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First record of rare mating behavior of Javan leopard *Panthera pardus melas* in Indonesia

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Abstract: we report the first observation of the mating behavior of the endangered Javan leopard (*Panthera pardus melas*) from Gunung Malabar Protected Forest in West Java and Alas Purwo National Park in East Java. We recorded the mating process of the Javan leopard using a camera trap on 20 November 2014 and 22 September 2020. We consider this to be the first record in the wild in Indonesia.

Key words: copulation; camera trap; carnivores; endangered; Java.

Short Communication

Being an endangered species with a population of 188–571 individuals (Wibisono et al. 2021), the Javan leopard (*Panthera pardus melas* G. Cuvier, 1809) lives in suitable landscapes estimated at 11,599 km^2 from West to East Java, Indonesia (Wibisono et al. 2018). The leopard and its prey are threatened by habitat loss and fragmentation, large-scale degradation by plantation companies, human encroachment into protected areas, poaching, retaliatory killing due to conflicts with people for livestock (Ministry of Environment and Forestry 2016; Gunawan et al. 2017). Apart from tracks, their presence is also recorded from camera trapping (Ministry of Environment and Forestry 2016), an indispensable tool in many wildlife studies worldwide ranging from simple documentation of animal presence to rigorous investigation of animal ecology (Sunarto et al. 2013). While not usually applicable for detailed behavioral studies in carnivores, camera traps can document certain aspects of animal behaviors, including breeding (Cain III et al. 2003).

Leopard mating behavior is mainly described from captivity, while records in the wild are limited (Laman and Knott 1997; Allwin et al. 2016; Trivedi and Mody, 2018). Most of the information on the social behavior of leopards in the wild comes from the African savannah and is little known in Asia (Arasteha et al. 2020). Leopards are a poorly understood solitary felid and additional studies could provide insights into both evolution and conservation management (Owen et al. 2010).

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Here we report a brief description of two cases of mating behavior between two pairs of Javan leopards in Gunung Malabar Protected Forest (GMPF) in West Java and in Alas Purwo National Park (APNP) in East Java. We believe these records will increase the understanding of mating behavior in this elusive and increasingly threatened large carnivore.

During the survey period from November 1 to December 30, 2014, in GMPF, we deployed camera traps using Cuddeback® X-change white flash model 1279 (NonTypical Inc., Park Falls, WI, USA) on 12 stations. We set them to take photographs and videos at one-minute intervals. In APNP we used Bushnell 119717CW Trophy Cam HD deployed on 48 stations from September to November 2020, with photographs taken at ten seconds intervals. Both in GMPF and APNP, all camera traps were active 24 hours per day. In GMPF, one of the cameras captured once the photograph and video of the Javan leopard mating process on November 20, 2014, and in APNP on September 22, 2020.

In both GMPF and APNP, the mating process was initiated by the female walking back and forth in front of the resting male. The female approached the male at times wagging the tail towards the male's body and head as pre-copulatory behavior. Then the female was mounted by the male and growled when copulation ended. During copulation, the male was holding or biting the female on the nape. After the copulation, they rested a few meters away from each other. This behavior was similar to what was described by Laman and Knott (1997) in Serengeti National Park, Tanzania, Trivedi and Mody (2018) in the agricultural landscape of Surat, India, and in captive leopards (Allwin et al. 2016).

Regarding duration and frequency, we recorded that the mating process lasted up to 40 minutes in GMPF. The process started with courtship at 03:22 am, and then ended with two copulations at 03:46 am and 04:02 am, which lasted 5 and 12 seconds each (Figure 1). In APNP the mating process lasted 16 minutes, with courtship beginning at 01:39 pm and ending at 01:52 pm, with a single copulation that lasted 8 seconds (Figure 2).

Figure 1. Mating behavior in Gunung Malabar Protected Forest (GMPF).

Figure 2. Mating behavior in Alas Purwo National Park (APNP).

Copulation frequency varies considerably in the leopard. Although we observed copulations around the camera trap twice, we believe the actual number of copulations might be higher, as observed by Trivedi and Mody (2018) and Timothy et al. (1997). Laman and Knott (1997) reported a pair of leopards that copulated thirteen times during an hour and a half (between 4:45 pm and 6:09 pm), with copulations lasting an average of three seconds (2-4 seconds), with an average interval between copulations of 6.5 minutes (2-17 minutes). Trivedi and Mody (2018) observed mating mainly after 5:00 pm and lasted six days with 18 copulations in total, with the duration of the copulations being 3.5 seconds (3-7 seconds) and the interval between copulations of 7.4 minutes (5-10 minutes).

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Authors' contributions

All the authors made a substantive intellectual contribution. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of interest

The authors declare no potential conflict of interest.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

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