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Gazella dorcas.

By Yoram Yom-Tov, Heinrich Mendelssohn, and Colin P. Groves

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Gazella de Blainville, 1816

Gazella de Blainville, 1816:75. Type species *Capra dorcas* Linnaeus (opinion 108 of the International Commission on Zoological Nomenclature).
Dorcas Gray, 1821:307. Type species *Capra dorcas* Linnaeus.

CONTEXT AND CONTENT. Order Artiodactyla, Suborder Pecora, Family Bovidae, Subfamily Antilopinae. The genus *Gazella* currently contains numerous species, and may be polyphyletic. In the above synonymy, only names applicable to the monophyletic "central group" of gazelles (Groves, 1981) have been listed.

Gazella dorcas (Linnaeus, 1758)
Dorcas Gazelle

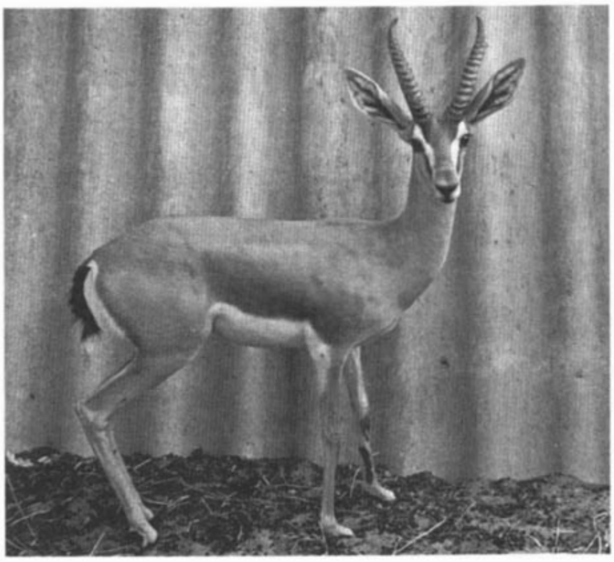
Capra dorcas Linnaeus, 1758:69. Type locality "Lower Egypt" (see Blaine 1913).
Antilope kevella Pallas, 1766:7. No locality.
Antilope corinna Pallas, 1766:7. No locality.
Gazella isabella Gray, 1846:214. Type locality "Abyssinia".
Antilope dorcas isidis Sundevall, 1845:267. Type locality "Sennaar, Sudan".
Gazella pelzelni Kohl, 1886:70. Type locality "Northern Somalia".
Gazella arabica rueppelli Neumann, 1906:244. Type locality "Tor [El Tur], Sinai, Egypt" (see Groves, 1983).
Gazella littoralis Blaine, 1913:295. Type locality "Khorasot, Nubian Desert, Sudan".
Gazella littoralis osiris Blaine, 1913:295. Type locality "Nakheila, Abara/Nile Junction, Sudan".
Gazella dorcas neglecta Lavauden, 1926:16. Type locality "Tadmeit Plateau, Algeria".
Gazella dorcas massaesyla Cabrera, 1928:242. Type locality "Rif Plateau, Morocco".
Gazella isabella beccarii de Beaux, 1931:210. Type locality "Baraka headwaters, Ethiopia".

CONTEXT AND CONTENT. The dorcas gazelle is one of the smallest living species of *Gazella*; only *G. saudiya* (which, contrary to usual practice, is not regarded herein as a subspecies of *G. dorcas*), is smaller. Other close relatives include *G. gazella*, *G. arabica*, *G. bilkis* and *G. bennetti* (Groves, 1985; Groves and Lay, 1985).

Six subspecies were recognized by Groves (1981):

G. d. dorcas (Linnaeus, 1758—*kevella*, *corinna*, *rueppelli*, and *sundevalli* are synonyms), see above.
G. d. massaesyla Cabrera, 1928 (synonym is *cabrerai*), see above.
G. d. osiris Blaine, 1913 (synonym is *neglecta*), see above.
G. d. isabella Gray, 1846 (*isidis* and *littoralis* are synonyms), see above.
G. d. beccarii de Beaux, 1931, see above.
G. d. pelzelni Kohl, 1886, see above. (On the inclusion of *G. pelzelni* in this species, see Groves, 1985).

