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On the biology of the Egyptian Mongoose, *Herpestes ichneumon*, in Israel

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Abstract

The biology of the Egyptian Mongoose was studied in Israel both in the field and in captivity. Daily and annual activity patterns are described, including social behaviour, reproductive biology, ontogenetic development and food habits.

Introduction

The Egyptian mongoose is one of the most common mammalian predators in Israel. It inhabits most of the country, except for desert habitats, but is more common in plains and valleys than in hilly areas. The mongoose prefers the vicinity of water or irrigated places and needs a certain amount of dense plant cover. As it is common near human settlements and has crepuscular habits it is relatively easy to observe, but in spite of these factors, surprisingly little is known so far about the biology of this species.

The present work is an attempt to study the biology and behaviour of the Egyptian mongoose in the field. Some complementary data were gathered from captive specimens reared in the Tel Aviv University Wildlife Research Centre (WRC) and from the Tel Aviv University Zoological Museum (ZM).

Methods and materials

Study area

Location: The study area is located in the fish pond area of Kibbutz Ma'agan Michael ($32^{\circ}32'N$ $34^{\circ}55'E$), in the northern Mediterranean coastal plain of Israel. It covers an area of about 3 km^2 , most of it artificial fish ponds, where the mongooses inhabit the levees between the ponds (Fig. 1). The study area is bordered by the Mediterranean Sea to the west, the Carmel Mountain to the east, the Taninim River to the south and extends to a fish pond area of another kibbutz to the north.

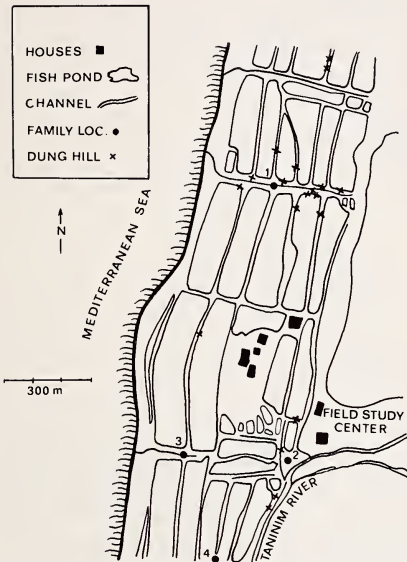


Fig. 1. Map of the study area. Circles – center of family home range. The numbers indicate the number of the family. X – permanent dung hills

Climate: The area has a characteristic East Mediterranean climate with mild, rainy winters and hot summers. There are 40–50 rainy days a year with an average annual rainfall of 600 mm. The average minimum of the coldest month and the average maximum temperatures of the hottest month are 11° and 27° , respectively. Relative humidity is high, ranging from 75–80 % (ROSENNAN 1970).

Vegetation: The vegetation in the study area is a mixture of two plant associations (ZOHARY 1959): One is typical for sandy soils near the seashore and characterised by bushes of *Artemisia monosperma*, *Tamarix tetragyna*, *Chrysanthemum coronaria* and *Inula viscosa*. The second association is typical of stream banks and is characterised by relatively large bushes of *Tamarix tetragyna* and *Rubus sanguineus*. The creation of artificial fish ponds made it possible for this second association of bank vegetation to spread into the fish ponds area.

Human influence: The study area is located near a kibbutz and a Field Study Centre of the Society for Conservation of Nature. Although human activity prevails on the roads between the ponds, there is little direct interference with the mongoose. Nevertheless, human activity influences the mongoose indirectly: food availability is high due to the occurrence of dead fish, dead chicks from a hatchery

and a garbage dump that supports a population of rats which are also consumed. On the other hand, dogs kill mongooses, particularly young ones, from time to time.

Field observations: The field work lasted from March 1978 until June 1980. Most investigations were conducted on 2 wild mongoose families inhabiting a small (900 m^2) area between the ponds and the Taninim River (Fig. 2). Both families became tame and behaved naturally at close proximity with the observer. One family (No. 1 in Fig. 1) was observed for a period of 4 months (March–July 1978) from a distance of 10 m by an observer sitting on the bank. The other family (No. 2 in Fig. 1) was observed from a jeep for the entire 2 year period. This family became tame within 3 weeks of daily food provisioning offered from the jeep. All individuals in these families were individually recognized by differences in their colour and shape of body, head and snout and by scars on their faces. Most observations on these families were conducted in the early morning from about sunrise until activity ceased 0.5–3 hours later. Altogether 195 observations were made that lasted 210 hours.

