Collection of African Civet *Civettictis civetta* perineal gland secretion from naturally scent-marked sites

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Abstract

Natural scent marking by African Civet *Civettictis civetta* was studied in three locations from the Jimma area, western Ethiopia. Scent-marks were found on 96 artefacts including trees, shrubs, bushes, electric and fencing poles, at a mean height of 31 cm above ground. Thirty-five percent of the scent-marked artefacts were located within 5 m of civetries. Each of the 13 sites where remarking was observed yielded a maximum of 0.4698 g/site and a minimum of 0.0092 g/site during the first collection and 0.1289 g and 0.0132 g, respectively, during subsequent collections. Re-marking was observed within five days after collection. The colour of the scent marks changed from whitish-yellow to dark-brown in a week. Non-invasive collection of perineal gland secretion in the wild, if properly managed, may be a sustainable alternative resource to African Civet farming.

Keywords: civet, civetry, perineal gland secretion, scent-mark, sustainable use

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የዝባድ አቀባብ ዘዴ በጅማ አካባቢ ምሳራብ ኢትዮጳያ በሶስት የተለያዩ ቦታዎች ጥናት ተካሂዶ ነበር። ይህም የዝባድ ቅባት በ96 ቦታዎች ማለትም በዛፍ ግንድ፣ በቁራሮ፣ በኤሌክትሪክና አጥር ላይ ከመሬት ከፍታ 31 ሳ.ሜ. ተገኝቷል። 35 በመቶ ዝባድ የተቀቡበት ቁሳቁሶች የተገኙት ጥርኞቹ ከማጀዳደብት አካባቢ 5 ሜኙር በላይ ከማይርቅበት ቦታ ነበር። ከ13 ቅባቱ ከተገኝበት ቦታዎች ከመጀመሪያ ስብስብ ከ0.0092 እስከ 0.4698 ግራም ሲገኝ በቀጣዩ ደግሞ ከ0.0132 እስከ 0.1289 ግራም ተገኝቶ ነበር። ዝባድም ከተሰበሰበ በኃላ በአምስት ቀናት ወስጥ እንደገና መቀባት ችለው ነበር። የዝባዱም ከለር ከነጭማ ቢጫ ወደ ቡናማ ጥቁር በሳምንት ወስጥ ሊቀየር ችላል። እንስሳወን ሳይረብሹ ዝባዱን ከአካባቢ ቦታዎች መሰብሰብ በማባ ከተሠራበት ጥርኝን ከቤት ወስጥ አኑሮ ከማኝው ወጪ የተሻለ አማራጭ ሊሆን ይችላል።

ቁልፍ ቃላት፡ ጥርኝ፣ መቀዳጃ ቦታ፣ ዝባድ፣ መቀባት፣ ዘላቂ አጠቃቀም

Introduction

Most viverrids have perineal scent glands (Pocock 1915), which secrete a musky fluid used for marking territories. The scent, when the gland is rubbed on natural surfaces like those of trees and rocks, is recognised by conspecifics and is used in olfactory communication (Ralls 1971, Eisenberg & Kleimen 1972, Roeder 1980, Ray 1995). Terrestrial civets (Viverrinae), including African Civet *Civettictis civetta* (Schreber, 1776), have perineal glands that produce a fluid known as 'civet' (Kingdon 1997, Balakrishnan & Sreedevi 2007a, 2007b, Bekele Tsegaye *et al.* 2008). In this species, perineal glands are rubbed after raising the tail on diverse species of trees, shrubs, grass, dry logs, poles, and rocky surfaces (Randall 1977, 1979, Bekele Tsegaye *et al.* 2008). Even though, with the advent of synthetics, 'civet' collection is not nearly so prevalent as it used to be, in Ethiopia, African Civets are kept in captivity to collect the 'civet' at an average yield of about 3–4 g per animal per week during optimal conditions. Perineal gland secretions (i.e. 'civet') are collected from captive individuals, and later refined into a compound, civetone, used as a fixative in the perfume industry (Yilma D. Abebe 2003). Civetone is also produced from the perineal gland secretion of Small Indian Civet *Viverricula indica* (É. Geoffroy Saint-Hilaire, 1803) in China (Ding 1986) and India (Mohan 1994), among other countries.

