Camelus dromedarius.

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Published 12 April 1991 by The American Society of Mammalogists

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Camelus Linnaeus, 1758


*Dromedarius* Gloger, 1841:xxxiii. Type species *Dromedarius afericanus* Gloger, 1841, by monotypy.

**CONTEXT AND CONTENT.** Order Artiodactyla, Suborder Tylopoda, Family Camelidae, Subfamily Camelinae, Genus *Camelus.* A key to the species of *Camelus* follows:

| One dorsal hump, pelage short | *C. dromedarius* |
| Two dorsal humps, pelage long and shaggy in winter | *C. bactrianus* |

*Camelus dromedarius* Linnaeus, 1758

Dromedary

*Camelus dromedarius* Linnaeus, 1758:65. Type locality “Africea.”

*Camelus dromas* Pallas, 1811:19. Type locality “Persiae parte australiore.”

*Camelus arabicus* Desmoulins, 1825:452. Type locality “Caucasus, Afrique.”

*Dromedarius africanaus* Gloger, 1841:134. Type locality “Nordafrika, Süden Asiens bis nach Indien hin.”

**CONTEXT AND CONTENT.** Context noted in generic summary above. The species is monotypic.

**DIAGNOSIS.** *Camelus* differs from *Lama* in being humped and having a shoulder height >1.7 m (Fig. 1). It has smaller, rounded ears, almost square feet, a longer and tufted tail, four teats (two in *Lama*), and three upper premolars (two in *Lama*; Simpson, 1984).

Dromedary and *C. bactrianus* digest in their adaptations to temperature extremes: The dromedary is extant in hot deserts and has a lighter frame, longer limbs, and shorter hair than *C. bactrianus,* which is better adapted to withstand low temperatures.

The cranium of the dromedary has a more pronounced sagittal crest, an indented nasal bone, a longer facial part and hard palate, and a smaller or absent ethmoidal fissure compared to the Bactrian camel (Leche, 1904; LeSueur, 1903). Because both camels have been subject to selective breeding control, much genetic variability exists and traits may overlap (Fig. 2).

The length of gestation is usually <400 days in the dromedary, whereas it exceeds this period in the Bactrian camel. The inflation of the soft palate during rut appears to be a trait unique to the dromedary (Pillers, 1956).

**GENERAL CHARACTERS.** Male dromedaries have a shoulder height of 1.8–2.0 m (height of hump is 20 cm more) and mass is 400–600 kg. Females are about 10 cm less in height and about 10% less in mass than males. Body shape is characterized by the long-curved neck, deep-narrow chest, one hump on the back,

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Fig. 1. Adult male *Camelus dromedarius* from Petra area of southern Jordan.

Fig. 2. Dorsal, ventral, and lateral views of cranium, and lateral view of mandible of *Camelus dromedarius* (Anatomical Museum, Veterinary Department, University of Brussels, no catalog number). Condyle-basal length is 469 mm.
long-thin legs, and broad-padded feet. The head is small in relation to body size, and the ears are large and protected by prominent supraorbital ridges. There are slit-like nostrils, a split upper lip, and a prominent lower lip. The upper, lower, and inner incisors are replaced by a tough dental pad, and the canines, especially the upper ones, are massive and pointed. The hindquarters are much less developed than the weight-bearing front legs (Wilson, 1984).

**DISTRIBUTION.** Domesticated dromedaries occur in the semi-arid and arid regions of the Old World, and a sizeable feral population exists in central Australia (Fig. 3). The population of camels in the world (including both dromedaries and Bactrian camels) numbers around $1.72 \times 10^6$ of which $1.28 \times 10^6$ live in the northern parts of Africa. All African camels are dromedaries; 84% of these occur in Somalia, Ethiopia, Sudan, Djibouti, and Kenya. Somalia ($5.7 \times 10^6$) and Sudan ($2.5 \times 10^6$) are the countries with the greatest densities of dromedaries. The southern limit of dromedaries that breed in Africa is determined by the degree of humidity and the occurrence of trypanosomiasis; the limit is demarcated by the 400-mm isohyet, following 15°N from Senegal to Niger and 13°N in Chad and Sudan. Only in the Horn of Africa do dromedaries exist as far south as 2°S where rainfall may be up to 550 mm/year. The 4.16 × 10^6 camels in Asia include a significant number of Bactrian camels; dromedaries occur from Turkey to the western parts of India, ranging as far north as Turkmenistan or 45°N (Food and Agriculture Organization, 1984).

