

Population Status, Feeding Ecology and Activity Pattern of Colobus Monkey (*Colobus guereza*) in Finote Selam Forest, West Gojjam, Ethiopia

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Abstract: Colobus monkey (*Colobus guereza*) is black and white in color distributed in forests and within savanna woodlands to the north of the moist forests of central Africa, often extending into highland or Montane forests. A study documents information on population status, feeding ecology and activity pattern of colobus monkey in Finote Selam Forest, Ethiopia. Data were collected using total count method, direct observation and scan sampling method from August 2014 to April 2015 seasonally from the study area. Data were analyzed using descriptive statistics and tested with Chi-square test and One-Way ANOVA. The results indicated that the average number of colobus monkey was 54 during the wet season and 57 during the dry season. There was no significant difference in the number of colobus monkey during the wet ($\chi^2 = 0.96$, $df = 3$, $P > 0.05$) and the dry ($\chi^2 = 22.8$, $df = 3$, $P > 0.05$) seasons. Colobus monkey consumed primarily leaves followed by fruits during wet season. However, during the dry season, they fed on leaves, fruits, shoots and flowers. Colobus monkeys spent much of their time on resting followed by feeding travelling and grooming. There was significant variation in activity budget between groups ($\chi^2 = 113.12$, $df = 3$, $P < 0.05$) during the wet and dry ($\chi^2 = 129.54$, $df = 3$, $P < 0.05$) seasons. Finote Selam Forest is highly threatened by the local community due to different activities. Therefore, Woreda Administration should work a lot with the community to ban negative activities and protect the Forest. Furthermore, different conservation measures should be taken in to consideration to increase the number of colobus monkey.

Key words: Activity pattern • Colobus monkey • Feeding ecology • Finote Selam Forest • Population status

INTRODUCTION

Colobus monkey (*Colobus guereza*, Ruppel, 1835) is black in color with white layer extending from the shoulder to the hip. It has long tail with white clump at the end and its face is encircled with white hair, with shaggy cheek hairs and a white band of color on the thigh. The layer is long which extends to the back on the lower abdomen. The tail is either white or yellow in colour from tip to base with a large white tuft at the end of the tail. At birth, the hair of infant colobus monkey is completely white and the face is grey and has no fur. Compared to the infant colobus monkey, adult colobus monkey has predominately black fur. The weight of adult male ranges between 9.3 and 13.5 kg; while the female weighs between 7.8 and 9.2 kg [1, 2].

Colobus monkeys are distributed in forests and within savanna woodlands to the north of the moist forests of central Africa, often extending into highland or

Montane forests [2]. Other habitat types include riparian, upland forest, moist lowland, medium altitude highland forests, rainforests, swamp forests and wooded grasslands [3]. In addition, they can also be found in high forest mountainous areas, including altitudes up to 3300 m.a.s.l. as well as areas under human use such as eucalyptus plantations [4]. One of the subspecies, *C. g. guereza* is found in forested areas of the Ethiopian highlands, west of the Rift Valley and down into the lowland reaches along the Awash River, the Omo River and in the Blue Nile Gorge.

Colobus monkeys are leaf eating primates. However, they appear to have the most varied and flexible diet. They predominately feed up on leaf material, fruits and seeds. According to Fashing [5], young leaves are preferred and eaten much more frequently than mature leaves. They reside in small groups that range in size 3-15 individuals; the group comprises one adult male, several adult females, juvenile males and infants. [4] noted that

sexual maturity in colobus monkey requires at least 6 years in males and 4 years in females. Each adult female produces young at every 20 months. The gestation period is 180 days. Colobus monkey is diurnal species and spends more time for resting. The remaining activity time budgets are used for feeding and moving. Since they are arboreal species that can be seen through the canopy by jumping from tree to tree and sleep at night with a single group occupying several adjacent trees close to a source of food [4]. There is no study conducted on colobus monkey in the study area. Therefore, the present aimed to: i) investigate current population status of colobus monkey in the study area; ii) show the feeding ecology of colobus monkey; and iii) examine diurnal activity pattern of colobus monkey in the study area.

MATERIALS AND METHODS

The study area: Finote Selam Forest is located in west Gojjam which lies between 37° 15' - 37° 16' longitudes east

and 10°40'-10°40' 30" latitudes north (Fig. 1). It is found 385 km away from Addis Ababa. It covers an area of 391 ha with altitude ranging from 1801-1850 m.as.l. The average minimum and maximum monthly temperature are 6.9°C and 30.9°C, respectively.

