Short Communications

Volatile components from the anal glands of the yellow mongoose *Cynictis penicillata*

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Twenty-two components of the odour of the anal-gland secretions of a male and a female yellow mongoose *Cynictis penicillata* were identified by dynamic solvent effect sampling, gas-liquid chromatography and mass spectrometry. The odour volatiles were considerably more diverse than those reported from the anal gland secretions of *Herpestes auropunctatus* and *H. ichneumon*.

Twee-en-twintig vlugtige verbindings uit die anaalklierafskeidings van 'n manlike en 'n vroulike witkwasmuishond *Cynictis penicillata* is geïdentifiseer d.m.v. dinamiese oplosmiddeleffekmonstering, gasvloeistofchromatografie en massaspektrometrie. Die komponente van die reuk was aansienlik meer uiteenlopend as dié gerapporteer vir die anaalklierafskeidings van *Herpestes auropunctatus* en *H. ichneumon*.

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Yellow mongooses are widespread throughout the south-western arid zone of the southern African subregion. They are colonial, diurnal viverrids which are predominantly insectivorous but occasionally take seeds or small, vertebrate prey. Their general biology has been reviewed by Smithers (1983).

Like other viverrids the yellow mongoose possesses a well-developed complex of glands around the anus (Macdonald 1985). The products of these glands are employed in scent marking throughout the animals' home ranges and in allomarking between colony members (Earle 1981; Wenhold pers. comm.).

Some of the volatile components of the anal gland secretions of a male and a female yellow mongoose are reported here.

Methods

Anal gland secretion was obtained from one mongoose of each sex. (Transvaal Museum numbers TM 39215 [female] and TM 39216 [male]). The contents of the anal sacs, and adherant material from the surrounding area, were collected in glass-stoppered, borosilicate glass tubes and held at liquid nitrogen temperature until analysis.

Palladium cell purified hydrogen was passed into each tube and over the secretion at a flow rate of 15 cm^3 min^{-1} and a temperature of 26–27°C, and entrained volatiles were sampled by the dynamic solvent effect (Apps, Pretorius, Lawson, Rohwer, Centner, Viljoen & Hulse 1987) using *n*-hexane as solvent. Sampling periods of 5 min were used for gas chromatography–flame ionization detector (GC-FID) analyses, extended to 20 min to increase the yield of volatiles for gas chromatography–mass spectrometry (GC-MS) analyses. To facilitate identification of some minor components a GC-MS run was carried out on a sample from which the carboxylic acids had been subtracted by passing the volatile-laden hydrogen over approximately 20 mg of sodium carbonate before it entered the concentrator.

GC-FID analyses were carried out on a Varian 3700 gas chromatograph fitted with a dynamic solvent effect inlet (Apps *et al.* 1987) and a 25 m × 0,3 mm × 0,4 μm methyl silicone capillary column. The carrier gas was hydrogen with a linear velocity of 55 cm s^{-1}. The starting temperature of both inlet and column was 40°C, the inlet was heated ballistically to 220°C after 2,2 min and the column temperature was programmed at 4°C min^{-1} after 7 min. The detector sensitivity was 4×10^{-11} A mv^{-1} full scale deflection. GC-MS analyses were carried out under equivalent conditions on a modified Varian 1400,

Table 1 Identifications of some volatile components of the anal gland secretion of the yellow mongoose *Cynictis penicillata*. Peak numbers correspond to Figure 1. Criteria of identification: L = mass spectral library search, R = chromatographic retention index (without R the stereochemistry is provisional)

Peak	Compound	Criteria
1	dimethyl disulphide	L R
2	hexanal	L R
3	butanoic acid	L R
4	3-methylbutyl ethanoate	L
5	pentanoic acid	L R
6	2-methylbutanoic acid	L R
7	hexanoic acid	L R
8	benzaldehyde	L R
9	dimethyl trisulphide	L R
10	1-methylpropyl propanoate	L R
11	phenylacetaldehyde	L R
12	3-(methylthio)-1-propanol	L
13	*p*-cresol	L R
14	indole	L R
15	propyl butanoate	L R
16	3-methylbutyl propanoate	L
17	3-methylbutyl 2-methylpropanoate	L
18	2-methylbutyl butanoate	L R
19	nonanal	L R
20	2-methylbutyl 2-methylbutanoate	L R
21	2-methylbutyl 3-methylbutanoate	L
22	decanal	L

