Supplementary Materials and Methods

Study site

This study was conducted in the Silaluo region (N27°48’, E98°20’) of the Drung River Valley, Gongshan County, Yunnan, China. This valley runs adjacent to Chayu in Tibet to the north, and Kachin State in Myanmar to the south and west. The Gaoligongshan and Dandanglika mountains are located to the east and west of the river, respectively. These mountains descend from north to south and are characterized by steep elevational drops (4 000 m maximum) (Li et al., 2015).

Due to the influence of the southwest monsoon and specific topographic features of the region, the climate of the Drung River Basin is mild, with an average temperature of 14.5 °C during 2010–2012. The highest average temperature was recorded in August (21.6 °C) and the lowest average temperature was recorded in January (6.6 °C) (Li et al., 2015). Relative monthly humidity ranged from 82% to 88%, with a mean of 85.2%. Annual mean precipitation was 2 745.1 mm and 94.1% of rainfall occurred between February and October, with a peak in March–April and June–September, respectively (Li et al., 2015). According to He & Li (1996), the Drung River Valley features dense forests and remarkable vertical zonation of vegetation: from low to high elevation, the vegetation includes monsoon evergreen broadleaf forest (1 500 m–2 400 m), mixed broadleaf-conifer forest (2 400 m–2 800 m), cold temperate coniferous forest (2 800 m–3 000 m), frigid-temperate coniferous forest (3 000 m–3 700 m), and alpine scrub and meadows (>3 700 m).

Study subjects

In total, ~19 groups of *T. shortridgei* comprising 250–370 individuals reside in the Drung River Valley, Yunnan, China (Cui et al., 2016). We conducted observations in the Silaluo area in the middle part of the Drung River Valley, which has a relatively high population density of langurs (around 16.0–16.8 individuals per km²) and better observation conditions than other areas. After one month of preliminary observation in July 2012, behavioral data collection occurred from August 2012 (except December) to September 2013 (without July due to heavy rains and fog). The study subjects included a total of five one male-multi female groups that ranged from 1 700 m to 2 300 m a.s.l. These groups contained one adult male, 2–3 adult females, and 3–5 offspring, ranging in size from 7 to 9 individuals for a study total of 39–41 individuals (Li et al., 2015).

Data collection
All groups were restricted to the forests east of the Drung River. There is a road (about 1500 m a.s.l.) west of the river and a steel cable for crossing, but no bridge. Due to the deep gully landscape and dense forests, we were only able to conduct observations along the road, rather than directly following the groups. The groups did not react to observers, local people, or vehicles present on the road. We tracked the langurs every day from 0700–1930 h and observed their feeding behavior at a distance of 60–800 m with a monocular telescope (Leica Televid 77, 8×42, Germany). We observed one group of langurs until they moved across the ridge and disappeared from sight, and then looked for another focal group. We did not witness any human disturbances influencing the langurs’ range use, or other large animals competing with the langurs for food, shelter, or other resources. Dietary data were collected for different age-sex classes – i.e., adult males and females, juveniles, and infants older than six months (identified by their silver coats) – using scan sampling at 10 min intervals (Altmann, 1974). The age-sex classes were categorized according to body size and color, and other morphological features such as chopped tail, whiskers, and nipples (see Li et al., 2015). When the langurs were feeding, we recorded the plant species and parts ingested. The dietary categories included buds, young leaves, mature leaves, petioles, flowers, fruits (including seeds), mosses, herbs and ferns, and bamboo shoots. Voucher specimens were collected for later identification at the Kunming Institute of Botany, Chinese Academy of Sciences, if a species could not be identified on the spot.

**Food availability**

To estimate food availability, we established seven vegetation plots (10×20 m²) within the home range of the Shortridge’s langurs. The plots were established at intervals of 500–800 m along a line transect (1 420 m–1 500 m a.s.l.). From the 1st to the 10th of each month, all shrubs and trees with diameters at breast height of more than 10 cm (Ma et al., 2017) were chosen to estimate the abundance of food parts (including mature leaves, young leaves, flowers, fruits, and buds). We recorded one of the following five categories of tree crown coverage: 0=<1%, 1=1%–25%, 2=26%–50%, 3= 51%–75%, and 4=76%–100% (Poulsen et al., 2001; Ma et al., 2017). A relative food availability index (Wi) was used to describe food availability:

\[ Wi = \frac{Oi}{P} \]

where \( Oi \) is the total scores of food availability of a given food type (e.g., young leaves, fruits) in month i, and \( P \) is the total score of the highest annual score of food availability for all
tagged tree/shrub species providing food types (Krebs, 1989; Xiang et al., 2012).

