

BREEDING BEHAVIOR OF YELLOW-BELLIED SAPSUCKERS

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THE lively displays, drummings, tappings, and vocalizations associated with the breeding behavior of Yellow-bellied Sapsuckers (*Sphyrapicus v. varius*) are in contrast to the quietness of these birds during migration. My investigations extended from 1951 through 1960, and observations on breeding behavior were made between April and September at Tamworth, New Hampshire, and, in winter, in a swamp near Seneca, Maryland. Six hand-raised individuals offered opportunities for further observations. The most detailed accounts of *Sphyrapicus* known to me are those of Howell (1952), who studied the three western species on their breeding grounds. Apparently *S. varius* has not been the subject of similar investigation.

METHODS OF COMMUNICATION

The following forms of expression are common to both sexes:

Vocalizations. (1) Breeding call. A high-pitched *kwee-urk, kwee-urk*, which is almost a squeal and, at full intensity, is delivered in sets of six or more. The breeding call is used primarily by the male to attract the female to the nest excavation or to other locations within a territory.

(2) Intimate notes. *Week week, wurp wurp* and similar low notes are exchanged when members of a family group come close together, as on a sap tree. In spring a loud, scratchy *quirk, quirk* is given by the members of a pair when meeting within their breeding territory. These *quirks* are usually accompanied by a raising of crests and occasionally by the bobbing dance described below.

(3) Disturbed notes. A mewling *c-waan* is given throughout the year when a sapsucker is mildly excited, as when an observer comes close to a nest or to a sap tree. This *c-waan* may also serve as a location note. When sapsuckers are extremely excited, as in direct conflicts, they make a shrill *quarr*.

Drumming. The drumming of sapsuckers begins rapidly but is drawn out like a slow, telegraphic code: *drr-a-da, da-da, da*. Single bursts may last from one and one-half to five seconds. Sapsuckers prefer to drum on places that reverberate loudly, such as a piece of metal, the hard, warped bark of a dead maple, or, most frequently, a stub that projects a few inches from the trunk of a dead pine or larch. The birds often bend their heads sideways to drum. Drumming is at full intensity on the breeding grounds in spring, where it apparently serves to attract a mate as well as to assert territorial dominance. Rival males may drum in response to each other. Females drum less regularly than males.

Tapping. Yellow-bellied Sapsuckers tap at a rate of four to five taps a second, in bursts of 30 or more taps. A male may tap quite steadily for several minutes while trying to attract his mate to a potential nest site, and she may tap there also if such a site appears suitable to her. Tapping thus serves to register agreement on a nest site.

Wing noises. (1) Ruffle. Sapsuckers usually fly silently, but they can make a ruffle noise with their wings as they fly from one tree to another. Such noises are common to a number of genera of woodpeckers (Kilham, 1959c) and appear to indicate mild excitement.

(2) Winnow. The noise that sapsuckers make in courtship flights is a snipelike winnow, which can be heard for 100 or more meters. I have presumed that the noise is made by the wings. The winnow is only heard when a sapsucker is in flight, and, because of the smallness of the aviary, it was not made by my hand-raised sapsuckers, although they performed all of the other early breeding activities, including the bobbing dance and tapping.

Displays. (1) Courtship flight. These flights take place to or from a nest excavation and, at full intensity, may be undulating or performed with short, fluttering wing beats. The performing bird flies at a level below that of its resting partner. When viewed from above, the flashing black and white pattern of the performing sapsucker, in combination with the winnow noise, produces a striking effect. This courtship flight appears to build attachment to the nest excavation as well as to stimulate the pair bond.

(2) Bobbing dance. Members of a pair dance by pulling the front part of their bodies straight up and down while making half-starting motions with their wings, thus displaying the yellow of their underparts and the red of their raised crests. The dance is accompanied by scratchy, *quirk* vocalizations. It appears to best advantage when the two sapsuckers are directly facing each other.

(3) Bill touching. Sapsuckers touch bills as a part of their courtship. Flickers (*Colaptes auratus*) also have this habit (Kilham, 1959c).

