MIRMECOBH

Abstract BOOK

XXIV SIMPÓSIO DE MIRMECOLOGIA

An international ant meeting

BELO HORIZONTE.MG

UFMG Universidade Federal de Minas Gerais · UFV Universidade Federal de Viçosa · CAPES · Bocaina Biologia da Conservação

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2.9 TOWARDS A SYNTHESIS OF ARBOREAL ANT ECOLOGICAL RESEARCH IN THE TROPICS

2.9.1 A RESOURCE BASED APPROACH ON THE STUDY OF ARBOREAL ANTS

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Arboreal ants are responsible for a large part of the biomass of tropical environments, with striking levels of diversity and abundance. Moreover, arboreal ants are involved in a high number of interactions in the tree canopies, from obligate-mutualisms with plants to interspecific competition with other ants. With such important features, arboreal ants have been intensively studied, and some important patterns were observed, generating classical concepts of ant ecology. However, even after all these years, there are still some open issues in the study of tropical arboreal ants. Here, I show data from around 10 years of study on arboreal ant communities in Brazilian savannas (i.e. Cerrado), and discuss some approaches over resource use in canopy ants. On this decade of research effort, me and my colleagues collected data from over a thousand individual full grown cerrado trees (i.e. around five meters tall). Importantly, to answer these questions we always mixed traditional sampling methods (i.e. arboreal pitfalls) with experimental approaches, in a way to get a more complete picture of the scenario of arboreal ant communities. First, I focus on the potential effects of food resource utilization on species assembly and community organization, and then I will move to the effects of shelter resources utilization. I specifically asked the following questions: A) Is there a significant impact of extrafloral nectaries (EFNs) on the organization of Cerrado arboreal ant communities? B) Is there a trade-off between the ability to find and dominate food resources (i.e. discovery-dominance trade-off) in the Cerrado canopy? C) How important are shelter resources for Cerrado arboreal ant species assembly and community organization? Overall, the results showed a limited influence of food resources on community organization and species assembly in Cerrado trees. Furthermore, we did not detect a discovery-dominance trade-off, since the first ants to arrive at a food resource were usually to ones to control it (i.e. discovery-defense strategy). On the other hand, by performing an experimental manipulation, we detected a significant effect of shelter resources heterogeneity on arboreal ant species diversity patterns. This studies highlight the importance to look deeper in the resource utilization patterns by arboreal ants, that may be directly to the high diversity patterns observed on the trees. (NSF, CAPES, CNPQ).

2.9.2 EXPLORING THE ECOLOGY OF ARBOREAL ANTS IN A TROPICAL FOREST

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Tropical forests canopies harbour a great abundance of ants, that compounds the major part of arthropod biomass of these habitats. There is evidence of "ant mosaics" on treetops, probably shaped by competition among dominant ants. Despite that, it is known that the canopy presents a high ant species richness. Therefore, the understanding of how canopy ant communities are structured, and how they partition space within the trees are exciting aspects of ant ecology. In this context, we sampled ants on trees within six circular plots (0.28 ha), at *Los Tuxtlas*, a Mexican tropical forest. Our objectives were: (1) What is the force that structures the ant community on the forest canopy? (2) Which factors determine the ant spatial dominance? (3) How the canopy and understory networks of ant-plant co-occurrences are structured? For the first objective, we assessed the results of competitive interactions of ants at food resources. The preliminary results indicated that the discovery-dominance trade-off is not the most important structuring factor of the canopy ant community. For the second objective, we installed several baits within trees (up to 8 sampling points per tree). On each of these sampling points, we measured some environmental variables (microhabitat conditions) that could determine ant species composition. We found that baits on lower heights from above the ground had a higher probability of being used, which could be related to greater availability of routes and the easiness to be used by ant species from either the top or closer to the ground. None of the environmental variables measured determined ant species composition, with dominant ants' accessing resources independently of ant species and microhabitat. We found that taller trees, with greater richness and abundance of epiphytes, lianas and other plants, had lower spatial dominance, given, mainly, by its higher spatial heterogeneity. For the third objective, we performed paired samples in all canopy trees and understory shrubs within the plots and built co-occurrence networks among ants and plants of each vertical strata. We found that the species composition of plants and ants differed between canopy and understory. Meanwhile, we found that the networks of each vertical strata were very similar in structure (network size, specialization, modularity, and nestedness), but with a higher interaction diversity in the understory than in the canopy. Our results suggest that ants use the resource in a generalized way, independently of the microhabitat or habitat conditions, and the identity of ant species. (CONACYT, INECOL)

