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Host Diversification May Split Epidemic Spread into Two Successive Fronts Advancing at Different Speeds

Host diversification methods such as within-field mixtures (or field mosaics, depending on the spatial scale considered) are promising methods for agroecological plant disease control. We explore disease spread in host mixtures (or field mosaics) composed of two host genotypes (susceptible and resistant). The pathogen population is composed of two genotypes (wild-type and resistance-breaking). We show that for intermediate fractions of resistant hosts, the spatial spread of the disease may be split into two successive fronts. The first front is led by the wild-type pathogen and the disease spreads faster, but at a lower prevalence, than in a resistant pure stand (or landscape). The second front is led by the resistance-breaking type, which spreads slower than in a pure resistant stand (or landscape). The wild-type and the resistance-breaking genotypes coexist behind the invasion fronts, resulting in the same prevalence as in a resistant pure stand. This study shows that host diversification methods may have a twofold effect on pathogen spread compared to a resistant pure stand (or landscape): on the one hand, they accelerate disease spread, and on the other hand they slow down the spread of the resistance-breaking genotype. This work contributes to a better understanding of the multiple effects underlying the performance of host diversification methods in agroecology. This is joint work with Y. Mammeri, Y. Aigu, S. E. Strelkov, and M. A. Lewis.