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Notes on the nesting behaviour of Yellow-footed Green Pigeon *Treron phoenicoptera* (Columbidae) at Jeypore Reserve Forest, Assam, India

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Abstract: We surveyed five nesting colonies of Yellow-footed Green Pigeon at Jeypore Reserve forest to study their nesting behaviour during two breeding seasons in 2008 and 2009. We observed the birds in five closely-watched nests and studied their behaviour starting from pair formation till hatching of squabs. Pair formation generally starts from the month of April followed by nest building and incubation, with ultimately, hatching of squabs during May, which continues up to the month of June. Both sexes share the duty of nest building and incubation. Breeding pairs took four shifting intervals during incubation period at a time interval of about 2–5 hrs in each shift. Incubation period ranges between 20–23 days.

Keywords: Behaviour, Columbidae, incubation, Jeypore Reserve Forest, squabs, Yellow-footed Green Pigeon.

The Yellow-footed Green Pegion *Treron phoenicoptera* (Columbidae) has been given the status of Least Concern (Birdlife International 2010). They belong to the important frugivorous group of tropical forests and perform the valuable service of seed dispersal and forest regeneration (Stiles 1985; Corlett 1998; McConkey et al. 2004) and in some cases are the sole vector for seed dispersal of certain tree species (Meehan et al. 2005). Data on their ecological and biological aspects is deficient as very few studies have been conducted on the Columbidae group as a whole (Wiley & Wiley 1979; Burger et al. 1989; Steadman 1997; Bancroft et al. 2000; Strong & Johnson 2001; Walker 2007). The Yellow-footed Green Pigeon is widely distributed throughout the Indian subcontinent and is a commonly sighted frugivorous bird in the tropical forests of eastern Himalaya (Ali & Ripley 1987). Very few studies are conducted on columbids in India (Ali & Ripley 1987) and some studies are mostly based on morphological adaptations (Bhattacharya 1994). Birdlife International (2010) placed this species under Least Concern category owing to its wide distribution and abundance but there is little information on its eco-biological aspects. Therefore, the present study was conducted to present preliminary data on biology of Yellow-footed Green Pigeon with special reference to its nesting behaviour.

Study area

The Jeypore Reserve Forest is located at Dibrugarh District of Upper Assam which falls between 27^{0}06$^{'}$–27^{0}16$^{'}$N & 95^{0}21$^{'}$–95^{0}29$^{'}$E (Image 1). The total area of the reserve is 108km^2. The terrain of the reserve is slightly undulating and is continuous with the forests of Arunachal Pradesh. Burhi-Dihing and the Dilli rivers form a part of the reserve boundary. Many small perennial streams and nullahs also flow within the Forest. Swamps and grassland patches also occur inside the forest (Kakati 2004). This forest is a part of an important IBA - the Upper Dihing West Complex, IBA Site No. IN-AS-45 and is notified as a reserve forest way back in 1888 (Kakati 2004). The habitat is tropical rainforest. Champion & Seth (1968) described it as "Assam Valley Tropical Wet Evergreen Forest" (category 1B/ C1) also called the