In addition to the above observations on individually recognized individuals, some data were gathered on all 4 mongoose families known in the study area. This was done by periodically walking between the ponds and noting mongoose numbers and activity. In order to determine food composition of the mongooses, dung hills were located and several hundred faeces were collected and examined in the laboratory.

Observations in captivity: Irregular observations of up to an hour each were made on a captive mongoose family in the WRC through July–August 1978 and January–March 1979. The family consisted of an adult pair and their male and two female offspring, born on 13th July, 1978. This family was kept in a $4 \times 2 \times 2\text{ m}$ wire cage which contained two wooden “dens” and several wooden logs. Food and water were provided ad lib. once daily. In addition two 20 day old mongoose cubs born at the WRC were separated from their mother in May 1978 and were hand-reared. They were first raised separately for a week by two persons, and then they were kept together in their keeper’s (RBY) home. They were free to move around the home and were regularly measured and observed.

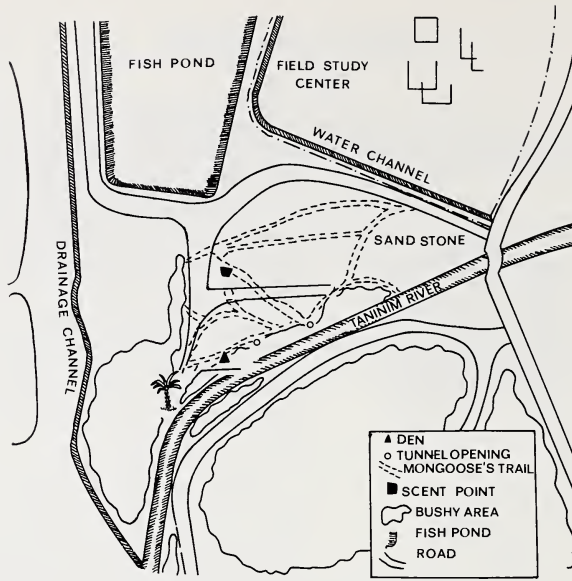


Fig. 2. Map of home range of Family 2

Marking: At the beginning of the study several methods of marking the mongooses were tried. Individuals were trapped in 15" × 15" × 42" Tomahawk live trap "208". Traps were baited with live chicks and captured mongooses were later anaesthetized with α -chloralose (250 mg inside a dead mouse or piece of meat). The following marking methods were tried:

- Freeze marking (Rood 1980): The hair which grew in the frozen spot was normal and not white.
- Neck collars: Since the mongoose neck is not smaller than the head in diameter, collars had to be tied to another collar behind the front legs. These body collars rubbed the underarms and caused skin wounds. Some were torn by the mongooses.
- Ear tags: Metal and plastic ear tags were difficult to attach because of the small size of the ear and were also torn off by the mongooses.
- Colour markings: Several paints were tried – hair dye, car spray paint, shoe-paint – all vanished within a few days due to intensive grooming. We also tried a colour marking gun (Ben Medows), but the marked mongooses removed the paint again by grooming. They also reacted by staying away from the observer's jeep after being sprayed. In summary, we failed to find a satisfactory marking method, and the only sure way of individual identification in this study was by observing individual physical differences.

Museum work: The furs and skulls of 37 mongooses from the ZM were studied and measured. All skull measurements were made with calipers to accuracy of 0.1 mm. Hair measurements were made to 1 mm accuracy. The following measurements were made in order to see if there are differences in skull measurements between males and females, and if there are seasonal differences in fur quality:

- Skull length – the maximal length of the skull between the occipital ridge and the upper incisors.
- Skull width – the maximal width of the skull between the zygomatic arches.
- Temporal fenestra width – the distance between the inner side of the right zygomatic arch and the brain case.

Masseter muscle depression – the volume of the depression between the right occipital and sagittal ridges was filled with plasticine, which was later removed and weighed to 1 mg accuracy.

