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Observations on the food habits of some African rodents

by

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Abstract: Food habits of four common species of African rodents: the giant rat *(Cricetomys gambianus)*, the black house rat *(Rattus rattus)*, the multimammate rat *(Mastomys natalensis)* and the pygmy mouse *(Mus minutoides)* were studied on the basis of stomach content analysis, habitat sampling, and experimental trials with caged animals.

Vegetable items (especially grass, grains and tubers) formed the bulk of the food of all the species. Oil-palm nuts and kernels were also common in the guts of *C. gambianus* and *M. natalensis*. Animal food components of all the rodent species comprised mainly insects (especially ants, crickets etc.). Vertebrate flesh and scales were also well represented in the guts of *C. gambianus*. Domestic and miscellaneous food items were recorded from *R. rattus*, most of which were trapped in human and animal shelters. Inorganic gut contents, primarily sand grains, were found in sizeable quantities in more than 70% of the rodents examined. Results of experimental feeding trials with caged rodents showed close correlation with those recorded from field samples, especially in terms of food choices and the relative quantities consumed. The ecological and practical implications of these observations are discussed in the light of the importance of the rodents as agricultural and domestic pests.

Adequate information on the food and feeding habits of various rodents is vital to a proper understanding of their ecology, modes of life and indeed their control (Taylor, 1968; Rosevear, 1969; Delany, 1971, 1972; Taylor and Green, 1976). This information may be gathered partly from field availability assessments of rodent food materials in established habitats; frequency of trappings (or observed visits) of rodents at particular food locations; direct study of gut contents of wild-caught rodents, and from experimental exposure of caged rodents to various types of food materials (Johnson, 1961; Hansson, 1970, 1971).

With particular reference to tropical Africa, whereas the biology and food habits of some species of rodents have been fairly well studied (Chapman *et al.*, 1959; Booth, 1960; Morris, 1963; Bellier and Gautun 1968), records of comparative studies of different rodents in specific or identical habitats have until

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recently been rather few and grossly inadequate (Cloudsley-Thompson, 1970; Cole, 1972, 1975; Alison, 1975).

This paper reports a comparative study of the food and feeding habits of four rodent species prevalent in Nsukka, Nigeria, with comments on their distribution and behaviour.

MATERIAL AND METHODS

Animals studied: A total of 153 rodents, comprising 37 giant African rats, *Cricetomys gambianus;* 29 black house rats, *Rattus rattus rattus;* 35 multimammate rats, *Mastomys natalensis;* and 52 pygmy mice *Mus minutoides* were examined in this study. The animals consisted predominantly (> 85%) of adults (males and females) trapped along with a few less common species from different parts of Nsukka (8° E and 7° N) between November 1975 and April 1976.

The giant rat, *C. gambianus,* otherwise known as the "pouched rat" is a large rodent (snout to anus length 30-39 cm, tail length 35 ± 2 cm and mean adult weight 950 g). It is usually widely distributed in forests and guinea savannah areas, and may be found as well in farms and refuse dumps, thriving commonly in burrows from where it emerges at night in search of food.

The black house rat, *R. r. rattus,* is a relatively small rat (snout to anus length 13-18 cm, tail length 20 ± 3 cm and mean adult weight 150 g). It is commonly found in dark locations in and around human and animal shelters, and in storehouses. The house rat is most active nocturnally, but may be found also during the day in quest of food and shelter.

The multimammate rat, *M. natalensis,* is much smaller than the house rat (snout to anus length 4.0-7.5 cm, tail length 1.7 ± 3.5 cm and mean adult weight 50 g); it is found mostly in tunnels and burrows in open grassland and forest areas and has been known to be diurnally active.

The pygmy mouse, *M. minutoides,* is very small (snout to anus length 4-7 cm, tail length 5 ± 0.9 cm and mean adult weight 20 g). It is rather peridomestic and is common amongst grassy tufts and refuse heaps around human and animal shelters. It is diurnally active.

