SHORT COMMUNICATIONS

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Field Application of Telazol® (Tiletamine Hydrochloride and Zolazepam Hydrochloride) to Immobilize Wild Red Howler Monkeys (*Alouatta seniculus*) in Venezuela

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ABSTRACT: Telazol® (TEL) (tiletamine hydrochloride and zolazepam hydrochloride combination) was used to immobilize 50 wild red howler monkeys (*Alouatta seniculus*) in Venezuela between October 1989 and February 1991. The mean (±SD) dosages of TEL used for adult males and adult females were 22.4 (±7.3) mg/kg and 22.5 (±5.0) mg/kg, respectively. Juveniles of both sexes received a mean dose of 30.5 (±5.6) mg/kg. The induction time for TEL ranged from 1 to 6.2 min. Thirteen animals were given an additional dosage of ketamine hydrochloride manually when they recovered from the first injection of TEL. Total recovery times ranged from 39 to 308 min. There were no apparent side effects to the fetuses of two pregnant females.

Key words: Red howler monkey, *Alouatta seniculus*, tiletamine hydrochloride, zolazepam hydrochloride, ketamine hydrochloride, chemical immobilization, field capture.

Our objective was to determine the effects of Telazol® (TEL) (A. H. Robins Co., Richmond, Virginia, USA) in wild red howler monkeys, *Alouatta seniculus* of Venezuela. Telazol has been used previously to immobilize several species of nonhuman primates successfully, both in captivity (Bree, 1972; Eads, 1986; Schobert, 1987) and in the wild (Glander et al., 1991). Thorington et al. (1979) concluded that sernylan (phencyclidine hydrochloride) was superior to ketamine (ketamine hydrochloride) and rompun (xylazine hydrochloride) for immobilizing free-ranging red howler monkeys. However, sernylan was removed from the commercial market and later was replaced by TEL, also called CI-744 (Franzmann and Lance, 1988).

Red howler monkeys were captured in the savanna woodland and gallery forest habitats of Hato Masaguaral (08°31'N, 67°35'W), a wildlife preserve and working cattle ranch, situated about 45 km to the south of Calabozo in Guarico State, Venezuela. Details of the study site habitats and long-term red howler field research are presented by Rudran, (1979), Troth (1979), and Agoramoorthy and Rudran (1992). From December 1989 to March 1990, and December 1990 to February 1991, 50 red howler monkeys were immobilized with a single TEL injection each, using a Pneu-dart rifle (rifle model 176, Pneu-dart, Inc., Williamsport, Pennsylvania, USA) and 1 cc syringe darts. We estimated and administered the minimum amount of TEL to achieve effective immobilization of each animal. An additional dose of ketamine hydrochloride (KET) (Vetalar® Parke-Davis, Morris Plains, New Jersey, USA) was given manually for 13 animals when they were not fully immobilized. Data from animals that needed more than one dose of TEL for immobilization were excluded because the time lapse between injections created difficulty in the calculation of induction and recovery time.

We took several precautionary measures

prior to darting red howler monkeys. Most darting was done during the dry season, from December to February; most trees and shrubs had shed their leaves and thus provided good visibility. Monkeys were darted before 1100 hr and after 1500 hr to minimize temperature stress. After selecting a group, the group was checked for estrous females and the home range was searched for extra-group males. If an estrous female, an invader male or any social change was noted, the darting operation was postponed. In addition, we avoided darting infants and pregnant females. After a group was located, the target animal was observed for 20 min. An animal was not darted until the following conditions were met: the animal was resting, the animal did not face the observer, and the hind quarter (target area) of the animal was clearly visible. The target animal was shot in the muscular region of hind quarter (upper thigh, close to tail base) while resting on a tree from a height of 5 to 20 m and caught with a hammock (2 × 2.5 m), before it hit the ground. All immobilized animals were kept in the shade. Ear tagging, weighing, measuring and collecting blood and hair samples were done in the field by the methods of Thorington et al. (1979). Six dehydrated animals were given 7 cc per kg body weight of lactated Ringer's solution (Kendall McGaw Laboratories, Inc., Irvine, California, USA) subcutaneously. All animals were closely monitored until they were mobile again. To avoid aggressive encounters with rival group members, captured animals were released near their own group members after the recovery.

Induction time was defined as the time between TEL injection and when the animal fell to the ground or began to hang by its tail with its head down. Initial recovery time was defined as the period between the loss of consciousness and the time when the animal could sit up for more than 10 sec. Final recovery time was defined as the time lapse between initial recovery and when the animal could climb at least 1 m above the ground. The initial recovery time plus the final recovery time was the total recovery time. Analysis of covariance (ANCOVA) was used to analyze induction time, initial recovery time, and total recovery time among different age, sex and status categories (resident, solitary, association); the amount of TEL (mg/animal) and body weight were used as covariants (SAS Institute Inc., 1985).

The animals immobilized included 36 adult males (>5 yr), eight adult females (>4 yr), and six juveniles (two females and four males aged 1.5 to 2.5 yr). Doses of TEL used for immobilization varied with age, sex and body weight (Table 1). The largest adult male (7.4 kg) was successfully immobilized with a TEL dose of 16.2 mg/kg. Thus a TEL dose lower than the mean of 22.4 mg/kg would be effective in immobilizing most red howler monkeys if a good injection occurred.

