SCENT MARKING IN THE BINTURONG, *ARCTICTIS BINTURONG*

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In this report, I discuss binturong scent marking behavior and factors influencing its rate and form in captivity. The binturong, *Arctictis binturong*, is a little-known arboreal viverrid inhabiting dense forests of northeastern India, Indochina, Indonesia, Thailand, Burma, and Malaysia (Tate, 1947; Medway, 1969). Morphologically, it is distinct among the viverrids, having dense shaggy black fur, often tipped with yellow or white, a long partly prehensile tail, and tufts on its ears. Binturongs feed on a mixed diet of fruit, small invertebrates, and carrion (Tate, 1947; Prater, 1965; Medway, 1969). Our knowledge of the behavior of this species comes mainly from descriptive accounts of the behavior of captive animals (Vosseler, 1929; Gensch, 1962, 1966; Huf, 1965; Bulîr, 1972).

A pair of binturongs, resident at the National Zoological Park since 1965, had not bred despite several attempts to evoke reproductive activity through changes in diet and housing. During an unsuccessful attempt to induce heat and ovulation in the female through the administration of PMSG (Pregnant Mare's Serum Gonadotropin), over 48 hours of behavior observations were recorded; these began in May 1972, one and a half months prior to treatment and continued through August 1972. One hundred I.U. of PMSG was administered to the female on 5, 7, 10, 11, and 12 July.

Behavior watches were conducted during most hours of the day, although the early morning and late afternoon were preferred since the animals were most active at this time. Several early evening and two nocturnal watches were conducted; at night an "Owleye" nocturnal vision device was used. Our observations suggest that captive binturongs are diurnal or crepuscular (Huf, 1965).

Daytime observations were divided into 30 minute blocks, and the frequency and duration of individual behavior patterns were recorded.

The binturong has a large oval-shaped perineal gland which is smooth and naked internally and covered by paired hairy labia. In the male, the gland is between the scrotum and penis; in the female, it is smaller and anterior to the vulva (Pocock, 1915). Some scent deposition undoubtedly occurs while an animal is sitting or climbing along a limb, if the perineal gland comes in contact with a surface. However, there is also a conspicuous

TABLE 1.—*Metatarsus scuffing in* Arctictis binturong; *sexual dimorphism in marking and the variation in scuffing rate in different marking contexts. N indicates the number of observed scuffing bouts.*

Behavior	Male	(N)	Female	(N)
Scuffing rate with perineal gland marking	14.4	(13)	10.3	(3)
Scuffing rate with urination	15.5	(17)	7.6	(11)
Scuffing rate without other marking movements	5.3	(30)	3.6	(13)
Average scuffs per bout	10.8	(60)	6.0	(27)

posture associated with the deliberate deposition of perineal gland secretions on particular scent-marking posts. Four elevated cage locations were marked; three were vertical metal poles framing the outdoor enclosure and the fourth was a diagonally-positioned limb which was supported by a vertical forked limb and led to the ground. To mark the diagonal limb, an animal embraced the limb with the forefeet and pulled itself up into an inverted slothlike position. Once positioned, it exhibited a series of metatarsus scuffs (see below), and pressed the gland to the limb with a forward pulling movement, which is an upside-down perineal drag. To mark the vertical metal poles, the binturongs pulled themselves up on the wire mesh, and then gave a metatarsus scuff while the body was supported by the forelimbs. As the perineal gland was pressed against the pole, the body was pulled upward; this marking position has been termed the upright quadrupedal (Wemmer, 1972).

Although this behavior was seen only three times in the female and 13 times in the male, these four marking posts were clearly an important focus of interest for the binturongs. For example, in the spring when the pair was transferred to their outdoor enclosure which had been unused over the winter, both animals immediately sniffed and later scent-marked these sites. It is likely that the odors from the previous summer were detectable; perineal gland secretions in *Genetta* and *Civettictis* retain their musky sweet smell on wood after 4 years (Wemmer, 1972).

Metatarsus scuffing, another scent-marking behavior, consists of alternate shuffling movements of the hind limbs with the animal supporting its weight mainly on the forelimbs. The major area of the hind limbs in contact with the ground (or scuffed surface) is the naked heel, the digits usually being raised up. This behavior occurs alone or in the context of urination and perineal gland marking.

Binturongs exhibit locus-specific defecation. Urination occurs on the ground using a squat posture. The male occasionally flexed his legs and took several steps forward towards the end of urination. In the squat position, the tail is held on the ground and becomes soaked with urine which presumably is transferred to tree limbs during climbing. During urination, the metatarsal area also becomes covered with urine, because metatarsus scuffing is exhibited before, during, and after voiding. Urine is then transferred to other loci during metatarsus scuffing in different contexts. Scuffing was common when the animals were disturbed, for example, when the female was caught for the injections and when both were initially moved to the outdoor enclosure.

