



Research note

## Use of sleeping perches by the lizard *Anolis uniformis* (Squamata: Polychrotidae) in the fragmented tropical rainforest at Los Tuxtlas, Mexico

### Uso de perchas para dormir por la lagartija *Anolis uniformis* (Squamata: Polychrotidae) en el bosque tropical fragmentado de Los Tuxtlas, México

Elisa Cabrera-Guzmán<sup>1,2\*</sup> and Víctor Hugo Reynoso<sup>1</sup>

<sup>1</sup>Colección Nacional de Anfibios y Reptiles, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México. Circuito exterior, Ciudad Universitaria, 04510 México, D.F., México.

<sup>2</sup>School of Biological Sciences, The University of Sydney. Tropical Ecology Research Facility, Middle Point, Northern Territory 0836, Australia.

\*Correspondent: [anfisenido@yahoo.com](mailto:anfisenido@yahoo.com)

**Abstract.** The use of nocturnal perches by the lizard *Anolis uniformis* is described. Bimonthly surveys were made throughout a year in small fragments and continuous tropical rainforest areas at Los Tuxtlas, Mexico. Twenty three juvenile individuals and 7 adults were recorded sleeping during the sampling time (18:00 - 23:00 h.). All individuals were found on leaves of plants of 14 species. Perch height ranged from 41.0 to 140.5 cm (mean: 90.1 cm juveniles; 80.6 cm adults) and the most frequent sleeping position observed was with the body oriented along the longitudinal axis of the leaf and the head facing the stem of the plant. This apparently vulnerable position can permit the perception of external stimuli such as proximity of predators; although, eco-physiological factors may also influence selection of sleeping perch sites.

Key words: perch, nocturnal, *Anolis uniformis*, Los Tuxtlas, to sleep, leaves, plants.

**Resumen.** Se describe el uso de perchas nocturnas por parte de la lagartija *Anolis uniformis*. Durante un año se realizaron muestreos bimensuales en fragmentos pequeños y áreas continuas de bosque tropical perennifolio en Los Tuxtlas, México. Se registraron 23 individuos juveniles y 7 adultos durmiendo durante las horas de muestreo (18:00 a 23:00 hrs). Todos los individuos fueron encontrados en hojas de plantas pertenecientes a 14 especies. La altura de las perchas varió entre 41.0 y 140.5 cm (promedio: 90.1 cm juveniles; 80.6 cm adultos) y la posición más frecuente de las lagartijas al dormir fue con el cuerpo extendido a lo largo del eje longitudinal de la hoja y la cabeza dirigida hacia el tallo de la planta. Esta posición, aparentemente vulnerable, puede permitir la percepción de estímulos externos como la aproximación de depredadores; sin embargo, factores eco-fisiológicos pueden también influir en la selección de sitios para dormir.

Palabras clave: percha, nocturna, *Anolis uniformis*, Los Tuxtlas, dormir, hojas, plantas.

The Lesser Scaly Anole *Anolis uniformis*, lives in wet tropical rainforests at low elevations from southern Veracruz, Mexico, through northern Guatemala, Belize, and northern Honduras (Campbell et al., 1989; Campbell, 1998; Lieb, 2001).

This diurnal lizard is the most common species in the fragmented tropical rainforest at Los Tuxtlas, Veracruz, Mexico, where they are active on the forest leaf litter and perched on low vegetation or tree buttresses during the morning and the afternoon (Villarreal and Heras, 1997; Urbina et al., 2006; pers. obs.). In the forest interior, its abundance contrasts with its absence in the surrounding

grass habitat (Urbina et al., 2006; Cabrera et al., in press). Despite being an important component of the herpetofauna of the region, many aspects of the ecology of *A. uniformis*, including use of nocturnal refuge sites, remain unstudied. Our observations in the field help to describe sleeping perches use.

Nocturnal perch or sleeping perch selection in anoles can be influenced by diurnal behaviour (including territorial defense, escape behavior, and microhabitat choice). Differences between diurnal and nocturnal perches may result from different selective pressures during day and night (Singhal et al., 2007).

