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Prevalence of Hematozoa in Overwintering American Redstarts (*Setophaga ruticilla*): No Evidence for Local Transmission

Mary C. Garvin,[1,3] Peter P. Marra,[2] and Sarah K. Crain[1] [1] Department of Biology, Oberlin College, Oberlin, Ohio 44074, USA; [2] Smithsonian Environmental Research Center, 647 Contees Wharf Rd., Edgewater, Maryland 21037, USA; and [3] Corresponding author: (email: mary.garvin@oberlin.edu)

ABSTRACT: We examined American redstarts (*Setophaga ruticilla*) for protozoan blood parasites on their wintering grounds to determine whether transmission of these parasites occurs prior to spring migration. A total of 73 blood smears from 37 birds were examined for presence and intensity of infection. Thirty-six birds were sampled in the fall, soon after arriving from northern breeding grounds, and the spring prior to departure. Two (5%) of the samples collected in the fall were positive for *Haemoproteus fringillae* and one (3%) had detectable infections of *Trypanosoma avium.* Individuals infected with *H. fringillae* were hatching year redstarts sampled in September and October. Intensity of infection was 78 and <1 infected erythrocytes per 10,000 erythrocytes, respectively. None of the birds had detectable infections when resampled prior to spring migration the following March.

Key words: Hematozoa, Jamaica, *Setophaga ruticilla.*

Protozoan blood parasites are common in passerine birds, but poorly studied in Neotropical-Nearctic migratory species (Valkiunas, 2001). We do not completely understand the annual variability of these infections and know very little about how they impact host fitness. This is unfortunate given the potential cost of blood parasites to their avian hosts (Bennett et al., 1988, 1993; Atkinson et al., 2000, 2001). Most of our current knowledge on the occurrence of blood parasites in migratory birds is from surveys conducted on the breeding grounds where infections are believed to be acquired (Janovy, 1966; Bennett et al., 1974). Relatively little work has been conducted on the southern wintering grounds (Young et al., 1993).

The American redstart (*Setophaga ruticilla*) is a Neotropical-Nearctic migratory passerine that breeds from Louisiana north to Newfoundland and west to Montana, north to Alberta, Canada. Redstarts can be locally abundant in areas that provide adequate habitat for breeding and wintering (Sherry and Holmes, 1997). Breeding populations from eastern North America appear to winter in the Greater Antilles and northern South America (Sherry and Holmes, 1997). During a larger study of an overwintering population of American redstarts in Jamaica, West Indies, we repeatedly sampled marked individuals to better understand the dynamics of blood parasite infections during the nonbreeding season. Here we report on parasite prevalence, intensity, and seasonal variation of infection in this population. This research was conducted on the southwestern portion of Jamaica at the Font Hill Nature Preserve, 13 km west of Black River, St. Elizabeth Parish and 5 km east of Whitehouse, Westmoreland Parish (18°02′N, 77°57′W). Habitat consisted of mangrove (*Avicennia germinans*) and adjacent logwood (*Haematoxylon campechianum*) scrub.

Samples were collected from redstarts soon after arrival from the breeding grounds and just prior to departure from Jamaica, between March 1994 and October of 1996. Redstarts were captured using mist nets, accompanied by a redstart song/chip playback and a stuffed decoy placed about 1 m above the ground at the center of the net (Holmes et al., 1989). Once redstarts were captured, they were sexed and assigned to two age categories according to plumage and skull ossification (Sherry and Holmes, 1997): hatching/second year (HY/SY) for birds in their first year after hatching and after hatching year/second year (AHY/ASY) for birds after their first breeding season. Birds were marked with serially numbered United States Fish and

Wildlife Service bands and two plasticine color bands to form a unique color band combination. Blood was collected by pricking the brachial vein and drawing blood into an unheparinized capillary tube. Thin blood smears were prepared and air dried, then fixed in absolute methanol upon return to the laboratory. Slides were stained in Wright-Geimsa stain (Fisher Scientific, Pittsburgh, Pennsylvania, USA) and examined for parasites by scanning under 1,000× magnification under oil immersion. A minimum of 100,000 erythrocytes was examined per slide. Erythrocyte numbers were determined by estimating the number of erythrocytes in each ¼ field of view, then extrapolating to determine the number of cells per entire field of view. Then the appropriate number of fields was read until approximately 100,000 erythrocytes were viewed for each slide. The intensity of infection, reported as number of infected erythrocytes or *Trypanosoma* per 10,000 erythrocytes, was calculated for each bird. Representative specimens were deposited in the United States National Parasite Collection (Beltsville, Maryland, USA, accession numbers 93517, 93518).

