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Crossarchus obscurus.

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Crossarchus obscurus F. Cuvier, 1825

Cusimanse

Crossarchus obscurus F. Cuvier, 1825:3. Type locality Sierra Leone.

CONTEXT AND CONTENT. Order Carnivora, Family Viverridae, Subfamily Herpestinae. The genus *Crossarchus* contains four species: *C. obscurus*, *C. platycephalus*, *C. alexandri*, and *C. ansorgei* (Goldman, 1984). All four species are known by the same vernacular name. *C. obscurus* is monotypic.

DIAGNOSIS. *Crossarchus* is distinguished from other Herpestinae by its elongated snout, five upper cheekteeth, five digits on forefeet and hind feet, tail length shorter than head and body, sole of hind feet naked except last third near heel, ectotympanic bullae bulbous but much less inflated than entotympanic bullae, and uniformly colored pelage (Coetzee, 1977). *C. obscurus* is the only species of the genus occurring west of the Dahomey Gap. Within *Crossarchus*, *C. obscurus* is similar in size only to *C. platycephalus*, but with longer length of palate and tympanic bullae, shorter length of maxillary and mandibular toothrows and mandible, shorter depth of braincase and mandible, and overall narrower skull (Goldman, 1984).

GENERAL CHARACTERISTICS. Cusimanses are small mongooses with a slender body, short legs, relatively short tail, and elongated rostrum (Fig. 1). *C. obscurus* averages 510 mm in total length and 790 g in body mass. Significant secondary sexual dimorphism is not present (Goldman, 1984). The forelimbs are plantigrade; it is uncertain if the hind limbs are plantigrade or semidigitigrade. Digital, interdigital, thenar, and hypothenar pads of the forefoot and hind foot are well developed (Fig. 2). The tail tapers evenly from base to tip; ears are short and round; pupils are horizontally elongated ovals (Ewer, 1973); snout extends considerably beyond the lower lip; longitudinal groove on upper lip is absent; claws on forefeet are long, shorter on hind feet; there are six mammae. Ears are capable of closing by movement of posterior ridges and not superior ridge (Ewer, 1973). Paired anal scent glands are present in both sexes with external orifices on either side of the anus; between orifices are fine longitudinal ridges that pass into central depression of anal sac (Pocock, 1916*a*). A baculum has not been described but according to Haltenorth and Diller (1977) is similar to that in *Mungos mungo*.

Pelage color varies considerably (Goldman, 1984; Rosevear, 1974; Schlitter, 1974). The long bristly guard hairs on the dorsum and tail are brown, with terminal ends often lighter, giving a faint grizzled appearance; the fur on the head and face is short and lighter in color; the legs are blackish brown. The dense underfur is lighter than the dorsal guard hairs. No crest or pair of whorls of hair are present on the nape as in *C. platycephalus* and *C. alexandri* (Goldman, 1984).

The skull is long and narrow, and rostrum elongated (Fig. 3). The posterior margin of the palatine is evenly emarginated, a posteromedial spinous projection may be present in some specimens; shape of palatine is not considered diagnostic (Goldman, 1984).

Gregory and Hellman (1939) described the cheekteeth of *Crossarchus*: P4 wide, with short metastylar shearing surface, well-developed parastyle, and prominent and slender inner cusp; M1 wide, paracone and metacone subequal, buccally projecting parastyle and metastyle; M2 resembles M1; p3 with hypoconid projecting buccally; m1 with sharp trigonid, paraconid and metaconid well-defined, talonid widened; m2 small and well developed, trigonid low, paraconid not visible, talonid with basin and hypoconulid rim; P1 and p1 absent. The dental formula is i 3/3, c 1/1, p 3/3, m 2/2, total 36.

External measurements (in mm) of *C. obscurus* (Goldman, 1984) are: total length, 440 to 560; tail length, 146 to 210; hind foot length (c.u.), 60 to 73; ear length, 20 to 26. Body mass ranges from 454 to 1,000 g (Goldman, 1984).

