
BULLETIN

of the

Chicago Herpetological Society



Volume 53, Number 3
March 2018



Crab-ripping: An Unusual Feeding Behavior Newly Recorded in Freshwater Snakes

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Abstract

Snakes swallow their prey whole and their prey size is thus limited by their maximal gape, with exceptions being three scolecophidian snakes known to be able to decapitate termites, and two mangrove-dwelling snakes (Squamata: Homalopsidae: *Gerarda prevostiana* and *Fordonia leucobalia*) that are able to remove and ingest pieces from crabs. Here we present the first report of crab-ripping in a freshwater snake, based on observations made on adult Spencer's Mountain Keelbacks (Squamata: Natricidae: *Opisthotropis cf. spenceri*) tearing apart live, freshly molted Chaiphum Crabs (Decapoda: Potamidae: *Larnaudia chaiphumi*) in a mountain stream in Phetchabun Province, northeastern Thailand. Our observations represent the sixth documented report of arthropod-ripping in snakes, and the first for natricids and freshwater snakes.

Keywords

Aquatic ecosystems, biodiversity, herpetofauna, Crustacea, ecology, feeding behavior, carcinophagy, Thailand.

Introduction

Because snakes swallow their prey whole, the size of their prey is directly limited by the size of their gape. Only very rare exceptions to this universal rule are known. They are found in two coastal marine Southeast Asian snake species, the homalopsids *Fordonia leucobalia* (Schlegel, 1837) and *Gerarda prevostiana* (Eydoux & Gervais, 1837) (Shine and Schwaner, 1985; Jayne et al., 2002; Burbrink and Crother, 2011), and in three scolecophidian species (Mizuno and Kojima, 2015). The mangrove-dwelling monotypic genera *Fordonia* and *Gerarda* have a specialized crustacean diet, and are able to tear apart their prey's body parts and appendages. In addition to the analysis of stomach contents including crustacean pieces, ripping of freshly molted crabs, whose body is still soft, has been directly observed and documented in *Gerarda*.

During a biodiversity survey along an unnamed stream passing through dry forest and mixed deciduous forest in Thai Dong and Sap Poep subdistricts, Wang Pong District, Phetchabun Province, several of us made crab-ripping observations on an extremely rare snake species of the natricid genus *Opisthotropis* whose natural history was so far undocumented. These observations not only allow better understanding the ecology of this enigmatic snake, but also documenting a wider phylogenetic distribution of arthropod-ripping among snakes than previously thought. Given the importance of these observations, our team made several dedicated field visits to confirm whether this peculiar feeding behavior was occasional or a well-established natural history trait of this snake.

Materials and methods

Visits to the stream occurred on 17 February, 9 March, 5 May and 23 December 2015. Each visit lasted about 6 hours, from before to after dusk, and included portions of the stream located within or just outside Wang Pong – Chon Daen Non-hunting Area. Other species of reptiles and amphibians found in the stream were recorded and photographed. Our field team included four persons (LC, KK, NC and TN), all with previous experience in locating snakes in the field. Two adult snake individuals, collected outside the non-hunting area, were preserved whole in 70% ethanol as vouchers in the herpetological collections of the Queen Saovabha Memorial Institute, Thai Red Cross Society, in Bangkok (collection numbers QSMI 1163-1164). The crabs were identified by the crab taxonomist Rueangrit Promdam (Prince of Songkla University, Songkhla), using comparative material from the crustacean collections of the Chulalongkorn University Museum of Zoology in Bangkok and of the Prince of Songkla University.

Results

We encountered respectively two, four, three and two individuals of *Opisthotropis cf. spenceri* during each site visit. Based on the possession by both voucher specimens of a single prefrontal, seven supralabials, 17 smooth dorsal scale rows on the neck and at midbody, and contact between loreal and corresponding internasal, they are referable to *Opisthotropis spenceri* according to Teynié et al. (2013) and Wang et al. (2017). However, due to small differences in pattern and scalation, and

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Figure 1. Live adult *Larnaudia chaiyaphumi* crab in a mountain stream in Phetchabun Province, northeastern Thailand. Photograph by K. Kunya.

pending the results of our current analysis of the material available for this and closely related species, we presently refer to them as *O. cf. spenceri*.

All snakes were found within the stream, between 253 and 985 m asl. Young snakes were found at lower elevations than adults. From 900 m asl upwards, only adults were met. Snakes were observed where the streambed substrate is composed of rock and rough sand, in transparent slow-moving water, and where the water depth does not exceed 30 cm. Although the stream was surveyed during day and night, the snakes were only found at night, with an activity peak around 8–11:00 P.M. The snakes were hiding under rocks or moving underwater on the stream bottom in search of soft-shelled individuals of the Chaiyaphum Crab (Decapoda: Potamidae: *Larnaudia chaiyaphumi* Naiyanetr, 1982), obviously avoiding hard-shelled individuals (Figure 1). Once a soft-shelled crab was located, the snake coiled its body around it, and constricted it until the carapace was partly separated from the body, then plunged into the crab body to swallow soft internal parts (Figure 2). It then methodically pulled legs and the abdominal flap through a loop of its body until they broke, and swallowed them (Figure 3). Three distinct snakes were observed preying on crabs and showing the same feeding method, indicating that this prey and feeding behavior are usual for this species.



Figure 3. *Opisthotropis cf. spenceri* swallowing the abdominal flap of a *Larnaudia chaiyaphumi* crab in a mountain stream in Phetchabun Province, northeastern Thailand. Photograph by N. Chomngam.



