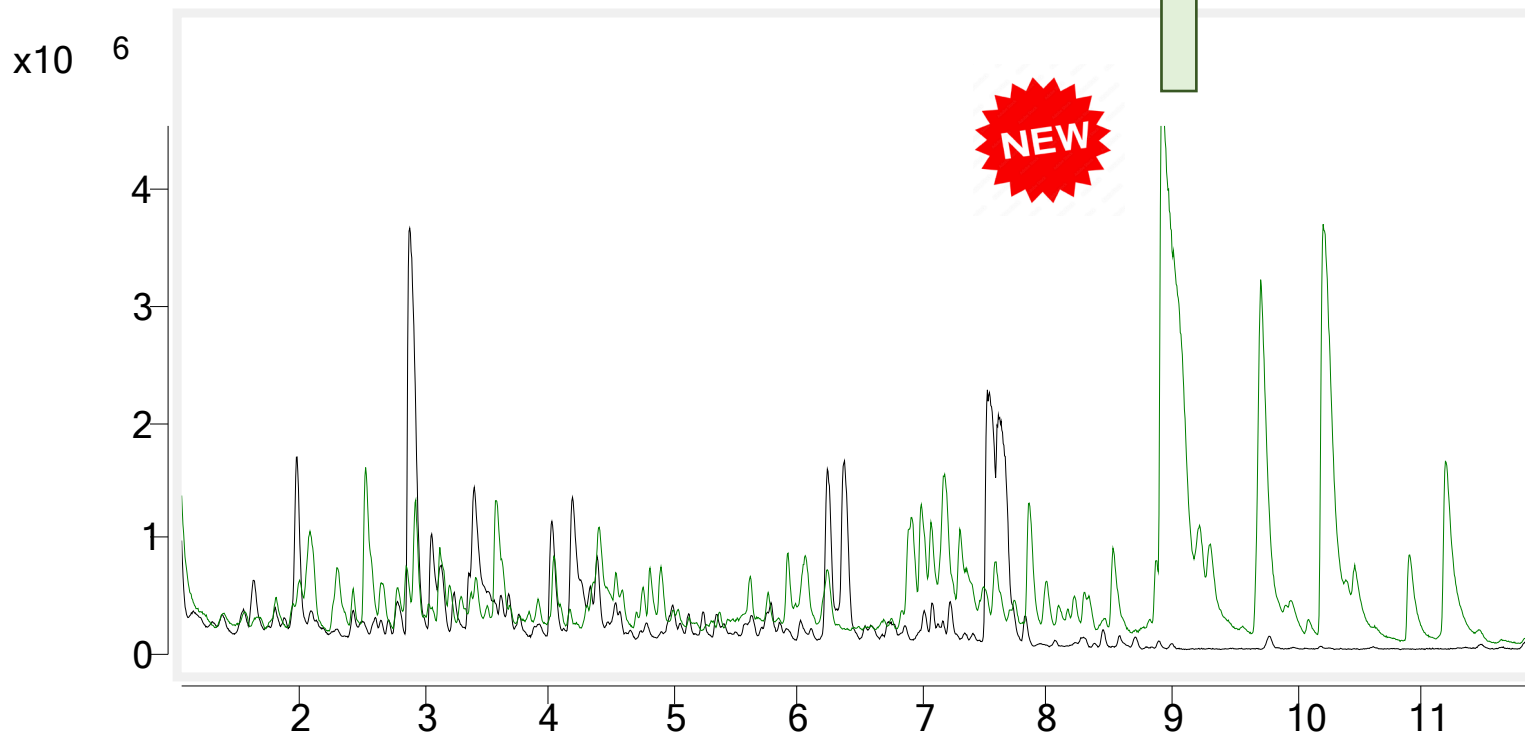
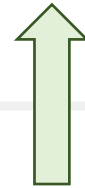
# Inner values also count: **inner leaf metabolites**

