

Faecal Fibre Length in the Malayan Tapir (*Tapirus indicus*) and the Sumatran Rhinoceros (*Dicerorhinus sumatrensis*)

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Abstract: An in-depth study was carried out at the Sumatran Rhinoceros Conservation Center (SRCC) to determine the difference between the faecal materials of the Malayan tapir (*Tapirus indicus*) and Sumatran rhinoceros (*Dicerorhinus sumatrensis*). A total of 68 faecal samples were taken for each species and tested for differences in fibre length. The dentition of both species was also measured to determine whether the size of premolars and molars affect the faecal fibre length. In general, average faecal fibre lengths in Malayan tapir do not exceed 2.00cm, whereas they do in the Sumatran rhinoceros. However, a good sample size of 30–50g or an equivalent of a quarter to half faecal bolus is adequate to establish a significant difference in the faecal fibre length. The premolars and molars of the Sumatran rhinoceros are significantly longer and wider compared to the Malayan tapir and this allows the Sumatran rhinoceros to browse on larger and tougher saplings. This ability may be the reason for the longer faecal fibre length in the Sumatran rhinoceros. The difference in faecal fibre length between the two species is an important criteria for Sumatran rhinoceros census and patrolling. This method provides reliable information on the two species and would certainly be an important aspect of large mammal census in Malaysia.

INTRODUCTION

Digested and undigested materials have long been used in studying the food and feeding habits of wild animals. This involves the isolation and identification of plant tissues excreted with the faeces (Stephen and Saharia 1995). Similarly, faecal material could be used in identifying species based on the size of fibre or epidermis of plants consumed. The fibre found in the Malayan tapir and Sumatran rhinoceros faeces are indigestible parts of plants, primarily the cortex and epidermis. The Malayan tapir and the Sumatran rhinoceros (order Perissodactyla) are known to occur in similar habitats in the wild. In captivity, the diet of the Malayan tapir mainly consists of *Artocarpus rigidis* and *Ficus* spp., supplemented with fruits and concentrates. This is similar for the Sumatran rhinoceros with the addition of *Macaranga triloba* and *M. giganteia* (Zainal-Zahari *et. al.* 1990). The average daily intake of forage for the Malayan tapir and Sumatran rhinoceros are 15kg and 33kg respectively.

Faeces of the Sumatran rhinoceros are irregularly round to oval boluses, 7–

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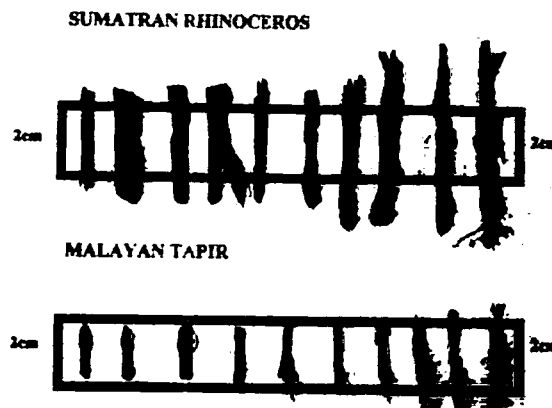
9cm in diameter with each weighing 100–200g. A normal defecation would consist of 6 to 15 boluses. The colour is greenish to yellowish brown turning dark brown after a few days (Zainal-Zahari *et al.* 1999). Tapir faeces are similar to those of the rhinoceros but smaller with a diameter of 4–6cm (van Strien 1985). A fresh tapir dropping consists of about eight boluses. It is light brown in colour and made up of coarsely ground leaves and twigs (Williams 1978).

Techniques used during inventories of Sumatran rhinoceros by Rhino Patrol Units (RPU) take into account both direct and indirect observations. Indirect signs that are observed and recorded include tracks, feeding signs, trails, tree markings, wallows and faeces. However, similarity in faecal boluses of the Malayan tapir and the Sumatran rhinoceros can be misleading. An in-depth study was thus carried out at the Sumatran Rhinoceros Conservation Center (SRCC), Sungai Dusun, Selangor, to determine differences between the faecal materials of the two species.

