



## **Spatio-temporal modelling for preventing cereal aphids' outbreaks at France scale**

Mamadou CISS <sup>(1)</sup>, Nicolas PARISEY <sup>(2)</sup>, Charles-Antoine DEDRYVER <sup>(3)</sup>, Jean-Sébastien PIERRE <sup>(4)</sup>

<sup>(1)</sup> *Arvalis-Institut-du-Végétal, Service Génétique, Physiologie et Protection des Plantes (SG3P), F-91720 Boigneville, France – mamadou.ciss@rennes.inra.fr*

<sup>(2)</sup> *INRA UMR 1349 IGEPP F-35653 Le Rheu Cedex, France – nparisey@rennes.inra.fr*

<sup>(3)</sup> *INRA UMR 1349 IGEPP F-35653 Le Rheu Cedex, France – charles-antoine.dedryver@rennes.inra.fr*

<sup>(4)</sup> *Université Rennes 1, CNRS UMR 6553 ECOBIO, campus de Beaulieu, avenue du Général Leclerc, F-35042 Rennes Cedex, France – jean-sebastien.pierre@univ-rennes1.fr*

### **Abstract**

The wheat aphid *Sitobion avenae* is a major agricultural pest in Europe. It causes many damages by direct feeding and can reduce yield up to several tons per hectare, in case of large outbreaks. Their overgrowths are hard to predict due to aphid heterogeneous distribution at the landscape scale over time. In the context of ECOPHYTO 2018, French national program for halving use of pesticide at 2018, it is important to design a spatially explicit Decision Support System (DSS) for preventing cereal aphids' outbreaks in order to help farmers in an optimal pesticide use.

In France, *S. avenae*'s migration can be represented as a wave from south-west to north-east which is linked to mean winter and spring temperatures influencing wheat and aphid development. In order to represent this phenomenon, we developed a two-dimensional convection–diffusion–reaction system, including parameterization and coupling to a Geographical Information Systems (GIS).

The simulation results show both spatial and temporal infestation's shape, by considering biotic (action of aphid's natural enemies, growth stage of the wheat,...) and abiotic (temperature, wind speed and direction,...) factors in the landscape, which will give farmers useful informations as where and when to spray their crops.