## Isolation of a bioactive metabolite from leaves of *Solanum bulbocastanum*

Biotests



Metabolite isolated, structure elucidated →  
**new compound, no reports available**



*S. tuberosum*

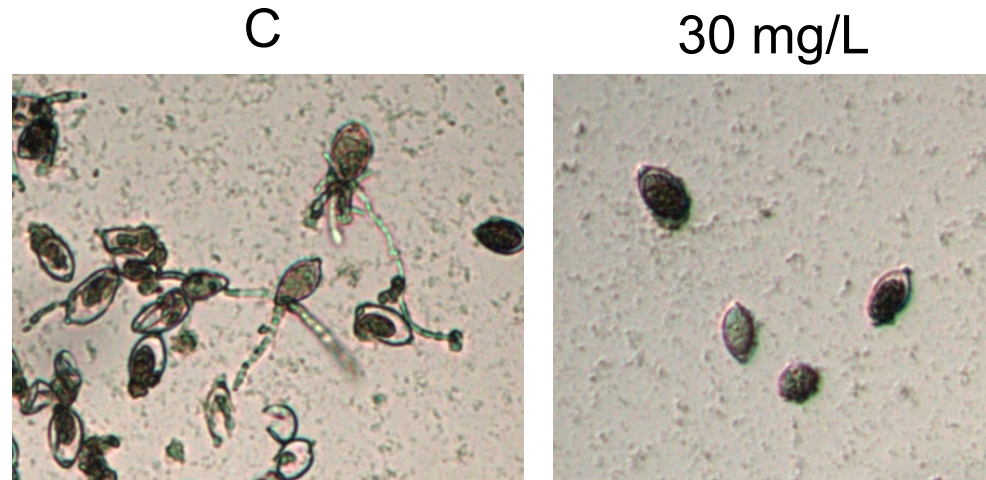
*S. bulbocastanum*



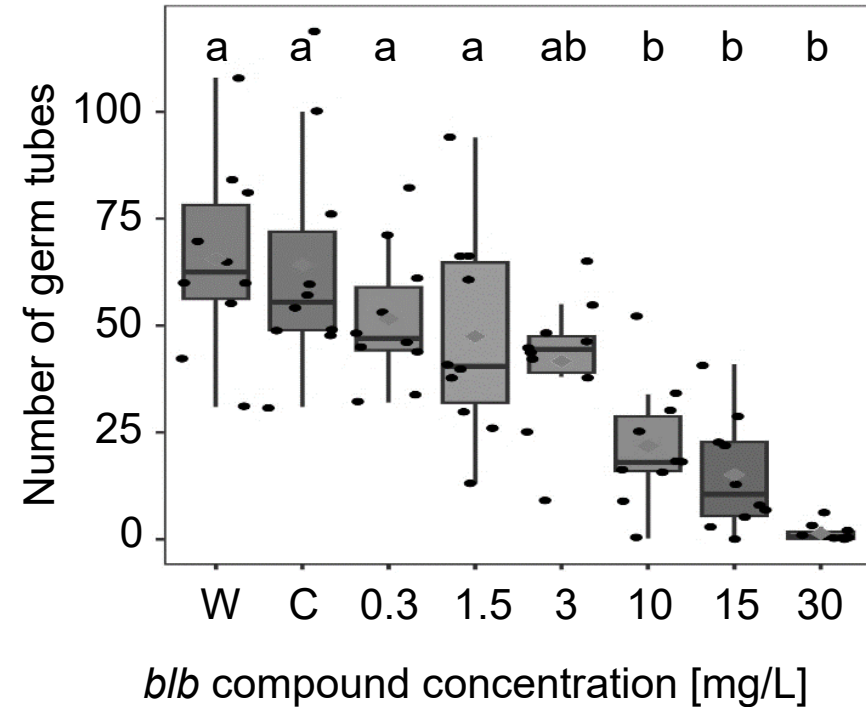