Dromedaries were exported to the Canary Islands in 1405; their populations survive there today. Between the 17th and 19th centuries attempts were made to introduce the dromedary to the Caribbean, Peru, Bolivia, Colombia, and Brazil; they were imported to the western United States in the 1850s and to Namibia in the early 1900s, but in none of these places do dromedaries exist today (Leese, 1927). The Australian population, dating back to about 1860, was estimated to number between 15,000 and 20,000 in 1969 (McKnight, 1969).

**FOSSIL RECORD.** The earliest camelid, the jackrabbit-sized *Protylopus*, occurs in the Upper Eocene of North America (Scott, 1924). During the transition from the Pliocene to the Pleistocene, members of the genus *Camelus* migrated across the Bering Strait and dispersed widely in Asia, eastern Europe, and Africa. The oldest remains, *C. xerulentus* and *C. antiquus*, are present in the Pinjar Formation of the Swan Hills in India (Colbert, 1935). The subspecies *Paracamelus* retains an additional pair of lower premolars and is reported from western Siberia, China, near the Sea of Azov, and the northern coast of the Black Sea (Howell et al., 1969). In the Near East, camel remains date to 600,000 years ago in Ubediya in the Jordan Valley (Haas, 1966). In Africa, *Camelus* ranged as far south as Tanzania during the Pliocene (Gentry and Gentry, 1969).

**FORM AND FUNCTION.** Dromedaries most often are sand colored, but all shades of brown ranging from almost black to nearly white occur. Piebal specimens with mouse-colored necks and backs, white bellies, faces, and legs are known from Kordofan and Darfur in Sudan (Leese, 1927). Hairs are longer on the throat, shoulder, and hump, and they are arranged in clusters consisting of two to three cover hairs and two to five groups of wool hairs. Each cover hair has a separate follicle and is associated with a ring of sebaceous glands, a tubular sweat gland, and an arrector pili muscle (Dowling and Nay, 1962; Lee and Schmidt-Nielsen, 1962). The black skin is tightly attached to underlying tissues and modified into horny pads at the sternum, elbows, carpals, stifles, and tarsals. The epidermis is 0.038-0.064 mm thick; the dermis is 2.2-4.7 mm in thickness (Gohbrial, 1970). Dromedaries do not sweat until they have reached the upper limits of their heat storage and their body temperature has surpassed 42°C (Yagi, 1985). The sweat evaporates from the skin rather than the tips of the hair, which also reduces water loss; in desert animals the water expenditure is about 50% greater than in unshorn ones (Schmidt-Nielsen, 1964).

The hump consists of fat bound together by fibrous tissue and stores fat for times of need; its size and shape vary with the nutritional status of the animal and it almost disappears in times of starvation. The accumulation of all body fat in one area, instead of the subcutis, also facilitates dissipation of heat (Macfarlane, 1977).

There are no face glands, but males have well-developed ocipital glands situated 5-6 cm below the nuchal crest on either side of the midline of the neck. They appear to be modified apocrine sweat glands and secrete a pungent coffee-colored fluid during the rut. The gland masses increase during rut and with age, ranging from 20 to 115 g in uncastrated animals (Singh and Bharadwaj, 1978).

The feet are pad-shaped and equipped with two dorsal nails; the two terminal pairs of phalanges and a cushion of semi-fluid fatty pads and elastic tissue are encased by collagen layers and a thick rubbery epidermis. The front feet (18 cm long, 19 cm wide) are larger than the hind feet (16 cm long, 17 cm wide; Gaulther-Pillers and Dagg, 1981). Exceedingly adapted to sandy desert, the feet can easily be injured by sharp stones and are unsuitable in slippery or muddy conditions.

