Extended breeding in a nest of Splendid Sunbird *Cinnyris coccinigastrus* on residential premises

by Taiye Adeniyi ADEYANJU[1,2], Temidayo Esther ADEYANJU[1] & Taiwo Crossby OMOTORIOGUN[1,3]
[1]A.P. Leventis Ornithological Research Institute,
P.O. Box 13404, Laminga, Jos Plateau State, Nigeria
[2]Department of Wildlife and Ecotourism Management, University of Ibadan, Nigeria.<taiyelongifolia@yahoo.com>
[3]National Centre for Biosystematics, Natural History Museum, University of Oslo, Norway

Received 14 August 2012; revised 21 February 2013

Summary

The study provides information on the incubation and nestling periods, weight gain, plumage development and nesting success of the Splendid Sunbird *Cinnyris coccinigastrus.* A single nest with six clutches, each of a single egg, was observed at a residence in Bodija Isopako, Ibadan, Nigeria. Five nest attempts were observed in 2011 (laying dates in May, June, August and October) and one in April 2012. The duration of incubation was 13–14 days, and chicks fledged between 12 and 13 days after hatching, to give an average period of 26 days between egg-laying and fledging. Within one breeding season, there was an average of 29 days between fledging one brood and laying a new clutch. This extended breeding strategy yielded 50% successfully fledged nests and 100 % hatching success. Human disturbance was the cause of all nest losses.

Résumé

Reproduction prolongée dans un nid de Souimanga éclatant *Cinnyris coccinigastrus* dans un local résidentiel. L'étude apporte des informations sur les périodes de nidification et d'incubation, le gain de poids, le développement du plumage et le succès de reproduction du Souimanga éclatant *Cinnyris coccinigastrus.* Un seul nid et six couvées, chacune d'un unique œuf, ont été observés dans une résidence de Bodija Isopako, Ibadan, Nigeria. La nidification a été observée cinq fois en 2011 (dates de ponte en mai, juin, août et octobre) et une fois en avril 2012. La durée d'incubation a été de 13–14 jours, et les poussins étaient couverts de plumes 12–13 jours après l'éclosion, donc un délai moyen de 26 jours entre la ponte et un

plumage complet. Au cours d'une saison de reproduction, il s'est écoulé en moyenne 29 jours entre le moment où une nichée se trouvait emplumée et une nouvelle ponte. De cette stratégie de reproduction prolongée a résulté un rendement de 50% de réussite pour les nichées emplumées et de 100 % pour les éclosions. Des perturbations d'origine humaine ont été la cause de toutes les pertes de nichées.

Introduction

Sunbirds may lay up to five eggs per clutch but are frequently observed to raise only one or two young, usually with a newly built nest for each brood (Fry *et al.* 2000, Cheke & Mann 2001, 2008).Nonetheless, five-egg clutches have not been documented for any sunbird in West Africa. Extended breeding and high fledging success as a result of close proximity to humans have been reported for the Scarlet-chested Sunbird *Nectarinia senegalensis* in Nigeria by Molokwu *et al*. (2005)although these authors did not comment on the high success rate they observed, where a pair of this savanna-dwelling species produced three broods in a single nest, with one egg in the first clutch, two in each of the two subsequent clutches, and 100 % fledging success. Although it is in a different genus and is a species of the forest region, the Splendid Sunbird *Cinnyris coccinigastrus* is also a medium-sized sunbird with a similar nest type to that of *N. senegalensis*, and is a monogamous, solitary nester (Cheke & Mann 2001, 2008). This paper describes the occurrence of six clutches in one nest of *C. coccinigastrus* between April 2011 and May 2012, five of them in a single breeding season and possibly all six by the same pair, by a house at Bodija Isopako, Ibadan, Oyo State, Nigeria (7°26′10″N, 3°55′24″E, elevation 197 m). Each clutch contained a single egg. We document the incubation and nestling periods, weight gain, plumage development and nest success rate. The original forest of the study area was dry and semi-deciduous, but most of it has been cut down for urban development. Relicts of a few forest trees still exist in some areas but the area now mainly comprises open, savanna-type vegetation, with farmland and buildings. Humans have reduced the available nesting sites for many bird species in Nigeria, so adaptation to nest around residential premises may be important to their survival.

