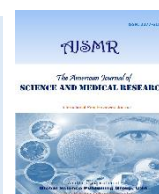




Contents lists available at ThomsonReuters

The American Journal of Science and Medical Research

Journal homepage: <http://globalsciencepg.org/ajsmr.html>

Food spectrum of Chital and Sambar in Eturnagaram Wildlife Sanctuary, Warangal, Telanagana State, India

Bapu Rao M¹, Narayana E² Vikram Reddy M^{3*}^{1,2} Applied Ecology Laboratory, Department of Zoology, Kakatiya University, Warangal-506 009, Telangana State, India³ Salim Ali School of Ecology and Environmental Sciences, Pondicherry Central University, Kalapet, Pondicherry-605 016, India

*Corresponding author:

E-mail: bapu7masadi@gmail.com<http://dx.doi.org/10.17812/ajsmr3402>

Received 11 October 2017;

Accepted 21 November 2017;

Available online 31 December 2017

ISSN: 2377-6196© 2018 The Authors.

Published by Global Science Publishing Group.

USA

ABSTRACT

An inventory of the food spectrum of Chital and Sambar at Eturnagaram wildlife sanctuary in Telangana State (India) was made through a three year study with an aim to explore the diet composition, preferable food plants and variation in plants composition by micro-histological analysis of fecal samples and freshly browsed plant species and their parts. Field and fecal observations revealed that Chital and Sambar consume a total of 56 and 54 plant species respectively. Sixty-seven food plants of Chital and Sambar were spread over into 23 families. Food plants of Chital and Sambar are 35 species of trees, 4 species of shrubs, 4 species of herbs and apart from 3 species of monocots and revised 21 species of grasses. Chital and Sambar were seen distribution in good numbers in the riparian vegetation areas and meadows of the sanctuary where the availability of fodder plants were available sufficiently.

Keywords: Chital, Food habits, Micro-histological analysis, Sambar, Wildlife sanctuary

1. Introduction

The general survival and reproduction of individuals depend on their ability locate and harvest sufficient food to meet their nutritional needs. Timings and selection of food plants are synchronized to meet the requirements of proteins, carbohydrates, fats, vitamins, water, minerals, trace elements, etc. (Chhangani and Mohnot, 2004). Food and water constitute the important components of a wildlife habit and are pre-requirements for the wellbeing of the wild animals as these animals depend on both of the resources for their substances. Availability and distribution of these resources in a wildlife habitat is patchy and vary temporally (Fortein et al., 2003). Various species of plants found in discrete meadows interspersed over forests landscape, play significant role in the diet of wild animal grazers. Certain species of wild animal can feed on a wide numbers of plants species, where as others are narrowly specialized on certain plant species ever certain parts of plants (Knapp, 1975).

Chital, *Axiz axis* (Erxleben, 1777), is one of the most common and widely distributed cervids in the South Asia, India, Sri Lanka and Bangladesh (Schaller, 1967). Mishra (1982) considered Chital primarily a grazer. On the basis of morpho-physiological ruminant feeding types, Chital is classified as an intermediate/mixed feeder (Hofmann, 1985).

The distribution range of Sambar (*Cervus unicolor* Karr, 1972) is wide populating large parts of India, South-East Asia, Indonesia, Southern China, the Philippines, Sri Lanka and Taiwan (Prater, 1971; Whitehead, 1972) and Geist (1998)

summarized the ecology of the Sambar as a highly adaptive, ubiquitous deer that can live on ocean shores and the subalpine. It has been found that different ungulate species have varying food and feeding habits. Some are purely grazers and others are mixed feeders (graze and browse). Much of the information available of food habits of Chital and Sambar are through the work of Schaller (1967), Hofmann (1985), Rodgers (1988), Mishra (1982), Srivatasva et al., (1996), Shankar (1994), Johnsingh and Shankar (1991), Ngamponsai (1987), Raman (1997), Shea et al (1990), Awasthi et al (2003) and Padamalal et al (2003).

This paper describes the food plants used by the Chital and Sambar though some the food plants were identified by microhistological analysis of fecal samples and fresh plants (specimens) collected from feeding grounds in Eturnagaram wildlife sanctuary, Warangal, Telangana State, India.