(4) Full wing threat display. When in conflict sapsuckers may raise their wings straight over their backs as a threatening pose. They resort to this bluff relatively infrequently, possibly because they are among the most pugnacious of woodpeckers and are more likely to engage in direct conflicts.

(5) Raised crest. A general expression of tension, from any cause, which may accompany other displays.

EARLY BREEDING BEHAVIOR

The study of three species of woodpeckers (Kilham, 1958, 1959b, and c), in addition to the pair of sapsuckers described below, has suggested that when the members of a breeding pair experience what appear to be difficulties in agreeing on a nest site, their displays, drummings, and vocalizations may be repeated many times in their efforts to communicate with each other. Such situations are especially favorable for the study of reproductive behavior. One such situation involving a pair of sapsuckers in 1959 was as follows.

Nest-site selection. Male A was unusual in returning in 1952 to the same nest hole that he had excavated and used for nesting in the previous year. Other sapsuckers of my experience have all started fresh excavation each year. On 5 May Male A attracted my attention by the winnow noise of his courtship flight as he flew to his nest hole, then popped inside. He looked out immediately to call three *kwee-urks*. His mate then flew to him in normal flight and looked inside, giving the *quirk* greeting. Another variation of the nest-hole meeting took place at 09:00. Female A first drummed on a dead pine, then she and her mate flew to the hole almost simultaneously and danced, pulling their heads up and down in lively fashion as they faced each other. Further variations in behavior took place on 6 May. The male frequently tapped in prolonged fashion when out of sight at the bottom of the nest hole, and on two of these occasions the female alighted to tap just within the entrance. I recorded this performance on a tape recorder. This apparatus was located 16 meters (50 feet) from the nest, and the male swung low and directly over the microphone on several of his winnowing courtship flights away from his mate, who remained at the excavation. His intense and unsuccessful efforts were apparently aimed at inducing her to accept the site. The pair failed to nest in 1959, and possible reasons for this failure are discussed in relation to territorial behavior.

Territorial conflicts. The intensity of the breeding behavior of Pair A was also reflected in conflicts with territorial rivals. This pair was the only one in the study area to have four pairs of other sapsuckers bordering on its centrally located territory. Other sapsuckers studied faced one or at the most two neighboring pairs. Male (MA) appeared greatly excited by the neighboring males, for he made the same rapid circuit of his territory day after day, drumming successively on two dead pines and then on a dead maple, the main drum tree on his east boundary. The maple had a strip of hard, loose bark on which MA drummed with such effect that the sound could be heard beyond the boundary of his territory. If the reverberation did not bring a rival male to the boundary, MA might feed briefly

on sap, then take a swift flight through the woods to his hole and call to his mate with a series of loud *kwee-urks*. He usually went from the nest to drum again on the dead pines. This circuit of intense activity was really a shuttling between his east and north boundaries where he seemed to be trying, and often successfully, to precipitate conflicts. On 4 May, for example, males A and B were drumming on either side of a wood road that formed their mutual boundary. This duet of answering drums was unaccompanied by vocalizations. The sudden arrival of Female A (FA) broke up this demonstration. All three birds then gathered in one tree, FA perching in a disinterested fashion while MA bobbed about in a dance, with tail fanned and crest raised, within 10 to 15 cm (4 to 5 inches) of his rival. FA now flew to another tree. MA, then MB, followed, and the whole spectacle of the sapsuckers, with their displays of brilliant yellow, red, and black colors, repeated itself on a succession of trees until Male B left. Such conflicts could be located by the intense, scratchy *quirks* of the males. The conflicts sometimes became swift, circular pursuits through the tree tops. Many of these pursuits originated at what I termed Conflict Birch, a sap tree at the juncture of three different territories and visited by all three pairs, but seldom in a peaceful manner. Male A was so taken up with these activities that he seemed to have little time for actual nesting. He was still making his circuit in June and July, and I wondered whether his failure to nest was due to the distracting effect of being crowded by rival pairs. All of the four neighboring pairs with fewer rivals nested successfully. Territorial conflicts of a more usual type may be illustrated by Male G. This male's drumming was almost entirely along his boundary with Pair F. On May mornings he might drum fairly steadily, with bursts of two- to two-and-one-half-second duration coming every seven or eight seconds. Both pairs, however, were well occupied with nest excavations, and I witnessed no conflicts.