DIAGNOSIS. Compared with its close relative, *G. gazella*, *G. dorcas* (Fig. 1) averages smaller; its ears are longer, 129–170 mm in male (ca. 110 mm in *G. gazella*), 135–160 mm in females (ca. 100–125 in *G. gazella*); ear length is 14–18.1% of head and body length (ca. maximum of 13.5% in *G. gazella*); forelimbs are longer compared with hindlimbs, the intermembral index (=total forelimb length expressed as percentage of total hindlimb length) is >79%; distal limb segments are longer, the tibia is generally more than 130% of femur length, and the metatarsal length is always more than 106.9% of femur length. The premaxillae of *G. dorcas* (Fig. 2) are more concave dorsally, and their nasal processes nearly always make broad contact with the nasal bones; the nasal bones wedge in a V into the frontals, and widen anteriorly (instead of posteriorly as in *G. gazella*—Harrison, 1968), and have shortened tips which are not, or are scarcely, longer than the lateral flanges; the preorbital fossa is smaller; the ethmoid fissures are wider; the supraorbital pits are smaller; the braincase is higher and more rounded, as in *G. bilkis*, but is more prominently ridged; the paroccipital processes are more ventrally directed, as in *G. bilkis* (Groves and



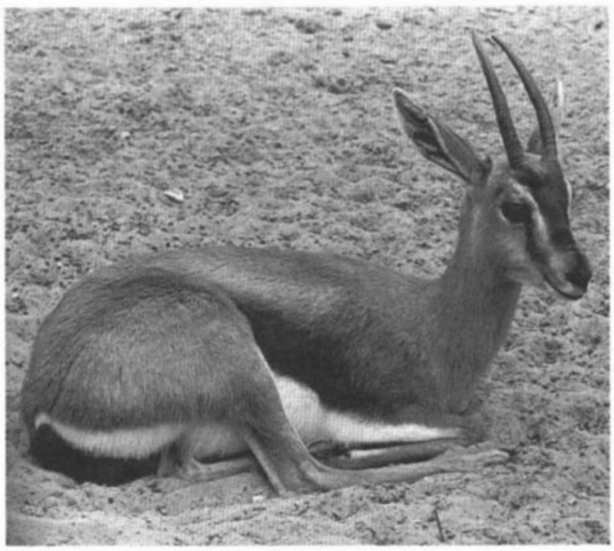


FIG. 1. Photograph of a male (above) and a female (below) *Gazella dorcas*, from the Negev Desert, Israel. Photographed by H. Mendelssohn at the Tel Aviv University Research Zoo.