We prepared a total of 73 thin blood smears from 37 redstarts. Thirty-six of these birds were sampled once in the fall soon after arrival and once in the spring prior to departure for the breeding grounds. Twenty-seven birds were sampled once in the fall of 1995 and again in the spring of 1996, seven were sampled in the fall of 1994 and again in the spring of 1995, one was sampled in the spring of 1995 and again in the fall of 1995, and one was sampled in the spring of 1996 and again in the fall of 1996. Overall prevalence of avian hematozoa infection was 8% (3/37) in the fall and 0% (0/36) in the spring. Seven samples were collected from HY birds sampled during their first fall, and seven from SY birds sampled prior to departure for spring migration. Thirty-two samples were collected from AHY birds and 27 from ASY birds. Seventeen of the samples were collected from males and 56 from females. In the fall sample, two HY birds had detectable infections of *Haemoproteus fringillae* (Burry-Caines and Bennett, 1992). Intensity of infection in the two positive samples was 78/10,000 and <1/10,000 for samples collected on 24 September and 9 October 1994, respectively. Both birds lacked detectable infections the following March prior to spring migration. In addition, one AHY bird sampled on 20 October 1995 had a detectable infection of *Trypanosoma avium,* with a intensity of <1/10,000 red blood cells. This infection also was undetectable the following March.

The low overall prevalence of hematozoa infection in American redstarts reported here is in accordance with an earlier survey of overwintering parulid warblers in Jamaica by Bennett et al. (1980), who found 6.5% prevalence in 123 overwintering warblers of 18 species and 5% prevalence in redstarts. *Haemoproteus* was detected in 2% and 0% of all warblers and redstarts, respectively. Likewise, on the northern breeding grounds, Greiner et al. (1975) found 1.4% prevalence of *Haemoproteus* in breeding redstarts during a survey of hematozoa across all seasons and geographic regions of North America. Similarly, in New Brunswick, Bennett at al. (1975) found 1.7% prevalence of *Haemoproteus* in breeding redstarts, and in New Jersey, Kirkpatrick and Suthers (1988) found 7.7% prevalence.

Infection status in the two individuals infected with *H. fringillae* changed from positive in the fall to undetectable in the spring. Species of *Haemoproteus* typically demonstrate seasonal patterns of infection (Weatherhead and Bennett, 1991; Garvin and Greiner, 2003); however, the pattern observed here is notable given that transmission in Jamaica is thought to occur between February and April (Bennett et al., 1980). We suspect that both infected birds acquired infections on the northern breeding grounds (Bennett and Fallis, 1960), given that both were HY birds sampled

soon after their initial arrival in Jamaica. Furthermore, intensity of both infections was lower than expected from recent infections in immunonaive HY birds. Studies of natural (Garvin and Greiner, 2003) and experimental (Garvin et al., 2003) infections in another passerine species, the blue jay (*Cyanocitta cristata*), revealed that, upon initial infection, HY birds displayed high intensity infections that decline over time until they are nearly undetectable after 8 wk. Infection later relapses during periods of stress and/or hormonal changes associated with breeding (Atkinson and van Riper, 1991) rather than being completely eliminated as a result of immune response (Bennett and Bishop, 1990).

Although it is possible that infections were acquired on the wintering grounds or during migration, relatively little research has been done to determine the diversity and seasonal abundance of arthropod vectors in the Neotropics. *Haemoproteus* spp. are known to be transmitted by hippoboscid flies (Diptera: Hippoboscidae; Adie, 1925) and species of *Culicoides* (Diptera: Ceratopogonidae; Bennett and Fallis, 1960). Broader ranges of arthropods are thought to transmit Trypanosomes; these include hippoboscid flies, *Ornithomyia* (Diptera: Hippoboscidae; Baker, 1956), mosquitoes, *Aedes* spp. (Diptera: Culicidae), and black flies, *Simulium* spp., (Diptera: Simulidae; Bennett, 1961; Bennett and Fallis, 1960). The overall low prevalence of hematozoa in the Neotropics is attributed to the absence or relatively low abundance of suitable arthropod vector species (Greiner et al., 1975; White et al., 1978).

Until detailed studies of the vectors of hematozoa have been conducted in the Neotropics, we are unable to determine the degree of transmission that occurs during overwintering.

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