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# Courtship behavior of *Mesoclemmys vanderhaegei* (Bour, 1973) (Testudines: Chelidae) under natural conditions in the Brazilian Cerrado

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**Abstract.** *Mesoclemmys vanderhaegei* is a Neotropical chelid lacking basic natural history studies. Based on a film made in December 2004, we describe the courtship behavior in this species. Field observations were conducted at Chapada dos Guimarães, Mato Grosso State, southwestern Brazil, in an oligotrophic stream amidst the savannah like Cerrado formation. We provide a schematic drawing of the behavioral sequences during courtship, as well as a flow diagram describing sequential responses of the female to the male behavioral patterns. *Mesoclemmys vanderhaegei* courtship behavior is similar to that described for other freshwater chelonians.

**Keywords.** Freshwater turtles, natural history, reproduction, ethology.

## Introduction

Courtship behavior in freshwater chelonians has been reported primarily in captivity (Legler, 1955; Mahmoud, 1967; Davis and Jackson, 1970; Murphy and Lamoreaux, 1978; Benefield, 1979; Astort, 1984; Pérez-Higareda and Smith, 1988; Vogt, 1993; Fritz, 1993; Fritz and Mann, 1993; Molina, 1996a; Molina, 1998; Novelli and Souza, 2007). References to this behavior in nature are scarce, and restricted to a low number of species (e.g., Cagle, 1950; Moll and Legler, 1971). Observations in captivity allow detailed description of all behavioral sequences during precopula and copula, as reported by many authors including Legler (1955), Mahmoud (1967), Davis and Jackson (1970), Black (1976), Murphy and Lamoreaux (1978), Astort (1984), Molina (1992a; 1996a; b), and Novelli and Souza (2007). However, under such conditions, there is a general lack of information on key environmental factors for chelonian reproduction, such as the depth and size of water bodies. The medium-sized chelid turtle (mean carapace length 151 cm) *Mesoclemmys vanderhaegei*, Vanderhaege's Toad-headed turtle, has an apparently wide geographic distribution in Paraná and Paraguay River Basins (Bour, 1973), in Northern Argentina, Paraguay, and Brazil (Iverson, 1992; McCord, Mehdi and Lamar, 2001; Baldo et al., 2007). Brazilian records are scattered in the states of Mato Grosso do Sul (Strüssmann et al., 2000), São Paulo (Souza, Martins and Sawaya, 2000), Mato Grosso, Goiás, the Federal District, and Tocantins (Villaça, 1999; Brandão et al., 2002; Souza, 2005). Bour and Zaher (2005), however, restricted the distribution of *M. vanderhaegei* to the upper and middle Paraguay River Basin, without clearly stating the reasons to do so.

In São Paulo State, *M. vanderhaegei* is only found in small and isolated remnants of Cerrado (a kind of savanna) vegetation. In fact, most of the Brazilian occurrences fall into Cerrado domain (Brandão et al., 2002), one of the most threatened biodiversity hotspots in South America (Klink and Machado, 2005).

The aim of this note is to illustrate and describe courtship behavioral sequences of a *M. vanderhaegei* pair in nature, as well as to compare our findings with previous descriptions for other freshwater turtles.

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**Figure 1.** General view and aspects of the upper part of Monjolinho Stream (15º36'S; 56º03'W), the habitat of *Mesoclemmys vanderhaegei*, at "Escola Evangélica do Buriti" (Chapada dos Guimarães, Mato Grosso State, Brazil): a – Headwaters amidst open Cerrado vegetation ("campo limpo" with sparse "buriti" palm tree individuals, *Mauritia* sp.); b – Partial view of the riparian vegetation along a channelized stretch of Monjolinho Stream, immediately upstream to a small, artificial impoundment where *Mesoclemmys vanderhaegei* was recorded in the wild; c – General view of the small impoundment surroundings; d – Water transparency and the dense aquatic vegetation covering the bottom of the channel and the impoundment of Monjolinho Stream (Photos: D. Morais).