METHOD

Faecal samples were obtained from seven Sumatran rhinoceros and three Malayan tapirs and mixed separately. A 20g sample of faeces was taken from each species for analysis. A total of 68 samples were taken for each species and tested for differences in fibre length. Samples were placed in plastic containers with 15–20 holes (2–3mm diameter) and sieved using water for ten minutes. Sieving was considered complete when the drained water become clear. The fibre of stems and leaves retained in the containers were then taken out and placed on a piece of paper for sorting. Selection of epidermis coverings of stems and twigs was carried out based on the physical characteristics (elongated, smooth and tough) of the material. These were then arranged from the longest to the shortest and ten of the longest samples were selected for measurement (Plate 1) using a veneer caliper (Mitutoyo, Japan). A Student's t-test was used to statically determine the significance of differences in the faecal fibre length of the two species.

Plate 1

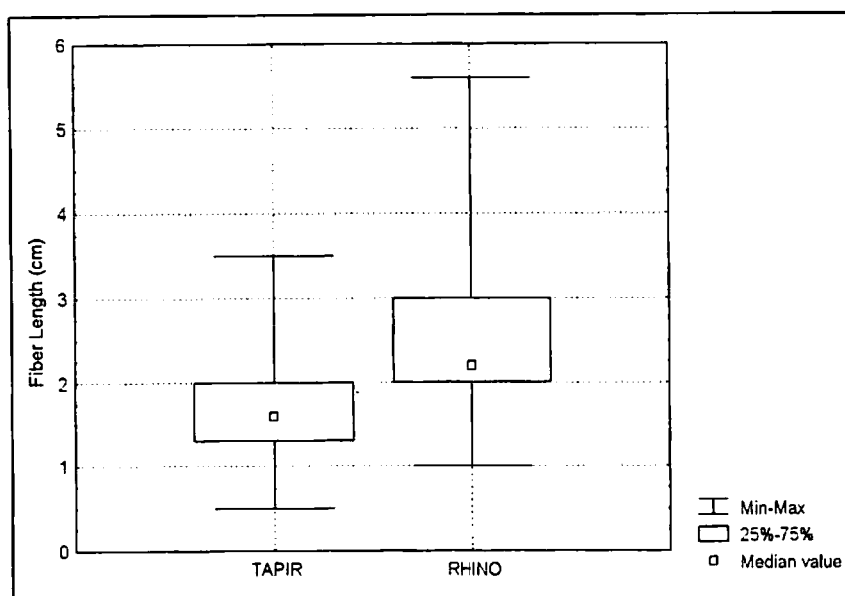


The dentition of both species was also measured to determine whether the size of the premolars and molars play a rôle in the faecal fibre length. The length and width of the premolars and molars from the mandible of the Malayan tapir and Sumatran rhinoceros were measured using a veneer caliper (Mitutoyo, Japan). The mean and standard deviation were then calculated for the premolars and molars of the tapir and the rhinoceros. A Student's t-test was also carried out to statistically determine the significant difference between the length and width of the premolars and molars of both species.

RESULTS

The average length of faecal fibres in the Malayan tapir and the Sumatran rhinoceros were found to be $1.67(\pm 0.54)$ and $2.45(\pm 0.93)$ cm respectively. In the Malayan tapir, the mean faecal fibre length ranged between 1.54 and 1.80cm ($\mu=0.05$). The mean faecal fibre length in the Sumatran rhinoceros ranged from 2.23 to 2.67cm ($\mu=0.05$). The minimum fibre length for the Malayan tapir was 0.50cm and the maximum length 3.50cm. In the Sumatran rhinoceros, minimum and maximum fibre length was 1.00cm and 5.60cm respectively. The median value for faecal fibre length in the Malayan tapir and Sumatran rhinoceros was 1.60cm and 2.20cm respectively and the variability around the central tendency (25%–75%) ranged from 1.30cm to 2.00cm for the tapir and 2.00cm–3.00cm for the rhinoceros (Fig. 1). The Student's t-test indicated a significant difference in the faecal fibre lengths between the two species.

Figure 1. Median, quantile and range for faecal fiber length in the Malayan tapir and the Sumatran rhinoceros.



The average length and width for the premolar of the Malayan tapir was found to be 22.9 (± 2.1)mm and 17.1 (± 1.7)mm respectively. Similarly, the average length and width for the molar was 24.1 (± 2.3)mm and 18.3 (± 1.0)mm. For the rhinoceros, the average length and width for the premolar was 27.4 (± 4.5)mm and 19.7 (± 2.9)mm while the molar was 34.5 (± 3.2) and 22.6 (± 2.1)mm respectively (Table 1).

