

ISSN 0073-8417

PUBLIKATIONEN ZU WISSENSCHAFTLICHEN FILMEN

SEKTION

BIOLOGIE

SERIE 11 · NUMMER 30 · 1978

FILM E 2474

**Heterohyrax brucei (Procaviidae)
Mating Behaviour (Open Air Shots)**



INSTITUT FÜR DEN WISSENSCHAFTLICHEN FILM · GÖTTINGEN

Film Data:

Silent, 16 mm, colour, 105 m, 9¹/₂ min (24 f/s). Produced in 1975/76, published in 1978.

The film is a research document and has been issued for use in research and higher education.

From Max-Planck-Institut für Verhaltensphysiologie, Seewiesen und Erling-Andechs, Dr. H.N. HOECK, Bogotá (Columbia). The film was shot in the Tanzania National Park during a field investigation. Supported by Serengeti Research Institute.

Form of Citation:

HOECK, H.N.: *Heterohyrax brucei* (Procaviidae) – Mating Behaviour (Open Air Shots). Film E 2474 of the IWF, Göttingen 1978. Publication by H.N. HOECK, Publ. Wiss. Film., Sekt. Biol., Ser. 11, Nr. 30/E 2474 (1978), 10 S.

Address of the Author of Publication:

Dr. H.N. HOECK, Estacion Biologica Charles Darwin, Santa Cruz-Galapagos, Casilla 58. 39, Guayaquil-Ecuador.

PUBLIKATIONEN ZU WISSENSCHAFTLICHEN FILMEN

Sektion BIOLOGIE

Sektion TECHNISCHE WISSENSCHAFTEN

Sektion MEDIZIN

NATURWISSENSCHAFTEN

Sektion ETHNOLOGIE

Sektion GESCHICHTE · PUBLIZISTIK

Herausgeber: H.-K. GALLE · Schriftleitung: E. BETZ, I. SIMON

PUBLIKATIONEN ZU WISSENSCHAFTLICHEN FILMEN sind die schriftlichen Ergänzungen zu den Filmen des Instituts für den Wissenschaftlichen Film und der Encyclopaedia Cinematographica. Sie enthalten jeweils eine Einführung in das im Film behandelte Thema und die Begleitumstände des Films sowie eine genaue Beschreibung des Filminhalts. Film und Publikation zusammen stellen die wissenschaftliche Veröffentlichung dar.

PUBLIKATIONEN ZU WISSENSCHAFTLICHEN FILMEN werden in deutscher, englischer oder französischer Sprache herausgegeben. Sie erscheinen als Einzelhefte, die in den fachlichen Sektionen zu Serien von etwa 500 Seiten zusammengefaßt und im Abonnement bezogen werden können. Jede Serie besteht aus 4 Lieferungen mit einer entsprechenden Zahl von Einzelheften; jährlich erscheinen 1–4 Lieferungen in jeder Sektion.

Bestellungen und Anfragen an: Institut für den Wissenschaftlichen Film
Nonnenstieg 72 · D-3400 Göttingen
Tel. (05 51) 2 10 34

HENDRIK N. HOECK, Seewiesen:

Film E 2474

Heterohyrax brucei (Procaviidae) – Mating Behaviour (Open Air Shots)

Author of the Publication: HENDRIK N. HOECK

With 4 Figures

Summary of the Film:

Heterohyrax brucei (Procaviidae) – Mating Behaviour (Open Air Shots). In the mating season ♂♂ regularly seek for ♀♀ in oestrus, testing by sniffing at the vaginas.

A ♀ in oestrus is constantly followed by one ♂ (usually a terr. ♂). Once mounted, a ♂ makes a series of 4–5 thrusts every 20 seconds, accompanied by weaving head movements; the penis is pressed against the vagina, but not introduced. The ♀'s back is hunched. After 3–5 min. the penis is fully introduced with a sudden jerk, whereupon the ♀ bites and chases the ♂.

Inhalt des Films:

Heterohyrax brucei (Procaviidae) – Paarungsverhalten (Freilandaufnahmen). In der Paarungszeit suchen ♂♂ regelmäßig brünftige ♀♀; sie vergewissern sich dieses Zustandes, indem sie an der Vagina schnuppern.

