

DIFFERENCES IN FEEDING BEHAVIOR OF MALE AND FEMALE HAIRY WOODPECKERS

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THIS report describes differences in feeding behavior of male and female Hairy Woodpeckers (*Dendrocopus villosus*) on diseased elms (*Ulmus americana*) in the vicinity of Lyme, New Hampshire, where these differences were most apparent, as well as on other trees, some of which were located in Tamworth, New Hampshire and in Seneca, Maryland in years from 1960 to 1964.

In the last year of more intensive study I was in the field for approximately an hour, on nearly every day of the week, usually in the early morning. In making observations on feeding behavior I kept a record of the species of tree, whether it was living or dead, on which part the woodpecker was active, such as trunk, limb, branch, or twigs, as well as noting the sex of the individuals, the particular individual as known by its head markings (see Kilham, 1960), and finally the manner of feeding.

FEEDING BEHAVIOR

The ways in which Hairy Woodpeckers extracted prey from within trees were separable into two categories: the uncovering of prey within bark or in wood immediately below and the extraction from deeper layers. These methods are described below in terms of behavior patterns involved.

Location and securing of superficial prey

Percussion.—Hairy Woodpeckers progressing along a limb may give rapid blows here and there to locate prey presumably by causing it to move or by a differential in reverberations between a tunnel and solid wood. On 11 January 1960, I watched a female in Seneca Swamp, moving up a limb of a red oak (*Quercus rubra*) percussing all the way. She swung her head in a sweeping motion as she gave blows at one angle and then at the opposite. The bill of *D. villosus* seldom describes a straight to and fro motion in such circumstances. The bill appears to be open the whole time, but after examining dents in birch bark made by a percussing female I believe that the bill closes on striking. The location and extraction of bark beetle larvae by the Great Spotted Woodpecker (*Dendrocopus major*), the European counterpart of *D. villosus*, is described by Sielmann (1959).

Pecking.—This is the uncovering of prey with relatively few blows against the bark or superficial layers of wood.

Peering and Poking.—Hairy Woodpeckers sometimes move up a tree peering and poking after prey without resorting to blows, in a manner suggestive of Brown Creepers (*Certhia familiaris*).

Scaling.—This can be the knocking off of bits of outer bark or of dead bark with exposure of underlying wood.

Extraction of prey from deeper levels

Excavation.—Extraction of larvae from tunnels $\frac{1}{4}$ inch or more deep in hardwood may take 15 or more minutes of exertion at a single spot where the woodpecker hews out splinters, often seizing them in its bill to shake them loose or to toss them aside. Excavation of this type is characteristic of male Hairy Woodpeckers.

Scanning from a distance.—Another characteristic of males is that they may hitch up tree trunks in slow, deliberate fashion, tipping their heads to one side, then the other, when obviously in search of places to excavate.

Actual Feeding

Hairy Woodpeckers make fine, vibratory motions with their heads when feeding in tunnels and crevices. These are associated with an extremely rapid darting of the tongue, almost snake-like, to a distance of $\frac{1}{2}$ inch beyond the tip of the bill, as I have observed with hand-raised individuals. When one of them explored my fingers with its tongue, the rapid movement felt like a fine jet of sand flicking about over the skin. On close inspection this darting appears to remove obstructing frass as well as larvae from tunnels. When swallowing larger forms of prey, the woodpeckers make opening and closing motions with their bills.

FEEDING ON ELMS

In the spring of 1963 I began to notice that practically all of the Hairy Woodpeckers feeding on elms dying of the Dutch elm disease in Lyme were females. This fact led me to start a more detailed study in midsummer. The adult woodpeckers had largely finished molting and caring for their young by this time and I was able to observe their feeding behavior in a fairly regular fashion until they ceased visiting the elms with an onset of cold weather, well below freezing, in early December. Table 1 summarizes observations made in this period of August through November. It is apparent that there was a sexual difference in attendance on the elms, since 19 of 20 woodpeckers feeding on them were females. Although I was in the field with equal frequency through all months of the year, I had only three observations of Hairy Woodpeckers feeding on dying elms in December and January. By February, however, they were feeding on them more frequently and I began a second period of observations in which the woodpeckers were often seen together, following pair formation in January. Table 1 summarizes these observations, made from February through April. It is again apparent that the females made the most visits to the elms, for they were seen feeding on 31 occasions as compared with only 2 for the males.

