BREEDING THE LONG-TAILED POUCHED RAT, *BEAMYS HINDEI*, IN CAPTIVITY

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ABSTRACT.—Methods for rearing the long-tailed pouched rat, *Beamys hindei*, in captivity are presented. Antagonism that prevented establishing permanent monogamous pairs began while the rats were still juveniles. Females did not breed until they were at least 5 months old. Minimum gestation was 22 days and there was no postpartum oestrus. An average lactation lasted between 5 and 6 weeks. Growth and development of the young are described.

The long-tailed pouched rat (*Beamys hindei* Thomas, 1909) is a rare, burrowing, nocturnal, small rodent that occurs in gallery forests of east-central Africa. For many years the genus was known from a few specimens collected at several widely separated localities. Almost nothing was recorded about its natural history until Hanney and Morris (1962) conducted field studies in Nyasaland. Subsequently, *B. hindei* was discovered in Tanzania by Hubbard (1970), who bred long-tailed pouched rats in captivity for the first time.

Presented herein are the results of studies conducted from 1966 to 1969 while I was a Research Mammalogist at the University of Utah. Information useful for breeding the species as a laboratory animal is emphasized and supplements the data by Hubbard (1970). Six generations were bred in captivity.

MATERIALS AND METHODS

Source of Original Stock

Twelve adults of various ages sent by air from Tanzania arrived in Utah on 6 June 1966 in excellent condition and free of ectoparasites. Of these, only two pairs produced young. Most of the others were killed during pairing trials or failed to breed and were held for other studies.

Care and Management

Pairs and females with nursing young were housed in stainless steel pans 1 meter square and 25 centimeters high with woven mesh sides and solid metal lids. Each breeding cage had two wooden nest boxes (45 by 18 by 20 centimeters) placed back to back in the center of the floor. Weaned young, male breeders temporarily separated from females, and surplus adults were kept singly in metal mouse pans (60 by 45 by 25 centimeters) without nest boxes. Shavings for floor material and a generous amount of straw for nesting were supplied all animals.

Dry rations consisted of a weekly feeding of a mixture composed by volume of 60 per cent rolled barley, 20 per cent alfalfa leaves, 10 per cent pigeon feed (corn, milo, wheat, dried peas), and 10 per cent sunflower seeds. Supplements included dry dog food and commercial mouse pellets supplied in excess of needs to permit the rats to satisfy their instincts of food storage. *Beamys* relished many kinds of fresh fruit, particularly avocado; avocado seeds were gnawed long after they became dry and hard. A quartered orange per week per animal satisfied the requirement of fruit when other kinds were unavailable. Mealworms and

crickets were eaten with obvious enjoyment. Water was necessary in captivity even when succulent foods were given.

The colony was secluded in a semi-darkened, windowless room, which was frequently darkened completely during daytime. Temperatures there fluctuated less than 5 degrees and averaged 70°F.

Extreme vigilance was necessary during pairing trials, especially the first time a pair was introduced. Nonreceptive females often attacked males relentlessly, biting them about the hips, base of the tail, and scrotum. Males seldom retaliated or defended themselves and several were wounded fatally in less than 24 hours. Arrangement of the nest boxes seemingly reduced fighting between newly paired animals and helped insure the survival of some males but failed to discourage attacks by the more persistent nonreceptive females. Females in estrus evidenced an immediate interest in the males, and what might have been a stormy period of adjustment was without incident. I did not witness actual mating. Initial compatibility followed by several days of increasingly antagonistic behavior from the female usually indicated a successful mating and signaled the necessity for separation. Exceptions occurred where serious strife did not begin until a few days before parturition. I was able to leave one pair together continuously through two pregnancies. Three of 50 pairing attempts resulted in death of the females, one of which was a juvenile. Pairings made to determine the age of puberty also established the futility of pairing long-tailed pouched rats before they were old enough to breed. I also sought to discover the minimum interval between parturition and the next estrus. On two occasions captive-born adult pairs lived together peacefully for over a year, sharing the same nest box and food stores but did not breed. These same animals failed to produce young when paired with the proven breeders. I finally abandoned all attempts to establish permanent pairs as too risky and unproductive. A larger cage might permit this arrangement.

I encountered similar problems that were never satisfactorily resolved while attempting to establish a production colony of kangaroo rats (*Dipodomys* sp.) many years ago. Eisenberg (1963) experienced the same difficulties with various heteromyids.

Results and Discussion

Reproduction

Captive long-tailed pouched rats matured slowly. The youngest breeding female conceived her first litter when she was 5 months and 16 days of age, but most males and females did not begin breeding until they were 45 to 90 days older. The youngest known-age female to breed in Hubbard's experience was 7 months and 1 week old. He described a 2-hour nocturnal courtship and mating ritual that was conducted in a cleared circle prepared by the female.

Gestations of 22 and 23 days were recorded for seven litters. These were not based upon observed copulations but represented minimum intervals between dates of pairing and birth of full-term young. Hubbard (1970) thought prenatal development lasted about 30 days.