Trapping and examination of rodents: Trapping was by use of locally made metal traps (toothed break-back and small baited spring traps). Also small elastic-mouthed gauze-net traps were employed where convenient. The traps were set at the edges of rodent nests and tunnels, along forest and grassland tracks, and in dark corners in human habitations, animal sheds and storehouses. They were checked three times each day (6.00 - 8.00 a.m., 12.00 - 2.00 p.m., and 6.00 - 8.00 p.m.). Rodents caught were removed and examined, and the traps re-set.

Identity, weight, size and estimated age were noted, as well as the place and time of trapping. Live rodents were killed with chloroform, and subsequently dissected to expose the full length of the alimentary tract. Portions of the oesophagus, crop, rectum etc. were then cut out, weighed and their respective contents examined in saline. Wet smears were also made of portions of the gut wall and examined microscopically.

Sampling of habitats for food materials: The immediate habitats from which rodents were trapped were combed (up to a radius of 3 m in each case) and potential rodent food items, e.g. kernels, gnawed fruits, etc. were noted and scored.

Burrows were excavated, the established rodent tracks and nests also explored for traces of the food items.

Studies with caged rodents: Cage observations were made of the food preferences and feeding rates of the respective rodents, using at least five captive adults of each species. Responses of the animals to different food items, in terms of acceptance scores and quantities of food consumed, etc., were observed and noted.

OBSERVATIONS AND RESULTS

Rodents were caught from six types of habitats viz; human habitations, food stores, animal shelters, farmlands, grasslands and forests. Percentage trapping of the respective rodent species from these locations varied considerably (Table 1). For instance the giant rat *C. gambianus* was especially preponderant in the open grassland and forest areas, while the black house rat *R. r. rattus* was restricted essentially to food stores, human dwellings and animal shelters.

TABLE 1

Types and distribution of rodents trapped from different locations in Nsukka, Nigeria

Localities and time of trapping		Numbers (and approximate percentages) of rodents trapped from different locations			
		Cricetomys gambianus (37) *	*Rattus rattus* (29) *	*Mastomys natalensis* (35) *	*Mus minutoides* (52) *
Human dwellings	Day	– (0.0)	1 (3.4)	– (0.0)	– (0.0)
	Night	– (0.0)	8 (27.6)	– (0.0)	5 (9.6)
	(Total)	– (0.0)	9 (31)	– (0.0)	5 (9.6)
Food stores	Day	– (0.0)	6 (20.7)	– (0.0)	– (0.0)
	Night	– (0.0)	7 (24.1)	– (0.0)	– (0.0)
	(Total)	– (0.0)	13 (44.8)	– (0.0)	– (0.0)
Animal shelters	Day	– (0.0)	2 (6.9)	– (0.0)	6 (11.5)
	Night	– (0.0)	5 (17.2)	4 (11.4)	4 (7.7)
	(Total)	– (0.0)	7 (24.1)	4 (11.4)	10 (19.2)
Farmlands	Day	1 (2.7)	– (0.0)	2 (5.7)	5 (9.6)
	Night	4 (10.8)	– (0.0)	7 (20)	18 (34.6)
	(Total)	5 (13.5)	– (0.0)	9 (25.7)	23 (44.2)
Grasslands	Day	5 (13.5)	– (0.0)	10 (28.6)	6 (11.5)
	Night	8 (21.6)	– (0.0)	7 (20)	8 (15.4)
	(Total)	13 (35.1)	– (0.0)	17 (48.6)	14 (26.9)
Forests	Day	7 (18.9)	– (0.0)	1 (2.9)	– (0.0)
	Night	12 (32.4)	– (0.0)	4 (11.4)	– (0.0)
	(Total)	19 (51.3)	– (0.0)	5 (14.3)	– (0.0)

* Total number of animals trapped.

