

# Management of Deer under Captive Condition at Chittagong Zoo, Bangladesh



**Md. Bayzid**

Roll No. 13/25

Registration No. 0947

Intern ID: E 25

Session: 2012-1013

**A clinical report submitted in the partial fulfillment of the requirements for the  
degree of DVM.**

**Faculty of Veterinary Medicine**

**Chittagong Veterinary and Animal Sciences University**

**Chittagong-4225, Bangladesh**

# Management of Deer under Captive Condition at Chittagong Zoo, Bangladesh

.....  
**Md. Bayzid**

Roll No. 13/25

Intern ID: E 25

Registration No. 0947

Session: 2012-2013

.....  
**(DR. Md. Moksedul Momin)**

**Supervisor**

**Department of Genetics and Animal Breeding**

**Faculty of Veterinary Medicine**

**Chittagong Veterinary and Animal Sciences University  
Chittagong-4225, Bangladesh**

## Table of Contents

<b>Table of Contents.....</b>	<b>iii</b>
<b>List of Tables.....</b>	<b>v</b>
<b>List of Figures .....</b>	<b>v</b>
<b>Abstract .....</b>	<b>vi</b>
<b>Chapter -1 .....</b>	<b>1</b>
Intruduction.....	1
<b>Chapter -2 .....</b>	<b>5</b>
Materials and Methods .....	5
2.1. Study period.....	5
2.2. Study location .....	5
2.3.Study population.....	5
2.4. Collection of data.....	6
2.4.1. Data collection on feeding process: .....	6
2.4.2. Data collection on phenotypic characteristics .....	6
2.4.3. Data collection on reproductive parameters .....	7
2.5. Housing measurements:.....	7
<b>Chapter: 3 .....</b>	<b>9</b>
Results & Discussion .....	9
3.1 Phenotypic characteristics .....	9
3.2. Phenotypic parameters.....	9
3.3 Feeding status of deer .....	10
3.4 Housing status of deer .....	12
3.4.1 Open corral .....	12
3.4.2 Shedder house.....	12
3.5 Reproductive parameter of deer .....	12
<b>Chapter: 4 .....</b>	<b>14</b>
Conclusion .....	14
<b>Chapter: 5 .....</b>	<b>15</b>

Limitations and Future Perspectives.....	15
<b>Chapter: 6 .....</b>	<b>16</b>
References.....	16
<b>Acknowledgements .....</b>	<b>18</b>
<b>Brief Biography .....</b>	<b>19</b>

## List of Tables

<b>SL No.</b>	<b>Title</b>	<b>Page</b>
Table 1	<b>Phenotypic characteristics of barking, spotted and sambar deer</b>	9
Table 2	<b>Phenotypic parameters of barking deer</b>	10
Table 3	<b>Different amount of feed supplied for barking, spotted and sambar deer</b>	11
Table 4	<b>Measurements of house of barking, spotted and sambar deer</b>	12
Table 5	<b>Reproductive performance of different types of deer at chittagong Zoo</b>	13

## List of Figures

<b>SL No.</b>	<b>Title</b>	<b>Page</b>
Figure. 1	<b>Chittagong Zoo</b>	5
Figure. 2	<b>Feeding of deer</b>	6
Figure. 3	<b>Spotted deer</b>	7
Figure. 4	<b>Barking deer</b>	7
Figure. 5	<b>Sambar deer</b>	7
Figure. 6	<b>Housing system of barking deer</b>	8
Figure. 7	<b>Housing system of sambar deer</b>	8
Figure. 8	<b>Housing system of spotted deer</b>	8