The mammary gland is composed of four quarters and divided into a left and right half by an intermammary ridge. The cone-
shaped, laterally-flattened teats have an average length of 2.4 cm and an average diameter of 1.5 cm at the base. No supernumerary teats were seen in 200 udders, but other mammals possess two. Each teat has a common nipple composed of two radiating, spine-like papillae; teats are white to yellow in color. The teats are situated on the udders, and the udder consists of two symmetrical halves. The udder contains the teats, which are oval in shape and have a rough texture. The teats are connected to the teat orifice by a duct known as the teat canal. The teat canal is a narrow tube that leads from the teat orifice to the mammary gland. The mammary gland is a complex organ that produces milk. Milk is produced by specialized cells called alveoli, which are connected to the ducts leading to the teats. The milk is then transported to the teats by the teat canals. The teat orifice is the opening through which milk is released. The teat orifice is usually located at the base of the teat. The udder is a large, fleshy organ that is located in a pocket of skin and fat called the inguinal pouch. The udder is composed of several lobes, each of which contains its own set of teats and ducts. The udder also contains a network of blood vessels and nerves, which provide nutrients and oxygen to the teats and ducts. The udder is connected to the rest of the body by a series of muscles and ligaments, which allow it to change shape and position as needed. The udder is a highly specialized organ that is essential for the survival and reproduction of mammals.
yellow, usually disc-shaped, and bilobate. The bulbourethral gland is almond-shaped and white; there are no seminal vesicles. The ampullary glands are absent in length (El-Raouf et al., 1972). The pelvic part of the urethra is spindle shaped and about 14.5 cm in length. The penis is covered by a triangular sheath that opens backwards; it is about 60 cm in length with a transverse hook-shaped gland that is well separated from the body (Wilson, 1984).

**ONTogeny and Reproduction.** Under most circumstances males and females are seasonal breeders. The breeding season usually occurs in winter, often overlapping the rainy season. The exact factors leading to the onset of rut and estrus are not known, but nutritional status and length of day are likely to be involved. In Morocco, males rut from mid-December to May (Charnot, 1963); in Egypt, from March to April (Abdel Raouf and El- Naggary, 1964); in India, from November to February (Singh and Prakash, 1964); and in Australia, from June to September (Mc Knight, 1969). In countries close to the equator, two breeding seasons occur; for example, in Somalia during June and from September to November (Hartley, 1984; Leese, 1927). In Saudi Arabia (Arthur et al., 1985) and Kenya (Wilson, 1986), males may be capable of mating and fertilizing throughout the year; spermatogenesis is continuous throughout the year (Osame and Plien, 1986).

Follicular activity is present all year, but it peaks during certain periods, usually during winter and spring (Navar et al., 1978). Ovulation is induced by mating and occurs within 30–40 h afterwards (El-Raouf et al., 1984). Estrus may cease 3 days later (Arthur et al., 1985). If no mating occurs, estrus lasts up to 2 weeks. In a study of five unamed dromedaries from Sudan, length of cycle averaged 28 days; the follicle matured within 6 days, maintained its size for 13 days, and regressed over 8 days (Musaa, 1984). The length of the cycle varies seasonally in Egypt; it is longest in spring and shortest in summer (Navito et al., 1976). The optimal time for mating is during the first 2 days of estrus; in India, conception required an average of 1.9 copulations on the first day, 1.8 on the second day, and >2 on the last 3 days (Gupta et al., 1978).

Ovaries are greatly developed and hyperplastic in the production of follicles. Twin ovulation had occurred in 14% of pregnant females in Saudi Arabia (Arthur et al., 1985). In 482 pregnancies, 99% of the fetuses were situated in the left horn. Egg migration appears to be frequent, for in 50% of left-horn pregnancies, the corpus luteum was in the right ovary. Although twin ovulations occur, twin pregnancies are reported only in 0.4% of cases (Musaa, 1984). Leese (1927) never found twin births.

In Kenya, pregnancy lasts 360–411 days (average, 377 days; Wilson, 1986). The average length of pregnancy in India is 390 days (Musaa, 1984). It is usually significant with sex of calf or sex of prevalence of calving (Mehata et al., 1962; Wilson, 1986), and it is highly inheritable (Ram et al., 1977).

Up to a crown-rump length of 50 cm, posterior and anterior positions of the fetus in the uterus are of the same frequency, but at a crown-rump length of 61–70 cm anterior positions are the rule. During the last 8 months of pregnancy most fetuses lie on their right side. The total quantity of fetal fluid is about 9 l, of which 80–90% is allostatic fluid; there is never >1 l of amniotic fluid (Musaa, 1984).