With the exception of the pygmy mouse, *Mus minutoides*, more rodents were caught during the night than during the day. Also, the rodents picked up from traps in the morning hours were comparatively better fed than those picked up in the early evenings, as is evident from comparative mean stomach weights (Fig. 1).

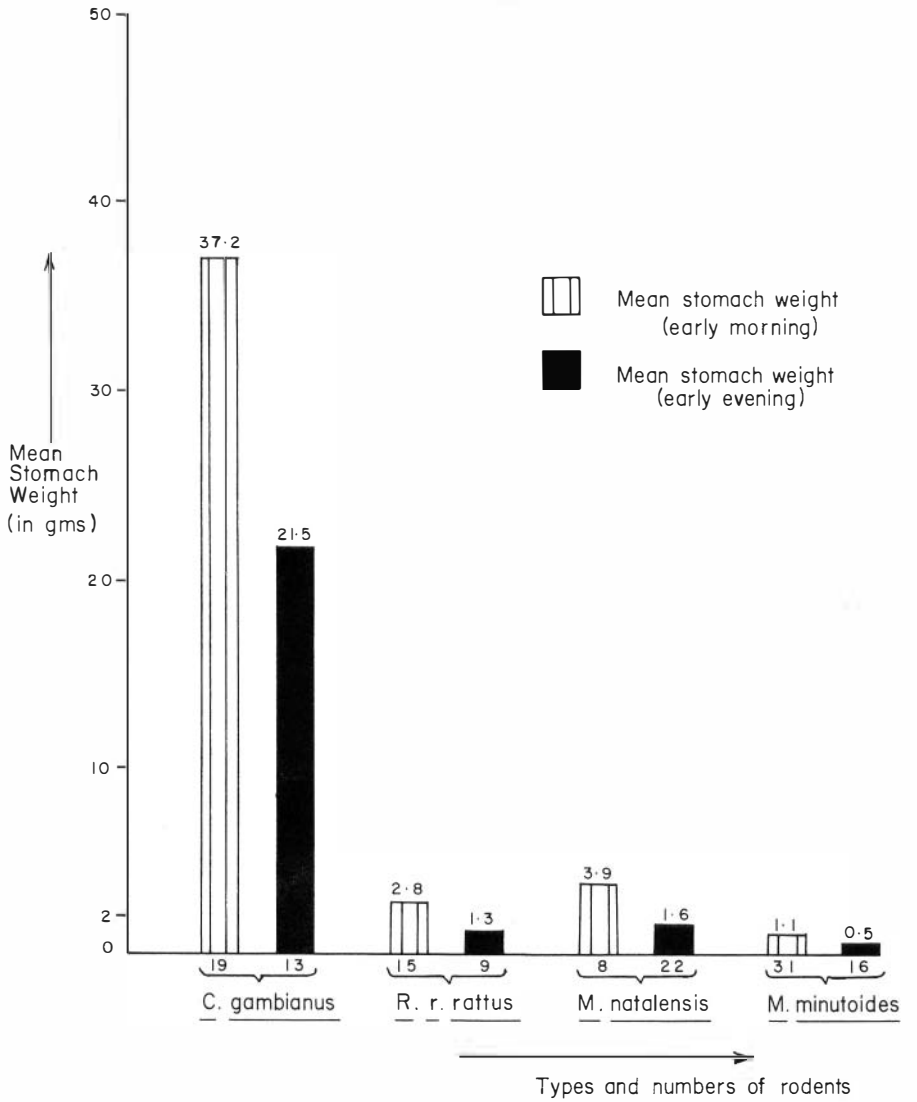


Fig. 1. Comparative stomach weights of day/night foraging rodents in Nsukka, Nigeria, as evidenced from early morning and early evening trapping collections.

Analysis of the gut contents of the various rodents revealed in each case a whole range of vegetable, animal and inorganic matter (Table 2). Among the most common of the vegetable items were grass, grains (especially maize, millet and rice) and tubers (mainly yams, cocoyams and cassava). Oil-palm nuts and kernels also occurred rather commonly in the guts of both *C. gambianus* and *M. natalensis*.

