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## Capture and Immobilization of Wild Brown Palm Civets in Western Ghats

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**ABSTRACT:** A mixture of 15 mg/kg body weight ketamine hydrochloride (KE) and 1.5 mg/kg body weight xylazine hydrochloride (XY) was used to successfully immobilize free-ranging brown palm civets (*Paradoxurus jerdoni*). Between March 1998 and June 1999, 10 immobilizations of 7 individuals were carried out in tropical rainforests of the Kalakad-Mundanthurai Tiger Reserve (India). Five males and two females were captured in Havahart live traps, using banana as bait. The mean dosage for the animals, whose weight (mean  $\pm$  SD) was 2.4 kg  $\pm$  0.8 was 36.0  $\pm$  11.0 mg KE and 3.7  $\pm$  1.1 mg XY, administered intramuscularly. Mean time for lateral recumbency was 6.1  $\pm$  3.78 min ( $n = 10$ ) and the mean time taken for complete recovery was 84.9  $\pm$  28.8 min ( $n = 9$ ). Recovery was gradual and no fatalities or injuries occurred during the operation. The drug combination used was effective and has the potential for immobilizing other viverrids.

**Key words:** Brown palm civet, immobilization, ketamine, *Paradoxurus jerdoni*, viverrids, xylazine.

Direct observations of the behavior and ecology of most small carnivorous mammals in tropical forests are difficult. This is because several species are rare, nocturnal, or arboreal in habit. The development of radiotelemetry techniques has, however, enabled the study of many rare and elusive species (Rabinowitz, 1991). This technique involves the capture and immobilization of animals. It is a challenge each time a new species is immobilized, since considerable intra- and inter-species variation in reaction to the drugs have been reported (Seal and Kreeger, 1987; Arnemo et al., 1994), which may be compounded by field conditions. This paper describes details of capture and immobilization of the brown palm civet (*Paradoxurus jerdoni*), a nocturnal and endemic species in the tropical rainforest of the Western Ghats (India).

The Western Ghats mountains extend approximately 1,600 km along the west

coast of India (between 8°N and 21°N). It is one of the biodiversity hotspots (Myers et al., 2000) and among the 200 critically important ecoregions in the world (Olson and Dinerstein, 1998). Twelve endemic mammals are known from this region (Swengel, 1990) and the brown palm civet is among them. It is restricted to the tropical rainforests of the Western Ghats, ranging from 8°N to 13°N (Corbet and Hill, 1992). Like other small carnivores of southern Asia, the ecology of this species is very poorly known, particularly due to its nocturnal and elusive habits. Techniques to capture and immobilize wild, free-ranging small carnivores, including viverrids, have not been commonly used or standardized in this region. Only one species of small carnivore, the common palm civet (*P. hermaphroditus*), has been studied in some detail in southern Asia (Joshi et al., 1995).

In this paper, we report the capture and immobilization of seven brown palm civets, three of which were recaptured and immobilized twice. This study was carried out in the mid-elevation tropical wet evergreen rainforests of Kalakad-Mundanthurai Tiger Reserve (Tamil Nadu, India; 857 km<sup>2</sup>; 8°25' to 8°53'N and 77°10' to 77°35'E) between March 1998 and June 1999. The study site was Sengaltheri (8°31'N, 77°26'E) located at 1,040 m above mean sea level.

Brown palm civets are relatively rare, nocturnal, and arboreal in their habit. Capture and immobilization was carried out as part of a radiotelemetry study on the ecology of the species. The process of capture took an average of 2 wk for each individual. This involved prebaiting track-plots situated on trails at sites where there were signs of animal movements (direct

TABLE 1. Drug dosage and time taken for each stage of immobilization procedure of the brown palm civet in Kalakad-Mundanthurai Tiger Reserve (India).

	Mean	SD	Range	<i>n</i>
Ketamine hydrochloride (mg)	36.45	10.98	18–52.5	10
Xylazine hydrochloride (mg)	3.65	1.10	1.8–5.25	10
Body weight (kg)	2.40	0.80	1.20–3.50	7
Time for lateral recumbency (min)	6.1	3.78	3–15	10
Down time (min)	84.9	28.76	49–138	9

sightings or scat-marking). Banana was placed as bait on track-plots. Baiting was continued for 3 or 4 days and shifted to another site if no animals consumed it. If bait was consumed, a Havahart live trap (large raccoon live animal cage trap 107 × 28 × 33 cm) was placed with both doors open on the track-plot and the baiting was continued until the animals were habituated to entering the trap. A week after the trap was placed on the track-plot, one of the doors was shut and baiting continued for 3 to 4 days prior to capture. The animals were observed to be calm when trapped. Civets were not captured in traps that were placed without prebaiting (*n* = 12 trials).

