

Notes on Activity Patterns of Five Species of *Sphaerodactylus* (Squamata: Sphaerodactylidae) from the Dominican Republic

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Photographs by the senior author except where noted.

Dwarf geckos of the genus *Sphaerodactylus* (“sphaeros”) are one of the dominant components of the West Indian herpetofauna in terms of species richness and sheer local abundance — 88 West Indian species and numerous subspecies are presently recognized (Henderson and Powell 2009) and some populations approach densities of 60,000/ha (Rodda et al. 2001). Indeed, they are such a ubiquitous feature of Caribbean herpetology that sphaeros and rum might well be staples of Caribbean islands. These geckos occupy the full scope of available habitats in the West Indies — coastal regions including mangrove thickets, cactus-covered xeric badlands, and montane cloud forests.

Sphaeros are tiny geckos, and include the smallest amniote species (Hedges and Thomas 2001). Overall, the genus is considered to be diurnally active, although nocturnal activity is reported for a few species. Most species live a secretive, semi-fossorial lifestyle that, coupled with their miniscule size, renders observation challenging (e.g., Henderson and Powell 2009). This difficulty has no doubt contributed to the fact that we currently know next to nothing about their behavior, ecology, distributions, and functional morphology. This dearth of knowledge, however, makes sphaeros very rewarding animals to study. Almost every day of fieldwork spent on these geckos generates new discoveries. In this paper, we discuss



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Male *Sphaerodactylus ladae* from Parque Nacional Francis Caamaño.



Male *Sphaerodactylus leucaster* from the karst hills of Monte Río, south of Azua. This lizard was active at night.



Juvenile female *Sphaerodactylus ladae* collected at night from Parque Nacional Francis Caamaño.

some recent observations of nocturnal or crepuscular activity patterns in five poorly known species from the Dominican Republic.

Nocturnality is the ancestral lifestyle for geckos, although diurnality has evolved multiple times. In fact, the family Sphaerodactylidae contains a mixture of diurnal and nocturnal species. The genera *Aristelliger*, *Saurodactylus*, *Euleptes*, and *Teratoscincus* are predominately nocturnal (although some species of *Aristelliger* are known to bask on exposed surfaces during the day; Henderson and Powell 2009). Every other genus in the family is largely diurnal, although nocturnal or crepuscular species are known from *Gonatodes*, *Pristurus*, and *Sphaerodactylus*. Sphaeros with recorded nocturnal activity patterns include *S. inaguae*, from xeric coastal areas in the Bahamas, *S. roosevelti*, from xeric forests of southwestern Puerto Rico, *S. savagei* from the xeric southeastern coast of the Dominican Republic, and *S. sputator* from the northern Lesser Antilles (references in Schwartz and Henderson 1991, Henderson and Powell 2009).

Inspection of where these species fall within published phylogenies (Hass 1991, Gamble et al. 2008) suggests that nocturnality has evolved multiple times within *Sphaerodactylus*. However, the differences between diurnal and nocturnal lifestyles may be exaggerated by human perception. Because sphaeros are largely semi-fossorial, they may be “active in a perpetual twilight” (Henderson and Powell 2009) regardless of the time of day. Therefore, even diurnally active sphaeros might possess the ocular morphology more typical of nocturnal lizards. In any case, so little is known about these geckos that a basic understanding of activity patterns is critical for

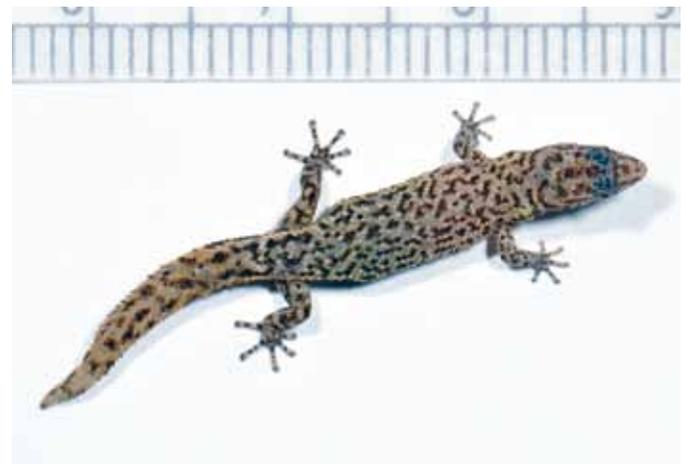
accurate survey work. Indeed, for most species, no published data address activity patterns.