Excavation. All eight pairs of sapsuckers that I observed in 1959 were searching for nesting sites in early May. But none found definitive ones immediately. Thus half of the pairs began three or four different excavations before completing one for nesting. The activities of Pair D were representative of this situation. Male and Female D worked in relays on 6 May, in a 2-cm ($\frac{3}{4}$ -inch) hole about 10 meters (30 feet) up in a tall, isolated stub. The blows from their bills came at a fast rate of nearly 100 a minute. An excavating sapsucker might work for periods of up to one-half hour before being relieved by its mate. Figure 1 illustrates a change-over at the hole. The male had been excavating when his mate alighted above and started a *quirk* dance. He tapped vigorously within the entrance, then flew away in courtship flight. The excavation was deserted by the following day, possibly because of the hardness of the wood.

QUIRK, QUIRK

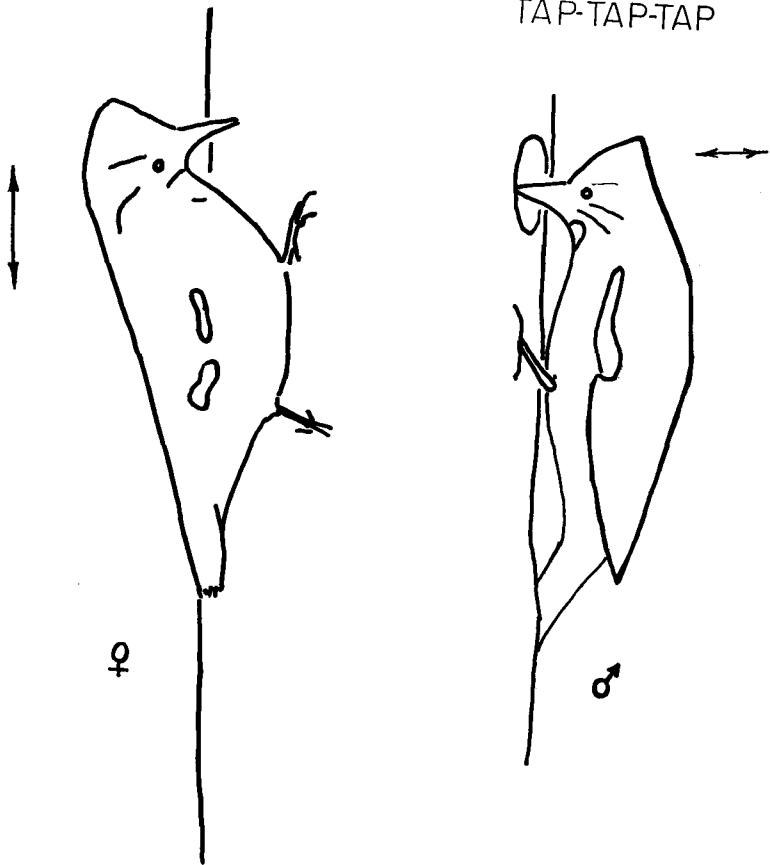


Figure 1. Change-over at excavating: male sapsucker taps as female alights and does bobbing dance accompanied by *quirk* notes.

Activities associated with completion of an excavation were observed in May 1960 with Pair C, which had a hole about three meters (10 feet) above the ground. Male C was able to get one-half of his body within the entrance on the 14th of the month. He was excavating out of sight three days later, when his steady, fast pecking sounded like a small motor within the stub. His mate usually came to relieve him in 10 to 15 minutes. She might enter, toss out 20-30 billfulls of sawdust, then come out to rest below the entrance without having done any pecking. Scratching and preening appeared to occupy much of her time. These activities were of

interest to me, for my pair of captive sapsuckers, the offspring of Pair C in the previous year, also did an unusual amount of scratching as their nest hole approached completion. It is conceivable that the ectoparasites of these woodpeckers are stirred into activity at this period, and this may involve their transfer to a succeeding host generation.

