THE PATTERN OF MIGRATION OF VILLAGE WEAVERBIRDS (*PLOCEUS CUCULLATUS*) IN SOUTHWESTERN NIGERIA

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ABSTRACT.—I investigated the migration of Village Weaverbirds (*Ploceus cucullatus*) in southwestern Nigeria in order to determine the sources of birds causing crop damage. I observed banded adult, juvenile, and nestling weaverbirds at their colonies, roosts, and feeding grounds. Over a 21-month period, 6 birds were recaptured at the point of ringing and another 6 at a maximum distance of 1.5 km from the point of ringing. This and other observations indicate that Village Weaverbirds do not undertake long-distance migrations and that local bird populations cause the damage to local crops. Some Village Weaverbirds roost on shrubs and grasses throughout the year, some breed and sleep in colonies in villages from January to early August and from October to early December, and some roost in tall trees near human dwellings from late December to April. The birds roosting on shrubs and grasses are more accessible than the birds roosting in tall trees, and their elimination would provide a more effective means of control than does the present method of scaring the birds from a particular area. *Received 2 December 1981, accepted 7 February 1983.*

VILLAGE Weaverbirds (*Ploceus cucullatus*), notorious avian pests, have been implicated in the destruction of many cereal and tree crop plants. They have contributed to the complete destruction of unprotected rice fields in southwestern Nigeria (Funmilayo and Akande 1977, 1979), and they defoliate crop plants such as maize, oil palm, coconut plam, and banana (Crook 1960, 1963; Collias and Collias 1964, 1970). Funmilayo (1975) reported that severely defoliated oil palm and coconut palm trees were unable to produce fruits. Village Weaverbirds damaged 30% (Funmilayo 1976) and more than 40% (Walsh 1969) of the maize ears in two different localities in Nigeria.

Apart from the various forms of scaring the birds away, there are no systematic measures currently available for reducing crop damage by Village Weaverbirds. Therefore, there is an urgent need for a better understanding of the ecology of this species as a prerequisite to formulating effective control measures. This study was designed to determine the annual movement and the sources of the birds that are responsible for crop damage in southwestern Nigeria. In this report, migration will be defined in its general sense to mean the movement of individuals in the population (Elton 1933).

STUDY AREA

The vegetation, rainfall, and grain crops of the study area are briefly described here because of the effect they have on weaverbird migration. The vegetation zone of southwestern Nigeria, from the coast through the hinterland, is made up of mangrove and coastal vegetation, freshwater swamp communities, dry lowland rainforest, derived savanna, and southern and northern guinea savanna (Keay 1953, Hopkins 1974).

The published mean monthly rainfall (for 48 yr; Anon. 1961) is used to describe the pattern of annual rainfall for this study area. Heavy rainfall (greater than 138 mm of rain/month) was recorded from May to October, except during August (when mean rainfall was only 89 mm/month). Thus, the rainy season (about May–October) is divided into early (May–July) and late (mid-August–October) rainy seasons. November, December, January, and February are the driest months, with means of 45.7, 10.2, 10.2, and 22.9 mm/month, respectively. There is heavier rainfall during March and April (88.9 and 137.2 mm/month, respectively) than during the preceding 4 months, even though the dry season can be said to last from November to April. Bushes are set on fire from the end of December to April, and patches of green vegetation are generally seen only along the streams.

Maize, rice, and guinea corn are the major cereals grown on peasant and institutional farms in the study area. Farms are established within a few kilometers