From April 2003 to March 2004, we conducted bi-monthly nocturnal (18:00 to 23:00 h) headlamp-assisted

Recibido: 28 julio 2009; aceptado: 12 marzo 2010

surveys as part of a long-term study of herpetological community structure. We surveyed 6 tropical rainforest fragments (<20 ha; ca. 35 years of isolation; 119-683 masl) completely surrounded by cattle pasture in Colonia Agrícola Ganadera Adolfo Ruíz Cortines, San Andrés Tuxtla, and 2 larger continuous vegetation areas in Laguna Escondida and Lote 67 from the Los Tuxtlas Tropical Biology Station rainforest (Table 1).

We searched for animals in all available microhabitats (plants, trees, lianas, leaf litter, etc.) from ground level to 2.5 m height, and recorded time, snout-vent length (SVL), age class, and sex for each sleeping *A. uniformis* found. For each sleeping perch, we recorded the substratum type, height from the nearest point to the ground (cm), environmental temperature and relative humidity (the latter with a thermohygrometer). For the posterior identification of the plants we marked the perch, photographed it or sampled it.

After 480 man hours of sampling effort (6 surveys x 5 hours x 8 sites x 2 people), we recorded 30 sleeping *A. uniformis* (from 18:48 to 21:55 h): 23 hatchlings and juveniles (mean SVL: 22.3 mm  $\pm$  4.5 SD, range 13-28 mm) and 7 adults (mean SVL: 37.2 mm  $\pm$  4.1 SD, range 31-43 mm) in the forest understory. We considered 30 mm SVL as the minimum body length of mature adults following Campbell et al. (1989). All sleeping lizards were located on the exposed or semi-exposed surfaces of seedlings and adult plant leaves of *Calathea ovandensis* (n=1), *Chamaedorea ernesti-augusti* (n=1), *Costus* sp. (n=1), *Croton schiedeana* (n=1), *Dieffenbachia oerstedii* (n=1), *D. seguine* (n=1), *Hamelia longipes* (n=2), *Hamelia* sp. (n=2), *Maranta* sp. (n=1), *Monstera acuminata* (n=3), *Philodendron tripartitum* (n=1), *Philodendron* sp. (n=1), *Piper hispidum* (n=1), *Piper* sp. (n=1), *Psychotria faxlucens* (n=1), *Syngonium podophyllum* (n=2), *Syngonium* sp. (n=2), *Urera caracasana* (n=1) and 6

additional unidentified plants (plant sp. 1 (n=2), plant sp. 2 (n=1), plant sp. 3 (n=3)). Lizards did not show an evident preference for a particular plant species. The percentage of used species is very similar.

Perch heights ranged from 41.0 to 140.5 cm (juveniles mean 90.1  $\pm$  29.7 SD; adults mean 80.6  $\pm$  13.4 SD). Environmental temperature on these perches ranged from 17 °C to 27 °C (mean 19.7  $\pm$  3.0 SD) and relative humidity from 59% to 98% (mean 88.8  $\pm$  11.9 SD). Most (67%) of the sleeping lizards were found in January, 2004 (Table 1), when the lowest temperatures and highest levels of humidity, precipitation, and fog occurred. This suggests that these lizards may change sleeping perch during the hot, dry season, to a higher place in the canopy or underground.

The most frequent sleeping position observed was with the body oriented along the longitudinal axis of the leaf, with the head facing the stem of the plant; 53% of the lizards were in this position. The other lizards were placed perpendicular on the leaf (20%) or with the head pointed towards the tip of the leaf (26 %) (Fig. 1).

Anole sleeping perches have been described in different detail for *Anolis cristatellus*, *A. gundlachi*, *A. krugi*, *A. occultus*, and *A. pulchellus* in Puerto Rico (Gorman, 1980; Goto and Osborne, 1989; Clark and Gillingham, 1990; Traverzo, 2008), *A. "anoriensis"*, *A. mariarum*, and *A. ventrimaculatus* in Colombia (Kattan, 1984; Molina-Zuluaga and Gutiérrez-Cárdenas, 2007), *A. darlingtoni* in Haiti (Thomas and Hedges, 1991), *A. gingivinus* in Anguilla (Shew et al., 2002), *A. fuscoauratus*, *A. punctatus*, *A. trachyderma*, and *A. transversalis* in Ecuador and Brazil (Vitt et al., 2002; Vitt et al., 2003a; Vitt et al., 2003b), *A. aeneus* and *A. richardii* in Grenada (Poche et al., 2005), as well as *A. grahmi*, *A. lineatopus*, and *A. valencienni* in Jamaica (Singhal et al., 2007). Branches and leaves of ferns, herbs, grasses, bushes, shrubs, and trees are