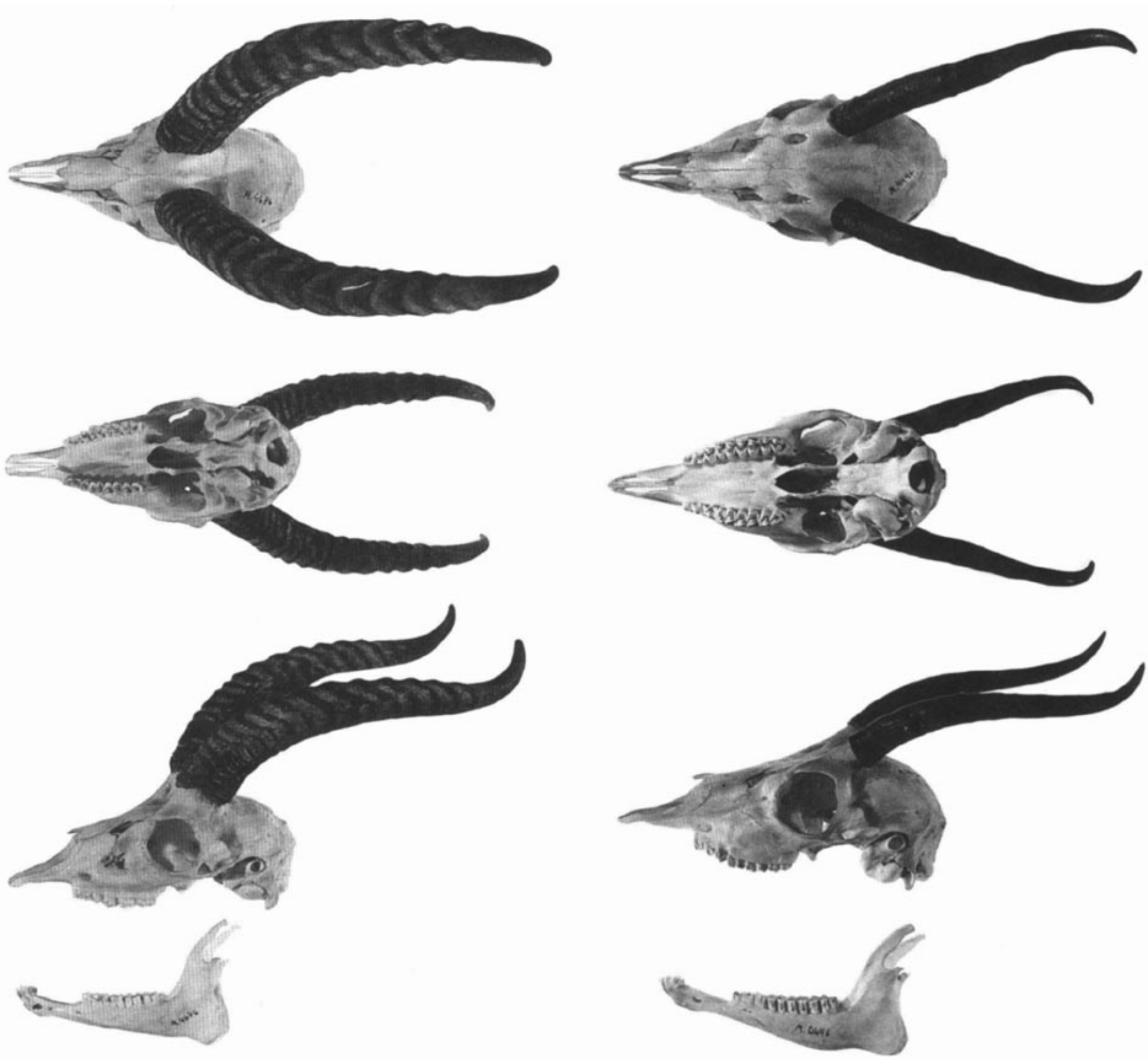


FIG. 2. Dorsal, ventral, and lateral views of the skull, and lateral view of the mandible of an adult male (left) and female (right) *Gazella dorcas*. Male, Zoological Museum, Tel Aviv University, M. 4676 from En Gedi, Israel. Greatest length of skull is 183.0 mm. Female, Zoological Museum, Tel Aviv University, M. 4446 from Sde Boqer, Israel. Greatest length of skull is 173.7 mm. Photographs by A. Shoob.

Lay, 1985). The horns are more compressed than in related species, and have 20–24 close-set rings in the male. The horns of the male, when viewed from the side, have a stronger curvature than do those of related species such as *G. gazella*, and when seen frontally are spread with the tips turning inward, showing the lyre-shape of gazelle horns more distinctly than those of most other species. The horns in the female are relatively strong, long, and ringed; the posterior border of the horn core is more rounded than in *G. gazella*; there is no marked groove running along the anterior edge of the core, but there are two along the posterior edge (Ducos, 1968). The horns of the female are much longer and stronger than those of *G. gazella* females.

GENERAL CHARACTERS. The mass of the adult males of specimens from Israel averages 16.5 (15–18) kg and that of females 12.6 (11.4–14.5) kg. Specimens from Egypt, including Sinai, are considerably smaller and more delicate. The color is a light sandy-brown. The lateral stripe is inconspicuous, but the facial pattern is well developed, and the light supraorbital stripe is almost white. There is a black spot on the bridge of the nose in some individuals. The ears are long, about 140 mm, and normally are carried slanting laterally, but prick up when the gazelle is tense. The tail is long, about 120.5 mm, and bushier than in *G. gazella*. The hooves are much narrower than those of the latter. The horns of males are about 250–280 mm long, and have 20–24 rings. The horns of the female are straight or slightly lyre-shaped in frontal view, 170–190 mm long, and usually with 16–18 more or less conspicuous rings. The male horns of *G. dorcas* reach their maximum length at the age of 2 years, as in *G. gazella*. The male reaches sexual maturity at one and a half years; little length is added to the horns thereafter, recognizable by a few narrow rings at the base of the horn. Female horns continue to grow until about the third year, but horn growth slows after one and a half years of age and more so after the third year (in litt.).

DISTRIBUTION. *Gazella dorcas* ranges across northern Africa from Rio de Oro, Morocco, Algeria, Tunisia, Libya and Egypt, south to the Sudan, northern Ethiopia, Somalia, and Chad in Africa, and is found in Sinai and Israel also (Fig. 3—Ellerman and Morrison-Scott, 1951; Groves, 1981).

FOSSIL RECORD. Remains of *G. dorcas* were found in late Paleolithic sites near Kom Ombo, upper Egypt (Churcher, 1972). There are subfossil occurrences of this species from Hesban, east of Jericho (where it occurred alongside *G. gazella*), and from sites in northern Africa (Uerpmann, 1986). Garrod and Bate (1937) identified in the Mt. Carmel Kebara Caves what they proposed were two species of gazelles, but Ducos (1968) raised doubts about this identification, and Davis (1977) identified only *G. gazella* from this cave. Hooijer (1961) identified *G. dorcas* in Ksar 'Akil, a Paleolithic rock-shelter in Lebanon, but Davis (1974) rejected this identification on the basis of comparison with recent material. Clutton-Brock (1979) identified the Pre-Pottery Neolithic gazelle in Jericho as *G. gazella*, but these animals were later referred to as *G. dorcas* (Tchernov et al., 1986/7). In the Levant and Israel, this species seems to be a post-glacial invader from northeastern Africa, displacing *Gazella gazella* by way of exclusion (Tchernov et al., 1986/7) in the more arid areas, and may never have existed north of the Negev and Judean deserts in Israel.

