

## Water consumption of Delacour's langurs (*Trachypithecus delacouri*) and grey-shanked douc langurs (*Pygathrix cinerea*) in captivity

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**Key words:** Water consumption, Delacour's langur, grey-shanked douc langur, *Trachypithecus delacouri*, *Pygathrix cinerea*

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### Summary

There are no information about the amount of water consumption of Delacour's langurs (*Trachypithecus delacouri*) and grey-shanked douc langurs (*Pygathrix cinerea*). This study provides the first long-term observation and measurement about water consumption of these species in captivity. The study was carried out at the Endangered Primate Rescue Center, Vietnam.

The study analyzed water consumption through food and active drinking. Both species cover about 60% of their demand on water through food which is provided as freshly cut leaves and about 40% through active drinking. The total water consumption is correlated with the air temperature, and increase by Delacour's langurs from 0,07 ml/g body weight by 24°C to 0.18 ml/g body weight by 32°C air temperature, and by grey-shanked douc langurs from 0,10 ml/g body weight by 24°C to 0,16 ml/g body weight by 32°C air temperature.

### Tập tính uống nước ở loài vọc mông trắng (*Trachypithecus delacouri*) và loài vọc chà vá chân xám (*Pygathrix cinerea*) trong điều kiện nuôi nhốt

#### Tóm tắt

Cho đến nay, những hiểu biết về lượng nước tiêu thụ của loài vọc mông trắng (*Trachypithecus delacouri*) và loài vọc chà vá chân xám (*Pygathrix cinerea*) chưa được nghiên cứu. Bài báo này cung cấp những dữ liệu đầu tiên căn cứ trên một nghiên cứu dài hạn đo đếm lượng nước tiêu thụ của hai loài trên. Nghiên cứu được thực hiện tại Trung tâm Cứu hộ Linh trưởng Nguy cấp, Việt Nam. Nghiên cứu đã đo đếm lượng nước tiêu thụ từ hai nguồn: thức ăn và việc uống nước. Kết quả cho thấy, cả hai loài đều hấp thụ khoảng 60% nhu cầu về nước từ thức ăn là lá cây tươi, 40% nhu cầu được hấp thụ từ việc uống nước trực tiếp. Tổng lượng nước tiêu thụ tương quan tỷ lệ thuận với nhiệt độ môi trường sống. Ví dụ: Ở loài vọc mông trắng, lượng nước tiêu thụ tăng từ 0,07 ml/g trọng lượng cơ thể tại nhiệt độ 24 C lên 0,18 ml/g tại nhiệt độ 32 C. Tương tự ở loài chà vá chân xám từ 0,10 ml/g lên 0,16 ml/g.

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#### Introduction

In recent years several studies were carried out about food and food contents on Colobines (Nijboer & Dierenfeld 1996; Otto, 2005; Pham Nhat et al., 2000; Workman, 2010) but the water consumption of these species are not studied yet. There are only some assumptions about the

water demand on the species (National Research Council, 2003; Nijboer et al., 1997). Based on missing observations on active water consumption of douc langurs in the wild Lippold (1977; 1998) supposed that red-shanked douc langurs (*Pygathrix nemaeus*) cover the total water demand only with their food.

In this study carried out from July to October 2008 at the Endangered Primate Rescue Center, Vietnam the total water consumption of Delacour's langurs and grey-shanked douc langurs was investigated and divided into water consumption through food and active water consumption through drinking. The total water consumption was also recorded in correlation of the air temperature.

The climate conditions at the Endangered Primate Center are identical with the condition in the distribution areas of the species and food composition and feeding times also very similar to the conditions in the wild.

**Materials and Methods**

**Animals**

The water consumption of Delacour's langurs were recorded on two adult individuals, one male about 10 years old and one female about 5 years old kept in one cage. The weight of the male was 8.7 kg, and of the female 8.4 kg.

The water consumption of grey-shanked douc langurs were recorded on two adult individuals, one male of 10 years old and one adult female also kept in one cage. The weight of the male was about 12 kg and of female weighed about 8 kg.

The couples are kept in cages 10 m x 5.5 m x 3.5 m, furnished with bamboo poles.

**Water consumption through food**

The leaves, provided in bundles of twigs containing about 10 to 12 tree species which partially changed daily (Table 1). The animals were fed three times a day: 6:30 to 7:00am, 11:00 to 11:30am and 4:00 to 4:30pm. The consumed amount of leaves was recorded through weighing before and after feeding.

To record the water content identical bundles of leaves were dried, first on air and than in an exsiccator with silica gel. An average of water content in the leaves by percentage was recorded and taken into account.