TABLE I
NUMBERS OF FEEDING VISITS BY MALE AND FEMALE HAIRY WOODPECKERS TO DYING ELMS
AS OBSERVED IN TWO SEASONAL PERIODS

Period of observation	Sex	Trees fed upon		Summary		M and F together
		Dying elms	Other	Total trees	Per cent on elms	
1963						
August through November	F	19	8	27	70%	Rarely
1964	M	1	19	20	5%	
February through April	F	31	54	85	37%	Frequently
	M	2	44	46	4%	

A number of aspects of the above situations not brought out by the figures alone were the following:

Behavior of females on elms.—Females of *D. villosus* displayed much energy when working on elms. They pecked, hewed, struck glancing blows, seized bits of bark in their bills to waggle them loose in an almost furious manner, then tossed them away, all at a faster, less interrupted pace than was usual on other trees. This tempo might be maintained for as long as half an hour. During this time a female would progress slowly along a limb, leaving it light brown in color due to an almost uniform removal of outer bark.

Behavior of males.—Although male Hairy Woodpeckers were feeding on dying elms on three occasions (see Table 1), their feeding was never as vigorous or prolonged as that described for the females. While one of the occasions was observed too briefly for analysis, circumstances attending the other two were noted in detail.

(a) On 8 February 1964, a female was working on an elm in typical fashion when her mate flew over and supplanted her. He pecked for several minutes on a light brown place from which she had already removed the outer bark, then flew away.

(b) On 4 April 1964, I found a pair of Hairy Woodpeckers working together on a dying elm. This was the only time I ever observed a male feeding on one of these trees in any prolonged manner. Since the female was working 6 feet above him, I had an opportunity to compare the feeding behavior of both sexes in extracting prey from the same type of bark. She worked rapidly with short to and fro, as well as horizontal motions of her head as she percussed and scaled off bark in strips up to 4 inches long. The sound from these activities was fast and regular. Her mate on the other hand, would give a number of deliberate blows, each accompanied by a full swing of the head,

pause, then give a few more. His activities as well as hers were seemingly limited to the bark itself. The male progressed only a foot up the trunk in the 15 minutes before he flew away. She continued to feed for a longer period.

Several points in the above episodes were noteworthy. The male in the first one appeared to have an urge to dominate at a feeding situation, even though it was one in which he had no interest, as shown by the fact that he flew away shortly afterward. The second episode was possibly more complex. Here the male and female used different patterns of behavior when feeding under essentially the same conditions. It appeared as if the male by "habit" or "innate" behavior was unable to work in the manner of the female which may have been the more effective one under the circumstances. This concept might explain why males came to elms so infrequently. Being unable to adapt themselves readily to bark feeding, they move to trees where their methods will uncover more food for less effort.

Added support for the above observations on sexual differences were contributed by Mr. Howard Hutchins of Lebanon, New Hampshire, who had an elm dying of Dutch elm disease in his backyard. In a record kept from November to April he observed female Hairy Woodpeckers feeding on the elm 18 times and a male only once.

Time of feeding young.—The only Hairy Woodpecker which I observed feeding on elms during May, June, and July, 1964, was Female B. Her nest was located 100 feet from a dying elm. Between 29 May, when I found the nest, and 12 June when the young emerged, she visited it repeatedly in gathering prey to feed them. I never observed that her mate did so. After three fledglings had left the nest on 12 June, I watched one of them following its mother up the trunk of the elm being fed every few minutes. On the following morning I found the two on another dying elm 200 yards from the nest carrying on as before. When next seen on an elm, on 18 July, Female B was feeding alone.

I had considerably fewer observations of Hairy Woodpeckers feeding from May through July, than in earlier months when trees were bare of leaves. July was a low point in numbers of observations in both 1963 and 1964. Although molting of the woodpeckers may have contributed to this situation, an additional factor may have been that the native elm bark beetle *Hylurgopinus rufipes* exists primarily in the form of developing eggs and small larvae which may not attract woodpeckers to dying elms until they reach a greater size. Kasten (1939) has written a life history of this species and gives description of its various stages of development throughout the year.