Ein brünftiges ♀ wird ständig von einem ♂ verfolgt (für gewöhnlich ein terr. ♂). Nach dem Besteigen macht das ♂ alle 20 Sekunden 4 bis 5 Stöße, die von einer Pendelbewegung des Kopfes begleitet werden; der Penis wird gegen die Vagina gedrückt, aber nicht eingeführt. Der Rücken des ♀ ist gekrümmt. Nach 3–5 Minuten wird der Penis mit einem plötzlichen Ruck ganz eingeführt. Daraufhin beißt das ♀ das ♂ und jagt es davon.

Résumé du Film:

Heterohyrax brucei (Procaviidae) – Comportement lors de l'accouplement (prises de vues en plein air). A la saison de l'accouplement, les mâles recherchent régulièrement des femelles en rut, touchant et flairant leurs vagins.

Une femelle en rut est poursuivie constamment par un mâle (généralement un mâle terr.). Avant de monter sur la femelle, le mâle effectue une série de 4 à 5 poussées toutes les 20 secondes, accompagnées de balancements de la tête; le pénis est pressé contre le vagin, mais pas introduit. Le dos de la femelle est arrondi. Au bout de 3 à 5 minutes, le pénis est introduit entièrement, avec une secousse soudaine, après quoi la femelle mord et chasse le mâle.

General Preliminary Remarks

The hyrax (Order Hyracoidea) belong, together with the elephants (Order Proboscidea) and the seacows (Order Sirenia), to the Super-Order of the Paenungulata or “nearly ungulates” (GRZIMEK [3], SIMPSON [13]).

Today three hyrax genera, all strictly herbivorous, are extant in Africa and Asia Minor; the nocturnal Tree hyrax *Dendrohyrax*, inhabiting trees, and the diurnal Bush hyrax *Heterohyrax* and Rock hyrax *Procavia*, both living mainly among rocks.

There are three species of Bush hyrax, *H.antinae*, *H.brucei* and *H.chapini*. *H.brucei*, with 23 subspecies, occurs mainly in the eastern part of the African continent (BOTHMA [1], HAHN [4]).

In the Serengeti National Park the Bush Hyrax *Heterohyrax brucei* inhabits the granite outcrops known as kopjes, often sympatrically with the Rock hyrax *P.johnstoni* (HOECK [5]). When occurring sympatrically, the two species share the same living burrows, bask together and have similar feeding periods. They also have an identical social structure, and some behaviour patterns and vocalizations are similar. They differ however in feeding behaviour, in the territorial call of adult ♂♂, and in their mating behaviour (HOECK [6]).

H.brucei live in family groups (harems) consisting of a sexually mature territorial ♂, several sexually mature and genetically related ♀♀ and their young of both sexes. Copulation can rarely be observed in the field, as the animals are constantly in motion and usually mate behind rocks or bushes, so that it is difficult accurately to determine how long any ♀ is in oestrus and how many times she mates. So far, observations suggest that ♀♀ are in oestrus once or twice yearly for up to three days, perhaps repeatedly during 4 weeks. The oestrus of all ♀♀ in a family group is synchronized. In the Serengeti there are two mating seasons, one in April-May, the second and more general one in August-October (HOECK [6]). Gestation lasts about 7½ months (MENDELSSOHN [7], MILLAR [9], ROCHE [11], SALE [12]); litters of up to three young were observed.

The ♂'s testicles, located inside the abdomen as with the elephant, swell and can weigh up to approx. 20 times as much as before the rutting season (GLOVER and SALE [2], MILLAR and GLOVER [8], NEAVES [10]). Both ♂♂ and ♀♀ reach sexual maturity at about 16 months of age (MILLAR [9]). Young ♀♀ usually remain with the family group, and can live for ten years or more. But ♂♂ leave the group on attaining puberty, and try to establish themselves at the periphery of an adjacent territory. Eventually these peripheral ♂♂ may take over a territory and a group of ♀♀.

Several peripheral ♂♂ may be found on the borders of a territory, depending on its area, topography and vegetation cover. A rank order exists between them. Some weeks before the rutting season there is an increase in the frequency of the territorial call, which is mostly performed by the territorial ♂♂, which also mark the rocks by urinating a few drops at a time (Fig. 1).

