The Wilson Journal of Ornithology 121(1):213–215, 2009

First Observation of Sap Well Use and Maintenance by the Glossy Flowerpiercer (*Diglossa lafresnayii*) (Thraupidae)

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ABSTRACT.—We report observations of a Glossy Flowerpiercer (*Diglossa lafresnayii,* Thraupidae) using and maintaining sap wells on three shrubs (Asteraceae: *Baccharis arbutifolia*) on the east slope of the Ecuadorian Andes. The flowerpiercer rotated among shrubs in a trapline fashion, licking and drinking sap and dragging its hooked upper mandible, and possibly also its lower mandible, along the wounds in the *Baccharis* trunks, presumably to keep sap flowing. This represents, to our knowledge, the first description of sap well use and maintenance in the Thraupidae. *Received 12 August 2008. Accepted 14 December 2008.*

Plant phloem sap is primarily used in transport of nutrients (predominantly sugars) from photosynthetic tissues to other regions of the plant (Freeman 2002, Douglas 2006). Sap is protected in woody plants by outer cork layers that include the outer bark of trees and shrubs (Fahn 1990, Freeman 2002), and by exudates that impede and eventually stop sap flow from wounds (Crafts and Crisp 1971). Many species have overcome these protections to feed on phloem sap, including insects (notably Hemipterans; Douglas 2006), mammals (e.g., Goldingay 1987), and birds, most notably sapsuckers (*Sphyrapicus*) (Picidae) (Tate 1973, Eberhardt 2000).

Many bird species across diverse families feed on sap flowing from pre-existing wounds (Foster and Tate 1966, Daily et al. 1993, Witmer 1996, Blendinger 1999, Chapman et al. 1999, Pejchar and Jeffrey 2004, Schlatter and Vergara 2005) or exuded in a modified form by sap-feeding insects (''honeydew'') (Reicholf and Reicholf 1973, Paton 1980, Gaze and Clout 1983, Douglas 2006). However, few bird species actively cause and maintain wounds in trees or other plants to feed on sap. Causing, maintaining, and attending sap wells has been described for several genera of woodpeckers (Picidae; e.g., *Melanerpes, Sphyrapicus, Dendrocopos, Picoides, Campephilus*) (Tate 1973, Blendinger 1999, Eberhardt 2000, Winkler and Christie 2002, Schlatter and Vergara 2005), and in one species each in Psittacidae (New Zealand Kaka, *Nestor meridionalis*) (O'Donnell and Dilks 1989, Morehouse 1997) and Drepanididae (Akiapolaau, *Hemignathus munroi*) (Pratt et al. 2001, Pejchar and Jeffrey 2004). Crimson Rosella (*Platycercus elegans*) have also been observed maintaining sap flow from wounds created by a mammal (yellow-bellied glider, *Petaurus australis*) (Chapman et al. 1999). We describe sap well use and maintenance by a neotropical tanager, the Glossy Flowerpiercer (*Diglossa lafresnayii*) representing, to our knowledge, the first description of the behavior in the Thraupidae.

OBSERVATIONS

We found an adult Glossy Flowerpiercer on 17 October 2006 flying between several *Baccharis arbutifolia* (Asteraceae) shrubs above Lago Papallacta, Napo, Ecuador (00° 22′ S, 78° 10′ W) at 3,350 m in montane Andean forest. The mean annual temperature in this area is 8.7 °C with mean annual precipitation of 972.4 mm (climate data from <5 km at 3,300 m; ITM, unpubl. data). The flowerpiercer would spend brief amounts of time at each shrub, scraping wounds on the trunk, and licking the exuding sap with its tongue before flying 5–10 m to another shrub. The bird would return to each shrub every 5–10 min and repeat the behavior. Upon inspection, we found sweet-tasting sap slowly welling in the scars that were apparently being maintained by the flowerpiercer through the repeated dragging of the hook at the tip of the upper mandible (and possibly also the lower mandible) along the wounds. Wounds in the shrubs varied in size, but consisted of a section without bark that

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transected the trunk (usually extending one third to one half of the way around the small 2–3 cm diameter trunks), in addition to longer sections that ran parallel to the trunk for 10–20 cm. Wounds were a few millimeters deep but, in some cases, appeared worn on one side. We observed the flowerpiercer drinking sap and dragging its bill along only one side of the scar, at the abrupt border of the scar and bark. The flowerpiercer did not attend the remaining worn side of the scar and area without bark during our observations.

