



## BIRD ENTANGLEMENT AND MORTALITY BY FRUITS OF THE ZAPALLO CASPI TREE *PISONIA ZAPALLO* IN THE DRY CHACO, ARGENTINA

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**Abstract** · Bird entanglement by plants may be globally widespread, but it is not a frequently studied phenomenon, and records in different regions of the world are still scarce. During a short visit to the El Impenetrable National Park, Chaco province, Argentina, in October–November 2022, we recorded 15 incidental cases of birds entangled or trapped by fruits of the tree *Pisonia zapallo*. Our report involves 12 bird species from eight families, with a wide range of body sizes and masses. To our knowledge, this is the first documented report on this phenomenon in continental South America.

### Resumen · Enredo y mortalidad de aves por los frutos del árbol zapallo caspi *Pisonia zapallo* en el Chaco Seco

Si bien el enredo de aves por plantas puede estar ampliamente distribuido en el mundo, es un fenómeno poco estudiado y aún son escasos los registros en diferentes regiones. Durante una visita corta al Parque Nacional El Impenetrable, provincia del Chaco, Argentina, entre octubre y noviembre de 2022, registramos 15 casos incidentales de aves enredadas o atrapadas por frutos del árbol zapallo caspi *Pisonia zapallo*. Nuestro informe involucra 12 especies de aves pertenecientes a ocho familias, con un amplio rango de tamaños y masas corporales. De acuerdo con la literatura consultada, este es el primer registro científico sobre este fenómeno en Sudamérica continental.

**Keywords:** Bird mortality · El Impenetrable National Park · entrapment · epizoochory · Nyctaginaceae

Animal entanglement by plant structures occurs when individuals are trapped by plant organs (e.g., inflorescences, fruits, seeds) and cannot fly or move freely. This is a cause of avian mortality because heavily entangled individuals are exposed to stress, extreme weather, predation, inanition, and dehydration (Harms 2020). It may not be a major cause of bird mortality worldwide compared to other phenomena such as predation, illness, and anthropogenic impact (Harms 2020). Yet, it may be one of the most bizarre and overlooked causes of avian natural death. Even though this phenomenon has been described in different geographic regions, indicating that it is globally widespread, much of its impact and biological significance are unknown. Most of the descriptions of bird entanglement by plants are from North America (e.g., Hinam et al. 2004, Hager et al. 2009, Palmer et al. 2009, Underwood & Underwood 2013, Wilder 2019) or Europe (e.g., Püschel & Birkhold 2000, Hölzinger 2011), and few others from the Indo-Pacific region (Seychelles Islands, Burger 2005), Africa (Grobler 1975, Donnelly & Webber 1974), and Oceania (Govett 1883, Walker 1991). Meanwhile, documented records on this phenomenon in the Neotropics and the Caribbean are scarce or lack proper documentation, with only a few reports restricted to Mexico (Banta & Marer 1974), Trinidad and Tobago (White 2002), and the Virgin Islands (Bond 1960). To our knowledge, there are no reports on this topic in South America.

The descriptions of bird entanglement by plants involve a wide variety of botanical taxa that bear hooked or sticky structures (e.g., Asteraceae and Nyctaginaceae), and the birds that have experienced entanglements are as diverse as the regions where they have been reported from. A pioneer report by Govett (1883) already portrayed the surprise and curiosity caused by bizarre

encounters of living and dead birds stuck on *Pisonia* fruits (Nyctaginaceae) in New Zealand. Years later, Burger (2005) also described more than 12 avian species of land and seabirds entangled by *Pisonia grandis* fruits and hundreds of deaths related to this phenomenon in the Seychelles Islands. In addition, plants such as the *Arctium* burdocks (Asteraceae) have been mentioned in various reports and have caught attention because of their impact on migrant and local passerines in Manitoba (Canada) (Underwood & Underwood 2013, Harms 2022). Moreover, Palmer et al. (2009) and Wilder (2019) reported entanglements by *Boerhavia* spiderlings (Nyctaginaceae) in Arizona (USA) of a Western Screech-Owl *Megascops kennicottii*, a Mourning Dove *Zenaida macroura*, and various passerines. Here, we document, for the first time, the entanglement and mortality of birds by a plant in continental South America, specifically by the dry fruits of the zapallo caspi tree *Pisonia zapallo*, Nyctaginaceae.

