ECOLOGY OF BABOONS *(PAPIO URSINUS)* AT CAPE POINT

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ABSTRACT

Observations on habitat, movements, population structure and recruitment of a troop of 85 free-ranging chacma baboons, *Papio ursinus*, were made in the Cape of Good Hope Nature Reserve, South Africa. The 3 700 ha minimum home-range for the troop, containing nine sleeping cliffs, included an intensively used area of 45 ha around a favoured sleeping cliff. The troop showed no clear environmental preferences, but occupied *Acacia cyclops* thickets and Upland Mixed Fynbos more frequently than expected from the spatial distribution of these vegetation types in the home-range. The baboons' diet included 95% vegetable matter (grass, seeds, fruit, leaves). Invertebrates (ants, grasshoppers, marine shellfish) were also taken. Daily distance (3–14 km) covered by the troop while foraging was greatest in summer. Female baboons had menstrual cycles and copulated throughout the year. The calculated reproductive rate (12%) was roughly 80% of those reported for congeners elsewhere.

INTRODUCTION

The chacma baboon *Papio ursinus* Kerr, 1792 is a trophic generalist (omnivore) occurring in a wide variety of environments. The baboons inhabiting the Cape Peninsula are particularly interesting because they are the southernmost primate population in Africa, inhabiting a coastal area with vegetation of low nutritive value. This paper discusses aspects of the ecology of a troop of baboons in the Cape of Good Hope Nature Reserve in relation to previous findings for congeners in other environments.

STUDY AREA

Geography and climate

The Cape Peninsula forms the most south-westerly portion of the African continent, jutting southwards into the sea for 64 km. The Cape of Good Hope Nature Reserve (34°15'S/ 18°25'E) occupies the southern tip of the peninsula, covering a triangular area of roughly 7 750 ha. The study area was defined by the home-range of the troop under observation and comprised the north-western and west-central sectors of the reserve, an area of roughly 4 000 ha.

The climate of the area is "mediterranean", unlike most of sub-saharan Africa, with wet cool winters and warm dry summers. The strong south-east winds in summer keep temperatures relatively low. North-west winds in winter bring rain. The rainy season (90% of annual precipitation) extends from about the middle of April to September. Highest average

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summer temperature (mean of daily maximum for February) is 20,3°C; the lowest average winter temperature (mean of daily minimum for July) is 15,5°C. The dominant weather factor in the reserve is wind. South-east winds (16–40 km/h, gusting to 102 km/h) occur regularly in summer and blow for a week or more at a time. The average wind speed in summer (south-easterly) is 21 km/h while the average winter wind speed (north-westerly) is 13 km/h.

Vegetation

The vegetation of the Cape of Good Hope Nature Reserve is classified by Acocks (1975) as "Macchia" (mountain fynbos) with a narrow strip of Strandveld on the west coast. Fynbos is an indigenous word for the evergreen sclerophyllous shrubland of the winter-rainfall area in the south-western Cape. The term reflects the fine-leaved form and shrubbiness of much of the vegetation. The most important plant families are Proteaceae, Ericaceae, Restionaceae, Compositae, Leguminosae and Bruniaceae. Shrub life-forms are basically of two xerophytic types. The ericoid leaf is small, hairy and brittle, while the proteoid leaf is larger, leathery and smooth. The place of grass is largely taken by coarse reed-like Restionaceae. The plant communities of the reserve have been documented by Taylor (1969) and his classification was used throughout this study. However, Taylor's plant community "Restionaceous Plateau Fynbos" was extended to include all areas of young successional vegetation, 1 to 4 years after fire. Defined thus, Restinaceous Plateau Fynbos covers approximately half of the study area.

Australian *Acacia* species (wattle), originally planted in the reserve as windbreaks around farmlands and sand stabilizers near the coast, have rapidly invaded the adjoining veld. The most aggressive of these species, *Acacia cyclops*, is concentrated on dune sands in the south with isolated patches occurring in moist areas all over the reserve. A stand of alien *Pinus pinaster* occupies part of a drainage system in the north-western sector of the reserve. A regular burning programme is operated as a control measure for alien vegetation.

Animals

No large mammalian carnivores occur in the reserve. The only potential predator remaining to baboons is a resident pair of black eagles *Aquila verreauxi.* Black eagles are reported occasionally to take young baboons (McLachlan & Liversidge 1957). Seven species of large mammalian herbivores (bontebok, eland, grysbok, mountain zebra, springbok, steenbok, vaal rhebok), comprising roughly 500 animals, are found in the reserve (Wright pers. comm.). The greatest avian biomass is contributed by 90 ostrich, *Struthio camelus.*

METHODS

The initial reaction of the baboons to my presence was always to flee, after giving a few alarm barks. Most juvenile and adult male baboons, however, became sufficiently accustomed to my presence after three months to allow me to approach within 2 m of them. This tolerance

progressively increased until most baboons in the troop allowed me to approach and to walk past within a few metres of them without interfering with their activities. The only exceptions to this were adult females, especially those with infants. Any movement caused them to run away, although they occasionally approached me quite closely (*ca* 4 m).

Ten days during January and February 1975 were spent in preliminary reconnaissance. One hundred and twenty-one days, involving 480 hours of field observation, were spent with the troop from March 1975 to February 1976. The troop was followed on foot from the first turn of the hour after sunrise on days chosen at random with respect to weather conditions. The position of the troop was noted every 30 minutes. A large-scale (1: 35 000) map of the reserve was divided for this purpose into 350 × 350 m grids, each grid identified individually by two pairs of numbers. The predominant food item(s) eaten by the majority (75% or more) of the troop during the preceding 30 minutes was recorded. Samples of plant species seen to be eaten were collected for identification. The route travelled by the troop was plotted on a large-scale map for each day of observation. Direct measurement from the map gave the distance covered during the day. Measurement was made only of day-journeys plotted for a full (dawn-dusk) day.

RESULTS AND DISCUSSION

A census was made of the troop whenever it crossed a road. The animals were classified according to age and sex, using categories defined by Altmann & Altmann (1970). Fourteen censuses were made between April 1975 and February 1976, but only the final two almost certainly included all animals (85) in the troop (Table 1). Troop-size has been reported to range from 15 to 80 ($\bar{x} = 44$) individuals for 21 chacma baboon troops studied in South Africa (Hall 1963; Stoltz & Saayman 1970).

