

**Black-necked spitting cobra *Naja nigricollis* Reinhardt, 1843 repels a large pack of banded mongooses (*Mungos mungo*).**

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**BLACK-NECKED SPITTING COBRA *NAJA*
NIGRICOLLIS REINHARDT, 1843
REPELS A LARGE PACK OF BANDED MONGOOSES
*MUNGOS MUNGO***

T. MADSEN & W. WÜSTER

Spitting cobras (*Naja* spp.) and the Rinkhals *Hemachatus haemachatus* are unique among snakes in that their ability to spit venom constitutes an example of contactless long-distance defence against predators. Recently Kazandjian et al. (2021) suggested that the spitting ability in cobras has evolved as a defence mechanism to repel attacks by early hominins.

Although a major part of mongooses (Herpestidae) diet consists of invertebrates (Neal 1970; Rood 1975; Avenant and Nel 1992; Bothma 1998; Mahmood et al. 2011; Basuony et al. 2013; Graw and Manser 2017), their diet often includes snakes, and may on occasion include cobras (Haltenorth and Diller 1977; Bothma 1998; supported by multiple videos on YouTube and other social media, e.g., <https://www.youtube.com/watch?v=Wev2CSOrAvg>; <https://www.youtube.com/watch?v=pq7791VZLYI>; <https://www.youtube.com/watch?v=IJgyos2HDTs>, many clearly showing natural interactions in wild, unconfined animals). This is also supported by their increased immunity to elapid neurotoxins (Barchan et al. 1992): occasional large meals can disproportionately enhance a predator's energy budget, promoting the evolution of venom resistance (Wiseman et al. 2019).

The typical behaviour of a spitting cobra

when confronted by humans is to spit at the face (Warrell and Ormerod 1976; Westhoff et al. 2005; Berthé et al. 2009). Spitting at domestic dogs has been noted in South Africa (e.g., Leisewitz et al. 2004), and there are frequent reports of this occurrence on social media, especially from South Africa. However, there is a remarkable lack of published reports of encounters between spitting cobras and natural predators, and to our knowledge no one has documented the behaviour of spitting cobras when confronted by mongooses.

In September 2021 we were sent a video (<https://youtu.be/7SKZIT79-yA>) filmed in Masai Mara National Park, Kenya, by Joyce Karry that shows how a Black-necked Spitting Cobra *Naja nigricollis* survives an encounter with approximately 15 Banded Mongooses *Mungos mungo* by spitting. The mongooses show clear signs of hesitation and reluctance to approach (Fig. 1). Eight seconds into the video, the cobra can be seen spitting (Fig. 2) resulting in the instant retreat of the entire pack of banded mongooses (Fig. 3). It is unclear whether any of the mongooses received venom in their eyes. The response of the first mongoose, directly opposite the cobra, corresponds to the first signs of the cobra opening its mouth. It is questionable whether any venom could have reached the mongoose by the time it

started to turn its head, suggesting it may have done so in the expectation of being sprayed rather than in response to venom reaching it. None of the mongooses showed obvious signs of ocular discomfort after the spitting act. The mongooses subsequently dispersed away from the cobra. According to Joyce Karry the cobra was alive after the mongooses left the site. As mentioned above, a major part of the Banded Mongooses' diet consists of invertebrates. It is therefore unclear whether their initial interest in the cobra was motivated by predatory intent or defence. However, we consider it significant that these members of a clade comprising well-known predators of large, venomous snakes showed clear awareness of the threat that venom spitting by cobras poses.

To our knowledge, this is the first documented

report of a spitting cobra using venom spitting in defence against an adversary other than a human or domestic dog. This raises the possibility that the ability to spit venom may also have evolved, or been retained, to reduce predation from not only hominins but also other predators like mongooses. Finally, the video discussed here underscores the potential and importance of citizen science in documenting rare encounters in the natural world (Maritz and Maritz 2020).

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Figure 1. The Banded Mongooses' *Mungos mungo* reaction to the Black-necked Spitting Cobra *Naja nigricollis* prior to it spitting.



Figure 2. The Banded Mongooses' *Mungos mungo* reaction when the Black-necked Spitting Cobra *Naja nigricollis* spits. The mongoose highlighted by the arrow turns its head down and away from the cobra, as would be expected if it were either just squirted or, even more interestingly, *expecting* to be squirted in the eyes. The blue arrow in the second panel indicates the left eye, which is plainly visible in the first panel.



Figure 3. The Banded Mongooses' *Mungos mungo* reaction after the Black-necked Spitting Cobra *Naja nigricollis* has spat. Note the considerable distance between the cobra and the mongooses compared to Figure 1.

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