

Nota Científica
(Short Communication)

**DETECTION AND USE OF FORAGING TRAILS OF THE
LEAF-CUTTING ANT *ATTA LAEVIGATA* (HYMENOPTERA:
FORMICIDAE) BY *AMPHISBAENA ALBA* (REPTILIA:
SQUAMATA)**

Campos, V. A., Dáttilo, W., Oda, F. H., Piroseli, L. E. & Dartora, A. 2014. Detección y uso de senderos de la hormiga cortadora de hojas *Atta laevigata* (Hymenoptera: Formicidae) por *Amphisbaena alba* (Reptilia: Squamata). *Acta Zoológica Mexicana (n. s.)*, 30(2): 403-407.

RESUMEN. Se provee información sobre un individuo de *Amphisbaena alba* (Reptilia: Squamata) que reconoce y usa un sendero de la hormiga cortadora de hojas *Atta laevigata* (Hymenoptera: Formicidae) en la sabana neotropical de Brasil. También registramos y describimos movimientos de desviación de obstáculos y el comportamiento de *A. alba* para reconocer el sendero de hormigas. Adicionalmente, discutimos cómo el mimetismo químico de *A. alba* pudiera estar involucrado en nuestra observación y sugerimos que esta relación va más allá de un simple inquilinismo, donde *A. alba* puede usar el nido como un sitio de reposo y alimentación para otros organismos asociados con nidos de hormigas cortadoras.

Palabras clave: Inquilinismo, nidos de hormiga, mimetismo químico, estrategia no agresiva, interacciones interespecíficas.

Amphisbaenians, or worm lizards, constitute a monophyletic group of highly specialized fossorial squamates with approximately 200 species (Pinna *et al.* 2010). Six families are recognized in the suborder Amphisbaenia, of which only Amphisbaenidae is present in Brazil with 68 known species (Pinna *et al.* 2010). The life cycle of amphisbaenians is almost entirely restricted to the interior soil of tropical and temperate environments (Kearney 2003), and their diet consisted mainly of small invertebrate prey (*e.g.*, beetles, ants and spiders) (Colli & Zamboni 1999). Because they live underground, the natural history of amphisbaenians remains poorly understood (Andrade 2006). This is applicable to *Amphisbaena alba* Linnaeus 1758, one of the most common and widely distributed amphisbaenids in South America east of the Andes (see Pinna *et al.* 2010). This species does not exhibit sexual dimorphism and its reproduction occurs apparently in the dry season (Colli & Zamboni 1999).

Associations of *A. alba* with leaf-cutting ants of the genus *Atta* is long-standing known (Riley *et al.* 1986). Some studies indicate that *A. alba* can be considered a facultative inquiline of leaf-cutting ant nests, such as *Atta cephalotes* (Stahel & Geijskes 1939, Riley *et al.* 1986), *Atta sexdens* (Stahel & Geijskes 1939) and some species of *Acromyrmex* (Della Lucia *et al.* 1993). Within the nests, individuals of *A. alba* feed primarily on small invertebrates, which are inquilines of ant nests (Riley *et al.* 1986). The present study adds new information on the association of *A. alba* with leaf-cutting ants after an observation made under natural circumstances in the Neotropical Savanna.

During a field expedition to the “Garimpo do Araés”, municipality of Nova Xavantina, Mato Grosso State, Brazil (14°52'59" S; 52°48'96" W, 334 m above sea level), an adult specimen of *A. alba* was observed following a foraging trail of the leaf-cutting ant *Atta laevigata* F. Smith 1858. During the observation, we employed the focal animal method to record all occurrences of specific behaviors of interest exhibited by the amphisbaenid. Ant workers were collected as vouchers and identified according to Della Lucia (1993), and subsequently deposited in the Entomological Collection of Universidade Federal de Mato Grosso (CEMT).

On April 23th 2009, at 08:50 h, after a rainy night, an individual of *A. alba* was found in activity on the soil surface in an area covered by Cerrado *sensu stricto* vegetation (Neotropical Savanna). Constantly tongue-flicking, the animal crawled for about 18 minutes, without going in any particular direction. At 09:08 h, it apparently detected a foraging trail of the leaf-cutting ant *A. laevigata*, which was not in activity at the time of observation. Tongue-flicking rate increased as soon as the animal entered the trail (Fig. 1A). The amphisbaenian deviated from obstacles (small stones with mean diameter of approximately 20 mm) on two occasions while moving along the trail, after which it soon returned to the trail and continued to move forward (Fig. 1B). With the head always near the ground while continuously tongue-flicking, the individual moved strictly forward along the trail for 53 meters until it reached and entered the main entrance hole of the ant nest, at 09:25 h (Fig. 1C). During the whole time, the distance between the observer and the individual of *A. alba* was approximately three meters. Additionally, we observed another individual of *A. alba* recognizing and using a foraging trail of *A. laevigata* in the same area in November 2011. However, we do not have detailed information about this behavior.

