OBSERVATIONS ON THE LIFE HISTORIES AND BEHAVIOUR OF SOME SMALL RODENTS FROM TANZANIA

C. ANDRESEN HUBBARD

*Malaria Institute, Amani, Tanzania**

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Although almost all Africa's mice have probably been collected, typed, measured and their embryos noted, very little is known of their habits. This study is therefore an attempt to fill the gap in our knowledge and was carried out between September 1961 and January 1966 while concurrently studying plague-bearing fleas in Tanzania. Part of the results, that on *Beamys* and *Tatera*, was published in 1970 (Hubbard), and since the present paper was written, a study on the South African *Mystromys albicaudatus* has also appeared (Hallett and Meester 1971).

Total observations covered about 4 500 animals which were captured in small 5 x 5 in. box traps built about a common snap mouse trap. The traps were baited with quick-cooking rolled oats as common rolled oats will not attract wild mice. Each mouse was lightly anaesthetised with chloroform, as ether is not suitable for flea collection, before removing the ectoparasites and taking body measurements. The animals were then either freed to collect more ectoparasites or turned into study skins. Pregnant females were retained in captivity and allowed to reproduce.

Most of the 500 skins involved in this study have been deposited in the Transvaal Museum, Pretoria. About 100 were deposited in the Zoological Museum, University of Puget Sound, Tacoma, Washington and the writer's live colonies of *Tatera* and *Beamys* are being maintained (1967) at the University of Utah, Laboratory Mouse Research Center, Dugway, Utah.

In the following pages all pregnant mice detained were provided with two or three weaverbird nests in which to have their families. The young were handled daily and with the exception of coucha rats and four striped grass mice the mothers seemed to accept this routine and offer little objection.

(All measurements, unless otherwise stated, are given in millimeters, and follow the customary sequence of: total length (To), length of head and body (H.B.), tail length (T.), length of hindfoot (F.), length of ear (E.).)

ACOMYS – SPINY MICE

The spiny mice have been described as very shy and they are seldom trapped. Roberts (1951) describes them as presumably omnivorous, though mainly granivorous and reports that very little is known about them. These statements are surprising as this mouse was the most frequently captured genus during the present investigation.

* Present address: 15115 S.W., 74th Avenue, Tigard 53, Oregon, U.S.A.

The species: Four spiny mice have been recorded from Tanzania and these with two forms collected for the first time in the north give the following Tanzanian species:
Acomys selousi de Winton 1897 in the southern half.
Acomys nubilus Dollman 1914 in the north-west quarter.
Acomys wilsoni wilsoni Thomas 1892 in the north-east quarter.
Acomys albigena Heuglin 1877 in the north-east quarter (first reported).
Acomys ignitus ignitus Dollman 1910 along the north-central border.
Acomys hystrella Heller 1911 in the north-east quarter.

Identifications of *A. hystrella* were carried out by the U.S. National Museum.

Description: Spiny mice are so called because the hairs on the back are combined in groups which resemble miniature quills. These become detached from the skin rather easily. Generally they inhabit dry, rocky or bushy country with the exception of *A. hystrella* which, in Tanzania at least, can be taken along waterways in dense grass which is permanently green. Most spiny mice are small; the head and body length is about 9 cm when stretched out. In *A. wilsoni* and *A. albigena* the whitish tail is about 5 cm long and unlike that of other mice, for it is slightly blown up, the skin fitting loosely over the bone like a sack which slips off at the slightest touch. This is probably employed as an escape mechanism. After the skin is shed from the tail the bone atrophies and the mouse becomes tailless or bob-tailed. The back is rich brown to reddish, the belly pure white, the feet are extremely small, ears medium, eyes black and not large. *A. ignitus* is larger, measuring 10 cm, the tail being mouse-like and not so easily detached. There may be some black in the top coat of this species.

A. hystrella is medium sized, up to 10 cm in H.B. and has a blackish mouse-like tail 8,9 cm long which does not fall off easily. The backs and sides are dark grey mixed with some red, the belly is pure white while the feet are small, ears medium, eyes black and not enlarged. A variation of this mouse is taken at 2 000 ft. in the Eastern Usambara Mountains and seems to be a melanistic form, with the back and sides almost black and the white on the belly reduced to small stars.

Behaviour: Spiny mice are generally gentle and seldom bite. On occasion, however, when living in groups in captivity an individual will kill and partially eat all the other members of the group. On several occasions the writer has witnessed the disappearance of newly born young and severe attacks on half-grown young.

Reproduction: The following breeding records were obtained from embryo counts and live births on 250 spiny mice which are considered here as a general group. Of this sample 90 were females of which 25 were pregnant. At examination the following distribution of embryos was recorded: seven females contained one embryo, fifteen contained two, two contained three and one contained four. In *A. wilsoni* the incidence of pregnant females was three out of five captured in October, two out of three in November, one out of three in December, three out of four in January, nine out of fifteen in February. In the case of *A. hystrella* three pregnancies were recorded in May and July and one in August. During December at Moshi a lactating female spiny mouse was found to be in early pregnancy suggesting that litters

follow one after another during the breeding season. Ansell (1960) and Hollister (1919) may be consulted for further reproductive records of this genus.

The young of *A. wilsoni* are very similar to the adults with the exception that the spines do not appear until the first moult. They travel with the mother during the first night after birth but do not hang, suspended from their mother's mammae as many small mice do. The young eat solid food during the first night out and, since the mother builds no nest, they must retreat into holes or crevices during the day. In contrast to the above *A. hystrella* are born naked and blind. Within two days a greyish fur begins to cover their pink backs and by this time the young become firmly attached to the mother's mammae. They remain attached even when the mother is startled and moves away. At eight days the young were fully furred and their eyes opened and soon after two weeks they were able to fend for themselves. Like most spiny mice, this species does not seem to build a nest for the young although one individual, taken at Muheza, Tanzania was observed to shred a weaver bird's nest completely in order to build a small pallet nest. Nest building in this individual continued for nine days until a litter of three was produced at 1400 hr. The young were fully furred at five days and quills appeared on the fourteenth day. It should also be noted that the young of the melanistic *A. hystrella* exhibit normal colouration when they become furred but become progressively darker at each moult.

Growth: In Table 1 the average growth of two *A. wilsoni* born fully-furred with eyes open is compared with two *A. hystrella* born naked, blind and helpless. In Table 2 the growth-rate of the latter is tabulated and independence from the mother shown after her death at 14 days.

TABLE 1

AVERAGE GROWTH RATE OF SPINY MICE IN MM

T428 – *Acomys wilsoni*
Taken at Same, Tanzania, February 20th.
2 young born February 25th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother	131	80	51	14	12
45 days	111	68	43	13	12
40 days	110	67	43	13	12
35 days	107	65	42	13	12
30 days	107	65	42	13	12
25 days	103	63	40	13	12
20 days	97	60	37	13	12
15 days	90	55	35	13	12
10 days	79	47	32	12	10
5 days	69	42	27	12	8
	Eyes open – fully furred				
Birth	65	40	25	12	6

T817 – *Acomys hystrella*
Taken at Sigi, Tanzania, July 16th.
2 young born July 25th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother	160	85	75	18	13
45 days	160	85	75	18	13
40 days	155	83	72	17	12
35 days	150	80	70	17	11
30 days	145	78	67	17	11
25 days	138	75	63	16	10
20 days	133	73	60	16	10
15 days	125	70	55	15	10
10 days	116	65	51	15	8
8 days	Eyes open				
5 days	92	55	37	14	6
	Blind – naked – pink				
Birth	71	46	25	12	4

TABLE 2

AVERAGE GROWTH RATE OF SPINY MICE IN MM

T2714 – *Acomys hystrella*

	Total	H.B.	Tail	Hind Foot	Ear
Mother ..	145	90	55	15	15
35 days ..	142	87	55	15	14
30 days ..	140	85	55	15	12
25 days ..	137	82	55	15	11
20 days ..	121	73	48	15	9
15 days ..	102	60	42	14	5
14 days ..	Mother dies – Quills here				
10 days ..	90	50	40	13	5
8 days ..	Eyes open				
5 days ..	75	45	30	12	5
Birth ..	62	40	22	10	5

General: Spiny mice drink water readily although in dry bush country it seems possible that they may, like the American Kangaroo rat, suck what they need from plant hydathodes. The mice do not appear to be hoarders and pay little attention to green feed. They eat insects readily as well as sliced orange. They are strictly nocturnal and will breed in captivity.

Plague and Parasites: Spiny mice have been found to be plague-positive in Egypt. They carry their own small flea which is spiny in appearance. The flea is *Parapulex chephrenis* (Rothschild 1903), north of the Sahara and the Sudan, and *Parapulex echinatus* Smit 1956 in East Africa. There is no mention of these fleas ever having been tested for plague-vector efficiency. On occasion the writer has removed the known vectors of plague from this mouse namely, *Xenopsylla brasiliensis* (Baker 1904) and *Dinopsyllus lypusus* J. and R., 1913.

