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SAPSUCKING IN THE WHITE-FRONTED WOODPECKER *MELANERPES CACTORUM*

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Resumen. Se describe por primera vez el comportamiento de alimentación con savia para un carpintero sudamericano (*Melanerpes cactorum*). En ambientes áridos del centro de la Argentina, *M. cactorum* practica hileras de agujeros en ramas y troncos vivos de algarrobos (*Prosopis flexuosa*), quebrachos (*Aspidosperma quebrachoblanco*) y talas (*Celtis* sp.) para alimentarse con la savia exudada. Este comportamiento aparece sólo en invierno cuando otros alimentos escasean, produciendo un impacto significativo en el ecosistema local. Nueve especies de aves, catorce de insectos y un marsupial fueron registrados alimentándose con savia. Fue observada por primera vez una hormiga podadora alimentándose masivamente con savia en condiciones naturales. *M. cactorum* regresa varios inviernos sucesivos a las heridas de los mismos árboles. Esta repetición y la consecuente cicatrización le da a los troncos un aspecto anillado característico provocando deterioros en la calidad de la madera.

Abstract. For the first time the sapsucking behavior of a Southamerican woodpecker (*Melanerpes cactorum*) is described. In arid environments of central Argentina *M. cactorum* makes rows of holes in living trees of *Prosopis flexuosa*, *Aspidosperma quebrachoblanco* and *Celtis* sp. and feeds on the exuding sap. This behavior appears only in winter when other food sources are scarce. Nine species of birds, fourteen species of insects (including a Leaf-cuthing ant) and a marsupial were recorded feeding at sap trees. *M. cactorum* returns succesive winters to the same sap trees. This repetitive use of sap holes in trunks leads to loss of timber. *Accepted 5 Mai 1993.*

Key words: Argentina, White-fronted Woodpecker, Melanerpes cactorum, *sapsucking behavior, associated fauna, damage to trees.*

INTRODUCTION

Sapsucking is an uncommon behavioral trait among Picidae, recorded mainly for three Nearctic species of *Sphyrapicus* and occasionally in other species (Turcek 1954, Kattan 1988, Short 1982).

In this paper we describe for the first time sapsucking by Southamerican *Melanerpes cactorum*, and record several birds, insects and a mammal attracted by the flowing sap. We evaluate the damage caused by ringing of trees.

STUDY AREA

Field work was carried out at the Reserva Forestal Chancaní, Dept. Pocho, province of Córdoba (31°25S, 65°26W) Central Argentina. The environment is ecotonal between dry western chaco forest and desert scrub. Observations were made in January and October of 1987, April, July, and October of 1990, and July and October of 1991 in two areas. Area 1 is a natural forest of quebracho (*Aspidosperma quebrachoblanco*) with scattered bushes of *Prosopis flexuosa*, *Acacia furcatispina*, and *Larrea divaricata*. Area 2 is a modified environment beside a farm pond surrounded by *Celtis* sp., *Prosopis chilensis* and *Cercidium praecox*.

RESULTS

Seasonal activity. During early spring, summer, and autumn we did not see *Melanerpes cactorum* making holes in trunks for sap, in spite of woodpecker abundance in the study areas. An examination of sap trees in areas 1 and 2 in early spring revealed that there had been no recent work on trunks and no insect activity. The individuals of *Melanerpes cactorum*, which spent most of their time at sap trees during the winter, were not seen at the same areas during one day of observation in spring.

Winter activity in area 1. More detailed observations were made on 18 and 19 July 1990, when two *M. cactorum* worked at several sap trees in an area of about 35×60 m. Tables 1 and 2 describe the trees used in area 1.

The activities of the two individuals during several hours of observations were mainly perch-

TABLE 1. Trees commonly used in area 1.

Tree	No.	Function	Height (m)	Trunk diameter (cm)
Aspidosperma quebrachoblanco	Q1	sap tree		20
	Q3	sap tree		19
	Q5	sap tree		15
	Q6	sap tree		20
Prosopis flexuosa	A1	sap tree		6
				10
				6
				8
	A2	sap tree		10
				8
				8
	A3	perch	4.5	28
	A4	perch	3.5	30
	A5	perch	3.5	25

ing and sapsucking. Sap trees were two young *Prosopis flexuosa* and six *Aspidosperma quebracho-blanco*. Perch trees were two *P. flexuosa*, one dead and another without leaves, where one individual or both frequently perched on the top branches. Sometimes individuals spent several minutes gleaning insects (possibly ants) from the bark of the branches. A secondary perch was used when they flew to the young main sap tree of this area (Q3). Most times they flew from a primary perch to a *P. flexuosa* (A5) close to Q3, perching there for a while, before reaching Q3. During two hours of continuous observations, the birds spent similar periods of time in sapsucking and perching, but it was more common to see both birds jointly at the perch trees than at sap trees.

