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ANTI-PREDATOR STRATEGIES OF, AND POSSIBLE THANATOSIS IN, JUVENILE COLLARED PECCARIES (*PECARI TAJACU*)

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Abstract—Little is known about the antipredator strategies of juvenile collared peccaries (*Pecari tajacu*). This note reports camera trap footage of an interaction between a young collared peccary and two potential predators, a gray fox (*Urocyon cinereoargenteus*) and a bobcat (*Lynx rufus*), as well as a personal observation of two young peccaries in what appeared to be physiological thanatosis (a state of tonic immobility). Juvenile mammals are particularly vulnerable to predation, and survivorship in this age class is a critical driver of population dynamics. Documenting the antipredator behaviors used by collared peccaries contributes to our understanding of the distribution of such behaviors among ungulate taxa, which is important in understanding the evolution of responses to predation.

Resumen—Se sabe poco acerca de las estrategias anti-depredación empleadas por las javalinas jóvenes (*Pecari tajacu*). Esta nota registra escenas captadas por una cámara trampa de la interacción entre una javalina juvenil y dos potenciales depredadores, un zorro gris (*Urocyon cinereoargenteus*) y un gato montés (*Lynx rufus*). También se reporta una observación personal de dos javalinas juveniles en lo que pareció ser tanatosis fisiológica (un estado de inmovilidad tónica). Los mamíferos juveniles son especialmente vulnerables a la depredación, y la sobrevivencia a esta edad es un factor determinante en la dinámica poblacional. Documentar el comportamiento anti-depredación empleado por las javalinas contribuye a nuestro conocimiento de la distribución de tales comportamientos entre especies de ungulados, lo que es importante para entender la evolución de respuestas a la depredación.

Antipredator behavior of juvenile ungulates can be broadly categorized as "hider" or "follower." In hider species, juveniles remain hidden throughout the day while their mother forages. Hiding behavior is considered an ecological correlate with forested habitat with ample cover (Lent, 1974). Collared peccaries (*Pecari tajacu*), also known as javelinas, are considered a follower species in that the young remain with the herd and, in most cases, are protected from predation by group defense (Byers and Bekoff, 1981). However, juvenile javelinas are known to be left behind when herds run from threats (Schweinsburg and Sowls, 1972). When left behind, juvenile javelinas have been reported to hide (Neal, 1959), but nothing is known about the efficacy of hiding in juvenile javelinas, particularly in desert environments with little to no cover.

Adult javelinas have pelage of a consistent gray tone, with a lighter collar that wraps over the shoulders, and they tend to run, stand their ground, or bluff-charge potential predators (Byers and Bekoff, 1981; Foldesh, 1982). Young javelinas, however, are reddish brown with a dark dorsal stripe; striped coats are associated with hiding behaviors in young ungulates (Stoner et al., 2003). Cryptic coloration, along with prone response behaviors to predator threats, is believed to reduce risk of predation by helping prey avoid initial detection or by depriving predators of specific cues to pinpoint prey location and actualize their attack (Caro, 2014).

The aim of this note is to report the camera-trap observation of a close encounter between a juvenile javelina and a gray fox (*Urocyon cinereoargenteus*) and, later, a bobcat (*Lynx rufus*) recorded on 28 June 2016, as well as a related in-person observation from 25 June 2016 of what appeared to be thanatosis, or tonic immobility, in two young javelinas.

The first observation was recorded during an ongoing research project on the ecology of animal-dug water resources in the Sonoran Desert. The study site was located in Hackberry Wash, an intermittent stream that flows into the Santa Maria River in the Upland Sonoran Desert of Arizona. The dominant vegetation at this site is foothills palo verde (*Parkinsonia microphylla*), creosote (*Larrea tridentata*), triangle-leaf bursage (*Ambrosia deltoidea*), saguaro cactus (*Carnegiea gigantea*), Joshua tree (*Yucca brevifolia*), and mesquite (*Prosopis juliflora*).

The camera used was a Bushnell Trophy Cam HD (Bushnell Outdoor Products, Overland Park, Kansas)

which was set to take pulses of three photographs every 3 s when triggered by motion. There was a waning quarter moon the night of 28 June 2016, and it was 30°C as recorded by the thermometers built into the camera. The area where the camera was facing was unvegetated, with a small 0.4-m-diameter water hole in the center of the image. Distances reported were estimated based on measurements of water holes from a survey on 10 July 2016.