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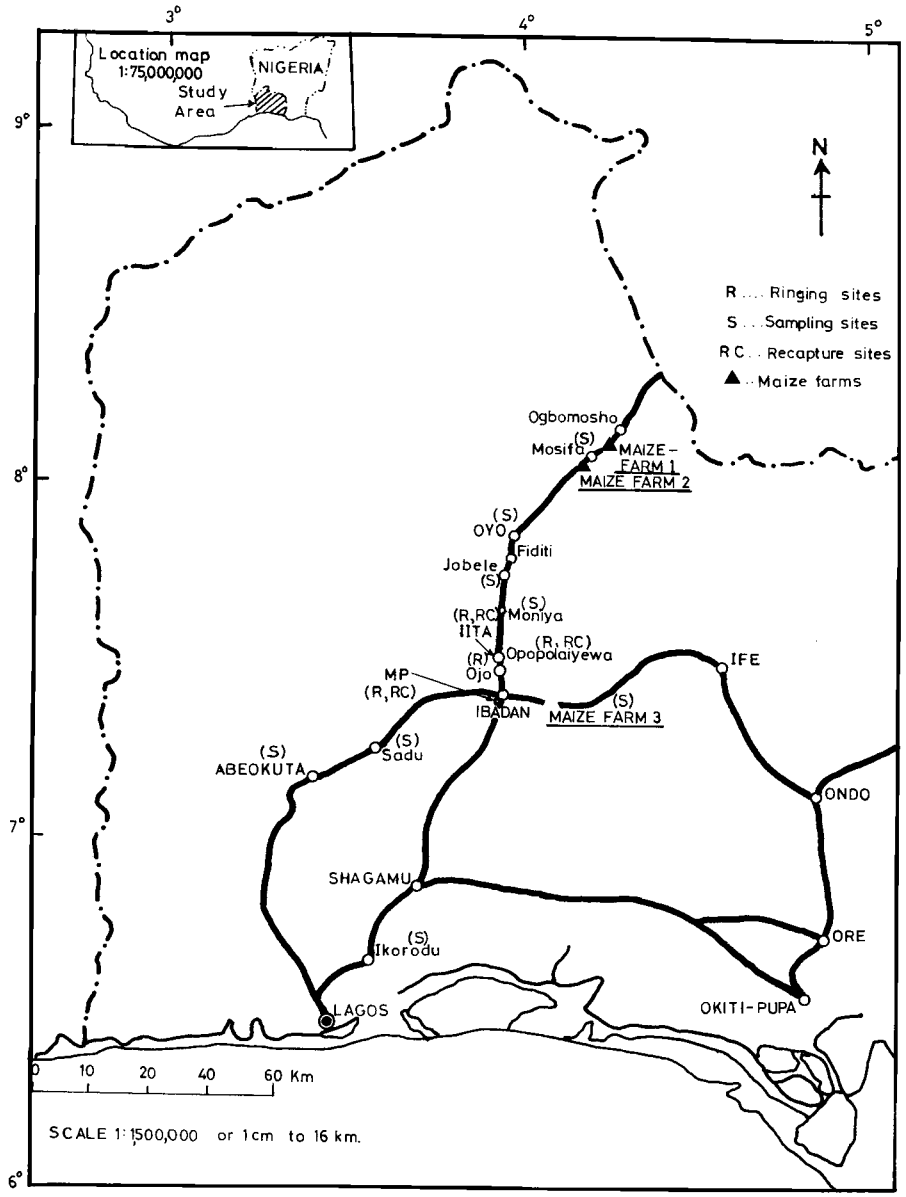

Fig. 1. Map of the study area in southwestern Nigeria. R = locations where birds were ringed. S = locations where populations were sampled in an attempt to recover ringed birds. Rc = locations where ringed birds were recovered. Sampling locations were chosen to ensure that ringed birds were captured no matter which direction they migrated after ringing.

of human habitation. Crops are sown on different dates within the growing season, so they mature at different times on farms within the same locality. Maize planted during the early rains starts maturing in May and begins to dry up in July and August. Late maize matures in October and dries up in November/December. Upland rice and guinea corn mature from September to October. Irrigated rice and maize, existing only on institutional farms, mature during the driest months of the year. Fruits from oil palm trees (both cultivated and wild) also ripen during the dry season. Village Weaverbirds in different colonies

TABLE 1. Recapture records in the study area from August 1976 to May 1978.