The normal calving interval is 2 years, although in countries with two breeding seasons two calves may be produced within 2.5 years if conditions are favorable. In Kenya the mean interval was 20.2 months. Females successfully rearing calves had a significantly longer interval than others (Wilson, 1986). In Kenya, estrus occurred 4.5–10 months after parturition, but in one instance a non-lactating female attained the estrous condition within 109 days (Evans and Powys, 1984).

In India, the mean mass at birth is 37.3 kg (26.4–52.3 kg), and males do not weigh significantly more than females. For male young, the average height at the hump was 123 cm, for female young, 115 cm (Bharagava et al., 1963; 1985). In Tunisia, mass at birth averages only 25.8 kg (Burgmeister, 1975).

Overall, there is a high rate of egg and early embryonic death: abortions and stillbirths occur in 18.2% in Somalia and 19.5% of pregnant females in Mali (Wilson, 1984). In Sudan, the annual calving rate drops from 35 to 40% (Breghava et al., 1985).

Spontaneous motor patterns of the young after birth (in min): chewing, 10; grinding teeth and head shaking, 18; shifting on the ground, 74; “vacuum activity sucking,” 100; kicking, 156; yawning, 160; urinating, 185; tail beating, 198; rubbing neck against mother, 294; body shaking, 304; rolling on the ground at 85 h. First attempts at standing are made at 10 min; standing for a few seconds at about 90 min; uncoordinated steps at 3.5 h; fairly regular steps at 5 h. First successful sucking occurs nearly 5 h after birth; scratching movements, suckling, and nibbling at objects and vegetation are performed during the first day of life. On the second day, calves drink urine and urinate at regular intervals, jump around, but spend most of the time resting (Gauthier-Filatov and Dagg, 1981).

Growth rates depend on maternal milk supply and the proportion of milk allocated to the young. Dromedaries kept by pastoralists often are fed only a small amount of their mother’s milk yield, resting at growth rates of 0.15–0.31 kg/day over a 1-year period compared with 0.44–0.58 kg/day in calves that can suckle ad libitum (Field, 1984).

In free-ranging herds, young stay with their mothers until they are 2 years old (Gauthier-Filatov and Dagg, 1981); dromedaries in Somalia are weaned by pastoralists at the age of 9–11 months by the mother’s feeding behavior (Field, 1984). In young with free access to their mother’s milk, weaning slows down growth (Hartley, 1984).

Females reach sexual maturity in 3 years and usually are mated for the first time at 4–5 years; they reproduce until 20 (Musul, 1928) or 30 years (Yasin and Wahid, 1957). In Kenya, the age at first parturition was 45.6–71.3 months (average, 54.2 months; Wilson, 1986). Males start rutting by 3 years, but are not fully active until 6–8 years old (Hartley, 1984; Novoa, 1970). The number of spermatocytes increases until 10 years of age, and the diameter of the seminiferous tubules until 9 years of age (Abdel Raouf and El-Naggary, 1965). One male serves about 40 females, but occasionally up to 100 and remains in service for 7 years (Hartley, 1984) or until 18–20 years of age (Leese, 1927). The maximum age for both males and females is 40 years (Gauthier-Filatov and Dagg, 1981; Wilson, 1984).

**ECOLOGY.** Dromedaries have been extinct in the wild for about 2,000 years. Except for the feral dromedaries in Australia, all herds thereupon are by human exploitation and are subject to the subject of much human manipulation (Köhler, 1981).

Of 205 young born in India, 16.1% died before 6 months of age and another 3.4% did not survive until the age of 3 years (Bharagava et al., 1963). In Kenya, pre-weaning deaths average 14% (Wilson, 1986). Because of the long calving intervals and high infant mortality, the maximum annual growth rate of a dromedary herd has been calculated at 8%. In some pastoral societies male young may be killed at birth to retain all of their mother’s milk for human consumption. Males used for work purposes usually are castrated at 4–6 years of age (Dahal and Hajet, 1976).

