

Notes on the nesting records of the Taiwan Partridge
Arborophila crudigularis

臺灣山鷓鴣鳥巢繁殖紀錄

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Abstract

The nesting and breeding behavior of the Taiwan Partridge (*Arborophila crudigularis*), an endemic species in Taiwan, is rarely reported. However, in 2001, 2005, and 2006, three nests were discovered in Huben Village, Yunlin County. These nests were found at the base of trees or bamboo in the dry creek valley, and were constructed using fallen leaves and fine twigs. The clutch size of the Taiwan Partridge was three to four eggs. In 2006, the nesting behavior of this species was observed and recorded by video. The incubation period was 24-26 days, and the average time that the parent spent sitting on the nest was 20.8 hrs, with a range of 18.4 to 24.8 hrs. The nesting adult usually left the nest only once in the early morning, during which time it picked up dead leaves and twigs in front of the nest with its bill and threw them back over the nest. The

newly hatched chicks (Day 0-1) left the nest with their parental bird, and did not return after Day 1 or Day 2.

摘要

臺灣特有種鳥類臺灣山鷓鴣 (*Arborophila crudigularis*) 的鳥巢及繁殖行為甚少報導，為補足其基礎繁殖行為資訊，本文提供 2001、2005 及 2006 年於雲林縣湖本村發現的 3 個繁殖紀錄。發現臺灣山鷓鴣於乾溪谷的樹木基部，以落葉與細樹枝築巢，每窩蛋數為 3-4 顆蛋。2006 年發現的巢，以錄影方式記錄，發現其孵蛋期為 24-26 天，親鳥平均每日孵蛋時數 20.8 小時 (18.4-24.8 小時)，坐巢親鳥通常僅於清晨離開鳥巢 1 次，並在離巢前啄起巢前的枯枝落葉覆蓋鳥巢。幼鳥孵化後於 0 或 1 日齡即可隨親鳥離巢活動，1 或 2 日齡時不再回巢。

Key words: Altricial bird, breeding behavior, clutch size, incubation period

關鍵詞：早熟鳥、繁殖行為、窩卵數、孵蛋期

The Taiwan Partridge (*Arborophila crudigularis*) is an endemic bird species widespread in the mountainous regions of Taiwan at elevations below 2,300m (Severinghaus et al. 2012; Luo 2000). Its population trend was considered to be declining due to deforestation and land use conversion two decades ago (Fan 2005). However, recent monitoring data show its population stable between 2011

and 2021 (Fan et al. 2022). Therefore, its conservation status is currently cataloged as the Least Concern by the Taiwan government and IUCN (BirdLife International 2016; Lin et al. 2016).

Despite the wide distribution of the Taiwan Partridge across Taiwan Island, there is a lack of up-to-date documentation of its life history and nesting behavior in field and captivity

settings (Cheng et al. 1978; Sun 2001; Madge et al. 2002). In 2001, 2005, and 2006, we had the opportunity to observe three nests in Huben Village, located in central Taiwan. In particular, we recorded the nesting behavior of the parent bird in detail using videography for the last nest. In this paper, we aim to compile and present the gathered information to further our understanding of the life history characteristics of the Taiwan Partridge.

Huben Village is located in Linnei Township in the northeastern region of Yunlin County in west-central Taiwan ($120^{\circ}37.1'E$, $23^{\circ}44.5'N$). The hills around the village, as well as the neighboring hills inside Linnei Township and adjacent Douliu City, have been designated as an Important Bird Area (IBA: TW-017), particularly for the Fairy Pitta (*Pitta nympha*), by the Chinese Wild Bird Federation in partnership with BirdLife International (Taiwan Wild Bird Federation 2001).

The area is approximately 2,200 ha, between 50m and 500m in elevation, and covered with Taiwanese Giant Bamboo (*Dentrocalamus latiflorus*) stands mixed with natural broad-leaved trees and sparsely distributed orchards and betel nut plantations. The climate is hot and wet from April to October, with a total precipitation of 2,000mm. In contrast, the climate is cool and dry from December to February, with a precipitation of less than 500mm (Taiwan Wild Bird Federation 2001). The Taiwan Partridge is a shy and elusive bird and can be challenging to observe. However, its call can often be heard in hilly areas that are well-forested with broad-leaved trees (Luo 2000; Sun 2001).

A local bird guide named Mr. Jing-Kai Chang discovered a Taiwan Partridge nest on the morning of 6 May 2006. At the time of discovery, there was no adult bird present, but an unmarked white egg was visible. Three days later, on 9 May at 15:00, we rechecked the nest and

found an adult Taiwan Partridge inside. The basal platform nest was constructed of dead leaves and twigs, resembling a pile of twigs and leaves. It was a flattish dome with a small, nearly round-shaped opening with an inner diameter of about 7cm (Figure 1).

The nest was located against a root growing out from the base of a broad-leaf tree (*Ficus fistulosa*) near the ridge of a hill in a narrow valley at an elevation of approximately 190m. The nest was on the foot of a gentle slope beside a dried ditch with a steep bank 0.9m high and 1.8m wide (Figure 2). There was a walking track 25m below the nest. The valley was mostly covered by broad-leaved trees, while a Taiwanese Giant Bamboo plantation covered the lower sides of the track and the slope below.

