Elephant death, possibly by constipation

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Elephants are generalist herbivores with a prolific consumption rate of approximately 4% to 7% of body weight per day (Laws et al. 1970; Ruggiero 1992). They are relatively inefficient in digesting, processing approximately only 40% of the consumed forage (Poole 1996). Hence, their faeces are a rich source of nutrients for other organisms (Laws et al. 1970) and they serve as dispersers of seeds for numerous plants (Dudley 1999). The forage they select is influenced by many factors including age, sex, habitat and season (Stokke 1999; Stokke and du Toit 2000). Social and associative learning may play a role in choice of plant species as young elephants commonly forage in family groups (Stokke 1999). Such learning reduces the likelihood that an individual elephant will ingest large quantities of a toxic or highly indigestible plant (Mubalama and Sikubwabo 2002; Osborn 2002). However, availability of forage may limit choice in diet, such as during drought or after fire. Mistakes in foraging decisions can be costly. As part of our ongoing study of elephant behaviour in Tanzania, we documented an instance of what was probably the ultimate costly mistake of a young male African elephant.

At Ndarakwai Ranch in Tanzania, we regularly observe elephants from an elevated platform located near a waterhole. We age elephants based on size as described by Moss (1996). From this vantage point on 21 December 2004, one of us (DV) noticed an elephant that showed signs of an ailment. An eight- to nine-year-old juvenile male (subsequently named Kwama, which means 'to be stuck' in Kiswahili), a calf and an adult female approached a waterhole we used for focal animal observations. The observer was interested in collecting fresh boluses of faecal material and noticed at 1545 that the juvenile male Kwama was defecating. A defecating elephant will raise its tail and the exiting bolus will be seen protruding from the anus. Kwama was seen rubbing his rear against a tree stump as two juveniles from another group approached to within 20 m and sniffed in his direction. The two juveniles departed without further investigations. Visibility was obscured by vegetation as Kwama moved away from the waterhole.

At 1636, Kwama returned to the waterhole, following the same calf and adult female. A bolus was seen protruding from his anus, just as it was earlier. Although his behaviour was not quantified, his actions did not seem odd nor in any way did he draw particular attention from the observer. Kwama did not appear to be uncomfortable or irritated and his physical appearance of skin tone, shape and height and his movements were similar to those of other juvenile males in his age range. He was seen drinking and interacting with the calf, and at 1647, the trio departed.

Subsequent encounters with Kwama showed that his behaviour had altered and his appearance changed. Elephant family units, at minimum, may include an adult female with her offspring (Moss 1983). The presence of Kwama with the two other elephants indicated a potential family unit. Kwama was seen again by the same observer four days later, on the morning of 25 December 2004. This time he was alone, but still had the half-protruded bolus. Although it is not unusual for males of Kwama's age to separate from their natal group, the sustained presence of the bolus was highly abnormal. Apparently, Kwama was constipated that is, the bolus was 'stuck'. During a 20-minute animal observation that began at 1029, it was evident that his behaviour was deviant from conspecifics of similar age and sex noted from observations at the waterhole.

Compared with other juvenile elephants, Kwama displayed lower levels of common state behaviour such as walking and eating, yet he spent a large portion of his time apparently seeking relief from constipation (table 1). Kwama displayed no bouts of eating and spent only 6 seconds drinking while other

juvenile elephants ate for about half a minute and drank for several minutes. Kwama walked very little. He spent much of the observation period motionless on his side in the mud (8.5 min., table 1), while other juveniles almost never did this. In fact, the longest any other juvenile was observed motionless on its side in the mud was 44 seconds. Kwama also wallowed in mud and rubbed his rear for longer periods than other juvenile elephants, yet he did not perform any mudding bouts. Mudding occurs when elephants use their trunks to disperse mud over the face and body. Other juveniles spent about 70 seconds mudding over the 20-minute observation period. His duration for each of these particular activities was quite different from data acquired from both male and female juveniles or for male juveniles only (table 1).

The short duration of maintenance activities such as eating and drinking and the longer periods of stationary behaviour suggest that Kwama's disorder impaired him from pursuing these activities. Constipation also may have attributed to his solitary status on 25 December 2004. His elevated durations of wallowing and lying in the mud and of rubbing his hind end on substrates indicate that he was trying to rid himself of the bolus. His speed of locomotion during his departure at 1049 from the waterhole was slow and punctuated with bouts of rubbing his anus against trees. In between bouts of rubbing, he would stand with his hind legs spread apart and stay motionless, in a posture indicating tenesmus (fig. 1). Kwama entered a wooded area approximately 100 metres away at 1108 as an adult male approached the waterhole. Attention was diverted from Kwama as observation was focused on the adult male.

