ANALYSIS OF MUSTH EPISODES IN CAPTIVE ASIAN ELEPHANTS (*ELEPHAS MAXIMUS*)

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Abstract

Analysis of data on musth episodes of Asian elephants (*Elephas maximus*) collected from Punnathoor Kotta of Guruvayoor revealed that the duration of musth was 99 +/- 36 days, increasing as age advances. Hours of bright sunshine had pronounced influence on the duration of musth. The number of elephants coming to musth showed peaks during January and August, which are the post monsoon periods in Kerala.

Key words

Asian elephants, Musth episodes, duration, captivity, analysis, Kerala

Abbreviations

BS - Bright Sunshine
Cdb - Dry bulb temperature
Cwb - Wet bulb temperature
THI - Temperature Humidity Index
THIe - Temperature Humidity Index in evening
THIm - Temperature Humidity Index in morning
THSI - Temperature Humidity Sunshine Index

Introduction

The population of domesticated elephants in India is between 2500-4000 (Lair, 1997). They are valuable not only for the work they perform but also as a future conservation tool against in-breeding or genetic drift in wild elephants. The information regarding many aspects of Asian Elephants is embarassingly scanty. As most of the elephants are kept either solitary or in small groups, a coordinated study on any aspect of elephant is difficult. Therefore, the elephant camp at Punnathoor Kotta under the Guruvayoor Dewaswom Temple having one of the largest concentration (47) of captive elephants in India, was selected for the present study.

The Asian Elephant is an integral part of cultural festivity and timber industry in Kerala. But they often turn vicious, especially during periods of musth, causing havoc to human life and property. Therefore it is imperative to have a thorough monitoring of the pattern of behaviour during musth. In the present study, musth episodes of 29 adult male Asian Elephants kept at Punnathoor Kotta during the last ten years were analysed.

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Materials and Methods

Data on 29 male Asian Elephants, which came to musth during the period from 1990 to 2000 were recorded. Data included details like date of onset of musth, date on which elephants were relieved from musth and date of birth of elephants. Based on these data age, duration of musth, month and season of musth were calculated.

Guruvayoor ($10^0$35' N, $76^0$0' E) is a temple town which lies in the coastal belt of Thrissur District of Kerala State in India. The meteorological data for the entire study period was collected. The data include the monthly mean values of ambient temperature, humidity and sunshine for the period between 1990 and 2000. Based on these values THI (Temperature Humidity Index) and THSI (Temperature Humidity Sunshine Index) were calculated using the formulae

$$THI = 0.72 (Cdb + Cwb) + 40.6$$

where,
Cdb - dry bulb temperature.
Cwb - wet bulb temperature.

and

$$THSI = \frac{(0.75\,BS)\,THIe + (24\text{-}0.75\,BS)\,THIm}{24}$$

where,
BS - hours of bright sunshine.
THIe - THI values based on evening (1500 hrs.) dry and wet bulb readings.
THIm - THI values based on morning (0900 hrs.) dry and wet bulb readings.

Analysis of data

The number of occurrences of musth and duration of musth periods were correlated with the monthly mean values of ambient temperature, humidity, sunshine, THI and THSI. The relation between duration of musth and age of elephant was also analysed.

Results

Duration of musth

The average duration of musth in captive elephants was 99 days with a standard deviation of 36 days. The duration varied between 10 and 205 days. The various parameters that were analysed in relation with the duration of musth were monthly mean values of temperature, humidity, sunshine, TI-R and THSII. The correlation coefficients of these parameters are given in the following table.

Parameters	Correlation coefficient
Temperature	- 0.615910
Humidity	+0.787261
Sunshine	- 0.801390
THI	+0.156536
THSI	+0.158860

Duration of musth and age of elephants

The scatter diagram shows the duration of musth periods 'of all the 29 elephants during the entire study period plotted against their age (Fig. 1). The regression line which shows an upward trend is based on the regression equation y = 0.8773x + 66.705 with a regression coefficient of 0.0767.

Duration of musth and meteorological parameters

The relation between duration of musth and mean monthly temperature for the entire study period is given in Fig. 2. The correlation coefficient was found to be -0.61591.

The relation is depicted in Fig. 3. Mean monthly sunshine was found to have a maximum negative correlation with the duration of musth among the various parameters analysed (Table 1).

Humidity was found to have a positive correlation with the duration of musth as illustrated in Fig. 4.

