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From elaborate to compact seasonal plant epidemic models

Seasonality, or periodic host absence, is a central feature in Plant Epidemiology. In this respect, seasonal plant epidemic models take into account the way the parasite overwinters and generate new infections. The former are termed primary infections while the latter are secondary infections. In the literature, one finds two classes of models: *elaborate* models, where primary infection dynamics are explicit [1, 2], and lower-dimensional, *compact*, models, where primary infection dynamics are implicit [3, 4]. The way compact models may derive from elaborate models has not been made explicit yet.

In this contribution, we show that approximating primary infection dynamics as a fast process compared to secondary infections in two elaborate models translate into two compact forms. Yet, these are less linear than the compact models usually found in the literature. It is only in some particular instances that we find back the latter models. In particular, we show that density dependence in primary infection dynamics has a profound influence on the compact form. Although both models seems to produce fairly similar dynamics, we highlight that there is a structural difference between the two with respect to the co-existence, or competitive exclusion, of different parasite strains.

References

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