Number of birds ringed					Number of birds recaptured							
Place	Date	Nestling	Adult[a]	Total	Place	Distance (km)[b]	Date	Weeks	Nestling	Adult[a]	Total	Sex[c]
Opopolaiyewa (colony)	8–9 June 1977		45	45	Opopolaiyewa	0	22 June 1977	1.9		1	1	M
					IITA maize plots	1.5	30 Aug 1977	11.9		1	1	M
	18 June 1977	21	33	54	Opopolaiyewa	0	24 July 1977	5.3		1	1	F
					IITA maize plots	1.5	30 Aug 1977	10.6		1	1	M
					IITA rice plots	1.5	24 Mar 1978	39.9		1	1	M
	22–24 July 1977	7	77	84	IITA maize plots	1.5	30 Aug 1977	5.4	1		1	J
					IITA *R. exaltata*	1.5	15 Dec 1977	20.7	1		1	J
IITA maize plots	30 Aug 1977		44	44	IITA *R. exaltata*	0	15 Dec 1977	15.3		1	1	J
					IITA rice plots	0	24 Jan 1978	21.0		1	1	F
					IITA rice plots	0	12 Mar 1978	26.3		1	1	F
					Opopolaiyewa	1.5	17 May 1978	38.1		1	1	M
Moor plantation maize plot	13 Aug 1976		48	48	Moor plantation	0	22 Aug 1977	53.0		1	1	F

[a] Adult includes males, females, and juveniles.
[b] Distance from ringing spot.
[c] M = male, F = female, J = juvenile.

breed at different times of the year, but the timing is such that there are birds breeding in the study area during every month of the year. Other details about the study area are available elsewhere (Adegoke in prep.).

METHODS

This investigation was carried out between 1976 and 1978 in villages and farms shown in Fig. 1. Nestling weaverbirds from the colony at Opopolaiyewa were ringed in June 1977. Each nestling was taken out of its nest and weighed, and one colored ring of size XCL was slipped onto one of its legs before it was returned to its nest. In ringing nestlings, I used rings of a different color for each month.

Adult, subadult, and juvenile birds were captured with mist-nets among feeding, roosting, or breeding populations at IITA (International Institute of Tropical Agriculture), Moor Plantation, Ojo, Opopolaiyewa, and maize farms 1 and 2. Each bird caught was weighed, and two rings of different colors but of the same size were placed on one leg. The relative positions of the two rings consequently aided in the identification of individuals sighted later.

Before each bird was released at the point of ringing, a record was made of the sex, body weight, type and relative position of the colored rings, the leg ringed, and the place and date of ringing for each bird. The records of all the birds ringed (including nestlings) were compiled into a "summary list of ringed birds." Marked birds were visually monitored to determine their annual movements. All the colonies established near IITA were observed twice monthly during both daylight and night hours between July 1976 and July 1978 to determine the months during which these colonies were inhabited or deserted by the birds.

Birds were captured from feeding, breeding, and roosting populations with mist-nets at least monthly during the entire study period. Whenever a ringed bird was recaptured or when ringed birds were observed and identified, the distance from the site at which the bird was originally ringed to the site at which it was recaptured or sighted was measured with a calibrated meter attached to a motor vehicle.

Large concentrations of roosting Village Weaverbirds found on the campuses of Ibadan Polytechnic and the University of Ibadan and at the villages of Fiditi, Jobele, and Ikorodu were observed at least twice a week in order to monitor their movements and roosting habits.

RESULTS

During the 2 yr of this investigation, birds were recaptured either at the point of ringing or at a maximum distance of 1.5 km from the point of ringing (Table 1), even though populations found several kilometers away from ringing spots were sampled in an attempt to recover ringed birds (Table 2). Locations where ringed birds were recovered are shown in Fig. 1. A total of 232 birds, of which 73 were nestlings, was ringed between 8 June and 24 July 1977 at the breeding colony at Opopolaiyewa. Of these, 7 birds (4 males and 3 females, 4.4%) ranging in age from juvenile to adult and 2 nestlings (2.7%) were recaptured while feeding with other birds near the colony at IITA, 1.5 km away. One male and one female ringed at Opopolaiyewa on 9 and 18 June 1977, respectively, were recaptured on 22 June 1977 (1.9 weeks after ringing) and 24 July 1977 (5.3 weeks after ringing), respectively, while feeding in a maize plot about 1.0 km away. I observed flocks of birds from the breeding population at Opopolaiyewa performing daily shuttle movements to suitable trees, where they obtained nesting materials, and to the maize plots, where they fed on maturing fruits, from May 1977 onward.