Male C roosted inside his excavation on 17 May. I was by the nest stub before dawn on the following morning and heard Female C call *kwee-urk* from the lower woods at 05:00. Her mate immediately gave six vigorous *kwee-urks* in reply, as he looked out from the entrance. He had been excavating before his mate called. I could barely see his head as he came to the entrance to toss out sawdust. The sawdust produced by sapsuckers consists of shreds 0.5 cm ($\frac{1}{4}$ inch) long, and appears as if gouged out with a fine chisel. It may be the crinkly consistency of the sawdust that enables sapsuckers to gather up large billfulls at a time.

Courtship and coition. Courtship activities at the time the nest was nearing completion consisted of (1) *quirk* notes and bobbing dances wherever the pair met, which was usually at the excavation, (2) of *kwee-urk* calls exchanged from a distance, and (3) of winnow flights. I observed copulation for the first time at 07:15 on 17 May. Female C had been excavating when she flew up to feed on sap at some drill holes in a maple, where her mate greeted her with *quirks*. She then moved out along a dead limb. Her position was not unusual as she perched crosswise, but it appeared to be an invitation to the male who approached immediately, beating his outstretched wings against the limb just before mounting on her back. He then fell gradually backward and to the left. His final position was upside down with his body at right angles to that of his mate, so that the tails of the two birds overlapped. I witnessed five of these copulations. Four of them took place on the same limb, and the last two on 20 May, when the first egg was laid. The sapsuckers continued excavating in spite of the egg, which was half buried in sawdust when I looked in with a light.

Pair C did no tapping during their week of final courtship, excavation, and copulation. This may be further evidence that tapping is only concerned with agreeing on a nest site rather than with final courtship activities.

INCUBATION AND REARING OF YOUNG

Incubation. Sapsuckers become relatively quiet with the onset of incubation. Pair B was favorably located for observation in June 1959, when it nested about six meters (20 feet) up in a live butternut (*Juglans cinerea*). Both birds were restless. The female would emerge from the nest to preen below the entrance and stretch her wings momentarily before re-entering. At times one heard a steady sound of excavating within the nest. On 23 June I saw Female B fly out with a billfull of sawdust and scatter it from

a neighboring tree trunk, a disposal method characteristic of actual nest sanitation rather than of initial excavation (Kilham, 1961). There was almost no ceremony when the members of the pair exchanged places at the nest. The female might do no more than call *c-waan* when she arrived near the hole. The male would then wriggle out of the entrance and fly away. He drummed occasionally and briefly on a tree about 10 meters (30 feet) from the nest. The generally quiet behavior of Pair C was interrupted on 25 June when both birds entered and left the nest, frequently greeted each other with scratchy *quirks*, and called *c-waan* more than on previous days. This excitement was apparently associated with the hatching of the young, for both parents were bringing insects by the following morning.

Feeding of young. I observed parent sapsuckers feeding young at 13 nests. The adults brought small insects when the young had first hatched, but their bills were stuffed with prey of assorted sizes when they came to feed older nestlings. Sapsuckers are extremely active when catching insects. They may fly up and hover in the air, fly against sprays of foliage, or hitch rapidly up tree trunks in pursuit of insects, even when their bills are already well filled. These fast activities are interspersed with visits to sap trees. The mixture of sap and insects is finally brought to the nest and carried inside, unless the young are old enough to take it at the entrance. Parent sapsuckers make repeated visits to their favorite sap trees. In June 1957, for example, I cleared limbs from a neighboring pine so that I was able to watch the members of a pair of sapsuckers coming every two to three minutes to a gray birch (*Betula populifolia*) for sap when I was only about 2.5 meters (8 feet) away. The almost frenzied activity of such parents is possibly stimulated by the constant vocalizations of their young, and the noise produced may carry 100 meters or more. On 4 July 1953 I watched a young one that moved its lower mandible up and down in a seemingly mechanical gush of vocalizations, which changed in intensity only when a parent came to feed it at the entrance.