Figure 2. *Opisthotropis cf. spenceri* penetrating into the body and swallowing soft parts of a *Larnaudia chaiyaphumi* crab in a mountain stream in Phetchabun Province, northeastern Thailand. Photograph by N. Chomngam.

Aquatic and riparian reptile species we found in syntopy with the *Opisthotropis* within the stream include *Platysternon megacephalum* Gray, 1831 (Platysternidae) (Figure 4), *Tropidophorus laotus* Smith, 1923 (Scincidae) (Figure 5) and *Hebius khasiense* (Boulenger, 1890) (Natricidae) (Figure 6; new province record, see Pauwels et al., 2009). Syntopic amphibians included *Limnonectes gyldenstolpei* (Andersson, 1916) (Dicroglossidae), *Megophrys major* Boulenger, 1908 (Megophryidae) and *Odorrana livida* (Blyth, 1856) (Ranidae).

Discussion

Until recently *Opisthotropis spenceri* was known only from two specimens from Lampang Province in northern Thailand, without biological data (Pauwels, 2009; Pauwels and Chan-Ard, 2012). Chuaynkern et al. (2014) reported two more individuals collected in a mountain stream in the northern Thai province of Nan. Chan-ard et al. (2015) mentioned that the species is terrestrial, which is contradicted by its morphology and by our field observations and those of Chuaynkern et al. (see also the review on ecological aspects of Chan-ard et al. [2015] by Pauwels and Grismer [2015]). Our observations represent the first record of the species in northeastern Thailand.

Until now crab-ripping was unknown in non-homalopsid



Figure 4. Adult *Platysternon megacephalum* found in syntopy with *Opisthotropis cf. spenceri* in a mountain stream in Phetchabun Province, northeastern Thailand. Photograph by N. Chomngam.



Figure 5. *Tropidophorus laotus* found in syntopy with *Opisthotropis* cf. *spenceri* in a mountain stream in Phetchabun Province, northeastern Thailand. Photograph by N. Chomngam.

snakes and in freshwater snakes. It thus represents an important addition to the known feeding behaviors of Natricidae, which, although they are also included in the Colubroidea, are only distantly related to the Homalopsidae (Figueroa et al., 2016). The monotypic genera *Fordonia* and *Gerarda* are known to eat only crustaceans, which they can swallow whole or rip apart, depending on the prey size and shape (Murphy, 2007). Our observations represent the first diet record for *Opisthotropis* (cf. *spenceri*, so it is not known if this snake has a specialized or exclusive carcinophagous diet. Chan (2011) observed in a small stream in Hong Kong an *Opisthotropis kuatunensis* Pope, 1928 with a freshly molted, dead *Cryptopotamon anacoluthon* (Kemp, 1918) (Decapoda: Potamidae) in its mouth, missing its chelae and most of its legs. Chan (loc. cit.) suggested that the snake possibly tore the missing parts off in the manner adopted by *Gerarda*, but could not confirm it because he did not actually observe this behavior. Karsen et al. (1998) noted that *Opisthotropis lateralis* Boulenger, 1903 feeds on “small shrimps, crabs and fish; possibly also on tadpoles,” without mentioning how crabs are eaten. Our new observations make it almost certain that Chan’s suggestion was correct, and crab-ripping might be practiced by several or all *Opisthotropis*, at least occasionally. Interestingly, the Lao common name of *Opisthotropis durandi* Teynié, Lottier, David, Nguyen & Vogel, 2013, is *ngu kung*, which means “shrimp snake,” and, although the diet of this species is still unknown, it was indeed found in small streams in syntopy with freshwater shrimps and crabs (Teynié et al., 2013). These authors did not explain in their article why the snake was called the “shrimp snake” by the locals, but it is in fact because they claim that it eats shrimps (A. Teynié, pers. comm. to OSGP, March 2017). Other *Opisthotropis* have accepted fish and earthworms in captivity (Karsen et al., 1998; Wang et al., 2017). The dietary habits of the monotypic genera *Isanophis*,



Figure 6. Adult *Hebius khasiense* found in syntopy with *Opisthotropis* cf. *spenceri* in a mountain stream in Phetchabun Province, northeastern Thailand. Photograph by N. Chomngam.

Parahelicops and *Paratapinophis*, also living in mountain streams in Southeast Asia and supposedly closely related to *Opisthotropis*, are still unknown, except for digested fish remains found in two *Paratapinophis* (Murphy et al., 2008; David et al., 2015). Freshwater snakes represent about 5% of all extant snakes and are found in diverse families and regions (Pauwels et al., 2008). The diet of many of them is poorly known, with no information available in many species, and it is very possible that carcinophagy and crab-ripping are widespread among aquatic snakes.

The freshwater crab *Larnaudia chaiyaphumi* is endemic to Thailand and shows a very localized distribution, centered around Phu Khieo in Chaiyaphum and Phetchabun provinces where it lives in forest streams; its conservation status is currently regarded as of least concern (LC) by the IUCN (Esser and Cumberlandidge, 2008; present observations). Our new locality record within a protected area reinforces its LC status.

Acknowledgments

We are grateful to Narong Baungrak (Protected Area Regional Office 11, Phitsanulok) for administrative support to our research, to Sakhon Chainok, Vichat Gairad, Nuttapong Kanha, Churaporn Khunsan, Nom Mungit, Pattaya Pantawong, Nuntita Ruksachat, Sutewas Saengsawang and Surin Saithong for logistical help in the field, and to Rueangrit Promdam (Prince of Songkla University, Songkhla) for the identification of the crabs. We thank Patrick David (Muséum National d’Histoire Naturelle, Paris) and Alexandre Teynié (INRA, Paris) for useful information on Lao *Opisthotropis*.

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