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THE DIET OF *PETROMUS TYPICUS* (PETROMURIDAE, RODENTIA) IN THE AUGRABIES FALLS NATIONAL PARK

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Abstract — The diet of *Petromus typicus* from three sites in Augrabies Falls National Park was analysed. Grass is the main item of the diet but the proportion of grasses to dicotyledons is determined to some extent by availability.

Introduction

In Augrabies Falls National Park there is a sparse population of dassie rats *Petromus typicus* (Smith, 1831) inhabiting the rock shelters of the pink gneiss drainage channels that run to the Orange River.

Plant canopy cover is good, ranging from 35% to 60% in the drainage channels and seldom falling below 10% even in the rockiest areas, but the composition varies from predominantly shrubs to predominantly grasses (Werger & Coetzee 1977).

Petromus is scattered through the different types of vegetation but each particular location is determined by the availablity of suitable shelters (George & Crowther 1981) rather than by the types of vegetation.

Petromus is a herbivore and, according to Shortridge (1934), its diet consists of 'mountain shrubs and herbs' with the addition of berries and seeds. But the compostion of its diet has not been analysed. Therefore, in September 1979, *Petromus* in each of three different but overlapping plant communities was systematically studied.

Materials and Methods

Three areas in the pink gneiss were chosen as study areas. One was low down in a dry channel, occupied by two *Petromus* and dominated by *Schotia afra* bushes and *Triraphis ramossissima* (Fig. 1). The second was about 20 m from the channel at a height of about 20 m (Fig. 2), where the vegetation, although patchy, was still abundant and consisted of a mixed community of grasses, herbs and small shrubs that included *Acacia mellifera, Lycium austrinum, Indigofera heterotricha* and *Hermannia stricta,* with the occasional *Cucumis dinteri, Solanum sisymbrifolium* and *Aloe dichotoma.* There were two *Petromus* at this site. The third site was about 60 m above the channel (Fig. 3) with about 10% plant coverage in patches of mainly grasses: *Triraphis ramosissima. Enneapogon scaber* and *Cenchrus ciliaris* with a

few *Monechma spartioides*, one *Lycium austrinum* bush and one *Pappea capensis* rooted between the rocks. Four *Petromus* lived at this site.

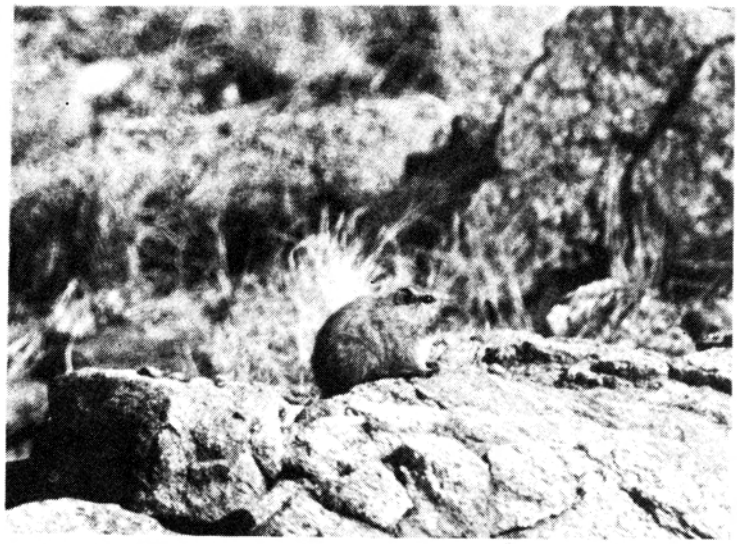

Fig. 1. *Petromus typicus* at site 1, in a dry drainage channel, surrounded by grass clumps and small herbs.

Fig. 2. Site 2 in the pink gneiss with a sparse coverage of grass and small shrubs.

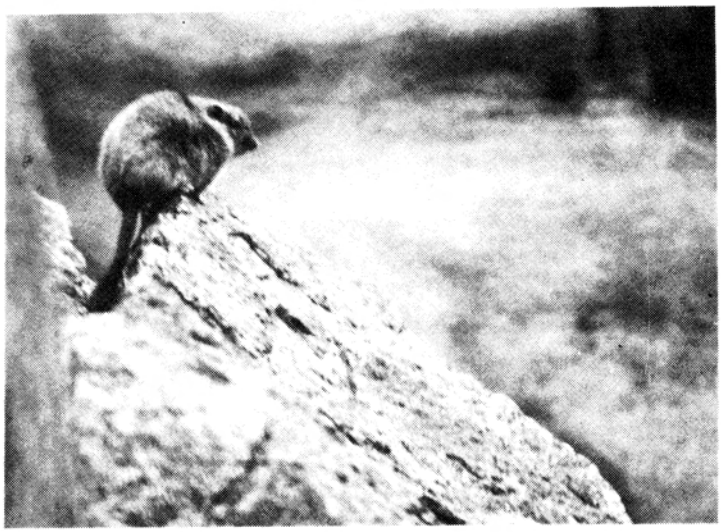

Fig. 3. *Petromus typicus* at site 3, some distance from the feeding ground.