In July 1977, when ears were dry in the maize plots near the breeding colony at Opopolaiyewa, many flocks of birds left the colony to attack rain-fed rice and maize plots at IITA. At the same time, many flocks of birds came to the same maturing rice and maize plots at IITA from colonies established approximately 1.5–2.5 km to the east, 1.5–2.0 km to the southeast, and 0.5–1.5 km to the south of IITA. This led to the

TABLE 2. Record of ringing and recapture of birds in the study area from 1976 to May 1978.

Location	Number captured	Number ringed	Number recaptured with ring	Distance from Opopolaiyewa (km)[a]
Mosifa	38	—	—	64
Oyo	102	—	—	34
Moniya	241	—	—	13
Ojo	—	20	—	3
Opopolaiyewa	389	228	7	0
IITA	442	44	4	1.5
Moor Plantation	213	48	1	12
Maize farm 1	11	6	—	74
Maize farm 2	13	8	—	63
Maize farm 3	57	—	—	8
Sadu	151	—	—	69
Abeokuta	78	—	—	74
Ikorodu	107	—	—	129

[a] Opopolaiyewa is taken as the point of reference, because more than 33% of the total number of birds ringed are from there.

concentration of many hundreds of birds around these croplands. Birds dispersed daily in the direction of their colonies after they fed on the rice and maize plots at IITA. During the months when breeding populations inhabited colonies, migration was limited to daily shuttle movements to obtain food and nesting materials. Observations with a search light at night (2000–2300) of nests in colonies established near IITA indicated that birds were sleeping in these colonies throughout all months of the year except late August–September 1977 and 1978 and early December 1977, when nests in these colonies were empty and birds were not breeding. This indicates that birds emigrated from these colonies in late August and again in early December in 1977 and in late August in 1978.

During each month from August 1977 to July 1978, a single large concentration of birds slept communally in night roosts established on *Rottboellia exaltata* (August–November 1977), on common cattail (*Typha latifolia*, December 1977–April 1978), and on shrubs near a human dwelling (May–July 1978). All night roosts were located within or near IITA, 1–2.0 km from rice and maize plots. These observations indicated that during the months when some birds were breeding and sleeping in colonies (January–August, October to early December 1977), other birds were sleeping in night roosts.

The roosting population at IITA fed daily either on rice or maize or on grasses like *R. exaltata* inside IITA. Two adult male birds weighed 43 g each when they were ringed at Opopolaiyewa on 9 and 18 June 1977, respectively. They weighed 48 g and 46 g when they were recaptured on 30 August 1977 (11.9 and 10.6 weeks after ringing) among the roosting population attacking rice and maize plots at IITA. Another male, ringed at Opopolaiyewa on 18 June 1977, was recaptured on 24 March 1978 (39.9 weeks after ringing) in an irrigated rice plot at IITA. Two nestlings ringed on 24 July 1977 at Opopolaiyewa were recaptured, while feeding with other birds, as juveniles, one on 30 August 1977 (5.4 weeks old) in a maize plot, and one on 15 December 1977 (20.7 weeks old) in an area of *R. exaltata* vegetation at IITA. These two nestlings were sparrow-like, and the 20.7-week-old juvenile weighed 31 g and possessed a rudimentary ovary weighing 3.9 mg. These results indicate that the population that bred in the colony at Opopolaiyewa and their offspring were among the birds that damaged rice and maize crops at IITA.

Out of the roosting population that attacked rice and maize plots at IITA, 44 birds were ringed on 30 August 1977, and 3 birds (1 male and 2 females, 6.8%) were recaptured at IITA. The male was recaptured on 15 December 1977 (15.3 weeks after ringing) while feeding on *R. exaltata*, and the two females were recaptured on 24 January 1978 (21.0 weeks after ringing) and on 12 March 1978 (26.3 weeks after ringing) while feeding on irrigated rice crops at IITA. These results indicate that birds from the roosting population were also responsible for damage to irrigated rice crops at IITA. Out of the population attacking upland rice and maize crops at Moor Plantation, 48 birds were ringed on 13 August 1976, and a female (2.1%) was recaptured on 22 August 1977 (53.0 weeks after ringing) while feeding at Moor Plantation. This indicates that, among the Village Weaverbirds attacking a crop in a given year, there may be some birds that damaged the same crop field during the previous year.

