

THE HABITS AND HABITATS OF SMALL RODENTS IN THE CONGO RIVER CATCHMENT REGION OF ZAMBIA AND TANZANIA*

DESMOND FOSTER VESEY-FITZGERALD

Tanzania National Parks

INTRODUCTION

The check-lists of Swynnerton and Hayman (1951) for Tanganyika, and of Lancaster (1953) and Ansell (1960) for Zambia, and the reclassification of the mammals of Southern Africa by Ellerman, Morrison-Scott and Hayman (1953), outline the distribution of the mammals of Tanzania and Zambia. Very little, however, is known about the habits or habitats of small mammals which are seldom seen in life. Although the species are far less numerous than those of birds, yet small mammals must be very abundant in individuals, especially during periodic plagues. There is practically nowhere where one or more species may not be found, although the distribution of each appears to be controlled by special habitat preferences. It is as a contribution to the scanty knowledge of the ecology of eastern African rodents therefore that this paper is written.

Of the four major components of the environment, namely climate, food, shelter and predators or parasites, it seems that provided the food and shelter requirements are satisfied, many of the species of small rodents occur in a wide variety of places and it is the purpose of the present article to give some evidence in support of this supposition. Within the Congo river drainage area of Zambia and Tanzania, habitats have been investigated ranging from highlands at 2500 metres to valleys at little over 500 metres, including vegetation types ranging from evergreen forest, through woodland to grassland and swamp. The importance of the drainage lines as an environment for small mammals has become apparent during this study, and so the present thesis develops around them.

TRAPPING METHOD

Trapping success depends on observation. Traps have been set where holes, shelters, runs, tracks or middens occur. In this way much knowledge is gained about the habits and distribution of the various species. No assessment of the abundance of the different species has been attempted, but some values for the relative frequency of each species in the different habitats can be given, because the traps used (steelplate break-backs) and the bait employed (groundnuts or rat-meat) have been standardised throughout the investigation. African rats are not likely to be trap-shy, but it is realised that some common species are not easily taken by this standard procedure.

* Paper received September 1963.

DESCRIPTION OF THE AREA

The study area (see Map) includes the Rukwa valley (800 metres) and the enclosing escarpments and drainage lines entering it; the Ufipa highlands (up to 2400 metres) and the Lake Tanganyika trough (750 metres); the Great Plateau of north-eastern Zambia, averaging 1200 metres and the Mweru-wa-Ntipa depression (900 metres), and the drainage lines entering them.

The whole of this area has a fairly similar climate, namely a single rainy season, November to April, followed by a practically rainless period, May to October. At Abercorn the average rainfall over the last 50 years is 44 in., the lowest-recorded being 30 in. (1937/8) and the highest 68 in. (1961/2). In the Rukwa valley the average rainfall is 31 in., the lowest being 25 in. (1952/3) and the highest 41 in. (1959/60). The coolest period is in the middle of the year, June and July, when the night temperature in the Rukwa valley falls to 60°F (16°C) and frosts may be experienced in the highlands. The hottest period is just before the rains, in October, when lowland (Rukwa valley) temperatures average 92°F (33°C), and highland (Abercorn) temperatures average 83°F (28°C) at midday. The humidity during the dry season may be very low, and dew at night practically negligible.

Relict blocks of forest enclosed by upland grassland, the latter apparently a secondary fire sub-climax formation, occur in the highlands. The intermediate heights are clothed mainly with mixed *Brachystegia* woodland, which covers a vast area in the district. The woodland varies with the topography and soil features and extensive areas are in decline as a result of human occupation, and these become overgrown with secondary fire-conditioned (*Hyparrhenia*) grassland. Associated with the drainage lines there is a well developed catena, woodland-woodland grassland-valley grassland, which is continually encountered. The lowlands are largely edaphic grassland, or swamp with local areas of thicket or relict forest (Vesey-FitzGerald 1955, 1963).

About half the species of rodents which have been collected occur in drainage lines. As a habitat these have several obvious advantages. Under a climatic regime so markedly seasonal as that prevailing in the study area, it is only in the drainage lines that sufficient moisture and green herbage remains available during the dry season, and the shelter offered by the herb mat there is less likely to be burnt out.