Mean annual rainfall in the area is 74.8 mm. According to Mulugojjam Taye *et al.*[6], the main rainy season of the study area occurs from June to September. There are different soil types in the area including, Luvisols, Fluvisols, Alisols, Nitisols, Vertisols, Leptosols and Regosols [7]. There are different types of plant species found in the study area. These include *Coffea arabica*, *Mangifera indica*, *Azadirachta indica*, *Vernonia amygdalina*, *Acacia abyssinica*, *Olea africana*, *Persea americana*, *Albizia sechimperiana* and *Cordia africana*. On the other hand, there are also different animals in the study like vervet monkey (*Ceropithecus aethiopicus*), porcupine (*Hystrix africaeaustralis*), Ardvark (*Orycteropus afer*), spotted hyena (*Crocuta crocuta*), reptiles, amphibians and different species of birds.

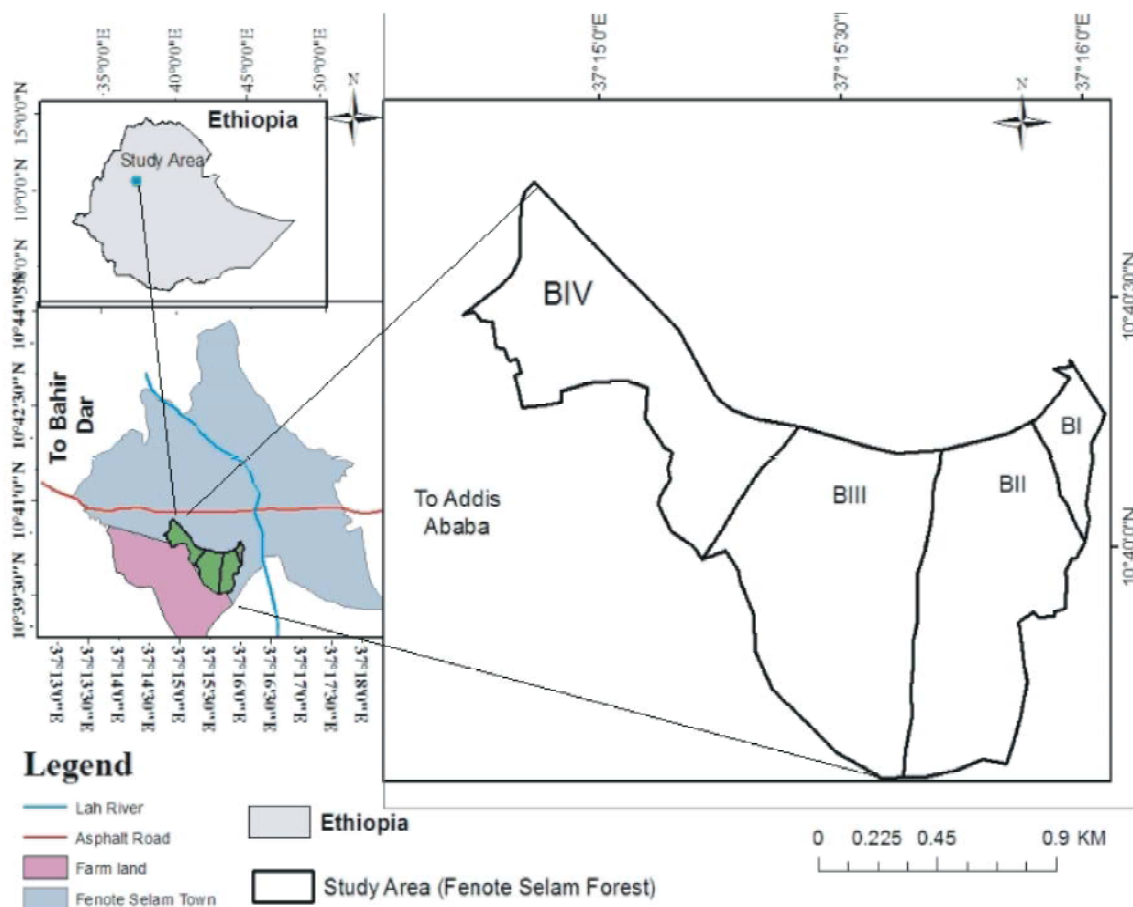


Fig. 1: Map of Finote Selam Forest and study sites

Methods

Pilot Survey: Before the actual data collection, pilot survey was conducted in August 2014. During this period, sample areas were selected and classified based on based on vegetation types.

