

SCIENTIFIC NOTE

Foraging Patterns of the Leaf-Cutter Ant *Atta laevigata* (Smith) (Myrmicinae: Attini) in an Area of Cerrado Vegetation

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*Ecologia Evolutiva de Herbívoros Tropicais/DBG, ICB/Universidade Federal de Minas Gerais, C. postal 486, 30161-970, Belo Horizonte, MG, e-mail: gwilson@icb.ufmg.br**Neotropical Entomology 33(3):391-393 (2004)*Padrões de Forrageamento da Formiga Cortadeira *Atta laevigata* (Smith) (Myrmicinae: Attini) em uma Área de Cerrado

RESUMO - A taxa de forrageamento pode interferir diretamente no impacto que *Atta laevigata* (Smith) exerce no ambiente. Os fatores que mais afetam a taxa de forrageamento foram avaliados utilizando-se dados de *A. laevigata* coletados por três meses no Parque Nacional da Serra do Cipó, MG. Um padrão bimodal de forrageamento foi observado em dias ensolarados. Amostras do peso seco coletadas nas entradas dos ninhos foram em média maiores nos dias ensolarados (0.9713 ± 0.1358 g), quando comparado aos dias chuvosos (0.4485 ± 0.1120 g). Ninhos grandes (0.9713 ± 0.1358 g) também possuíam maiores coletas de peso seco comparadas aos ninhos pequenos (0.2752 ± 0.0463 g). Indivíduos de *A. laevigata* trocam de entradas de ninhos para entradas com melhores condições microhabitacionais tanto em dias chuvosos como ensolarados. A combinação da temperatura, umidade, tamanho de ninho e especialização de microhabitats parecem ser os fatores reguladores mais importantes dos padrões de forrageamento de *A. laevigata* no Parque Nacional da Serra do Cipó.

PALAVRAS-CHAVE: Especialização de microhabitats, herbivoria, limitação no forrageamento, Serra do Cipó

ABSTRACT - Foraging rate can directly affect the impact that *Atta laevigata* (Smith) has on the environment. We attempted to assess the factors which most affect foraging rate of *A. laevigata* using data collected over a three month period in the Parque Nacional da Serra do Cipó in Minas Gerais, Brazil. A bimodal foraging pattern was observed on clear sunny days, based on collected dry weights of vegetative material being carried towards nest entrances. Sampled entrances on clear sunny days yielded a daily average dry weight twice as high (0.9713 ± 0.1358 g) as on rainy days (0.4485 ± 0.1120 g). Larger nests (0.9713 ± 0.1358 g) yielded higher dry weights than smaller nests (0.2752 ± 0.0463 g). Field observations showed Ants switched to nest entrances with more suitable microhabitat conditions in both rainy and sunny days. A combination of temperature, humidity, nest size, and microhabitat specialization were the most important factors influencing *A. laevigata* foraging pattern.

KEY WORDS: Foraging constraints, herbivory, hotspot, microhabitat specialization, Serra do Cipó

Leaf-cutter ant colonies of *Atta* spp. have the largest herbivory impacts in most habitats of the New World tropics (Wilson 1980). They may account for the destruction of up to 17% of the total leaf production in tropical rainforests (Begon 1996). Despite its importance in forest dynamics and structure, the impact of the leaf-cutter ant *Atta laevigata* (Smith) on the cerrado habitat has received little attention. This question becomes more relevant as the cerrado has recently been nominated as one of the earth's hotspots of biological diversity, i.e., a biome of high species diversity but under severe threat (Myer *et al.* 2000).

Based on significant ant impacts documented in other regions of the New World tropics, we felt that *A. laevigata*

herbivory could be responsible for causing large impacts in the cerrado as well. Hence, our goal was to determine *A. laevigata* foraging patterns in order to subsequently determine overall ant impact on vegetation. *A. laevigata* impact is important because if we are to accurately understand the dynamics of the cerrado system, the effects of a species that could possibly have the largest herbivory impact in that system needs to be studied. Our hypothesis was that foraging patterns would be significantly different in relation to various factors such as varying weather conditions, nest size, and air temperature throughout the day. In another study of arid region ants, foraging ceased when soil surface temperature reached 40°C (Whitford 1999).