Twelve adult male baboons were observed during each of the last five censuses (Table 1). Four of these were noticeably larger than the others. Twenty-eight adult females were observed during the February census, although this is possibly a slight overestimation since adult females were more difficult to categorize than were males.

Thirty-six juveniles were counted in the February census (Table 1). A juvenile male (aged 2–3 years) with a blue tag in his left ear was easily identifiable. This animal had been removed from another troop in the reserve and released into this troop in June 1974 (Lloyd pers. comm.). Five brown infants were counted in April 1975. This number decreased in successive censuses, presumably as the animals aged and moved into the juvenile class. No brown infants were observed after the September census (Table 1). At least ten infants were born in the period May to November (Table 4). Nine of these were alive at the end of the study.

"Adult sex ratios" and ratios of adult to immature animals for 11 troops in South Africa are given in Table 2. The term "adult sex ratio" is widely used in the non-human primate literature (Hall 1962; Altmann & Altmann 1970; Stoltz & Saayman 1970). This ratio, when derived from field data, is of limited use for a number of reasons. Female baboons, for instance, are categorized "adult" at 4 years and older, whereas males are not "adult" until 6

TABLE 1.

Censuses of *O* troop, April 1975–February 1976.

	3 Apr	8 Apr	18 Apr	30 Apr	5 May	21 May	4 Jun	1 Jul	11 Aug	8 Sept	7 Nov	14 Jan	22 Jan	3 Feb
Adult male	6	6	8	8	8	10	8	8	9	12	12	12	12	12
Adult female	12	5	8	9	6	15	14	20	21	23	23	25	26	28
Juvenile female									15	13	10	7	4	
Juvenile male									19	13	12	11	9	
Total juveniles	25	35	19	34	27	37	34	37	40	38	39	37	38	36
Brown infant	5	4	5	3	4	3	2	3	4	2				
Black infant						1		1	3	6	6	9	9	9
Unidentified		9	4		1		2							
Total baboons	48	57	45	58	55	66	63	69	77	81	80	83	85	85

TABLE 2.

Composition of chacma baboon troops in South Africa.

No. adults							
Males	Females	No. juveniles	No. infants	Troop total	"Adult sex ratio"	"Adult to immature ratio"	Source
5	21	27	?	53	1 : 4	1 : 1	Hall (1962)
1	10	9	?	20	1 : 10	1 : 1	,, ,,
3	12	13	?	28	1 : 4	5 : 4	,, ,,
2	8	16	?	26	1 : 4	5 : 8	,, ,,
18	31	15	13	77	1 : 2	5 : 3	Stoltz & Saayman (1970)
19	24	7	10	60	5 : 6	7 : 3	,, ,, ,,
9	18	4	6	37	1 : 2	3 : 1	,, ,, ,,
11	11	2	6	30	1 : 1	3 : 1	,, ,, ,,
16	21	6	2	45	4 : 5	9 : 2	,, ,, ,,
12	28	36	9	85	3 : 7	8 : 9	Present study

years of age (Altmann & Altmann 1970). Males between 4 and 6 years are categorized as "sub-adult" (Altmann & Altmann 1970) or juvenile (Stoltz & Saayman 1970). "It was, however, sometimes difficult to distinguish sub-adult males from adult females" (Stoltz & Saayman 1970). I frequently found difficulty in distinguishing non-turgescent females from juveniles. Further problems arise when classifying immature animals. A juvenile category comprising individuals incapable of fully functional mating (Hall 1962) is not comparable with one formed on the basis of a size criterion. Categories based on body size are not strictly comparable between studies, since size can be assessed only subjectively in the field.

Opportunistic, but not accurate, counts were made of three other baboon troops in the reserve when these were encountered on roads. Approximate home-range data indicate that these troops correspond with Hall's (1962) troops *C, N* and *S*. Maximum counts of these troops, obtained by Hall (1962), Millar (1970) and the present study, are given in Table 3. One hundred baboons were trapped for removal from *S* and *N* troops during 1967 and 1968 (Millar 1970), although the total number of baboons taken from the reserve since 1960 is not known. The troop described in this paper is referred to as *O* troop in the following pages.

Female baboons in *O* troop exhibited all stages of menstrual cycle throughout the year. The number of females with maximum turgescence at the mid-point of each month is given in

TABLE 3.

Size of three baboon troops in the Cape of Good Hope Nature Reserve, including all age and sex classes.

Census year	Troop	Max. no. animals	Source
1959	C	53	Hall (1962)
1967	C	45	Millar (1970)
1970	C	30	Millar (1970)
1975	C	27	Davidge (this study)
1959	N	20	Hall (1962)
1967	N	50	Millar (1970)
1970	N	16	Millar (1970)
1975	N	35	Davidge (this study)
1959	S	26	Hall (1962)
1967	S	45	Millar (1970)
1970	S	9	Millar (1970)
1975	S	6	Davidge (this study)

Table 4. Female baboons in the Transvaal have also been reported to have menstrual cycles throughout the year. Table 4 also gives the minimum number of births in each month of the study. Dates of birth were known only approximately, since new-born infants were first observed after an unknown period (maximum of 14 days) following parturition. New-born infants (total 10) were observed in seven out of eleven months. The troop increased in size by 12% in 1975 (Table 1).

Ten infants (Table 4) were born during 8 424 "female-days" (24 adult females × 351 days covered by the study). This gave a reproductive rate of one infant per female every 842 days. A rate of one infant per female every 661 days was calculated from 6 608 "female-days" for savanna *Papio cynocephalus* (Altmann & Altmann 1970). A similar reproductive rate (one infant per female every 665 days) was calculated from 17 304 "female-days" for forest-living *P. anubis* (Altmann & Altmann 1970, from data given by Rowell 1966). The reproductive rate of *O* troop thus appears to be roughly 80% of those recorded for congeners elsewhere.

Home-range

The home-range of primates is that area normally occupied by an animal throughout its adult life (Jolly 1972). An area marked on a map as being the home-range of an animal is useful but misleading, since not all parts of the range are used equally (Rowell 1966). The part of the home-range habitually used for sleeping and feeding is termed the core area (Kaufmann 1962). This term is used here for that part of the home-range occupied by *O* troop for more than 2% of observation time (Figure 1).