In the absence of properly bred, captive populations, African Civets are regularly captured from the wild. Most die within the first three weeks of captivity, presumably from stress during capture, transport, and quarantine (FDRE-LSMA 2003). In Ethiopian farms, wild African Civets are usually confined to a cage of approximately 90 × 30 × 30 cm. They are also treated cruelly at the time of extraction of the glandular secretion and hence animal rights activists have severely criticised African Civet farming practices in Ethiopia (WSPA 2000).

In response to such criticisms, the Ethiopian Wildlife Conservation Authority has initiated programmes to improve African Civet farming by limiting the capture to male African Civets from the wild and providing nominal incentives to farmers through supply of cages at a subsidised rate. However, poor success in keeping captive African Civets alive suggests a better alternative might be to collect secretions themselves from wild settings, thus incurring no physical risk to the animals (Balakrishnan & Sreedevi 2007a, Bekele Tsegaye *et al.* 2008). The present investigation aimed to assess the possibility of collection of African Civet perineal gland secretion from scent-marked sites in their natural habitat.

Study area and methods

The investigation was carried out in the Jimma Zone (7°18′–8°56′N, 35°52′–37°37′E), Ethiopia, where African Civet has been traditionally farmed. Jimma town is surrounded by the districts of Mana in the north, Dedo in the south, Seka Cherkosa in the west, and Kerisa in the east. The land-use types of the Zone are approximately: 42% cultivated land (crops and coffee plantation), 25% forest, 12% grazing land, 4% reserve areas for cultivation, 14% for construction and related purposes, and 3% of wetlands (Anon. 2010).

Civets have specific defecation sites or latrines called 'civetries' that help confirm their presence in their habitats. Of 13 areas where latrines were found during preliminary observations, three villages, Kito (Bosa Kito), Beda Buna (Ankeso) and Jeran (Merewa or Kujo Muja) (Fig. 1), were selected for their representation of

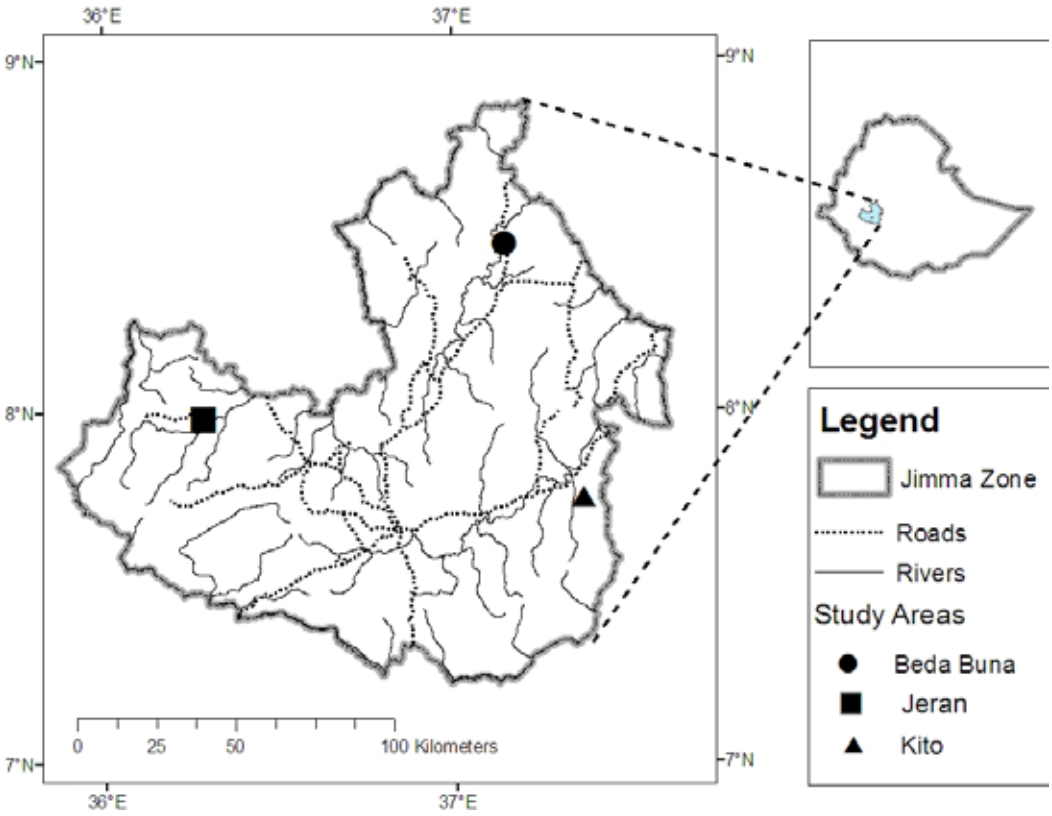

Fig. 1. Study area, showing locations of study sites.

