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Strychnine poisoning in African wild dogs (*Lycaon pictus*) in the Loliondo game controlled area, Tanzania

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The retaliatory persecution of large carnivores is a worldwide conservation concern. We report a case of malicious strychnine poisoning of African wild dogs (*Lycaon pictus*) in the Loliondo Game Controlled Area (LGCA), Tanzania. Eight out of ten individuals (80%) in one of our study packs were poisoned in retaliation for a livestock attack. Samples were collected from the internal organs for toxicological analysis. The results revealed that strychnine poison was the sole cause of the wild dogs' deaths. We discuss the conservation implications and suggest that more effort is required to create balanced mitigation strategies for sustainable conservation of the species.

Key words: *Lycaon pictus*, *poisoning*, *livestock predation*, Loliondo game controlled area.

INTRODUCTION

In Africa, large carnivores present enormous challenges to conservation (Ray et al., 2005; Woodroffe et al., 2005). Species including cheetahs (*Acinonyx jubatus*), wild dogs (*Lycaon pictus*), Ethiopian wolves (*Canis simensis*) and lions (*Panthera leo*) have all been impacted by external threats (Dutson and Sillero-Zubiri, 2005; Goller et al., 2010; IUCN/SSC, 2008; Kissui, 2008; Somers et al., 2008; Woodroffe et al., 2004). Species with large home ranges tend to suffer more from fragmented habitats because their ranging behaviour takes them beyond the boundaries of isolated habitat patches into matrix habitats, which are often unsuitable or even hostile (Woodroffe, 2010). As habitats are increasingly becoming fragmented, species such as African wild dogs are more and more exposed to accidental snaring, retaliation killing by poisoning or spearing, road accidents and diseases contracted from domestic dogs (Cleaveland et al., 2000; Masenga, 2011; Woodroffe et al., 2007). Some wild dogs have extensive home range (>800 km^2) increases their risk of encountering human activities and, hence, appears to elevate their vulnerability to local extinction (Woodroffe, 2010). African wild dogs cooperate in hunting their prey which consists mainly of medium-sized ungulates particularly impala (*Aepyceros melampus*) but may range in size from hares (*Lepus* spp) and dik diks (*Madoqua* spp) to kudu (*Tragelaphus strepsiceros*) and even, occasionally, eland (*Taurotragus oryx*) (Van Dyk and Slotow, 2003; Woodroffe et al., 2007). Wild dog can attack the livestock whenever came across with them that resulted into conflict with farmers (Woodroffe et al., 2005). Although, some carnivore deaths occur naturally, a significant proportion involves deliberate killing by

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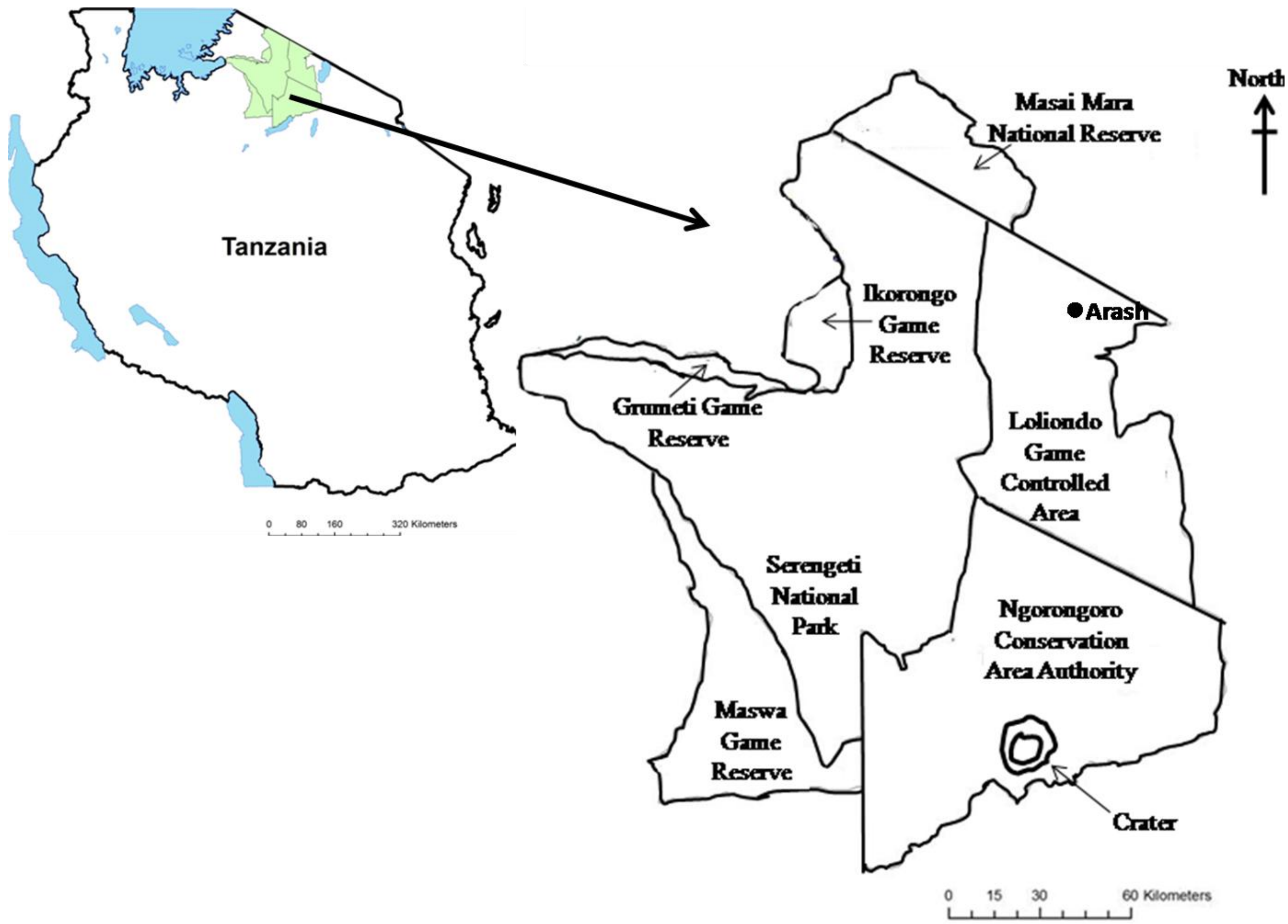

