ASPECTS OF THE BREEDING BIOLOGY OF BLUE-BILLED WEAVER *Spermophaga haematina*

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ABSTRACT

Some aspects of the breeding biology of the Blue-billed Weaver Spermophaga haematina were examined for two consecutive years (i.e. 1999 and 2000), on the commercial farm of Obafemi Awolowo University, Ile-Ife, Nigeria. Forty four visits of 128.6 man hours were utilized searching for nests. Forty one active nests were monitored daily from 07.00 to 09.00h and from 17.00 to 19.00h to record the fate of clutches. The clutch size, breeding and nesting successes, and recruitment of fledgling per breeding seasons were determined. They were found to construct loose globular nests with side entrance out of grass inflorescences. Apart from grass inflorescences some narrow grass leaves, large soft skeletonized leaves or other fine inflorescences lining the interior form part of the nests. The nests had an external mean diameter of 112.42 ± 5.07mm, mean internal diameter 71.50±5.56mm and a mean entrance diameter of 27.83±2.41mm. Blue-billed Weaver displayed a seven-month breeding season from March to September with a peak lying between April and July. The long breeding period showed the efficiency with which the species may have utilized different food resources and hence occupy broad feeding niches. The clutch size was between 1 to 3 eggs with more than 80% of the forty-one completed clutches for the two seasons accounting for 3 eggs each. The mean clutch size was 2.74 and 2.67 eggs for 1999 and 2000 respectively. Synchronous hatching of the eggs yielded nestlings of almost the same age. Adaptations to low level nesting in Blue-billed Weaver were reduced incubation period (14.00±1.21 and 15.00± 61 days for 1999 and 2000 respectively), reduced fledgling period (15.00±0.82 and 15.00±0.25 days for 1999 and 2000 respectively) coupled with rapid growth rate of the chicks which ensured survival and early departure from the nest. Recruitment was estimated at about 34 and 27 chicks for 1999 and 2000 respectively with low mortality at hatching.

Keywords: *Nests, clutch size, hatchlings, fledglings, recruitment.*

INTRODUCTION

The availability of food seems to be a major factor affecting clutch size in various birds. It has been observed that clutches are generally smaller in years when less high protein food is available or at the end of a favourable period when food is becoming scarce (Cody, 1966, Bengtson, 1971). However, in some species food

supply seems only to affect the timing of breeding and not clutch size (Yom- Tov, 1974). A general theory of clutch size produced by Cody (1966) assumed clutch size to be a hereditary phenotypic characteristic which, to some extent, is modifiable by environmental conditions. Among many species of birds, pigeons and humming birds lay two eggs and many sandpipers lay a clutch of four eggs whereas most lay six to fifteen or more eggs. Maclean (1973) reported that bustards, starlings and weaver birds found in Africa lay smaller clutches in very dry years than in the years of ample rainfall.

Incubation ordinarily is delayed until all the eggs or all but one, are laid. This ensures that all young will hatch at nearly the same time. But the generalized observation was modified by Rand (1967) who observed that some species like the barn owl and some cuckoos may start incubation with the first egg. This ensures that the eggs hatch over a period of days. The resultant young are then of various sizes and ages. This may be of some advantage to the bird, in that, in times of food scarcity the weakest starve and the strongest survive instead of all the young being half-starved. Incubation period is correlated to some extent with egg-size, larger eggs generally requiring longer time to hatch. Nearly all bird species brood their young until they leave the nest and thereafter resort to frequent off-nest hovering. Brooding plays an important role in the survival value of birds in early life (*Hiraldo et al.*, 1990) and it gradually decreases with feather development and may cease altogether during the late stages nest life.

In this study active nests were visited daily to record the clutch size, fate of clutches, determine breeding and nesting success and recruitment of fledglings per breeding season.

MATERIALS AND METHODS

The study was carried out on the commercial farm of Obafemi Awolowo University, Ile-Ife from September 1999 to August 2000. Forty four visits were made through the study area making a total 128.6 man hours searching for nests. The longest period was three hours and the shortest was two hours fifteen minutes. A total of forty one active nests were identified and a nest record was filled in and completed for each.

The nests were checked daily from 07.00 to 09.00h and from 17.00 to 19.00h for the presence of eggs. The daily checking process continued until there were no more addition of eggs to the nests. The total number of eggs laid per nest gave the clutch size for that breeding period. Five active nests were selected for each breeding season in order to determine the mean clutch size, mean length, mean width and mean weight of the eggs for the species.