The frequency of feeding visits may vary with the closeness of the observer and other factors. On 18 June 1957 the members of one pair made 11 visits in 88 minutes when I was nearby, but only three were by the female. On the other hand one or the other of the birds arrived at the nest every two to three minutes when I stood well away in the woods.

Male sapsuckers appear to roost in nest holes through all stages of nesting. Male C spent the night in his fresh excavation as soon as it was sufficiently large. At a time when the eggs were being laid in 1958, Male A was roosting in his nest hole on the two successive mornings it was observed at dawn. Male A roosted in its hole on both nights observed in 1957, when the young were fully fledged. He entered at 20:14 on 18 June, while on the following evening he removed a last load of excreta from the

nest at 20:16, then re-entered for the night four minutes later. The nestlings took 12 minutes to taper off their daytime vocalizations after his entry. I have never observed that female sapsuckers roost in their nest holes.

Captive young. Young sapsuckers begin their vocalizations at an early age, although one may not hear the noise from the ground. On 19 June 1959 I removed two very small young from a nest that still contained fresh egg shells. When these nestlings were brought to the house, one could hear their *woi, woi, woi* vocalizations from across a large room. Both appeared frantic in their demands for food. At almost any stimulus from an observer, they stretched their necks and their vocalizations became harsh. On being fed, they settled down to a series of soft, froglike, *woi-se* notes. I took six other sapsuckers from nests when they were ready to fly and found that, as after nest leaving under natural circumstances, their begging notes were comparatively low and sounded somewhat like a flock of terns in the distance.

FAMILY LIFE AFTER NEST LEAVING

Sapsuckers may spend as long as 26 days in their nest after hatching, as I determined for the young of Pair B, which finally left on 22 July 1959. The young from most nests leave early in July. They feed on sap at the drill holes of their parents from the time they first appear, but are fed insects for the first week or two. Family groups remain together in peaceful fashion during the summer. I was able to observe the family life of Pair A at close range in July and August 1953 by sitting in a hemlock about three meters (10 feet) from a yellow birch where the four sapsuckers spent much of their time taking sap or resting against the bark. Juveniles did not drill holes for themselves.

MIGRATION

Family groups. Sapsuckers migrate through central Maryland in the early fall. Five years of observation in Creek Wood indicated that some of the birds may migrate in family groups. On 2 October 1960, for example, a juvenile sapsucker (WP), marked by an asymmetrical white patch, joined a second juvenile and an adult female at a band of drill holes. One of the juveniles then flew to join an adult male on a neighboring tree. WP and another juvenile were near the same spot a week later, but four conflicts on 22 and 23 October suggested that the group was breaking up into the usual winter dispersal of single individuals. These conflicts were dramatic. In the first of them, WP flew to a pin oak making a *quarr* note, and hitched up to within a few centimeters of an adult male at some drill holes. The male kept shifting away. In another moment, however, the

two sapsuckers were locked in conflict and fell straight to the ground, making *quarr* notes as they did so. WP flew away. The male ascended the oak trunk with a mass of small feathers, which he had difficulty wiping off against the bark, sticking to his bill. He then flew after WP in a long, circular pursuit out over a field.

Creek Wood has been occupied by a single male sapsucker in successive winter seasons from 1956 through 1961. Almost all sapsuckers wintering in the vicinity of Maryland are males. This situation agrees with Howell's observation (1953) that female sapsuckers migrate farther south than males. Sapsuckers become very quiescent during the late fall. Their mottled, fluffed-out plumage gives an effect of camouflage as they rest motionless against the bark of trees. This comparative inactivity was equally apparent among my captive individuals.

Sapsuckers exhibit little in the way of breeding behavior during migration. I have heard brief drumming in the early fall, but in Maryland I have observed no more than an increased restlessness and calling of *c-waan* in early spring, when the female sapsuckers begin to appear again.

ARRIVAL ON BREEDING GROUNDS

Male sapsuckers arrive on their breeding grounds at Tamworth, New Hampshire, when the woods are still filled with snow. The following observations were made in April 1960.