# A metabolite from *Solanum bulbocastanum* (*blb*) reduced sporangia germination of *Phytophthora infestans*

Gorzolka *et al.*, in preparation

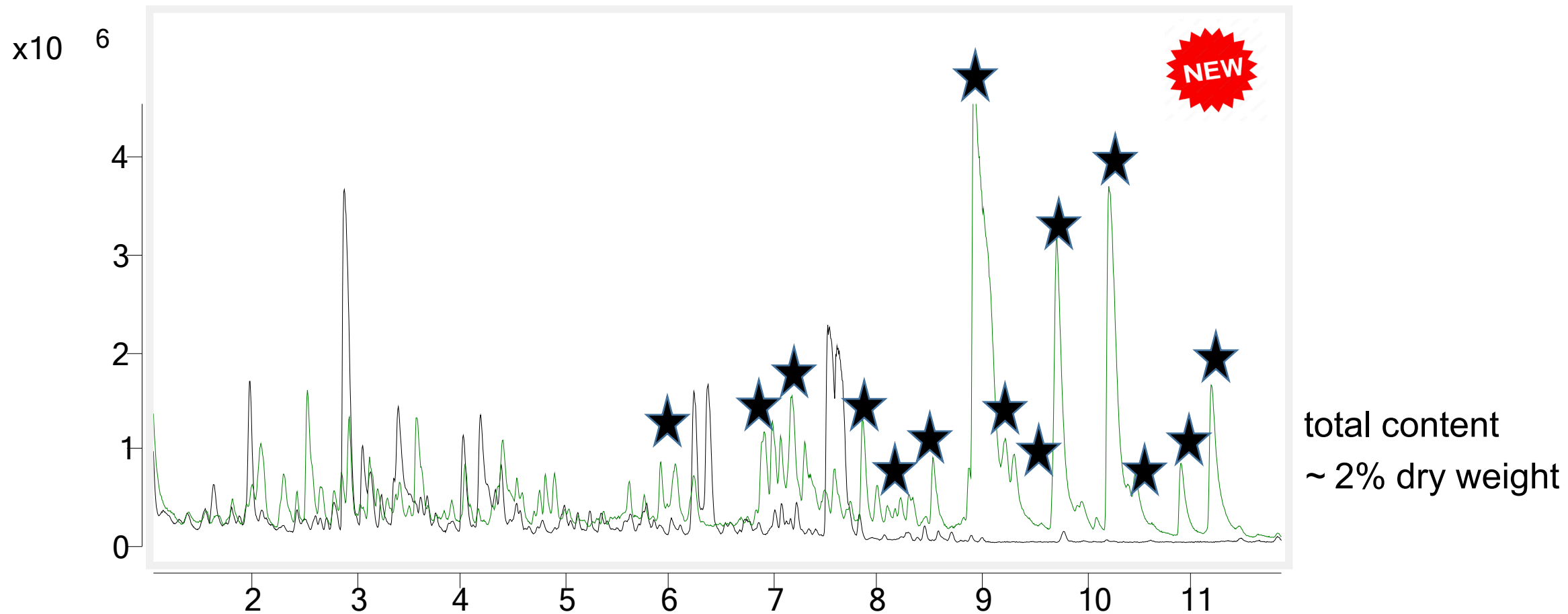


*Phytophthora infestans*  
spore germination



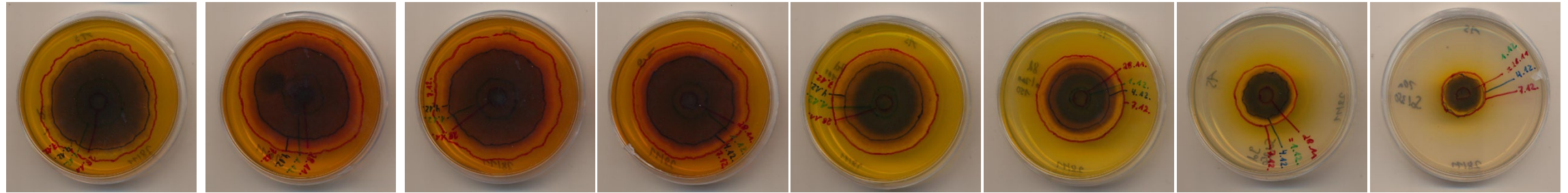
ANOVA, tukey's post hoc test  
 $p < 0.05$ ,  $n = 10$  (\*5 repetitions)

