Influence of host intraspecific competition on the dynamics of host-parasitoid systems

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Since long time ago, one of the basic tenets of ecology is that intraspecific competition is an essential component of population's regulation. However, whilst the influence of intraspecific competition on single population dynamics has been widely studied, this is not the case for interacting populations, in particular for host-parasitoid models. In most of these models, the host intraspecific competition is rigidly represented when not totally neglected. In order to investigate the contribution of this intraspecific competition on host-parasitoid dynamics, we have developed a model expressed in terms of delayed differential equations. This formalism allows to consider the population's stage structure and consequently leads to a relatively accurate description of insects life-cycles [1]. In this model, intraspecific competition is accounted for by using a flexible density dependence function that allows us to assess the effects of different parameters linked to this competition on the dynamics of the system. Our work particularly focuses on the influence of two factors that were generally neglected in previous studies: the strength of the competition and possible differences in the effect of intraspecific competition between healthy and parasitized hosts. By combining analytical studies and simulations, we show that the presence of parasitoids in the system markedly changes the effects of competition on population dynamics. In particular, position in the "contest"-"scramble" spectrum, which plays a crucial role in

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single-population dynamics [2], may have a smaller effect in populations subjected to parasitism. Our results also suggest that differences in susceptibility to competition between healthy and parasitized hosts play a major role on the stability of the system, stability being increased by a higher level of susceptibility of healthy hosts. In conclusion, our work unfolds how strong the interactions between top-down (parasitism) and bottom-up (intraspecific competition) effects can be in the regulation of host-parasitoid systems

References

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