This study was carried out at Parque Nacional da Serra do Cipó situated in the central part of the state of Minas Gerais (Fernandes 1994). The dominant vegetation type is a tropical savanna named “cerrado” including varying forms of physiognomies (see Goodland & Ferri 1979, Eiten 1993). The climate is typical of tropical altitudinal savanna habitats, with well-defined dry and rainy seasons. The annual mean temperature varies between 17°C and 21°C and the annual mean precipitation is 1450 mm (see Madeira & Fernandes 1999). *A. laevigata* is the most evolutionarily complex member within the Attini tribe due to the polymorphism of its individuals and utilization of fungus as a food source (Leal & Oliveira 2000, Anderson & McShea 2001). Plant material collections were conducted from November 2002 to January 2003. Plant parts were collected by removing loads carried by all ants to the highest activity nest entrance during the sampling period. Three ant mounds of varying sizes were selected for this study. These ant mounds, hereafter called 1, 2, and 3, had 7.06 m², 79.52 m², and 272.69 m² in area, respectively. Forty samples (nest 1 = 12; nest 2 = 12; nest 3 = 16) of vegetative material consisting mostly of fresh leaf parts were collected. The sampling occurred during the first and last fifteen-minute intervals of three 1h periods throughout the day, which resulted in six daily collection periods (Fig. 1). Collection periods were preliminarily based on temperature and humidity variations, as extreme values for either one or both of these conditions can severely limit individual activity (Wilson 1971, Hölldobler & Wilson 1990). During the fifteen-minute collection periods, the collection of vegetative material was continuous.

We hypothesized that the majority of *A. laevigata* activity at the study site was diurnal and directly linked to temperature changes throughout the day. On clear sunny days the ants exhibited a bimodal foraging distribution with peaks in the early morning and afternoon and a low at midday (Fig. 1). This finding was consistent with daily temperature patterns;

the highest temperatures generally corresponded to the decreased activity at midday. We plotted dry weights of collected material from nest 2 versus environmental temperature on a clear day. The three highest dry weights were obtained when temperatures were between 30°C and 33°C. Comparatively lower dry weight samples were obtained immediately following periods of rain. A slightly increased foraging rate was observed post rain event (Fig. 1). Differences in foraging patterns lead us to conclude that *A. laevigata*, like many other ant species, seems to be guided not by just one but by several environmental cues and adapts its foraging to match the immediate conditions of its microhabitat (Hölldobler & Wilson 1990). In a further attempt to ascertain *A. laevigata* impact on vegetation, we compared the total collected dry weight of nests on clear days (0.9713 ± 0.1358 g, $n = 10$) versus total collected dry weight of nests on rainy days (0.4485 ± 0.1120 g, $n = 10$). Collected dry weight total was approximately twice as high for nests on clear days than nests on rainy days ($P < 0.001$, $U = 95.00$).

Bimodal patterns of foraging are typical of many desert species (see Hölldobler & Wilson 1990). *A. laevigata* in the cerrado could be exhibiting the same pattern because of the influence that the cerrado’s five month dry season (see Madeira & Fernandes 1999) could have on ant foraging behavior. The foraging pattern observed during rainy days seemed to be related to microhabitat conditions, since most of the ant activity immediately following periods of rain related to maintenance and upkeep of the nests. These maintenance activities not only changed the pattern of foraging (e.g. which nest entrance individuals use), but also reduced the dry weights of vegetative materials brought to the nest by individuals not tending the nest. Microhabitat conditions also played an important role during clear sunny days. During our study, individuals switched to other nest entrances that were shaded during the hottest parts of the day, allowing for

