Locusta migratoria but not Spodoptera littoralis after a single deficient meal during ad libitum feeding. *Physiol. Entomol.* **15**: 235–242.

STEINHOFF G. 1982: Ökologische Freilanduntersuchungen an Geradflüglern (Orthopteroidea) des Bansenberges in der Eifel. *Decheniana (Bonn)* **27**: 100–173.

WALTERT M. 1994: *Untersuchungen zur Nahrungsökologie der Westlichen Beißschrecke Platycleis albopunctata (Orthoptera: Tettigoniidae)*. University of Würzburg, 42 pp.

WEDELL N. & RITCHIE M.G. 2004: Male age, mating status and nuptial gift quality in a bushcricket. *Anim. Behav.* **67**: 1059–1065.

Received March 4, 2005; revised and accepted August 10, 2005

*Eur. J. Entomol.* **103**: 253–254, 2006
ISSN 1210-5759

## BOOK REVIEW

BASSET Y., NOVOTNÝ V., MILLER S.E. & KITCHING R.L. (eds): ARTHROPODS OF TROPICAL FORESTS: SPATIO-TEMPORAL DYNAMICS AND RESOURCE USE IN THE CANOPY. Cambridge University Press, Cambridge, 2003, xvi + 474 pp. ISBN 0-521-82000-6 (hard cover). Price USD 110.00.

In retrospect, it seems incomprehensible that we would have explored the ocean depths, reached the peaks of the highest mountains and the frigid north and south poles of our planet, and walked on the moon a quarter of a million miles from Earth, long before devising ways to move about the forest canopy — a mere 46 meters away — with any but the most primitive methods. The canopy not only was closer and more tangible than these destinations, it was often in plain view. We could almost taste our quarry, or observe it through binoculars, yet it remained quite literally out of reach. The best we could do was shoot down branches to obtain plant specimens, fog the foliage with pyrethrins to sample its arthropod inhabitants and, more recently, ascend one tree at a time using mountain-climbing gear.

Why the delay in reaching the canopy? Quite simply, gravity, fear, and lack of incentive. Though gravity is our ally in reaching the ocean depths, it is a formidable obstacle when moving in the opposite direction, up. Overcoming it and remaining aloft requires extreme acceleration and sustained speed – both counterproductive to canopy research. Lack of incentive, except by biologists. Why would anyone want to go up there? It is scary. There's no money to be made there, no pearls or sunken treasure. The canopy doesn't offer the allure of great and distant adventure; it's too close to home.

Biologists, on the other hand, long suspected that the canopy was where the action was. All evidence indicated it: arthropod samples collected by fogging trees with insecticides or by raising ultraviolet and mercury-vapor light traps into the canopy with pulleys, revealed that diverse and abundant life was to be found there. That view was supported further by observations made by the few people who had reached the canopy using climbing gear, and by the well-known fact that forest gaps and forest edges — which may be viewed as mini sections of "the canopy brought to ground level" — are known to be much more productive places to collect insects than is the forest understory.

The biologist's dream was to find a gentle way to reach the tree-tops and move about freely and silently without greatly disturbing the plants and animals one wished to study. It took a leap of imagination, by the late Alan Smith (Smithsonian Tropical Research Institute, Panama), to realize that an item of existing technology, the canopy crane, could be diverted from its original use, to perform quite a different task: lift biologists into the forest canopy, and, by coordinating the crane's vertical, horizontal, and circular motions, deliver researchers to any point

within the 3-dimensional space of a large, cylindrical area of forest.

Our ability to address fundamental questions about insects and other terrestrial arthropods, depends upon being able to sample and compare arthropods at all forest levels, from the soil and leaf litter through the tallest tree tops. How many species of insects are there? How are they distributed in space and time? How do they interact and partition their resources? Arthropods of Tropical Forests was compiled by an international group of entomologists dedicated to seeking answers to these and other basic questions. The 35 chapters were written by 80 authors from 18 countries. The 1,704 references are listed together at the end of the book, rather than at the end of each chapter, making it easy to locate the publications of any one author, and avoiding multiple citations of the same works. Two interesting disparities perhaps reflect the newness of canopy biology. Two countries, Germany and Venezuela, together account for more than one third of the 80 chapter authors. Of the more than 960 authors cited in the References, only 14 account for nearly 15% of the 1,704 papers listed.