Although scarce, our observations suggest that individuals of *A. alba* in nature could use chemical cues along trails to locate and reach nests of leaf-cutting ants of the genus *Atta*. Riley *et al.* (1986) experimentally demonstrated that *A. alba* can follow ant trails and suggested that the orientation cue used is predominantly olfactory, and methyl 4-methylpyrrole-2-carboxylate could be the major trail pheromone, although there could be a complex of pheromonal factors (Robertson *et al.* 1980). Additionally, the same authors also observed that individuals of *A. alba* maintained

the head near to the ground surface and increased tongue-flicking rate while following trails of *A. cephalotes*.

Chemoreception is an advantageous adaptation component to fossorial habit organisms (López & Martín 2001), which could help *A. alba* to locate nests of the leaf-cutting ants from the genus *Atta*. It is possible that when *A. alba* moves along the trail, ants pheromone particles could adhere to the amphisbaenian body, thus enabling it to chemically mimetize leaf-cutting ants of the genus *Atta*, in order to get a kind of “passport entry” into the nest. We already know that pheromones found on the trail of leaf-cutting ants can last up to 96 hours (four days) (Moreira & Della Lucia 1993). Therefore, regardless of the presence or absence of ants on the trails, if a trail

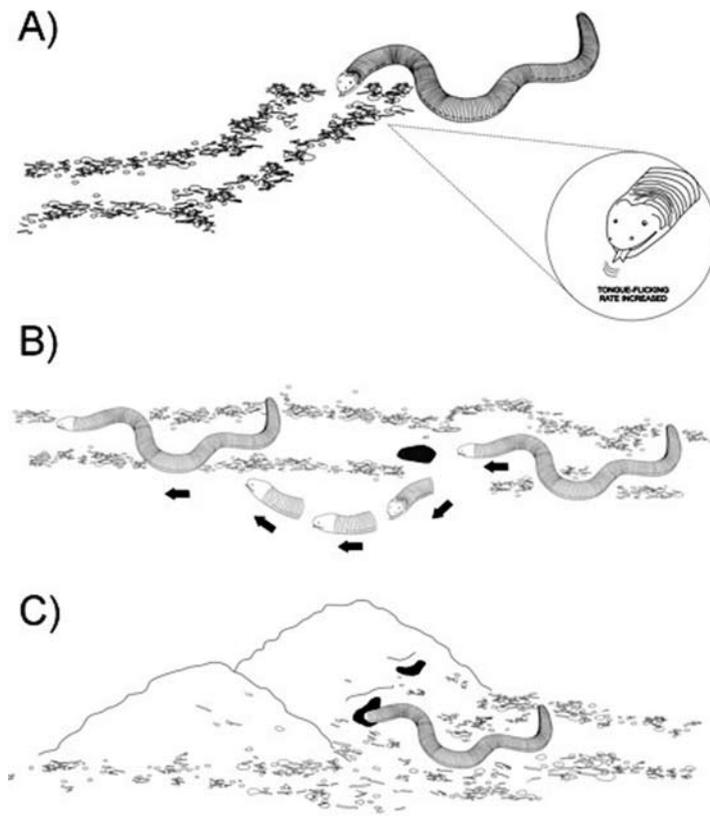


Figure 1. The specimen *Amphisbaena alba* (A) detected a foraging trail of leaf-cutting ants, which was not in activity at the time of observation (tongue-flicking rate increased as soon as the animal entered the trail); the amphisbaenian deviated from obstacles (B) while moving along the trail, after which it soon returned to the trail and continued to move forward; and the individual reached and entered the main entrance hole of ants nest (C).

is active, individuals of *A. alba* could acquire the ants pheromone. In fact, organisms entering the nests of ants developed elaborate morphophysiological and behavioral adaptations, otherwise they would be recognized by the ants and attacked (Della Lucia *et al.* 1993).