After receiving a TEL injection, an intramuscular dose of KET was given to 13 animals that had not become fully anesthetized. Seven adult males received a mean KET dose of 22.9 mg/animal (range 10.0 to 30.0; SD = 7.6). Three adult females received a mean KET dose of 16.7 mg/animal (range 15.0 to 20.0; SD = 2.9) and two juveniles each received doses of 10.0 mg/animal. The mean dose of TEL in this study is greater than reported for three mantled howler monkeys (*Alouatta palliata*) in the wild (14.8 mg/kg, $n = 3$; Glander et al., 1991) and in captivity (3.9 mg/kg, $n = 4$; Bush et al., 1977). However, six wild spider monkeys (*Ateles geoffroyi*) of Costa Rica were immobilized with a mean dose of 22.1 mg/kg (Glander et al., 1991); this is similar to the doses reported here for the red howler monkeys. But Bush et al. (1977) used TEL to successfully immobilize 16 species of captive nonhuman primates with a mean dose of 2.4 to 3.9 mg/kg. These doses were about five to nine times lower than the doses used for field immobilization of red howlers in our study, as well as mantled howlers (Glander et al., 1991). The reasons for this discrepancy

TABLE 1. Observations of red howler monkeys in Venezuela after single intramuscular injections of Telazol®, 1989 to 1991.

	Adult males (>5 yr) (n = 36)			Adult females (>4 yr) (n = 8)			Juveniles (>1.5 to 2.5 yr) (n = 6)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Body weight (kg)	5.8	0.8	4.0–7.4	4.7	0.6	4.0–5.6	2.8	0.4	2.4–3.5
Dosage (mg/animal)	125.8	29.9	65–170	105.6	27.2	70–140	86.7	23.4	60–120
Dosage (mg/kg)	22.4	7.3	11.3–42.5	22.5	5.0	16.4–31.1	30.5	5.6	25.0–38.5
Induction time (min)	3.3	1.5	1.3–6.2	2.7	0.7	1.8–4.2	2.3	1.1	1.0–4.0
Initial recovery time (min)	52.8	22.2	19–106	39.1	17.2	23–66	90.0	47.8	55–182
Time to final recovery (min)	46.8	44.0	12–250	44.4	23.0	20–95	51.0	11.8	40–70
Time to total recovery (min)	99.6	51.5	39–308	83.5	20.8	64–118	141.0	44.6	95–222

probably are that howler monkeys have prehensile tails and in the field may need a higher dosage than in captivity to induce their free fall from trees; in captivity, it's easy to handle an animal when it holds on with its tail, but in the field, this can be a problem (Glander et al., 1991); and captive conditions provide better opportunity to physically restrain animals and manually inject a complete dose of a drug. The recommended doses reported here for the red howler monkeys are specifically for field conditions using Pneu-dart system only and should not be used for monkeys in captivity.

The reaction of the 50 darted animals varied from running a distance of 2 to 10 m, checking the dart wound by touching and sometimes licking the blood drops from dart wound. Usually the darted animals remained closer to their groups and could be observed until they fell from the tree. Sixteen immobilized animals hung by their prehensile tails and were brought down by a pole or by hand. One casualty occurred. A 5.8 kg adult male darted with 12.1 mg/kg TEL fell and became wedged in the fork of a tree; he was dead when retrieved.

There was no significant difference ($P > 0.05$) in the adjusted means of induction times between adult males and adult females when TEL and body weight were used as covariants. The status of males (resident, invader or solitary) was not significantly related to induction time ($P > 0.05$). The adjusted mean induction time of juveniles was not significantly different than that of adults ($P > 0.05$). Also, there was no significant difference ($P > 0.05$) in the adjusted means of initial recovery time between adult males and females. However, the juveniles had significantly longer recovery times than adults ($P < 0.01$), probably because they received higher doses per kg of TEL than adults (Table 1). The total recovery time was positively correlated ($r = 0.85$) with the amount of additional KET applied ($P = 0.017$). There was no difference ($P > 0.05$) in the initial and total recovery time among males of different status. Also, there was no significant difference ($P > 0.05$) in the total recovery time between juveniles and adults.

In general, TEL appeared to be a good immobilizing agent for wild red howler monkeys. However, three adult males had individual variations in responding to TEL and had a longer recovery time compared to the mean (±SD) total recovery time of 99.6 (±51.5) min. First, an adult male weighing 5.4 kg that received 24.1 mg/kg TEL had a total recovery time of 210 min. In a second case, an adult male weighing 5.0 kg that received 28.0 mg/kg recovered after 308 min. In a third case, an adult male weighing 7.2 kg received 18.1 mg/

kg TEL and recovered after 128 min. Males in the first and third cases received lower doses than the 22.4 mg/kg average, while the male in the second case received a slightly higher dose. Although these three males had exceptionally long recovery times, neither self-mutilations nor convulsions occurred. Despite the fact that TEL crosses the placental barrier, two adult females delivered healthy infants. These infants were born 1.5 and 2.0 months after the immobilization; thus TEL doses may be safe for pregnant females.

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