The grid-hour system (Rowell 1966) indicates the intensity of home-range use. The percentage of total observation time spent by *O* troop in a particular 350 × 350 m area of the reserve is represented by one or more dots in the corresponding map-grid (Figure 1). It can be seen that the troop used intensively a relatively small part of its home-range. This core area is approximately 45 ha.

The approximate annual home-range is shown in Figure 2. Each blocked grid represents at least one observed daylight occupation of that area during the study. The approximate minimum area of this home-range, enclosed by a line drawn around the outer occupied grids,

TABLE 4.

Number of births, and female baboons with maximum turgescence, for each month (March 1975–February 1976).

Month	M	A	M	J	J	A	S	O	N	D	J	F
No. turgescent females	1	3	1	1	2	2	2	3	2	4	3	3
No. births	0	0	1	0	1	2	1	1	3	1	0	–

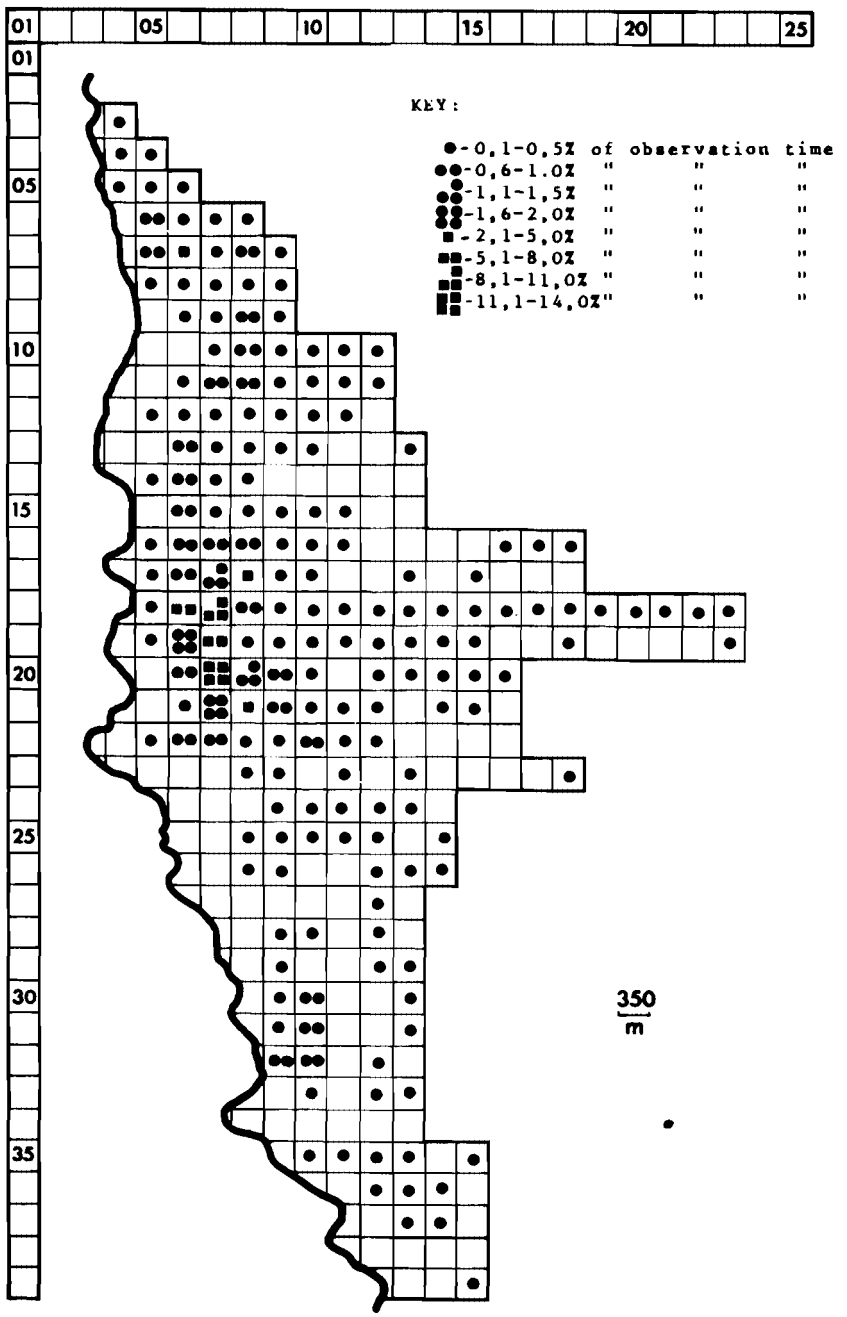

FIGURE 1.

Percentage of total time spent observing *O* troop in 350 m grid-squares.

