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Habitat Utilization and Diet of the Harvest Mouse, Micromys minutus, in an Urban Environment

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Dickman C. R., 1986: Habitat utilization and diet of the harvest mouse, *Micromys minutus*, in an urban environment. Acta theriol., 31, 19: 249—256 [With 2 Tables].

The distribution of the harvest mouse, *Micromys minutus*, was surveyed in 50 discrete patches of habitat within the City of Oxford using hair sampling tubes and live trapping, and by searching for breeding nests. Mice occurred in ten habitat patches ranging in area from 0.30 ha to 1.76 ha. Animals were associated most strongly with patches containing a dense and relatively undisturbed cover of grass and herbs (orchard, scrub and long grass), but in single instances animals were found in woodland, a churchyard and an overgrown garden. Analysis of faecal pellets collected from nests and live-trapped animals showed *M. minutus* to be omnivorous. Seeds, fruit, monocotyledon and dicotyledon leaves and insects were major dietary items, but fungus, moss, root material and other invertebrates were also consumed. The harvest mouse successfully persists in the urban environment of Oxford, but has been overlooked in previous studies.

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1. INTRODUCTION

The harvest mouse, *Micromys minutus* (Pallas, 1771) occurs in a wide variety of habitats, but favours areas of tall, dense vegetation. In Britain, this species has been recorded most frequently in hedgerow, bramble and on the edges of fields, but it occurs also in heathland, moorland and in the tidal areas of salt marshes (Harris, 1979). Large populations of *M. minutus* may build up locally in agricultural areas. For example, Rowe & Taylor (1964) recorded up to 110 animals in corn ricks in England; in corn ricks in Russia between 2,000 and 5,000 animals have been estimated (Sleptsov, 1947).

In correspondence with its ability to exploit diverse habitats, *M. minutus* probably eats a wide variety of foods. Captive animals eat seeds, green shoots, fruit and meat, and may chase and consume moths and flies (Trout, 1977, 1978a). Information on the diet of wild *M. minutus* is sparse. However, in Russian populations cereal and grass seeds pre-

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dominate in the diet in autumn and winter, while the proportion of insect and green plant material increases in spring (Sleptsov, 1947).

Despite its flexible habitat selection and diet, *M. minutus* appears to be scarce in the urban environment. Jüdes (1981) reported that this species was less abundant on dry soils near a village in Germany than in adjacent rural areas. In England, isolated records of *M. minutus* exist from Lincoln (Johnson, 1977), Sheffield (Clinging, 1984), Milton Keynes (Dickinson, 1975) and from the outskirts of London (Cotton, 1981). The effects of urbanization on *M. minutus* are poorly known. This paper aims to 1) describe the distribution of *M. minutus* in habitat patches in the City of Oxford, and 2) provide a preliminary assessment of the diet of these urban populations.

2. MATERIAL AND METHODS

2.1. Study Area

Harvest mice were recorded during a general survey of mammals carried out mostly within the limits of the City of Oxford (population 120,000). Fieldwork was conducted in 50 patches of semi-natural and disturbed vegetation. The patches range in size from 0.16 ha to 20 ha, and are surrounded by roads, walls, watercourses or cleared areas which probably restrict the movements of *M. minutus*. The patches together occupy 75.3 ha, and represent 1.56% of the total city area. Patch vegetation was classified as woodland, scrub, orchard, long grass, parkland, churchyard, allotment and house garden.

2.2. Survey Methods

Systematic searches for the breeding nests of *M. minutus* were made in each habitat patch in late autumn and early winter in 1983. Most nests were detected in brambles, grass or reeds, 15 cm to 65 cm above the ground, but one was found among willow herbs, *Epilobium angustifolium* (L.), at a height of 1 m. Thirty to 80 hair sampling tubes (Suckling, 1978) were set opportunistically or on grids in all habitat patches between April and October 1983, and March and June 1984, and the hairs of *M. minutus* identified by scale casting and cross-sectioning techniques (Brunner & Coman, 1974). Thirty to 50 Longworth live traps were also set on grids in 29 habitat patches between June and August, 1983. Traps were prebaited for 24 h — 36 h with oats and fly pupae before being set, and then checked near dawn and dusk for three consecutive days. Captured *M. minutus* and other small mammals were uniquely toe-clipped, sexed, weighed and released.

2.3. Analysis of Diet

The diet of *M. minutus* was assessed by means of faecal analysis. Faecal pellets were collected from used traps or from within the breeding nests, and air dried for several days. Slides were then prepared using the method of Phillipson,

Sarrazin-Comans and Stomatopoulos (1983), and the volume of different dietary components estimated according to the procedure of Sparks and Malechek (1968). Faecal pellets collected from the breeding nests were probably produced by several individuals. However, since these could not be distinguished, I treated the mixture of pellets from each nest as individual samples.