The type of vegetation eaten was identified from direct observation and from an analysis of droppings. *Petromus* defaecates at fixed points outside the entrances to rock shelters (and at random on lookout platforms and while foraging). Fresh droppings were collected at entrances morning and evening for five consecutive days at each site.

In each analysis, ten droppings from each site, five from the morning, five from the evening collection, were crushed together. Five samples of approximately 5 mg each were taken from each crushing, soaked and thoroughly mixed in water to separate the contents. The samples were dried in watchglasses and the plant material that surfaced was picked out and sorted into monocotyledons and dicotyledons. This process was repeated until all recognisable plant material had been sorted.

Alternatively, faecal samples were treated with warm 10% nitric acid, macerated, washed in water and allowed to settle, following the method of Storr (1961). The samples were dehydrated in alcohol and two drops from each sample allowed to dry on warm slides and mounted. Reference slides of common plants on the site were prepared in the same way. The area of monocotyledonous and dicotyledonous material was measured on each slide and the dry weight calculated from the known ratio weight/area for the main components of the sample.

Samples of common plants in the area were collected at peak foraging time of 1 000 hours, at a temperature of 17°C and 40% relative humidity. The samples were weighed fresh, dried at 70°C for 24 hours and reweighed to obtain the moisture content. In addition, nitrogen content of samples was measured.

The dry weight of plant material required for weight maintenance was assessed from observations of two captive *Petromus* of 146 g average weight.

From the same two captive animals water content of fresh droppings was measured.

Observations

Table 1 gives an analysis of the contents of droppings from the three sites as determined by the two methods. At each site the value for dicotyledons obtained from the microscopic analysis of slides was higher than the value obtained from the samples separated in bulk. There were opportunities for sampling errors in both methods. In the bulk separation method unidentified material, containing spines and hairs of dicotyledons, distorted the figures in favour of monocotyledons. In the microsocopic analysis, dicotyledons spread thinner than monocotyledons and biased the calculation of dry weight in favour of the dicotyledons. But both methods ranked the three sites in the same order.

On balance, average value was taken as giving the right order of magnitude. At one site, direct observation came nearest the value for bulk analysis but, since each mouthful could not be identified and weighed, the figure has not been included.

Whichever figure is accepted, the greater part of the diet of *Petromus* in the dry season consisted of monocotyledons, effectively grasses: *Enneapogon scaber, Cenchrus ciliaris* and *Triraphis ramosissima.* The remains of leaves and stalks were more common in the faeces than the remains of flower heads and seeds of both grasses and dicotyledons. On no occasion were there any animal remains.

At site 1 the dicotyledonous component of the diet was almost entirely leaves of *Schotia afra;* at site 2 *Schotia afra* was supplemented with *Hermannia stricta* and a little *Cucumis dinteri;* at site 3 the 10% dicotyledonous material was mainly *Lycium austrinum* leaves.

Table 1

The proportions of monocotyledons and dicotyledons in the diet of Petromus typicus *at three sites in Augrabies Falls National Park in September 1979*

		monocotyledons			dictyledons		
		dry wt mg	%	av. %	dry wt mg	%	av. %
site 1	method 1 (bulk)	17,5	73	69	6,5	27	31
	method 2 (microscopic)	6,7	65		3,6	35	
Site 2	method 1	10,6	71	65	4,4	29	35
	method 2	5,5	60		3,7	40	
site 3	method 1	19,5	93	90	1,5	7	10
	method 2	7,9	87		1,2	13	

Petromus can maintain its weight in captivity on 5.7 g dry weight of mixed vegetation a day containing 0.5 g protein.

Direct observation showed that 75% of the grasses consumed is made up of blades and stalks from the base of clumps where the water content is three times greater than in the higher stalks. The water content of dicotyledon leaves is considerably higher than that of grasses. Table 2 shows the water content and protein content of samples of grasses and dicotyledon leaves. Table 3 shows the estimated consumption of dry matter, water and protein per day per animal at the three sites.

Discussion

Direct observation has shown that *Petromus typicus* can maintain its body weight in captivity on 5.7 g dry weight of plant material or an average of 15 g wet weight of plant material. At 39 g dry matter per kilo of animal this is a little more than the bigger *Procavia capensis* uses (33.6 g per kilo, Sale 1966) and less than a rat (50 g per kilo, Spector 1956). This figure corresponds with those of other small mammals living in a semi-arid environment (personal observation).

