Herpetology Notes, volume 3: 079-083 (2010) (published online on 23 March 2010)

The Corpse Bride: a case of Davian Behaviour in the Green Ameiva (*Ameiva ameiva*) in southeastern Brazil

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Abstract. Herein, we report necrophilia (Davian behaviour) in the lizard *Ameiva ameiva* in Brazilian Atlantic Forest Domain. A male *A. ameiva* was found during a sunny day courting and trying to copulate with a road-killed female. The presence of developed ovarian follicles confirmed that the female was in breeding condition. The female probably died while making a chemical trail to attract reproductive males. Apparently the male's behaviour was influenced by the high temperature of the female's body that was warmed up by the heat of the sun. Although Davian behaviour is not expected to occur frequently, a high number of dead reproductive females in Brazilian roads could result in a high frequency of necrophilia in *A. ameiva*.

Keywords. Squamata, Teiidae, courtship, necrophilia, reproduction.

Introduction

Necrophilia has been reported in several species of all major groups of tetrapods. There are observations of this kind of behaviour in mammals (Dickerman, 1960; Bagemihl, 1999), birds (Lehner, 1988; Moeliker, 2001; Bagemihl, 1999), amphibians (Meshaka-Jr., 1996; Bettaso, Haggarty and Russel, 2008; Sinovas, 2009) and reptiles (Amaral, 1932; Belluomini and Hoge, 1957/1958; Lambiris, 1966; Sharrad, King and Cairney, 1995; How and Bull, 1998; Vitt, 2003; Fallahpour, 2005; Brinker and Bucklin, 2006). The name *Davian behaviour* was first used by Dickerman (1960) when he observed necrophilia in ground squirrels *Citellus* (now *Spermophilus*). The term is a reference to a limerick about an old necrophiliac miner named Dave.

In the present work we describe courtship behaviour of an adult male *A. ameiva* with a dead conspecific female during fieldwork in southeastern Brazil.

The Green Ameiva, *Ameiva ameiva* (Linnaeus, 1758) has one of the widest distributions among New World tropical lizards, occurring in most of tropical and subtropical South America on east of the Andes, extending north to Panama (Vitt et al., 2008). This heliothermic medium-sized teiid (snout-vent length 40-190 mm) inhabits a great number of ecosystems, spanning from semi-arid regions to wet lowland forests, and even habitats that are disturbed by human activity (Vitt and Colli, 1994; Sartorius, Vitt and Colli, 1999).

Ameiva ameiva is sexually dimorphic, with adult males being larger than females (Colli, 1991; Vitt and Colli, 1994; Rocha, 2008). Reproductive period varies along a broad geographical range, tending to be continuous in areas where rainfall is abundant throughout the year or highly unpredictable, and cyclical in areas with a highly seasonal climate (Colli, 1991; Vitt and Colli, 1994). However, continuous reproduction has been reported in

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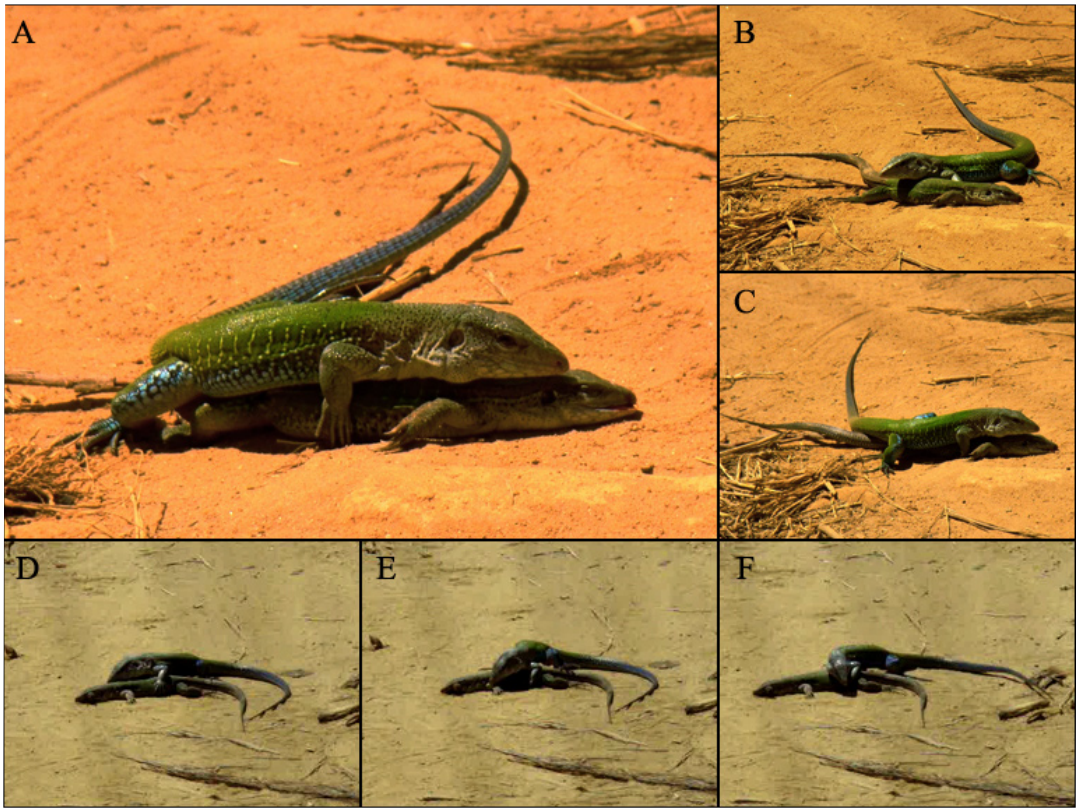