Dromedaries are found only in areas with a long dry season and short rainy period; they are sensitive to cold and humidity (Wilson, 1984). Dromedaries primarily are browsers, with shrubs and forbs composing as much as 70% of their diet in winter and 80% in summer. They also graze, “sucking up” grass and succulents with a “vacuum cleaner like technique” (Newman, 1984:253). The 332 forage plants that have been recorded for the dromedary include Aristida pungens, Acacia tortilis, Panicum turgidum, Launaea arborescens, and Balanites aegyptiaca in the Sahara (Gauthier-Pilato, 1984). Feral dromedaries in Australia favor Trichodesma zeylanicum and Euphorbia tannensis; forage plants fed to dromedaries in India include Figna acnutifolia, V. foggii, Cyanopsis tetragonoloba, Melilotus parviflora, Euclea sativa, Trifolium sp., and Brassica campestris. Regardless of area, Acacia, Atriplex, and Salsola are common in the diet (Reidman, 1984).

Food intake in relation to body mass is low. About 5–10 kg of dry matter are sufficient to perform a day’s work of carrying 120 kg over 30 km, but dromedaries can live on 2 kg of dry matter for limited periods. Under lush conditions they tend to eat beyond their immediate needs and store this in their hump (Gauthier-Pilato, 1984).

Dromedaries need about six to eight times as much salt as other animals and one-third of their food intake must be from halophytes, such as Tragana nudatum, Atriplex halimus, Nuxalnia peruviana, and Anabasis aristoides. In the absence of this, 45–60 g of salt has to be substituted (Leese, 1927), as salt is important for alimentary absorption of water (Yagli, 1985) and salt deficiency leads to cutaneous necrosis and cramps (Peck, 1939).

Although even small amounts of grain may lead to indigestion
in animals not accustomed to it, the diet of working dromedaries must be supplemented with about 2 kg of grain/day (Leese, 1927). Dromedaries also can utilize a wide variety of agricultural feeds, by-products, and human waste (Knoes, 1984).

The most important parasitic disease is trypanosomiasis caused by Trypanosoma evansi, T. brucei, T. congolense, and T. simiae; it is transmitted by Glossina sp. and various Tabanidae. Manifested by weakness, recurrent fever, and anemia, it usually ends in death. Other internal parasites include the endoparasites Fasciola gigantica, cestodes (Echinococcus polynymphus and Toenia marginata), and nematodes (Trichuris, Nematodirus, Strongyloides, Haemonchus, and Onchocerca). Among external parasites, the mange mite Sarcoptes scabiei is of economic importance. The flea Xenopulex alaktur and ticks, such as Rhipicephalus, Amblyomma, and H. aloloma, cause physical irritations. Larvae of the camel nasal fly Cephalopsia tiliator can cause brain compression, nervous disorders, and death. Other illnesses with an impact on dromedary productivity are: pyogenic diseases and wound infections with Corynebacterium and Streptococcus; pulmonary affections caused by Pasteurella (hemorrhagic septicaemia) and Rickettsia; camelpox caused by an orfie virus; anthrax, an infection with Bacillus anthracis; and cutaneous skin necrosis caused by Streptococcus sp. and lactic salt in the diet (Curasson, 1947; Richard, 1984; Wilson, 1984).

As a means of communication and transport, dromedaries have played a significant role in human history. Their potential to provide milk and meat under extremely arid conditions has enabled humans to inhabit otherwise unexploitable deserts. Today, dromedary husbandry is increasingly recognized as an ecologically-sound method of producing protein-rich food in drought-stricken areas (Köhler, 1981).

The earliest tentative evidence for domestication of dromedaries comes from archaeological sites on a small island off the Abu Dhabi coast, where camel bones and two stelae depicting dromedaries dating to about 4,000 years ago were unearthed (Hoch, 1979). By about 3,100 years ago, northern Arabian tribes had adopted the dromedary as a riding animal and made use of it on raids. By about 2,000 years ago, dromedary caravans transported incense from southern Arabia to the Mediterranean Sea. Trade along the Silk Route started about 2,000 years ago. Although at first both dromedaries and Bactrian camels were employed, the Parthians soon started breeding hybrids that proved to be superior beasts of burden (Bullet, 1975). Rockdrawings of dromedaries hunted by boarsmen are known from the Arabian peninsula; dated to about 3,000 years ago, they provide the most recent evidence for wild dromedaries (Köhler, 1981).

