

PEER-EDITED NOTE

FIRST RECORD OF DEFENSIVE BEHAVIOR IN CAMPBELL'S RATTLESNAKE
(*CROTALUS CAMPBELLI*)

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Abstract.—We report the first record of defensive behavior in Campbell's Rattlesnake (*Crotalus campbelli*), a recently described rattlesnake endemic to the Sierra Madre Occidental of Mexico. The behavior was video-recorded in an adult male in pine-oak forest, Nayarit, Mexico. The individual exhibited a complex defensive repertoire: alert posture, dorsally compressed S-coil, retrograde retreat (sideways and backward movement while maintaining defensive posture and head orientation toward the threat), crypsis through immobility, and escalated threat display with caudal vibration. The retrograde defensive retreat allowed continuous visual monitoring of the threat while preserving a strike-ready posture. This behavior is similar to other species of *Crotalus*. This observation adds to the natural history knowledge of *C. campbelli*.

Key Words.—antipredation, defense tactic, natural history, Sierra Madre Occidental.

Resumen.—Reportamos el primer registro de comportamiento defensivo en la Víbora de Cascabel de Campbell (*Crotalus campbelli*), una víbora de cascabel recientemente descrita endémica de la Sierra Madre Occidental de México. El comportamiento fue videograbado en un macho adulto en bosque de pino-encino, Nayarit, México. El individuo exhibió un repertorio defensivo complejo: postura de alerta, enrollamiento en S comprimido dorsalmente, retirada retrógrada (movimiento lateral y hacia atrás mientras se mantiene la postura defensiva y la orientación de la cabeza hacia la amenaza), cripsis mediante inmovilidad, y exhibición de amenaza escalada con vibración caudal. La retirada defensiva retrógrada permitió el monitoreo visual continuo de la amenaza mientras se preservaba una postura lista para el ataque. Este comportamiento es similar al de otras especies de *Crotalus*. Esta observación añade al conocimiento de la historia natural de *C. campbelli*.

Palabras clave.—antipredación, historia natural, Sierra Madre Occidental, táctica defensiva.

Campbell's Rattlesnake (*Crotalus campbelli*) is a medium-sized rattlesnake (adult snout-vent length about 50 cm) endemic to the Sierras de las Costas subprovince of Jalisco, Colima, and Nayarit, Mexico, where it inhabits pine-oak forests at elevations of 1,200–2,200 m (Bryson et al. 2014; Heimes 2016; Reyes-Velasco 2023). Described only 11 y ago (Bryson et al. 2014), many aspects of its ecology, behavior, and general biology remain poorly studied or entirely unknown. Defensive behavior in rattlesnakes (genus *Crotalus*) typically comprises a consistent suite of antipredator responses, including threat postures, defensive coiling, immobility or slow retreat, head elevation with lateral compression, caudal vibration, and defensive strikes (Campbell and Lamar 2004; Greene 1997; Carbajal-Márquez et al. 2018; Núñez-Valdez et al. 2025). These tactics reflect broader diversity in snake antipredator behaviors, which can be classified into primary evasion strategies (e.g., rapid locomotor escape, crypsis through immobility, erratic movements), secondary threat displays (e.g., body flattening, head triangulation, caudal exhibition,

and rattling in rattlesnakes), active confrontation (e.g., strikes, often dry bites and defensive coiling), and specialized deception tactics (e.g., thanatosis or Batesian mimicry; Durso and Mullín 2014; Gibbons and Dorcas 2002; Sazima and Abe 1991; Scudder and Burghardt 1983; Tozetti et al. 2009).

Snakes frequently employ a hierarchical response based on perceived threat level: primary responses (crypsis, escape), secondary (threat displays), and tertiary (active confrontation) (Gibbons and Dorcas 2002; Tozetti et al. 2009). The expression of these behaviors is modulated by multiple factors, including body size (larger snakes tending toward more aggressive tactics; Delaney 2019), phylogeny and species-specific repertoires, sex (males sometimes more aggressive), environmental context, and prior experience (Gregory 2016; Scudder and Burghardt 1983).