Maxima and minima for selected skull dimensions (in mm) are: condylobasal length, 64.8 to 75.0; length of rostrum, 22.2 to 26.7; length of palate, 35.4 to 40.7; zygomatic breadth, 32.2 to 37.9; mastoid breadth, 27.0 to 30.4 (Goldman, 1984).

DISTRIBUTION. *Crossarchus obscurus* inhabits the high forest zone and associated riparian forests of Ghana, Ivory Coast, Liberia, and Sierra Leone (Fig. 4), and possibly Guinea (Goldman, 1984). Altitudinally, *C. obscurus* ranges from sea level to about 1,000 m (Bintamane Mountain, Sierra Leone). At present there is no record of *C. obscurus* east of the Volta River in eastern Ghana and western Togo forest. Specimens of *C. obscurus* have not been reported from the Dahomey Gap (savanna regions of Ghana, Togo, and Benin); this region possibly contributes to the restriction of gene flow between populations of *C. obscurus* and *C. platycephalus* (Goldman, 1984). The cusimanse is the most common mongoose in West Africa (Booth, 1960).

FOSSIL RECORD. Broom (1937) described *Crossarchus transvaalensis* on the basis of a right mandibular ramus from an early Pleistocene cave at Bolt's Farm, Transvaal, Republic of South Africa. The cheekteeth of *Crossarchus* and *Mungos* are similar (Gregory and Hellman, 1939), thus the assignment of this specimen to *Crossarchus* is somewhat doubtful. Savage (1978) noted that herpestid genera are difficult to distinguish from fossil material and listed early Pleistocene *Crossarchus* fossils from Olduvai Gorge I, Tanzania (*Crossarchus* sp.), and a tentatively assigned *C. transvaalensis* from Kromdraii, 2 km E Sterkfontein, Transvaal.

FORM AND FUNCTION. Martin (1834) described aspects of the general anatomy of a female cusimanse: the liver is tripartite; spleen flat, elongated, and narrow; pancreas with large transverse lobe; stomach muscular, with longitudinal striae along larger curvature, singularly contracted in midsection; small intestine without bands or sacculi; pointed caecum 25 mm in length. Kidneys with distinct cortical structures, tubuli terminate in one large conical papilla. The right lung has three lobes, the left two. The tongue is about 50 mm long, smooth at sides, covered with bristly papillae at center towards tip; at the base three isolated papillae form a triangle.

FIG. 1. Captive adult *Crossarchus obscurus* at the Department of Zoology, University of Toronto. Photo by author.

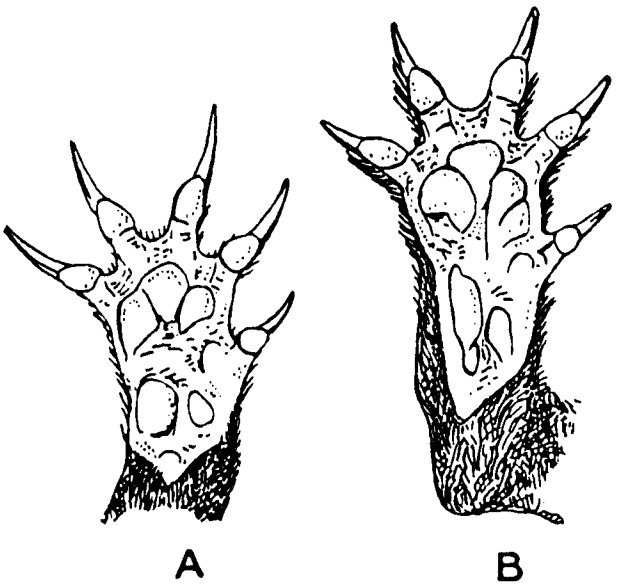

FIG. 2. Drawings of feet of *Crossarchus obscurus* from Pocock (1916*a*) showing: A, right forefoot from below; B, right hind foot from below, sole naked except portion near heel.

