Ideotype construction from an architectural model of pea

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There is an increasing need for growing legume species in Europe in order to reduce dependency on imported vegetable proteins. Currently, pea (*Pisum sativum*) is the principle source of vegetable proteins. However, the productivity rate of pea crop is still under its potential mainly due to fungal foliar diseases. The most damaging ones are caused by *Ascochyta pisi, Mycosphaerella pinodes and Phoma medicaginis*.

Dynamics of such diseases have been shown to depend on plant architecture *e.g.* Leaf Area Index (LAI), plant height, internode length (Le May *et al.*, 2009). Virtual models of canopy architecture therefore appear as suitable tools for studying and modelling plant–pathogen interactions and diseases dispersal.

We have developed a 3D architectural model of pea growth based on the L-system formalism and developed on the L-Py platform (Boudon *et al.*, 2010). Initial parameters were based on data from a field-grown crop of winter pea *cv* Lucy. The above ground architecture is represented as a succession of phytomers emitted by main stems and branches. Phytomers are considered as a collection of organs encoded as modules that support their state *i.e.* age, length, topology and geometry. The rate of phytomer emission was set for main stems and branches. The number of branches and their time of emergence are attributes of each node of stems.

Coupled with epidemiologic models, this simulator can be used as a conceptual framework for studying the effects of pea architectural parameters on disease development and dispersal. Indeed, the present model is able to build contrasted canopies of ideotypes with regard to LAI and its spatial distribution (plant density, phytomer number, branching ability, axis orientation, leaf growth), plant height (internode growth), foliage orientation (leaf geometry) and dynamics of growth (rate of phytomers and branch emission, organ growth kinetics).

Moreover, the formalism chosen in the present study also allows to assess the benefits of intercropping systems, comprising pea-wheat mixtures, towards disease pressure such as the wheat/*Septoria tritici* pathosystem (Robert *et al.*, 2008).

References

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