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Short Communication

A preliminary study on the morphometrics of the Bornean Elephant

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ABSTRACT

This is the first morphometric study on the Bornean subspecies of the Asian elephant (*Elephas maximus borneensis*). The morphological measurements of captive *E. m. borneensis* in Sabah were taken and compared to those of the captive elephants (*E. m. indicus*) in Peninsula Malaysia in an attempt to see if there were any morphological differences. No significant differences were found in the selected measurements between Bornean elephants and Peninsula Malaysia elephants (ANCOVA, $r > 0.05$). Results indicated that there is positive relationship between age and the selected morphometric measurements.

INTRODUCTION

The Asiatic elephant is a widely distributed species covering much of South Asia in the west to Indochina in the east and a larger part of Southeast Asia including Peninsular Malaysia, Sumatra and Borneo. Some populations are distinguishable through morphological characters such as the colour of skin, pigmentation and sometimes by the characteristics veins in the ears (Kurt & Kumarasinghe, 1998). Sometimes, different populations prefer to live in certain habitats. These differences accounted for the recognition of different subspecies. Three are currently recognized i.e *Elephas maximus indicus* (Indian elephant), *E. m. maximus* (Sri Lankan elephant) and *E. m. sumatrensis* (Sumatran elephant) (Sukumar, 1989; Sukumar *et al.*, 1991; Fleischer *et al.*, 2001). The main reason on why the Bornean elephant is categorized under Indian or Sumatran sub-species was because the inadequacy of the original descriptions of the Bornean conspecific in terms of the morphological characters and sample size (Fernando *et al*, 2003).

Although a number of morphometric studies on Asian elephant were done and published (Wemmer & Krishnamurthy, 1992; Daniel, 1998; Othman, 1990; Othman, 2003) there was no morphometric study carried out to differentiate the sub-species. The Bornean elephant, the newly classified sub-species, is believed to be the smallest in size and observed to have larger ears, longer tails, straighter tusks and a more rounded body (Fernando *et al.*, 2003). The sub-species, however, was classified based on genetic analysis by Fernando *et al.* (2003)

Keywords: Bornean elephant, morphometric measurements

despite the known historical accounts of its origin (De Silva, 1968; Ibbotson, 2003; Shim, 2003). A morphological study is desirable to confirm a distinct group of organism (Hawksworth, 1995), which prompted this study.

MATERIALS AND METHODS

The Captive Populations

External morphological measurements of fifteen captive elephants from Peninsular Malaysia were made from April to May 2005 at Malacca Zoo and at Kuala Gandah Elephant Conservation Centre in Pahang. Measurements of six elephants from Sabah were taken at the Lok Kawi Zoological and Botanical Park from July 2005 to January 2006. Measurements were made on selected characters as follows: (a) ear length (EL), (b) ear width (EW), (c) tail length (TL) and (d) chest girth (CG), using a tailor's tape (Butterfly; 150 cm) and a longer measuring tape (Tricle; 30 m/100 feet) depending on the characters measured (Figure 1). The measurements were repeated three times for each elephant and averaged. Data were analyzed using the Analysis Covariance (ANCOVA) carried out via SPSS version 12.0 (SPSS Inc, Chicago). Elephants are known to grow throughout life and age is an important factor determining their morphological characteristics (Koehl, 1996; Daniel, 1998; Reilly, 2002). Since the sample size was small (Sabah population, $n = 6$, West Malaysia population, $n = 15$), we used ANCOVA to control for the age factor in both populations.

RESULTS

Based on the ANCOVA and controlling for age (Figure 2), there was no significant difference in any of the characters between the two captive populations ($p>0.05$). However there was a significant relationship between age and each variable ($p<0.05$), stressing the important influence of age on the morphology of elephants.