Hair length – the maximal length of the hair on the body near the hind leg. Wool amount – estimation of the amount of wool in the body was made. There were 3 grades, ranging from 1 (almost no wool) to 3 (thick fur). Tooth eruption – this was studied using skulls of 9 specimens of known age, which were raised in the WRC.

Results and discussion

Morphology

Data on body and skull morphology of the Egyptian mongoose are given in tables 1 and 2. Males were significantly heavier ($p < 0.05$) and larger than females. Males did not have significantly longer or wider skulls. However, the size of the masseter muscles, as indicated by the width of the temporal fenestra or the volume of the occipital depression was significantly larger in males ($p < 0.01$ and 0.05 , respectively). Hence, the general impression in the field that males have wider heads is created by the development of this musculature.

Mongoose fur consists of brown-yellow woolly hairs and long black and white contour hairs, and this combination gives an impression that the fur is brown-grey. We did not find seasonal variation in the amount of wool and hair length (Table 3), in agreement with

Table 1
Body morphology of adult mongooses

	n	Body Weight g	Body and Head Length cm	Tail Length cm	Ear Length cm	Hind foot Length cm
Males	12	2953 \pm 458	53.5 \pm 2.4	39.7 \pm 7.0	2.7 \pm 0.8	10 \pm 0.5
Females	5	2640 \pm 521	49.0 \pm 5.9	42.5 \pm 2.6	2.3 \pm 0.2	9 \pm 0.4
P		0.05	0.05	N.S.	N.S.	N.S.
Mean \pm standard deviation						

Table 2
Skull measurements (in mm) of adult mongoose

	n	A Skull width	B Skull length	C Width of temporal fenestra	D Occipital depression volume ¹	E Skull width length
Males	18	50.97 \pm 1.53	991.6 \pm 0.38	15.31 \pm 0.10	1.60 \pm 0.44	0.508 \pm 0.16
Females	8	47.80 \pm 4.52	95.53 \pm 0.41	12.58 \pm 0.99	1.31 \pm 0.62	0.499 \pm 0.45
P		N.S.	N.S.	0.01	0.01 — 0.05	N.S.
¹ Given in g of plasticine needed to feel this depression (for details see text). Means \pm standard deviations.						

Table 3

The maximal length of the hair on the body near the hind leg (cm), and amount of wool on scale of 3 grades

Measurements of museum specimens in Tel Aviv University Museum

Month	n	Mean (\pm SD) Hair Length	Amount of Wool
Dec-Feb	6	5.7 (\pm 0.8)	2.7
Mar-May	4	6.4 (\pm 1.1)	2.4
June-Aug	3	6.1 (\pm 0)	2.2
Sep-Nov	9	4.8 (\pm 2.0)	1.9

HARRISON (1968), but there were marked individual variations in these 2 parameters, contrary to HARRISON (1968).

Senses

Mongoose employ their olfactory, auditory and visual senses in that order of importance. In order to locate distant objects they use smell and hearing and for near or static objects they use their sense of smell only. Vision is preferred to locate moving objects. When hearing far away voices, even very weak ones, they turn their snouts to that direction and sniff. They may walk towards the source of noise and when about 2 m from it they stop reacting to the voice and begin to make sweeping movements with the snout. When offered by the observer a dead smelly chick in one hand and a live, cheeping one in the other, the mongoose sniffed at both and took the dead one. Their sense of smell is quite fine and they can identify other specimens by slight differences in their individual odour (HEFETZ et al. 1982). However, it is not accurate in locating close objects. The same is true for hearing: mongooses hear even very weak noises, but cannot locate the source of the noise by hearing alone. Mongooses hardly notice a static prey but locate moving objects accurately. They seem to identify at least two colours, yellow and red. Evidence to support this comes from the following observations. 1) The plumage of chicks offered to the mongoose in order to attract them to an observer was yellow. On the 25th October 1979, a mongoose climbed the observer's jeep and caught the first yellow object it saw – which was a yellow tissue paper. 2) Another type of bait used were lumps of red and white minced meat. On 16th April 1980 such lumps were thrown from the observer's jeep to 2 mongooses. When one of the lumps was thrown, a mongoose ran to catch it, but instead of running to the place where the meat was, it ran to a patch of red and white *Sedum microcarpum* plant, 20 cm away from the place where the meat fell. Only after sniffing at the plant it turned and went to the meat. However, the above discrimination between colours might also be explainable by differences in brightness rather than colour.

