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First observation of intraspecific aggression between two Persian leopards

Intraspecific aggression is a common characteristic of felids, often leading to serious injury or even death. The most common causes of aggression among felids are competition for food, territory and mates. Such aggressions are a significant cause of mortality among leopard *Panthera pardus* populations in Africa. However, evidence on the significance of this behaviour in other leopard subspecies is rare. Four cases of intraspecific killings in Persian leopards *P. p. tulliana* have been documented in Iran. All cases were discovered after the aggression ended with limited information on the cause of the aggression. In Turkmenistan, in April 2024, we documented intraspecific aggression between two male Persian leopards for the first time on camera traps. In this case, we observed that competition over mating could be a significant factor in intraspecific aggression. Males might be more tolerant of each other during periods of high resource availability, as hypothesised with cougars. However, prey depletion may trigger more encounters and aggression related to mating and territory as well.

Intraspecific aggression is a common characteristic of felids, often leading to serious injury or even death (Macdonald et al. 2010). It is associated with competition over territory, prey and mating. It can occur within and between the sexes (Balme & Hunter 2013).

It is a significant cause of mortality among leopard populations in South Africa (Balme et al. 2009). Intraspecific aggression is also a factor in infanticide (Balme & Hunter 2013). However, evidence on the significance of this behaviour in other leopard subspecies is rare.

Farhadinia et al. (2018) were the first to report four cases of intraspecific killing in Persian leopards in Iran. All cases were discovered after the aggression ended (two of the dead leopards were collared) and two involved leopards that were killed in proximity to killed prey. While it can be assumed that these aggressions were related to prey, the real cause of these interactions remains unknown. While intraspecific aggression is a well-known phenomenon amply documented with African leopards, how such aggression unfolds has not been observed in Persian leopards to date.

Since 2018, there has been a systematic country-wide effort to understand the distribution and ecology of Persian leopards in Turkmenistan and to assess habitat connectivity with Kazakhstan and Iran. Turkmenistan is home to ca. 60–80 individual leopards (Rosen et al. 2024). These include ca. 30–40 leopards in the Kopetdag Mountains separating Iran from Turkmenistan, 5–10 individuals in Sunt Hasardag, 10–15 in Badhyz Reserve and surroundings, and 10–15 in the Balkan Range – Garabogazgol Ustyurt cluster (Rosen et al. 2024).

Dushak Erekdag, in the Kopetdag Mountains in Turkmenistan on the border area with



Fig. 2. Leopard Melegush feeding on horse carcass (Photo Team Bars Turkmenistan/MoEPT/CXL). All videos of the encounter can be viewed at <https://t1p.de/dgueh>.

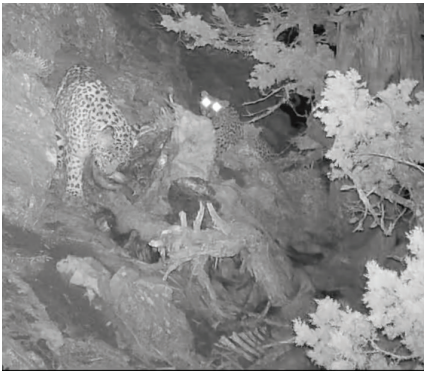


Fig. 3. Leopard Melegush continues to feed while in the background leopard Serdar approaches (Photo Team Bars Turkmenistan/MoEPT/CXL).

Iran, is currently visited by at least 9 identified leopards. Here, the home ranges of a female called Merjen who in 2022 had two cubs, a male Atamyrat and a female Selbi intersect with the ranges of several other male leopards. We applied camera trapping to understand leopard density, spatiotemporal distribution and interactions.

Study Area

Dushak Erekdag (37.957000° N / 57.905900° W) is an approximately 140 km² wide forested area in the Kopetdag Mountains in Turkmenistan adjacent to the Kopetdag State Reserve in the border area with Iran (See SOM; Map of the Dushak Erekdag area in the Kopetdag mountains). With elevation ranging from 1,000 m to 2,500 m asl, this area is characterised by deep gorges that hold the rare water points where wildlife congregates, especially during the summer. The vegetation in the Kopetdag Mountains represents the typical Irano-Touranian region and is dominated by juniper *Juniperus spp.* woodlands, bulbous bluegrass *Poa bulbosa* and desert sedge

Cyperaceae (Manafzadeh et al. 2013, Farhadinia et al. 2022).

This area has historically been abundant in large wild prey, bezoar goat *Capra aegagrus* and urial *Ovis vignei*, the key staples of leopard diet, as well as Indian crested porcupine *Hystrix indica* and wild boar *Sus scrofa*. It is also home to wolf *Canis lupus* and striped hyena *Hyena hyena* (increasingly rarely observed, likely due to persecution) as well as red fox *Vulpes vulpes* and corsac fox *Vulpes corsac*. Manul *Otocolobus manul* is very rare, likely due to predation by herding/guarding dogs compounded by predation by leopards (T. Rosen, pers. obs.) while the Afro-Asiatic wildcat *Felis lybica* is frequently observed.

In 2019, we identified the presence of at least 10 leopards in this area. However, since 2020, there has been an observed steady and rapid wildlife decline due to intense poaching activity, despite this being a border area with restricted access (Rosen et al. 2024). The leopard population might have suffered as a result: between 2020 and 2023, two leopards were found dead (a young female and an adult male), one of which was apparently shot.

