Tropical Forest Canopies: The Last Biotic Frontier

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More than 65 years ago, William Beebe (1917) wrote, "Yet another continent of life remains to be discovered, not upon earth, but one to two hundred feet above it. . . At present we know almost nothing of it. Up to now gravitation and tree-trunks swarming with terrible ants have kept us at bay, and of the tree-top life we have obtained only unconnected facts and specimens." Nothing much has changed in the last six decades to improve our knowledge of tropical forest canopies, the last biotic frontier. In addition, we are now faced with the projected loss of most of the tropical forest within the next 25 years at a rate of 7 to 12 million ha per year (U.S. National Research Council 1980).

In the early 1970s, I began studies of tropical forest canopy arthropods to gather new facts and connect old ones in such a way that current and future studies are enhanced to a maximum degree satisfying what Raven (1980a) called a need to "record coexistence and to be able to retrieve, for study, whole groups of organisms that occurred together for further analysis." My studies concern the tropical canopy beetle biota mainly, the general tropical arboreal arthropod fauna secondarily (but in an important way), and the relationship of these arthropod biotas to seasons, trophic adaptations, size distribution of taxa, ratios of higher taxa constituting the fauna, and richness of species and their distributions. These are all matters of importance in understanding tropical ecosystems. Results thus far have been startling! It is clear that, as we move into the 1980s and early 1990s, entomology's role and responsibility in tropical biology will increase dramatically.

Preliminary results and analyses indicate that there may be as many as 30 million species of insects, not 1.5 to 10 million as previously estimated (Erwin 1982), and that species of the tropics are, in general, restricted to very specific types of habitats within the supposedly "homogeneous green carpet of forest" which makes up the tropical "jungle." It is already clear from my studies that most tropical arthropod species live in the tree tops where there are green leaves, fruits, flowers, and sunshine, and it is also clear that ants constitute the greatest number of individuals and biomass in the canopy as well as on the ground. To gather canopy arthropods for study and obtain data about forest canopies, I have employed a technique long used by mosquito control personnel—an insecticidal-fog-generating machine (see Fig.3)—which I modified for use in the tree tops.

Methods of Canopy Fogging

The first attempt at true fogging of forest canopies seems to have been that of Roberts (1973). Others (Martin 1966, Gagné and Martin 1968) had earlier obtained canopy samples with hydraulic sprayers, but later

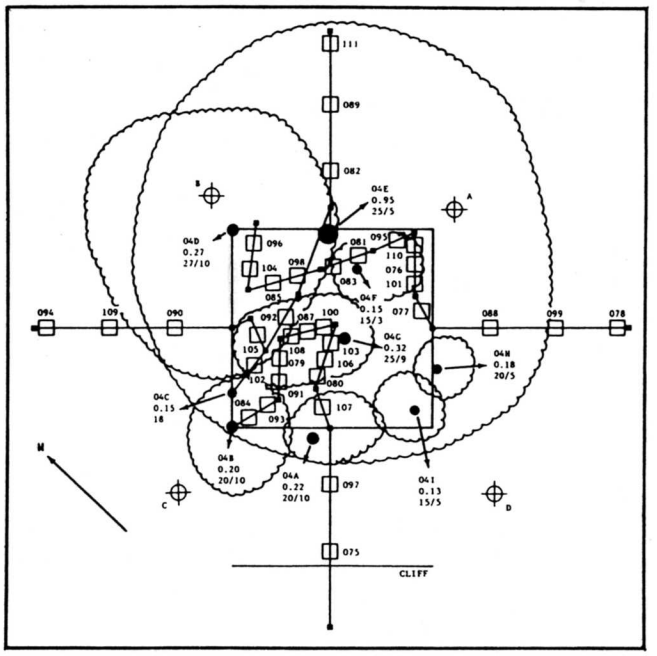

Fig. 1. Configuration of plot for canopy sampling at Tambopata Reserve, Peru, showing assigned tree numbers/letters, tray numbers, tree DBH, and canopy height/depth, and fogger pull-up sites (letters A-D). Plot size 12 by 12 m; tray size 1 m^2.

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