



HAL
open science

Potential herbicidal metabolites from *Fusarium venenatum* against major parasitic weed branched broomrape *Phelipanche ramosa* (L.) Pomel

Ana Bendejacq-Seychelles, Christian Steinberg, Anaïs Corréard,, Carole Reibel, Jean-Chrisologue Totozafy, Gregory Mouille, Samuel Mondy, Stéphanie Gibot-Leclerc

► To cite this version:

Ana Bendejacq-Seychelles, Christian Steinberg, Anaïs Corréard,, Carole Reibel, Jean-Chrisologue Totozafy, et al.. Potential herbicidal metabolites from *Fusarium venenatum* against major parasitic weed branched broomrape *Phelipanche ramosa* (L.) Pomel. The 17th World Congress on Parasitic Plants, Jun 2024, Nara, Japan. . hal-04594724

HAL Id: hal-04594724

<https://hal.science/hal-04594724>

Submitted on 30 May 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Potential herbicidal metabolites from *Fusarium venenatum* against major parasitic weed branched broomrape *Phelipanche ramosa* (L.) Pomel

Ana BENDEJACQ-SEYCHELLES¹, Christian STEINBERG¹, Anaïs CORREARD¹, Carole REIBEL¹, Jean-Christophe TOTOZAFY², Grégory MOUILLE², Samuel MONDY¹, Stéphanie GIBOT LECLERC¹



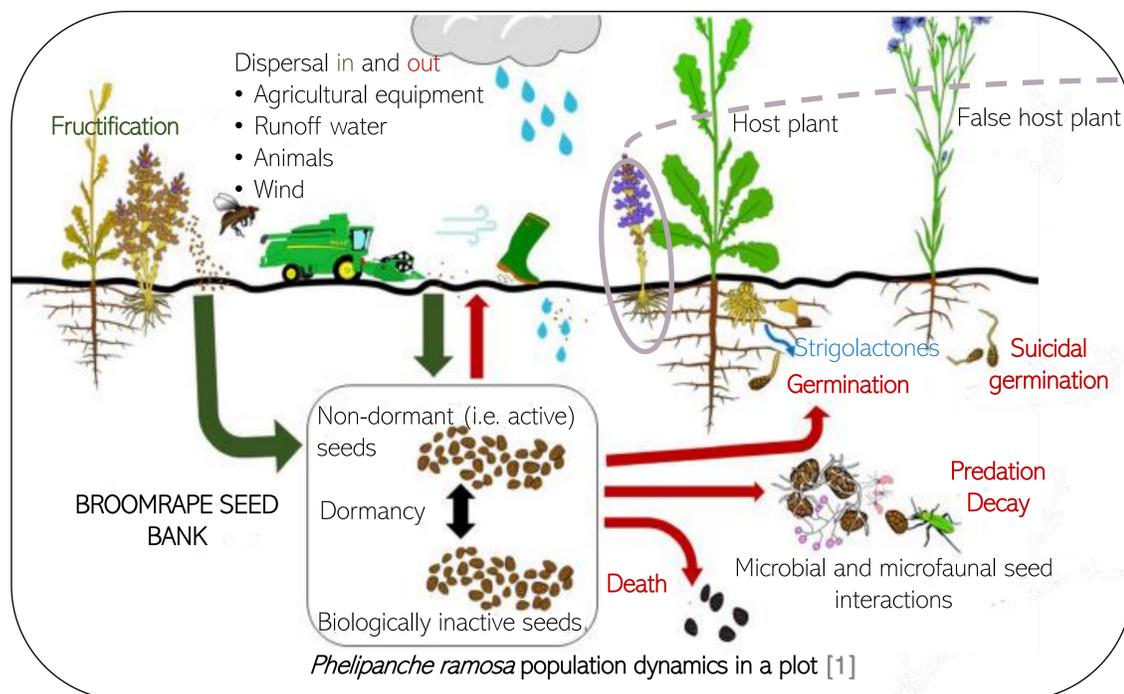
¹ Agroécologie, INRAE, Institut Agro, Univ. Bourgogne Franche-Comté, Dijon, France

² Institute Jean-Pierre Bourgin, INRAE, AgroParisTech, Univ. Paris Saclay, Versailles, France



CONTEXT and RESEARCH QUESTION

Branched broomrape (*Phelipanche ramosa* (L.) Pomel) a damaging parasitic weed that could be managed by fungal metabolites



Nationwide collection of symptomatic broomrapes and isolation of *Fusarium* sp. strains inhibiting seed germination and causing necrosis on stems [2]

Major role played by *Fusarium* sp. in the appearance of lethal necrotic symptoms [3]. Metabolites?

Fusarium venenatum = promising candidate for a biocontrol of branched broomrape [2]. How to identify *Fusarium venenatum* metabolites having a phytotoxic activity towards *Phelipanche ramosa*?