## Materials and Methods

Field observations were conducted in Monjolinho Stream (15º24'51.9"S; 55º48'11.5"W), within the limits of "Escola Evangélica do Buriti", Chapada dos Guimarães Municipality, Mato Grosso State, southwestern Brazil, at an altitude of approximately 640 m above sea level. It is an oligotrophic, perennial stream, with its headwaters (Fig. 1) situated amidst the Cerrado physiognomy of "campo limpo" (detailed descriptions of Cerrado vegetation types were provided by Eiten 1972, 1990).

Approximately 70 years ago, Monjolinho's water flow was diverted to a human-made lateral channel (2.5 m wide, 50.0 cm deep), partially dammed by a small impoundment (around 6.0 m wide x 10.0 m long x 1.0 m deep). A rich submersed macrophyte community established along the slow moving, clear waters both along the channel and at the bottom of the impoundment.

Courtship sequences were filmed with a video camera (Camcorder JVC model GR-SXM260US, S-VHS Digital, zoom 700x), and recorded through the "all-occurrence sampling" method (Altmann 1974).

## Results and Discussion

Courtship behavior involving two individuals of *M. vanderhaegei* was observed on the 21 December 2004, 1837h, in the small impoundment of Monjolinho Stream, in rainy weather, air temperature 20ºC, and

**Table 2.** Flow diagram of stimulus-reaction chain during *Mesoclemmys vanderhaegei* courtship recorded on 21 December 2004 at Monjolinho Stream, Chapada dos Guimarães, Mato Grosso State, Brazil. Arrows indicate the behavioral sequence recorded during the observed courtship.

| Time | Male behavior | | Time | Female behavior |
|---|---|---|---|---|
| 6:38:05p.m. | frontally approaches the female | ⇨ | 6:40:23p.m. | tries to bite the male on the neck |
| | | ⇙ | | |
| 6:40:26p.m. | moves backward | ⇨ | 6:40:26p.m. | tries to escape, swimming straightforward |
| | | ⇙ | | |
| 6:40:30p.m. | chases the female from a short distance, by the left side | ⇨ | 6:40:41p.m. | becomes stationary |
| | | ⇙ | | |
| 6:40:43p.m. | overtakes the female | | | |
| | | ⇩ | | |
| 6:40:44p.m. | turns towards the anterior part of the female's body, assuming frontal position and staying *tête-à-tête* with her | | | |
| | | ⇩ | | |
| 6:40:49p.m. | frequently moves towards the right mid-lateral portion of the female's carapace, sometimes towards her left mid-lateral portion | ⇨ | 6:40:49p.m. | follows with her head each of the male's movements, directly facing him |
| | | ⇙ | | |
| 6:42:28p.m. | tries to mount, after trying to approach five times from the left side and four times from the right side of the female's carapace | ⇨ | 6:42:33p.m. | swims away, describing a circular pattern near the bottom, with the carapace slightly inclined towards the male |
| | | ⇙ | | |
| 6:42:33p.m. | pursuits the female, also swimming in circles behind her | ⇨ | 6:42:40p.m. | suddenly stops, remaining motionless for some seconds |
| | | ⇙ | | |
| 6:42:47p.m. | presses the female's body against the substrate and mounts her | ⇩ | | |
| 6:43:10p.m. | with the neck fully extended, bending his head down and laterally sliding it in short and fast movements, rubbing his chin against the anterior part of the female's carapace | ⇩ | | |
| 6:43:10p.m. | probable intromission and copulation | ⇨ | 6:44:15p.m. | swims away |

water temperature 22ºC. The duration of the observed mating sequence totaled six min and 10 sec. A flow diagram of the mating sequences is presented below (Tab. 1), and main postures of the pair during mating are schematically represented in Fig. 2. Immediately after the assumed sexual intercourse (see below), the male swam away from the female and no additional interaction was observed between the pair, as already noted for other chelonians (Molina, 1996b).