General Biology

Family structure

The 4 mongoose families in the study area lived in permanent home ranges in families which consisted of 2–3 females with their young and adult male. At the beginning of this study Family 2 consisted of a male and 3 females. Three parturitions took place during the period of observations: 3 cubs were born in 1978 and 7 in 1979. The same male was observed in Family 2 territory during the whole observation period of 2.5 years, though mostly alone. Out of 18 observations he was seen 7 times when other members of the family were present. When together with the family, amicable gestures (mutual sniffing, ritual bitings and licking etc.) were observed. In addition to the families, there were indications that other mongooses were present which did not have permanent home ranges.

Daily activity

Mongoose are crepuscular and were not active under extreme climatic conditions such as strong wind and heavy rain, or when ambient temperatures rose above 27 °C or were below 11 °C. They spent most of their time in thickets or bushes, but also in open and half-open areas, which they used mainly on sunny hours after rains.

Permanent trails were created by walking preferably along certain routes rather than randomly all over the home range (those of Family 2 are shown in figure 2). If any individual happened to be off a trail because it chased prey or any other reason, it always returned by the shortest route to the nearest trail, even if it was not always the shortest route to its target.

The mongooses of Family 2 preferred to eat their prey in one of two permanent places located inside thick bushes. When food was caught elsewhere, it was carried to one of these two places to eat.

Scent marking

Mongooses used either scent points or dung hills to mark their home ranges. Scent points were located on big stones, corners of rocks etc., always on or near trails. Marking is done using the anal glands by lowering the hind part of the body so that the ano-urogenital region touches the ground. Sometimes the animal only touches the marked place, while on other occasions it drags its pelvis on the ground.

Each of the 2 intensively watched wild families had one known scent point (see Fig. 2 for scent point of Family 2), but members of the captive family marked in many places in their cage. Any of the wild or captive family members marked their scent points. In nature, no age or sex differences in marking activity were observed, but in the WRC, when in stress, the male used to mark more intensively than the female. Members of the wild families sniffed their scent points any time they passed near it. Hence, in 48 % of the observations done on Family 2 during 1979, one or more individuals were seen marking their scent point. When in stress, mongooses marked more frequently. For example, when we caught the captive females for collecting anal secretion, the male ran to and fro to his scent points and marked them in succession.

The dung hills were located in permanent places (Fig. 1), always in half open areas. As with scent points, dung hills were used by all family members. Some dung hills were used continuously for at least 2 years. In 2 cases where territories became vacant (due to death of the owners caused by dogs) and were re-occupied, the older dung hills were deserted and new, permanent dung hills appeared. In several cases all faeces were collected from dung hills for faecal examination. In each case new faeces appeared in the same spot within 1–2 days. Not all faeces found in the field were deposited on dung hills: single faeces were also found, randomly dispersed, and were probably deposited by solitary individuals which did not have permanent home ranges. It is reasonable to assume that all faeces are smeared with anal gland secretion when passing through the anus.

The above evidence suggests that mongooses, similarly to other mammals (Hyaenas, MAC DONALD 1978; KRUUK 1972; Jackals, MAC DONALD 1979), use dung hills as marking spots.

Reproductive biology

This description is based on observations of Family 2 and on the captive family. Mongooses live in polygynous families of one male with up to 3 females with their cubs. Mating took place in the early spring (end of February–end of March). Three matings were observed in the field (26th February 1978, 3rd and 23rd March 1979) and several in the WRC (15–16th February 1978 and 23rd–26th February 1979). Normally mongooses have only one litter annually. However, if they have lost their cubs they may mate again in the same year. This happened in May 1978 in the captive family after their 2 cubs were taken for hand-rearing when they were 20 days old. Second litters were observed also in nature when food was plentiful, e.g. during a population explosion of rodents (H. MENDELSSOHN, pers. comm.).