1.1 Study area:

Eturnagaram wildlife sanctuary is one the oldest sanctuaries in Telangana, declared during 1953. Earlier it was as Tadvai wildlife sanctuary. The forests of the sanctuary contain predominantly teak with miscellaneous species of plants supporting a number of both herbivorous and carnivorous wild animals. This sanctuary is situated in Warangal revenue district of Telangana in its Mulugu revenue subdivision and revenue mandals of Tadvai, Eturnagaram and Govindraopet. The sanctuary area comprising Eturnagaram and Tadvai Forest Ranges extends over 806.15 KM² and the

Eturnagaram range an area of 380.35 KM². It is located in northeast direction at about 80 km from Warangal city, and at elevation of 251' above sea-level, and between longitude 79° 30' East to 80° 42' East and latitude 17° 15' North to 18° 40' North, located in the Deccan peninsular biogeographical zone and Chhota-Nagpur biotic province with dry deciduous forest (Rodgers and Panwar, 1992). The area is rich in both flora and fauna representing Deccan plateau and Godavari river system.

2. Materials and Methods

2.1 Specimen collection from feeding sites

The food spectrum of Chital and Sambar in the sanctuary was monitored directly during the study period, and an inventory of their food plants was made through direct observations of these animals at different feeding sites inside the sanctuary. Soon after these animals leave the feeding locations these sites were examined for freshly browsed plant species and their parts, which were collected carefully, brought to the laboratory and the plants were examined and identified.

2.2 Micro-histological analysis

This study was based on the microscopic recognition of indigestible plant fragments mainly the epidermal features that are characteristic of different plant groups (Metcalfe, 1990). It is widely used method for studying diets in ungulates (Anthony and Smith, 1974) Holechek and Gross, 1982; Robins et al., 1975) and is the most accurate method for all estimating diets of herbivores (Dearden et al., 1975).

The fecal analysis requires the collection, preservation and preparation of fecal samples and reference slides. Fresh fecal samples were collected by following fresh tracks of Chital and Sambar and recording their feeding sites from different habitats. The sixty-seven plants were collected for the preparation of reference slides on the basis of their abundance and which appeared to have been eaten by the animals.

The food plant parts were identified from the small pieces of the leaf portions, with help of a binocular stereomicroscopic zoom microscope (Wild, Heidelberg) and a related key (Todd and Hansen, 1973; Srivastava et al., 1996). Prof. Vastavaya S. Raju. Department of Botany, Kakatiya University, Warangal identified the collected plant species.

3. Results and Discussion

In the present investigation, we have studied the diet of Chital and Sambar consisted of diverse species of food plants. Field and fecal observations revealed that Chital and Sambar consume a total of 56 and 54 plant species (35 species of trees, 4 species of shrubs, 4 species of herbs, 3 species of monocots and 21 species of grasses) respectively (Table-1). Sixty seven food plant species of Chital and Sambar were spread over into 23 families. Among the 21 species of grasses; *Andropogancortortus*, *Apludamutica*, *Cynodondectylon*, *Eleusineindica*, *Oryzalatifolia*, *Panicumantidotale*, *Pennisetum* spp., *Saccharamsponteneum*, *Tremadatriandra* and *Vetiveriazinzinoides* are the main grass species of in diet of Chital and Sambar (Table-2).

From January to April, Chital and Sambar were observed extensively browsing on tender leaves of *Bambusaarundinaceae* and *Dendrochalamusstrictus*. Among the herb and others, *Asparaqus recemosa* and *Diascorea* spp. were the

most preferred species and ranked high preference during April and May due to availability of new shoots which sprout after the forest fire.

During the summer particularly from the end of the February onward wild animals including Chital and Sambar were found forage on the riparian vegetation along the banks of streams and moist depressions (sunken places). The riparian vegetation, which were fed by Chital and Sambar along with different perennial water bodies of the sanctuary. It was observed that Chital and Sambar showed both grazing and browsing behavior. They preferred green grass when available but otherwise fed on coarse dry grasses and large variety of leaves, flowers and fruits of different herbs. They browsed on a wide variety of plant parts particularly leaves.