A frontal approach of the female by the male during the first phase of turtles' courtship sequence, as here reported in *M. vanderhaegei*, differs from what is

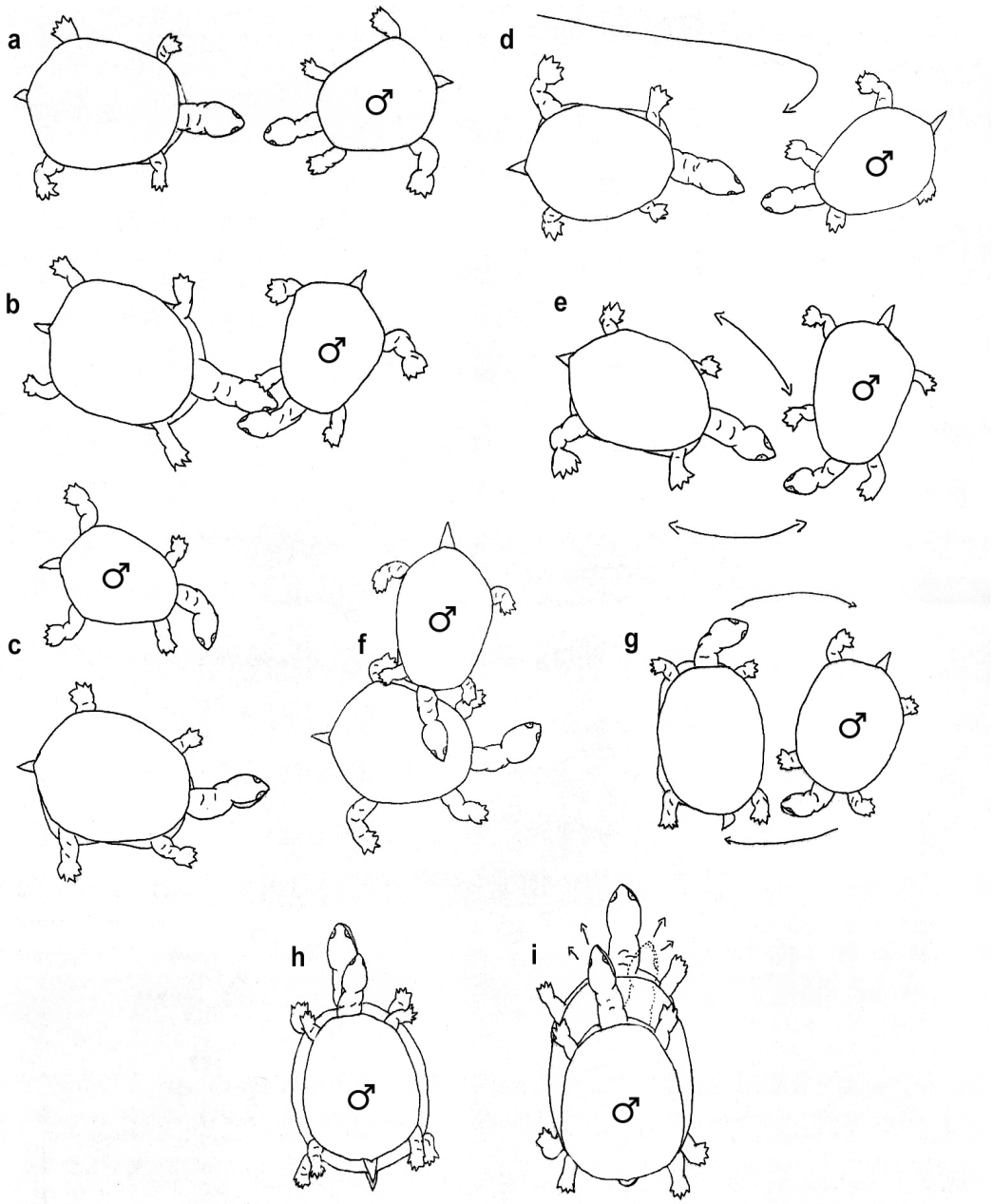


**Figure 2.** Schematic representation of courtship sequences between a *Mesoclemmys vanderhaegei* couple observed in nature; a – couple encounter; b – the female tries to bite the male; c – the female swims away and the male chases her; d – the male overtakes the female, standing face to face with her; e – the male alternately moves towards the left and right sides of the female; f – the male tries to mount the female; g – the female swims away and the male chases her, both of them swimming in circles; h – the male presses the female against the substrate and mounts her; i – the male begins to slide his head from one side to the other over the anterior portion of the female's carapace in fast and short movements (the copula presumably occurred during this phase).

known for other previously studied freshwater turtle species. The posterior approach usually reported in the literature (e.g., in Moll and Legler, 1971; Murphy and Lamoreaux, 1978; Astort, 1984; Pérez-Higareda and Smith, 1988; Fritz and Mann, 1993; Novelli and Souza, 2007) suggests that specific and sexual recognition may be determined by means of cloacal olfactory examination, as pointed by Mahmoud (1967) and

Molina (1992a; 1996a; 1996b).

