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Evolutionary insights from semi-discrete plant epidemic models.

The coexistence of closely related plant parasitic species is ubiquitous in agriculture. However, understanding the ecological determinants of evolutionary divergence in parasites still represents an issue, in both evolutionary biology and agricultural sciences. To our knowledge, the only ecological mechanism which has been generically shown to promote phenotypic divergence in plant parasitic species is spatial host heterogeneity. However, spaceis not the only source of ecological heterogeneity. Interestingly, crop plant parasites face abrupt, periodic changes in host density due to planting and harvesting. In this paper, we investigate whether such heterogeneity in time can promote evolutionary divergence as well. We make use of an epidemic model that combines continuous and discrete dynamics, to capture sharp seasonal events. Performing an evolutionary invasion analysis, we show that evolutionary branching of the parasite phenotype can occur, assuming there is a trade-off between intra- and inter-season transmission abilities. Since there are experimental evidence for such a trade-off, this study provides further ecological bases for the coexistence of closely related plant parasite species. Moreover, this study provides original insights regarding the coexistence of mono- and poly-cyclic sibling plant pathogens.