

The nesting ecology of weaverbirds in Ekona farms, Southwest Region, Cameroon

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Abstract— Ecological factors play a key role in determining nest construction and success in weaver birds. The objective of this survey was to determine the ecological role on the nest construction in weaver birds in Ekona farms. The research data was collected from March – August 2016, by randomly laying six transects of 1km long and 100m wide each within the study area, and four different locations were visited also to observe the daily nesting-activities of the weaver birds. The ecological data of the weaver birds nesting behaviour was observed and recorded, against the day-period, weather and seasonal changes. The data was analysed using Chi-square and Pearson correlation statistical models. The result showed a positive correlation between the weaver birds' population and nest density in both seasons ($R^2=0.5407$ at $P < 0.05$). Moreover, from the analysis, the relationship between nest-building and plant-type used recorded significance ($X^2=69.1040$, $df=28$ at $P < 0.05$). In addition, it was observed that nest-building in the sunny weather was more intense than in rainy weather, 54.57% for sunny, 42.86% for rainy and 2.7% for cloudy weather conditions. Furthermore, there was a significant relationship ($X^2=830.752$, $df=44$ at $P < 0.05$) between weaver birds' activities and the day-period. The study has revealed that both the seasonal and weather changes can affect the nest-building activities of the weaver birds in Ekona farming area.

Keywords— Weaver birds, population distribution, nesting behavior, nest building, weather.

I. INTRODUCTION

Weaver birds form large foraging flocks and nesting colonies, are often involved in synchronized competitive actions such as displacing other bird species in foraging areas and mobbing intruders near and within colonies (Lahti, 2003). Weaver birds build elaborate, enclosed nests in often dense colonies, and prefers the proximity of human habitation and agriculture (Lahti *et al.*, 2002). Weaver nests represent one of the most remarkable constructions produced by any animal. In most species

the male makes the major contribution to nest construction, and the female adds lining if she accepts a nest. In the 'true' weavers (subfamily Ploceinae) males construct intricately woven nests using thin strips of plant material. Typically, nest-building starts with the construction of a bridge between supports, usually thin twigs. The male then perches on this bridge while weaving the nest bowl (Collias and Collias 1964). The nest entrance is either to the side or faces vertically downwards; in some species it is extended into a tunnel from 10 cm to more than 1 m long. Nests of buffalo-weavers (*Bubalornis niger*) and sparrow-weavers (*Plocepasser mahali*) are composed of dry pieces of vegetation, inserted and interlocked into a complex structure without any weaving or knotting (Collias and Collias 1964). Several weaver species strip the leaves of the twigs around their colonies; this makes the colony more visible but it may be a displacement activity (Oschadleus 2000). In the polygynous species, males build a succession of nests to which they attract females by displaying; the females line the nest, lay, incubate, and rear the nestlings with no or little male assistance. Colonies can consist of hundreds of males or single males (Tarboton 2001). In the monogamous species, sexes share parental duties and build a single nest per breeding season (Tarboton 2001).

A diverse type of host plants preferred by *Ploceus philippinus* was observed in various types of habitats like agricultural fields, forest areas, dams, hillslopes, open wells and irrigation channels. Selection of host plant for hanging the nest is one of the important factors for nest weaving. The plant twigs are generally thin pliable and pendant to horizontal branches (leaves in case of palms) are selected by *Ploceus philippinus* to suspend its nest. Twigs having at thickness more than a human thumb are generally not selected possibly because they can't be accommodated in the grip of claws during the knitting of fibers for the nest initiation. Strongly upward facing branches are also not preferred. Twigs which are sufficiently tough and strong as

to support the weight of nest are selected. Their terminal or bulb terminal portions are used to anchor the report nests. Resources that limit the size and distribution of animal populations can also determine the composition and structure of communities in ecological networks. For example, abundance of food often determines how bird species compete and coexist in communities (Mac Nally & Timewell 2005). For shelter-using species such as cavity-nesting birds and mammals, population size and community structure may be determined by the availability of shelters (Aitken & Martin 2008). The weaver nests are used both for breeding and roosting and are normally located in a compact group on one side of the nest-tree. The nest have breeding nests (with one entrance) and are easy to identify, they often do not serve a single function: roost nests are often converted into breeding nests and vice versa. Nest building is an important activity of weaverbirds in which all group members participate. Nests have a marked influence on the survival of weaver groups and the communal nest building may therefore be a form of altruism. The selective forces responsible for this altruism could be of prime importance in shaping weaver sociality. When birds build nests, more than one environmental constraint is often involved in determining the nest site. Some bird species often nest on cliffs and not in trees, presumably as an adaptation against predation. However, this nest site preference causes chicks to be exposed to a prohibitive amount of shade and cold. Mosher & White (1976) found that golden eagle (*Aquila chrysaetos*) nests were situated on cliffs where the chicks were exposed to the maximum amount of solar radiation,

and that this improves survival in a cold environment. Golden eagle nest placement is thus a response to predation as well as to ambient temperatures at the nest site.

