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# Sex Differences in the First Basic Plumage of the Black-capped Vireo

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## ABSTRACT

The Black-capped Vireo (*Vireo atricapilla*) is sexually dimorphic in adult plumage. In the first basic plumage it also has two color morphs and it has been speculated that each corresponds to a different sex. I collected blood samples from 14 hatch-year Black-capped Vireos and compared their presumed sex based on plumage to their actual sex based on DNA evidence. In all cases, the two agreed, providing strong evidence that the sex of young in first basic plumage can be determined reliably by their appearance alone. Furthermore, I found that the sex of young birds could be determined correctly within two to three weeks after fledging, when they are in the early stages of the first prebasic molt. The ability to determine the sex of this species in first basic plumage has the potential to enhance studies that take place during fall migration or on the wintering grounds when young birds could be expected to compose a significant portion of the overall population.

## INTRODUCTION

The Black-capped Vireo (*Vireo atricapilla*) is a migratory songbird that has been listed federally as an endangered species in the United States since 1987 (Ratzlaff 1987). This species is unique among vireos in that it has sexually dimorphic adult plumage (Grzybowski 1995). The young (i.e., hatching year [HY]) of this species also display two plumage morphs and Grzybowski (1995) observed that young birds developing song were of one morph. Although this observation supports the hypothesis that the two HY plumage morphs represent the two sexes, it is not entirely conclusive, and Pyle (1997) noted that for young Black-capped Vireos during the period from

August to March "more study is needed on the reliability of these plumage differences" for indicating sex. The purpose of this study was to test whether the two first basic plumage morphs of the Black-capped Vireo do indeed correspond to male and female plumages. Throughout the text I use the plumage nomenclature of Humphrey and Parkes (1959) and indicate the equivalent nomenclature of Howell et al. (2003) in parentheses, if it is different.

When Black-capped Vireos fledge, they are completing the growth of their juvenal plumage. This plumage apparently has the same appearance for all individuals, although its brief duration and the difficulty of capturing individuals act as an obstacle to careful study of this plumage. Within two to three weeks, these birds commence a first prebasic (preformative) molt that typically replaces all body feathers as well as all wing coverts except the primary coverts. The resulting first basic (formative) plumage is the one I will concern myself with in this paper. This plumage lasts until a prealternate molt on the wintering grounds replaces a variable number of head feathers and tertials, and sometimes the central rectrices. The timing of this prealternate molt is unclear, but Grzybowski (1995) found evidence that it may start as early as November, and it is complete before birds arrive back on the breeding grounds. Thus, it is unclear how long or even whether the first basic (formative) plumage is exhibited by birds in the early months of their second calendar year.

## METHODS

From late June through July of 2005 and 2006, I collected blood samples from 14 HY Black-capped Vireos at Fort Hood Military Reservation, Coryell and Bell Counties, in central Texas. Twelve of these birds were in complete, fresh first basic (formative) plumage. The remaining two individuals were mostly in juvenal plumage but were in the early stages of their first prebasic (preformative) molt. I captured these birds singly by broadcasting recordings of conspecific vocalizations or those of

Eastern Screech-Owl (*Megascops asio*) to lure them into a mist net. I determined the age of each bird based on plumage and eye color then noted the presumed sex of each bird based on its plumage. After banding each bird, I used isopropyl alcohol to clean one of its toes, my hands, and the cutting surfaces of a fingernail clipper. Next, I used the fingernail clipper to remove approximately 75% of the length of the claw of one middle toe to induce bleeding. Several early attempts revealed that removing <75% of the claw resulted in no bleeding at all. I transferred the blood to a paper card until a printed circle 12 mm in diameter was covered. Bleeding from the cut claw was slow and it typically took five min to accomplish this task. I recorded the band number on the card and, after allowing samples to dry, stored each individually in transparent zip-lock plastic bags. I applied styptic powder and direct pressure to the wounded claw to stop bleeding before releasing each bird and all flew away normally. Before release, I recorded numerous digital images of each bird to document the plumage of each.