Data analysis

To reduce bias resulting from unequal sample sizes (hours per day and days per month) due to difficult observation conditions, we measured the monthly percentage of different food species and plant parts consumed by averaging the feeding events recorded per month. We then obtained seasonal dietary compositions by calculating the average time spent feeding on plant parts taken monthly (Gupta & Kumar, 1994; Le et al., 2019; Stanford, 1991; Xiang et al., 2012; Zhou et al., 2007, 2018). We only calculated dietary composition in spring and autumn rather than summer and winter due to their low feeding records (<150).

Seasons were divided into spring (February–April), summer (May–August), autumn (September–November), and winter (December–January) according to the phenological changes in the deciduous broadleaf trees in the seven vegetation plots and 14 cross-shaped quadrants at 100 m intervals. This phenological definition of seasons has been used previously (Xiang et al., 2010) as animals may vary food plants based on phenology and spatiotemporal distribution in temperate forests. The beginning of spring was considered to be the date when the cumulative frequency of buds ready to sprout was more than 10%. The beginning of summer was estimated to be the date when the cumulative frequency of leaves unfolding was more than 90%. Autumn started when the cumulative frequency of discolored trees was more than 5%. Winter began when 50% of trees had shed their leaves (Yang, 1983).

We searched for Trachypithecus species-related dietary papers published in Chinese in the China Academic Journal Network Publishing Database (CAJD) and the China National Knowledge Infrastructure (CNKI, http://www.cnki.net/), and for papers in English through the Web of Science database (http://apps.webofknowledge.com), using "diet or food" and "langurs or Trachypithecus" as search terms. We included reports after filtering papers as per Tsuji et al. (2013). Primate taxonomy followed that of Roos et al. (2014). We used Spearman rank correlation to explore the relationship between the percentages of food parts in the diet and their availabilities in the plots.
**Supplementary Tables**

