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To cite this version:

David Camilo Corrales, Marie-Hélène Robin, Bruno Jaloux, Cécile Le Lann, Anne Le Ralec, et al.. Towards the prediction of levels of infestation of Acyrthosyphon pisum in pea-wheat mixtures. European Conference on Crop Diversification., Sep 2019, Budapest, Hungary. hal-02484883

HAL Id: hal-02484883
https://institut-agro-rennes-angers.hal.science/hal-02484883

Submitted on 19 Feb 2020

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Towards the prediction of levels of infestation of *Acyrthosyphon pismum* in pea-wheat mixtures

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European Conference on Crop Diversification. 18-21 September 2019, Budapest, Hungary

Introduction

*Acyrthosyphon pismum* commonly known as pea aphid reaches densities in some places high enough to become a significant economic problem. Considering the growing interest in species mixtures, especially for their role in pest control, we designed a tool to predict pest injuries in pea-wheat mixtures. Using the qualitative modelling framework Injury Profile SIMulator (IPSIM), we built a model to predict *A. pismum* final infestation in pea-wheat mixtures.

IPSIM method

The development of IPSIM-Pea/Wheat-Aphids followed 4 steps:

1. Identification and organisation of attributes
2. Definition of qualitative values for each attribute
3. Creation of aggregative tables

![Hierarchical structure](image)

- Scientific Literature
  - FA: Final Attribute
  - AA: Aggregated Attribute
  - IA: Input Attribute
- Attributes
  - Nominal and quantitative input data
  - Ordinal input data
  - IPSIM model

Example of aggregative table. $A_A = f(A_B, A_C)$

4. Assessment of predictive quality

Preliminary results

Hierarchical structure is presented in Figure 1. We identified 17 attributes, 11 input attributes, and 6 aggregated attributes, including the final attribute (*Acyrthosyphon pismum* level of infestation).

Qualitative scales were defined for the basic and aggregated attributes. For instance, the “Temperature” attribute was described using a two-value scale: favourable or unfavourable to aphid development.

![Confusion matrix](image)

Discussion

It is now the phase to assess the predictive quality of the model. This evaluation consists in comparing observed and simulated classes of aphid infestation severity using an independent dataset covering a wide range of production situations. In addition, to run IPSIM-Pea/Wheat-Aphids, it is necessary to design a converter that can transform nominal input variables, or quantitative input variables into ordinal variables. Currently, we are building a dataset from field experiments in order to evaluate the model.

Acknowledgments: we are grateful to the European project ReMiX “Redesigning European cropping systems based on species MIXtures” for the technical and scientific support. This project has received funding from the European Union’s Horizon 2020 Program for Research & Innovation under grant agreement n°727217.