Table-1. List of food plants eaten by Chital and Sambar in Eturnagaram wildlife sanctuary

S. N	Name of species	Family	Chital	Sambar
1	<i>Acacia catachu</i>	Fabaceae	++	++
2	<i>Aeglemarmelos</i> L.	Rutaceae	++	--
3	<i>Anogeissuslatifolia</i>	Combretaceae	++	++
4	<i>Bauhinearacemosa</i>	Fabaceae	++	++
5	<i>Brideliahamiltoniana</i>	Euphorbiaceae	++	++
6	<i>Brideliaretusa</i>	Euphorbiaceae	--	++
7	<i>Cassia fistula</i>	Fabaceae	++	++
8	<i>Catunarrgumspinos</i>	Rutaceae	++	++
9	<i>Cordiadiichotama</i>	Boraginaceae	++	++
10	<i>Dichrostachyaciner</i>	Mimoseaceae	++	++
11	<i>Diospyrosmelanoxylon</i>	Ebenaceae	++	++
12	<i>Embllicaofficinalis</i>	Euphorbiaceae	++	++
13	<i>Erythroxyllomonogynum</i>	Linaceae	++	++
14	<i>Euginia vulgaris</i>	Myrtaceae	++	--
15	<i>Ficusbengalensis</i>	Moraceae	++	++
16	<i>Ficusglomerata</i>	Moraceae	++	--
17	<i>Gardenia latifolia</i>	Rubiaceae	++	++
18	<i>Garugapinneta</i>	Anacardiaceae	++	--
19	<i>Gmelinaarborea</i>	Verbenaceae	++	++
20	<i>Grewiaabutifolia</i>	Tiliaceae	++	++
21	<i>Limoniaacidissima</i>	Rutaceae	--	--
22	<i>Madhucalatifolia</i>	Sapotaceae	++	++
23	<i>Mangiferaindica</i>	Anacardiaceae	--	--
24	<i>Manilkarahexandra</i>	Sapotaceae	++	++
25	<i>Miliusatomentosa</i>	Annonaceae	++	++
26	<i>Moringatinctoria</i>	Rubiaceae	++	--

27	<i>Schleicheratrijuga</i>	Sapindaceae	--	++
28	<i>Syzygiumcumini</i>	Myrtaceae	++	++
29	<i>Tamarindusindica</i>	Fabaceae	++	--
30	<i>Terminalialalata</i>	Combretaceae	++	--
31	<i>Terminaliabellerica</i>	Combretaceae	++	++
32	<i>Terminaliachebula</i>	Combretaceae	++	--
33	<i>Xyliadolabrifformis</i>	Mimoseaceae	++	++
34	<i>Xyliaxylocarpa</i>	Mimoseaceae	++	++
35	<i>Ziziphusxylocarpa</i>	Rhamnaceae	++	--
36	<i>Cassia auriculata</i>	Fabaceae	++	++
37	<i>Helicteresisora</i>	Sterculiaceae	++	++
38	<i>Pavettaindica</i>	Rubiaceae	--	++
39	<i>Ziziphusjuba</i>	Rhamnaceae	++	++
40	<i>Bauhineavahlia</i>	Fabaceae	++	--
41	<i>Calycipteris floribunda</i>	Combretaceae	++	++
42	<i>Criptolepisbuchana</i>	Asclepiadaceae	++	++
43	<i>Zizyphusoenoplia</i>	Rhamnaceae	++	++
44	<i>Asparagus recemosa</i>	Liliaceae	++	++

On the onset of the rainy season they were found to feed upon various shrubs *Cassia auriculata*, *Helicteresisora*, *Pavettaindica* and *Ziziphusjuba*. It was observed that when the Chital and Sambar browsed the canopies of small trees, they bended the tree keeping its stem in between its forelimbs, stomach and hind limbs making the tree stem bent. They fed on leaves of different tree species, among the 35 tree species identified, *Acacia catechu*, *Aeglemarmelos*, *Anogiessusspp.*, *Bauhinia spp.*, *Cassia spp.*, *Catunaregumspinosa*, *Cordiadihotama*, *Diospyrosspp.*, *Emblica spp.*, *Gardenia spp.*, *Mongiferaindica*, *Limoniaacidissima*, *Madhucaindica*, *Syzygiumcumini*, *Terminalia spp.*, and *Ziziphus spp.* are the main food species of Chital and Sambar. They were also found to forage on fallen leaves, flower and mature fruits of trees such as *Catunaregumspinosa*, *Diospyrosspp.*, *Emblicaofficinalis*, *Ficus spp.*, *Mangiferaindica*, *Madhukaindica*, *Syzygiumcuminin*, *Terminaliaspp.*, and *Ziziphus spp.* etc.

