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RESEARCH ARTICLE

CASES OF UNUSUAL MELANISM IN *SCIURUS NIGER* L. (1758) FROM VIRGINIA

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ABSTRACT

After opportunistically observing an Eastern Fox Squirrel (*Sciurus niger* L. [1758]) with non-agouti melanism restricted to its venter, face and limbs in Wythe County, Virginia, we sought to determine whether this pattern of ventral melanism occurred elsewhere in the Commonwealth. Using museum specimens, research-grade images from iNaturalist, and our own camera-trapping data, we expanded our search state-wide. We discovered Eastern Fox Squirrels exhibiting the same pattern of ventral melanism in 11 counties and one independent city. Our report emphasizes the value of combining data from contemporary field research, historical museum specimens, and vetted citizen science image submissions to examine pelage patterns on a wider scale

Keywords: Eastern Fox Squirrel, iNaturalist, museum specimens, pelage coloration.

BACKGROUND

As part of a large-scale surveying effort for Allegheny Woodrats (*Neotoma magister* Baird, 1857) in western Virginia, we deployed game cameras from 18 May 2023 to 1 June 2023 at Big Survey Wildlife Management Area (WMA) in Wythe County. We selected four boulderfields, deploying 22 cameras across these sites. No woodrats were found at any of the sites. In 2024, as part of similar searches for Allegheny Woodrats, we deployed cameras outside a privately-owned cave in Botetourt County (37.582624 °N, 79.765223 °W). We deployed five cameras at the cave opening and along a rockface adjacent to the cave from 18 June 2024 to 1 July 2024. No Allegheny Woodrats were detected on any of these cameras.

CASES OF UNUSUAL MELANISM

An examination of the images from 2023 in Wythe County revealed an adult Eastern Fox Squirrel (*Sciurus niger* L. [1758]) with unusual pelage. This individual exhibited standard wild-type coloration on its dorsal surface and non-agouti melanism on its venter, face, and limbs (Fig. 1). Because of this distinctive pattern of pelage coloration (Tye et al. 2015), we believe this animal was observed at Rocks2 (36.885077 °N, 81.052362 °W) across multiple cameras on 18, 19, 20, and 21 May (Fig. 1). We observed the same pattern of ventral melanism in a second Eastern Fox Squirrel photographed during 2024 Allegheny Woodrat surveys outside a privately-owned cave in Botetourt County (Table 1). We submitted representative examples of these Eastern Fox Squirrel images to iNaturalist (Table 1).