**Supplementary Table S1. Dietary composition of *Trachypithecus* species.**

| Species               | Latitude  | Longitude | Elevation (a.s.l.) | Precipitation (mm) | Species | Leaf* | Fruit & Seed | Mature leaf | Young leaf | Fruit | References                        |
|-----------------------|-----------|-----------|--------------------|--------------------|---------|-------|-------------|------------|------------|-------|-----------------------------------|
| *T. auratus*          | –7.7      | 108.7     | N/A                | N/A                | 85      | 70.7  | 23.9        | 0.75       | 69.9       | 21.2  | Tsuji et al., 2019                |
| *T. obscurus*         | 5.5       | 100.2     | N/A                | N/A                | 56      | 60.3  | 19.9        | N/A        | N/A        | 19.9  | Leen et al., 2019                 |
| *T. germaini*         | 10.1      | 104.6     | 100                | 2156.6             | 58      | 72    | 22.7        | 9.5        | 58         | 22.7  | Le et al., 2019                   |
| *T. obscurus obscuru*²| 11.8      | N/A       | 54                 | 1281               | N/A     | N/A   | N/A         | N/A        | 38         | N/A   | Aggimarangsee, 2006               |
| *T. phayrei*          | 16.5      | 101.6     | 700                | N/A                | N/A     | 46.2  | 39.5        | 12.4       | 31.3       | 39.5  | Suarez, 2013                      |
| *T. francoisi*        | 22.3      | 107.3     | 300                | 1240               | 97      | 76.6  | 17.1        | 15.5       | 61.1       | 17.1  | Li et al., 2016                   |
| *T. francoisi*        | 22.4      | 106.9     | 300                | N/A                | 90      | 56.9  | 31.4        | 13.9       | 38.9       | 17.2  | Zhou et al., 2006                 |
| *T. francoisi*        | 22.4      | 106.9     | 300                | 1373               | 92      | 71    | 17.4        | N/A        | N/A        | 17.4  | Zhou et al., 2018                 |
| *T. leucocephalus*    | 22.4      | 107.7     | 500                | N/A                | N/A     | 85.7  | 6.6         | 15.6       | 69.8       | 6.6   | Zhang et al., 2019                |
| *T. leucocephalus*    | 22.5      | 107.9     | 234.5              | N/A                | 50      | 87.9  | 7.7         | 8.4        | 74.9       | 6.8   | Li et al., 2003                   |
| *T. geeti²*           | 23.7      | N/A       | 3000               | 2000               | 53      | 43.8  | 46.9        | 2.4        | 41.1       | 21.2  | Gupta & Chivers, 2000             |
| *T. crepusculus*      | 24.4      | 100.7     | 2100               | 1836               | 148     | 54.2  | 32.1        | 24.7       | N/A        | N/A   | Fan et al., 2015                  |
| *T. pileatus*         | 24.7      | 90.1      | 25                 | N/A                | 51      | 48    | 32          | N/A        | N/A        | 28    | Monirujjaman & Khan, 2017         |
| Species          | Leaf Mass | Leaf Area | Leaf Base Width | Leaf Tip Width | Leaf Base Length | Leaf Tip Length | Leaf Other Traits | Leaf Other Traits | Latitude | Longitude | Elevation | Precipitation | References |
|------------------|-----------|-----------|-----------------|----------------|------------------|-----------------|--------------------|--------------------|-----------|-----------|-----------|---------------|------------|
| T. phayrei       | 24.8      | 98.8      | 2000            | 717.8          | 50               | 52.6            | 40.9               | 4.1                | N/A       | 22.2      | Ma et al., 2017 |
| T. pileatus      | 27.0      | 92.3      | 1000            | 2545           | 52               | 68              | 16                 | 6                  | 57        | N/A       | Solanki et al., 2008 |
| T. shortridgei    | 27.8      | 98.3      | 1900            | 2745.1         | 52               | 47.7            | 28.7               | 25.2               | 15.2      | 28.7      | Our study                  |
| T. francoisi     | 28.6      | 108.3     | 744             | 952            | 164              | 63.9            | 32.2               | N/A                | N/A       | 25.7      | Hu, 2011                  |

1Leaf: including buds, petioles, young leaves, and mature leaves.
2Data on latitude, longitude, elevation, and precipitation were from Tsuji et al. (2013).
3N/A: Not available.
**Supplementary Table S2.** Monthly food species and percentage of feeding records for different plant parts consumed by *Trachypithecus shortridgei*.

