Host specificity and species diversity in the tropics

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How many species?

How many species are there on Earth? This is probably one of the first questions asked by the humankind. The debate is still controversial and recent estimates vary from 2 to 100 million species. A new method for collecting insects from the canopies of tropical forests has given additional insight to these questions.

Craning for better view in tropical forests

A study of host specificity and species richness of herbivorous beetles associated with 24 tree species and 26 liana species was carried out in the canopy of the dry tropical forest in Parque Natural Metropolitano close to Panama City. A tower crane situated in the forest was used to access the canopy (Fig. 1). After 700 hours spent in the crane-gondola during one year, a total of 35,479 beetle individuals belonging to 1,165 species were collected (Ødegaard 2003). Out of this material 2,561 host observations of 697 beetle species were recorded as feeding observations and probability based methods. Most species and individuals belonged to two beetle families, the leaf beetles and weevils.

Lianas appear to be very important growth forms of plants for the maintenance of species richness at this site (Ødegaard, 2000a). Lianas and trees were hosts for a similar number of phytophagous beetle species, but the beetles associated with lianas were more host-specific than those associated with trees. For instance, a large group of virtually unknown weevils survive by scraping the tendrils of lianas that weave through the canopy (Fig. 2). These are important findings in the context of estimating global species richness of arthropods, because previously trees have been regarded as the only hosts of importance in tropical forests.

The average host specificity for the phytophagous beetles in this forest in Panama is estimated to range from 7-10% if the forest consists of between 300 and 550 species of trees and lianas, i.e. fewer than one out of ten species are on average monophagous in the beetle community (Ødegaard et al., 2000). The species richness of phytophagous beetles in the same forest is estimated to contain 1,600-2,000 species (Ødegaard 2003).These results are applied when revising host specificity-based estimates of global arthropod species richness. It is concluded that the higher estimates of 30-100 million species of tropical arthropods are not tenable. By way of comparison, the revised estimate gives approximately 5 million species, which resembles the results of other independent estimation methods. However, uncertainty is still too high for promoting a confident conclusion on the number of species existing on the planet (Ødegaard, 2000b).

Figure 1. *The canopy crane in the tropical dry forest of Parque Natural Metropolitano in Panama. Photo STRI.*

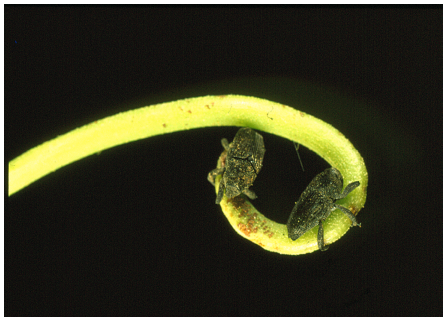

Figure 2. *Two weevils of the subfamiliy Baridinae scraping tendris of a liana. More than 70 species of beetles appeared to be specialized on tendrils in the tropical dry forest. Photo STRI.*

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Other papers on the issue:

- Sandlund, O.T, Tømmerås, B.Å. & Ødegaard, F. 1997. Veien til en ukjent biologisk verden - med bygningskran i tretoppene. *Naturen* 121: 245-251.

- Ødegaard, F. 1999. Host specificity as a parameter in estimates of arthropod species richness. Ph.D. thesis. Norwegian University of Science and Technology (NTNU).

- NINA Temahefte 17

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host specificity
beta-diversity
species richness

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Wet tropical forests have more species

A comparative study of 52 plant species was recently carried out in a tropical wet forest site at the other side of the isthmus of Panama at Fort Sherman (Fig. 3). This site had 40% more beetle species than in the dry forest and the beetle fauna at was even more host specific. Lianas didn't dominate in the wet forest but their beetle faunas were more specific than on trees confirming the results from the dry forest. The species composition in the two forests was rather distinct although the sites were located only 80 km apart. Only 12% of the total number of 2473 beetle species were common to both sites. These results may have implications of estimates of global species richness. More species (alpha-diversity), high species-turnover (beta-diversity) and more host-specific species all account for higher global species richness (Ødegaard in prep).

Figure 3. *Aerial view of the crane site in the tropical wet forest at Fort Sherman in Panama. Photo STRI.*

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