

Preliminary observations of geophagy amongst Cambodia's Colobinae

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Summary

Geophagy amongst the genus *Pygathrix* and silvered langur species group have never been recorded in the wild. Here we describe several instances of primates coming to the ground in order to eat soil from salt licks in Veun Sai-Siem Pang Conservation Area, northeastern Cambodia. This camera trapped salt lick was used several times per month by both taxa and often for several hours at a time. The resource is clearly important as monkeys face predation risk in accessing it. Each species accesses the salt lick at different times of day, suggesting avoidance behavior. Soil composition has not been analysed to date, however consumption may either be an attempt to buffer the digestive system against toxins ingested through a predominantly leaf-based diet or may provide essential minerals to the diet.

Những quan sát ban đầu về tập tính ăn đất ở những loài khỉ ăn lá tại Campuchia

Tóm tắt

Tập tính ăn đất ở giống *Pygathrix* và vọc bac chưa từng được ghi nhận ngoài tự nhiên. Trong tài liệu này chúng tôi mô tả một số quan sát về việc khỉ ăn lá xuống đất để ăn đất có khoáng muối tại khu bảo tồn Veun Sai-Siem Pang, vùng đông bắc Campuchia. Bẫy ảnh được sử dụng và ghi nhận cả hai taxa xuống đất vài lần trong tháng và vài giờ mỗi lần. Nguồn đất này rõ ràng là quan trọng đối với chúng bởi vì nguy cơ bị vật dữ ăn thịt là rất cao khi xuống đất. Mỗi loài xuống khu vực khoáng muối tại những thời gian khác nhau trong ngày chứng tỏ có sự luân phiên, tránh nhau. Tuy thành phần của đất chưa được phân tích, nhưng việc ăn đất này có thể là cách chúng chống lại độc tố có trong lá cây hoặc trong đất có chứa nguồn khoáng vì lượng hết sức cần thiết cho sự phát triển của loài.

Introduction

Due to recent taxonomic reassessments and new discoveries Cambodia's number of primate taxa has increased in recent years from nine to eleven species (Rawson, 2010). With the discovery of red-shanked douc langurs in northeastern Cambodia (Rawson & Roos, 2008) and the division of the silvered langur species group (Roos et al., 2008), Cambodia is now recognized as home to four species of leaf-eating monkey (sub-family Colobinae); the red-shanked douc langur (*Pygathrix nemaeus*), the black-shanked douc langur (*P. nigripes*) and potentially two species of silvered langurs (*Trachypithecus germaini* and *T. margarita*).

While phenotypically the one known population of red-shank douc langurs in Cambodia are widely variable, and in some instances resemble grey-shanked douc langur (*P. cinerea*) which also likely occur in northeastern Cambodia, genetic assessments suggest the population discussed here are red-shanked douc langurs (Rawson & Roos, 2008).

Colobines are known to engage relatively frequently in geophagy, defined as the deliberate consumption of soil (Krishnamani & Mahaney, 2000). Of 39 species of primate recorded as engaging in this behavior either in captivity or wild conditions, eight are colobine taxa (Krishnamani & Mahaney, 2000). A number of hypotheses have been put forward to explain the function of geophagy in primates, including: a buffer against toxins in the diet; alleviation of gastrointestinal problems; a dietary mineral supplement that it is used in times of resource scarcity; and as a cultural phenomenon (see Krishnamani & Mahaney, 2000 for a full review).

While relatively common in Colobines, and primate folivores in general, to date this phenomenon has not been recorded in either douc langurs or silvered langurs. Here we describe the first recorded instances of geophagy in these taxa, documented with camera trap photos in Veun Sai-Siem Pang Conservation Area, northeastern Cambodia.

Materials and Methods

All data come from the Veun Sai-Siem Pang Conservation Area, located in Veun Sai and Siem Pang Districts of Ratanakiri and Steung Traeng Provinces respectively, northeastern Cambodia. The site comprises approximately 55,000 hectares of mainly semi-evergreen/evergreen forest at low elevation and is the subject of conservation partnership between the Forestry Administration, Conservation International, Poh Kao, des Tigres et des Hommes and local communities and authorities.

A significant part of this work is surveying and monitoring wildlife species found at the site. As part of this research we deployed camera traps at a number of locations across the site in order to capture photos of rare and cryptic species. We used Reconyx PC85 units, set to take bursts of three photos with one second intervals when triggered. As part of this work we captured primates utilizing salt licks, and based on this we set one camera at a single salt lick in evergreen forest that primates were known to frequent to gain further information about this behavior. The salt lick (UTM 0689051/1552440) was camera trapped for a total of 127 days between 4th January and 22nd August 2010.

