

MARKHOR IN CHITRAL GOL

by

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Summary. *The paper deals with the population dynamics and feeding behaviour of Markhor (Capra falconeri falconeri) in Chitral Gol. The estimated population of 225 consisted of all age classes but with lower male/female and the young per female ratios. The percentage of yearling and the young in the population suggested a normal population on the increase. Feeding habits and food plants preferred by the animal were observed and the results of the analysis for nutritional contents of food plants have been reported.*

The area. Chitral Gol is a narrow valley of about 80 km.² It starts about 3 km. west of Chitral town, runs as a gorge for about 18 km. and then broadens into three sub valleys, each surrounded by high peaks. A number of small watersheds—Meran, Tangogh, Kasawer, Bakhtanshal, Bironshal, Gokhshal, Chhat, Duni, Dundini—drain into Chitral Gol, the principal stream which joins the Kunar river near Chitral town.

The elevation of the tract varies from about 1,500 to 4,900 metres; twenty four peaks exceed 3,000 metres. The area is steep and rugged with gradient varying from 45 to 120°. Landslips are common causing deposition of scree and morain at the foot of the mountains. Soil depth varies from almost zero on steep slopes and areas over 3,000 metres elevation, to about a metre on gentle slopes, and still deeper at valley bottoms.

The climate is dry temperate. Frost and snow start from September on high peaks and November in the valley. Snow stays till March in valleys and June on mountains. Rainfall is mostly received during December to May. No climatic records are available for Chitral Gol. The following data are for the nearby town of Chitral, elevation 1436 metres. The rainfall for Chitral Gol will be higher, and temperatures lower. No information is available for snowfall.

Month	Temperature °C			Rainfall (m.m.)
	Mean	Mean Maximum	Mean Minimum	
January	3.6	7.6	0.3	36
February	5.2	9.4	0.9	41
March	9.6	14.4	4.7	94
April	14.8	20.6	8.9	104
May	21.2	27.5	15.0	48
June	26.8	33.3	20.3	18
July	29.5	35.9	23.1	15
August	28.9	35.1	22.6	18
September	24.5	31.1	23.6	18
October	18.3	24.8	11.8	33
November	12.1	23.3	6.5	08
December	6.1	10.3	2.0	31

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Temperature, °C

Mean annual	—	16.8
Mean monthly maximum	—	28.1
Highest recorded	—	43.3
Mean monthly minimum	—	6.2
Lowest recorded	—	12.2

Rainfall, m.m.

Mean annual	—	462
Highest annual	—	675 (1931)
Lowest annual	—	218 (1905)
Months with less than 5 mm		10
No. of rainy days	—	42