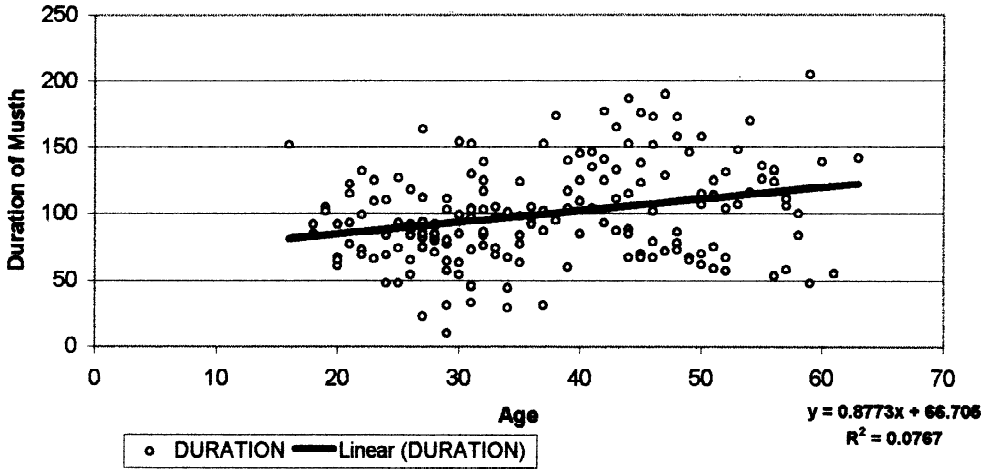

Figure 1. Duration of musth and age of elephants.

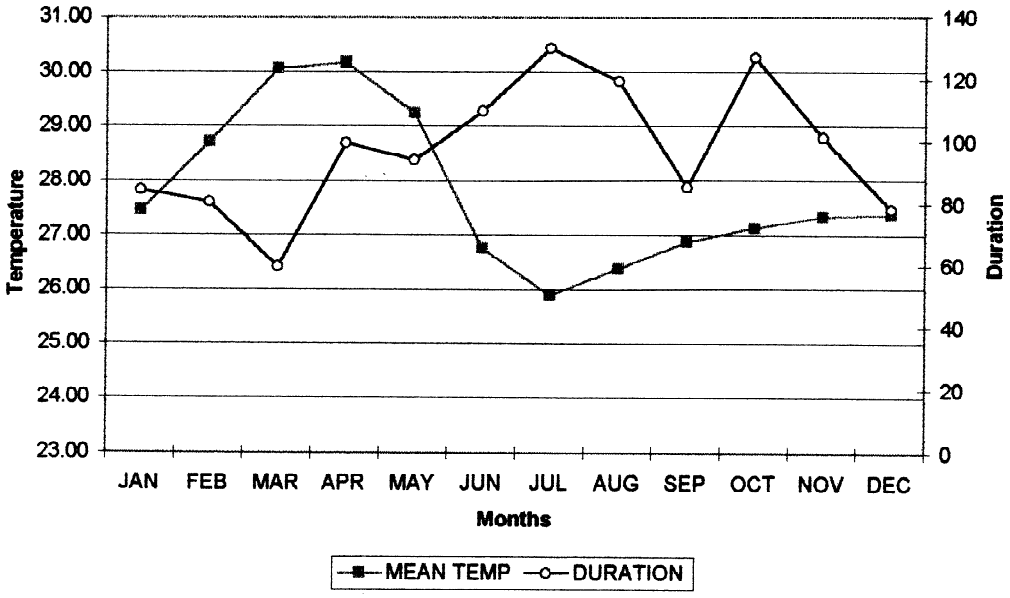

Figure 2. Duration of musth and mean monthly temperature.

