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The effect of tree hardness on woodpecker nest entrance orientation.—Previous work has indicated that woodpeckers in southwestern Virginia orient the entrances to their nest cavities in a slightly downward direction and predominantly toward the east-northeast (Conner 1975). Blume (1961), Lawrence (1966), and Dennis (1969) have suggested that moisture on the underside of a sloping trunk might favor fungus growth that would soften the sapwood and make excavation through that side of the tree easier. As the woodpeckers in southwestern Virginia typically select trees with heart rots for nest sites (Conner et al. 1975), once they have excavated through the sapwood, excavation of the rotted heartwood of the nest tree is usually easy. The present study was designed to determine if the hardness of the sapwood of woodpecker nest trees has an effect on determining woodpecker nest entrance orientation in southwestern Virginia.

During the summers of 1974 and 1975 I measured the hardness of the sapwood portion around the outsides of the nest cavities of Common Flickers (*Colaptes auratus*) (10 nests), Pileated Woodpeckers (*Dryocopus pileatus*) (10 nests), Hairy Woodpeckers (*Picoides villosus*) (8 nests), and Downy Woodpeckers (*P. pubescens*) (9 nests) on the Jefferson National Forest near Blacksburg, Virginia. Three different levels around the outside diameter of the nest cavities were tested: A circle around the nest tree at the level of the nest entrance, a circle 5 cm above the nest entrance, and a circle 5 cm below the nest entrance. Hardness was tested at eight different positions equal distances apart on the circles around the nest trees at each of the three levels. Hardness at each position was measured by the total number of equal force impacts needed to drive a 0.5 cm diameter spike 4 cm into the sapwood of the nest tree. The equal forced impacts were delivered by a hammer with a 30 cm radius arm that was hinged to a 50 cm board. The board was placed on a nest cavity and leveled. The hammer was raised to a position perpendicular to the board and let fall a 90° arc to hit the spike that was positioned vertically in a hole in the board. The number of impacts necessary to drive the spike 4 cm from its starting position were counted.

A one-way analysis of variance was calculated to see if any particular side of the nest trees was softer than the other portions for each species of woodpecker individually and for all species combined. All of the tests failed to detect any significant differences in hardness around the outsides of the nest trees. This indicated that the woodpeckers apparently did not select the softest side of the tree for excavating their nest entrances.

An unavoidable problem in a study of this sort is the impossibility of testing for hardness the sapwood that originally occupied the site of the entrances to the nest cavities. The possibility exists that the entrances were the softest portion of the trees at that height. Other evidence tends to support the view that woodpeckers do not excavate into the softer side of the nest tree. The tests I made above and below each nest entrance were not significantly softer than other sides of the tree. Kilham (1968, 1971) suggested that the strength of the nest tree, especially around the nest entrance, might be of great importance as a deterrent to prevent predators from chewing their way into a nest cavity. Kilham (1971) reported several successful predations by raccoons (*Procyon lotor*) on Yellow-bellied Sapsuckers (*Sphyrapicus varius*). DeWeese and Pillmore (1972) and Franzreb and Higgins (1975) found evidence indicating that black bears (*Ursus americanus*) successfully preyed on Common Flickers and Yellow-bellied Sapsuckers, respectively by chewing into the nest tree at and below the nest entrance.

As my data do not indicate that the woodpeckers selected the hardest or the softest side of the tree for nest entrances, the hardness of the sapwood of the nest tree apparently has little or no effect on the orientation of the nest entrance. My results should not be misinterpreted to say that woodpeckers do not select for hardness at all. Over 70% of the nest cavities that I examined had firm sapwood around the entire cavity. Excavation of nest cavities in trees with firm sapwood surrounding the entire cavity would probably have a selective value in being a predator deterrent.

In conclusion, I suggest, as before (Conner 1975), that the slight downward orientation of woodpecker nest entrances in southwestern Virginia has a selective value in that the nests are easier to defend against predators and competitors, and that they are less likely to fill with rain water. I thank Lawrence Kilham for reviewing the manuscript and making excellent suggestions.

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Harris' Hawks lay three clutches of eggs in one year.—Double clutches of eggs by raptors in the wild, producing two broods of young in one year, are uncommon. Harris' Hawks (*Parabuteo unicinctus*) and other North American falconiforms have been recorded double clutching (Mader 1975, Living Bird 14: 59–85). Three clutches of eggs laid by the same breeding pair of raptors producing young from one or more clutches is apparently rare.

I studied a Harris' Hawk trio (two adult males and one adult female), in Pima County, Arizona in 1975 that laid three clutches of eggs in different nests in one year. Two nests fledged young and all were located in ironwood trees (*Olneya tesota*). This polyandrous trio included two banded hawks (one with an additional color band) and one with distinct plumage. I saw both males copulate with the same female. The first nest had a clutch of four eggs 28 February and fledged three young. The second, found with two eggs on 4 June, failed from unknown causes during incubation. The third nest was found on 26 October with an addled egg and three recently fledged young. One of the males was not seen at the third nest while the other two adults were. The three adults were continually sighted at all the nests prior to this.

This particular Harris' trio was a resident group that I had followed intensively since 1973 and had watched from blinds at four different nests (total of 280 h). Each adult cared for the young by either feeding them and (or) supplying prey at the nest (see Mader op. cit., for a quantitative account of the individual hawks' roles). From 1973 to 1975 this trio nested at least 6 times (twice successfully in 1974) and laid a total of at least 21 eggs (3.5 per nest) that produced 14 fledglings (2.3 per nest). This can be interpreted on a per year basis as follows: 1973, 4 eggs yielded 3 fledglings; 1974, 7 eggs yielded 5 fledglings; 1975, 10 eggs yielded 6 fledglings. It is possible that the hawks nested twice in 1973 and that I did not find the second nest. All the nests were located within a 1200 m radius. In contrast to the productive record of this trio, 50 Harris' Hawk nests in a prior study (Mader op. cit.) averaged only 2.96 eggs and 1.6 young per nest.