The length, maximum width and shell thickness of each egg were taken with Drapper vernier calipers 4816 and the weight with a Salter spring balance using a paper cone.

Using Mayfield (1961) breeding success was taken as the total number of fledged young per number of eggs laid while nesting success was taken as the number of nests producing at least one fledgling per total number of nests. Recruitment was determined using the total number of fledglings raised per season.

A total of 243 Blue-billed Weavers were caught by mist nets during the last two weeks of each month from January 1999 to December 2000 to determine the condition of brood patch in female birds, to give an idea of the period of nesting and the proportion of juveniles in monthly netting samples. All were sexed and aged by plumage, ringed on the tarsi either with a unique combination of five colours, with a numbered coloured ring or with both, and released at the site of capture (Payne, 1980).

RESULTS

Blue-billed weaver nests were large loose globular structures with a side entrance constructed out of grass inflorescences. Little variation existed in the nest materials but for narrow grass

leaves or large, soft skeletonized leaves or fine inflorescences which may line the interior of the nest. The dimensions of the nest structure showed an external mean diameter of 112.42 ± 5.07mm (range 106-118mm); mean internal diameter of 27.83:f:2.4mm (range 25-33mm). The nests were placed by the birds in the forked branches of some low bushes at a mean height of 133.92±10.60cm from the ground.

Palpable eggs were found in netted females from late March to August of the two breeding seasons. Conditions of the brood patches also indicated a six-month nesting season from March to August and almost all the females examined from March to September had a brood patch (Table 1).

The eggs were plain white with almost constant shape but with some, a little elongated than the others. Intra-clutch variation was less common than inter-clutch variation. Table 2 shows that little variation existed in the weights (0.87-1.11 and 0.89-0.97g) and measurements (13.40-14.41 X 9.84-10.40 and 13.42-14.10 X 9.63-10.23mm^2) of completed eggs in the clutches for 1999 and 2000 breeding seasons respectively. Analyses of these indicated that- there were no significant differences (P>0.05) in the mean egg weights and dimensions of the birds eggs for the two breeding seasons when a t-test was carried out. The mean shell thickness was 0.06mm for twenty pieces measured.

All original clutches of the birds were from direct observation of the nests. The clutches were found to contain one to three eggs with more than 80% of the forty-one completed clutches for the two seasons accounting for three eggs each. A mean clutch size of 2.14 eggs was recorded for the year 1999 and 2.67 eggs for the year 2000. However the mean clutch size of the species for both seasons was 2.71 eggs (Table 3). Fifteen full-day observations were made during the incubation period. Observations at two nests on colour-marked birds showed that only one female and one male participated in incubation at each of the nests. The female incubated the eggs at night but were frequently relieved by the males during the day-time. The mean number of changeovers for the nests were 1.00/h and 1.04/h at the two nests from a total of 180h of observation. The mean time the birds were ab-

Table 1: Brood patch condition among pooled adult female Blue-billed weaver *Spermophaga haematina* for 1999 and 2000

	Months											
Condition of brood patch	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
None	3	3	-	-	-	1	1	-	-	2	4	5
Defeathered	-	-	8	2	1	-	-	-	-	-	-	-
Vascular	-	1	3	7	10	1	1	-	-	-	-	-
Oedematous	-	-	2	11	28	17	14	5	-	-	-	-
Wrinkled	-	-	-	-	5	4	8	-	1	-	-	-
Total	3	4	13	20	44	23	24	5	1	2	4	5

Table 2: External measurements (mm) and weights (g) of *Spermophaga haematina* eggs (n) from five different nests during 1999 and 2000 reproductive seasons

Nest	Number of eggs (n)	1999 Length Mean ($\overline{XL}$)	SD	Range	Breadth Mean ($\overline{XB}$)	SD	Range	Weight Mean ($\overline{XW}$)	SD	Range
1	3	14.04	0.278	13.53-14.41	10.20	0.244	9.84-10.40	0.96	0.037	0.91-1.01
2	3	13.83	0.408	13.40-14.36	10.16	0.176	9.94-10.36	0.95	0.039	0.91-1.02
3	3	14.03	0.062	13.96-14.11	10.24	0.053	10.18-10.31	0.91	0.023	0.87-0.94
4	3	14.06	0.094	13.94-14.17	10.17	0.037	10.12-10.21	0.94	0.032	0.93-1.00
5	3	13.99	0.098	13.89-14.12	10.15	0.076	10.09-10.26	1.09	0.020	1.07-1.11
$\overline{X}$	3.00	14.03	0.247	13 .40-14.41	10.19	0.168	9.84-10-40	0.97	0.065	0.87-1.11