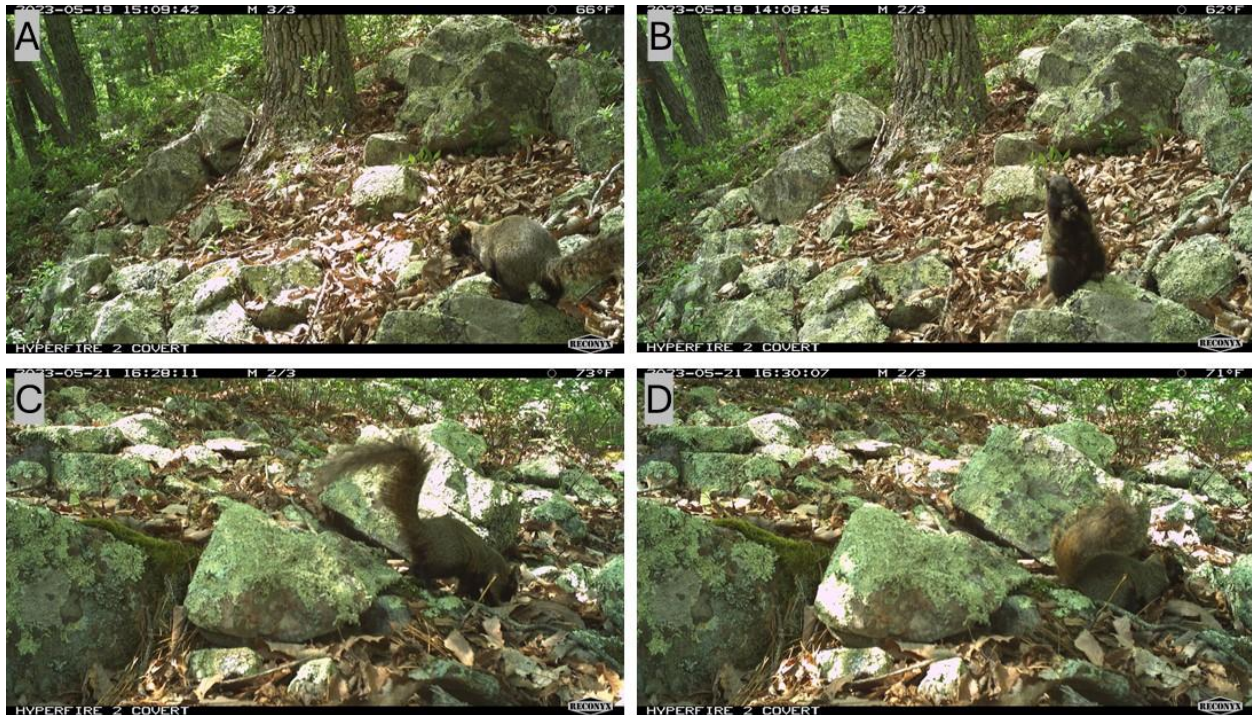


Figure 1. Images of adult Eastern Fox Squirrel (*Sciurus niger*) with non-agouti black venter, face, and limbs from Big Survey Wildlife Management Area in Wythe County, Virginia. Individual in A, B imaged on 19 May 2023 and C, D imaged on 21 May 2023 at separate cameras set at “Rocks2” site.

To get a sense of how widespread this specific pattern of ventral melanism is in Virginia fox squirrel populations, we searched for this unusual pelage coloration from several resources. First, we examined research-grade photos of Eastern Fox Squirrels available on the iNaturalist website (N=617 unique individuals across ca. 1087 images). We re-examined images from seven years of Allegheny Woodrat camera surveys (2018-2024) and documented the total number of Eastern Fox Squirrel individuals captured on camera. We also examined 162 Eastern Fox Squirrel specimens from Virginia that are housed in the Mammal Collection of the Virginia Museum of Natural History. Lastly, we reached out to 10 current or retired curators at colleges and state institutions in Virginia and North Carolina that might house additional specimens of Eastern Fox Squirrels from Virginia. From eight responding institutions and their collective 23 specimens, none featured the ventral melanism we describe here.

Table 1. Records of Eastern Fox Squirrels exhibiting ventral, face and limb melanism in Virginia, as noted from authors' field images, current and historical museum specimens, and research-grade images on iNaturalist. Date (exact or approximate) and county, as well as approximate coordinates (latitude/longitude) are listed for each specimen. We also provide web links for all images in iNaturalist (<http://www.inaturalist.org/observations/#####>).

