Development and validation of a mechanistic model accounting for the effect of soil moisture, weather and host growth stage on the development of *Sclerotinia sclerotiorum*.

Irene Salotti[1], Vittorio Rossi[1]

[1] Department of Sustainable Crop Production (DIPROVES), Università Cattolica del Sacro Cuore, via Emilia Parmense, 84, 29122, Piacenza, Italy.
E-mail: irene.salotti1@unicatt.it; vittorio.rossi@unicatt.it

Introduction

Sclerotinia sclerotiorum (Lib) de Bary is a ubiquitous pathogen that causes disease on > 500 host plants distributed worldwide. The control of these diseases is difficult because of the long-term persistence of sclerotia in the soil, which represent the primary inoculum and produce air-borne ascospores able to infect host plants. Combination of cultural practices and applications of biocontrol agents for reducing the number of sclerotia in soil, and fungicide sprays against ascosporic infections are the main disease management options. Mathematical models provide a better understanding of the environmental conditions that are conducive to production of apothecia and infection by ascospores and may improve the timing of fungicide applications so reducing the unnecessary sprays.

Model description

By using the systems analysis, we developed a new mechanistic, dynamic, weather-driven model for the prediction of *S. sclerotiorum* epidemics on different crops by mobilizing the available knowledge retrieved through a systematic literature review. The model accounts for i) the production and survival of apothecia; ii) the production, dispersal, and survival of ascospores; iii) infection by ascospores; and iv) lesion onset.

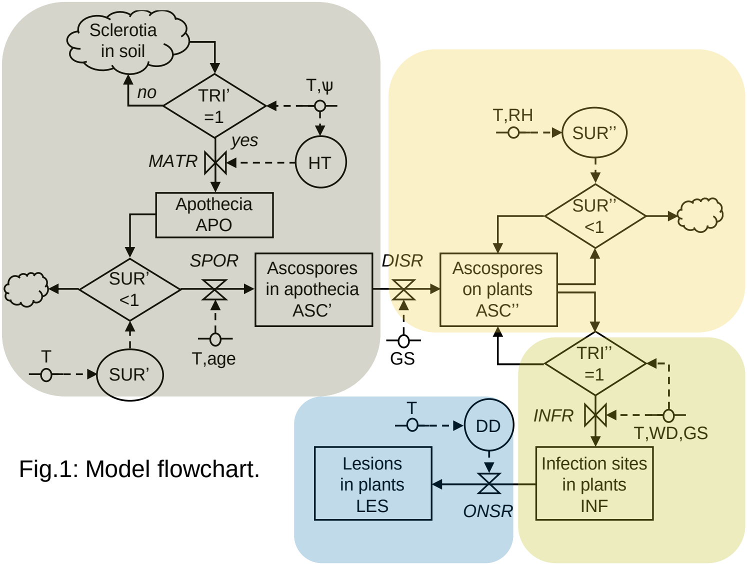

Fig.1: Model flowchart.

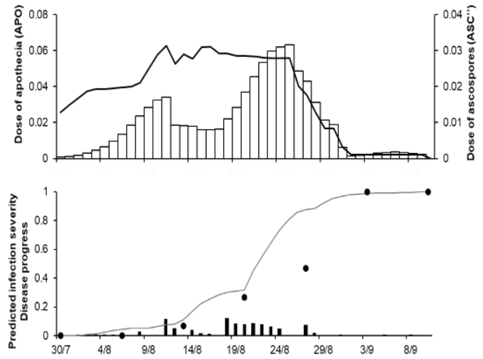

Fig.2: Model outputs for Manitoba (CA) in 2002, on sunflower.

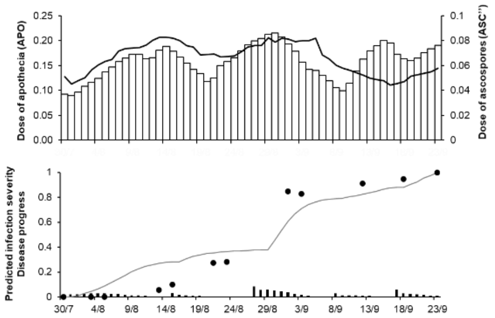

Fig.3: Model outputs for Michigan (USA) in 2015, on soybean.

Model performances

The ability of the model to predict the occurrence of apothecia and the progress of the disease was evaluated for epidemics with different climates, soil types, and host crops (soybean, white bean, and carrot) using independent data obtained from trials conducted in Ontario (CA), Manitoba (CA), Michigan (USA), and in Wisconsin (USA).

The model showed 0.82 accuracy and 0.73 specificity in predicting the presence of apothecia, with a posterior probability of correctly predicting the presence or absence of apothecia of 0.804 and 0.876, respectively.

Comparison of model output with real observations showed a concordance correlation coefficient of 0.948, and a root mean square error of 0.122.

Overall, the model provided an accurate and robust representation of the real system, and could support decision making for disease control.

This research was financially supported by the LIFE AGRESTIC project. The LIFE AGRESTIC project has received funding from the LIFE Programme of the European Union (grant agreement LIFE17 CCM/IT/000062)