Cey. J. Sci. (Bio. Sci.) Vol. 25, 1998
SHORT COMMUNICATION

A PRELIMINARY STUDY OF THE FOOD PREFERENCE OF DOMESTICATED ELEPHANTS *(ELEPHAS MAXIMUS L)* IN SRI LANKA.

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ABSTRACT

Food preference of three domesticated elephants were studied for a period of seven consecutive days. Four food items viz. jak (Artocarpus heterophyllus) leaves and twigs, a browse mixture (excluding jak), Panicum maximum and a grass mixture (excluding Panicum maximum) were offered to the animals in separate bundles. Elephants were allowed to feed on these for 24 hours and at the end of each feeding trial, food items were separated into four initial groups and the remnants were weighed. On the basis of the amount consumed and discarded, food preference was calculated using the Manly's Alpha index. All three elephants used in the experiment showed a higher preference for either Panicum maximum or grass mixture.

INTRODUCTION

Sri Lanka has a long tradition of domesticating wild elephants. Ancient kings domesticated elephants for cultural pageants, war and even to show their strength and wealth. The elephant has a tremendous cultural significance to both Buddhists and Hindus in Sri Lanka. Elephants in Sri Lanka play a significant role in religious activities, especially in religious festivals known as 'Esala Perahera' and Navam Perahera' (Illangakoon, 1993). At present, elephants are domesticated primarily for heavy work, especially in areas where large machinery cannot be used. However, some people in Sri Lanka still prefer to keep an elephant as symbol of their wealth and social standing.

Although the domesticated elephants play a major role in Sri Lanks's culture, only a few surveys have been carried out to estimate their number and range. In 1946, Sri Lanka (then Ceylon) was said to have 736 elephants in captivity (Santiapillai and de Silva, 1994) and by 1955, there were at least 670 animals in captivity (Deraniyagala, 1955). In 1970 a census carried out by Jainudeen and Jayasinghe (1970) revealed that there were 532 domesticated elephants. According to Santiapillai and Jakson (1990), the number has declined to less than 500 since then and today there are about 480 elephants in private hands and 60 in Pinnawala elephant orphange (C. Santiapillai, pers. comm.)

Most of the captive elephants are to be found in the southwestern and central provinces in Sri Lanka. Because of the enormous cost encountered in purchasing an elephant, certain degree of wealth is necessary to maintain it. Therefore, in Sri Lanka, most of the elephant keepers own only a single animal. Information of these domesticated elephant was often collected during the perahera seasons (Illangakoon, 1993).

Food preference of domesticated elephant has rarely been investigated in Sri Lanka. However, a considerable amount of work has been carried out to estimate the food preference of wild elephants (Mckay, 1973; Vancuylenberg, 1977; Ishwaran, 1983).

The present study was designed to identify the food preference of domesticated elephant.

MATERIALS AND METHODS

Three elephants were used for the study. As an index of reference the elephants were designated as Elephant 1, Elephant 2 and Elephant 3. The information about these elephants was obtained from the owner. Elephant 1 was an adult female, about 2.3 m tall at the shoulder and was about 35 years old. Elephant 2 was and adult male about 12 years old and 2.1m tall. Elephant 3 was an adult tusker about 15 years old and 2.1m tall. These elephants were used for entertaining tourists during the day. They were bathed after work (at 1600hrs) and moved to the sites where they spend the night. Feeding trials were conducted in these sites while elephants were kept tethered to the trees. Each elephant was given a diet of four food items ie. Jak leaves and twigs, a browse mixture (excluding jak), *Panicum maximum* grass, a grass mixture (excluding *Panicum maximum*). Grass mixture contained a number of common gras s species lik e *Digitaria didactyala, Brachiaria setegera, Axonopus compressus* etc. whereas browse mixture contained leaves and twigs of tree species such as *Acacia, Randia dumentorum* etc. available in the area. Feeding trials were done only with one elephant at a time. Food items were given at 1700 hrs each day in four separate bundles and each item was weighed before giving it to the elephant. The elephant was then allowed to feed until 1700 hrs of the following day . Roughly equal amounts o f food were provided for each feeding cycle and all The food items were always given in excess. At the end of each feeding cycle (ie. after 24 hrs) remaining food items were separated into four initial groups and weighed again to note the amount discarded. The total amount of boli defecated during each cycle was collected. Number and the total weight of the boli were recorded. The animals wee not taken away during the period of experiment and were not fed on other foods. Feeding trials were conducted for seven consecutive days with each elephant.