Behavior of lone males. The seven males studied occupied areas more or less identical with breeding territories that I had observed the previous May and June. Male A, for example, flew on a circuit of the same drum trees. He resembled the other males in doing a considerable amount of drumming, with bursts coming at intervals of 40 to 60 seconds. His behavior toward a neighboring male, B, who came into A's territory rather frequently to drum on the glass insulators along a line of telephone poles, was comparatively tolerant. On 16 April, however, B was drumming on a nearby tree when Male A flew over and started drumming about five meters (15 feet) above, then swooped down, displaced B, and continued to drum on the spot vacated by his rival. Drumming was the most prominent of the activities of the lone males. I heard some *kwee-urks*, *quirk* greetings, and snatches of winnow flights, but none of them in any sustained fashion until the arrival of the females.

Arrival of the females. Of seven males in the study area, six had no mates as far as I could discover in dawn-to-dusk observation between 16 and 21 April. On the morning of 21 April, however, I found females in all of the territories. I discovered one of them at 06:30, when I heard a peculiar duet of drumming. Male D was making considerable noise on his usual dead pine, when the female started a low drumming on a branch of

no particular resonance. This uneven duet continued for several minutes. The female then flew from one tree trunk to another, her crest raised as she approached the male, who flew off in winnow flight when she arrived in his tree.

Territory E differed from the other territories in that a female was present after 16 April. Male E was drumming near dawn on 20 April when his mate began a low drumming on a rotten stub 60 meters away. She flew to her mate after 10 minutes, and a bobbing dance with *quirk* greetings took place. Male E then flew in winnow flight to a beginning excavation. He worked here in a desultory fashion for 10 minutes, then started tapping as his mate flew to join him. His delicate tapping, just inside the hole, lasted for two minutes. He then flew downhill in winnow flight. It was evident from this and other episodes that sapsuckers may begin their searches for a suitable nesting site soon after arrival on their breeding grounds and that males take the lead in this activity.

OBSERVATIONS ON CAPTIVE SAPSUCKERS

Breeding pairs. I have had two pairs of sapsuckers in captivity, one in 1958 and the other in 1960. Both pairs carried on bobbing dances, tapping, excavation of nest holes, and copulated. As far as I was aware, however, neither pair laid eggs. Several facts may have contributed to these nesting failures. In spite of obvious attempts to do so, the sapsuckers were unable to perform courtship flights in the space available. Also, one of the females had injured claws and could not wriggle through the nest hole. The nearly completed cycles of breeding behavior did afford opportunities, however, for close and repeated observation of much that I had seen in the field. Episodes of additional interest were as follows.

Onset of breeding behavior. The captive sapsuckers showed first signs of breeding behavior in late December, when they began to call *c-waan* and to fly about in an alert, restless manner. Tapping and drumming started in sporadic fashion in January. One of the females, for example, tapped every morning when I turned the lights on, remaining in the corner of the aviary where she roosted to do so. Males and females began to touch bills in February, when they lost much of their juvenile plumage, and acquired a full black band or jugulum on the breast.

Selection of a mate. I had one male and three females in 1960. These females were graded in plumage so that No. 1 had a bright yellow belly and red crest, No. 2 retained a slightly dull cast, and No. 3 was only slightly different from a juvenile in appearance and was dominated by the two other females. The male had a decided preference for the subdued female. His reactions to the three potential mates were shown in an experiment that I repeated on two occasions. The male was first left alone in

his cage for a preparatory period of three days. He did a great deal of drumming when alone and almost incessantly from 06:00 to 08:00 every morning. I reintroduced the brightest female on 11 May. The male attacked immediately. Following a medley of *quarr* notes and much pursuing back and forth, the female finally crawled behind logs in an effort to escape. I then removed the first female and introduced No. 2. She was greeted with a *quirk* dance, but the male then began flying about restlessly without displaying any further interest. His response to the final return of the dull female was quite different, in that he accepted her immediately and courtship and nest excavation were resumed.

