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NOTES ON EARLY POST-NATAL DEVELOPMENT OF THE NAMAQUA GERBIL *DESMODILLUS AURICULARIS*

by

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Abstract – Early post-natal development is discussed of five litters of *Desmodillus auricularis* born in captivity. Litter size ranged from one to three, with a mean of two. Nipple-clinging was absent and young developed slowly, with eyes opening on day 22 and weaning occurring on day 33.

Introduction

Most data on the development of Southern African rodents have been summarized by Meester and Hallett (1970) and Hallett and Meester (1971). Gerbils of the genera *Gerbillurus* and *Desmodillus* have proved difficult to breed in captivity (Hallett and Keogh, 1971; Stutterheim and Skinner, 1973) and consequently information on their development is limited. Although five litters of *Desmodillus auricularis* were born in captivity only two complete litters survived to maturity; this paper presents data on the development of one of these. It forms part of a more comprehensive study on the ecology and behaviour of rodents in the Kalahari Gemsbok National Park.

Material and Methods

Test animals were live-trapped in the Kalahari Gemsbok National Park during January and July 1972, using hardboard or Sherman aluminium traps, with a mixture of rolled oats, peanut butter, golden syrup and cooking oil as bait. After transportation to Pretoria they were housed individually in plastic cages, 43,2 cm x 27,9 cm x 22,9 cm, with wire lids. The floors were covered with 3–6 cm of fine, red Kalahari sand. Sunflower seeds, oats and millet were provided *ad lib.*; green foods were provided only occasionally. No water was initially supplied. From July onwards pairs were introduced to glass-walled terraria, dimensions 60 cm x 30 cm, accommodated in a room with a 16:8 hour light-dark cycle and with temperature kept at 25°C $\pm$ 5°C. In addition, two pairs were introduced into an outdoor enclosure with a total floor surface of 37,6 m². Four breeding boxes were equally distributed in this enclosure (Stutterheim and Skinner, 1973). Fertile matings occurred leading to the

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birth of five litters of altogether 10 young. Young were measured daily and their mass determined on a Mettler scale. Day of birth is given as day 0; subsequent days are numbered consecutively. The study terminated on day 45.

Results

Breeding

Although five litters were born, *Desmodillus* seem solitary in habits (Nel, unpublished data) and do not breed readily in captivity.

In one mating the male was killed by the female just after copulation. In other cases the male was not tolerated in the same cage by the female and was usually killed. It seems, therefore, that the male is only tolerated by the female for a brief period at the time of copulation, a condition common to some other gerbils as well (Lay, 1972).

To study the effect of space on the breeding and social behaviour of *Desmodillus*, four adults (two males and two females) were released in the outdoor enclosure. After two weeks both males had been killed and eaten by the females, although enough food had been provided. Three weeks later the one female was killed and eaten by the other. Mating was not observed in the outdoor enclosure and no litters were born.

In one family kept in the laboratory a male of a litter mated with his mother or sister and one young was born. The same male again mated with his mother or sister on a later date but was killed by her before birth of the second litter.

Morphological development

At birth the young were pink in colour, with a translucent skin through which the internal organs of the abdominal region were visible. The body was hairless except for a few vibrissae. Dorsally a very light grey tinge was visible. This tinge is caused by the start of hair proliferation (Hallett and Meester, 1971). The eyes were closed and the ear pinnae were folded down over the external auditory openings. The toes were fused. The sex of the newborn young could be distinguished by the size and position of the urinogenital papilla but some young were eaten by the mother before they could be sexed.

The average mass of five newborn young was 1,84 g. Mean total length at birth was 37,7 mm with a mean head-body length of 28,2 mm and a mean tail length of 9,5 mm. A mean hindfoot length of 6,4 mm was obtained.

Subsequent morphological development was as follows:

(i) *Mass increase*

Mass increase and percentage mass increase at 1-day intervals are shown in Figs. 1 and 2. Mass increased steadily from 1,84 g at birth to 29,02 g at day 45 when observations were discontinued. A slight decrease in mass increase was noted on day 21 (beginning of weaning)

and day 33 (end of weaning) (Fig. 2). During the first four days a much higher percentage mass increase was maintained than on subsequent days (Fig. 1). However, the data are not sufficient to show whether the body mass increase or the percentage mass decrease are statistically significant. Growth curves for total body length and hind-foot length (Figs. 2 and 3) are closely comparable to that of mass increase.

