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Short Communication

Additional observations on the nest and eggs of *Stenocercus caducus* (Squamata: Tropiduridae) with a report of nest usurpation

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The Brown Leaf Lizard *Stenocercus caducus* (Cope, 1862) (Squamata: Tropiduridae) arguably is the most widely distributed of the more than 60 species of *Stenocercus* Duméril and Bibron, 1859 (Nogueira and Rodrigues 2006, Torres-Carvajal 2007, Torres-Carvajal and Mafla-Endara 2013). It is found in forested habitats in Paraguay, Brazil, Bolivia, and Argentina; although it is a common lizard, its habits are poorly known owing to its cryptic behavior (Scrocchi *et al.* 1985, Ávila *et al.* 2008, Cacciali and Rumbo 2008, Silva *et al.* 2010). Little is known about the nesting behavior in this species, but limited data available suggest that they are sexually dimorphic and reproduce in the rainy season, laying a clutch of two to four eggs (Ávila *et al.* 2008, Cacciali and Rumbo 2008). This pattern appears to be typical of many tropidurid lizards (Vitt 1993, Van Sluys *et al.* 2002). Herein, we report some additional observations on nesting behavior of *S. caducus* from Paraguay.

On 07 December 2017 at 16:15 h, a female *Stenocercus caducus* was observed sitting at a nest hole at the side of a forest trail in well-preserved semideciduous Atlantic Forest at Estancia Nueva Gambach, a property located at the southern tip of Área para Parque San Rafael, Itapúa department, Paraguay (26.63210° S, 55.65982° W, 270 m a.s.l.). She had wedged the posterior half of her body into the hole, with her hind feet pressed against the sides and her tail sticking out the top of the hole (Figure 1A). The nest had been dug recently, at the edge of the trail that observers walked multiple times per day, into humid, loose, red soil and the area in front of the nest had been cleared of leaf litter. Vegetation surrounding the rear of the nest site was approximately 50 mm high. We observed two white eggs in the nest while the female

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apparently was in the process of laying a third egg. Later, at 18:45 h, we observed that the female had covered the clutch with loose soil (but no leaf litter) and was now sitting motionless on top of the nest.

On 08 December 2017, when the female was no longer present at the nest site, we carefully excavated the nest and measured the eggs and the nest hole. The eggs were handled using gloves and measurements were recorded using a 30 cm ruler with 1 mm divisions. Egg (E) dimensions were as follows (length × width): E1 = 25 × 10 mm; E2 = 24 × 9 mm; E3 = 15 × 5 mm. Because we noticed no size difference between the two eggs observed the day before, we assume that E1 and E2 were laid first. What may be assumed to be the third egg (E3) was notably smaller, with one end crushed against E1 (the tip of E3 was flattened and stuck to the shell of E1). The eggs came apart as we removed them from the nest and there was no visible damage to E1 and no cracking in the shell of E3. All eggs were soft and whitish in color. They were reburied in their original positions after the data were recorded.

The nest chamber was 90 mm deep; the entrance was approximately circular and 45 mm in diameter. The nest lacked a lining and the eggs had been laid directly on its floor. Beyond the entrance was a short sloping surface at a 45° angle.

At 10:29 h on 09 December 2017, we were surprised to find that the previous clutch had been dug out of the nest, and a new adult female (larger with a markedly different color pattern) was now sitting over the nest and laying a new clutch of eggs (Figure 1B). E1 had been removed 168 mm away from the nest entrance (Figure 1C), E2 was 100 mm from the entrance, and E3 was at the nest entrance, in contact with the left forefoot of the new female (Figure 1D). Presumably, the sitting female dug the nest out to deposit her eggs in the chamber. Had a predator excavated the nest, the eggs would have been consumed rather than abandoned on the surface.

In Mato Grosso do Sul state, Brazil, *Stenocercus caducus* was found to have a mean clutch size of 2.75 ± 0.95 eggs; eggs were 13.07–21.58 mm ($\bar{x}$ = 17.83 mm) in length and 7.79–9.58 mm ($\bar{x}$ = 8.73 mm) in width (Ávila *et al.* 2008). These maximum values are notably smaller than those of E1 and E2 reported here, whereas E3 (which was somewhat deformed) was smaller than the minimum range value. Cacciali and Rumbo (2008) did not take morphometric data from the Paraguayan nest (also at Área para Parque San Rafael) that they observed; however, their clutch of two eggs with an estimated egg length of 23 mm is consistent with our observations.

Ávila *et al.* (2008) provided no information about the nest holes in their study, but there are significant differences between the nest observed here and that observed by Cacciali and Rumbo (2008). Firstly, the chamber is more than twice as deep as the 3–4 cm reported by those authors. Furthermore, they stated that on re-examining the nest the following day, they found it covered with soil and leaf litter and could "find no obvious evidence of the nest made the day before". The nest we observed was slightly visible the following day because an area of about 50 mm in front of it had been cleared of larger leaves. This was possibly a result of the loose red soil that had been ejected from the nest (during the original digging and consequent usurpation) and had covered some of the leaf litter, rather than the female having actively cleared away the larger leaves.

