

# Volatile Components in Dorsal Gland Secretions of the Chacoan Peccary, *Catagonus wagneri*

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The dorsal gland secretions of captive-reared male and female Chacoan peccaries (*Catagonus wagneri*) were analyzed by gas chromatography-mass spectrometry. C<sub>8</sub>–C<sub>19</sub> carboxylic acids, squalene, cholesterol, cholestanol, and cholest-7-en-3-ol were present in both males and females. Heptylbenzene, C<sub>14</sub>–C<sub>18</sub> methyl esters, and an isomer of springene were observed in males. C<sub>15</sub>–C<sub>19</sub> aldehydes were observed in females. The composition of the dorsal gland secretions of *C. wagneri* is compared to what has been reported for other peccaries (*Tayassu* spp.).

**Key words:** Chacoan Peccary, *Catagonus wagneri*, Dorsal Gland

## Introduction

The Tayassuidae is a family of pig-like mammals represented by three extant species: the collared peccary (*Tayassu tajacu*), which ranges from Arizona to Argentina; the white-lipped peccary (*T. pecari*), which ranges from southern Mexico to Argentina; and the Chacoan peccary (*Catagonus wagneri*), the largest species (ca. 40 kg), which inhabits the semi-arid Chaco Alto thorn forest of northwestern Argentina, southeastern Bolivia, and northwestern Paraguay. All peccaries possess a prominent dorsal gland situated in the middle of the rump (Sowls, 1984). Peccaries rub this gland against branches and other objects during scent marking (Sowls, 1984), and against conspecifics during alloanointing (Handen and Benirschke, 1991; Waterhouse *et al.*, 2001).

Analyses by gas chromatography-mass spectrometry (GC-MS) of dorsal gland secretions of free-ranging, adult *T. tajacu* (Waterhouse *et al.*, 1996) and *T. pecari* (Waterhouse *et al.*, 2001) reveal squalene and several isomers of springene, a diterpene homologue of farnesene. Straight- and branched-chain esters occur in females of *Tayassu* spp., but these compounds are absent or poorly represented in males. The secretions of *T. pecari* also contain C<sub>5</sub>–C<sub>18</sub> carboxylic acids, 2-methoxyphenol, four monoalkanoate esters of methylhydroquinone, and two compounds tentatively characterized as C<sub>16</sub> lactones (Waterhouse *et al.*, 2001).

We report the results of an analysis by GC-MS of the dorsal gland secretions of captive-reared *C. wagneri*. This species, which is endangered (CITES Appendix I), was formally described in 1975, although it had been familiar to indigenous people in parts of its range (Wetzel *et al.*, 1975). Behavioural observations of captive *C. wagneri* reveal that adults alloanoint juveniles and adults with this gland (Handen and Benirschke, 1991).

## Materials and Methods

Secretions were obtained from captive-reared *C. wagneri* maintained at the Phoenix Zoo, AZ, USA, and the San Diego Zoo, CA, USA. Phoenix animals were fed apples, cantelope, carrots, yams, watermelon, and Econo-mate/Herbivore Supplement (Eagle Milling Co., Casa Grande, AZ, USA), which consists chiefly of hay. San Diego animals were fed carrots, collard greens, dandelion greens, hay, kale, and turnips. Samples were obtained during health inspections, where animals were immobilized by dart injection with ketamine, medetomidine, midazolam, and butorphenol.

Secretions were obtained as described in Waterhouse *et al.* (1996). Samples were collected from four males and three females from Phoenix, and from two males and three females from San Diego. Males ranged in age from 5 to 8 months; females ranged from 2 months to 4.9 years. Each sample

analyzed contained secretions from one to three individuals, pooled according to sex.

Samples were stored at  $-78^{\circ}\text{C}$ . They were extracted with *n*-hexane and a  $1\ \mu\text{l}$  sample was injected into a Hewlett-Packard 6890 gas chromatograph fitted with a HP5 capillary column ( $30\ \text{m} \times 25\ \mu\text{m} \times 0.25\ \mu\text{m}$  film thickness) coupled to a Hewlett-Packard 5973 mass spectrometer. Samples were analyzed using a temperature program starting at  $40^{\circ}\text{C}$  for 3 min, followed by an increase of  $4^{\circ}\text{C}/\text{min}$  to  $240^{\circ}\text{C}$ , and then 20 min at  $240^{\circ}\text{C}$ . Compounds were tentatively identified by comparison with reference spectra in the NIST98.1 library of the Chemstation software.

