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Fecal Pellet Measurements of Manipur Brow-Antlered Deer With Respect to Sex and Age Classes

Imran Khan and S. P. Goyal

Wildlife Institute of India, Dehra Dun, India

Measurements were made of fecal pellets for captive brow-antlered deer (*Cervus eldi eldi*) from different age and sex classes. Pellet measurements increased linearly with increases in age, except for length and width measurements in males. Differences in dimensions were statistically significant between sexes and among some age classes. This procedure may be useful in differentiating between the sexes, and to some extent between ages, of wild-living individuals.

Key words: growth, antlers, wildlife

INTRODUCTION

The Manipur brow-antlered deer (*Cervus eldi eldi*) is the most endangered subspecies of *Cervus eldi*. A single wild population of ~50 individuals is found in a small area (40 sq km) at the southwestern bank of Loktak Lake (24° 29′ N, 93° 50′ S) in Manipur, India. These deer are difficult to locate in the wild due to their crypticity, evasive behavior, and the relative impenetrability of their habitat [Gee, 1960; Ranjitsinh, 1975]. There is therefore an urgent need for development of indirect methods to obtain information on the distribution and demography of this animal. Fecal material is one indirect index that is used to study population size and habitat preferences of wild forms [Putman, 1984; Hannan and Whelan, 1989]. The objective of this study was to determine whether or not pellet measurements could be used to discriminate between sex and age classes of brow-antlered deer.

MATERIALS AND METHODS

The study was conducted during December 1989 on 12 individuals kept at the National Zoological Park (New Delhi). Animals were provided with food and water

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Address reprint requests to Dr. Surendra P. Goyal, Wildlife Institute of India, Chandrabani, P.O. Box 18, Dehra Dun 248006, India.

TABLE 1. Number of animals used in various sex and age classes

Age class	Male	Female
0	1	—
1	—	—
2	1	2
3	1	1
4	4	2

ad libitum. Food consisted mainly of green fodder (*Trifolium alexandrinum, Avenna sativa, Brassica compestris, Ficus religiosa,* and *Morus alba*) and ration mixture. The ration mixture consisted of 22% wheat bran, 12% horse gram, 13% maize, 16% barley, 8% oats, 26% oil cake, and 2% mineral mixture. The following commonly used criteria [Schaller, 1967; Barrette, 1991] provided the basis for establishing the different age classes:

Males

Class 0 stag. There is visible extension of the frontal bone in the form of a bony pedicel of ~2–3 cm. In the second year of growth, two rosy spikes with active blood circulation appear and begin to curve backward.

Class 2 stag. There is further growth of the antler with the appearance of branch lines in the main beam. The length of the main beam at this age varies 3–5 cm.

Class 3 stag. Hardening of the antlers takes place, and both the brow tine and main beam accelerate in the form of an arc. The length of the main beam reaches 5–8 cm.

Class 4 stag. The main beam grows upward to about ~8–10 cm, and fingerlike projections occur from the junction of the main beam and brow tine or from the innermost part of the browtine to the junction.

Females (Age Estimates Based on Body Size)

Class 2 hind. From 1 or 2 years of age.

Class 3 hind. Subadult female.

Class 4 hind. Females that have attained the body size of adults.

Fresh fecal pellets were collected from each individual early in the morning on a daily basis for 7 successive days (see Table 1 for numbers of individuals in each class). Pellets were oven-dried at 70°C for 3 days. The length, maximum width, and weight of 10 pellets randomly selected from each individual were then recorded. Size dimensions were taken to the nearest millemeter, using a Vernier caliper, and weight was determined to the nearest 10 mg with an analytical balance (Mettler, Germany). ANOVAs and *t* tests were carried out with an SPSS program on an IBM PC/AT computer.

RESULTS AND DISCUSSION

Weight, width, and length of pellets for the different age and sex classes are shown in Figure 1. We found that pellet length did not change in males from age class 2 onward, whereas in females it increased from a mean of 12.2 to 14.2 mm as they