Figure 1. An adult male *Ameiva ameiva* courts a dead conspecific female (MZUFV 766). The male mounts on the back of the female (A, B, C), and later makes series of movements with hind limbs, trying to pair his cloaca with the female's (D, E, F). Photos and video frames by E. T. da Silva.

habitats with marked seasonality (Rocha, 2008).

Despite the availability of biological data concerning its reproduction, information on courtship and reproductive behaviour of *Ameiva ameiva* remains scarce. To the best of our knowledge, the only observations on *A. ameiva* courtship in the wild were those presented by Manata and Nascimento (2005) in Serra do Cipó National Park, southeastern Brazil, and by Vitt (2003) at Amazon of northern Brazil.

Materials and methods

Observations took place during an environmental impact assessment on 12 March 2009, on a dirt road at the urban area of the district of Tabajara, municipality of Inhapim, Atlantic Forest of the state of Minas Gerais, southeastern Brazil (19.586500º S, 41.762614° W). There was herbaceous vegetation on one side of the road, near a pen, and a house on the other side. Observations were written down on a notebook, and some photos and videos were taken using a digital camera (Sony DSC H 50).

Results

At 10:50 a.m. (air temperature *ca.* 33 ºC), we saw at a 5-6 m distance, an adult male of *Ameiva ameiva*, mounted on the back of a conspecifc dead adult female (probably killed after being run over by a vehicle), on the centre of the road. The male pressed his gular region against her back, rubbed it repeatedly with lateral movements of his head and flicked tongue several times. Then, he made a series of movements with his hind limbs, trying to oppose his cloaca with the female's (Fig. 1), but apparently not everting his left or right hemipenis.

At 10:59 a.m. a second male, slightly smaller than the first one, came from the vegetation and began to approach the female, being promptly chased away by the first male. Both males ran to the bushes close to the road's edge. At this time, the female's tail lifted up, and we checked to see if she was still alive (Fig. 2). After confirming it was dead, the female's body was returned to its former position. Soon after, the first male returned, circled around the female, and rubbed his