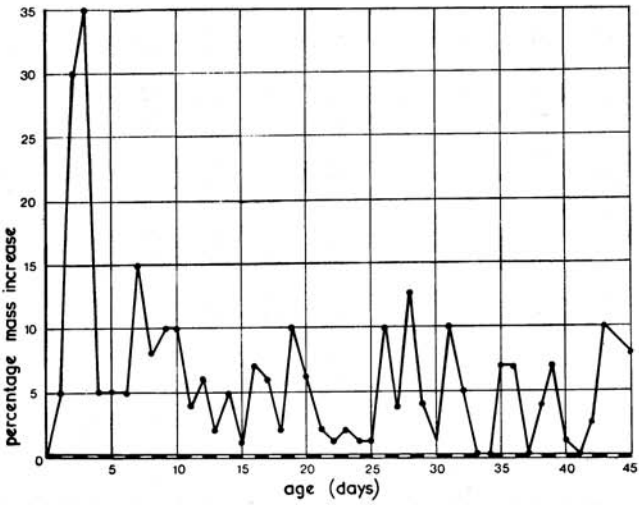

Fig. 1. Percentage mass increase of young *Desmodillus auricularis* from birth until 45 days of age.

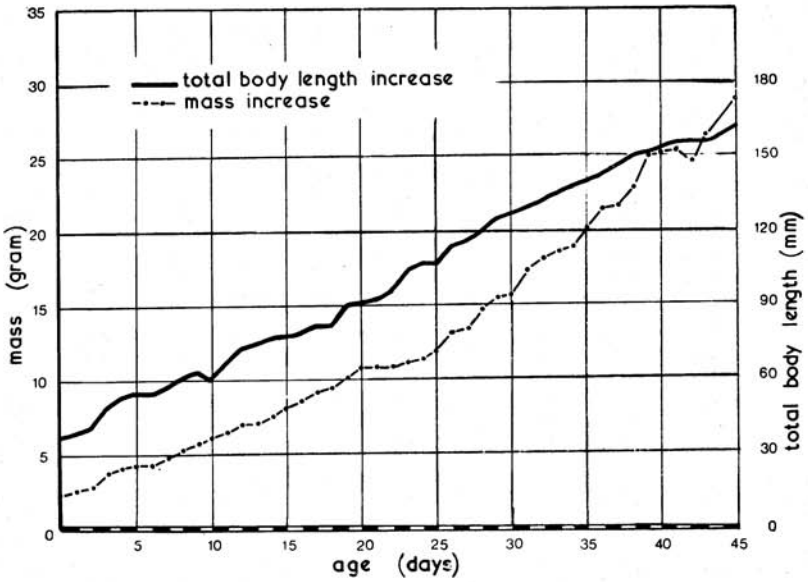

Fig. 2. Growth curves (increase in mass and body length) of young *Desmodillus auricularis* from birth until 45 days of age.

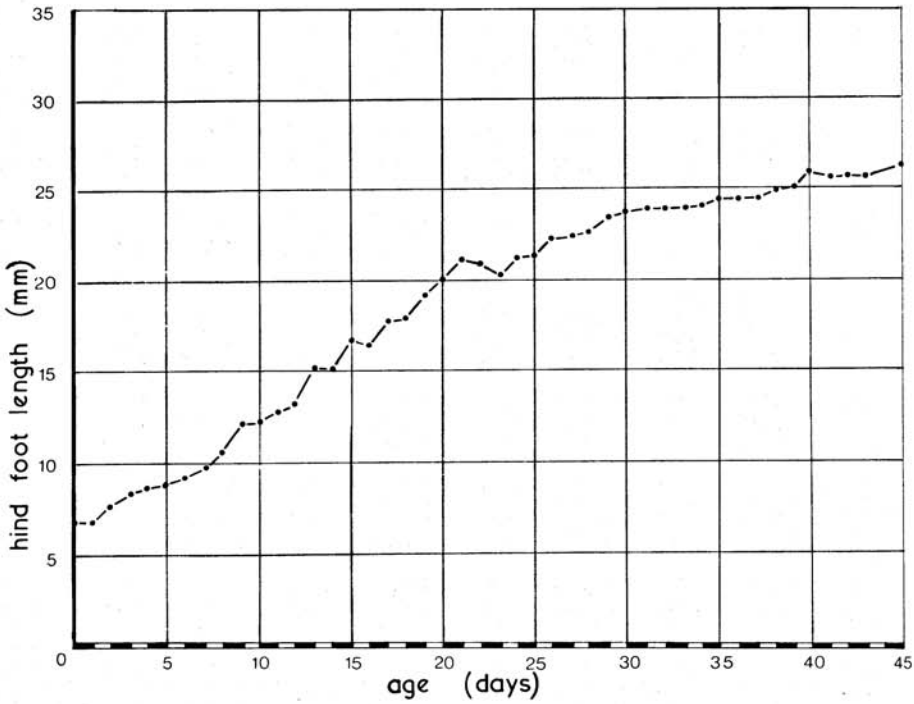

Fig. 3. Hindfoot length increase of young *Desmodillus auricularis* from birth until 45 days of age.