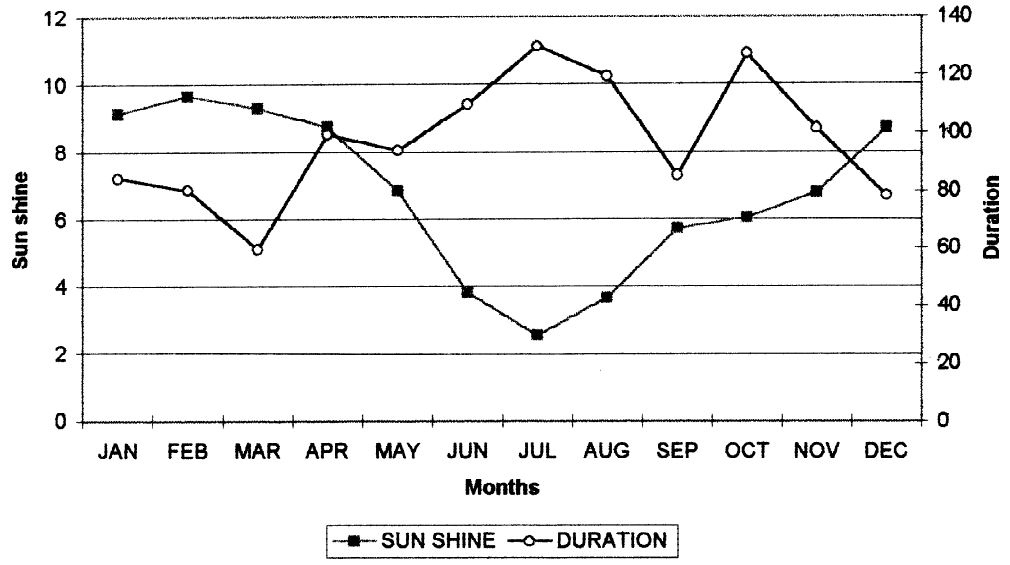

Figure 3. Duration of musth and mean monthly sunshine.

Occurrence of musth

The number of occurrences of musth in different months of a year was found to show a definite periodicity with peaks occurring during January and August (Fig. 5).

Age of occurrence of first musth

The average age of occurrence of first musth was found to be 23.94. But in some elephants first musth occurred at 16 years of age and some symptom of musth was noticed for 35 years. The correlation between the number of occurrences of musth and the various parameters are given in the Table 2.

The relationship between the occurrence of musth and mean monthly temperature is given in Fig. 6. THSI was found to have the maximum negative correlation with the number of occurrences of musth (Fig. 7)

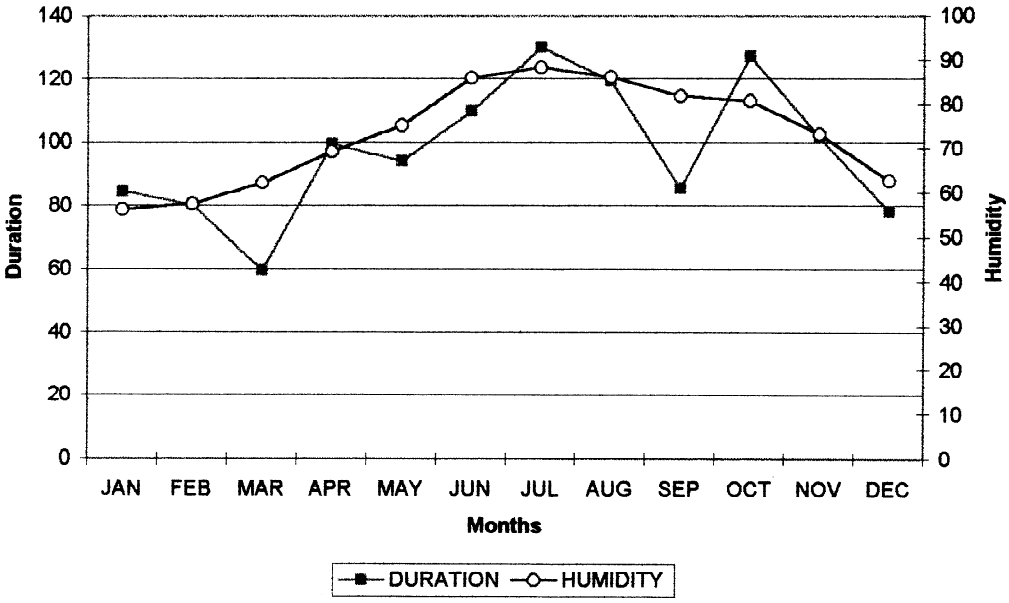

Figure 4. Duration of musth and mean monthly humidity.

