

Differences in group member response to intruding conspecifics and frightening or potentially dangerous stimuli in Dwarf Mongooses (*Helogale undulata rufula*)¹

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Introduction

The Dwarf Mongoose (*Helogale undulata rufula*) is the smallest of the viverrids and inhabits the savannah areas of East Africa. It lives in family groups of approximately twelve individuals, these being matriarchies headed by the alpha female and her consort, the alpha male. Only the alpha pair breeds and offspring are ranked with respect to age and sex, young animals being rank high to older ones and females rank high to males (RASA 1972). This rank order is based on dominance/submission relationships and the order in which animals approach to feed or to mark objects and reflects "privilege".

General observation indicated that group members responded differentially to the presence of conspecific intruders and to frightening and potentially "dangerous" situations. In order to determine which group members played a significant role in the two contexts, a naturally developed, captive colony of twelve individuals was investigated.

Materials and methods

The colony was housed in a wire mesh cage 4.5 × 3 m in size, furnished with eight nestboxes as retreats for the animals. Each individual of the group was identified by a pattern cut into the fur of the back. In experiments to determine colony responses to conspecifics, a strange mongoose was placed in a cage 40 × 20 cm in size directly inside one of the side walls of the colony cage so that it was clearly visible to all colony members. The "intruder" was caged to prevent it being severely damaged by the colony members which viciously attack group strangers and may even kill them. Six different test animals were used in rotation to prevent rapid individual recognition of the "intruder" from influencing the results. Colony members usually dashed at the caged animal, spat and growled at it aggressively and attempted to bite it through the cage walls.

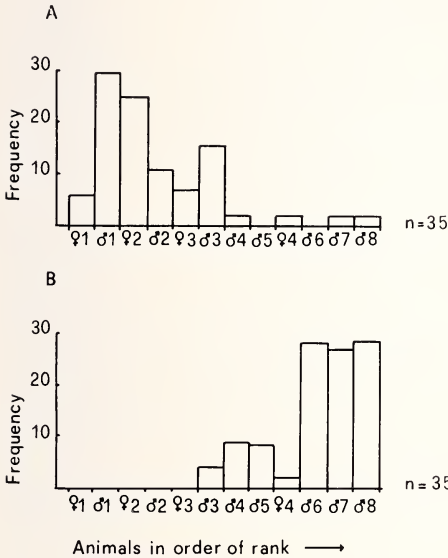
In experiments to determine colony response to frightening stimuli, an electric buzzer was installed in one of the nestboxes not regularly frequented by the group but adjacent to a preferred sleeping box. This could be activated by a switch on the observer's desk overlooking the cage. The buzzer was sounded when all group members were asleep in one of the nearby nestboxes so that all animals were stimulated approximately equally. All animals responded to the buzzer sound with immediate precipitous flight.

To prevent learning effects, both experiments were performed at irregular intervals of about a week with at least 3 days separating those of the two experimental series. A total of 35 experiments were conducted in each series and the first three individuals approaching the strange conspecific or the nestbox containing the buzzer recorded. An animal was considered as having "approached" when it was separated from the conspecific or nestbox by less than 15 cm.

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Results

The frequency with which different group members approached and attacked the caged conspecific and entered the nestbox containing the buzzer first, second or third are shown in the figure (A and B) respectively. No differentiation was made in the order in which the first three animals approached, each receiving one point when it approached amongst the first three.



The differences in approach frequencies for group members. A. with respect to intruding conspecifics and B. frightening stimuli. The first three animals to approach in each case were recorded on 35 separate occasions. The figures show the total approach frequencies for animals in order of rank

The data show that there is a clear differentiation in individuals approaching first in the two experimental situations. In the first case, a significant tendency for high ranking individuals to approach first could be shown (Spearman's Rank Corr. Test, $p < 0.01$), in the second, it was the low ranking subordinate males which showed the greatest tendency to investigate (Spearman's Rank Corr. Test, $p < 0.01$).