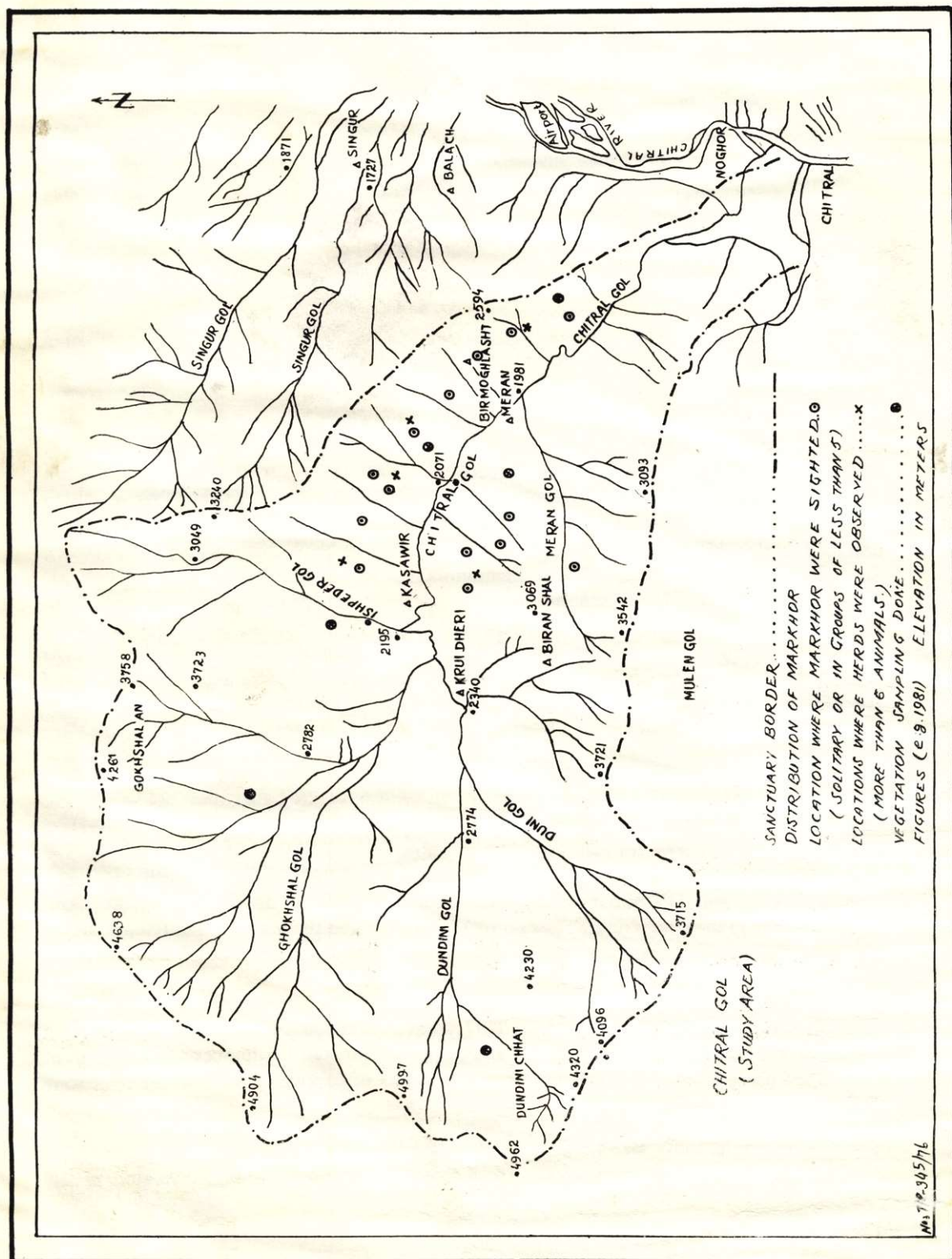
Mean annual humidity	—	63
Period covered (years)	—	40

Vegetation. At elevations up to 2400 metres the vegetation type is dry temperate oak forest (*Quercus ilex*)—(Champion, Seth and Khattak, 1965) with the following species composition.

- I. *Quercus ilex*
- II. *Pistacia mutica*, *P. khinjak*, *Prunus amygdalis*, *Fraxinus xanthoxyloides*, *Salix* spp., *Celtis australis*,
- III. *Sophora mollis*, *Sorbaria aucuparia*, *S. tomentosa*, *Spiraea* sp. *Lonicera quinquelocularis*, *Cotoneaster nummularia*, *Rumex hastatus*, *Haloxylon* sp., *Daphne oleoides*, *Rosa* spp., *Artemisia maritima*, *A. scoparia*, *Ferula narthax*, *Verbascum thapsis*, *Polygonum* sp., *Cousinia thompsonii*, *Taraxicum officinalis*,
- IV. *Rheum* sp., *Astragalus* sp. *Valeriana* sp., *Impatiens* sp.
- IV a. *Pennisetum feaeidum*, *Bromus japonicus*, *Oryzopsis* sp., *Phacelurus speciosus*, and *Arundinaria* sp.