In nature, *Beamys major* is seasonally polyestrous during the wet and early dry season (Hanney and Morris, 1962), but my captive *B. hindei* produced young throughout the year. The maximum number of litters produced in 12 months was five. The most young born by a female in a year was 16.

There was no postpartum estrus. This was not unexpected because the average lactation of 5 to 6 weeks was about double the length of gestation. Apparently the next estrus cycle following parturition did not begin until lactation

FIG. 1.—Newborn *Beamys hindei* less than 8 hours of age.

had ceased or nearly so. This conclusion was based on many unsuccessful attempts to breed females immediately after parturition and at varying intervals before their young were weaned. The minimum interval between births of two consecutive litters where the first was reared to weaning age was 62 days. When a litter died at birth, females often bred again about 7 to 14 days later. For example, female no. 18 bore a litter on 1 August 1968 that died on 2 August. She was paired on 11 August and gave birth to her next litter on 4 September. A fully adult female received from Tanzania bore her last litter 2 years later when she was at least 3 years of age.

Litter size for *Beamys major* in Nyasaland was four to seven (Hanney and Morris, 1962). Young per litter based on 39 litters totaling 110 young reared during my study ranged from one to five (average 2.8), with a mode of three. Average litter size began to decline with the eighth or ninth litter, and most terminal litters contained one young.

About 50 per cent of the *Beamys* born in captivity failed to breed.

Growth and Development

At first glance, neonates appeared pink and naked, but close inspection revealed a covering of fine, short, pale gray hairs that became progressively sparser ventrally (Fig. 1). The feet, throat, tail, and inguinal region were naked. Their stage of development at this age approximated that of newborn desert woodrats (*Neotoma lepida*), a species with a gestation of about 30 days. Hubbard (1970) recorded newborn *Beamys* as pink and naked.

At birth the claws were well formed but soft, the ears folded, and eyes closed. The eyeballs were not apparent through the skin, although their location was marked by barely discernible eye slits. Mystacial vibrissae were present but easily overlooked. The forehead marking characteristic of older juveniles (Fig.

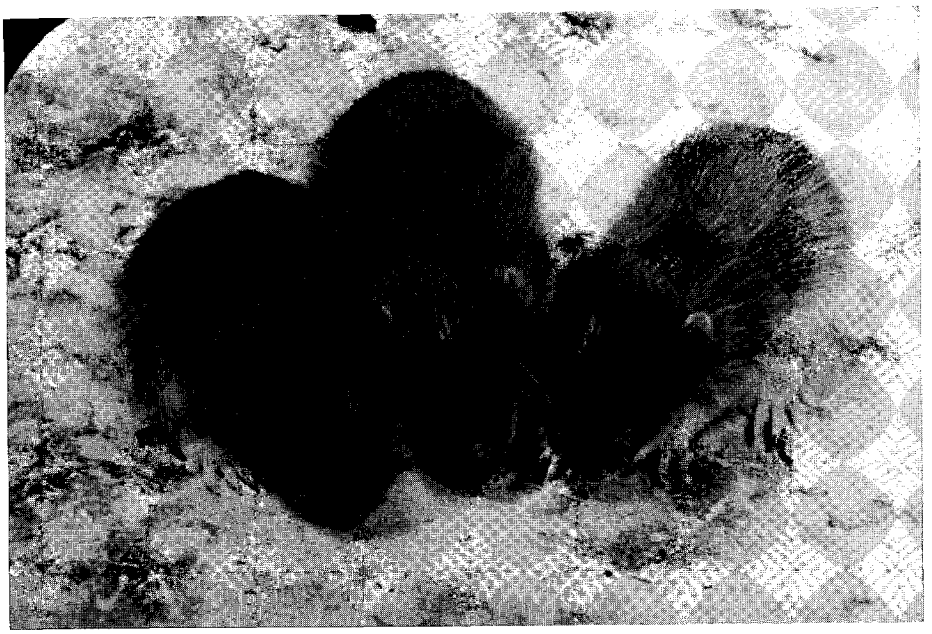

FIG. 2.—Juvenile *Beamys hindei* 15 days of age. Note head markings, which disappear before the adult pelage is acquired.

2) was present but indistinct. Young less than 8 hours old could carry their heads erect (Fig. 1) but were unable to make coordinated movements or elevate the ventrum from the substrate. Many made sucking sounds or faint shrill cries when handled. Weights of 13 newborn animals ranged from 2.1 to 4.3 grams (average 3.2). The heaviest of these came from a litter of one. Measurements of tails (base to tip) and hind feet (heel to end of longest toe, including nail) of four individuals ranged from 9 to 10 and 6 to 8 millimeters, respectively.

The ears unfolded by day 3, but auditory meatuses remained closed until about day 14. The tails of all young except four shriveled and dropped off before day 7, a condition resembling ringtail in laboratory rats and usually attributed to excessive heat-loss because of low relative humidities. Humidities maintained at 55 to 65 per cent prevented ringtail in *Rattus norvegicus* (Porter, 1967), but I did not have an opportunity to test the effectiveness of this preventative measure on *Beamys*. The relative humidity at the laboratory seldom exceeded 25 per cent—a much drier atmosphere than normally experienced by long-tailed pouched rats in the burrow systems described by Hanney and Morris (1962).