ACCOUNT OF THE SPECIES*

In all a total of 29 species belonging to 20 genera have been studied: 13 genera are represented by single species, five by two, and two by three species in the area.

Muscardinidae (dormice)

The forest dormouse *Graphiurus murinus* is common and widespread, and specimens have been taken in all types of wooded vegetation; it frequents houses and roofs in deforested tracts of country, and has in fact become a minor domestic pest. It shelters in any available

* The nomenclature followed in the main is that of Ansell (1960).

cavity, including holes in the ground, crevices in rocks and hollow trees. It is an active climber and catholic in its feeding habits. Insects and fruit are consumed. During the fruiting season of the *Parinari* trees the sweet pulp round the stone is greatly favoured. This dormouse is almost entirely nocturnal, though captive individuals have been observed to feed during the day. In their shelters they are protected from climatic extremes and from fires, but as their range of movement is based on available shelter, they must endure long periods during the dry season without access to surface water. Their moisture requirements must therefore be satisfied in their food, and by their ability to avoid high temperatures and low humidities by sheltering from extremes. Specimens have been collected throughout the year and no evidence of a period of aestivation has been obtained. Hazards from predators are to some extent avoided by their ability to shed their brittle tails; tailless individuals are quite common.

The rock dormouse *Graphiurus platyops* is larger and less common than *murinus*. It is a woodland species and apparently an opportunist shelterer. Undoubtedly rock crevices provide a favoured shelter, and specimens have been taken in such places in the Zambezi valley. But cavities in trees, and gerbil (*Tatera*) burrows are also used. This species is not recorded from Tanzania although it occurs in the Mporokoso district of Zambia near to the border.

Muridae (*rats, mice and gerbils*)

The thicket rat *Thamnomys dolichurus* is a climbing animal restricted to arborescent vegetation. Vesey-FitzGerald (1962a) gives evidence that three recognisable sympatric ecological races occur in the area, which are related respectively to forest, woodland and thicket. It inhabits roofs in built-up areas. In suitable places it is common. Food comprises insects and vegetable matter. The fist-shaped nest is made of dry grass blades, and is hidden under loose bark of trees, within cavities, or under the eaves of roofs. It is strictly nocturnal and adults shelter during the day in their nests even when they are not rearing young.

The Nile grass rat *Arvicanthis niloticus* is represented by a large, very dark coloured form which is associated with the black illuvial soils of flood plain grasslands. It is extremely abundant in the Rukwa valley where a long series of specimens has been collected, but it has not been found in the Northern Province of Zambia. In the Rukwa valley it lives under the dense herb mat of treeless flood plain grassland and is active day and night. The soil of the flood plains, although extremely hard when dry, is usually of a blocky texture and often deeply fissured. *Arvicanthis* makes tunnels which connect with these fissures and so is able to gain access to deeper levels with the minimum of effort. Usually the holes are in pairs, an entrance and exit, but groups of a larger number of holes, up to 15, are not unusual. Large warrens of this nature probably indicate long usage rather than a large number of inhabitants because both excavating and trapping have failed to yield more rats from the large hole groups than from the small ones. Extensive runs under the herbage emanate from the holes, and piles of cut grass in the pathways indicate feeding places. Mongooses, kites and owls are their main predators, and snakes live in the burrows. Large numbers of these rats are excavated by local Africans who esteem them as a relish.

The house rat *Rattus rattus* is well established in African villages throughout the Congo basin of Zambia and Tanzania; it is possible that the invasion of the area has taken place mainly from the north and east (Ansell 1960). The only native species with which the house rat comes into contact is the multimammate mouse. But whereas the former shelters in the thatched roof of African huts, and upon being disturbed immediately climbs to the rafters, the latter shelters at ground level. The two species therefore occupy different ecological niches. In European-style houses and stores, the multimammate is the usual house rodent. Both feed on household scraps of all sorts.

Only one specimen of the house rat has been collected away from a village, and this was near to fallow lands. This unique specimen was a large, white-bellied individual conforming to the 'frugivorous' variety, whereas the village rats are all of the grey-bellied 'alexandrinus' type, which apparently do not survive in deserted villages, in cultivations or in any type of indigenous vegetation.