diverse, human-encroached habitat types. Kito was close to human settlements, with *Eucalyptus globulus* plantations and sugarcane fields nearby. Beda Buna was dominated by coffee *Coffea arabica* plantations, but also had some natural forest nearby. The Addis Ababa – Jimma highway passes through this area. Jeran is a small farming village. In this area, most latrine sites were within farmland. The predominant crop types in the farm were maize *Zea mays*, sorghum *Sorghum vulgare*, and barley *Hordeum vulgare*.

Data were gathered between August 2005 and February 2006, involving 105 days of field observations. Every month, five days of field observations were made uniformly in each of the three study sites. Data were collected while walking through the roads and foot tracks, looking for African Civet latrines and scent marks. Objects with scent marks were counted. Identities of each object, height at the centre of each scent mark, and, for vegetation, girth at height of marking were recorded. Distance of scent-marked object from nearest latrine, distance of mark from nearest road or foot path, and general colour of the mark were recorded. Objects with scent-marks were numbered consecutively and the maximum available secretion was scraped out using a leaf blade without disturbing the marked site. The collected secretion was separately packed in a pre-weighed plastic sheet (6 × 6 cm). Each sample was weighed at a laboratory of Addis Ababa University using a digital balance. Sites were checked every day for at least 25 days during the field observation periods to know frequencies of scent-marking and re-marking.

To check for preference in object type for scent-marking, 20 quadrats of 5 × 5 m² were laid in different parts of the study area. All suitable objects in each quadrat were taken into account. Paired t-test analysis was carried out to check whether there was a difference in the quantity of 'civet' available on the scent-marked sites during the first and second markings. Data were treated under SPSS 14.0 (Levesque 2007).

Table 1. Height and girth of locations of different vegetation/ object in the Jimma study areas where African Civets Civettictis civetta *scent-marked.*

Plant/Object	Number of trees/plants scent-marked	Height (cm) Mean ± SD	Girth (cm) Mean ± SD
Eucalyptus globulus	60	31.87 ± 1.91	5.26 ± 4.80
Psidium guajava	7	29.43 ± 3.10	3.27 ± 1.58
Erythrina brucei	4	31.44 ± 2.47	11.08 ± 5.26
Solanum campylacanthum	7	31.89 ± 1.95	2.31 ± 0.85
Coffea arabica	12	31.86 ± 2.18	4.96 ± 2.66
Sorghum vulgare	2	30.00	4.00
Maytenus sp.	1	30.00	0.80
Electric pole	2	30.25	36.0
Vernonia amygdalina	1	30.00	2.30
Total/ Mean	96	31.00 ±1.41	5.66 ± 3.10

Results

African Civet scent-marks were found on a total of 96 trees, shrubs, bushes, and poles in the three study sites (Table 1). Scent-marks were most often found on natural surfaces around civetries, and along road-sides and foot paths. Scent markings were recorded at a mean height of 31.00 ± 1.85 cm (Fig. 2). Newly scent-marked sites with fresh glandular secretion were whitish-yellow, turning dark brown in a week. Marking heights on different species of trees/ vegetation did not show any statistically significant variation. The average girth of the vegetation where scent-marks were located

Fig. 2. A site of repeated scent-marking of African Civet Civettictis civetta *on a eucalyptus, Ethiopia.*

was 5.66 ± 3.10 cm. The lowest circumference at the marks was seen on *Maytenus* (0.8 cm) and the thickest was an electricity pole (45 cm). The circumference of marked objects showed wide variation.

The amount of secretion collectable from the sites varied from 0.0571 to 0.4715 g, but amount available on different types of objects showed no systematic variation. Nor did quantity of secretion available per marked site vary systematically with distance from civetry ($F = 5.706$, $df = 6$, $p > 0.05$; Table 2). Scent-marked objects were seen from <1–125 m distant from latrines. The highest percentage of scent-marking was observed close to civetries: within 5 m radius, 35% of suitable objects were scent-marked, but the quadrat 125 m away from any latrine had only 12.5% of suitable objects scent-marked (Table 3).

