**West African Ornithological Society**
**Société d'Ornithologie de l'Ouest Africain**


# Join the WAOS and support the future availability of free pdfs on this website.

http://malimbus.free.fr/member.htm

If this link does not work, please copy it to your browser and try again.

If you want to print this pdf, we suggest you begin on the next page (2) to conserve paper.

# Devenez membre de la SOOA et soutenez la disponibilité future des pdfs gratuits sur ce site.

http://malimbus.free.fr/adhesion.htm

Si ce lien ne fonctionne pas, veuillez le copier pour votre navigateur et réessayer.

Si vous souhaitez imprimer ce pdf, nous vous suggérons de commencer par la page suivante (2) pour économiser du papier.

February / février 2010

# DIET AND BREEDING SEASONALITY OF THE BRONZE MANNIKIN Lonchura cucullata (SWAINSON) AND THE BLUE-BILLED MANNIKIN Lonchura bicolor (FRAZER) IN WESTERN SIERRA LEONE

by Hazel S. S. Thompson

Received 2 February 1988
Revised 29 June 1988

## INTRODUCTION

The Bronze Mannikin - Lonchura cucullata and the Blue-billed Mannikin - Lonchura bicolor are small, similar-sized (8-10g) estrildine weavers found only in the Afro-tropical region of Africa. Recent reports indicate that they regularly cause damage to cereal crops in several West-African countries (Bruggers and Ruelle 1981, Manser 1984, Bashir 1984). In Sierra Leone, they are readily recognised as pests by local farmers due to their destructive feeding on rice and other small grain crops.

There have been no previous detailed studies on the diet and breeding biology of L. bicolor. It is however known to consume grass-seeds and insects (Bannerman, 1949), and various workers have reported incidental observations on its breeding biology (Bannerman 1953, Mackenzie 1979, Macdonald 1979). The reproductive behaviour of L. cucullata has been studied in captivity (Morris, 1957), and a field study of its life history carried out in Zimbabwe (Woodall, 1975). The diet of L. cucullata is also known to consist mainly of grass-seeds and insects, especially termites (Bannerman 1949, Woodall 1975, Heaton 1982). Woodall (1975) has presented a list of food plants taken by L. cucullata and also gives anecdotal accounts of the birds feeding on nectar, lettuce leaves and strands of filamentous algae. However, these studies do not relate the ecology of the species to agriculture practices or consider its status as a pest.

This study was designed to examine the food habits and time of breeding of L. cucullata and L. bicolor in relation to local rice-growing practices. A quantitative investigation of preferred diet was made in order to assess the importance of agricultural crops (mainly rice) in the diet at different times of the year. Breeding seasonality was monitored primarily to determine the timing of periods of high food demand in relation to local rice-growing patterns.

## STUDY AREA AND METHODS

The study was conducted in a 62-hectare area at Lumley, a coastal region in Western Sierra Leone. The area included: experimental farm plots; uncultivated areas with a permanent cover of grass throughout the year; Mangrove swamps along a river and creek, and small plantations of citrus and palm-kernel trees. Rice was cultivated on the experimental farm plots during the wet-season (May to October) and a variety of other crops including Maize Zea mays Guinea-corn Sorghum and groundnuts Arachis hypogea were grown during the dry season (November - April).

Birds were trapped with mist-nets weekly from January 1984 to August 1985. Trapped birds were killed then dissected in the field and their crops and gizzards removed. The frequency of occurrence of different food items was determined using a 30x binocular microscope. The various crop and gizzard contents were then separated, oven-dried at 100°C for 24 hours and weighed. This procedure enabled the percentage weights contributed to the birds' diet by major food items for each month to be calculated.

Mannikins were observed feeding in the field with 10 x 50 mm binoculars and the different food items either identified on the spot or samples collected for later identification.

Seasonal variation in the breeding activity of the two species was monitored primarily by examination of the gonads of trapped adults. The length of the larger testis in dissected males and the diameter of the largest oocyte in females were measured to the nearest 0.1 mm using vernier calipers and recorded. Individuals with gonads more than half the size of the largest measured value for each species were considered to be in breeding condition. In practice, this meant that females with an ovum or follicle at least 6.0 mm in diameter for L. cucllata and 7.0 mm for L. bicolor were considered to be in breeding condition. Similarly, males of both species with tastes > 4.0 mm long were considered to be capable of breeding. The presence of individuals in immature plumage in monthy mist-net catches was taken as an indication that successful breeding had already occurred.

RESULTS

Diet Composition

Twenty-one feed items consisting of cereal crops, fruits, wild grass-seeds, algae and insects were identified in the crops and gizzards of both L. cucullata and L. bicolor (Table 1). The majority of the food species were common to the diets of the two species. The most notable exception was the oil-palm Elaeis guineensis which was found as fibrous bits of the mesocarp of ripe fruits in the crop and gizzard of L. bicolor but was absent from the diet of L. cucullata (Table 2).