In the mating season ♂♂ approach the ♀♀ regularly to smell the vagina. In this oestrus-testing the ♂ approaches slowly in a cringing attitude but with abrupt movements, as if insecure and ready to flee (Fig. 2). The hairs surrounding the



Fig. 1. Urine markings of adult ♂♂ can often be seen on the rocks a few weeks before the start of the mating season



Fig.2. An adult ♂ approaches an adult ♀ in the typical cringing posture, and with erected dorsal hairs

dorsal gland are fully erected, a sign of excitement in the hyrax, and he emits shrill calls almost inaudible to humans (ultrasound?).

The ♀ also erects her dorsal hairs, and either allows the ♂ to approach, or grumbles at him or even chases and bites him as he retreats. But if he is accepted the ♂ presses against the ♀'s side, with his head to her rump, and both circle several

times. The ♂ smells the vagina. If the ♀ is not in heat he leaves again, if she is he follows her, and mounts with erected penis. During mounting the ♀ may not stand, so that the ♂ has to repeat the process, following her, sniffing at the vagina, calling and mounting again. This may happen several times, the ♀ sometimes even becomes aggressive, grumbling and erecting the dorsal hairs or even biting the ♂.

Finally the ♂ grasps the ♀'s sides firmly with his forelegs, the ♀ hunches her back, stretching the hind legs. The ♂ makes several thrusting movements, while wagging the head from side to side, sometimes opening the mouth slightly and drawing back the lips, probably calling. The penis is not introduced, but pressed against the vagina (Fig.3). The dorsal hairs of both animals are now flattened again. The

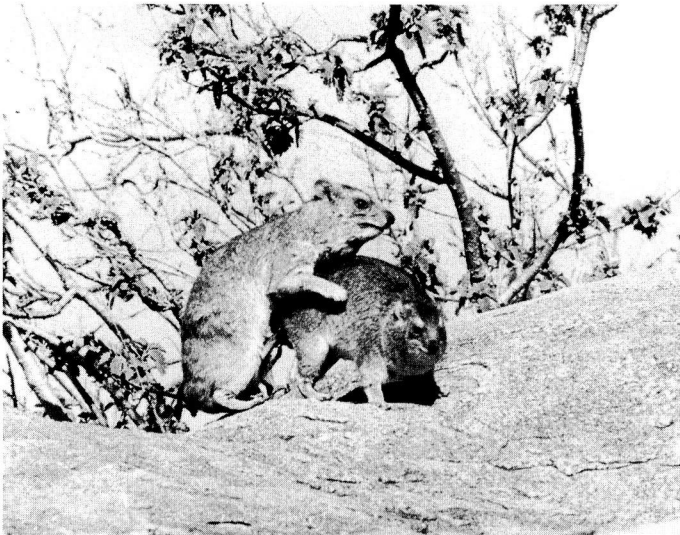


Fig.3. While mating the ♀ hunches her back, the ♂ presses his penis against the vagina, his lips are slightly drawn back, probably calling

position being maintained, the penis slackens for about 20 secs, when several renewed thrusts are made with fully erected penis but still without introduction. This process is repeated from 3–5 min. The penis is finally introduced with a sudden jerk, in which the ♂ lifts his hind legs from the ground. The ♀ jumps forward suddenly, turns and bites and chases the ♂, which springs away. But after a few minutes he returns, and follows the ♀ as long as she is in oestrus. Another copulation may follow in 1–3 hours.

The frequency of agonistic interactions between sexually mature ♂♂ increases in the rutting season. Peripheral (per.) ♂♂ try to mate with a ♀ in oestrus. The territorial (terr.) ♂♂ chase away any per. ♂♂ they encounter in their territories. Per. ♂♂ may provoke a terr. ♂ by approaching too near when he is following a

♀ in heat. The terr. ♂ will chase them away again and again, sometimes becoming so exhausted that he can only defend an area immediately around the ♀.

The terr. ♂ or a high-ranking per. ♂ will immediately interrupt any discovered copulation of the lower ranks. Terr. ♂♂ were never observed to mate with first-oestrus ♀♀; these usually mated with per. ♂♂.