## Abstract

The study was carried out at Chittagong Zoo, Bangladesh. Data were collected for a period of fifteen days from 1<sup>st</sup> September 2018 to 15<sup>th</sup> September 2018 on phenotypic characteristics, phenotypic parameters, feeding management, housing management and reproductive performance by using a predesigned well-structured questionnaire. There were three types of deer namely barking, spotted and sambar deer and the population number respectively four, ten, and two. The coat color was reddish and “V” shaped black colored mark in forehead and black colored muzzle for barking deer. For spotted deer coat color was reddish brown with white spotted (but under throat, neck, abdomen, tail there is whitish color). The coat color of sambar deer were Deep brown. For male and female barking deer, the ear length was 3.50. The length of foreleg for male and female were 21 and 19.8 inches, the lengths of hind leg were 22.5 and 19.3 inch, distance between two ears was 3.7 and 3.6 inch respectively. The length of antler of male was 3.8 inch. Available feeds supplied to different types of deer were soft green grass, gram, wheat bran, green gourd, pumpkin, carrot and gooseberry. All types of deer were kept within an open enclosure. For barking deer, 9 feet’s height fence with chain link mesh used for their restriction in specific surrounding area. For the spotted deer, the open corral area was surrounded by with a fence of iron as like as sambar deer’s open corral. For every species there were shed houses inside the open corral. For barking deer, it was also observed that the weaning age, length of estrous cycle, age at first fawning and gestation length were ranging from 4-6 months; 12-20 days, 16-20 month and 6-7 months. For spotted deer, length of estrous cycle, age at first fawning and gestation length were ranging from 14-22 days, 16-20 month and 7-8 months and for sambar deer, 16-24 days, 24-30 month and 8-9 months respectively. The findings of this study will be helpful for policy maker in Bangladesh in sense of conservation of deer though study period was very short and the population size was small.

**Keywords:** Barking, Spotted, Sambar Deer; Chittagong Zoo; Phenotypes; Feeding; Housing; Reproduction.

## Chapter -1

### Intruduction

In Bangladesh there are found six deer species in different area namely, Spotted deer or Chital (*Axis axis*), Hog deer or Laguna (*Axis porcinus*), Musk deer or Kasturi (*Moschus chrysogaster*), Swamp deer or Barahsingha (*Cervus devaucelli*), Sambar or Jarayo (*rusa unicolor*), Barking deer or Ratuwa (*Muntiacus muntjak*). Among these six species of deer, Musk deer and Swamp deer are protect by government (enlisted as endangered species) whereas Spotted and Barking deer are mostly seen. Among the six spices available in Bangladesh. Sambar (*Rusa unicolor*) is the largest. The Maya Harin or the barkingdeer (*Muntiacus muntjac*) is the smallest. Deer have been morphologically classified as ruminants, their main fodder in the forest are the leaves and fruits of keora, new leaves of possur, gewa and various grass, but they supplement their calcium requirement by chewing fallen deer antler and eating crabs, shrimps etc. The spotted and barking deer is found in large numbers in dense deciduous or semi-evergreen forests and open grasslands. They do not occur at higher elevation forests where they are usually replaced by other species such as the Sambar deer. The chital (*Axis axis*) also known as spotted deer or axis deer is a deer which commonly inhabits wooded regions of Bangladesh, Bhutan, India, Sri Lanka, and Nepal and in small numbers in Pakistan. However it occupies a wide range of habitats from mainly grass, shrub vegetation in Wilpattu National Park, Sri Lanka (Barette *et al.*, 1976) to denser areas in the Gir forest of India (Moe *et al.*, 1994). Although the deer is mainly a grazer in lowland Bangladesh, fruits, leaves and seedlings from a wide variety of tree, shrubs and forbs species are also utilized (Sanquist *et al.*, 1999)

In Bangladesh, spotted deer is found throughout the sundarban forest, but the population is densely seemed to be higher in the south particularly concentrated in the marine grassland. The total population estimate of spotted deer ranges between 50000 to 80000 individual (Azad *et al.*, 2005). The availability of drinking water, trees for shade, grass for forage and absence of high rugged terrine are four factors influence the spotted deer to concentrate in certain area. Deer found throughout the world either in

the wild or as farmed animals. The Indian Muntjac (*Muntiacus muntjak*) is commonly called the "barking deer" due to the bark-like sound that it makes as an alarm when danger is present. This is widespread throughout Southern Asia, but is one of the least known Asian animals. Muntjacs has reddish coat of a rather uniform hue, without any conspicuous markings on the legs or tail. The color of the belly and the inside of the legs are a little paler. The tail is short and pointed; the muzzle is rather large and black. There are no noticeable seasonal changes in coat color. Newborn have a spotted coat, but since they are very small and remain hidden rather than following their mother during the first few weeks of life, one is unlikely to see spotted fawns in the field. There is no sexual difference in coat color except for the two black lines that run along the antler pedicles of males and that extend down the face. Both sexes have large pre orbital glands located at the corner of the eyes that appear as a sigmoid fold of skin right in front of the eye. They are larger in males and are very conspicuous when reverted prior to marking with them or during intense aggressive interactions (Barette *et al.*, 1976) and (Doubost *et al.*, 1971). Spotted deer has Reddish brown with white spotted. A dark stripe runs down the back from the nape to the tip of the tail. The abdomen, rump, throat and the insides of the legs, tail and ears are white. A black band circles the muzzle.