The impact of weather on the population biology of birds has been a major field of study by ornithologists over the past half century (George *et al.*, 1992). Weather not only affects the metabolic rate of birds (e.g. Cold weather requiring increased energy expenditure for body maintenance), but also exerts other indirect and direct effects on bird behaviour. For example, it can influence foraging conditions and the ability to carry out other essential behaviours, such as courtship. Weather also impacts on breeding success through, for example, chilling or starvation of young (Humphrey, 2004). Extreme weather events, such as prolonged frozen spells and droughts, can have catastrophic effects on bird populations, including long-term effects on whole cohorts (Humphrey, 2004). The aim of this study was to investigate the effect of weather and seasonal changes of the nest-building activity of the weaver birds in Ekona farmlands.

II. MATERIALS AND METHOD

Study area

This study was carried out in Ekona town which is located in Muyuka Sub-Division found in Southwest Region of Cameroon. Ekona is located between latitude 4° 9' N of the equator and longitude 9° 14' E of the Greenwich Meridian. The town is located along the Atlantic Coast within the Gulf of Guinea. The area has a surface area of about 179km² with an estimated population of 17513 people (National institute of statistics, 2005).

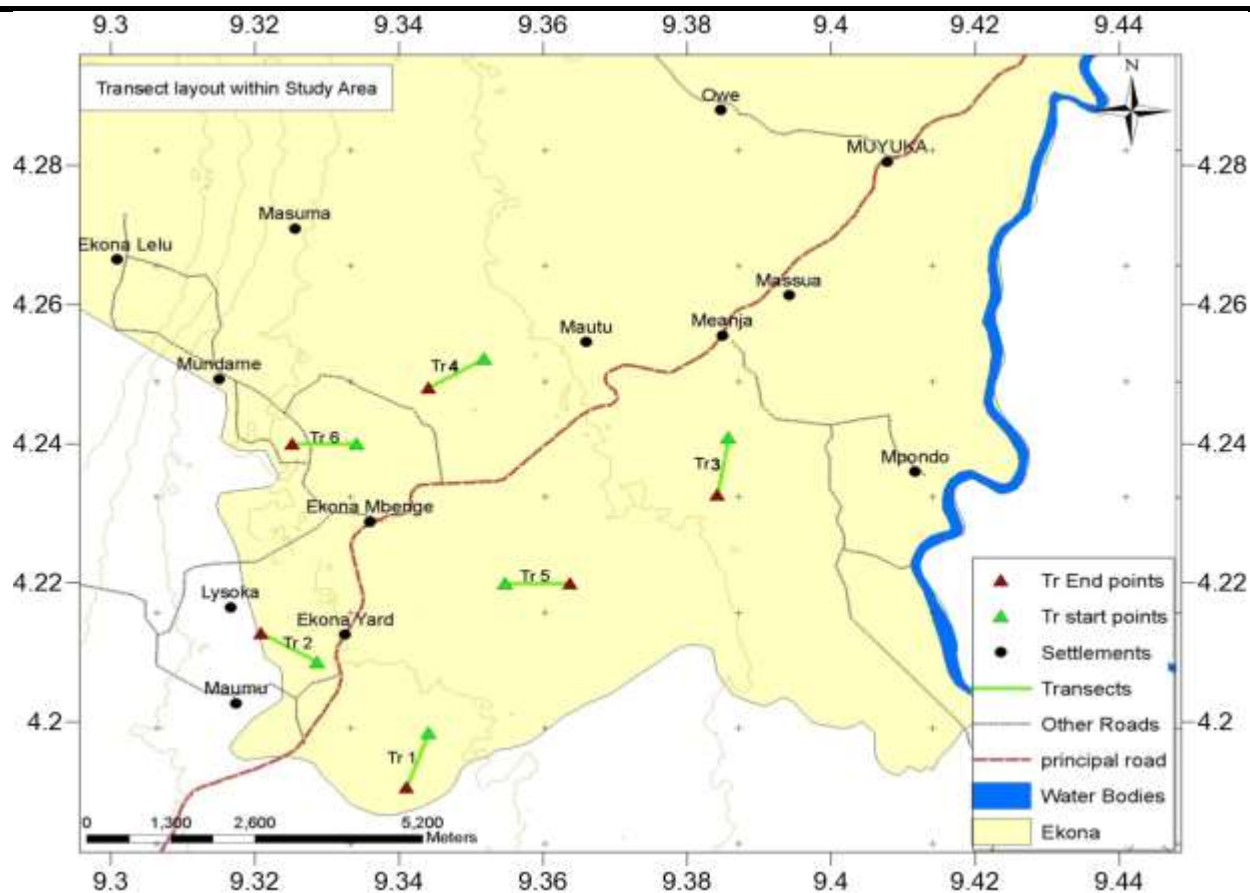


Fig.1: Map showing the location of study area, Source (Field Study, 2016)