2.9.3 ANTS AND THEIR ECOSYSTEM SERVICES IN MEXICAN AGROECOLOGICAL SYSTEMS

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Arboreal ants are ubiquitous organisms in tropical agroecosystems. Although ants are often viewed as harmful in farms (due to the mutualistic relationships ants form with hemipterans, common agricultural pests), ants are important predators in several agroecosystems, including coffee. Ant communities can be strongly affected by agroecosystem management that alters availability of resources (e.g., prey) and microclimatic conditions (e.g., temperature) and by interactions with parasitoids (e.g., phorid flies). We examined the role of ants as providers ecosystem services within coffee agroecosystems and specifically ask how changes in available resources, microclimate factors, and presence of parasitoids affect predation services provided by ants. We worked in shaded coffee agroecosystems in Chiapas, Mexico to understand ant interactions with the coffee berry borer (*Hypothenemus hampei*). We conducted a series of experiments to test predation under a variety of conditions. First, we tested ant predation on the borer to identify important predatory ant species. Second, we conducted seasonal observations, a rainfall exclosure experiment, and stable isotope analysis to test how temperature and seasonal differences affect predation and diets. We conducted an experiment to test whether adding vegetation connections facilitates removal of pest species from coffee plants. Finally, we examined how presence of phorid parasitoids and ant diversity influences pest-predation. Several species of arboreal ants in the genera *Azteca*, *Pseudomyrmex*, and *Procryptoerus* are efficient borer predators. We found that certain ant species remove more borers during the dry season, however, limiting rainfall did not increase borer removal, likely due to higher prey availability and more protein in the diet in the rainy season. Activity of one predator, *Azteca sericeasur*, increased with vegetation connections and borer removal was three times higher on connected plants. Greater distance from the nesting tree negatively influenced ant activity on control coffee plants, but not on connected plants, suggesting that connections could compensate for more intensive management with fewer trees. Finally, presence of phorid flies significantly reduced effectiveness of *Azteca sericeasur* as a predator, however, phorid presence also revealed synergistic effects of ant diversity, not observed without presence of this parasitoid. Thus, a parasitoid-induced predator behavioral change revealed the importance of functional redundancy and predator diversity for control of this important pest. In sum, both abiotic factors such as temperature and vegetation connections as well as biotic factors such as prey availability, presence of parasitoids and ant diversity can strongly affect the role of arboreal ants as predators in agroecosystems. (NSF, USDA)

2.9.4 THREE-DIMENSIONAL ANT DISTRIBUTION IN RAINFORESTS AND A METHOD TO DETECT ANT MOSAICS

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It is not easy to observe and/or gather the ants living tropical rainforest canopies due to the difficulty in accessing tree crowns. Among them, some territorially-dominant arboreal ant species (TDAAs) are spatially segregated forming "ant mosaics" of territories. Classical sampling methods attempting to document arboreal ant distribution in tropical forests require climbing trees and are time-consuming. In addition, competition or association between ant species are inferred indirectly. Our aims were to: (1) develop a rapid assessment protocol (the Standardized Baitline Protocol, hereafter SBP) allowing TDAAs, associations between them and their three-dimensional colony extension to be detected; and (2) to evaluate the SBP in terms of coverage of the local ant assemblage. In the SBP, tuna and honey baits are spread every 5m along a rope twined around tree trunks on all upper canopy trees present within a circular plot of 30m radius. The extension of dominant ant territories is assessed by conducting aggression tests between ants foraging on the baits. Mutual tolerance between species is evaluated with statistical approaches and with *in-situ* observations on the baits. The SBP was tested in three lowland rainforest sites in Papua New Guinea and compared with a complete inventory of arboreal ants on all trees in a "Whole Forest" (WF) plot of 0.4ha and a subset of it containing only upper canopy trees. We found the following. (1) TDAAs occupied both understory and canopy trees in the WF plot. (2) The SBP collected less than half of the local arboreal ant assemblage. (3) In terms of local ant richness the representativeness of the SBP method declined with the increased dominance of the TDAAs. We present these conclusions. (1) The SBP appeared adequate to rapidly detect TDAAs and ant mosaics, but should be complemented by other methods to document the local ant assemblage diversity. (2) A key advantage over previous methods is the use of behavioural observations to assess species associations and the 3D extension of colonies. (3) The SBP also has potential for monitoring and understanding the dynamics of TDAA colonies and for detecting invasive species or supercolonies. (FNRS, CAS, CNRS, Our Planet Reviewed Papua New Guinea)

3.3.102 DISTANCE-DECAY OF COMPOSITIONAL SIMILARITY IN GROUND BUT NOT IN CANOPY ANT ASSEMBLAGES IN A TROPICAL RAINFOREST

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Both decreases in compositional similarity with increasing geographic distances between sites (i.e. distance-decay relationship) and vertical stratification of species composition are key issues in ecology. However, the intersection between these two trends is just beginning to be investigated. Most studies have shown that ant assemblages are vertically stratified in tropical forests since the environmental conditions of the canopy differ substantially from those of lower strata. At the same time, the taxonomic similarity of ants at ground level decreases with increasing geographic distance. Here we use the same comprehensive sampling methods in the canopy and the ground level in a tropical rainforest remnant on the coast of the Gulf of Mexico to evaluate for the first time a distance-decay relationship within vertical strata in insect assemblages. We found that the ant assemblage was vertically stratified; ant species richness was higher at ground level than in the canopy, and the species composition differed between the two vertical strata. Moreover, we observed that β-diversity increased with geographic distance at ground level, but not in the canopy strata. However, contrary to our prediction, there was less species turnover (lower β-diversity) between vertical strata than between trees. These findings reflect differences in the dispersal capacity and nest habit of ants from each vertical stratum. In short, our results illustrate the importance of sampling more than one vertical stratum to understand the spatial distribution patterns of biological diversity in tropical rainforests. (CONACYT-Mexico)