

Brief Communication:

An Infanticide Attempt After Male Takeover in Diana Monkeys (*Cercopithecus diana diana*) in Taï, Côte d'Ivoire

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INTRODUCTION

The killing of infants by conspecific males has been directly observed in 35 species of wild primates and its occurrence has been inferred in an additional 16 species (Palombit 2012). A meta-analysis of observed and suspected infanticide revealed that: infanticidal males tended to be related distantly, if at all, to infants they attacked; females who lost infants to infanticide tended to resume ovarian cycling quickly after the infant loss; and males who attempted infanticide were more likely to have sexual access to females than males who do not (van Schaik 2000). Several competing hypotheses attempt to explain the occurrence of infanticide in primate taxa.

Sarah Blaffer Hrdy (1974, 1994) proposed that infanticide is an adaptive, sexually selected strategy for infanticidal males. By killing the unweaned offspring of rival males, infanticidal males bring about the premature end of lactational amenorrhea and resumption females' estrous cycles. Other researchers contend that infanticide is an unnatural behavior, a social pathology resulting from overcrowding and anthropogenic habitat disturbance (Curtin & Dolhinow 1978). A third hypothesis suggests that infanticide is a byproduct of generalized aggression following male transfer and/or male acquisition of higher dominance status: infant death in these cases is a side effect of male aggression (Bartlett *et al.* 1993; Sussman *et al.* 1994).

Here, we report an attempted infanticide following the replacement of the resident adult male in a group of free ranging Diana monkeys



Figure 1. An adult female Diana monkey in Taï National Park. Photograph by E. Kane.

(*Cercopithecus diana*) in Taï National Park (Figure 1), Côte d'Ivoire and assess which hypothesis best explains this observation.

METHODS

The incident occurred in the study grid of the Taï Monkey Project, an approximately 1 km² area of evergreen rain forest on the western border of Taï National Park. Taï National Park in Southwestern

Côte d'Ivoire is the largest remaining intact segment of the Upper Guinea Forest in West Africa. It is primarily composed of 330,000 ha of protected primary moist evergreen rainforest, with a 20,000 ha buffer zone surrounding the park's boundary. At the study site of the Taï Monkey Project, seven species of monkey are habituated and have been under regular observation since 1989, including Diana monkeys, who live in single male groups and exhibit female philopatry (Buzzard & Eckardt 2007). The primate community in Taï also includes several prosimians, an additional monkey species rarely found in the study grid (spot-nosed monkey, *C. nictitans*), and the Western subspecies of chimpanzee (*Pan troglodytes verus*) (McGraw *et al.* 2007).

Observations reported here were made by the authors using *ad libitum* notes (Altmann 1974) in the course of all-day follows of habituated Diana monkey (*Cercopithecus diana diana*) groups during which routine feeding data were being collected. This group has been under regular study since 1989, and all adults are individually recognized. F. Gnépa has been the primary observer of this group since January 2010; E. Kane began following this study group in June 2013. At the time of these observations, the group consisted of one adult male (Fred), eight adult females, two subadult females, and several juveniles of unknown sex. Following these observations, Fred disappeared and the new male whose behavior is reported here remained in the group as the resident male.

RESULTS

We began our week of daily follows on October 13, 2013, and that day recorded the presence of the group's resident male, Fred, all adult females, subadults, and juveniles. We observed no infants in the group on October 13 or on any day prior. Our final scan sample at 18:00 on the evening of October 13 is the last time we observed Fred in the group. Heavy rainfall on October 14, 2013, prevented data collection during that day. On October 15, we arrived at the group's sleeping tree at 07:00 and found group members either resting or foraging on insects in the upper canopy. The group was in a polyspecific association with three other taxa: *Ptilocolobus badius*, *Procolobus verus*, and *Cercopithecus campbelli*.

At approximately 07:15, we observed that an adult female (Melo) had an infant clinging to her ventrum; we suspect this infant was born between October 14 and 15 since no infants were observed

with the group prior to October 13. At 07:35, the group began vocalizing with females emitting high-pitched alarm calls. At 07:38, an adult male in the upper canopy chased several adult females (including Melo), and a subadult female. At 07:41, the male lunged at Melo, and the infant fell from her ventrum about 15 m to the ground. The infant immediately started screaming, and most of the adult females in the group gathered in the canopy directly above the infant, staring down at it and making contact calls. Melo attempted to climb down to the ground at 07:46 and 07:54, but on both occasions, the adult male chased her into the upper canopy. At this point, we recognized that this was not the resident male (Fred), but a different male whose tail was bleeding and broken at the tip.