Sphaerodactylus leucaster and *S. thompsoni*

Sphaerodactylus leucaster and *S. thompsoni* are poorly known xerophilic geckos from Hispaniola. During recent research trips to the Dominican Republic, we collected individuals of these species under dead *Agave* plants and rocks, respectively, during the day. Shortly after collecting these animals, we noted the presence of vertically elliptical pupils, which stands in contrast to the round pupil characteristic of most species in the genus, and is more typical of nocturnal geckos. Considering the oppressive heat of the habitat (exposed surface temperatures often surpass 60 °C during the heat of the day), we decided to survey habitats at night to see if these geckos were active, and perhaps more abundant than daytime surveys implied.

On successive nights, we observed multiple animals of both species moving around on exposed surfaces. For *S. leucaster*, we observed a total of 20 individuals (all adults or sub-adults) over the course of two separate nights (21 August 2009, 14 January 2010) on a karst-strewn hillside south of Monte Río, Azua Province. We found individuals of both sexes on the ground or on the sides of rocks revealed by direct encounters or reflective eye-shines. Once disturbed, geckos would run for the nearest cover, which was either dead *Agave* or karst talus. For *S. thompsoni*, we observed >30 animals during multiple nights of searching (August 2009 and January 2010) and at multiple localities along the Alcoa Road between Cabo Rojo and Las Mercedes. The geckos were on karst rocks at 2000–2300 h, and included both sexes and all age classes. Animals were frequently found on vertical rock faces, and were rarely far from crevices. A number of animals also were found by flipping small talus piles. In such instances, geckos were often on the undersides of the rocks. We found more animals in these piles at night than we did with similar effort during the day. Our field observations are recapitulated for both species by captive specimens; animals emerge after the lights are turned off and remain active for several hours.

We collected microhabitat temperature data for some individuals of *S. thompsoni* by using an infrared temperature gun to record the surface temperature at the site of encounter. The average surface temperature was 31.9 ± 1.5 °C ($N = 6$). We also recorded the temperature of active, but undisturbed, tarantulas (*Phormictopus cancerides*), which we have witnessed killing *Sphaerodactylus ladae*. The average tarantula temperature was 29.1 ± 0.8 °C ($N = 3$). Although the sample size is small, a Student's *t* test indicated that the difference in average temperatures of these species was significant ($t = 2.97$, $df = 7$, $P = 0.02$). These limited and admittedly very preliminary data suggest that interactions between tarantulas and geckos might be minimized by different thermal preferences.



Female *Sphaerodactylus cryphius* from an old rock quarry between Duvergé and Jimaní. The scale is in mm. This gecko was collected as an adult underneath a dead *Agave* during the afternoon in August 2008; she is still alive as of 27 January 2011.

Sphaerodactylus ladae

Sphaerodactylus ladae is known only from the Dominican Republic, where it inhabits the scrubby foothills of the Sierra de Martín García and the surrounding lowlands toward the city of Azua. We have collected this species from near Ranchería and at Parque Nacional Francis Caamaño. To our knowledge, the latter site represents the most northern and eastern records for this species. Geckos were abundant at both sites. At Ranchería, we collected animals during the day from beneath dead and rotting *Agave* plants, completely oblivious to what we would discover later at Parque Nacional Francis Caamaño. In January 2010, one of us (ML) visited the park to photograph the area at sunset and conduct a preliminary survey of the area at night. This trip resulted in the collection of three adult *S. ladae*, which were moving around, fully exposed, just after sunset. We revisited the site one year later in January 2011 at 2200–2300 h and found five animals actively moving around in shallow leaf litter collected on a boulder-strewn hillside. All were female and included two adults and three juveniles (DPS sexed them based on pattern and the absence of an enlarged escutcheon patch). We observed but failed to secure an additional three animals. The habitat at this site consists of karst limestone boulders with a short scrub canopy. The exposed ground between large rocks consists of shallow leaf litter atop gravel. We observed all of the geckos completely exposed on these patches of leaf litter.

We also collected three *S. leucaster* at Parque Nacional Francis Caamaño, where they occur sympatrically with *S. ladae*. One adult female and two juveniles were active at 2200–2300 h in exposed patches of leaf litter adjacent to large limestone rocks. Sympatry between *S. ladae* and *S. leucaster* is noteworthy because these species are similar in size, activity pattern, and appearance (males have a pale gray body with a streaked, bright yellow head; females are a dull purple-gray, with bold dorsolateral lines).

