WHITE-WINGED DOVE (*ZENAIDA ASIATICA*), A NEW SPECIFIC ITEM IN THE DIET OF *CTENOSAURA SIMILIS* (SQUAMATA: IGUANIDAE)

LA PALOMA ALA BLANCA (*ZENAIDA ASIATICA*), UN NUEVO REPORTE ESPECÍFICO EN LA DIETA DE *CTENOSAURA SIMILIS* (SQUAMATA: IGUANIDAE)

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Resumen.– El garrobo (*Ctenosaura similis*) se encuentra principalmente en ambientes xéricos en la vertiente del Pacífico de Mesoamérica. La especie ha sido considerada omnívora, con un cambio ontogenético en su dieta; los juveniles son insectívoros y los adultos son principalmente herbívoros. El garrobo consume diferentes tipos de materia vegetal y animal, sin embargo, hay pocos informes de eventos concretos de depredación. Aquí reportamos la depredación de la paloma ala blanca (*Zenaida asiatica*) por el garrobo en Costa Rica. Una paloma adulta fue capturada en el nido por un garrobo, y el único volantón del nido fue depredado por otro garrobo hembra cuando cayó al suelo después del evento de depredación. La paloma ala blanca ha incrementado su distribución y abundancia y explota principalmente hábitats abiertos donde anida incluso en infraestructuras de humanos, donde queda expuesta a depredadores que habitan principalmente en este tipo de hábitat como el garrobo. Discutimos el contexto de este evento de depredación y agregamos a la paloma ala blanca a una lista basada en la recopilación de presas reportadas como consumidas por el garrobo tanto en su área de distribución natural como en sitios donde ha sido introducido.

Palabras claves.– Bosque Húmedo Premontano Tropical, cambio ontogénico, depredación, garrobo, omnívoro.

Abstract.– The Black Iguana (*Ctenosaura similis*) mainly inhabits xeric environments at the Pacific slope of Mesoamerica. It has been considered omnivorous, showing ontogenetic changes; juveniles are insectivorous, while adults are primarily herbivorous. The Black Iguana consumes several types of plant and animal material; however, there are very few reports of the actual predation events. Here we report the predation by the Black Iguana in Costa Rica upon a White-winged Dove (*Zenaida asiatica*). A female Black Iguana took one adult from its nest, and the only nestling of the nest was predated by another female Black Iguana when it fell to the ground after the predation event. The White-winged Dove has increased its distribution and abundance, exploiting mainly open habitats, including nesting in human infrastructure, where it is exposed to predators inhabiting this habitat, such as the Black Iguana. We discuss the context of this predation event and add the White-winged Dove to a list based on the compilation of prey reported as consumed by the Black Iguana both in its natural distribution area and in sites where it has been introduced.

Key words.– Black Iguana, omnivore, ontogenetic change, predation, Tropical Moist Premontane Forest.

Most lizards are exclusively or primarily carnivorous, although many species eat some plant material (Cooper & Vitt, 2002). Nevertheless, only 2% of all lizard species are herbivorous, many of which are presumed omnivorous, especially as juveniles (Sokol, 1967; Furness, 2021a). The family Iguanidae includes omnivorous or strictly herbivorous lizards with a large body size (Savage, 2002). The most diverse genus of this family is *Ctenosaura* with 15 species (Uetz et al., 2022). Among them, the Black Iguana (*Ctenosaura similis*) has been generally described as herbivorous or strictly vegetarian (Smith, 1946; Hotton, 1955;

Dion & Porras, 2014). However, Bailey (1928) recognized that this lizard also consumes some insects, primarily beetles, and grasshoppers. Taylor (1956) described the food habits of *C. similis* as consisting "chiefly of the leaves of trees and shrubs, grass, and small terrestrial plants, as well as fruits, and small seeds. Some insects especially grasshoppers are also taken" (p. 182). However, Álvarez del Toro (1960) wrote that the feeding habit of this species is omnivorous, consuming leaves, buds, fruits, mice, little birds, young iguanas, and frogs. He also wrote that near houses, this iguana takes chicks of domestic hens and human feces (p. 91). Other authors have described this species as occasionally carnivorous, or indicate seasonal or ontogenetic changes in the species diet (Klein, 1977; García-Rosales et al., 2020). Fitch and Hackforth-Jones (1983) suggested that adult Black Iguana primarily eats leaves, flowers and fruits during the dry season, although their diet also includes small animals (Traveset, 1990). Some authors have reported specific vegetal items (Henderson, 1973; Fitch & Hackforth-Jones, 1983; Janzen, 1982; Janzen, 1985; Roberts & Heithaus, 1986; Mora, 2010). Consequently, the Black Iguana is an omnivorous species that consumes various vegetal and animal food items (Mora, 2010).