At higher elevations the type grades into the dry temperate coniferous forest with the inclusion of *Cedrus deodara* and *Pinus gerardiana*. Still higher, the latter is replaced by *Juniperus macropoda*, and the following species are added to the ground vegetation.

- III. *Jasminum* sp., *Ferula narthax*, *Asperula oppositifolia*, *Merendrea aitchisonii*, *Prunus prostrata*, *Arabidopsis wallichii*, *Ephedra nebrodensis*, *Scrophularia variegata*, *Ephedra procera*, *Polygonum gilseii*, *P. mucronatum*, *Nepeta raphanorhiza*, *Prangos pabularia*, *Viburnum cotonifolium*, *Leptorhabdos linifolia*.
- IV. *Plantago major*, *Plantago lanceolata*, *Tulipa* spp., *Iris* sp., *Arenaria* sp., *Dianthus angulatus*,
- IV a. *Chrysopogon* sp. *Poa sinaica*, *Dactylis glomerata*, *Aristida* sp.



The tree limit is at 3350 metres and the following species comprise the alpine meadows above it.

- II. *Salix* spp.
- III. *Viburnum cotonifolium*, *Juniperus communis*, *J. recurva*, *Rosa macrophylla*, *Polygonum mucronatum*, *Hypericum perforatum*, *Thymus serpyllum*
- IV. *Taraxicum officinalis*, *Lactuca viminea*, *Trifolium repens*, *Vicia* sp., *Plantago major*, *Plantago lanceolata*, *Potentilla* spp., *Nepata podostachys*, *Saxifraga* sp., *Galium* sp., *Anemone* sp. *Tulipa* spp.
- IV a. *Festuca ovina*, *Poa sinaica*, *Poa* sp., *Agropyron* sp., *Agrostis* sp.

The Markhor. The Markhor (*Capra falconeri* Wagner) belongs to the division Artiodactyla of the hoofed animals (Ungulates) and is a member of the Bovidae family, which includes cattle, sheep and goats. Markhor is a goat (genus *Capra*). The species (*falconeri*) has been divided into 7 sub-species, 5 of which are found in Pakistan. The members of the species are distributed in the mountains of north-western India, Pakistan, Afghanistan and Russian Turkistan (Schaller and Mirza, 1971). In Pakistan it is found in the Himalayas from the valley of Kashmir westwards, and the Hindu Kush. Precise distribution is Pir Panjal range in Kashmir (*C.f. falconeri*), Northern Areas. (*C.f. falconeri*) and (*C.f. cashmiriensis*), Chitral (*C.f. cashmiriensis*), hills of N. Waziristan (*C.f. megaceros*), Suleman mountains (*C.f. jerdoni*) and the mountain ranges of Baluchistan (*C.f. megaceros*) and (*C.f. falconeri*). The one sub-species found in Chiltan range Quetta had been designated as *C.f. chiltanensis* (Prater, 1971). Shaller (1975), however, is of the view that there are only two sub-species existing in Pakistan viz. *C.f. falconeri* and *C.f. megaceros* and the two sub-species *C.f. cashmiriensis* and *C.f. jerdoni* are the simple variations of the sub-species mentioned before, whereas *C. f. chiltanensis* is not the Markhor but is a variety of Sind ibex (*Capra hircus*).

The Markhor found in Chitral Gol has been classified as *C. f. cashmiriensis* (Schaller and Mirza, 1971) and now as *C. f. falconeri* (Schaller and Khan, 1975). The southeastern limit of its distribution lies in vallies bordering the Neelam River (Azad Kashmir); towards north the sub-species is distributed throughout the Northern Areas. The distribution extends in a narrow band across northern Indus Kohistan, Swat and Dir into Chitral. The southern limit of its distribution lies at about 35° 20' N, where the river Kunar crosses into Afghanistan and the northern limit at about 36° 10' N. Its distribution is also contiguous with eastern Afghanistan near the Chitral (Pakistan) border.

