First report of predation on Speckled Chachalaca (*Ortalis guttata*) eggs by Puffing Snake (*Phrynonax polylepis*) in Central Peru

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Egg predation by snakes are commonly reported for generalist species such as members of genus *Drymarchon*, *Panterophis* and *Elaphe*, which opportunistically eat reptile or bird eggs (Fitch 1963, Chiavacci & Bednarz 2013). Only a reduced number of snake species are known to be egg-eater specialists. One specialist species is a member of the genus *Dasypeltis* from Africa (Gartner & Greene 2008), and also, Neotropical snakes like *Drepanoides anomalus* and *D. couperi* (Martins & Oliveira 1998, Stevenson *et al*. 2010, Prudente *et al*. 2014). Occasionally, generalist snakes such as *Drymarchon corais erebennu*s, (Marion & Fleetwood 1978), *D. corais* (Cunha & Nascimento 1993, Bernarde & Abe 2010), *Leptophis ahaetulla marginatus* (Lopez *et al.* 2003), *Rachidelus brazili* (Sawaya *et al.* 2008) and *Phrynonax* spp. (Greene 1997) have been reported as cracid egg predators. Despite this, bird egg predation is still considered a rare event for Neotropical snakes (Prudente *et al.* 2014).

Regarding Neotropical colubrids, over recent years its taxonomy has been unraveled, causing changes in the systematics of this group, which included the relocation of some species into different clades (Zaher *et al.* 2009, Grazziotin *et al.* 2012, Pyron 2015, Jadin *et al.* 2014). This is the case of the "puffing snakes" of the old genus *Pseustes*, considered one of the main bird egg predators in the Neotropics. As a result, this taxon has been currently dismissed, and its remaining members have been assigned to the genus *Phrynonax* (Jadin *et al.* 2014).

Phrynonax poecilonotus and *Phrynonax polylepis* are two cryptic species currently considered as geographically separated lineages; *Phrynonax poecilonotus* occurs in Mesoamerica and *Phrynonax polylepis* in South America (Jadin *et al.* 2014). Both have formal reports for diet, all of them under the name *Pseustes poecilonotus*. Therefore, considering the locations of these records, we assign them to *Phrynonax poecilonotus* or *Phrynonax polylepis* according to the case.

Although Greene (1997) reports a snake assigned to *Pseustes poecilonotus* as an egg eater, lack of records for such events prevents us from being able to determine the current identity of the referred species. Robinson *et al.* (2005) reports *Pseustes poecilonotus* as the main snake species predator of nests of Chestnut-backed (*Myrmeciza exsul*) and Spotted Antbirds (*Hylophylax naevioides*) in Panama. Given the locality, we consider this record belonging to *Phrynonax poecilonotus*.

Also in Costa Rica, *Phrynonax poecilonotus* has been reported as the dominant nest predator for Chestnut-backed Antbird, as it was responsible for 80% of nest predations (37 of 46 nests) (Visco & Sherry 2015).

In South America, Dixon & Soini (1986) report one individual of *Phrynonax polylepis* at Iquitos, Peru, trying to swallow an egg in a nest of Spix's Guan (*Penelope jacquacu*), and Cisneros-Heredia (2005) includes eggs of Cracidae as part of the diet of *Phrynonax polylepis*. Additionally, Oniki (1979) reports an event of predation on a White-backed Fire-eye (*Pyriglena leuconota*) nest by a snake within genus *Pseustes* in Brazil. However, because previously the genus *Pseustes* included *Pseustes sulphureus* (species currently moved to genus *Spillotes* (Jadin *et al.* 2014)), incomplete data of taxonomical identity or photographs for this record does not allow us to confirm if it corresponds to a snake of the current genus *Phrynonax* or to *Spillotes sulphureus*.

