Modelling of spatial diffusion of soil-borne infections

Roumen Anguelov[1], Rebecca Bekker[1], Yves Dumont[2]
Department of Mathematics and Applied Mathematics, University of Pretoria
South Africa
Umr Amap, CIRAD, Montpellier, France
roumen.anguelov@up.ac.za, rebeccaabekker@gmail.com, yves.dumont@cirad.fr

Gilligan [1] proposed an SEIR compartmental model with linear diffusion of the infectives to model the propagation of the infection. It turns out that the model admits a travelling wave solution which suggests a way in which the plant population could possibly be affected. Murray's rabies model is mentioned as the inspiration for the inclusion of diffusion on the infected plants [2].

In this talk we investigate the effect of spatial spread of root infection has on the dynamics of a disease. We consider linear diffusion as in Murray's rabies model, but also nonlinear diffusion as in porous medium. In both models we investigate numerically the existence of travelling wave solutions and their properties.

Although, some of the properties of the SEIR models correspond to practically observed phenomena, e.g. wave-like spread of infection, there are many aspects of the these models that are difficult to interpret biologically, e.g. roots do not really diffuse. We propose here a new host-pathogen model where the diffusing agent is the unattached pathogen. We show that the disease free equilibrium is always asymptotically stable and it may co-exist with an endemic spatially homogenous stable equilibrium. We investigate the possibility for creating a barrier by reducing the diffusibility of the unattached pathogen.

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References

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