Besides the differences in the mating behaviour of *P.johnstoni* (HOECK [16]) and *H.brucei*, there is a very distinct difference in penis anatomy (Fig.4). The penis

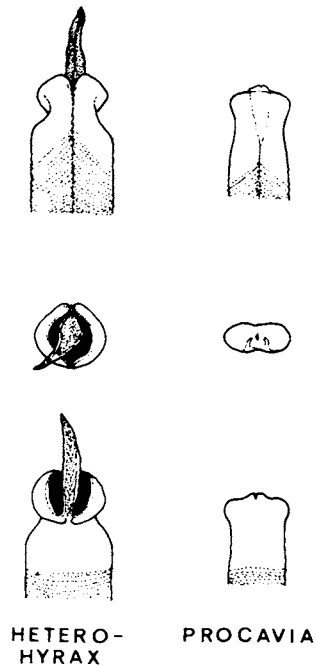


Fig.4. Diagram illustrating external penis anatomy of *H.brucei* and *P.johnstoni*. Top line: ventral view, middle line: view from above the supine animal, bottom line: dorsal view

of *H.brucei* is complex, and measures over 6 cm when fully erected, while *P.johnstoni* has a simply-built penis measuring approx. 2–3 cm when erected (HOECK [6]).

The differences in mating behaviour and penis anatomy (the female reproductive tract has not been examined) are very effective mechanisms permitting close coexistence without interbreeding.

Complementary to this film see Films E 2176 (HOECK [14]), E 2177 (HOECK [15]), E 2178 (HOECK [16]) on Grooming, Feeding and Mating Behaviour of the Rock hyrax and E 2266 (HOECK [17]) on Feeding Behaviour, E 2473 (HOECK [18]) on Play Behaviour of the Bush hyrax.

Acknowledgements

I would like to thank the Tanzania National Park Trustees, the Serengeti Research Institute, the Max-Planck-Institut für Verhaltensphysiologie, Seewiesen, Prof.

W. WICKLER and Prof. J. JACOBS for making the study possible, and especially my wife PIA, who assisted generally and helped locate and track these very evasive creatures.

Description of Film

Testing of non-oestrous ♀♀

1. A peripheral ♂ (per. ♂) approaches a ♀ from the side and sniffs at her vagina. He moves away, turns back, calls twice and erects the dorsal hairs. The ♀ approaches him, also displaying the dorsal hairs. They remain side by side, the ♂ pushing against the ♀ and sniffing at the vagina. The ♂ departs.
2. A per. ♂ approaches an invisible ♀ with abrupt movements, calling and displaying the dorsal hairs.
3. A territorial ♂ (terr. ♂) (rump to camera) and a ♀ face each other, both displaying the dorsal hairs. As the ♀ slowly approaches the ♂ retreats backwards. The ♀ turns her rump towards the ♂, he averts briefly, she sniffs at his anus. They sit rump to rump.
4. Dorsal hairs erect, a per. ♂ approaches a ♀. He pushes against her, sniffing at the vagina, the ♀ springs away. The sequence is repeated.

Oestrous ♀♀ and mating

- 5–7. A terr. ♂ with erected dorsal hairs approaches a ♀ in oestrus. Nose-greeting follows, and the ♀ scratches herself (displacement scratching).
A per. ♂ nears the pair, the terr. ♂ stares at him and makes champing motions, dorsal hairs erect (threat display). Suddenly he leaps and chases the intruder, then returns to the reclining ♀, sniffing her and briefly licking her head.
8. A terr. ♂ encounters a ♀, both displaying dorsal hairs and pushing against each other. The ♀ turns away, the ♂ calls (mouth open, lips drawn back), then follows her, sniffs at her vagina and mounts. The ♂'s dorsal hairs are erected, the ♀'s subside. She walks away, he follows and twice attempts to mount.
9. A terr. ♂ mounts with penis fully erected but no dorsal hair display. He makes 4 or 5 thrusting movements, moving the head synchronously from side to side. The penis is not introduced.
10. Front view of a copulation between a young per. ♂ and a young ♀, clearly showing the synchrony between the thrust and the head movements.
11. Several mounting attempts of a terr. ♂. The ♀ walks away and threatens him, grumbling and displaying the dorsal hairs.
12. Copulation of a young per. ♂ and a young ♀. He grips her sides with his forelegs, the ♀'s back is hunched. He makes several thrusting movements, pressing his fully erected penis against her vagina, but not introducing it. The penis slackens for some 20 sec while he remains motionless, then he again makes several thrusts plus head movements, pressing the fully erected penis against the vagina. This sequence is repeated several times. Mating is suddenly interrupted by a terr. ♂ who tries to bite the per. ♂, then turns as the ♀ threatens him, and pushes her with his rump. The per. ♂ and the ♀ flee, pursued by the terr. ♂.

