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Field report

First ever record of a black-coloured maned wolf

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Abstract

Records of atypical black individuals of Neotropical canids are extremely rare. Here, we report the first ever record of a black-coloured maned wolf *Chrysocyon brachyurus*, either wild or in captivity. Using camera traps to survey a protected area in the Brazilian Cerrado we obtained 30 maned wolf photographic records, 25 in its common reddish colour and five (16.6% of the records) in the previously unknown black phenotype. We suggest this is possibly an independent event of melanism in canids, discuss its potential evolutionary benefits and give recommendations for further research.

Colouration in animals has many functions and is often influenced by genetic and environmental factors (Hubbard et al. 2010). According to Caro (2005) it has three primary purposes: concealment, communication, and regulation of physiological processes. Despite the vital role of colouration for species, individuals of unusual colours can arise in a population. If these atypical coloured specimens perform in the same way or better than the regular coloured individuals, the new colouration may be retained in the population for several generations and become relatively common, such as in the melanistic wolves *Canis lupus* of western North America (Musiani et al. 2007) and leopards *Panthera pardus* in south-east Asia (Kawanishi et al. 2010).

Descriptions of atypically coloured specimens of carnivores are frequent in the literature (Delibes et al. 2013), and melanism has been observed in species of canid (Apollonio et al. 2004), felid (Eizirik et al. 2003), viverrid (Gaubert and Mézan-Muxart 2010) and mustelid (Hosoda et al. 2005). For Neotropical carnivores, black phenotypes have been reported for several felid species (Eizirik et al. 2003; Schneider et al. 2012), however, apart from the report of near-melanistic hoary foxes (*Lycalopex vetulus* - Cabrera 1931; Vieira 1946), there is no record of atypical black individuals for Neotropical canids (Sillero-Zubiri et al. 2004).

The maned wolf (*Chrysocyon brachyurus;* Illliger, 1815) is a Near-Threatened omnivorous and generally solitary canid that inhabits grassland and savanna in central South America (Dietz 1985; Paula and DeMatteo 2015). The species has a unique appearance, with a distinctive reddish coat colour, slender and tall body, short tail, long legs and ears. The typical maned wolf colouration is so characteristic that the species' Latin name makes reference to it (*Chrysocyon*: golden dog). Here we report what is, to the best of our knowledge, the first ever record of a black-coloured maned wolf, either wild or in captivity.

Located in northern Minas Gerais state, Brazil, Veredas do Acari Sustainable Reserve (VASR – Figure 1) protects 600km^2 of savanna vegetation (typical Cerrado ecosystem physiognomy; sparse trees and large shrubs about 2-8m tall with a grass layer at the ground level – Ratter et

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al. 1997) and veredas (humid grasslands along water courses and dominated by the palm species *Mauritia flexuosa*). Inside the reserve there are also some anthropogenic habitats created prior to its establishment. In 2013, three VASR rangers were trained on the basic use of camera traps with the objective of conducting a preliminary survey of medium- and large-sized mammal species in the protected area. They deployed six 35mm film camera traps with passive infrared sensor (model Tigrinus 6.0c) on internal roads and animal trails within the two major vegetation types found at the protected area. Camera traps were attached to trees at 25-30cm from the ground; no bait was used to attract animals. Each camera trap site was surveyed for at least one month, after which time park rangers were free to move the unit to another sampling site or to leave it for another 30-day period in the same location. Camera trapping was conducted from May to December 2013 and overall 20 different sites were surveyed (Figure 1). The maximum distance between camera trap sites was 22km, and the minimum was 0.4km. Due to the limited training given to park rangers and the fairly complex camera trap model used (date and time of the photo is stored in a data logger, not printed on the film) we could not retrieve information about date and time of the photographic records. Similarly, although reserve rangers recorded the geographic coordinates of each camera trap site, we were unable to accurately link each photo with its exact location due to missing information on field forms. Nevertheless, we were still able to associate each photograph film with a broad geographic portion of the reserve and also, based on the background of the photo, to identify records from the same sampling site. While this situation is not ideal, it does not compromise the main objective of this manuscript: report the first record of a black maned wolf.