AETHOMYS – THE BUSH AND KAISER RATS

The Species: Members of the *Aethomys chrysophilus* group are generally called bush rats and are distinguished by their white bellies, while those of the *Aethomys kaiseri* group are called kaiser rats and have grey bellies.

In Tanzania the bush rats are:

Aethomys chrysophilus voi (Osgood 1910), which is described from Voi, Kenya. This is the first record from Tanzania and identification was confirmed by Kenya National Museum.

Aethomys chrysophilus singidae (Kershaw 1923), found generally in Tanzania.

The kaiser rats found in Tanzania are:
Aethomys kaiseri hindei Thomas 1902, found in the north-eastern portion and described from Machakos, Kenya.
Aethomys kaiseri manteufeli (Matschie 1911), found in the western part.
Aethomys walambae pedester (Thomas 1911), found in the north-western corner.

Habitat: Both kaiser and bush rats can be taken in bushy, dry country or in rocky outcrops. Kaiser rats will frequent waterways but bush rats seem not to do so.

Behaviour: Bush rats and kaiser rats are usually of stable temperament and soon become tame. They do, however, have sharp teeth and can inflict a serious bite if provoked. They have never been seen to maim or kill one another when held in captivity in groups. Bush rats have a sweet-smelling musk, a definite voice and can be pugnacious.

Reproduction: Eighty-five specimens of bush rats were examined, of which thirty-five were females. Ten of these were pregnant and the following embryo counts were recorded: one with one embryo in October while in January two contained two embryos, four contained three and one contained four. From October 1st through January the males were in full rut. On January 21st a lactating female was found which contained three embryos. Lactating females were captured in October and in December. Ansell (1960) may be consulted for further reproductive data in respect to *Aethomys chrysophilus* de Winton.

During mid July the writer found a large group of kaiser rats at Muheza which had concentrated in the area, probably because of the dryness of the surrounding bush. Fifty-five kaiser rats were examined but of sixteen females only four were pregnant.

Two pregnant females, taken on July 15th, were placed in captivity to observe their reproductive behaviour. One produced two young and the other three. Another very large female (taken on July 19th) measuring 170.140.30.18 mm contained three small embryos. A fourth captured on August 19th and measuring 155.143.28.15 mm gave birth soon afterwards to two males and two females which measured on the average 42.17.7.3 mm. A female born in captivity produced five young, the largest litter recorded here, at six months of age.

Of the two pregnant females in captivity, one, No. T2692, produced two young using a weaver bird's nest for privacy which had been placed inside the cage. The mother measured 150.120.30.15 mm and the young averaged 45.22.10.4 mm at birth. Shortly after birth they became tightly affixed to their mother's mammae and their behaviour followed a well defined daily pattern. During the day the mother rested on her side so the young could nurse while she kept watch at the main entrance of the nest. At 1600 hr each day the nest entrance was blocked with grass from the inside and from this time until 1900 hr the animals remained quietly within the nest – apparently a sleeping period. At 1900 hr when it became dark the mother removed the grass plug from the entrance after careful surveillance of the exterior and periodically through the night would leave the nest in order to feed. At 0500 hr the next morning she would retire for the day. This family group was transported in a noisy vehicle on the tenth day after the young were born and, apparently due to this stress, the mother killed both young by biting through the skulls just between the eyes, the fore brain being destroyed.

The second pregnant female, T2691, produced three young after four days. At birth the backs of the young were covered with grey fur but the small feet and bellies were naked and bright red. At ten days the mice were heavily furred, with whitish feet and bellies while the backs and sides were yellowish brown. The eyes opened on the 14th day. The mother constructed a ball-shaped grass nest about 12,7 cm in diameter for her young. After the tenth day she would open the top of the nest each evening, presumably for ventilation.

Growth: Young kaiser rats develop very fast while they are nursing. The H.B. growth is about 2,5 mm per day, the tail about 3 mm and the hind foot about 1 mm. Within 15 days they venture outside the nest to feed with their mothers. Average growth for a litter of three (of which two survived after the second day) appears in Table 3.

TABLE 3

AVERAGE GROWTH RATE OF KAISER RAT IN MM

T2691 – *Aethomys kaiseri hindei*
Taken at Muheza, Tanzania, July 15th.
3 young born July 19th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother ..	250	150	100	30	15
45 days ..	235	140	95	28	15
40 days ..	230	135	95	26	15
35 days ..	220	130	90	25	15
	Taken from mother				
30 days ..	200	120	80	24	15
25 days ..	180	110	70	23	15
20 days ..	160	100	60	22	15
15 days ..	143	86	57	20	11
14 days ..	Eyes open				
10 days ..	125	72	53	18	8
5 days ..	87	60	27	12	5
Birth	67	45	22	10	4

General: Kaiser rats are large, as much as 15,2 cm in H.B. and could be described as brown rats with naked black tails. The bellies are grey, they have fairly large black eyes and medium ears. In captivity they readily eat grains, fruits, nuts and vegetables. They also drink water readily. They are terrestrial, nocturnal and have a definite call which is a medium-pitched rhythmical chit, chit, chit.

Plague and Parasites: Members of the genus *Aethomys* have been found to be plague-positive in the Congo. The writer has found them carrying *Xenopsylla brasiliensis* in good numbers between September and March and on occasion *Dinopsyllus lypusus*, both known vectors of plague. At Muheza, 500 ft. elevation, the kaiser rats and some 500 other mice examined have never been found carrying fleas.

ARVICANTHIS – THE COMMON GRASS MOUSE

Although *Arvicanthis* has frequently been found to be plague-positive even less is known about this rather common genus than about *Acomys*.

The Species: At the time of writing there seems to be in Tanzania a single species and seven subspecies of unstriped or common grass mice. They are:
Arvicanthis abyssinicus reichardi (Noack 1887) on the eastern shore, Lake Tanganyika.
Arvicanthis abyssinicus rubescens Wroughton 1909 in the north-west.
Arvicanthis abyssinicus virescens Heller 1914 in north central Tanzania.
Arvicanthis abyssinicus muansae Matschie 1911 south of Lake Victoria.
Arvicanthis abyssinicus tenebrosus Kershaw 1923 in central Tanzania.
Arvicanthis abyssinicus pallescens Dolmann 1914 in the Crater Highlands.
Arvicanthis abyssinicus neumanni (Matschie 1894) throughout the Masai Steppe.

Description: This species is approximately the size of the well-known Norwegian rat, it has a plump appearance and measures about 14 cm in head and body and has a 10,2 cm tail. It inhabits grassy plains and the writer has not found it in mountainous, forested areas. During October, west of Lake Natron and through the Serengeti the number of *A. a. muansae* had reached the level of a population explosion. In areas where the grass had been burned the mice were concentrated in the grass strip between wheel tracks. They were so numerous, one could hardly avoid stepping on them and many were killed by passing trucks. Survivors were feeding upon the dead. Two colour forms were observed, namely, the usual grey mottled kind and a blackish form. Those mixed in play and used the same burrows. A system of trails joined the burrows and extended far out into the foraging area.

Reproduction: About 100 specimens were examined. No embryo counts of *A. a. muansae* were taken because the females captured in October were not breeding and those taken later were in such an advanced state of pregnancy that they were placed in detention cages to produce their young. A female *A. a. virescens*, T2888, captured on August 17th between Gonja and Kihurio at the Kalimawe Dam was carrying five full-term embryos.

On December 30th a pregnant female *A. a. muansae* was captured and on January 8th she produced seven young in a large 15,3 cm grass nest which she had constructed. The young left the nest at approximately 14 days to feed but returned each day during the heat of the afternoon (1400–1600 hr) to rest. At dusk they would emerge again for a brief feeding period before retiring for the night. Another pregnant female, *A. a. pallescens*, T1735, was captured on the floor of Ngorongora Crater, Tanzania on January 21st. Two days later she produced

three young which were pink, blind and naked at birth. Within three days they became fully furred and a distinct black line showed down the middle of their grey backs. These mice emerged from the nest at 8 days for the first time. It is also of interest to note that the mother slept separately from the young in a bamboo tube. She only entered the nest to nurse the young and repacked the nest firmly over them before retiring to the bamboo tube.

This species is recorded as having juveniles in Zambia in March and October (Ansell 1960); and with three to six embryos in Kenya in the months January, May and June (Hollister 1919).

Growth: The average growth of three common grass mice is depicted in Table 4.