Thyroid glands are situated on each side of upper rings of trachea. Cheek glands at bases of the genal vibrissae are related to scent marking (Ewer, 1973) and are probably enlarged sebaceous glands, as in *Herpestes edwardsi* (Rensch and Dücker, 1959). The anal glands in *C. obscurus* probably are modified sebaceous and apocrine glands, as in *Herpestes auropunctatus* (Gorman et al., 1974). Brain size (weight) in *C. obscurus*, based on measurements of cranial capacity, is 9.78 g (Gittleman, 1986). Rioch (1931) described main myelinated-fiber connections and nuclear configurations of the thalamus and hypothalamus of *C. obscurus*: dorsal nucleus of lateral geniculate is small and lamination not distinct, ventral geniculate nucleus is large, and midline group of nuclei well developed with numerous commissural fibers.

The alisphenoid canal may be present or absent depending on the degree of ossification (Ewer, 1973; Pocock, 1916*b*). The foramen rotundum opens alongside the anterior orifice of the alisphenoid canal (Pocock, 1916*b*). Anterior portion of tympanic bulla has circular depression medial to external auditory meatus (Gregory and Hellman, 1939).

Ewer (1972) observed molting in a captive female obtained and reared in Ghana: shedding occurred throughout the year with distinct peaks in May-June and October-November, corresponding with the beginning and end of the rainy season (from May to October).

ONTOGENY AND REPRODUCTION. Females are polyestrous; when not pregnant a captive repeatedly came into estrus on nine occasions in 13 months (Ewer, 1972). Births in captivity have been recorded for all months of the year. Ovulation is possibly coitus induced. Parturition follows a gestation of approximately 8 weeks. Litter size ranges from two to four, usually four. A female *C. platycephalus* from Cameroon had five embryos (Eisentraut, 1963). Possibly two to three litters are produced per year by *C. obscurus* (Haltenorth and Diller, 1977).

At birth, young measure about 9 to 10 mm in head and body length and 3 mm in tail length; eyes are closed, body fully haired with underfur, rostrum is short, and forelimbs are large. Eyes open by day 12, captives eat solid food by week 3, and guard hairs are noticeable by week 5. Sexual maturity is attained at about 9 months (Haltenorth and Diller, 1977). Longevity in captivity has been estimated at 9 years.

ECOLOGY AND BEHAVIOR. Cusimanses are gregarious and highly social. *C. obscurus* is largely diurnal and forages in dense herbaceous undergrowth of the high forest, and in areas that result from the succession of high forest destroyed through cultivation (Rosevear, 1953). *Crossarchus* is unique among other social mongooses (*Helogale*, *Mungos*, *Suricata*) by inhabiting forest rather than primarily open habitats such as savanna, woodland, open grassland, and semi-arid bush (Rood, 1983). Cusimanses commonly are found near water (Aeschlimann, 1965) and are known to forage after dark (Ewer, 1973). *C. obscurus* forages individually or in family groups of as many as 20 or more individuals; groups possibly represent one to three family units, each with a mated pair and surviving young of two or three litters (Rosevear, 1974). Group foraging is thought to be well developed (Booth, 1960). When foraging, animals turn over small stones and pieces of wood, and scrape and root through leaf litter, while maintaining continuous vocal contact with the group (Ewer, 1973). Cusimanses may climb sloping trees when foraging (Booth, 1960; Dorst and Dandelot, 1969; Ewer, 1968; Kingdon, 1977). Durrell (1958) observed a cusimanse (*C. platycephalus*) wading in shallow water turning over rocks with the aid of its long snout, in search of freshwater crabs.

