Biocontrol of the parasitic plant species Phelipanche ramosa, using rapeseed rhizosphere fungi or phytotoxic metabolites

Dïnia Cartry, Stéphanie Gibot-Leclerc, Eric Nguema-Ona, Eric Bernaud, Véronique Edel-Hermann, Nadine Gautheron, Carole Reibel, Christian Steinberg

Biocontrol of the parasitic plant species *Phelipanche ramosa*, using rapeseed rhizosphere fungi or phytotoxic metabolites

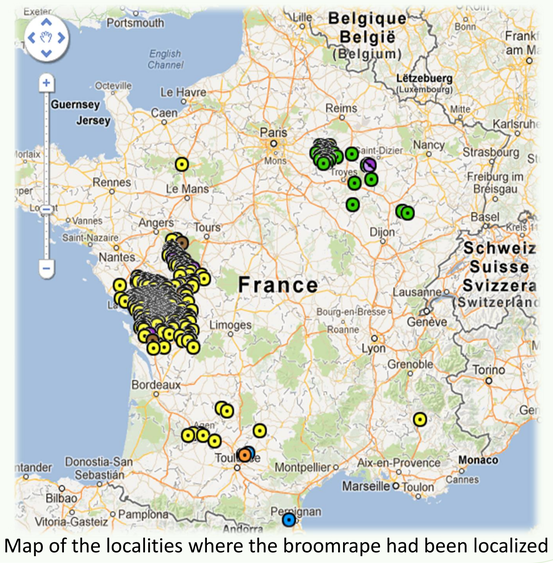
Dïnia Cartry [1], Stéphanie Gibot-Leclerc[2], Eric Nguema-Ona[3], Eric Bernaud[1], Véronique Edel-Hermann[1], Nadine Gautheron [1], Carole Reibel[2], Christian Steinberg [1]

[1] INRA, UMR 1347 Agroécologie, 21000 Dijon, France
[2]AgroSup Dijon, UMR 1347 Agroécologie, 21000 Dijon, France
[3] CMI Groupe Roullier, 35400 Saint Malo, France

Branched broomrape, *Phelipanche ramosa (L.)* Pomel

-> holoparasite whose germination is necessarily triggered by the host roots exudates
-> wide range of host species (Brassicaceae, Solanaceae, Fabaceae…)
-> 100 000 to 200 000 seeds per individual surviving 20 years in the soil
-> no effective conventional management strategy

Main objective: to develop a biological method, using different approaches, to control the broomrape during its underground stages in cultivated fields



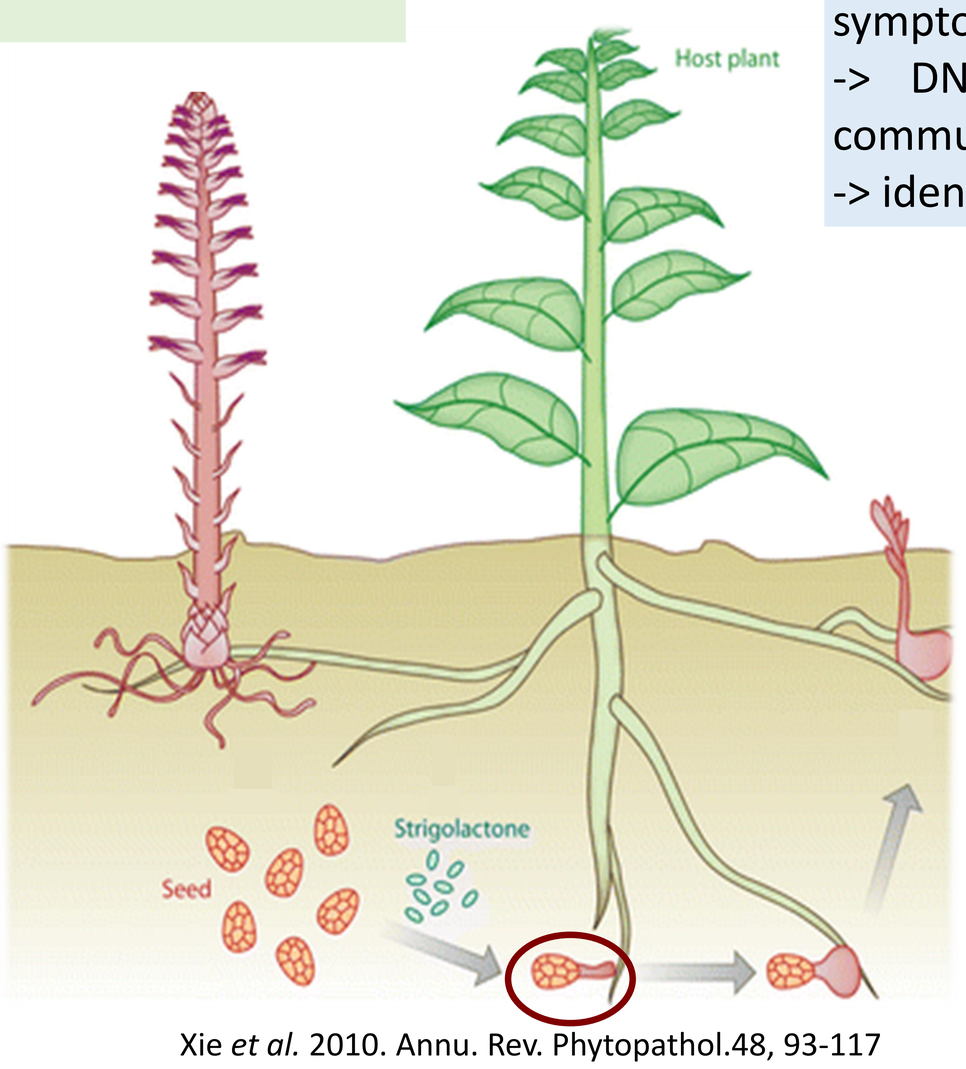
Map of the localities where the broomrape had been localized