Several authors have questioned the reliability of faecal analysis for assessing diet, due to the problem of differential digestibility of different food items (Hansson, 1970, 1971; Ferns, 1976: Phillipson *et al.*, 1983). To avoid undue bias, I therefore classify foods into broad dietary categories and make no attempt to identify food items to species.

3. RESULTS

3.1. Distribution of M. minutus in Habitat Patches

Micromys minutus was found in 10 of the 50 habitat patches surveyed. Mice were associated most strongly with scrubby habitats with a dense and relatively undisturbed cover of grass and herbs (Table 1). Single records of *M. minutus* were obtained from a large, overgrown garden

Table 1
Distribution of *Micromys minutus* in habitat patches in the City of Oxford

Habitat	Total No. of patches	No. patches with *M. minutus*	% occurrence
Woodland	12	1	8.3
Scrub	9	3	33.3
Orchard	2	2	100.0
Long grass	4	2	50.0
Parkland	5	0	0.0
Churchyard	3	1	33.3
Allotment	5	0	0.0
House garden	10	1	10.0

and a patch of woodland with a grassy understory; none was obtained from cultivated parkland or allotment. The ten patches ranged in area from 0.30 ha to 1.76 ha.

A total of 26 nests was found in nine patches, with 1—7 nests occurring in any one patch. The current presence of *M. minutus* was detected by hair sampling tubes in five of these patches and also in the tenth patch where no nests were found. Longworth traps captured only four individuals in two patches of scrub, despite a total trapping effort of 3858 trap nights.

Most breeding nests were constructed of grass species which were available locally within each patch. Nine nests were constructed using

Dactylis glomerata L., six using *Agropyron spp.*, five using *Phleum pratense* L., two using *Arrhenatherum elatius* (L.), one each using *Avenula pubescens* (Huds.) and *Phragmites australis;* the nest material used for the remaining two nests could not be identified.

3.2. Analysis of Diet

Faecal pellets were obtained from 18 breeding nests in orchard, long grass and scrub between September and January, and the dietary components are shown in Table 2. *Micromys minutus* is clearly omnivorous in each habitat. Seeds, fruit, green leaves and insects were consistently

Table 2

Percentage volume of foods found in the diet of *Micromys minutus* in three different habitats in the City of Oxford. Values are means ±standard deviation; *H* is the Kruskal-Wallis statistic.

No. of nests	Orchard 9	Long grass 4	Scrub 5	*H*	*P*
Fungus	9.7±9.2	3.3±4.7	2.6±2.8	3.28	n.s.
Moss	0.2±0.7	0	3.8±3.6	3.39	n.s.
Monocotyledon Leaf	12.4±8.4	20.8±14.5	6.8±6.9	4.51	n.s.
Dicotyledon Leaf	9.4±7.6	3.8±4.8	19.0±11.8	4.81	n.s.
Fruit	27.2±20.3	6.3±4.8	14.8±6.4	6.62	<0.05
Seed	20.2±13.3	45.0±19.6	30.0±12.8	4.20	n.s.
Root	0.2±0.7	1.0±2.0	4.2±5.9	1.13	n.s.
Insect	12.0±11.4	15.5±10.0	16.2±12.2	1.22	n.s.
Other invertebrate	3.8±4.8	0.3±0.5	0	5.08	n.s.
Vertebrate	0.3±1.0	0	0.2±0.5	0.23	n.s.
Other [1]	4.4±5.3	4.3±4.4	2.4±2.9	0.38	n.s.

[1] Includes fibrous material, plant hooks and hairs which could not be classified with other dietary categories.

well represented, whereas other invertebrates (mainly spiders and snails), fungus, moss, vertebrate and root material appeared less frequently. Consumption of fruit (apple and blackberry) was higher in orchard than in long grass or scrub; no other statistically significant difference between the habitats was detected. Most invertebrate remains were adult and larval beetles (families *Scarabaeidae, Chrysomelidae* and *Coccinellidae*), lepidopteran larvae (family *Noctuidae?)* and small homopteran bugs. Vertebrate remains were found in two nests only and comprised hairs of *M. minutus* and the vole *Microtus agrestis* (L.). Faecal pellets from the four live-trapped *M. minutus* contained similar categories of food to pellets collected from the nests. Mean values are:

of monocotyledon and dicotyledon leaves is highest in long grass and scrub, and again reflects the local abundance of these food categories. In Warszawa, the striped field mouse, *Apodemus agrarius* (Pallas), has exploited the urban environment more effectively than other species of small rodents (Andrzejewski *et al.*, 1978). This species also eats a wide variety of plant and animal prey, but the diet is less diverse in urban than in suburban parts of the city (Babińska-Werka, 1981). In the present study there was little indication of dietary restriction in urban *M. minutus;* however, comparative dietary information from non--urban areas in Britain has not been obtained.

