



Research Paper

Reproductive ecology of Kessler's thrushes, *Turdus kessleri*, in the northeastern edge of the Qinghai-Tibetan Plateau

Accepted 25th, January 2021

ABSTRACT

The breeding ecology of Kessler's thrush *Turdus kessleri* were studied at river valley and mountain slope of Luqu County, Gansu province from April to August in 2012 and 2015. The results showed that the breeding period of *T. kessleri* was from latter half of April to first half of July. *T. kessleri* nested mainly in oak bush, and also in fir forest. The average clutch size was 3.86 ± 0.24 (range = 3 - 4, n = 14), the mean egg weight was 8.49 ± 0.12 g (n = 36), and the mean egg size was 31.62×22.36 mm (n = 50). Both males and females participated in incubating the eggs, but females incubated the eggs more than males. The hatching success rate of 14 nests was 88.6% (n = 44) and nestling hatched in 12 - 16 days (n = 6). The male and female fed the nestling tighter during both the brooding period and post brooding period, but mainly by male. The nestling flew out of the nest moved around the nest area, during which parents keep feeding nestlings. Our field observations contribute to the understanding of the breeding ecology of Kessler's thrushes.

Hu Jie, Zeng Jinyuan, Song Jingshu and Song Sen*

School of Life Sciences, Lanzhou University, Lanzhou 73000, China.

*Corresponding author. E-mail: songsen@lzu.edu.cn
Tel/Fax: 18109464130/
09318912560.

Key words: Kessler's thrush, *Turdus kessleri*, breeding ecology, clutch size, Qinghai-Tibetan Plateau.

INTRODUCTION

Kessler's thrushes, *Turdus kessleri*, belonging to Passeriformes, Turdidae, *Turdus*, are mainly distributed in the east of Tibet, Gansu, Qinghai, Sichuan, and the northwest of Yunnan in China (Jepson, 1991; Mackinnon et al., 2000; Zhao, 2001; Zheng, 2017). Kessler's thrushes mostly inhabit alpine coniferous forests at altitudes of 3000 - 4500m a.s.l, and alpine shrubland above the forest line during the breeding period, although Kessler's thrushes may occur at altitudes as low as 2100m a.s.l. in winter (Ma et al., 2000; Zhao, 2001; Lei and Lu, 2006). However, little data based on field observations are available for Kessler's thrushes, due to the fact that they are relatively rare. As such, we conducted a preliminary study on the breeding ecology of Kessler's thrushes in Luqu County, in the northeastern edge of the Qinghai-Tibetan Plateau of Gansu province. Research was carried out from April to August when field studies were conducted in 2012 - 2015.

METHODS

Study area

Fieldwork was conducted at valleys (including valleys near rivers) in Luqu County, in Gannan Tibetan Autonomous Prefecture of Gansu Province. The area had an attitude of 3100 -3600 m a.s.l. The study area belongs to the humid climate region of the Tibetan plateau, and includes perennial strong ultraviolet radiation, and a short frost free period which only July - September the area is frost-free. There exist a big temperature gap between day and night, and the temperature at night is low, with an average annual temperature of 2.3°C (Ren et al., 2016). The average annual rainfall is 630 - 780 mm, and there are 2357.8 h of sunshine, resulting in a climate that is generally cold and damp. This region has five main vegetation types, namely



Figure 1: Nest and eggs of Kessler's thrush, and a Kessler's thrush incubating eggs.

goat willow (*Salix caprea*) – common sea buckthorn (*Hippophae rhamnoides*) forest, *Salix oritrepha* - *Berberis hemsleyana* shrub, *Caragana sinica* shrub, shrubby cinquefoil (*Potentilla fruticosa*) shrub, and weed meadow (Chen, 2014).

Data collection and statistical analyses

We located areas where Kessler's thrushes were active based on visual observations, and then searched the shrubs for nests. We marked the location of nest positions with GPS, and marked the nest trees. We recorded the morphology, size, and material of the nest, as well as the egg shape, and measured the egg weight (± 0.01 g, with an electronic balance) and size (± 0.02 mm, with an electric vernier caliper). Digital camcorders (ZX1, Eastman Kodak Company) were used to record adult behaviors at the nest. During nest construction, we placed a tripod 1 m diagonally above the nest to make adults accustomed to the presence of the tripod. When alarm-calling to the tripod discontinued, we mounted a camcorder on it. Following the commencement of video recording, no further nest-visiting activities occurred, except replacing camcorder battery and measuring nestlings. Subsequently, no nest desertions occurred during the video recording period. Videos were recorded at 9:00 - 17:00 every two days

All statistical analyses were performed with IBM SPSS Statistics version 19.0 (IBM Corporation, Armonk, New York, USA). Values are reported as mean \pm SE, and $p < 0.05$ was considered statistically significant.

