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ACTIVE ANTING WITH A MILLIPEDE (DIPLOPODA) BY A TURQUOISE JAY *Cyanolyca turcosa* (CORVIDAE) IN THE SOUTHERN ANDES OF ECUADOR

Hormigueo activo con un milpiés (Diplopoda) por una Urraca Turquesa *Cyanolyca turcosa* (Corvidae) en los Andes del sur de Ecuador

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Abstract

Some ectoparasites of birds can have adverse effects on their hosts' fitness. Therefore, anti-parasitic behaviors such as 'anting' have evolved to combat various parasites. This note provides a new report of anting behavior in a Turquoise Jay *Cyanolyca turcosa* in Cajas National Park, located in the high Andes of southern Ecuador. An adult bird was observed using a medium-size millipede to actively rub its plumage, suggesting a potential external parasite removal strategy (anting). After 12 min of this behavior, the millipede was consumed by the bird. This observation opens up the possibility that anting behavior is more common than previously acknowledged.

Key words

Anti-parasite behavior, Azuay, Cajas National Park, ectoparasites, Passeriformes.

Resumen

Algunos ectoparásitos de las aves pueden tener efectos adversos sobre la aptitud de su hospedador. Por lo tanto, comportamientos antiparasitarios como el "hormigueo" han evolucionado para combatirlos. En esta nota, presento un nuevo reporte de este comportamiento en la Urraca Turquesa *Cyanolyca turcosa* en el Parque Nacional Cajas, ubicado en los altos Andes del sur de Ecuador. Observé a un individuo de *C. turcosa* adulto utilizando un milpiés de tamaño medio para frotar activamente su plumaje, lo cual sugiere una estrategia de eliminación de parásitos externos (hormigueo). Tras 12 min de este comportamiento, el milpiés fue consumido por el ave. Esta observación abre la posibilidad de que este comportamiento sea más común de lo que se pensaba.

Palabras clave

Azuay, comportamiento anti-parasitario, ectoparásitos, Parque Nacional Cajas, Passeriformes.

External parasites have adverse effects on bird survival (Lehmann, 1993; Bush & Clayton, 2018), affecting the host's health, reproduction, and social behavior (Møller, 1993; Proctor & Owens, 2000; Whiteman & Parker, 2004; Bush & Clayton, 2018). These external parasites usually adhere to their hosts, generally feeding on blood, feathers or skin (Hopla *et al.*, 1994). Therefore, birds need to avoid, control, or reduce these parasites (Clayton *et al.*, 2010; Bush & Clayton, 2018). Several strategies have evolved to mitigate the negative effects of ectoparasites. One example is 'self-anointing', or simply 'anting,' where birds rub arthropods that contain secondary compounds on their bodies to create an adverse environment for parasites (Weldon & Carroll, 2006; Morozov, 2015). Originally, the term was applied to the use of ants, but it later expanded to the use of other arthropods such as millipedes. This behavior has been reported for several bird species, most of them passerines (Bush & Clayton, 2018; Pérez-Rivera, 2019; Coulson, 2023). Birds may use the behavior of actively rubbing feathers with insects to self-medicate in order to eliminate ectoparasites, bacteria, and fungi from their plumages. In addition, anting may make the arthropods edible by eliminating the secondary toxic or noxious chemical compounds that some of them possess (Potter, 1970; Weldon & Carroll, 2006; Morozov, 2015).

Field observations were opportunistically made during a walk on the main forest trail at the north side of the Llaviuco lagoon, Cajas National Park, Azuay province (-2.8414, -79.144, 3200 m a.s.l.). Photos of this behavior were taken using a Canon R5 mirrorless camera and a Canon 400 mm f 5.6 telephoto lens. The event was recorded on 19 May 2023, in a cloudy morning at 11h00. Bird identification was based on Freile & Restall (2018). *Cyanolyca turcosa* is common in the Cajas National Park area, usually associated with forest and forest edges (Astudillo *et al.*, 2015) and is commonly observed in foraging flocks in upper forest strata. The arthropod taxonomy was based on Hogue (1993), which allowed to identify it as a millipede (Class Diplopoda), possibly belonging to the Superorder Juliformia given its dark coloration and medium size.