Dromedaries can produce large quantities of milk under intensive and semi-intensive conditions and the milk production is high (Newman, 141). The milk production is about 6 to 8 liters per day, and the fat content is about 3.5 to 4.5% (Knoes, 1984). Dromedary milk is white and froths when shaken. The specific gravity is 1.0305, the pH is 6.5–6.7, and it contains 70 cal/100 g (Shalash, 1984a). Four liters provide the caloric requirements of one adult and 1.8 l meets the protein needs (Dahl and Hjort, 1976).

Dromedaries are systematically exploited for milk in large dairy farms in the Soviet Union, especially in Turkestan, Kazakhstan, and Turkmenistan, where they are kept in herds of 3,000–5,000 animals (Dahl and Hjort, 1976; Gauthier-Pilters and Dagg, 1981). Attempts at large-scale dromedary milk production also have been made in Pakistan (Knoes, 1984). The acidity of dromedary milk stored at 30°C increases more slowly than that of Bos taurus milk with little change in taste. Converting milk into butter can be difficult, but is successfully practiced in the U.S.S.R. where the cream of milk with a fat content of 4.2% yielded 25.8% butter (Kullie, 1959). Dromedary milk has been evaluated through interviews (Ramet, 1987), and can be stored as curds (Shalash, 1984a). In India, dromedary milk is ascribed certain therapeutic effects and used to cure jaundice, spleen trouble, dropsy, tuberculosis, and asthma (Knoes, 1984).

Pastoralists themselves rarely eat dromedary meat and reserve slaughter for ritual occasions and food shortages. The main dromedary exporting countries are Sudan and Somalia. Sudan yearly exports about 60,000 dromedaries to Egypt, 10,000 to Libya, and an unidentified number to Saudi Arabia for slaughter (El-Amin, 1984). Dromedary meat resembles beef in taste, but contains less fat. The meat of dromedaries older than 5 years contained a mean of 76.2% water, 22.0% protein, 1.0% fat, and 0.9% ash. The mean carcass mass is 208.5 kg (141.0–310.0 kg). The dressing percentage is 55–70% (Shalash, 1984a).

Bleeding live dromedaries is common among some dromedary herders in East Africa, such as the Turkana, Rendille, Gabbraba, and Sakuye Borana (Dahl and Hjort, 1976). The annual blood yield from one dromedary can be as much as 33.3 l (Schwarz, 1984).

Wool and skins are by-products. An annual yield of 3 kg of wool for younger animals and 2 kg for older animals is reported from Tunisia (Burgemeister, 1975), but dromedaries in the Sudan produce only 1.5 kg/animal. Dromedary wool is used to make blankets, robes, and tents. Dromedary leather is used for saddles, whips, and saddlery (El-Amin, 1984).

Dromedaries are used as riding animals and beasts of burden and also for traction; they pull carts and ploughs, and provide power for oil mills and wells (Wilson, 1984). They played an important role in military history, and the Romans, British, and French had dromedary corps in Africa. In nomadic societies, dromedaries carry women and children during migration. Riding dromedaries travel at a speed of 65–80 km/day over a period of 2 weeks (Gillespie, 1962). Larger daily distances can be covered, up to 144 km in 1 day or 224 km over 2 days, but dromedaries require adequate rest periods. In a dromedary race in Saudi Arabia, the winner covered 22 km in 45 min (El-Amin, 1984). Pack dromedaries move at a pace of 2–3 km/h and usual loads are around 200 kg, but frequently 400 kg or more are transported over long distances. For ploughing, dromedaries are often harnessed together with oxen or donkeys, although one dromedary is supposed to be more efficient than a pair of oxen, able to plough 1 ha in 20 h (Wilson, 1984).