TABLE 4

AVERAGE GROWTH RATE OF COMMON GRASS MOUSE IN MM

T1735 – *Arvicanthis a. pallescens*
Taken at Ngorongoro Crater, January 21st.
3 young born January 23rd at Moshi.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother ..	250	145	105	30	15
40 days ..	235	130	105	29	15
35 days ..	218	118	100	27	15
30 days ..	196	106	90	26	14
25 days ..	175	94	81	24	13
20 days ..	155	82	73	20	12
15 days ..	135	70	65	16	11
10 days ..	110	60	50	14	10
7 days ..	Eyes open				
5 days ..	85	50	35	11	8
Birth	60	40	20	10	6

General: These mice are omnivorous in captivity and drink a great deal of water.

Plague and Parasites: It is difficult to judge how dangerous *Arvicanthis* is in pooling plague in plague foci. It has frequently been found to be plague-positive. Although the mouse has no flea of its own it does at times carry large numbers. At Same, for instance, it was carrying medium numbers of *Xenopsylla cheopis*, long associated with plague; and in the Serengeti, the mice harboured a close relative, *X. bantorum* Jordan 1928, which will probably prove a vector of plague when tested. They also carry, although irregularly, the flea *Dinopsyllus lypusus* which is a known vector.

BEAMYS – THE LONG-TAILED POUCHED MICE

Only *Beamys hindei* Thomas 1909 is found in Tanzania. Hubbard (1970a) described the capture of 12 of these rare mice alive in the high mountains and recorded their breeding in captivity to the third generation and their arrival at Dugway, Utah, where they have been maintained. Strangely, at Dugway all the young lost their tails while at Amani only a very few young aborted them.

CRICETOMYS – THE GIANT RAT

Giant rats evidently occur in Africa almost anywhere south of the Sahara in mountainous, forested country.

Species: In spite of the wide range of this genus there is apparently only one species, *Cricetomys gambianus* Waterhouse 1840 and in Tanzania four subspecies have been recorded as below:
Cricetomys gambianus viator Thomas 1904, in the south-west.
Cricetomys gambianus consensi Hinton 1919 on Zanzibar and Pemba Islands.
Cricetomys gambianus osgoodi Heller 1912 in the north-east.
Cricetomys gambianus proparator Wroughton 1910 in the north-west.

Description: These animals are large measuring on the average 75 cm with one male in the writer's collection measuring 91,5 cm. The tail is generally about half the total length, sometimes it is up to 65 mm longer than the head and body and in one case 20 mm shorter. The tail is naked, grey at its base with the distal half white. When they climb the tail is slightly prehensile. The general colour of the coat is brownish. The feet are large, as are the ears but the black eyes are not particularly big. They are nocturnal and their raids on gardens are notorious. They possess large thin-walled cheek pouches which can carry as many as 100 grains of maize. These pouches are emptied by use of the cheek muscles or, if necessary, the material is forced out of the pouch with the help of the front paws.

They eat a wide variety of vegetables, fruits and seeds and are hoarders. The faecal pellets are 1,9 cm long and 0,6 cm in diameter and these are accumulated in large midden heaps. If their feed is fresh and contains sufficient moisture, they need very little, if any, water.

Behaviour: When detained the big rats become tame overnight. However, sudden movements or sharp noises cause them to lash out and they can inflict a serious bite. In captivity they sleep together without problems but in nature it is probable that only one individual lives in any single hole in which they build a grass pallet. They are powerful animals and once a male and female animal succeeded in cutting and tearing their way through the half-inch wire mesh of their enclosure. Although formidable-looking, these big rats are easily handled by the tail, up which they cannot climb.

Reproduction: Of 100 specimens examined, 50 were females but no embryo counts are available. The litter size is usually three and on occasion, four.

On August 16th a captive female No. T933 gave birth to four young which measured 8,9 cm in H.B. They were naked, blind and pink at birth and at two weeks fine hair had just covered their bodies. Between the second and third week they were fully furred, the bellies pure white, the backs and sides clear pearl grey. It is of interest that in another litter, born on March 15th (female No. T2247), the first fur to cover the bodies at about 12 days was red and not grey. The belly fur was, as before, pure white. Between 60 and 70 days the red gradually changed to grey except for a patch between the ears which remained red. After 70 days the faces below the top of the eyes, became almost coal black. Skins were prepared at 45, 75 and 90 days to show this colour change. The mothers of both these litters were caught at Amani from where only *C. g. osgoodi* is reported.

During the first month after birth female No. T2247 was seen to roll the young over on their backs, irritate the area around the external genitalia and anus with her tongue and swallow the excreta of the young. At 30 days, after their eyes had opened the young left the nest for the first time and every day deposited their faecal pellets in their own little midden heaps. At 60 days the young began for the first time to fill their pouches with maize grain and to hide their own hoards of corn.

It would seem that giant rats may reproduce twice a year, namely during the early months and then for the second time towards the end of the year.

Growth: The average growth of two litters has been summarised in Table 5.

TABLE 5

AVERAGE GROWTH RATE OF GIANT RAT IN MM

Cricetomys gambianus

Grey young – T933
Taken at Amani, Tanzania, August 15th.
4 young born August 16th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother	810	400	410	85	40
	Removed from mother				
45 days	600	300	300	60	30
40 days	490	260	230	54	28
35 days	381	208	173	47	25
	Eyes open				
30 days	272	158	114	40	22
25 days	247	151	96	38	20
20 days	222	144	78	35	18
15 days	200	125	75	30	15
10 days	170	115	55	22	10
5 days	144	101	43	18	7
Birth	117	87	30	15	5

Red young – T2247
Taken at Amani, Tanzania, March 11th.
3 young born March 15th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother	780	380	400	85	45
90 days	610	320	290	65	40
75 days	563	300	263	71	40
60 days	468	250	218	63	85
45 days	370	202	168	55	28
40 days	292	172	120	48	23
35 days	257	160	97	43	20
	Eyes open				
30 days	232	147	85	39	17
25 days	200	130	70	33	15
20 days	166	112	54	26	12
15 days	153	105	48	23	10
10 days	141	97	44	20	8
5 days	118	83	35	15	5
Birth	101	69	27	11	3

Plague and Parasites: Giant rats have been found to be plague positive. At Amani they carry no fleas but on Mt. Kilimanjaro, 200 miles away, the flea *Xenopsylla crinita* J. & R. 1922 has been removed from them, as well as on Zanzibar Island. This flea has never been associated with plague. In Kenya *Xenopsylla crinita* J. & R. 1922, *Xenopsylla tortus* J. & R. 1908 have been removed from this rat and in Uganda *Dinopsyllus semnus* J. & R. 1913. None of these fleas has been associated with plague.

The parasitic earwig *Hemimerus vosseleri* Rehn & Rehn is found on the local rats and as many as 65 of these 2 cm parasites have been removed from a single rat. Giant rats captured in thick forest carry large numbers of several kinds of ticks.

DASYMYS – THE SHAGGY SWAMP RAT

The writer's experience with the shaggy swamp rat *Dasymys incomtus* is limited. In Tanzania only one was captured, a male, 3 miles south of Njombe. In Kenya, however, on March 3rd six males and six females were taken on the river in the city park of Eldoret which is 10 miles south-west of the type locality. The six females were not pregnant but Ansell (1960) reports embryos in April and May with a count of seven and nine at Ndola. *Dasymys* can be distinguished from *Otomys* by the absence of grooves in the incisors.

Plague and Parasites: Dasymys has been found to be plague positive in the Congo. At Eldoret at about 7,000 feet elevation these animals carried only *Dinopsyllus longifrons* J. & R. 1913 which has as yet not been associated with plague. The single specimen taken at Njombe carried only a male *Dinopsyllus echinus* J. & R. 1913, also not associated with plague.

DENDROMUS – GRASS CLIMBING MICE

Species: In Tanzania there appear to be five species, covering eight recognised forms:
Dendromus mesomelas nyasae Thomas 1916 in the south-west corner.
Dendromus mesomelas hintoni Bohmann 1939 in the Morogoro district.
Dendromus mesomelas kilimandjari Bohmann 1939 in the Moshi district.
Dendromus whytei pallescens Osgood 1910 in the north-east corner.
Dendromus pumilio pumilio Wagner 1841 from Lake Victoria and South.
Dendromus pumilio uthmoelleri Bohmann 1939 above Babati and Ufiome.
Dendromus nyikae Wroughton 1909 on Ukerewe Island.
Dendromus nigrifrons nigrifrons (True 1892) from Mt. Kilimanjaro.

Most Tanzanian climbing mice extend either south into Zambia or north into Kenya and Uganda.