The bush rat *Aethomys chrysophilus* occurs commonly throughout the mixed *Brachystegia*-woodland where suitable shelter is available in nooks and crannies among boulders; its presence is manifest by the accumulations of gnawed fruit. It is also occasionally taken in runs of other species under the herb mat of streamsides, and as a casual shelterer in piles of thatching grass, and in holes of *Tatera*. But rocky sites on slopes provide its true home, and in such places the spiny mouse *Acomys* is its usual associate. *Aethomys chrysophilus* lives in small colonies which are centred on suitable shelter. The species is nocturnal and very active during the early part of the night. They scramble over rocks and probably climb trees. Their main food consists of fallen hard dry fruits (drupes) of shrubs and trees such as *Combretum*, *Grewia* and other species. These are collected on the ground and carried to a favoured shelter to be eaten. The supply of such food is likely to be ample at any season.

Aethomys nyikae is also common. It is an opportunist shelterer in casual holes, which have been made by other rats, in cavities in termite heaps, wood piles, among boulders and even occasionally in houses and stores. Although this species has been found to consort with other rodents, it appears to be a more solitary species than *chrysophilus*, and the two have not been taken together. It is nocturnal and terrestrial and its food consists of fallen dry fruits.

The multimammate mouse *Praomys natalensis* has been collected on the floor of forests with *Praomys jacksoni* and two of the species of *Lophuromys*, along drainage lines with *Otomys*, *Pelomys* and *Dasymys*, in flood plain grassland with *Arvicanthis*, among rocks with *Aethomys chrysophilus* and *Acomys*, in warrens of *Tatera*, and in villages and houses with *Rattus*. Its diet is as varied as its shelters. All kinds of stores are eaten, such as grain, mealie meal, dried fish, chocolate and soap. The multimammate mouse also have cannibalistic tendencies and is certainly insectivorous because it feeds readily on adult locusts and excavates the eggs of these insects after they have been laid in the ground.

Chapman *et al* (1959) have studied the growth and breeding of *Mastomys* (*Praomys natalensis*). At intervals this versatile species reaches plague proportions, and then its unusual

abundance provides a key 'industry' for a number of predators, as well as a 'shield' protecting other species from predator pressure. Evidently therefore the study of the biological and ecological relationships of *Praomys natalensis* is complicated and likely to be full of interest.

The soft-furred mouse *Praomys jacksoni* is confined to forest but it survives in quite small relict blocks, and in gallery forest fringing streams. Associated with such discontinuous habitats, some ecological races have been recognised (Vesey-FitzGerald 1962b). It is crepuscular and nocturnal and shelters among all kinds of debris on the forest floor, where it is not subject to marked seasonal extremes. The home range of a group may be restricted to the vicinity of a single forest tree such as *Parinari*, which sheds its fruit on the ground. It collects the fruit by making sorties from a convenient shelter. The fruit is then carried back to the shelter where the hard shell is gnawed at leisure in order to get at the kernel; the debris of continual feeding indicates that such shelters are used during a prolonged period possibly amounting to the life span of several generations. Indeed this method of livelihood is practised by other ecologically similar species. Since *Praomys jacksoni* is also very easily caught in traps baited with rat-meat, it may also be omnivorous in its diet.

Three species of striped grass mice of the genus *Lemniscomys* occur in the area.

The punctated grass-mouse *L. striatus* has never been collected in the flood plain grasslands of the Rukwa valley where the common grass rodent is *Arvicanthis niloticus*. This is probably because *L. striatus* is mainly diurnal and the open grasslands, after dry season fires, would not afford sufficient shelter for their safety. Its usual habitat is thick vegetation, composed of grass tussocks and woody herbs, such as is found fringing streams, in old cultivated lands, and along the edge of seasonal swamps where reeds (*Phragmites*) and isolated colonies of *Cyperus papyrus*, or thickets of *Syzygium* trees occur.

It makes well defined runs which radiate from one or two holes. Very often the holes are situated within a thicket, and it has been observed that the extensions of the runs beyond the shelter of the woody growth are not used after the overhead grass has been burnt off. Little piles of cut grass stems mark feeding sites at intervals along the runs.

The striped grass mouse *L. barbarus* has been collected along the Ugalla and Malagarasi rivers in central Tanzania, which are on the fringe of the present study area. This species appears, however, to occupy the same ecological niche and to have the same habits as *striatus*.

