

A Note on *Capra Falconeri* — (Wagner, 1839)

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Eingang des Ms. 8. 6. 1968

Introduction

The International Union for Conservation of Nature and Natural Resources Survival Service Commission has included the Markhor — *Capra falconeri* in its Red Data book Volume 1 which lists all the known mammals whose future existence is threatened. Little information has been published concerning this magnificent wild goat in the past thirty years and even earlier writers tended to confine themselves to the best methods of hunting the Markhor or descriptions of the wide variations which occur in horn form and shape. It is a particularly difficult animal to study for a number of reasons. Not only does its rarity make it hard to locate but its natural habitat lies in the higher more inaccessible crags of mountains where physical barriers make close observation generally impossible. In addition to these physical difficulties the main distribution of the Markhor lies in those remoter frontier regions where for political or security reasons foreigners are unwelcome if not actually prohibited from going.

This note, based on rather casual and haphazard observations is intended to show the many gaps in our present knowledge and to stimulate further interest. The form of presentation has been based upon the headings adopted by Dr. SCHALLER in his painstaking and brilliant field studies of wild ungulates inhabiting the Kanha game sanctuary (SCHALLER 1967).

Descriptions of Animal

The name Markhor (Kh pronounced as in SUCHEN) comes from the Persian words meaning snake eater, a description having its origins apparently in superstitious beliefs. Like all the goats the Markhor is a comparatively thick set animal with short sturdy legs, a heavy body and, for an ungulate, comparatively big feet. Thus, though it is not adapted for running fast its legs undoubtedly enable it to negotiate difficult terrain and to make prodigious leaps from a standing position or traverse rock faces where few predators would dare to follow.

Like other members of the genus *Capra* the Markhor is distinguished from wild sheep by the absence of suborbital glands, and the absence of inguinal glands or pedal glands in the hind feet. Domestic goats possess this pedal gland in the forefeet but a captive 13 month old female Markhor in my possession shows no trace of this gland. Markhors have convex foreheads like *C. ibex* and in contrast to the concave forehead of wild sheep (SANDERSON 1964). Compared with all the indigenous breeds of domestic goats in the same region, the much greater size of the Markhor is striking. A captive *C. f. falconeri* of 6 months age which was being reared with 2 foster mother goats, could only reach their udders by lying on its sternum (observed GILGIT 1964). Similarly the horns of male Markhor are very much more massive than any domestic breed. A basal girth of 10 to 11 inches and overall length measured along one keel of up to 50" being normal for mature bucks of the nominate race. 65" measured along one keel is the record. (LYDEKKER 1907, PRATER 1965 et. al.).

Broadly speaking, the various subspecies of Markhor fall into two distinct types. The animals to the north and in the Himalayan regions are much bigger in size with considerable development of the neck and chest ruff in winter. Their horns tend to be longer with an angular or more open type of spiral. On the lower and south westerly portion of its range the much smaller races *megaceros* and *jerdoni* occur with straighter horns (fig. 1) and practically no chest ruff in winter. These animals are sandy yellow in colour in the summer whilst those of the north are reddish grey.

Mature males weigh about twice as much as the females, an approximate difference which can be observed in many other quite unrelated mammals which are highly territorial at mating time. A four year old *C. f. falconeri* which appeared full grown (except for horn growth) stood 39" high at the withers (see fig. 3, below) and this