We calculated encounter frequencies for primates that visited the site, with an independent encounter defined as beginning when a period of 30 minutes had expired between photos of the same taxon. A 30 minute interval was necessary as primates often disappeared for long time intervals as they accessed the salt lick, which is partially underground.

All photos were entered into a database, which included information on exact time photos were taken. We transformed times into decimals for comparison of means using Mann-Whitney U-test in SPSS Statistics version 17.0 and then transformed them back for presentation. All other time related statistics were conducted with Oriana version 3.21.

Results

We captured 1226 photos of red-shanked douc langurs on 20 days, constituting 20 encounters at the salt lick over the 127 day camera trapping period. Average encounter frequency over the period was one visit per 6.35 days. Total time spent during the 127 days of camera trapping at the

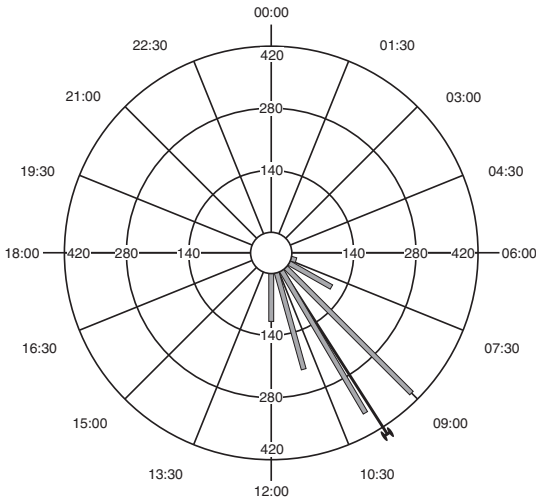


Fig.1. Frequency histogram, by hour, of camera trap photos taken of red-shanked douc langurs. Mean time of records and 95% confidence intervals shown.

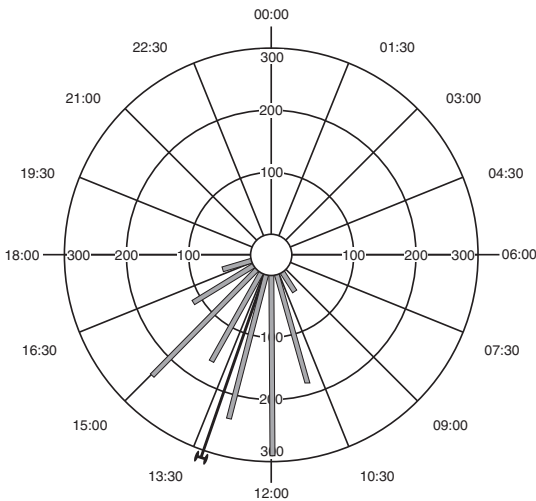


Fig.2. Frequency histogram, by hour, of camera trap photos taken of silvered langurs. Mean time of records and 95% confidence intervals shown.

salt lick for red-shanked douc langurs was 24 hours and 44 minutes with an average visit lasting 1 hour and 14 minutes (SD ± 54 mins 44 secs). Based on an analysis of the time that each photo was taken, we determined that the mean time for photos taken of douc langurs at the salt lick was 09:50 (95% CI of 09:46-09:53; Fig. 1.).

We captured 1320 photos of silvered langurs on 14 days constituting 14 encounters at the salt lick over the survey period. Average encounter frequency over the period was one visit per 9.07 days. Silvered langurs spent a total of 21 hours and 28 minutes at the salt lick, with average visit duration of 1 hour and 32 minutes (SD ± 1 hour 19 minutes). Based on an analysis of the time that each photo was taken, we determined that the mean time for visiting the salt lick was 13:18 (95% CI of 13:12-13:24; Fig. 2.).

Based on comparisons of median time for photos of both species of primate, red-shanked douc langurs and silvered langurs visited the salt lick at significantly different times of day ($U = 65839, p < 0.001, n_{\text{douc}} = 1226, n_{\text{silver langur}} = 1320$, Mann-Whitney U -test). Red-shanked douc langurs visited the salt lick predominantly in the morning and silvered langurs visited in the early afternoon. There was no significant difference between the duration of visits to the salt lick by different primate species ($U = 339.5, p = 0.713, n_{\text{douc}} = 20, n_{\text{silver langur}} = 14$, Mann-Whitney U -test).

