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Capitalizing knowledge on pests to support the design of pesticide-free systems

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The need for more knowledge on minor crops' pests

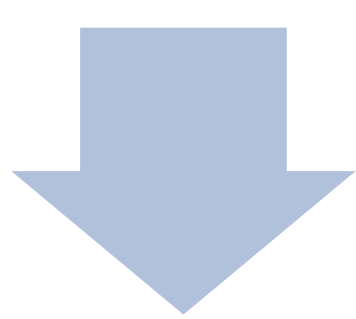
- To control pests without pesticide, innovative cropping systems should be designed, at different spatial scales
- To this aim, crop diversification is a major lever (Meynard et al., 2018)
- Yet, we face a lack of scientific and technical knowledge on minor crops, and on their pests, and practices to control them

Our OBJECTIVE

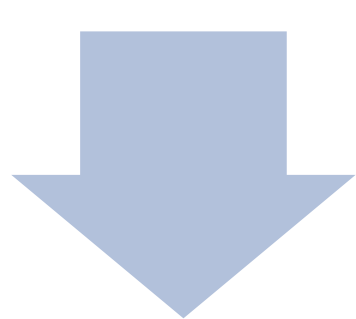
Was to develop a **knowledge-based tool** to gather knowledge on pests, and practices able to control them, in the view to support the design of pesticide-free systems

DEVELOPPING the TOOL showing links between functions acting on pests and practices

We first observed designers of low-pesticide systems, in design workshops, to identify the knowledge they used



Gathering all this information, we then developed generic knowledge-based tool to support exploration (generative knowledge structures, Brun et al., 2016)



We then built the tool on the example of legume pests with various contributors (students, researchers, ...)



- Extract of the knowledge-based tool on lentil bruchid (*Bruchus signaticornis*)



Pest life cycle stages	Functions	Sub-Functions	Farming practices
<ul style="list-style-type: none"> Weevil larva <p>The larvae enter the pod and feed on developing seeds. The larval stages last from 3 to 6 weeks, depending on climatic conditions.</p>	Limit larvae development	Introduce plant with natural resistance	Selecting varieties with thick pods to limit larvae entrance Choosing varieties with low thousand kernel weight (= small seeds) Selecting varieties producing tannins, vicilin, lecithin, or inhibitory molecules (<i>under test</i>)
		Promote larval parasitism	Developing a safe environment for auxiliaries within the fields or fields borders (e.g., no pesticide, flower strips) Promoting the emergence of new generation parasitoids after harvest (<i>under test</i>)
		Destroy the larvae	Harvest before the larvae emergence, at 70% humidity of the grains, and dry them for storage
<ul style="list-style-type: none"> Pupa

- Rules to build the tool:

- The tool describes the successive **pest life cycle stages**
- For each stage, **functions** that can impair the pest life cycle were defined. Sub functions were given when different strategies were possible to reach the function
- For each function, a range of possible **farming practices** was proposed
- We specify whether this knowledge is (i) stabilized (frequent) or hypothetical, and whether it arises (ii) from literature or from innovative farmers

Perspectives

- The tool is thought to be evolutive, being enriched by feedbacks from users in design situations (Cerf et al., 2012)
- Such knowledge-based tool should be included in the national GECO platform, to enhance a wide contribution and use (Guichard et al., 2017)
- Knowledge derived from on-farm innovation tracking could enrich such tool (Salembier et al., 2021)

>> Knowledge capitalization is a difficult and time-consuming activity, needing crafting, BUT is determinant to document and share scattered actionable knowledge, thus enhancing open innovation for agroecological transition

What research to meet the pesticides reduction objectives embedded in the European Green Deal?

Dijon-France, 2nd June 2022