Although this report does not provides enough information to conclude the actual relationship between *A. alba* and leaf-cutting ants, if chemoreception is involved this relationship may go beyond a simple inquilinism. Worm lizards use nests of *A. laevigata* as refuge after heavy rains (see Stahel & Geijskes 1939). *A. alba* can use leaf-cutting ants nests as sites for egg laying and feeding on other organisms associated with nests. Thus, the ability to recognize chemical trails of *A. laevigata*, added with experiments performed by Riley *et al.* (1986) suggest that chemosensory adaptation helps in the recognition of *Atta* nests.

ACKNOWLEDGMENTS. We thank Tamí Mott and Christine Strüssmann for helpful discussions and comments on earlier versions of the manuscript. We gratefully acknowledge funding from the CNPq to W. Dáttilo and from the CAPES to F.H. Oda.

LITERATURE CITED

- Andrade, D. V., Nascimento, L. B. & Abe, A. S. 2006. Habits hidden underground: a review on the reproduction of the *Amphisbaenia* with notes on four Neotropical species. *Amphibia-Reptilia*, 27: 207-217.
- Colli, G. R. & Zamboni, D. S. 1999. Ecology of the worm-lizard *Amphisbaena alba* in the Cerrado of Central Brazil. *Copeia*, 3: 733-742.
- Cooper, W. E., López, P. & Salvador, A. 1994. Pheromone detection by an amphisbaenian. *Animal Behavior*, 47: 1401-1411.
- Della Lucia, T. M. C., Moreira, D. D. O. & Oliveira, M. A. 1993. Inimigos Naturais e Organismos Associados aos Ninhos, pp. 131-150. In: Della Lucia, T.M.C. (Ed). *As Formigas Cortadeiras*. Editora Folha Viçosa, Minas Gerais.
- Kearney, M. 2003. Systematics of the Amphisbaenia (Lepidosauria: Squamata) based on morphological evidence from recent and fossil forms. *Herpetological Monographs*, 17: 1-74.
- López, P. & Martín, J. 2001. Chemosensory predator recognition induces specific defensive behaviors in a fossorial amphisbaenian. *Animal Behavior*, 62: 259-264.
- Moreira, D. D. O. & Della Lucia, T. M. C. 1993. Duração do feromônio de trilha de *Acromyrmex subterraneus subterraneus* e sua capacidade de atração em diferentes concentrações. *Revista Árvore*, 17: 202-212.
- Pinna, P. H., Mendonça, A. F., Bocchiglieri, A. & Fernandes, D. S. 2010. A new two-pored *Amphisbaena* Linnaeus from the endangered Brazilian Cerrado biome (Squamata: Amphisbaenidae). *Zootaxa*, 2569: 44-54.
- Riley, R. G., Silvershein, R. M., Carroll, B. & Carroll, R. 1974. Methyl 4-methylpyrrole-2-carboxylate: a volatile trail pheromone from the leaf-cutting ant *Atta cephalotes*. *Journal of Insect Physiology*, 20: 651-654.
- Riley, J., Winch, J. M., Stimson, A. F. & Pope, R. D. 1986. The association of *Amphisbaena alba* (Reptilia: Amphisbaenia) with the leaf-cutting ant *Atta cephalotes* in Trinidad. *Journal of Natural History*, 20: 459-470.

Robertson, P. L., Dudzinski, M. L. & Orton, C. J. 1980. Exocrine gland involvement in trailing behaviour in the Argentine ant (Formicidae: Dolichoderinae). *Animal Behaviour*, 28: 1255-1273.

Stahel, G. V. & Geijskes, D. C. 1939. Ueber den Bau der nester von *Atta cephalotes* L. und *Atta sexdens* L. (Hym. Formicidae). *Revista de Entomologia*, 10: 27-28.

**VITOR AZARIAS CAMPOS,¹ WESLEY DÁTILLO,^{2*} FABRICIO HIROIUKI ODA,³
LUIS EDUARDO PIROSELI⁴ & ALINE DARTORA⁴**

¹Universidade Federal de Mato Grosso, 78060-900. Cuiabá, Mato Grosso, Brazil. ²Instituto de Neuroetología, Universidad Veracruzana, 91190 Xalapa, Veracruz, Mexico. * Corresponding author. e-mail: wdattilo@hotmail.com. ³Universidade Estadual de Maringá, 87020-900. Maringá, Paraná, Brazil. ⁴Universidade do Estado de Mato Grosso, 78300-000, Tangará da Serra, Mato Grosso, Brazil.