Description. Schaller and Mirza (1971) have identified the following age and sex classes on the basis of differences in size and pelage colour, on the number of horn rings at times discernable from a distance and on photographs of captive animals whose ages were known.

Adult male, class III, 4.5 years and older: 95 to 100 cms at the shoulders, with dignified and patriarchal appearance. Horns long, dark and spiralling, diverging widely

and forming an open spiral. In some cases, the divergence is less and two complete spirals are formed.

Flowing beard and mane falling from neck and shoulders to the knees. Beard long, prominent, black. Flowing ruff of white hair on chin, neck and chest. Sometimes white tufts on chin, neck and chest, and forearm and stifle.

Spinal crest of elongated dark hair from nape to neck. Dark flank stripe separating the white belly from the brownish, blackish or greyish sides. Sometimes a vertical slash of dark hair in front of the shoulders and before the haunch, and a grey patch on the thigh.

Tail black, often fringed with a few white hair, shanks white with a dark wedge just below the callus of the knee.

Young adult male (class II) age 3-1/2 years: Resemble class III except that horns are shorter, ruff less voluminous and white hairs to a fringe on the fore-arm and across the chest.

Sub adult male (class I) age 2-1/2 years: The size of the sub adult males is comparable to that of females. Horn length 35 to 40 cms. Pelage colour dark brown, neck greyish; ruff lacking.

Yearling male, age 1-1/2 years: Resemble females in pelage colour and size. Horns like those of females but darker and somewhat longer and broader.

Females: Compared with adult males, adult females are less strikingly marked and are about half as heavy. Pelage colour fawn-to rusty except the face which is greyish. Belly white, a dark line of hair runs along the neck from chin to chest and another down the back. Beard short and wispy. The thin spiralling horns are about 25 cms. long.

Size of yearling females, 1-1/2 years old, is smaller, the muzzle shorter and the horns are only half as long as those of adults.

The young, six months old, can readily be distinguished from other classes as their size is considerably smaller than the yearlings, and their horns are straight and only 7 cms. long.

Population dynamics. Method: The census was taken during February-March 1975 when Markhor concentrate at lower elevations in the main valley which was still under snow and the number of livestock was the minimum. A previous attempt in the summer of 1974 failed because the animals had migrated to higher elevations and were highly dispersed.

Since Markhor, like most other big game species, form discreet herds each of which remains confined to a certain part of the valley (Schaller, 1971), different zones of the valley were marked after a reconnaissance survey and each zone surveyed thoroughly with the help of two local guides. Binoculars (8 × 30 and 7 × 50) were used for spotting and for further observation of the animals. Spotting of the animals was possible in the morning

just after sunrise to 10.00 a.m. and before sunset, from 3.00 p.m. to 5.00 p.m. In between, the animals were seen only casually which was attributed to their stray walks.

Spotting of animals was easy in clear weather, when the gleaming snow presented an excellent background. But the weather most of the time remained cloudy and visibility was very poor, and it was with an effort that the animals could be observed. The animals after being spotted were observed for as much time as was possible or allowed by the animals. Observations were discontinued when the animals moved from one place to another while feeding or when disturbed, when they disappeared under the shade.

Since it was difficult to class all animals by age groups, due to poor visibility and the distances involved while spotting, the animals were classed only as males, females, yearlings and young. Males of class I, II and III were all included in the category 'males' whereas the females formed a distinct group. Yearling males and females of the age one year and 8 months also were not further categorized according to sex and were classed as yearlings only. The youngs were less than 8 months old and were easily recognised and classed.

By this time the rut had long been over and mixed herds had started disintegrating though some were still in tact—the largest seen comprised 26 animals. The males, and the females with yearlings and the young had formed separate herds. Some solitary males and females with one or two young or yearlings were also observed. The largest male herd comprised eight animals. Each herd over five animals was analysed for age and sex. Only five herds could meet this condition.

