Short Note

Four-eyed opossum (*Philander opossum*) predation on a coral snake (*Micrurus nigrocinctus*)

Mario J. Gómez-Martínez¹*, Allan Gutierrez² and Fabrice DeClerck¹

¹ Department of Agriculture and Agroforestry, CATIE 7170, Turrialba, Costa Rica, e-mail: majagoma@catie.ac.cr
² Programa de Biología, Universidad Nacional Autónoma de Nicaragua, Managua, Nicaragua

*Corresponding author

Keywords: Bothrops; human-dominated landscape; neurotoxin; Nicaragua; pasture; riparian.

The four-eyed opossum (*Philander opossum*) is a Neotropical marsupial that ranges from east-central Mexico to northeastern Argentina (Castro-Arellano et al. 2000). *P. opossum* has been registered in every country of Central America, where it inhabits tropical evergreen forests and secondary growth, but it has also been observed in crop-lands. The species is terrestrial and is most commonly found near streams or moist areas (Reid 1998). The species predominantly forages on the ground and middle canopy layers (Handley 1976). *P. opossum* is agile and quick; some authors have stated that it appears more alert than other didelphids (Nowak 1991). Depending on the reference, the species is reported as primarily carnivorous (Emmons and Feer 1990), omnivorous (Hershkovitz 1997) and frugivorous-insectivorous (Atramentowicz 1986). Castro-Arellano et al. (2000) report a variety of food items forming its diet, including fruit, corn, nectar, frogs, small mammals, reptiles, amphibians, birds and their eggs, insects, crustaceans, snails, earthworms and carrion.

Castro-Arellano et al. (2000) provide the most recent and complete review of *P. opossum* ecology, behavior and natural history, but do not refer to the species consuming venomous species, nor do the authors make any references to interactions between *P. opossum* and venomous snakes. However, resistance of South and Central American marsupials against viper venoms, especially from the genus Bothrops, the genus responsible for the greatest number of snakebite fatalities regionally, has been recorded by Jurgilas et al. (2003) who isolated a snake venom metallopeptinase inhibitor from *P. opossum* serum. However, the venom used was from *B. jararaca* whose venom is hemmorhagic, in contrast to the neurotoxic venom of *Micrurus*. No references regarding resistance of *P. opossum* to *Micrurus* venom has been found. Nor were we able to find reports referring to *P. opossum* eating coral snakes or other venomous species.

*Micrurus nigrocinctus* is a medium-sized coral snake with females attaining a maximum length of 1150 mm and males between 500 and 750 mm. According to Savage (2002), the species is common in lowland and premontane forests, in pastures, coffee farms and urban gardens.

The observation documented here was made in June 2007 in a riparian forest fragment in a pasture dominated landscape of Matiguás, Nicaragua (12° 53’ 25” N 85° 16’ 38” W). The site is a heavily fragmented landscape where only 14% of the original forest cover remains (Useche 2007); however, these forest fragments remain heavily connected via a complex system of riparian forests, live fences, and pastures with high tree densities (>35 individuals ha⁻¹). Our observation took place while conducting a survey of reptiles and amphibians of forested and non-forested riparian corridors bordered by pastures with high and low tree densities. Throughout this study, conducted from March to August of 2007, a total of 18 snake species and 31 individuals, including two species of false coral snakes (*Erythrolamprus mimus* and *Pliocercus euryzonus*) and a single species of true coral snake (*Micrurus nigrocinctus*) were observed. Two individuals of *E. mimus*, one individual of *P. euryzonus*, and three individuals of *M. nigrocinctus* were observed during 600 h of sampling effort along 30 km of transect. Out of the six individuals, five were found in riparian forests regardless of whether the adjacent pasture had high tree cover or not. One individual of *E. mimus* was found 5 m from the streambed in a pasture with high tree density, and refers to the case documented here.

On June 4th 2007 at 19:00 h, we began a 50-m transect in a riparian forest with an adjacent pasture of low tree density. We initiated our transect searching for amphibians and reptiles when we observed a *P. opossum* 4 m to the side of the transect, raking leaves, turning over logs and stones searching for prey. The opossum continued down the stream where we lost sight of it. We sighted the opossum 10 min later approximately 4 m from the riverbank. At this time, we observed the opossum removing leaf litter and excavating a small hole from which the tail of a coral snake (*M. nigrocinctus*) was protruding. The opossum began to pull the snake from the hole, biting it along the full length of its body and grasping it with its claws (Figure 1). As we approached and began to take photos, the opossum became momentarily distracted and lost grasp of the still living coral that momentarily escaped into the hole. The opossum managed to recapture the coral before it had completely escaped and continued to withdraw the coral from the
hole, biting it as it removed it, and placing it to the side. Once the snake was fully extracted, the opossum bit the snake and quickly hopped to a new position in an apparent evasive measure to avoid the snake's head. At this point the snake was still alive, though its movements were slower, probably severely wounded. The snake did continue to attempt escape. The opossum moved the snake down slope towards the streambed. By the time we were able to catch up with the opossum, the snake had been killed. During our observation time, we never saw the opossum being bit by the snake despite at least two attempted strikes, nor did we see the opossum bite the snake's head. We took a final photo (Figure 2) showing the opossum with the snake. Judging by the estimated 110 cm estimated length of the coral and indications by Savage (2002) that males of the species attain lengths between 500 and 750 mm, we concluded that this individual was an adult female. The opossum moved into the dry streambed where it disappeared for approximately 3 min. When we were able to see the opossum for a final time, the snake's head had been removed. At this time, the opossum left the snake on the ground, and retreated upslope for a couple of meters. We left the snake in place and continued the transect. The total observation time from the second sighting of the opossum until its departure was less than 15 min.

There are no known reports of P. opossum predation on coral snakes. However, there is a report of Didelphis albiventris predation on the pitviper B. jararaca in captivity, where the adult and juvenile opossums were observed killing and ingesting the snakes after biting them in the head and neck region (Oliveira and Santori 1999). Because the opossum became tired of our presence, we were unable to observe whether its killing of the snake was for consumption, or to possibly maintain a nesting area free of potential threat to its young, though we assume the former. The opossum was apparently unconcerned by the warning coloration of the coral. Jurgilas et al. (2003) noted that the species is immune to the hemotoxin of Bothrops, which begs the question whether the species is also immune to the neurotoxins of Micrurus, or whether it relies primarily on its agility to avoid being bitten?

Acknowledgements
Funding for the research cited in this article came from a generous grant from the World Bank-Netherlands Partnership Program “The impact of improved cattle management practices on biodiversity conservation”.

References