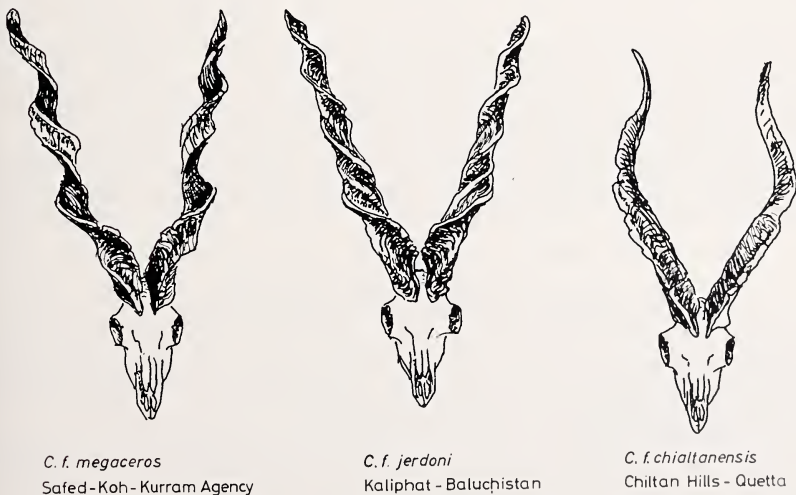
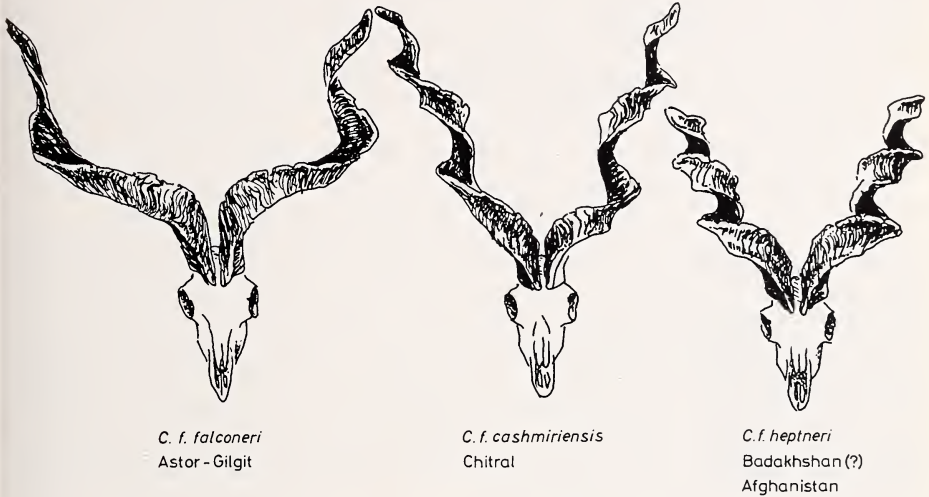


Fig. 1. Typical heads illustrating the six subspecies of *Capra falconeri* here considered to be valid

would seem to correspond with the maximum height of 41" quoted by other authors (LYDEKKER 1907, FINN 1929, STOCKLEY et al.).

In the writer's experience similar measurements in earlier books tend always to be high possibly because they were taken from dead or fallen animals whence it is difficult to make full allowance for the extent of flexion of the pastern. Even this measurement is much below the 46" quoted by Dr. JERDON (JERDON 1874) as being typical of the species.

The horns are very dark brown in colour, closely approximate at the base and with the frontal keel or ridge twisting outwards and spirally. Besides a luxuriant black beard, mature males of the Himalayan subspecies develop a thick ruff of long mixed black and white hairs from the chin down to the brisket. In contrast to what some observers have written (PRATER et al.) this ruff can appear whiter in many younger males than in some aged animals. There is a crest of longer darker hairs running down the hind neck between the withers and along the spine and this is found in *C. f. jerdoni* as well as the northern races. A long fringe of white hairs develops on the front of the stifle and behind the elbow in mature bucks only in the Himalayan races. *C. f. jerdoni* never develops the long ruff of hair down its chest even in winter and in this respect the paintings of even such well known artists as PAUL BARRUEL (PRATER 1965) and JOHN LEIGH-PEMBERTON (World Wild Life Fund Survival Series 1966) are misleading since they both show Markhor with the *C. f. jerdoni* type of horns.

The very short tail is fringed with longer coarser black hairs and the belly and lower limbs contrast sharply with the body, being creamy white and framed just above the hock and carpal joint by darker brown hairs which also extend down the front of the white stocking legs. This leg pattern, repeated with slight variations, in *C. ibex* and *C. hircus* is conspicuous from a great distance and is often the first means of detecting the animal and may well serve in species contact and recognition. There are small hairless callosities on the front of the carpal joints. The dew claws or vestigial outer toes appear completely disconnected from the skeleton, consisting of large rounded horns which also probably assist the animal as a braking mechanism when it glissades down steep rock faces.

Females have a well developed beard (in contrast to the females of *C. hircus* which are beardless). They possess two mammae. Their horns are upto 14" long in *C. f. falconeri* and 4" to 6" long in *C. f. jerdoni*. Thin and backward curving they lack the spiral twist of the males' horns. The iris is greyish yellow — not so pale as in *Ovis orientalis* but paler than the more golden brown colour of *C. hircus* and *C. ibex*. The ears are lined with fine white hairs and are comparatively shorter than the ears of *C. ibex*. Adult females lack the dark dorsal stripe seen in old males.