FORM. The Saharan subspecies of the dorcas gazelle are very pale fawn, with a brown stripe bordering the white of the underside, and a paler sandy stripe above it; the forehead and midface are slightly darker than the body. Subspecies from north of the Sahara exhibit more ochre, with dark flank- and face-stripes; those from Israel and the Red Sea coast and hinterland are darker reddish-brown-gray with a less well-marked light flank-band, the dark facial stripes are blackish, the midfacial tone is dark chestnut, the light face-stripes have a yellow tone, and there generally is no nose-spot. The horns are nearly straight in populations in Somalia, but more out-curved elsewhere; mean horn length in males varies from 266 mm in Somalia to 201 mm in Tibesti. The horn length of females averages only 62% of that of males in Somalia, but nearly 80% in the Sahara (Groves, 1981).

Body dimensions vary considerably, with the Israel and Red Sea gazelles the largest. Mass mean and range of measurements of males in Israel, Sinai, and from the Red Sea Hills of the Sudan are 16 kg (14.6–18.2, n = 5—in litt.), but reach 19 kg in northern Chad (Oboussier, 1974) and 20 kg in Air, Niger (Brouin, 1950). Females from Israel and Sinai average 12.6 kg (11.4–14.5, n = 8); other populations are poorly known. Mass of females in these populations is 77% of that of males, compared with 73% in *G. gazella*. Head and body length of *G. dorcas* from Israel, Sinai, and Sudan averages 955 mm (890–1014, n = 10) in males, and 952 mm (885–1010, n = 9) in females. The tail is 11–16% of the head and body in Sinai and Israel (authors' unpublished data), but 17.5–17.7% in Air, and 21.2–21.5% in Chad; the hindfoot is relatively longer in Air and Chad (33.5–37.6% of head and body) than in Israel and Sinai (28.7–35.2%); the ear seems also to be longer in the Sahara (14.8–17.7% of head and body length, compared with 14.0–15.8% in Israel and Sinai. Finally, Saharan representatives are stockier with the cube root of body mass 2.76–3.14% of head and body in males (Oboussier, 1974), but only 2.62–2.74% in Sinai and Israel; this is not to say, however, that all members of this species are not exceedingly slender, graceful animals.

The vertebral formula is C 7, T 13, L 6, S 3–5, Cd 13–15, total 42–46. The cervical vertebrae make up to 33.3% of total vertebral column length, the thoracics 37.8%, the lumbars 22.1%, the sacral 6–9%; all are within the range of other species of the genus (Oboussier, 1974). The gall bladder lies in a fossa in the liver. The caudate lobe of the liver is small and laterally positioned; there is no Spigelian lobe. The small intestine is 13.86 m long, the large intestine 5.79 m, the caecum 381 mm in an adult male (Garrod, 1877). The brain had a mass of 68–81 g in three adult males. The left cerebral hemisphere was the longer in one specimen, the right in three (Oboussier, 1974).

FUNCTION. The vision of gazelles is acute and seems to be the most important sense, allowing them to identify enemies and conspecifics from a distance—they can see an arm waving from a distance of 1 km. Their hearing and sense of smell apparently are not used for detecting predators, but rather mainly for food selection and intraspecific communication (H. Mendelssohn, pers. obs.).

Dorcas gazelles are well adapted to the harsh climate of the desert. Captive *G. dorcas*, fed sorghum, consumed an average of 420 g/day (=1592 Kcal) during November, and 380 g/day (=1440 Kcal) in May, the hottest month in Khartoum. The average daily water consumption of these gazelles (from drinking, metabolic water, and water in food) was 590 ml during November and 840 ml during May. A total of 1083 g of *Acacia* leaves provided all the necessary energy, and more than its minimum requirement of water in November (Carlisle and Ghobrial, 1968). In Israel, the gross energy intake of captive *G. dorcas* was 600 $KJ/Kg^{-1}day^{-1}$ (Shkolnik, 1988).