A typical mating sequence is described below:

The male spent much time walking after the female while sniffing her vulva, and prolonged allogrooming and licking took place. Mostly, allogrooming sequences of about 1½ minute were initiated by the female, but sometimes the initiation was by the male, and then the sequences lasted a few minutes. The male sniffed while walking, and both the male and the female emitted pip tones (the same tones as the cubs', though lower). Unlike females of the same species observed by DÜCKER (1960) the female in the WRC had no

unusually swollen or red vulva. Self-licking of this area took place during the whole year (in nature as well as in the WRC), though they were more frequent during the mating season.

Several short non-ejaculatory matings were made, each of which lasted 30–60 seconds. In these matings, the male mounted the female, clasped her strongly in the inguinal region with his anterior legs and bit it impeding bites. The female did not object, lowered her head and lifted her pelvis, while moving her tail aside. In some of the matings they both fell on their sides. After every short mating, the female escaped from the male. In between the matings, the male chased the female violently and even bit her aggressively. During mating and in the intromissions, both emitted the pip tones. In one of the observations (15. 2. 78) 10 such matings took place within 35 minutes.

Ejaculatory matings lasted longer than non-ejaculatory matings (6–7 minutes). In one observation several successive matings were recorded, each lasting 2–3.5 minutes.

Gestation and parturition

Gestation lasts about 60 days (H. MENDELSSOHN, pers. comm.) and litter size in the WRC was 3.3 (range 1–4, S.D. = ± 0.67 , $n = 10$). Parturition has not been observed in the field since females give birth inside thickets. The cubs first appeared outside the thicket at an estimated age of 6 weeks (by comparing their size to the cubs born in captivity). Parturition dates for Family 2 were extrapolated by subtracting the estimated age of the cubs from the dates that they were seen. In 1978 two of the females gave birth, one in mid-April (one cub) and the other one at the end of May (2 cubs). In 1979 two of the females gave birth to 2 cubs each, in mid-April and mid-May.

Ontogenetic development

Some stages of the development of the hand-reared cubs are described below: The newborn cubs had sealed eyes and ears. Later their eyes were “milky” coloured until their 21st day, when they turned shiny black and at this stage the cubs reacted to movements. At their 25th day the cubs reacted to voices. They appeared to sniff at close objects on their 39th day. On their 45th day the irises of the eyes turned grey and vision was noticeably better. At this age wild cubs were first seen outside the den. The cubs tried to stand and even to walk when 21 days old, but they fell after a few steps. Three days later they walked faster but their hind legs still stumbled sometimes. When they were 4 weeks old they walked unhesitatingly. Jumping was first observed when they were 37 days old. When about 2 months old, the cubs listened and sniffed while standing on their hind feet and at the age of 72 days the cubs showed complete hunting behaviour. At that age wild cubs were observed to follow adults closely while walking on trails. The cubs were often seen to imitate the accompanying adult. They imitated hunting and fear behaviour and also arbitrary movements, raised their heads when the adults did, withdrew when the adults withdrew, etc. Even the hand-reared cubs imitated their keepers sometimes, e.g. when one of us (R. B. Y.) was weeding in the garden, the cubs did the same with their mouths. This was the only time cubs were observed to perform this behaviour. They increased the distance from accompanying adults and imitated them less as they grew older, and when 3 months old they sometimes ran ahead of the adult. At 4 months old the cubs can tour the surroundings without an adult being around.

Figure 3 shows that there was no difference in the morphological development of the male and female hand-reared cubs during the first 3 months (at that age they were both killed by dogs). They gained weight and grew in length, reaching a body weight of about 800 g (a third of the adult weight) and body and head length of about 42 cm at this age.

Although at the age of 4 months the cubs are capable of hunting by themselves, they do