Population estimation. A total of 358 animals were flushed out of which 258 animals could be classed according to the age/sex whereas 59 animals could not be graded. Many of the animals spotted were seen twice or thrice but by carefully outlining the areas of their occurrence and identifying the herds and individuals, the total population was estimated to be 225.

The result of the count is given below:

Locality	Number of animals				
	Male	Female	Yearling	Young	Total
Thok Jal	5	8	4	8	25
Shukur Gol	2	3	3	2	10
Loh	10	16	7	6	39
Thusi	9	10	4	7	30
Daleem Dehar	7	20	3	5	35
Mardeen	5	9	—	4	18
Tangogh	6	13	4	12	35
Kasaveer	4	4	2	2	12
Shush Mologh	5	4	3	3	15
Chutak	2	3	—	1	6
Meran ¹	(6)	(4)	(2)	(3)	(15)
Total:	55	90	30	50	225

1. Reported but not seen.

Total number of animals	225
Percentage of males	27.1
Percentage of females	40.00
Percentage of yearlings	13.4
Percentage of young	17.5
Number of yearlings per female	0.33
Number of young per female	0.56

The sex ratio in the young is unknown but a ratio of 1:1 has been suggested based on the birth records of 93 markhor of unspecified race in various zoos of the world. The juvenile sex-ratio was 45 males and 48 females (Jarivs 1956-68; Cf. Schaller and Mirza, 1971). The adult sex-ratio in the Markhor in Chitral was found to be un-even i.e., 55 males and 90 females, which might have been caused due to the loss of adult males wandering out of the sanctuary into the adjoining valleys where the hunting pressure is very high.

Roberts (1969) has suggested a high twinning rate in the adult females and single births in the young. This is also confirmed by Schaller and Mirza (1971). They have estimated a ratio of 1.3-1.4 young per female in 1970, 1972 and 1974. In the present study a ratio of 0.56 young per female was observed which is very low. This may be attributable to juvenile mortality and to the predation in younger stages.

Mortality from 6-18 months age between the age 6 months and 18 months has also been reported to be very high (50%) (Schaller and Mirza, 1971). The ratio of yearling per female in this study (0.33) corresponds to the ratio (0.5) quoted by Schaller (1971); the difference could be accounted by the difference in time of census—2 to 3 months later than that of Schaller's.

Though the loss is very high in the juvenile and younger stages, the population is still vigorous as shown by the percentage of young (17.5) and yearlings (13.4) in the population which indicates a normal growth pattern. The population is considered to be on a steady increase, as the population of 125 ± 10 (Schaller and Mirza, 1971) has increased to 225 (the present study).

Vertical distribution. Markhor occupies different ranges in different seasons. Winters are passed at lower elevations and summers at higher. They remain confined to these areas all through summer whereas with the advent of winter the descent starts and they reach lower valleys where the climate is less severe as compared to their summer ranges. Some other factors viz. shortage of food and the search for their mates also contribute towards their seasonal migration.

Factors affecting the population. The following factors are relevant to the growth of the population:

- (i) **Poaching:** Since the declaration of the area as game sanctuary in 1971, it is assumed that the area is fully protected and poaching has been stopped. But the summer range is too far off to be controlled properly. No reports on poaching were, however, made during this period. On the last day of the visit, a female

markhor was reported to have been killed illicitly under circumstances which suggest that planned poaching is still going on.

- (ii) Predation: The main predator in the area was the snow leopard (*Panthera uncia*). Schaller (1971) has reported that 5 out of 16 droppings of snow leopard collected, contained the remains of markhors. But for the past two years no leopard has been reported from the area. (*Canis lupus*) and bear (*Selanarctos thibetanus*) are other possible predators but no reports of their predation have been made. A wolf once was observed attacking a young, the herd gathered and the adults took the herd under their guard and the wolf fled away.
- (iii) Diseases: One female markhor of 5 years age was reported to have died of Anthrax in January 1974. The disease is common in livestock and probably was transmitted through them. Diseases of some minor magnitude have also been reported but they are not fatal.
- (iv) Predation by dogs: Dogs are a fatal enemy of the young. No dogs are allowed in the sanctuary.
- (v) Falcons: Falcons prey upon the young. During the visit once three falcons attacked a young but the herd gathered and the males forced them to retreat. The birds again tried, twice, but could not succeed.