(ii) *Hair proliferation*

During the first few days of life the skin became less translucent and less bright pink in colour. The dorsal grey tinge was clearly visible and the vibrissae noticeably enlarged on day 4. A few hairs (1–3) were also noticed on the eyelids on day 4 although the eyes were still closed.

The dorsal grey tinge was much darker on day 5 and quite prominent on day 6. According to Meester (1960) this grey tinge is a consequence of the growth of contour hairs forming the juvenile pelage. Only on day 12 was the first pelage visible on the dorsal and lateral surfaces. A white spot of hair behind the pinnae (characteristic of adult *Desmodillus*) appeared on day 14, and also the white down on the ventral parts and the beginning of hair growth on the appendages.

At this stage no hair growth was observed on the pinnae.

On day 15 the ventral and tail hair were more prominent and a dark line of hair appeared on the borders of the pinnae. The colour of the young then closely resembled that of adult *Desmodillus*. The pads of the hindfeet and pinnae became hairy on day 19. The pelage was well developed on day 22 except for a naked patch around the genitalia.

(iii) *Ears*

The ear pinnae were folded over the external auditory openings at

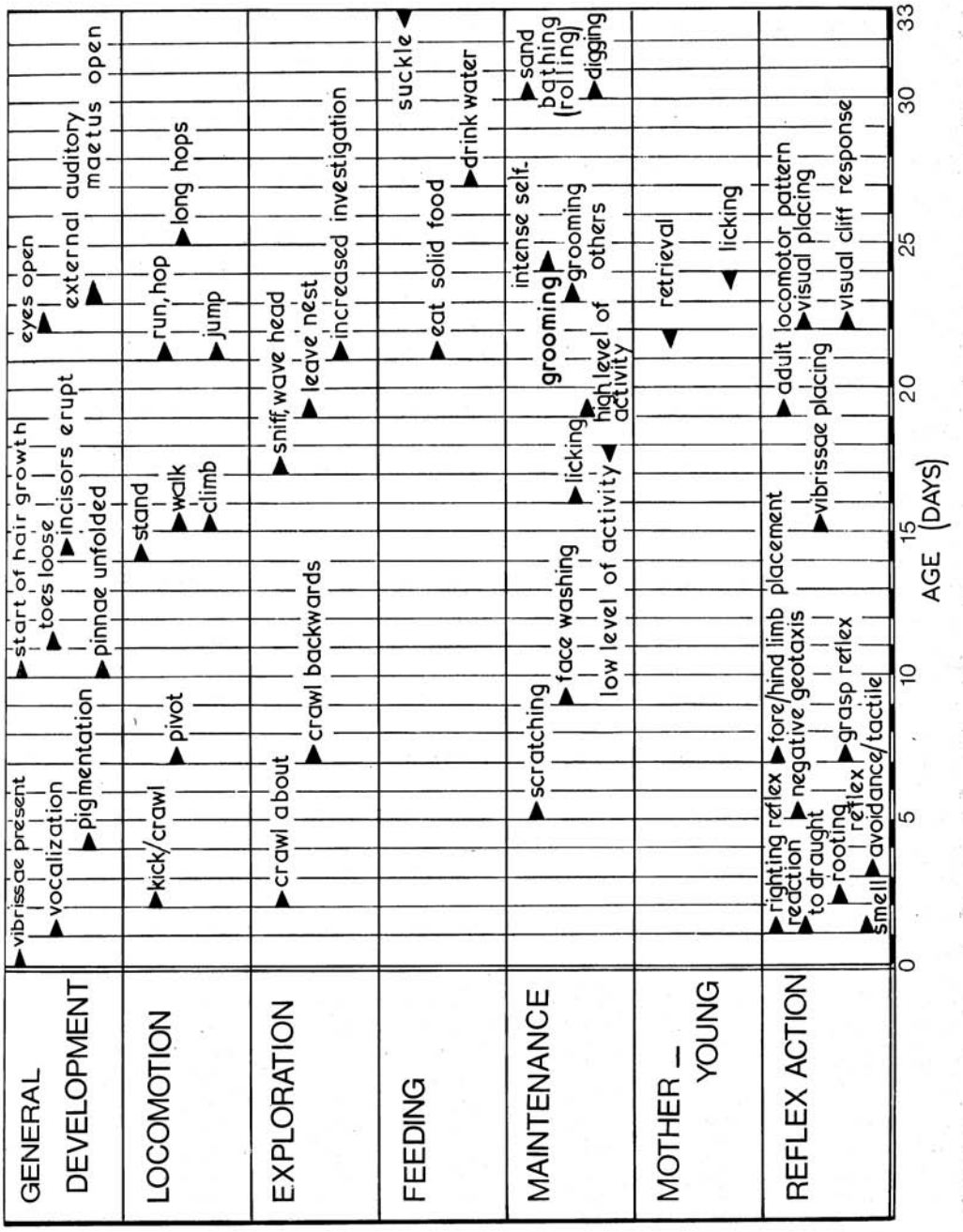

Fig. 4. General development and development of reflex responses and behaviour patterns in a litter of *Desmodillus auricularis* born in captivity.

birth. On days 4 and 5 the pinnae started to loosen but were only completely unfolded on day 12. The meatus did not open until day 23.

(iv) *Toes*
At birth the toes of all the feet were attached to each other. The toes started loosening on day 6. The differentiation of the toes of the front feet was completed on day 11, when the toes of the hind feet were still slightly attached.

(v) *Incisors*
The incisors were invisible at birth. In two young the lower incisors erupted on day 14 while the upper incisors erupted on day 15.

(vi) *Eyes*
The eyes appeared as dark slits on day 14. In the two young observed the eyes were completely opened on day 21 and 23.

Development of reflex responses and behaviour patterns

Data on the development of some aspects of behaviour are summarized in Fig. 4. As can be seen from this figure, mobility develops gradually. Although young can kick and crawl from day 2, motor co-ordination is poor, especially for the hindlimbs. Only on day 5 does the co-ordination between front and hindlimbs improve, and crawling becomes more vigorous. Walking starts on day 15, although movements of hindlimbs are still ungainly. This persists until day 17, followed by upright walking or standing. The transition to running is rapid, starting on day 19 and resorted to frequently by day 21. The tail was seen to be held stiffly and vibrated horizontally on day 19, but not thereafter. The significance of this is not clear, as adults have not been noticed to exhibit this behaviour pattern.

