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Case Study:

Two Cases of Dead-Infant Carrying by Female Zanzibar Red Colobus (*Piliocolobus kirkii*) at Jozani-Chwaka Bay National Park, Zanzibar

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INTRODUCTION

In nonhuman primates, the death of conspecifics can elicit both behavioural and physiological responses (Engl *et al.* 2006; Anderson 2016; Watson & Matsuzawa 2018). Females in particular can display intensive caretaking and prolonged carrying of their deceased infants. The reasons this behaviour occurs and its taxonomic distribution are not well understood but a host of proximate and ultimate explanations are discussed within the growing field of primate thanatology – the study of death and the dying (Anderson 2010; Das *et al.* 2019; Gonçalves & Carvalho 2019).

In a recent review of cases of dead-infant carrying Gonçalves & Carvalho (2019) identified 110 cases in 34 species (or subspecies) (median = 2; range = 1 – 25 cases per taxon), with the two species contributing almost half of all cases being chimpanzees (*Pan troglodytes*, 25 cases) and gray langurs (*Semnopithecus entellus*, 23 cases). Only 3 cases are known for African colobines. Two in ursine colobus (*Colobus vellerosus*: Teichroeb & Sicotte 2008) and one in Ugandan red colobus (*Piliocolobus tephrosceles*: Struhsaker 2010). One argument that has been suggested to explain this paucity is that African colobines are especially arboreal and it may be relatively more difficult for them to carry a body, while also navigating the complexities of locomotion in the canopy (Struhsaker 2010). There are some indications, however, that the occurrence of dead-infant carrying in African colobines is likely an underestimate.

One observation comes from Kiwengwa, a forest reserve in the north of Zanzibar. There, a medium-

sized juvenile Zanzibar red colobus (*Piliocolobus kirkii*) was attacked and killed by three adult males from the same group. His mother was seen to make numerous and repeated, but unsuccessful attempts to drag him up a tree for more than 2 hours (Nowak 2007). This suggests that had she been able to, she probably would have carried the corpse. Dead-infant carrying in this species has also been reported by national park staff on at least one occasion at Jozani-Chwaka Bay National Park (Ali Kirenge, pers. comm., August 2018).

Here we provide new evidence of dead-infant carrying among Zanzibar red colobus that in one particular case continued for long enough that the carcass of the infant was mummified.

METHODS

Observations took place at Jozani-Chwaka Bay National Park (JCBNP), Zanzibar, the stronghold of the endemic Zanzibar red colobus, and in the adjacent agricultural matrix on the south-eastern edge of the national park, which also supports multiple colobus social groups (Davenport *et al.* 2017). A detailed description of this study site is presented in Siex and Struhsaker (1999). Since July 2018 members of the Zanzibar Red Colobus Project (<https://www.zanzibarredcolobusproject.org>) have been monitoring several groups of red colobus in this area. The first observation of dead-infant carrying occurred in one of our main study groups, the ATG group. At the time this group consisted of 2 adult males, 8 adult females and 3 immatures. The



Figure 1. Female Zanzibar red colobus (*Piliocolobus kirkii*) carrying the mummified remains of an infant (presumably her own) at Jozani-Chwaka Bay National Park, Zanzibar (29 August 2018). Photographs by A. Georgiev.

group's range was situated entirely in the agricultural matrix (farmland, interspersed with fallow land and groves of fruit crop trees). The second observation took place in an unfamiliar group encountered within the interior of the national park. While no information on the ranging area of this group is available, the location of the encounter suggests that it was likely situated within the ground-water forest and mahogany strands portions of JCBNP.

Observations of the first case (supported with a low-resolution mobile phone photo of the mother holding the dead infant) were made by AK and were described orally to AG and AW; observations of the second case were made by all authors. From the moment the female with the dead infant was spotted she was monitored continuously for as long as she remained in sight.