This form of predation may be effective only for solitary or stranded young.

Herd side and composition. The size and composition of markhor herds keeps on changing with season. Males and females are represented in the herds at the time of the rut whereas separate herds are formed after the rut is over. At the time of the visit, the rut had long been over and the herds had started disintegrating and reshaping. The composition of 5 herds seen during the visit in March-April 1975 was as follows:

Herd No.	Male	Female	Yearling	Young	Total
1	—	13	5	9	27
2	8	—	—	—	8
3	11	7	2	3	23
4	8	4	3	—	15
5	—	4	—	4	8

Only those herds were noted which numbered more than 6. Individuals in groups of upto 4 were spotted quite often. Such groups varied in composition. Sometimes these consisted of males or females only, whereas these often comprised of females accompanied by yearlings and the young.

Only in three cases did the males accompany the females with the young and that too for a very short time.

The largest herd observed consisted of 27 animals and the second largest of 23 animals. Such large herds are, reportedly, not common. It may be that two herds joined on their patrol for a while and subsequently disintegrated. The herds were observed for 7 and 10 minutes respectively. Then they crossed over the ridge and were hidden from view.

Food habits. The feeding habits of markhor were studied in Chhatt area which was reasonably protected and where no signs of livestock grazing were observed at the time of study. Browsed plants were noted by ground check. Direct observations on feeding markhor were also made through binoculars. The following species were found to be eaten at the time of the study:

Merendra aitchisonii, *Tulipa stellata* var. *chrysantha*, *Tulipa* sp., *Arabidopsis wallichii*, *Nepeta raphanorhiza*, *Polygonum mucronatum*, *P. gilseii*, *Lactuca viminea*, *Cousinia thompsonii*, *Dianthus angulatus*, *Scrophularia variegata*, *Asperula oppositifolia*, *Aster altaicus*, *Chesney* sp., *Leptorhabdos linifolia*, *Ephedra procera*, *Lonicera* sp., *Prunus prostrata*, *Cotoneaster nummularia*, *Astragalus* sp., *Rosa* sp., and a plant of *Caryophyllaceae*.

The following plants were found to be eaten during winter:

Quercus ilex (leaves), *Prunus amygdalis* (twigs), *Pistacia mutica* (twigs) *Pistacia khinjak* (twigs), *Sophora mollis* (twigs), *Astragalus* sp. (roots), *Sorbaria tomentosa* (shoot tips), *Cotoneaster* (twigs), *Lonicera* (twigs), *Rumex hastatus* (twigs), *Artemisia maritima* (twigs), *A. scoparia* (dried shoots), *Bromus* sp. (dried grass shoots), *Agrostis* sp. (dried grass shoots).

The markhor keeps moving while feeding thus covering large distances during the daily patrol in search of food and water. Even if food is in plenty the animals still keep on strolling and would not stay in one place. From early spring to late autumn they occupy alpine grazing grounds where forbs and grasses are available. A variety of flora presents a wide choice of diet and the animals generally nibble the current year's tender shoots. Browse is almost absent on these ranges.

After snowfall, the animals descend to lower elevations. Here ground cover is scanty and the available forage comprises the current year's growth of trees e.g. *Quercus ilex*, *Prunus amygdalis*, *Pistacia mutica* and *P. khinjak*; and shrubs e.g. *Sophora mollis*, *Cotoneaster nummularia* and *Lonicera quinquelocularis*; and dried forbs and grasses.

Green leaves of *Quercus ilex* trees form the major part of their diet.

