Modelling cropping system effects on branched broomrape dynamics in interaction with weeds

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Branched broomrape (*Phelipanche ramosa* L.) is a parasitic plant that infects crop and weed species in more than 20 families (*Solanaceae, Brassicaceae*, *Asterasceae*…). It is a major pest of winter oilseed rape in France causing up to 90% of yield losses. No curative method is available, the control of the parasite can only be achieved by combining cropping techniques. Simulation models are useful tools to help to design such complex management strategies.

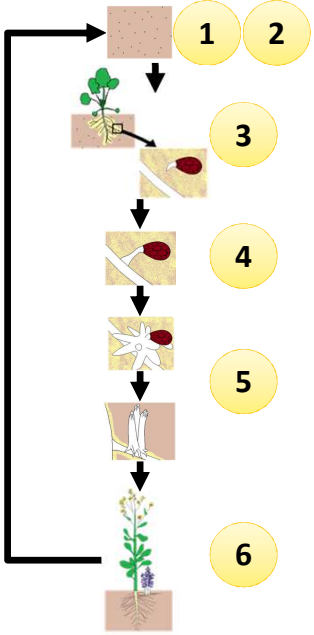
➔ **Aim:** To develop PHERASYS, a model of the effects of cropping systems on *P. ramosa* dynamics in interaction with weeds in order to test combinations of techniques by simulation and deduce efficient parasite management strategies.

Materials & Methods

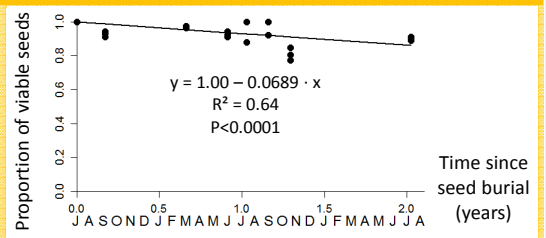
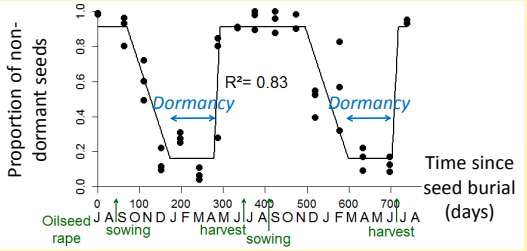
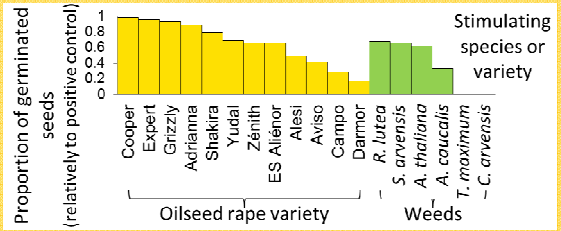
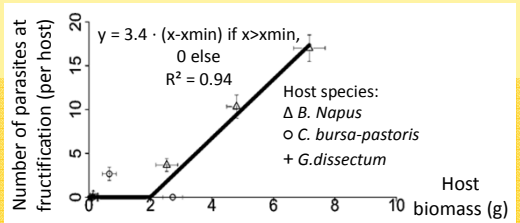
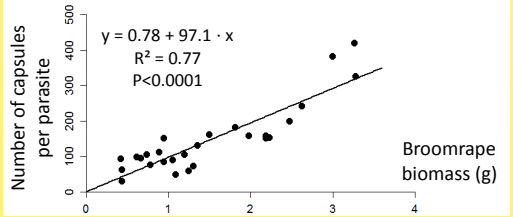
- Modelling of *P. ramosa* dynamics as a succession of processes of its life-cycle at a daily time-step
- Functions and parameters of the model based on literature and experiments[1,2,3]
- Connection to the FLORSYS model which simulates multiannual crop and weed host dynamics from cropping systems and pedoclimate[4]

Results

PHERASYS = model of *PHE*lipanche *RA*mosa dynamics in cropping SYStems in interaction with weeds



P. ramosa life cycle on oilseed rape

	Process	Modelled as a function of	Example on oilseed rape
1	**Seed mortality under field conditions**	• Time since seed rain	
2	**Seed dormancy**	• Season • Soil temperature and water potential	
3	**Germination stimulated by host root exudates**	• Stimulating species or variety • Host root volume (FLORSYS output) • Hydrothermal time since stimulation	
4	**Attachment on host root**	• Host root volume (FLORSYS output)	
5	**Survival on the host to fructification**	• Number of parasites attached on host plant • Host biomass (FLORSYS output)	
6	**Seed production and release**	• Parasite biomass • Number of capsules /total parasite biomass ratio • Number of seeds per capsule	

Discussion

- PHERASYS points to potential management improvements:
  - *P. ramosa* fresh seeds display dormancy during winter → delayed crop sowing could reduce infestation
  - Low annual seed mortality of buried seeds (7%) → burying seeds by tillage does not deplete seed bank
- Perspectives: simulate different rotations (ex: % of host crops, include catch and trap plants), tillage strategies (deep tillage vs. no till), sowing densities (minimizing parasite-host encounters)

References : [1]Gibot-Leclerc et al., (2012). *Flora* 207, 512-521.
[2]Moreau et al., (2016). *Frontiers in Plant Science* 7, 1033.
[3]Pointurier et al., (2016). 23e Conférence du COLUMA. AFPP, Dijon, France.
[4]Colbach et al., (2014). *European Journal of Agronomy* 53, 74-89.

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