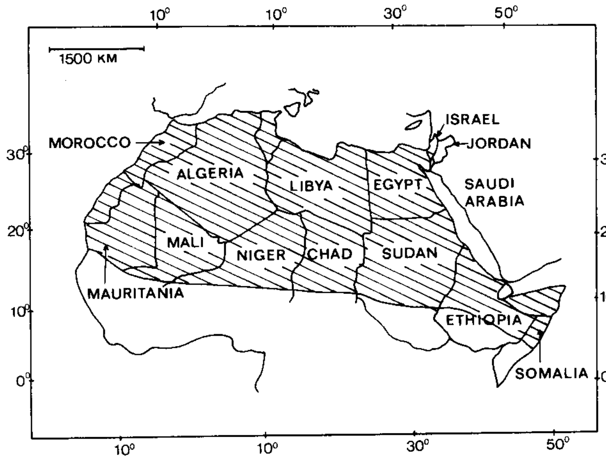


FIG. 3. Geographic distribution of *Gazella dorcas*, adapted from Harrison (1968). Subspecific boundaries are not known.

Animals maintained on dry sorghum had an average daily total water consumption of 4.1 L/100 kg body mass in winter and 5.6 L/100 kg body mass in summer. They withstood lack of free water for 9–12 days in winter, with a body mass loss of 14%–17%, and for 3–4 days in summer, with body mass loss of 17%–20%. When deprived of free water they reduced water loss by reducing urine output 3–4 fold and doubling its concentration. In winter there was a 70% increase in the urea and 52% in the potassium concentration but a decrease of 43% in sodium and 26% in chloride. The thermal load of 15°–20°C during summer caused a 30% reduction in the volume of the urine produced with no significant effect on its concentration (Ghobrial, 1974). Gazelles must drink even in winter if fed on dry food only (Cloudsley-Thompson and Ghobrial, 1965; Ghobrial, 1974, 1976; Ghobrial and Cloudsley-Thompson, 1966). The moisture gained by gazelles when feeding on *Acacia* leaves is sufficient to cover their water loss during winter, but not during summer (Ghobrial, 1974). In Israel, however, most populations live in areas where no free water is available. It seems that in such areas gazelles maintain their water balance by behavioral adaptations, and by feeding early in the morning when the water content of food plant tissues is higher than later in the day, and by feeding on green leaves and pods of *Acacia* and on various shrubs (Mendelssohn and Yom-Tov, 1987).

Captive dorcas gazelles drink water equivalent to 3.1% (1.0–4.9%) of their body mass daily (Ghobrial, 1974, 1976). In summer they drink daily the equivalent of 4.5% of their body mass. Preformed water and metabolic water supplied on average 0.2% and 1.2% of their daily water requirement in winter, and 0.15% and 0.88% in summer, respectively. The daily output of urine averaged 2.1% of body mass and the concentration of solubles in the urine averaged 1.4 osmols/liter. The daily production of feces averaged 0.3% of body mass, with a water content of 52%. In summer, urine and feces output decreased by about 30% and 50%, respectively, and the water content was reduced 3-fold. Gazelles began to sweat at ambient temperatures of 25°C. Cutaneous water loss (from their body surface of 0.76 m^2) varied with ambient temperature and increased from 2.8–5.6 $gh^{-1}m^{-2}$ at 20°–22°C, to 81.8–87.4 $gh^{-1}m^{-2}$ at 26°–30°C. The respiratory rate increased with temperature from 45–55 breaths/min at 28°C, to 50–75 breaths/min at 29°C. Respiratory water loss was 0.15–0.35 mg/min. The total water loss during the day in summer reached 300–400 ml/12h, dropping to 75–100 ml/12h at night (Ghobrial, 1974, 1976). When deprived of water, body temperature fluctuated from 38.1° to 40.2°C. Rectal temperature ranged from 38.6° to 39.2°C in winter, and from 38.8° to 39.8°C in summer. Maximal rectal temperature was 41°C (at ambient 47°C) and minimum was 37.7°C (at ambient 10°C—Ghobrial, 1974, 1976).

ONTOGENY AND REPRODUCTION. The testes of seven adult males from breeding groups in Abu Dhabi, ascribed to this species (some might have been *G. saudiya*), measured 18–22 mm in diameter; all contained sperm, as did the efferent ducts. Sperm was being actively produced in males in November, December and January, but not in one in March (Bland, 1985).

