A LABORATORY STUDY OF CACHING IN *DESMODILLUS AURICULARIS*

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Many seed-eating rodents have been reported to cache seeds for use as an energy source during the non-growing season (Fleming & Brown 1975). *Desmodillus auricularis* (A Smith, 1834), a common rodent in arid and semi-arid parts of southern Africa, is known to cache seeds such as dubbeltjies (*Tribulus* sp.) in its burrows, but there are few quantified data on this important behaviour. This paper presents the results of a laboratory study of caching by *D. auricularis*. The purpose was to evaluate the following questions: 1) what is the propensity to cache in this species; 2) are there sex differences in caching; and 3) what is the relationship between sleeping sites and caching sites?

The animals used in this study were wild-caught as adults in March 1975 on the edge of the Namib Desert in South West Africa (25°18'S/15°55'E, Maltahöhe District). They were housed singly or in pairs in 47 × 24 × 22 cm plastic cages with sand bedding; laboratory food (Wayne Lab-Blox) and water were provided *ad lib*. Temperatures in the animal room were 24 ± 3°C, and the photoperiod was 14 hours light, 10 hours dark.

Each experimental apparatus consisted of a circular metal arena 76 cm in diameter, with 46 cm high walls and a wire mesh floor. Each of two holes at opposite sides of the arena opened into a chamber consisting of a clay drainage tile (9,5 cm inside diameter, 32 cm long). Two compressed cotton Nestlets (Ancare Corp.) were placed in each chamber at the beginning of each test period. Sand for dusting and/or caching was provided in two 19 × 43 × 2,5 cm cardboard trays placed on the floor of each arena. Test temperature and light cycle were similar to that in the colony room. Lighting in each arena consisted of a 100 watt white light bulb and a 7,5 watt white light bulb for "day" and a 7,5 watt white light bulb for "night". Drinking water was provided *ad lib*.

Test runs of seven nights each were conducted between 31 March and 5 May 1976. Eight male and eight female *D. auricularis* were used. Animals which had previously been housed singly were paired several weeks before testing. None of the females was pregnant or lactating during the test runs, but the breeding condition of males was not noted. Three days prior to each test run, sunflower seeds were given to the animals to allow experience in handling and eating this novel food source. Each test animal's mass was determined, and it was placed individually in an arena between 13h00 and 16h00 on the first day of the seven-day test run. Sixty grams of laboratory food were scattered over the floor of the arena, and 60 g of unhusked sunflower seeds were placed in a central feeding station consisting of a 355 ml tin can with seed-dispensing holes cut in its sides. Between 09h00 and 12h00 on each following day of the test runs, any laboratory blocks remaining on the floor of the arena and any seeds left in the can were removed and their mass measured; 60 g of each food type was replaced in the arena. On each morning, the side chambers were examined to determine sleeping sites. Subsequent to the last night of the test run, each animal was removed from the arena and its mass determined. The mass of whole sunflower seeds in each tile was determined after the broken hulls of those eaten were removed. The apparatus was thoroughly washed and dried between each run. Statistical analyses were conducted using Chi-square and Student's t-tests (Sokal & Rohlf 1969).

All test animals removed some seeds and laboratory blocks from the arena and cached them in one or both of the two tiles. Only a few cases of caching in areas other than the tiles were observed: one male formed a cache, primarily of laboratory blocks, on the wire mesh floor, and three females and one male kicked some sand from the trays, burying the base of the can containing the sunflower seeds. The nightly percentage of the total mass of each food type cached by animals of each sex during the tests did not change over test nights (expected value = 100

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per cent/7 nights of the test run = 14 per cent; χ^2 for males = 0,063; $P > 0,5$; χ^2 for females = 0,011; $P > 0,9$).

The mean total mass of sunflower seeds and laboratory blocks removed (*i.e.* cached or eaten) from the arena is given in Table 1. A Student's t-test showed no difference between males and females in the mass of seeds or blocks cached ($P > 0,5$ for each food type). The observed differences between mass of seeds and laboratory blocks cached were not significant ($P > 0,1$) for either males or females.

TABLE 1

Mean total mass ± SE (g) of sunflower seeds and laboratory blocks removed (*i.e.* cached or eaten) by male and female *Desmodillus auricularis*.

Sex	*Sample size*	*Sunflower seeds*	*Laboratory blocks*
Males	8	197,8 ± 31,5	289,5 ± 40,5
Females	8	164,1 ± 42,2	175,3 ± 52,4

Thirty-three per cent of the seeds and 26 per cent of the laboratory blocks cached by *D. auricularis* males were found in the tiles in which they slept; these percentages for females were 32 and 10 respectively. A χ^2 test on pooled male and female data showed these percentages to differ significantly from randomness (for lab blocks, $\chi^2 = 5,070$; $P < 0,05$; for sunflower seeds, $\chi^2 = 3,853$; $P > 0,05$), with more food storage in the non-sleeping sites.