At 08:06, an adult female who is frequently in proximity to Melo climbed down towards the baby, but the new male lunged at her with bared teeth and she climbed back up to the understory. She descended to the ground a second time at 08:14 and briefly touched the baby with her hand, but almost immediately climbed back up to the main canopy. Adult females who had been vocalizing with contact calls stopped calling and climbed up to the main canopy. The infant, still on the ground, continued screaming.

At 08:16, a solitary adult male chimpanzee appeared about 5 meters from the infant. He was not calling or buttress drumming, and the Diana monkeys made no alarm calls before his approach. He approached the infant and picked it up by the ankle, running and dragging it behind him for about 40 meters before throwing it against the trunk of a *Piptadenastrium africanum* tree and running away from the group. At 08:25, the infant started screaming again. At 8:29, Melo descended to the ground and picked up the baby, who immediately started nursing. Melo was peripheral to the group for the rest of the day, and we did not observe her interacting with the strange adult male. Several other adult females chased this new adult male twice during the day but we observed no further physical contact. We left the group at 18:05.

Our next contact with the group was at 06:45 the morning of October 16. Our first observation of Melo was at 07:30, and we did not observe her, or any other female, carrying an infant. We did not see the infant after October 15. No other infants were born in this group in 2013, although two infants were born in an adjacent group during October 2013, both of whom survived at least through August 2015. Melo gave birth to an infant in October 2014 who was still alive as of January 2016. As of this writing, the adult

male first seen in the study group on October 15 is the sole adult male in the group, and Fred has not been observed in this or any adjacent Diana monkey group.

DISCUSSION

We attribute the disappearance of Melo's infant to death from the combined effects of (1) the new male's attack, (2) the subsequent fall to the forest floor, and (3) injuries sustained after the chimpanzee threw it against a tree. Although it is not clear whether the infant would have died from the initial attack and fall without the additional trauma caused by the chimpanzee, we strongly suspect that this was the result of attempted infanticide rather than a chimpanzee hunt. Chimpanzees at Tai very rarely successfully hunt Diana monkeys (2% of hunts, 4% of successful captures) and when they do hunt, it is generally a social activity; in this case, the chimpanzee was solitary and did not eat the infant (Boesch & Boesch 1989).

These observations are inconsistent with the social pathology hypothesis, which attributes aggression and infanticide to artificially high population densities and the effects of anthropogenic disturbance (Curtin & Dolhinow 1978). The study group's home range is in an undisturbed patch of primary forest with no signs of anthropogenic disturbance, and no behaviors indicative of poaching pressure (Koné & Refisch 2007). Population density in this area is low, with 2-3 groups per square kilometer (Buzzard & Eckardt 2007; Kane, unpublished data), and inter- and intragroup aggression are rare: 1 aggressive intergroup encounter occurs approximately every 9 days, and 1.4% of behaviors recorded during scan samples were aggressive intergroup interactions (Buzzard & Eckardt 2007; Kane, unpublished data).

Our observations are consistent with both the generalized aggression and sexual selection hypotheses. The generalized aggression hypothesis predicts that infanticide occurs as a byproduct of generally elevated rates of aggression coincident with male takeovers or shifts in the dominance hierarchy (Bartlett *et al.* 1993), and indeed this infant death occurred in the context of aggression towards several females immediately following a male takeover. The sexual selection hypothesis suggests that infanticide is an adaptive behavior for males who kill unweaned infants and bring their mothers into estrus earlier than if the babies had survived. This attempted infanticide occurred – at most – within 24 hours of the disappearance of the resident male and group

takeover by a new male, and the infant who died was almost certainly the offspring of the former resident male.

Although we did not observe Melo mating with the new male over the next five months, she gave birth to an infant the following year (2014) who was still alive as of January 2016. Diana monkeys, like most guenons, are seasonal breeders, and typically have an approximately two-year interbirth interval (Butynski 1988; Cords 1988; Kane, unpublished data). Melo's interbirth interval was shortened by the loss of her infant, which ended lactational amenorrhea and restarted her estrous cycles. Consequently, she and the new male reproduced sooner than they would have if the infant had survived.

To our knowledge, this is the first description of attempted infanticide in *Cercopithecus diana*. With these observations, we add to the list of species known to, or strongly suspected to, commit infanticide in the wild, including three other forest guenons (*Cercopithecus ascanius*: Struhsaker 1977; *Cercopithecus campbelli*: Galat-Luong & Galat 1979; *Cercopithecus mitis*: Butynski 1982, Fairgrieve 1995, Cords & Fuller 2010). Our observations provide limited support for the assertion that infanticide may be an adaptive strategy for male primates even in seasonally breeding taxa, who increase their reproductive success by shortening females' interbirth intervals. While we can reject the social pathology hypothesis, our observations support both the generalized aggression and sexual selection hypotheses for infanticide.

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