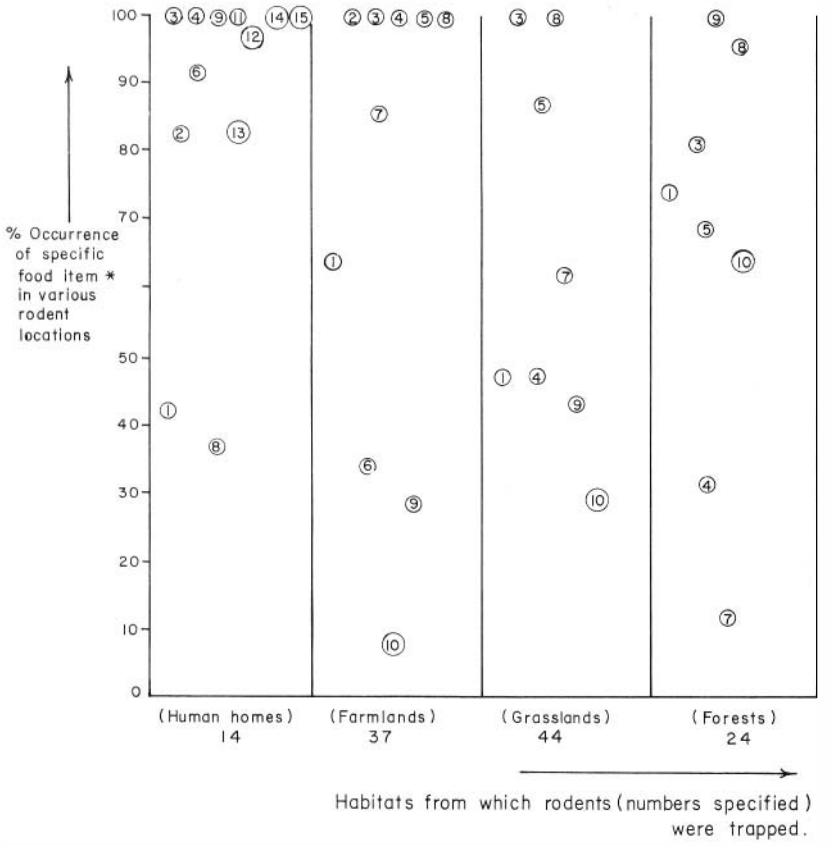
Of the animal food items only arthropods (especially insects: ants, crickets etc.) were found commonly in the guts of all four rodent species. Many *C. gambianus* and *R. r. rattus* had sizeable components of vertebrate flesh, scales and bone material in their guts and little or no trace of annelid worms, molluscs or other invertebrates. Very few *M. natalensis* had vertebrate flesh and exoskeletal material in their guts, but practically none of them bore soft-bodied invertebrate food material.

TABLE 2

Comparative occurrence of different types of food items in the guts of various wild-caught rodents