Nest	Number of eggs (n)	2000 Length Mean ($\overline{XL}$)	SD	Range	Breadth Mean ($\overline{XB}$)	SD	Range	Weight Mean ($\overline{XW}$)	SD	Range
1	3	13.74	0.160	13.51-13.96	9.91	0.216	9.63-10.14	0.94	0.015	0.91-0.95
2	3	13.66	0.229	13.48-13.98	10.08	0.108	9.94-10.20	0.91	0.026	0.89-0.93
3	3	13.63	0.020	13.61-13.15	10.16	0.050	10.11-10.21	0.94	0.010	0.92-0.96
4	3	13.66	0.149	13.42-13.83	10.07	0.198	9.74-10.23	0.94	0.016	0.92-0.97
5	1	14.10	-	14.10	10.18	-	10.18	0.93	-	0.93
$\overline{X}$	2.40	13.71	0.194	13.42-14.10	10.04	0.195	9.63-10.23	0.93	0.023	0.89-0.97

sent from each of the nests were 27.31±2.43 and 29.06±2.10 minutes giving an attentiveness of 72.69±2.43 and 70.94 ±2.10 minutes respectively.

Synchronous hatching of the eggs yielded nestlings of almost the same age so that the mean period of incubation 14.00±1.21 days and 15.00±0.61 days were got for 1999 and 2000 breeding seasons respectively. The nesting periods were 15.00±0.82 and 15.00 ± 0.25 days for 1999 and 2000 respectively. Breeding success were 53.97% and 56.25% and similarly nesting success were 82.60% and 72.22% for 1999 and 2000 reproductive seasons respectively.

The estimated figures for recruitment were got from Table 1. A total of 34 and 27 fledglings were recruited in 1999 and 2000 respectively. Post-fledgling period showed that the proportion of juveniles in the monthly netting samples rose from March to May and remained high till August (Figure 1). However, a little above half of the several fledglings ringed in 1999 and 2000 were recaptured but the rest were never retrapped in subsequent years, indicating either post fledgling mortality, dispersion or both. There appeared to be a similarity in the level of recruitment of young blue-billed weavers into the population from year to year.

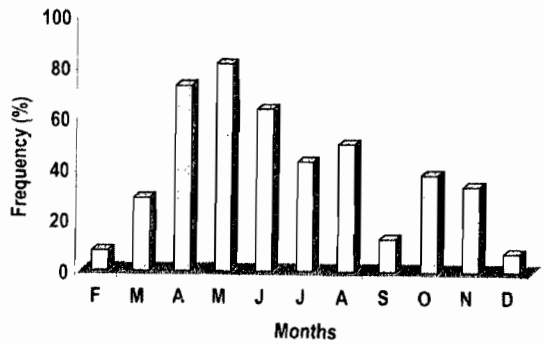

Fig. 3: Seasonal changes in the proportion of juvenile Blue-billed weaver netted in the pooled monthly samples from 1999 to 200

DISCUSSION

Several workers (Moreau 1950, Lack 1968, Ward 1969, Fodgen 1972. Payne 1980, Akinpelu 1994) had noted that seasonal breeding in most tropical birds appeared to be adaptively timed so that young are raised when food is most plentiful blue-billed weaver seemed to conform to this pattern in South-Western Nigeria. Biannual breeding which had been reported in a number of tropical birds (Wilkinson 1983, Din 1986, Akinpelu 1994) was completely absent in this bird. The Blue- billed weaver only showed one reproductive peak throughout the year which

Table 3: Nesting outcome in the commercial farm section used by Blue-billed Weaver *Spermophaga haematina* in 1999 and 2000.

Year	Number of nests	Number of eggs	Clutch size	Number of hatchlings (%)	Number of fledglings (%)	Nest with fledgling (%)
1999	23	63	2.74	51(80.95)	34(53.97)	19(82.60)
2000	18	48	2.67	35(72.92)	27(56.25)	13(72.22)
Total	**41**	**111**		**86(77.48)**	**61(54.95)**	**32(78.00)**
Mean $(\overline{X})$	-	**2.71**	**2.71**	**2.10**	**1.49**	**1.91**

was very much in concert with the findings of Akinpelu (1994) on *Estrilda melpoda*. The seven-month breeding season from March to September was fairly long for a seasonally breeding bird. The long season according to Earle (1982) probably showed the efficiency with which Blue-billed weaver used different food resources at different times of the year which enabled them to build up enough protein reserve for egg production. Thus, this species with relatively long breeding seasons may occupy broad feeding niches.