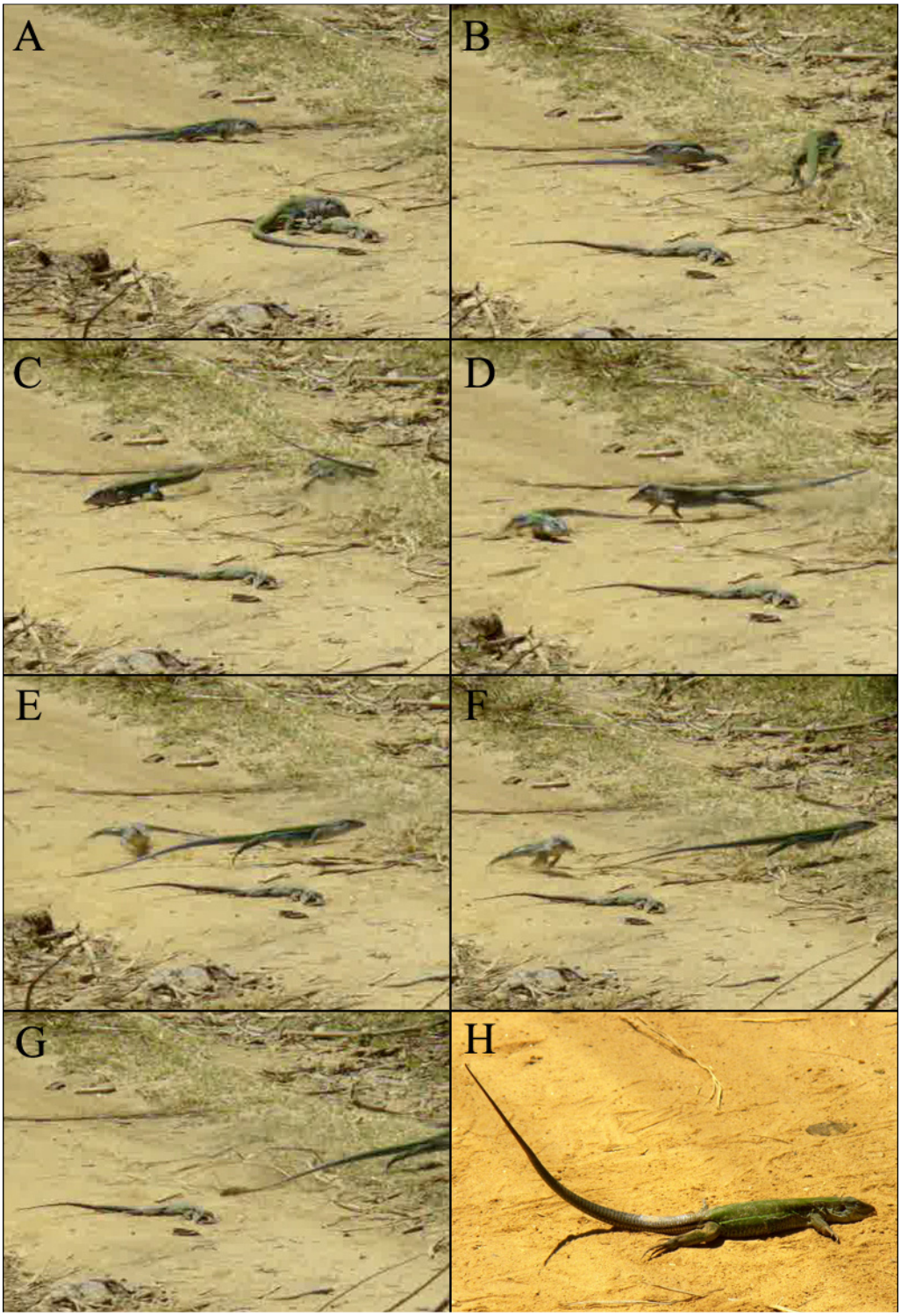

Figure 2. A second male *Ameiva ameiva*, slightly smaller than the first one, came from the vegetation and begins to get closer to the female, being promptly frighten by the first male (A-F). Both males ran to the bushes close to the edge of the road (G). At this time, the female's tail lifted up (H). Photo and video frames by E. T. da Silva.

head repeatedly, before attempting another courtship engagement. The second male returned three more times, only to be chased again by the first one. Later, the second male stayed around the area and crossed the road.

A total of 11 charges of the first male over the female were observed, within 20 minutes since the beginning of the observations. The last charge was at 11:09 a.m., and during the coupling trial the male went away from the dead female twice, to short distances, still remaining in the proximity of her body, without entering the vegetation. After that, he abandoned the female's body. Eight minutes after the male left the scene, the female's body began to present signals of dehydratation. Her tail was erect and head and front limbs were contracting. We took the lizard from the road and collected it at 11:17 a.m. The two males were observed in close proximity for five more minutes, apparently foraging.

We interrupted the male's behaviour five times. In three of them, we moved the female's body away from the road due to the passing of vehicles (returning it to the same place soon after). Another time was for photographic record, and the other was during the spontaneous lifting of the female's tail. There were also two voluntary departures of the first male besides the ones reported, as a response to the second male's approaches. In all charges of the first male over the female there were coupling trials or courtship behaviour.

The dead female was fixed in 10% formalin and dissected, which revealed the presence of six apparently fertilized eggs (14.1 x 12 mm; 14.45 x 12.35 mm; 14 x 13 mm; 14.65 x 12.5 mm; 15 x 12.2 mm; 14.7 x 12.75 mm) and several follicles in development (18 in the right and 14 in the left ovary).