In most of its range and under natural conditions, mating takes place during September–November. Near agricultural areas, however, where green food and water are available throughout the year, mating occurs in other seasons (Mendelssohn and Yom-Tov, 1987). In the southern Arava Valley in Israel, captive females mated occasionally 2 weeks after parturition, if they had lost their fawn (Mendelssohn, pers. obs.). Pregnancy lasts 6 months (169–181 days—Dittrich, 1972; Haltenorth and Diller, 1980; Slaughter, 1971). In Chad the calving season occurs in November-December (Haltenorth and Diller, 1980), and in Air (Niger) at the end of October, although some are born as early as September (Brouin, 1950). The mother gives birth to a single fawn with a body mass of 1.3–1.7 kg; twins are rare (Furley, 1986), occurring in Algerian populations, but have never been observed in Israel. The newborn is well developed, with eyes open and fully developed fur. Immediately after birth the female licks the young and eats the afterbirth tissues. The fawn tries to stand within the first hour, but standing on the full length of the toes rather than on the tips. Unlike the mountain gazelle (*G. gazella*) the dorcas fawn may nurse on its first day, while dam and fawn are lying down (in litt.).

The first fawn usually is born when the dam is 2 years old (Mendelssohn, 1974), but captive females have been observed to mate successfully at less than one year of age (Furley, 1986). This has not been observed in Israeli *G. dorcas* in the field or in captivity. In the Negev Desert about 90% of adult females become pregnant, but no pregnant yearlings were observed (Baharav, 1983). Nursing is carried out with the mother and young standing in an anti-parallel posture. The young suckles while the female licks the umbilical and genital regions of the young. This enhances defecation and urination by the young, and the mother eats its feces. Suckling lasts from less than a minute to about 2 minutes and takes place several times a day. During the first 1–2 weeks of its life the young spends most of its time lying curled up with eyes closed in a shallow depression in the soil or under bushes (Baharav, 1983; Brouin, 1950; Hufnagl, 1972; Mendelssohn and Yom-Tov, 1987). The dam grazes and rests at some distance from the hidden fawn. The laying-up period of the *G. dorcas* fawn is shorter than that of the *G. gazella* fawn (Mendelssohn and Yom-Tov, 1987).

At about 2 weeks of age, the young gradually begins to follow its mother and to feed on solid food. The suckling period lasts for about 3 months and the fawn weighs about 7 kg at weaning (Baharav, 1983). At that age the mother and young join a small herd of up to 12 individuals (Mendelssohn and Yom-Tov, 1987).

ECOLOGY. Dorcas gazelles inhabit savannas, semi-deserts and deserts. They live in plains, broad wadis, and occasionally in canyons and hilly country, but avoid steep terrain. They prefer hammada (stony desert) to sands, but do occur in sandy areas (although not on shifting dunes), and not in saline deserts. In these habitats they face extreme desert conditions where ambient temperature may reach 55°C in Sudan (Ghobrial, 1974) and 45°C in Israel, and the average rainfall is 25 mm with large annual fluctuations (Yom-Tov and Ilani, 1987). The process of establishing a reserve at M'Sabih Tales near Sidi Chiker, Morocco, for this species was documented by Loggers (1985).

The daily activity of *G. dorcas* is determined mainly by climate. In summer they are active during the early morning (0500–0800) and the evening (1600–1800—Ghobrial and Cloudsley-Thompson, 1976), whereas in winter they may be active all day long provided the ambient temperature is not high. Where persecuted, and on clear nights, they become nocturnal (Mendelssohn and Yom-Tov, pers. obs.).

Dorcas gazelles are excellent runners and for several hundred meters may reach a speed of 80 km/h (Yom-Tov and Mendelssohn, unpubl. data); Brouin (1950) reported speeds of 75 km/h over suitable terrain, and noted that the run is interspersed with bounds. During midday in summer they rest while either standing or lying in the shade of *Acacia* trees or bushes. On cold and windy nights they lie in shallow depressions dug with their feet in places protected by rocks or bushes, but also in the open if no such places are available. Generally, they prefer to rest in places from which they are able to survey their surroundings well. In Egypt, at high ambient temperatures they may seek shade near overhanging cliffs (Osborn and Helmy, 1980) as they also do in southern Sinai, where they dig their resting pits in the shade of the cliffs (Mendelssohn, unpubl. data).

