

EARLY BREEDING BEHAVIOR OF LINEATED WOODPECKERS

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Lineated Woodpeckers (*Dryocopus lineatus*), widely distributed in Central and South America, resemble Pileated Woodpeckers (*D. pileatus*) in many aspects of their breeding behavior. A purpose of the present study was to observe the courtship and related behavior of the neotropical species within this larger relationship (Mayr and Short 1970, Short 1975). Although Skutch (1969) has described the nesting behavior of *D. lineatus*, his account dealt largely with the later aspects of breeding.

Our studies were made in several dry seasons (January and February). Those of the first author were on a pair in the Panama Canal Zone in 1971 (30 h of observation time) and on eight pairs that were excavating nest holes at Tikal, Guatemala (82 h), 1976 to 1978. Observations on a pair in Trinidad (88 h) were made by the second author in 1976-77 while at the Simla Research Station. All of the study areas were in, or close to, edges of deciduous tropical forest.

METHODS OF COMMUNICATION

INSTRUMENTAL EXPRESSIONS

Drumming. The drumming of Lineated Woodpeckers, at rates of one to three bursts a minute, appears to be used in relation to territory defense and communication between the members of a pair. Types of drumming in relation to circumstances are detailed below.

Tapping and drum-tapping. Many woodpeckers tap with their bills at a regular, countable rate, inside or outside of nest cavities in relation to change-overs of partners (Kilham 1959a). Lineated woodpeckers have, like Pileated Woodpeckers (Kilham 1979), a rapid form of tapping—drum-tapping—that is used interchangeably.

Heavy-sounding flight. Lineated Woodpeckers usually fly silently but under certain conditions they fly with a "heavy flight" that is audible.

Rapping. When disturbed, as by an intruder close to the nest, Lineated Woodpeckers strike hard single blows.

DISPLAYS

Threat display. A Lineated Woodpecker may extend its wings nearly full length to the sides when faced by an intruder (Fig. 1A). This display flashes the undersides of the wings and is often accompanied by rapping.

Bill-waving dance. In this display the head and bill are held straight up and jerked about, accompanied by a swaying body. When seen from the rear with the bird in a vertical position, the head and bill swing in an arc of about 45° (Fig. 1B). The display appears to be a way of drawing attention to the performer in courtship or in conflict. It was once seen being performed by a male prior to copulation and several times in relation to interspecific intruders.

Bill-touching. Touching or brief fencing with bills was seen at change-overs at the nest in Trinidad, the display being similar to that described for the Crimson Crested Woodpecker (*Campephilus melanoleucos*; Kilham 1972).

Raising of crest. This display seems to reflect excitement by any cause and may accompany other displays.

VOCALIZATIONS

High call. This is a series of 8 to 20 *wics* or, at higher intensity, of loud *wuks* that diminish at the end. The bill is slightly open and the whole body shakes. High calls are used in communication between members of a pair at a distance as well as in announcement of territorial ownership.

Kay-rar-r-r-r. We have used Skutch's (1969) rendition of this call. Other renditions are *pit-airr*, *peek-churr*, and *kwirr-a-r-r*. It is a two-part call—the first part sharp and staccato, and the second mostly a series of rolling *rrs*. It was given in two contexts. One was by a bird of either sex when excavating within a nest cavity. Skutch stated of the later nesting period that "some parents become very noisy as they approach the nest—they cling to a neighboring portion of a tree and repeat over and over the peculiar rolling *kay-rar-r-r-r*." This call, like the *wic*, *wic*, *wic*, is given, he stated, by well-developed nestlings. A second context,