Figure 1. Map of the Serengeti ecosystem including the Loliondo game controlled area and Arash village.

people as a means of revenge for livestock attacks.

Strychnine is a highly poisonous substance that is used to control problem animals worldwide, particularly crop harvest pests such as rats, house mice and ground squirrels but also a variety of birds and mammals (Cheney et al., 1987; Hudson et al., 1984). It is a highly toxic compound, and its use has been restricted by laws in most countries (Wamock and Schwarzbach, 1995). The mode of action of strychnine toxicity is well known (Cheney et al., 1987). Once absorbed, strychnine enters the blood stream and acts on the central nervous system, affecting the transmission of nerve impulses (Apa et al., 1991), with the poisoned individual succumbing due to excessive salivation, ataxia and severe tetanic convulsions followed by death within a short time (Fazekas et al., 2008). Currently, the use of poisoned baits as a means of killing wild carnivores in Tanzania is increasing within and around protected areas (Kideghesho, 2008). The Loliondo Game Controlled Area (Figure 1) varies in terms of habitats as from grass plains to forest. However, there are mountain forests classified as closed evergreen forests, which contain major tree species such as *Fagaropsis anglolensis* (Olmoljoi), *Olea welwitschii* (Ololiondo), *Juniperus procera* (Oltarakwa).

Acacia species are dominant in open scattered valley forests (Ojalamini, 2006). Here, we report a case of strychnine poisoning in the Loliondo game controlled area (LGCA) and the implications for conservation.

MATERIALS AND METHODS

Case report

On 21 April 2011, it was reported that individuals in a pack of ten wild dogs were dying from unknown causes. A team of researchers and wildlife veterinarians immediately followed up with the case at Arash village in the LGCA where the incident occurred. Both dead and living wild dogs were found. The live animals were observed to be ataxic and falling over with convulsions when trying to move; in the end, a total of eight wild dogs died. Two individuals survived and moved away from the dead animals and still surviving. A thorough post-mortem examination was conducted, and several samples were obtained from all visceral organs (liver, lungs, kidneys, spleen, stomach, intestines, and heart), the stomach and intestinal contents, blood clots and lymph nodes. On site, all of the samples were preserved in a car refrigerator for a maximum of 6 h.

The tissue samples were then sub-sampled and preserved in different ways including freezing at -20°C, 10% formalin and absolute ethanol; the stomach and intestinal contents were frozen at -20°C. The sub-samples, including the liver, lung, stomach and intestines with contents, kidney, spleen and heart were sent to the Onderstepoort Veterinary Institute (OVI), University of Pretoria, South Africa, for toxicological analyses.

Laboratory analysis

An analysis for strychnine was accomplished using a thin layer chromatographic (TLC) method for extracting strychnine. The samples were mixed with 10 ml of ammonia base and extracted with 100 ml of dichloromethane plus acetonitrile (80 + 20 ml, respectively) for 1 h on a shaker. The extract was acidified with 50 ml 1 M HCl and then filtered using litmus paper as an indicator. The filtrate was shaken out in a separating funnel for 2 min, and the layers were allowed to separate. The top layer was transferred to a separating funnel using 10 ml of ammonia solution, and 100 ml of ether plus chloroform (80 + 20 ml, respectively) was then added and shaken out for 2 min, allowing ventilation to avoid pressure build up. The layers were allowed to separate, and thereafter, the top layer was transferred to a rotary evaporation flask and evaporated to dryness at 50°C and cooled. Chloroform (2 ml) was added to a flask containing the dried top layer to dissolve it. The dissolved layer was then spotted onto a TL plate with the standards (10 × 10 cm plate), removed, dried, checked under UV light, sprayed with chromogenic reagent and confirmed using a fluorescein solution.

