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Reproductive and parental care notes for *Norops beckeri* (Boulanger, 1891) in northern Guatemala

Köhler (2010) reviewed the species of anoles related to *Norops* (as *Anolis*) *pentaprion* in Central America, based on an analysis of coloration, morphometrics, and scalation, and recognized seven species in the region. Of these, *Norops* (as *Anoli*s) *beckeri* (Boulenger, 1881) was resurrected from synonymy for the *pentaprion*-like populations of anoles distributed from southeastern Mexico to northern Nicaragua. *Norops beckeri* can be distinguished from species related to *N. pentaprion* in Central America in that the proximal subdigital scales of the toes are differentiated as slightly broadened lamellae, and the dewlap in males contains 5–6 gorgetal-sternal scale rows, with about 16–18 scales per row. From 1 June to 14 July of 2015, during an excursion with Indigo Expeditions to Estación Biológica Las Guacamayas, Parque Nacional Laguna del Tigre, Departamento de Petén, Guatemala, we observed the behavior of a female *N. beckeri* that presumably had deposited a clutch of seven eggs in a bromeliad (Bromeliaceae).

On 9 July at approximately 1130 h, we found seven eggs within the leaves of a bromeliad in a tree, at a height of ca. 5 m above the ground. The tree was located next to a balcony at the research station, which allowed us an opportunity to observe the eggs. The color of one of the eggs was brown, and it was lying partially in a pool of water at the base of the leaves. One of the eggs appeared indented, which often is a sign that hatching is imminent (Fig. 1).

Fig. 1. Seven *Norops beckeri* eggs deposited on the base of a bromeliad leaf at Estación Biológica Las Guacamayas, Parque Nacional Laguna del Tigre, Departamento de Petén, Guatemala. The top egg was indented, often a sign that hatching is imminent, and the color of the bottom egg (partially submerged in water) was a pale brown, unlike the rest of the clutch.
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We did not observe any changes to the eggs on 10 or 11 July, but the following day at 1030 h, we witnessed an adult female *N. beckeri* grasping a leaf perpendicular to the eggs. The female kept examining the eggs and appeared to be exhaling heavily over them, and then started licking them. The female then retreated to the top of the bromeliad, but after approximately 2 min returned to the eggs and repeated the aforementioned behaviors. She repeated this process four times, before retreating higher up in the tree; 15 min later, however, she repeated these behaviors. We took photographs and video footage at a distance, so as not to disturb the female (Fig. 2A–C).

On 14 July at 1000 h, we observed the female on a different leaf of the bromeliad, at a distance of ca. 30 cm from the eggs. The female appeared to have positioned herself in an area where she could observe the eggs. On 15 July, we observed a Mexican Parrot Snake (*Leptophis mexicanus*) in the vicinity of the clutch, perhaps attempting to prey on the adult female. During this time an 8th egg was deposited, and all of the other eggs apparently had hatched.

We believe the female *N. beckeri* displayed maternal care in two ways. The first was by guarding the eggs and apparently distracting a potential predator. By retreating from the eggs, the female *N. beckeri* might have been drawing the attention of the snake away from the eggs. Although the diet of *L. mexicanus* consists largely of anurans, this species feeds on a variety of food items, including anoles and bird eggs (Henderson, 1982: Lee, 1996; Savage, 2002); anole eggs, therefore, might constitute part of the natural diet of this snake. The second way of displaying maternal care was by actively tending to the eggs and the nest. The female was observed examining the clutch, exhaling air over the eggs, and what appeared to be either cleaning of the eggs with her tongue or removing water from the base of the bromeliad; this conclusion was difficult to confirm owing to the angle of our observations. Cleaning the eggs seems unlikely, however, as most reptiles lay their eggs underground where they are subject to a large amount of substrate debris, as well as bacteria. The female perhaps was exhaling air over the eggs to provide fresh air, presumably to prevent the air around the eggs from stagnating. The eggs were deposited in an area that likely would accumulate water, thereby resulting in unviable eggs. We propose that the female was exhibiting a combination of the last two behaviors.

Additionally, our observations support the proposal that anoles lay independent, single eggs every 5–25 days during the breeding season (Losos, 2009), as the female *N. beckeri* deposited an additional egg to the clutch we first observed. These observations allowed us to report previously unknown behavioral traits by an interesting species, but they also bring additional questions. Further work is necessary to answer questions regarding the selection of an oviposition site that was prone to flooding, and to clarify the potential behaviors of the parental care we observed.