| Month        | Scan No. | Feeding records | Bud | Young leaf | Mature leaf | Petiol | Flower | Unripe fruit | Moss | Herb and Fern | Bamboo shoot | No. of parts eaten | No. of species eaten | Unidentified food parts |
|--------------|----------|-----------------|-----|------------|-------------|--------|--------|--------------|------|---------------|--------------|---------------------|-----------------------|------------------------|
| 12-Aug       | 129      | 31              | 0   | 0          | 0           | 0      | 41.4   | 0            | 58.6 | 0             | 0            | 2                   | 2                     | 2                      |
| 12-Sep       | 252      | 108             | 0   | 0          | 17.6        | 8.8    | 4.4    | 49.5         | 6.6  | 7.7           | 3.3          | 2.2                 | 8                     | 12                    | 17                     |
| 12-Oct       | 193      | 100             | 0   | 0          | 35.1        | 1.1    | 18.1   | 19.1         | 14.9 | 11.7          | 0            | 0                   | 6                     | 12                    | 6                      |
| 12-Nov       | 234      | 176             | 0   | 0          | 21.5        | 4.7    | 49.7   | 2.7          | 2.7  | 20.8          | 0.7          | 0                   | 6                     | 10                    | 27                     |
| 13-Jan       | 198      | 102             | 0   | 4.4        | 58.9        | 22.2   | 0      | 3.3          | 5.6  | 3.3           | 0            | 2.2                 | 7                     | 9                     | 12                     |
| 13-Feb       | 163      | 151             | 5.9 | 1.5        | 30.1        | 12.5   | 1.5    | 0            | 41.9 | 5.9           | 0            | 8                   | 14                    | 15                    |                        |
| 13-Mar       | 258      | 228             | 2.9 | 42.6       | 26.3        | 3.3    | 2.9    | 0            | 2.9  | 13.9          | 5.3          | 0                   | 8                     | 21                    | 19                     |
| 13-Apr       | 19       | 18              | 7.7 | 38.5       | 46.2        | 7.7    | 0      | 0            | 0    | 0             | 46.7         | 0                   | 5                     | 4                     | 5                      |
| 13-May       | 72       | 38              | 0   | 33.3       | 16.7        | 0      | 0      | 0            | 3.3  | 0             | 0            | 3                   | 5                     | 8                      |                        |
| 13-Jun       | 10       | 13              | 0   | 25.0       | 8.3         | 8.3    | 0      | 0            | 58.3 | 0             | 0            | 0                   | 4                     | 2                     | 1                      |
| 13-Aug       | 103      | 58              | 0   | 22.2       | 16.7        | 0      | 7.4    | 0            | 44.4 | 9.3           | 0            | 0                   | 4                     | 6                     | 4                      |
| 13-Sep       | 19       | 3               | N/A | N/A        | N/A         | N/A    | N/A    | N/A          | N/A  | N/A           | N/A          | N/A                 | N/A                    | N/A                    | 3                      |
| **Mean±S**   | 85.5     | ± 1.5±2.        | 15.2±17. | 25.2±16. | 5.8±7. | 7.4±12 | 11.1±19 | 17.6±23 | 10.2±12 | 5.6±13.8 | 0.4±0.9 | 5.5±2. | 8.8±5.8 | 9.9±8.1 |

D: 71.6, 8, 3, 8, 0, 0.5, 0.8, 0.9, 0.4

1N/A: Not available.
**Supplementary Table S3.** Observed food components of *Trachypithecus shortridgei* diet.

