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Field Immobilization of Pygmy Spotted Skunks from Mexico

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ABSTRACT: We immobilized 21 pygmy spotted skunks (*Spilogale pygmaea*), in the tropical deciduous forest at the Chamela Biological Station (Mexico) from October 1994 to May 1997, with a mixture of ketamine (KH) and xylazine (XH). Skunks were immobilized with a mean (±SD) dosage of 15.7 ± 8.3 mg/kg KH and 8.1 ± 4.3 mg/kg XH. Mean induction and recovery time (n = 21) were 1.7 ± 1.6 and 34.2 ± 12.2 min, respectively. One individual was immobilized with XH, induction time was 1 min, and recovery time was 45 min. Foaming salivation was observed in this animal. No other adverse effects were observed for the other animals in this sample.

RESUMEN: Inmobilizamos a 21 zorrillos pigmeos (*Spilogale pygmaea*) en el bosque tropical caducifolio en la Estación de Biología Chamela (Mexico), entre Octubre de 1994 a Mayo de 1997 utilizando una mezcla de hidrocloruro de ketamina (KH) e hidrocloruro de xilazina (XH). La especie se inmobilizó con una dosis (media ± DE) de 15.7 ± 8.3 mg/kg KH y 8.1 ± 4.3 mg/kg XH. El tiempo promedio de inducción fue de 1.7 ± 1.6 min. El tiempo promedio de recuperación fue de 34.2 ± 12.2 min. Un individuo fue anestesiado exclusivamente con XH, con un tiempo de inducción de 1 minuto y su recuperación tomó 45 min. Este animal presentó salivación espumosa. No se observaron otras reacciones adversas a las drogas en ninguno de los otros animales de la muestra.

Key words: Immobilization, ketamine, pygmy spotted skunk, *Spilogale pygmaea*, xylazine.

The pygmy spotted skunk (*Spilogale pygmaea*) is endemic to the Pacific coast of Mexico (Hall, 1981; Ceballos and Miranda, 1986). This species is endangered according to international (United States Fish and Wildlife Service, 1986) and Mexican (Secretaría de Desarrollo Social, 1994) conservation agencies. Despite this, little is known concerning the species. A technique to allow researchers to handle individuals without placing them in risk to better understanding the ecology of this species is required.

Several species of skunks have been immobilized with different drugs and dosages under field and laboratory conditions. Striped skunks (*Mephitis mephitis*) were anesthetized with ketamine (KH) and xylazine (XH) at a 10:1 ratio, using 20 to 30 mg/kg and 2 to 3 mg/kg, respectively (Rosatte et al., 1990). A male western spotted skunk (*Spilogale putorius*) captured in Durango (Mexico) was anesthetized with 4.5 mg/kg KH and 1.8 mg/kg XH (Servín et al., 1994). The island spotted skunk (*Spilogale gracilis amphiala*) has been anesthetized with KH at 15 mg/kg (Crooks, 1994).

Ketamine creates a dissociative anesthesia and is one of the most commonly used immobilizing agents in wildlife (Seal and Kreeger, 1987) Xylazine is a non-narcotic sedative analgesic that can produce transitory hypertension prior to prolonged hypotension (Hsu, 1985). A mixture of KH and XH results in smooth induction and recovery (Harthoorn, 1976; Belant, 1995). Herein, we report on the use of KH and XH for field immobilization of pygmy spotted skunks for research purposes in the tropical deciduous forests of western Mexico.

Pygmy spotted skunks were captured at the Chamela Biological Station (State of Jalisco, Mexico: 19°30′N, and 105°03′W). Capture periods were October 1994; March and May 1995; January, March, May, and October 1996; and March and May 1997. All skunks were captured using four sizes of wire box-traps (Tomahawk Trap Co., Tomahawk, Wisconsin, USA) and two sizes of Sherman traps (Sherman Trap Co., Tallahashee, Florida, USA). Wire box traps were baited with live chickens and sausage; Sherman traps were bait-

TABLE 1. Dosages and physiological responses of pygmy spotted skunks (*Spilogale pygmaea*) from Jalisco, Mexico immobilized with Ketamine and Xylazine.

Category	Xylazine (mg/kg)	Ketamine (mg/kg)	Induction time (min)	Recovery time (min)
Overall	8.1 ± 4.3[a]	15.7 ± 8.3	1.8 ± 1.6	34.2 ± 12.3
	(3.5–20.0)	(7.0–40.0)	(0.2–6.5)	(17–62)
Male	8.9 ± 5.3	16.5 ± 10.3	1.6 ± 0.7	34.4 ± 12.7
	(3.5–20.0)	(7.0–40.0)	(1–3)	(17–62)
Female	6.5 ± 0.5	14.1 ± 2.3	2.1 ± 2.9	31.0 ± 4.1
	(5.9–6.9)	(11.8–17.3)	0.5–6.5	(27–35)
Subadult	7.1 ± 2.0	15.9 ± 4.8	1.7 ± 1.9	32.0 ± 8.0
	(5.7–10.0)	(11.4–20.3)	(0.2–4.5)	(25–42)

[a] Mean ± standard deviation (range).

ed with oat meal, peanut butter, and fatty acid scent tabs.