The low level of first approaches for the alpha female was due to this animal's habit of stopping about 1 m from the intruder and vocalising aggressively, at the same time looking over her shoulder towards her mate, ♂ 1, and then fixating the intruder once more, this sequence being repeated several times. The behaviour pattern is reminiscent of "hetzen" observed in mallard ducks (LORENZ 1941). She was never observed to approach the intruder ahead of her mate and usually remained at a distance until he started the attack.

Discussion

The findings indicate that, within a mongoose family group, differences exist in the responses of individuals towards intruders and frightening stimuli. Conspecific intruders are first attacked by high ranking group members, both male and female, while frightening stimuli are first investigated by low ranking males.

The latter finding is unlikely to be dependent on differences in activity level between high ranking and low ranking animals since, with respect to two independent measures of general activity, food hunting (scratching through litter) and running

(moving at least 2 m at a rapid trot or gallop), these animals had significantly lower scores than high ranking animals (Spearman's Rank Corr. Test, $p < 0.01$ in both cases, RASA, in prep.).

In baboons (WASHBURN and DEVORE 1961), low ranking males are also found to encounter potentially "dangerous" objects or frightening situations first. This, however, is suggested to be due to the fact that they maintain a peripheral position with respect to other troop members. They are therefore more likely to encounter such situations by chance than other group members. In *Helogale*, however, subordinate males do not maintain a peripheral position but are fully integrated in the group. Further evidence of their encounter with a frightening stimulus not being due to chance is afforded by the behaviour of the group after the buzzer is sounded. All animals flee immediately and huddle in a corner of the cage as far away from the stimulus source as possible. The subordinate adult males then detach themselves from the group and approach the nestbox concerned apparently "purposefully". This observation indicates that "chance encounter" can be eliminated as a determinant of their behaviour.

Another possible explanation for their being the first to approach is that they have higher exploratory tendencies (curiosity levels) than high ranking individuals. To eliminate this as a factor, five non-frightening but unknown objects (ball, small cardboard box, book, large shell, jar) were introduced into the cage separately on three occasions each and the first three animals to approach recorded. The results obtained paralleled those for intruding conspecifics, high ranking animals approaching first (Spearman's Rank Corr. Test, $p < 0.01$). This finding indicates that high exploratory tendencies cannot be responsible for the apparently goal-directed behaviour observed in low ranking males towards frightening stimuli.

The response of subordinate males to frightening stimuli shows parallels with behavioural differences observed in other contexts. For example, presentation of potentially dangerous prey (e. g. large snakes) results in it being attacked by the same group of animals. Although alpha animals and juveniles may approach first, they rapidly retreat to some distance away after short investigation and the killing of the prey is left to low ranking males. Once the prey is killed, the high ranking animals then take it from them. When, however, the prey is not capable of inflicting severe damage (e. g. mice, lizards etc.) the high ranking animals are the ones which perform the kill (RASA 1973). These low ranking males are also the most active as group 'guards', sitting at some elevated point above the group and giving warning vocalisations should predators appear. They guard more frequently and for longer periods of time than any other group members (RASA in prep.). It appears, therefore, that in potentially dangerous situations, this group of animals play a primary role.

In high ranking individuals, the high level of attack directed towards group strangers is paralleled in a high level of intra-group aggression, their frequency of attack towards subordinates being significantly greater than that for low ranking animals (RASA in prep.). High rank may therefore be associated with a high level of intraspecific aggressivity in general.

The data suggest that, within a Dwarf mongoose family group, a division of labour may be present with respect to group defence against intruders and the execution of potentially dangerous tasks such as the investigation of frightening situations, the killing of dangerous prey etc. Such an arrangement would be of adaptive significance to the species in that it hinders the exposure of 'biologically valuable' animals to potentially lethal or damaging situations. 'Biologically valuable' animals can be considered as the alpha pair (group leaders and the only individuals to breed), females (future potential group leaders and breeding stock) and juveniles

(dependent on older group members for survival and 'developing potential' for the group).