Grass-seeds formed the major dietary component of both species. 60.3% and 42.9% respectively of L. cucullata and L. bicolor examined had eaten grass-seeds (Table 2). Seventeen different seed types were distinguished in the diet of L. cucullata and fifteen in that of L. bicolor. The most frequently encountered seed species was Panicum laxum found in 21% of L. cucullata and 19% of L. bicolor birds sampled. Only two identified seed types were not common to the diets of the two species, namely: Panicum maximum found only in the gut of L. cucullata and Eleusine indica found only in L. bicolor. However, since these seed types occurred in only a small proportion of the two species (less than 4%) this could have been due to sampling error and may not reflect any dietary difference.

L. bicolor less frequently ate rice than L. cucullata, but c. three times as many L. bicolor had eaten insects compared with L. cucullata (Table 2). All insects eaten were adult (Hymenoptera, Isoptera, Coleoptera and

Table 1

Food Items Identified in L. cucullata and L. bicolor Crops and Gizzards

| | | |
|---|---|---|
| *Elaeis guineensis | Palmae | Fruit mesocarp |
| Eugenia uniflora | Myrtaceae | Fruit mesocarp |
| Oryza sativa | Graminae | Seed |
| Sorghum sp. | Graminae | Seed |
| Panicum laxum | Graminae | Seed |
| +Panicum maximum | Graminae | Seed |
| Anadelphia tenuiflora | Graminae | Seed |
| Andropogen guyana | Graminae | Seed |
| Pennisetum sp. | Graminae | Seed |
| Brachiara stigmatisata | Graminae | Seed |
| *Eleusine indica | Graminae | Seed |
| Eragrostis aspera | Graminae | Seed |
| Axonopus compressus | Graminae | Seed |
| Paspalum sp. | Graminae | Seed |
| Spirogyra sp. | Alga | Filament |
| Oecophylla longinoda | Fermicidae | Whole/fragments |
| Macrotermes bellicosus | Termitinae | Whole/fragments |
| Hunting wasps | Pompilidae | Fragments |
| Weevils | Curculionidae | Fragments |
| Ants | Myrmecinae | Fragments |
| Flies | Orosophilidae | Fragments |

* = eaten by L. bicolor only
+ = eaten by L. cucullata only

Table 2

The percentage occurrence of different food items in the crops and gizzards of L. cucullata and L. bicolor

| | Number examined | Rice | Grass Seeds | Insect | Algae | Oil palm | Sorghum | Eugenia uniflora |
|---|---|---|---|---|---|---|---|---|
| L. cucullata | 305 | 26.9 | 60.3 | 4.6 | 4.9 | 0 | 14.3 | 1.3 |
| L. bicolor | 315 | 9.2 | 42.9 | 12.4 | 4.4 | 16.2 | 13.9 | 6.0 |

Diptera), except for unidentified pupae recovered from L. bicolor individuals in May 1984. Termites (Macrotermes bellicosus) and ants (Myrmicinae and Oecophylla longinoda) were the most favoured insects.

Filamentous alga Spirogyra was found as characteristic green filaments in the crops and gizzards of both L. cucullata and L. bicolor with approximately the same frequency (Table 2).

Variations in Diet

The seasonal variation in the percentage composition by dry weight of the food of L. cucullata and L. bicolor is shown in Fig. 1. L. cucullata ate grass-seeds throughout the year. Grass-seeds were absent from the gut contents of all L. bicolor individuals examined in November and December 1984, when mature rice was present.

Both bird species fed more on grass-seeds in the wet-season, (May to October) when most of the grasses in the study area flowered, than the dry season. Seeds formed an average of 72.6% and 71% of dry weight of food consumed in the wet season by L. cucullata and L. bicolor respectively, but only 44% and 32% in the dry season.

The patterns of insect consumption by L. cucullata and L. bicolor were broadly similar. The birds fed on insects during a period extending from February (in the middle of the dry season) to August for L. cucullata and September for L. bicolor. The proportion of birds of the two species feeding on insects was highest in May at the onset of the rains (Fig 2). This was probably due to the increased availability and apparent ease of capture of termites (Macrotermes bellicosus) at this time of the year when reproductives swarmed on nuptial flights.

Consumption of Spirogyra corresponded with its availability in the field during the wet season (Fig. 2). In 1984, L. cucullata ate algae from August to December and L. bicolor from September to December. In 1985, algae appeared in the diet of L. cucullata in May.