Colonization of the study areas by *M. minutus* has possibly been facilitated in recent times by the system of rivers, rail and canal links which connect Oxford City to more rural surroundings. Potential source populations of *M. minutus* are known from Wytham Woods and areas of pasture on the edge of the city area (Oxford County Museum Records), and the city is now ringed by an extensive green belt (Scargill, 1980). Yet, the extent of use of such dispersal routes is unclear. Trout (1978b) estimated that the mean trap-revealed lifetime movement of animals was only 32.4 m, and recorded no movements greater than 100 m. It is clearly possible that some populations of *M. minutus* have persisted in suitable patches of habitat in Oxford throughout the period of city growth. Archaeological records show that species of small rodents have been present in other British cities for several centuries (Armitage, 1985). The continuous presence of *M. minutus* in urban centres may thus have been simply overlooked, as have populations of this species in many other parts of its range (Harris, 1979).

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fungus 1.5 ± 1.9%, monocotyledon leaf 23.0 ± 9.5%, dicotyledon leaf 15.0 ± ± 4.1%, fruit 23.8 ± 4.8%, seed 26.2 ± 8.5%, root 1.8 ± 2.1%, insect 7.8 ± ± 6.1%, and other invertebrates 1.0 ± 2.0%.

4. DISCUSSION

In 1939 *M. minutus* was thought to be absent in Oxfordshire (Elton, 1939), but by 1982 it was known from 15 different localities within the county and was reported to be "probably increasing" (Surch & Campbell, 1982). These conflicting assessments suggest that *M. minutus* has been under-recorded in Oxfordshire in recent years, as it has been in other parts of Britain (Harris, 1979). Searching for breeding nests is probably the most reliable method of detecting the presence of *M. minutus*, but placement of hair sampling tubes, especially above ground in shrubs and dense herbage, can provide important additional information (Dickman, 1986). Longworth live traps are probably not suitable for detecting *M. minutus* at least during the summer months, unless they are set on stakes at nest height in suitable cover (Warner & Batt, 1976). The present study, using the three survey methods, confirms that *M. minutus* is widely distributed in the City of Oxford in patches of habitat providing a relatively continuous and undisturbed cover of grasses and herbs.

The habitat preference of *M. minutus* in Oxford is similar to that exhibited by animals in more rural areas (*e.g.* Dillon & Browne, 1975; Trout, 1977; Harris, 1979). This suggests that *M. minutus* may persist in the urban environment provided that refuge areas of natural or semi-natural vegetation are left intact. In the short term, such refuges need not be very large: Dickinson (1975) and Johnson (1977) recorded *M. minutus* on narrow roadside verges in, respectively, Milton Keynes and Lincoln, while the smallest habitat patch containing animals in the present study was 0.3 ha. However, the longer term persistence of *M. minutus* in urban areas may depend on additional factors such as the number and dispersion of suitable habitat patches, their proximity to source areas, and the degree of disturbance to which the patches are subjected. Dickman & Doncaster (1986) suggest that small mammals generally do not perceive the urban environment, but they may be affected by it indirectly if urban processes modify the growth or structure of patch vegetation.

The omnivorous diet of *M. minutus* may be a factor allowing it to exploit the urban environment. For example, seed is the major dietary component in long grass and scrub, but fruit predominates in orchards due to the local abundance of apples and blackberries. Consumption

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UŻYTKOWANIE ŚRODOWISKA I DIETA BADYLARKI, *MICROMYS MINUTUS*, W WARUNKACH MIEJSKICH

Streszczenie

Badano występowanie badylarki, *Micromys minutus* (Pallas, 1771), na 50 różnych powierzchniach w mieście Oxford, używając tub kontrolnych, umieszczonych w krzewach i roślinności zielnej (określanie gatunku po pozostawionej sierści) i pułapek żywołownych, oraz szukając gniazd. Badylarkę stwierdzono na 10 powierzchniach (o wielkości od 0.30 do 1.76 ha). Były to najczęściej tereny gęsto porośnięte roślinnością (sady, zakrzaczenia i wysokie trawy), ale w pojedyńczych przypadkach wykryto obecność zwierząt w lesie, na terenie przykościelnym i w zarośniętym ogrodzie (Tabela 1). Analiza odchodów zbieranych w gniazdach i uzyskanych od złowionych osobników wykazała, że *M. minutus* jest zwierzęciem wszystkożernym. Nasiona, owoce, liście roślin jedno- i dwuliściennych oraz owady były najważniejszymi elementami diety. W małych ilościach zjadane były także inne bezkręgowce, grzyby, mech i korzonki (Tabela 2).