RESULTS AND DISCUSSION

The post-mortem findings of the eight carcasses showed similar lesions in the internal organs including haemorrhagic lesions on the serosal surfaces, lungs, endocarpdium, stomach and intestinal mucosa as well as a congested liver, kidneys and heart. Externally, some of the wild dog carcasses had bleeding from the mouth and anus. Histopathological examination revealed changes indicative of an acute circulatory disturbance, passive congestive hyperaemia and occasionally mild interstitial oedema in the liver, spleen, kidney, heart and pancreas. The toxicological analysis revealed the presence of strychnine in the stomach and intestinal contents but not other pesticides such as organophosphates, organochlorides and carbamates. Strychnine poisoning is an exceptional and potentially fatal poison for animals wherever it is used. In the case presented here, the presence of strychnine in the stomach contents of the dead wild dogs confirmed long-held suspicions that deliberately poisoned bait played a major role in the deaths of the studied wild dog pack in the LGCA. Furthermore, the history of the livestock attack and the post-mortem findings, histopathological findings and clinical manifestations of the dying wild dogs, including ataxia, convulsions and hypersensitivity to stimuli (our approach in this case) are typical characteristics of strychnine poisoning (Meiser and Hagedorn, 2002; Wood et al., 2002). Other clinical signs such as vomiting, hyperthermia and horizontal pendular nystagmus have also been reported (Burn et al., 1989). Our case vomiting was not observed, and we were unable to establish the body temperature because of the nature of the species involved.

The clinical effects of strychnine poisoning vary considerably. The exposure lethal dose varies between and within species depending on age and route of administration. In adult domestic dogs, if ingested in a large quantity, death occurs within a short time frame (Fazekas et al., 2008; Meiser and Hagedorn, 2002). According to Durkin (2010), the effects of strychnine poisoning are evident within 15 to 30 min, and little can be performed to reverse its consequences, particularly in free-ranging wild animals. For our case, the observed time frame to death was approximately 30 to 60 min post-ingestion, signifying that the quantity of poison ingested might be large, although, we were unable to establish the toxin levels, a weakness of our toxicological analysis. Malicious and accidental strychnine poisonings have been described in other species (Wamock and Schwarzbach, 1995). We are currently unaware of documented exposures in wild dogs in Tanzania, although, persecution by humans has been linked to the decline of wild dogs and other carnivores Africa (Gusset et al., 2008, 2009; Ikanda and Packer, 2008; Kissui, 2008; Packer et al., 2005; Rasmussen, 1999; Woodroffe et al., 2005). In addition, organophosphates have been used to kill one wild dog pack in our study area (Masenga, 2010, 'unpublished report'). The current case may reflect two important considerations, first and foremost being the low conservation awareness among the community in this area and perhaps other parts of the country in which humans and wild carnivores co-exists.

Secondly, the communities might be losing their tolerance towards wild carnivores, which suggests that there is a need for a compensation scheme to be instituted by the wildlife authority to serve the population in the country, although, this contradicts Gusset et al. (2009) suggestions. Lack of balanced mitigation plans coupled with continuous frequent livestock attacks by wild carnivores has created a negative attitude in the community towards species conservation in different ecosystems (Kissui pers. comm. and Masenga pers. Observation). We therefore suggest that more effort should be put towards community education while working towards cost-effective and sustainable mitigation strategies. No traces of strychnine or any of the other pesticides were detected in the liver, lung, kidney, spleen or heart. Several studies have shown that the poison is a competitive antagonist of the inhibitory neurotransmitter glycine at receptors in the spinal cord, brain stem and higher centres (Chen et al., 2011; Wood et al., 2002). Strychnine has been reported to possess high permeability, and the dominant mechanism of its absorption is through passive diffusion (Chen et al., 2011). In cases in which a large dose of strychnine is ingested, the stomach contents are recommended as the most suitable sample for toxicological analysis (Meiser and Hagedorn, 2002).

Our analysis revealed the presence of strychnine in the stomach contents but not in other organs, which agrees with the results from other studies (Meiser and Hagedorn, 2002; Wood et al., 2002). However, much higher levels of strychnine can be detected in the urine and blood of the victim (Fazekas et al., 2008).

CONCLUSION AND RECOMMENDATIONS

We conclude that the histopathological data, post-mortem examination and toxicological analysis are consistent with strychnine poisoning. We therefore suggest that more effort should be targeted to raise community awareness and review legislation to restrict the availability and use of poisons by the community without instruction from a qualified person.

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