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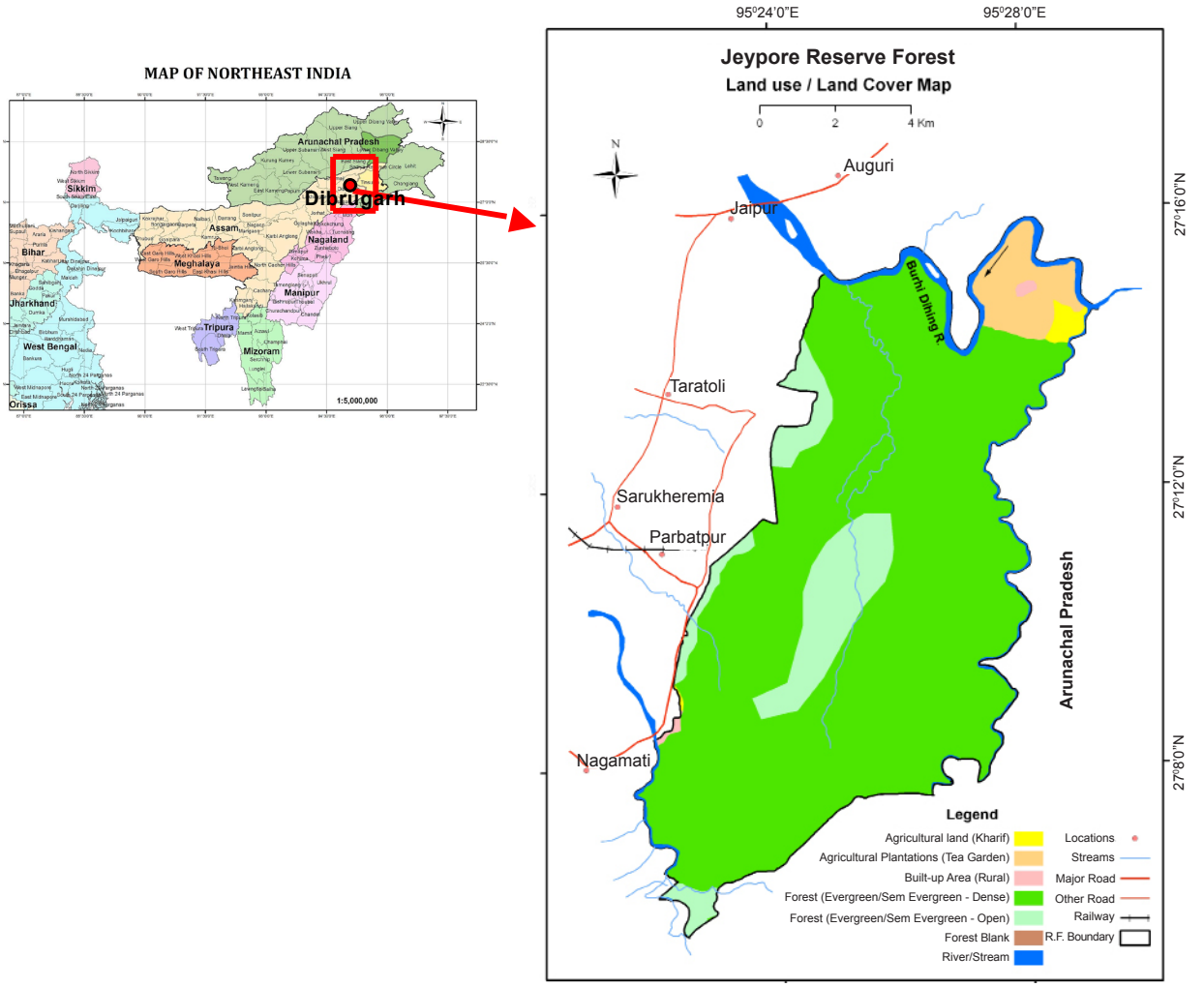

Image 1. Location of Jeypore Reserve Forest, Dibrugarh District, Assam.

Upper Assam *Dipterocarpus-Mesua* Forest. The forest is characterised by a top canopy dominated by *Dipterocarpus macrocarpus* reaching heights of 50m, a middle canopy dominated by *Mesua ferrea* and *Vatica lanceaefolia* and undergrowth consisting of woody shrubs such as *Saprosma ternatum*, *Livistonia jenkinsiana* and canes *Calamus erectus* etc. (Kakati 2004).

Methods

We studied the Yellow-footed Green Pigeon at Jeypore Reserve Forest between January 2008 and December 2009 for two years and made observations on its nesting behaviour. Visits were made on the five nesting colonies encountered during the breeding seasons starting from early April to late July each year.

Pigeon activities were observed using binoculars (8×40 and 7×35). Telephoto lenses (135–500 mm) on 35mm still cameras were used to record behavioural activities. Digital camcorders were also used to film the behavioural activities which were later analyzed. Behavioural sequences were timed with a wristwatch. Observations at five closely watched nests were made from an elevated platform about 5–10 m from the nests. At the nests, at least two hours each was spent recording pigeon activities at morning (0600–0800 hr), noon (1100–1300 hr) and evening (1600–1800 hr) but these timings changed according to weather conditions. Bad weather hampers bird activities as observed personally in case of the pigeons.

All nests located were assigned numbers and were plotted on maps of the study area. In general, activity at the closely watched individual nests was checked every two days throughout the breeding period starting from nest building to hatching of squabs.

Results

Pair formation: Pair formation usually started in the month of April at Jeypore Reserve Forest in 2008 and 2009. At this time, birds were seen flying together, feeding together, roosting and preening together in pairs on feeding trees (Image 2a).

It was observed that formation of pairs usually began when the male pigeon starts calling from a perch simultaneously performing a "tail–wagging' dance display. Whenever a pigeon landed near its territory, the resident male flew to the newly arrived pigeon and started displaying with the dance and "wooh-woo-whoo-woo" whistle. If the arriving pigeon was a female then she stayed near the displaying male in a submissive posture. Chasing of females by displaying males was frequently observed until the arriving female gave in and joined the male in the dance. During the first days of pair formation, the pairs allo-preened, fed and rested together in suitable tree branches.