Most of the time the animals were observed feeding on oak (*Quercus ilex*) trees, sometimes nibbling its low, hanging branches and sometimes feasting high upon the tree. They jumped from slopes to tree crowns, balanced themselves on the branches, and con-

tinued feeding. 5 animals at a time were seen on different branches of a tree. The duration of single feeding varied—the maximum observed was 30 minutes. After feeding on a tree, they descended with a swift leap to the ground. This is also a feeding device for the youngs. A mother was observed on a low hanging branch, balanced so that the tips almost touched the ground where the two youngs were feeding.

While feeding on the ground flora, the animals showed variable behaviour. They acted quite independently even in groups. One group of animals was observed on a clear day for an hour (from 8.40 a.m. to 9.40 a.m.) in March 1975 and the following successive pattern was noted.

Duration (minutes)	Activity	
	Lying down	Feeding
10	3	5
2	1	7
13	6	2
20	4	4
5	5	3
3	2	6
5	3	5
2	4	4

The maximum activity was observed during mornings and evenings though it was not altogether absent at noon. Maximum sightings were made during the first 3 hours after the sunrise and 2 hours before sunset. Only straglers were seen feeding in between.

Nutritional quality of forage plants. Specimens of the forage plants were collected from the site on May 14, 1974 (Chhat) and March 6, 1975 (Meran), dried in the shade for 24 hours, packed in polythene bags and brought to the Institute on May 20, 1974 and March 12, 1975. Here they were analysed by the Chemistry Branch using Official Methods of the

Association of Official Agricultural Chemists of U.S.A. (Horwitz, 1960). The results are given below:

Species	Moisture %	Total ash %	Crude fats %	Fiber %	Crude proteins %	Carbohy- drates %
<i>Lactuca viminea</i>	5.0	9.3	5.0	20.0	12.3	48.3
<i>Prunus prostrata</i>	6.0	6.5	4.0	15.9	14.8	52.8
<i>Polygonum gilseii</i>	7.6	10.6	3.0	19.5	6.2	53.1
<i>Astragalus</i> sp.	7.8	5.9	2.9	28.9	14.8	39.7
<i>Rosa macrophylla</i>	7.6	5.0	3.9	12.9	11.1	59.5
<i>Sorbaria tomentosa</i>	6.6	6.3	4.0	5.3	19.6	58.2
<i>Cotoneaster nummularia</i>	6.2	8.2	3.3	7.0	14.4	69.9
<i>Rumex</i> sp.	9.6	1.2	4.6	3.1	19.6	61.9
<i>Ferula narthax</i>	9.0	2.6	4.4	7.8	15.7	60.5
<i>Taraxicum officinalis</i>	11.6	15.6	4.2	7.1	11.8	49.7
<i>Cousinia thompsonii</i>	10.7	10.2	5.8	15.7	19.6	38.0
<i>Asperula oppositifolia</i>	9.3	8.9	3.7	26.1	11.8	40.2
<i>Ephedra nebrodensis</i>	8.0	8.8	2.7	14.3	11.8	54.4
<i>Scrophularia variegata</i>	6.5	6.8	2.5	18.7	12.3	53.2
<i>Compositae</i>	9.0	7.4	2.7	24.9	15.8	40.2
<i>Cruciferae</i>	6.5	6.8	2.5	18.7	12.3	53.2
<i>Quercus ilex</i> (foliage)	6.0	7.6	6.8	18.6	—	—
<i>Sophora mollis</i> (foliage)	5.6	5.7	4.2	32.0	—	—

Specimens belonging to:

<i>Caryophyllaceae</i>	8.5	10.3	3.4	19.0	15.8	43.0
<i>Quercus ilex</i> (leaves)	6.0	7.6	6.8	18.6	5.5	62.3
<i>Sophora mollis</i> (twigs)	5.6	5.7	4.2	32.0	7.0	45.5
<i>Rumex hastatus</i>	7.7	6.4	2.9	31.1	3.2	48.7
<i>Agrostis</i> sp.	5.8	4.0	2.3	24.0	2.7	60.5

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