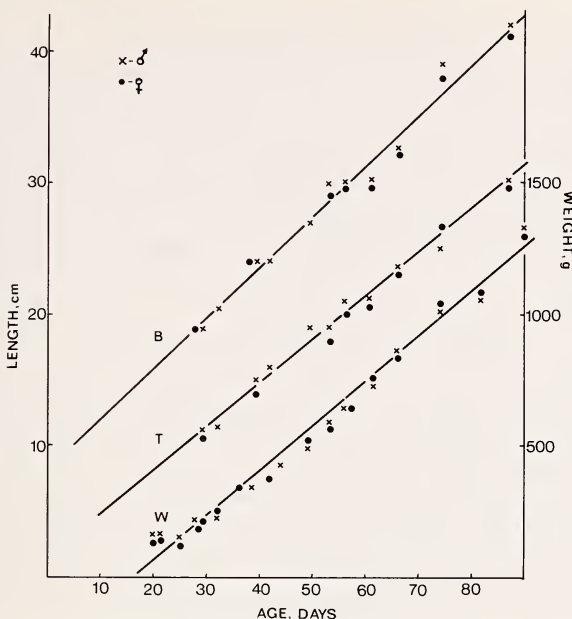


Fig. 3. Growth rates of hand-reared male and female Egyptian mongooses. B: body and head length (cm); T: tail length (cm); W: body; A: age (days) weight (g). $B \text{ cm} = 0.386 \times A + 8.138$; $r = 0.9886$; $n = 19$; $T \text{ cm} = 0.327 \times A + 1.666$; $r = 0.993$; $n = 19$; $W \text{ g} = 16.67 \times A - 263.73$; $r = 0.9923$; $n = 32$

not leave their mothers and stay with the family until they are 1 year old, or even more. Young dwarf mongooses stay with their family at least three years, and help their parents to take care of the following litters (RASA 1977; ROOD 1978). Young slender mongooses (*Herpestes sanguineus*) leave their mother when they are two months old, and become independent.

Tooth development was studied using skulls of specimens of known age. At the age of 2.5 months the young had all their teeth except for molars (i.e. they had 32 instead of the full number of 40 teeth). Three months later, they had all teeth. The first premolars were replaced at 9 months of age. Lack of study material prevented us from giving more details.

Parental care

Suckling

Female mongoose nurse while lying on their side. Nursing while sitting (as with *Suricata* – EWER 1963) was not observed. Mothers' milk is the cubs' only food until they are 1 month old. Both hand-reared cubs and the cubs that were raised in the WRC began eating solid food when 32 days old (although solid food was offered to the hand-reared cubs several days before that age). The cubs continue to suckle until they are 2 months old. The hand-reared cubs stopped being interested in the artificial nipple at the age of 64 days. One 4 month old cub from Family 2 was seen trying to suckle, but the female did not permit him.

A cub can suckle from any mother in the family. In one observation a cub was seen suckling sequentially from two females of its family, and they both permitted him to do so (the two females had cubs at that time).

Carrying cubs and baby-sitting

Like other carnivores, mongooses carry their cubs by holding them gently between their teeth. The captive female in the WRC was seen doing so several times. Carrying was seen only once in the field, when a cub of about 2 months old was carried into a thicket.

In the field the cubs are always accompanied by at least one adult. The adult is not always the cubs' mother. It may be another nulliparous female, another female, a father, or even a yearling. However, it may be significant that one female which was not a mother was never observed with the cubs. Changing "shifts" was observed many times. In some cases a cub appeared with one adult, and joined another and only then the first one left. In other cases an adult was sitting among the playing cubs, till another adult arrived. After a few minutes of overlap, the first one would leave the area. Many times, more than one adult (mostly females) were with the cubs. The cubs were seen grooming, mounting and playing with all the females, with no preference for any. Observations of the adult male and the yearling "baby-sitting" with the cubs were recorded too. Baby-sitting such as this was recorded in the dwarf mongoose, *Helogale undulata* (RASA 1977; ROOD 1978; ZANNIER 1965) and the banded mongoose, *Mungos mungo* (ROOD 1975).

Although the adult male was seen with its young, it was never seen playing with them (the yearling male used to play with the cubs). This is contrary to EWER's (1963) observations that male *Suricata* frequently played with cubs. The cubs were first seen alone at the age of 4 months.

Guarding the cubs

Between the ages of 4 months and 1 year, the cubs spent more and more time alone. However, the females are never far from the young, and ran to help the cub if it seemed to be in trouble.

The male also defends the young. In one of the rare observations in which the male was "baby sitting", the observer in the jeep made a quick movement and the cubs ran away quickly with bristled hairs towards the resting male. The male jumped to its feet and ran quickly towards the jeep. Defending the young is a major role of the male *Suricata*, while the female deals with nursing, grooming and cleaning (EWER 1963).