Discussion

Geophagy or soil eating has not been recorded in wild silvered langurs or douc langurs, despite several long-term ecological studies at numerous sites (Ha Thang Long et al., 2010; Hoang Minh Duc, 2007; Kool, 1993; Lippold, 1977, 1998; Lippold et al., 2010; Mitani et al., 2010; Phaivanh Phiapalath & Pongthep Suwanwaree, 2010; Rawson, 2009). The phenomenon has however been recorded in several other Asian colobine species (see Krishnamani & Mahaney, 2000 for a review) and has been recorded in douc langurs in captivity (U. Streicher, pers. comm.).

The frequency of visits by both groups of douc langurs and silvered langurs to this salt lick to engage in geophagy suggests that this is a common behavior among these taxa at this site. The behavior has also been identified at several other camera trapped salt licks in Veun Sai-Siem Pang

Conservation Area as part of ongoing survey efforts, suggesting this is not a localized phenomenon. Limited camera trapping of salt licks in the more southerly Mondulkiri Province by WWF has however failed to record primate geophagy, despite the presence of black-shanked douc langurs and silvered langurs at the site (Gray, pers comm.).

For these primates in Veun Sai-Siem Pang Conservation Area, coming to the ground for long periods of time to consume soil may pose a significant risk of predation. Douc langurs and silvered langurs are predominantly arboreal with few published records of terrestrial behavior in douc langurs (Hoang Minh Duc, 2007; Lippold, 1998; Nadler, 2008; Rawson, 2009) and none to our knowledge of silvered langurs, although they doubtless display such behavior. Historically, at least, tiger (*Panthera tigris*) was present at the site, and other predators such as leopard (*Panthera pardus*), clouded leopard (*Pardofelis nebulosa*), and dhole (*Cuon alpinus*) which still occur at the site may also pose a threat to primates. Leopard and tiger diets in Thailand were found to commonly comprise primates (including arboreal colobines), occurring in 10.4% and 5.0% of fecal samples, respectively (Rabinowitz, 1989). Given that the threat of predation is real, and that both douc langurs and silvered langurs are spending considerable time on the ground (Fig 3. and 4.), the benefits of geophagy must be considerable.

Red-shanked douc langurs and silvered langurs at the site use the salt lick at different times of the day. On only one occasion did both species utilize the salt lick at the same time. Douc langurs were already present at the salt lick when a group of silvered langurs arrived at 09:30. The douc langurs can be seen vocalizing as the silvered langurs arrive, and the douc langurs subsequently moved off and the silvered langurs entered the salt lick area, although the douc langurs quickly returned, led by an adult male. The two groups then continued to use the salt lick, apparently at the same time, for over one hour with no noted conflict, until the silvered langurs moved off around 10:23. It is hypothesized that in general the two species are using the salt lick at different times to avoid competition.

The function of geophagy for colobines in Veun Sai-Siem Pang Conservation Area is unknown, however, theories of soil consumption in primates fall broadly in to two categories; use for alleviation of gastro-intestinal disorders and mineral supplementation of the diet (Krishnamani & Mahaney, 2000). Neither theory can be ruled out without feeding ecology data and chemical analysis of soil samples. It is however unlikely to be related to reproduction as all age and sex classes engage in the practice. Collection and analysis of soil samples will be necessary to attempt to differentiate between hypotheses, however based on photos only, it appears that soil being consumed is kaolin clay (W. Mahaney, pers. comm.).

Salt licks are a congregation location for many mammals in addition to red-shanked douc langurs and silvered langurs, including gaur (*Bos gaurus*), sambar (*Cervus unicolor*) and muntjac (*Muntiacus muntjac*). These areas should be the target of enforcement activity based on their importance and potential level of threat. Snare removal around these areas should be a priority as these could pose a threat to these primates when moving terrestrially as well as other species.

Conclusions

Soil eating or geophagy has been recorded for red-shanked douc langurs and silvered langurs in northeast Cambodia. This is apparently a very common behavior at the site for both taxa, which spend large amounts of time on the ground consuming clayey soils. While it is not clear the role that geophagy has in these species feeding ecology, it is apparently a behavior with significant benefits



Fig.3. Red shanked douc langurs (*Pygathrix nemaeus*) accessing the salt lick. Photo: Conservation International.



Fig.4. Silvered langurs (*Trachypithecus germaini*) accessing the salt lick. Photo: Conservation International.

to these primate populations as large amounts of time engaged in terrestrial activity puts these arboreal primates at increased danger of predation.

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