Table 3 shows the relative proportions of male and female L. cucullata and L. bicolor birds utilising various food items. Although there were some differences in the consumption patterns of the sexes, these differences were not statistically significant ($p > 0.10$ $x^2$, 1 d.f.). These results indicated that there was no difference in the quantitative composition of the diet of male and female birds in the two species.

Table 4 shows the mean weight of food items in the crops of L. cucullata and L. bicolor at different times of the year. Crop content weights were highest in October for both L. cucullata (123.2 ± 2.6 mg) and L. bicolor (137 ± 23.5 mg). Minimum crop content weights (34.4 ± 7.6 mg) for L. cucullata and (23.3 ± 2.2 mg for L. bicolor) occurred in June. Food intake and probably food availability was highest at the end of the wet-season and lowest at the start of the wet-season.

The Importance of Agriculture Crops

Rice formed a constituent of the diet of L. cucullata throughout the year (Figs. 1a and 3a) even when rice was not being cultivated in the field. In contrast L. bicolor only ate rice when cultivated rice in the field

Fig.1a: Seasonal Variations In The Percentage Composition By Dry Weight Of The Food Of L.cucullata

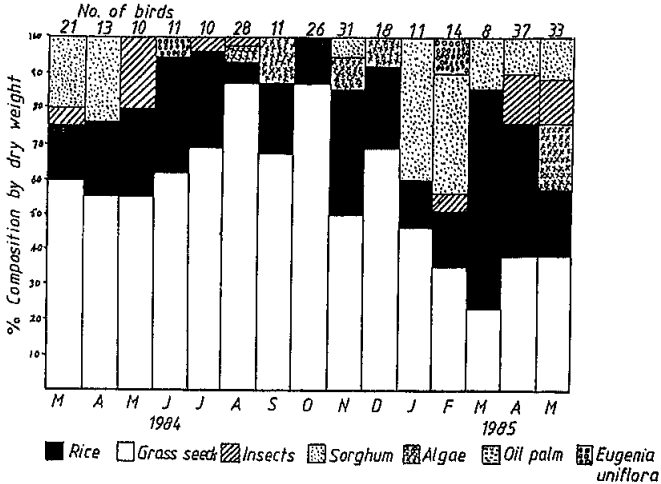



Fig. 1b: Seasonal Variation In The Percentage Compostion By Dry Weight Of The Food Of L. bicolor

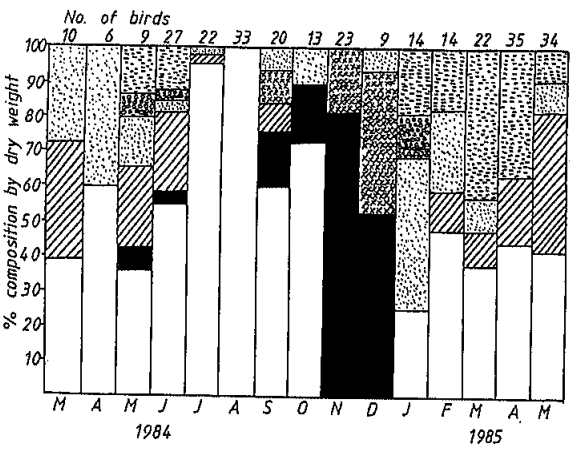


*Fig. 2: Seasonal Occurrence Of Insects And Algae In The Diet Of L. cucullata And L. bicolor*

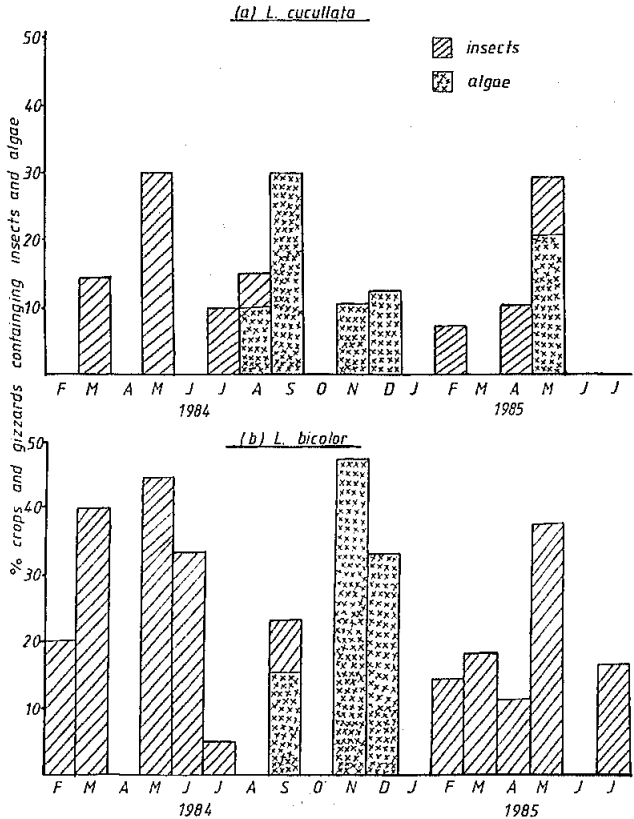


Table 3

Proportions of male and female birds of L. cucullata and L. bicolor containing various food items