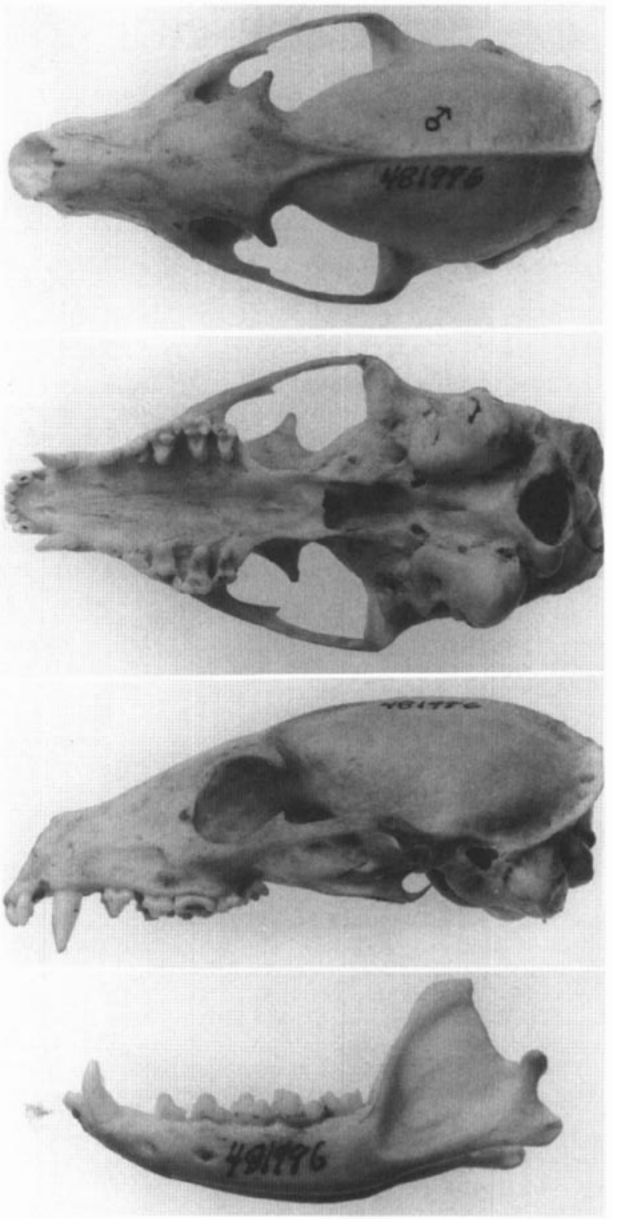

FIG. 3. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Crossarchus obscurus* (USNM 481996, male from Tars Town, 25 km N Zwedru, Grand Gedeh County, Liberia). Zygomatic breadth is 36.5 mm.

Groups may "wander in a circular course, returning to the same place from time to time" (Dorst and Dandelot, 1969:124); from observations of hunters, they seldom are seen for more than a few days in the same place (Michaelis, 1972). Cusimanses take refuge under fallen logs or thick vegetation, in burrows with several entrances (sometimes dug into termite mounds), and in hollow trees

with openings near the ground (Booth, 1960; Dorst and Dandelot, 1969; Rahm, 1966). Animals may excavate burrows (Haltenorth and Diller, 1977; Malbrant and Maclatchy, 1949).

The diet of *C. obscurus* includes snails (Gastropoda), earthworms (Oligochaeta), spiders (Arachnida), crabs (Decapoda), woodlice (Isopoda), centipedes (Chilopoda), millipedes (Diplopoda), grasshoppers and crickets (Orthoptera), cockroaches (Blattaria), beetle (Coleoptera) and mason wasp (Euménidae) larvae, frogs, snakes (including poisonous snakes), lizards (including buried eggs), birds (including eggs and nestlings), and small mammals (up to size of a cane rat, *Thyronomys swinderianus*), and fruits and berries (Aeschlimann, 1965; Allen and Coolidge, 1930; Booth, 1960; Dorst and Dandelot, 1969; Durrell, 1958; Ewer, 1973; Haig, 1931; Haltenorth and Diller, 1977; Rosevear, 1974). Struhsaker and McKey (1975) reported two cusimanses (*C. platycephalus*) in Cameroon attacked a 2 to 2.5-m-long black cobra (*Naja melanoleuca*) 2.5 to 3 m above ground in a tree. Predators may include larger carnivores and birds of prey (Haltenorth and Diller, 1977).

Ectoparasites of *C. obscurus* include the ticks (Acarina) *Ixodes cumulatimpunctatus* and *I. muniensis* (Morel, 1966), *I. rasus* (Aeschlimann, 1967), and *Laelaps liberiensis* (Herrin and Tipton, 1976); the chewing louse (Mallophaga) *Suricatoecus occidentalis* (Emerson and Price, 1980); and the flea (Siphonaptera) *Ctenocephalides crataepus* (Haeselbarth et al., 1966).