Population Estimate: To estimate population size of colobus monkey in the study area total count method was employed during wet and dry seasons [8]. The study area was divided into four blocks (B-I, B-II, B-III and B-IV) using natural and artificial boundary [9]. Censuses was conducted during early morning and late afternoon in each block in wet and dry seasons repeatedly [10]. Counts were carried out using unaided eyes binocular. During census, individuals were identified based on age and sex. Surveys were conducted to resolve the presence or absence of colobus monkeys in different part of the study area following [11, 12].

Feeding Ecology: To study the feeding ecology, repeated standard observation and focal sampling method were used following [13]. Focal sampling consisted of watching an individual for a fixed period (10 min) with an aided eye or with binocular according to the distance of the encountered colobus monkey from the observer. Data such as plant species, part of plant eaten and time spent for foraging were recorded[14]. Parts of the plant consumed by the study animal were classified as young leaves, fruits, shoots and flowers. Specimens of plant species collected from the study area were pressed, dried and taken to Debre Markos University for identification purpose.

Activity Pattern: Data on activity pattern of colobus monkey was collected using scan sampling method [15]. Focal animal was randomly selecting by stratifying based on age and sex. However, if the focal animal was in a group, the activity of the group was considered at the beginning of the observation. Observation was conducted for five minutes at every 15 minutes interval from early morning (6:00) to late afternoon (18:00) during the wet and dry seasons. Activities like feeding, playing, grooming, chasing, fighting and resting were recorded [16].

Data analysis: Data were analyzed using SPSS software version 20 and Microsoft Excel. Descriptive statistics was used to calculate population size. Comparison of food items consumed were computed using chi-square test across seasons.

RESULTS

Population Estimate: The maximum number of colobus monkey in the study area recorded during the dry season was 57 and 54 during the wet season (Table 1). On the other hand, the maximum group size was 9 ± 1.2 . There was no significant difference in the number of colobus monkey during the wet and dry season ($\chi^2 = 0.96$ df = 3, $P > 0.05$). However, there was significant difference in the number of colobus monkey among blocks ($\chi^2 = 51.5$, df = 5, $P < 0.05$).

Of the total individuals sighted in the study area, 54.1% constituted adult female, 7.2% adult male, 18.9% sub adult female, 3.6% sub adult male and the remaining 16.2% constituted unidentified juveniles. The number of animal group significantly differed during the wet ($\chi^2 = 22.8$, df = 3, $P < 0.05$) and the dry ($\chi^2 = 86.81$, df = 6, $P < 0.05$) seasons. Adult female groups constituted the largest during both wet (51.9%) and dry (56.1%) seasons. Whereas sub adult male groups constituted the least value during wet (1.8%) and dry (5.3%) seasons. Sex and age ratio of colobus monkey differed ($P < 0.05$) across seasons. The sex and age ratio of sub adult females and sub adult males (1:9) were greater during the wet season while the sex and age ratio of males and females (1: 6.3) were greater during the dry season.

Feeding Ecology: Colobus monkeys were observed feeding 11 plant species in nine families during both wet and dry seasons in the study area. The plant species were trees and shrubs. There was significant variation the type of food consumed during wet ($\chi^2 = 155.4$, df = 1, $P < 0.05$) and dry seasons ($\chi^2 = 205.8$, df = 3, $P < 0.05$). *Albizia sechimperia* was the most frequently consumed food item during the wet (34.7%) and dry (20.1%) seasons. On the other hand, *Olea africana*, *Rhus glutinosa*, *Persea Americana* and *Hibiscus rosa sinensis* were not consumed by colobus monkey during the wet season (Table 3).

Colobus monkey largely consumed young leaves (97.7%) and the remaining 2.3% constituted fruits during the wet season. However, during the dry season, their diet constituted young leaves (58.8%), fruits (23.2%), shoots (16.6%) and flowers (1.4%). There was significant variation ($\chi^2 = 43.12$, df = 3, $P < 0.05$) in parts of plant consumed by colobus monkey during the wet and dry seasons (Fig. 2).

Activity Pattern: Colobus monkey was observed doing different activities in the study area. The major activities were resting, feeding, traveling and grooming. There was

Table 1: Number of colobus monkey recorded in wet and dry season

Season	B-I	B-II	B-III	B-IV	Total
Wet	11	14	16	13	54
Dry	11	15	18	13	57
Mean	11	14.5	17	13	55.5

Table 2: Age and sex ratio of colobus monkey during the wet and dry season in the study area

Season	AM: AF	SAM : SAF	M : F	AM: SAM	AF : SAF
Wet	1:4	1:9	1: 7.4	4:1	3.1:1
Dry	1:4	1:4	1:6.3	1.3:3	2.7: 1

Table 3: Percentage of food items consumed by colobus monkey during wet and dry seasons