**Active water consumption through drinking**

Water inside the cages was provided in bowls with about 25 cm diameter. Every morning and evening the water content was measured and the difference recorded as consumed water. Observations ensured that the data do not record urine or the jumping of the animals to the water bowls. The evaporation of the water

**Table. 1.** Most common food tree species during the study.

| Family         | Species  |
|----------------|--|
| Asteraceae     | <i>Chromolaena odoratum</i> L.   |
| Convolvulaceae | <i>Ipomoea batatas</i> L.  |
| Euphorbiaceae  | <i>Sapium discolor</i> Müll.Arg.   |
| Fabaceae       | <i>Leucaena leucocephala</i> Lam.<br><i>Delonix regia</i> Bojer<br><i>Dalbergia balansae</i> Prain |
| Malvaceae      | <i>Hibiscus rosa-sinensis</i> L.   |
| Oleaceae       | <i>Ligustrum confusum</i> Decne  |
| Oxalidaceae    | <i>Averrhoa carambola</i> L.   |
| Rubiaceae      | <i>Wendlandia paniculata</i> DC.   |
| Rutaceae       | <i>Euodia leptota</i> Merr.  |
| Sapindaceae    | <i>Nephelium chryseum</i> Blume<br><i>Dimocarpus longan</i> Lour.                                  |

during the day was taken into account through identical water bowls outside the cages.

### Weather condition

Important parameters for the water consumption are air temperature and humidity. During the feeding times – three times a day – temperature and humidity was recorded and as daily “average air temperature”.

### Statistics

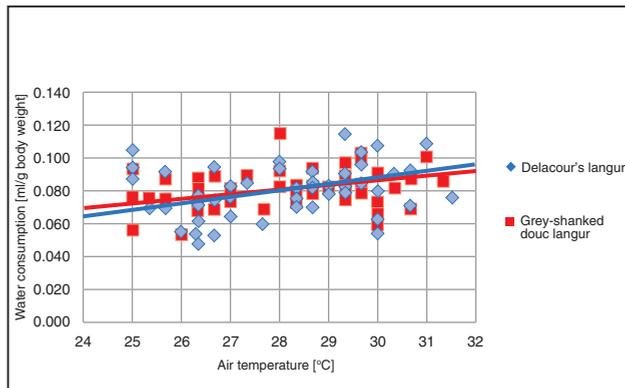
The recorded data were statistical analyzed with SPSS, and the normal distribution with Kolmogorov-Smirnov and Shapiro-Wilk-Test. The average of the data was determined with paired and not paired one and two side T-tests, and correlation analysis following Pearsons R.

## Results

### Water consumption through food

Delacour's langurs consumed through food - depending from the air temperature (by 24 and 32°C) - between 0.065 to 0.098 ml/g body weight which results in a daily water consumption through food between 566 to 853 ml for the male (8.7 kg) and between 546 to 823 ml for the female (8.4 kg).

The grey-shanked douc langurs consumed roughly the same amount, between 0.065 to 0.095 ml/g body weight (by 24 and 32°C). For the 12 kg male is this 780 to 1.140 ml/day and for the 8 kg female 520 to 760 ml/day (Fig. 1).



**Fig.1.** Daily water consumption of Delacour's langurs (*Trachypithecus delacouri*) and grey-shanked douc langurs (*Pygathrix cinerea*) through leaves in relationship to the daily average air temperature during feeding time.

The food consumption increased with the higher air temperature which is probably caused by a higher energy and water demand.

### Water consumption through drinking

The animals of both species regularly cover their water demand through drinking (Fig. 4 and 5). This behavior is also supported by observations in semi-wild areas at the Endangered Primate Rescue Center and in the wild (Fig. 6 and 7) (Nadler, 2008; Workman, 2010).



**Fig.4.** Delacour's langur (*Trachypithecus delacour*) drinking in a cage at the Endangered Primate Rescue Center. Photo: Hanno Kullik.



**Fig.5.** Grey-shanked douc langur (*Pygathrix cinerea*) drinking in a cage at the Endangered Primate Rescue Center. Photo: Hanno Kullik.



**Fig.6.** Black-shanked douc langurs (*Pygathrix nigripes*) drinking rain water from a natural "water bowl" in a granite block. Photo: Tilo Nadler.

The Delacour's langurs consumed daily 0.01 to 0.08 ml/g body weight (by 24 and 32°C). The water consumption increased with the increase of the air temperature (Fig. 2). The Delacour's langur male consumed daily between 87 to 696 ml and the female between 84 and 672 ml (by 24 and 32°C).

Grey-shanked douc langurs consumed 0.03 to 0.06 ml/g body weight (by 24 and 32°C). There was also an increase of the consumption with the increase of the air temperature.

The grey-shanked douc langurs drunk more water below 28°C than Delacour's langurs but above 28°C the water consumption of Delacour's langurs was higher.

The douc langur male consumed daily between 360 to 720 ml and the female between 240 and 480 ml (by 24 and 32°C).

### Total water consumption and the relationship to air temperature

The total water consumption increased with the air temperature, resulting in a higher amount of consumption from leaves and through drinking water (Fig. 3). The total water consumption of Delacour's langurs increase from 0.07 ml/g body weight by an air temperature of 24°C to 0.18 ml/g body weight by an air temperature of 32°C. For an individual with an average weight of 8.5 kg is this a daily amount of 595 ml and 1.530 ml respectively.