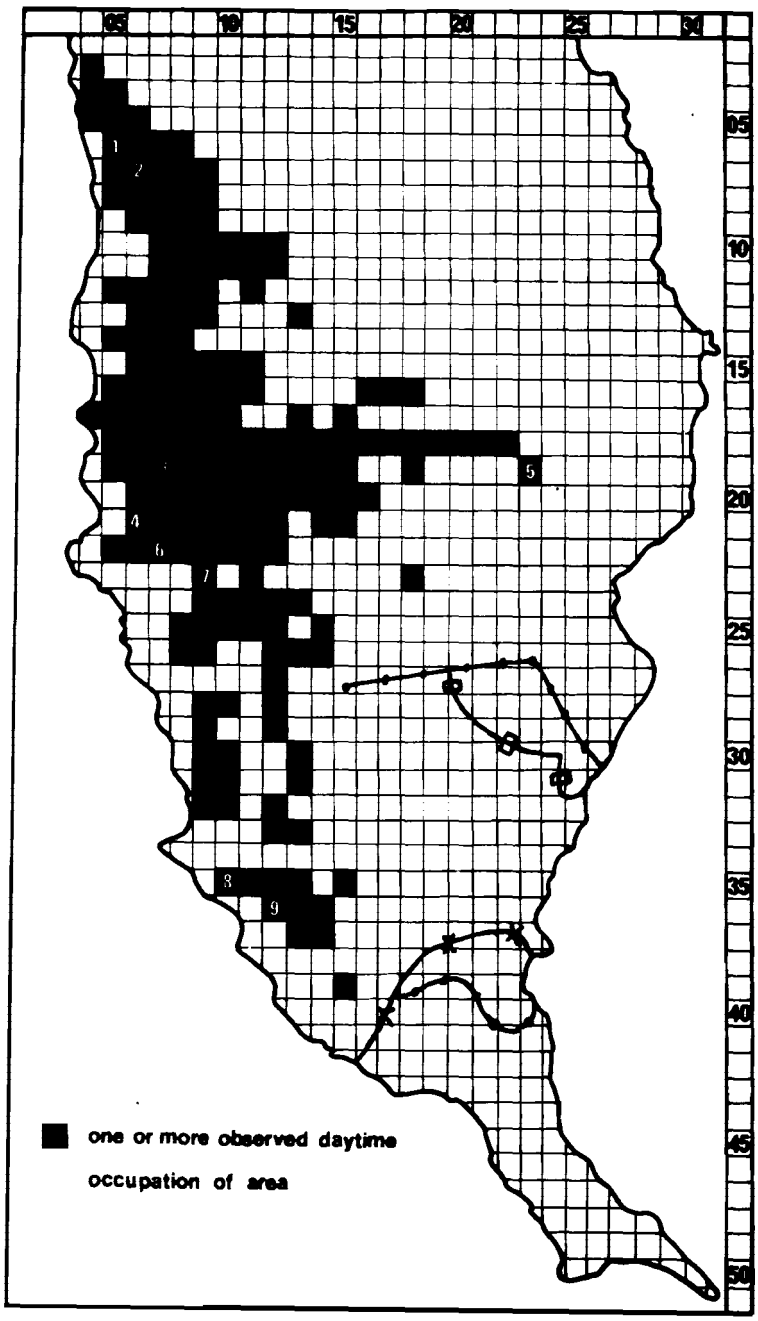

FIGURE 2.

Occupation of 350 m grid-squares by *O* troop, based on one or more daytime observations, March 1975–February 1976. The limits of home-range for other troops in the reserve (Hall 1962) are also shown. ●——● = limits of *C* troop, □——□ = southern limits of *N* troop, ×——× = northern limits of *S* troop. Numbers 1 to 9 indicate sleeping cliffs.

is 3 700 ha. The home-range was extended in January 1976 to include a farm outside the northern boundary of the reserve. The area covered by this extension is not known and is not included in home-range data given here. The home-range is approximately twice the area of those reported for *Papio cynocephalus* (Altmann & Altmann 1970) and *P. anubis* (DeVore & Hall 1965) in savanna. Home-ranges reported for other troops in the reserve (Hall 1962: Fig. 2) are 900 ha (*N* troop), 1 470 ha (*S* troop) and 3 370 ha (*C* troop). Troop size is linearly correlated with minimum home-range area in the reserve (Figure 3).

Home-range data for other troops in the reserve were collected from opportunistic personal observations and rangers' reports. The troop at Cape Point sleeps and forages throughout the year mainly near the car-park. The animals are adept at begging and stealing food from visitors These baboons range only within boundaries prescribed for *S* troop (Hall 1963). A troop within the home-range of *C* troop was encountered several times from September to February. The home-ranges of *C* and *O* troops overlap marginally. There was no evidence of *C* troop's use of west-coast sleeping cliffs during the winter months. It has been suggested (Hesterman pers. comm.) that the baboons of *C* troop are a summer breakaway group from *N* troop. *N* troop (Hall 1963) ranges over the north-eastern sector of the reserve, as well as an unknown area outside it. This home-range extends as far south as the Homestead restaurant. The baboons are seen frequently (up to four times a week) along the Smitswinkel Bay road, begging food from the public. There appears to be no overlap between *N* and *O* troops' home-ranges.

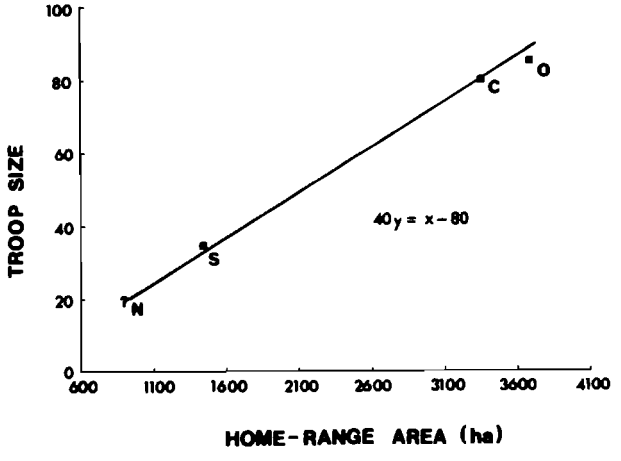

FIGURE 3.

Relation between troop size and home-range area for four troops in the Cape of Good Hope Nature Reserve. Data for troops *N*, *S* & *C* taken from Hall (1963).

Day-range

Day-range is the average distance travelled by a troop in one day (Jolly 1972). Figure 4 shows distances covered during 51 dawn-to-dusk day-ranges of *O* troop. The mean was 7,9 km (range 3,0–13,8 km). Mean day-ranges previously reported for *Papio ursinus* are 4,8 km (Hall 1962) and 8,0 km (Stoltz & Saayman 1970). "Studies in southern Africa, Kenya and on hamadryas in Ethiopia all indicate the average distance travelled by baboons during a day is three miles (4,8 km) . . . The distance the group or any individual baboon actually walks is much greater, since feeding activity is meandering" (DeVore & Hall 1965).

Data on day-ranges were arranged into five periods each embracing ten observations (Table 5). Maximum average day-ranges occurred in the summer period 4 November–3 February. These were significantly longer than the average day-ranges in the winter period 6 May–24 June ($t = 4{,}61$; $p < 0{,}01$), and do not agree with Hall's (1962) findings for other troops in the reserve, whose longest day-ranges occurred in winter. No seasonal variation in day-range was found for *Papio ursinus* in the Transvaal (Stoltz & Saayman 1970) or for *P. cynocephalus* in Kenya (Altmann & Altmann 1970).