Courtship and Copulation: Courtship display among the Yellow-footed Green Pigeon was usually started by the male calling from a prominent perch. Whenever a female arrived at the perch, the male started to perform the display by turning 180^0 on the perch, then he expanded his throat subsequently bowing deeply and making the 'wooh-woo' sound. Afterwards he spread his tail and turned another 180^0 and repeated the display. Initially, the female remained still watching the male perform but later on she joined the male and eventually moved close to the male in a submissive posture. After about five seconds, the male stepped onto the female's back and twisted his tail under the female's tail to make cloacal contact. During the act, the male gave a quick wing flutter and then stepped off the female's back. The copulation lasted for about three seconds and the pair stayed on the branch for about 10–15 minutes before they set off to the nearby fruiting trees. Courtship and copulation were mostly seen during early morning 0600–0800 hr and evening 1600–1800 hr respectively during our

Image 2. Nesting behaviours of *Treron phoenicoptera* in the study area.
a - Breeding pair; b - Nest building activity; c - Incubation activity; d - Nest exchange behaviour of breeding pair

study period.

Nest building: Building of nests by the Yellow-footed Green Pigeon was watched closely at five nests for more than 50 hours. It was observed that both the sexes share the duty of nest building, although the male did majority of the work ranging from gathering of nest materials to delivering while the female sat on the nest mending it (Image 2b). Most of the nest building activity occured between 0700–0930 hr and 1500–1800 hr. Nest materials such as twigs were collected from dried branches of trees about 20–40 m from the nest sites. The twig gathering areas were defended against intruding pigeons. The male pigeon broke suitable twigs from the branches and carried towards the nest and the waiting female gently arranged it into the nest structure securely.

Apart from these, the frequency of nest building by the parents was maximum during the early stage of nest building activities but it gradually declined during later stages. The frequency of nest building trips was maximum during the 2nd and 3rd day which gradually decreased in the following days (Table 1).

Exchange of incubation duty: Both male and female pigeons shared the duty of incubation (Image 2c). They were seen exchanging incubation duty about four times a day at an average interval of 2–4 hours depending upon the weather condition and food availability.

Two nests were closely watched during 2008 and 2009 at Jeypore Reserve Forest to determine the time interval between each shift and it was found that the average time interval between each shift in Nest 1 which was on a *Bombax ceiba* tree was approximately 3, 4 and 2 hours respectively between 1st– 2nd, 2nd–3rd and 3rd–4th shifts. Similarly, the average time interval at the Nest 2 which was on a *Michellia champaca* tree was found to be 4, 2 and 3 hours respectively between 1st–2nd, 2nd–3rd and 3rd–4th shifts (Fig. 1).

It was also observed that shifting incubation duty was delayed and took longer time when the food source is far from the nesting tree and it took place regularly when plenty of food was available near the nest.

Clutch size: The clutch size of Yellow-footed Green Pigeon, ranged from 1–2 in all the live nests located during 2008 and 2009. Eggs are spotless white, typical Columbidae, about 5cm long and weigh about 9.5–14.3 g.

Nest exchange behaviour: During shifting of incubation, the breeding pair showed some peculiar behaviour while exchanging their duty (Image 2d). The incoming bird stayed on the perch for about 30–40 minutes, preening and resting before going to the nest. Sometimes the bird also whistled in a typical 'whoo- woo- whoo-woo' sound by frequently moving its tail. After this, the other bird sitting on the nest earlier, responsed to the advertisement call of the incoming bird by moving its tail rhythmically. Both the pair moved their tail for about two minutes before the incoming bird slowly walked inside the nest and checked the eggs. The resident bird then flew away to the nearby fruiting tree.

Nesting season and days of incubation: During the study period of two years, the nesting season started during the month of April and ended by June.

During the breeding season of 2008, seven live nests were discovered near Tipam Mandir and were watched closely for nesting behaviour and incubation period. The average incubation period of five nests

Table 1. Nest building activity at five Yellow-footed Green Pigeon nests at Jeypore Reserve Forest, during May–June, 2009

Days of Nest building	Hours of observation	Hours of nest building	No. of trips to nest	No. of trips/ min to nest
Nest A				
1	5.20	4.18	26	0.10
2	4.30	3.35	31	0.15*
3	4.50	3.50	34	0.16*
4	6.10	5.22	23	0.07
5	8.20	1.11	5	0.07
Nest B				
1	4.10	3.30	28	0.14
2	3.30	2.50	37	0.25*
3	-	-	-	-
4	5.00	4.11	21	0.09
5	6.10	0	-	-
Nest C				
1	2.30	2.10	19	0.15
2	3.50	2.40	31	0.22*
3	4.00	3.15	38	0.20*
4	3.00	2.09	23	0.18
5	5.00	0	-	-
Nest D				
1	2.00	1.20	15	0.21
2	-	-	-	-
3	2.30	1.50	21	0.24*
4	3.00	2.20	17	0.19
5	4.00	0	-	-
Nest E				
1	2.00	1.05	13	0.21
2	-	-	-	-
3	2.00	1.35	24	0.30*
4	2.00	1.15	19	0.28
5	3.00	0	-	-

* - Nest Building activity gradually decreases during 4th and 5th days.
'0' indicates that adults were seen sitting on the nest but no nest building is seen.