The fact that female birds are heterogametic, whereas males are monogametic, provides a basis to determine the sex of birds using molecular techniques. Fridolfsson and Ellegren (1999) describe a method for accomplishing this by first amplifying DNA samples by polymerase chain reaction and then examining them using agarose electrophoresis. Using these techniques, Avian Biotech International (1336 Timberlane Road, Tallahassee, FL 32312) determined the sex of the Black-capped Vireos I sampled.

## RESULTS

Based on plumage, the presumed sex of eight of the 14 HY Black-capped Vireos was male and six were female. In all cases, sex determination by DNA agreed with the presumed sex based on plumage.

The most obvious differences in plumage between the sexes of the 14 birds I sampled were on their breasts and heads. The breasts and throats of the females were buff, whereas these areas were white on the males. The spectacles of males were bright white, whereas those of the females were pale buff, often darker in the lores. The remainder

of the head plumage of the females was olive-gray with no black. On the males, this same area was slate gray with black on the forehead, cheeks, and outlining the spectacles.

## DISCUSSION

Despite the relatively small number of birds sampled, the results of this study provide strong evidence that the sex of Black-capped Vireos in first basic (formative) plumage can be determined reliably. The perfect correspondence between presumed sex based on plumage and actual sex based on DNA analysis supports this conclusion. Because the adult plumage of this species is sexually dimorphic, it is not surprising that the dimorphism of the first basic (formative) plumage would also be sexual.

Males in first basic (formative) plumage are most easily recognized by a combination of black on the head and a white breast. Females can be recognized easily by their lack of black on the head and a buff breast. The difference in crown color (slate gray for males versus olive-gray for females) is recognized easily, but not without prior experience with both plumage types.

The results of this study indicate that the sex of Black-capped Vireos can be recognized shortly after young birds begin their first prebasic (preformative) molt. I sampled two individuals that were just beginning this molt and yet was able to determine their sex correctly based on the color of a small number of feathers emerging from their sheaths. In one of these cases, a presumed male, only a few feathers at the front of the crown were < 50% free (by length) of sheathing. These were dark gray and black, colors present only on males at this age. The other of these two birds was presumed to be a female based on the color of only a few breast feathers. These were about 50% emerged from their sheaths and each was buff, a color consistent only with the female plumage. DNA evidence confirmed the presumed sex of both birds. Because the Black-capped Vireo begins its first prebasic (preformative) molt only 15 to 20 d after fledging (Grzybowski 1995), it is thus possible to determine the sex of this species at nearly all times except for the relative short period when it is entirely in juvenal plumage.

Before young Black-capped Vireos return to the breeding grounds as second-year (SY) birds, their appearance changes as a result of the replacement of many of their head feathers. Little is known about the timing of this prealternate molt. However, it appears to be variable in extent because SY males on the breeding grounds retain a variable number of gray feathers on the back of their heads from the juvenal plumage. It is important to note that this variation apparently includes relatively rare individuals that molt few or even no head feathers while on the wintering grounds. As evidence of this, I have observed four SY vireos (three males and one female) on the breeding grounds that appeared to have had no prealternate molt; that is, their plumage was still the same as the first basic (formative) plumage. Males with this appearance could easily be mistaken for females. The best in-hand clues to the true sex of such males include their white breast (usually buff on adult females), the presence of a cloacal protuberance, and their lack of a well-developed brood patch.

Little is known about the Black-capped Vireo away from its breeding grounds, and the ability to determine the sex of birds in first basic (formative) plumage potentially benefits studies during this time when young birds may comprise a significant portion of the entire population. For example, sex could be examined as a factor in studies of the species during migration or on its Mexican wintering grounds. Additionally, greater awareness of the first basic (formative) plumages could decrease confusion with the similar Dwarf Vireo (*Vireo nelsoni*). The young female Black-capped Vireo with its olive-gray cap is particularly similar to this species. Although the winter range of the Black-capped Vireo is not known completely, it appears to overlap with that of the Dwarf Vireo, particularly in the Mexican states of Jalisco, Michoacan, and Guerrero (Howell and Webb 1995).

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