Common name	Species	Family	Relative Percentage	
			Wet season	Dry season
Large podded albizia	<i>Albizia sechimperiana</i>	<i>Fabaceae</i>	34.7	20.1
Bitter leaf	<i>Vernonia amygdalina</i>	<i>Asteraceae</i>	17.3	3.4
Acacia	<i>Acacia abyssinica</i>	<i>Fabaceae</i>	2.7	6.7
African wild olive	<i>Olea africana</i>	<i>Oleaceae</i>	9.3	2.8
Large leaved cordial	<i>Cordia africana</i>	<i>Boraginaceae</i>	0	12.8
Large leaved cordial	<i>Dracaena steudneri</i>	<i>Dracaenaceae</i>	4	8.9
	<i>Rhus glutinosa</i>	<i>Anacardiaceae</i>	0	7.8
Mango	<i>Mangifera indica</i>	<i>Anacardiaceae</i>	5.3	17.3
Avocado	<i>Persea americana</i>	<i>Lauraceae</i>	0	6.1
Neem	<i>Azadirachta indica</i>	<i>Meliaceae</i>	26.7	8.9
	<i>Hibiscus rosa-sinensis</i>	<i>Malvaceae</i>	0	5.2
Total			100	100

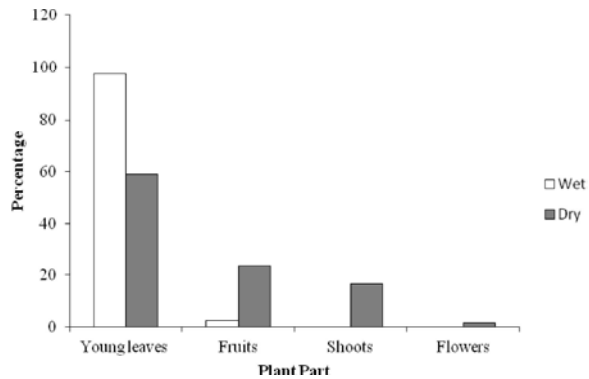


Fig. 2: Percentage of plant part consumed by colobus monkey in the study area during the wet and dry seasons.

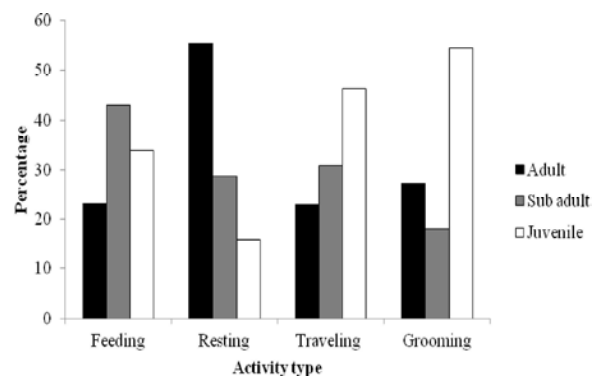


Fig. 4: Percentage of activities conducted by colobus monkey among age groups during wet season.

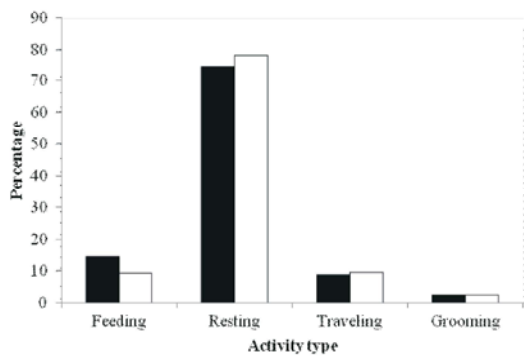


Fig. 3: Percentage of activities conducted by colobus monkey during the wet and dry seasons

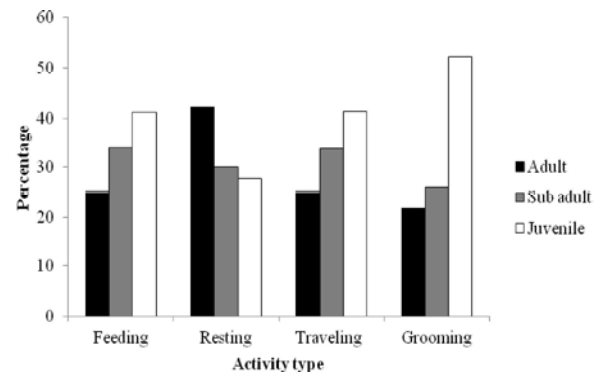


Fig. 5: Percentage of activities conducted by colobus monkey among age groups during dry season.

significant variation in terms of activity budget of colobus monkey ($\chi^2 = 113.12$, $df = 3$, $P < 0.05$ during wet season and ($\chi^2 = 129.54$, $df = 3$, $P < 0.05$) dry season. From the total observation, the animal spent 74.3% of its time for resting, 14.5% for feeding, 8.7% for traveling and the remaining 2.5% for grooming during the wet season. On the other hand, the study animal spent 78.4% of its time for resting, 9.5% for feeding, 9.5% for traveling and 2.7% for grooming during dry season (Fig. 3).