The single-striped grass mouse *L. griselda* has only been taken within the study area on rare occasions and under circumstances which suggest that it is a woodland rather than an open grassland inhabiting species.

The four-striped grass mouse *Rhabdomys pumilio* has been collected within the study area in the highlands (Poroto mountains and Ufipa plateau) at elevations between 2000–3000 meters; but it is not recorded from Zambia (Ansell 1960)*. This is also a diurnal mouse and its well defined runs pass under tussock grass herbage in stream valleys (which it often shares with *Otomys*) and under the rank herbage at the edge of forest blocks in upland grass-land

* *Rhabdomys pumilio* has since been recorded from the Zambia side of the Nyika Plateau (Ansell, 1964, *Puku* 2: 42–43)—Ed.

vegetation. *Rhabdomys* therefore occupies a habitat which is relatively immune from fires and the other effects of the dry season, and overhead shelter normally remains available throughout the year. No special observations have been made on the food which presumably consists of grass and seeds.

The harsh-furred mouse *Lophuromys flavopunctatus* occurs on the forest floor, and under rank secondary vegetation which grows where the forest has been recently destroyed. In this secluded and equable environment it is active both by day and night, and is very common where it occurs. Abundant fallen seeds and insects are available at all seasons under the rank herbage. These certainly provide its main food supply. The mouse shares the feeding shelters of *Praomys jacksoni* and the runs of the grass-feeding *Otomys*.

L. sikapusi occurs on the fringe of the study area in the Malagarasi drainage (Long. 3100E. Lat. 0500S.) in central Tanzania. This species inhabits the edge of edaphic grasslands which are liable to seasonal flooding. Apparently it is a grass-feeder.

The pygmy mouse *Mus minutoides* is common. It occurs in a variety of habitats where the vegetation is usually secondary or in decline. It also enters dwellings. It is a bold creature and may frequently be seen scampering about on bare ground at night. It is an opportunist shelterer and makes use of any hole or fissure or even temporary shelter such as a woodpile, travellers' loads, or a ground sheet laid down for the night in camp. The young are born (dry season months) in such places. These mice probably do not excavate their own holes. No special observations have been made on their feeding habits, but household crumbs and dry natural history specimens are frequently consumed. Numbers undoubtedly become victims of the smaller rodent-eating snakes, such as the common *Crotaphopeltis* and *Boaedon*, and nestlings are eaten, one after the other, by *Atractaspis*. During periods of *P. natalensis* plagues, *Mus minutoides* is particularly abundant, suggesting that it may obtain some protection from predators by consorting with the superabundant multimammate mice.

The greater pygmy mouse *Mus triton* is local, and restricted to the dense vegetation on forest floor or in stream valleys, where it consorts with other species belonging to the drainage line community.

The rufous-nosed rat *Oenomys hypoxanthus* is a rare and little-known species in eastern Africa. Except for a doubtful Tanzania record (Swynnerton and Hayman 1950), a specimen from the Mbisi forest on Ufipa is the first one to be collected in the territory. Subsequently Swynnerton (*in litt.*) found the species occurring on an island in Lake Victoria. The existence of *Oenomys* in the Mbisi forest, like the existence there of the red colobus monkey *Colobus badius tephrosceles* and several species of birds with western affinities, indicates a former ecological link with the West African faunal area, probably along the highlands bordering the eastern coast of the Lake Tanganyika rift. This single specimen was trapped in a run of *Otomys*, but Loveridge (1956) intimates that this species is arboreal.

The African water-rat *Dasymys incomtus* is common in all drainage lines, where it shares its habitat with *Pelomys*, *Otomys* and sometimes *Arvicanthis*. Specimens have been collected

along drainage lines traversing flood plain grassland in the Rukwa valley, and on the plateau among tussock grasses and other herbs fringing streams and bogs. Because it invariably consorts with other rats, no individual observations on its habitat, shelter or food have been made. But it survives in the dense semi-floating grass mat over deep water when the valley grasslands become flooded; at such times other species appear to be drowned or to have moved to dry land.