The animals were nightly provided with constant quantities of two food types and had access to several potential caching sites for a period of seven nights. Most of the animals began caching on the first night and continued caching at a relatively constant rate over the seven nights of the test period. The rodents nightly collected and transported combinations of the two food types averaging 96 per cent of their body mass. The data indicate that there is indeed a great propensity to cache in this species.

There were no observed sex differences in caching. This finding is in contrast to many previous studies of small mammal food storage. In a laboratory study of *Gerbillurus paeba*, Stutterheim & Skinner (1973) observed food collection and storage by females but not by males. Sex differences in degree of caching have also been reported in laboratory rats (Wolfe 1939), hamsters (Smith & Ross 1950), heteromyid rodents (Fleming & Brown 1975), and gerbils (Nyby *et al.* 1973). Although the reproductive condition of test males was not noted in this study, we recognize that androgen levels may play a role in the male's hoarding behaviour (Nyby *et al.* 1973). It is not possible to state whether the similarity in caching between sexes of *D. auricularis* is due to low body concentrations of androgen or is related to phenomena other than hormonal levels in males.

Almost all food was stored in the tile containers rather than being "scatter hoarded" (Morris 1962) in the arena. The large stores of food found by Nel (1967) in side chambers of *D. auricularis* burrow systems in the Kalahari Desert suggest that the pattern of caching obsrved in this study is similar to that of free-ranging individuals.

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REFERENCES

FLEMING, T H & BROWN, G J 1975. An experimental analysis of seed hoarding and burrowing behavior in two species of Costa Rican heteromyid rodents. *J. Mammal.* 56: 301–315.

MORRIS, D 1962. The behaviour of the green acouchi (*Myoprocta pratti*) with reference to scatter hoarding. *Proc. zool. Soc. Lond.* 139: 701–732.

NEL, J A J 1967. Burrow systems of *Desmodillus auricularis* in the Kalahari Gemsbok National Park. *Koedoe* 10: 118–121.

NYBY, J, WALLACE, P, OWEN, K & THIESSEN, D D 1973. An influence of hormones on hoarding behavior in the Mongolian gerbil (*Meriones unguiculatus*). *Horm. Behav.* 4: 283–288.

SMITH, W I & ROSS, S 1950. Hoarding behavior in the golden hamster (*Mesocricetus auratus auratus*). *J. genet. Psychol.* 77: 211–215.

SOKAL, R R & ROHLF, F J 1969. *Biometry.* San Francisco: Freeman.

STUTTERHEIM, C J & SKINNER, J D 1973. Preliminary notes on the behaviour and breeding of *Gerbillurus paeba paeba* (A Smith 1834) in captivity. *Koedoe* 16: 127–148.

WOLFE, J B 1939. An exploratory study of food-storing in rats. *J. comp. Psychol.* 28: 97–108.

NEW LOCALITY RECORDS FOR *CROCIDURA MARIQUENSIS*

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The black musk shrew *Crocidura mariquensis* has not previously been recorded south of 25° S and west of 27° E in the Transvaal. Specimens have been collected at localities 24 26 DB (near the type locality), 26 27 AD (I Rautenbach pers. comm.), and at 26 27 DC in the Orange Free State (Lynch 1975). These localities have been plotted using the degree square locus system (Davis 1958).

On 22 November 1976, an adult female *C. mariquensis*, Transvaal Museum specimen TM 27185, was collected in the grain store at Bossies, Transvaal (26° 33'S/25° 37'E). A second specimen, an adult male, was found dead at Barberspan Nature Reserve (26° 33'S/25° 36'E) on 27 April 1977. The occurrence of *C. mariquensis* in the Barberspan area had been suspected for some months. Samples of barn owl (*Tyto alba*) pellets collected on 12 September 1976 and on 28 December 1976 at Barberspan Nature Reserve, contained *Crocidura* skulls that were tentatively identified as *C. mariquensis*.

The present records extend the known distribution of *C. mariquensis* some 150 km west and 200 km south of previous recorded localities. It is of interest to note that the rainy seasons of 1973/74, 1974/75 and 1975/76 were above average in the western Transvaal (rainfall at Barberspan of 897 mm, 931 mm and 959 mm respectively; mean rainfall = 540 mm over 14 years). *Crocidura mariquensis* occurs in moist habitats (N Dippenaar pers. comm.), and the present records may be linked to the increased moisture level of the general area during these three years.

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REFERENCES

DAVIS, D H S 1958. Degree-square distribution diagrams: mapping system in use at the Medical Ecology Centre, Johannesburg. In *Cartography of vectors of disease, Bakavu-Lwiro.* CCTA/CSA Publ. 29: 49–53.

LYNCH, C D 1975. The distribution of mammals in the Orange Free State, South Africa. *Navors. nas. Mus. Bloemfontein*, 3: 109–139.