	Food types	Numbers (and approximate percentages) of rodents and type of food items in the gut			
		Cricetomys gambianus (32)	*Rattus rattus* (24)	*Mastomys natalensis* (30)	*Mus minutoides* (47)
Vegetable matter	Palm nuts and kernels	25 (78.1)	4 (16.7)	17 (56.7)	12 (25.5)
	Maize grains	9 (28.1)	13 (54.2)	1 (3.3)	4 (8.5)
	Other seeds	5 (15.6)	2 (6.2)	8 (26.7)	27 (57.4)
	Leaves (including grass)	31 (96.9)	11 (45.8)	26 (86.7)	40 (85.1)
	Tubers (yam, cassava etc.)	12 (37.5)	13 (54.2)	15 (50)	18 (38.3)
	Roots/stem fibres	23 (71.9)	8 (33.3)	14 (46.7)	10 (31.3)
	Succulent fruits	– (0.0)	10 (41.7)	– (0.0)	2 (4.2)
Animal matter	Annelid worms	4 (12.5)	2 (8.3)	3 (10)	– (0.0)
	Molluscs & shells	– (0.0)	– (0.0)	4 (13.3)	– (0.0)
	Insects (especially Ants and grasshoppers)	19 (59.4)	8 (33.3)	16 (53.3)	25 (53.2)
	Arachnids (especially spiders)	– (0.0)	2 (8.2)	– (0.0)	4 (8.5)
	Scales	2 (6.2)	3 (12.5)	– (0.0)	4 (8.5)
	Feathers	1 (3.1)	– (0.0)	– (0.0)	– (0.0)
	Hairs	15 (46.9)	1 (4.2)	– (0.0)	7 (14.9)
	Vertebrate flesh	17 (53.1)	21 (87.5)	– (0.0)	8 (17)
	Bones and cartilage	10 (31.2)	8 (33.3)	– (0.0)	– (0.0)
Inorganic & miscellaneous substances	Sand grains	32 (100)	11 (45.8)	28 (93.3)	34 (72.3)
	Wool and cloth	– (0.0)	4 (16.7)	– (10.0)	– (0.0)
	Paper	– (0.0)	5 (20.8)	– (0.0)	– (0.0)
	Cardboard	– (0.0)	1 (4.2)	– (0.0)	– (0.0)
	Plastic	– (0.0)	3 (12.5)	– (0.0)	– (0.0)
	Wax	– (0.0)	1 (4.2)	– (0.0)	– (0.0)
	Soaps	– (0.0)	7 (92.2)	– (0.0)	– (0.0)
	Biscuits	– (0.0)	11 (45.8)	– (0.0)	5 (10.6)
	Bread	– (0.0)	4 (16.7)	– (0.0)	– (0.0)

Of the inorganic and miscellaneous gut contents of the rodents, sand grains were easily the most common. They were found in the guts of virtually all *C. gambianus* and *M. natalensis* examined, and in nearly three quarters of the *M. minutoides*. Other substances found in the guts of the rodents, especially in *R. r. rattus*, included bits of paper, soap, and biscuits.



*KEY

1	Palm nuts and kernels
2	Maize / rice grains & peas
3	Vegetables and grasses
4	Tubers (yam, cassava, etc.)
5	Gnawed roots and stems
6	Succulent fruits
7	Worms and molluscs
8	Ants, Beetles, Crickets, etc.
9	Vertebrate flesh / bone
10	Feathers scales shells, etc.
11	Wool and Cloth
12	Paper, cardboard etc.
13	Plastic, wax, etc.
14	Soaps
15	Biscuits and Bread crumbs

Fig. 2. Percentage frequency of different food items in the guts of rodents trapped from different habitats in Nsukka, Nigeria.

Results of environment samplings showed rather interesting spatial distribution and frequency of particular food items in specific habitats (Fig. 2). Relative spread and abundance of such food items as grains, tubers and insects tended to tally proportionately with recovery rate of these items from guts of those rodents most rampant in the particular niches.

Experimental feeding trials with captive (caged) rodents gave very high acceptance scores (Table 3) of insects and grain food. In addition *C. gambianus* showed spontaneous acceptance of both fresh pawpaw and raw flesh, while *R. r. rattus* and *M. minutoides* were very receptive to smoked fish and vegetables, respectively. Captive *M. natalensis* gave consistently positive response to various vegetable items including palm fruits, tubers and green leaves, but would not feed on any other test food items. As for the quantities of food consumed by the respective rodent species, this varied considerably in relation to the acceptance scores.

DISCUSSION

Results of this study emphasize the influence of habitat on the food habits of the four rodent species, and are of special importance in the light of the fact that these include some of the most important agricultural and domestic rodent pests in this part of West Africa.