Zapallo caspi is a native tree to the Great Chaco biome in Argentina, Bolivia, Paraguay, and Brazil, and it is found near swamps or gallery forests close to watercourses (Standley 1931, López & Anton 2006, Zuloaga et al. 2019). It is commonly known as “caspi zapallo”, “zapallo caspi”, “árbol mata-pájaros”, “ombu-ra” or “Francisco Álvarez” (López & Anton 2006). Zapallo caspi has an epizoochory mechanism for seed dispersion. It has paniculated infructescences that can hold from 10 to dozens of fruits. The infructescences are drop-like, one-seeded anthocarps (fusion of the fruit and a persistent calyx, c. 10 mm long, 2–3 mm diameter) that secrete a sticky resin that strongly adheres to fur, feathers, and similar surfaces (Standley 1931, Burger 2005). These anthocarps, referred to in the literature as seeds (Govett 1883, Burger 2005), are the main dispersal unit and are hereafter referred to as fruits. Zapallo caspi blooms yearly between August and December (Cabrera et al. 2013). During and after this period, infructescences fall and tend to accumulate on the ground, creating large masses or cushions ranging from c. 0.3 x 0.3 m to c. 4 x 2 m, or even can conform a homogeneous coverage of larger areas on the forest ground (pers. observ., Figures 1A–B).

We conducted ornithological surveys during 2022 in El Impenetrable National Park (EINP), Chaco province, Argentina. We visited the study region in two opportunities: 1) 26 October to 7 November, and 2) 13 to 19 December, and focused our surveys on the forest by the Bermejito river (25°10'44" S,

61°5'44" W; 139 m a.s.l.), in proximity to the National Park ranger's base camp La Armonía.

During our first visit, we found 15 incidental cases of bird entanglement by zapallo caspi fruits. These cases involved 12 species from eight families and three orders (Table 1). The body length and mass of entangled birds varied widely, from a small Chivi Vireo *Vireo chivi*, to a large White-tipped Dove *Leptotila verreauxi*, showing that not only small birds are vulnerable to these entanglements (Figures 1C–I). In all 15 cases, birds had fruits attached to their primary and secondary feathers, and to their body coverts. Seven of the 15 birds (46.6%) were dead. All living birds were found on the ground, frequently discovered by their vocalizations and struggling noises. We freed all of them by removing numerous attached fruits (8–30 per bird) from their plumage (Figure 1F–I). Despite having detached all fruits from them, some birds could not fly well after being released. Several birds had their tail stuck to their wings, and the most heavily entangled ones had fruits stuck to their body cover feathers up to the point that they were immobilized, having their neck bent.

We cannot assure that this kind of entanglement directly caused the death of the birds. Nonetheless, we assume that entanglement and immobilization, followed by dehydration and inanition, were the possible causes of their deaths. Only one Pale-breasted Spinetail *Synallaxis albescens* and a Creamy-bellied Thrush *Turdus amaurochalinus* seemed to have died long before our finding (they were already decomposed or dry, see Figures 1C–D). Other birds seemed to have died a day or two before we found them. Although bird entanglement by plants may not be a direct cause of death, our observations suggest that other factors (e.g., extremely hot and dry weather) most certainly lead to fatal outcomes. In contrast, during our ornithological surveys, we mist-netted a Ruffous-bellied Thrush, and three unidentified flycatchers (not mentioned in Table 1) that had two to five fruits adhered to their plumage, seemingly showed no difficulty flying when released. So, it seems that the attachment of fewer fruits may not be harmful to medium size birds.

On our second visit (13–19 December 2022) to the National Park, we did not register any case of bird entanglement, and at that time, most zapallo caspi fruits had begun to dry out and degrade. Both of our visits to the El Impenetrable National Park occurred during a prolonged period of drought in the re-

**Table 1.** Bird species found entangled with the zapallo caspi tree *Pisonia zapallo* fruits in El Impenetrable National Park, Argentina, from 26 October to 7 November 2022. Body length and mass from Billerman et al. (2022).

Species and family	Bird found		Length (cm)	Mass (g)
	Dead	Alive		
White-tipped Dove <i>Leptotila verreauxi</i> (Columbidae)	-	1	23.5–29.0	96.0–157.0
Little Nightjar <i>Setopagis parvula</i> (Caprimulgidae)	1	-	19.0–21.0	25.0–42.0
Pale-breasted Spinetail <i>Synallaxis albescens</i> (Furnariidae)	1	-	13.0–16.0	9.0–17.0
Elaenia <i>Elaenia</i> sp. (Tyrannidae)	1	-	-	-
Vermilion Flycatcher <i>Pyrocephalus rubinus</i> (Tyrannidae)	-	1	13.0–14.0	11.0–14.0
Crowned Slaty Flycatcher <i>Empidonomus aurantioatrocristatus</i> (Tyrannidae)	1	-	17.5–18.0	Mean: c. 27
Tropical Kingbird <i>Tyrannus melancholicus</i> (Tyrannidae)	-	1	18.4–22.0	32.0–42.5
House Wren <i>Troglodytes aedon</i> (Troglodytidae)	-	1	11.5–12.5	8.9–14.2
Chivi Vireo <i>Vireo chivi</i> (Vireonidae)	1	2	13.0–15.6	12.0–25.1
Rufous-bellied Thrush <i>Turdus rufiventris</i> (Turdidae)	-	2	23.0–25.0	68.0–82.0
Creamy-bellied Thrush <i>Turdus amaurochalinus</i> (Turdidae)	1	-	22.0–25.0	52.0–73.0
Sayaca Tanager <i>Thraupis sayaca</i> (Thraupidae)	1	-	16.0–17.0	28.0–34.0