### Results and Discussion

Our analysis of the dorsal gland contents of *C. wagneri* reveals some compounds or compound classes reported from the dorsal gland of other peccaries (*Tayassu* spp.) (Table I). We observed

$\text{C}_8$ ,  $\text{C}_{15}$ ,  $\text{C}_{16}$ , and  $\text{C}_{19}$  carboxylic acids in the secretions of *C. wagneri*. A more extensive series of acids ( $\text{C}_5$ – $\text{C}_{18}$ ), including phenylacetic and 3-phenylpropanoic acids, was reported in *T. pecari* (Waterhouse *et al.*, 2001). Squalene, which occurs on the integument of many mammals (Lindholm and Downing, 1980; Albone, 1984), was observed in all samples of *C. wagneri*. Two isomers of squalene were reported in the secretions of *T. tajacu* (Waterhouse *et al.*, 1996). Cholesterol also occurred in all samples of *C. wagneri*. Neither this compound nor the other two sterols observed in this species (cholestanol and cholest-7-en-3-ol) have been reported from the dorsal gland of *Tayassu* spp.

All of the male *C. wagneri* we examined exhibited traces of an isomer of springene, a diterpene hydrocarbon originally isolated from a skin (dorsal) gland of another artiodactyl, the springbok antelope (*Antidorcas marsupialis*) from Africa (Burger *et al.*, 1978, 1981). We tentatively identify

Table I. Compounds identified in dorsal gland secretions of male (M) and female (F) *Catagonus wagneri*. Numbers in parentheses indicate the number of individuals contributing to each sample.

Compound	M (1)	M (1)	M (1)	M (1)	M (2)	F (1)	F (2)	F (3)
<i>Hydrocarbons</i>								
Heptylbenzene	+	+	+	+	+	–	–	–
(6 <i>E</i> ,10 <i>E</i> )- $\beta$ -Springene	+	+	+	+	+	–	–	–
Squalene	+	+	+	+	+	+	+	+
<i>Carboxylic acids</i>								
Octanoic acid	–	–	–	–	–	–	+	–
Pentadecanoic acid	+	+	+	+	+	–	–	–
$\text{C}_{16}$ acid	+	+	–	+	+	–	+	–
Hexadecanoic acid	–	+	–	–	+	–	+	–
Methyl 9-octadecenoic acid	+	+	–	–	+	–	–	–
<i>Alcohols and aldehydes</i>								
14-Methyl-8-hexadecenol	–	–	–	–	–	–	+	–
Pentadecenal	–	–	–	–	–	–	+	–
Heptadecenal	–	–	–	–	–	–	+	–
9-Hexadecenal	–	–	–	–	–	–	+	–
13-Octadecenal	–	–	–	–	–	–	+	–
<i>Esters</i>								
Methyl 12-methyltridecanoate	+	+	+	+	+	–	–	–
Methyl 7-tetradecenoate	+	+	+	tr	+	–	–	–
Methyl tetradecanoate	+	+	+	+	+	–	–	–
Methyl hexadecanoate	+	+	+	+	+	–	–	–
Methyl 9-hexadecenoate	+	+	+	+	+	–	–	–
Methyl 14-methylhexadecanoate	+	+	–	–	+	–	–	–
<i>Sterols</i>								
Cholesterol	+	+	+	+	+	+	+	+
Cholestanol	+	+	+	+	+	+	+	+
Cholest-7-en-3-ol	+	+	+	+	+	+	+	+

+, Present; –, not present; tr, trace.

this isomer in *C. wagneri* as (6*E*,10*E*)- $\beta$ -springene on the basis of its mass spectrum and its retention time relative to another component, hexadecanoic acid. Several isomers of springene were reported in *T. pecari* and *T. tajacu*, but in contrast to *C. wagneri*, the springenes in these species occur in relatively high concentrations (Waterhouse *et al.*, 1996, 2001).