Forty-two individual day-ranges were plotted against maximum daily air temperatures (Figure 4). The relationship was assessed by the Pearson product-moment coefficient of

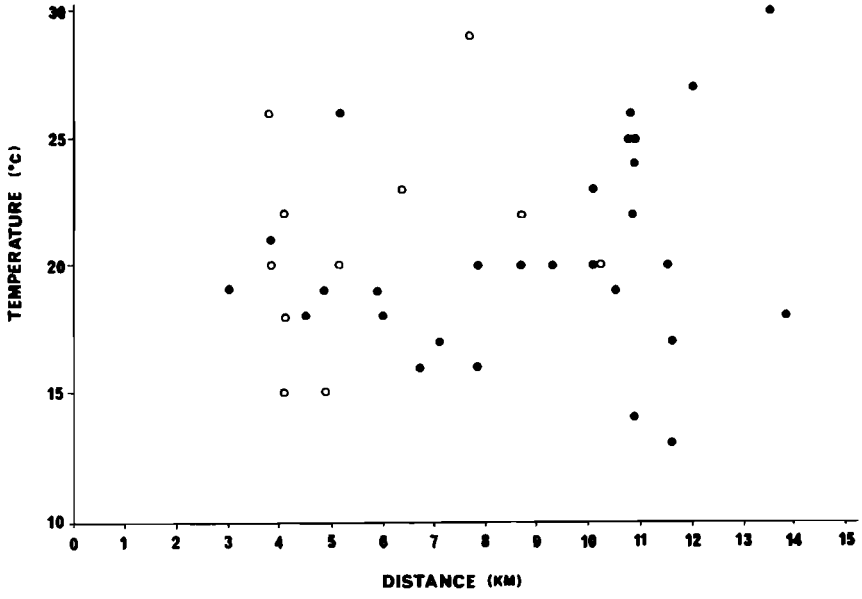

FIGURE 4.

Correlation between daily maximum temperature and maximum distance walked, March 1975–February 1976. O, day-ranges beginning and ending at the same sleeping site; ●, day-ranges beginning at one sleeping site and ending at another.

correlation (Roscoe 1969). There was no correlation between the two variables (r=0,16; $p>$ 0,05). However, other baboon troops in the reserve were found to travel farthest on cool winter days (Hall 1962). A negative correlation $r = -0{,}50$; $p < 0{,}01$) was found for troops in the Transvaal: "baboons in the study area, therefore, tended to travel farther on cooler days" (Stoltz & Saayman 1970).

Day-ranges involving the return of *O* troop to the sleeping cliff used the previous night (Figure 4) were significantly shorter ($t = 4{,}25$; $p < 0{,}01$) than those in which different sleeping cliffs were used. This agrees with findings for other troops in the reserve (Hall 1962).

Sleeping sites

Baboons sleep in the safest place available (DeVore & Hall 1965). Baboons in Rhodesia and Kenya usually sleep in tall trees (Hall 1963). Chacma baboons in montane areas of South Africa use the base, or face, of a steep cliff as a sleeping site (Hall 1963). Sleeping sites have a characteristic smell and are marked by an accumulation of dung (Stoltz & Saayman 1970).

O troop habitually uses cliff-faces for sleeping, as do other troops in the Cape of Good Hope Nature Reserve (Hall 1962). However, a small group (8–12 baboons) was seen to descend from wattle trees early one morning. The rest of the troop was sitting and lying on the sleeping cliff nearby. Other baboons in the reserve have been recorded emerging in the early morning from behind dense bushes at the base of a cliff (Hall 1963). Baboons of *O* troop were generally in the vicinity of a sleeping cliff by 16h00 throughout the year.

Nine separate sleeping cliffs (Figure 2) were used on 114 nights from March 1975 to February 1976. "The number of sleeping sites used by a troop seems to be a direct function of the number of tall and spacious trees or of the extent of the steep cliffs available" (DeVore & Hall 1965). Three troops in the eastern Cape, reported by a farmer, each habitually used only one sleeping site (Hall 1963).

TABLE 5.

Mean day-ranges, March 1975–February 1976.

Period	Mean length of day-range (km)	SD	Range	Number day-ranges
17 March–5 May	8,1	±14,4	3,0–13,5	10
6 May–24 June	5,2	± 4,1	3,7–10,1	10
25 June–20 Aug.	7,6	± 6,1	4,5–10,8	10
8 Sept.–28 Oct.	9,3	± 8,7	4,8–13,8	10
4 Nov.–3 Feb.	9,4	± 4,2	5,9–11,5	10

The observed frequency with which the sleeping cliffs were used is shown in Table 6. The troop was not observed to use sleeping cliffs 7 and 8 (Figure 2) until September 1975. However, old faeces at these sites indicated that the cliffs had been used previously by baboons. *O* troop had not been known to use the area containing site 9 prior to January 1976 (Wright pers. comm.). Use of this site appears to be linked to the extension of home-range.

Sleeping cliffs used on consecutive nights were recorded for 65 pairs of nights. The troop returned to the previous night's sleeping cliff on 29 of 65 days recorded. Consecutive nightly use of a site (two or more occasions) occurred most frequently from March to June, and at site 4 (23 of 29 days; 79%). The frequency and constancy of use of sleeping site 4 indicates a core area within the home-range.

Range in relation to vegetation

Squared paper was overlaid on Taylor's (1969) vegetation map for the reserve. The vegetation type covering more than 50% of a 0,65 cm square on the map was taken as representative of that square. The distribution of the six vegetation types within *O* troop's home-range thus obtained is shown in Figure 5 and Table 7. The large area covered by "Restionaceous Plateau Fynbos" is mainly an effect of a fire in March 1975 which burnt the majority of the northern sector of the home-range.

A large percentage of monthly observation time was spent in alien vegetation (Table 8). An average of 21% of all observation time was spent by the troop in the 5% of its home-range covered by alien vegetation. The proportion of time spent in Upland Mixed Fynbos was large in relation to the occurrence of this type (40% of observation time in 28% occurrence). Average percentage of time spent in Coastal/Dune Fynbos was roughly equivalent to the percentage of home-range covered by this vegetation type. Little time was spent in Restionaceous Plateau Fynbos and Restionaceous Tussock Marsh with respect to the percentage occurrence of these vegetation types.

TABLE 6.

Average use of sleeping sites for quarter-year periods. Values are percentages of total observation nights during each period. (For location of sleeping sites see Figure 2.)