Four Student's t-tests ($\mu=0.05$) were carried out individually for the length and width of tapir and rhinoceros premolars and molars. All of the t-tests showed significant differences between the length and width of the premolars and molars of the two species.

Table 1. The average length and width of the premolar and molar for the Malayan tapir and the Sumatran rhinoceros.

Species	Dentition	N	Length (mm)	Width (mm)
Malayan tapir	Premolar	20	22.9 \pm 2.1	17.1 \pm 1.7
	Molar	18	24.1 \pm 2.3	18.3 \pm 1.0
Sumatran rhinoceros	Premolar	11	27.4 \pm 4.5	19.7 \pm 2.9
	Molar	16	34.5 \pm 3.2	22.6 \pm 2.1

DISCUSSION

The faecal fibre length in the Malayan tapir was found to range from 0.50–3.50cm (average of 1.54–1.80cm) and is similar to results of previous studies in Taman Negara where the length was found to range from 1.00–3.50cm (Williams 1978). In the Sumatran rhinoceros, the range of faecal fibre lengths recorded during the study was 1.00–5.60cm (average of 2.23–2.67cm). This is in contrast to studies in Gunung Leuser National Park, Indonesia, where a faecal fibre length of 1.00–2.00cm was recorded (van Strien 1985). This difference could be due to the methods used in separating the fibres from the faeces, the types of forage consumed or the sample size.

In general, the average faecal fibre length of the Malayan tapir did not exceed 2.00cm while in the Sumatran rhinoceros it did exceed 2.00cm. A good sample size is important to establish a significant difference in faecal fibre length between the two species. A sample size of 30–50g or the equivalent of a quarter to half the faecal bolus is sufficient for the measurement. A triplicate sampling of the bolus, totaling ten faecal fibres each, would provide an accurate measure. A sample size of over 30 is advisable to ensure an approximately normal sampling distribution (Levin and Fox 1988).

The significant difference observed between the dimensions of the molars and premolars of the two species could relate to the cut sizes of plant material consumed. In addition, the sizes of undigested plant material (mainly the cortex

and epidermis) in the faeces would be related to the sizes of consumed foliage. The premolars and molars of Sumatran rhinoceros are significantly longer and wider compared to those of the Malayan tapir. The size and shape of the premolars and molars of an animal play an important role in the feeding habits of the animal. In ungulates, the lateral motion of the jaw during feeding causes foliage to be chewed laterally or to sizes related to the width of the molars and premolars. In the Malayan tapir, the average width of the molar and premolar is 1.77cm in contrast to 2.14cm in the Sumatran rhinoceros. The bigger premolars and molars in the Sumatran rhinoceros allow the animal to browse on larger and tougher plant material. A feeding trial in Zoo Melaka, Malaysia indicated that the Sumatran rhinoceros consumes stems and leaves down to about 30cm from the shoot (Zainal-Zahari et. al. 1990). This is in contrast to the Malayan tapir, which consumes the more palatable parts of plants including the young leafy materials and soft stems. Similar reports from Taman Negara also indicate that the tapir is a selective browser, usually eating only the young leaves and growing twigs of shrubs and tree species (Williams 1978). The ability of the Sumatran rhinoceros to feed on tougher plant parts may be the reason for longer faecal fibre lengths.

The difference in faecal fibre length between the two species is an important criteria to use during census and patrolling for the Sumatran rhinoceros. Apart from tracks, feeding signs, soil scrappings and debarking, faecal boluses are also found during these surveys (Zainal-Zahari et. al. 1999). The colour and physical characteristics of Malayan tapir and Sumatran rhinoceros faeces can be very similar, particularly those that are old and decomposing. In addition, some faecal boluses of Sumatran rhinoceros are as small as those of the Malayan tapir. However, even in very old and decomposing faeces, the cortex and epidermis of plant fibres eaten are still intact and can be measured. As this method provides fast and reliable information to distinguish between the two species, it would certainly be an important aspect of large mammal census-taking in Malaysia. Accurate population counts are important to avoid overestimating the number of individuals of the endangered species, especially the Sumatran rhinoceros, by confusion with field data of the Malayan tapir.

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