Straight- and branched-chain esters were reported in the dorsal gland of *Tayassu* spp. These compounds in *T. tajacu* range from C<sub>14</sub>–C<sub>6</sub> to C<sub>16</sub>–C<sub>12</sub> (Waterhouse *et al.*, 1996), whereas in *T. pecari* C<sub>8</sub> to C<sub>10</sub> farnesyl esters are present (Waterhouse *et al.*, 2001). Esters in these species were detected primarily in females. We observed seven C<sub>14</sub> to C<sub>18</sub> methyl esters in *C. wagneri*, but only in males. The mass spectra of these compounds displayed the following *m/z* values (rel. int.): methyl 12-methyltridecanoate, 242 [M<sup>+</sup>] (2), 199 (21), 143 (21), 87 (72), 74 (100), 55 (28), 43 (41); methyl 7-tetradecenoate, 240 [M<sup>+</sup>] (2), 209 (9), 166 (14), 124 (16), 110 (16), 98 (28), 97 (29), 96 (31), 87 (37), 74 (50), 69 (47), 55 (100), 41 (66); methyl tetradecanoate, 242 [M<sup>+</sup>] (4), 199 (10), 143 (20), 87 (66), 74 (100), 55 (26), 43 (33); methyl pentadecanoate, 256 [M<sup>+</sup>] (2), 213 (9), 199 (17), 143 (23), 87 (73), 74 (100), 55 (40), 43 (38); methyl hexadecanoate, 270 [M<sup>+</sup>] (4), 227 (9), 199 (4), 143 (20), 87 (70), 74 (100), 55 (45), 43 (61); methyl 9-hexadecenoate, 268 [M<sup>+</sup>] (2), 236 (9), 194 (9), 152 (14), 123 (16), 110 (21), 98 (34), 97 (38), 96 (38), 87 (40), 83 (41), 74 (53), 69 (55), 55 (100), 41 (71); and methyl 14-methylhexadecanoate, 284 [M<sup>+</sup>] (6), 241 (8), 199 (8), 185 (11), 143 (25), 87 (72), 74 (100), 55 (61), 43 (57).

We observed monounsaturated C<sub>15</sub>, C<sub>16</sub>, C<sub>17</sub>, and C<sub>18</sub> aldehydes in a sample pooled from two female *C. wagneri* from San Diego. The mass spectra of these compounds showed the following *m/z* values: pentadecenal, 206 [M<sup>+</sup>-18] (6), 135 (12), 121 (32), 111 (25), 98 (50), 97 (41), 83 (48), 81 (45),

69 (39), 67 (55), 57 (40), 55 (100), 43 (61), 41 (99); 9-hexadecenal, 238 [M<sup>+</sup>] (1), 220 [M<sup>+</sup>-18] (5), 149 (5), 135 (11), 121 (27), 111 (22), 98 (48), 97 (42), 83 (44), 81 (48), 57 (41), 55 (100), 43 (64), 41 (98); heptadecenal, 234 [M<sup>+</sup>-18] (3), 185 (4), 135 (9), 129 (7), 121 (15), 111 (21), 98 (38), 97 (37), 83 (39), 81 (40), 69 (53), 67 (43), 57 (39), 55 (100), 43 (67), 41 (84); and 13-octadecenal, 248 [M<sup>+</sup>-18] (3), 166 (4), 150 (5), 135 (7), 121 (21), 111 (23), 98 (42), 97 (40), 83 (50), 81 (46), 69 (61), 67 (48), 57 (45), 55 (100), 43 (52), 41 (90). All compounds were characterized by a [M<sup>+</sup>-18] peak resulting from the loss of H<sub>2</sub>O, which is typical of aldehydes. However, only 9-hexadecenal displayed a molecular ion. All spectra showed prominent peaks at *m/z* 98, representing a McLafferty-type rearrangement of an unsaturated compound. The base peak in all the spectra is *m/z* 55. Examination of the mass spectra of the unsaturated aldehydes in the NIST library fails to reveal consistency between the position of the carbon-carbon double bond and prominent peaks at *m/z* 55 and 98, hence it is not possible to identify the positions of the carbon-carbon double bond in the molecules. Aldehydes have not heretofore been reported from the dorsal gland of tayassuids.

We also observed an unknown compound in the secretions of *C. wagneri* present in a sample of two females from San Diego. Its mass spectrum indicates that the unknown may be dodecenal. The spectrum exhibits an ion at *m/z* 164, which may correspond to a [M-18] peak, and, as with other unsaturated aldehydes in the sample, a peak at *m/z* 98.

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