

Agroécologie AGRO

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.



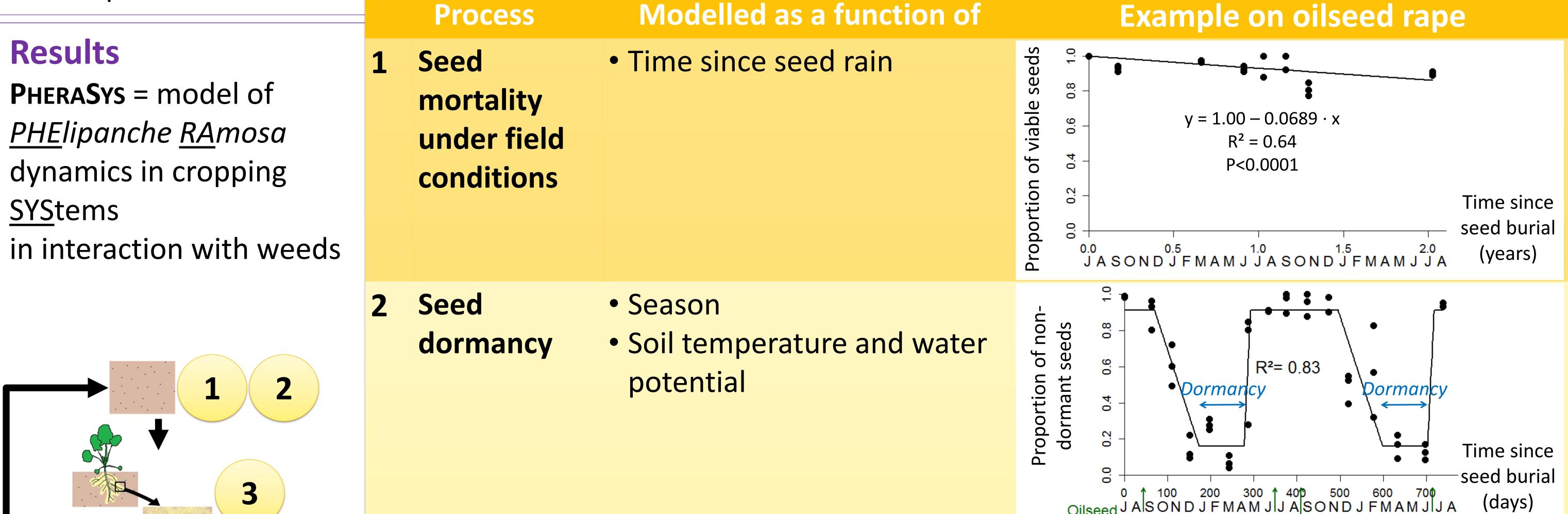
variety

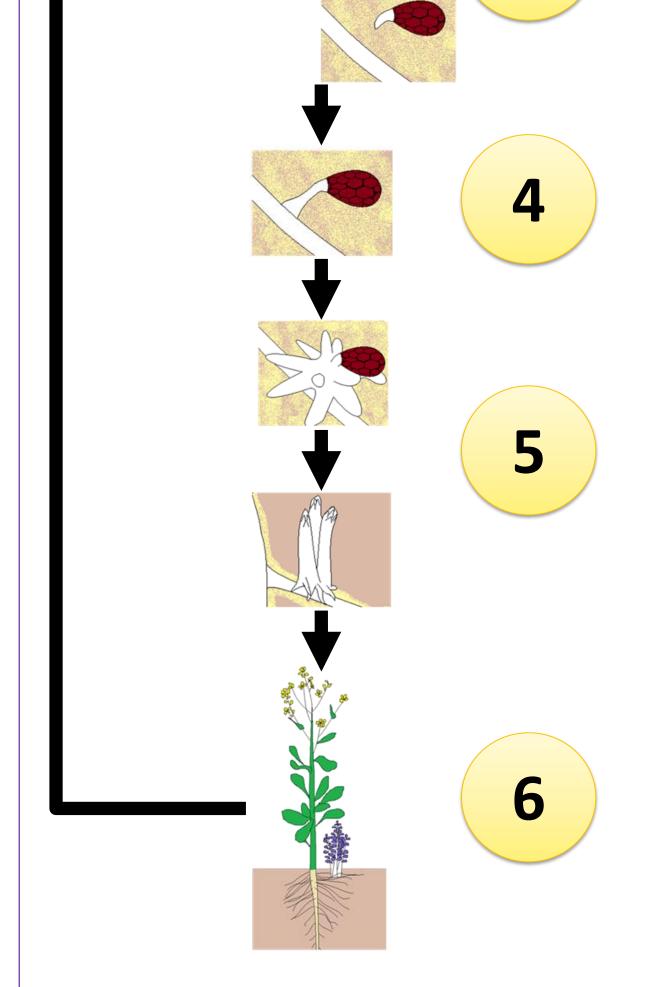
Host

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 pedoclimate⁴



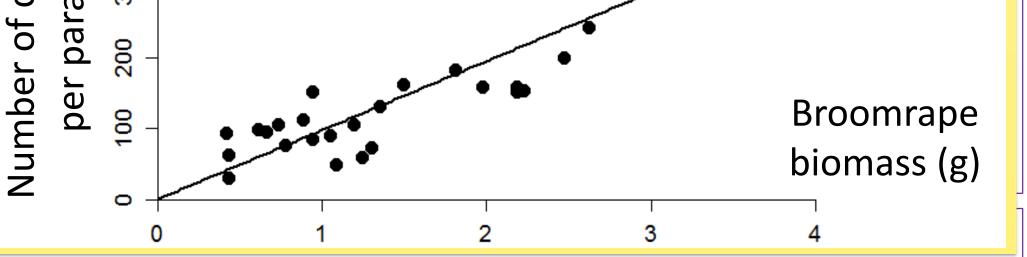


Oilseed J AlSON D J F M A M J J A SON D J F M A M J J A SON D J F M A M J J A SON D J F M A M J J A harvest harvest harvest ontrol) 8.0 9.0 of germinated **Germination** • Stimulating species or Stimulating species or stimulated variety 0.4 **by host root** • Host root volume relatively to positi eeds drianna Shakira Expert Grizzly Coopei Yuda Ales Zénith Aliénoi Aviso Campo exudates (FLORSYS output) Proportion • Hydrothermal time since stimulation Oilseed rape variety Weeds Host root volume Attachment 20 fructification (per host) Number of parasites at $y = 3.4 \cdot (x - xmin)$ if x > xmin, (FLORSYS output) on host root 0 else S $R^2 = 0.94$ Host species: Survival on Number of parasites 10 $\Delta B.$ Napus attached on host plant the host to • C. bursa-pastoris **က** -+ G.dissectum fructification • Host biomass ⊢⊕⊣ ¹⁰ biomass (g) (FLORSYS output) 500 • Parasite biomass Seed capsules $y = 0.78 + 97.1 \cdot x$ 8 • Number of capsules production $R^2 = 0.77$ asite P<0.0001

P. ramosa life cycle on oilseed rape

> /total parasite biomass ratio and release

> > • Number of seeds per capsule



Discussion

PHERASYS points to potential management improvements:

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- *P. ramosa* fresh seeds display dormancy during winter \rightarrow delayed crop sowing could reduce infestation
- Low annual seed mortality of buried seeds (7%) \rightarrow 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 : ¹Gibot-Leclerc et al., (2012). *Flora* 207, 512-521. ²Moreau et al., (2016). Frontiers in Plant Science 7, 1033. ³Pointurier et al., (2016). 23e Conférence du COLUMA. AFPP, Dijon, France. ⁴Colbach et al., (2014). European Journal of Agronomy 53, 74-89.

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