Material and Methods

Fusarium venenatum MIAE2836 suspension (10⁵ spores/mL)



Phelipanche ramosa mixed with glucose-free liquid minimum medium (0.1 g/mL)

Sampling in Erlen (20 mL) :

- Blank : LMM (x4)
 - Broomrape alone (x4)
 - Fungus alone (x4)
 - Interaction (x4)
- Shaker incubator (25°C, 125 rpm, 24h)



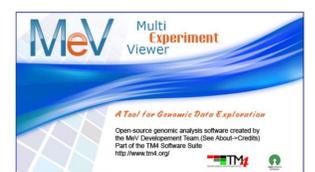
Untargeted metabolomics analysis by UHPLC/Q-ToF

MZmine 3

1. Data processing

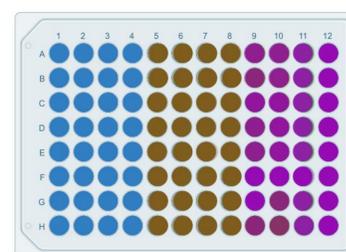
MetGem

2. Construction of molecular networks



3. Statistical analysis

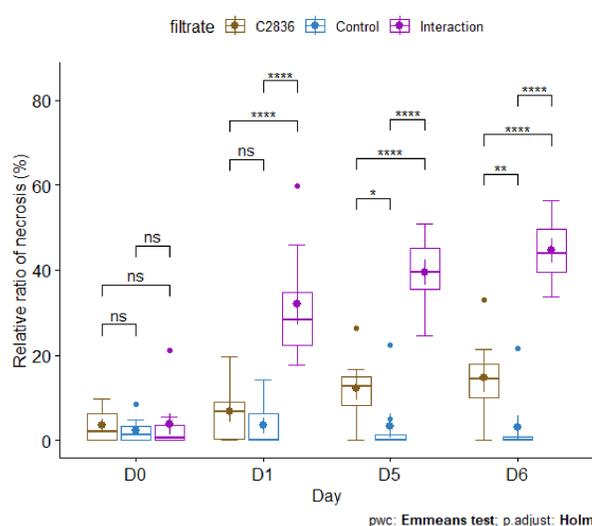
Phytotoxicity tests on microcalli and image analysis



- Negative control (100 µL of sterile distilled water)
- Fungus alone (filtrate/water (50/50 µL))
- Interaction (filtrate/water (50/50 µL))



Results and Discussion



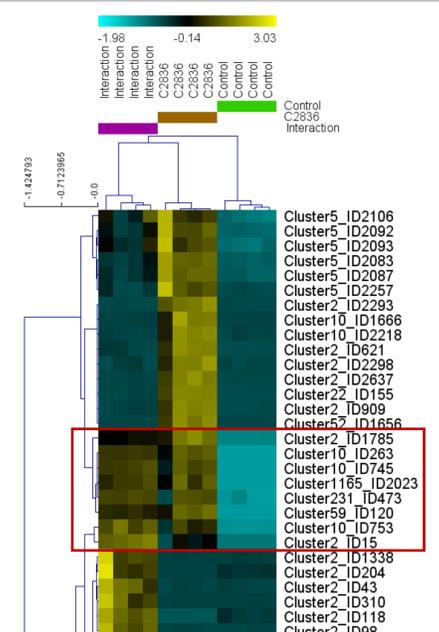
A phytotoxic activity of fungal filtrates towards microcalli highlighted

- Necrosis development as early as D1 with fungal filtrates
- Quantification by image analysis of necrosis due solely to fungal filtrates

Fusarium venenatum MIAE02836, a promising candidate to biocontrol *Phelipanche ramosa*

- Phytotoxic activity towards the early development stages of the plant
- Dual ability to inhibit germination and cause stem necrosis [2]
- Potential of the metabolites to reduce seed bank = a major issue to control *P. ramosa* [4]

Several fungal metabolites accumulated during the interaction: potential phytotoxic fungal metabolites? Several fungal metabolites known to be phytotoxic to weeds and parasitic weeds [4-5] -> need to characterize and identify molecules of interest



Conclusion and Perspectives

✓ Tests on microcalli, image analysis and untargeted metabolomic analysis confirmed the phytotoxic potential of *Fusarium venenatum* MIAE2836 towards the early development stages of *P. ramosa*.

Medium term goal: pursue to acquire knowledge on the pathogenic interaction by a multi-omic approach aiming at identifying the producing genes and the phytotoxic fungal metabolites

Bibliography :

- [1] Cartry *et al.* 2021. DOI: [10.1007/s13593-021-00669-0](https://doi.org/10.1007/s13593-021-00669-0)
 [2] Gibot-Leclerc *et al.* 2022. DOI: [10.1093/femsec/fiac024](https://doi.org/10.1093/femsec/fiac024)
 [3] Cartry. 2023. <https://www.theses.fr/s217673>
 [4] Evidente. 2023. DOI: [10.3390/microorganisms11040843](https://doi.org/10.3390/microorganisms11040843)
 [5] Bendejacq-Seychelles *et al.* 2023. DOI: [10.1002/ps.7813](https://doi.org/10.1002/ps.7813)

Acknowledgments: The authors would like to thank the "Santé des Plantes et Environnement" department of INRAE (grant "Appel à projet scientifique "innovation" IB 2021" to C.S. and S.G.L.), SELEOPRO (grant for young researchers to A.B.-S.) and the French Ministry of Agriculture and Food Sovereignty (grant "Formation complémentaire par la recherche" to A.B.-S.) for their financial support. This work benefits from the support of IJPB's Plant Observatory technological platforms.