Feeding the cubs

When the cubs began to eat solid food, their mother (or another female) brought food in her mouth to them. Even though the cubs began "exploration trips" with adults after the age of 6 weeks, they are left in a nearby bush while the adults hunt alone, and the prey was brought to them there. Again, the adults delivered food to any offspring that belonged to the same family.

Though the cubs were capable of hunting by themselves from the age of 4 months (the hand-reared cubs did so from the age of 2.5 months), the adults continued to give food to the young till they were 1 year old, and sometimes even afterwards. There was one observation in which an adult female gave up her food to a year and a half old male and even guarded him so that he could eat without being disturbed. Until the cubs were approximately 3.5 months old, the adult gave up their food without resisting. From that age on, it appears that the adults are unwilling to give up food. Every time one of the females caught something she ran away from the cubs. However, if they did not notice her, she waited till they saw the prey in her mouth and only then she started running. If the cubs lost contact with her, she waited till they found her again, and then continued running. When one of the cubs caught up with her, she dropped the booty with no objection, and stayed near the cub till it had finished eating. Most times the cub took the prey to the nearest bush and ate it there, and the female stood or lay down near the place to

guard the cub. EWER (1963) described similar behaviour in the *Suricata* and interpreted it as competition for food. In our opinion, this phenomenon may be compared to nestling feeding in birds. The one which rises higher and flaps its wings more vigorously, gets the food the parents bring. This ensures that when there is a shortage of food, the strongest will survive. In penguins, grown-up chicks are frequently forced to run after their parent in order to get food. Similarly, in mongoose, the cub that runs fastest would get the prey and this may be a way for the cubs to develop dexterity.

One of the adult females from Family No. 2 did not always behave according to this pattern and was observed several times running away with her booty without the cubs seeing it, in 1978 as well as in 1979.

Attachment of the young to their family

The young stay with their family until the next litter is born a year or even more later. A female yearling of Family 2 stopped appearing in the area when the 1979 cubs appeared, while the yearling male did show up, but much less frequently than before, and only for short visits. During these visits he spent most of the time with the newborn cubs.

The reason for the disappearance of the young may be male aggression: In 1978 a 6 months old cub was seen being chased by the male of Family 2 and was not seen again. In the captive family, when the breeding season approached, the male persistently chased and bit his yearling son but not his two yearling daughters. The yearling male had to be separated from the family, even though the adult female did not give birth in that year.

Food and foraging behaviour

The remains of the following food items were found in faeces: Invertebrates – Ticks (Ixodidae), Molluscs – Broken shells of various snails (*Helicella* spp., *Theba* spp.), a freshwater crab (*Potamon pomatios*), Crustacea: Decapoda; and various insects: beetles from the families Carabidae, Tenebrionidae and Scarabaeidae; ants (*Camponotus* spp.), flies (Syrphidae), bugs (Pentatomidae), crickets (Gryllidae) and cockroaches (Polyphagidae). Vertebrates – scales of fishes; Scales of various reptiles – lizards, skinks, and bones of an embryo of a terrapin (*Mauremys caspica*); bones of anuran amphibians (*Rana ridibunda*, *Bufo viridis* and *Hyla arborea*); claws and feathers of various birds, but mainly of domestic chicks; bones and teeth of various rodents rats – (*Rattus rattus*), voles – (*Microtus guentheri*) and others. Most remains were of domestic chicks, littered in garbage dumps in the study area and rats.

Although no quantitative study on food was made, the above list demonstrates the diversity of the mongooses' diet and habitats where they catch their food. Digging for insects or reptile eggs is done with the front legs and snout alternately. Insects are caught either incidentally or after active search. Mongooses were observed many times sniffing at the stems of annual plants and performing now and then sharp catching movements to pick up flower beetles from flowers, or collecting ants and other insects from the ground. Most fish were probably eaten after they died and were either washed ashore from the fish ponds or remained there after ponds were drained by the fishbreeders. Mongooses were, however, observed to fish in the drainage canals between the ponds.

Hunting was observed many times. Typically a mongoose was seen to either lay tense on the ground or stand frozen for a few seconds and then to run fast and catch the prey. Adults caught relatively large prey items by neck biting, and small items by head biting. The prey was killed instantly and eaten from its head. Young mongooses caught prey wherever they grabbed it, and sometimes while running to the bush, corrected their hold.