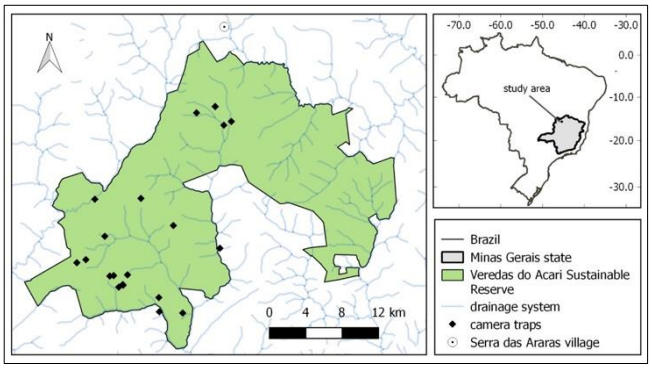

Figure 1. Camera trap sites surveyed at Veredas do Acari Sustainable Reserve, south-eastern Brazil. Inset shows study area location in northern Minas Gerais state, Brazil.

Ten species of medium- and large-sized mammals were recorded at VASR during the study (Table 1), including records of the unusually coloured maned wolf (Figure 2a, b). Maned wolves were recorded in 30 photographs, 25 in its common reddish colour (Figure 2c) and five in the previously unknown black phenotype (Figure 2a, b), which represents 16.6% of the species' photographic records. The species is frequently recorded in northern Minas Gerais (Fundação Pró-Natureza 2003; Ferreira et al. 2017), including a private reserve close to VASR (Ferreira and Oliveira 2014), and in other regions of the Cerrado (Rodden et al. 2004), but a black maned wolf had never been recorded before, either by camera trap or any other means. In the past, few reports of local people described the observation of a black maned wolf roaming in the region, but these reports were never confirmed. The black-coloured animal in the camera trap photographs has all the distinctive morphological characteristics of a typical maned wolf. However, its coat is very dark and relatively homogenously coloured, varying from dark brown to black, with the reddish colouration totally absent (Figure 2a, b). The white patch on the throat is also absent, although the tip of the tail is still white (Figure 2b). As in regular-coloured maned wolves (Figure 2c), the legs appear to be darker than the rest of the body. Interestingly, a similar colouration pattern is observed in maned wolf cubs during their first weeks: an entirely dark brown/blackish coat (Dietz 1985).

Table 1. Mammal species recorded using camera traps at Veredas do Acari Sustainable Reserve, south-eastern Brazil.

Scientific name	Common name
Pilosa	
Myrmecophaga tridactyla	Giant anteater
Carnivora	
Leopardus pardalis	Ocelot
Leopardus tigrinus	Oncilla
Puma concolor	Puma
Cerdocyon thous	Crab-eating fox
Chrysocyon brachyurus	Maned wolf
Perissodactyla	
Tapirus terrestris	Lowland tapir
Artiodactyla	
Pecari tajacu	Collared peccary
Mazama gouazoubira	Grey brocket deer
Ozotoceros bezoarticus	Pampas deer

Figure 2. Camera trap photographs of maned wolves with different coat colours at Veredas do Acari Sustainable Reserve, south-eastern Brazil. **a** and **b** records of a black maned wolf, in **b** it is possible to note a lighter-coloured patch in the tip of the tail; **c** regular-coloured maned wolf, highlighting the darker legs in relation to the body.

Camera trap records of the black-coloured maned wolf were obtained in five different sampling sites located in the central and south-western portions of the reserve, always at night time (or at least with minimal sunlight since the camera flash was triggered in all records). Consider-

ing the maximum distance between camera trap sites, the species' relatively large home-range (Jácomo et al. 2009) and the presence of a single animal in each photo, it is possible that all photographic records came from the same individual. Therefore, at this stage we cannot say that there was more than one black maned wolf living at VASR at the time of our survey. Records of regular-coloured and black animals in the same location happened in two camera trap sites, showing that both forms used the same area.