Only twice was a *M. cactorum* seen making a hole for sap. It spent six minutes in both cases. While pecking the bark the head was turned to

TABLE 2. Description of holes in the sap trees of area

Tree	Number, orientation, distance from ground	Size of holes (mm)		
		width		depth
Q1	34 S—SE 5 N 0.9—2.5 m			
Q3	226 S—SE 20 N—NE 0.9—2 m	10		
Q5	142 S—SE 18 N 0.6—2 m			
Q6	16 S—SE 1 N	—	—	—
A1	trunk 1: 163 in 15 rows trunk 2: 233 in 25 rows trunk 3: 60 in 9 rows trunk 4: 290 in 23 rows randomly orientated 0.5—1.5 m	4	2	3
A2	74 in several rows randomly orientated 0.3—1.35 m			

one side and then the other, almost touching the respective shoulder, resulting in a horizontal oval hole. The same movements were made to enlarge holes and the same position (with the head turned to one side) was adopted for sapsucking. While sap was still flowing from the first hole, six hours later, a second hole was made near the first, revealing that at least sometimes new holes are made despite sap availability. Also the two young *P. flexuosa* (A1 and A2) had recent rows of holes evidently made without waiting for the sap to flow.

The most common activities at sap trees were feeding on sap and enlarging preexisting holes. In both cases *M. cactorum* spent several seconds at each hole. Birds visited different sap trees on successive days; for example, on 18 July 1990, an individual was in Q1 and Q2 for one hour, whereas the next day Q2 was not visited.

The next winter only one *M. cactorum* was present, and only Q3 showed signs of recent activity. No birds were in this tree during several hours of observations over two days.

Winter activity in area 2. At this place a group of five individuals was observed in detail during July 1990 and the next year. Trees of this area are described in Table 3.

The main sap tree was a young *P. flexuosa* (A1) close to a dead tree (A2) used as perch. In 1990, A2 was a secondary perch where the birds paused for a moment before reaching A1. In 1991, more time was spent in A2 and sometimes the birds went away after some minutes without visiting A1. Also, during two days of observation in 1991 the group spent more time in A1 than in 1990. Usually, the five individuals arrived and left from these trees within a few seconds. This is in contrast with the pair of area 1 which rarely visited the same sap tree simultaneously.

TABLE 4. Birds associated with sap trees.

	July 1990	July 199
Area	Passeriformes	
	Furnariidae	
	Leptasthenura platensis	
	Cranioleuca pyrrhophia	
	Tyrannidae	
	Stigmatura budytoides	
	Thraupidae	
	Piranga flava	
	Emberizidae	
	Coryphospingus cucullatus	
	Poospiza torquata	
Area 2	Trochiliformes	Passeriformes
	Trochilidae	Furnariidae
	Sappho sparganura	*Pseudoseisura lophotes*
	Passeriformes	Tyrannidae
		Stigmatura budytoides
	Furnariidae	Thraupidae
	Pseudoseisura lophotes	*Piranga flava*
	Tyrannidae	
	Stigmatura budytoides	
	Icteridae	
	Icterus cayanensis	

The main activity was feeding on sap from holes already made. Individuals adopted the position described above.

The roost hole of this group was found in 1990, 200 m SW of the study area. On 21 July, at 18:26 and just before sunset, the five individuals entered a hole, 4 m up in a dead branch of a *Celtis* sp. The next year, the birds approached this hole before sunset but only one entered, the others leaving and returning several times without entering, possibly disturbed by our presence.

Other vertebrates associated with sap trees. Nine species of birds and a marsupial were observed feeding on sap in the study areas, in the winter of 1990 and 1991. Table 4 summarizes information on birds.

TABLE 3. Trees commonly used in area 2.

	No.	Function	Height (m)	Trunk diameter (cm)
Prosopis flexuosa	A1	sap tree	5	27
	A2	perch	5	26
	A3	sap tree	7	27
	A4	sap tree	6	27
Prosopis chilensis	A5	perch and sap tree	10	33
Celtis sp.	T1—T4	sap trees	10—12	35—40
	T5	perch	2.5	20

In 1990, the temperature reached 16 °C, but usually was below 7 °C; in 1991, temperatures were higher, reaching over 20 °C, and were above 15 °C during observations. Perhaps this fact and the reduced activity of *M. cactorum* in area 1 during 1991, could have caused the differences in species diversity between the two winters. Species differences between areas would be the result of different environments, but *Piranga flava* previously recorded for area 1 was then present in area 2 as well.