County	Date	Record Type	Latitude	Longitude	Observation URL/Specimen ID
Accomack	3/3/2013	Image	37.895631	-75.369324	iNat: 209781
Accomack	5/28/2015	Image	37.996150	-75.395498	iNat: 102414386
Accomack	9/12/2015	Image	37.897017	-75.367219	iNat: 99489122
Accomack	4/27/2018	Image	37.952972	-75.313250	iNat: 56477982
Accomack	3/29/2021	Image	37.896113	-75.366176	iNat: 72405003
Accomack	5/15/2021	Image	37.897285	-75.368886	iNat: 79565513
Accomack	5/15/2023	Image	37.89727	-75.3669	iNat: 162468511
Accomack	5/19/2023	Image	37.896205	-75.366150	iNat: 162534820
Accomack	5/16/2024	Image	37.896205	-75.366150	iNat: 216158614
Accomack	2015-2018	Specimen	37.896205	-75.366150	VMNH 146767; NDM 4613 old VMNH003362
Augusta	4/18/1992	Specimen	38.071778	79.079944	VMNH 33926; NDM 1780 old VMNH000506
Augusta	10/26/2020	Image	38.166091	-79.034480	iNat: 63608472
Augusta	1/12/2022	Image	38.167012	-79.035034	iNat: 104835706
Bedford	1/26/2021	Image	37.449308	-79.261417	iNat: 68652861
Bedford	5/5/2022	Image	37.317098	-79.398963	iNat: 115612476
Botetourt	6/29/2024	Image	37.582624	-79.765223	iNat: 234330678, 234330672
Fauquier	6/13/2016	Image	38.991299	-77.971359	iNat: 59248138
Giles	4/7/2021	Image	37.307803	-80.637428	iNat: 73226674
Henry	5/7/2023	Image	36.752188	-79.866692	iNat: 160446561
Mecklenburg	3/11/2019	Image	36.758440	-78.213691	iNat: 21247656
Montgomery	5/4/2022	Image	37.296765	-80.377838	iNat: 116478779
Montgomery	11/18/2023	Image	37.199529	-80.563749	iNat: 191396230
Rockbridge	10/30/1990	Specimen	37.639929	-79.541818	VMNH 33895; NDM 1682 old VMNH000475
City of Newport News	2/25/1914	Specimen	37.129510	-76.542120	VMNH 37335; VT1113
Wythe	5/19/2023	Image	36.885077	-81.052362	iNat: 234328332, 234328330, 234328327
Wythe	5/21/2023	Image	36.885077	-81.052362	iNat: 234329733, 234329732, 234329730

On iNaturalist, we observed ventral melanism with wild-type dorsal pelage coloration in photos of animals from 10 counties (Table 1, Fig. 1, Fig. 2). In our Allegheny Woodrat camera photos, we documented eight individuals across 2023 and 2024 surveys, and none from 2018–2022. Across Big Survey WMA, we found four additional fox squirrel individuals that did not exhibit ventral melanism present in the individual squirrel at Rocks2. In 2024 cameras, we documented the Botetourt County melanistic squirrel plus three additional squirrels (Franklin County, Grayson County, and Roanoke County) that lacked ventral melanism.