The synchronous hatching of the eggs which yielded nestlings of almost the same age provided a mechanism by which competitive differences amongst siblings were eliminated, so that in the event of food becoming limiting, parents would be able to cope effectively with three nestlings which was the maximum clutch size for the species. Thus "brood reduction" strategy was probably non-existent in the species. In the Blue-billed weaver reduced incubation period and reduced fledgling period coupled with rapid growth rate were some of the adaptations selected for low level nesting to ensure chicks survival and early departure from the nest. Thus, natural selection did not optimize on the number of eggs but rather on the number of broods which could be successively and successfully raised. Therefore, a lower fledgling period will ensure that parental investment in two chicks was more profitable than in three chicks.

In an idealized life cycle of a species (from egg laying to hatching, fledgling and an adult) population control mechanism were found to exert their influence most at early hatchling stages when many chicks attempted to fly. Mortality from nestling to fledgling stages was 22.9 - 33.3%.

Predatory pressures due to Eritrean Shikra *Accipeter badus*, snakes when chicks were present in nests and brood parasitism as a result of Didric Cuckoo and Pintailed Whydah *Vidua macroura* recorded by Din (1986) in *Ploceus cucullatus* and Akinpelu (1992) in some estrildid species were not observed in this study. However, due to small colony size, recruitment was estimated at about 34 and 27 chicks for 1999 and 2000 respectively, with low mortality at hatching. Post natal mortality appeared low because the proportion of juveniles in the monthly netting remained high.

It is concluded that the small clutch size, synchronous hatching of eggs, short incubation and nestling periods, coupled with the absence of predatory pressures ensures that almost equal number of chicks were recruited into the population per breeding season.

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REFERENCES

Akinpelu, A. I. (1992). Studies on the reproductive activities of three estrildid birds (Family: Estrildidae) in Ile-Ife, Nigeria. Ph.D. Thesis, Obafemi Awolowo University, Ile-Ife, (unpublished).

Akinpelu, A I. (994). Breeding seasons of three estrildid species in Ile-Ife, Nigeria. *Malimbus* 16: 94-99.

Bengtson, S.A (1971). Variation in clutch-size in ducks on relation to food supply. *Ibis* 113: 523-526.

Cody, M.L. (1966). A general theory of clutch size. *Evolution* 20: 174-184.

Din, N.A (1986). Breeding biology of some weaver birds in Ile- Ife, Nigeria. Ph.D. Thesis. Obafemi Awolowo University, Ile-Ife. 281pp. (unpublished)

Earle, R.A (1982). Aspects of the breeding biology and ecology of the white bellied sunbird. *Ostrich* 53: 65-73.

Fogden, M.P.L. (1972). The seasonality and population dynamics of equatorial forest birds in Sarawak. *Ibis* 114: 307 - 343.

Hiraldo, F, Veiga, P.J. and Manez, M. (1990). Growth of nestling black kites *Milvus migrans*: effects of hatching order, weather and season. *J. zool. Lond.* 222(2): 197-214.

Lack, D. (1968). Ecological Adaptations for Breeding in Birds. Mathuen. London: G.L. (1973). Maclean: The Sociable Weaver, Part 3: Breeding biology and Moult. *Ostrich* 44: 219-240.

Mayfield, H. (1961). Nesting success calculated from exposure. *Wilson Bull.* 73: 255-261.

Moreau, R.E. (1940). Incubation and fledgling of African birds. *Auk* 57: 313-325.

Moreau, R.E. (1950). The breeding season of African birds. 1: Land birds. *Ibis* 92: 223-267.

Payne, R.B. (1980). Seasonal incidence of breeding, moult and local dispersal of Red-billed Firefinches *Lagonosticta senegala* in Zambia. *Ibis* 122: 43--56.

Rand, AL. (1967). Ornithology: An introduction. Harmondsworth, Middlesex, England: Pengium Books Ltd. 368pp.

Ward, P. (1969). The annual cycle of the yellow-vented bubul *Pycnonotus goiavier* in a humid equatorial environment. *J. Zool. Lond.* 157: 25-45.