A flock of eight *C. turcosa* was moving in the forest near the main trail, apparently foraging. One of them was perched 2 m above the ground and held a millipede in its bill. Then, this individual flew and perched for several minutes on a fallen tree at 1 m above the ground (Fig. 1A). Holding the millipede in its bill, it systematically rubbed it on its body, repeatedly leaving and pecking the millipede from the branch where it was perched. During the anting, the bird rubbed the millipede on its right flank and then on the left (Fig. 1B), in its underparts and undertail coverts (Fig. 1C). Subsequently, it left the millipede on the branch, where it remained coiled. During this pause, the bird visually inspected its plumage and then self-preened (Fig. 1D), probably looking to see if ectoparasites emerged due to the effect of the toxic secondary components released by the millipede. This behavior of preening and inspecting was repeated at least three times. Then, the bird flew to a new perch on a higher branch with the millipede in its bill. There, it killed the millipede by pecking (Fig. 1E) and then swallowed it (Fig. 1F). Finally, after eating the millipede, the jay flew back to join the flock. During this event, the rest of the flock remained foraging or perching nearby. No interaction was observed between the self- anointing individual and the rest of the flock. This behavior lasted *c.* 12 min.

Anting with a millipede by *C. turcosa* was recently reported by Coulson (2023) from observations in Guango (2700 m a.s.l.), Napo Province, northeast Ecuador. She described this behavior in detail and suggested that this technique could be used to repel and remove ectoparasites, and prepare food for consumption. This suggestion agrees with my own, as the observed individual systematically rubbed the millipede on its feathers for a few minutes, preened its plumage using its bill, and finally ate the millipede.

Figure 1: Turquoise Jay *Cyanolyca turcosa* active anting with a millipede in Cajas National Park in May 2023. A) perching and holding the millipede in its bill prior to the active anting; B) rubbing the millipede on its left side; C) rubbing the millipede in the underparts and undertail coverts; D) Inspecting its plumage and then self-preening; E) killing the millipede; F) Consuming the millipede (Pablo Sebastián Padrón).

Millipedes release defensive compounds when threatened (Shear, 2015). In some species, these chemical components are highly toxic and contain secondary chemicals such as benzoquinones (Shear, 2015), which have anti-parasitic properties that directly affect parasites (Weldon *et al*., 2003). This effect was demonstrated by the study of Carroll *et al*. (2005), where millipede benzoquinones significantly inhibited the climbing ability of ticks on their host, effectively repelling them. The specific mechanisms of the utilization of millipede secondary compounds, their effect on ectoparasites, and the benefits and implications for bird survival are still unclear and need to be investigated. The millipede reported by Coulson (2023) was identified as potentially pertaining to the

orders Spirobolida or Spirostrepda. These are taxonomically included in the Superorder Juliformia (Enghoff *et al*., 2015), to which the millipede observed here might belong. However, the number of observations and the precision of the taxonomic identification of the millipedes in Coulson's (2023) and this study are still insufficient. Thus, further studies should collect the millipede(s) for precise taxonomic identification.

Although anting is present in different orders of birds (Bush & Clayton, 2018; Pérez-Rivera, 2019; Coulson, 2023), it is more frequent in Passeriformes and particularly more common in corvids (Corvidae) (Morozov, 2015). Several species in this family exhibit remarkable cognition compared to those in other families (Taylor, 2014). This higher condition is expressed in complex behaviors such as innovations in foraging modes, the use of temporary tools, or the presence of advanced social behaviors (Taylor, 2014). Thus, high cognition of corvids could favor the learning and implementing of complex behaviors like anting. Some species that show this behavior include Northwestern Crow *Corvus caurinus*, American Crow *C. brachyrhynchos*, Eurasian Jay *Garrulus glandarius*, and Eurasian Magpie *Pica pica* (Simmons,1957; Hendricks & Norment, 2015).

More detailed studies of this behavior and its potential benefits to birds are needed. This new report raises the possibility that this behavior is more common than previously thought and that it is geographically more widely distributed, including high elevation areas. It also suggests that depredation pressure on millipedes at high elevations is apparently strong enough that it is beneficial for them to retain secondary compounds. Finally, this observation illustrates a biotic interaction across several trophic levels (predator/prey/parasite), which is generally poorly documented in tropical systems. Furthermore, although many studies suggest that biotic interactions play a larger role in driving community structure at lower than high elevations, this is an example of how biotic interactions might also be important at high elevations.

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