The creek rat *Pelomys fallax* usually occurs in rather damp environments where access to water is possible throughout the year, and where the overhead shelter is not normally destroyed by fire. Specimens have been collected in flood plain grassland, mixed woodland, cultivations, edges of bogs, stream sides, the perimeter of forest, in termitaria thicket and rubbish heaps in gardens—habitats which it usually shares with other species. The creek rat is active both by day and night. Incidental holes, connected by runs under the herbage, mark the home range of this species. Grasses are its normal food.

Differences of opinion exist over the nomenclature of the spiny mice *Acomys*, but following Ansell (1960), the common species in our area is referred to *A. cahirinus* Desmarest. It is widespread in suitable habitats and has nearly always been found associated with rocks, in the crevices of which it shelters. It has been collected in dry deciduous thicket woodland on the eastern escarpment of the Rukwa valley in sites where it has no possible access to water during the long months of the dry season. It also occurs where streams pass through rocky gorges, in woodland on the Ufipa escarpment, and in secondary grassland areas in the Abercorn district. This species commonly associates with *Aethomys chrysophilus*.

Acomys is nocturnal and has a mainly insectivorous diet. Middens, which represent the accumulation of the feeding waste of generations of spiny mice, can be found in sheltered nooks of its habitat. These accumulations are composed of a remarkable assortment of discarded hard fragments of beetles, bugs (Heteroptera), ants, termites, millipedes, spiders and small snails. Fragments of seed testa also occur and pellets of mouse dung add to the rubbish.

The pouched mouse *Saccostomus campestris* has been captured in valley grassland, in secondary grassland, in old cultivated lands on the beach sands of Lake Tanganyika, in mixed *Brachystegia* woodland on hillsides, and in mixed *Acacia* woodland in the Rukwa valley. *Saccostomus* is therefore not restricted to any special type of vegetation, but occurs more frequently in areas where the herbage is in decline and subject to seasonal fires. For shelter it makes free use of any holes which are available such as those originally excavated by *Tatera* and other rats; it is doubtful if it ever does its own burrowing. The pouched mouse is one of the few species in which the feeding habits are readily ascertainable because it collects its food in the cheek-pouches where it may be found in an un-masticated state. Dry seeds, mainly Leguminosae, especially cultivated beans, form its main diet. In *Colophospermum mopane* woodland (which is extralimital to our area) the germinating 'beans' of this tree are eaten. The seeds are collected at night during sorties which alternate with periods under shelter where the food is masticated.

The giant rat *Cricetomys gambianus* is a forest frequenting species, and occurs commonly in the better stands of woodland, in secondary growth and in thicket. It shelters in warrens which are partly located in cavities of termitaria, and partly constructed by the rats themselves. From the warren, well used runs radiate to feeding areas which may be quite far away. Food consists of the fruit of wild trees which are climbed easily. Considerable damage is also done to cultivated fruit and root-crops.

The fat mouse *Steatomys pratensis* is common in sandy places. The species is greatly relished by Africans, and such large numbers are excavated in some areas that it is becoming scarce. Fat mice are assiduous burrowers and the loosened soil of cultivations favours their distribution. Their presence is revealed by small mounds of excavated subsoil, but no entrance to the burrow is visible because the tunnel becomes plugged with loose sand. The burrow may descend to a depth of 18 inches or more thus reaching an horizon of relatively constant temperature and humidity where the inmate obtains protection from climatic extremes. During the dry season fat mice are said to aestivate in a deep chamber. It seems likely however that feeding may be continuous because specimens collected at the end of the dry season (October) were still excessively fat. If excavated by a predator, or pursued along their burrows, fat mice attempt to escape by burrowing forwards and blocking the passage behind them.

Fat mice are strictly nocturnal as far as their above ground activities are concerned. Food consists of seeds; in cultivations peanuts and finger millet grains are collected and carried back to the burrow to be eaten. Middens comprising the fragments of such meals are found in the underground passages.

