Interspecific communal oviposition and reproduction of three lizard species in Southeastern Cuba

Yasel U. Alfonso¹, Pierre Charruau²*, Gabriel Fajardo¹ and Alberto R. Estrada³

Abstract. In lizards, conspecific communal oviposition has been observed in various families, but few studies report interspecific communal oviposition (ICO), where individuals from two or more species deposit eggs in the same nest cavity simultaneously. In our research, conducted in summer of 2011 in semi-desertic lowlands of Cardonal town, Southeastern coast of Guantánamo province, Cuba, we found a nest of 20 lizard eggs (12 recently hatched and 8 intact) in a dead, dry agave plant. Non-hatched eggs were collected, measured and incubated at ambient conditions in a plastic box and hatched after 16 to 35 days. Hatchlings appeared to belong to three species of different genera from two families: Sphaerodactylus armasi (Gekkonidae), Tarentola crombiei (Gekkonidae) and Anolis argillaceus (Iguanidae). This work presents new information on the reproduction of these three species and constitutes the first report of ICO involving lizard species from different families.

Keywords. Interspecific communal oviposition, Cuba, Sphaerodactylidae, Gekkonidae, Iguanidae, reproductive ecology.

Introduction

Colonial and communal nesting have been usually used to describe the same behaviour of aggregation during nesting or egg-laying in amphibians and reptiles (Graves and Duvall, 1995). However, Espinoza and Lobo (1996) made a difference between these similar but distinct behaviours. These authors define communal nesting as “the nonincidental deposition of eggs at a shared nest cavity by two or more conspecifics” and colonial nesting or oviposition as “behaviour in which nests are constructed adjacent to one another, but the eggs are generally not deposited in the same nest cavity” (Espinoza and Lobo, 1996). In this study, we consider communal nesting, communal oviposition and communal egg-laying as synonyms but we will only use the term communal oviposition. Communal oviposition has been described in a diversity of amphibian (Jockusch and Mahoney, 1997; Zina, 2006; Doody, Freedberg and Keogh, 2009) and reptile taxa (Graves and Duvall, 1995; Albuquerque and Ferrarezi, 2004; James and Henderson, 2004; Doody, 2006; Radder and Shine, 2007; Braz, Franco and Almeida-Santos, 2008; Doody, Freedberg and Keogh, 2009; Gurgel de Sousa and Freire, 2010). In lizards, communal oviposition has been observed in various families, mainly in Gekkonidae (Rand, 1967; Espinoza and Lobo, 1996; Oda, 2004; Tulli and Scrocchi, 2005; Somaweera, 2009; Gurgel de Sousa and Freire, 2010; Montgomery et al., 2011). Furthermore, reports of this life trait in lizards mainly involve individuals of a single species and this is defined as conspecific communal oviposition (CCO). However, few studies report interspecific communal oviposition (ICO), where individuals from two or more species deposit eggs in the same nest cavity simultaneously. In Florida, Krysko, Sheehy and Hooper (2003) reported ICO involving four gecko species of two genera.

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Figure 1. Map of localization of study sites and geographic distribution of Sphaerodactylus armasi in Guantánamo Province (Cuba).
However, we are not aware of any study reporting ICO involving various lizard species from different families. Herein, we report the first observation of ICO involving *Sphaerodactylus armasi* Schwartz and Garrido, 1974 (Squamata: Gekkonidae: Sphaerodactylidae), *Tarentola crombiei* Diaz and Hedges 2008 (Squamata: Gekkonidae: Gekkonidae) and *Anolis argillaceus* Cope 1862 (Squamata: Iguanidae: Polychrotidae). We also present some information on reproductive ecology of these species.

**Materials and methods**

Fieldwork was carried out from July 5 to August 20, 2011 in Baitiquiri Ecological Reserve, Cardonal town and Imías Natural Reserve in Southeastern coast of Guantánamo province, Cuba (Fig. 1). The survey consisted of observation and capture of Guantánamo coastal geckoes (*S. armasi*) and a search for nests to determine reproductive traits of the species. We measured the snout-vent length of individuals captured with a vernier caliper (mm). We only found one nest (Fig. 2A) inside a dead, dry *Agave sp.* (approximately 50 cm high and 85 cm of diameter) in semi-desertic lowlands of Cardonal town (20º03´36´´N and 74º47´04´´W, NAD27 for Cuba, altitude: 16 m asl). The nest consisted of a cavity with dry agave fibre, removing the fibre we observed 20 eggs, 12 were recently hatched and eight were intact. We collected the eight non-hatched eggs and placed them in a plastic box (30x20x15 cm) with substratum consisting of dry agave fibre. Eggs were then transported to the laboratory of the Department for Desertification and Drought of the Centro de Aplicaciones Tecnológicas para el Desarrollo Sostenible (CATEDES) at Cardonal town (Fig. 1), where they were incubated at ambient conditions of temperature and humidity in the same plastic box. We measured maximum and minimum diameters of each egg with a vernier caliper (mm) and we waited for hatching. At hatching we determined the species of each neonate and measured their SVL with a vernier caliper (mm).