**Table 1.** Number of sleeping *Anolis uniformis* recorded per site and survey

Site	Size (ha)	Localization	Number of sleeping anoles					
			Apr. 03	June 03	Sep. 03	Nov. 03	Jan. 04	Mar. 04
Fragment 1	1.4	18° 36' 29.50" N, 95° 08' 46.64" O	0	0	0	0	13	0
Fragment 2	2.8	18° 36' 25.90" N, 95° 08' 37.35" O	0	0	0	2	1	0
Fragment 3	3.6	18° 36' 6.72" N, 95° 08' 18.76" O	0	1	0	1	0	1
Fragment 4	6.2	18° 36' 58.19" N, 95° 07' 46.47" O	0	0	0	0	1	0
Fragment 5	6.6	18° 35' 48.52" N, 95° 07' 11.15" O	0	0	0	2	1	0
Fragment 6	17.4	18° 36' 41.63" N, 95° 08' 21.12" O	0	0	0	1	2	1
Laguna Escondida	C	18° 35' 27.12" N, 95° 05' 17.76" O	1	0	0	0	2	0
Los Tuxtlas Biological Station	C	18° 35' 6.48" N, 95° 04' 30.72" O	0	0	0	0	0	0

C=Continuous forest.



**Figure 1.** Adult *Anolis uniformis* on sleeping perch (*Chamaedorea ernesti-augusti*) in a 3.6 ha rainforest fragment at Los Tuxtlas (Photo by Marco A. Márquez).

the sleeping perches reported for these lizards. Similar to our observations with *A. uniformis*, many species (*A. anoriensis*, *A. cristatellus*, *A. ginigivinus*, *A. grahami*, *A. gundlachi*, *A. krugi*, *A. lineatopus*, *A. mariarum*, *A. trachyderma*, and *A. ventrimaculatus*) use the surfaces of leaves as their main sleeping sites (Kattan, 1984; Clark and Gillingham, 1990; Shew et al., 2002; Vitt et al., 2002; Molina-Zuluaga and Gutiérrez-Cárdenas, 2007; Singhal, et al., 2007; Traverzo, 2008). However, most species use at least 2 different perch types.

*Anolis uniformis* appears to cease daily activity when the forest understory gets dark. At this time, they seek for a sleeping perch in plants predominantly with simple, broad, horizontal leaves. Whether this pattern reflects availability or selection of sleeping sites was not examined, however, because 43.3% of the lizards were found in a very small (1.4 ha) and disturbed forest fragment with low plant species richness we suspect that in many instances occupation of sleeping perches was based on availability rather than on perch selection. The lack of detection of sleeping lizards in the largest and least disturbed forest (Los Tuxtlas Biological Station) may indicate that lizards are less conspicuous because of forest structure complexity, but they could also sleep higher in the canopy or show lower densities than the populations in small fragments. Nonetheless, 2 male *A. uniformis* were observed sleeping on the same leaf on a plant at Lote 73 of the Los Tuxtlas Tropical Biology

Station rainforest (Hernández-Ordóñez pers. com.), and adult individuals were observed sleeping on the leaves of forest plants in the botanical garden of Los Tuxtlas Biological Station (Becerra pers. com.), showing that individuals do use the same kind of perches in continuous forest.

Sleeping perches used by *A. uniformis* can expose them to nocturnal predators such as snakes (*Imantodes cenchoa* and *Leptodeira* spp.), tarantulas, and other spiders common in the study area. However, it has been proposed that sleeping is an antipredator behaviour that reduces the likelihood of attracting the attention of predators by prey remaining immobile (Meddis, 1975).