The young kids have quite a conspicuous dark dorsal stripe. In young females, the horn buds are first visible at the age of about three months though they are probably visible after a few weeks in males. Their colour is similar to adult females.

Geographical and Ecological Distribution

The Markhor is found in a comparatively restricted area from the north western end of the great Himalayan chain spreading in a southerly arc down through the mountain ranges of Waziristan and Baluchistan (fig. 2).

The centre of its distribution where the nominate race *falconeri* lives, comprise the outer ranges or buttresses of the Nanga Parbat Massif (STOCKLEY 1928) whilst the eastern limit of its range comprise the Pir Panjal hills to the south-east where the race *cashmiriensis* is found. To the north of this again, in Baltistan, the *cashmiriensis* race is found and also to the south and west of Gilgit into Sind Kohistan and Chitral.

The western limit of its range is probably in the Kuhitang plateau of Uzbekistan whilst the southern limit of its range are the Kohi Maran hills in the end of the Suleiman range. In between, its distribution is patchy, due to it having been exterminated from certain more accessible mountain ranges. For example it is now not found in the Sheikh Badin hills of Waziristan or the Isa Khel hills where it survived until the 1940s (STOCKLEY 1936). Also it no longer occurs above Attock in the Ziarat hills where it also survived up to the 1940s. (R. NANA pers. comm.). A very few still survive in the Koh-e-safed range as well as in the Khanori hills to the north of Malakand tribal territory (R. NANA pers. comm.). The position further south is a little better with small herds surviving around the Quetta hills (Takhatu-Zarghun-Kaliphat) as well as behind Hindu Bagh and Fort Suleiman in the Toba Kakar and Tor Ghar ranges (Major S. A. KHAN pers. comm.). Again in Takht-i-Suleiman they still survive (T. BRAHAM pers. comm.). This distribution pattern is best understood by reference to the sketch map (fig. 2) which is based upon information obtained from a number of local hunters, forestry department officials and big game hunters besides those persons mentioned above.

Ecologically, the Markhor is confined to forest steppe country verging into artemesia steppe wherever the slopes are precipitous.

Altitudinally it avoids the gently sloping alpine meadows found higher up where *C. ibex* likes to feed and also the lower more gently sloping hills where *Ovis orientalis* feeds in the same areas. Such steppe forest is generally characterised by thin and scattered *Juniperus* on the north faces with little or no forest cover on the southern slopes. In Nuristan (Afghanistan) Chitral and parts of Sind Kohistan its habitat is dominated by *Quercus ilex* (Balot) scrub. In Takht-i-Suleiman *Pinus gerardiana* is the dominant forest species.

All writers seem to stress the fact that *falconeri* lacks the under wool of *C. ibex* and is therefore not tolerant of snow and cold conditions. Though there is some altitudinal migration, it seems useful to show that the ecological valence of *C. fal-*



Fig. 2. Distribution of the six subspecies of *Capra falconeri*

coneri as a species is very considerable, from a viewpoint of altitude as well as relative humidity and temperature. Steppe forest is characterised by extreme diurnal temperature variation as well as seasonal extremes. In the bare rocks, insolation can raise day temperatures in early summer to the low 90° Fahrenheit (= 32° C) whilst at night the same areas experience freezing temperatures — a difference of over 58° Fahrenheit. The continental climatic effect, coupled with high altitude and low humidity, contributes to extreme seasonal variations also and even in the lower hills around Quetta in the southern most limit of its range, minimum winter temperatures of 12° F have been recorded whilst the same areas experience day temperatures of 104° F in summer. In winter cold drying winds are characteristic which must further contribute to any mammals heat losses. Again in the Pir Panjal mountains, monsoon influences create quite humid conditions in August whilst by contrast in the Gorshani hills it remains extremely arid throughout the year. Markhor thrived as low as 2,000 ft in the Isa Khel hills (STOCKLEY op. cit.) and I have observed an old buck at 13,500 ft in late October in the Kargan Nullah (Gilgit). Though there is some seasonal altitudinal migration, due to competition from domestic goats and pressure of hunting this is very restricted for *C. f. jerdoni* which remains throughout the year near the crest of the highest mountain ridges. Even in the Himalayas the older males do not descend much below 7,000 ft or 8,000 ft during the winter, and temperature differences in mid December between 7,000 feet and 13,000 feet are only comparative and may still be described as severely cold at those lower altitudes. Moreover, on the steeper slopes frequented by the Markhor, and in these arid ranges snowfall is usually so thin that it would not cause great discomfort. I have observed a young male Markhor in late November in fairly deep snow at 11,000 feet which seemed quite tolerant of the conditions. The Markhor can thus be described in ecological terms as a remarkably eurythermic animal and its ability to withstand such temperature extremes seems worthy of further study. A young male killed on January 2nd in Chitral which I examined had soft greyish under fur though this was unlike wool and its outer pelage felt harsh and thin compared to that of *C. ibex*.