Description: Climbing mice are usually some shade of grey above but Hollister (1919) states that some are quite bright and reddish in colour. Ansell (1960) reporting from Zambia describes the animals as living in tall grass but also as arboreal and semi-terrestrial. In size they average 8,9 cm in head and body with 10,2 cm prehensile tails. The front feet bear three

long slender toes. The mice are said to be seed and insect eaters but the writer has never found them easy to take in baited traps.
Reproduction: Seven of these mice taken in mid July at Ngorongoro Crater showed no sexual development nor did one taken at Manyara in October. Roberts (1951) states that the mice build grass nests in which two escape doors are maintained and they will rebuild old bird nests to have two escape doors. He is also of the opinion that the normal litter size is three to four but that he has recorded as many as eight embryos. Ansell (1960) has reported a series of embryo counts from Zambia for February, March and April, the counts being three, four, five and six.

Plague and Parasites: Dendromus has been found to be plague positive in the Congo. In Tanzania the writer has found this mouse carrying the following fleas which have not yet been associated with plague: *Nosopsyllus incisus* (J. & R. 1913), *Dinopsyllus grypurus* J. & R. 1913, and *Ctenophthalmus verutus* Smit 1960.

GERBILLUS – THE PIGMY GERBILS

These mice are buff-coloured, approximately 5 cm in length and possess a silky fur. Like the American kangaroo rats they use their front feet for hands and hop on their hind limbs. They are very attractive animals. In Tanzania they were collected only at the sand pit about midway between Moshi and Arusha Chini. They are trapped in this area in the ratio of one pigmy gerbil to ten of the big black-tailed gerbils.

Species: There appear to be only two species of pigmy gerbils in Tanzania:
Gerbillus harwoodi luteus (Dollman 1914) from Masailand.
Gerbillus pusillus Peters 1878 perhaps south of Mt. Kilimanjaro and described 13 miles north of Voi, Kenya.

Reproduction: Of five animals examined, four were females, one of which was pregnant with an embryo count of three on September 29th. The animals dig burrows in sand. The entrances are not obvious and are probably plugged from within.

Plague and Parasites: At the Arusha Chini sand pit the pigmy gerbil's close association with the black-tailed gerbil causes the latter's fleas, *Xenopsylla difficilis* to appear on them occasionally. At this time neither the mouse nor the flea has been associated with plague.

GRAPHIURUS – THE DORMICE

These mice are the only mice in East Africa which have a furred tail. The average male measures 8,9 cm in head and body and 8,9 cm in tail. They are grey in colour and arboreal in habit. A total of 14 animals was collected, seven females and seven males, at Amani, Gonja, Arusha, Lake Manyara and the floor of Ngorongoro Crater.

The Species: Four species have been reported from Tanzania:
Graphiurus parvus dollmani Osgood 1910, south west slope Mt. Kilimanjaro.
Graphiurus murinus collaris (A. & M. 1933), south west area of Republic.
Graphiurus murinus isolatus Heller 1912, north-east quarter of Republic.
Graphiurus microtus (Noack 1887), north-west quarter of Republic.
Graphiurus smithii (Thomas 1893), scattered through Tanzania.

Description: Dormice are quiet and nocturnal but will bite when disturbed. They build ball-shaped nests from plant fibres, which they first chew to a suitable fineness, in hollow trees and crevices of trees. They will rebuild bird nests and even use spider nests for nesting purposes. They are not easily trapped on the ground and prefer meat, cheese and insects to oats. Locally they are greyish-brown above and grey to dirty white below.

Duff-Mackay in a personal communication reports that dormice live in beehives west of Lake Natron where they are considered a nuisance by the local bee-keepers.

Reproduction: None of the seven females captured, as described above, was pregnant. Hollister (1919) reports that Heller recorded embryo counts of two, three and four during November.

Plague and Parasites: Graphiurus has never been associated with plague. The dormouse, like *Beamys* and *Mastomys* has a very fine and very dense fur which may make the attachment of fleas difficult. They seldom carry fleas although the holotype of *Dinopsyllus pringlei* Hubbard 1963 was removed off one at Amani and the holotype of *Dinopsyllus kempi* J. & R. 1913 was taken off *G. m. saturatus* in Kenya.

LEGGADA (*MUS*) – THE PIGMY MICE

The generic name *Leggada* has been used in preference to *Mus*.

Species: These mice vary considerably in size and can be as small as 5,1 cm in length. In colour they are mousey grey to buff above but the belly fur is characteristic. Grey bellies are of the *triton* group, white bellies of the *minutoides* group and orange bellies of the *bufo* group:
Leggada (*Mus*) *triton murillus* (Thomas 1910).
Leggada minutoides bellus (Thomas 1910) ranges over most of state.
Leggada minutoides vicinus (Thomas 1910) ranges in eastern part.
Leggada minutoides indutus (Thomas 1910) in southern portion.
Leggada bufo Thomas 1906 from Ngorongoro and southwards.
Leggada gerbillus A. & L. 1933 from central portion.
Leggada tenellus suahelicus Thomas 1910 from southern slopes of Mt. Kilimanjaro.
Leggada birungensis L. & G. 1925 in the Mbulu area.

Description: The triton group of pigmy mice look generally like house mice and have the same characteristic odour as house mice. The *minutoides* and *bufo* groups seem to lack this characteristic odour and are very small and attractive animals. They can be trapped in oat-

meal-baited traps. The writer's records cover 40 specimens from Amani, Sigi, Korogwe, Sunga, Mamba, Gonja, Moshi, Mt. Meru, Lake Manyara, Ngorongoro, Seronera and Njombe. At Njombe 18 specimens were caught representing all three species groups.

Reproduction: In spite of hundreds of records found for this mouse very few embryo counts are available. Ansell (1960) reports a November count of three and a February count of five. The writer captured six pregnant females during March at Njombe. These animals all produced four young which were blind, red and naked at birth.

Plague and Parasites: Pigmy mice have been found to be plague-positive in South Africa and the Congo. They have no fleas of their own, but may carry a number of species, picked up as strays. For instance at Seronera, the Serengeti, these mice carried *Xenopsylla bantorum* Jordan 1938; at Ngorongoro *Dinopsyllus grypurus* J. & R. 1913, *Xiphiopsylla lippa smithi* Hubbard 1966, *Listropsylla basilewskyi* Smit 1960, *Ctenophthalmus acanthurus* J. & R. 1913; on Mt. Meru *Dinopsyllus lypusus* J. & R. 1913; at Njombe *Ctenophthalmus gilliesi* Hubbard 1963 and *Ctenophthalmus calceatus cabirus* J. & R. 1913. In general, however, the mice are immaculately clean, and of the fleas listed no more than one was collected per mouse.

LEMNISCOMYS GRISELDA – THE SINGLE-STRIPED GRASS MOUSE

The Species: Two forms of the single-striped grass mice are recorded from Tanzania:
Lemniscomys griselda rosalia (Thomas 1904) from almost all over the republic.
Lemniscomys griselda maculosus (Osgood 1910) reported from Mbulu district, but described from Voi in Kenya.

Description: The single-striped grass mouse is fairly large measuring about 12,7 cm in head and body and about the same length of tail. While other grass mice have a plump appearance, this group is long and slender. It is brownish in colour and with the first fur there appears a definite black line extending down the middle of the back from the ears to the base of the tail. The belly is whitish.

They are diurnal, terrestrial and will bite when provoked. They make their homes on grassy plains, in isolated grass patches and bushy country. Their diet appears to be mostly grass although seeds are probably eaten when available. The nest is a round ball of grass with one entrance.

Reproduction: Only one embryo count was recorded, namely four at full term, from a female captured on April 1st at Ifikara. Ansell (1960) records three juveniles about 12 days of age in February in Zambia. On July 11th, at Muheza a female was secured which produced six young in a trap. On October 25th another captive female No. T3016 gave birth to two young. At birth the young are naked and blind, pink on the belly and dark grey on the back. Their average growth rate is depicted in Table 6.

Growth was extremely rapid and at five days they were fully furred and the eyes were open on the eighth day. During January five females, captured in Lake Manyara National Park, were examined. None of these was pregnant.

TABLE 6

AVERAGE GROWTH RATE OF SINGLE-STRIPE GRASS MOUSE IN MM

T3016 – *Lemniscomys g. rosalia*
Taken 10 miles S.E. Muheza, October 22.
2 young born October 25, at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother ..		125	No	25	18
30 days ..	195	100	95	24	17
25 days ..	180	90	90	22	15
20 days ..	150	80	70	20	12
15 days ..	120	65	55	18	12
10 days ..	95	55	40	15	10
8 days ..	Eyes open				
5 days ..	65	40	25	10	3
Birth	30	22	8	5	2

Plague and Parasites: This mouse has been found to be plague-positive in the Senegal. At Manyara the specimens examined carried many *X. cheopis* Rothschild 1903, many *C. c. tholatus* Troub 1963 and some *D. lypusus* J. & R. 1913, all of which are likely vectors of plague. Other specimens examined carried no fleas.