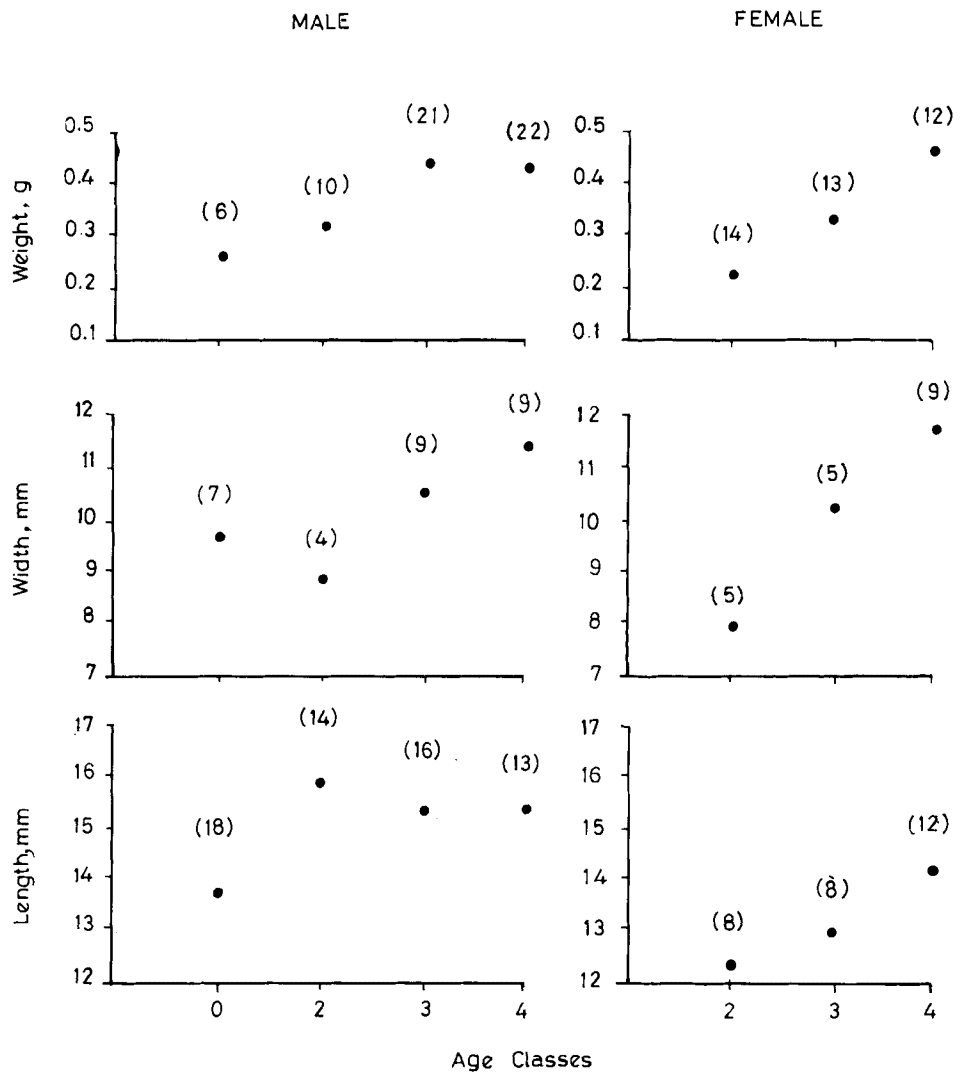

Fig. 1. Relationships between age classes and mean fecal pellet measurements in male and female. Values in parenthesis = % coefficient of variation (CV).

aged. Pellet width increased gradually from class 2 onward in both sexes. Weight increased in males up to age class 3, then became constant. In females, pellet weight increased from 0.22 to 0.46 g with increasing age. The ANOVA indicates that male pellet width and weight differences, but not length, were significant ($P < 0.001$) between age classes. In females, differences between age classes were significant ($P < 0.001$) for all measures. Individual variation (percent coefficient variation) for pellet measurements in males was relatively greater for length and weight than for width, whereas in females pellet weight showed relatively more variation than either length or width. T tests indicated that it is possible to differentiate between age and sex classes in these animals by using a combination of pellet measurements (Table 2).

TABLE 2. Test of significance (t test) of pellet measurements

Sex and age class combination[a]	t values		
	Length	Width	Weight
1. Male : Class 4 vs. Female : Class 4 (d.f. = 56)	2.08*	1.18	1.11
2. Male : Class 3 vs. Female : Class 4 (d.f. = 26)	1.52	3.19***	0.54
3. Male : Class 2 vs. Female : Class 4 (d.f. = 26)	2.56**	8.51***	6.91***
4. Male : Class 3 vs. Female : Class 3 (d.f. = 18)	2.73**	0.59	3.59**
5. Male : Class 2 vs. Female : Class 2 (d.f. = 28)	6.39***	5.15***	8.44***
6. Male : Class 0 vs. Female : Class 2 (d.f. = 28)	2.27*	7.95***	4.39***

[a]Values in parenthesis = degrees of freedom.
* = Significant at $P < 0.05$.
** = Significant at $P < 0.01$.
*** = Significant at $P < 0.001$.

A proposal for establishment of a second population of Manipur brow-antlered deer in Pabitara Wildlife Sanctuary in Assam is under consideration by Indian authorities. Captive bred individuals would be used [Khan et al., 1992]. The technique described here could be useful in monitoring both the newly introduced and the existing wild populations. At this point, it is not known whether seasonal changes in diet of wild-living deer would affect the weight or dimensions of fecal pellets. Follow-up research in which captive diets are varied could help to resolve this question.

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