Sambar deer contain deep brown body color. The coat is coarse and shaggy. In stags it forms a mane about the neck and throat. In hot weather much of the hair is shed. The general color is brown with a yellowish or greyish tinge; under parts are paler. Old stags tend to become dark, often almost black. They carry the grandest horns. The antlers are stout and rugged. The Indian Muntjacs or barking deer are polygamous animals. Females reach puberty during their first to second year of life. These females are polyestrous, with each cycle lasting about 14 to 21 days and an estrus lasts for 2 days. The gestation period is 6 to 7 months and they usually bear one offspring at a time but sometimes produce twins. Axis deer most commonly occur in herds of ten to fifty individuals of both sexes. Chital hinds have three weeks long estrous cycles whereas sambar deer estrous cycle depend on seasonal variation and range about three to four weeks and barking has two to three weeks long. A stag will follow and guard a hind in estrous. During this time the stag will not eat. The pair will do several bouts of chasing and mutual licking before copulation. Stags guarding estrous females will make high-pitched growls at



lesser stags that hung about. The Chital or spotted deer is listed by the IUCN as Least Concern "because it occurs over a very wide range within which there are many large populations". However population densities are below ecological carrying capacity in many places due to hunting and competition with domestic livestock. Two primary reasons for its good conservation status are its legal protection as a species and a network of functioning protected areas. It seems success in rearing Chital in many parts of the country. In Private farm of Bohaddarhat in Chittagong district it was very successful. Although they have no formal record they had increased about three times in number of Chital within six years i.e. from 15 to 20. It is also in good condition in Bongobundhu shekmujibur Rahman safari park, Dulahazara, Cox's bazar. Breeding in captivity at the center seems to be satisfactory (Deodatus and Ahmed., 2002).

In Chittagong zoo, at present there are about 53 species and total number of animals is about 286. The deer are conserved in captive condition. At this state, these three types of deer keep separately in different shed and open corral in which the animal can move easily to and fro for relaxation and comfortable leading of life. Inside the open corral there is small shed house for shelter at adverse condition like rain and sunlight in every separate deer's house. In open corral there is huge amount of space for running of deer and fence is given around the space.

This study will reflect a growing concern on the ground about how to manage the increasing deer populations in a way which recognizes different legitimate interests. This study provides a social science perspective on deer management based on the case study of Chittagong Zoo. It focuses in particular on what kinds of individual and collective action is needed to improve the current situation. The social, economic and landscape impacts of wild deer and the management of the wild deer population in the Bangladesh have not previously been the subject of sustained social science research and analysis. However, in recent years the challenges surrounding the management of deer have begun to attract the attention of academics. Conservation of nature and natural resources is now a global concern. The world deer industry is growing about 20% annually & about five millions deer's currently being farmed. Without proper scientific knowledge on conservation management, natural resource utilization is very difficult.

**General Objectives:**

- To study the management practice (feeding system and housing condition).
- To know the phenotypic variation, productive and reproductive parameters.

## Chapter -2

### Materials and Methods

#### 2.1. Study period

The study was carried out from 1<sup>st</sup> september to 15<sup>th</sup> September, 2018 at Chittagong Zoo.

#### 2.2. Study location

The study was conducted at Chittagong Zoo which is located at Khulshi, Pahartali, Bangladesh adjacent to Foy's lake. The Zoo was established at 28th February, 1989 having total area is about 6.0 acres and covered with sloppy, hilly, flat bends along the side lakes with steep sides. There is natural forest over the hills with good numbers of trees and surrounded by a boundary wall of about six feet high.



Figure 1: Chittagong zoo.