| | | No. examined | Rice | Grass Seeds | Algae | Insects | Oil palm | Sorghum |
|---|---|---|---|---|---|---|---|---|
| L. cucullata | Males | 52 | 54.4 | 40.0 | 7.6 | 5.7 | 0 | 9.6 |
| | Females | 66 | 33.6 | 45.4 | 8.0 | 3.0 | 0 | 15.1 |
| L. bicolor | Males | 65 | 7.6 | 30.7 | 6.2 | 7.6 | 20.0 | 10.7 |
| | Females | 67 | 16.4 | 31.3 | 4.4 | 13.4 | 23.8 | 11.9 |

Table 4

Mean crop content weights (mg)

| MONTH | Mean weights (mg) ± 1 s.e. | |
|---|---|---|
| | L. cucullata | L. bicolor |
| March 1984 | 39.6 ± 4.7 | 49.0 ± 8.8 |
| April | 44.0 ± 5.5 | - |
| June | 34.4 ± 7.7 | 23.3 ± 2.2 |
| July | 72.0 ± 8.3 | 31.8 ± 1.4 |
| August | 56.3 ± 2.4 | 89.4 ± 9.5 |
| September | 91.25 ± 7.2 | 41.7 ± 4.0 |
| October | 123.2 ± 2.6 | 137.0 ± 23.5 |
| November | 53.3 ± 2.8 | 40.5 ± 2.8 |
| December | 61.1 ± 3.6 | 37.3 ± 3.6 |
| January 1985 | 55.7 ± 2.7 | 59.1 ± 3.5 |

was vulnerable to attack i.e. in May and June at the start of the rice-growing season and from September to December after the rice had attained the milk stage. These periods also coincided with peak rice consumption by L. cucullata.

Guinea-corn was eaten by both L. cucullata and L. bicolor mainly in the dry season (Fig. 3), when it was cultivated. However, this species also grew wild in the area.

L. bicolor consumed oil palm fruits in addition to rice and sorghum (Fig. 3b). Maximal exploitation of the different agricultural crops by L. bicolor occurred at different times of the year with the birds switching attention from one crop to another as each became available in the field. Thus, between September and December 1984, when many L. bicolor birds were feeding on mature rice in the field, very few individuals fed on guinea-corn and oil-palm was not eaten at all. After December, when rice was no longer available in the field, consumption of guinea-corn and oil-palm increased dramatically.

It is noteworthy that although maize was present in the study area, it was not eaten by either L. cucullata or L. bicolor. This may have been due to its comparatively large grain-size, compared to the bill size of the mannikins.

Breeding Seasons

Figs. 4a and 4b show the seasonal variation in the gonad size of L. cucullata and L. bicolor. (N.B. During some months of the year, all gonad measurements were ≤1 mm, the minimum value that could be accurately measured with vernier calipers: all such values were taken as 1.00 mm, and these points have no error bars). The data suggest that in 1984, females of the two species were in breeding condition during a three to four month period toward the end of the rains i.e. from August to November for L. cucullata and between September and November in the case of L. bicolor. Males showed peaks of breeding activity in August and December for both species and also in September for L. bicolor alone.

The monthly variation in the percentage of immature birds trapped is shown in Fig 5. There were no L. cucullata immatures in the mist-net catches during July and August 1984. Similarly, L. bicolor immatures were absent from the trapped population during August, September and October 1984. Woodall (1975) gives the duration of immature plumage in L. cucullata as "about two or three months". There is no information published for L. bicolor but general observations made during this study would suggest immature plumage would not be retained for more than three months. Immatures presumably produced as a result of breeding activity during 1984 were first trapped on the 20th September (L. cucullata) and 3rd November (L. bicolor). Recruitment of juveniles into the adult population occurred primarily between September and February for L. cucullata and from November to February for L. bicolor. After February, the proportion of juveniles in the trapped populations of the two species declined rapidly as juveniles assumed adult plumage. These results suggest that in 1984, breeding in the mannikin populations occurred mainly toward the end of the rains and early dry season with L. bicolor starting to breed slightly later than L. cucullata. In the case of L. cucullata, this is supported by the fact that nests with eggs or young

Fig. 3 : Seasonal Occurrence Of Agricultural Crops In The Diet Of L. cucullata And L. bicolor