Menezes & Marini (2017) in an extensive review of bird nest predators in the Neotropics, mention only three cracid species nests being predated, all by monkeys of the genus *Cebus* (Capuchins): Great Curassow (*Crax rubra*) and Crested Guan (*Penelope purpurascens*) by *C. capucinus* and Rufous-vented Chachalaca (*Ortalis ruficauda*) by *C. olivaceus*. They also mention that within the families with at least 10 species of identified nest predators, Colubridae is included (the only reptile family, along with six birds' families and one mammalian family). In Texas (United States), snake predation has been reported as the major cause of nest failure for Plain Chachalaca (*Ortalis vetula*) (Marion & Fleetwood 1978). They mention that Texas indigo snakes (*Drymarchon corais erebennus*) swallowed entire clutches of eggs, "leaving no traces in the nest or on the ground" (sic).

As for cracids, we realized that there is little information on *Ortalis guttata* breeding biology, despite being a common and widely distributed species in Amazonia in Colombia, Ecuador, Peru, Bolivia and Brazil (BirdLife International 2016). The only reference we locate was Toledo-Lima *et al*. (2013), who found an active nest in early February in northeastern Brazil. The nest was 3.2 m high on top of a tree, and was low cup/fork with a basket and the internal chamber flat without any distinct material. The average egg measurements were 55.0 × 38.4 mm and they were dull white color with rough shells.

Consequently, due to the scarcity of data on egg predation and *O. guttata* breeding biology, we decide to report this predation event by *P. polylepis* on *O. guttata* eggs. This is a contribution to the Chachalaca's natural history knowledge and predation mechanism by snakes in tropical rainforests.

On 24th November 2014 at 14:00 hours, at Cuello de la Bella, Tingo Maria National Park, Huánuco department, central Peru (9°20'24.55"S / 76° 0'4.33"O, 1070 m), we found a female *P. polylepis* (CORBIDI 15575) swallowing an egg from a nest of Speckled Chachalaca (*O. guttata*), very close to our camp site (approximately 1 m away). The snake had already consumed one egg (Fig. 1A & B). We noticed this event because the couple of Chachalacas were stridently calling over their nest. The snake was captured and removed, leaving a third egg still in the nest. Curiously, the remaining egg was predated the same day, three hours later, by a male *P. polylepis* (CORBIDI 15574; Fig. 2). All three eggs were later opened and we noticed that they were freshly laid (there were only yolk and egg white, no traces of embryo development). The snakes' Snout-Vent Length was 116.4 cm for the female and 87.2 cm for the male and mouth length (measured from the last supralabial scale to same scale of the other side of mouth) was 82.14 mm for the female and 78.4 mm for the male.