#### 2.3. Study population

There are three species of deer in Chittagong zoo. These are spotted deer (*Axix axis*), barking deer (*Muntiacus muntjak*), and sambar deer (*Rusa unicolor*). Total population size for barking deer is 4, 10 for spotted deer and 2 for sambar deer. Four barking deer consisting of two adult male, one adult female & one juvenile were present at the time of the study. Two sambar deer and both are female. There are presences of ten numbers of spotted deer in where six are female and four male and all are adult.

## 2.4. Collection of data

Data was collected through direct observation by the researcher using predesigned well-structured questionnaire.

### 2.4.1. Data collection on feeding process:

Data collected on different characteristics (e.g. frequency of feeding per day, types of feed supplied, amount of feed offered) by direct visual observation, from record books and by conducting a discussion with the employees who are directly involved in management of deer.



Figure 2: Feeding of deer.

### 2.4.2. Data collection on phenotypic characteristics

#### Phenotypic characteristics measurement

- Direct visual observation used for body coat color estimation.
- From shoulder and hip joint to hoof length used for fore and hind legs length.
- Tail measurement was taken by tape which estimated from the base to the tip of tail.
- Measuring tape used for taking of length from the base to tip of ear.
- Base to the tip of antler shown as length of antler was taken by tape.



Figure 3: Spotted deer



Figure 4: Barking deer

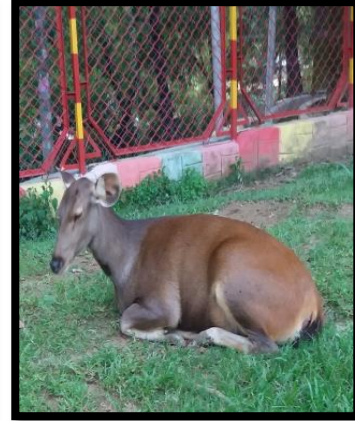


Figure 5: Sambar deer

### 2.4.3. Data collection on reproductive parameters

Information about puberty, length of estrous cycle, gestation period, age at first fawning, litter size, weaning period, survival rate (mortality of fawns) & other special traits were taken from the zoo record book by using questionnaire.

Age at puberty - The age at puberty which a ewe first shows estrus sign and behavior may be defined as age at puberty. It was measured in days.

Age at first fawning - It is defined as the age when the ewe gives first lamb in her life. In this study it was measured in days.

Gestation length - It was calculated that as interval from conceived to parturition. The duration of gestation was expressed in terms of days.

Weaning period - Age at which fawn leaves from their mother or when fawn starts to take green grass rather than suckling is called weaning period.

### 2.5. Housing measurements:

Types of house, structure of the houses, and measurement of the houses all details are recorded by own measurement and observation during the study period. There are two types of house used for deer's livelihood. Large fence restricted area offered as open corral for easy movement as well as for grazing and inside the open corral, there is

small structured shed house for the shelter from adverse sunlight, rain. Feed are supplied in the shed house.



Figure 6: Housing system of barking deer.



Figure 7: Housing system of sambar deer.



Figure 8: Housing system of spotted deer.

## Chapter: 3

### Results & Discussion

#### 3.1 Phenotypic characteristics

The phenotypic characteristics of the barking, spotted and sambar deer were observed during the study period and the findings are shown in table 1. In this study, the body coat color of barking deer was light reddish whereas the coat color of spotted deer is reddish brown with white spot (but under throat, neck, abdomen ,tail there is whitish color) which is similar to the findings of (Pratar *et al.*, 1997). But the coat color to the sambar deer was deep brown and this agreed with the findings of findings of (Phillips *et al.*, 1984). Some variation observed and this might be due to the genotype environmental interaction.

**Table 1: Phenotypic characteristics of barking, spotted and sambar deer**

Characteristics	Spotted Deer	Barking Deer	Sambar Deer
Body coat color	Reddish brown with white spotted (but under throat, neck, abdomen, tail there are whitish color)	Light reddish	Deep brown
Fore head	V shape black color mark	Curve shape	Comparatively narrow and longer than spotted deer.
Inner canthus of eye	Deeper area	Shallow	More deeper

#### 3.2. Phenotypic parameters

In this report, the length of hind leg, the length of foreleg, tail length and distance from ear to ear was found higher in male than female but surprisingly ear length was larger

in female than male (shown in table 2) which is more or less similar to the findings of (Pratar *et al.*, 1997) and (Miazi *et al.*, 2016).