It is, however, precisely these animals which are first to attack intruders. This situation can be rarely, if ever, considered to be associated with risk, however, since the result is fairly clear-cut at the outset, a territorial group having a distinct advantage over a single intruder. This advantage is reflected in the fact that the animals attacking intruders are, with the exception of the alpha pair, all comparatively physically weak, non-breeding females being appreciably smaller than males.

The low ranking adult males are the largest group members, with the exception of the alpha pair, and thus physically better equipped to deal with potentially dangerous situations than their siblings. As has been shown, they are also the group members which actively engage in such encounters or place themselves in a position where they are more likely to be exposed to danger. A probable reason for the alpha pair, despite their physical attributes, not joining in such activities is a prevention of their loss to the group should the situation turn out to be lethal. This would have severe disruptive effects on the group as a whole (RASA, in prep.), the same having been shown for monkey troops (TOKUDA and JENSEN 1968). Compared with the 'biologically valuable' animals previously listed, low ranking males can, however, be considered as 'expendable' to some extent, their loss to the group having less disruptive repercussions.

In the Dwarf Mongoose, therefore, behavioural mechanisms may have been selected for by which survival of 'biologically valuable' animals is promoted without sacrificing group protection in general. Whether or not the behaviour of the low ranking males can be considered as 'altruistic' is, however, debatable since their predilection for situations in which death or damage to the individual can result is probably more socially determined than voluntary.

Summary

Within a Dwarf Mongoose family group, defence against conspecific intruders is carried out by high ranking individuals, investigation of frightening or potentially dangerous stimuli by low ranking males. The latter's behaviour is not due to higher activity levels, chance encounter of the situation or high exploratory tendencies. The possible biological significance of the findings for the species is discussed.

Zusammenfassung

Aufgabenverteilung in einer Gruppe von Zwergmangos (Helogale undulata rufula) bei der Reaktion auf das Eindringen fremder Artgenossen sowie auf 'furchterregende' oder potentiell 'gefährliche' Reize

Innerhalb einer Familiengruppe von Zwergmangusten übernehmen hochrangige Tiere die Verteidigung gegen fremde Artgenossen, niederrangige Männchen jedoch die Erkundung bedrohlicher oder potentiell gefährlicher Reizsituationen. Das Verhalten der letzteren hängt nicht von einem höheren Aktivitätsniveau, zufälliger Begegnung mit den Reizen oder einer hohen Erkundungsbereitschaft ab. Die mögliche biologische Bedeutung dieser Befunde für die Arterhaltung wird diskutiert.

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"Teat order" in Hyrax (*Procavia johnstoni* and *Heterohyrax brucei*)

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Teat constancy is known in pigs (NACHTSHEIM 1925; DONALD 1937; HÖPLER 1943; BURGHARDT 1957; MCBRIDE 1963), cats (EWER 1960; ROSENBLATT 1972) and rats (BONATH 1972), all altricial mammals. Hyraxes are precocial, bearing fully developed young after a gestation period of approximately 7½ month (ROCHE 1962; MENDELSSOHN 1965; SALE 1965 a, b). The Rock hyrax *P. johnstoni* and the Bush hyrax *H. brucei* were observed in the Serengeti National Park, Tanzania, for 30 month. Most animals were marked. Hyraxes are the most characteristic resident mammals of the rock outcrops (kopjes), living in family groups consisting of an adult ♂, several adult ♀♀ and juveniles of both sexes. ♀♀ within a group have synchronized birth (1—4 young observed) and are genetically related (HOECK, in prep.).



Fig. 1. two infants (about 3 months old) of *P. johnstoni* suckling from the pectoral teats. The fur in front of the dam's hind legs is disordered where the infants suck from the inguinal teats

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