Breeding activity by birds in the tropics may be initiated by many factors, including rainfall (Hau *et al*. 2008). In the savanna region of Nigeria, rainfall begins in June, whereas in the forest region, including the transitional zone around Ibadan (Elgood & Sibley 1966),it begins in March, peaking around September, and extending to October although, between years, rainfall varies in amount and in the early and peak months. There is a pronounced dry season from December to February. The annual rainfall in the Ibadan area is 1500–2000 mm (Ezealor 2002). The rains bring an abundance of food, including flowers, insects, and fruit. In the savanna, *N. senegalensis* began breeding in March (Molokwu *et al.* 2005), although the single egg

of the first clutch there suggests that food resources were not optimal then (*cf*. Fry *et al*. 2000).Egg-laying by *C. coccinigastrus* has been recorded in September–October in Senegal and Sierra Leone, July–October in Gambia, all year round in Ghana, and March–June in Nigeria (Fry *et al*. 2000, Cheke & Mann 2008). Nests are built by females alone, and are pouch-shaped, of fibres, leaves, grass, bark, down and cobwebs, lined with down and suspended from a thin branch 2–3m above the ground (Fry *et al.* 2000, Cheke & Mann 2008). Nonetheless, information on the incubation period, nestling period, weight gain and plumage development are not available for *C. coccinigastrus* (Fry *et al*. 2000, Cheke & Mann 2008).

Results

Observations on five clutches in 2011

A pair of *C. coccinigastrus* was first noted in the first week of April 2011. Having failed in attempts to build a nest at the corners of TAA and TEA's residence in the third week of March, owing to interference by humans, the female finally built on a disused electric lamp holder *c.*2.4 m above ground, hanging in front of the entrance of the house. Although the pair was not colour-ringed, the female soon became accustomed to us and only flew away from the nest when other persons approached it. The female also showed a repeated sequence of movement around the compound which could easily be recognized by us. In addition, no other *C. coccinigastrus* were observed in the vicinity. The pair was often observed feeding on nectar from a Caricature Plant *Graptophyllum pictum* in the compound.

We observed only the female building the nest (*cf.* Fry *et al*. 2000, Marksman *et al*. 2002, Molokwu *et al.* 2005, Cheke & Mann 2008), which was oval and pouch-like, made from grass, leaves of herbs, fibres and paper. The nest was lined with soft silky material collected from the inflorescence of a Silk-cotton tree *Bombax* sp., plus down feathers. The nest was started on 5 April and completed in 10 days.

Courtship display was observed soon after the nest was built, while the pair fed around the compound or chased one another. The pair *w*as observed mating while perched on electric cables. The male regularly perched on the top of a Mango tree *Mangifera indica c.* 100 m away from the nest in a neighbour's compound, and the female always departed from the nest to that tree when displaced from the nest; this behaviour resembles that reported by Cheke & Mann (2008), who stated that territorial males sing from regular perches and perform courtship song flights before landing high up to be joined by the female, the latter holding its tail depressed and wings drooped. The male defended its territory and no other sunbirds were observed within the compound, although the pair often left the compound to feed in other areas.

Eggs in all six clutches were smooth but profusely and evenly lined with streaks of brown on pale grey (*cf.* Fry *et al.* 2000). During incubation, the incubating bird was not easily displaced by an approaching intruder, and the female was only away from

the nest during feeding bouts, usually for *c.* 5–30 min., with foraging periods longer in the afternoons than in the mornings. The first brood hatched on 15 May (Table 1). The feeding, brooding and caring of nestlings was carried out by only the female, while the male was often out of sight, although when he was around the compound he was never far away from his preferred perch.

Ten days after the first clutch hatched (Table 1), the nest and brood failed when neighbours knocked it down and threw away the nestling, as a result of superstitious belief. About 3h later, the nest but not the nestling was found by TAA, and the nest was fixed back in place on the lamp holder, using sewing thread and trying to match the shape and earlier positioning. Three hours later, the female was observed at the nest, although she may have been there prior to the nest being refitted because it was an alarm call by the pair which had made us aware that the nest had been attacked.

A second clutch of a single egg was laid on 15 June (Table 1). At about 10h50, the female was heard giving distinctive loud squeals, which alerted us to the fact that the egg had just been laid, with the nest having been empty a little earlier. The egg weighed 1.7 g at 10h50 that day, and measured 19.5 x 13.3 mm.

The third nesting attempt was also a clutch of a single egg, which hatched and successfully fledged on 23 Sep 2011. The male nestling, sexed by its blackish neck, once released a faecal sac during observation, which weighed *c.* 0.4 g. The nestling was ringed and measured the day before it fledged, at 17h25 on 22 Sep 2011: wing 49 mm; mass 9.9 g.

The fourth attempt occurred when a single egg was laid on 8 Oct 2011. It measured *c.*19.0mm in length, but it was broken while being measured. A replacement clutch of a single egg was laid seven days later, and the chick successfully fledged on 12 Dec 2011 (Table 1).

During this sequence of broods, the female added layers of white down feathers, possibly from domestic poultry, into the nest.

The 2012 brood

The single egg of this clutch was laid about 11h55 on 14 Apr 2012. The male was observed in close proximity to the nest at the time. The egg hatched on 27 Apr at *c.* 14h50 (13 days incubation), when the male was heard giving a loud barking call close to the nest for about 6 s "rauraurauraurau", before leaving.