**Table 2: Phenotypic parameters of barking deer**

Parameters	Male barking deer	Female barking deer
Ear Length (inch)	3.5 5±0.5	3.7
Fore Leg Length (inch)	21	19.8
Hind Leg Length (inch)	22.5	21.3
Tail length (inch)	5.3	5.5
Distance from ear to ear (inch)	3.7	3.6
Length of Antler (inch)	3.8	-
Time of growth of Antler	After 1 year	-
Drop out of Antler	Every 6 months after	-
Shedding of Antlers	During June-July	-

### 3.3 Feeding status of deer

The feeding status of the barking, spotted and sambar deer were observed during the study period and the outcomes are shown in a table 3. Various available soft green grasses (e.g. para, german, helencha, green spinach, red spinach) and concentrate (e.g. wheat bran, gram and rice polish) supplied regularly to the deer twice in a day and the given amount shown in table 3. Additionally they are supplied vitamins, minerals and some seasonal vegetables (e.g. green gourd, pumpkin, carrot, cabbage, papaya). The amount depends on the availability.

Highest amount of feed ingredients were supplied (15.4 kg/day) to sambar deer due to large rumen and body size and smallest amount of feed ingredients were offered (6.76 kg/day) to barking deer due to small body size. These ingredient and amount is approximately similar with (Miazi *et al.*, 2016) and (Hudson and R J., 1999).



**Table 3: Different amount of feed supplied for barking, spotted and sambar deer**

Feed ingredients	Barking deer			Spotted deer			Sambar deer		
	Amount supplied (kg)/ animal/ day			Amount supplied (kg)/ animal/ day			Amount supplied (kg)/ animal/ day		
	Fore noon	After noon	Total (kg)/ animal/ day	Fore noon	After noon	Total (kg)/ animal/ day	Fore noon	After noon	Total (kg)/ animal/ day
1.Soft green grass.(para, german, helencha, green spinach ,red spinach)	0.5	0.5	1.0	1.0	1.0	2.0	2.0	2.0	4.0
2.Wheat bran	0.5	0.5	1.0	1.0	0.5	1.5	1.5	1.0	2.5
3.Gram	.15	.10	.25	.25	.25	0.5	0.5	0.4	0.9
4.Green gourd	1.0	0.5	1.5	1.0	1.0	2.0	1.5	1.5	3.0
5.Pumpkin	1.0	0.5	1.5	1.0	0.5	1.5	1.5	1.0	2.5
6.Carrot	0.5	0.5	1.0	0.5	0.5	1.0	1.0	0.5	1.5
7.Gooseberry	.05	.05	0.1	0.1	0.1	0.2	0.2	0.2	0.4
8.Cabbage/Papaya	0.2	0.2	0.4	0.3	0.3	0.6	0.3	0.3	0.3
9.Common salt	.005	.005	.01	.01	.01	.02	.01	.01	.02
10.Total	3.905	2.855	6.76	5.16	4.16	9.32	8.51	6.91	15.4

### 3.4 Housing status of deer

The housing measurement of the Barking, spotted and sambar deer were taken through using measuring tape, during the study period and the findings are shown in table 4.

#### 3.4.1 Open corral

There found larger corral area in case of spotted deer at Chittagong zoo (about 5880 square feet) than sambar and barking deer and this is due to having increased population number than others species. For each different species the height of fencing area of open corral found about 7 feet high which are chain linked pattern. The corral patterns of different deer providing almost similar structure. This space usually offered to the deer in captive condition for their livelihood and larger space allowed the animals as better producer and reproducer (Moe *et al.*, 1994) (600 sq. feet/animal).

#### 3.4.2 Shedder house

The shedder house of the deer is gable type and area of shedder house is found larger in case of spotted deer comparing to others. The wall of the shedder house is made of concrete and the roof is made of metal angle and asbestos material.