Inventory of the food spectrum the range of food materials that wild animals usually feed and available perennial and ephemeral water resources are necessary in the contact of conservation of wild animals.

Food availability is difficult to estimate for Chital, which are known to feed on parts of over 160 different plant species (Schaller, 1967; Johnsingh and Sankar, 1991). They consume predominantly grass in the wet season and browse during the dry season (Schaller 1967; Mishra, 1982; Prasad and Sharatchandra, 1984). As determining monthly feeding habits of Chital in each habitat measuring availability of each item of their diet was not possible during this study, an alternative index of productivity of food namely rainfall, was used. Rainfall is known to be related to grassland and scrubland

productivity in semiarid and drier habitats (Misra and Misra, 1984). In the forest habit in the study area, Chital feed mainly on fallen leaves and fruits of trees, and grass and edible shrubs are scarce (Ram et al., 1996). Such food was available more during drier months as tree shed their leaves and fruits prior to rains. Most trees shed their leaves during the drier months providing food for Chital (Raman, 1997).

Table-2. Grasses and grasslike plants eaten by Chital and Sambar in Eturnagaram wildlife sanctuary

S. N	Scientific Name	Family	Chital	Sambar
1	<i>Ardopogoncontortus</i> L.	Poaceae	L	L
2	<i>Apludamutica</i> L.	Poaceae	L	L
3	<i>Apocopiswightiil</i> Ness	Poaceae	--	L
4	<i>Aristidiaadscensionis</i> L.	Poaceae	L	L
5	<i>Bambusaarundinaceae</i> L.	Poaceae	TL	TL
6	<i>Chlorisdolicostachya</i> Swartz	Poaceae	L	--
7	<i>Chrysopogonorientalis</i> Camus	Poaceae	--	L
8	<i>Cynodondactylon</i>	Poaceae	L	L
9	<i>Dendrochalamusstrictus</i> L.	Poaceae	TL	TL
10	<i>Dinebraretroflexa</i> Vahl	Poaceae	--	L
11	<i>Eleusineindica</i> L.	Poaceae	L	L
12	<i>Ergrostrisunoidoides</i>	Poaceae	L	L
13	<i>Heteropogoncontortus</i> L.	Poaceae	L	L
14	<i>Oryzalatifolia</i> L.	Poaceae	L	L
15	<i>Oplismenuscompositus</i> L.	Poaceae	--	L
16	<i>Panicumantidotale</i>	Poaceae	L	L
17	<i>Pennisetum</i> spp.	Poaceae	L	L
18	<i>Rottboelliaexaltata</i>	Poaceae	--	L
19	<i>Saccharamspontaneum</i> L.	Poaceae	L	L
20	<i>Tremedatiandra</i> Forsk al	Poaceae	L	L
21	<i>Vetiveriazinzanaoides</i>	Poaceae	L	--
22	<i>Dioscoreaoppositifolia</i> L.	Dioscoreaceae	L	L
23	<i>Dioscorea</i> spp.	Dioscoreaceae	L	L

L= Leaves; TL= Tender Leaves

Chital are known to feed on more than 160 species of plants (Schaller, 1967; Johnsingh and Sankar, 1991). Schaller (1967) showed that graze formed the bulk of the feed of Chital, while Mishra (1982) considered chital primarily a grazer. On the basis of morpho-physiological ruminant feeding types, Hofmann (1985) classified chital as an intermediate/mixed feeder. Rodgers (1988) had categorized chital as a generalist feeder, with a diet consisting of grasses, forbs, and leaves of woody plants. In Sariska, chital was a grazer as long as green grasses were available (monsoon and post-monsoon seasons),

but switched over to fallen leaves, flowers and fruits in winter (Sankar, 1994).