The nestling weighed 2.8 g and gained 10.1 g over ten days (Table 2). When weighed more than once the same day, it was always heavier later in the day (Table 2: except on Day 11, see below), which probably results from its using up much of its food reserves during the night. On returning to the nest after feeding bouts, the female was observed to gular flutter, occasionally repositioning the young in the first 2–3 min. after returning. It would reposition nest materials and nestling if the nest had been disturbed in its absence. The female fed the chicks by regurgitation, probing into the wide open bill of the nestling. No analysis was carried out by us to determine prey type but the parents were observed feeding on invertebrates, and on a few occasions

Table 1. Splendid Sunbird nesting sequence.

Brood no.	Laying date	Time*	Hatching date	Fledging date	Laying to fledging interval (days)	Interval between fledging or loss and next laying (days)
1	2 May 2011		15 May 2011	Destroyed 25 May 2011		22
2	15 Jun 2011	10h50	29 Jun 2011	10 Jul 2011	26	50
3	28 Aug 2011		10 Sep 2011	23 Sep 2011	27	16
4	8 Oct 2011		Destroyed 10 Oct 2011			7 (replacement)
5	17 Oct 2011	12h29	30 Oct 2011	12 Nov 2011	26	154 (non-breeding season)
6	14 Apr 2012	11h55	27 Apr 2012	Destroyed 8 May 2012		

*Time nest checked after hearing distinctive squeals from the female; having also been checked within the previous 30 min.

Table 2. Development of one nestling in 2012.

Date	Nestling day	Time	Mass (g)	Description
27 Apr	1	15h15	2.8	No feathers; belly dark with transparent skin; eyes closed or nearly so; silent when handled.
28 Apr	2	11h40	2.3	
29 Apr	3	15h00	3.8	Pin feathers emerging on rump and wings; mouth phalanges swollen; uncoordinated motions.
30 Apr	4	10h30	4.5	
1 May	5	12h30	5.3	Pin feathers on most feather tracts; bill cream-coloured; coordinated movements, bill
		16h00	6.5	points up; low begging calls; eyes still nearly closed. Female brought larger insects.
2 May	6	9h00	6.7	Feathers cover head, down mid-line of back, ending at rear of rump; chest with yellowish pin-feathers on mid-line and ventral edges; still brooded by female.
3 May	7	7h30	7.8	
4 May	8	9h45	9.1	
5 May	9	7h30	9.6	Neck fully feathered; feathers on head, ventral and dorsal parts of the body growing; bill
		17h15	10.5	longer and darker.
6 May	10	8h30	10.3	Flight feathers breaking out from sheaths.
		18h15	12.9	
7 May	11	8h30	10.5	
		9h30	10.2	

insects were seen to be fed to the chicks. Feeding bouts were observed to shorten from *c.* 15 to 5 min. as the nestling grew and needed more food. The male's defence of the territory was supported by the female. Occasionally when the male called persistently from his preferred perch on top of the Mango tree, the female abandoned incubation to join the male and stayed away from the nest for longer than her usual *c.* 15-min. absences.

On the night of Day 10 the female did not roost at the nest as it previously had, which aroused suspicion that something was wrong. Then, observations on Day 11 revealed no feeding activity at the nest by either of the parents and, although the male could be observed moving around the compound and calling, repeatedly visiting the female's preferred perches, the female was not seen at all throughout that day and again did not roost at the nest that night. The weight of the nestling began to fall (Table 2).

Although the male and a female were observed around the nest the following day (Day 12), no feeding activity occurred; both adults went to the nest and called to the nestling but the nestling just kept giving and its normal low begging call, about every 2 s, and did not emerge. This female appeared to us, from her behaviour, to be a different bird from the female parent. She did not feed the young throughout the day, her behaviour at the nest was different from previous observations, and she did not use the same perches as the female parent. We searched the whole compound for the female that evening but she could not be found. The nestling was found dead the next morning (Day 13, 48 h after feeding stopped) and we disposed of it.

Re-nesting activity was observed between the male and the possibly new female at the same nest about three weeks later. This female lined the nest again neatly with soft feathers, but the nest was destroyed again by humans as a result of superstitious belief and its remains could not be found on 4 June, when observations ended. The pair however found another location in a neighbour's compound and began nesting there.

Discussion

The initial nest-building took 10 days. Fry *et al.* (2000) reported a nest built desultorily by *C. coccinigastrus* in 30 days, while Molokwu *et al.* (2005) reported *c.* 7 days for nest building in *N. senegalensis*. Laying took place in April, May, June, August, and October. The sizes of the eggs were similar to those reported by Fry *et al.* (2000: two eggs measured 18.5 x 15.3 mm and 19.1 x 13.1 mm).