LEMNISCOMYS STRIATUS – THE PUNCTATED GRASS MOUSE

The Species: Tanzania has three punctated grass mice:
Lemniscomys striatus massaicus (Pagenstecher 1885) from Ukerewe Island.
Lemniscomys striatus ardens (Thomas 1910) from Kilimanjaro and district.
Lemniscomys striatus luluae Matschie 1926 in the Ufipa region.

L. striatus are sometimes called by the popular name of zebra rats but they are more generally known as the punctated or spotted grass mice. The stripes are interrupted and appear as lines of dots. They measure about 12,7 cm in head and body and the same in length of tail.

Hollister (1919) gives the following embryo counts on *L. s. massaicus* from Kenya: June (4), January (2), February (2) and July (3 and 4). The writer was not able to capture any pregnant animals.

Plague and Parasites: These mice have been found to be plague-positive in the Congo and East Africa. The writer has found them carrying the fleas *X. cheopis*, *D. lypusus*, *C. c. cabirus*, which are all vectors of plague as well as *C. c. wilkesi* Hubbard 1963.

LEMNISCOMYS BARBARUS – EIGHT-STRIPED MICE

In these mice the lines on the back are fairly definite. Three subspecies have been recorded in Tanzania.
Lemniscomys barbarus convictus (Osgood 1910) on the slopes of Kilimanjaro.
Lemniscomys barbarus manteufeli Matschie 1911 about Lake Victoria.
Lemniscomys barbarus spekei (de Winton 1897) in central part of Tanzania.

These grass mice are not as large as *striatus*, available measurements indicate that the head and body length is about 10,2 cm and the tail up to 12,7 cm. The writer has had no experience with these mice.

LOPHUROMYS – CHOCOLATE BROWN MICE
(With a newly recorded subspecies from Tanzania)

These mice are said to have the most attractive appearance of all African mice. The writer prefers the popular name "Chocolate Brown" to "Harsh-furred" or "Brush-furred" used in the literature as these mice have fur which is extremely soft and shiny.

The Species: The original chocolate brown mouse was described as *Mus aquilus* by True in 1892 from the 8 000 ft. level on Mt. Kilimanjaro. Under the subspecies *Lophuromys aquilus aquilus* it has been recorded from practically all the mountainous regions of Tanzania. However, those taken by the writer in the north-east corner of Tanzania were identified as *Lophuromys flavopunctatus margarettae* Heller 1912. This finding extends the range of this mouse down from central Kenya. This mouse is found in the mountains east of Mt. Kilimanjaro and apparently the species *flavopunctatus* takes presidence over *aquilus*. *Lophuromys flavopunctatus aquilus* (True 1892) ranges on Kilimanjaro and to the west and south.

Lophuromys sikapusi manteufeli Matschie 1911, described from Mwanza and listed in literature from many parts of northern Tanzania is considered by the writer as the juvenile form of *L. f. aquilus*. *Lophuromys sikapusi ansorgei* de Winton 1896 was described from south-eastern Kenya and is considered by the writer to be the juvenile form of *L. f. margaretta*. (See paragraph on moult.)

Description: The fur is a rich brown colour on the sides and back while the bellies pass through a rich burnt orange to tan as the mouse matures, and finally greyish as it grows old. They are medium sized, a large male will reach 14 cm in head and body with a 7,7 cm tail. They are not forest dwellers nor denizens of particularly high elevations. They do, however, live on the fringes of forests and could be considered grass mice. They are seldom found in grass which would dry up during the dry season and prefer grass patches along streams. At 3 000 ft. altitude they are the most common mouse taken but the writer has collected a few as low as 500 ft. Like spiny mice the skin is fragile and the tails are shed with ease.

These mice are terrestrial and not strictly nocturnal. They do not build trails and their diet appears to consist mostly of grass. They readily enter box traps baited with oatmeal. They seldom bite in detention.

Reproduction: The reproductive organs of 171 females were examined of which 38 proved to be pregnant. The incidence of pregnant females by months was January (4), February (1), March (3), April (5), May (14), October (3), November (6), December (2). The embryo count gave three females with one embryo, 27 with two, seven with three, and one with four.

On February 9th an entire family of *L. f. margarettae* was captured. The male was in full rut and measured To. 225, H.B. 145, T. 80, F. 25, E. 15. This was the largest male taken by the writer. Judged by measurements the two young mice of this family group were six weeks of age. The female of this group was not nursing the young and on February 16th she produced three young which were blind, pink and naked at birth. They emerged from the nest for the first time at 16 days and at 50 days the moult had taken place, the belly colour changing to the adult colour of tan.

Another captive female, T561, produced three young on April 17th at 1400 hr. The average growth rate of these young is reflected in Table 7.

TABLE 7

AVERAGE GROWTH RATE OF CHOCOLATE BROWN MOUSE IN MM

T561 – *Lophuromys f. margarettae*
Taken at Amani, April 17th.
3 young born April 17th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother ..	185	120	65	24	12
54 days ..	180	120	60	22	12
25 days ..	146	95	51	22	12
20 days ..	142	91	51	20	11
15 days ..	125	85	40	19	10
10 days ..	110	75	35	18	9
6 days ..	Eyes open				
5 days ..	90	60	30	18	8
Birth	67	48	19	12	4

On the fifth day after birth the young were fully furred and their eyes opened when they were six days old. The writer has seldom seen a female *Lophuromys* build a nest for the young although one captive female did fashion a 15 cm ball-shaped nest with one entrance from grass litter placed in her cage. Usually they use any convenient accommodation without building a nest. Moreover, neither burrows nor nests were ever seen in the field.

The Moult: The moult which occurs in *Lophuromys* at six weeks is an important consideration in the systematics of this genus. For example on April 14th a female, almost fully grown and

measuring To. 200, H.B. 130, T. 70, F. 20, E. 16, still exhibited the typical juvenile burnt orange colour which extended from the tip of her lower jaw over the belly to the base of the tail and up the sides to mix and disappear into the chocolate brown of the sides and back. On April 17th a fine band of tan began to appear on the middle of the belly, extending up the sides. By April 21st half the belly was tan and after a further week the burnt orange colour had disappeared to give way to the adult tan colouration. There are no embryo counts for the orange-bellied *Lophuromys* and there cannot be as they are all juvenile. Mammalogists of note have named specimens born of tan-bellied mothers, *L. f. margarettae*, as *sikapusi* not knowing of their origin. An interesting case, therefore, of synonymy.

Plague and Parasites: Lophuromys has been found to be plague positive in the Congo. Moreover, the writer has found this mouse to be a good flea carrier. The list of fleas carried by the mouse is rather long and varies with elevation. The writer lists the mouse as the favoured host of the flea *Dinopsyllus lypusus* which is a known vector of plague. This flea is found fairly generally below the 4 000 foot level on this mouse, the mouse sometimes carrying a dozen or more of these big fleas. At and below this level the mice will also carry *Ctenophthalmus c. tholatus* and pick up a few strays. At about 5 000 feet the mice carry *Dinopsyllus longifrons* and within their range the following fleas: *Nosopsyllus incisus*, *C. c. cabirus*, *C. c. hemingwayi*, *C. evidens wilkesi* Hubbard 1963, *C. grzimeki* Hubbard 1965, *C. c. schmiederi* Hubbard 1966, *C. verutus* Smit 1960 and *C. eximius*.

MASTOMYS – COUCHA RAT, MULTIMAMMATE MOUSE, SHAMBA RAT

The coucha rat is the most adaptable and most widely distributed mouse in East Africa. The genus is of interest to plague specialists because it is said to be plague resistant.

The Species: Although the name *coucha* was used as late as 1951 by Swynnerton and as late as 1953 by Lawrence and Loveridge, today it seems that *natalensis* takes precedence and that the generic name to be used is *Mastomys*. At the moment five types of coucha rats are reported in Tanzania.

Mastomys natalensis microdon (Peters 1852) in the southern portion.

Mastomys natalensis durumae (Heller 1912) in the north east quarter and described from Mombasa, Kenya.

Mastomys natalensis hildebrandtii (Peters 1878) from the north west quarter and described from Voi, Kenya.

Mastomvs natalensis victoriae (Matschie 1911) from all over Tanzania.

Mastomys natalensis itigiensis (Hatt 1935) from the Singida District.

It is suggested that *M. n. victoriae* and *M. n. itigiensis* are synonyms of *M. n. microdon*.

Description: This animal can be taken almost anywhere in East Africa except in rain forest. They possess a vicious, nervous temperament. They are nocturnal, terrestrial and omnivorous. They have been found at altitudes ranging from sea level to 8 500 ft. and in both dry bushy country and swampland.