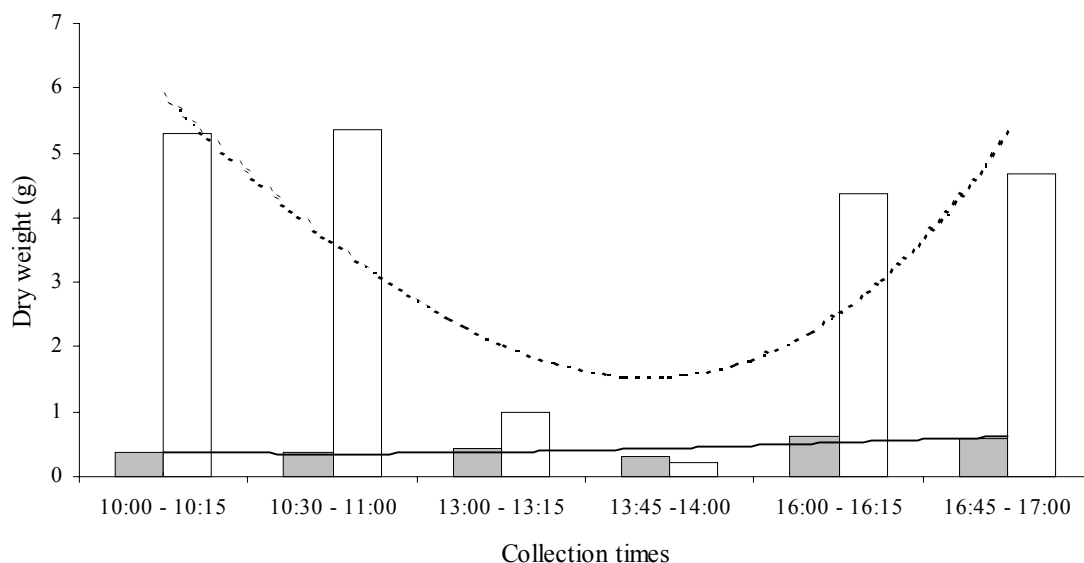


Figure 1. Average dry weight of collected vegetative material at ant nest 3 during clear, sunny days (white columns, $n = 12$). Bimodal tendency represented as dashed line. Average dry weight of collected vegetative material at nests 1, 2, 3 on rainy days (dark columns, $n = 28$). Increasing line tendency represented as black line post early morning rain event.

continued, although much reduced, foraging at a time of day when foraging would normally be temperature restricted.

Nest size also influenced the amount of vegetative material brought to *A. laevigata* nests. We observed that ants at the large nest (nest 3) collected roughly three times as much vegetative material as did ants at the small nest (nest 1) (large nest = 0.9713 ± 0.1358 g, n = 10; small nest = 0.2752 ± 0.0463 g, n = 10; $P < 0.05$, $U = 84.00$). Nest size is considered the best indicator of a nest's age (Hernandez *et al.* 1999). Thus, we assumed that larger nests were older, more developed, and contained more individuals. Consequently, larger nests could, by virtue of sheer size, exert a larger impact on the plant community.

Finally, ant nest abundance data were collected yielding a total of 24 *A. laevigata* nests in three randomly selected transects of 300 m each. Ant nest abundance is provided here strictly for informative purposes; its effects on habitat are currently being reviewed in greater detail and should be presented in future studies.

Determining *A. laevigata*'s foraging patterns and how they are controlled by different variables such as temperature, humidity, and nest size are important in correctly assessing this species' impact on the cerrado habitat. Limited data prohibit a comprehensive assessment of actual leaf-cutter ant herbivory at this time. This study is one of the first to describe the impact of *A. laevigata* herbivory on natural cerrado habitats and provides the fuel for future research. We are currently in the process of collecting more data across the marked environmental and vegetational differences that characterize typical cerrado habitats.

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