Sleeping on plants permits an animal to be less vulnerable to terrestrial predators (Martins, 1993), and exposed perches could facilitate detection of approaching predators because cues about the immediate surroundings, especially movements, may be more easily obtained (Lima et al., 2005). For anoles, sleeping on leaves can provide warning of climbing predators because parts of the plant move when the stem is disturbed. Thus, when anoles' perches are disturbed, they wake up and drop to the forest floor, where they remain motionless or flee. Alternately, lizards can move to other locations on the plant or through plants. This is facilitated when the head of a sleeping lizard is already facing toward the stem (Vitt et al., 2002; Singhal et al., 2007; Traverzo, 2008). Nevertheless, it has been demonstrated that sleeping is not an effective antipredator strategy for anoles against some snakes such as *Corallus grenadensis* in Grenada and *Imantodes cenchoa* in Amazonian Ecuador and Brazil. These snakes forage actively by moving slowly through vegetation, tongue-flicking leaf and branch surfaces using chemosensory, thermal and visual cues to locate quiescent anoles. Once these snakes detect a lizard, they approach from adjacent branches and prey on it (Vitt et al., 2002; Yorks et al., 2004).

Other factors suggested as relevant to the selection of sleeping sites by lizards are body temperature during the night, body temperature at emergence from the overnight period of inactivity, voluntary hypothermia for conservation of energy, other physiological reasons, and territorial defense advantages (Christian et al., 1984; Kattan, 1984). Because more energy is used overnight if a lizard sleeps in a covered site, lower energetic cost



can favor the selection of exposed sites (Christian et al., 1984).

Further research into the sleeping behavior of *A. uniformis* is required, including perch fidelity, perch differences between sexes and age classes, factors determining perch selection, and the physiological and ecological consequences of sleeping-site selection.

We thank Marco A. Márquez, Arturo García, and J. Carlos Rosas for helping during the field surveys. Álvaro Campos Villanueva for plants identification; Michael Crossland and Joshua Amiel for improving the English language in this note; Genaro Gutiérrez for helping in fragments size estimation; Omar Becerra and Omar Hernández Ordóñez for providing details about observed sleeping individuals, and the Palacios-Domínguez family for providing housing and support during most of the field work. Founding was provided by PAPIIT-DGAPA, UNAM.