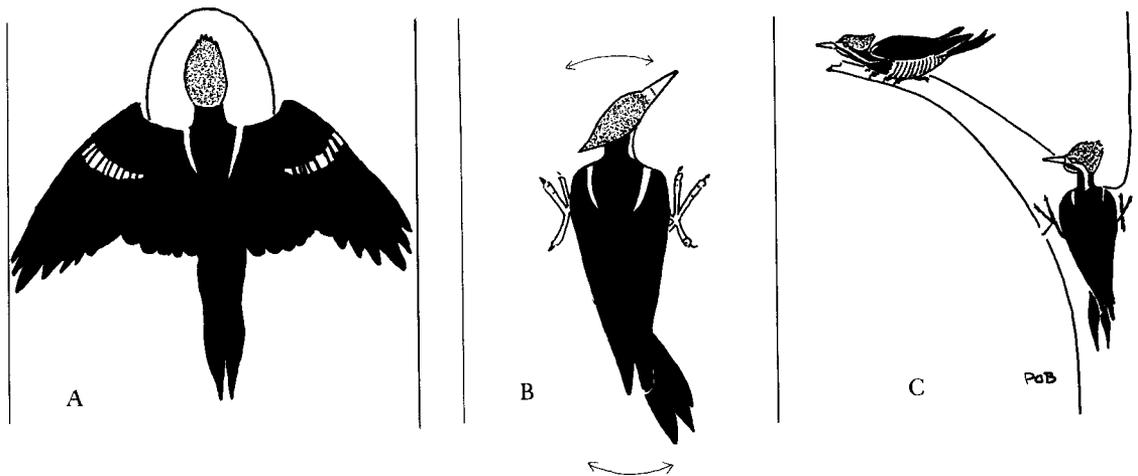


FIGURE 1. Displays and posturings of Lineated Woodpeckers. A. Threat display. B. Bill-waving dance. C. Female in invitation pose to copulation (compressed crosswise on limb) as male approaches.

as for the *chup* described below, was when a Lineated Woodpecker or a pair of them were met in the woods. This was especially true in Panama where a *pit-air-r-r* seemed like a call of mild alarm.

Chup or peek. This short, sharp monosyllable was given singly or for minutes at a time. Like the *kay-rar-r-r-r* with which it was often associated, it was heard when the birds of a pair were excavating.

Low notes. Members of pairs may make *hn*, *hn* or other notes when close to each other, as when changing places at the nest.

EARLY NESTING ACTIVITIES

EXCAVATION OF NEST HOLES

Ten nest cavities were located 6 to 20 m above the ground in dead trees or dead tops of live trees at or near the edges of clearings. The Trinidad nest was in a dead immortalle (*Erythrina micropteryx*). Most of the pairs were exposed to people and even vehicles in the vicinity.

Sharing of work between the sexes. The longest times that any birds were watched excavating was 16 days for one pair and 18 days for another. As both pairs were discovered only after excavations were begun, the time needed to excavate cavities must have been longer. Males did approximately twice as much work at excavating as females (Table 1). Females worked as much as did males in pecking wood and tossing chips and their sessions of work were equally long. For pair A, the male worked an average of 42 min per session ($N = 14$), and his mate worked an average of 55 min ($N = 6$). Comparable figures for pair C were 48 min for the male and 44 min for the female.

One female, instead of tossing chips from the entrance, on two occasions flew out and discarded them at a distance of about 50 m, a phenomenon also seen for other woodpeckers (Kilham 1959b).

Unattended nests. Lineated Woodpeckers left their nests unattended for varying periods. In 4,980 min of watching at the Trinidad nest the woodpeckers were away for 2,703 min, or 55% of the time. This pair may have been unusual. Their nest was later abandoned. At five nests watched in Guatemala, birds were away for periods of 10 to 60 min. Females were more apt to leave the nest unattended than males. With pairs A and C the females did so 12 times, while their partners, who had over twice as many sessions at the nest, did so only 10 times.

Roosting in nest cavity. For the four pairs watched at dawn, it was the male that spent the night in the nest as soon as it had been sufficiently excavated. In the Trinidad nest, the female roosted in the cavity after 10 February when the male, struck by a Ferruginous Pygmy-Owl (*Glaucidium brasilianum*), did not return.

RELATIONS BETWEEN PARTNERS

Change-overs at the nest. The member of the pair in the nest, in relief at the task of excavating, might give a High Call from the entrance and be answered by a High Call from its partner, the latter coming to the hole within minutes or seconds. Sometimes the partner came immediately without answering. A male on two occasions answered the call of the female with a single burst of drumming. One male once drummed inside the nest cavity in response to a High Call from his mate at a distance.

TABLE 1. Division of work of excavating nest cavities between male (M) and female (F) Lineated Woodpeckers.

Pair (geographic location)	Sex	Excavating	
		Minutes observed	Percentages of total time
A (Guatemala)	M	582	64
	F	332	36
C (Guatemala)	M	770	61
	F	488	39
I (Trinidad)	M	1,425	68
	F	657	32

By the time a partner arrived at the hole the occupying bird was tapping out of sight inside on 8 of 30 change-overs. On two occasions the arriving female drum-tapped on the outside. Soft vocalizations may have been exchanged more often than we heard them, which was only twice. There was considerable variation in the way members of pairs called to and greeted each other and no two change-overs were the same. Twelve of 30 change-overs witnessed for pairs A and C were silent. The Trinidad pair, on eleven occasions, fenced or touched bills.