Numbers and Status

The following estimates are based upon talking to numerous local villagers and hunters and are no more than shrewd guesses. In Gilgit which may be considered its stronghold, the Markhor has declined greatly in numbers during the past two decades by the account of many local residents and officials. A well known hunter and prominent local expert estimates the total population of the Markhor to be not more than 1,000 (Brigadier ASLAM KHAN pers. comm.). This would appear to be an under estimate. Only one valley in the surrounding range, Kargah, is well preserved and this is principally preserved as a shooting reserve for local officials. Having spent two periods of ten days camping in this region and after talking with local villagers I estimate the population of this one valley at not less than 500 to 600 so that for the whole Agency it might well be over 2,000. In Chitral to the west and Kohistan to the south west where *C. f. cashmiriensis* predominates, there is also heavy hunting pressure by local villagers and only one small valley near Chitral, Gol Nullah is preserved by the officers of the local Scouts. Here the population is estimated to be 200 (Major S. A. KHAN pers. comm.) and total combined population of Chitral and Kohistan may well be less than 1,000. I have no recent information on the status of the Markhor in the Pir Panjal range in India though E. P. GEE has reported it to be precarious. Nothing is known of the numbers surviving in the Malakand hills though they must be very few. In the Kohi-safed none have been shot since 1964 though one was seen

in 1967 (Col. DASTAGIR pers. comm.) and the numbers may well be under 50. Extensive areas of forest on the Takht-i-Suleiman provide better refuge for Markhor and numbers may be over 300 in that region. In the Tobar Kakar and Torghar hills, where human hunting pressure is least severe, the main concentration of *C. f. jerdoni* still survives (ROBERTS, I. U. C. N. Red Data book) and numbers could be over 500. The isolated populations of Takhatu may be as high at 70 to 80, 40 to 50 on Kaliphat and Wam. It is estimated at between 50 to 60 on Zarghun, whilst Chiltan may have under 40 and Murdar less than 10. Thus though the total population of *C. f. jerdoni* may be in excess of 1,000, it is severely threatened as it survives in discontinuous and isolated pockets.

It should be emphasised that the pressure on the Markhor throughout its range is two fold. Increased numbers of domestic goats which disturb the Markhor and compete for range and also increased use of firearms by all local residents. I have not been able to estimate anything of the numbers and status in Afghanistan but they are extremely rare (Dr. KLOCKENHOFF in litt.).

Rutting Season

Unlike the domestic goat which is poly oestrous, this is very restricted in the Markhor which comes into oestrous once a year only. In the Himalayas it lasts only for 2 to 3 weeks from about December 15th to early January. In Gilgit a large and obviously dominant buck was seen to have a harem of eight does on December 12th whilst on December 18th in an adjacent area a four year old buck was seen searching for and pursuing a female with two half grown young. In Chitral on January 2nd a herd of 25 markhors was observed with 3 mature bucks apparently feeding peaceably together indicating that the rut was partially over.

In Baluchistan the rut appears to start about one month earlier and may last up to six weeks into early December. During this season throughout its range the males descend to lower elevations to establish territories and collect females. A male in Chitral on December 26 was seen to be rounding up straying females and driving them back to its territory (Major S. A. KHAN pers. comm.). The attraction is however mutual and in Gilgit on Dec. 12th. I have observed that when an old male moved off, several females ceased foraging and followed him. In fact it is characteristic of the males that at this season they possess a very strong musky odour which is not discernible at other seasons and I believe this plays a significant role in attracting females to the territory of dominant males. T. ROBERTSON who shot a young male in Gilgit in December 1966 kept only a small portion of the neck and shoulder skin but found that even after placing this in the sun for 13 months, that it was too malodorous to be tolerable within six or seven feet.