The camera footage began with a herd of javelinas drinking from the shallow water hole. The included supplemental movie (Supporting Information S1, available at http://dx.doi.org/10.1029/SWNAT-D-17-00006.1.s1) begins with the last adult to drink, who left at 1841 h. At 1938 h, a very young javelina, of ~15 cm in length, appeared alone at the site. The young javelina proceeded to lay down in the foreground of the video frame near the water hole. Forty-eight minutes later, at 2026 h, a gray fox, ~70 cm head–body length, visited the water hole ~1.5 m from the javelina. After 10 s, the fox lifted its head and stared in the direction of the prone and motionless javelina, perhaps alerted by scent cues or by sound (Fig. 1a). The fox looked up three separate times while drinking, staring intently toward the javelina with ears slightly back, before leaving the area at 2028 h. The third time the fox looked up, the javelina had lifted its head and shifted its weight. The fox did not approach the javelina during this encounter.

At 2106 h, 88 min after the javelina laid down, a bobcat ~90 cm in length visited the waterhole. While the bobcat drank, the javelina made several minor adjustments in its position—lifting its head and shifting sides. After ~7 min of drinking, the bobcat left the waterhole and approached in a crouch to within ~30 cm of the prone javelina (Fig. 1b). Thirty-eight seconds elapsed (with no recorded images because of a lack of detectable motion) between the bobcat taking this position and it turning and returning to the water hole. The bobcat left the area sometime after 2115 h and before 2132 h, as the camera did not record it leaving. At 2242 h, the young javelina rejoined an adult javelina that came to drink from the waterhole.

This observation relates to an earlier observation that occurred in-person to EJL, on 25 June 2016, in a steep drainage in the Black Mountains above Hackberry Wash where he startled a javelina herd of ~17 individuals. The adults scattered up canyon, with individuals splintering off and running up side canyons and steep talus slopes. Fifteen minutes later, EJL came upon two young javelinas lying prone partway up a rocky pouroff, with barely perceptible breathing movements (Fig. 1c). These javelinas appeared to be more mature than the javelina captured on the trail camera and were ~20 cm long. Walking around the two javelinas was going to be exceedingly difficult so EJL yelled, then approached to within 1 m, and finally poked the hind limb of the rearmost javelina with a long stick. The hind limb jiggled as if completely numb and neither javelina reacted.