Putting observations together, it is likely that at least 20 female Hairy Woodpeckers in two townships were included in the above studies.

TABLE 2

CONTRAST IN FEEDING HABITS OF MALE AND FEMALE HAIRY WOODPECKERS ON VARIOUS TREES EXCLUSIVE OF ELMS. (August 1963 through April 1964)

Sex	Type of feeding	White pine	White birch	Yellow birch	Black cherry	Maple	Red oak	Aspen	Other trees	Summary	
										Totals	Per cent
M	Superficial	0	0	—	6	2	0	2	0	10	12.3
	Deep	1	5	—	10	23	18	11	3	71	87.7
	Totals	1	5	—	16	25	18	13	3	81	100
F	Superficial	22	17	15	4	12	1	2	5	78	87.7
	Deep	1	4	0	1	3	0	0	2	11	12.3
	Totals	23	21	15	5	15	1	2	7	89	100

FEEDING ON TREES OTHER THAN ELMS

Observations on Hairy Woodpeckers were made almost entirely in woodlands which represented their home ranges since I wanted to study breeding and other habits as well as the spectrum of their feeding behavior, which might not have been possible close to houses and feeding stations. In covering these wider areas I found that some of the findings relating to elms were also encountered on other types of trees.

White pines.—Table 2 shows that there were 23 observations of female Hairy Woodpeckers feeding on white pines (*Pinus strobus*) as compared with only one for males. The feeding was of several types. In three instances, all in winter, females sought prey by peering and poking as they moved up the rough bark of field-grown pine. This manner of feeding was also observed for Downy Woodpeckers (*Dendrocopus pubescens*). Other instances were on pines with bark more or less adherent, which females scaled, sometimes from areas a foot or more in extent or knocked from the small region where a limb entered the trunk, particularly in pines which were still living.

Hardwood trees.—When male Hairy Woodpeckers were observed feeding, they were usually excavating the dead trunks or limbs of aspens (*Populus tremuloides*), black cherries (*Prunus serotina*), red oaks (*Quercus rubra*), and maples (*Acer saccharum* and *A. rubrum*). These trees occurred mainly in two types of situations, either along stone walls and dirt roadways which had protected them from lumbering or in fairly mature woods. When members of a pair were feeding together in such situations the female might feed on dying elms if by the roadway, or on white (*Betula papyrifera*) and yellow (*B. alleghaniensis*) birches if in woodlands. There were two ways in which

the sexes differed; first that they tended to work on different species of trees and second, to seek prey by different methods (Table 2). These differences were not absolute. Females were percussing, pecking, poking, or scaling to reach their prey (superficial types of feeding) in 87% of observations and excavating (designated as deep type of feeding in Table 2) in only 12 per cent. Percentages for males in these types of activities were exactly the reverse.

CHANGE OF FEEDING BEHAVIOR IN LATE SPRING

Both male and female Hairy Woodpeckers adopted an additional pattern of feeding as new insect populations emerged in the spring. On 4 and 5 May 1964, for example, Male B picked insects from the base of one white birch after another while his mate, in the same group of trees, seized them by fluttering up against the bark of the trunks. Neither did any pecking or excavating. There was nothing specific about this behavior as White-breasted Nuthatches (*Sitta carolinensis*) and Downy Woodpeckers were observed feeding in similar fashion on the same mornings.

Hairy Woodpeckers caught much of their prey from surfaces of trunks and branches when feeding their young. I had a favorable opportunity to observe this with Pair B. Each parent would remain near the nest when the other was away, spending much of its time looking for insects on adjacent trees at the edge of a pasture. Although the two birds behaved alike some of the time, Female B was usually the more active, seizing prey as she happened to come upon it when moving rapidly about, without resorting to percussing or pecking. Her mate was nearly always more deliberate. As is the case for male Hairy Woodpeckers searching for a place to excavate on oaks or other trees, Male B might move slowly from one perch to another, flying over to seize an insect only when he had first spotted it from a distance.