To record the nesting behavior of the Taiwan Partridge, we monitored the nest (Martin et al. 1997) and utilized a digital video camera system to monitor the nest for seven days and 20.5 hrs,

starting from 15:02 on 28 May 2006 to 11:29 on 5 June 2006. The system consisted of a 12mm camera set in a 56×56×76mm waterproof box on a tripod positioned 1.5m from the nest. Equipped with 24 infrared emitting diodes (950 nm), recording resolution 720×484, and a digital recorder (EDSR400H, EverFocus Electronics Corporation, Hsi-Chih, Taipei, Taiwan), the camera was connected to the recorder which was located 20m away using a 50m cable. We recorded video images five times per second, and a 250-GB hard disk was sufficient to store the recordings for 24hrs a day for 14 days. The equipment was powered by three rechargeable, 12-volt, deep-cycle batteries, and a hand-held color monitor allowed us to check the status of the nest without disturbing it. We checked and replaced the recorder's batteries every other day.

We inspected the nest on the morning of 1 June 2006 when the parent bird had left. We discovered four

unmarked white eggs in the nest (Figure 3). Three chicks hatched in the presence of the adult at 08:26 on the morning of 4 June. We presumed the female completed laying her clutch on the morning of 9 May 2006. The incubation period lasted at least 24 days up to 1 June 2006 and no more than 26 full days to the morning of 4 June 2006. During the period from 28 May until hatching, the parent bird left the nest eight times. This happened almost once a day during the morning between 06:57 and 09:24, with the exception of June 1 when the parent left twice, once at 09:24 in the morning and again at 12:55 in the afternoon. The mean duration of the parent bird sitting on the nest was 20.8 hrs with a range of 18.4 to 24.8 hrs, with the exception of the two instances on 1 June when the parent left the nest for only 1.3 hrs (Table 1).

Before leaving the nest, the parent bird heaved it a few times and then pushed itself out of the top opening in

just a few seconds. It immediately used its bill to pick up dead leaves and twigs in front of the nest, throwing them back over the nest. It took the parent 4.5 ± 3.2 min (mean \pm standard variation, $n = 8$) with a range between 0.27 min and 9.77 min to complete the above-mentioned task. Afterward, the parent left the nest in the same direction every day. Reentry to the nest was much quicker than leaving, taking less than a half minute. The parent left a small and poorly defined opening when reentering the nest.

When the three newly hatched chicks left the nest on the morning of 4 June 2006 (Day 0-1), the parental behavior remained consistent with previous days. The parents spent 2.5 minutes tending to the nest before leading the chicks out and returned to the nest at 16:51 later that day. However, on the following morning of 5 June 2006 (Day 1-2), they left the nest at 06:00 and did not return.

We also recorded the clutch sizes

and habitats of two other Taiwan Partridge nests in Huben Village before 2006. In the first nest, we observed three eggs on 15 April 2001, and three chicks hatched on 27 April 2001. The second nest had four eggs and was discovered in June 2005, but a parent was found dead near the opening of the nest. Both nests were located in habitats that were fairly similar to that described in 2006, but with certain disparities. They were found in a small valley covered by a canopy dominated by broad-leafed trees. The nest found in 2001 was located on a small platform along a steep slope about 1.5m above the base of the valley, while the nest found in 2005 was at the base of a Thorny Bamboo (*Bambusa stenostachya*) clump.

In this study, we measured the sizes of four eggs from the two nests observed in 2001 and 2006 (Table 2). We found that the size and weight of the eggs were similar to those reported in captive records (length: 38.78mm, width:

29.67mm, weight: 18.08g) (Huang et al. 2001). However, because eggs lost mass during incubation and were not weighed at the beginning of incubation, their weights are likely to be underestimated (Westerskov 1950, Drent 1973).

Cheng et al. (1978) state that the breeding season of the Taiwan Partridge is from late-February to August, nesting near the base of a tree or in crevices among boulders, with a clutch size of six to eight eggs and an incubation period of 24 days. However, we were unable to verify the source of their data. In captivity, the clutch size is two to three eggs and the incubation period is about 23 days (Huang et al. 2001). However, another captive record indicated a clutch size of four to six eggs and an incubation period of 20 to 21 days (Madge et al. 2002). Our field observations showed that the Taiwan Partridge laid three to four eggs per clutch and had an incubation period of 24-26 days, somewhat different from previous

descriptions. Our current understanding of the nesting behavior and life history traits of the Taiwan Partridge are limited to anecdotal accounts. We hope that the results of our study will serve as a starting point for future investigations into the nesting behavior of the Taiwan Partridge.

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Table 1. Nest exiting and entering times (hour:min:sec) of the adult Taiwan Partridge from 29 May to 5 June 2006

Entering	Exiting	Duration	Leaving Time
29 May, 13:57:40	30 May, 08:48:40	18:51:00	3:23:53
30 May, 12:12:33	31 May, 06:56:53	18:44:20	1:38:44
31 May, 08:35:37	1 June, 09:23:56	24:48:19	2:14:55
1 June, 11:38:51	1 June, 12:55:10	01:16:19	0:05:06
1 June, 13:00:16	2 June, 07:21:32	18:21:16	3:34:41
2 June, 10:56:13	3 June, 09:00:30	22:04:17	1:49:47
3 June, 10:50:17	4 June, 08:26:39	21:36:22	8:22:47
4 June, 16:49:26	5 June, 06:00:19	13:10:53	-

Table2. Egg measurements (mean and ranges in parentheses) of the Taiwan Partridge

	N	Length (mm)	Width (mm)	Weight (g)
2001	3	40.9(39.5-41.8)	29.5(28.8-30)	19.2(18-20)
2006	1	40.4	31.1	18.8



Fig. 1. Nest of Taiwan Partridge nest in its early hatching period found in Huben Village, Taiwan, 9 May 2006.



Fig. 3. Four unmark white eggs in the Taiwan Partridge nest taken on 1 June 2006, in Huben, Taiwan.



Fig.2. Nesting environment of the Taiwan Partridge found in Huben, Taiwan, 2006. The red circle indicates the exact nest location.