Discussion

Vitt (2003) was the first to report necrophilia in *Ameiva ameiva*, at Amazon biome in northern Brazil. He shot a female that was being courted by a large male, who instantly ran off. Soon after, the male returned, tongue flicked the area, located the female and tried to mate with her, when he was shot. The same process was done later with a second smaller male (Vitt, 2003). Although the report of Vitt (2003) is quite similar to the one presented here, the fact that he killed both males soon after they tried to mate with the dead female did not allow him make some behavioural observations (*i.e.* the number and duration of coupling attempts or the interactions between the larger and the smaller male).

The presence of ovarian follicles in development shows that the dead female found by us was in breeding season. Unfortunately, we do not know whether the first male was already courting the female when she was run over, or if he first found her only after she was killed. If he was courting the female when she was killed (and he luckily escaped), he just did not notice that his partner was dead, continued the courtship and coupling trials, like the case reported by Vitt (2003).

In both sexes of *Ameiva ameiva*, the ventral skin of the thighs shows a single row of 16-23 femoral pores, each one opening in the centre of a modified scale, resembling a rosette (Imparato et al., 2007). As in other lizard species, these pores are connected to internal glands that produce a solid secretion containing non-volatile chemical cues that play a relevant role in social behaviour (Pianka and Vitt, 2003; Imparato et al., 2007). Therefore, the female was probably secreting chemical cues to attract breeding males to copulate. In *A. ameiva* this method of signal dispersion is intimately dependent on the locomotion, where the animal left a trail of chemical signals on the substrate (Imparato et al., 2007). Thus, the female could have been killed while engaged in this behaviour.

The female's chemical trail probably attracted both male's attention. The explanation for the males did not know the female was dead might stand in the fact that *Ameiva ameiva* is heliothermic, with relatively high active body temperatures. Vitt and Colli (1994), studying eight populations of *A. ameiva* in four Brazilian biomes found that these lizards are active with body temperatures from 26.4 to 42.2. ºC (mostly from 36 to 40 ºC). Observations reported here occurred during a hot day, when the air temperature was at 33 ºC. This fact may allow the body temperature of the dead female to remain elevated, as she was directly exposed to sunlight, in the centre of the dirt road, and this condition may have confused the males.

If we are correct, special conditions may favour necrophilia in *Ameiva ameiva* as a "behavioural mistake". In fact, this kind of mistake appears to occur in several reports of animal necrophilia, when a reproductive male tries to mate with a stationary and seemingly "receptive" female (Lambiris, 1966; Lehner, 1988; Sharrad, King and Cairney, 1995; How and Bull, 1998; Vitt, 2003; Fallahpour, 2005; Brinker and Bucklin, 2006). In some cases, necrophilia can also be just a result of a coupling trial by a male that usually do not access partners carefully, a common behaviour in some anurans (Meshaka-Jr., 1996; Bettaso, Haggarty and Russel, 2008; Sinovas, 2009).

It is important to note that a high number of road killed reproductive females of *Ameiva ameiva* possibly occur along some Brazilian highways, especially in sunny days and could even result in a high frequency of Davian behaviour in this species, as reported for some explosive-breeding anurans in United States (Meshaka-Jr., 1996). However, the benefits of being the first to encounter a female probably outweigh the costs of the mistakes that can happen sometimes, like trying to couple with a dead partner (Sinovas, 2009). It is possible that the impact of Davian behaviour on the evolution of reproduction is nonexistent (Sharrad, King and Cairney, 1995).

The female *A. ameiva* (135 mm. snout-vent length) is deposited in the lizard collection of *Museu de Zoologia João Moojen*, *Universidade Federal de Viçosa*, in Viçosa, Minas Gerais, Brazil, under the label MZUFV 766.

Acknowledgments. We are grateful to *Limiar Engenharia Ambiental* for financial support and *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* (IBAMA) for collection permits (#123/2009 NUFAS/MG; process #02015.014980/2008-50) to ETS, PSC, MPCO, AVN and PSS; Prof. Jorge Dergam for suggestions and English revision on an early version of the manuscript; Prof. Izabel Maldonado for identification of eggs and follicles; Carla S. Cassini, Kamelia Algiers, Ligia Pizzatto and Walter E. Meshaka Jr. provided essential bibliography. Prof. Eric R. Pianka suggested valuable references and critically reviewed a first draft of this paper. An anonymous referee also made valuable suggestions on the final version of the text.

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Accepted by Sebastian Steinfartz; Managing Editor: Alexandru Strugariu