In spite of the large number of melanistic carnivore species, unusual black canid individuals are mostly from the *Canis* genus, such as wolf (Anderson et al. 2009), coyote (*Canis latrans* – Mowry and Edge 2014) and golden jackal (*C. aureus* – Ambarli and Bilgin 2013). For *C. lupus* and *C. latrans*, molecular evidence suggests the mutation for melanism occurred first in domestic dogs with later introgression to wild animals through hybridization (Anderson et al. 2009). This mutation happened possibly around 45,000 years ago (Anderson et al. 2009), millions of years after the divergence between maned wolf and grey wolf (Wang et al. 2004), indicating possible independent events of melanism mutations. Interestingly, independent melanism events have been confirmed in Felidae, with at least four independent genetic origins in this family (Eizirik et al. 2003). Due to the phylogenetic distance between *Canis lupus* and maned wolves (Wang et al. 2004; Prevosti 2010), a recent (<15,000ybp) mutation introgression from domestic dogs to the South American canid through hybridization is unlikely – and despite rumours, a hybrid between those two species has never been recorded. A more feasible explanation for the black coat in the maned wolf is an independent genetic mutation for melanism, which could, among other possibilities, involve a mutation that favours the retention of the cub colour in an adult individual.

Melanism clearly has adaptive value for some species. The appearance or proliferation of melanic forms of some insects since industrialization is probably one of the best examples of Darwinian evolution in the wild (Majerus and Mundi 2003). Correlations between coat pattern and habitat have also been observed for some mammals (Dice 1947; Hoekstra et al. 2005; Musiani et al. 2007), indicating that colouration has adaptive value by either decreasing the probability of being detected by predators or increasing predation efficiency. In felids, Eizirik et al. (2003) suggested that in certain ecological circumstances melanistic individuals may have an adaptive advantage over their regular-coloured conspecifics. For the black maned wolf however, it is unclear if the dark colouration has any adaptive value and we can only speculate the potential advantages of such colour.

The individual photographed is an adult and an apparently healthy specimen. Thus, the uniform black coat did not prevent it from achieving adulthood – though this observation does not prove that the survival rate of black maned wolves is similar to the regular coloured individuals. As roughly 50% of the maned wolf diet is composed of vertebrates, especially rodents, armadillos and terrestrial birds (Motta-Júnior et al. 1996; Jácomo et al. 2004; Rodrigues et al. 2007), hunting is an important activity in the species' life. The dark coat may give some advantage when hunting small prey at night, since against the dark background a darker maned wolf may appear more inconspicuous than a reddish one. Furthermore, in the same way as recently observed for oncilla *Leopardus tigrinus* (Graipel et al. 2014), melanistic maned wolves may be more active during bright nights than regular-coloured individuals. This would allow black individuals to have longer hunting periods, possibly giving them a slight competitive advantage. To a lesser extent, a black coat may also give adaptive advantage by helping avoid predation by the mostly nocturnal puma *Puma concolor*, which can prey on maned wolves in some circumstances (Dr. Flavio Henrique Guimarães Rodrigues, pers. comm.). However, predation is probably not a major evolutionary pressure for maned wolves. In any case, we must highlight that these are potential advantages only and we have no data to corroborate them at this point. In fact, the rarity of the black phenotype in maned wolves does not indicate that this form has a higher adaptive value than the typical reddish-coloured animal.

Understanding the evolutionary and ecological implications of the black colouration in maned wolves will only be possible through systematic ecological studies assessing the differences between the two phenotypes. Similarly, only the collection of samples from black maned wolves will elucidate the molecular bases and the mechanism responsible for the black phenotype in this Neotropical canid. We thus recommend VASR to be considered a priority site for future studies of maned wolf ecology and genetics, and suggest that this population should be regarded as extremely important for the genetic diversity of the species.

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