Endoparasites of *C. obscurus* include the protozoan (Telosporea) *Isospora garnhami* (Bray, 1959), the fluke (Trematoda) *Paragonimus uterobilateralis* (Voelker, 1973), and the pentastome (Porocephalida) *Armillifer armillatus* (von Haffner, 1973).

Sight, hearing, and smell are well developed in *Crossarchus*. Communication in dense vegetation of the high forest is facilitated by audition and olfaction. Upon hearing loud rustling or crackling sounds captive animals immediately retreat to cover (Ewer, 1968; Haig, 1931; Rosevear, 1974). *Crossarchus* has an elaborate vocal repertoire; a pain scream is not exhibited (Ewer, 1973). Comfort movements observed in captives are yawning and stretching. Individual and mutual grooming are poorly developed. Secretions of the anal gland are deposited on vertical objects by a handstand and on horizontal surfaces by an anal drag; handstand secretions usually are preceded with secretions from the cheek glands. Scent marking is performed by both sexes. Captives urinate and defecate in a selected location; defecation is preceded by well-defined scratching movements; feces are not buried. Cusimanses mark urine and feces of other species with anal gland secretions and urine (Ewer, 1973).

Small prey mammals are killed with a single bite oriented at the back of the neck; the prey is not shaken (Ewer, 1973). Cusimanses dig mainly with the claws, but also use the snout to assist in moving soil and leaf litter; small invertebrates dug from the ground usually are given a quick shake as they are picked-up (Ewer, 1968). In some mongoose species, hard objects (for example, eggs) are opened by being hurled with the forefeet back between the hind feet and against a hard surface. Neither Ewer (1973) nor I observed this behavior in captive cusimanses but it was reported by Haltenorth and Diller (1977) and Nowak and Paradiso (1983), and observed in a captive animal by Naundorff (1936).

Aggressive encounters among conspecifics are observed infrequently in captive animals. Cusimanses kept as pets are known to attack dogs much larger than themselves without hesitation (Rosevear, 1974). A threat display consists of the hair being fully erected, back arched, and limbs extended. The animal moves forward at a walk, moving from side to side, and may alternate moving forwards and backwards; the tail is with maximal piloerection, held sloping downwards and with each step swung from side to side (Ewer, 1973). Play behavior commonly is observed in wild and captive animals. Aeschlimann (1965:40) observed six cusimanses in Ivory Coast "playing tag in an open space" with a group of mona monkeys (*Cercopithecus mona*).

I observed copulatory behavior in a captive pair on 10 separate occasions. During copulation the male clasps the female's back just forward of the pelvic region with his forefeet. The male also grasps the female at the back of her neck with his mouth; true neck biting does not occur. Pelvic thrusts by the male frequently are accompanied by growls of 2 to 3 s duration. Mounting occurs in bouts lasting up to 1 min; the longest series of bouts observed was 45 min. Copulation was initiated and terminated by the male. A stylized form of fighting with bites directed at the neck often accompanies courtship (Ewer, 1973).

West African cusimanses are tamed easily and frequently kept as pets (Ewer, 1968, 1973; Haig, 1931; Naundorff, 1936). A captive adult male *C. obscurus* was successfully immobilized with 20 mg of ketamine hydrochloride and 3 mg of xylazine.