Table 2

Water and protein content (g) of food items at 17°C 40% RH in September 1979

	dicotyledon leaves	green grass blades	dry grass blades & stalks
wet weight	100	100	100
dry weight	24,5	42,4	81,8
weight of water	75,5	57,6	18,2
N content	0,73 (2,97%)	0,5 (1,2%)	0,5 (0,62%)
protein content (N x 6.25)	4,56 (18,6%)	3,18 (7,5%)	3,17 (3,9%)

Table 3

Estimated daily consumption of plant material, water and protein by a Petromus typicus *requiring 5.7 g dry material each day.*

	monocotyledons				dicotyledons				total		
	dry wt	water	protein	total	dry wt	water	protein	total	dry wt	water	protein
site 1	3,9	4,2	0,26	8,1	1,8	5,5	0,33	7,3	5,7	9,7	0,59
site 2	3,7	4,0	0,24	7,7	2,0	6,2	0,37	8,2	5,7	10,2	0,61
site 3	5,2	5,6	0,34	10,8	0,6	1,8	0,1	2,4	5,7	7,4	0,44

At Augrabies Falls National Park, droppings analysis at the three sites showed that the bulk of *Petromus* diet is composed of grasses of different genera. The result confirmed analyses made at sites in South West Africa (the Khomas Hochland and the Namib) where the amount of grasses consumed varied from 55% to 91% of the diet. To some extent, variation in the proportions of monocotyledons to dicotyledons in *Petromus* diet can be accounted for by availability. At site 3 (and at all sites in the Namib) grasses were the main plant cover and the proportion of grasses in the diet was at its highest (90%).

But *Petromus* shows some discrimination between monocotyledons and dicotyledons. At site 1 grasses comprised only 40% of the plant cover (Werger & Coetzee 1977) but 69% of the diet. *Petromus* also discriminates between different genera within each group.

At Augrabies Falls National Park, a disproportionate amount of the available *Enneapogon scaber* and *Cenchrus ciliaris* was taken, considering that *Triraphis ramossissima* was the dominant grass. *Stipagrostis uniplumis* was not liked. In the Khomas Hochland, the most abundant grass *Enneapogon cenchroides* was the most liked: though *Enneapogon* species are not considered to be highly palatable (Roberts & Fourie 1975). Again, *Stipagrostis* species were not liked. In the Namib, the favourite grass *Anthephora pubescens* was selected from a great variety of grasses including several species of the unpopular *Stipagrostis*.

The obliquely ridged hypsodont cheek teeth, large infraorbital canal and deep zygomatic arch for masseter muscle attachment and ossified lower jaw symphysis of *Petromus* are eminently suitable for chewing lignified and abrasive grasses.

At the three sites in Augrabies Falls National Park, *Petromus* took (apart from grasses) the shrubby leaves of *Schotia afra* at site 1, *Schotia afra* and *Hermannia stricta* at site 2 and *Lycium austrinum* at site 3. The wetter leaves and fruits of *Cucumis dinteri* were eaten with relish on all three sites when they were available. To obtain *Schotia* and *Lycium* leaves, *Petromus* (like *Procavia*) climbed the trees (Fig. 4). Unlike *Procavia,* however, *Petromus* bolted back down and ran for cover to eat them.

At site 1, *Petromus* droppings were compared with *Procavia capensis* droppings. The material in *Procavia* droppings was similar to that of *Petromus,* consisting of grasses and dicotyledon leaves. But *Schotia afra* formed 80% of the *Procavia* droppings and grasses only 20%.

The protein intake of the *Petromus* grass and shrub diet varied from about 0.45 g to 0.6 g a day which, at 9% of the daily food intake, corresponds closely with estimates made for the herbivorous diet of the impala *Aepyceros melampus* in Zimbabwe (Dunham 1980).

There is nothing remarkable about the *Petromus* diet.

It is not known how efficient *Petromus* is at utilizing its food. The stomach is simple and there is a moderately large caecum. One of the advantages of being a small diurnal mammal in a rocky desert environment may be that digestion of food is helped by the high temperature of the sunlit rocks on which the animal sprawls.

These observations were made during the dry season in September and (it could be argued) *Petromus* diet may be different at other times of the year. But the

Fig. 4. *Petromus typicus* in a *Lycium* bush.

Table 4

Estimate of water availability and water requirements for Petromus typicus *at site 3*

	water gain (g)		water loss (g)
Free water in food	7,4	respiration (Schmidt-Nielsen)	3,8
Water from oxidation (for 88% carbohydrate content)	3,0	water for faeces (at 75%)	1,2
		water in urine (at 5% conc.)	3,0
Total	10,4		8,0

tendency is for many herbivores to switch away from grasses to wetter plants in the dry season (Taylor 1969; Spinage, Ryan & Shedd 1980) and for many rodents to include invertebrates in their diet (Schmidt-Nielsen 1964; Nel 1978). Therefore, it is reasonable to suppose that *Petromus* diet is composed mainly of grasses throughout the year.

It could be argued that this presents water problems. The amount of water available in the diet is shown in Table 3. At site 3 the minimum available for the dry season was 7.4 g: a balance sheet for water gain and loss can be drawn up for site 3 (Table 4).

It is not known to what extent *Petromus* can concentrate its urine. The kidney has a long papilla and a proportionately large medullary area to cortical area suggesting that it has some powers in this respect (personal observation). However, in this calculation this has not been assumed nor has any assumption been made about the capacity to excrete dry faeces.

Breeding occurs in December and January in the wet season when plant growth provides plenty of water for the lactating female (Shortridge 1934).

It is clear that, even in the dry season in an area classified as a cold desert (Köppen 1931) but where the mean daily temperature at this season is below 20°C, there is enough water available in the plants for a diurnal rodent to exist on a diet of grasses.

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