Preference for different food items were calculated using Manly's Alpha index (Krebs, 1989). Preference index for experiments in which food items are declining could be given by the formula:

$$\alpha_i = \frac{\log pi}{\varepsilon^m_{J=1}\ {}^P j}$$

Where: α_i = Manly's alpha (Preference index) for prey type i

p_i, p_i = Proportion of prey $_i$ or $_i$ remaining uneaten at the end of experiment

(i=1,2,3.....,m;j=1,2,3.....m) = e_i / n_i

e_i = number of prey typei remaining uneaten at the end of experiment

n_i = Initial number of prey typei in experiment

m = number of prey type

RESULTS

Of the total food items given per cycle (for all three animals), Jak has the highest weight comprising about 37.33 ± 6.46% as it was offered to elephant with branches and twigs. Grass. mixture was the second highest, constituting about 28.28 ± 7.77% of the amount give, Browse mixture was about 16.78 ± 5.65% and *Panicum* was about. 17.58 ± 5.58% of the total amount given per feeding cycle. Average amounts of each food item given to and consumed by each animal are shown in Table 1.

Amounts of food ingested varied from animal to animal. Ingested amount as a percentage of the food given and the amount defecated as a percentage of the ingested amount is given for each elephant in Table 2. Average number of boli defecated per cycle and the average wet weight per bolus are also presented.

Elephant I consumed about 58.8% of grass mixture given to it. Ingested proportions for other food items were; 56.4% *Panicum*, 38.3% of jak and 27.6% of browse mixture. Elephants 2 and 3 ingested highest proportions of *Panicum* given to them. Proprotions for Elephant 2 and 3 were, *Panicum* 69.2% and 72.4%, grass mixture 60.9% and 55.25%, jak 56.8% and 62.2%, browse mixture 55.6% and 48.23% respectively. Manly's Alpha indices of preference for each elephant is given in Figure 1. Elephant 1 preferred grass mixture over all the other food items thus having a higher value for Alpha (0.35), while second preference was for *Panicum* (Alpha = 0.33). The other two food items (jak and browse mixture) were consumed to a lesser extent (Alpha 0.19 and 0.13 respectively). Elephant 2 had high preference for *Panicum* (Alpha = 0.31) while grass mixture was preferred as the second choice (Alpha = 0.25). Jak and browse mixture were the least preferred food items (Alpha = 0.22 for both food items.). Elephant 3 also preferred *panicum* over the other food items (Alpha = 0.31). The next preferred item was grass mixture (Alpha = 0.25). Jak was the third preferred item (Alpha = 0.24), while browse mixture was least preferred (Alpha = 0.20).

DISCUSSION

Most of the elephant keepers in Sri Lanka prefer to feed their animals with jak or kithul *(Caryota urenus)* leaves. On the information based on a survey conducted using 181 domesticated elpehants, Illangakoon (1993) concluded that all captive elephants is Sri Lanka, were given kithul in some quantily as a part of their normal diet and about 90% animals showed a clear preference for it over other kinds of food given to them. However, the information for this study was collected f rom interviews conducted with the mahouts and also it is very unlikely that grass had been given as a food item. Since it is already known that kithul is highly preferred it was not included for the present experiment. As kithul is becoming a scarce resource, it is advisable to look to alternate food sources for the domesticated elephant in Sri Lanka.

Manly's preference index is based on the proportions of the ingested and discarded quantities of a given food item given in excess and it does not depend on the quantities available at the beginning of the feeding trial. The results show that all three elephants used in the experiment preferred either *Panicum* or grass over the other food items offered to them. This indicates that elephant used in this study had a high preference for grass species when they were given a choice of food items. Ishwaran (1979) repotted similar observations for wild elephants in Gal Oya area of Sri Lanka.

Studies on the food preference of wild elephants in Sri Lanka generally report that grass is the most preferred food item. McKay (1973) estimated that elephants in the Ruhuna National Park spend about 86% of their feeding time on short grasses. However, in Gal Oya, elephants spend roughly equal proportion of time on grazing and browsing (McKay, 1973). Grasses, sedges and legumes form the major parts of the daily food requirement of these elephants (Vancuylenberg, 1974). Dhakal and Ojha (1995) reported that in Nepal's Royal Chitwan National Park all elephants spend their whole time grazing on grassland as grasses have much higher protein content than browse plants during the monsoon. During this period elephant keepers also cut grasses for night feeding (Sukumar, 1978).

In the wild, an adult elephant daily consumes about 150kg of food and defecates about 80 kg of it (Vancuylengerg, 1977). In the present study, each elephant consumed about 100 kg and defecated about 40 kg.