Apart from the roosting population at IITA, other populations were found roosting from October to December in grasses and shrubs near many villages in the study area. Bushes were set on fire in mid-December. Apart from removing sources of food, burning destroyed the birds' roosting sites established in shrubs and grasses. From late December to April, concentrations of birds made up of many hundreds of individuals were found on the campuses of the University of Ibadan and Ibadan Polytechnic and in the villages of Fiditi, Jobele, and Ikorodu. They slept in tall trees (including *Terminalia catalpa*, *Mangifera indica*, and *Spondias mombin*) near students' hostels or human dwellings in villages. Unlike the roosting population at IITA, which slept in the same night roost for many days before changing to a new night roosting site, these roosting populations were more mobile, feeding on grasses growing along streams (e.g. guinea grass, *Panicum maximum*), fly-catching insects on flowering trees (e.g. *Bombax* sp.), and eating the mesocarp of ripe oil palm fruits. The birds changed night roosting sites almost daily. The large size of this mobile population and the fact that it was the only population found in an area in which many smaller roosting populations had existed shortly before bushes were burnt suggest that the

small roosting populations fused after their roosts were destroyed by fire.

Although I caught more birds during the rainy season than during the dry season (Table 3), this difference does not reflect the actual field situation. Birds sampled during the dry season were caught during the early part of the dry season (November to early December), when irrigated rice and maize were available in the fields and when grasses (particularly *R. exaltata*) had not yet been set on fire. It is interesting to note that after the annual bush fire, when hundreds of birds were observed to attack mature rice fields for most hours of the day, very few birds were caught with the mist-net, because there was a lack of good cover, and the net was easily sighted and avoided by birds. Individuals in the mobile population fed in tall trees for most hours of daylight, which also made mist-netting the birds impossible. Consequently, from mid-December to April, an assessment of the migratory behavior of these populations was limited to visual observations. These indicated that birds migrated over distances longer than the maximum 1.5 km obtained for the recaptured birds. During May, green grass was abundant, grasses like *Eragrostis* sp. were bearing mature fruits, and early maize was maturing in some fields near streams. Many colonies that had been abandoned earlier were re-occupied, and new colonies were established near croplands. Populations of Village Weaverbirds roosting in tall trees were rarely seen during this period, which suggests that many individuals from the roosting populations disbanded to breed in colonies.

Three adult males from the breeding population at Opopolaiyewa were ringed on 8, 9, and 18 June 1977 and were seen on 15 March 1978 (39.7 weeks after ringing), on 15 December 1977 (27.0 weeks after ringing), and on 16 June 1978 (52.0 weeks after ringing) building nests in the colony at Opopolaiyewa. These results indicate that some birds that had bred earlier in the colony at Opopolaiyewa returned to breed after they emigrated to roost at IITA. None of the 14 birds ringed in the colonies established near maize farms 1 and 2 was recaptured. These pieces of land were not cultivated after the birds were ringed, and Village Weaverbirds were not found to inhabit these colonies.

After the first sample of birds was ringed at Moor Plantation on 13 August 1976, a total of 44 samples consisting of 701 birds was obtained between August 1976 and May 1978 among populations breeding in colonies and those roosting or feeding at IITA and Moor Plantation. Out of these 701 birds, a total of 354 was ringed for observations of migration, but only 12 (3.4%) birds were recaptured, some at the place of ringing, some at a maximum distance of 1.5 km from the place of ringing, and some up to 53.0 weeks after ringing.

TABLE 3. Number of birds captured during the dry and rainy seasons at IITA and Moor Plantation from August 1976 to May 1978.