The duration of incubation was 13–14 days, while the chicks fledged between 12 and 13 days after hatching, with an interval 26 days between egg laying and fledging. On average, it took approximately eight weeks to initiate and successfully raise a brood before starting another. Post-fledge rearing of juveniles takes 1–3 months among sunbirds (Cheke & Mann 2001).This signifies that the breeding season for *C.*

coccinigastrus in the southwest of Nigeria begins around April in the early rains and lasts for approximately eight months, probably coinciding with increases in invertebrate abundance. The feeding, brooding and caring of nestlings was carried out by only the female, as reported by Cheke & Mann (2008).

Smaller clutches will be favoured if larger clutches result in higher nest failure (Slagsvold 1984), and parents would also be able to produce a smaller replacement clutch more rapidly, as observed in this study. Re-nesting after destruction of an egg took *c.*7 days, once during our study. However, re-nesting after destruction of the nestling took*c.*22 days, which happened twice. The overall average time between two clutches in a single nesting season was longer (*c.* 29 days). Fry *et al*. (2000) report an observation for *C. coccinigastrus* in which the time between fledging and initiation of a new clutch was 3 months, with the new nest reportedly built using material from the old nest.

Safer nest sites should typically possess larger clutches or result in an increased number of broods (Jetz*et al*. 2008). Predation at human habitations is often much reduced, except in cases such as in this study, where humans are also involved in predation. Increase in the number of nest attempts in a single breeding season will spread out predation risk across all clutch attempts. In this study all eggs successfully hatched, and nest destruction was limited to post-hatching. The last chick in our study apparently died of starvation, perhaps following loss of the female parent, although further studies would be required to investigate the cessation of feeding of nestlings by the parents. This study reveals a high overall nest success: using Mayfield's (1971) method with the data in Table 1, the success rate of eggs hatching was 83 % over an incubation period of 14 days, the success rate of nestlings fledging was 66 % over a nestling period of 13 days, with an overall success rate of 55 %. This is much higher than is often observed for tropical birds (Oniki 1979) and, given that all losses were the result of direct human interference, indicates that breeding in proximity to people may result in considerably reduced losses caused by other predators of this species.

Acknowledgments

We thank APLORI for collaboration and technical support, and Mr A.P. Leventis for funding APLORI. We gratefully acknowledge the Luxembourg Ministry of Cooperation, Ministry of Health, Ministry of Research and Centre de Recherche Public-Santé for their generous financial and moral support through the Institute of Immunology, Laboratoire National de Santé, who provided funding for part of TAA's Ph.D. programme at the University of Ibadan during which these observations were made. We also thank the National Centre for Biosystematics at the Natural History Museum, University of Oslo, and the Research Council of Norway for sponsoring TCO's field work in Nigeria. This is contribution no. 63 from the A.P Leventis Ornithological Research Institute.

References

CHEKE, R.A., MANN, C.F. (2001) *Sunbirds: A Guide to the Sunbirds, Flowerpeckers, Spiderhunters and Sugarbirds of the World.* Christopher Helm, London.

CHEKE, R.A. &MANN, C.F. (2008) Family Nectariniidae (Sunbirds). Pp. 196–321 *in* DEL HOYO, J., ELLIOTT, A. & CHRISTIE, D.A. (eds) *Handbook of the Birds of the World*, vol. 13. Lynx, Barcelona.

ELGOOD, J.H. & SIBLEY, F.C. (1964) The tropical forest edge avifauna of Ibadan, Nigeria. *Ibis* 106: 221–241.

EZEALOR, A.U. (2002) Nigeria. Pp.661–692 *in* FISHPOOL, L.D.C. & Evans, M.I., (eds) *Important Bird Areas in Africa and Associated Islands*. Pisces, Newbury.

FRY, C.H., KEITH, S. &URBAN, E.K. (eds) (2000) *The Birds of Africa*, vol. 6. Academic Press, London.

HAU, M., PERFITO, N. & MOORE T.G. (2008) Timing of breeding in tropical birds: mechanisms and evolutionary implications. *Orn. neotrop.* 19 (Suppl.): 39–59.

JETZ, W., SEKERCIOGLU, C.H. & BOHNING-GAESE, K. (2008) The worldwide variation in avian clutch size across species and space. *PLoS Biol.* 6: 2650–2657.

MAYFIELD, H.F. (1971) Suggestions for calculating nest success. *Wilson Bull.* 87: 457–466.

MOLOKWU, M., OTTOSSON, U. & AZI, J. (2005) Observations at a Scarlet-chested Sunbird *Chalcomitra senegalensis* nest. *Malimbus* 28: 45–46.

ONIKI, Y. (1979) Is nesting success of birds low in the tropics? *Biotropica* 11: 60–69.

SLAGSVOLD, T. (1984) Clutch size variation of birds in relation to nest predation: on the cost of reproduction. *J. anim. Ecol.* 53: 945–953.