RESULTS

Case 1. On 31st July 2018, in the agricultural areas to the south-east of JCBNP, ATG group was attacked by two dogs from a nearby village. The dogs killed an infant (<3 months old, judging by the black natal coat colour) and an adult male. After AK chased away the dogs, the mother of the infant picked up the dead body and carried it for two days, at times holding it across her lap. In August, following this incident, individuals from the ATG group became noticeably weary when coming down from the trees and stayed only briefly on the ground,

often grabbing terrestrial herbaceous vegetation and rapidly climbing into the trees.

Case 2. On 29th August 2018 in the main section of JCBNP tall-canopy ground-water forest, we came across an unknown group of red colobus. We spotted an adult female carrying the mummified remains of an infant. Judging by the stage of mummification (very dark skin, stretched and dry, flaying in parts, parts of the skeleton visible through the thin skin; the overall shape of the body distorted), the corpse may have been at least 2 weeks old (Figure 1). The female remained with the group and continued to perform normal behaviours such as feeding, self-directed scratching and resting. While moving between trees, she carried the infant in her left hand. While resting she either held it in her left hand or laid it across her legs in order to use both of her hands. The presumed mother was observed investigating the corpse by sniffing it and moving its limbs. She groomed it and swatted flies away from it on multiple occasions. The rest of the group did not show obvious signs of aversion or avoidance, nor did they interact with the mother or the dead infant. On the morning of the 30th August 2018 we lost track of the female in the dense canopy. Observations in the group continued until late afternoon but a female carrying a dead infant was not seen again. She therefore either split from the group (one of the two males seen earlier was also not seen later) or had dropped her infant, making her difficult to identify among all other females in this unfamiliar group.

DISCUSSION

Dead-infant carrying in African colobines has only rarely been documented (Teichroeb & Sicotte 2008; Struhsaker 2010). The two new cases reported here, for the Zanzibar red colobus (ZRC), confirm previous unpublished observations (Ali Kirenge, pers. comm., August 2018) and expand the list of species in which this behaviour has been documented.

The second case we report on also adds to a small subset of dead-infant carrying events, in which females carried the corpses of deceased infants long enough for those to become mummified. Most known cases of dead-infant carrying in primates conclude over the course of a few days and prolonged carrying is rare. Three such observations come from chimpanzees: mothers carried infant corpses for 19, ≥ 27 , and 68 days and in all three cases the infant corpses underwent complete mummification (Matsuzawa 1997; Biro *et al.* 2010). In geladas (*Theropithecus gelada*), over an almost 4-year study 14 females were seen to carry dead infants between 1 h and ≥ 48 days post-mortem (Fashing *et al.* 2010). Most of these episodes were over by the 4th day post-mortem but in three cases they continued to mummification and lasted for 13 days, ≥ 16 days, and ≥ 48 days. A report on a captive Tonkean macaque (*Macaca tonkeana*) suggested that the preservation of the body's shape via mummification may have contributed to the prolonged display of maternal behaviours (Marco *et al.* 2018). The observation of prolonged dead-infant carrying reported here is unusual given that ZRC, unlike geladas, chimpanzees and captive macaques, are a highly arboreal species.

One commonality among the cases of extended carrying (≥ 10 days) of dead infants in the wild has been suggested to be the extreme climate of the environment, either cold (e.g., mountain gorillas, Japanese macaques) or arid (geladas, chimpanzees), potentially slowing down decomposition and aiding mummification (Fashing *et al.* 2010). While Jozani experiences two seasons of heavy rain, our observations of a mummified infant took place during the long dry season, similarly to the chimpanzee cases at Bossou (Matsuzawa 1997; Biro *et al.* 2010).

These two cases are too few to allow us to speculate on the proximate or functional explanations for dead-infant carrying in this species, or on the implications for inferring death-awareness in the ZRC. Nevertheless, they do contribute to the growing literature on thanatology in nonhuman

primates, demonstrating the widespread occurrence of such behaviours across taxa.

Finally, the observation of dogs killing two members of our study group highlights the fact that like in other primates in a similar anthropogenic context (Waters *et al.* 2017), the ZRC may experience a greater nonhuman predation risk that the absence of natural predators in their habitat may lead us to believe.

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