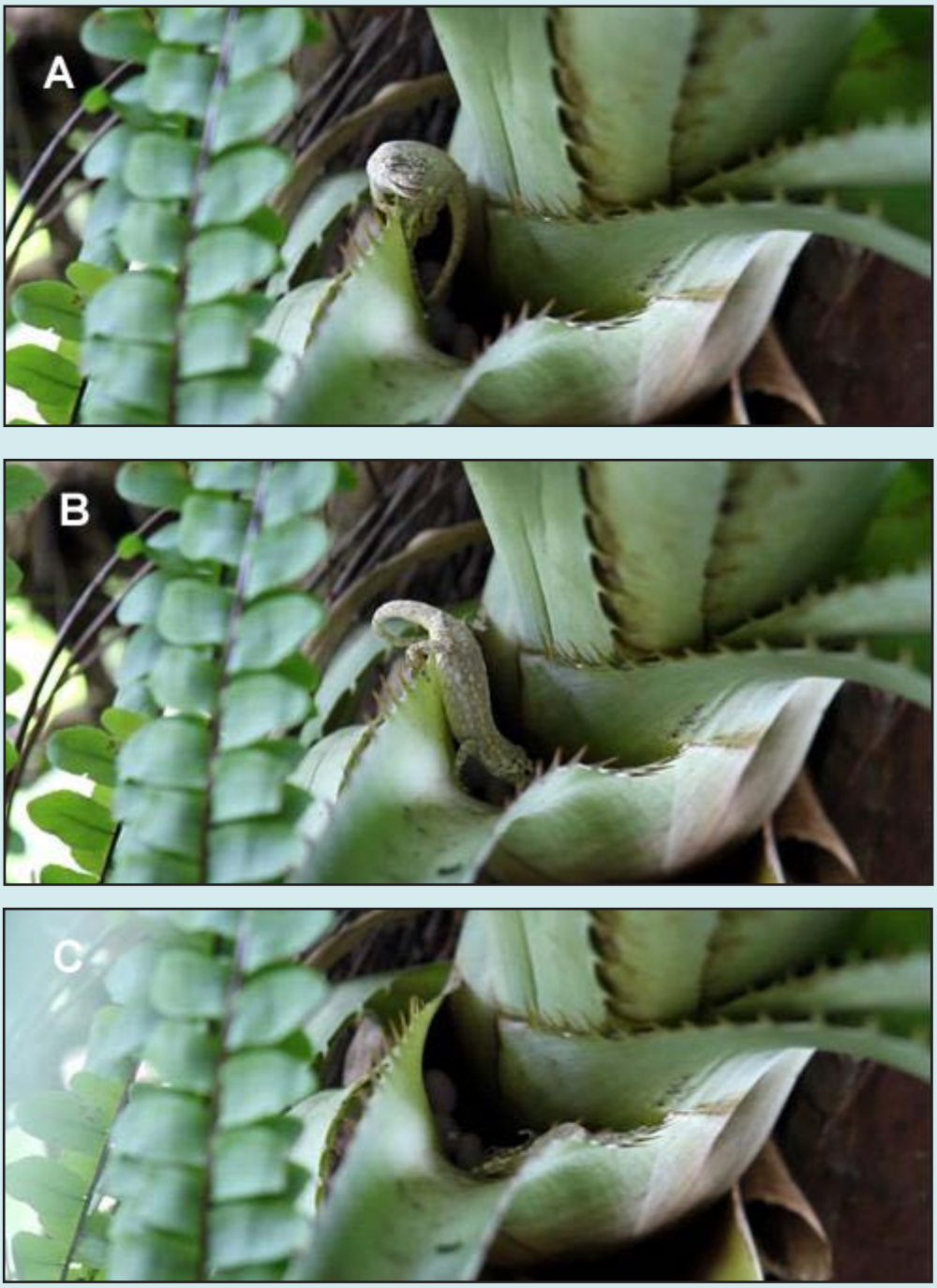

Fig. 2. Video stills of the female *Norops beckeri*: (A) grasping the edge of a bromeliad leaf; the female was observed lapping her tongue after entering the bromeliad to lick her eggs and/or the water at the base of the leaf; (B) entering the bromeliad; and (C) inspecting the eggs prior to exhaling air and licking them. © Kimberly C. Carter

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Phrynosoma solare. **Nocturnal activity**. Several reports in the literature have noted nocturnal activity in primarily diurnal reptiles, including *Gopherus agassizii* and *Gambelia wislizenii* (Huey, 1982), *Sceloporus clarkii* (Martínez-Méndez et al., 2013), and the horned lizards *P. platyrhinos*, *P. cornutum*, *P. modestum*, and *P. asio* (Harris, 1958; Williams, 1959; Lara-Resendiz et al., 2013; Raya-García, 2014). Most of these records are from arid environments.

On 28 August 2016 at 0049 h, we observed an adult male Regal Horned Lizard, *Phrynosoma solare*, active at night in desert scrub habitat near Hermosillo, Sonora, Mexico (28°48'45.74"N, 110°49'27.06"W; datum WGS 84; elev. 235 m). We assume the individual was active because it was found in an open area, with rocky soil and no evidence of a refuge (bunchgrass, shrubs, or a hole) within 4 m, and also because it was near (1.5 m) an active ant nest.

In the Sonoran Desert, diurnal lizards such as *Phrynosoma* are exposed to high diurnal temperatures (up to 43ºC; Lara-Resendiz et al., 2014), which shortens their time for diurnal activity and forces their retreat. After sunset, however, they can prolong their potential foraging time, as high diurnal temperatures result in elevated temperatures in the air, tree trunks, the soil, and rocks, which might be enough to maintain a lizard's body temperature in the activity range until midnight or later. Thus, this observation suggests the possibility that *P. solare* might complete its biological activities at night, because of the high daytime temperatures.

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