**Results and discussion**

The eggs took between 16 and 35 days to all hatch, and hatchlings belonged to three species of different genera and from two families, Gekkonidae and Iguanidae (table 1). Three eggs corresponded to *S. armasi* and were the smallest, the two larger eggs corresponded to an *Anolis sp.* belonging to the *A. argillaceus* complex and the other three eggs corresponded to *T. crombiei* and were of intermediate size (Fig. 2B, table 1).

*Sphaerodactylus armasi* is an endemic species of the southern coast of Guantánamo province (Schwartz and Garrido, 1974, 1985; Fong and Díaz, 2004; Fig. 2C-D). This species inhabits the coastal xerophytic scrub that grows over semi-desertic lowlands and karstik marine terraces associated with *Agave sp.* plants. (Schwartz

**Figure 2.** Photography of A) the interspecific communal nest discovered in this study at Cardonal town, Southeastern Cuba, B) a neonate of *S. armasi* with eggs of *S. armasi* (1), *Tarentola crombiei* (2) and *Anolis argillaceus* complex (3), C) a gravid female of *S. armasi* with an oviductal egg, D) a neonate of *S. armasi* with two eggs of the same species, E) a communal nest of *A. argillaceus*, and F) a recently hatched neonate of *A. argillaceus*. Photography by: Yasel U. Alfonso (A-D) and Alberto R. Estrada (E-F).
Reproduction of three lizard species in Cuba

Table 1. Data of eight eggs collected from the communal nest of lizard species at Cardonal, Southeastern Cuba. MIT: minimum incubation time, SVL: snout-vent length.

<table>
<thead>
<tr>
<th>ID</th>
<th>Collection date</th>
<th>Hatching date</th>
<th>MIT (days)</th>
<th>Species</th>
<th>Maximum diameter (mm)</th>
<th>Minimum diameter (mm)</th>
<th>Hatchling SVL (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06/08/2011</td>
<td>22/08/2011</td>
<td>16</td>
<td><em>Sphaerodactylus armasi</em></td>
<td>7.8</td>
<td>6.2</td>
<td>11.8</td>
</tr>
<tr>
<td>2</td>
<td>06/08/2011</td>
<td>10/09/2011</td>
<td>35</td>
<td><em>Sphaerodactylus armasi</em></td>
<td>8.5</td>
<td>6.4</td>
<td>13.6</td>
</tr>
<tr>
<td>3</td>
<td>06/08/2011</td>
<td>10/09/2011</td>
<td>35</td>
<td><em>Sphaerodactylus armasi</em></td>
<td>7.9</td>
<td>6.7</td>
<td>11.5</td>
</tr>
<tr>
<td>4</td>
<td>06/08/2011</td>
<td>27/08/2011</td>
<td>21</td>
<td><em>Tarentola combiei</em></td>
<td>10.8</td>
<td>7.2</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>06/08/2011</td>
<td>27/08/2011</td>
<td>21</td>
<td><em>Tarentola combiei</em></td>
<td>12.7</td>
<td>9.3</td>
<td>22.8</td>
</tr>
<tr>
<td>6</td>
<td>06/08/2011</td>
<td>27/08/2011</td>
<td>21</td>
<td><em>Tarentola combiei</em></td>
<td>11.4</td>
<td>8</td>
<td>21.7</td>
</tr>
<tr>
<td>7</td>
<td>06/08/2011</td>
<td>29/08/2011</td>
<td>23</td>
<td><em>Anolis argillaceus</em></td>
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<td>10</td>
<td>15.1</td>
</tr>
<tr>
<td>8</td>
<td>06/08/2011</td>
<td>29/08/2011</td>
<td>23</td>
<td><em>Anolis argillaceus</em></td>
<td>14.2</td>
<td>11.3</td>
<td>16.5</td>
</tr>
</tbody>
</table>

and Garrido, 1985). The reproductive aspect of Cuban *Sphaerodactylus* is poorly known and information on laying, hatching and hatchlings is only available for three species, *S. argus* (Lee, 1996), *S. elegans* (Holanova, 2003) and *S. pimienta* (Regalado, 2006). This study brings the first information on *S. armasi* reproductive ecology. We observed 70 individuals of *S. armasi* in dead and dry plants of agave. Thirty-six were males with a mean SVL of 27.9 ± 3.35 mm (range: 20.1-32), 12 were juveniles with a mean SVL of 17.2 ± 2.61 mm (range: 12.7-21) and 22 were gravid females with SVL of 26.8 ± 3.45 mm (range: 18.6-30.2). All the females presented a single oviductal egg with maximal development (Fig. 2C). Thus, reproductive females seem to deposit only one egg at a time as reported for other species of *Sphaerodactylus* (Duellman and Schwartz, 1958; Lee, 1996; Holanova, 2003; Köhler, 2008). Eggs were small, white, hard-shelled and slightly oval (Fig. 2B). Mean maximum and minimum egg diameters were 8.1 ± 0.4 mm and 6.4 ± 0.3 mm, respectively (table 1). Hatchlings had a mean SVL of 12.3 ± 1.1 mm (table 1). The incubation length reported for *Sphaerodactylus* is 50-125 days (Rivero, 1978; Holanova, 2003; Regalado, 2006; Köhler, 2008) and based on the minimum incubation time observed in this study (16 and 35 days, table 1), eggs of *S. armasi* were found and collected several weeks after their deposition by the female. Moreover, as *S. armasi* seem to deposit only one egg at a time and as two eggs of this species had the same minimum incubation time (table 1); it is likely that at least two females of *S. armasi* laid eggs in the nest. The observation of three females of *S. armasi* near the nest on the agave plant supports this argument.