There was significant variation ($P < 0.05$) in terms of the activity budget among different age groups. From the total activities conducted by all age groups, juveniles showed the largest percentage for traveling (46.2%) and grooming (54.6%). While adults and sub adults spent more time for resting (55.7%) and feeding (43.1%), respectively during the wet season (Fig. 4). On the other hand, juveniles spent most of their time for feeding (41.3%), traveling (41.3%) and grooming (52.2%) where as adults used more time for resting (42.2%) than other age groups during the dry seasons (Fig. 5).

DISCUSSION

According to the present study, the population sizes of colobus monkey in the study area were 57 during the dry season and 54 during the wet season. The result of this study illustrated variation of population size among study blocks. This is probably due to the difference in vegetation distribution. Similarly, according to Fashing *et al.* [17]. Also, high vegetation distribution resulted in high population size of black and white colobus monkey in Kakamega Forest, Kenya. Group of sub adult females of black and white colobus monkey were more abundant than other age groups. This will have a good opportunity to increase their population in the study area in the future.

According to the present study, colobus monkey foraged on 11 different plant species during both wet and dry seasons in the study area. Their foods were mainly leaves, shoots, fruits and flowers. According Fashing [14], colobus monkeys are leaf-eating primates. Different studies on the other hand have shown that young leaves are preferred and eaten much more frequently than mature leaves [18]. They also suggested that wild colobus is engaged on leaves due to its high protein and fiber contents. Young and mature leaves contain 20-30% of protein. Some authors noted that colobus monkey look for swamp plants, bark and drink water from mud puddles to ingest ample levels of minerals lacking in their primary

food components [19, 20]. This primate obtained most of its diet from leaves, principally young leaves [21]. Likewise, [2] noted that colobus monkeys are most of the time prefer and engaged on leaves that are less vulnerable to seasonal fluctuations. Fruits are frequently consumed by colobus monkey when unripe [3]. *Albizia sechimperiana* was the staple food for black and white colobus monkey during both wet and dry seasons. There was significant variation in parts of plant consumed by colobus monkey during the wet and dry seasons.

The type of food and plant species was different seasonally, most plants in the study area shaded their leaves during dry season and the study animal changed their foraging seasonally and the most predominant food type was young leaf and followed by unripe fruits. Food availability and preference might be the major reason for seasonal variation in food items consumed.

Activities of primates can be determined by their habitat types. In turn, their habitat is influenced by the availability of food, water, cover and other environmental factors [22]. According to this study, colobus monkey spent more time for resting followed by feeding. Similarly, a study conducted in Rau Forest Reserve, Moshi, Tanzania reported that black-and-white colobus monkey spent much time resting (57.7%), followed by feeding (27.7%) [23]. Since leaves are more abundant and evenly distributed than fruits and, folivores generally spend less time for feeding and moving, more time resting, travel shorter distances per day and occupy smaller home ranges [24].

Grone's (2009) idea also agrees with the issue that colobus monkeys are diurnal species and spends over half of the day resting, with the remaining hours of daylight devoted mostly to feeding and moving. High resting might be due to behavioral thermoregulation that colobus monkey resting under shaded tree canopies during afternoon [14].

Activity by age groups varied significantly. Adults spent more of their time resting than sub adults and juveniles during both seasons. This is probably because as animals getting older and older they become less active and rest more to save their limited energy. Juveniles and sub adults were observed spending more time feeding than adults during the dry and the wet season, respectively. This might be due to the need of more energy for their daily activities than adults. Similarly, Juveniles were observed spending more time feeding than adults in Rau Forest Reserve, Tanzania [23].

CONCLUSION

Finote Selam Forest is suitable place of colobus monkey. However, the area is facing problems due to human settlement, expansion of agriculture, overgrazing and deforestation.—All these problems led to the displacement of black and white colobus monkey to other areas. The survival of the species depends heavily on planning and implementing on the conservation and management of the forest habitat. Therefore, special attention should be given to conserve the forest and animals which reside in it. Further studies should be conducted on the different aspects of colobus monkey in the study area.

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