ECOLOGY OF PHASMIDS (PHASMATODEA) IN A MOIST NEOTROPICAL FOREST:

A STUDY ON LIFE HISTORY, HOST-RANGE AND BOTTOM-UP *VERSUS* TOP-DOWN REGULATION

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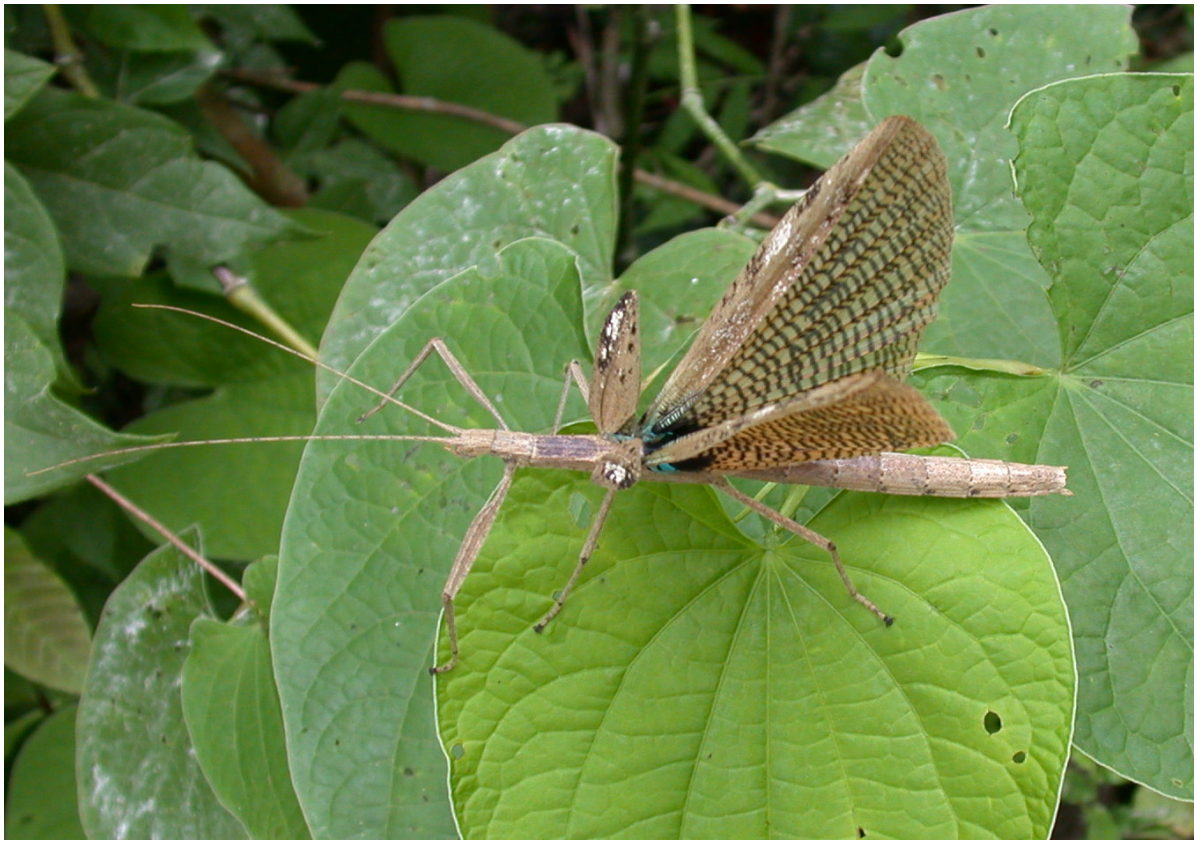
ABSTRACT

Herbivory is discussed as a key agent in maintaining dynamics and stability of tropical forested ecosystems. Accordingly increasing attention has been paid to the factors that structure tropical herbivore communities.

The aim of this study was (1) to describe diversity, density, distribution and host range of the phasmid community (Phasmatodea) of a moist neotropical forest in Panamá, and (2) to experimentally assess bottom-up and top-down factors that may regulate populations of the phasmid *Metriophasma diocles*.

The phasmid community of Barro Colorado Island was poor in species and low in density. Phasmids mainly occurred along forest edges and restricted host ranges of phasmid species reflected the successional status of their host plants. Only *M. diocles* that fed on early and late successional plants occurred regularly in the forest understory.

A long generation time with a comparably low fecundity converted into a low biotic potential of *M. diocles*. However, modeled potential population density increased exponentially and exceeded the realized densities of this species already after one generation indicating that control factors continuously affect *M. diocles* natural populations. Egg hatching failure decreased potential population growth by 10 % but was of no marked effect at larger temporal scale.



A female of *Metriophasma diocles* displays all its beauty (on *Piper marginatum*; © by the Author).

Interspecific differences in defensive physical and chemical leaf traits of *M. diocles* host plants, amongst them leaf toughness the supposedly most effective anti-herbivore defense, seemed not to affect adult female preference and nymph performance. Alternatively to these defenses, I suggest that the pattern of differential preference and performance may be based on interspecific differences in qualitative toxic compounds or in nutritive quality of leaves. The significant rejection of leaf tissue with a low artificial increase of natural phenol contents by nymphs indicated a qualitative defensive pathway in *Piper* evolution. In *M. diocles*, oviposition may not be linked to nymph performance, because the evolutionary prediction of a relation between female adult preference and nymph performance was missing. Consequently, the recruitment of nymphs into the reproductive adult phase may be crucially affected by differential performance of nymphs.

Neonate *M. diocles* nymphs suffered strong predation pressure when exposed to natural levels of predation. Concluding from significantly increased predation-related mortality at night, I argue that arthropods may be the main predators of this nocturnal herbivore. Migratory behavior of nymphs seemed not to reflect predation avoidance. Instead, I provided first evidence that host plant quality may trigger off-plant migration.

In conclusion, I suggest that predation pressure with its direct effects on nymph survival may be a stronger factor regulating *M. diocles* populations, compared to direct and indirect effects of host plant quality, particularly because slow growth and off-host migration both may feed back into an increase of predation related mortality.

A newly hatched nymph of *Metriophasma diocles* sitting on a pile of eggs (© Christian Ziegler)