Spatially mixed crops to control the stratified dispersal of airborne fungal diseases

Titre	Spatially mixed crops to control the stratified dispersal of airborne fungal diseases
Type de publication	Article de revue
Auteur	Sapoukhina, Natalia [1], Tyutyunov, Yuri [2], Sache, Ivan [3], Arditi, Roger [4]
Editeur	Elsevier
Type	Article scientifique dans une revue à comité de lecture
Année	2010
Langue	Anglais
Date	2010/11/24
Numéro	23
Pagination	2793 - 2800
Volume	221
Titre de la revue	Ecological Modelling
ISSN	0304-3800
Mots-clés	Diffusion model [5], Fungal disease epidemiology [6], Invasion [7], Long-distance dispersal [8], Resistance management [9]

Résumé en anglais	Intraspecific crop diversification is thought to be a possible solution to the disease susceptibility of monocultured crops. We modelled the stratified dispersal of an airborne pathogen population in order to identify the spatial patterns of cultivar mixtures that could slow epidemic spread driven by dual dispersal mechanisms acting over both short and long distances. We developed a model to simulate the propagation of a fungal disease in a 2D field, including a reaction-diffusion model for short-distance disease dispersal, and a stochastic model for long-distance dispersal. The model was fitted to data for the spatio-temporal spread of faba bean rust (caused by Uromyces viciae-fabae) through a discontinuous field. The model was used to compare the effectiveness of eight different planting patterns of cultivar mixtures against a disease spread by short-distance and stratified dispersal. Our combined modelling approach provides a reasonably good fit with the observed data for the spread of faba bean rust. Similar predictive power could be expected for the management of resource-mediated invasions by other airborne fungi. If a disease spreads by short-distance dispersal, random mixtures can be used to slow the epidemic spread, since their spatial irregularity creates a natural barrier to the progression of a smooth epidemic wave. In the context of stratified dispersal, heterogeneous patterns should be used that include a minimum distance between susceptible units, which decreases the probability of infection by long-distance spore dispersal. We provide a simple framework for modelling the stratified dispersal of disease in a diversified crop. The model suggests that the spatial arrangement of components in cultivar mixtures has to accord with the dispersal characteristics of the pathogen in order to increase the efficiency of diversification strategies in agro-ecosystems and forestry. It can be applied in low input agriculture to manage pathogen invasion by intercropping and cultivar mixtures, and to design sustainable systems of land use.
URL de la notice	http://okina.univ-angers.fr/publications/ua7717 [10]
DOI	10.1016/j.ecolmodel.2010.08.020 [11]
Lien vers le document	http://dx.doi.org/10.1016/j.ecolmodel.2010.08.020 [11]

Liens

[1] http://okina.univ-angers.fr/n.sapoukhina/publications
[2] http://okina.univ-angers.fr/publications?f[author]=11802
[3] http://okina.univ-angers.fr/publications?f[author]=11803
[4] http://okina.univ-angers.fr/publications?f[author]=11804
[5] http://okina.univ-angers.fr/publications?f[keyword]=11816
[6] http://okina.univ-angers.fr/publications?f[keyword]=11817
[7] http://okina.univ-angers.fr/publications?f[keyword]=11818
[8] http://okina.univ-angers.fr/publications?f[keyword]=11819
[9] http://okina.univ-angers.fr/publications?f[keyword]=11820
[10] http://okina.univ-angers.fr/publications/ua7717
[11] http://dx.doi.org/10.1016/j.ecolmodel.2010.08.020