Reproduction: Of 225 females examined 30 were pregnant. The embryo counts were: one female with two embryos, two with three, one with five, six with six, two with seven, three with eight, five with nine, six with ten, two with eleven, and one each with thirteen and sixteen. By months the incidence of pregnancy was January (16), February (1), May (1), March (4), July (5), September (1) and November (1). By location the count was Muheza (8 in January, 4 in July and 1 in September), Lake Manyara (8 in January, 1 in August), Iringa and Njombe (5 in March), Himo (1 in February).

In addition to the above it was observed that eight females captured in January from the top of the Rift Wall above Lake Manyara National Park were all pregnant with embryo counts ranging from seven to sixteen. At the bottom of the wall 16 females were captured which showed no trace of sexual development. Apparently, the warm sunny conditions at the top of the Wall had favoured sexual activity while cool and damp conditions 1 000 ft. below in the Park had inhibited development. On September 1 a large female was captured at Muheza which had 20 well-developed mammae, thus the name multimammate mouse.

The young of coucha rats are quite strong and vigorous at birth. Within a day, long, blackish and sparse hair appears on the back while the feet and belly remain pink. They do not grow particularly rapidly and the average growth rate of two litters, consisting of three young and nine young respectively, is given in Table 8 which shows that size of family apparently does not effect the growth rate.

The eyes open after 14 days and it seems likely that the mothers reduce the litter size themselves. For example, on January 15 a pregnant female was captured which produced 11 young, two days later the young were reduced to six.

TABLE 8

AVERAGE GROWTH RATE OF COUCHA RAT IN MM

Mastomys natalensis durumae

Taken July 24th, Muheza, Tanzania.
Young born August 1st at Amani.

	T2744–3 small young in litter						T2758–9 large young in litter				
	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*		*Total*	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother	250	130	115	22	18	Mother	250	130	115	22	18
40 days						40 days	170	90	80	22	16
35 days	142	80	62	20	15	35 days	160	90	70	22	15
30 days	130	75	55	18	14	30 days	155	85	70	22	15
25 days	120	70	50	15	11	25 days	150	82	68	20	13
21 days				Extreme sense perception developed							
20 days	110	65	45	14	8	20 days	143	78	65	18	12
15 days	80	50	30	12	6	15 days	100	60	40	15	10
14 days						Eyes open					
10 days	65	41	24	11	5	10 days	85	53	32	12	7
5 days	53	35	18	9	4	5 days	58	45	13	10	5
Birth	35	25	10	5	2	Birth	45	33	12	7	2

When bird nests are not provided the mother will fashion a shallow cup-shaped nest from the litter on the cage floor. She usually defends any interference with her young very vigorously. The young do not become firmly attached to the mammae as in the case of certain other mice described previously. No nests were found in the field but Roberts (1951) states that they will use any convenient hole in the ground or in foundations of houses.

Plague and Parasites: It has been noticed that old coucha rats, some as large as 145.130.25.22 change colour from the usual dark grey to a reddish-brown. It is almost impossible to skin these animals. The muscles are frequently filled with cysts of green pus, the livers are filled with cysts and ascarids crawl from the mouth. When T2744 was turned into a skin after raising her small family it was noticed that there was a large lesion on her side which communicated with an internal abscess. Her mesentaries were filled with cysts and there were 50 ascarid worms, each up to 3,8 cm long, in her stomach. These worms had not descended into the duodenum.

Coucha rats have been found to be plague positive all over Africa, and are said to be plague resistant. In spite of this, in the writer's opinion these mice are poor carriers of fleas. For example, 16 animals from Rhombo, south slope of Kilimanjaro, on 25 May carried no fleas. Their fur is very dense and fine and fleas find it very difficult to travel through it. The coucha rat does not have a flea of its own but like the American *Peromyscus*, it is in every crevice and cranny and thus picks up all the stray fleas dropped by other mice. Of 450 mice examined 271 were found to carry no fleas, 152 carried from 1–6 and 27 carried from 7–20 fleas. The fleas found were: *Echidnophaga gallinacea*, *Xenopsylla bantorum*, *X. brasiliensis*, *X. cheopis*, *X. morgandaviesi*, *X. versuta*, *Nosopsyllus incisus*, *Leptopsylla a. aethiopica*, *L. a. nakuruensis*, *Dinopsyllus echinus*, *D. grypurus*, *D. longifrons*, *D. lypusus*, *D. pringlei*, *Stivalius torvus*, *Ctenophthalmus blandulus*, *C. c. cabirus*, *C. c. tholatus*, *C. eximius*, *C. gilliesi*, *C. leptodactylus*.

OTOMYS – THE SWAMP RATS

These large, dark grey animals could perhaps be better described as grass mice than swamp rats. They also appear to be denizens of the higher elevations. At Ngorongoro Crater, both on the floor and on the rim they were plentiful in the grass and there were no swamps in the near vicinity. At Olalaa, west of Lake Natron they were plentiful at mid-day with no water available in the immediate vicinity. At Shume and Sunga, at an elevation of 6 000 ft. in the western Usambara Mountains they were still found in grass, not necessarily near water. They readily enter box traps baited with oatmeal.

The Species: Three of the seven forms of *Otomys* reported from Tanzania come from the slopes of Mt. Kilimanjaro. These are:
Otomys typus zinki Bohmann 1943 known only from the type locality.
Otomys angoniensis elassodon Osgood 1910 as far south as Iringa.
Otomys divinorum Thomas 1910 from about Rombo.
Otomys denti sungae Bohmann 1943 from the western Usambara Mountains.

Otomys kempi Dollman 1915 from the mountains about Morogoro.
Otomys percivali Dollman 1915 from the Iringa District.
Otomys anchietae lacustris A. & L. 1933 in south west Tanzania.

Description: These animals vary in size but average 17,7 cm in head and body and one half that in tail length. They have a plump appearance, with blackish fur, and like grass mice they engineer trails through grass and brush. They are terrestrial, probably diurnal and feed mostly upon grass and weeds. It is possible, however, that they may use their heavy, grooved incisors to feed upon the bark of shrubs.

Reproduction: Ansell reports foetuses in May, June and August at Ndola and in January at Kabompo. Hollister (1919) reports the following embryo counts from Kenya, January (1), October (2, 1). Heller (1909) recorded three embryos in a female collected at the Engare Ndare River in June. On May 21st a female *O. d. sungae* was captured at Shume by the author and contained two embryos. A captive female *O. a. elassodon* taken on the floor of the Ngorongoro Crater produced four young on October 4th but the young died shortly after birth. On August 27th a captive female produced one young measuring 50.20.8.2 mm which she failed to nurse and as a result it died shortly after birth.

Plague and Parasites: Otomys has been found to be plague positive in East Africa. Being high elevation mice, the various *Otomys* carry high elevation fleas. At Sunga *Dinopsyllus titan* Hubbard 1963 was found on them and at Ngorongoro Crater they carried *Dinopsyllus longifrons, Ctenophthalmus evidens wilkesi* and *Ctenophthalmus cophurus hemingwayi.* These fleas have not yet been found to be vectors of plague but close relatives have.

PELOMYS – THE CREEK RATS

Specimens of this genus are large, their head and body being about 15,2 cm in length and the tail approximately the same. Although they are called creek rats, the writer has seldom found them along water-ways. They could perhaps be better described as grass mice.

The Species: From Kenya and Tanzania there seems to be but one species, *fallax,* which extends into Zambia but in the southern part of East Africa there is also *minor* which is called the lesser creek rat. Throughout this range the common form is:
Pelomys fallax iridescens Heller 1912, described from Teita Mountains, Kenya.
Pelomys fallax insignatus Osgood 1910, described from Fort Hill, Malawi, and found in the south-west region of Tanzania.

Description: The coat is reddish-brown, flecked with black and the belly dirty white. Individuals exhibit a black streak down the middle of the back and the upper incisors are grooved. Roberts (1951) has described them as diurnal, partly aquatic and that they occur in coarse vegetation, along streams and rivers. In the writer's experience, they readily become tame but will bite

occasionally. The writer's records range from an elevation of 500 ft. at Muheza to 8 000 ft. at Ngorongoro Crater. One record of a genet preying upon *Pelomys* was obtained.

Reproduction: Of the 25 animals examined only one pregnant female was captured during May. This animal produced three young in captivity. After 14 days the young left the nest to feed with the mother and at 30 days their average measurements were To. 192, H.B. 106, T. 86, F. 27, E. 16 mm. Ansell (1960) recorded nine embryos during April and seven during May.

Plague and Parasites: This genus has been found to be plague positive in East Africa. The writer has found it carrying the following fleas: *Dinopsyllus lypusus*, *D. longifrons*, *Ctenophthalmus calceatus cabirus*, *C. blandulus*, *C. verutus* and *C. evidens wilkesi*.