| No. | Species                      | Family      | Plant type$^1$ | Part eaten$^2$ | Month | % of total feeding records | All year |
|-----|------------------------------|-------------|----------------|----------------|-------|----------------------------|----------|
| 1   | *Macrothamnium macrocarpum*  | Hylocomiaceae | M              | M              | 1–3, 8–11 | 5.3 | 6.6 | 19.1 | 5.3 | 21.2 |
| 2   | *Scapania verrucosa*        | Scapaniaceae | M              | M              |          |     |     |     |     |     |
| 3   | *Saurauia napaulensis*      | Actinidiaceae | T              | Pe             | 1–4, 8   | 5.5 | 1.1 | 24.6 | 4.4 |
|     |                              |             |                | Ripe Fr        | 9, 10    |     |     |     |     |     |
| 4   | *Dendropanax burmanicus*    | Araliaceae  | S              | Ripe Fr        | 11       |     |     | 18.8 | 7.1 |
| 5   | *Schefflera octophylla*     | Araliaceae  | T              | Yl             | 3        | 0.7 |     | 0.3  |     |
|     |                              |             |                | Pe             | 1–3, 9   | 0.7 | 2.3 | 10.5 | 2.1 |
|     |                              |             |                | Fl             | 9, 11    | 4.7 |     | 1.8  |     |
|     |                              |             |                | Unripe Fr      | 1        |     |     | 3.5  | 0.3 |
|     |                              |             |                | ?              | 3        | 0.4 |     | 0.1  |     |
| 6   | *Lindsaea odorata*          | Lindsaeaceae | F              | HF             | 2, 3, 5, 6, 9 | 12.1 | 0.4 |     | 4.6 |
| 7   | *Wendlandia speciosa*       | Rubiaceae   | T              | Unripe Fr      | 10, 11   | 7.0 |     | 2.7  |     |
|     |                              |             |                | Yl             | 3        | 3.6 |     | 1.5  |     |
| 8   | *Turpinia dulongensis*      | Staphyleaceae | T              | Unripe Fr      | 8, 9     | 28.6 | 2.3 | 3.8  |     |
|     |                              |             |                | Ripe Fr        | 10       | 0.8 |     | 0.3  |     |
| 9   | *Meliosma oldhamii*         | Sabiaceae   | T              | Yl             | 3        | 5.5 |     | 2.2  |     |
|     |                              |             |                | MI             | 3        | 2.5 |     | 1.0  |     |
|     |                              |             |                | B              | 3        | 0.4 |     | 0.1  |     |
| 10  | *Ilex godajam*              | Aquifoliaceae | T              | Ripe Fr        | 11       | 8.6 |     | 3.2  |     |
| 11  | *Dipentodon sinicus*        | Celastraceae | S              | Ripe Fr        | 9        | 1.2 |     | 0.4  |     |
|     |                              |             |                | Unripe Fr      | 19.8     |     |     | 2.7  |     |
| No. | Species                     | Family         | Habitat | Flowering Season | Height (m) | Diameter (cm) | Identification Notes |
|-----|----------------------------|----------------|---------|------------------|------------|---------------|---------------------|
| 12  | *Jasminum subhumile*       | Oleaceae       | V       | MI               | 1, 3, 4    | 3.6           | 15.8 2.8             |
|     |                             |                | YI      |                  | 1          | 1.8           | 0.2                 |
| 13  | *Neomicrocalamus prainii*  | Gramineae      | H       | MI               | 1–3, 11    | 1.1           | 0.8 21.1 2.7         |
|     |                             |                | YI      |                  | 3          | 0.4           | 0.1                 |
| 14  | *Celastrus orbiculatus*    | Celastraceae   | V       | YI               | 3          | 5.5           | 2.2                 |
|     |                             |                | MI      |                  | 3          | 0.4           | 0.2                 |
| 15  | *Ficus neriifolia*         | Moraceae       | T       | YI               | 3          | 5.5           | 2.2                 |
| 16  | *Cyclobalanopsis glauca*   | Fagaceae       | T       | Fl               | 8          | 13.2          | 1.8                 |
|     |                             |                |         |                  | Ripe Fr    | 10            | 0.8 0.3              |
| 17  | *Dipteris conjugata*       | Dipteridaceae  | F       | MI               | 2, 3       | 4.4           | 0.4 1.8              |
| 18  | *Millettia sapindifolia*   | Leguminosae    | V       | MI               | 3, 5, 10   | 2.2           | 2.2 1.0              |
|     |                             |                | YI      |                  | 3, 6       | 0.4           | 0.4                 |
|     | *Elaeocarpus*              | Elaeocarpaceae | T       | Unripe Fr        | 1, 3       | 2.2           | 5.3 1.3              |
| 19  | *borealiyunnanensis*       |                |         |                  |            |               |                     |
| 20  | *Meliosma thomsonii*       | Sabiaceae      | T       | MI               | 2, 3       | 3.3           | 1.3                 |
| 21  | *Toddalia asiatica*        | Rutaceae       | V       | Ripe Fr          | 11         | 1.2           | 0.4                 |