The total water consumption of grey-shanked douc langurs increased from 0.10 ml/g body weight by an air temperature of 24°C to 0.16 ml/g body weight by an air temperature of 32°C. For a male with 12 kg body weight is a daily amount of 1.200 ml and 1.920 ml respectively.

### Discussion

Observations in the wild and in the semi-wild areas at the Endangered Primate Rescue Center show various langurs consume water from water sources on the ground. The rare observations in the wild are most probably the result of shy behavior of the animals in close distance to an observer. The animals don't visit the ground if they discover an observer.

Observations on Delacour's langurs and grey-shanked douc langurs in captivity show that the animals regularly consume water which is most probably necessary for digestion and metabolism. About 60% of the total water demand is covered from the leaves which contain a rather high amount of water but 40% was consumed through active drinking.



Fig.7. Delacour's langur group moves to a lake for drinking. Photo: Tilo Nadler.

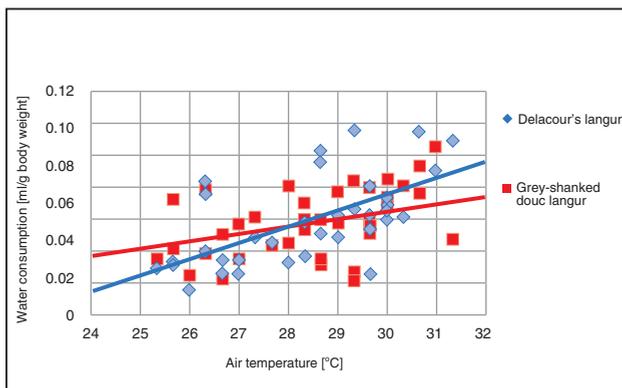
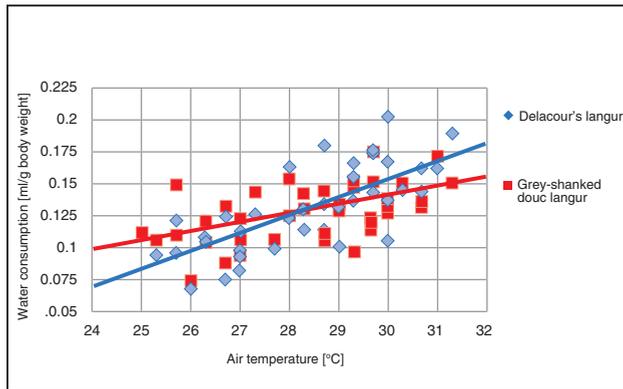


Fig.2. Daily water consumption of Delacour's langurs (*Trachypithecus delacourii*) and grey-shanked douc langurs (*Pygathrix cinerea*) through drinking in relationship to the daily average air temperature during feeding time.



**Fig.3.** Daily total water consumption of Delacour's langurs (*Trachypithecus delacouri*) and grey-shanked douc langurs (*Pygathrix cinerea*) in relationship to the daily average air temperature during feeding time. (Pearson Correlation: Delacour-langurs  $r = 0.721$ ,  $p=0.01$ ,  $n=38$ ; grey-shanked douc langurs  $r = 0.624$ ,  $p=0.01$ ,  $n=39$ ).

Most probably all Indochinese langurs and douc langurs are dependent on active water consumption through drinking in addition to the water content in food, mostly leaves.

There is little information about the amount of water consumed on other primate species, especially Colobines and folivore species. Hanuman langurs (*Semnopithecus entellus*) which are frugivore and folivore, with a high amount of fruits (15% to 25%), cover their water demand mostly through food but drink also water if available (Chalise, 1994; Koenig & Borries, 2001; Sayers & Norconk, 2008). The mantled howler monkeys (*Alouatta palliata*) cover their demand on water through food, but likely visit other water sources (such as depressions at junctures of tree limbs and trunk) (Glander, 1978). This species is probably more of a frugivore and prefers juicy fruits (Nowak, 1999; Wilson & Reeder, 2005). Rhesus macaques (*Macaca mulatta*) and long-tailed macaques (*Macaca fascicularis*) have a daily demand on drinking water of 4% to 8% of the body weight (0.04 to 0.08 ml/g body weight in captivity; German Primate Center, 2010). Schroeder et al. (1999) measured water intake in rhesus monkeys (*Macaca mulatta*). This study shows that older monkeys drank significantly less than young adults (380 ml/day and 750 ml/day respectively). Suzuki et al. (1989) measured for long-tailed macaques a daily total water intake from food and drinking water of 0.076 ml/g body weight for males and 0.10 ml/g body weight for females, and Zorbas et al. (1997) for rhesus macaques a daily mean water intake of 0.122 ml/g body weight.

Compared to this data the daily demand on water consumption by Delacour's langurs and grey-shanked douc langurs is rather high. Delacour's langurs consumed daily 7 to 18% of the body weight, grey-shanked douc langurs 10 to 16% relative to air temperatures of 24 and 32°C respectively.

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