BEHAVIOR. Dromedaries that are allowed to roam without supervision form stable groups of 2–20 individuals (Gauthier-Pilters and Dagg, 1981). The basic social unit is the family group consisting of one male, one to several females, subadults, and young. Surplus males are solitary or form bachelor herds (Klingel, 1985). Of 28 herds studied in Algeria, 13 consisted of males, females, and young; six of males and females without young; five of females and young; and four of males only (Gauthier-Pilters and Dagg, 1981). In Turkmenistan, herds include one male and 10–15 females with young, or males only (Baskin, 1974). During studies in Australia, no spontaneous changes of group membership were recorded. Family groups tend to stay by themselves, but they may coalesce to larger groups when disturbed (Klingel, 1985). During droughts, herds of up to 500 were observed in Australia (McKnight, 1969). Dromedaries graze for 8–12 h/day and spend an equal amount of time ruminating. They move many times a day, especially when vegetation is poor, split up into groups of one or two. In guarded herds they rest at night and feed during the day, lying down during the hottest hours of the day. Herds allowed to graze at night rest during daytime (Gauthier-Pilters, 1984).

The feral dromedaries in Australia are not territorial and do not monopolize a particular area or resource. Short-term home ranges are 50–150 km², and annual home ranges are estimated at several thousand km² (Klingel, 1985).

Dromedaries browse up to a height of 3 m. They grasp the food with their lips and chew each bite 40–50 times, occasionally changing from one side of the jaw to the other. If the food is thorny, the mouth is kept open while chewing. They either break off branches or strip off the leaves in one movement (Gauthier-Pilters and Dagg, 1981).

In the Sahara, dromedaries often remain without drinking water from October to April or May, existing solely on the water content of the forage (Gauthier-Pilters, 1984). In temperatures of 30–50°C, they can go for 10–15 days without water, and only during the hottest temperatures of the year do they need to drink every 4–7 days. They take a large quantity of water, drinking at a speed of 10–20 l/min. The maximum quantity drunk in one session was 130 l (Gauthier-Pilters and Dagg, 1981).

Except for rutting males, there is little aggressive behavior. Gauthier-Pilters and Dagg (1981) never observed any quarrels among females, or between females and males, and only rarely between castrated males. Dromedaries push each other with their whole body or with lowered head and neck; they might snap at each other without biting. They do not deliberately spit, but they might vomit cud if hurt or excited (Gauthier-Pilters and Dagg, 1981).
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Males in family herds prevent contacts of their females with bachelor males by standing or walking between them and drive them away, even outside the breeding season. In family groups, the male is the dominant member of his group from the year he is born, while the females take turns in leading (Klingel, 1985). Dromedaries have a natural tendency to walk single file, especially when approaching wells (Gauthier-Pilters and Dagg, 1981).

Rutting males threaten each other by making themselves as tall as possible, uttering low noises, and displaying a typical sequence of lowering, lifting, and bending their necks backwards. Other elements of threatening behavior are teeth grinding with excessive salivation, inflation of the dulla, and rubbing the poll glands on the shoulders. When male dromedaries approach each other or females, they stop several meters apart, spread their hind legs, urinate on their tails and then flap these onto their backs. Males eager to fight move in circles, frothing at the mouth, and hold the chin near the ground. Fighting males try to bring their opponent to the ground by biting at his legs and taking his head between their jaws. They attack each other either from the front or from the side. One serious fight was observed in which two males unbalanced each other and then interlocked their necks; if they had not been separated by humans they would have suffocated (Gauthier-Pilters and Dagg, 1981).

Dromedaries develop attachments to their home areas and to places with which they have certain experiences; they return there over long distances. A dromedary returned to a herder in Timbuktoo (Mali) over a distance of 1,400 km after it had been sold (Gauthier-Pilters and Dagg, 1981). Similar observations were made in Australia (Bock, 1968). Female dromedaries tend to return to the place where they first gave birth (Gauthier-Pilters, 1984) or last suckled their young (Baskin, 1974).

Dromedaries have no special locations for defecating and urinating, and do not assume any particular postures for these functions. No marking behavior was observed in free-ranging dromedaries in the Sahara (Gauthier-Pilters and Dagg, 1981), but male dromedaries in Israel mark areas with secretions of their poll glands (Yagil and Etzion, 1980).

The most frequent comfort movement is scratching parts of the body with the front or hind legs, or with the lower incisors. The legs often are rubbed against each other or on trees. Dromedaries also like to roll in sandy places and form lines waiting for their turns (Gauthier-Pilters, 1984).