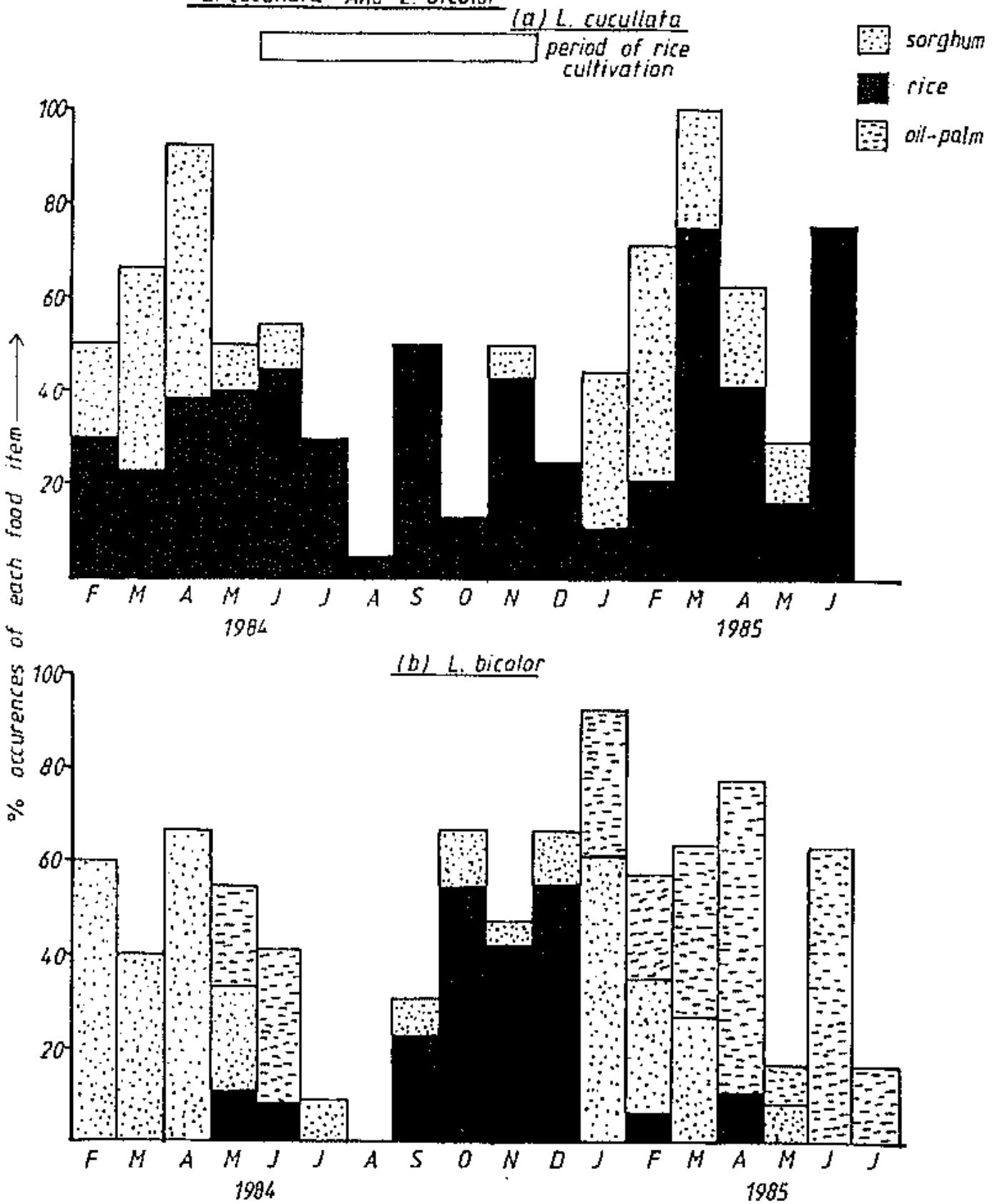
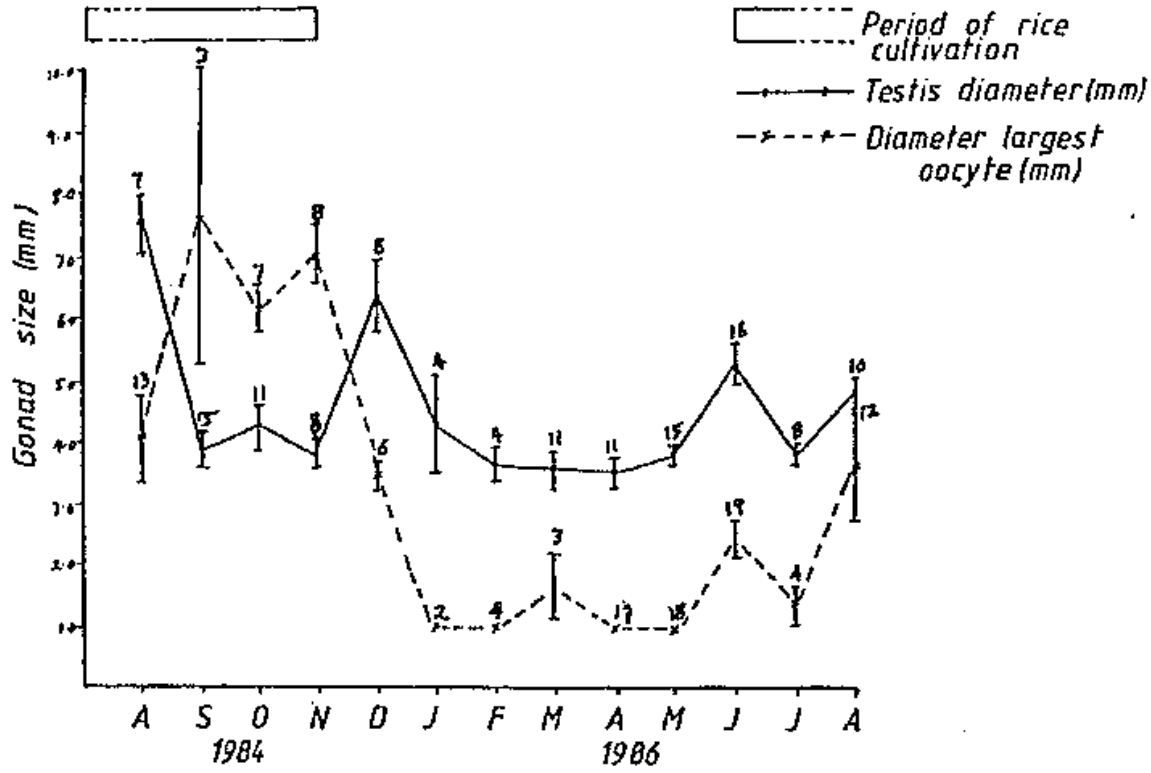