Microbiology

Objective: to identify biocontrol candidates of broomrape

Method
-> harvest of symptomatic tissues (stems and seeds)
-> isolation and identification of fungal isolates on culture media
-> testing these strains on healthy tissues (stems and seed)


Gibot-Leclerc *et al.* 2012
Flora 207, 512–521

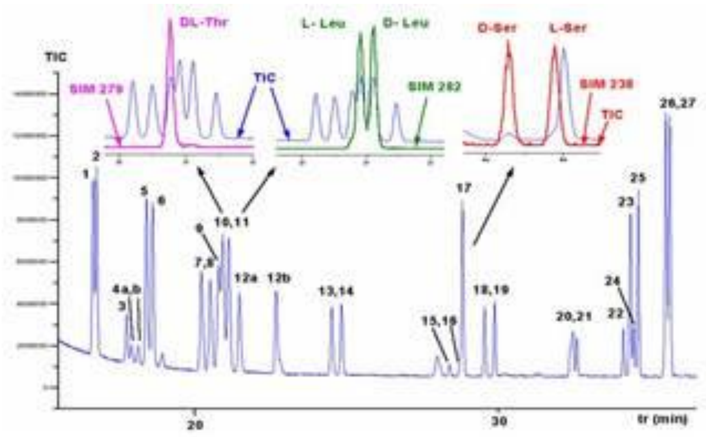


Xie *et al.* 2010. Annu. Rev. Phytopathol.48, 93-117

Metabarcoding

Objective: to characterize the diversity of fungal endophytes. To identify pathogenic fungi, and to decipher the origin of the endophytic communities (soil, plant…). To identify fungi which stimulate the plant defense reactions

Method
-> DNA extraction and amplification of fungi from symptomatic and asymptomatic stems and seeds
-> DNA sequencing of the different fungal communities
-> identification of fungal pathogens



Cytology

Objective: to describe pathogen penetration mechanisms in the seeds and stems of broomrape

Method
-> analysis of the penetration process (pathogenic fungi-seeds, pathogenic fungi-stems)
-> observation of the tri-partite interaction (pathogenic fungi, parasitic plant and host plant)


Gibot-Leclerc *et al.* 2012

Metabolomics

Objective: to identify metabolites that can be used as phytotoxic products in cultivated crops

Method
-> metabolites extraction of pathogenic candidates
-> phytotoxicity test of identified metabolites

- ❖ This project will emphasize interactions between three organisms (a host, a parasite and a pathogen) at both molecular, microscopic and macroscopic levels
- ❖ The global approach is required to understand and target the broomrape weakness in a biocontrol strategy
- ❖ Finally the outcome will be a potential biocontrol product for broomrape either as a fungal strain or a phytotoxic metabolites