Dromedaries pace naturally. They walk at a speed of about 5 km/h or 40 strides/min; while pacing they can cover 7–25 km/h. They gallop only under exceptional circumstances (Dagg, 1974).

When lying down, dromedaries select smooth places. They go down slowly, first falling onto their carpals, then bending their hind legs, and finally settling down on their front quarters. They remain in this position until they are able to get up. They are good swimmers (Lesley, 1929).

The signs of estrus include restlessness, bleating, vulval swelling, and vaginal-mucus discharge (Arthur et al., 1985). Rutting males sniff at the female's genitals or excretions and subsequently display flehmen. Occasionally, they bite the female on the hump or vulva, utter low noises, and protrude the dulla, or rub the poll glands on their shoulders. Receptive females often spread their hind legs and present their genital regions while also urinating. On approach of a male, they rapidly move their tails up and down. During copulation, the female lies down in eternal recumbency. If she does not go down spontaneously, the male slides his nose along her head, neck, and back to her genital region and nuzzles his neck on her vulva; he might force her down with his neck, or bite her stiles. He mounts putting his frontlegs on either side of her shoulders, then sits on her with his sternum on her hump, while his hind legs are flexed and his stiles on the ground. Copulation lasts 7–35 min, averaging 11–15 min. The female ruminates during this time and might grunt or nibble at the male's neck, whereas the male often cries out, salivates, blows his dulla (Gauthier-Pilters and Dagg, 1981) or gurgles (Abed-Rauf and El-Naggar, 1964). Often, the rest of the herd forms a circle around the mating couple (Arthur et al., 1985).

Information on the duration of labor and delivery is not consistent; reported time spans vary from 302 (Sharma and Vyas, 1970) to 374 (Elias and Cohen, 1986) to 490 min (Musa, 1983) for the period between the first signs of discomfort and the expulsion of the allantochorionic sac. The first stage of labor is characterized by restlessness, frequent urination, and interruption of feeding. Some females lie on their sides and roll around. Signs of discomfort include moans and facial expressions of pain. In births observed by Elias and Cohen (1986), the cervix was completely dilated about 95 min after the first signs of discomfort, and straining occurred about 2–3 times/min after the head had appeared in the birth canal. Expulsion lasts about 30 min during which the dromedary adopts a sitting position. The nose of the fetus appears before the front feet; the whole body is expelled almost as soon as the head appears. Birth is relatively easy because the fetus is well lubricated and streamlined (Arthur et al., 1985). Expulsion of the allantochorionic sac occurs after another 30–65 min. The mother noses and nibbles her young, but does not lick it (Gauthier-Pilters and Dagg, 1981).

GENETICS. The diploid number of chromosomes is 74. The autosomes consist of 5 pairs of small to medium-sized metacentrics and submetacentrics and 31 pairs of acrocentrics (Hsu and Bemirschke, 1974). The X chromosome is the largest of the metacentric and submetacentric group. The karyotype is notably uniform, not only among C. dromedarius and C. bactrianus, but also among the Old World and New World Camelidae (Taylor et al., 1968).

For about 1,000 years, first-generation hybrids between dromedaries and Bactrian camels have been systematically bred in regions where they are sympatric (Turkmenistan, Iran, Afghanistan; Balliet, 1975). These hybrids are characterized by either a long hump with a slight indentation or a small and a large hump, and exceed their parents in size and strength; they are excellent work and pack animals. Another useful hybrid is the cross between a first-generation hybrid female and a male Bactrian camel, and a subsequent cross between a female of this type and a male Bactrian camel. Other types of hybrids are either bad-tempered or runts (Kolpakov, 1935).

The well-documented data from Turkmenistan contradict frequent statements in the literature (for example, Gray, 1972) that hybrid males are sterile. They also suggest that there is no genetic barrier between Bactrian camels and dromedaries, or if one exists, it is partial at best (Köhler, 1981).

LITERATURE CITED


El-Eis, E., and D. Cohen. 1986. Parturition in the camel (Camelus dromedarius) and some behavioural aspects of their newborn. Comparative Biochemistry and Physiology, 84A:413–419.


Editors of this account were Troy L. Best and Alfred L. Gardner. Managing editor was Don E. Wilson.

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