Dominance at the nest hole. On 2 February female C (FC) flew to the empty nest excavation, gave a High Call, then drum-tapped within the entrance as MC alighted beside her. He pecked at her and she left as he entered. Another indication of male dominance or possessiveness was that in 7 of 30 change-overs or attempted change-overs, the male did not slip out of the hole when the female came to relieve him. The reverse situation, with FC remaining in the hole, happened only twice: on 11 February and near the time of egg-laying when females of some woodpeckers appear to become dominant (Kilham 1959b).

Both members of a pair in the nest at the same time. This was seen four times for pair C between 11 and 15 February at or close to the time of egg-laying. Twice the female entered on top of the male. After about 30 s he flew out on one occasion as she did on the other. The male twice entered on top of the female, as described also for Pileated Woodpeckers (Kilham 1979).

Copulatory behavior. Initiation of copulatory behavior, as seen for four pairs, appeared to be by the female moving out on a limb as the male ascended the trunk and moved toward her. She took a compressed position with body crosswise to the limb (Fig. 1C) and the male then mounted. In one

of three copulations the male pecked gently at the head of the female as cloacal contact was established. Copulations lasted 6 to 12 s, after which the male fell off to the left. One Lineated Woodpecker fell off to the right, which is unusual as discussed in Kilham (1979) for the Pileated Woodpecker.

Once a pair threatened a Ferruginous Pygmy-Owl occupying their nest hole; subsequently the female moved away to take an invitation pose. The male did a bill-waving dance before the hole, then joined her in full copulation. This was the only copulation that took place near the nest.

INTERSPECIFIC CONFLICTS

Hole-nesting birds which showed casual but not persistent interest in woodpecker nest cavities included Collared Araçaris (*Pteroglossus torquatus*), White-crowned (*Pionis senilis*) and Red-lored (*Amazona autumnalis*) parrots, Streaked Flycatchers (*Myiodynastes maculatus*) and Masked (*Tityra semifasciata*) and Black-tailed (*T. cayana*) tityras. These birds were chased away from the vicinity of holes without displays. When a Brown Jay (*Psilophinus morio*) alighted 4 m above one Lineated Woodpecker nest, the female, who had been excavating, came out raising and lowering her crest as she rapped on the tree trunk. She then flew to within 30 cm of the jay, holding her wings out in a threat display and drawing her head back to rap especially hard. The jay paused, then flew off.

The Trinidad pair once left their nest unguarded for 50 min when the female returned to find it occupied by a Ferruginous Pygmy-Owl. She raised her crest and flashed her wings (in threat displays) seven times while perched on the rim of the hole and giving hard raps. When her mate arrived, she left. He flashed his wings more often than she had and held them extended for a longer period of time, about 3 to 5 s (Fig. 1A). He rapped along the trunk at the sides and back of the cavity as she had done.

A second owl arrived and struck the male. He fluttered to the ground giving a loud *peek-peek-chrr*, but recovered and returned. The first owl retreated to the bottom of the nest and did not leave until the woodpeckers had departed. The female returned alone and no sooner entered the nest than an owl flew to the rim. She jabbed at it with her bill and it left. The female roosted in the nest that night; the male did not return until the next day.

On two occasions following disturbance over an intruder, a male Lineated Wood-

pecker struck at his mate when she came to the hole. With pair A this was just after the male had struck at a female Pale-billed Woodpecker (*Campephilus guatemalensis*) and with pair C, when a Red-lored Parrot was 2 m above the hole when the female looked in.

TYPES OF DRUMMING

As noted for Downy Woodpeckers (*Picoides pubescens*; Kilham 1974), woodpeckers make different types of drumming in different situations.

Duet. On 1 February MC was drumming at a rate of two bursts a minute and FC was responding with low, soft drums when she flew to the nest in heavy-sounding flight. She drum-tapped several times, preened briefly, then drummed as before, her drums following those of MC directly or within 30 s.

Preening and drumming. At 16:45, which was close to roosting time, MC drummed occasionally and gave one High Call as he leisurely preened. Such behavior was commonly noted when the sun first shone on the tree tops.