Mongoose in the study area scavenged in the local garbage dump, fed on dead chicks, human food remains and hunting rats. Finally, mongooses are well known as predators of

snakes, including venomous ones, such as *Vipera palaestinae*, and influence the population size of these snakes (MENDELSSOHN et al. 1971).

Interaction with other animals

Today mongoose have no predators in Israel apart from dogs. Some mongoose are killed by cars, but this poses no serious threat to the population.

In the study area, mongoose interacted with various wild animals. They were observed three times to approach a nutria (*Myocastor coypus*) den, but were attacked and retreated with bristled hairs. They react similarly when mobbed by spur-winged plovers (*Vanellus spinosus*), or hooded crows (*Corvus corone*). On the other hand they do not hesitate to approach feral cats, and young of the two species were observed playing together.

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Zusammenfassung

Über die Biologie des Ichneumons, Herpestes ichneumon, in Israel

Die Biologie des Ichneumons (*Herpestes ichneumon*) in Israel wurde an freilebenden und gefangenen Individuen untersucht.

Diese vor allem dämmerungsaktiven Tiere leben in Familien, die aus einem erwachsenen Männchen und 2 bis 3 Weibchen mit ihren Jungen bestehen. Der größte Teil der Aktivität spielt sich in dichtem Pflanzenwuchs ab, weniger in offenem oder halboffenem Gelände. In ihrem Revier haben sie Wechsel, Markierungsstellen, die mit dem Sekret der Analdrüsen markiert werden, und Kothaufen. Die Markierungsstellen und die Kothaufen werden von allen Familienmitgliedern benutzt.

Die Paarungen finden zu Beginn des Frühlings statt. Normalerweise werfen Ichneumons einmal im Jahr, aber Zweitwürfe kommen vor, wenn die Jungen des ersten Wurfs verloren gingen. Das Paarungsverhalten wird beschrieben. Die Trächtigkeit dauert ungefähr 60 Tage, und die durchschnittliche Anzahl der Jungen ist 3,3 (S.D. + 0,67, n = 10). Die Entwicklung der Jungen wird eingehend beschrieben. Alle Familienmitglieder beteiligen sich an der Aufzucht der Jungen, die bei allen Muttertieren saugen können.

Ichneumons fressen Vertreter verschiedener Tiergruppen: Säuger, Reptilien, Vögel, Fische, Insekten und andere Arthropoden und Mollusken.

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Seasonal and local differences in the weight of European badgers (*Meles meles* L.) in relation to food supply

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Abstract

Studied were the weights of badgers *Meles meles* in the wild and in captivity. All animals were lighter in summer than in winter, despite the fact that captive badgers had food ad libitum. Captive badgers were heavier than wild ones, badgers from southern England were heavier than those from Scotland, and badgers from eastern Scotland heavier than those from the west. It is argued that the seasonal weight fluctuations occur independently of food supply, but differences between regions may be caused by food availability.

Introduction

The weights of wild European badgers (*Meles meles* L.) fluctuate more or less predictably with the seasons; here we describe an experiment which shows that this annual variation is independent of the availability of the badgers' natural foods.

In studies of mammalian ecology, the weight of animals is often used as an indicator of "condition", and linked to their chances of survival (review in HANKS 1981). Body weight is in many species closely related to nutritive status and food supply (KLEIN 1970; HANKS 1981). An increase in body weight in autumn and corresponding decrease in winter and spring, is known for several carnivores, e.g. bears (FOLK et al. 1972) and raccoon (MECH et al. 1968).

In the badger annual weight fluctuations have been noted by several authors (e.g. SOUTHERN 1977; NEAL 1977). In Britain the species feeds mostly on earthworms (SOUTHERN 1977; KRUUK 1978; KRUUK and PARISH 1981), which are more difficult to obtain during the dry summer months (KRUUK 1978), and this paper describes a test of the possibility that the badgers' low summer weight is caused by a shortage of food at that time of year. The opportunity to investigate this arose when we could, over a period of six years, weigh badgers which were kept in a large enclosure with a natural vegetation, and under natural climatic conditions, but with a controlled supply of food. If annual weight fluctuations of wild badgers were caused by variation in food availability, we would expect

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