Stigmatura budytoides showed greatest dependence on this food source, being a very frequent visitor to sap trees of both areas during both winters. Some days these birds spent more time in the sap trees than did the woodpeckers. During both winters *Pseudoseisura lophotes* was also frequent in A1 of area 2. The other species of birds were more occasional visitors. Conversely, other common birds of these environments such as *Polioptila dumicola*, *Drymornis bridgesi*, *Lepidocolaptes angustirostris*, and *Zonotrichia capensis* were never observed feeding on sap, in spite of their abundance in vegetation near sap trees.

Stigmatura budytoides was commonly driven away from sap holes by *Melanerpes cactorum*, and this species, in turn, by *Pseudoseisura lophotes*, the largest species. Groups of three–five individuals of *S. budytoides* and up to three of *P. lophotes* were common at sap trees without intraspecific disturbance. *P. flava* was always seen in couples and the other birds occured as isolated individuals.

On 11 July 1991, we observed the marsupial *Didelphis albiventris* feeding on sap. The two previous nights we had seen this marsupial at 20:00 on the top branches of A1 in area 2 when we came to collect insects at sap holes, so the next day we stayed near A1 from 18:00 to avoid disturbance. At 19:40, in darkness, the marsupial walked to the base of the trunk and climbed slowly, stopping to lick sap at different rows of holes. Feeding continued for some minutes even when we illuminated the trunk. Then the individual went up into the branches, possibly disturbed by the continuous light.

Sap feeding by insects. We encountered five species of ants, five of flies, three of moths, and one cockroach feeding on sap. Table 5 summarizes data on insects associated with sap trees.

TABLE 5. Insects feeding at sap trees.

	sap tree, area	day	night
Hymenoptera			
Formicidae			
Camponotus substitutus	A1 (2)	*	
Acromyrmex hispidus	A1 (2)	*	
Dorymyrmex exsangis	A1 (2)	*	
	Q3 (1)	*	
Brachymyrmex patagonus	Q3 (1)	*	
Pheidole vafra	Q3 (1)	*	
Diptera			
Sarcophagidae sp.	A1 (2)	*	
Calliphoridae			
Sarconesia chlorogaster	A1 (2)		
Muscidae			
Fannia sp. 1	A1 (2)		
Fannia sp. 2	A1 (2)		
Dolichopodidae			
Systenus sp.			
Lepidoptera			
Noctuidae sp.	A1 (2)		*
Geometridae sp.	A1 (2)		*
Blattodea sp.	A1 (2)		*

In 1990, with low temperatures, only one *Systenus* sp. and several *Pheidole vafra* were collected in several days, all of them in Q3 of area 1. In 1991, with higher temperatures, different flies and ants were common during the day and moths and other ants during the night. In Q3 of area 1, *Brachymyrmex patagonus* was abundant during the day and in A1 of area 2, *Dorymyrmex exsangis* and *Camponotus substitutus* were common, especially at night. One individual of *Acromyrmex hispidus* was seen on the afternoon of 9 July on the trunk of A1 and then, at night, hundreds of individuals were discovered feeding on sap, covering almost all the holes. Later, in October, the same species was usually found cutting the new leaves of *Prosopis* trees.

Damage to trees. Sections of small branches (up to 16 cm diameter) of *Celtis* sp. and *Aspidosperma quebrachoblanco* showed work on the same row of holes in four succesive winters. This repetition of the work and the consecuent scarring give a ringed aspect to the oldest trunks of *Celtis* sp., *Aspidosperma quebrachoblanco*, and *Schinopsis haenkeana*. In contrast, other trees attacked, as *Prosopis flexuosa*, *Zizyphus mistol*, *Jodina rhombifolia*, and *Fagara coco*, did not show great deformities. In spite of abundance, *Cercidium praecox* was not attacked.

Dimensions of recent holes are in Table 2. In a young *A. quebrachoblanco* (Q3), holes were larger (10x7x19 mm) as a consequence of enlargement, and they were isolated or grouped in short rows of four holes. At least in Q3, holes were clearly grouped on the south side of the trunk, which was not reached by direct sun for most of the day. In contrast, Foster & Tate (1966) observed *Sphyrapicus thyroideus*, making holes on sunny sides of trunks.

Sections of a small branch of *Celtis* sp. showed wounds as dark dotted lines and longitudinal sections showed that the wounds in different rows were connected by vessels containing a dark substance, possibly tannin. Sections of a small branch of *A. quebrachoblanco* showed wounds as small purple triangles and without connection among successive rows. In an area of 100x100 m with 52 *A. quebrachoblanco*, 23% of the trunks were ringed.

DISCUSSION

Short (1982) states that melanerpines of the genus *Sphyrapicus* are specialists at sapsucking and do not peck trunks to obtain insect larvae, giving rise to the English name "sapsucker". *Melanerpes formicivorus* sometimes feeds on sap in different areas and seasons. However, it does not make holes in regular rows (Kattan 1988). Turceck (1954) registered occasional ringing of trees by two melanerpines and two non-melanerpines in the Palearctic region.