Kwama's spoor was followed by the observer and he was found at 1337 rubbing his hind end against an acacia tree. The observer got to within 10 metres and was able to get the first close-up sighting of the bolus. Its coloration resembled elephant faecal material that was several days old. The skin around the protruding bolus appeared stretched and the enclosed portion of the bolus appeared to have a larger diameter than the exposed half (fig. 1). He continued to move slowly but ate grass while walking. During the following days, several sightings of Kwama were reported by staff members and his condition was said to be poor. He was always alone and people could approach to an arm's length with no display of aggression from him. On 3 January 2005, Kwama was found dead with the bolus protruding from his anus; he had been constipated for at least 13 days.

The carcass was in rigor mortis during investigation, indicating that death had occurred in the previous 24 hours. The length of the tusks (33 cm) and length of the hind foot (30 cm) confirmed the age at 8–10 years (Lee and Moss 1995; Moss 1996). There was discoloration in the skin around the anus, which was bulging with faeces. A staff member who volunteered to dissect the anus pulled out several metres of coarse, fibrous faeces (fig. 2). Small, sharp points that resembled thorns were found in the faeces and another staff member recognized these points as features of the sisal plant *Agave sisalam*. The fleshy stems of sisal are often used to manufacture twine for rope; the stems end in sharp points. Sisal is distributed in small patches at Ndarakwai and is not restricted to a specific area. Although Kwama was not witnessed eating sisal, elephants were the only species seen to eat the fleshy sisal stems. Compared with other types of vegetation, qualitative visual censuses indicated that sisal plants exhibited the least amount of browse damage such as chewed stems. This perhaps indicates that this plant is not included in the diet of many herbivores. The vegetation Kwama consumed was in abundance and had also been browsed by other elephants.

It is conceivable that the sisal Kwama ate formed one long, continuous cable-like segment that may have stretched from intes-

Table 1. Comparison of activity (number of times per minute) for the constipated juvenile male elephant, Kwama, based on observation of male and female juvenile elephants (n = 17, 20-minute focus each) and of just male juvenile elephants (n = 8 except for wallow where n = 1). Values are mean ± SE per minute

Activity	Elephant juveniles		
	Kwama	Male and female	Male
Eating	0	0.37 ± 0.22	0.8 ± 0.45
Drinking	0.10	2.2 ± 0.59	2.7 ± 1.08
Walking	0.32	1.75 ± 0.39	2.0 ± 0.78
Reclining on side	8.50	0.09 ± 0.05	0
Mudding	0	1.2 ± 0.35	0.5 ± 0.32
Rubbing	1.15	0.15 ± 0.10	0.21 ± 0.19
Wallowing	1.75	0.25 ± 0.13	0.16

tines to rectum. Occurrences of faecal matter measuring two-thirds of a metre and weighing close to 10 kg have been encountered by the observer (DV). These types of faeces are held together via long, fibrous material, similar to that found inside Kwama, and it is difficult to separate it into sections. The bulging nature of the anus may have been the result of an enormous bolus with a diameter larger that of the anus. Kwama's tendency to soak in the mud and rub on trees may have been attempts to eject the faeces. His continued consumption of fibrous grass may have worsened his condition. Ingestion of foreign matter can cause serious problems for wildlife. However, there were no foreign objects in the faecal matter such as plastic bags that might have contributed to the constipation.

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Figure 1. Juvenile elephant Kwama leaning forward with his hind legs spread in an apparent attempt to discharge the faeces, Ndarakwai Ranch, Tanzania.

Observations were not made about the dentition, but dental problems may have affected mastication, leading to subsequent problems down the alimentary system. Poor mastication of the sharp tips of the sisal stems may have contributed to the impaction of faecal matter. Based on our observations and limited necropsy, the most probable contribution to mortality would be related to the poorly digested, lengthy components of the sisal plant and the likely concomitant problems with nutrient uptake, although other factors such as infection cannot be ruled out.

The incidence of constipation is probably low in wild elephants and other animals, but the selection of forage is certainly an important aspect of their behaviour ecology. Some species may practise self-medication to relieve ailments (Wrangham 1995; Lozano 1998). We have no evidence for or against such a practice in the case of Kwama. In social species, individuals may attempt to assist conspecifics in distress. For example, elephants have been observed to help calves out of mud holes. We saw no other elephants interacting with Kwama that indicated they recognized the problem or attempted to remove the bolus using their trunk. While numerous studies have examined the foraging ecology of elephants (for example, Stokke 1999; Stokke and du Toit 2000; and references therein), few have targeted the relationship between plant defences and species selection (Osborn 2002), especially over the course of development. The developmental process by which a generalist herbivore incorporates species into the diet would be worthy of further study.

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Figure 2. Long fibrous strands of sisal *Agave sisalam,* dissected from the anus of Kwama, that may have affected the blockage of faeces.

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