Elephants are both grazers and browsers and their food consumption can vary according to the season, region and/or the individual requirement (Sukumar, 1989). As a generalized feeder, the elephant consumes a large number of plant species. However, they exhibit strong preferences for certain high quality plant foods and thus their food habits are usually described in terms of hieracrchy of food classes (Dhakal and Ojha, 1995). In Sri Lanka, most of the domesticated elephants are fed on a mixed diet of kithul leaves or logs, jak branches, or coconut palm branches (Illangakoon, 1993). Their food preference has been judged by the choice of these species. If grass is also included in the diet, elephants will have a better selection of food items depending on their nutritional demands. At a time when jak and kithul trees are becoming a scarce resource, elephant owners should think of including grass into their elephant's diet. Better understanding of nutritional demands and food preferences of domesticated elephants is essential for the maintenance of a healthy population of elephant in captivity.

ACKNOWLEDGEMENTS

We thank Dr. N. Ishwaran for the help given during the initial phase of this study and Mr. Henry Gunasekara, the owner of Island Elephant Park, Kandy, for allowing us to carry out the experiments in his elephant park. Assistance given by Mr. D.G. Jayatissa, Mr. R.M.D. Somarathne and Mr. Aththanayake is also acknowledged. This project was funded by a grant given by the University of Peradeniya, Sri Lanka.

TABLE 1 -Average weight (kg) of the food items given to each elephant per day (figures in Parentheses represent the amount consumed per day)

	JAK	*BROWSE MIXTURE*	*PANICUM GRASS*	*GRASS MIXTURE*
Elephant 1	77.6 ± 16.0	39.1 ±18.3	36.0 ± 9.7	58.3 ± 20.7
	(29.8± 16.9)	(10.8 ± 7.0)	(20.3 ± 7.2)	(34.3 ± 5.6)
Elephant 2	55.2 ± 5.0	21.2 ± 3.7	26.6 ± 2.4	44.6 ± 9.8
	(31.4 ±10.6)	(11.8 ± 1.8)	(18.6 ± 0.9)	(27.2 ± 9.3)
Elephant 3	61.8 ±14.7	27.3 ± 6.7	28.6 ± 13.2	48.8 ± 5.3
	(38.5 ± 7.3)	(17.6 ± 4.4)	(20.6 ± 8.0)	(24.1 ± 3.5)

TABLE 2 Average amounts of the total food given, discarded and defected per feeding cycle

	WIGHT OF TOTAL FOOD GIVEN (kg)	*AMOUNT INGESTED (as a% of food given)*	*AMOUNTED DEFACATED (as a % of food ingested)*	*NO. OF BOLI DEFECATED*	*WET WEIGHT PER BOLUS (kg)*
Elephant 1	210.8	45.1	64.9	65	0.95
Elephant 2	147.6	60.1	22.97	68	0.31
Elephant 3	161.5	62.04	40.28	82	0.49

Accepted for publication August 1996

REFERENCES

Deraniyagala, P.E.P 1955. Some extinct elephants, their relatives and the two living species. National Museum of Ceylon, Colombo.

Dhakal,G and N.P. Ojha. 1955. Studies on diet preferences on the elephant (Elepha maximus) on Royal Chitiwan National Park. *Tiger Paper,* **22:** *29-31.*

Illangakoom. A. (1993) A preliminary study of the captive elephants in Sri Lanka. *Gajah*, **11**:29-42.

Ishwaran, I. (1979) Ecological studies on populations of elephants in the Gal Oya area in relation to distribution, habitat preference, competition and food availability, M. Sc. thesis, University of Peradeniya, Sri Lanka (Unpublished).

Ishwaran, 1983. Elephant and woody-plant relation ships in Gal Oya, Sri Lanka.*Biological Conservation,* **26**:*255-270.*

Jainudeen, M. R. and J. B. Jayasinghe. 1970. A census of the tame elephant population in Ceylon with reference to location and distribution. *Ceylon Journal of Science ((Biological Sciences)* **8**: 63-68.

Krebs. C. J. 1989. *Ecological Methodology.* Harper & Row, Publishers, New York; 371-405.

McKay. G. M. 1973 Behaviour and ecology of the Asiatic elephant in southeastern Ceylon. Smithsonian Contribution to Zoology, 125 Washington DC., 113pp.

Santiapillai, C., and P. Jackson. 1990. The Asian Elephant : An Action Plan for its Conservation. IUCN, Gland, Switzerland, 79pp.