Dorcas gazelles feed on leaves, flowers and pods of various *Acacia* trees (*A. raddiana*, *A. tortilis*) and on leaves, young twigs and/or fruits of several species of bushes. They prefer *Astragalus vogelli*, *A. spinosus*, *Crotalaria aegyptia*, *Eragrostris bipinnata*, *Nitraria retusa*, *Ochradenus baccatus*, and *Zizyphus spina-christi*, but also eat *Argyrolobium saharae*, *Convolvulus tanatu*, *Farsettia ramosissima*, *Hippocrepis contricta*, and *Trichodesma africanus*. Rarely, they feed on salt plants such as *Anabasis articulata*, *Atriplex halimus* and *Suaeda* sp., and were observed feeding on *Alhagi maurorum* (Baharav, 1980, 1982; Carlisle and Ghobrial, 1968; Osborn and Helmy, 1980; H. Mendelssohn, in litt.). They sometimes browse on trees while standing on their hind legs, similar to the gerenuk (*Litocranius walleri*—Shalmon, 1987). After rains they graze on annuals and have been observed digging out bulbs of geophytes (Mendelssohn and Yom-Tov, 1987). The importance of *Acacia* trees for gazelles is reflected also in their population density: five individuals per km^2 where there are many *Acacia* trees, compared with 0.09 individuals per km^2 in areas without *Acacias* (Baharav, 1980).

In the southern Negev in spring, gazelles spend 2–8 hours a day browsing and grazing, and during this time may walk as far as 12 km. The time they spend in a particular feeding area depends on food availability. During winter and spring, when green food (annuals and leaves of bushes) is abundant, they spend up to 40 min in one area, but much less during summer (Baharav, 1980). The time spent in each area is also a function of group size; the larger the group the less time it spends in each area. This is due to aggressive interactions between the females in the group (Baharav, 1982).

In Israel, *G. dorcas* can live without drinking water provided they get moisture from the food. The high water content of *Acacia* leaves, bulbs, and even dead annuals (at night and early morning) is sufficient, and *Acacia* leaves are the primary summer food (Baharav, 1980). However, when water is available they may drink, as they do in desert oases and at other water sources (Osborn and Helmy, 1980). They can drink up to 10% of their body mass per day (Ghobrial, 1974). Meinertzhagen's (1954) observation that gazelles drink sea water was contradicted by Ghobrial's (1976) experimental results, which showed that "gazelles do not voluntarily imbibe sea water to any great extent, even when deprived of fresh water". However, when sea water was diluted 50% and 25%, animals maintained their original weight. Dorcas gazelles normally avoid eating halophytic plants, probably because they would need extra water in order to excrete the salt ions (Ghobrial, 1976).

Gazelles are hunted by the cheetah (*Acinonyx jubatus*, leopard (*Panthera pardus*, lion (*Panthera leo*—these three predators were largely exterminated throughout the range of the species), serval (*Felis serval*), caracal (*Felis caracal*), wolf (*Canis lupus*), and hyaena (*Hyaena hyaena*). Fawns might be taken by smaller cats (*Felis* spp.), ratel (*Mellivora capensis*), jackal (*Canis aureus*, *C. mesomelas*), foxes (*Vulpes* spp.), and eagles (*Accipitridae*—Haltenorth and Diller, 1980), and even adults are attacked by eagles (Hufnagl, 1972). In Israel, the main predators are, apart from humans, caracals and wolves. When agitated, *G. dorcas* react by tail twitching and later by holding the tail upright (Aldos, 1986), skin shivering, and bouncing leaps with head high (stotting and galloping—Walther, 1966).

Notwithstanding the fact that in many areas large predators of gazelles were exterminated, *G. dorcas* populations in most of their range are in danger due to overhunting; they were largely exterminated in the Atlas area, Arabia, and the Near East (Haltenorth and Diller, 1980). A recent survey in Egypt revealed that hunting and habitat destruction caused their disappearance from much of Egypt (Saleh, 1987). In Libya, despite legal protection, populations have declined through hunting, but there is also a captive breeding program (Hufnagl, 1972). In the Sudan hunters take advantage of gazelle concentrations during migrations to kill them in large numbers (Ghobrial, 1974). In Israel, dorcas gazelle populations were almost exterminated by military poaching between 1956–1963 (Mendelssohn, 1974), but quite effective protection from poaching by Bedouin and army personnel was followed by an average annual increase of 7% during 1964–1985 (Yom-Tov and Ilani, 1987); this increase has slowed recently, probably due to caracal and wolf predation. The population in the Arava and southern Negev Desert was estimated to number 1500 in 1985 (Yom-Tov and Ilani, 1987). The gazelles increase wariness if poaching is occurring.

Captive inbred populations show high mortality of young due partly to low resistance of the young to infections (Ballou and Ralls, 1982). No seasonality was observed in sperm production or in hormonal concentrations of captive males (Howard et al., 1983). Food availability and predation are correlated with the reproductive success of gazelles. In areas with much food (i.e., *Acacia* trees and bushes) average reproductive success was 0.24 fawns per mature female per year, compared with 0.16 fawns per female in relatively poor feeding areas (Baharav, 1983). The high mortality of fawns in 1964–85 resulted in a relatively low mean annual growth rate of 9% for *G. dorcas* populations in rich areas of the southern Negev and Arava in Israel, whereas in poor areas it was 3% (Yom-Tov and Ilani, 1987). Longevity in captivity is up to 15 years, somewhat more than that of the mountain gazelle (Mendelssohn and Yom-Tov, 1987).