Sambar has been observed to feed on more than 139 species of plants (Schaller, 1967; Johnsingh and Sankar, 1991). The food requirements of sambar are less specialized than those of other deer (Schaller, 1967). Sambar would graze or browse depending upon the forage available at any given point of time (Bentley, 1978; Kelton, 1981; Ngampongsai, 1987). Young green grasses are the preferred forage of sambar in Kanha, but browse is often important during seasons when green grasses are scarce (Schaller, 1967). Analysis of fecal pellets of sambar in Kanha National Park revealed that browse was a dominant dietary component (Martin, 1977). In Sariskasambar were observed grazing as long as the green grasses are available, but switched over to browse and fallen leaves, flowers and fruits in winter and summer (Sankar, 1994; Raman, 1997). Richardson (1972) reported that the diet of sambar greatly varied from large amount of browse in the dry season to an almost complete dependence on grass and herbaceous plants in the wet season in Texas. This flexibility of sambar diet from graze to browse has enabled the wide distribution of this species. Sambar would inevitably consume seedlings and samplings of forest trees and consequently impede forest regeneration (Padmalal et al, 2003). Sambar has been classified as an intermediate feeder (grazer/browser) (Hofmann, 1985), with a tendency towards rough are grazing (Stafford, 1995). They live in rainforest, feeding on leaves, fruits and bark of trees (Kurt, 1990). A total of 41 plants were found in rumen samples of Sambar in New Zealand (Stafford, 197).

4. Conclusions

Fecal analysis and field observations clearly indicate that the Chital and Sambar have great flexibility of food habits and consume a variety of food. It was observed the Chital grazed mainly on green grasses of short varieties in wet season. In the absence of short grasses they fed on tips of the tall and coarse grassed in the summer. Browsing on tender leaves and twigs was observed on several occasions, especially during summer. They were also found to forage on fallen leaves, flowers and mature fruits of trees. It was observed that Sambar was relatively less selective in their feeding. A greater part of their preference overlapped they fed on a variety of plants.

Competing interests

The authors have declared that no competing interests exist.

References

- [1]. Anthony RG and Smith NS (1974) Comparison of rumen and fecal analysis to describe deer diets. *Journal of Wildlife Management* 38(3):534-540.
- [2]. Awasthi A, Uniyal SK, Rawat GS and Sathyakumar S (2003) Food plants and feeding habits of Himalayan ungulates. *Current Science*. 85:719-723
- [3]. Bentley A (1978) An introduction to the deer of Australia. Koetong ed. Koetong Trust Service, Victoria, Australia.
- [4]. Chhangani AK and Mohnot (2004) Crop raid by Hanuman Langur *Semnopithecus entellus* in and around Aravallis (India) and its management. *Primate Report* 69:35-47.
- [5]. Dearden BL, Pegau RE and Hansen RM (1975) Precision of microhistological estimates of ruminant food habits. *Journal of Wildlife Management*. 39(2):402-407.
- [6]. Fortein D, John MF, O'Brodovich L and Frandson D (2003) Foraging ecology of bison at the landscape and plant community level: the applicability of energy maximization principles. *Oecologia*. 134:219-227.
- [7]. Geist V (1998) *The Deer of the World. Their Evolution, Behaviour, and Ecology*. Stackpole Books, Mechanicsburg, MA
- [8]. Hofmann RR (1985) Digestive physiology of the deer—their morphophysiological specialization and adaptation. Pp 393-407, *The Royal Society of New Zealand Bull.* 22.
- [9]. Holechek JI and Gross BD (1982) Training needed for quantifying simulated diets from fragmented range plants. *Journal of Range Management*. 35(5):644-646.
- [10]. Johnsingh AJT and Sankar K (1991) Food plants of chital, sambar and cattle on Mundanthurai plateau, Tamil Nadu, South India. *Mammalia* 55:57-66.
- [11]. Kelto SD (1981) Biology of Sambar Deer (*Cervus unicolor* Kerr, 1972) in New Zealand with particular reference to diet in a Manuwata flax swamp. Master's Thesis, Massey University, Palmerston North, New Zealand.
- [12]. Kelton SD and Skipworth JP (1987) Food of Sambar deer (*Cervus unicolor*) in a Manawatu (New Zealand) flax swamp. *New Zealand Journal of Ecology*, 10:149-152.
- [13]. Knapp R (1975) Wildlife and vegetation in the tropics, sub-tropics and other regions. *Animal Res. Development*. 1:7-19.
- [14]. Kurt F (1990) Sambars (subclass Rusa) In: Grzimek B Ed. *Grzimek's encyclopedia of mammals*. New York, McGraw Hill, Pp 164-171.
- [15]. Martin C (1977) Status and ecology of the Barasingha (*Cervus duvaucelibranderi*) in Kanha National Park (India). *Journal of Bombay Natural History Society*. 74:60-132.
- [16]. Metcalfe, 1990
- [17]. Mishra HR (1982) The ecology and behavior of Chital (*Axis axis*) in the Royal Chitwan National Park, Nepal, Ph.D. Thesis, University of Edinburgh. UK. 240 Pp.
- [18]. Misra MK and Misra BN (1984) Biomass and primary production in an Indian grassland. *Trop. Ecology*. 25:239-247.
- [19]. Ngampongsai C (1987) Habitat use by the Sambar (*Cervus unicolor*) in Thailand: A case study for Khao-Yai National Park. Pp 289-298. In: CM Wemme (Ed) *Biology and management of the Cervidae*. Smithsonian Institution Press, Washington D.C.
- [20]. Padmalal UKGK, Seiki Takasaki S and Jayasekara P (2003). Food habits of sambar *Cervus unicolor* at the Horton Plains National Park, Sri Lanka. *Ecological Research*, 18:775-782.
- [21]. Prasad SN and Sharatchandra HC (1984). Primary production and consumption in the deciduous forest ecosystem of Bandipur in South India. *Proc. Indian Acad. Sci. (Plant Sci.)* 93:83-97.
- [22]. Prater SH (1971). *The book of Indian animals*. Journal of Bombay Natural History Society, Bombay.
- [23]. Raman TRS, Menon RKG and Sukumar R (1996) Ecology and management of chital and blackbuck in Guindy National Park, Madras, *Journal of Bombay Natural History Society*. 93:178-192.
- [24]. Raman TRS (1997) Factors influencing seasonal and monthly changes in the group size of chital or axis deer in southern India. *Journal of Biosciences* 22:203-218.