RESULTS

Nest site selection and nest construction

Fourteen nests were found in Luqu during our field studies in 2012 – 2015. Four nests were built in sea buckthorn trees, five in goat willow trees, and five in *B. hemsleyana* shrub. Nest sites were located at elevations between 3106 - 3597 m a.s.l. The average height from the ground was 0.9 m in sea buckthorn trees, 0.6 m in goat willow trees, and 0.3 m in *B. hemsleyana* shrubs. Kessler's thrushes built bowl nests, with suborbicular and intricate structures. The nests' outer layer was knitted with shrub branches, *Artemisia* stalks, and a few gramineous plant stems and leaves.

The nests' inner layer was woven with gramineous plant stems and leaves (Figure 1). The basic nest material was derived from the thrushes' surroundings, and the nest size matched the size of Kessler's thrush exactly (Figure 1).

Egg laying and the characteristics of eggs

The clutch size ranged from three to four eggs, and the mean clutch size was 3.86 ± 0.24 ($n = 14$). The shape of eggs was blunt elliptic, and egg shells were light green, similar in color to duck eggs, and egg surfaces were decorated with dense rose tan, ficelle, and brown dots and spots, which were relatively dense at the blunt end of the eggs (Figure 2). The mean egg weight was 8.49 ± 0.12 g (7.68 - 9.50 g, $n = 36$), the mean length was 31.62 ± 0.37 mm (28.88 - 34.14 mm), and the mean width was 22.36 ± 0.22 mm



Figure 2: The eggs of Kessler's thrush.

(20.34 - 23.92 mm, n = 50).

Incubation and brooding behavior

Based on our observations, the earliest hatching time was 12 April, 2013, and the nest that hatched the latest hatched on 7 July, 2014. As such, the breeding period of Kessler's thrushes is thought to be from early April to mid-July. According to the video, both males and females participated in incubating the eggs, but incubation was done predominantly by females. We observed the behavior of courting feeding, in which the male will call and stand a certain distance away from the nest, observing for a while, and then feeds the female when females return to the nest after obtaining food. We confirmed the hatching time, and the incubation time of six nests. The incubation period of one nest was 16 days, one nest was incubated for 12 days, and the remaining four nests were incubated for 14 days. We also confirmed the brood time of four nests simultaneously. For three of these nests, the brooding time was 15 days, and for one nest it was 17 days. In the later incubation period, the parental birds were reluctant to leave the nest, and would not leave the nest, even if researchers approached it. When researchers approached the nest and came very close to nests, incubating parent birds flew away from the nest, but remained nearby, and vocalized, while the other parent also moved to a location close to the nests and vocalized, seemingly as a warning or to drive away the intruders.

During observations on 15 nests, three were predated in the incubation period, and in other nests we found chicks after hatching. Of the 44 eggs that were not predated, 39 hatched, resulting in a total hatching rate of 88.6%. The chicks were fleshy when first hatched, and only had sparse villi on their back, the top of their head, and the root of their wings, and the other parts were naked (Figure 3). The abdomen of Kessler's thrush chicks was particularly large, the optic vesicle was pale grey when eyes were closed, and the

mouth crack reached the eyes (Figure 3). The chicks opened their eyes at approximately at 6 - 7 days of age. Seven hatched chicks from two nests were lost to predation, and, as such, the fledging rate was 80.0%. We found one nest which was built in 2012, and reused in 2013, but not during the breeding period. Both males and the females brood the offspring, although brooding is done mostly by females. Males mainly foraged in the early breeding period, while the female kept the nest warm. Males would deliver food to the females, and then females would feed their young, and themselves. In the late breeding period, both males and females left the nest to forage, and providing food for the offspring together. The males also stayed alert whilst females foraged. The chicks displayed begging behavior immediately after hatching.

DISCUSSION

Previous studies reported that Kessler's thrushes nested in holes in rocks near streams (Zhao, 2001; Lei and Lu, 2006). Yang et al. (2012) found that the habitats of Kessler's thrush were Faber's fir (*Abies fabri*) forest and alpine shrub oak, whereas we found that Kessler's thrushes nested in sea buckthorn trees (shrub), goat willow, and *B. hemsleyana* shrubs, which indicates that Kessler's thrushes may nest in a variety of nesting habitats, and demonstrates that Kessler's thrushes can adapt to different habitats, which is an adaptive strategy that can improve breeding success.

The clutch size of Kessler's thrushes in our survey was 3 - 4, which was greater than the 2 - 3 eggs reported by Yang et al. (2012), but lower than the 4 - 5 eggs reported by previous studies (Zhao, 2001; Lei and Lu, 2006). The average weight of eggs in our study was heavier than that reported by Yang et al. (2012). Badyaev and Ghalambor (2001), through comparing populations of Passerines at different altitudes, found that species/populations at high altitude have smaller clutch and brood sizes, a longer nesting period, incubation period, brood period, and a



Figure 3: The nestlings of Kessler's thrush.

longer nest feeding period than species/populations at low altitudes. Furthermore, high altitude species/ populations had significantly lower annual fecundity, but provided more parental care, and in particular had higher rates of male feeding investment. However, the reproductive efforts in high altitude species/populations will be reflected in the number of offspring and the quality of generations. The study area of Yang et al. (2012) is located in the range of 3900 - 4200m a.s.l., while the elevation range of our study was between 3100 - 3400 m a.s.l., and we found lower clutch sizes and average egg weights at a higher altitude, which is contrary to the conclusion obtained by Badyaev and Ghalambor (2001). We do not have a reasonable explanation for this phenomenon, but recommend that more in-depth and detailed studies be conducted, especially at different altitudes.