DISCUSSION

Morphology is the basic method to classify species but measurements on exceptionally large wild animals are difficult to make. Consequently, most studies were done based on cranial measurements or dental characteristics of museum specimens or fossils (du Toit *et al.*, 1987; Hillis, 1987). Unfortunately, even when using preserved material the most common problem still concerns inadequate data for reliable statistical analysis, a problem especially true for specimens of exceedingly large animals.

The physical characteristics of Bornean elephant as being smaller and different in certain characters were not confirmed in this study. The measurements to be tested were not available elsewhere for the Bornean elephant and our data provide the only measurements on those characteristics. Obviously, the confirmation would require many sets of data from many individuals representing all age classes.

In some circumstances, such measurements can be done on many animals prior to translocation programs or when the animals are using grassland or opened forests. Othman (2003) analyzed morphometric data from wild elephant gathered over a ten-year translocation program (1993 to 2003) in Peninsular Malaysia. Similarly, Daniel (1998) conducted a five year study on the growth of the Indian elephant and measured them every year on the same dates and replicated each measurement four times. In Borneo, such extensive replication is impossible because of the scattered elephant populations, the typically impregnable forest habitat and the tiny number of individuals in captivity. The importance of morphological analysis is so crucial until Fernando *et al.* (2003) suggested that a formal reinstatement of the *E. m. borneensis* taxa await a detailed morphological analysis of Bornean elephants and their comparison with other populations.

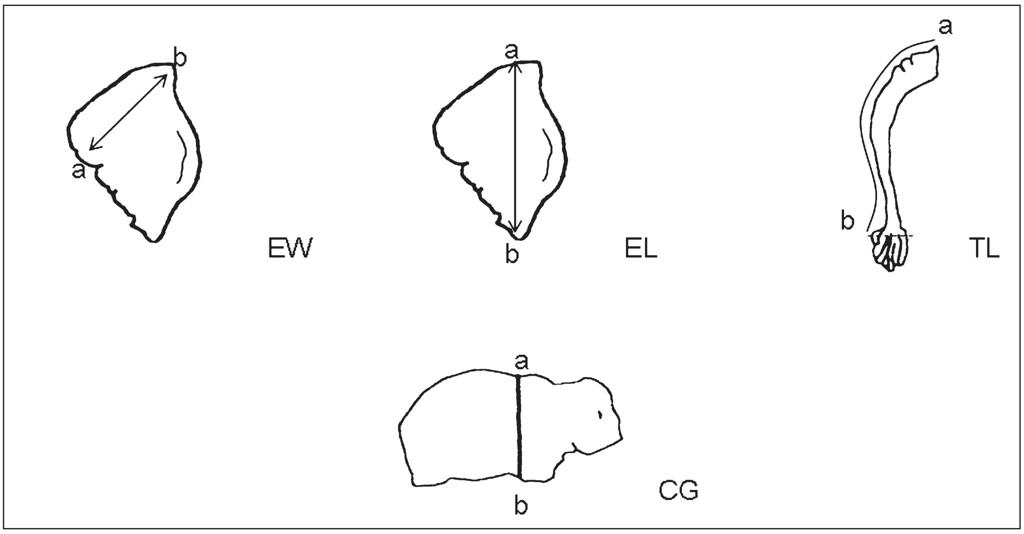
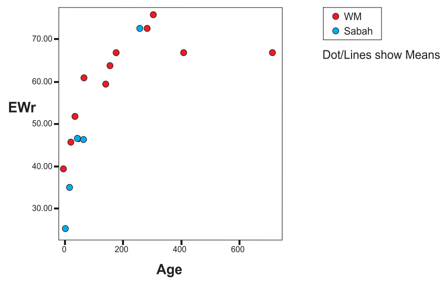


Figure 1: The external morphological measurement of each variable in cm (EL = ear width, EL = ear length, TL = tail length, CG = chest girth) *The drawings are not to scale*

Measurements definition

Ear width	:	From the starts of the ear to the widest point of the ear
Ear length	:	The upper end of the ear to the lowest point of the ear
Tail length	:	The tail along its entire length and measure at the end of the last vertebra (not including the hair)
Chest girth	:	Measured immediately behind the forelegs by wrapping the tape around the torso