Grooming started early (day 5) with scratching by the hind foot of the trunk and the base of the forelimb, while the hindlimb on the other side makes simultaneous scratching movements. By the next day both front and rearlimbs were used in scratching, the ear now also being scratched. Movements leading to eventual face-washing slowly developed from this day (day 6) until the sequence was performed *in toto* by day 9, although perfect co-ordination of movements only appeared by day 16, when licking of the forefeet was first seen. On the following day (day 17) sitting on the hindlegs was resorted to during face-washing, although at times the animals would topple over. At this stage most grooming consisted of face-washing.

Sandbathing consisted, as in *Gerbillurus paeba paeba* (Stutterheim and Skinner, 1973) of a half roll each side onto the back. This was resorted to frequently from day 30, when digging was also first noticed.

Up to the eighteenth day general activity was of a low level; from day 19 the young became far more active, and faster-moving.

Desmodillus tamed easily and no aggressive or defensive behaviour was directed at the observer, apart from huddling when about to be taken out of the terrarium for measuring and determining mass. From day 15 onwards the young would readily climb onto an outstretched hand and up a bare arm, showing no fear of being handled, and without squeaking.

Desmodillus seem solitary in habits (Nel, unpublished data) and the young, apart from contact in the nest, showed little inclination to remain near each other when taken out. Independent movements were resorted to from an early age, and little synchronous behaviour of the littermates could be discerned. From day 25 play was evident; the young would follow each other, or chase one another, in the terrarium; this was also the first stage in the development of sexual behaviour (see Ewer, 1968) as during following, naso-anal contact was maintained and mounting occured although with incomplete orientation (piggy-back). On day 36 fighting or mock-fighting was first observed. This consisted of one animal chasing the other, biting the base of its tail, until the chased turned around and the two rolled over, pawing and possibly biting each other, although no wounds could be seen afterwards. This sequence continued into the nest, with the one lying underneath closing its eyes while being bitten. The young afterwards calmed down quickly and remained together without further signs of excitement. Throughout all this the mother, who remained in the nest, made no effort to separate her two young.