According to our nest observations, which included observations between 9:00 - 17:00, for a total of 108 hours we recorded brood behavior 592 times, and the average interval for male feeding was 21.5 ± 1.6 min ($n = 492$), and for female feeding it was 41.6 ± 4.1 min ($n = 180$), which indicated that the male feeding interval was significantly lower than that of females (ANOVA, $F_{1,591} = 131.85$, $p < 0.001$). The average feeding interval of both parents was 27.6 ± 1.9 min ($n = 592$). As the age of chicks (in days) increased, the feeding interval tended to become shorter. The video playback data indicated that the chicks often pushed each other when the parents provided food, which indicates the existence of the competition phenomenon in a nest. After leaving the nest, the chicks mainly moved around the nest, mostly concealed under thickets or forest cover. At this time, the male parent would still feed the chicks, which is similar to the behavior of several birds in families that

brood outside the nest (Gao et al., 1984; Wu et al., 1996; Zhou et al., 2003, 2006; Piao et al., 2010).

We observed that one previously constructed nest (in 2012) was reused in 2013, but, as we did not mark the breeding birds, we cannot be sure whether the same pair of parents used the same nest again, or if different breeding individuals utilized an old nest in order to save time and energy, which would require further study.

Research on birds in China is rapidly expanding, and research efforts on endemic species, or species of birds that are mainly distributed in China should be strengthened, especially for those species on which is little field data are available.

CONCLUSIONS

According to our observations and video playback, we found that the mating system of Kessler's thrushes is likely monogamous, and both parents feed their offspring. The female parent mainly incubates the eggs during the incubation period, and the male mainly forages and feeds the offspring and the female in the breeding period. Both males and females fed the nestlings during the brooding period and post brooding period, but feeding was done mainly by males and the male feeding interval was significantly lower than that of females.

ACKNOWLEDGEMENTS

This research was funded by the National Natural Science Foundation of China (No. 31301889), the Ph.D. Programs

Foundation of the Ministry of Education of China (20120211120040) and the Fundamental Research Funds for the Central Universities (lzujbky-2016-89).

REFERENCES

- Badyeav AV, Ghalambor, KC (2001). Evolution of life histories along elevational gradients: trade-off between parental care and fecundity. *Ecology* 82(10):2948-2960.
- Chen ZY (2014). Study on the flora of seed plants and the wild resource plants in Luqu County of Gansu Province. Lanzhou: Xibei Normal University.
- Gao W, Song, YJ, Li, FM (1984). Observation on the breeding habits of *Anthus hodgsoni*. *J Zool.*, 19(2):8-9.
- Jepson P (1991). The occurrence of Kessler's Thrush *Turdus kessleri* in Nepal. *Forktail*, 6:83-85.
- Lei FM, Lu TC (2006). *China endemic Birds*. Beijing: Science Press.
- Mackinnon J, Phillipps K, He FQ (2000). *A field guide to the birds of China*. Changsha: Hunan Education Publishing House.
- Piao ZW, Jin ZM, Yang CW, Liu Z, Li DW (2010). Observation on the breeding habit of *Phoenicurus aureus*. *J. Anhui Agric. Sci.* 38(9):4614-4615, 4623.
- Ren QM, Luo S, Du XJ, Chen GL, Song S, Du B (2016). Helper effects in the azure-winged magpie *Cyanopica cyana* in relation to highly-clumped nesting pattern and high frequency of conspecific nest-raiding. *J Avian Biol.* 47(4):449-456.
- Wu JY, An WS, Xue EX, Han TY, Lan YT, Gai Q (1996). A study on breeding ecology of *Coracia pyrrhocorax*. *Chinese J. Ecol.* 15(5):27-30.
- Yang N, Zhang K, Dou L, Zhang XF, Li BJ, Yue BS, Ran JH (2012). Observation on the breeding habits of *Turdus kessleri*. *Sichuan J. Zool.* 31(1):68-70.
- Zhou YB, Zhang X, Suo JZ, Jiang GH, Hu JC, Chen J (2006). Breeding ecology and nest-site selection of the Spotted Doves in Northeastern Sichuan, China. *Chinese J. Zool.* 41(3):7-12.
- Zhou LZ, Wang QS, Song YJ (2003). Breeding ecology of a bird *Aegithalos concinnus*. *Chinese J. Ecol.* 22(2):24-27.
- Zhao ZJ (2001). *A Handbook of the birds of China, Vol. 2: Passeriformes*. Changchun: Jilin Science and Technology Press.
- Zheng GM (2017). *A checklist on the classification and distribution of the birds of China (Third Edition)*. Beijing: Science Press.