In Gilgit the young are born at the end of May to early June which would indicate a gestation period of about 160 days. Similarly in Baluchistan the young are born early in April. Other authorities have given the gestation period as varying from 147 to 180 days (H. VASS 1961, WALKER 1964 et al.), whilst the Director of Oklahoma City Zoo, where markhor have been successfully bred, suggests a gestation period of as long as 161–189 days (Dr. OGILVIE in litt.).

It is significant that due to climatic extremes there is no new vegetative growth before the end of the first week in April, whilst summer heat and drought kills the grasses and other annals by early July (SCHWEINFURTH 1957). It would appear therefore that the limited rutting season is the result of a high degree of adaptation to the maximum plant growth cycle and the requirements of pregnant and lactating females. Thus the does have access to more nutritious young herbage for 3 or 4 weeks before parturition.

Rate of Reproduction

Judging from horn growth females would appear to be capable of breeding when 19 to 20 months old and this is confirmed by observations at Oklahoma City Zoo (Dr. OGILVIE in litt.) though West Berlin Zoo has no observations of females breeding before 3½ years of age (Dr. H.-G. KLÖS in litt.); and Dr. V. G. HEPTNER considered 3 years to be the age of sexual maturity (HEPTNER 1961). Young females invariably bear single young and older females generally bear twins and this has also been observed in captive herds (Mr. TREUS, Director Askanya Nova Zoo — USSR, in litt., Dr. KLÖS in litt.). It is noteworthy that *Ovis orientalis*, which occurs in adjacent areas to the markhor almost throughout its range, bears twins much less commonly. I recall seeing a small herd of 3 females markhor early in November each with twins.

Mortality and Interaction with other Animals

A very experienced local hunter in Gilgit (MUHAMMED IBRAHIM) states that the markhor may live to eighteen years and he has known certain males of this age. It is significant that Dr. WALKER also gives 18 years as the maximum age (WALKER 1964). In general however, a 12 or 13 years old animal would be aged and though it is fairly easy to count the annular rings on the horns of sporting trophies the oldest of such heads which I have been able to count indicated an animal of only 10 years. Unfortunately only the frontal portion of the skull was preserved so it was not possible to examine the teeth. However an Ibex (*C. ibex sibirica*) skull in my possession shows thirteen annular rings on its horns, and the transverse ridges on the molars and pre-molars are worn completely smooth with the teeth almost level to the gums. This would indicate an animal incapable of dealing very efficiently with its normally fibrous diet and at that age likely to be in a debilitated and half starved condition.

Throughout its range the markhor has to forage in close proximity to domestic flocks of goats; particularly in the summer months when the flocks are driven to the mountain crests. It is very liable therefore to infection from contagious diseases and in 1966 an epidemic was reported in Chitral which caused deaths amongst wild Ibex and Markhor (Prince BURHAN-UD-DIN pers. comm.). It is suspected that this was probably Rinderpest. A young male Markhor killed in Chitral on January 2nd was found to have its back heavily infested with Bot Fly larvae (*Hypoderma* sp.) (C. WINKLER pers. comm.). This parasite is undoubtedly spread from domestic sheep and goat flocks.

In the northern Himalayas also there must be heavy pressure on young and weak animals from natural predators. In both Gilgit and Chitral the leopard (*Panthera pardus*) and Snow Leopard (*Panthera uncia*) are quite sympatric and known to hunt Ibex and Markhor. Wolves are also plentiful though probably much less capable of climbing after Markhor. Golden Eagles (*Aquila chrysaetos*) are not uncommon and may conceivably attack new born kids. An old male is probably well able to defend itself from all predators except man.

While observing a small herd for two days in Gilgit and when attempting to encircle them from above, we found no trace of the Markhor anywhere on the hill side. Subsequently we found fresh tracks of a Snow Leopard which in the soft dust indicated they were but a few hours old and it was later ascertained that the entire herd had retreated into the next valley, no doubt frightened by the Leopard's stalk.