13–14. Copulation with intromission: A per. ♂ is mounted, gripping the ♀'s sides. While making thrusting motions he opens his mouth, probably calling. At the third thrust-sequence the glans penis rubs the vagina and the ♂ introduces the penis with a sudden violent jerk; his hind legs leave the ground. The ♀ jumps forward, turns and bites and chases the fleeing ♂.

Bibliography

- [1] BOTHMA, J.P. DU: Hyracoidea. In: Preliminary Identification Manual for African Mammals, edited by J. MEESTERS. Smithsonian Inst., Washington D.C. 1966.
- [2] GLOVER, T.D., and J.B. SALE: The reproductive system of the male Rock Hyrax. J. Zool. 156 (1968), 351–362.
- [3] GRZIMEK, B.: Grzimeks Tierleben. Bd. 12. Zürich/München 1972.
- [4] HAHN, H.: Von Baum-, Busch- und Klippschliefern, den kleinen Verwandten der Seekühe und Elefanten. Die Neue Brehm-Bücherei. Wittenberg Lutherstadt 1959.
- [5] HOECK, H.N.: Differential feeding behaviour of the sympatric Hyrax *Procavia johnstoni* and *Heterohyrax brucei*. Oecologia 22 (1975), 15–47.
- [6] HOECK, H.N.: In preparation.
- [7] MENDELSSOHN, H.: Breeding the Syrian hyrax *Procavia capensis syriaca* Schreber 1784. Int. Zool. Yb. 5 (1965), 116–125.
- [8] MILLAR, R.P., and T.D. GLOVER: Seasonal changes in the reproductive tract of the male Rock hyrax, *Procavia capensis*. J. Reprod. Fert. 23 (1970), 497–499.
- [9] MILLAR, R.P.: Reproduction in the Rock hyrax (*Procavia capensis*). Zoologica Africana 6, 2 (1971), 243–261.
- [10] NEAVES, W.B.: Changes in testicular Leydig cells and in plasma testosterone levels among seasonally breeding Rock hyrax. Biology of Reprod. 8 (1973), 451–466.
- [11] ROCHE, J.: Nouvelles données sur la reproduction des Hyracoides. Mammalia 26 (1962), 517–529.
- [12] SALE, J.B.: Breeding season and litter size in Hyracoidea. J. Reprod. Fert., Suppl. 6 (1969), 249–263.
- [13] SIMPSON, G.G.: The principles of classification and a classification of mammals. Bul. Amer. Mus. Nat. Hist. 85 (1945).

Filmography

- [14] HOECK, H.N.: *Procavia johnstoni* (Procaviidae) – Hautpflegeverhalten (Freilandaufnahmen). Film E 2176 des IWF, Göttingen 1976. Publikation von H.N. HOECK, Göttingen 1976, 8 S.
- [15] HOECK, H.N.: *Procavia johnstoni* (Procaviidae) – Nahrungsaufnahme (Freilandaufnahmen). Film E 2177 des IWF, Göttingen 1976. Publikation von H.N. HOECK, Göttingen 1976, 12 S.
- [16] HOECK, H.N.: *Procavia johnstoni* (Procaviidae) – Paarungsverhalten (Freilandaufnahmen). Film E 2178 des IWF, Göttingen 1976. Publikation von H.N. HOECK, Göttingen 1976, 8 S.
- [17] HOECK, H.N.: *Heterohyrax brucei* (Procaviidae) – Fortbewegung im Geäst und Nahrungsaufnahme (Freilandaufnahmen). Film E 2266 des IWF, Göttingen 1977.

Publikation von H.N. HOECK, Publ. Wiss. Film., Sekt. Biol., Ser. 10, Nr. 60/E 2266 (1977), 11 S.

- [18] HOECK, H.N.: *Heterohyrax brucei* (Procaviidae) – Young Playing with Each Other and with Young *Procavia johnstoni*. Film E 2473 of the Inst. Wiss. Film, Göttingen 1978. Publication by H.N. HOECK, Publ. Wiss. Film., Sekt. Biol., Ser. 11, No. 29/E 2473 (1978), 8 S.

Sources of the Figures

Fig. 1–4: H.N. HOECK.