Growth was rapid and by day 7 the youngsters were fully furred dorsally (in terms of density), although fur on the underparts remained sparse. The longest vibrissae were about 6 millimeters. By day 9, both upper and lower incisors were erupted but unmodified for nipple grasping. Nipple clinging was seldom observed in long-tailed pouched rats and never to the degree common in

cricetids such as *Neotoma*, *Peromyscus*, and *Mystromys*. Nursing *Beamys* of all ages usually disengaged from the nipples before they were dragged past the edge of the nest regardless of how hurriedly the mother moved. Young 2 weeks old were well furred and able to crawl without difficulty. The longest vibrissae were about 11 millimeters. Their eyes were closed but this did not prevent them from venturing up to several inches from the nest; the incisors appeared fully erupted and young of this age ate small amounts of fresh fruit stored near the nest by the parent. The average weight of seven individuals was 19.0 grams.

The eyes opened in about 3 weeks, which agrees with Hubbard's (1970) findings. One litter 20 days old had two individuals with eyes closed and one with them open. All young 21 days or older had their eyes open and could walk and climb with assurance. Although nursing continued, the feces were black and hardened indicating some solid food was eaten. One youngster that was 21 days old had seeds in both pouches. The average weight at this time for six animals was 28.1 grams.

At one month postpartum, *Beamys* averaged 43.5 grams in weight and still suckled, although they now ate increasingly larger amounts of fruit and other solid food and made longer excursions outside the nest box. At 37 days of age the average weight of 10 rats of both sexes was 59.2 grams with a mean differential of about 5.5 grams in favor of males. Their average daily weight gain since birth was 1.5 grams per day. The head spot began to disappear, although traces of it were visible 2 to 4 weeks longer. Most young nursed from 5 to 6 weeks but the duration of lactation was difficult to establish accurately because juveniles continued to share their mother's nest after weaning.

Juveniles were blackish-gray with immaculate white underparts. At about 4 months of age they began acquiring the brownish adult pelage. A clearly defined molt pattern was not apparent. The seasonal variability in adult coloration described by Hanney and Morris (1962) did not occur in captivity; the color remained brown throughout the year, but did intensify with age. Rats 3 to 4 years old had the brownest coats.

Behavior

Beamys spent most of the daylight hours in their nests. All or most of what I recorded as diurnal activity, that is, leaving the nest to urinate, defecate, or briefly partake of food and water, probably took place underground in the wild. The burrows excavated by Hanney and Morris (1962) had latrine and storage chambers separate from the nests. Hubbard (1970) described the toilet habits of captive *Beamys* in detail.

Captive females with young usually investigated disturbances that awakened them and continued their vigilance at the nest box entrance until satisfied that their families were not threatened. Older females were the most aggressive.

In my judgement, long-tailed pouched rats see poorly. Their exploratory behavior in unfamiliar surroundings suggests more dependence on taction and smell than sight. Their small eyes and ears and soft, dense, mole-like pelage

suggest specialization for an underground existence. This, however, is combined with an unusually well developed climbing ability. An escaped adult nested in a box on a high shelf that could only be reached via a smooth, vertical, wooden brace. Hanney and Morris (1962) implied that certain food items stored by *Beamys* had to be obtained by climbing.

I discontinued the use of nesting cotton because the rats consistently removed it from their nest boxes as though its presence was objectionable. The older animals assembled material and fashioned simple, rounded cavities lined with the coarsest shavings available. Two individuals lined their nests with dried orange peelings, which may have represented an acceptable substitute for the leaves used in nature (Hanney and Morris, 1962).

Beamys were compulsive storers of food and usually began caching sunflower seeds, grains, and fruit as soon as they were fed. The process continued at least as long as favorite items were present and regardless of how much already had been hoarded. Hay leaves were not stored. Females with young seemed more motivated to cache food than other adults. The instinct seemed weakly developed in rats less than 4 months old, due perhaps to the lengthy postnatal maternal association. All food was stored in the nest box.

Litters kept intact after weaning shared a common nest and continued to live in apparent social stability for several weeks. In time quarrels over spacial arrangements and food stores began that soon resulted in deaths or serious injury if the rats were not separated. Even at this age females were dominant.

Additional Mortality Factors

Adults died from fighting and various infirmities associated with old age. Ordinarily, the latter would not occur because routine management practices eliminated animals before they became senile. Preweaning age losses averaged about 18 per cent and usually happened in the first 3 days. Some litters were destroyed and eaten; others were abandoned. I experienced no difficulty fostering the latter on other *Beamys*, but *Mus* and *Peromyscus maniculatus* refused to accept them. Long-tailed pouched rats were immune to the mite outbreaks that sometimes plagued other colonies and caused mortality in nestlings. No deaths from disease were diagnosed.

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