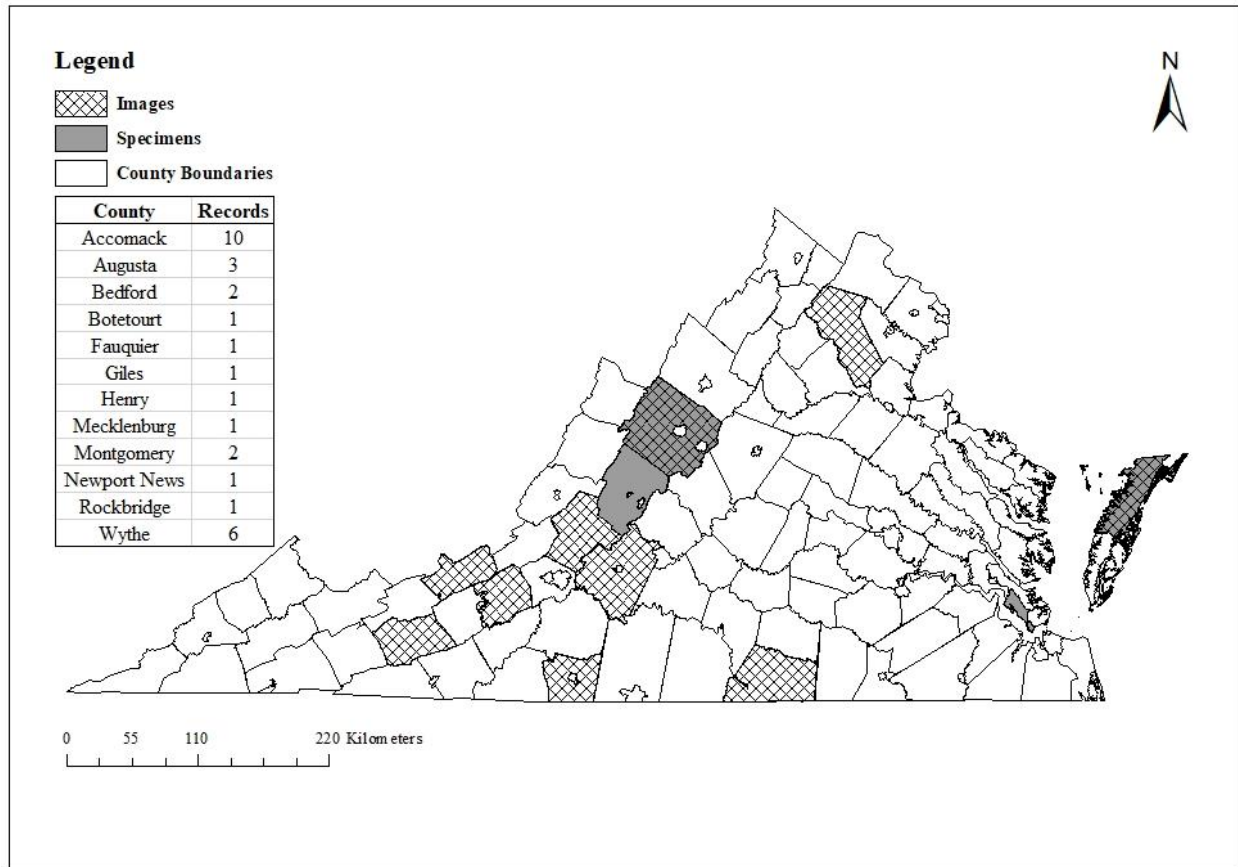


Figure 2. Virginia locations of Eastern Fox Squirrels (*Sciurus niger*) with ventral melanism, based on original research efforts (images), museum specimens, and research-grade images available on iNaturalist. Cross-hatching and shading are indicative of counties with documented ventral melanism by images or museum specimens, respectively. Counties with both cross-hatching and shading have documented ventral melanism by both an image and a specimen.

The same pattern of ventral melanism was also present in 4 of 185 museum specimens (2.2%; Table 1). Two of these melanic specimens were collected in two counties not represented in the iNaturalist photos (Rockbridge County and Warwick County, which is now the City of Newport News). Because the unusual melanism we describe here occurs throughout Virginia (Fig. 2), the genetic mutations responsible for this color pattern are not readily associated with variation in environmental factors (e.g., forest types or climatic regimes), but we hesitate to speculate on the functional cause of this pattern at this time (but see McRobie et al., 2019 or Consentino et al., 2023).

Kiltie (1989) examined museum specimens to perform a comprehensive survey of dorsal melanism in Eastern Fox Squirrels. Although Kiltie (1989) did not report any specimens with the

ventral color pattern we observed, we have no reason to believe that such specimens were absent from the collections he visited. While multiple fox squirrel color morphs with partial melanism have been documented (e.g., Moore 1956), our described form of ventral melanism does not appear to be confined to one subspecies or one geographic area.

McRobie et al. (2019) recently presented evidence that melanism in Eastern Fox Squirrels from the Gulf and Atlantic Coastal Plains is associated with a mutation in the agouti signaling protein (ASIP) gene. This gene controls the pattern of black pigmentation (restricted to the mane, tail, and legs) exhibited by bay horses (Oyebanjo et al. 2022). We suggest it is a possible candidate for the pattern of ventral melanism in the Eastern Fox Squirrel we report here.

CONCLUSIONS

Our study shows that an unusual pattern of melanism occurs in multiple populations of Eastern Fox Squirrels located throughout Virginia. Here, we demonstrate the importance of gathering data from all available sources to interpret trends. Our combined use of opportunistic discoveries during original research efforts, historical and contemporary museum specimens, and research-quality, vetted iNaturalist images allowed us to document the statewide occurrence of an unusual pattern of melanism in Eastern Fox Squirrels. Citizen science is helping us to elucidate melanistic patterns for congeneric Eastern Gray Squirrels (*Sciurus carolinensis* Gmelin, 1788), through collaborative projects like the NSF-funded Squirrel Mapper project (squirrelmapper.org). Perhaps the next step for Eastern Fox Squirrels is to initiate a similar program to understand the distribution of the color morphs for this species. It's possible that casting a wider net for Eastern Fox Squirrels with ventral melanism may elucidate geographic patterns not detected on our study scale.

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