**Table 4: Measurements of house of barking, spotted and sambar deer**

Types of deer	Open corral (feet)			Shedder house (feet)		
	Length	Width	Height	Length	Width	Height
Barking deer	30	20	9	10	8	11
Spotted deer	105	56	7	17.5	14	11
Sambar deer	84	21	7	14	7	10

### 3.5 Reproductive parameter of deer

The reproductive parameters of the Barking, spotted and sambar deer's are shown in table 5. For barking deer, the length of estrous cycle was ranging from 12-20 days, which is more or less similar to the findings of (Chapman, N G.,1997) (17-24 days); (Mylrea *et al.*,

2004)(12-23 days) and (Azad *et al.*, 2005) (14-21 days).For sambar deer ,the range is 16-24,which is supported by (Wemmer & C., 1998).For spotted deer, the average age at first fawning was ranging from 16-20 months; which is supported by (Azad *et al.*, 2005)(14-18 months); (14-17 months) and (Vos, A.D., 1982) (1.5-2.0 years). In case of Vos finding it differs from our finding that it may be due to management as well as feeding practice differences. For barking deer, the average age at first fawning was ranging from 16-20 months; which is similar with (Vos, A.D., 1982) (1.5-2.0 years). In case of (Vos, A.D., 1982) finding it differs from our finding that it may be due to management as well as feeding practice differences. The gestation period of barking deer was ranging from 6-7 months, for spotted deer 7-8 month, which is similar to the findings of (Chapman, N G., 1997) (6-7month) and (6-8 month) and for barking deer(Chapple *et al.*, 2003) (231-237 days). In this study, the age of puberty of spotted, barking and sambar deer were 1.2 year, 1.3 year and 2-2.5 year chronologically ,which is supported by the findings of (Mulley *et al.*, 1990) (1.3year for spotted deer and 1 year for barking deer); (Chapman, N. G., 1997),(Flesch *et al.*, 1999) (1.8 year for sambar deer and 1year for barking deer).This variation due to may be the feeding, environmental temperature and management fluctuation.

**Table 5: Reproductive performance of different types of deer at Chittagong zoo**

Criteria	Spotted	Barking	Sambar
Breeding time(mostly)	April-may	April-may	October-November
Gestation period	7-8 month	6-7 month	8 -9month
Age of puberty	1.2 year	1.3 year	2 -2.5 year
Length of estrous cycle	14-22 days	12-20 days	16-24 days
Litter number	1	1	1
Age of first fawning	16-20month	16-20month	24-30month
Lifespan	12-15year	10 year	20 year

## **Chapter: 4**

### **Conclusion**

The study was emphasized on management of different types of deer in captive at Chittagong Zoo of Bangladesh and revealed that the coat color of barking deer, spotted deer and sambar deer was light reddish, reddish brown with spot and deep brown, respectively. The ear's length, the length of foreleg and hind leg distance from ear to ear were more in male barking deer than the female one. The amount of feed supply to the sambar deer were more than other types of deer. The housing space for spotted deer was more than other deer's house. Reproductive performances were superior in case of barking deer whereas the performances were inferior in case of sambar.

## **Chapter: 5**

### **Limitations and Future Perspectives**

In this study there were some limitations (which may cause some variations in the study result) such like as:

1. The study period was too short.
2. The study focused on Chittagong zoo only. So there was no scope for comparison of management fault or production loss or better from other zoo. The population size was only 16.

This study provides the baseline information about the management status of deer in Chittagong zoo, Bangladesh. So, following recommendations are given for future studies:

1. Comparison of management system of different kinds of deer in different zoo and safari park in Bangladesh.
2. Comparison of production status among different species of deer.