Period	Sleeping site									Total nights observation
	1	2	3	4	5	6	7	8	9	
March–May (autumn)	2	23	8	62	0	2	0	0	2	32
June–Aug. (winter)	5	12	3	64	0	7	0	0	8	28
Sept.–Nov. (spring)	2	24	4	25	6	13	5	12	10	32
Dec.–Feb. (summer)	0	0	7	70	19	0	0	0	4	18

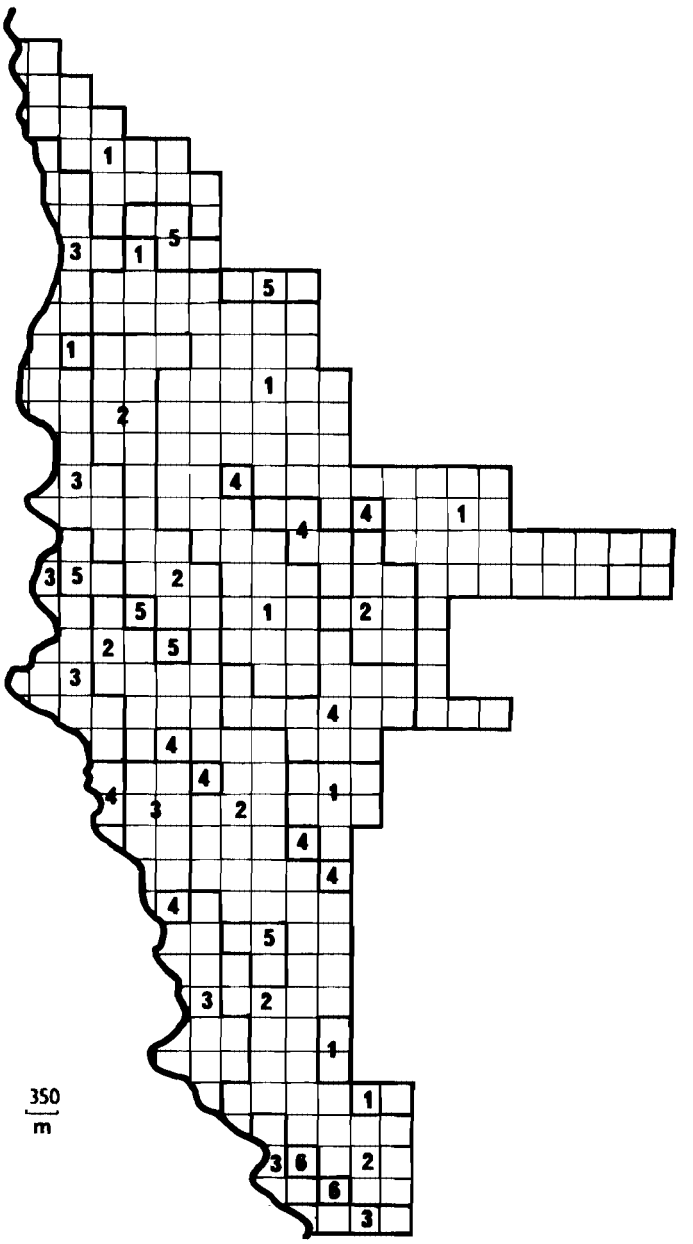

FIGURE 5.

Distribution of vegetation types within *O* troop's home-range (from Taylor 1969).

1, Restionaceous Plateau Fynbos; 2, Upland Mixed Fynbos; 3, Coastal/Dune Fynbos; 4, Restionaceous Tussock Marsh; 5, Alien vegetation; 6, *Maurocenia* Tall Scrub.

TABLE 7.
Occurrence of vegetation types in home-range (from Taylor 1969).

Vegetation type	Occurrence in home-range (%)	Area within home-range (ha)
Upland Mixed Fynbos	28	1 029
Restionaceous Plateau Fynbos	39	1 445
Alien vegetation	5	183
Restionaceous Tussock Marsh	9	343
Coastal/Dune Fynbos	18	686
Maurocenia Tall Scrub	1	24

TABLE 8.

Percentage observed monthly time spent in different vegetation types:

1, Upland Mixed Fynbos; 2, Restionaceous Plateau Fynbos; 3, Alien vegetation; 4, Restionaceous Tussock Marsh; 5, Coastal/Dune Fynbos; 6, *Maurocenia* Tall Scrub; 7, Beach areas.

	Vegetation type							Number hours observation
Month	1	2	3	4	5	6	7	
March	15	10	29	4	20	1	20	45,0
April	17	15	33	2	25	2	6	89,5
May	31	6	44	0	15	0	4	79,0
June	37	2	48	0	11	0	1	41,5
July	42	14	12	0	27	0	5	42,5
Aug.	35	31	18	8	8	0	0	39,0
Sept.	34	4	20	0	34	7	1	37,0
Oct.	41	35	10	0	12	0	1	53,5
Nov.	43	1	5	0	48	0	3	31,5
Dec.	41	3	8	0	45	0	3	33,0
Jan.	80	4	12	0	4	0	0	12,5
Feb.	66	7	12	0	15	0	0	20,5
Average	40	11	21	1	22	1	4	

Monthly changes in use of vegetation types can also be seen in Table 8. More time was spent on average in Upland Mixed Fynbos from October to February, when inflorescences of *Leucospermum conocarpodendron* were maturing (Rourke 1972), than during the rest of the year (54% and 30% respectively). The greatest percentage of time spent in Restionaceous Plateau Fynbos was during March and April (immediately after the fire) and from July to October. The vegetation is rich in sprouting geophytes during post-burn and winter periods (Wicht 1945), and thus is apparently attractive to baboons. The reduced occupation of Restionaceous Plateau Fynbos areas in spring and summer (September–February) appeared to reflect the decrease in plant food potentially available to baboons after the winter flush had died. The most frequent occupation of areas of alien vegetation was in May and June. *Acacia cyclops* seeds were observed to dehisce during this period and were readily available on the ground. The troop occupied mainly Coastal/Dune Fynbos and Upland Mixed Fynbos areas in November and December, when *A. cyclops* was flowering and few seeds were available. The increase in occupation of Coastal/Dune Fynbos areas in November and December can possibly be related to the availability of berries of *Nylandtia spinosa* and other species. Beach areas were visited mainly in March and April. The infrequent occupation of the beach in other months was rarely for foraging purposes.

