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# Survival and Fitness of a Female Northern Cardinal (*Cardinalis cardinalis*) after Partial Loss of Melanin-based Feather Coloration

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## ABSTRACT

An incidence is described of a female Northern Cardinal's losing the ability to produce melanin over part of its body when its plumage was replaced during the fourth prebasic molt. The most dramatic abnormality was apparent in the feathers of the crest, head, nape, throat, rump and wings, but only head, nape, throat, and rump became colorless, i.e. white, because the feathers of the other regions produced carotenoid-based red colors, which they retained. The cardinal survived for at least another two and one-half years without further change of the plumage pattern. This time period included three breeding seasons during which the bird was observed to be reproductively active.

## INTRODUCTION

Localized losses of melanin production in birds result in patches of plumage that are white or retain only melanin-independent coloration such as carotenoid-based reddish hues. A patchy white appearance due to melanin loss is referred to as leucism; but when the loss of melanin occurs in regions where other pigments are present as well, the condition can be referred to as schizochroism (Harrison 1985). Albinism, in contrast, is the consequence of a total pigment loss over the entire body, including eyes and body parts not covered by integuments like hair or feathers (Harrison 1969, Harrison 1985; Buckley 1987). Here I report what might properly be called an instance of spontaneous schizochroism in a three-year old female Northern Cardinal (*Cardinalis cardinalis*) that survived for almost another three years.

## METHODS AND RESULTS

In a wooded area near my home in Tallahassee, FL, I banded on 12 Jul 1996 a normal-looking hatching-year female Northern Cardinal (band 871-60837). No changes of the plumage were apparent through 31 Dec 1998, the date of the eleventh recapture after banding. It was not until 18 Mar 2000 that I captured the bird again, and at that time its head, nape, breast, and rump were entirely white except for some red in the crest (Fig. 1). Furthermore, many coverts of the wing as well as a few flight feathers and one central rectrix were pinkish red rather than having the normal coloration of brown mixed with red. Because the only possible occasion for feather replacement between December 1998 and March 2000 was the prebasic molt in the fall of 1999, it must be concluded that at that time melanin-type pigments had not been deposited in the feathers of parts of the body although their carotenoid-based red pigments were retained.

After the encounter with the bird in March 2000, I recaptured it another seven times at the same location, last on 13 Apr 2002. Unfortunately, comparisons of the aberrant plumage in pictures taken in 2000 and 2002 were somewhat inconclusive because the true colors on the wings in the pictures taken in 2000 are obscured by shadows. Nevertheless, if changes in the plumage had occurred since 2000, they were very minor. Of the wings, the more informative photographs from 2002 are shown because they document that the extent of pigment aberration was not identical on the right and left wings (Fig.2).

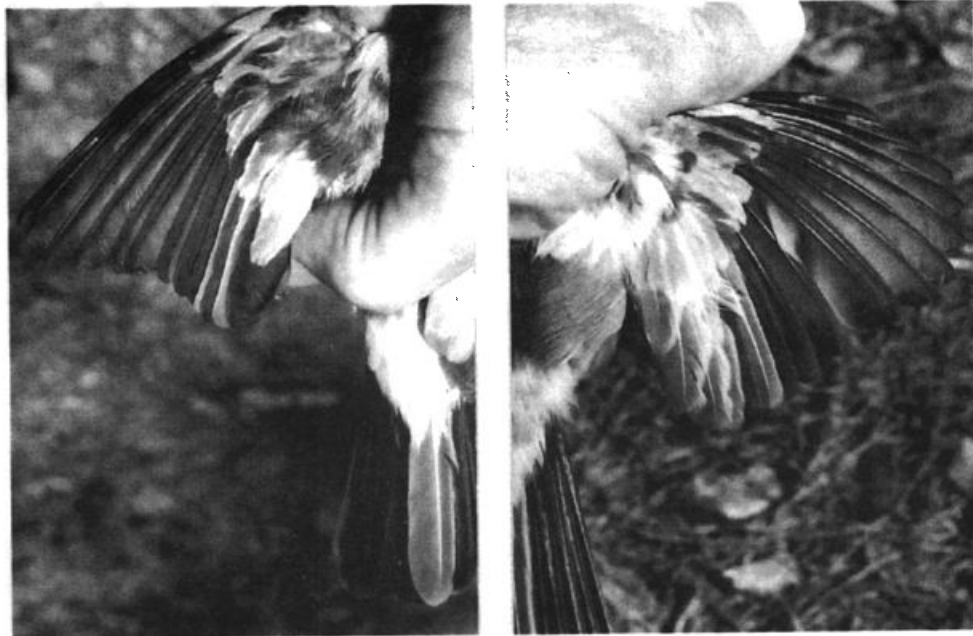


**Fig. 1. Female Northern Cardinal after spontaneously turning schizochroic. The underside of the bird has retained the normal brown coloration, whereas many of the wing coverts are rose-colored because melanin is absent. (I thank Dr. P. Rutkovsky for taking the photograph when I captured the bird on 18 Mar 2000.)**

The bird appeared to be perfectly fit, as it not only survived but attracted a mate: When I caught the bird in spring 2000, I noticed a brood patch, and I discovered her nest in July, which fell victim to predation after the young had hatched. In March 2001, I observed the abnormally plumaged female in the company of a male; and when I captured her on 13 Apr 2002, she again had a brood patch. Indeed, on 20 May 2002, I discovered her on her nest, apparently incubating, but four days later the very conspicuously located nest was deserted and empty. This was my last record because I did not encounter the bird again.