|     |                             |                | MI      |                  | 1          | 5.3           | 0.4                 |
|     |                             |                | YI      |                  | 1          | 1.8           | 0.2                 |
| 22  | *Sauruia erythrocarpa*     | Actinidiaceae  | T       | Pe               | 2, 3       | 2.5           | 1.0                 |
| 23  | *Daphniphyllum himalense*  | Daphniphyllaceae | T | Unripe Fr | 6 | 7.7 | 1.0 |
| 24  | *Luculia yunnanensis*      | Rubiaceae      | S       | Fl               | 10         | 2.3           | 0.9                 |
| 25  | *Impatiens margaritifera*  | Balsaminaceae  | H       | HF               | 5, 9       | 3.3           | 1.2 0.9              |
| 26  | *Ficus oligodon*           | Moraceae       | T       | YI               | 3          | 1.8           | 0.7                 |
| 27  | *Laurocerasus zippeliana*  | Rosaceae       | S       | Fl               | 10         | 1.2           | 0.4                 |
| 28  | *Betula utilis*            | Betulaceae     | T       | YI               | 4, 5       | 0.7           | 2.2 0.6              |
| 29  | *Lyonia ovalifolia*        | Ericaceae      | S       | Fl               | 8          | 0            | 4.4 0.6              |
| No. | Species                          | Family       | Genus   | Species   | Size | Width | Height | Maturity | Size  | Width | Height | Maturity |
|-----|---------------------------------|--------------|---------|-----------|------|-------|--------|----------|-------|-------|--------|----------|
| 30  | Evodia rutaecarpa                | Rutaceae     | S       | B         | 2    | 0.7   | 0.3    |          |       |       |        |          |
| 31  | Smilax lanceifolia               | Liliaceae    | V       | MI        | 3, 9 | 0.4   | 0.4    | 0.3      |       |       |        |          |
| 32  | Laurocerasus undulata            | Rosaceae     | S       | Fl        | 10   |       | 1.2    | 0.4      |       |       |        |          |
| 33  | Juglans cathayensis              | Juglandaceae | T       | B         | 2, 3 | 1.5   | 0.6    |          |       |       |        |          |
| 34  | Reevesia pubescens               | Sterculiaceae| T       | MI        | 6    | 2.2   | 0.3    |          |       |       |        |          |
| 35  | Corylopsis trabulosa             | Hamamelidaceae| S       | Yl        | 3    | 1.1   | 0.4    |          |       |       |        |          |
| 36  | Trachelospermum axillare         | Apocynaceae  | S       | Fl        | 3    | 1.1   | 0.4    |          |       |       |        |          |
| 37  | Astilbe rivularis                | Saxifragaceae| H       | MI        | 10, 11| 2.3   | 0.9    |          |       |       |        |          |
| 38  | Chimonobambusa armata            | Gramineae    | H       | Bs        | 9    | 0.8   | 0.3    |          |       |       |        |          |
| 39  | Cephalostachyum virulentum       | Gramineae    | H       | Bs        | 1    |       |        | 3.5      | 0.3   |       |        |          |
| 40  | Zanthoxylum scandens             | Rutaceae     | V       | MI        | 2    | 0.7   | 0.3    |          |       |       |        |          |
| 41  | Turpinia macrosperma             | Staphyleaceae| T       | Unripe Fr | 8    |       | 2.2    | 0.3      |       |       |        |          |
| 42  | Michelia doltsopa                | Magnoliaceae | T       | Fl        | 2    | 0.7   | 0.3    |          |       |       |        |          |
| 43  | Scurrua parasitica               | Loranthaceae | S       | MI        | 3    | 0.7   | 0.3    |          |       |       |        |          |
| 44  | Embelia parviflora               | Myrsinaceae  | V       | MI        | 10   | 0.8   | 0.3    |          |       |       |        |          |
| 45  | Hicriopteris gigantea            | Gleicheniaceae| F       | MI        | 2    | 0.7   | 0.3    |          |       |       |        |          |
| 46  | Musa rubra                       | Musaceae     | H       | Yl        | 2    | 0.4   | 0.1    |          |       |       |        |          |
| 47  | Holboellia fargesii              | Lardizalaceae| V       | MI        | 9    | 0.4   | 0.2    |          |       |       |        |          |
| 48  | Pilea cadierei                   | Urticaceae   | H       | MI        | 9    | 0.4   | 0.1    |          |       |       |        |          |
| 49  | Decaisnea insignis                | Lardizalaceae| S       | MI        | 9    | 0.4   | 0.1    |          |       |       |        |          |
| 50  | Solena amplexicauli              | Cucurbitaceae| V       | MI        | 9    | 0.4   | 0.2    |          |       |       |        |          |
| 51  | Prenanthes yakoensis             | Compositae   | V       | MI        | 1    |       | 1.8    | 0.2      |       |       |        |          |
1 Plant type: T: Tree; V: Vine; S: Shrub; H: Herb; F: Fern; M: Moss.

2 Part eaten: Fr: Fruits, Yl: Young leaves; Ml: Mature leaves; Pe: Petioles; Fl: Flowers; Bs: Bamboo shoots; B: Buds; M: Mosses; HF: Herbs and ferns.

3 Combined during data collection.

"?": Unknown plant type.

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