

Pelvic spur use during courtship and mating in the red-tailed boa *Boa constrictor*

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Some phylogenetically basal snake species have pelvic girdles and vestigial hind limbs that are seen externally as pelvic spurs, which are probably a plesiomorphic character in the Alethinophidia (Stickel & Stickel, 1946; Palci et al., 2020; Senter, 2022). These pelvic spurs are generally larger in males than in females (Hoge, 1947; Slip & Shine, 1988; Shine & Slip, 1990; Hofer et al., 2021). Moreover, pelvic spurs have musculature, innervation, and vascularisation and can move autonomously (Hoge, 1947; Bellairs, 1950; Carpenter et al., 1978; 1979). The pelvic spurs of boids and pythonids are known to be used by males during combat, courtship, and mating (Carpenter et al., 1978; Barker et al., 1979; Slip & Shine, 1988; Walsh & Murphy, 2003) and such use has been suggested as an ancestral character (Senter et al., 2014; Senter, 2022).

The red-tailed boa *Boa constrictor* Boidae, is a large viviparous snake (with a female-biased sexual size dimorphism), which inhabits areas of Mexico, Central and South America (Pizzatto & Marques, 2007; Nogueira et al., 2019). In Brazilian populations, vitellogenesis occurs in spring and summer, testicular growth in autumn, and courtship and mating in autumn and winter (Pizzatto & Marques, 2007; Garcia & Almeida-Santos, 2021). Here, we provide the first report of the use of pelvic spurs during courtship and mating in the red-tailed boa.

Our observations were made in two conservation breeding facilities in Brazil, one located in the municipality of Betim (state of Minas Gerais, south-eastern Brazil) and the other in the municipality of Cornélio Procópio (state of Paraná, southern Brazil). In both facilities, snakes were kept individually in enclosures at room temperature and under natural photoperiod. Water was provided ad libitum, and heaters were used when temperatures dropped below 15 °C. During the mating season, one adult female and one to two adult males were placed in the same enclosure (140 × 70 × 70 cm). To stimulate mating behaviour, freshly shed skins of other males were occasionally placed within the enclosure. To minimise stress, the snakes were monitored for only one hour at irregular intervals during the day when the behaviours occurred. Breeding pairs were left together for 3–21 days unless they showed intense courtship and mating activity;

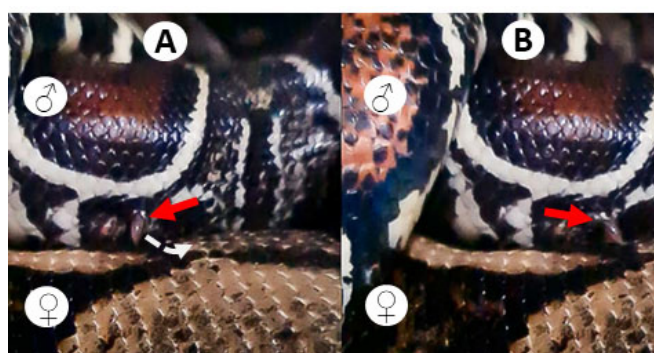


Figure 1. Pelvic spur (red arrow) use by a captive male red-tailed boa *Boa constrictor* during courtship in a breeding facility in the municipality of Cornélio Procópio, state of Paraná, southern Brazil

in these cases, they were left together longer. The first set of observations was made between May and August 2019 at the Betim breeding facility, where six males and four females were paired. The second set of observations was made from April to September 2021 at the Cornélio Procópio facility, where five males and three females were paired weekly from early autumn (30 March 2021).

In general, as soon as the males detected females in the enclosure they remained motionless and increased tongue flicking frequency. Then, males and females started moving through the enclosure. Males then climbed on the females' backs and aligned their bodies to those of the females. Next, the males began to rub their spurs gently on the side of the females' bodies, moving in a posterior to anterior direction, this is shown for boas in the Cornélio Procópio breeding facility in Figure 1 and for the Bentim facility in a video (BHS video, 2023). The spurs repeatedly moved from a resting to an erect state. The movement and touch of the spurs may stimulate females to contract their bodies and change position, thus facilitating cloacal apposition and hemipenis intromission. Spur use may be particularly relevant for smaller males because they may not have enough strength to move the body of large females.

The timing of our observations coincides with that of previous reports on courtship and mating (Pizzatto &

Marques, 2007; Garcia & Almeida-Santos, 2021). Moreover, three mated females from the Cornélio Procópio breeding facility gave birth to a total of 51 offspring in the summer, similar to that reported in the literature (Garcia & Almeida-Santos, 2021). These results contrast with those of Gadd (1983), who reported unsuccessful parturition after courtship and mating with little use of spurs. Our data would appear to reinforce the critical role of pelvic spurs for successful courtship and mating in red-tailed boas.

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