SIZE OF PREY

It is possible that the habit of excavating to which the males of *D. villosus* are especially inclined leads them to feed on larger sized prey, on the average, than do females. While this situation is difficult to prove, I have observed situations where they caught excessively large grubs. One of these was on 23 March 1964, in Tamworth. A male had been working on a well-rotted birch when he pulled out a larva so large that he was unable to swallow it on the first attempt. He made no effort to dismember it. When he had finally forced the grub down, he remained motionless for some minutes with eyes closed to slits, as if uncomfortable with the immediate effects.

A second instance was on 5 June 1964, in Lyme. I was watching for Male B when he arrived at his nest hole with a grub nearly 2 inches long and $\frac{1}{2}$ inch wide, which he tried without success to poke down the throat of an awaiting young one. The grub may well have been the larva of the sugar

maple borer (*Glycobius speciosus*). Male B next flew to the woods. To my surprise he returned still carrying the grub and made a second attempt to feed it to a young one. After several more attempts, interspersed with clumsy efforts to lodge the larva in various crevices and shake it, as if into smaller or more flexible pieces, he forced it into a young one on the fifth attempt.

A revealing aspect of the two above episodes was the relative ineffectiveness of *D. villosus*, in comparison with such species as the Red-headed Woodpecker (*Melanerpes erythrocephalus*) (Kilham, 1958b) in dismembering large prey.

FEEDING BEHAVIOR WITHOUT SPECIAL DIFFERENCES

Hairy Woodpeckers of both sexes may feed in more or less similar fashion under a variety of conditions, among which are:

Feeding on ground.—Males and females may both come to the ground to feed, but do so most extensively in early spring. It is probable that some forms of bark beetles become especially available at this season for, as stated by Graham (1963:218) those established in fallen stems and covered with snow in winter may escape the fatal effects of low temperatures. Several episodes illustrated the behavior of *D. villosus* in weeks following the melting of the snow.

On 20 April 1963 I was able to follow a female Hairy Woodpecker for $\frac{3}{4}$ of an hour as she hopped along the ground or flew from the base of one tree to another in a mixed woodland. She worked on one stick half-buried in leaves for 15 minutes. It seemed possible on this and on other occasions after a rain, that *D. villosus* may be especially attracted to the ground when sticks and logs are well soaked.

On 6 May 1963 I followed a male who spent 35 minutes working over logs, stumps, and branches left by a lumbering operation. The slash was a mixture of hardwoods and hemlock. At one log the male clung with body parallel to the ground at the juncture of earth and wood.

Suet.—About a dozen Hairy Woodpeckers recognized by individual head markings (Kilham, 1960), came to our suet holders in winter. Female B, whose roosting habits I observed for some months, flew exactly a mile to reach our suet nearly every morning, her actual course involving stops on a number of trees. Later in the year both males and females brought juvenile young to feed them on suet directly. The holder was well used in July after some months of comparative neglect.

Sap.—The following examples illustrate that Hairy Woodpeckers of both sexes take sap in spring.

On 29 March in Tamworth and on 1 April 1963 in Lyme I observed males visiting maples where sap was streaming down the bark from fissures made by wind damage in winter or possibly by bites of red squirrels (*Tamiasciurus*

hudsonicus) (Kilham, 1958a). The woodpecker imbibed drops wherever they happened to form.

Sapsuckers (*Sphyrapicus varius*) take sap from aspens in late April, drilling bands of holes on branches at a time when catkins are elongating. These were the only sapsucker holes where I observed *D. villosus*. On 18 April 1964 both members of a pair of Hairy Woodpeckers fed at the holes on one aspen at the same time and on 28 April, a female took sap from another aspen when the owning female sapsucker was feeding only 6 feet away in seeming indifference to the intruder. When a Myrtle Warbler (*Dendroica coronata*) came to take sap, however, the sapsucker drove it away immediately.

COMPARISONS WITH OTHER SPECIES

Pileated Woodpeckers.—There are resemblances between the smaller excavations of Pileated Woodpeckers (*Dryocopus pileatus*) and larger ones made by males of *D. villosus*. This is especially true when Hairy Woodpeckers are working on soft wood. On 17 November 1957 I located a male by the blows he was making on a dead poplar (*Populus heterophylla*) in Seneca Swamp. He would loosen a chip in vigorous fashion, seize it in his bill, then toss it away in a manner not unlike that of *D. pileatus*. Some of the chips falling onto a pile below were several inches long. The Hairy Woodpecker made a sizable hole within a relatively short time, which I might have mistaken for the workings of the larger species had I come by later.