Our observations raise interesting questions about potential competition for nest sites and female breeding strategies. Cacciali and Rumbo (2008) noted that the laying female is "vulnerable to predator attack," but is protected because she is "cryptic on the leaf litter background." We noted that this species freezes when approached by an observer, allowing an extremely close approach (to within 30 cm) and relying entirely on its cryptic coloration for protection. Although such a defense may be effective during the largely inactive process of egg-laying, the same cannot be said for the active process of nest excavation, which necessarily requires movement of both the

Figure 1. (**A**) An adult female *Stenocercus caducus* laying eggs. (**B**) A second adult female depositing eggs in the nest after ejecting the three eggs from the first female. (**C**) E1 following its ejection from the nest. (**D**) Second adult female depositing eggs. The three ejected eggs are visible different distances away from the nest: E1 = 16.8 cm from the nest entrance; E2 = 10 cm from the entrance; E3 at the entrance, touching the left front foot of the second female. (Photographs by R. L. Smith.)

lizard and the soil. It may be during excavation that the lizard is under most danger of detection, and not whilst laying its eggs. Thus, some females may adopt strategies that reduce the time spent excavating, such as rapidly digging out the soft soil of an existing nest, to reduce the threat of predation. Further studies are required to confirm this and evaluate the impact of intraspecific competition on female reproductive behaviors.

Nest usurpation is moderately well documented in birds and usually is associated with competition for resources, with interspecific nest usurpation seemingly more commonly reported than intraspecific (Whitmore 1981, Baker and Payne 1993, Doherty Jr. and Grubb Jr. *et al.* 2002, Frye and Rogers 2004, Kronland 2007, Maugeri 2007, Ferrer 2008, Nath 2009, Sandoval and Barrantes 2009, Margalida and García 2011, Berl *et al.* 2013, Eguchi *et al.* 2013, Haslam *et al.* 2016, Horrocks 2016, Kasner and Pyeatt 2016, Rowe and Phillips 2016, Luchesi and Astié 2017, Myrvold and Kennedy 2018). However, it is rarely observed in most reptiles, perhaps because of the more cryptic nesting behavior of most species and the fundamental ecological differences related to parental care and nest defense among the groups.

Studies of nest-site choice and nest construction in non-avian reptiles have shown that there are important evolutionary elements in these behaviors, with incubation conditions affecting the phenotype of the offspring, and nest-site location potentially contributing to hatchling survival (Refsnider 2016). In some species, females may be forced to lay their eggs communally because of a scarcity of suitable nest sites, whereas others may choose to nest communally because of the possible fitness benefits of a particular site (Blouin-Demers *et al.* 2004, Radder and Shine 2007, Doody *et al.* 2009). A third possibility is that females may choose to steal an attractive nest site from another female to retain all the benefits for her own offspring without any of the costs of competition with unrelated individuals (Doody 2015). With this in mind, the construction of the deep nest by the usurped female here may represent a considerable risk investment, thereby becoming a valuable and desirable resource for "cheating" females to reap the benefits without exposing themselves to the potential costs.

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References

Ávila, R. W., V. L. Ferreira, and C. Maidana. 2008. Reproductive biology and feeding habitats of *Stenocercus caducus* (Iguanidae) in a semideciduous forest in Central Brazil. *South American Journal of Herpetology 3:* 112–117.

Baker, J. L. and R. L. Payne. 1993. Nest usurpation of a starling nest by a pair of Red-bellied Woodpeckers. *Florida Field Naturalist 21:* 33–24.

Berl, J. L., J. W. Edwards, and J. S. Bolsinger. 2013. Attempted conspecific cavity usurpation by Red-headed Woodpeckers (*Melanerpes erythrocephalus*). *Canadian Field-Naturalist 127:* 343–345.

Blouin-Demers, G., P. J. Weatherhead, and J. R. Row. 2004. Phenotypic consequences of nest-site selection in black rat snakes (*Elaphe obsoleta*). *Canadian Journal of Zoology 82:* 449–456.

Cacciali, P. and M. Rumbo. 2008. *Stenocercus caducus* (NCN). Reproduction. *Herpetological Review 39:* 94.

Doherty Jr., P. F. and T. C. Grubb Jr. 2002. Nest usurpation is an 'edge effect' for Carolina Chickadees *Poecile carolinensis. Journal of Avian Biology 33:* 77–82.

Doody, J. S., S. Freedberg, and J. S. Keogh. 2009. Communal egg-laying in reptiles and amphibians: evolutionary patterns and hypotheses. *Quarterly Review of Biology 84:* 229–252.

Doody, J. S., H. James, K. Colyvas, C. R. McHenry, and S. Clulow. 2015. Deep nesting in a lizard, *déjà vu* devil's corkscrews: first helical reptile burrow and deepest vertebrate nest. *Biological Journal of the Linnean Society 116:* 13-26.

Eguchi, K., N. Yamaguchi, K. Ueda, and R. A. Noske. 2013. The effects of nest usurpation and other interference by the Blue-faced Honeyeater on the reproductive success of the Grey-crowned Babbler. *Emu 113:* 77–83.