Fig. 4 : Seasonal Variation In Gonad Size

4 (a) L. cucullata




4 (b) L. bicolor

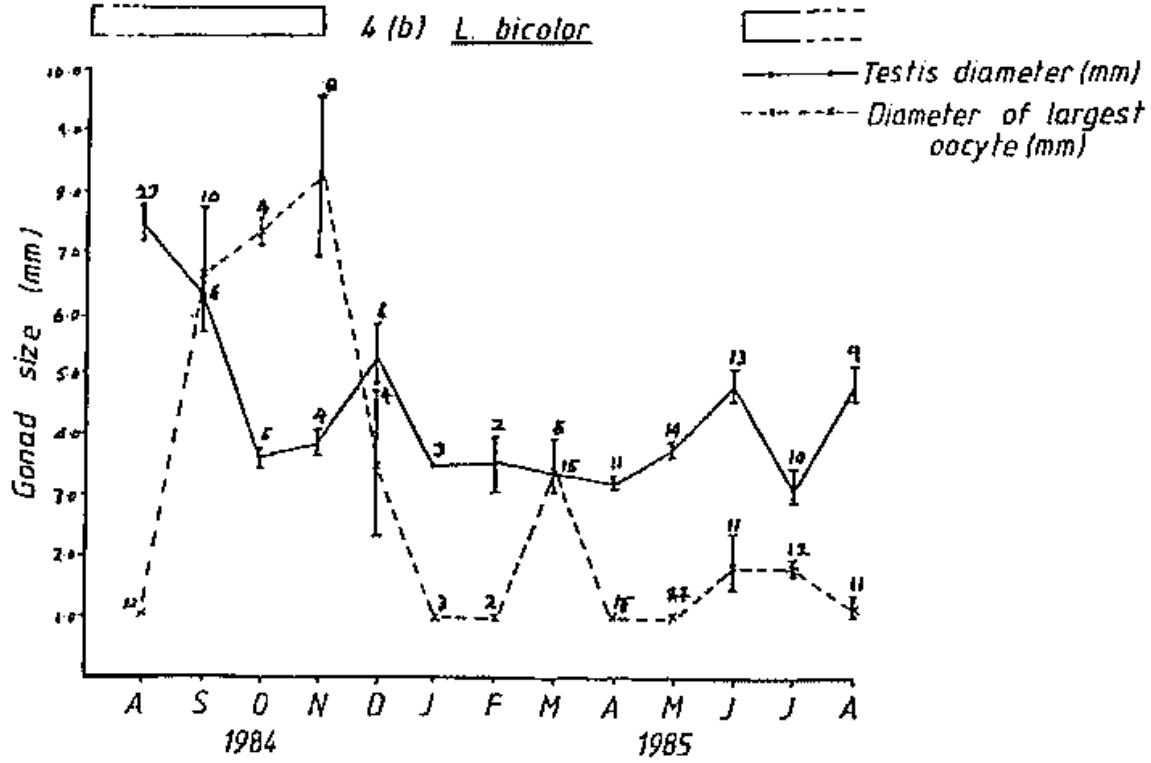
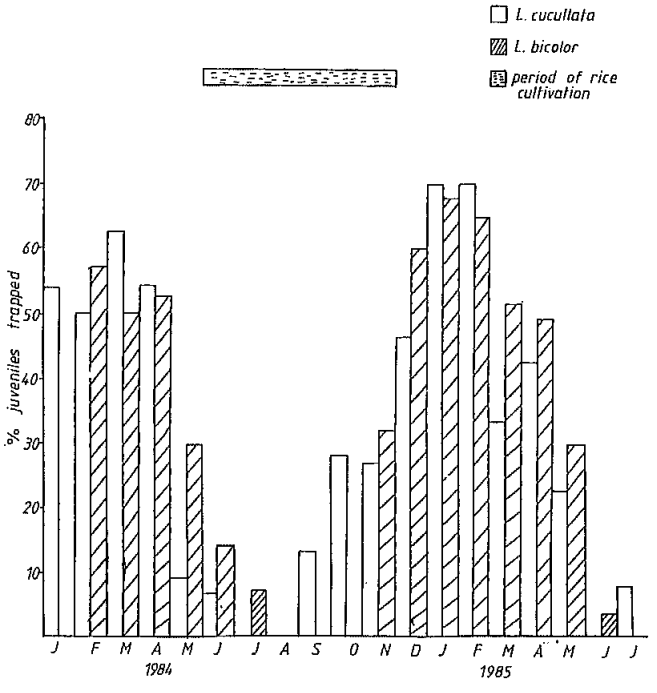