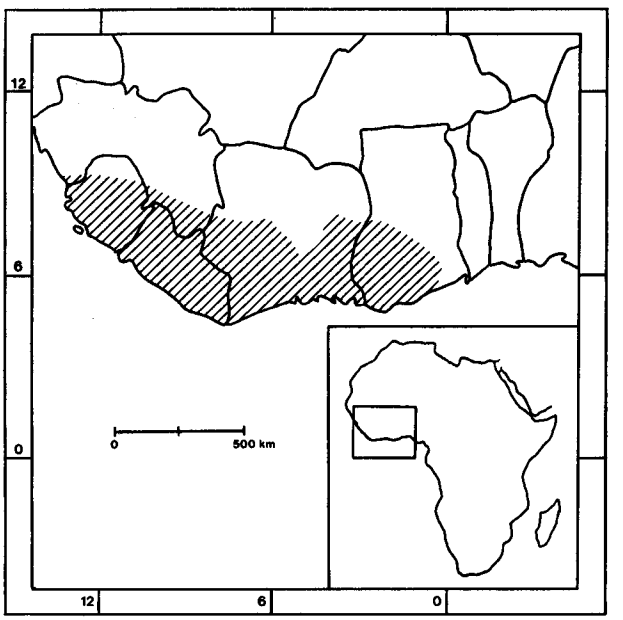

FIG. 4. Geographic distribution of *Crossarchus obscurus*.

GENETICS. The diploid chromosome number of *C. obscurus* is 36, and was described by Fredga (1972) from one male. The karyotype consists of five metacentric (centromeric indices of 46.5 to 39.3), six submetacentric (36.3 to 29.2), and six subtelocentric (24.6 to 12.8) autosomal pairs. The X and Y chromosomes are metacentric with centromeric indices of 43.3 and 42.1, respectively. The largest chromosome of the complement is stl (absolute mean length of 5.69 μm) and the smallest is the Y (1.00 μm). The karyotype of *C. obscurus* is similar to those of *Helogale parvula* and *Mungos mungo*; the C2 chromosome in *H. parvula* and *M. mungo* is submetacentric, but subtelocentric in *C. obscurus*, most likely a result of a small reduction in length of the short arm of this chromosome in *C. obscurus* (Fredga, 1972).

REMARKS. Most of the available information on the biology of *Crossarchus* is from captive animals. Field studies on cusimanses are completely lacking (Rood, 1983); however *C. obscurus* commonly is found throughout its range and has been referred to as "one of the best-known carnivores of West Africa" (Booth, 1960: 66).

Haltenorth and Diller (1977) and Nowak and Paradiso (1983) followed Rosevear (1974) in estimating a gestation of 10 weeks derived from one litter born 73 days after the last parturition; copulation was not documented (Rosevear, 1974:289). I observed three gestation periods in one captive *C. obscurus* in which both copulation and parturition were documented; the average was 58 days.

The generic name *Crossarchus* is from the Greek *crossotos* meaning "fringed" and *archos* meaning "anus," referring to the appearance of the anal sac; the specific name *obscurus* is from the Latin adjective meaning "dark" or "dusky," referring to pelage color.

Mongooses of the genus *Crossarchus* collectively are referred to as cusimanses (also kusimanses), but also have been called long-nosed (Booth, 1960; Coetzee, 1977; Ewer, 1972, 1973; Hayman, 1935; Kingdon, 1977), smooth-nosed (Rosevear, 1953), lesser long-nosed (Rosevear, 1974), short-tailed (Allen and Coolidge, 1930), dark (Dorst and Dandelot, 1969), and brown mongooses (Malbrant and Maclatchy, 1949). I do not recommend separate vernacular names for each species of *Crossarchus*. Local native names in Ghana are ahweaa, ahweaa biri, awisa, awonzi, avisea, wia, and mayagyiga (Hinton and Dunn, 1967); "senna" by the Khrahn people of Tar, Liberia (Schlitter, 1974).

In the past, *Crossarchus* was identified with *Mungos* Geoffroy and Cuvier, and as a result there appears in the literature (for

example, Walker et al., 1975) accounts of *Crossarchus* that pertain to *Mungos*, and vice versa (also noted by Hinton and Dunn, 1967; Michaelis, 1972; Rosevear, 1974; Walker et al., 1975).

Honacki et al. (1982) elevated Herpestinae to familial rank and suggested (p. 272) that *Crossarchus* "may include *Liberiictis*." Until the relationships between these genera are studied in detail *Liberiictis* should be retained as distinct at the generic level; comparative studies on facial musculature (Pape, 1980) and dentition (Pagel, 1985) support this view.

S. J. Edwards (Animal Parasitology Institute, United States Department of Agriculture) supplied parasite information. Mark E. Taylor, C. Brian Robbins, and John L. Gittleman critically reviewed the manuscript.

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