Hunting pressure from man, as already stated, is probably the principal factor in limiting numbers especially in the more accessible mountain ranges inhabited by *C. f.*

jerdoni and *C. f. megaceros*. It is also unfortunate that in nearly all the mountain areas where the markhor still survives, that the carrying of a rifle by the locally men is a status symbol of compelling significance and it is no coincidence that in the former North West Frontier areas where such rifles are locally manufactured, the Markhor has already become extinct (ROBERTS — I. U. C. N. Red Data Book).

The local populace also possess a tradition of marksmanship and love of hunting which poses a serious threat to all shootable creatures in such regions. In mid-winter when the rut combined with severe weather brings the markhor down to the valley mouths, there is hardly a home in Gilgit which does not depend upon local killed markhor meat to supplement their meagre diet (MIAN MANZOOR-UL-HAQ, District Forest Officer pers. comm.). Because of their greater palatability it is commonly the females and younger animals which are killed at this time. The relatively few game licence paying hunters, searching for a trophy, are therefore an insignificant factor when compared with the local villagers with ample time to study the habits and movements of a nearby herd. Mr. WINKLER reported seeing a large male with an obviously broken foreleg in a herd of some 20 animals on January 2nd in Chitral, and this was alleged to be the result of a bullet wound.

General Behaviour and Range Movements

Like most wild ruminants the markhor only feeds for a few hours in the early morning and evening and even lies down to rest for intervals while feeding. During the greater part of the day it lies down and chews the cud. In the height of the summer especially when domestic goats encroach upon their territory, I believe that they feed mostly during the night hours. It has also been observed that in the late autumn most animals are well fed and spend much longer periods lying down especially the older bucks which only emerge for very restricted periods.

In Gilgit they do drink and I have observed females with young descend to a spring in the early evening and afterwards climb up to the more inaccessible cliffs. In some areas where the only water is right at the bottom of the valley they do not descend to drink until after darkness falls and even then appear to drink only every second or third day.

Regarding their food habits, like all the Caprinae they will freely eat browse as well as grasses and other annuals. I have never seen Markhor eat *Juniperus* though it is commonly associated with this tree. However when snow is on the ground they depend heavily upon the browse provided by *Quercus ilex* where it is available and are even capable of climbing into the lower branches to reach the leaves of this evergreen oak. In Gilgit the *Ilex* is rare and the markhor depends more on the smaller thorny bushes and shrubs such as *Hippophae rhamnoides* and *Pistacia interregima*. In the spring, summer and autumn, the bulk of their diet consists of the *Artemesia maritima* bushes and this seems to be their principal food. I have also seen them feeding on *Tanacetum* bushes. Grasses also form an important part of their diet and *Pennisetum orientale* which grows up to 12 or 13,000 ft. seems to be the main food grass, but they no doubt also graze *Poa* and *Stipa* species and *Enderpognon persicum*, grasses which freely grow in the artemesia steppe (SCHWEINFURTH 1957).

In the Himalayas there is some seasonal altitudinal migration of herds observed, particularly of females and immature males which descend valley sides towards their mouths in mid-winter, though even here they try to keep to the highest slopes. In Baluchistan due to interference from domestic goats, the herds seem to keep to fairly restricted areas near the most inaccessible and higher cliffs of the mountains. Similarly older males even in the Himalayas do not descend as far as the females. For example

one old male I have observed remains during the summer months in the vicinity of the summit ridges of a peak about 13,500 ft. high on the right flank of the Dormushkh Nullah in Gilgit. In mid winter he descends to a spur on the opposite side of this very steep sided and short nullah (ravine). Here the elevation is about 8 to 9,000 feet and the total distance is about three miles from the summer range.

It has also been observed that herds tend to move along well defined tracks in single file except when foraging, just like domestic goats.

The Markhor's response to predators has already been mentioned. Their eye-sight appears to be exceptionally acute as well as their sense of smell and hearing. I have frequently seen them climb on to some prominent boulder apparently to survey the surrounding territories and they also seem to have no inhibitions about standing on the skyline if they happen to reach a ridge with a commanding view. Animals so viewed up to a distance of half a mile (with a telescope) appeared to be equally intent in watching their human observers.