### **DISCUSSION**

Albinism, leucism and schizochroism are not rare occurrences among animals. Indeed, free-living birds having patchy white or even completely white plumages are described or documented quite often. Encounters with such birds usually are single events, however, and do not reveal whether the abnormal pigmentation was present at hatch or acquired later in life, and its effects on the bird's fitness remain unknown. Even so, instances of a spontaneous appearance of a leucistic plumage pattern in free-living birds have been reported. Of such observations I will mention three, one of a



**Fig. 2. Left and right wing of the schizochroic Northern Cardinal on 13 Apr 2002. Many of the melanin-deprived rose-colored feathers appear almost white in these black-and-white reproductions of the color photographs.**

Gray Catbird (*Dumetella carolinensis*) and the other two of Song Sparrows (*Melospiza melodia*).

The reported spontaneous appearance of white in the plumage of a catbird occurred in the time span of 40 days between two captures. It took place during the first prebasic molt and affected only the second primaries of both wings (Keith et al. 1999). Root (1944) had a similar experience with a Song Sparrow. He had banded a normal-looking bird in Massachusetts on 26 Sep 1941 and recaptured it a month later on 24 Oct, showing "incomplete and asymmetrical albinism." Root describes white patches over the upper body and elsewhere, and he reports that among the flight feathers only one tertial was white, and in the tail only the two innermost left rectrices. Regrettably, this pattern does not provide any information about the age of the bird because it is consistent with the known feather replacement pattern during a first as well as a subsequent prebasic molt (Pyle 1997).

The other observation of a Song Sparrow was reported by Johnson (2001) from a banding station located on Virginia's eastern shore. He captured a returning leucistic bird in 2000 that he had banded as a normal-plumaged first-year individual in 1999. According to information provided by B. Johnson (pers. comm.), banding and recapture occurred in mid-November, and pigment abnormalities were noted on crown, cheeks, throat, lower breast, back, rump, and underwings. Because Song Sparrows do not have a prealternate molt, and the individual referred to by Johnson had essentially completed its body molt on both capture dates, the leucistic pattern must have developed during the second prebasic molt.

In the literature, a partial absence of melanin production is typically treated as an inheritable genetic disorder (e.g. by Harrison 1985, Buckley 1987), mainly on the basis of data collected from caged birds. Aside from genetic disorders that result in an inability to produce pigment-producing melanocytes over parts of the body, genetic defects have been described that lead to a premature death of existing melanocytes as a result of an inadequate mechanism of protection against oxygen radicals (Bowers et al. 1994). The mere observations of spontaneous occurrences of melanin loss as described here certainly do not allow any

conclusions about the underlying genetic dispositions or about the nature of physiological or environmental triggers if such are involved. In the specific case of this Northern Cardinal, the pigment abnormality appeared spontaneously after several normal molts, and subsequent molts neither reversed nor exacerbated it. The extensive loss of pigmentation had no noticeable effect on the reproductive activity of the bird, perhaps because the affected individual was a female and, therefore, could choose a mate rather than having to be chosen (see Wolfenbarger 1999). Its long survival may be attributable to the protection afforded by the understory and trees of its home range. Indeed, a similarly afflicted female cardinal observed by Hartman (1968) in a much more open habitat succumbed to predation three months after it was first seen.

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## News, Notes, Comments

### High Incidence of Avian Pox in Southeast Michigan, Fall 2003

Avian pox is a viral disease which occurs worldwide and has been reported in at least 20 families of birds (Friend and Franson 2001). The common, cutaneous form is characterized by warty, scabrous lesions on the bare parts of birds, particularly the feet, legs, and bill. Because other diseases may present in a similar manner, a pathologic examination is necessary to confirm infection by one of the avian pox viral strains (Van Riper et al. 2002). However, bird banders generally categorize birds with these very visible lesions as having “avian pox,” as I do in this paper.

Of the 24,636 birds handled by the Rouge River Bird Observatory at the University of Michigan-Dearborn (Wayne Co., MI) from August 1992 through July 2003, only 17 (0.07%) showed evidence of avian pox. These 17 individuals represented six species: American Robin, *Turdus migratorius* (6); Yellow Warbler, *Dendroica petechia* (3); Chipping Sparrow, *Spizella passerina* (1); White-throated Sparrow, *Zonotrichia albicollis* (1); Northern Cardinal, *Cardinalis cardinalis* (2); and Red-winged Blackbird, *Agelaius phoeniceus* (4).

In fall 2003, incidence of avian pox was of greater frequency. From mid-August through early November, 44 of 2,426 birds handled (1.8%) had

avian pox. In this sample, 43 of the 44 birds were hatching-year (HY) American Robins; the other was a HY Northern Cardinal. This represented 12.3% of the robins captured this fall, and 15.8% of the HY robins.

This fall was also the first time we have observed pox lesions on bills. Of the 44 birds, 12 (27.3%) involved the bill, consisting of large, warty growths, raw, bloody patches where scabs had come off; or bill deformities such as eroded patches and missing chunks that were likely the result of healed pox lesions. Four of the 12 had pox lesions only on the bill, eight had pox on both the bill and feet or legs. Of the other 44 birds, 32 (including the cardinal) had (lesions only on the feet or legs).

Birds with pox symptoms were captured throughout the season, and thus must have included both locally nesting birds and migrants. Until 21 Sep, all growths were crusty and friable, easily falling off, shedding pieces, or bleeding. At that point, some birds were captured with growths that appeared to be healing. These growths were reduced in size and less friable: the skin was regrowing over missing toenails. By 26 Oct, birds were being captured that had no active growths, but evidence of healed lesions. The last birds with crusty, active-appearing lesions were captured on 1 Nov.

The cutaneous form of avian pox is not usually fatal unless the growths interfere with breathing, vision,