



# Catching the Predator? A Common Opossum, *Didelphis marsupialis* (Mammalia: Didelphidae), Eating a Terciopelo, *Bothrops asper* (Reptilia: Viperidae), in Costa Rica

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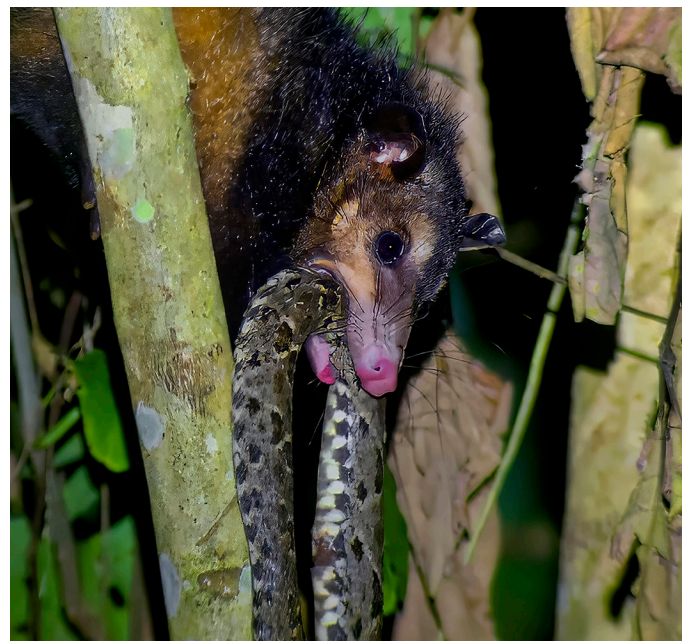
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The Common Opossum (*Didelphis marsupialis*), locally called “zorro pelón,” is a small marsupial widely distributed from central, eastern, and southeastern Mexico in North America through Central America and into northern South America, including Colombia, Venezuela, Ecuador, the Guianas, and northwestern Brazil (Reid and Gómez Zamora 2024), where it is a common inhabitant of practically all bioclimatic regions at elevations from sea level to 2,200 m asl. Due to its notable capacity to adapt to environmental modifications and its generalist/opportunistic feeding strategy that includes consumption of fruits, invertebrates (e.g., insects, arachnids, crustaceans), vertebrates (e.g., lizards, snakes, rodents, birds, including domestic chickens), and carrion, opossums thrive near and within human-modified habitats in rural areas and even in densely populated urban sectors (Reid and Gómez Zamora 2024).

The Terciopelo or Central American Lancehead (*Bothrops asper*) is a large, terrestrial, venomous species that ranges widely from southern Mexico through Central America and northwestern South America (Colombia [Valle del Cauca], Venezuela, and western Ecuador) to extreme northern Peru (Campbell and Lamar 2004; Boundy 2020). In Costa Rica, it is common in the rainforests of the Northern Zone and Caribbean slope and in the central and southern Pacific, as well as on the Pacific side of the Guanacaste Mountain Range (transitional zones), and the southern Peninsula de Nicoya in Puntarenas at elevations from sea level to 1,670 m (Solórzano 2022). These snakes feed on a variety of prey that includes invertebrates and small vertebrates by juveniles and vertebrates (e.g., lizards, other snakes, birds, and small to moderately-sized mammals such as rodents, agoutis, and several species of marsupials) by adults (Solórzano 2022).

At 0743 h on 31 December 2024, we encountered an adult Common Opossum (*Didelphis marsupialis*) with a sub-

adult Terciopelo (*Bothrops asper*) (~80–110 cm total length) in its mouth (Fig. 1) in the Mirador Sector, La Fortuna de San Carlos, Alajuela Province (10.51781, -84.56966), on a narrow gravel road surrounded by scattered bushes and trees and pastures (Fig. 2). As we approached, the opossum responded to our vehicle by climbing (with the snake) a bush on the shore to a height of 3–4 m above the ground. At the time of the encounter, the snake was already dead; consequently, we could not determine whether it was hunted and subdued by the opossum or scavenged. The snake’s body had only a small



**Figure 1.** An adult Common Opossum (*Didelphis marsupialis*) eating a subadult Terciopelo (*Bothrops asper*) in Mirador Sector, La Fortuna de San Carlos, Alajuela Province, Costa Rica. Photograph by Kathleen Andrea Espinoza Guido.





**Figure 2.** Habitat where an adult Common Opossum (*Didelphis marsupialis*) was found eating a Terciopelo (*Bothrops asper*) (Fig. 1). Photographs by Kathleen Andrea Espinoza Guido.

ventral wound, which could have been caused by an opossum bite or a vehicle.

Opossums and venomous pitvipers are sympatric in the Americas; however, trophic relationships had not been studied until relatively recently (Voss 2013). Several species of opossums are known to be resistant to the venoms of pitvipers and are known to feed on them (Vellard 1945; Perales et al. 2005); however, pitvipers also hunt and eat opossums (Voss and Jansa 2012; Voss 2013). Perales et al. (1994) suggested that venom resistance in larger (> 500 g) species of opossums evolved as an adaptation for predation on venomous snakes. On the other hand, the accelerated evolution of venom toxins could suggest that these snakes are in a coevolutionary arms

race with the resistance of their prey to toxins (Jansa and Voss 2011; Pricoli 2019).