The Black Iguana has been observed foraging among seagrass in an intertidal beach zone (Furness, 2021a). One interesting aspect of the food habits of this species is the occurrence of ontogenetic changes; juveniles prey mainly on insects (Montanucci, 1968; Lee, 2000) and reduces this intake to only 6% at the end of the first year of life, while adults feed mainly on plant material (Mora, 2010). This species can also eat carrion; there are two examples of it scavenging on toads (Pasachnik & Corneil, 2011; López & Mora, 2021), one fish, and at least three bird species (García-Rosales et al., 2020). Evidence of vertebrate predatory habits is less common, although few cases have been reported. Lee (2000) pointed out that adult Black Iguana

Figura 1. Hembra de garrobo (*Ctenosaura similis*) consumiendo una paloma ala blanca (*Zenaida asiatica*) en Taboga, Guanacaste, Costa Rica.

Figure 1. A female Black Iguana (*Ctenosaura similis*) consuming a White-winged Dove (*Zenaida asiatica*) at Taboga Forestry Reserve, Guanacaste, Costa Rica.

Tabla 1. Ítems alimentarios por taxa consumidos por juveniles (J) y adultos (A) del garrobo (*Ctenosaura similis*).

Table 1. Food items of taxa consumed by juveniles (J) and adults (A) of the Black Iguana (*Ctenosaura similis*).

Group	Taxa	Age	Source
Invertebrates	Insects:12 orders in Costa Rica 3 orders in México	J	Mora, 2010; García-Rosales et al., 2020
	Insects (8 families in 5 orders)*	NI	Krysko et al., 2009
	Crustaceans, mollusks, myriapods	J	Mora, 2010
	Isopoda*	J	Krysko et al., 2009
	Spiders (Araneae, Amblypygi, 2 unidentified groups)	J	Mora, 2010
	Lycosidae	A	Fitch & Henderson,1978
	Hogna annexa (Araneida Lycosidae)*	J	Krysko et al., 2009
	Tarantula *Aphonopelma crinirufum*	A	Dion & Porras, 2014
	Tarantula *Brachypelma vagans*	A	Avilés-Novelo et al., 2019
	Ghost crab *Ocypode gaudichaudii*	A	Arndt, 1999
Lizards	*Aspidoscelis, Sceloporus, Marisora brachypoda*	A	Henderson, 1973; Campbell, 1998
	Basiliscus vittatus	A	Cedeño-Vázquez & Beutelspacher-García, 2016
	Iguana rhinolopha	A	Van Devender, 1982
	Ctenosaura bakeri	A	Maryon et al., 2020
Sea turtles	Hatching *Eretmochelys imbricata*	A	García-Rosales et al., 2020
Birds	*Mimus gilvus*	A	Avilés-Novelo et al., 2019
	Zenaida asiatica	A	This report
	Setophaga sp.	A	García-Rosales et al., 2020
Eggs and chickens	*Sterna antillarum*	A	García-Rosales et al., 2020
	Amazona auropalliata	A	Dahlin et al., 2018
Rodents	*Oryzomys, Scotinomys, Sigmodon*	A	Campbell, 1998
Bats	*Eumops* sp.	A	Fitch et al., 1971
Post-Mortem	Fish	A	García-Rosales et al., 2020
	Rhinella horribilis	A	Pasachnik & Corneil, 2011
	Incilius luetkenii	A	López & Mora 2021
	Progne subis, Zenaida sp.	A	García-Rosales et al., 2020
Cannibalism	*Ctenosaura similis*	A	Mora, 1991; Mora et al., 2015; García-Rosales et al., 2020
Vertebrates *	*Gopherus polyphemus*	A	Avery et al., 2009
	*Anolis sagrei, Anolis distichus***	A	Krysko et al., 2009
	Plestiodon inexpectatus	A	Krysko & Juan, 2014
	Sciurus carolinensis	A	Furness, 2021b

* Outside the native range of the Black Iguana.