In the Neotropical chelid *Phrynops geoffroanus* (Schweigger, 1812), female's receptivity may also be detected by the male during such initial posterior examination, with courtship pursuing when a female is detected. Alternatively, an aggressive interaction may be elicited when a male is detected during this phase (e.g., Molina, 1992b; 1996b).

The possibility that we actually missed the first step of the courtship sequence, and that specific and posterior sexual recognition had already occurred when we started our observations, cannot be neglected. In *Phrynops hilarii*, for example, males usually approach the females frontally, after having examined their cloacal region (Black, 1976; Murphy and Lamoreaux, 1978; Astort, 1984; Fritz and Mann, 1993).

Head movements were only observed during the initial phase of *M. vanderhaegei*'s mating sequence (Figure 2). During this phase, the male repeatedly rubbed his chin over the dorsal surface of the female's carapace, sliding his head from one side to the other in short and fast movements, with the neck completely extended, as already noted for other species such as *C. longicollis* (Murphy and Lamoreaux, 1978), *P. hilarii* (Fritz and Mann, 1993), *H. maximiliani* (Novelli and Souza, 2007).

Since the courtship sequence reported herein occurred about 1 m deep and sediments resuspended while the observed pair of *M. vanderhaegei* interacted, copulation itself was not observed. Indeed, to witness the exact moment of the copula is a difficult task when studying free living chelonians, as already noted by previous authors (e.g., Cagle, 1950). According to Molina (1992a; 1996b), copulation only occurs when the female is sufficiently stimulated, tails from both individuals are juxtaposed, and the penis is inserted into the female's cloaca. In *P. geoffroanus*, it was observed that females continuously move during courtship and that a successful mating is greater facilitated when they remain motionless (Molina, 1996a), as here reported for *M. vanderhaegei.*

Total duration of the courtship observed in *M. vanderhaegei* was considerably shorter than reported for other freshwater turtles. The four phases described by Molina (1992a; 1996a; 1996b), including: 1) search for the female, 2) pursuit of the female, 3) precopula, and 4) copulation, may last from 15 to 90 minutes, depending on the female's receptivity. Novelli and Souza (2007) observed that courtship plus mating included the same four phases mentioned above and totaled about 23 minutes in captive *Hydromedusa maximiliani*. Although the reproductive behavior in chelonians is considered stereotyped (Molina, 1992a; Souza, 2004), interspecific, intraspecific and environmental influences must be considered potential variation sources for features such as the total duration of the mating sequence and the duration of each phase.

As neither of the two *M. vanderhaegei* individuals observed in courtship was captured for sexual identification, the possibility of homosexual behavior could not be completely discarded at first. However, homosexual behavior is an uncommon occurrence in freshwater turtles (e.g., Cagle, 1950), even under captivity conditions involving overpopulation or absence of mature conspecific females (Molina, 1992b; 1996a). Indeed, systematic observations on the mating behavior of captive *P. geoffroanus* suggest that an aggressive interaction could have occurred in this case (Molina, 1992b; 1996a).

The occurrence of courtship behavior in December, in the beginning of rainy summer in southwestern Brazil, corroborates observations from individuals of *M. vanderhaegei* bred in captivity in the Southeast, where mating was observed from spring to early summer, between September and January (Corazza and Molina, 2004). The finding of hatchlings (with fresh umbilical scars) in December in Chapada dos Guimarães and in the neighboring municipality of Cuiabá suggests, however, that reproduction in this species might begin earlier than here reported, at least in Cerrado habitats from Central Brazil.

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