Santiapillai, C. and K. H. G. M. de Silva. 1994. An action plan for the conservation and management of Elephant *(Elepha maximus)* in Sri Lanka, *Gajah*, **13**: 1-24.

Sukumar, R. 1989. *The Asian elephant : Ecology and management.* Cambridge University Press, 255pp.

Vancuylenberg, B. W. B. 1974. The feeding behaviour of the Asiatic elephant in south-eastern Ceylon. M. Sc. thesis, University of Sri Lanka, Peradeniya Campus.

Vancuylenberg, Feeding behaviour of the Asiatic elephant in south-east Sri Lanka. in relation to conservation. *Biological Conservation,* **12** :33-53.

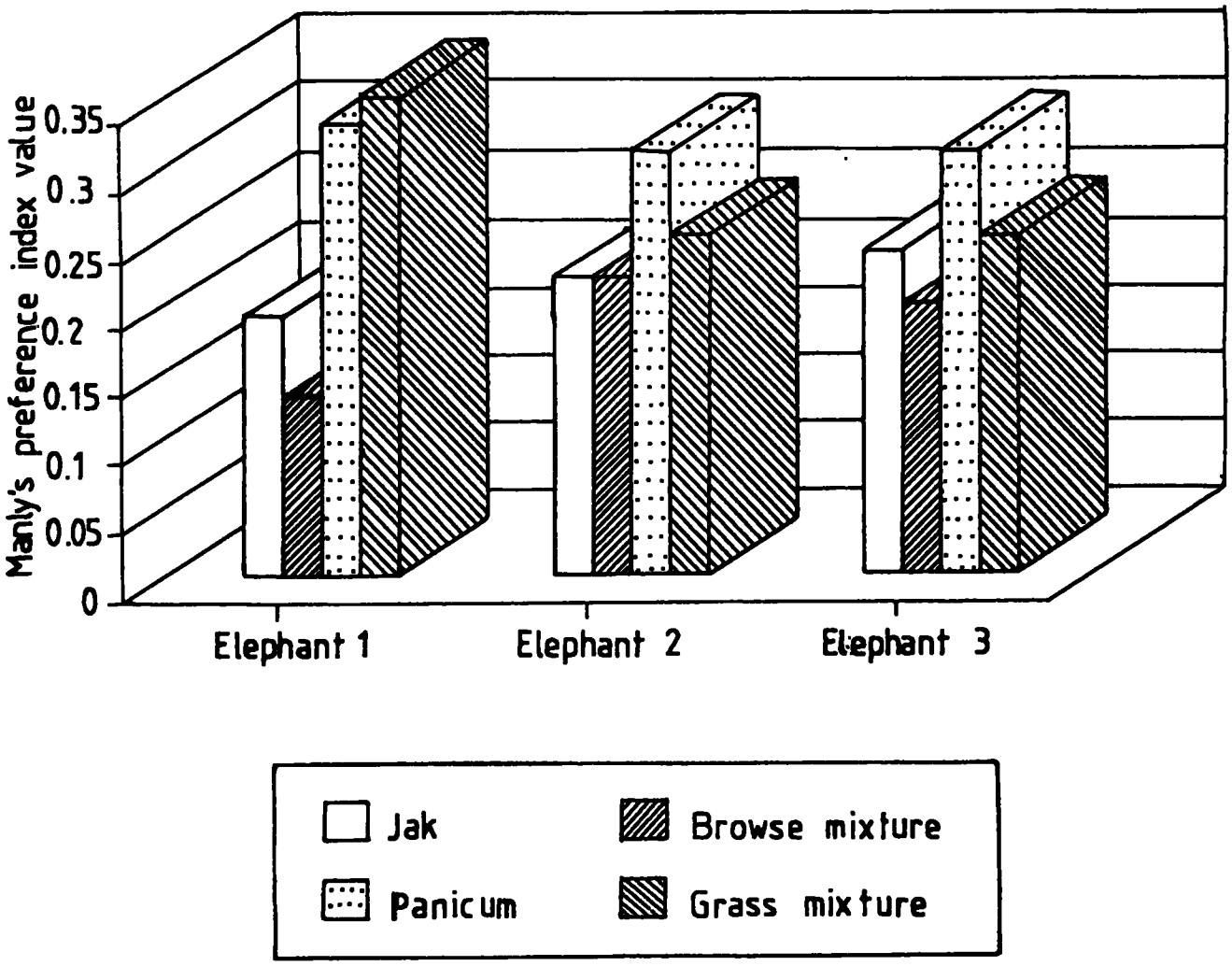

Figure 1: Preference indices for four food items