Attempted nesting. Three full copulations and a number of attempts occurred on 3 and 4 June. A peculiarity of the dull female, which never acquired complete nuptial plumage, was a habit of spending the night within the nest, a custom associated with males under usual circumstances. My male sapsucker, however, spent the night on the outside of the box. He continued excavating for a week after copulation, but, when actual nesting appeared improbable, I placed all four sapsuckers in an outside cage. The male unfortunately attacked and killed the three females a week later. His sharp bill either penetrated their skulls or tore the skin before I was aware of what was happening. Similar attacks, made by a male Flicker, when attempts at nesting in the aviary broke down, are described elsewhere (Kilham, 1959c).

It would appear that hand-raised sapsuckers may develop a considerable urge to breed and nest in captivity. The males are not easily discouraged. Had more space been available, I might have had the same degree of success with the sapsuckers that I have had with Downy Woodpeckers (*Dendrocopos pubescens*), Flickers, and Red-bellied Woodpeckers (Kilham, 1961a), all of which laid full sets of eggs and incubated them in the aviary. The latter species raised two broods to the point of nest leaving.

COMPARISONS WITH OTHER WOODPECKERS

The following are among the unique features of the breeding behavior of sapsuckers: (1) the telegraphic form of drumming, (2) the bobbing dance without bill waving, (3) a courtship flight associated with the nest site, and (4) the stiff beating of lowered wings by the male just prior to copulation. Actual copulation, including the fall to the left and the final reversed position, is similar to that described for *Centurus* (Kilham, 1961a). The courtship flight of *Sphyrapicus* appears to have no counterpart among other woodpeckers. It is performed to or from a potential nest, by a single bird at a time, and is thus unlike the duet flights of Hairy Woodpeckers (*Dendrocopos villosus*), which are carried out over the territory of the female in months prior to nest excavation (Kilham, 1960).

Dances are not uncommon among woodpeckers, generally involve bill waving, and may be associated with courtship, threat to rivals, or both. Dances associated with courtship are usually accompanied by a special vocalization, such as the *woick, woick* of Pileated Woodpeckers (*Dryocopus pileatus*) (Kilham, 1959b) or the *chewki, chewki* of Flickers. Bill waving is usually a silent affair when used as a threat display against rivals of the same sex. This is true of both Flickers and Hairy Woodpeckers. Flickers resemble sapsuckers, possibly by chance, in displaying yellow on their underparts and a wide, black jugulum in their dances.

Red-bellied and Red-headed (*Melanerpes erythrocephalus*) woodpeckers differ from the above species in a number of aspects of their breeding behavior, for they have no dance displays or courtship flights in any definite sense. The members of pairs of both *Centurus* and *Melanerpes* communicate largely by breeding calls, intimate notes, and mutual tapping (Kilham, 1958, 1959a, 1961a).

Among features of breeding behavior common to a number of genera of woodpeckers are (1) the use of drumming as an assertion of territorial dominance, (2) tapping to register agreement on a potential nest site, and (3) the male's habit of spending the night on the nest.

SUMMARY

1. Sapsuckers have breeding territories that may be used in successive years and whose boundaries are distinguishable, in some directions, by locations of drumming trees and zones of conflict of the males, as well as by the usual flights of the pairs involved. Males are the first to arrive in spring and do much drumming at this time.

2. Female sapsuckers drum less frequently than males. The members of a pair may have duets of drumming early in the breeding season, preliminary to more active courtship.

3. The male takes the lead in a courtship that centers on the nesting site. Principal activities involved are: (1) loud *kwee-urk* calls with which males may try to attract their mates from a distance; (2) tapping, which is usually started by an excavating sapsucker on the arrival of its mate; (3) a bobbing dance, which displays yellow bellies and raised red crests and is accompanied by scratchy vocalizations; and (4) a winnowing, courtship flight, which may be performed by either member of a pair, to or from the nest hole.

4. Copulatory behavior begins as the excavation approaches completion. The female may solicit copulation by moving to a particular location. The male makes a peculiar downward beating of his wings just prior to mounting.

5. Male sapsuckers roost in excavations as soon as there is room. Excavating may continue in sporadic fashion during egg laying, incubation, and the rearing of young.

6. Nestling sapsuckers make almost incessant vocalizations from an early age. This stream of noise carries a considerable distance and stimulates the parents to make frequent visits with bills full of a mixture of sap and insects. The begging cries become subdued after nest leaving.

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