Plant food

A list of 77 plant species is given in Appendix 1, including only those seen to be eaten by baboons. Almost the entire diet (approximatey 95%) of the baboons throughout the year consisted of plant food. The list does not include 41 species recorded by Hall (1962). A combination of Hall's records and my own makes up 114 plant species (Appendix 2).

Animal food

The mainly herbivorous diet of *O* troop was supplemented by animal food. Grasshoppers (Orthoptera) appeared to be the chief item and were taken on the ground or chased and sometimes caught in mid-air. Ants (Formicoidea) were infrequently eaten, usually by picking up 6 to 12 individually between thumb and forefinger. Bark was sometimes prized loose from a tree and the exposed insects picked up with the tongue. Similar behaviour has been recorded for *S* troop (Hall 1962). These items all appeared to be taken opportunistically.

O troop was observed feeding in the marine littoral zone at low tide on several occasions. It was impossible to identify all food items taken, but one marine shellfish, the common limpet *Patella granularis*, was confirmed. The baboons lifted clumps of beach-stranded kelp (*Ecklonia, Laminaria*) with one hand and made grabbing movements with the other hand. It seems likely that small crustaceans were collected in this way. Crabs (*Cyclopgrapsus punctatus* and *Plagusia chabrus*), sandhoppers (*Talorchestia*) and sea-lice (Isopoda) have been identified from the faeces of other troops in the reserve (Hall 1962). Juvenile baboons on one occasion picked up eggs of an oyster-catcher (*Haemantopus*) and played with them. The undamaged eggs were later discarded (Marais pers. comm.).

None of the baboons was seen eating scorpions, although individuals overturned up to ten stones a day. No scorpions were found under 30 stones which I overturned at random. A large insect larva was seen lying undamaged at the bottom of a hole dug by baboons a few

minutes earlier.

A description of feeding techniques is given elsewhere (Davidge 1976).

Mineral supplements

Individuals of all age and sex classes drank brackish water from pools just above the high-water mark at the coast. This behaviour was also reported for other troops in the reserve (Hall 1962). Adult male baboons (and, once, a juvenile) ate small handfuls of claylike material on four occasions. The "clay" was taken from the treated surface of dirt roads and from a pile of road-surfacing material. *S* troop has previously been reported to eat white clay (Hall 1962, 1963). "Large clods of earth without any roots or bulbs" were found in *Papio ursinus* stomachs collected in the Transvaal (Loskop Dam) in February (Moolman & Breytenbach 1976). These authors concluded that "soil eating might be the result of the absence of an essential mineral or trace element".

Temporal variation in diet

The number of hours in a month spent feeding on each food item was calculated from data on "predominant food eaten". These values were expressed as a percentage of the total number of observation hours in that month (Table 9) to give the relative importance of various food items in the diet.

The baboons utilized *Acacia cyclops* seeds throughout the year and proteaceous

TABLE 9.

Percentage time spent feeding on various food items, March 1975–Feb. 1976.

Food item	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Acacia cyclops seeds	18	82	48	37	9	17	14	4	19	39	30	30
"Underground storage organs"	19	7	19	20	36	24	54	50	35	12	0	20
Proteaceous inflorescences	5	3	2	4	0	0	0	4	22	20	55	19
Grass	0	0	9	22	38	6	30	4	0	0	0	0
Restionaceae seeds	0	0	0	0	0	27	0	30	4	0	10	0
Berries	0	2	2	0	0	5	0	8	11	12	0	25
Pinus seeds	51	0	2	0	2	0	0	0	0	0	0	0
Carpobrotus	0	0	0	0	0	0	0	7	9	12	5	6
Twiner	0	0	16	14	3	0	1	0	0	0	0	0
Arctotis	0	0	0	2	11	20	0	0	0	0	0	0
Marine shellfish	5	2	1	1	1	1	1	0	0	4	0	0
Acorns of *Quercus robur*	2	3	0	0	0	0	0	0	0	0	0	0
No. hours observation	60	74	25	28	20	21	23	29	33	30	12	14

inflorescences in the dry summer months. "Underground storage organs" of plants were taken in the winter, when rain induced germination. The baboons utilized the abundant, tender "grass" that grew at the onset of winter rains. Marine shellfish were eaten mainly in the dry season.

Care must be taken when comparing temporal variation in the diets of *Papio ursinus* from different areas. The Cape Peninsula has a winter rainfall, whereas most of the remainder of the distributional range for *P. ursinus* receives rain mainly in the summer. Thus, food plants of ecological equivalence are potentially available to baboons at different times of the year.

CONCLUSIONS

This troop is one of the largest chacma baboon troops yet studied. The proportion of juvenile and infant animals indicates that the troop is still expanding, despite a slightly lower reproductive rate than that for baboons elsewhere.

The baboons are omnivores relying heavily on vegetable matter. The diet includes a large proportion of alien *Acacia* seeds. The increasing availability of this concentrated food source possibly contributes to the continued growth of the troop. However, the need for supplementary vegetable matter necessitates an expansion of foraging areas as the numbers increase. This requirement, compounded by the burning of a large part of the troop's traditional range and the lack of predation, have probably caused the recent expansion of home-range. This in turn has necessitated the use of more sleeping cliffs than is usual for chacma baboon troops. The animal protein requirements are apparently met by eating orthopterans in the summer and shell-fish in the winter, obviating a need for the hunting found for other *Papio* species.

The generally low nutritive value of the vegetation is a possible reason for longer day-ranges than those for congeners elsewhere. The day-ranges are longest in summer, thus differing from findings in the Transvaal. However, the longest day-ranges in both areas are during the dry season (summer in the Cape and winter in the Transvaal), presumably the time of lowest food availability.

Continued monitoring of *O* troop in the future should provide information on the social and physiological effects of large troop-size. An interesting question is whether the troop will eventually split into smaller units. The findings of this study point to a review of the current burning programme for the reserve, unless a population control programme is undertaken.

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APPENDIX 1.
Plant species eaten, March 1975–February 1976.
* Plants utilized in more than one category.