Although there was variation in the number of scuffs per bout, both animals scuffed more in the context of urination or perineal gland marking than when the scuffing occurred alone (Table 1). For example, the male averaged 14.4 and 15.5 scuffs per bout

TABLE 2.—*The behavior of a binturong pair before, during, and following hormone (PMSG) treatment of the female**

Behavior	Stages							
	I		II		III		IV	
	♂	♀	♂	♀	♂	♀	♂	♀
Mean activity (per cent)	30.8	30.1	35.5	28.0	15.2	21.5	10.7	14.4
Mean number of seconds sniffing urine and scent marks	12.2	8.8	40.1	12.5	5.7	4.6	5.0	5.1
Mean number of metatarsal scuffs	4.3	1.9	7.7	3.2	3.1	.4	2.7	.6
Mean number of seconds anogenital grooming	16.0	2.6	48.5	4.9	1.9	.9	12.1	3.3
Mean number of seconds spent sniffing and grooming the partner	6.3	2.3	11.7	4.8	4.0	3.6	1.7	1.3

* Observations during the period of hormone administration were divided into two separate stages (II and III) to compensate for the decreased activity during the latter part of the injection period (11–14 July). All means are for a 30-minute period. Number of periods during different stages are I = 24; II = 24; III = 27; IV = 21.

when perineal gland marking and urinating respectively, but otherwise only 5.3 scuffs per bout. As Table 1 indicates, however, short scuffing bouts were seen more frequently than long ones.

Considerable sexual dimorphism was seen in these scent-marking patterns (Table 1). For each context, the male displayed more metatarsus scuffing bouts than the female. Moreover, the male also exhibited more scuffs per bout than the female, averaging 10.8 as compared with the female's 6.0 scuffs per bout, for all contexts.

Two other scent-distributing behaviors were observed. Both animals pressed the side of the body against the wire mesh of the enclosure at a single site. This site was also sniffed. The male was observed several times rubbing the forehead and cheeks for up to 25 seconds. The two loci which were marked in this way were regularly examined by both animals.

Hormone treatment appeared to have an initial stimulating effect on those behaviors involved in scent marking. Following treatment of the female, both animals increased the frequency of scent deposition and scent investigation (Table 2). However, about six days after PMSG treatment was initiated, when activity levels suddenly decreased dramatically, scent marking and olfactory investigation of scent marks and urine also decreased.

In the female, two of the total of three perineal gland marks seen during the study occurred during Stage II. Moreover, of the total of 24 scuffing bouts observed during Stages I–IV in the female, 16 occurred during Stage II despite the fact that Stage II encompassed 12 hours of observation while Stages I, III, and IV totalled 36 hours.

Although the animals interacted infrequently, there appeared to be some initial effect of PMSG treatment on the social interactions of the pair (Table 2). Both animals sniffed and groomed each other more frequently and the male spent more time attending the female. For example, on the day following treatment, the male spent approximately 3 minutes of one watch lying on his venter facing the female while she was feeding, and occasionally trying to approach. Such sustained interest had not been observed previously.

A final behavior pattern which appeared to be affected by the hormone treatment was anogenital grooming, which increased dramatically in the male and was often accompanied by penile erection (Table 2).

The scent-marking patterns of *Arctictis* display a high degree of specialization in that the use of both an upright and inverted quadrupedal posture for perineal gland marking has not been reported for other viverrids. Only *Cryptoprocta* uses an upright quadrupedal stance, but this is for marking with a sternal gland (Wemmer, 1972). Presumably the inverted slothlike posture is derived from the upright quadrupedal stance.

Disturbance by people evoked marking. Vosseler (1929) described this same behavior occurring when an individual was excited, impatient, or waiting for food. Thus, certain types of conflict situations may induce scuffing outside the context of urination or perineal gland marking. A second type of stimulus which affects the levels of perineal gland marking and scuffing is odor, both familiar and strange. Strange scents clearly induce marking; at the conclusion of the main study, perfume was applied to two of the male's prefcrred marking sites and he began to perineal-gland mark shortly thereafter. The increased marking activity shown by the male after the female was injected with hormones may have been provoked, in part, by a change in the odors emanating from the female. Certainly the male displayed more interest in the female's odor shortly after she was administered hormones. He would descend from the raised platform as she began to urinate and would sniff her urine for extended periods both during and after the urination. His increased genital grooming and frequent erections also suggest that the binturong male was being stimulated by changes either in the female's odor or behavior or both.

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