Chapters are arranged in 5 groups, each with its own introduction: The five chapters (1–5) making up Part 1 "Arthropods of tropical canopies: current themes of research" provide the setting for the rest of the book. They discuss canopy entomology, its terminology, its methods, and its theoretical concepts, from an historical point of view, and review the literature on vertical distribution of forest arthropods.

The six chapters (6–11) forming Part 2 "Vertical stratification in tropical forests" present new data on stratification of forest arthropods in diverse locations and using a variety of collection methods: ants and bark beetles in two oak crown layers, in Malaysia; pyraloid moths in space and time, in the understory and canopy, in Borneo; effects of canopy foliage structure on densities of butterflies and birds, in Sarawak; stratification of spiders, in Tanzania; arthropod fauna (mainly oribatid mites) species richness in suspended soils in one tree species, in Gabon; flying insects attracted to yellow pot traps in understory and canopy of two trees in a lowland rainforest, in Surinam.

The six chapters (12–17) that comprise Part 3 "Temporal patterns in tropical canopies" address a more diffuse topic, arthropod seasonality: fluctuating abundances of five herbivorous insect orders and two predatory wasps, in response to two mass flowering events, in Sarawak; relative importance of ecological versus historical and evolutionary hypotheses in arthropod assemblages, a time series study in the Hawaiian archipelago; seasonality and relative abundances of canopy beetles, on two tree species, in Uganda; seasonality and community composition of springtails, in three forest types, in Mexico; seasonal variation of canopy arthropods, mainly insects, on nine tree species in dry and wet seasons, in the Central Amazon; arthropod seasonality in tree crowns with different epiphyte loads, collected every two weeks, in three types of traps, in Panama.

The six chapters (18–23) that form Part 4 "Resource use and host specificity in tropical canopies" are less cohesive than the previous parts, but all are concerned either with changes in arthropod assemblages following disturbance, or differences in community structure related to differing local factors: beetle community differences along a gradient from undisturbed forest through forests allowed to regenerate for 40, 10, and 5 years, in Malaysia; arthropod assemblages in three representative species of savanna trees, in Ivory Coast; relative abundances of ant-repelling versus ant-attracting flowers in savanna and forest trees, in Venezuela; taxonomic composition and host specificity of phytophagous beetles in a dry forest, in Panama, with new estimates for the number of arthropod species in the tropics — this is the finest chapter in the volume; microhabitat distribution of forest grasshoppers (s. l.) and partitioning of space and food resources, in the Amazon; flower-visiting beetle diversity in relation to two mass-flowering tree species; in Venezuela.

Part 5 is the finale "Synthesis: spatio-temporal dynamics and resource use in tropical canopies". These final twelve chapters (24–35) form the least cohesive section. One would have expected them to be reviews or syntheses of topics addressed previously in the book: stratification, temporal variation, host specificity, and resource use. However only five, plus the concluding chapter are purely review papers: a review of habitat use and sandwich-stratification in microarthropods, Collembola (springtails) and oribatid mites; a review of early derived mites associated with an ecological island habitat, decaying wood; a review of the scant literature on canopy arthropod diel activity and stratification patterns, with new data obtained by three trapping methods, in Gabon; a review of mosaic patterns in dominant ants of rainforests and plantations, with implications for manipulating them to defend trees against sap-sucking insect herbivores; a review of species richness and distribution of canopy insect herbivores in savannas and rainforests. The remaining six chapters are based on new data, though perhaps from a more synthetic or generalized viewpoint than earlier chapters: a comparison of insect herbivore distribution patterns on saplings and mature trees of a single tree species, in Panama; diel, seasonal, and hurricane disturbance-induced variation in invertebrate assemblages, in Puerto Rico and Panama; understory tree relatedness and the size and composition of their insect faunas, in Australia; the year to year dynamics of interactions between bees and thrips with their canopy resources (flowers of 30 plant species), in Panama; an inventory of monophagy through extreme polyphagy in caterpillars of 31 saturniid moth species in Costa Rica; influences of forest management on insects, from selectively logged, to clear felled, to replanted or commercial forest plantations, in Malaysia; the summary and synthesis chapter which emphasizes work presented in this volume, to examine patterns of vertical stratification, temporal distribution, resource use and host specificity of arthropods in tropical rainforest canopies.

This work is an important milestone in canopy biology. It provides an historical perspective on canopy research, its theoretical concepts and terminology, and summarizes what is and isn't known about canopy arthropods of tropical forests. While emphasizing recent data, it indicates areas in need of attention and explores future directions. The volume is well-populated with tables and graphs.

*A. Aiello*
*Smithsonian Tropical Research Institute, Panama*