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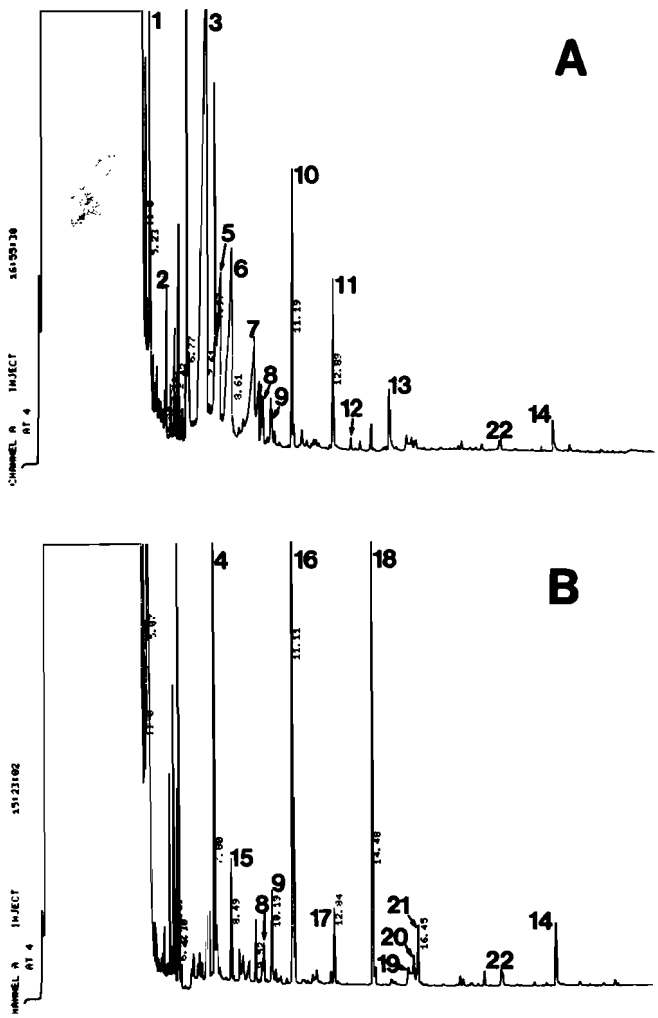

Figure 1 Chromatograms of volatiles from the anal gland secretion of A: a male, and B: a female yellow mongoose *Cynictis penicillata*. For analytical conditions see text. Peak numbers correspond to Table 1.

using helium as carrier gas, with an open split interface to a VG Micromass 16F spectrometer operating in the electron impact mode. The source temperature was 220°C and the electron energy was 70 eV. Identifications were based on mass-spectral library searches and, where possible, were confirmed by retention indices.

Results

The peri-anal area of both the male and the female yellow mongoose was thinly covered by a dark brown, waxy material with an odour, neither strong nor unpleasant, closely resembling that of dried beef. The anal sacs contained a milky fluid with the sour, cheesy smell of short-chain carboxylic acids. Anal gland secretion from both sexes yielded complex mixtures of volatiles of diverse chemical character (Table 1, Figure 1).

Discussion

Gorman, Nedwell & Smith (1974) found a mixture of short-chain carboxylic acids in the anal scent pockets of the small Indian mongoose *Herpestes auropunctatus* and Gorman (1976) established that differences in the ratios of these acids could form the basis of individual odour recognition. A mixture of heavier, branched acids was found in *Herpestes ichneumon* by Hefetz, Ben-Yaacov & Yom-Tov (1984). The short, straight-chain carboxylic acids of the yellow mongoose resemble those of *H. auropunctatus* rather than *H. ichneumon*, although the apparent differences among the three species may, to some extent, be due to differences in methods of collection and analysis of secretion.

In neither *H. auropunctatus* nor *H. ichneumon* were compounds other than carboxylic acids identified, although Hefetz *et al.* (1984) record the presence of unidentified compounds in *H. ichneumon*. A more extensive survey of various species would be necessary to put this apparent difference into a systematic context.

Only four of the 22 compounds identified; benzaldehyde, dimethyl trisulphide, indole and decanal were present above the trace level in both sexes (Figure 1). Although one individual of each sex is too small a base for definite conclusions it appears that the inter-sexual differences in *Cynictis* volatiles are much more complex than they are in *ichneumon*, where a single compound; 2,4,6,10-tetramethylundecanoic acid is found in males and not in females (Hefetz *et al.* 1984).

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