

**Non-linear mixed models for disease incidence and severity:
Modeling plant diseases in tropical crops**

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Progress curves are used in plant disease epidemiology to describe temporal changes in the proportion of diseased plants (disease incidence) or in the proportion of diseased plant material (disease severity). Models typically used are intrinsically nonlinear and the observations are taken longitudinally on the same unit (for example, the plant or the plot). Data are binary, proportions based on an integer denominator, or real numbers in $(0, 1)$. Non-linear mixed models can accommodate all these features, since they implicitly incorporate correlation between longitudinal observations, and can be applied with different distributions. Since the full likelihood is specified, likelihood based inference can be applied and both unit specific and marginal inference are available. In this paper we fit non-linear mixed models to describe disease incidence progress curves of papaya ring spot virus in papaya and disease severity of black Sigatoka (caused by the fungus *Mycosphaerella fijiensis*) in banana. We compare the results of fitting nonlinear mixed models, discuss alternatives to conduct marginal inference to estimate percentile curves of interest, and interpret the results in the analyzed examples.

Keywords: binary data, logistic-normal, marginal models, subject specific models.