**Figure 1.** Bird entanglement and mortality by the zapallo caspi Tree *Pisonia zapallo* fruits in El Impenetrable National Park, Argentina. **A)** Large cushions of *P. zapallo* fruits found on the ground in multiple forest and open areas. **B)** Close-up of a cushion of *P. zapallo* fruits. A pencil (15 cm) is included as a reference scale. Examples of birds found entangled by *P. zapallo* fruits **C)** a dead Creamy-bellied Thrush *Turdus amaurochalinus*; **D)** Carcass of a Pale-breasted Spinetail *Synallaxis albescens*; **E)** Dead Chivi Vireo *Vireo chivi*; **F)** Alive White-tipped Dove *Leptotila verreauxi* having the wings clamped together with the tail; **G)** Alive Tropical Kingbird *Tyrannus melancholicus* and **H-I)** Alive female Vermilion Flycatcher *Pyrocephalus rubinus* with fruits under the wings, flanks, chest and tail. All pictures by the authors, except that of the Tropical Kingbird, which Park Ranger Nestor Cofres kindly provided.

gion, mainly caused by an abnormally persistent La Niña period that started in early 2020 (Voiland 2022), which may have facilitated the accumulation of these fruits in large masses on the ground. Based on the blooming season of zapallo caspi (August–December; Cabrera et al. 2013), we hypothesize that this drought and the associated hydric stress may have forced the trees to accelerate their blooming and posterior fructification process (i.e., higher accumulation of fruits in a shorter period), thus generating an excess of fruits on the ground, greater than on a less extreme season. If the drought season had kept on extending in the region, bird entanglement by plants might have had a greater impact on local bird communities.

Our finding follows a general pattern of previous bird entanglement and mortality studies. While a few attached fruits may not directly threaten birds, mortality seems highly related to an excess of attached structures that suffocate and immobi-

lize individuals. Small passerines are the most recurring birds reported dead by entanglement with plant structures, including *Pisonia* fruits (Govett 1883, Walker 1991, pers. observ.). Yet, it is astonishing that birds like the Lesser Noddy *Anous tenuirostris* (97–120 g; Gochfeld et al. 2020) have died by entanglements by *Pisonia* fruits (Walker 1991, Burger 2005).

It is not evident that seed dispersal of *Pisonia* trees could benefit from bird deaths. A heavily entangled individual would be unable to disperse fruits far away from the parent tree, unlike a bird that carries just a few fruits (Burger 2005). We suggest that bird mortality caused by entanglement by *Pisonia* fruits is a side-effect of their seed dispersion mechanism and likely related to high nearby activity from the birds (e.g., nesting on or foraging around them). Some of the birds we found entangled, such as the Rufous-bellied Thrush and the House Wren *Troglodytes aedon*, forage on low forest strata (Johnson 2020, Collar 2020), and others (e.g., Little Nightjar *Setopagis*

*parvula* nest on the ground (Provost 2020). Based on this, it is highly probable for birds to stumble upon zapallo caspi fruits when foraging close to the ground or close to vegetation holding the fruits or even when nesting. Additionally, previous experiments showed no significant benefits of the presence of bird carcasses on the germination and seedling establishment of *P. grandis* in the Seychelles Islands (Burger 2005).

Finally, our findings of bird mortality by entanglement with plants were all incidental, as in other cases and regions (Hager et al. 2009). Still it is unusual to find as many cases as we did in such a short period of time. Most reports on bird entanglement by plant structures involve one or a couple of individuals per finding (i.e., Donnelly & Webber 1974, Palmer et al. 2009). Previous reports have performed systematic searches that summed up to 39 birds (Hinam et al. 2004, Underwood & Underwood 2013, Wilder 2019) in successive regional visits. Others have provided important compilations of cases in different regions (Püschel & Birkhold 2000, Hager et al. 2009, Harms 2020) that helped to build a comprehensive vision of this phenomenon. Therefore, the high number of cases we observed in such a short period and the high density of *Pisonia* trees in the region (pers. observ.) suggest that bird entanglement and mortality may be overlooked in the Chaco region.

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