** A neonate consumed by a neonate Black Iguana.

NI = not informed

occasionally preys on insects, lizards, eggs of their species, rodents, birds, and even bats. Few items have been identified to species level, e.g., the lizard *Marisora brachypoda* in Belize (Henderson, 1973) and a juvenile Utila Spiny-tailed Iguana *Ctenosaura bakeri* taken by a subadult Black Iguana in Honduras (Maryon et al., 2020).

The Black Iguana is locally abundant especially in several localities of Northwestern Costa Rica, such as Palo Verde and Santa Rosa national parks (Mora, 1989; Almonte et al., 2021), and Taboga Forestry Reserve (TFR). According to general distribution and specific habitats, Taboga is a coexistence zone for the Black Iguana and the White-wing Dove (*Zenaida asiatica*). The White-winged Dove is a reasonably large bird reaching 27 cm with a weight of 145 g (Stiles & Skutch, 1989). In this note, we report predation of the Black Iguana on the White-winged Dove.

On 20 May 2020 at 1030 h, we observed and photographed a female Black Iguana capturing a White-winged Dove from a nest in a building at TFR, Cañas, Guanacaste (10.338194 N, 85.150722 W; 30 m a.s.l.). The TFR is located at the Tropical Premontane Moist Forest, basal transition life zone (Holdridge, 1967). The building where the observation took place is large, with pitchforks made of peeled logs. White-winged Dove commonly nests on the tops of the posts at the trusses level, at 2.40 m of height. On several occasions, we have observed iguanas climbing the poles and trying to prey on the nests, but the parents defend them with pecks. However, on this occasion, an adult female iguana grabbed a parent by its wing, climbed down with it, and ate it on a nearby rock (Fig. 1). During the predation event, the only fledgling of the nest tried to fly but it fell to the ground, where it was immediately preyed upon by another female iguana smaller than the one that climbed the post. Due to this predation event and the identification of this specific prey, we searched for information to summarize the animal's food items already described for this iguana (Table 1).

Several authors have considered the Black Iguana omnivorous, carnivorous, or opportunist. It also has been recognized that its diet has seasonal and ontogenetic changes (Mora, 2010; García-Rosales et al., 2020). As much as 90% of the diet of young Black Iguana consists of insects, but within their first year of life, the quantity and diversity of animal matter decrease as the intake of vegetable matter increases (Mora, 2010). Individuals of Black Iguana of two months old consume 50% animal matter, but one-year-old individuals consume only 6% in average (Mora, 2010). Ninety percent of the prey items found in the stomach contents were insects (14 families), plus other invertebrates (Table 1). Additionally, hatchlings have been observed feeding on feces of adult iguanas (García-Rosales et al., 2020) and they have been also seen consuming human feces (Álvarez del Toro, 1960),

The variety of plant species consumed by *C. similis* is high, it was reported to consist of 39 species (Furness, 2021b), based on a report from Florida including 24 native and 14 nonindigenous plants (Krysko et al., 2009). However, these authors did not count 42 species (20 families) reported as consumed by juvenile individuals of 2 – 12 month old in Costa Rica (although not all of them were identified at the species level, Mora, 2010) and nine species reported from México (García-Rosales et al., 2020). As result, there are at least 90 plant species reported as consumed by the Black Iguana.

Adult Black Iguana has been considered primarily vegetarian, and also an opportunistic omnivore (Dion & Porras, 2014). However, it consumes a considerable amount of animal items, although, few have been reported at the species level in the literature; most reports refer to general categories such as invertebrates, insects, frogs, birds, or others (Table 1; Dion & Porras, 2014). Even though some reports refer only to the genus, some have provided information at the species level, including some large invertebrates (Table 1). Records also include some items taken post mortem (Table 1). Black Iguana also shows cannibalistic behavior consuming juveniles (Mora, 1991; Mora et al., 2015; García-Rosales et al., 2020). Outside its native range, the Black Iguana has been reported as a predator of five more vertebrates (Table 1). To our knowledge, this is the first report of a Black Iguana preying on live adult birds and, in specifically upon the White-winged Dove.

Ctenosaura similis is a true omnivore and highly opportunistic predator. Since the species is abundant and widely distributed, it can be a model organism for ecological studies (López & Mora, 2021). Several interactions of this species in the dry forest are examples of this condition, including its role as an important seed disperser (Janzen, 1985; Traveset, 1990; Benítez-Malvido et al., 2003), and a bird predator in the lowland tropical moist forest, one of the most threatened tropical ecosystems (Janzen, 1988).

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