Vocal communication amongst adults is rare but they frequently emit their alarm call which is a sort of sneezing snort quite unlike the bird like chirrup of Ibex when alarmed and less explosive in sound than the alarm snort of the Urial. During the rutting season also males have been heard to frequently utter a grunting call rather the same sound as made by a domestic billy goat (Major A. S. KHAN pers. comm.). When frightened or excited I have observed that the tail is invariably cocked up over the hind quarters.

The Markhor does not associate in such big herds as the Himalayan Ibex. In Gilgit I have never seen bigger herds than twelve individuals, even in areas where they were relatively plentiful and three to four is the more usual number. However in Baluchistan where the available safe foraging range is more restricted it appears as though bigger numbers congregate and a herd of 20 to 25 individuals is not uncommon (J. WOOD-ANDERSON pers. comm.). In 1965 a herd of thirty was also counted in Chitral (Major S. AMANULLAH KHAN pers. comm.). Such herds usually consist of females with young and immature males. I have also seen a herd of six young males in early November and this habit of younger males congregating together is observable in the Himalayan Ibex also (PRATER op. cit.). Adult males always remain solitary except during the rutting season.

In Baluchistan it is noteworthy that during the heat of the day older markhor, especially males, often lie up right inside fissures or natural caves. One old male at Wam in Baluchistan was observed to live at the mouth of a steep rock cleft or fissure into which it retreated when approached (J. WOOD-ANDERSON pers. comm.). This habit has not been observed in Gilgit where the natural terrain probably offers more secure refuge.

Interaction with other Animals

There is considerable evidence to suggest that the Markhor has hybridised with the Sind Ibex in the southern position of its range, and that this has resulted in the production of the *C. f. chaltanensis* type of horns which may be a hybrid and not a separate race. In the Pir Panjal range Markhor have been observed grazing on the same slope as Tahr, *Hemitragus jemlabicus* (JERDON 1874). In Gilgit I have seen Himalayan Ibex and Markhor, if not on the same ground, at least within easy sight of each other and the same has been observed in Chitral (Prince BURHAN-UD-DIN pers. comm.). Generally speaking Ibex remain at higher altitudes and prefer the open upland pastures for grazing where markhor never venture. In the Baluchistan hills *Ovis orientalis* frequents the same ground as *C. f. jerdoni*, though the former does not ascend to the highest cliffs or in such steep terrain as the markhor. In Chitral also it has been observed that the Shapu (*O. o. vignei*) inhabits the same ground.

Domestic goats are however, clearly the main intruders and competitors with markhor for food and living space. There are no reliable statistics for the northern areas for making any estimate of such livestock but the numbers have greatly increased in the past two decades because many of the nomadic herders who own such flocks are no longer free to migrate southwards in winter across the „cease-fire“ line into Indian held Kashmir. There has also been a significant increase in the human population in such northern areas and since available cultivatable land cannot be increased, there has been a tendency to increase goat herds. The Gilgit domestic goat population could very well be in the region of 20,000.

Leadership and Agonistic Behaviour

Young males frequently spar with one another and I have observed that they do this by standing up on their hind legs and striking with their fore feet, as well as pushing with locked horns. Such fights are never prolonged or severe and probably indicate a testing of relative status.

The habit of rearing up on the hind legs before attack has been observed in both



Fig. 3. Representatives of two subspecies of *Capra falconeri* — Above: Eight year old captive male of Straight Horned Markhor — *C. f. jerdoni*; captured in the Toba Kakar range on the Afghan border as a three to four days old kid; in possession of Mr. HAZRAT SALIM A. ALFA-ROQUI — Below: Captive male of Astor Markhor — *C. f. falconeri*, captured as a newborn kid in Gilgit (Kargah Nullah); kept by the Pakistan airforce ski training school in Gilgit — Left: 3½ years of age in typical posture prior to attack — Right: the same Markhor 4½ years of age

C. f. jerdoni and *C. f. falconeri* and is a very characteristic gesture. The head is held to one side at the same time. The females will also adopt this aggressive gesture.

A captive male was observed to make a mildly agonistic display when any stranger entered the enclosure which consisted of standing broadside on with the chin tucked in and horns turned forward, thus displaying their size and length in a vertical plane and to maximum advantage.