Interval of re-marking was not uniform. In all scent-marked locations whence 'civet' was collected and the animals re-marked, this occurred within five days. Among the 13 scent-marked locations with repeated collection of 'civet', the maximum and minimum available was 0.4698 g and 0.0092 g, at first collection, and 0.1289 g and 0.0132 g during subsequent collections (Fig. 3). The quantity of 'civet' available may have declined from the first to second collections (Table 4).

Table 2. Amount of perineal gland secretion of African Civet Civettictis civetta *collected from scent-marked objects in Jimma study areas in relation to the nearest latrine site, Ethiopia.*

Distance of marked sites from the latrine (m)	Number of samples	Secretion (g) Mean± SD
0–100	40	0.1244 ± 0.01
101–200	22	0.0925 ± 0.07
201–300	10	0.1104 ± 0.02
301–400	8	0.0653 ± 0.02
401–500	7	0.0849 ± 0.02
501–600	6	0.1015 ± 0.03
601–700	3	0.0942 ± 0.07

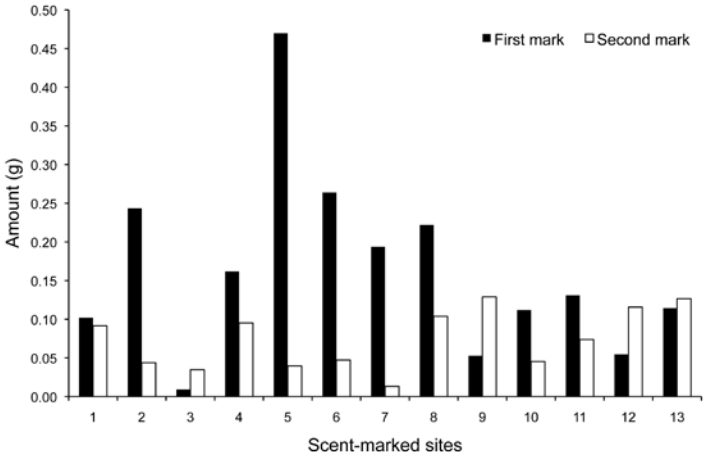

Fig. 3. Maximum quantity of perineal gland secretion of African Civets Civettictis civetta *available for collection on first and second collections from 13 scent-marked sites in Jimma area in Ethiopia.*

Table 3. Number of suitable objects for scent-marking in quadrats in Jimma study areas, Ethiopia, and proportion with observed scent-marks of African Civets Civettictis civetta *(quadrat size = 25 m²).*

Distance of quadrat from latrine site (m)	Number of suitable objects for scent-marking	Number of scent-marked objects	Percent of scent-marked objects
<10	20	7	35.00
20	4	1	25.00
25	6	2	33.33
30	15	3	20.00
70	14	2	14.28
80	15	3	20.00
90	22	3	13.63
125	8	1	12.50
300	0	0	0
600	13	0	0
750	21	0	0

Discussion

More scent marks were observed on *Eucalyptus globulus* than on any other trees in the study area, where there were a large number of coppices of the former species that might explain the greater number of scent-marking on this species. The smooth surfaces of

Table 4. Availability of 'civet' during the first vs second marking by African Civet, Ethiopia.

Variables	Samples	Mean (g)	Standard error	Standard deviation	95% Confidence Interval	
First marking	13	0.1638	0.0332	0.1199	0.0913	0.2362
Second marking	13	0.0738	0.0107	0.0387	0.0504	0.0972

the eucalypts might also facilitate active scent-marking in opposition to rougher surfaces of the barks of other trees, even though African Civets can scent-mark on trees with rougher barks (Bekele Tsegaye *et al*. 2008). Randall (1979) reported that African Civets scent mark at a significantly higher proportion on trees and shrubs from which they eat the fruits. The present findings show that they not only scent-mark fruit-bearing plants in the surroundings, but any suitable objects including non-fruit-bearing plants, and electric and fencing poles.