Necrotic stomatitis, associated with serum-negative bacteria including *Pasteurella multocida*, was recorded in Al Ain Zoo, United Arab Emirates; if not too seriously affected, the gazelles were successfully treated with intramuscular oxytetracycline at 20 mg/kg body weight every 3 days (Furley and Wardman, 1985). *Strongyloides, Trichurus*, and other gut helminths occur in wild gazelles (Hufnagl, 1972).

Antibodies of bluetongue and parainfluenza virus (P13) were not found in captive *G. dorcas*, unlike many other gazelle species; on the other hand, antibodies to malignant catarrhal fever (MCF) occurred, and three animals infected with mucosal disease (bovine viral diarrhea) all died (Furley, 1985).

BEHAVIOR. Gazelles have few calls. The alarm call sounds like a short bark (Flower, 1932), but perhaps it is better described as a short, loud snort. The "annoyed" call sounds like a long growling "rooo" (Haltenorth and Diller 1980). Females produce a low grunt to call the fawn. A loud bleating call is produced in extreme danger and pain (Mendelssohn and Yom-Tov, 1987).

In extreme desert conditions *G. dorcas* lives in pairs but where grazing is favorable lives in family herds consisting of an adult male and several females and young. Herds of 5–12 individuals are not uncommon in wide wadis with many *Acacia* trees and bushes in the southern Negev Desert (Baharav, 1980), and herds of 2–8 in suitable areas in Libya (Hufnagl, 1972). Herds of up to 100 animals during migration were noted by Haltenorth and Diller (1980), and Hufnagl (1972) states that large concentrations build up at the beginning of the cold season in Libya. *G. dorcas* may associate with the dama gazelle (*G. dama*) and grazing camels (*Camelus dromedarius*). Herd composition is determined largely by the distribution and abundance of food. After rains they tend to disperse on wide plains and graze on annuals, whereas during dry summers they concentrate in wide wadis where bushes and trees provide green food and shade.

In the Sudan gazelles migrate in summer from the west to the Nile Valley, whereas gazelles inhabiting the region of the Red Sea hills migrate to the coastal plain of the Red Sea in winter. Both migrations reflect the need for water and food (Ghobrial, 1974).

During the mating season an adult male may guard a small (several hundred m^2) territory, threatening or attacking approaching males. The territory is marked by concentrations of droppings and urination at permanent spots. Territorial males are found in areas with good grazing and may guard territories throughout the year, with maximum activity during the principal periods of sexual activity, April–November in western Libya (Essghaier and Johnson, 1981) and September–November in the Arava, Israel (Mendelssohn, pers. obs.). Dung heaps are scattered throughout the territory rather than along its border (Essghaier and Johnson, 1981). They do not mark with secretion from the preorbital glands that are quite small, but appear to use interdigital and frontal glands by digging in dung heaps and rubbing the base of the horns against trees and bushes, respectively (authors' unpubl. data).

Bachelor herds consisting of 2–5 males were observed in the southern Negev and Arava. In these areas *G. dorcas* spent the day grazing and browsing in the wide wadis, but at night stayed in the foothills nearby or on the wide hammada (reg) plains. They prefer to bed down for the night on the hammada plateaus from where they have a good view of the surroundings and can detect approaching predators. A harem consisting of 1–4 females and young accompanied by an adult male has a home range of 25 km^2 there (Baharav, 1980).

GENETICS. The diploid number of chromosomes is 31 for the male, and 30 for the female. The karyotype of *G. dorcas*, like that of *G. gazella*, has an X-autosome translocation; all autosomes are metacentric, but the Y is a small acrocentric (Effron et al., 1976). *G. saudiya*, formerly referred to this species (Groves, 1981) has a distinctive karyotype (Rebholz et al., 1991).

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Editors of this account were ELAINE ANDERSON, J. ALDEN LACKEY, and KARL F. KOOPMAN. Managing editor was JOSEPH F. MERRITT.

Y. YOM-TOV AND H. MENDELSSOHN, DEPARTMENT OF ZOOLOGY, TEL AVIV UNIVERSITY, RAMAT AVIV 69978, ISRAEL; C. P. GROVES, DEPARTMENT OF ANTHROPOLOGY, AUSTRALIAN NATIONAL UNIVERSITY, GPO BOX 4, CANBERRA 2601, ACT, AUSTRALIA.