Skunks were immobilized with a 1 ml hand syringe in the wire box traps or in 3.81 ziplock® plastic bags after removal from Sherman traps. Each skunk was injected intramuscularly in the thigh with a 2:1 combination of KH (100 mg/ml, Ketaset, Aveco, Inc., Fort Dodge, Iowa, USA) and XH (100 mg/ml, Rompun, Miles Inc., Shawnee Mission, Kansas, USA).

Induction time was defined as the interval between injection and when recumbency was achieved. Recovery time was recorded as the time between recumbency and standing position. A commercial ointment (Artificial tears, The Butler Co., Columbus, Ohio, USA) was applied to the eyes to prevent desiccation. A consecutive number was tattooed on each ear. We recorded standard measurements used in mammalogy and weight of each individual. Skunks were aged based upon tooth growth, gum recession, and weight (Mead, 1967). All skunks were fitted with a radio transmitter attached to a collar or harness. Upon full recovery skunks were released at the capture location.

One-way analysis of variance (ANOVA) was used to test for differences in XH and KH across age and sex classes and between induction and recovery times across these classes (Sigmastat for Windows 1.0, Jandel Corporation, San Rafael, California, USA). Simple correlation analysis was used to test for dose response across induction and recovery times (Sigmastat for Windows 1.0, Jandel Corporation).

Twenty-one pygmy spotted skunks were captured during the trapping sessions; 14 were in Sherman traps and 7 in wire box traps. Sex and age composition included 17 adults (13 male, 4 female) and four male subadults.

Two of 21 skunks sprayed with no warning of either foot stamping or handstand posture. Foot stamping was observed on four occasions without spraying. The remaining animals were calm when approached; they reacted and sprayed only when punctured by the needle.

Seven animals were injected twice because handling time was insufficient to attach the radio transmitter. The skunk that was anesthetized only with XH reacted with convulsions and foaming salivation; however, only 4 min subsequent to this the skunk resumed breathing and heart rate typical of other immobilized skunks. To reduce potential heat stress this skunk was rubbed with a wet cloth.

Mean induction time for the pygmy skunks was 1.8 ± 1.6 min (range = 0.2–6.5) (Table 1). Mean recovery time was 34.2 ± 12.2 min (range = of 17–62). Mean male induction time was 1.6 ± 0.7 min (range = 1–3). Mean male recovery time was 34.4 ± 12.7 min (range = 17–61). Mean female induction time was 2.1 ± 2.9 min (range = 0.5–6.5). Mean female recovery time was 31 ± 4.1 min (range = 27–35). Mean subadult induction time was

1.7 ± 1.9 min (range = 0.2–4.5). Mean subadult recovery time was 22 ± 8 min (range = 25–42). Induction time with XH was 1 min, with a recovery time of 45 min. Typical early recovery behavior included ear twitching, and increased respiration. The control of the head was first gained and was almost simultaneous for both front and hind legs.

We found no significant differences between XH within males, females and subadults (ANOVA, F = 0.58, df = 2, P = 0.570), nor between KH (ANOVA, F = 0.114, df = 2, P = 0.893). Also, no significant differences were found between induction time and age/sex classes (ANOVA, F = 0.179, df = 2, P = 0.838) or recovery time (ANOVA, F = 0.147, df = 2, P = 0.8648).

We wanted to determine if drug dosage was related to time of recovery and we found no significant correlation between mg/kg KH and induction time (r^2 = 0.8, F = 0.143, P = 0.710), and between mg/kg XH (r^2 = 0.02, F = 0.004, p = 0.95). Time of recovery was not significantly related to mg/kg XH (r^2 = 15.6, F = 3.7, P = 0.069). Time of recovery was positively but not significantly correlated with mg/kg KH (r^2 = 42.2, F = 13.9, P = 0.014). Sample size was too small to test for differences between dry and wet season.

Although anesthesia of skunks has been a standard procedure, previous studies have not described the reactions of skunks or recovery times (i.e. Crooks, 1994; Servín et al. 1994). Commonly used dosages of a 5:1 ratio for KH/XH are described for various species such as mountain lion *Puma concolor* (Logan et al., 1986) and racoon *Procyon lotor* (Belant, 1995). We decided to reduce the dosage of KH because full recovery time was reduced (López-González, 1994) and also the animal was less exposed to temperature and humidity conditions that prevail in tropical deciduous forests. Benefit from a reduced dosage of KH was the simultaneous recovery of movement in both front and hind limbs, which reduced full recovery time. No vomitis or hemorhage was observed in any of the captured animals after induction, as has been reported elsewhere (Fuller and Kuehn, 1983; Pigozzi, 1987). We detected arrhythmic heartbeat only on the skunk anesthetized with pure XH, but none of the others showed this or as was seen in wolves (*Canis lupus*) by Kreeger et al., (1986). We could not attribute sleeping time or recovery time to either drug. This was similar to the effect seen in Lynx (*Lynx canadensis*) by Poole et al. (1993), but contradictory to other studies that found a dual relationship (Fuller and Kuehn, 1983; Kreeger et al., 1986; Servín et al., 1990). These differences could be attributable to different metabolism in different mammalian taxa (McNab, 1989). Sleeping time appears to be highly related to individual differences.

Successful immobilization of skunks allowed us to examine for external parasites, make precise measurements, and was less stressful to the animal. Kinlaw (1995) indicated that anesthesia is probably unnecessary if welder gloves were worn to protect from bites. However, this procedure does not allow you a complete assessment of physical condition of the individual, and processing time is probably more stressful.

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