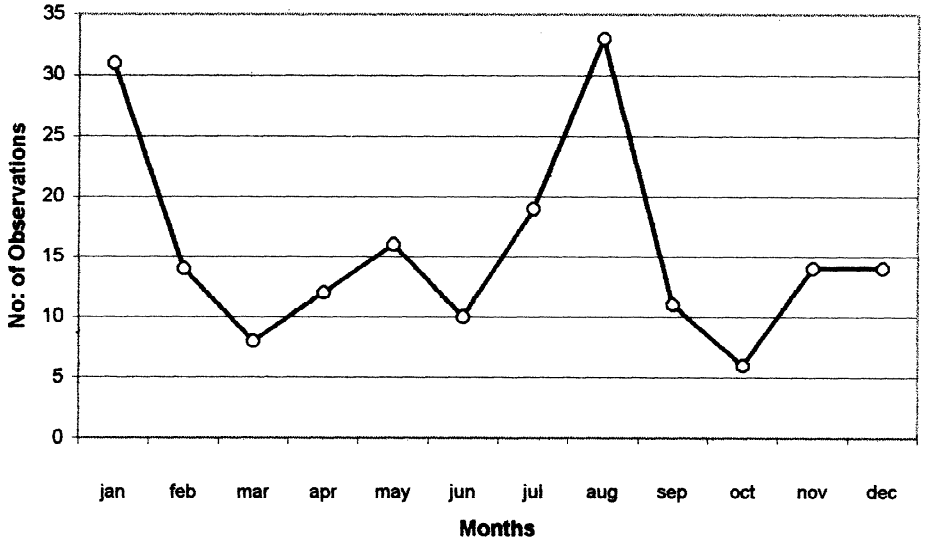

Figure 5. Month and occurence of musth.

Parameters	Correlation coefficient
Mean temperature	- 0.344846
Humidity	+0.026630
Sunshine	- 0.167211
THI	- 0.418851
THIS	- 0.463505

Discussion

Chandrasekharan *et al.* (1989) observed the duration of musth to be 60-90 days in most of the cases and Saseendran (1994) reported a much shorter duration of 21.38 days in elephants at Mudumalai. But the present study revealed that the duration is highly variable with an average of 99 +/- 36 days. Individual animals tend to show similar duration during subsequent musth periods with a slight increase in duration as the age advances. The relation between the duration of musth and age of the ani-

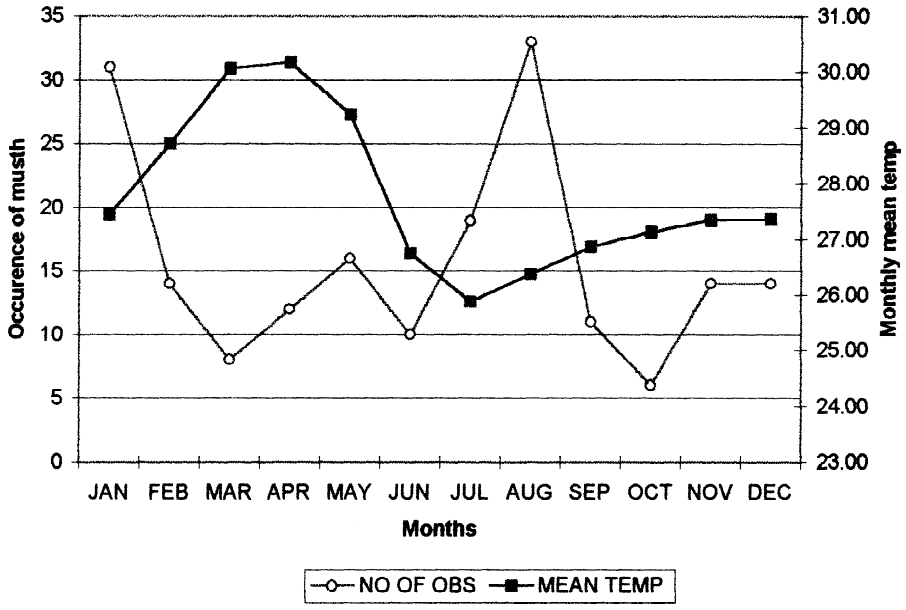

Figure 6. Occurence of musth and mean monthly temperature.