Fig. 5 Monthly Variation In % Juveniles Trapped L. cucullata And L. bicolor



were found within the study area only from August to November. There were no records of L. bicolor nesting activity because it apparently nested outside the study area.

## DISCUSSION

### Diet

The presence of rice in the diet of L. cucullata throughout the year suggested a dependence on human habitations and grain stores for food. Government rice stores within the study area probably provided good sites for such foraging as evidenced by flocks of L. cucullata being seen frequently feeding on rice spread on the ground for drying or prior to threshing. Thus this species caused some post - as well as pre - harvest loss of rice in the study area.

Overall consumption patterns indicated that L. bicolor was much less dependent on rice than L. cucullata. However, the fact that L. bicolor ate only rice and filamentous algae (no grass seeds) when mature rice was in the field in November and December, suggested that L. bicolor probably prefered cultivated rice when available, to grass-seeds. This was in contrast to L. cucullata in whose diet, grass-seeds comprised the bulk of the food eaten in November despite the presence of mature rice in the field. It is possible therefore, that L. cucullata may be more easily attracted away from rice than L. bicolor if alternative food sources (e.g. grass-seeds) are available.

Avery (1980) has suggested that algae may function as a protein supplement in the diet of Lonchura striata in Malaya during breeding. This may also have been the case for L. cucullata and L. bicolor since algae-eating occurred toward the end of the wet-season when the birds were breeding. However, since algae were only available in the study area during the rains, consumption by L. cucullata and L. bicolor was probably more closely-linked to availability.

The marked similarity between the diets of L. cucullata and L. bicolor and the fact that they were often seen taking food items from the same sites indicated considerable niche overlap. Such co-existence of two closely-related species in apparent opposition to Gause's (1934) competitive exclusion principle may have been possible because of the utilization of superabundant food supplies represented by grass-seeds (Murton et. al., 1964). However, as seed stocks dwindle through the dry-season, inter-specific competition probably increased. This may have been responsible for the greater ecological separation and recourse to non-grain food items shown by the two species in the dry-season: L. bicolor resorted to oil-palm which L. cucullata did not eat between January and July, but L. bicolor fed on insects to a much greater extent than L. cucullata over approximately the same period.

### Breeding Seasonality

Several workers (Moreau 1950, Ward 1969, Fogden 1972, Payne 1980) have noted that seasonal breeding in most tropical birds appears to be adaptively timed so that young are raised when food is most plentiful. L. cucullata and L. bicolor seem to conform to this pattern in western Sierra Leone. Breeding in the two species occurred mainly between August

and November, toward the end of the rains, coinciding with the flowering of numerous grass-species, maturation of rice in the field and the availability of Spirogyra. The coincidence between breeding and rice maturation may have some influence on rice damage. Increased feeding resulting from increased energy demand for egg-production and rearing of young may promote foraging for rice. However, the availability of filamentous algae in the fields may to some extent have attracted birds away from feeding on the rice plants.

