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ABSENCE OF SYNCHRONIZATION EITHER IN DEFAECATION OR URINATION OF THE SRI LANKAN ELEPHANT *(Elephas maximus maximus)* IN CAPTIVITY.

by

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ABSTRACT

The main aim of this study was to examine whether synchronization in defaecation is present in the Sri Lankan elephant as is reported for the African elephant. The other secondary aims were to investigate whether such a phenomenon exists with respect to urination and to obtain baseline data related to these two phenomena. The study was conducted at the National Zoological Gardens of Sri Lanka using eight captive elephants. The results show that there is no synchronization either in defaecation or in urination. Furthermore, the study shows that the Sri Lankan elephant, in captivity, defaecates approximately 13 times per day, each episode lasting for about 33 sec. About 5 faecal boluses are passed at each defaecation episode and each single bolus weighed approximately 1.5kg. Among the parameters monitored and computed, a gender difference was seen only in the weight of the boluses, where the weight was significantly lower in the females in comparison to the males. On the other hand, the elephants urinated approximately 10 times per day, each episode having a mean duration of about 22 sec.

INTRODUCTION

Synchronous defaecation appears to be present in several species of ungulates, and it is claimed that such an allelomimetic behaviour has an adaptive value, especially in the wild (Scott, 1969). In

this regard, Rees (1983) recently had reported the presence of some degree of synchrony in the defaecation of African elephants *(Loxodonta africana)*, using seven captive individuals (01 male and 06 females). To the best of our knowledge, either the presence or absence of such a phenomenon is not scientifically documented for the Sri Lankan elephant *(Elephas maximus maximus)* which is a subspecies of Asian elephant *(Elephas maximus)*. Since the Sri Lankan elephant is a threatened species which may vanish by early 21st century, in our opinion, the documentation of whatever scientific data of this subspecies is extremely important, if not essential.

The main purpose of this study was to examine whether a synchronization exists in defaecation in the Sri Lankan elephant as is reported for its African cousin. Secondly, we investigated whether a synchronization exists with respect to urination in the Sri Lankan elephant and thirdly, explored the relationship between defaecation and urination, if any.

METHODS

Eight healthy elephants (03 males and 05 females) belonging to the National Zoological Gardens of Sri Lanka were used in this study. The mean age (mean ± SEM) of these elephants was 19.75 ± 5.4 years (range; 06-50 years). These elephants are usually secured by iron chains wrapped around their hind limbs close to the ankle and kept in their quarters in a parallel row with their heads facing the same side. The elephants are taken out for baths (08.30h - 10.30h) and elephant dancing in the evening (17.00h - 18.00h).

This study was conducted once a week (6.15h to 12.15h) for ten weeks from 06.09.91 to 05.11.91. Weighed quantities of food (tree trunks of *Caryota urens* L. (kitul in Sinhala) and leaves and woody parts of branches of *Artocarpus heterophyllus* Lam. (kos in Sinhala), *Cocos nucifera L.* (Pol in Sinhala) *Pisonia grandis* Roxb. (Lettacochcha in Sinhala), *Ficus elastica* Roxb. (Rubber in Sinhala), *Erythrina variegata* L. (Erabadu in Sinhala), *Ficus tsiela* Roxb. (Ehatu in Sinhala), *Averrhoa bilimbi* L. (Bilin in Sinhala), *Ficus benghalensis* L. (Nuga in Sinhala), and *Ficus racemosa* L. (Attikka in Sinhala), was offered to each animal at 18.00h each day and was kept in position till 6.00h on the following morning (15min. before the commencement of the observations). Remaining food, if any, was weighed.

Each animal was observed from the rear end throughout the study period (6h) by a single person and defaecation and urination times (onset and termination) were recorded using a stop watch (Herwins, U. K.) with an accuracy of ± 0.5 sec. If a defaecation occurred within 60sec. of urination or viceversa then, in the analysis of results, it was considered that both phenomena occurred simultaneously. The number of faecal boluses passed out per each episode of defaecation were also noted. The boluses were immediately removed and weighed.

The results are expressed as means ± SEM and statistical evaluations were made using RxC test of independence using G-test statistics and Student's t-test.

RESULTS

The data obtained and parameters computed are summarized in Tables 1 and 2. The ten day study period was divided into 480 periods of 7.5min each as described by Rees (1983), starting at 6.15h and ending at 12.15h (a duration of 6h). During this period 268 episodes of defaecation and 203 episodes of urination were evident. The maximum number of defaecations occurred between 7.15 - 7.30h: 35 occasions; 21 in males and 14 in females. On the other hand, the maximum number of episodes of urination was 31 (19 in males and 12 in females), and this too occurred between 7.15 - 7.30h. There were a number of occasions where several elephants simultaneously defaecated or urinated at a particular time within the 7.5min time framework. (defaecation: 05 individuals once, 04 individuals once, 03

individuals in four occasions, and 02 individuals in thirty nine occasions. Urination: 04 individuals once, 03 individuals in four occasions and 02 individuals in twenty four occasions.) However, as shown in Table 1, when total number of defaecations and urinations were considered this synchronization either in defaecation or in urination was not statistically significant (G-test, $p>0.05$). Furthermore, there was no significant difference (G-test, $p>0.05$) in the incidences of synchronization of these two parameters within the males, within the females and between males and females (see Table1).

Table 1: Percentage synchronized defaecations and urinations among the elephants at the National Zoological Gardens of Sri Lanka.

	Entire group	Male-Male	Female-Female	Male-Female
% Synchronization of defaecation	19.02(51/268)	5.22(14/268)	9.70(26/268)	8.20(22/268)
% Synchronization of unrination	14.42(29/201)	3.98(08/201)	3.98(08/201)	10.44(21/201)

Supernator in parenthesis denotes number of synchronized defaecations or urinations and the denominator denotes total number of defaecations or urinations.