No sibling care, as mentioned by Meester (1960) for *Praomys* (*Mastomys*) *natalensis*, was ever noted. No hoarding was observed. However, as food was provided *ad lib.*, and usually scattered all over the floor of the cage, this behaviour pattern could not be distinguished; adult *Desmodillus* are known to larder hoard (Nel, 1967).

The development of reflex actions is summarized in Fig. 4. For definitions of various actions we follow Evans (1970). Reaction to light (on-off flicking of a 60 watt lightbulb 15 cm away) evoked no response until day 17, when a slight negative phototaxis became apparent. No auditory reflex could be elicited by means of tapping a pen against a glass jar. The sense of smell appears to be present at birth; in three litters the young responded to cigarette smoke on day 2.

Mother-young relations

The retrieval response of the mother was weakly developed, although it could be enhanced by stimulating the young to squeak. On day 1 the young were grasped behind the neck, on the back or the belly; from day 2 onwards they were invariably carried crosswise in the mother's mouth, being grasped on the centre of the back. After retrieval, or after the young were replaced in the nest subsequent to handling, they were washed, starting with the head and forelegs. Up to day 14 the mother, when leaving the nest, covered the young with nesting material. However, at no stage were they defended although the mother did shelter the young for the first few days, by huddling over them.

Although solid food was first taken by the young on day 21, suckling continued for another 12 days. From birth the young were loosely attached to the nipples, and nipple-clinging did not occur.

At times the mother would handle the young with her forefeet (even lifting them completely from the floor) when washing them.

Injuries and mortality

As mentioned above, of five litters born only two complete litters survived to maturity. The first litter consisted of three young. On day 6 the female ate the weakest one, although the disparity in mass between this one and the largest one was not great (2,8 g : 3,2 g). The other two young (a ♂ and ♀) developed to maturity. This group of three was kept together and produced one young about eight months later, although whether the original female or her daughter was the mother is not known. The male was taken out on day 3, but at some time during this day the young was eaten. Another young was born a month later, surviving to maturity; in this case the male was killed and consumed. A third litter, born to another female and without the male being present in the cage, consisted of one stillborn young, a second which died on day 1 (removed from the cage) and a third, consumed by the female on day 3. This female showed little interest in the young and was not seen to suckle or groom them; possibly lack of milk caused this abnormal pattern of parental care.

Leaving of the nest

In captivity this first occurred on day 19. However, during trapping in the Kalahari Gemsbok National Park from November 1970 until July 1972, of 64 individuals caught the smallest had a total length of 161 mm (corresponding to an age of 45 days) and a mass of 23 g (corresponding to an age of 30 days). One other individual was trapped with 161 mm total length, but with a mass of 30 g, thus corresponding in both respects with an age of 45 days. Four individuals of 32 g (172–188 mm total length), two of 33 g (182 and 189 mm) and one of 35 g (178 mm) were also taken. In nature an age of 45 + days thus seems to be the time when young first leave the nests (and burrows) to start roaming.

Discussion

The paucity of data does not allow any real comparison with the species studied by Meester and Hallett (1970) and Hallett and Meester (1971). However, it seems that in *Desmodillus*, as in some other gerbils (Lay, 1972), the male is only tolerated by the female for a brief period during mating and, therefore, plays no role in parental care of the young. The implied solitary nature of adult individuals is borne out by trapping results; during 3 470 trapnights 64 individuals were caught, but only six at stations where others were caught as well during the same trapping session.

Compared to *Tatera brantsii* (Meester and Hallett, 1970) nipple-clinging

is absent in *Desmodillus*, although *Tatera* also frequently resort to mouth-carrying. According to these authors late eruption of incisors but early weaning affects nipple-clinging. This is substantiated by *Desmodillus* where eruption occurs on day 14–15. The low litter size (mean 2,0) in the mouth-carrying *Desmodillus* may demonstrate the survival value of underground nests, as is also shown by comparing the burrowing *Tatera* (2,0 per litter) and the surface-dwelling *Rhabdomys pumilio* (7,0 per litter) (Meester and Hallett, 1970). In general, compared to *Tatera*, the development of locomotion in *Desmodillus* is much slower, and weaning occurs very late.

The low litter size coupled to mouth-carrying and very late weaning in *Desmodillus* does not agree with the findings of Hallett and Meester (1971) who found mouth carrying only in species with large litters, but, as stated above, protection offered by deep underground nests may be the reason for this discrepancy.

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