

SHORT ARTICLES

ATTACK OF AN INFANT BY A FEMALE IN A TROOP OF HOWLER MONKEYS (*ALOUATTA PIGRA*)

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Introduction

Within the New World primate family of Atelidae, infanticidal attacks are most commonly reported in howler monkeys (*Alouatta* spp., Crockett, 2003; Knopff et al., 2004; Aguiar et al., 2005; Agoramoorthy and Rudran, 2009; Van Belle et al., 2010; Pavé et al., 2012). The howler monkey species that have been observed to exhibit this behaviour are black and gold howler monkeys (*Alouatta caraya*, Crockett, 2003; Pavé et al., 2012); Colombian red howler monkeys (*A. seniculus*, Agoramoorthy and Rudran, 1995; Beltrán and Stevenson, 2012); mantled howler monkeys (*A. palliata*, Crockett, 2003); brown howler monkeys (Martins et al., 2015); and Yucatán black howler monkeys (*A. pigra*, Crockett, 2003; Van Belle et al., 2010). In these documented attacks there is a lack of detail regarding the involvement of females, as the male is usually identified as the aggressor. These attacks are likely to occur following the immigration of a new male to a troop (Van Belle et al., 2010; Beltrán and Stevenson, 2012), up to five months after taking over a troop (Agoramoorthy and Rudran, 2009). A majority of infanticidal attacks in howler monkeys involve assumed unrelated assailant and victim, therefore these instances align with the sexual selection hypothesis (Hrdy, 1979).

Female howler monkeys do engage in agonistic behaviours and female-female aggression that can lead to emigrations, consequently influencing the female composition of troops. This behaviour has been observed in black and gold howler monkeys (Calegaro-Marques and Bicca-Marques, 1996; Giudice, 1997), Yucatán black howler monkeys (Brockett et al., 2000) and Colombian red howler monkeys (Pope, 2000). It has been reported in the red howlers that this behaviour resulted in a mother sustaining an injury while caring for her infant (Crockett, 1984).

Here we report an observation of an attack by a wild born female Yucatán black howler monkey on an unrelated female and her infant, recently immigrated to the troop.

Methods

Extirpation of howler monkeys in North-eastern Belize occurred approximately 70 years ago (Tricone, 2018). The local NGO and conservation organisation Wildtracks

has been reintroducing Yucatán black howler monkeys into protected areas of Northern Belize since June 2011. Wildtracks reports a first-year post release survival rate of 95% and a survival rate of 70% after one year since reintroduction (Wildtracks, 2014; Tricone, 2018). These reintroductions are made up of howler monkeys confiscated from the illegal pet trade and translocations of monkeys that have been isolated by the increase of forest clearance and fragmentation elsewhere in northern and central Belize. Wildtracks has released a total of 28 howler monkeys between 2011-2014 (Tricone, 2018), and at least eight per annum during 2015, 2016 and 2017. These reintroduced howler monkeys began to reproduce in 2014 (Wildtracks, 2014). We conducted behavioural data collection on a troop of Yucatán black howler monkeys in the Northern Biological Corridor (11,000 ha) in northern Belize between 28th June and 15th July 2019. The troop consisted of one adult male, two adult females, and an approximately 6-week-old male infant. The male, and the female with the infant (hereafter referred to as the mother), were translocated wild howler monkeys that had been released on separate occasions by Wildtracks. The second female (hereafter simply referred to as the female) is believed to be a first generation wild-born individual from various howler monkeys released by Wildtracks. We identified monkeys by anogenital characteristics and pigmentation (Horwich, 1983a; Van Belle et al., 2010; Tricone, 2018).

Results

We recorded behavioural data on this troop on the 29th June 2019, with the male as our focal individual from 07:47. The male rested from 07:47 to 08:30 in a guanacaste tree (*Enterolobium cyclocarpum*) before feeding on leaves of guanacaste and ramon (*Brosimum alicastrum*) as well as fig fruit (*Ficus* spp.). Resting resumed from 09:30 to approximately 11:30, with the whole troop resting in the same fig tree. At approximately 11:30 the male approached the mother who was carrying the infant ventrally, and engaged in 'sexual following' behaviour, which involved continual following of the mother, resting near her, and resting his head near her ano-genital region. After a few minutes the mother then moved away from the male, in a seemingly calm manner. The male continued sexual following behaviour of the mother, who repeatedly moved away (but remained in the same fig tree), after which the male began displaying tongue flick sexual behaviour. These patterns of behaviour were repeated by the male and mother in the same seemingly relaxed manner until 12:36, when the mother moved away from the male in an increasingly hurried manner as he approached her. At 12:49 the other adult female, who had been resting in the same fig tree, became active and engaged together with the male in pursuing the mother. Both the female and the male engaged in an aggressive display of branch shaking aimed towards the mother. At 13:00,