Sexual Behaviour

This is typical of the Bovidae, i. e. a male will follow a female with head stretched out and horns laid across its back and will appear to test the female's state of oestrus by sniffing her urine and will try to drink it if possible. On such occasions it exhibits flehmen (the curled upper lip observed also in rams and bulls). This action which I have observed in wild markhor corresponds with observations amongst the captive herd at Oklahoma (Dr. OGILVIE in litt).

I have not personally been able to witness a fight between mature males during the rut but the speed with which a four year old male descended a scree in pursuit of a group of three females during the rutting season, was impressive. With dust flying he made no attempt at concealment or circumspection.

Major A. S. KHAN observed a fight in Chitral late in December between two large males which took place in deep snow and lasted about half an hour. Besides pushing with locked horns they were observed trying to strike downwards in stunning blows with the frontal ridge of their horns. The younger male with horns about 35 inches long tried several times to escape and was often rolled in the snow but the larger animal always ran above it and cut off its retreat.

In captivity male markhorns will readily mate with domestic goats (FINN 1929) and I have seen the progeny from two such cases in Quetta and Gilgit. A male *C. f. falconeri* in Naltar Gilgit was mated to a female *Capra ibex* in 1965 but the progeny was stillborn.

Female young Relations

The young seem to associate with their dams for a very long time — certainly until the onset of the rut when they are seven months old. One old hunter (MUHAMMED IBRAHIM) who is an acute observer, maintains that they remain with their dams even up to one year when the next kid is born. I have not had the opportunity to be able to verify this fact. When newly born the young shows no fear of humans and for three or four days thereafter can easily be captured. The mother conceals them in some rock cleft where they remain lying while she forages and she returns to suckle them at intervals. After four days or so the baby markhor learns to follow its mother and is soon able to climb quite difficult places.

It has been noticed that young Markhor when 1 or 2 months old frequently kneel to suckle and even develop this habit when foraging. The baby markhor frequently calls its mother by bleating and the sound is indistinguishable from a domestic goat. When suckling the baby waggles its tail rapidly from side to side (c. f. the baby gazelle which tends to paw one leg when suckling).

Conclusions and Summary

Our present scanty knowledge indicates that despite its incredibly harsh environment the markhor is much bigger than all domestic goats and also able to withstand greater temperature extremes. The highly selective breeding behaviour with emphasis on size of master bucks plus the monoestrus cycle probably has contributed to this development.

Considering its lack of under wool, its ability to withstand such temperature extremes seems worthy of further study, as also the reasons why it has not been successful in extending its range further East or South where there would seem to be equally suitable terrain.

The possibility of *Capra falconeri chialtenensis* being a hybrid instead of a valid race also seems worthy of further study.

The numbers and distribution of the Markhor has drastically declined since the 1940s due largely to competition from domestic goats for grazing, and hunting pressure from local hill men. If we are to take timely and necessary steps to preserve this fine animal more detailed knowledge of its distribution and biology is urgently required.

Acknowledgements

I am grateful to Dr. J. NIETHAMMER for encouraging me to write this note as well as to the many friends who freely supplied information concerning their own observations, from which this article is largely drawn.

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SCHRIFTENSCHAU

WALTHER, FRITZ: **Verhalten der Gazellen.** Die Neue Brehm-Bücherei Nr. 373. A. Ziemsen Verlag, Wittenberg-Lutherstadt 1968. 144 S., 51 Abb., 3 Tab. 10,20 DM.

Vergleichende Verhaltensforschung war jahrelang nur das Arbeitsgebiet von Ornithologen und Fischspezialisten. Die Verhaltensforscher waren im Hinblick auf die Säugetiere immer etwas mißtrauisch, weil man unter dem Einfluß der Psychologen meinte, daß Säugetiere zu viele individuelle Verschiedenheiten zeigten. Was die Huftiere anbetrifft, hat der Verfasser bahnbrechende Arbeit verrichtet. So ist denn jetzt eine vergleichende Übersicht erschienen über das Verhalten der Gazellen-Gruppe im engeren Sinne.

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A. C. V. VAN BEMMEL, Rotterdam

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Zeitschrift/Journal: [Mammalian Biology \(früher Zeitschrift für Säugetierkunde\)](#)

Jahr/Year: 1967

Band/Volume: [34](#)

Autor(en)/Author(s): Roberts Tom J.

Artikel/Article: [A Note on Capra Falconeri - \(Wagner, 1839\) 238-249](#)