#### Literature cited

- Cabrera-Guzmán, E., D. Arroyo-Lambaer, M. Plasman and V. H. Reynoso. In press. La lagartija *Anolis uniformis*, especie modelo para evaluar efectos de la fragmentación del hábitat sobre poblaciones aisladas en Los Tuxtlas. In *Avances y perspectivas en la investigación de bosques tropicales y sus alrededores: Los Tuxtlas*, R. Coates and V. H. Reynoso (eds.). Instituto de Biología, UNAM.
- Campbell, J. A., D. R. Formanowicz Jr. and P. B. Medley. 1989. The reproductive cycle of *Norops uniformis* (Sauria: Iguanidae) en Veracruz, Mexico. *Biotropica* 21:237-243.
- Campbell, J. A. 1998. Amphibians and reptiles of northern Guatemala, the Yucatan, and Belize. *Animal Natural History Series*. University of Oklahoma Press. 380 p.
- Christian, K. A., C. R. Tracy and W. P. Porter. 1984. Physiological and ecological consequences of sleeping-site selection by the Galapagos land iguana (*Conolophus pallidus*). *Ecology* 65:752-758.
- Clark, D. L. and J. C. Gillingham. 1990. Sleep-site fidelity in two Puerto Rican lizards. *Animal Behaviour* 39:1138-1148.
- Gorman, G. C. 1980. *Anolis occultus*, a small cryptic canopy lizard: Are there pair bonds? *Caribbean Journal of Science* 15:29-31.
- Goto, M. M. and M. A. Osborne. 1989. Nocturnal microhabitats of two Puerto Rican grass lizards, *Anolis pulchellus* and *Anolis krugi*. *Journal of Herpetology* 23:79-81.
- Kattan, G. 1984. Sleeping perch selection in the lizard *Anolis ventrimaculatus*. *Biotropica* 16:328-329.
- Lieb, C. S. 2001. The anole lizards of Mexico: A taxonomic overview. In *Mesoamerican Herpetology: Systematics, Natural History, and Conservation*, J. D. Johnson, R. G. Webb and O. Flores-Villela (eds.). Centennial Museum, Special Publ. 1, University of Texas at El Paso, El Paso, Texas. p. 31-42.
- Lima, S. L., N. C. Rattenborg, J. A. Lesku and C. J. Amlaner. 2005. Sleeping under the risk of predation. *Animal Behaviour* 70:723-736.
- Martins, M. 1993. Why do snakes sleep on the vegetation in Central Amazonia? *Herpetological Review* 24:83-84.
- Meddis, R. 1975. On the function of sleep. *Animal Behaviour* 23:676-691.
- Molina-Zuluaga, C. and P. D. A. Gutiérrez-Cárdenas. 2007. Uso nocturno de perchas en dos especies de *Anolis* (Squamata: Polychrotidae) en un bosque Andino de Colombia. *Papéis Avulsos de Zoología* 47:273-281.
- Poche, A. J. Jr., R. Powell and R. W. Henderson. 2005. Sleep-site selection and fidelity in Grenadian anoles (Reptilia: Squamata: Polychrotidae). *Herpetozoa* 18:3-10.
- Shew, J. J., S. C. Larimer, R. Powell and J. S. Parmerlee. 2002. Sleeping patterns and sleeping-site fidelity of the lizard *Anolis gingivinus* on Anguilla. *Caribbean Journal of Science* 38:136-138.
- Singhal, S., M. A. Johnson and J. T. Ladner. 2007. The behavioral ecology of sleep: Natural sleeping site choice in three *Anolis* lizard species. *Behaviour* 144:1033-1052.
- Thomas, R. and S. B. Hedges. 1991. Rediscovery and Description of the Hispaniolan Lizard *Anolis darlingtoni* (Sauria: Iguanidae). *Caribbean Journal of Science* 27:90-93.
- Traverzo, P. F. J. 2008. Hábitat estructural nocturno y fidelidad al dormitorio en *Anolis cristatellus* y *Anolis krugi*. Tesis Maestría en Biología. Universidad de Puerto Rico. Recinto Universitario de Mayagüez. Mayagüez, Puerto Rico. 53 p.
- Urbina-Cardona, J. N., M. Olivares-Pérez and V. H. Reynoso. 2006. Herpetofauna diversity and microenvironment correlates across a pasture-edge-interior ecotone in tropical rainforest fragments in the Los Tuxtlas Biosphere Reserve of Veracruz, Mexico. *Biological Conservation* 132:61-75.
- Villarreal, J. L. and L. Heras. 1997. Historia natural de especies, *Anolis uniformis*. In *Historia Natural de Los Tuxtlas*, E. González, R. Dirzo and R. Vogt (eds.). Universidad Nacional Autónoma de México. México, D.F. p. 476-478.
- Vitt, L. J., T. C. S. Avila-Pires, P. A. Zani and M. C. Espósito. 2002. Life in shade: The ecology of *Anolis trachyderma* (Squamata: Polychrotidae) in Amazonian Ecuador and Brazil, with comparisons to ecologically similar anoles. *Copeia* 2:275-286.
- Vitt, L. J., T. C. S. Avila-Pires, M. C. Espósito, S. S. Sartorius and P. A. Zani. 2003a. Sharing Amazonian rain-forest trees: Ecology of *Anolis punctatus* and *Anolis transversalis* (Squamata: Polychrotidae). *Journal of Herpetology* 37:276-285.
- Vitt, L. J., T. C. S. Avila-Pires, P. A. Zani, S. S. Sartorius and M. C. Espósito. 2003b. Life above ground: Ecology of *Anolis fuscoauratus* in the Amazon rain forest, and comparisons with its nearest relatives. *Canadian Journal of Zoology* 81:142-156.
- Yoks, D. T., K. E. Williamson, R. W. Henderson, R. Powell and J. S. Parmerlee Jr. 2004. Foraging behavior in the arboreal boid *Corallus grenadensis*. *Studies of the Neotropical Fauna and Environment* 38:167-172.