On the same plant near the nest, we also observed two adult Crombie’s wall geckos (*Tarentola crombiei*). *Tarentola crombiei* is an endemic, recently described species from the arid south coast of Granma, Santiago de Cuba, and Guantánamo provinces in eastern Cuba (Díaz and Hedges, 2008). The main habitat of the species is coastal xerophytic scrub growing over semi-desertic lowlands and karstik marine terraces (Díaz and Hedges, 2008). The only information on reproduction of this species is available from Díaz and Hedges (2008). These authors reported several conspecific communal nests collected in dry clumps of Agave sp. at the type locality of this species (west side of the mouth of Río Jauco, Guantánamo) (Díaz and Hedges, 2008). Mean egg diameters reported by Diaz and Hedges (2008) were 12.1 x 9.1 mm (n = 12), coinciding with maximum and minimum means found in this study for this species (11.6 ± 1.0 mm and 8.2 ± 1.1 mm, n = 3, table 1). Mean hatchling SVL reported by Diaz and Hedges (2008) for *T. crombiei* (mean = 24.6, range = 23.8–25.7 mm, n = 5) is slightly higher than mean hatchlings SVL found in this study (mean = 21.5 ± 1.4 mm, n = 3, table 1). The species is reported to deposit only one egg at a time (Diaz and Hedges, 2008) and as the three eggs found in this study show the same minimum time of incubation (21 days, table 1), these had likely been deposited by different females. This is also supported by observation of various individuals of *T. crombiei* near the nest.

For the last two and larger eggs collected, we were unable to determine the actual species as it appeared to be an *Anolis sp.* and it is difficult to determine the species from hatchlings. We could only say that it belongs to the *A. argillaceus* complex present in this locality (Rodríguez-Schettino, 1999). Mean maximum and minimum diameters of the eggs were 13.9 ± 0.4 mm and 10.7 ± 0.9 mm, respectively (table 1). Mean hatchlings SVL was 15.8 ± 1.0 mm (table 1). In all anoles, females lay only one egg at a time (Köhler, 2008). Thus, as the two anole eggs found in this study...
had the same minimum time of incubation, it is likely that they were deposited at the same time by different females. Furthermore, communal oviposition has been reported in *A. argillaceus* and nests were localized in rotten wood on the ground (Fig. 2E-F) (Estrada, 1987).

In a recent publication, Doody, Freedberg and Keogh (2009) review communal oviposition in reptiles and amphibians and show that it is much more common than previously recognized. These authors also review the different “by-product” (saturated habitat, sexual selection, social behaviour) and “adaptive” (attack abatement, maternal benefits, reproductive success-based, thermoregulation, aggressive usurpation, interspecific brood parasitism, multiple defenders) hypotheses developed to explain communal oviposition in reptiles (Doody, Freedberg and Keogh, 2009). However, although several hypotheses exist, very few have been tested in wild or laboratory conditions and in very few species (Doody, Freedberg and Keogh, 2009). Furthermore, Doody, Freedberg and Keogh (2009) only include CCO and do not report either ICO cases or hypotheses for those. In this study, the information collected seems to indicate that more than one female of three different species laid eggs in the same nest. Thus, these species can be designated as conspecific and interspecific communal egg-layers. Although ICO has been already observed in lizards from different genera of the same family (Krysko, Sheehy and Hooper, 2003) we are not aware of any report of ICO involving lizards from different genera and families. This reveals our limited knowledge on nests, eggs and reproductive strategies of reptiles as mentioned by Doody, Freedberg and Keogh (2009). Moreover, if no clear explanation has already been found for CCO, where only one species with individuals sharing the same characteristics are involved, what could be the explanation for ICO, involving individuals from different species, genera and families with different physiological, biological and behavioural characteristics?

Thus, this study brings first information on reproduction ecology of *S. armasi* and new information on the reproduction of *T. crombiei* and *A. argillaceus*. Then, based on our observation, these species can be qualified as conspecific and interspecific egg-layers. This is the first report of interspecific oviposition involving lizard species from different genera and families, revealing our still poor knowledge on reproductive strategies of lizards. More effort has to be done to search for other cases of ICO in order to rule out this case as an accidental event.

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