Species of *Sphyrapicus* feed, besides utilizing sap, on insects caught while flying or gleaned from branches, phloem and fruits (Bent 1939, Howell 1952, Kilham 1977, Short 1982) depending upon the season and geographical area. It seems that sapsucking is always present to some extent but it becomes the principal feeding behavior in late winter and early spring when fruits and adult insects are not available. Kattan (1988) states that *Melanerpes formicivorus* feed on insects and fruits at favourable seasons while at unfavourable ones sapsucking and acorn foraging increase.

Our winter observations on *Melanerpes cactorum* confirm that this species also feeds on sap, obtained by making regular rows of holes like species of *Sphyrapicus*. It does not woodpeck, and the insects it feeds on are obtained by gleaning on bark. In spring and summer, when adult insects and fruits are available, *M. cactorum* does not feed on sap. It is possible that this specialized behavior of melanerpines and other species is a response to food scarcity.

Although sapsucking behavior would suggest a close phylogenetic relationship between *M. cactorum* and species of *Sphyrapicus*, it is important to emphasize that there are non-melanerpines that occasionally show sapsucking behavior as well (Turcek 1954).

Sap is a high energy food source. Sapsucking behavior appeared in different groups of animals and very early in evolution, being registered as far back as the Devonian (Kevan *et al.* 1975). Shear & Kukalova-Peck (1990) state that half of the Upper Carboniferous insects were sapsuckers and this fact would have favoured the increase of bark thickness in plants (Smart & Hughes 1973). Later, sapsucking appeared in vertebrates capable of making holes in trees despite bark thickness. It is interesting that the manner of making holes is similar in different groups. Insects that attack herbaceous stems for sapsucking also make rows of punctures around stems, to which they return periodically to feed (Tanada & Holdaway 1954). This convergent behavior implies that such a manner of obtaining sap from stems or trunks must be efficient, allowing the animal to reach more vascular elements with minor stem damage. The behavior may have evolved to minimize structural damage. Furthermore, Tanada & Holdaway (1954) state that damaged areas have more sugar content, and Miller & Nero (1983) observed that repeated wounds in the same area stimulate sap flow.

Ringing of trees by sapsucking activity results in significant economic loss of timber. We recorded 23% damaged trees of *Aspidosperma quebrachoblanco*, the dominant species in the area studied. Mac Atee (1911) recorded 277 species of trees attacked by sapsuckers in North America; trees of 29 species showed a tendency to die and 28 species became seriously deformed.

Foster & Tate (1966) give the most complete account of insects, birds, and mammals associated with sap trees. Probably most of them feed opportunistically on sap and others on insects attracted by sap. Only some species of hummingbirds are reported as true commensals, establishing a close relationship with sapsuckers (Sutherland *et al.* 1981, Miller & Nero 1983, Kattan & Murcia 1985) perhaps due to the simi-

lar sacharose contents (15—25%) of the sap and nectar preferred by hummingbirds. In our study only *Stigmatura budytoides* showed a close relationship with sap trees, but more studies will be necessary to ascertain the importance of this relationship.

Most insects collected during this study were opportunistic feeders. Wheeler (1910) states that one of the principal sources of nourishment for ants is the secretion of plants, as sap exuded from wounds. The genera *Pheidole*, *Brachymyrmex*, *Dorymyrmex*, and *Camponotus* include species which feed on honey-dew, nectar, or other secretions of plants, so the presence of species of these genera in sap trees was expected. In contrast, *Acromyrmex hispidus*, as other leaf-cutting ants, was earlier considered to be monophagous on fungi. Recently, Littledyke & Cherret (1976) proved that species of Attini, usually feed on plant sap from leaves that they cut. However, our record is the first of massive feeding on sap from wounds in natural conditions. It is possible that ants accidentally found the flowing sap as they ascended the tree for leaves (as was observed in October).

Some relationships have been reported between flies and sap. Chillcott (1960) stated that some species of *Fannia* are particularly attracted by sap. Moreover larvae of species of *Systenus* frequent sap accumulated in stem wounds (Wirth 1952, Robinson 1970).

As stated by Foster & Tate (1966), activities of sapsuckers produce a significant effect on the local ecosystem. In winter, in the area studied, food resources are critical for (1) some birds which generally feed on fruits, nectar or adult insects, (2) for adult insects which feed on nectar or other plant secretions, and (3) for all active animals that directly or indirectly utilize plant secretions or insects. In the area studied, the sap trees of *Melanerpes cactorum* can provide one of the most important food sources for animals that depend upon plant secretions.

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