Peculiarities in the distribution of the animals, as evidenced by the locations from which they were trapped, are probably indicative of the activity range of the respective species. Hence the more active *C. gambianus* reaches further out on grasslands and forests, while *R. r. rattus* and *M. minutoides* are more restricted in their distribution. The relevance of this to the ecology of each rodent type is worth noting, particularly in relation to some of the principles enumerated by Hansson (1971).

Recovery frequency of specific food items from guts of the rodents provide interesting indices of their food choices. Of course the latter depends for most rodents on the availability of the food material near their nests, burrows or tree holes (Rosevear 1969, Delany 1972). Thus the food of the giant rats, *C. gambianus,* comprised, not surprisingly, of mainly nuts and kernels, vegetables, roots and stems, insects, as well as raw vertebrate flesh and bone material (probably from predatory kills) while grains and seeds, cooked tubers, meat and such other items as biscuits, bread etc. were the most frequent gut contents of the house rats, *R. r. rattus.*

As should be expected, vegetable food items (especially green leaves) were on the whole, the most common diet of all the rodents, as against animal and inorganic substances. Of special interest however is the fact that insects and other arthropods also occurred as favourite components of the food of practically all the four rodent species. The frequent occurrence too of sand, pebbles and other inert materials in guts of the animals is equally significant, although this may be considered essentially as roughage or 'grit' of some type.

These results are in keeping with a number of earlier observations. For instance Booth (1960) had noted that rodents generally prefer vegetable matter to any other category of food. Also Morris (1963) observed that plant materials were more abundant in the food of *C. gambianus,* and recorded several species of plants from burrows of these rats, while Fall *et al.* (1971) observed that although *R. rattus* and *R. exulans* had a wide range of food, including a variety of insects, plant food

TABLE 3

Comparative acceptance and consumption rates of different food items by captive (caged) rodents. (n = 5 for each rodent species)

Food items	Acceptance scores				Quantity consumed			
	C. gambianus	*R. rattus*	*M. natalensis*	*M. minutoides*	*C. gambianus*	*R. rattus*	*M. natalensis*	*M. minutoides*
Palm fruits	++	+	++	+	M	L	M	L
Pawpaw	+++	++	++	–	M	M	M	N
Maize grains	++	++	+++	++	F	M	M	F
Grass leaves	+	+	++	+++	F	L	F	M
Yam tuber	++	+	++	+	M	L	F	L
Insects	++	+++	+++	+++	M	M	M	M
Smoked fish	+	+++	+	+	L	M	L	L
Raw flesh	+++	–	–	–	M	N	N	N
Cardboard paper	–	+	–	–	N	L	N	N
Soap	–	+	–	–	N	L	N	N
Biscuits	–	++	–	+	N	F	N	L

+++ = Spontaneous, ++ rapid, + = slow, – = no reaction/rejection:

M = much, F = fair, L = little, N = none.

predominated the diet of both species. Furthermore Alison (1975) had found termites and other insects to be very important in the diet of *M. natalensis* in parts of East Africa, and suggested that the availability or scarcity of these insects may significantly influence their monthly protein intake.

That most of the rodents trapped during the night were better fed than those caught in the early evening hours, as evidenced by their mean stomach weights, confirms the nocturnal habits of these animals, especially *C. gambianus* and *M. natalensis*. The differential stomach weights of rodents captured during the day or at night can also be of special relevance in interpreting their feeding rhythms and ecology, in line with earlier studies by Pinter and Negus (1965), Sadler (1974), Sigdestad *et al.* (1974), and Barnett *et al.* (1975).

Results of the experimental feeding trials with caged rodents agree in the main with those recorded from the field samples, especially in terms of the food choices and the relative quantities consumed by the respective species. Also there is evidence of the adaptability of some of the captive animals to various foods, as for example in the case of *C. gambianus*, which in keeping with the findings of Hanney (1965) were freely omnivorous in captivity, although mostly vegetarian in the wild. Furthermore, it should be noted that the observed mean acceptance scores for the various food items by the different rodents underscore the extent of their relative voraciousness.

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