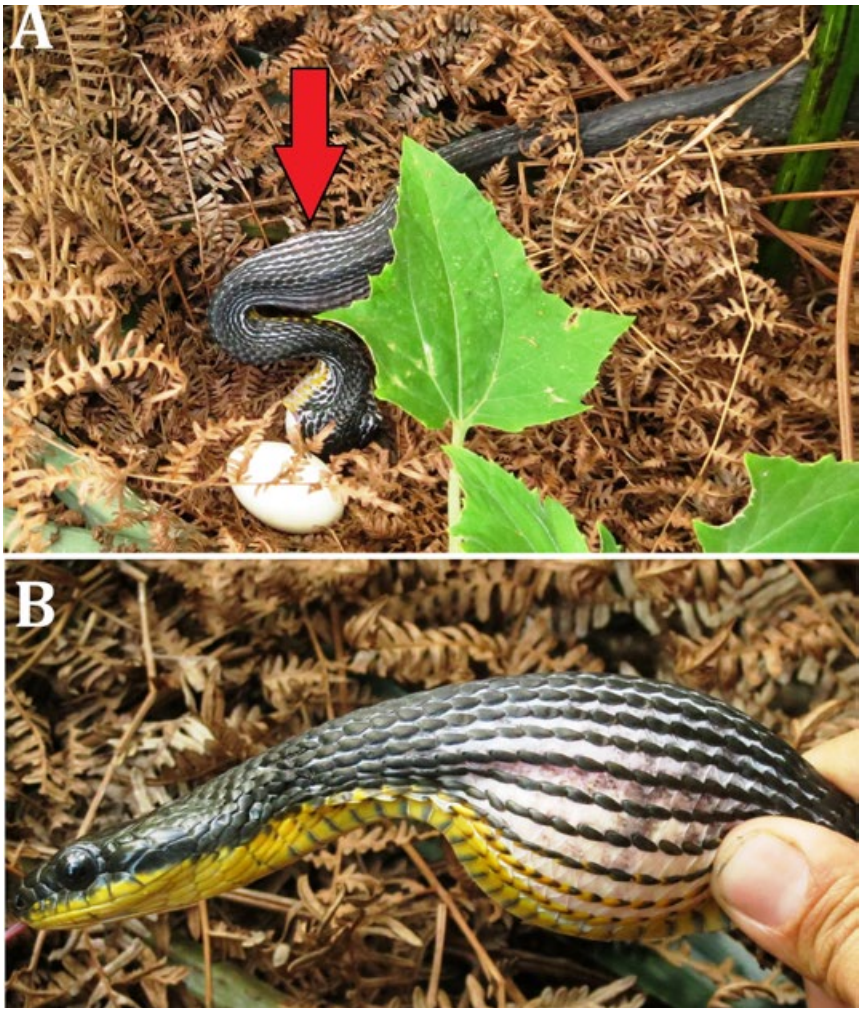

Figura 1. A) Female *Phrynonax polylepis* swallowing a Speckled Chachalaca (*Ortalis guttata*) egg. Note the red arrow pointing an already swallowed egg; B) Detail of *Phrynonax polylepis* with a swallowed *Ortalis guttata* egg. Photos: F. Angulo.

Figure 2. Male of *Phrynonax polylepis* (CORBIDI 15574) caught after predation of a Speckled Chachalaca (*Ortalis guttata*) egg. Photo: G. Chavez.

The Speckled Chachalaca nest was in a small, second growth patch on the ridge of a hill, surrounded by montane forest on a hillside facing the Huallaga River. It was about 1 m from a clearing we made to set a campsite. The nest was built at 1.6 m from ground level in a small patch of secondary vegetation dominated by the fern *Pteridium aquilinum*, locally known as *Shapumba*. This fern is an aggressive invader of disturbed areas (Jacobs & Peck 1993). The nest was naturally covered with live plants and leaves, especially *Munnozia hastifoli*a. The nest itself was built over a bed of dry ferns (Fig. 3) and was a shallow cup made of exclusively dry leaves of *P. aquilinum*, of 11 cm of diameter. The remaining egg (later predated) measured 56 x 40 mm and the color was pure white (Fig. 4).

Figura 3. Speckled Chachalaca (*Ortalis guttata*) nest location. Note the red arrow pointing where the nest is. The dry fern is *Pteridium aquilinum* and the plant to the left of the arrow is *Munnozia hastifolia*. Photo: F. Angulo.

Figure 4. Speckled Chachalaca (*Ortalis guttata*) nest and remaining egg (later predated by a male of *Phrynonax polylepis)*. Photo: F. Angulo.

Egg size and color, and internal chamber features reported by Toledo-Lima *et al.* (2013) are consistent with our observations. However, time of breeding and nest height differ significantly. Our observation happened in late November, just at the beginning of the typical rainy season in eastern Peru montane forest which goes from October through March or April (Zubieta *et al.* 2017), however, the predation event happened on a sunny day after several rainy days, conditions that are suggested to relate to higher reptile activity (Duellman, 2005).

Visco & Sherry (2015) mention that predator diversity and abundance is often higher along habitat boundaries such as agriculture/forest edges because both forest-dwelling predators and generalist predators from agricultural habitat can access nests. The nest we found was located remarkably low on the bushes surrounding a recently opened area (our campsite). This might result in an easier predation opportunity for the snake, considered semi-arboreal (Dixon & Soini 1986), since it's possible that the Chachalacas left the nest unattended due to our presence, and the snake took advantage of this situation to depredate the eggs.

Although this report provides evidence for depredation of *O. guttata* nests, further research is necessary to determine the frequency by which these kind of events occur and their impact on nest success of Peruvian populations of the Speckled Chachalaca.

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