On the day of capture, the trap was set at dusk, and a radio transmitter was attached to the door such that the capture of an animal would activate pulse transmission. Signals were monitored every 5 min from a nearby location and thus we could determine capture of an animal almost immediately. Within 30 min after capture, the animal was transferred into a box trap (30 × 30 × 30 cm) and brought to the field station. It was weighed using a 10 kg hanging scale and the drug dosage calculated based on body weight. The individual was then immobilized with an intramuscular administration of a mixture of ketamine hydrochloride (KETMIN 50®, Themis Chemicals Ltd., Hyderabad, India) and xylazine hydrochloride (XYLAZIN® 2% solution, Indian Immunologicals, Hyderabad, India; following Palomares, 1993). A mixture of 15 mg KE/kg body weight and 1.5 mg XY/kg body weight was administered into the animal's hindquar-

ters, using a hand-held 2 ml disposable syringe.

Approximately every 10 to 15 min, rectal temperature (for one individual) and respiration rate (for all individuals) were recorded. Time taken for lateral recumbency and the down time (period from lateral recumbency to complete recovery) was recorded. During the handling of animals for fitting radio-collars, a sterile solution of methyl cellulose (MEZOL®, Syntho Pharmaceuticals Pvt. Ltd., Lucknow, India) was applied to moisten the eyes and prevent corneal ulcers.

Ten immobilizations of seven individuals (3 adult males, 2 sub-adult males, 2 adult females) were carried out between April 1998 and June 1999. All individuals weighed between 1.2 and 3.5 kg. Except for one female and a recaptured sub-adult male which had some injuries unrelated to capture, all individuals were in good health condition. Nine of the immobilizations were made using a single dosage of 15 mg/kg body weight of KE and 1.5 mg/kg body weight of XY (Table 1). An additional dose of 18.2 mg KE and 1.8 mg XY was injected into an adult female that was being immobilized for the second time in 11 mo. Despite the additional dosage, unlike as observed in all other immobilizations, complete relaxation of skeletal muscles was not attained and she remained only partially immobilized.

There was considerable inter-individual difference in their response to the drugs administered. Time taken for each stage of immobilization is given in Table 1. Recovery from immobilization was gradual. Rectal temperature decreased very slightly

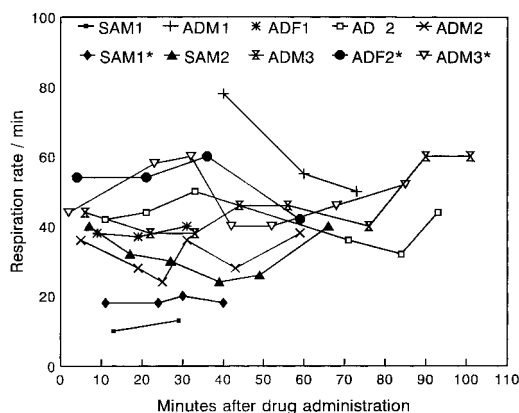


FIGURE 1. Respiration rate of immobilized brown palm civets in the tropical rainforest of Kalakad-Mundanthurai Tiger Reserve. Abbreviations are SAM = sub-adult male, ADM = adult male, ADF = adult female, \* = signifies recapture.

from 38.9 C (13 min after drug administration) to 37.8 C (29 min after drug administration). The respiration rate did not show any particular pattern of change with time. There were intra- and inter-individual differences in the variation in respiration rate (Fig. 1).

Spasmodic convulsions were not observed during immobilization. Two individuals vomited while recovering. No animal died or suffered any physical injury during capture, immobilization, handling, or recovery. After complete recovery, all individuals were released (within 1.5–6.5 hr after capture) at the capture site.

The dosage of 15 mg KE/kg body weight and 1.5 mg XY/kg body weight was found to be effective for successful immobilization of wild brown palm civets. No fatal or other adverse effects were observed during the operation. A mixture of KE and XY has been used in immobilizations of carnivores in past studies. The dosage used varied from 5 mg of KE/kg and 1 mg of XY/kg body weight of raccoons *Procyon lotor* (Deresiensi and Rupprecht, 1989), 4.2 mg of KE/kg and 6.5 mg of XY/kg in Egyptian mongooses (*Herpestes ichneumon*) (Palomares and Delibes, 1992), and 1.4–1.9 mg of KE/kg and 1.9–2.4 mg of XY/kg in African wild

dogs *Lycaon pictus* (Osofsky et al., 1996). In these earlier studies, the dosage of XY was lower or higher than in this study, however, the ratio of XY to KE was greater than reported here. The modified ratio of KE and XY mixture used in this study was based on trials on captive common palm civets and small Indian civets (*Viverricula indica*) and free-ranging common gray mongooses (*H. edwardsii*) in India. Yohimbine hydrochloride was not used as the animals did not exhibit any adverse responses to the XY and recovered from immobilization in an acceptable period of time.

XY has been reported to decrease body temperature and respiration rate (Seal and Kreeger, 1987). No consistent reductions in respiration rates were observed in this study, probably due to the small dosage of XY. A combination of KE and XY will counteract the adverse effects observed with these drugs when they are administered individually (Deresiensi and Rupprecht, 1989). Therefore administration of KE and XY in combination seems to be safe and effective in immobilization of brown palm civets.

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