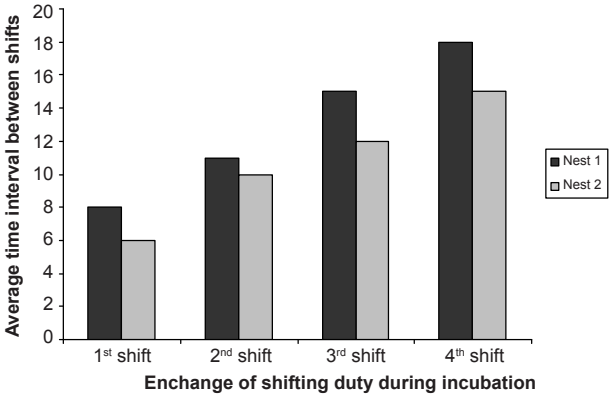

Figure 1. Average time interval during exchange of Incubation duty in two closely watched nest trees of Yellow-footed Green Pigeon at Jeypore Reserve Forest during 2008 and 2009.

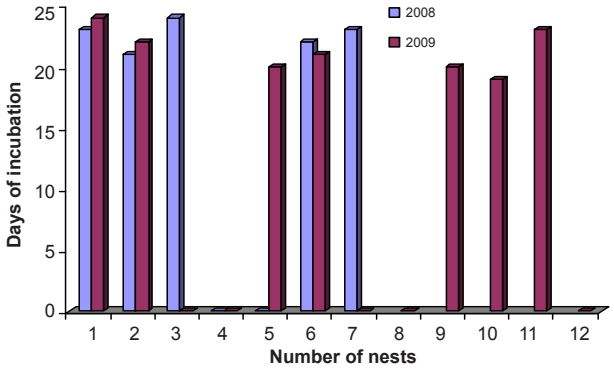

Figure 2. Incubation periods of successful nests in different nesting colonies of Jeypore Reserve Forest during 2008 and 2009.

was 23 days while two nests were destroyed by storm on the eleventh and fifteenth days of incubation (Fig. 2). One squab each hatched on all the five successful nests. In 2009, pair formation and nest building was observed from the first week of May. A total of twelve live nests were closely watched for nesting behaviour and incubation periods. The average incubation periods of seven nests was 21 days and one squab each were hatched in six nests while one nest hatch had two squabs (Fig. 2). The remaining five nests were abandoned or destroyed before hatching due to heavy storm and thus were not successful.

Post-hatching behaviour: It was observed that nest attentiveness declined after hatching of the young one. The nest with newly hatched young squabs were left a unattended for few hours after the fourth day of hatching and was largely unattended after the tenth day of hatching. After the tenth day the parents come to the nest only to feed the young and left soon after feeding. Sometimes they stayed on the nearby perch to protect the young from predators as in one case the parents were seen chasing away a crow which circled the nest.

Discussions

The Jeypore Reserve Forest is one among the few remaining tropical forest patches of eastern Assam which is unique for its varied avian fauna (Saikia & Devi 2011). The present study was one of the few attempts to gather valuable data regarding the bird's nesting behaviour and breeding biology.

From the study it was revealed that the breeding season of Yellow-footed Green Pigeon starts from April and lasts till June at the study area. The season may start even earlier in other areas, but no birds were observed to breed during March here. Pair formation and nest building starts by early April and they make open nests of mostly twigs in tall trees near the forest edges and human habitation areas. It is interesting to note that during the two breeding seasons, not a single nesting colony of Yellow-footed Green Pigeons were encountered inside the closed forest. Both sexes were seen sharing nest building and duty of incubation. As per the observations, only one or two squabs are hatched as the clutch sizes were normally one or two eggs per pair and that the days of incubation range between 20–24 days. Parental care and nest attentiveness declines after 10 days post hatching of squabs and parent were seen chasing away predators such as crows, hawks etc. during the first few days after hatching.

It may be mentioned that the present population status of *Treron phoenicoptera* in the wild is unknown but evidences suggest that the species might be facing serious threat from habitat loss and hunting (Walker 2007). Long-term population monitoring and ecological studies are required immediately. Conservation programs must also focus on these least studied important frugivores which are abundantly available now-a-days but might become rare and threatened in the near future if left unchecked.

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