The well-marked breeding season (August to November) observed in this study for L. cucullata is in marked contrast to the 10-month breeding period reported for L. c. scutata in Zimbabwe (Woodall, 1975). However, where data obtained over a wide area (as in the case of Woodall) or gathered over many years are pooled, a false impression of ill-defined breeding seasons may be obtained (Ward, 1969). It is thus significant that records from a single location (Hartfield) given by Woodall (1975) indicate a four-month breeding season; the duration of which agrees closely with that obtained in this study.

SUMMARY

The diet and breeding seasonality of the mannikins Lonchura cucullata and Lonchura bicolor were studied in a rice-growing locality in the Western peninsula of Sierra Leone from January 1984 to August 1985. Field observations and stomach analyses indicated that the birds ate cereal crops, grass-seeds, insects, algae and fruits. Crops of agricultural importance eaten were rice Oryza sativa, Guinea-corn Sorghum and oil-palm Elaeis guineensis.

Only L. bicolor ate oil-palm. Rice in the mature grain stage was apparently more prone to attack by L. bicolor than L. cucullata. Breeding occurred from August to November in L. cucullata and from September to November in L. bicolor, coinciding with maturation of rice in the field and the availability of the filamentous alga Spirogyra.

RESUME

L'alimentation et la réproduction saisonnière des spermètes Lonchura cucullata et L. bicolor ont été étudiées dans la région rizière de la péninsula occidentale du Sierra Leone du mois de janvier 1984 jusqu'au mois d'août 1985. Les enquêtes sur les lieux et les analyses d'estomac témoignent que les oiseaux mangent des céréales, des graines fourragères, des insectes, des algues et des fruits. Les produits mangés qui ont une importance agricole étaient le riz Oryza sativa, les graines de Guinée Sorghum et le palmier à l'huile Elaeis guineenses.

L. bicolor seul mangeait le palmier à l'huile. Il paraissait que le riz bien mûri était plus vulnérable aux attaques par L. bicolor que par L. cucullata. La réproduction avait lieu de août à novembre pour L. cucullata et de septembre à novembre pour L. bicolor, ce qui coincide avec le maturation du riz dans les champs et avec la disponibilité de l'algue filamenteuse Spirogyra.

ACKNOWLEDGEMENTS

The study was supervised by Professor H.G. Morgan and Dr. A. Tye and supported by a grant from the Research Committee of the University of Sierra Leone. Dr. R.A. Basimi commented on early drafts. I wish to express my sincere thanks to them all.

REFERENCES

AVERY, M.L. (1980) Diet and Breeding Seasonality among a population of sharp-tailed Munias - Lonchura striata in Malaysia. Auk 97: 160-166.

BANNERMAN, D.A. (1949, 1953) Birds of Tropical West Africa. Vols 2 & 6. Oliver and Boyd, London.

BASHIR, E.A. (1984) Bird damage problems to rice under humid tropical conditions in Liberia, West Africa. UNDP/FAO Report RAF/11/022.

BRUGGERS, R.L. & RUELLE, P. (1981) Economic impact of pest birds on ripening cereals in Senegal. Protection Ecology 3: 7-16.

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

GAUSE, G.F. (1934) The Struggle for Existence. Hafner edition (1969), New York.

HEATON, A.M. (1982) Bronze Mannikins fly-catchng. Malimbus 4: p49.

MACDONALD, M.A. (1979) Breeding data for birds in Ghana. Malimbus 1: 36-42.

MACKENZIE, P. (1979) Birds of the Calabar area. Malimbus 1: 47-54.

MANSER, P.D. (1984) Rice pests in the Gabon. Rice Commission Newsletter Vol. XXXIII No. 1.

MOREAU, R.E. (1950) The breeding seasons of African birds I. Land birds. Ibis 92: 223-267.

MORRIS, D. (1957) The reproductive behaviour of the Bronze Mannikin - Lonchura cucullata. Behaviour 11: 156-201.

MURTON, R.K., WESTWOOD, N.J & ISAACSON, A.J. (1964) The feeding habits of the Woodpigeon Columba palumbus, Stock Dove, C. oeneas and Turtle Dove, Streptopelia turtur. Ibis 106: 174-188.

PAYNE, R.B. (1980) Seasonal incidence of breeding, moult and local dispersal of red-billed fire-finches - Lagonosticta senegala in Zambia. Ibis 122: 43-56.

WARD, P. (1969) The annual cycle of the yellow-vented bulbul in a humid equatorial environment. J. Zool. (Lond). 157: 25-45.

WOODALL, P.F. (1975) On the life-history of the Bronze Mannikin. Ostrich 46: 55-86.

Hazel S. S. Thompson, Zoology Department
Fourah Bay College, Freetown