Hairy Woodpeckers occasionally take advantage of the excavations of *D. pileatus* to feed more deeply within trees than they could by their own exertions alone. I observed this on 16 March 1963, in Tamworth, when a male flew to an excavation of *D. pileatus* which was about 5 inches deep and 4 inches wide in the base of a sugar maple, and entered completely. After tossing out a few chips he enlarged the holes with blows of his own, making feeding motions as if finding prey. He may have been finding larvae of the pigeon horntail (*Tremex columba*) as far as I could determine from a subsequent inspection, but he was not at ease in his operations. He came out several times to look about. A Pileated Woodpecker was 50 yards away the whole time, pecking loudly and making random *cuks*, but it was 20 minutes before it came any closer. The Hairy Woodpecker flew out immediately. I apparently frightened the Pileated, for three times it flew nearly to the excavation, but shied away at the last moment.

Downy Woodpeckers.—Females of *D. villosus* paralleled Downy Woodpeckers in feeding on dying elms, but it seemed curious to have encountered *D. villosus* infrequently and *D. pubescens* with considerable frequency on these trees in Maryland (Kilham, 1961), the reverse of the situation in New Hampshire. The fact that in Lyme the native elm bark beetle and in Seneca, the

European beetle (*Scolytus multistriatus*) were the ones encountered may have made this difference.

An opportunity to observe interrelations between *D. villosus*, *D. pubescens*, and Yellow-bellied Sapsuckers arose from a situation in Lyme. This centered on a group of white birches drilled by a family of sapsuckers in the summer of 1963 and next to them, a dying elm. A female Downy Woodpecker visited the drill holes many times a day but I never observed it on the elm. In contrast a female Hairy Woodpecker fed on the elm not infrequently, but took no interest in the birches. The sapsuckers occasionally drove away the Downy Woodpecker. They likewise took no apparent interest in the bark beetle larvae, although they often rested on the bare limbs of the elm.

Three-toed Woodpeckers.—Black-backed Woodpeckers (*Picoides arcticus*) take advantage of wind-blown trees to feed on larvae of engraver beetles, as I have observed on mountaintops as well as at the Connecticut Lakes in northern New Hampshire. This species occasionally moves southward in the non-breeding season. When out of their normal habitat they feed on two types of trees which are especially attractive to females of *D. villosus*, namely dying elms and white pines. West and Spiers (1959), for example, found that a number of observers of one invasion reported *P. arcticus* as feeding on elms dying with the Dutch elm disease, with an uncovering of the fawn-colored, inner bark. Reports on the attraction of dead white pines for Black-backed Woodpeckers are presented by Van Tyne (1926). I had a similar experience in Tamworth on 22 September 1962 when I watched a male scaling bark for 30 minutes on a white pine which I had cut down the previous April.

EVOLUTION OF SEXUAL DIFFERENCES IN FEEDING HABITS

The observations presented here suggest that male and female Hairy Woodpeckers differ in some types of feeding behavior and may in this manner make a more effective use of their environment. One might imagine that the male's habit of excavating for wood-borers would insure a fairly constant food supply from dead limbs and trunks in a forest of large trees. No environments, however, are completely stable. Areas of blowdown would provide niches of fallen trees favorable to proliferation of bark beetles. The Dutch elm disease has been similar to such blowdowns in providing food supplies for new populations of such insects and secondarily, for female Hairy Woodpeckers feeding upon them.

It would seem likely that the sexual differences in feeding habits of *D. villosus* have resulted from several selection pressures. A few of these are considered below in relation to concepts of other investigators as well as to details of the breeding season when the differences may be particularly advantageous.