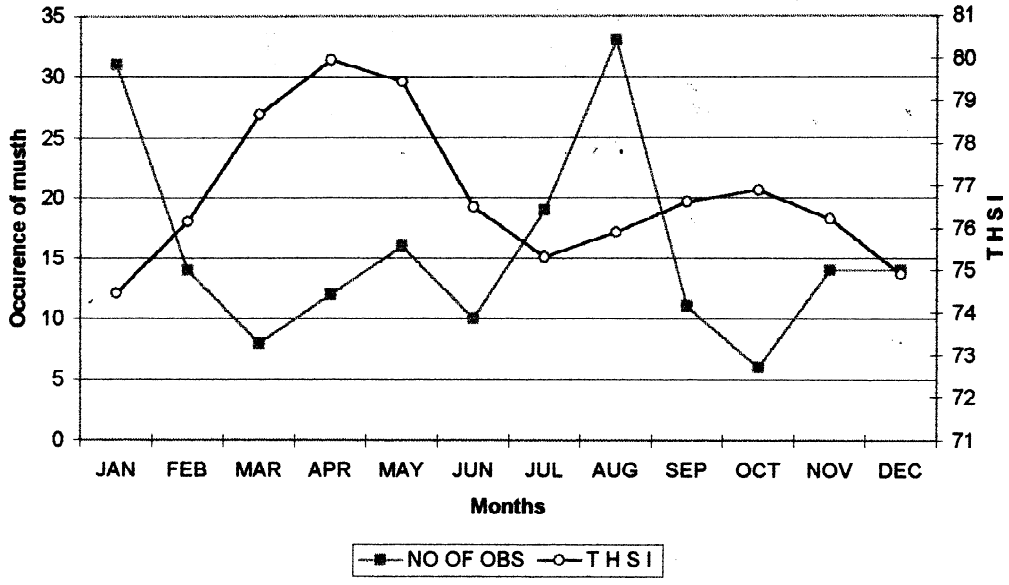

Figure 7. Occurence of musth and THSI.

mal helps to predict the duration of musth in elephants. Analysis of the duration of musth with different meteorological parameters has indicate that the hours of bright sunshine has the most pronounced influence on the duration of musth. This is probably because the short photoperiod has a stimulatory effect on the pineal gland of the adult male elephants which in turn affect its breeding behaviour. Environmental influence on the duration of musth period is further supported by the definite positive correlation with humidity and negative correlation with ambient temperature.

Out of the 29 elephants studied only one showed occurrence of

musth twice in a year. Age of occurrence of first musth was 23.94 years, which is in confirmation with the findings of Steel (1889), Evans (1901), Jainudeen *et al.* (1972) and Chandrasekharan *et al*. (1989). Individual elephants continued to exhibit musth behaviour almost throughout the same season. The number of animals coming to musth showed definite peaks during January and August months (post monsoon periods of Kerala) when the atmospheric temperature is low (Eisenberg *et al*., 1971) and stress indicated by THSI is minimum.

The findings obtained in the present investigation about different aspects of musth behaviour and the factors influencing its duration and occurrence can be used effectively for developing strategies for musth management of Asian Elephants.

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CENTIPEDES (SCOLOPENDRIDAE) OF COIMBATORE ZOOLOGICAL PARK AREA, ANAIKATTY, WESTERN GHATS

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The Western Ghats, a hotspot of biodiversity has no dearth of centipedes. The centipede diversity in Western Ghats is represented by 42 species, belonging to six families, three tribes and nine genera (Yadav, 1993ab). Their distribution and taxonomy have been studied by Attems (1930). Systematic survey and studies on centipedes have so far been restricted to the Deccan and the Western Ghats of Pune and Maharashtra, (Jangi & Dass, 1984; Yadav, 1993a,b). The present study of centipede is from rain shadow area of Western Ghats of Anaikatty, Coimbatore. This report is a part of the inventory of invertebrate diversity of the Coimbatore Zoo site.

The zoo site is located adjacent to the reserve forest, at 76°45' longitude and 11°06' latitude and at an altitude of 600-700 m. in the rainshadow area of the Western Ghats. The area is a catchment zone bordered by hill slopes (of 90-125 m. tall) on three sides and the Kodungarai River in the west. The vegetation type here could be described as dry deciduous scrub (an interphase of dry deciduous and thorn forests). Annual rainfall ranges from 1000-1200 mm, maximum during the northeast monsoon between September and November.

Intensive surveys and specimen collection for species identification were carried out during January to December 1997. This yielded seven species of centipedes (Table 1). The microhabitat of all the centipedes is the wet sandy/moist area, under stones and leaf litters. Centipede occurrence was high during the monsoons and post monsoon season (September to December). *Scolopendra amazonica*, *Rhysida nuda subnuda* and *Otostigmus politus* were the most common centipedes recorded during the study period. The *Scolopendra hardwickei*, which is reportedly an uncommon species in this area (Jangi & Dass, 1984), was recorded from this region.

From January to April, 13 individuals (11.5%) were recorded. In

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