The grey pygmy tree mouse *Dendromus* sp. The genus *Dendromus* is in need of revision but Ansell (1960) gives characters for separating *mystacalis* and *melanotis*. Following these the only species collected in the study area was identified as the latter. However Davis (*in litt.*) considers that the former may be referred to. Therefore pending examination of more material, attributing these notes to any particular species of *Dendromus*, must be taken as being provisional. This mouse constructs a spherical nest of grass, about the size of a closed fist, which is supported by herbaceous vegetation above ground level. The nests are loosely constructed without any definite entrance, access being gained through the loose straws composing the bundle. Several nests of this type are constructed within a limited area, and the adults shelter by day in some of them. The mice quickly vacate the nest and escape under the cover of the herb mat if they are disturbed. The young (up to six have been found in one brood) are reared in these nests, and nestlings have been found in April and June. These mice are extremely vulnerable to grass fires, indeed they only survive among the rank herbaceous vegetation of boggy drainage lines where the late flowering grasses are usually sufficiently green not to burn when the early dry season fires commence, and which become to some extent protected from later fires by the surrounds having been burnt early in the season. *Dendromus* also thrives in suburban gardens which are, in effect, fire-protected areas.

Vlei rats of the genus *Otomys* are in need of revision. A species determined as *O. anchietai*

Bocage is the common one in the area investigated (Ansell 1960)*. These rats are mainly diurnal and they live in small colonies. They make well defined runs under the shelter of the dense bog herbage and here enjoy a relatively equable climate, with perennial access to water and immunity from dry season fires. It is quite absent from grasslands where the sheltering herb mat is burnt off each year. They feed entirely on the pith of herbs and grasses which are cut into short lengths and from which the outer layer is stripped. The debris is deposited in little piles at intervals along the runways. *O. anchietai* gives birth to a single young one in an advanced stage of development. No nests or burrows are constructed since the dense vegetation affords protection from overhead predators. The habitat of *Otomys* is shared with *Pelomys* and *Dasymys* and sometimes with *Rhabdomys*.

The grooved-tooth savanna gerbil *Tatera valida taborae* has been collected at Tabora (type locality), along the Malagarasi drainage, in the Rukwa valley and on the Ufipa plateau, where however the population appears to be mixed with *T. v. liodon* (Vesey-FitzGerald in preparation). This gerbil inhabits well drained sandy soils, above flood level, on the perimeter of valley grasslands. It is particularly abundant along the edges of flood plain grasslands in the Rukwa valley where its honey-combed warrens may extend for many miles along a belt facing the tree line. It is also common in sandy alluvium along rivers, and in old gardens where the soil has been loosened by cultivation. It feeds on the underground parts of grasses and sedges. In compact soil these roots are obtained by shallow excavations, but in loose soil superficial tunnels are made and the rhizomes are gnawed from below the surface. This activity very soon destroys all the herbaceous vegetation and the surface of *Tatera* warrens is therefore characteristically bare and honey-combed, especially during the dry season. During the rains when the grass is long and there is less nutrient stored in their parts underground, the gerbils feed on green grass blades.

These gerbils are extremely sedentary and seldom leave the vicinity of their holes. Typically the burrow has one or more open entrances giving access to tunnels which descend gently to a chamber 18 in. to 2 ft. (45—60 cm.) below the surface. From the chamber there is usually a steeply ascending escape passage which just reaches the surface but is not opened except in an emergency. The larger warrens consist of a collection of such groups of holes, each entrance leading to a chamber, but they are not usually interconnected, and the inmate defends its shelter from intruders. Well marked surface runs lead from one entrance to another, and these may traverse short distances of open country to adjacent warrens. These rats are entirely dependent on the shelter of their burrows for protection from climate and predators. During the dry season many small rodents exist without access to free water; in the case of gerbils their dry season food also is dry. Moreover the surface of the bare ground becomes very hot during the day time. The gerbils are able to survive these extremes by sheltering in their burrows by day and by only being active at night. Predators are avoided by remaining in the close vicinity of their protective holes, but the serval cat *Felis serval* and the wild cat *Felis libyca* are regular nocturnal visitors to gerbil warrens, where they lie in wait near the holes and pounce

* *Otomys anchietai* has since been rejected from Zambian list (Ansell, 1964, *Puku* 2: 47)—Ed.

on the rats as they emerge. Snakes find shelter within the warrens themselves, and the puff-adder *Bitis arietans* is an important predator of the adults and the house-snake *Boaedon fuliginosus* of nestlings.

The smooth-tooth savanna gerbil *Tatera valida liodon* occurs at Abercorn, in the Mporokoso district, at the south end of Lake Tanganyika at Sumbu, throughout the Mweru-wa-Ntipa depression and on the Zambian side of Lake Mweru. The environment occupied, and the warrens made, are similar to those of *taborae*, but *liodon* also tends to extend into woodland where the soil has been loosened in cultivation clearings. The habits, food and predator relationships are the same as for *taborae*. It appears therefore that the two races occupy the same ecological niche. Intermediates occur on the Ufipa plateau near the Zambian border.