- [25]. Richardson WA (1972) A natural history survey of sambar deer (*Cervus unicolor*) on the powerhorn ranch Calhoun country, Texas M.Sc., Thesis, Texas A & M University, Texas, 76.
- [26]. Robins CT, Vansoest PJ Mautz WW and Moen AN (1975) Feed analysis and digestion with reference to white-tailed deer. *Journal of Wildlife Management*. 39(1):67-79.
- [27]. Rodgers WA (1988) The wild grazing ungulates of India: an ecological review. Pp 404-419. In: P. Singh and PS Pathak (Eds) Rangelands-resource and management. Proceedings of the National Rangeland Symposium, IGFRI, Jhansi, November, 9-12, 1987, IGFRI, Jhansi
- [28]. Rodgers WA and Panwar HS (1992) Planning a wildlife protected area network for India: An exercise in applied biogeography, In: Tropical ecosystem : ecology and management. Eds: Singh KP and Singh JS, Wiley Eastern Limited, India, Pp 93-107.
- [29]. Sankar K (1994) The ecology of three large sympatric herbivores (chital, sambar and nilgai) with special reference for reserve management in Sariska Tiger Reserve, Rajasthan, Ph.D. Thesis, University of Rajasthan, Jaipur.
- [30]. Schaller GB (1967) The Deer and the Tiger: A study of wildlife in India. The University of Chicago Press, Chicago, Pp.370.
- [31]. Shea SM, Flynn BL, Marchinton RL and Lewis JC (1990) Social behaviour, movement ecology, and food habits. In: Ecology of Sambar deer St. Vincent National Wildlife Refuge, Florida. Bulletin no. 25, Tall timbers research station, Tallahassee, Florida.
- [32]. Shukla R and Khare PF (1998) Food habits of wild ungulates and their competition with livestock in Pench Wildlife Reserve, Central India. *Journal of Bombay Natural History Society*. 95(3):418-421.
- [33]. Srivastava KK, Bhardwaj AK, Sony G and Zacharias VJ (1996) Micro-histological studies on the food habits of sambar, gaur and cattle in Periyar Tiger Reserve in winter. *The Indian Forester*. 122(10):937-942.
- [34]. Stafford KJ (1995) The stomach of the Sambar deer (*Cervus unicolor unicolor*). *Anatomia Histologia Embryologia*. 24:242-249.
- [35]. Stafford KJ (1977) The diet and trace elements status of Sambar deer (*Cervus unicolor*) in Manawatu district, New Zealand, *New Zealand Journal of Zoology*, 24:267-271.
- [36]. Todd JW and Hansen RM (1973) Plant fragments in the fecal of bighorn as indicators of food habits. *Journal of Wildlife management*, 37(3):363-366.
- [37]. Whitehead GK (1972) Deer of the World. Constables and Co., Ltd., London, UK