## Chapter: 6

### References

- Acharjo, L. N. and Mishra, C. G. (1981). Notes on weight and size at birth of eight species of Indian wild ungulates in captivity. *Journal of the Bombay Natural History Society* .77:504-507.
- Azad, M. A. K., Hossain, M. M., and Bhuiyan, A. K. F. H. (2005). Feeding and management of spotted deer at Dhaka zoo. *International Journal of Zoological Research*.1:48-52.
- Barrette, C. (1976c). Some aspects of the behaviour of muntjacs in Wilpattu National Park, Srilanka. *Journal of mammalogy*.41:1-34.
- Chapman, N. G. (1997). Upper canine teeth of Muntiacus (Cervidae) with particular reference to M.reevesi. *Journal of zoology*.2:32-36.
- Chapple, R.S., A.W. English and R.C. Mulley. (2003). Characteristics of the estrous cycle and duration of gestation in chital hinds (*Axis axis*). *Pubmed.gov*.98:23-26.
- Deodatus, F.D. and Z.U. Ahmed, (2002). Directives for Wildlife Management Planning of the Sundarbans Forest.SBCP, Khulna, Bangladesh. Towards ecotourism.
- Dubost, G. (1971). Observations éthologiquessur le Muntjac (Muntiacusmuntjac Zimmermann 1780 et. Reevesi Ogilby 1839) en captivitéet semi-liberté. *Z. Tierpsychol. Laboratoire d'Ecologie Ge'ne'rale,Franch.* 28:387-427.
- Flesch, J.S., R.C. Mulley and P.N. Mulley, (1999).The growth rate and metabolisable energyintake of farmed fallow deer between 12 and 25 weeks of age. *Aust. Deer Farm. Asian Australian journal of animal science*.10:14-17.
- Hudson and R J. (1999). Wildlife production: Trends and issues. In: *Diversified livestock..*
- Miazi, O. F.,Miah, G., Bilkis, T., Khan, M. K. I., Das, A., Momin, M. M., Mahmud, S. ,Dey, P. C. (2016). Phenotypic and Reproductive Parameters of Barking Deer

Under Management Condition of Chittagong Zoo. *International Journal of Genetics and Genomics*. 5:40-44

- Moe, S. R. (1994). Distribution and movement pattern of deer in response to food quality and manipulation of grassy habitat: A case study with emphasis on axis deer (*Axis axis*) in lowland Nepal. *Canadian journal of zoology*.70:1238-1243
- Moe, S., P. Wegge. (1994). Spacing behavior and habitat use of *Axis deer (Axis axis)* in lowland Nepal. *Canadian Journal of Zoology*.72:1735-1743.
- Mulley, R.C., A.W. English and A. Kirby, (1990). The reproductive performance of farmed fallow deer in New South Wales. *Australian veterinary journal*.67: 281-286.
- Mylrea, G. E., Mulley, R. C., English, A. W. and Evans, G. (2004). Reproductive cycles of farmed female barkingDeer. *Journal of reproduction, fertility and development*.11: 167-174.5.
- Phillips, W. W. A. (1984). *Manual of the mammals of Sri Lanka*.Wildlife and nature protection society of Sri Lanka. 2nd edition.pp-33
- Prater, S. H. (1997).The book of Indian Animals. Bombay Natural History Society, Bombay. Tenthimpression, pp-294.
- Sanquist,. (1999).Sundarban Biodiversity Conservation Project: An Overview. SBCP, Khulna,Bangladesh, pp- 4.
- Vos, A. D,. (1982). Deer farming guidelines on practical aspects, food and AgricultureOrganization of theUnited Nations. Rome, Italy. FAO animal production and health paper.27
- Wemmer, C. (1998). Deer.Status survey and conservation action plan.IUCN/SSCDeer specialist group.IUCN, Gland, Switzerland and Cambridge, UK.IUCN library system.

## **Acknowledgements**

I wish to acknowledge the immeasurable grace and profound kindness of Almighty “Allah” the supreme authority and supreme ruler of universe, who empowers the author to complete the work successfully.

I feel proud in expressing my deep sense of great gratitude and indebtedness to respected teacher and Supervisor DR. Md. Moksedul Momin, Assistant professor, Department of Genetics and Animal Breeding, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University for his trustworthy and scholastic supervision.

.I would like to special thanks to DR. Md. Shahadat Hossain Suvo, Deputy Curator of Chittagong Zoo, for his cordial helps during data collection and observation’s.

**The Author**

**September, 2018**



### **Brief Biography**

This is Md. Bayzid, son of Md. Mizanur rahman and Asmat ara khanam from Adarsha sadar Upazilla under Comilla District of Bangladesh. He conceded the Secondary School Certificate Examination (SSC) in 2009 from Fakir Bazar High School and College, Comilla and then Higher Secondary Certificate Examination (HSC) in 2011 from Comilla Victoria Govt. College. He is intern student of Doctor of Veterinary Medicine (DVM) of Chittagong Veterinary and Animal Sciences University (CVASU), Bangladesh. He has keen interest to work in research on microbiology and enhancing the prestige of Veterinarian and Livestock Sector.