PRAOMYS – THE AFRICAN FOREST DEER MOUSE

These forest-loving, dark tree mice resemble the American deer mice very closely. In fact, Heller (1909) described one from Sotik in Kenya as *Mus peromyscus*. These mice are often referred to as "soft-furred rats" but they are not rat sized. The mouse *taitae* was described from west of Voi, Kenya, captured in the Teita Hills. Hatt in 1940 separated the form from Mbulu from it and called it *octomastis*.

The Species: The two forms reported from Tanzania are:
Praomys delectorum taitae (Heller 1912) in north-east Tanzania and adjacent Kenya.
Praomys delectorum octomastis (Hatt 1940) from Mbulu district.

Description: These mice are shy, timid and medium sized with long tails. A large specimen had the following measurements: To. 234, H.B. 100, T. 134, F. 24, W. 20 mm. They are slender and graceful animals and, although forest dwelling, they prefer the fringes of forests to the dense interior. They are certainly terrestrial but climb readily and can be trapped at the bases of trees. There are two colour forms of the mouse in north-east Tanzania, the usual dark-grey-backed form and a light-brown-backed type. The bellies are white. At Mamba, at 6 000 ft. elevation in the South Pare Mountains on the Saseni River the mice are grey-backed but in the forest five miles away the colour of the back is tan to light brown. This variation was also noted at 6 000 feet at Sunga in the western Usambara Mountains. These mice do not adapt well to detention and in a natural state are probably omnivorous and nocturnal.

Reproduction: Of 100 females examined 12 were pregnant. The incidence of pregnancy by months was: September (5), November (4), January (1) and March (2). Embryo counts gave two females with two embryos, five with three, two with four, one with five and two with six. A captive female from Amani, measuring To. 27, H.B. 95, T. 112, F. 23, E. 21 mm, produced six young during May and after 20 days the young were fully grown.

Plague and Parasites: This mouse has not yet been found to be plague positive. It is the favoured host for *Dinopsyllus grypurus* J. & R. 1913, *Stivalius torvus* (Rothschild 1908) and

Ctenophthalmus leptodactylus Hubbard 1963, none of which have so far been associated with plague.

RHABDOMYS – FOUR-STRIPED GRASS MOUSE

These mice are medium sized and are found at higher elevations in grassland.

The Species: Through all of East Africa this mouse is *Rhabdomys pumilio diminutus* (Thomas 1893), which was described from east of Naivasha, Kenya.

Description: Although known as four-striped mice there are in fact seven stripes down the back, four black ones, two white ones and a central greyish one. The general colour is brownish with head and body measurements of about 11,4 cm and a tail measuring 8,8 cm. The belly is whitish.

The author has captured these mice at 4 500 ft. (Arusha), at 6 000 ft. (Mufindi and Njombe), 7 500 ft. (on the rim of Ngorongoro Crater), 6 000 ft. (on the floor of Ngorongoro Crater) and there are reports of it being taken at 12 100 ft. on Mt. Kilimanjaro. Captive animals at Amani were very active from daylight to 1000 hr, from 1000 hr to 1400 hr they only occasionally left their retreats. From 1400 hr to 1600 hr they were quiet and then became active until dusk.

Reproduction: Embryo counts obtained were: Arusha, February, one with six embryos; Njombe, March, two with five embryos and one with three. During late August a captive female, No. T2931, taken at Ngorongoro Crater rim demolished three weaver-bird nests in her cage, stacked the debris into a pile and disappeared therein. Next day a pencil was thrust into the pile which exploded into flying mice and debris. The four young were wide-eyed and fully furred like the mother, who regrouped the pile, stuffed in the young, crawled in herself and pulled the grass in tightly. The mother was highly excited by the high-pitched whistle of the young. The average growth-rate of these young is given in Table 9.

Plague and Parasites: This mouse has been found plague positive in South Africa. At Njombe it was found carrying a few of the fleas *C. c. cabirus* and *C. gilliesi*; at Arusha *X. cheopis* and *X. morgandaviesi*, *D. lypusus* and *C. c. tholatus*; at Ngorongoro Crater, *D. longifrons*, *N. incisus*, *C. verutus* and *C.c. cabirus*.

SACCOSTOMUS – THE SHORT-TAILED POUCHED MICE

The writer's experience of this genus was limited to two specimens taken along a stream at Seronera, Serengeti and one specimen on top of the Rift Wall at Lake Manyara National Park. These were identified by the National Museum as *Saccostomus campestris umbriventer* and *S. c. elegans*.

TABLE 9

AVERAGE GROWTH RATE OF FOUR-LINED GRASS MOUSE IN MM

T2931 – *Rhabdomys p. diminutus*
Taken Ngorongoro Crater, August 27th.
4 young born August 29th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother ..	185	110	75	25	10
30 days ..	175	100	75	20	10
25 days ..	170	95	75	18	10
20 days ..	155	90	65	16	10
15 days ..	145	85	60	16	10
10 days ..	115	70	45	15	8
5 days ..	85	50	35	12	5
..	Eyes open – fully furred				
Birth	70	45	25	10	3

The Species: Saccostomus campestris umbriventer Miller 1910 which was described from Sotik, Kenya, this being its first recorded appearance in Tanzania.
Saccostomus campestris elegans Thomas 1897 described from Karonga, Nyasaland and found in Tanzania as far north as Mpwapwa.

Both Roberts (1951) and Ansell (1960) have described this mouse. The writer's specimens were pearl grey above and immaculate white below. The two specimens from Seronera were both males and their average measurements were: To. 160, H.B. 112, T. 48, F. 19, E. 15 mm. The Lake Manyara specimen was a young male.

Plague and Parasites: Saccostomus has not yet been associated with plague. The mouse carried a flea of its own, *Xenopsylla sarodes*, of which 80 were removed from the young individual caught in Manyara National Park. This flea is not known to be a vector of plague.

STEATOMYS – THE FAT MOUSE

The popular name of this genus is misleading as it has a typical mouse-like appearance, but according to Roberts (1951) they become very fat and aestivate for part of the year in underground nests.

The Species: Specimens captured by the writer at Arusha and in the Serengeti at Seronera and Olalaa were identified by the National Museum at Nairobi as:
Steatomys athi Heller 1910 which was described from the Athi Plains, Kenya.

Steatomys loveridgei Thomas 1919 is reported from the central portion of Tanzania. *Steatomys muanzae* Kershaw 1923 from the same area.

Plague and Parasites: The fat mouse has been found to be plague positive in South Africa. In Tanzania the writer has found the following fleas on this mouse: *X. bantorum*, *D. lypusus*, *L. a. nakuruensis*, *C. e. wilkesi.*

TATERA – THE GERBILS

(With a sub-species here reported for the first time from Tanzania)

Including the new sub-species, there are nine forms of gerbil in Tanzania, including a new species described by the author (1970).

The Species:
Tatera robusta pothae Heller 1910 from Olalaa, west of Lake Natron and described from Potha, Kapiti Plains, Kenya (new record).
Tatera robusta swaythlingi (Kershaw 1921) in the north-east quarter.
Tatera robusta vicina (Peters 1878) in the north-east region.
Tatera robusta muansae (Matschie 1911) south of Lake Victoria.
Tatera schinzi loveridgei Hatt 1935, Kilosa.
Tatera leucogaster consensi (Kershaw 1921) in the east-central region, but as far west as Iringa and Njombe.
Tatera leucogaster taborae (Kershaw 1921) in the Tabora District.
Tatera pringlei Hubbard 1970 from Muheza.

Description: These mice usually live in sandy soils or other soils in which they can construct their complicated burrows. They are sandy coloured with large hind feet and legs for hopping and small front feet used like hands. The long tail is used for balance and they usually close their burrow entrances from within during the day, thus making them difficult to find. They require dust baths to maintain their soft, silky fur in good condition and if these are not available the coat becomes matted, the animals deteriorate and eventually die. They bite on occasion but have a gentle disposition and defend themselves more frequently with a backward sweep of the hind legs. They are nocturnal and terrestrial. The large black-tailed gerbils measure as much as 17,7 cm in head and body with 20,3 cm tails.

Reproduction: The writer captured 52 females of which four were pregnant. On December 28th a female (*T. robusta*) was taken with eight embryos at Arusha Chini and on February 25 at Same a captive female (also *robusta*) from Same gave premature birth to six young in a trap which were mauled by the mother. Ansell (1960) reports embryo counts ranging from four to seven from Zambia for this genus.