Rendezvous after roosting. The members of the eight pairs at Tikal often assembled after emerging from roost holes, following a single High Call or burst of drumming from either partner. On 13 February MC first looked from his roost hole at 06:35. Not hearing from his mate as far as one could tell, he drummed single bursts within the nest, about once every 5 min until 07:05. He then flew to feed at nearby trees, continuing to give occasional High Calls and bursts of drumming.

Location. MC flew to his hole on 14 February when it was empty and entered, drumming one burst inside. Single bursts after a flight served, it seemed, to inform one partner where the other had gone.

Agonistic. Territorial invasion by a conspecific nearly always lead to drumming, by owners as well as intruders. On 9 February when MC and FC were both by their nest hole, an intruder (sex undetermined) was drumming within sight of it. FC flew to the same tree, advanced along a branch in a bill-waving dance, then chased the intruder in flight.

Failure of a nest hole. One pair excavated a hole 8 m up in a dead tree of very hard wood at a level with a fruiting body of a fungus. The work progressed from 7 to 23 January. Toward the end of this time the birds had to peck hard to produce even a few splinters. They seemed to have reached

the limit of the softer wood induced by fungal decay. The cavity, even though large enough for the birds to enter, was still too small for nesting and it was abandoned on 24 January. On this day another female began drumming on a dead branch at 06:15 and continued without interruption for 70 min, giving a total of 108 bursts at intervals of about 50 s. Her mate did not come either to her or to the nest hole. The two of them drummed often on succeeding days as they searched for a new site.

Scaling of behavior. Five of the nine pairs of Lineated Woodpeckers were relatively quiet and did little drumming while excavating. Two pairs that had difficulties in finding a suitable stub, in contrast, did much drumming and calling. This behavior by pair H appeared to disturb pair C. The latter had a successful excavation, but they drummed daily in response to their neighbors who frequently approached or crossed their territorial border. This heightened activity under conditions of crowding is what we have considered a scaling of behavior (Kilham 1977), as described by Wilson (1975).

DISCUSSION

Results of this study on Lineated Woodpeckers and of observations of Pileated Woodpeckers in the United States (Kilham 1959b, 1976, 1979) suggest that these species share many behaviors. Patterns found comparable include the methods of communication (with the exception of a few vocalizations), relations between partners, excavating, greetings by nest holes, and types of drumming. These similarities support Short's opinion (1975) that *D. lineatus* and *D. pileatus* should be considered as forming a superspecies. As discussed elsewhere (Kilham 1979) the amount of excavating done by female Pileated Woodpeckers, one-third of the total, exceeds that done by smaller woodpeckers. The arguments presented there should, if valid, apply to female Lineated Woodpeckers which also do one third of the excavating (Table 1).

Although the drumming, tapping and displays of *D. lineatus* and *D. pileatus* are identical, their vocalizations are not. One would never mistake one species for the other. However, a vocalization sounding differently can be used in the same way, as is true of the High Calls of the two species. The *peek* and *kay-rar-r-r-r* of Lineated Woodpeckers are more puzzling. They are to some extent a counterpart of the random

cuks of Pileated Woodpeckers, but why they should be used at length by some pairs while excavating and later by parents and older nestlings (Skutch 1969) is difficult to understand. One would think such vocalizations would attract predators. Skutch (1966) found that hole-nesters he studied in the neotropics had 60% greater nesting success than open nesters. It may be, therefore, that woodpeckers can afford to be more noisy. The survival value of such behavior, however, is not clear unless it increases attraction to the nest and of the members of the pair to each other.

SUMMARY

The early breeding behavior of Lineated Woodpeckers was studied in Guatemala, Panama, and Trinidad against a background of studies on Pileated Woodpeckers in the southern United States. While the drumming, tapping, and displays of the two species were found to be essentially the same, the vocalizations were different. The *peek* and *kay-rar-r-r-r* vocalizations used by some pairs of *D. lineatus* in extended fashion while excavating have no exact counterpart with *D. pileatus*. The various types of drumming of Lineated Woodpeckers are described, as are intrapair relations.

The task of excavation was shared by the two sexes, with males doing two-thirds and the females one-third of the work. Other hole-nesting birds approaching nest excavations were driven away. Rapping and threat displays, with crest raised, were elicited by Brown Jays and a pair of Fer-

ruginous Pygmy-Owls. Males rather than females usually roosted in nests at night.

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