In the Dushak Erekdag area, there are approximately 20–30 horses left on the mountain to graze in winter and around 100 in summer. However, due to harsh winter conditions, with temperatures dropping to –20°C, some horses die. In summer, many horses also die because of lack of water (water is brought from Ashgabat by truck). In June 2024 alone, somewhere around 30 horses died. Horse carcasses offer a food source for leopards in this region (Ghoddousi et al. 2017).

Methods

Since 2019, we have maintained a network of camera traps across the entire Dushak Erekdag area (Fig. 2), starting with 10 traps between 2019 and 2023, and expanding to 20 traps since April 2023. In 2023, we adopted the protocol described in Ghoddousi et al. (2019) to standardise Persian leopard monitoring in Turkmenistan, with some adaptations. Throughout the country, we have identified “core leopard monitoring units”, defined as 10 x 10 km² cells with confirmed leopard occurrences. The core area of Dushak Erekdag is one such unit. Also, we considered neighbouring 10 x 10 km² cells adjacent to core leopard areas or other suitable habitats as key survey units.

We deployed camera traps (10 Solaris Weapon 4K with trigger speed of 10 s, 5

Browning Dark Ops Pro DCL Nano with trigger speed of 1 s, and 5 Browning Strike Force Full HD Extreme with trigger speed of 5 s) near known leopard trails, water points, scratch logs/trees and opportunistically moved them near horse and wild ungulate carcasses. We mounted the camera traps on trees and rocks, 35–40 cm above ground level. We programmed them to take photos and videos (Solaris) and videos only (Browning). We checked cameras at least once every four to six weeks. To assess whether leopards visit the carcasses of dead horses, we placed three camera traps around the carcass of a pregnant mare that had died on 30 March 2024.

Results and discussion

Throughout 2023, only one adult dominant male named Serdar was recorded in the Dushak Erekdag area. However, in December 2023, a second, older-looking male named Melegush was observed. Between January and March 2024, Melegush and Serdar were often recorded hours apart on the same camera traps, with Serdar typically vocalising.

In March 2024, the female Merjen was observed without cubs for the first time. The cubs were observed alone and together on various camera traps, indicating that they had recently separated from their mother. They were often observed not far from where Merjen had been recorded, which also seemed to indicate that she was likely mating or preparing to mate.

Our camera trapping records showed that on 30 March 2024, Merjen visited the carcass and guarded it for some time both during the day and most of the night. She appeared very alert and nervous throughout the observation. Meanwhile, on nearby camera traps we recorded the movements of Serdar and Melegush crossing paths. That same night, we heard some commotion, and we speculated that the two leopards might have been having a confrontation. On the afternoon of 31 March 2024, Melegush visited the carcass with an injury to his leg, which could have been a result of the confrontation. Between 31 March and 1 April 2024, Melegush and Merjen continued to alternate visits to the carcass. Presumably, during these interactions, mating occurred.

On 1 April 2024, the horse herders came and moved the carcass to a nearby ravine. After this, only Melegush continued to use the carcass, while Serdar was observed nearby.

On 6 April 2024 at 4:40 h, while Melegush was feeding on the carcass, the eyes of another leopard appeared in the background in the camera trap video. Melegush kept eating until sometime after 5:00 h when the silhouette of the leopard, Serdar, appeared. At 5:05 h, Serdar pounced on Melegush who was completely caught off guard. The two leopards fought aggressively, at times rolling deeper into the ravine (Figs 2–4). The fight ended at 5:40 h when Serdar limped away. It was unclear how badly Melegush was injured at that moment. The next day, we observed a trail of blood leading to a resting spot not far from the fight. Melegush seemed to have spent some time there before moving on.

The mystery was resolved on 19 April 2024, when Melegush reappeared at the carcass. Although he displayed signs of an old injury on his leg, he appeared otherwise healthy and in good condition.

During all this time, Serdar never consumed or visited the carcass: we speculate that the conflict was less about the food and more about the female and dominance over the territory. The carcass proved a very good place to ambush a competitor.

From this observed case, we assume that competition over mating could be an important factor in intraspecific aggression. Males might be more tolerant of each other during periods of high resource availability, as hypothesized with cougars (Elbroch et al. 2016). However, prey depletion may trigger more encounters and aggression related to mating and territory.

Since April 2024, other dominant-looking males, Juma, Kerwen and Rustem, have appeared on cameratraps, their paths intersecting with that of Serdar. While Serdar is still marking extensively (i.e. scraping and rolling), he is no longer vocalising while marking. Meanwhile, Selbi (Merjen's daughter) is commonly camera-trapped in a gorge not far from her mother. Merjen was observed in late June 2024 visibly pregnant and had cubs sometime in July 2024.

Across their range and in Turkmenistan, Persian leopards navigate an increasingly fragmented landscape that has suffered significant wild prey loss (Ghoddousi et al. 2017). As described above, the aggression of large cats is a common and well-known behaviour – and can happen irrespective of prey availability. But the main triggers of aggression are often unclear. While no mortality has been documented to date in Turkmenistan from intraspecific aggression, it is possible that



Fig. 4. Melegush and Serdar facing each other during the fight (Photo Team Bars Turkmenistan/MoEPT/CXL).

resource availability can provoke intraspecific aggression and potentially also mortality. Conservation efforts aimed at reducing poaching pressure on both leopards and prey, leading to prey recovery, can potentially reduce such aggressions and associated mortality. Last but not least, this case reinforces the importance of investigating natural causes of mortality in Persian leopards (Farhadinia et al. 2018) and causes of intraspecific aggressive behaviour as one of the main reasons for mortality in leopards.

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Supporting Online Material SOM is available at www.catsg.org/catnews.

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