the mother began moving faster and jumping to other trees, and the infant (still being carried by the mother) began distress vocalisations while the female and male continued pursuit. After moving approximately 25 m from the fig tree, the mother turned and took an alternate route back to the same tree, evading the male and female who continued their hurried pursuit. From the fig tree, the mother moved approximately 15 m in another direction before the female caught up. The female pulled the infant from the mother, bit his left arm, and dropped the infant. The infant fell from the canopy to the forest floor from a height of approximately 15 m. The mother continued climbing through the canopy away from the crying infant, being pursued by both the female and the male. The infant remained ignored on the floor until retrieved by the tracking crew and transported to Wildtracks for veterinary treatment.

The infant suffered a complete break of his left humerus, with a slanting puncture wound from the bite and is currently undergoing rehabilitation at Wildtracks for eventual release. During the remaining time we spent tracking the troop, the mother remained with the male and female that had previously attacked her. No additional aggressive behaviours were observed during this period. We observed affiliative behaviours between all three, but no instances of copulation were observed.

Discussion

We report on an attack of an infant howler monkey by an unrelated female and the sequence of events that appear to be initiated by an attempted mating of the mother as evidenced by the male's display of sexual following and tongue flick sexual behaviour (Horwich, 1983b). During an attempted infanticide in a troop of Colombian red howler monkeys, a male went to attack an immigrant female's offspring and resident females acted in the mother's defence (Palacios, 2000). In contrast to this previously reported defensive behaviour in unrelated females, we observed the opposite.

The mother was not observed with this troop prior to this study and had been observed as still being with her original release troop in early 2019. Based on the average gestation period of howler monkeys being 180-190 days, and sightings of the mother with her original release troop, it seems highly likely that the mother was a relatively recent immigrant to the troop. Therefore, it is highly doubtful that the infant was related to the male attacker. For this reason, it appears that the male's aggression could be explained by the sexual selection hypothesis (Hrady, 1979). It is also possible that the male's aggression was a result of raised stress level induced by a failed mating attempt. In addition, the aggression displayed by the female has contributed to increasing her reproductive success (in comparison to the mother's)

aligning the female's motives with the sexual selection hypothesis.

Considering the continued pursuit of the mother by the female, this appears to be an act of female-female aggression, in which the infant got hurt. Although female-female aggression in howler monkeys is thought to facilitate emigration (Brockett et al., 2000), this was not observed for the duration of our study period, but may have occurred after the study.

The resource competition hypothesis suggests that the likelihood of infanticidal attacks carried out by males or females is equal (Hrady, 1979; Crockett, 2003). If food resources are limited, it has been hypothesised that to increase reproductive success, female howler monkeys could kill offspring of unrelated females (Crockett, 2003). Food resources did not appear limited, as there was an abundance of fruiting fig trees in the study area and howler monkeys rarely deplete feeding patches (Righini et al., 2020). In addition, the troop remained in this area for at least an additional 16 days after the attack, suggesting that food resources were not limited.

The female's motivations may be holistically supported by multiple hypotheses, as attacking the mother and her unrelated infant could benefit the female in different ways. In comparison to the attacked mother, the female's reproductive success has increased due to the attack, aligning with the sexual selection hypothesis (Hrady, 1979). Resource competition would decrease with emigration of the mother, aligning with the resource competition hypothesis (Hrady, 1979). Although we did not observe emigration of the mother, it may have been a motive for the attack, so that the female would have had increased access to the male or decreased resource competition.

The social pathology hypothesis suggests that social crowding and increased levels of human harassment are causes of infanticide in Hanuman langurs (*Presbytis entellus*, Boggess, 1984). The nonadaptive hypothesis of social pathology has been suggested but not confirmed as a cause of infanticide in howler monkeys (Knopff et al., 2004). Social crowding in a small home range (potentially due to surrounding conspecifics) may lend support to this hypothesis. Despite the howler monkeys in our study being habituated and previously tracked without incidence, it could be suggested that the nearby presence of humans caused increased stress levels. This, in combination with potential social crowding provides support towards the social pathology hypothesis as potential motive for the aggressive behaviour towards the mother and infant demonstrated by the female.

Understanding demographic trends such as infant mortality of endangered species like the Yucatán black howler

monkey can be critical for appropriately planning and implementing conservation strategies.

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