The bush gerbil *Tatera leucogaster* occupies sandy soils of woodland and riverine herbage, where it excavates burrows leading to a chamber 8—18 in. (20—45 cm.) below the surface. The chamber is often lined with dry grass. There are usually one or two other tunnels forming escape routes but the hole groups of this species are normally small and scattered. Surface runs under the ground herbage are usually well marked, and *leucogaster* feeds at some distance from its holes. Otherwise its food, and strictly nocturnal period of activity, resemble that of *taborae*.

Boehm's gerbil *Tatera (Gerbilliscus) boehmi* inhabits woodland with an herbaceous ground cover, as well as open spaces within thicket vegetation; it also associates with both *liodon* and *taborae*. Its burrows have only one or two entrances which are not marked by much excavated soil. Frequently the burrows of other species of *Tatera*, or the long tunnels of mole-rats *Cryptomys* are used. This species is strictly nocturnal, and its forays extend over wide areas, but no detailed observations have been made on its food.

SUMMARY

The 29 species of small rodents (Muscardinidae and Muridae) which inhabit the Congo drainage of Tanzania and Zambia have been studied by standardised trapping in the habitats in which each lives. Evidence is given that the essential ecological conditions which govern the distribution of each species are embodied in their particular requirement for adequate food and shelter. Food appears to be seldom in short supply but shelter, especially in habitats which have been degraded by fire, may be a limiting factor.

Provided these essential requirements are satisfied, the rodent fauna is shown to be grouped into several well marked communities which are related to the soil vegetation catena of the drainage lines. Forest, woodland and grassland inhabiting communities are recognisable and it is indicated that human activities tend to restrict the range of some species, but allow the spread of others.

ACKNOWLEDGEMENTS

Very great help has been given by Mr. W. F. H. Ansell in naming the specimens discussed in

this paper, and thanks are also due to Dr. D. H. S. Davis for elucidating the tangled synonymy of the genus *Tatera*, and to Mr. R. W. Hayman for answering many systematic queries. The author is also grateful to Mr. Ananyia Mwangomo for patiently preparing the many hundreds of skins upon which this study is based.

REFERENCES

- ANSELL, W. F. H. 1960. *Mammals of Northern Rhodesia*. Govt. Printer, Lusaka.
- CHAPMAN, B. W., R. F. CHAPMAN and I. A. D. ROBERTSON. 1959. The growth and breeding of the multimammate rat *Rattus (Mastomys) natalensis* (Smith) in Tanganyika. *Proc. Zool. Soc. Lond.* 133: 1-9.
- ELLERMAN, J. R., T. C. S. MORRISON-SCOTT and R. W. HAYMAN. 1933. *Southern African Mammals*. London.
- LANCASTER, D. G. 1953. *A Checklist of the Mammals of Northern Rhodesia*. Govt. Printer, Lusaka.
- LOVERIDGE, A. 1956. *Forest Safari*. Butterworth Press.
- SWYNNERTON, G. H. and R. W. HAYMAN. 1951. A Checklist of the Land Mammals of the Tanganyika Territory and the Zanzibar Protectorate. *E. Afr. Ug. Nat. Hist. Soc.* 20, (90): 274-392.
- VESEY-FITZGERALD, D. F. 1955. The Vegetation of the Outbreak Areas of the Red Locust in Tanganyika and Northern Rhodesia. *Anti-Locust Bull.* 20: 1-31.
- VESEY-FITZGERALD, D. F. 1962a. Ecological races of the Forest Mouse *Grammomys dolichurus* Smuts. *Occ. Papers Nat. Mus. S.R.* No. 26B: 746-749.
- VESEY-FITZGERALD, D. F. 1962b. Ecologically isolated populations of *Rattus (Praomys) moric* Trouessart, Soft-furred Rat, in eastern Africa. *Occ. Papers Nat. Mus. S.R.* No. 26B: 750-754.
- VESEY-FITZGERALD, D. F. 1963. Central African Grasslands. *J. Ecol.* 51: 243-274.