Within *Crotalus*, behavioral plasticity is increasingly evident through reports of specialized tactics, highlighting the value of detailed observations in understudied species. Recent studies document this



FIGURE 1. Defensive behavioral sequence of *Crotalus campbelli* in pine-oak forest, Nayarit, Mexico. (Upper Left) Alert posture with slight head elevation and dorsally compressed S-coil directed toward the observer. (Upper Right) Retrograde defensive retreat showing sideways movement while maintaining defensive posture and head orientation toward the threat. (Lower Left) Crypsis through immobility among leaf litter. (Lower Right) Escalated threat display with tightened coil and elevated head position. (Photographed by José Adiel Hernández Triana).

diversity, including reverse crypsis in the Transvolcanic Rattlesnake (*C. triseriatus*; Domínguez-Acevedo et al. 2024) and unpredictable aggressive defense in the Mexican Pygmy Rattlesnake (*C. ravus*; Núñez-Valdez et al. 2025). Our objective was to document the first record of defensive behavior in *C. campbelli*, a species for which no behavioral data have been previously published, and to describe the specific tactics observed in the context of rattlesnake antipredator repertoires.

On 6 July 2025 at 1231, we observed an adult male *C. campbelli* in Reserva de la Biosfera Estatal Sierra San Juan, Municipio de Xalisco, Nayarit, Mexico (21.47983°N, -104.99287°W; WGS 84; 1,615 m elevation), within pine-oak forest. The snake was on the forest floor and its defensive behavior was filmed by José Adiel Hernández Triana (68-second video link available at: <https://doi.org/10.5281/zenodo.17635813>). Upon detection, the snake adopted an alert posture with slight head elevation and rapidly formed a dorsally compressed S-shaped defensive coil directed toward the observer (Fig. 1). This posture increased apparent body size and positioned the anterior body for a potential strike, consistent with typical rattlesnake defensive behavior (Campbell and Lamar 2004; Greene 1997). The snake then executed a retrograde defensive retreat, moving slowly sideways and backward while maintaining the S-coil posture and head orientation toward the observer. It periodically remained motionless among leaf litter to enhance crypsis (Campbell and Lamar 2004). As disturbance persisted,

the snake tightened its coil, raised its head higher in a pronounced threat display, and produced continuous audible rattling via caudal vibration.

This behavior differs from typical escape (rapid fleeing involving turning away from the threat; Gregory 2016) and from reverse crypsis (forward movement with oscillating head and body; Domínguez-Acevedo et al. 2024; Ryerson 2017). The defensive repertoire of *C. campbelli* (alert posture, dorsally compressed S-coil, immobility, caudal vibration, and retrograde retreat) shares core components with other *Crotalus* species, including defensive coiling, rattling, and immobility documented in the Prairie Rattlesnake (*C. viridis*; Duvall et al. 1985), the Mohave Rattlesnake (*C. scutulatus*; Armstrong and Murphy 1979; Medica 2009), and the Southern Pacific Rattlesnake (*C. oreganus helleri*; Glaudas et al. 2005). The retrograde retreat, in which the snake moves backward while maintaining defensive posture and head orientation toward the threat, closely resembles the backing-up behavior described in the Tzabcan Rattlesnake (*C. tzabcan*; Carbajal-Márquez et al. 2018), though in *C. campbelli* it occurs from an S-coil posture and may escalate to rattling, whereas in *C. tzabcan* it follows body flattening and occurs without rattling.

The retrograde defensive retreat documented here constitutes the first published record of any defensive behavior in *C. campbelli*. It represents a distinctive strategy that enables: (1) continuous visual monitoring

of the threat while increasing distance; (2) preservation of a strike-ready posture; and (3) rapid escalation to intensified defense if needed. This tactic is likely adaptive in dense forest-floor habitats with limited escape routes, where crypsis is partially compromised by disturbance but retreat must remain controlled. This observation adds to the natural history knowledge of *C. campbelli* and contributes to documenting the diversity of antipredator responses in the genus. Documentation of such antipredator responses supports efforts in human-snake conflict mitigation and conservation.

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