The height at which the scent-marks were laid denotes mostly the height of the posterior quarters of the animals, which might also give an indication about the approximate age of the individuals (Bekele Tsegaye *et al*. 2008) when marking on rigid artefacts. The range of the signal and the level of perception of the message are influenced by the height at which the signal is laid, since the latter can be easily perceived by conspecifics if the scent-marked sites are at or around the height of the nostrils (Müller-Schwarze 1983). Civets exhibited a tendency to scent-mark at higher frequencies on objects within 5 m of civetries, meeting with the fact that the species was reported to spend more time around civetries when active (Bekele Tsegaye 2006).

Out of the 96 scent-marks observed during the present investigation, only thirteen were found to be re-marked. The low rate of re-marking might reflect the long lasting nature of the odour (Eisenberg & Kleiman 1972). There were several scent-marks on objects on road-sides and on foot paths. As for many wild mammals, roads, foot paths, and animal tracks (Odendaal *et al.* 1980) might be the main foraging tracks of the civets. Areas close to human settlements also had several scent-marked sites. Out of the total scent-marked sites located during the present investigation, 74% were in Kito, where availability of food in natural habitat and human settlements was high.

The difference in the quantity of marked secretion available for collection might be linked to the age of the individual, since adult and more dominant individuals might secrete more than the young and subdominant ones (Eisenberg & Kleiman 1972). In many mammals, sign-posts are repeatedly scent-marked (Mykytowycz 1970). African Civet scent-marks sign-posts repeatedly, but the present investigation reveals only 13.5% of objects being remarked, when the marked secretion was collected from the site. Even though more objects around civetries were scent-marked, there was no systematic variation in the amount of secretion available on sign-posts in relation to the distance from the civetry. As the scent once marked persists for a long duration, re-marking is not essential over a short time-scale for the purpose of communication (Mykytowycz 1970, Ralls 1971).

Sexual dimorphism is well known in size, frequency and pattern of scent marking in various mammal species (Mykytowycz 1970, Ralls 1971, Eisenberg & Kleiman 1972, Adams 1980), with larger glands in males. However, this has not been observed in Small Indian Civet (Balakrishnan 2002). Ethiopian owners of African Civets expect more secretion from the males (Bekele Tsegaye unpublished) and hence they are interested to keep only males in their farms. Wild scent-marked sites cannot be discriminated into that of males and females, and hence to evaluate this belief, a detailed experimental study would be required.

The present investigation suggests the feasibility of collection of civet gland secretion from the wild. Even though there may be a drop in amount of secretion available between first and second marking, it was possible to collect the scent-marked secretion from scent-marked sites. Trained local people could collect this resource; such sustainable use might be a good source of foreign exchange for Ethiopia, and support the livelihood of local people. At present, there is only one African Civet farm with government license as per the records of the Oromia Forest & Wildlife Enterprise, which is the Ethiopian government authority to issue license for such farming. However, there are not less than 200 unauthorised African Civet farms in Ethiopia (Bekele Tsegaye unpublished). As African Civet farming and extraction processes in Ethiopia are under severe ethical criticism (WSPA 2000), it is essential to develop techniques of extraction of the gland secretion without maintaining African Civets in deplorable captive conditions. In response to such criticism, the Ethiopian Wildlife Conservation Authority ordered that only males be held captive. This will not help to improve the situation in relation to captive conditions, for which civets need to be maintained in semi-natural enclosures (see Balakrishnan & Sreedevi 2007a, 2007b), providing an appropriate place to breed and to collect the 'civet' without harming animals.

The present investigation supports the earlier view (Bekele Tsegaye *et al*. 2008) that gland secretion might be collected from the wild with minimal disturbance to African Civets in their natural habitat and there is no need to keep them captive for the 'civet' business to run effectively. It remains essential to study behaviour of African Civets, so as to fix the frequency of the collection of 'civet' from the wild as not to disrupt civet behaviour. In a recent study on River Otters *Lontra canadensis*, Oldham & Black (2009) showed that the response of otters to the removal of scent marks was no longer significantly different from the baseline values by the third day, even though there was a 9-fold increase in urine marking and a 5-fold increase in the number of scat-jellies on the first day. A similar study on free-living African Civets could be made to evaluate their behavioural response to the removal of scent marks from the marked environmental sign-posts. Individuals already running African Civet farms can be incorporated and trained in collection of the glandular secretion from the wild. To increase in-country benefit, the secretion can also be processed and civetone can be extracted in the country itself before its export.

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