TAIL BIFURCATION IN *PLESTIODON COPEI* (TAYLOR, 1933) (SQUAMATA: SCINCIDAE)

BIFUCACIÓN DE COLA EN *PLESTIODON COPEI* (TAYLOR, 1933) (SQUAMATA: SCINCIDAE)

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Resumen.— La autotomía caudal es una estrategia de escape común en lagartijas. Esta estrategia puede afectar la adecuación de los individuos al asociarse con costos energéticos causados por la regeneración de la cola. Diversos registros han reportado anomalías de la cola en varias familias de lagartijas. En esta nota reportamos un espécimen de *Plestiodon copei* encontrado en campo con la cola bifurcada. Las radiografías mostraron formación de cartílago en los dos segmentos sin osificación después del plano de ruptura de la cola.

Palabras clave.— Autotomía caudal, bifurcación de la cola, regeneración de la cola, Scincidae.

Abstract.— Caudal autotomy is a common escape strategy in lizards to avoid predation. This strategy can affect the fitness of the individuals associated to energetic cost caused by tail regeneration. Several records of tail anomalies have been reported in various families of lizards. In this note we reported a tail bifurcation specimen of *Plestiodon copei* found in the wild. An X-ray showed that the two branches are not ossified after the fracture plane in the tail, with cartilage formation in both branches instead.

Keywords.— Caudal autotomy, tail bifurcation, tail regeneration, Scincidae.

Caudal autotomy is an anti-predator strategy, commonly as a decoy used in lizards to increase the likelihood of survival in risk situations; but in consequence, the fitness may be reduced by costs associated with the loss of the tail tissue, energetic requirements associated with regeneration, also can affect mate access and mating success (Salvador et al., 1995), social status (Fox et al., 1990), protection from predators (Bateman et al., 2014), locomotion (McElroy & Bergmann, 2013), and the unavailability of the lost tail during subsequent predation events (Downes & Shine, 2001; Barr et al., 2020). In several species of lizards, the abnormal caudal regeneration have been observed of two forms, intra- and inter-vertebral autotomizing and have been published in various families of lizards: Agamidae (Ananjeva & Danov, 1991), Anguidae (Conzendey et al., 2013), Iguanidae (Koleska et al., 2017), Gekkonidae (García-Vinalay, 2017), Gymnophthalmidae (Pheasey et al., 2014), Lacertidae (Koleska & Jablonsky, 2015), Liolaemidae (Castro-Pastene, 2015; Chavez-Villavicencio & Tabilo-Valdivieso, 2017), Scincidae (Vergilov & Natchev, 2017), Teiidae (Gogliath et al., 2012), and Tropiduridae (Martins et al., 2013; Passos et al., 2014). In the family Scincidae there are 53 of 1669 species of skinks with record of some abnormality in tail regeneration (Barr et al., 2020), particularly, lizards in the family which caudal bifurcation has been recorded are *Liopholis whitii* (Hickman, 1960), *Plestiodon fasciatus* (McKelvy & Stark, 2012), *Plestiodon inexpectatus* (Mitchell et al., 2012), *Plestiodon skiltonianus* (Miles et al., 2020), *Brasiliscincus heathi* (Magalhäes et al., 2015), and *Ablepharus kitaibelii* (Vergilov & Natchev, 2017).

Plestiodon copei (Taylor, 1933) is a viviparous, diurnal, insectivorous skink whose range includes the Mexican states of Michoacán, Morelos, Puebla, Mexico State, Mexico city, Tlaxcala, and Veracruz (Fernández et al., 2006; Johnson et al., 2017). It occurs in temperate coniferous forest (Castro-Franco & Bustos-Zagal, 1994). In Mexico, records of tail bifurcation are scarce or anecdotic, e.g. *Urosaurus bicarinatus* (Mata-Silva et al., 2013). Here we report the first case of tail bifurcation in a population of *P. copei* and the first time that tail regeneration abnormalities are reported in the *Plestiodon brevirostris* group.

On 6 October 2019, we found an adult female of *P. copei* in El Capulín, Amanalco de Becerra, Mexico State, Mexico (19.2988° N, 99.9686° W, WGS84; 2875 m a.s.l.). The 3.1 g specimen was

Figure 1. a. Hembra adulta de *Plestiodon copei* encontrada en campo. b. Bifurcación caudal en *P.copei*, mostrando la diferencia en las escamas de la cola. c. Vista dorsal con rayos X de la bifurcación caudal. d. Vista lateral con rayos X de la bifurcación caudal.

Figura 1. a. Adult female *Plestiodon copei* found in the field. b. Caudal bifurcation in *P. copei*, showing the scale differences. c. X-ray of caudal bifurcation in dorsal view. d. X-ray of caudal bifurcation in lateral view.

under a rock in a pine-oak forest (Fig. 1a). The snout-vent length (SVL) was 58.29 mm, total length of the original portion of the tail was 34.51, and its maximum width was 4.93 mm. The tail was bifurcated dorso-ventrally 8.15 mm posteriorly to the vent. The length of the dorsal regenerated branch was 26.36 mm and maximum width 3.81 mm, while the ventral branch had a length of 20.57 mm and maximum width of 3.63 mm. The scales on the bifurcated portion of the tail were small and morphologically quite different from those on the original portion of the tail (Figs. 1a and 1b).

Additionally, we obtained both dorsal and lateral radiographs (Figs. 1c and 1d respectively). The X-ray showed that the two branches are not ossified after the fracture plane in the tail, with cartilage formation in both branches instead. In lizards, previous studies have reported abnormalities in caudal regeneration when the lizards experience incomplete caudal autotomy (Ramadanović & Zimić, 2019). In that case, tail bifurcation is expected since the original tail (ossified) remains attached to the organism. In this way, the new tail is regenerated as an unsegmented cartilage tube that resists ossification (Lozito & Tuan, 2015), provoked by a partial rupture of the original tail and resulting in two or more segments at the injury point (Ananjeva & Danov, 1991). Nevertheless, the caudal bifurcation we observed in *P. copei* lacks ossified vertebrae in both forks of the tail since that ossification was not observed after fracture plane (Fig. 1d).

We therefore suggest that this fork comes from a second process of caudal autotomy (with prior regeneration of cartilage) where a semi-rupture of the cartilaginous tail promotes a second tail with cartilage. Other explanations are also possible. Future studies need to deepen in the knowledge about the energetic cost of tail regeneration in bifurcated tails. Furthermore, including morphological measurements, the frequency of this pattern in populations, and experimental approaches to increase our understanding of the ecological effects of abnormal tail regeneration and its influence on lizard survival.

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