We identified three shrubs the flowerpiercer was attending sequentially, possibly attending additional shrubs out of view before returning to locations we identified. All three shrubs were the same species and of similar size (diameter at breast height 2–4 cm; 3–5 m tall). Wells ranged from ~1 to 2 m above the ground. Additional *Baccharis arbutifolia* shrubs near those with active wells showed scars that resembled healed wounds used by the flowerpiercer. The shrubs being used were >5 m apart, despite the presence of other similar size *Baccharis arbutifolia* in closer proximity. At least one additional Glossy Flowerpiercer was frequently heard singing and seen in the immediate area of the sap wells, and was chased from the vicinity of one of the wells by the one confirmed individual that attended the wells. Birds were not banded, and we could not distinguish or identify the gender of individuals; we cannot dismiss the possibility that more than one individual attended the wells.

We returned to the location on 19 October 2006 and obtained a video of presumably the same bird at one of the sap wells, allowing close observation of the bird's behavior. The video is available in the Handbook of the Birds of the World's Internet Video Collection (http://ibc.hbw.com/ibc/). The bird first arrived at the wound, and licked and drank sap that had accumulated in the upper part of the wound. The bird then dragged its hooked upper mandible (and possibly also its lower mandible) along the wound in the trunk, working its way down. Twenty-three sec later, the bird reappeared, dragging its hooked upper mandible along the same sections of wounded trunk, dragging downward in independent motions, hopping up to attend progressively higher sections of the wounded trunk. Once the entire wound had been scraped twice, the bird flew away. We presume dragging of the hooked upper mandible reopened the wound to allow continued sap flow. We are unclear as to the extent to which the lower mandible was dragged along the wound on the shrub, and it is possible the lower mandible had an important role in keeping open the wound. No other birds were seen attending the sap wells during video-taped or direct observations at the site. Our total observation time at the site over the 2 days was ~4 hrs. Weather during our observation period on both days was cool and cloudy with brief periods of sun.

DISCUSSION

Flowerpiercers are generally well-known for their ability to obtain nectar from flowers by piercing the base of corollas and drinking the nectar without pollinating the plant (Skutch 1954, Moynihan 1963, Vuilleumier 1969, Isler and Isler 1999). Flowerpiercers also feed on nectar by entering the corolla directly (and pollinating some flowers), and eat fruit, Müllerian bodies of *Cecropia* trees, flower petals, and insects (Skutch 1954; Moynihan 1963; Vuilleumier 1969; Hilty and Brown 1986; Fjeldså and Krabbe 1990; Isler and Isler 1999; Rojas-Nossa 2007; R. C. Dobbs, pers. comm.). We regularly observed Glossy Flowerpiercers feeding on nectar (both by piercing the base of corollas and by probing the corollas) within 5 km of the sap wells, but did not observe the focal bird foraging on anything but sap.

Sap wells are often attended (or parasitized) by other species that consume the exuding sap (e.g., Foster and Tate 1966, Daily et al. 1993, Blendinger 1999, Chapman et al. 1999), and we observed a similar situation at the sap well we video-taped. We observed 5 insects attending the sap well (including Diptera) during 12 min of video, apparently consuming sap. No other birds were observed attending the sap well during our limited time of observation, despite many co-occurring hummingbirds and tanagers in the area. We did not observe flowerpiercers eating insects that were attending the sap well.

We suspect this Glossy Flowerpiercer inflicted the original wound in the *Baccharis* using the same technique that it used to maintain sap flow; however, we did not witness the original formation of the wound. Other species have been observed secondarily maintaining sap

wells they did not create (e.g., *Platycercus elegans*; Chapman et al. 1999); however, no other species of vertebrate is presently known to create sap wells in montane forests of the eastern Andes of Ecuador. The distinct wound pattern used by the Glossy Flowerpiercer is unlike most others described for sap feeders. The use and maintenance of this trapline of sap wells represents, to our knowledge, a novel behavior in the Thraupidae.

ACKNOWLEDGMENTS

We thank James Law, Patricio Pillajo of the Fundación Terra for helping with plant identification, and Rob Dobbs for sharing unpublished observations of flowerpiercers feeding on *Cecropia.* We thank P. G. Blendinger, C. E. Braun, and an anonymous reviewer for helpful comments on the manuscript. We acknowledge funding from Virginia Tech Advance postdoctoral fellowship (FB), National Science Foundation IOS 0545735 (ITM), National Science Foundation International Research Fellowship OISE-0700651 (FB), Natural Sciences and Engineering Research Council of Canada (PRM), and a Baillie Family Endowment (PRM).

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