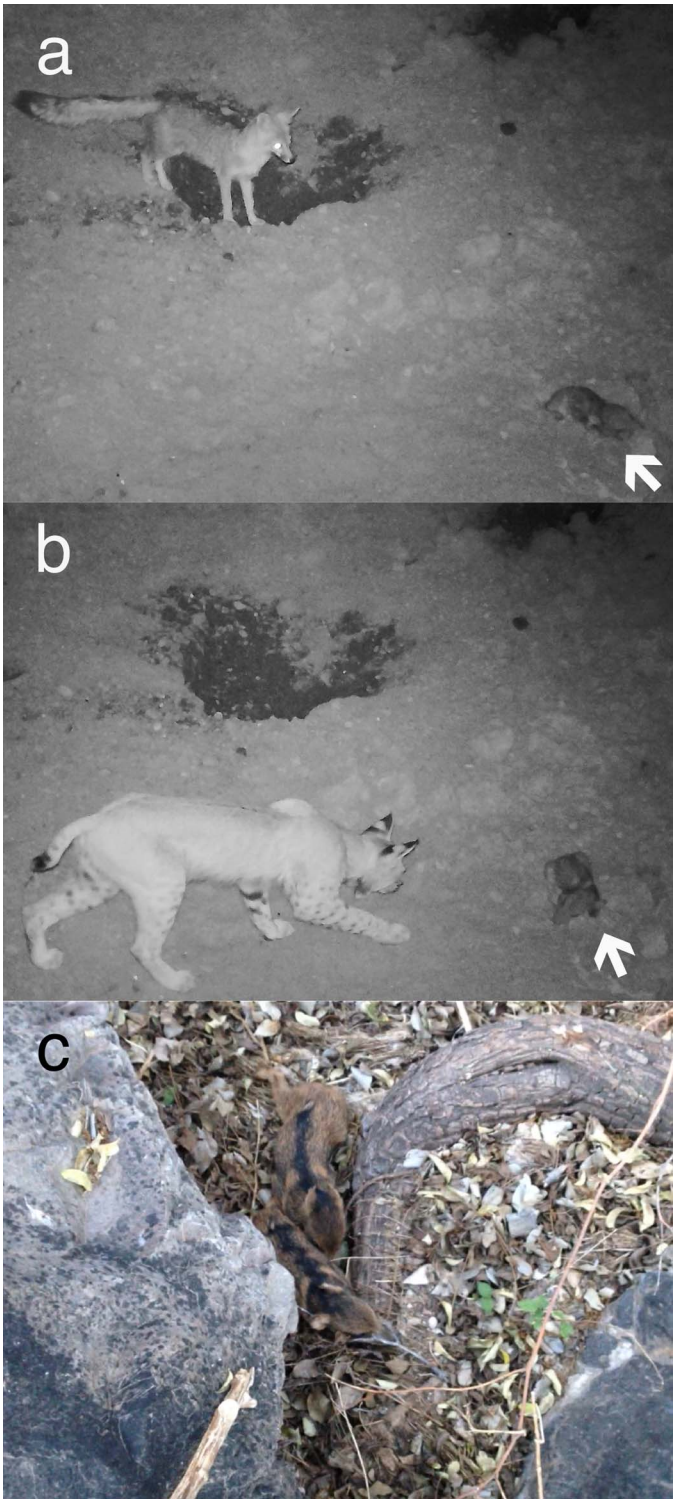

Fig. 1—Interactions between a young collared peccary (*Pecari tajacu*) and two potential predators, (a) a gray fox (*Urocyon cinereoargenteus*) and (b) a bobcat (*Lynx rufus*) in the Sonoran Desert, Arizona, on 28 June 2016, and (c) a related personal observation on 25 June 2016 of two young peccaries in apparent physiological thanatosis in the Black Mountains, Arizona. Arrow indicates location of young peccary in a and b. (Color version is available online.)

The trail camera footage suggests that hiding behavior is an important component of juvenile javelina behavior. This is supported by the amount of time that the young javelina remained at the site near the water hole (nearly 3 h total). This might also suggest an adaptive reason for the lack of functional scent glands in juvenile javelina (Hannon et al., 1991) and their pelage patterns (visible in Fig. 1c), both of which are distinct aspects of juvenile morphology. These traits might be part of a suite of adaptive components that form this hiding predator avoidance strategy.

Furthermore, the second observation suggests that young javelinas might experience thanatosis, as do domestic pigs (*Sus scrofa*; Erhard and Mendl, 1999), in which all voluntary activity is stopped in certain threatening situations and the animal cannot be roused. However, the micromovements and shifting of the javelina in the trail camera footage suggest that there is individual variation in the extent to which javelinas enter thanatosis or that javelinas feign dead without entering the physiological state of thanatosis.

The interaction captured by the trail camera leaves more questions than answers. It is likely that the gray fox did not initiate attack because it was unable to confirm the existence of the prey or because it could not pinpoint the location of the prey, which is believed to be one of the functions of cryptic coloration (Caro, 2014). This is remarkable given the total lack of hiding cover afforded to the javelina. However, an inability to confirm the presence of the javelina does not adequately explain the failure of the bobcat to attack, given the close proximity of the cat to the javelina over an extended period of time. There are other possibilities as well, such as being satiated or averse to the taste or smell of javelina even though juvenile javelinas lack functional scent glands (Hannon et al., 1991), although bobcats are known to attack even adult javelinas (Foldesh, 1982).

An additional possibility exists—that the bobcat decided not to initiate attack. Interspecies interactions are likely more nuanced and complex than commonly thought; for example, it has been shown that parental care responses can be initiated by stimuli shared by many mammals (Lingle and Riede, 2014). Predators have been recorded caring for the young of their prey or adopting the young of prey species, such as the lioness (*Panthera leo*) that cared for as many as eight young East African oryx (*Oryx beisa*) on separate occasions (National Geographic, http://channel.nationalgeographic.com/wild/unlikely-animal-friends/videos/the-lioness-and-the-oryx/). Cases of predator discretion in attacking prey are not well documented in the literature, but such events suggest that predators experience a range of subtle impulses that can influence prey selection and attack.

Juvenile ungulates are particularly vulnerable to predation, and survivorship in this age class is a critical driver of large herbivore population dynamics (Lingle and Riede, 2014); thus understanding the variety of antipredator behaviors, and their distribution among ungulate taxa, is important to understand these evolutionary responses. It appears that young javelinas, while typically acting as followers, hide in response to separation from their herd or in response to predation threat, which might explain their distinct pelage patterns and lack of functional scent glands. This observation is also interesting as it provides a window into the lives of these organisms; the failure of the bobcat to attack the javelina may suggest a failure of perception, discretion, or choosiness.

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