Season	IITA	Moor Plantation	Total
Rainy			
Maize plot	238	161	249
Rice plot	9	7	16
Total	247	168	415
Dry			
Maize plot	12	15	27
Rice plot	11	3	14
R. exaltata	115	75	190
Total	138	93	231

DISCUSSION AND CONCLUSIONS

The data obtained on migration were scanty, because only a small proportion (3.4%) of the birds marked with rings ($n = 354$) was recaptured. My results are comparable to previous records, however. Elliot and Jarvis (1970) recorded only one recapture (0.002%), 24 months after ringing, 21 m away, out of 524 Village Weaverbirds ringed in South Africa between 1963 and 1968. The major set-backs of this method of investigation were that mist-nets could not be used effectively during the late dry season when roosting populations of hundreds of individuals were sighted and that, on many occasions, villagers prevented the capture of Village Weaverbirds, especially when the birds were residing in their villages. Funmilayo (1975) reported a similar antagonistic stance that villagers in this study area took against the capture or molestation of Village Weaverbirds. In the future, a larger number of Village Weaverbirds may have to be ringed to

achieve a higher recapture rate. The methods adopted here, however, appear to be suitable for the collection of more data in the future.

Evidence that food played an important role in the pattern of migration in this species was obtained. When sources of food became scarce near their colonies, breeding populations emigrated from their colonies to IITA, where rice and maize were maturing. It appears that the sources of food were so localized in IITA that the roosting population inhabiting IITA was sedentary, utilizing the same source of food and night roosting sites for many months. On the other hand, other roosting populations at Ikorodu, Jobele, University of Ibadan, and Ibadan Polytechnic, where abundant localized sources of food were not located, were mobile, searching for food in their localities and changing night roosts daily. Visual observations indicated that this population migrated over distances of more than the 1.5 km recorded for recaptured birds. This observation is not surprising, because undetermined migratory distance has been implicated for the Village Weaverbird, which was reported to disappear from Richard Toll (16°25'N, 15°42'W) in Senegal shortly after irrigated rice was harvested and grasses were denuded by fire and livestock (Collias and Collias 1970). It is important to stress, however, that these roaming populations may be a threat to the success of large-scale irrigation schemes planned for the study area (Anon. 1975). Village Weaverbirds did not establish colonies near maize farms 1 and 2 during the next cropping season after the birds were ringed, probably because no cereal was cultivated on these pieces of land after the birds were ringed. Furthermore, the female Village Weaverbird ringed among the population attacking rice and maize plots at Moor Plantation in 1976 was recaptured at Moor Plantation in 1977 among birds that were attacking the rice and maize plots.

The present results, indicating that Village Weaverbirds do not undertake long-distance migrations, agree with previous records in South Africa (MacLachlan 1962, 1963; Elliot and Jarvis 1970). This is a useful finding for control, because it indicates clearly that damage to crop plants is caused by the local bird populations. Control of the local bird populations will therefore stop damage, especially to graminaceous crops in each locality.

More than 80% of Village Weaverbird colonies are located in villages (Bannerman 1949, Adegoke 1979). The birds inhabited the same colony for more than one year, deserting the colony occasionally and coming back finally before the end of the year. This suggests that birds from a colony may be responsible for crop damage over subsequent years. Therefore, the elimination of colonies of Village Weaverbirds with avicides as suggested by Funmilayo and Akande (1979) may reduce crop damage considerably. But the taboo and protection that villagers accord colonies located in their villages (Funmilayo 1975) and the hazard of poisoning human beings and their livestock with avicide would limit the applicability of this method of control. The migration of Village Weaverbirds away from villages to roost in grasses and shrubs, as indicated in the present investigation, is therefore of tremendous advantage in control, because birds could be more safely eliminated in such roosts.

This research has raised a point of scientific interest for the future in that it has indicated a phase in the ecology of this species around which a more effective control method could be formulated. Explosives and application of toxic pesticides have been widely used against Red-billed Queleas (*Quelea quelea*) in the tropics (De Grazio et al. 1971). Park (1980) indicated that the adverse effect to the environment of aerial application of endosulfan in the gallery forest habitat of tsetse flies (*Glossina* spp.) in the Niger section of the 'W' National Park was temporary and insignificant. Whichever method of roost elimination is investigated, however, its cost and consequences to the environment should be evaluated before its use is recommended.

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