# Numerous derivatives of this compound were detected in *Solanum bulbocastanum* -> „Solamines“



Gorzolka *et al.*, in preparation

# A solamine mix from *Solanum bulbocastanum* (blb) reduced mycelial growth of *Alternaria solani* in Agar Dilution Assays



C

5

25

50

100

150

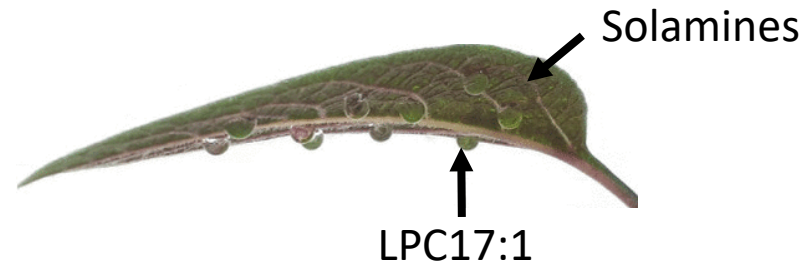
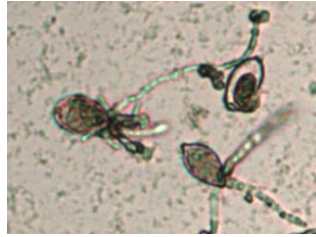
250

350

solamine mix [ppm]

*Alternaria solani* 774\_1  
(kindly provided by  
Hans Hausladen, TU munich)  
Radial growth in 9 days

# Summary



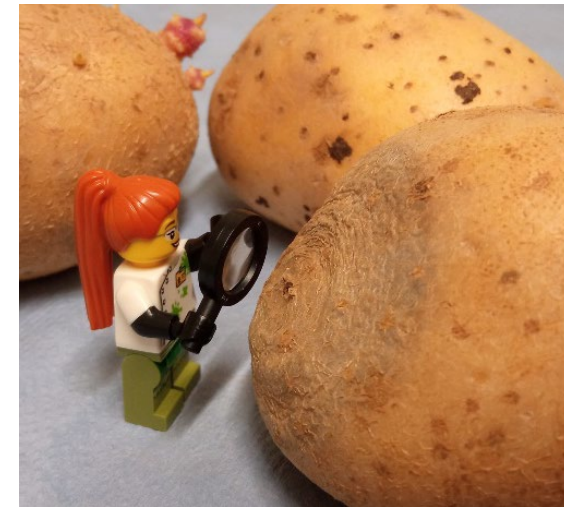
Different **resistance layers** of *Solanum bulbocastanum*

**Leaf surface metabolites:** LPC17:1 against *Phytophthora infestans*

**Inner leaf metabolites:** Solamines against *Phytophthora infestans*, *Alternaria solani*, *Fusarium* ssp., insect pests (CPB, Epitrix)

Future research:

- ❖ *Alternaria solani* conidia germination inhibition by solamines and leaf extracts
- ❖ Screening of *S. bulbocastanum*-BC1-population for *Alternaria solani* resistance and metabolite patterns
- ❖ More factors and metabolites -> interplay and boosting effects?



# Acknowledgements

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Roman Gäbelein (JKI-ZL)



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Bundesministerium  
für Ernährung  
und Landwirtschaft

Projektträger



Bundesanstalt für  
Landwirtschaft und Ernährung

aufgrund eines Beschlusses  
des Deutschen Bundestages

**FKZ 28A8706A-C19**

# Thank you for your attention!



I am happy about questions, suggestions and discussion!

or contact me:

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