Larger pitvipers (such as some species of *Bothrops*) appear to be more successful when hunting opossums, likely owing not only to the toxicity but also to the amount of venom they can inject. An example of this was an experiment carried out in captivity during which an adult *Didelphis marsupialis* was introduced into the terrarium of an adult female *Bothrops asper* (~190 cm total length) (A. Solórzano and M. Sasa, unpubl. data). The snake immediately bit the opossum, which took approximately 16 minutes to die before being swallowed by the snake (Fig. 3). Similarly, Oliveira and Santori (1999), provoked encounters in captivity between several South American Opossums (*Didelphis albiventris*) and juvenile Jararacas (*Bothrops jararaca*) as did Almeida-Santos et al. (2000) between several *D. marsupialis* with small South American Rattlesnakes (*Crotalus durissus*) (total lengths 60–90 cm). In both instances, the opossums killed the snakes by biting them repeatedly while sometimes receiving defensive bites from the snakes. Although the opossums are resistant to snake venom, such predatory behavior probably does not constitute a specialization for hunting snakes, but rather an evolutionarily acquired behavior for manipulating their prey, which is typical of carnivorous mammals (Oliveira and Santori 1999).

The few recorded interactions show opossums successfully killing and eating especially smaller venomous snakes, whereas opossums are more likely to be victims of large snakes. However, more data are necessary to better understand the ecological context in which resistance to venoms and venom toxicity have co-evolved and to what extent it favors the respective predators and prey.



**Figure 3.** An adult female Terciopelo (*Bothrops asper*) (~190 cm total length) eating an adult Common Opossum (*Didelphis marsupialis*) in captivity. Photograph by Davinia Beneyto Garrigos.

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### Literature Cited

- Almeida-Santos, S.M., M.M. Antoniazzi, and O.A. Sant'Anna. 2000. Predation by the opossum *Didelphis marsupialis* on the rattlesnake *Crotalus durissus*. *Current Herpetology* 19: 1–9. <https://doi.org/10.5358/hsj.19.1>.
- Boundy, J. 2020 [2021]. *Snakes of the World: A Supplement*. CRC Press, Boca Raton, Florida, USA.
- Campbell, J.A. and W.W. Lamar. 2004. *The Venomous Reptiles of the Western Hemisphere*. Cornell University Press. Ithaca, New York, USA.
- Jansa, S.A. and R.S. Voss. 2011. Adaptive evolution of the venom-targeted vWF protein in opossums that eat pitvipers. *PLoS ONE* 6: e20997. <https://doi.org/10.1371/journal.pone.0020997>.
- Oliveira, M. and R. Santori. 1999. Predatory behavior of the opossum *Didelphis albiventris* on the pitviper *Bothrops jararaca* (translated). *Studies on Neotropical Fauna and Environment* 34: 72–75. <https://doi.org/10.1076/snfe.34.2.72.2105>.
- Perales, J., H. Moussatché, S. Marangoni, B. Oliveira, and G.B. Domont. 1994. Isolation and partial characterization of an antithrombotic complex from serum of South American Didelphidae. *Toxicon* 32: 1237–1249. [https://doi.org/10.1016/0041-0101\(94\)90353-0](https://doi.org/10.1016/0041-0101(94)90353-0).
- Perales, J., A.G.C. Neves-Ferreira, R.H. Valente, and G.B. Domont. 2005. Natural inhibitors of snake venom hemorrhagic metalloproteinases. *Toxicon* 45: 1013–1020. <https://doi.org/10.1016/j.toxicon.2005.02.028>.
- Pricoli, F.G. 2019. A Corrida Armamentista Predador Presa Entre Serpentes e Mamíferos na América Do Sul: Uma Revisão do Conhecimento e Metodologias para Estudo da Resistência de Marsupiais Didelphidae (Didelphimorphia) ao Veneno de Jararaca. Monografia de Conclusão do Curso de Especialização Animais de Interesse em Saúde: Biologia Animal do Instituto Butantan, sob orientação de Erika Hingst-Zaher, Sao Paulo, Brasil.
- Reid, F.A. and G. Gómez Zamora. 2024. *Pocket Guide to the Mammals of Costa Rica*. Cornell University Press. Ithaca, New York, USA.
- Solórzano, A. 2022. *Serpientes de Costa Rica: Distribución, Taxonomía e Historia Natural*. Litografía e Imprenta LIL S.A., Tibás, San José, Costa Rica.
- Vellard, J. 1945. Resistencia de los “*Didelphis*” (zarigueya) a los venenos ofídicos (Nota prévia). *Revista Brasileira de Biologia* 5: 463–467.
- Voss, R.S. 2013. Opossums (Mammalia: Didelphidae) in the diets of Neotropical pitvipers (Serpentes: Crotalinae): Evidence for alternative coevolutionary outcomes? *Toxicon* 66: 1–6. <https://doi.org/10.1016/j.toxicon.2013.01.013>.
- Voss, R.S. and S.A. Jansa. 2012. Snake-venom resistance as a mammalian trophic adaptation: lessons from didelphid marsupials. *Biological Reviews* 87: 822–837. <https://doi.org/10.1111/j.1469-185X.2012.00222.x>.