Sphaerodactylus cryphius

A final xerophilic species we have observed while active at night is *S. cryphius*. This observation, however, is limited to a single individual observed after 2200 h crawling in leaf litter near the base of a limestone cliff at an old rock quarry between Duvergé and Jimaní. Additional work is necessary to clarify if this is an isolated incident or typical of this species.

Sphaerodactylus cochranæ

Sphaerodactylus cochranæ is known only from the southern shore of the Bahía de Samaná. This beautiful and rarely seen species has been collected by only a small handful of herpetologists. On 11 September 2009 at 1800–1845 h (just around dusk), we observed four geckos within a 50-m radius on leaf litter near the coast in Parque Nacional Los Haitises. Three of the sightings were between 1830 and 1845 h, suggesting that they were just becoming active. Alternatively, the animals were ending activity and seeking roosting spots; however, this seems unlikely, considering that we spent much of the day in suitable habitat and did not collect any individuals. Additionally, previous informal nighttime surveys in Los Haitises conducted in 1996–1998 by one of us (REG) recovered active *S. cochranæ* in and around bromeliads.

Discussion

Our success in finding and collecting *S. ladae*, *S. leucaster*, and *S. thompsoni* increased at night. Furthermore, we substantially reduced our impact on the habitat during nocturnal searches because we did not have to disturb dead *Agaves* and rock piles. Considering the close phylogenetic relationship of *S. leucaster* and *S. thompsoni*, we hypothesize that the related species *S. asterulus*, *S. rhabdotus*, and *S. shrevei*, which also inhabit xeric habitats, are



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Female *Sphaerodactylus cochranæ* perched on the top leaf of a bromeliad that is common at localities where this species lives. These geckos have been seen crawling in the axils of this plant at night.

also nocturnal and might occur in greater abundance than daytime surveys imply. Similarly, *S. schuberti*, the presumed relative of *S. ladae* from the Sierra de Neiba (Thomas and Hedges 1998), might be nocturnal as well. *Sphaerodactylus schuberti* is only known from the type locality, but this area is very similar to habitats in which we have collected *S. ladae*. Similarly, the ranges of these species might well have been underestimated.

Imagining a gecko as small as *S. cryphius* surviving in brutally hot and dry habitats is difficult. Nocturnal behavior could conceivably allow this

species to forage when surface temperatures have cooled substantially from daytime highs. However, we must note that we never observed *S. plummeri* active at night during surveys for *S. thompsoni*. *Sphaerodactylus plummeri* is approximately the same size as *S. cryphius* and lives in similar habitats on the southern part of the Barahona Peninsula. However, we readily collected *S. plummeri* during the day at the same sites at which we collected *S. thompsoni* the night before. Although more research is necessary, this is highly suggestive of temporal niche partitioning.



A fisheye view of typical habitat of *Sphaerodactylus thompsoni* and *S. plummeri*. Note the high percentage of exposed surfaces and xerophytic vegetation.



A fisheye view of the habitat where we collected *Sphaerodactylus cryphius* and *S. rhabdotos* during the day. This habitat, with a mixture of scrub vegetation, dead *Agave*, and limestone rocks is typical of localities where we have collected *S. ladae* and *S. leucaster*.



Coastal leaf litter in Parque Nacional Los Haitises where we collected *Sphaerodactylus cochranæ*. The orange flag in the center of the image denotes the exact place where a gecko was first seen.



Juvenile *Sphaerodactylus schuberti* collected at the type locality near La Descubierta in August 2009.



Male *Sphaerodactylus plummeri* collected at the type locality along the Alcoa Road in August 2009.

Nocturnality has evolved multiple times within *Sphaerodactylus*, and nocturnal sphaeros are largely restricted to hot and dry habitats. Although a more rigorous comparative analysis is necessary (and forthcoming), we hypothesize that nocturnality is an adaptation to xeric conditions as it would almost certainly reduce evaporative water loss by restricting activity to cooler periods. Such transitions between activity patterns may be facilitated if sphaeros are already pre-adapted to low-light conditions because of their semi-fossorial nature. Future work should investigate the ocular morphology of species in a comparative framework, as well as quantify activity across species in terms of ambient light conditions — instead of emphasizing time of day. The observation that *S. leucaster* and *S. thompsoni* possess vertically elliptical pupils, typical

of most nocturnal geckos, whereas *S. laeae* has round pupils, suggests that multiple paths could facilitate seeing in the night.

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Urban box turtles, such as this Orate Box Turtle (*Terrapene ornata ornata*) in Lubbock, frequently cross roads and sometimes get hit by cars.