On December 28th a captive female *T. r. swaythlingi* from Gonja produced six young, the average growth rate of this litter is contained in Table 10. At two weeks they were fully

TABLE 10

AVERAGE GROWTH RATE OF GERBIL IN MM

T1568 – *Tatera r. swaythlingi*
Taken at Gonja, Tanzania, December 23rd.
6 young born December 27th at Amani.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother ..	315	140	175	35	18
60 days ..	252	110	142	33	17
55 days ..	220	100	120	33	17
50 days ..	205	95	110	31	15
45 days ..	190	90	100	29	14
40 days ..	175	85	90	27	13
35 days ..	160	80	80	25	13
30 days ..	145	75	70	23	12
25 days ..	130	70	60	20	12
25 days ..	Eyes open				
20 days ..	113	65	48	17	10
15 days ..	100	60	40	15	8
10 days ..	86	55	31	13	7
5 days ..	73	50	23	11	5
Birth	60	45	15	9	3

furred but their eyes did not open until the 25th day. Another captive female, also from Gonja, produced a litter of five on December 30th.

On December 25 at Same small cries led to three small fully-furred but blind black-tailed gerbils huddled in a kitchen sink 36 inches off the ground. The mice were missing in the morning.

The reproduction of *T. pringlei* has been reported on (Hubbard 1970b).

Plague and Parasites: Gerbils have long been associated with plague. South Africa has condemned them for a long time. They have also been found plague positive in the Congo. Surprisingly enough, in East Africa, they carry three fleas of their own which have never been tested for vector efficiency. These fleas are *Xenopsylla debilis*, *humilis* and *difficilis* all described off gerbils from Kenya by Jordan in 1925. Rarely does one find these fleas on other animals and one rarely finds other fleas on the gerbils. Once in a while one does find *Xenopsylla nubica* Rothschild 1903 on East African gerbils and this flea has been shown to be an efficient vector of plague in West Africa.

TATERILLUS – THE SLENDER GERBILS

The Species: Only *Taterillus gracilis osgoodi* (Wroughton 1910) is recorded from Tanzania.

Description: Either these slenderly built gerbils are rare in their range or baits do not interest them. Only two were taken during this study, the records being:
Same, Nov. 28, 1961, (T191), female: To. 275, H.B. 125, T. 150, F. 35, E. 18.
Gonja, May 10, 1966, (T3333), male: To. 285, H.B. 125, T. 160, F. 35, E. 18.

These gerbils are vicious and must be handled with gloves. When placed with *Tatera* they promptly killed them. The two recorded above carried no fleas.

THAMNOMYS – AFRICAN TREE MOUSE
(With a first record for one species in Tanzania)

The Species: In Tanzania the following species occur:
Thamnomys dolichurus surdaster (Thomas and Wroughton 1908) which has been taken pretty generally over Tanzania.
Thamnomys dolichurus polionops Osgood 1910 from Llukenia Hills, Kenya.
Thamnomys dolichurus littoralis Heller 1912 from Mazeras.
Thamnomys ibeanus ibeanus Osgood 1910 from Molo and reported here for the first time from Tanzania.

Description: The colour of these mice is a soft tan and the belly, even when they inhabit muddy water-ways, is an immaculate snow white. The tail is almost twice as long as the body and the mouse is generally considered as being arboreal. Nevertheless, the author captured 100 specimens in traps placed on the ground, baited with oatmeal. Moreover, they must forage outside of forests as they have been captured several miles from the nearest trees and water. The writer has captured them at elevations as low as 500 ft. but they are far more common around forests above 2 500 ft. The author obtained specimens from Muheza (500 ft.), Gonja (2 300 ft.), Same (2 500 ft.), Amani (3 000 ft.), Manyara (3 500 ft.), Arusha (4 500 ft.), Mamba (5 500 ft.), Shume, Sunga, Mufindi and Njombe (6 000 ft.). A large male will measure To. 285, H.B. 115, T. 170, F. 25, E. 20 mm.

Reproduction: Ansell (1960) reports two females with four embryos in February and April at Nolola and a female with four in December. Of the 100 specimens examined by the writer only five females were pregnant. At Amani on September 25th a female was captured with 3 embryos and on June 28th at Muheza another with three. In addition three captive females produced three, five and four young on 5th of May, 20th of August and 31st August respectively. All these were *T. d. surdaster.*

The females construct elaborate triangular-shaped nests with three escape doors, one at each apex (Fig. 1). Nests are usually situated in tangled bushes or shrubs. One of the nests found was well hidden by green leaves and measured 10 x 10 x 15,2 cm. The walls were about 2,5 cm thick and made entirely of grass, coarse on the outside and fine within. The doors were

FIGURE 1
Nest of *Thamnomys dolichurus surdaster*. There are three escape doors, one below, one to the right and one to the left above.

of special construction. A dry fine grass shield was erected about 2,5 cm inside the door opening, in the shape of a screen. The mouse thrust its nose through this shield, forcing the screen apart when leaving the nest. After the mouse had passed through, the screen fell back into place completely blocking the entrance. The nest was very clean and free from parasites. When adapting weaver birds' nests for their own use in detention they are satisfied with one entrance but furnish this with the usual screen.

The young of this genus become firmly attached to the mammae of the mother. At birth they are blind and have fine black hair on the back, the belly and feet are naked and pink. In some of the juveniles two distinct black stripes were present on the back but by the tenth day they had all assumed the adult colour patterns. At 12 days the eyes opened and as the young increased in size the mother gradually thinned out the walls of the nest, presumably to increase ventilation. The average growth rate of a litter of four is reflected in Table 11.

TABLE 11

AVERAGE GROWTH RATE OF TREE MOUSE IN MM

T2865 – *Thamnomys d. surdaster*
Taken at Shume, Tanzania. August 13th.
5 born August 20th at Amani.
Family reduced to 4, August 22nd.

	Total	*H.B.*	*Tail*	*Hind Foot*	*Ear*
Mother ..	275	115	160	20	15
30 days ..	210	95	115	20	15
25 days ..	200	90	110	20	12
20 days ..	165	75	90	20	10
15 days ..	150	70	80	18	8
12 days ..	Eyes open				
10 days ..	111	52	59	16	6
5 days ..	83	43	40	10	4
Birth	57	35	23	5	3

Plague and Parasites: These mice have been found to be plague-positive in the Congo and in East Africa. Fifty of them taken at Amani carried no fleas but at elevations of 5 000 feet they carry quite a few in good variety. The author has removed from them, *Nosopsyllus incisus* (J. & R. 1913) of which they are the favoured host; *D. longifrons*, *L. a. aethiopica* (Rothschild 1908), *C. leptodactylus* Hubbard 1963, *C. eximius* J. & R. 1913, *C. gilliesi* Hubbard 1963, none of which have so far been associated with plague.

New Record: Thamnomys ibeanus ibeanus Osgood 1910 is a mouse which has not before been recorded from Tanzania. The author's record is from the stream above the school-house at Lushoto, western Usambara Mountains, October 27th, the identification having been made at the Kenya National Museum. The female, T1315, measured 305.130.175.25.26 and the mouse was carrying a male of the flea *Leptopsylla a. aethiopica.*

THALLOMYS – PENCIL-TAILED TREE RAT

Roberts (1951) refers to this species as the Damar Acacia Rat and has given a full description of this animal and no purpose will be served in repeating this description.

There are no breeding records available and only one species recorded from East Africa, viz. *Thallomys damarensis scotti* Thomas and Hinton 1923. Until 1951 this species had only been reported from Kikuyu in the vicinity of Dodoma in the centre of Tanzania. The writer's single specimen was taken at Seronera on October 6th in the Serengeti. This specimen carried a few *Xenopsylla bantorum* fleas.

THRYONOMYS – THE CANE RATS

Cane rats are found in suitable reed beds, along waterways or in sugar cane plantations throughout Africa south of the Sahara. This species is *Thryonomys swinderianus*, the subspecies in Tanzania being *variegatus* (Peters 1852). These animals are large and the author has collected only one specimen at Muheza. This animal was reddish brown, 55,8 cm (H.B.) and a tail of 17,7 cm. Since the flesh of these animals is considered a delicacy by many peoples of Africa there are records of them being taken practically all over Tanzania. Hunting dogs with bells on their collars are used to hunt these rats.

The lesser cane rat, *Thryonomys gregorianus gregorianus* is much smaller and has a more restricted distribution in Tanzania, having been reported only from Karema on the eastern shore of Lake Tanganyika.

The adults are clothed with coarse spiny hair giving the appearance of stiff-textured bristles. These animals dive and swim with ease, especially at night. Ansell (1960) has reported an embryo count of four during January in Zambia. These rats have not yet been associated with plague. They seem to carry no fleas.

ZELOTOMYS – BROAD-HEADED MICE

This genus has rarely been collected. It is not mentioned by Roberts (1951) and very little is known about its habits, habitat and reproduction. In Kenya there are two forms namely, *Zelotomys hildegardeae hildegardeae* (Thomas 1902) and *Zelotomys hildegardeae vinaceus* Heller 1912. Very recently specimens were obtained north and west of Banagi, this being a new record for Tanzania.

These mice measure approximately 12,7 cm in head and body with 10,1 cm tails. They have as yet not been associated with plague and no fleas have been reported from them.

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