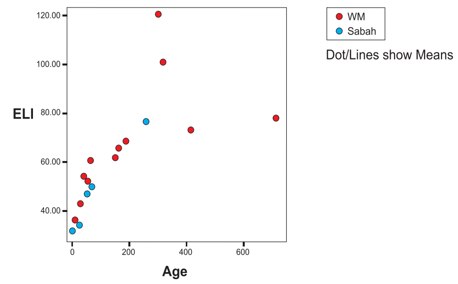


Test of Between-Subjects Effects

Dependent Variable: EWr

Source	df	F	Sig.
Age	1	10.345	.005
WM_S	1	2.259	.150

R Squared = .502 (Adjusted R Squared = .447)

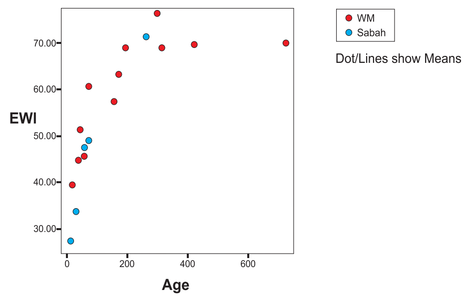


Test of Between-Subjects Effects

Dependent Variable: ELl

Source	df	F	Sig.
Age	1	10.503	.005
WM_S	1	1.046	.320

R Squared = .467 (Adjusted R Squared = .408)

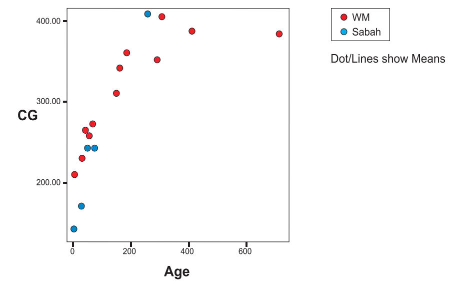


Test of Between-Subjects Effects

Dependent Variable: EWl

Source	df	F	Sig.
Age	1	14.767	.001
WM_S	1	1.775	.199

R Squared = .560 (Adjusted R Squared = .511)

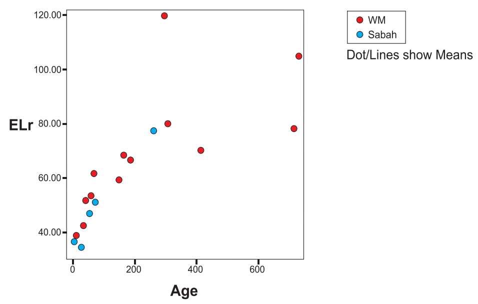


Test of Between-Subjects Effects

Dependent Variable: CG

Source	df	F	Sig.
Age	1	20.123	.000
WM_S	1	1.501	.236

R Squared = .617 (Adjusted R Squared = .574)

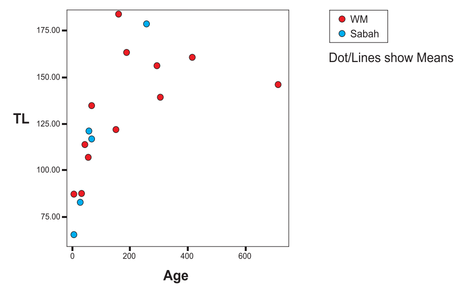


Test of Between-Subjects Effects

Dependent Variable: ELr

Source	df	F	Sig.
Age	1	10.492	.005
SM_S	1	.715	.409

R Squared = .453 (Adjusted R Squared = .392)



Test of Between-Subjects Effects

Dependent Variable: TL

Source	df	F	Sig.
Age	1	6.631	.019
WM_S	1	.126	.726

R Squared = .318 (Adjusted R Squared = .243)

Figure 2: Interactive scatter plot graphs that showed the linear relationship between each variable and age while the tables below showed the ANCOVA's results

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