Part of plant eaten	Taxon
UNDERGROUND STORAGE ORGANS	*Albuca* sp.
	Amaryllidaceae
	Babiana villosula
	Cyanella capensis
	Gladiolus sp.
	Gynandriris rogersii
	Hyobanche sanguinea
	Iridaceae
	Moraea bituminosa
	Othonna heterophylla
	Oxalis polyphylla
	Pelargonium longifolium
	Satyrium bicorne
	Satyrium odorum
	Watsonia spp.
ROOT CORTEX	*Lobelia pinifolia*
	Monadenia micrantha
	**Pelargonium capitatum*
	Roella amplexicaulis
	Trachyandra tabularis
	Wachendorfia spp.
FLOWERS/INFLORESCENCES	Amaryllidaceae
	Aristea spiralis
	Aspalathus capensis
	Bobartia gladiata
	Bobartia indica
	**Carpobrotus edulis*
	Coleonema album
	Cullumia setosa
	Dorotheanthus bellidiformis
	**Elegia cuspidata*
	Erica coccinea
	Erica mammosa
	**Fagelia bituminosa*
	Gymnodiscus capillaris
	Leucospermum conocarpodendron
	Leucospermum hypophyllocarpodendron
	Liparia parva
	Liparia sphaerica
	Mimetes hartogii
	Oxalis spp.
	**Pelargonium capitatum*
	Salvia aurea
	Sideroxylon inerme
	Tarchonanthus camphoratus
LEAVES	*Aethephyllum pinnatifidum*
	Arctotis acaulis
	Briza sp.

Part of plant eaten	Taxon
	**Carpobrotus edulis*
	Corymbium africanum
	**Cynanchum obtusifolium*
	Erodium moschatum
	Olea exasperata
	**Pelargonium capitatum*
	Rhus lucida
	Twiner (unidentified)
BERRIES	*Asparagus asparagoides*
	Diospyros glabra
	Euclea racemosa
	Maurocenia frangularia
	Nylandtia spinosa
	Olea capensis
	Rhus laevigata
SEEDS	*Acacia cyclops*
	Acacia saligna
	**Elegia cuspidata*
	Elegia vaginulata
	**Fagelia bituminosa*
	Hypodiscus aristatus
	Pentameris macrantha
	Phylica buxifolia
	Pinus pinaster
	Tetraria bromoides
	Willdenowia lucaeana
WHOLE PLANT	*Caucalis africana*
	**Cynanchum obtusifolium*
	Cynodon dactylon
	Medicago hispida
	Oxalis luteola
	Oxalis obtusa
UNKNOWN	*Protea cynaroides* (pith, insects?)
	Tetraria thermalis (leaf base?)
	Watsonia sp. (stem of young plant?)

APPENDIX 2.
Plant species eaten by baboons in the Cape of Good Hope Nature Reserve.

Taxon	Recorded by Hall (1962)	Present study
Acacia cyclops	+	+
Acacia saligna	+	+
Aethephyllum pinnatifidum		+
Albuca canadense	+	
Albuca sp.		+
Amaryllidaceae		+
Anomalesia cunonia	+	

Taxon	Recorded by Hall (1962)	Present study
Anthericum divaricatum	+	
Arctotheca calendula	+	
Arctotis acaulis		+
Arctotis aspera	+	
Aristea spiralis		+
Aspalathus capensis		+
Asparagus asparagoides		+
Astephanus neglectus	+	
Babiana nana	+	
Babiana villosula	+	+
Berkheya ilicifolia	+	
Bobartia gladiata	+	+
Bobartia indica		+
Briza sp.		+
Carpobrotus edulis	+	+
Cassine barbara	+	
Caucalis africana		+
Chrysanthemoides monilifera	+	
Coleonema album		+
Corymbium africanum	+	+
Cotula turbinata	+	
Cullumia setosa		+
Cullumia squarrosa	+	
Cyanella capensis		+
Cynanchum obtusifolium		+
Cynodon dactylon	+	+
Diospyros glabra		+
Dischisma sp.	+	
Dorotheanthus bellidiformis	+	+
Elegia cuspidata		+
Elegia vaginulata		+
Erica cerinthoides	+	
Erica coarctata	+	
Erica coccinea		+
Erica mammosa	+	+
Erica phylicifolia	+	
Erica plukeneti	+	
Erodium moschatum		+
Euclea racemosa	+	+
Fagelia bituminosa		+
Ferraria undulata	+	
Gladiolus sp.	+	+
Gymnodiscus capillaris		+
Gynandriris rogersii		+
Hyobanche sanguinea	+	+
Hypodiscus aristatus		+
Hypochoeris glabra	+	
Iridaceae		+
Leucadendron salignum (= *adscendens*)	+	
Leucadendron laureolum (= *decorum*)	+	
Leucadendron coniferum (= *sabulosum*)	+	
Leucospermum conocarpodendron	+	+
Leucospermum hypophyllocarpodendron		+
Liparia parva		+
Liparia sphaerica		+

Taxon	Recorded by Hall (1962)	Present study
Lightfootia parvifolia	+	
Lobelia pinifolia		+
Lobostemon montanus	+	
Maurocenia frangularia		+
Maytenus oleoides (= *Gymnosporia laurina*)	+	
Medicago hispida	+	+
Metalasia muricata	+	
Mimetes hartogii		+
Monadenia micrantha		+
Moraea bituminosa		+
Myrica cordifolia	+	
Nylandtia spinosa		+
Olea capensis	+	+
Olea exasperata		+
Othonna filicaulis	+	
Othonna heterophylla		+
Oxalis dentata	+	
Oxalis luteola		+
Oxalis obtusa		+
Oxalis polyphylla		+
Passerina paleacea	+	
Pelargonium capitatum	+	+
Pelargonium longifolium		+
Pelargonium tabulare	+	
Pentameris macrantha		+
Phylica buxifolia		+
Pinus pinaster	+	+
Polygala myrtifolia	+	
Protea cynaroides		+
Protea lepidocarpodendron	+	
Protea scolymocephala	+	
Roella amplexicaulis		+
Rhus glauca	+	
Rhus laevigata (= *mucronata*)	+	+
Rhus lucida		+
Rumex sp.	+	
Salvia africana	+	
Salvia aurea	+	+
Satyrium bicorne		+
Satyrium odorum		+
Scirpus cartilagineus	+	
Senecio elegans	+	
Sideroxylon inerme		+
Tarchonanthus camphoratus		+
Tetraria bromoides		+
Tetraria involucrata	+	
Tetraria thermalis	+	+
Torillis sp.	+	
Tritoniopsis dodii	+	
Wachendorfia sp.		+
Watsonia tabularis	+	+
Willdenowia lucaeana	+	+