Lack (1944) has presented an hypothesis that species with identical feeding habits will not occupy the same areas and conversely that those occupying the same habitat must have differences in feeding habits. This concept has led Rand (1952) to raise the question of whether the same can apply to males and females of a single species. In the Huia (*Heteralocha acutirostris*), for example, the female was able to reach some wood-boring grubs with her long, curved bill which were not accessible to the male with his short, straight one. There are also ways for reducing competition for food other than such structural devices. Rand has further pointed out that it is not uncommon for females of various species to migrate farther south in winter than males, a situation which Howell (1953) has described for Yellow-bellied Sapsuckers.

Opinions differ as to what constitutes competition. Andrewartha and Birch (1954) have defined it as the seeking of a resource which is in short supply by a number of animals. If one applies this concept to the sexes of *D. villosus*, it is obvious that they do compete under certain circumstances. At a suet holder, for example, a male coming in will almost invariably drive away a feeding female. On the other hand, there appears to be no evidence of any shortage of food on a large breeding territory which agrees with Andrewartha and Birch's further statement that natural populations consume only a small proportion of food in their areas. It is possible, however, that the situation may appear less simple to a male Hairy Woodpecker. One can imagine that some supplies of food are more desirable to him than others, due to their accessibility, quality, or other differences, and that most trees in his territory are of relatively little interest from his point of view. What he seeks on his rounds are often special stubs well supplied with larvae he can reach. This situation can be represented by an episode observed in Tamworth in 1963. Male D had been coming to a white birch stub containing sizable larvae. When he returned on 23 March, Male E was excavating the stub, apparently lured to it from his own territory. Male D approached the intruder making shrill *wick-a-wick* notes and performing a bill-waving dance. His rival left immediately. If the members of a pair of Hairy Woodpeckers had similar food habits they would presumably be attracted to such stubs at the same time, on occasions, and the male would drive the female away as at a suet holder. Such competition could be disadvantageous, especially so if one considers that at least 3 months of the breeding period are largely involved in building up social bonds which will enable the members of a pair to meet the hazards of raising young in effective cooperation. Friction arising from repeated competition would tend to weaken the pair bond at a crucial period. It seems possible, therefore, that selection pressures could act to promote differences in feeding, roosting, and other habits where competitive friction might arise.

Another probable advantage of sexual differences in feeding habits relates to the location of nests. Nesting sites which are really suitable for *D. villosus* appear to be scarce. A pair will usually select a living tree with a rotten center, providing that it is a safe distance from the ground and of the right diameter. There is little indication that they pay much attention as to whether the tree is in a particularly good feeding area. Thus, three of four nests found in 1964 were located rather unfavorably with respect to food as judged by the distances the parents had to fly to obtain it for their young. The fourth, however, was well located in this respect. Thus, as described above for Pair B, the female fed her young repeatedly from a nearby elm while her mate was able to obtain larger grubs from other trees not far away. 1964 was an average year in regard to weather. In an adverse season of cold and wet, however, the fact that the male was adept at securing one kind of food and the female another might enable them to work the more limited resources of their immediate environment to best advantage in the task of feeding themselves and young.

A point in conclusion is that *D. villosus* may not be uniform in habits throughout its continental range but consist of local populations or demes adapted to particular climates, types of woodland, insect populations, and sets of avian and other competitors making up their immediate environments. Such descriptions as I have given above may not fit all localities. Ecologic conditions, furthermore, are in a constant state of change with tree diseases due to insects (Van Tyne, 1926), blowdowns, floods (Yeager, 1955), and fires (Blackford, 1955) providing opportunities for observing the adaptability of woodpeckers. These situations can serve as natural experiments like the Dutch elm disease in New Hampshire. While the above account of Hairy Woodpeckers has been focused on interpretation of a natural experiment in sexual variation in feeding habits, it is part of continuing studies of the breeding and agonistic behavior of *D. villosus* in relation to its total ecology.

SUMMARY

Observations on elms dying of the Dutch elm disease in central New Hampshire indicated that Hairy Woodpeckers were the only ones to avail themselves of the new food supply represented by the bark beetles, in any sustained fashion.

The elms attracted females almost exclusively. In seeking an explanation for this phenomenon a year around study was made of both sexes, with attention to the types of trees on which they fed and their manner of doing so. It then became apparent that females of *D. villosus* differ from males in much of their feeding behavior and are especially adapted to feeding on bark beetles. The elm disease gave expression to a potential which would have been less striking under usual circumstances.

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