Ferrer, D. G. 2008. Usurpación de un nido de pájaro carpintero real común (*Colaptes melanchloros*) por ñanday (*Nandayus nenday*). *Revista Nuestras Aves 53:* 34.

Frye, G. G. and K. K. Rogers. 2004. Probable cavity usurpation via interspecific killing by the Mountain Bluebird (*Sialia currucoides*). *Northwestern Naturalist 85:* 126–128.

Haslam, W. F., R. A. Rowe, and J. L. Phillips. 2016. A mixed brood following usurpation of a Carolina Chickadee nest by Tree Swallows. *Southeastern Naturalist Notes 15:* N44–N49.

Horrocks, N. P. C. 2016. Usurpation of a Crowned Lapwing *Vanellus coronatus* nest by African Wattled Lapwings *V.senegalensis*. *Ostrich 87:* 95–97.

Kasner, A. C. and D. N. Pyeatt. 2016. Eurasian Collared-Dove (*Streptopelia decaocto*) usurps nest of American Robins (*Turdus migratorius*). *Wilson Journal of Ornithology 128:* 198–200.

Kronland, W. J. 2007. Nest usurpation by Red-headed Woodpeckers in southeastern Montana. *Wilson Journal of Ornithology 119:* 486–489.

Luchesi, M. N. and A. Astié. 2017. High rates of nest usurpation by Grayish Baywings (*Agelaioides badius*) in active nests of House Wrens (*Troglodytes aedon*) in central Andes. *Wilson Journal of Ornithology 129:* 630–632.

Margalida, A. and D. García. 2011. Intraspecific nest usurpation in the Bearded Vulture *Gypaetus barbatus* in Catalonia (Ne Spain). *Ardeola 58:* 303–308.

Maugeri, F. G. 2007. Usurpación de un nido de chorlito doble collar (*Charadrius falklandicus*) por el tero común (*Vanellus chilensis*). *Ornitología Neotropical 18:* 121–125.

Myrvold, K. M. and B. P. Kennedy. 2018. Shifts in Great Blue Heron habitat use following nest site usurpation: implications for salmonids. *American Midland Naturalist 179:* 105–125.

Nath, N. K. 2009. Jungle Myna *Acridotheres fuscus* usurping the nest hole of Grey-headed Starling *Sturnus malabaricus*. *Indian Birds 4:* 115.

Nogueira, C. and M. T. Rodrigues. 2006. The genus *Stenocercus* (Squamata: Tropiduridae) in extra-Amazonian Brazil, with the description of two new species. *South American Journal of Herpetology 1:* 149–165.

Radder, R. S. and R. Shine. 2007. Why do female lizards lay their eggs in communal nests? *Journal of Animal Ecology 76:* 881–887.

Refsnider, J. M. 2016. Nest-site choice and nest construction in non-avian reptiles: evolutionary significance and ecological implications. *Avian Biology and Research 9:* 76–88.

Rowe, R. A. and J. L. Phillips. 2016. Suspected usurpation of Tree Swallow nests by Eastern Bluebirds in west-central Virginia. *Northeastern Naturalist 23:* 482–489.

Sandoval, L. and G. Barrantes. 2009. Nest usurping occurrence of the Piratic Flycatcher (*Legatus leucophaius*) in southwestern Costa Rica. *Ornitología Neotropical 20:* 401–407.

Scrocchi, G. J., A. Marcus, and E. Lavilla. 1985. *Ophryoessoides caducus* (Cope). *Revue Francaise d´Aquariologie 2:* 292–293.

Silva, D. J., M. Santos-Filho, and T. M. Sanaiotti. 2010. Aspectos ecológicos de *Stenocercus caducus* (Squamata: Iguanidae) em fragmentos de floresta no sudoeste de Mato Grosso, Brasil. *Revista Colombiana de Ciencia Animal 2:* 286–302.

Torres-Carvajal, O. 2007. A taxonomic revision of South American *Stenocercus* (Squamata: Iguania) lizards. *Herpetological Monographs 21:* 76–178.

Torres-Carvajal, O. and P. M. Mafla-Endara. 2013. A new cryptic species of *Stenocercus* (Squamata: Iguanidae) from the Andes of Ecuador. *Journal of Herpetology 47:* 184–190.

Van Sluys, M., H. M. A. Mendes, V. B. Assis, and M. C. Kiefer. 2002. Reproduction of *Tropidurus montanus* Rodrigues, 1987 (Tropiduridae), a lizard from a seasonal habitat of southeastern Brazil, and a comparison with other *Tropidurus* species. *Herpetological Journal 12:* 89–97.

Vitt, L. J. 1993. Ecology of isolated open-formation *Tropidurus* (Reptilia: Tropiduridae) in Amazonian lowland rain forest. *Canadian Journal of Zoology 71:* 2370–2390.

Whitmore, M. J. 1981. Egg predation and possible usurpation of an Australian Magpie-Lark's nest by Apostlebirds. *Emu 81:* 111–112.

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