Table 2: Some parameters of defaecation and urination of Sri Lankan elephants in captivity at the National Zoological Gardens of Sri Lanka.

Parameter	Entire group (n=8)	Male (n=3)	Female (n=5)
Total number of defaecation episodes	268	98	170
Number of defaecations/individual/day	13.2	12.96	13.44
Number of faecal boluses/defaecation (Mean±SEM)	5.53±0.33	5.56±0.17	5.54±0.17
Average weight of a faecal bolus(kg) (Mean±SEM)	1.47±0.28	1.54±0.10	1.04±0.03
Duration of a defaecation episode (sec.)(Mean±SEM)	33.23±0.94	33.30±1.63	33.18±1.17
Total number of urination episodes	203	79	124
Number of urinations/indivdual/day	10.08	10.32	9.84
Duration of Urination episodes (sec.)(Mean±SEM)	22.20±1.05	20.28±1.13	22.95±1.4
Percentage of defaecations accompanied by urinations/total number of defaecations	61.69 (164/268)	64.28 (63/98)	59.41 (101/170)
Percentage of urinations accompanied by defaecations/total number of urinations	80.78 (164/203)	80.76 (63/79)	81.45 (101/124)

As shown in Table 2, in the entire group within the 7.5min time framework, about 81% of urinations made by the elephants were accompanied by defaecations. In contrast, within the same time framework, only about 61% of total defaecations were accompanied by urinations. Furthermore, 92.65% of defaecations in the entire study period was followed by urinations (note that this figure was arrived at by timing of only 53 occasions of simultaneous urinations and defaecations from a total of 164 such occasions). A similar percentage of occurrence was also evident within a given sex. The rest of the data obtained and computed are also depicted in Table 2. There was no statistical difference in any of these data except for the weight of the faecal boluses, where the weight was significantly ($p < 0.001$, Student's t-test) lower (by 32.42%) in the females.

The average food intake (kg) for the male elephants was 89.05 ± 0.5 ± 34.16 (range 35.35 - 152.25) which was 22% higher than for the females (average intake being 69.58 ± 10.79kg; range 38.16 - 97.7kg).

DISCUSSION

Synchronization in biological processes is not a new concept. For example, synchronization of menses in girls living in hostels has been reported (Graham and McGrew, 1980). Recently, Rees (1983) has shown a synchronization in defaecation in the African elephants kept in captivity. However, the results of this study clearly shows that in the Sri Lankan elephant, at least in captivity, there is no synchronization of defaecation. In addition, our study demonstrates that there is no synchronization in urination either in the Sri Lankan elephant. However, these observations do not necessarily preclude the existence of such a phenomenon in the wild or amongst the calves and juveniles in the wild.

There can be several possibilities for the variance of our results on defaecation with that of Rees (1983). Species difference is one such possibility. Differences in foraging patterns and quality of food may be another possibility: in Rees's study (1983) the elephants were allowed to forage freely even during the period of observation whilst in this study, the animals had no access to food during such times; in his study, elephants were fed with unnatural food such as hay, straw, carrots or beetroots as opposed to a whole gamut of natural food (see materials and methods) given in this study. Rees (1983) had used basically sub-adults (mean age = 11 years) and his elephants were untied with provision for free movements. On the other hand, in this study, the elephants used were essentially adults (mean age = 19.75 years) which were chained in their quarters. This is a major difference between the two studies which could account, at least in part, to the variances in the results. As adult elephants do not have potential predators, synchronization in defaecation is of adaptive significance perhaps only to a moving herd consisting of young individuals. In complete contrast, it is likely that in captivity, in the African elephant, there is no synchronization in defaecation as is observed in the Sri Lankan elephant in this study, because the statistical test used and the assumptions made by Rees (1983) seem improper as he has included the no-defaecation intervals also to the 2x2 contingency table thereby increasing the G-value to achieve statistical significance. In this study, on the other hand, statistical comparisons were made by RxC test of independence using G-test where no defaecation intervals are excluded from the calculations.

McKay (1973), based on his field observations at Ruhuna National park and Gal Oya-Lahugala area, has reported that in the Sri Lankan elephant urination may occur without defaecation, but a defaecation is almost invariably followed by urination. Our results are in partial agreement with his first observation, since in this study, only about 18% of urination episodes occurred without a defaecation. However, we observed defaecation episodes often occurring (38%) without any urinations. Thus, there seems to be a greater tendency for defaecations to occur independent of urinations. On the other hand

in the instances where defaecations and urinations occurred together (164 occasions) a defaecation was almost invariably followed by a urination as stipulated by McKay (1973) [note that there were 164 such occasions although we have timed only 53].

According to McKay (1973) in the Sri Lankan elephant, in the wild, 4 - 7 faecal boluses are passed at one time with an average of five, and each bolus in the adult weighs between 1 - 3 kg upon defaecation. Our results in captivity are in close agreement with those of McKay (1973) and further show that the weight of the faecal bolus produced by the female elephants are significantly lower than that of males. This may be attributed to the size differences and differences in food consumption between the sexes; usually female elephants are smaller than the males and consume a lesser quantity of food (Kotagama, 1990), and for a given digestive system a positive correlation exists between the amount of food consumed and faecal matter produced (Macdonald, 1985). The mean defaecation time for the Sri Lankan elephant in this study is 33 sec. To our knowledge, this has not been scientifically reported previously.

To date, the daily urine output of the Sri Lankan elephant is not reported. To obtain meaningful results on this parameter, the water intake has to be quantified accurately. As such, we did not attempt to monitor urine output in this study. However, this study indicates that Sri Lankan elephant, at least in captivity, urinates about 10 times per day having a mean duration of 20 - 23 sec.

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