The observation and counting of weaver birds' nest

Birds are perhaps the easiest of animals to enumerate. They are often brightly coloured, relatively easy to see, and highly vocal. They are also very popular to study, often give away their presence vocally and their calls and songs help to detect many species of birds. There are, however, some potential pit falls in birds' song as a census tool. In the present study, the field work consisted of direct observation of birds in the open and hide situations (Colinetal, 1993). During Field survey, the exact location of nesting activity of weaver birds was detected by following their calls and songs. The nest-built on tall plants and in remote places were observed from distance with binoculars. In each transect, birds' nests were counted within 10 sampling points for spot-count method. The same points were used both in dry and wet seasons. Upon reaching a point, 2-5 minutes were provided for the birds to settle in case of any disturbances (Bryan *et al.*, 1984). Ten minutes were used to count and record all birds nest and activities observed or heard within 30m radius (Terborgh *et al.* (1990) and Robinson *et al.*, (2000)). The study was conducted from 06:30am – 6:30pm each day (Stevenson and Fanshawe,

2002). A total number of 6 transects were laid, with a dimension of 1 kilometer in length and 100m in width within disturbed and undisturbed vegetation habitats. In laying these transects, a compass was used to get the direction and bearing readings for each of the transects. A Global Positioning System was also used to get the geographic coordinates to mark the starting and ending points of each transect. A measuring tape (100m) was used in measuring the length and width of the transect line. The direct counting method used involved the observation and counting of weaverbird nests along the transect line. This method has been used to monitor relative abundance of diurnal raptors, sparrow-weaver colonies (Douthwaite, 1992a). The nests were observed on a transect-walk for each day of the month within the entire study period. Four different zones with different groups (colony) of weaverbirds were visited for a period of 4 months. The ecological parameters like weather changes, day-period and seasonal changes were recorded at same time. The research data collected was analysed by using Chi-square and Pearson correlation statistical packages.

III. RESULTS**Nests count**

During this study, a total number of 2,710 weaverbirds nests were counted and recorded as shown in table 1. Table 1 also shows the percentage of weaverbirds' nests population found in each transect with T1 having a nest

population of 777, T2= 678 nests, T3= 318 nests, T4= 323 nests, T5= 240 nests and T6= 374 nests, with percentages of 28.8%, 25.1%, 11.7%, 11.9%, 8.9% and 13.9% respectively. The total average mean nest population was 415 nests.

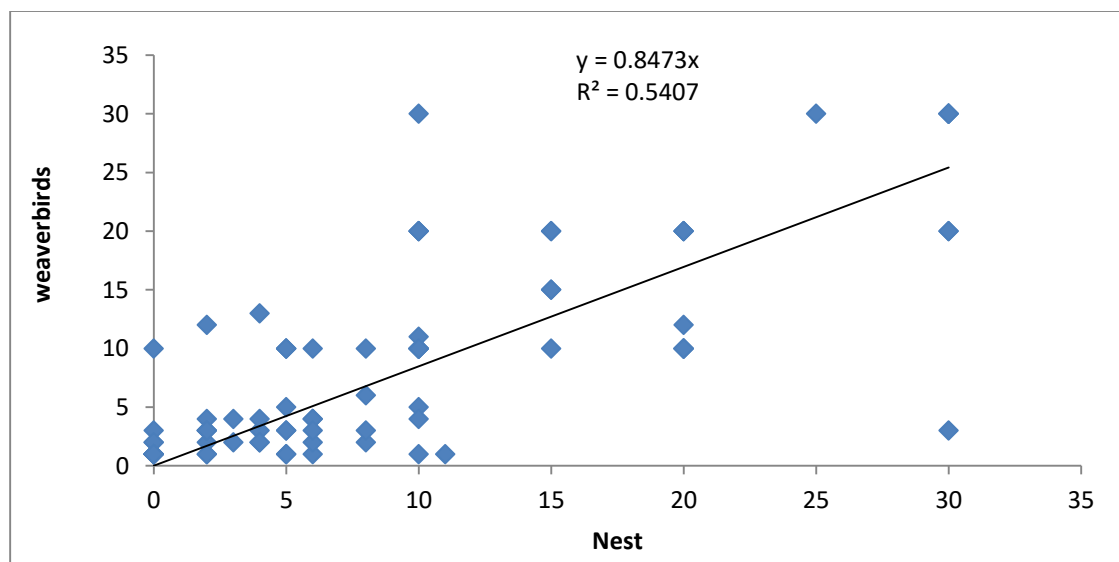
Table.1: Nests count

Months	T1	T2	T3	T4	T5	T6
March	66	82	33	54	9	36
April	130	131	68	56	25	60
May	98	152	46	58	40	72
June	139	113	56	75	64	95
July	199	138	57	44	50	52
August	145	62	58	36	52	59
Total	777	678	318	323	240	374
	(28.8%)	(25.1%)	(11.7%)	(11.9%)	(8.9%)	(13.8%)

T= transects

Relationship between weaver bird nest in the Dry and wet seasons

The results has shown (fig.2 and 3) a positive correlation on the weaverbird nest population distribution and seasonal changes ($R^2 = 0.5407$ at $P < 0.05$). Also, the results showed a negative correlation of the nests distribution in the wet season, fig. 3.

*Fig.2: Relationship between weaver birds and nest population in the Dry season*

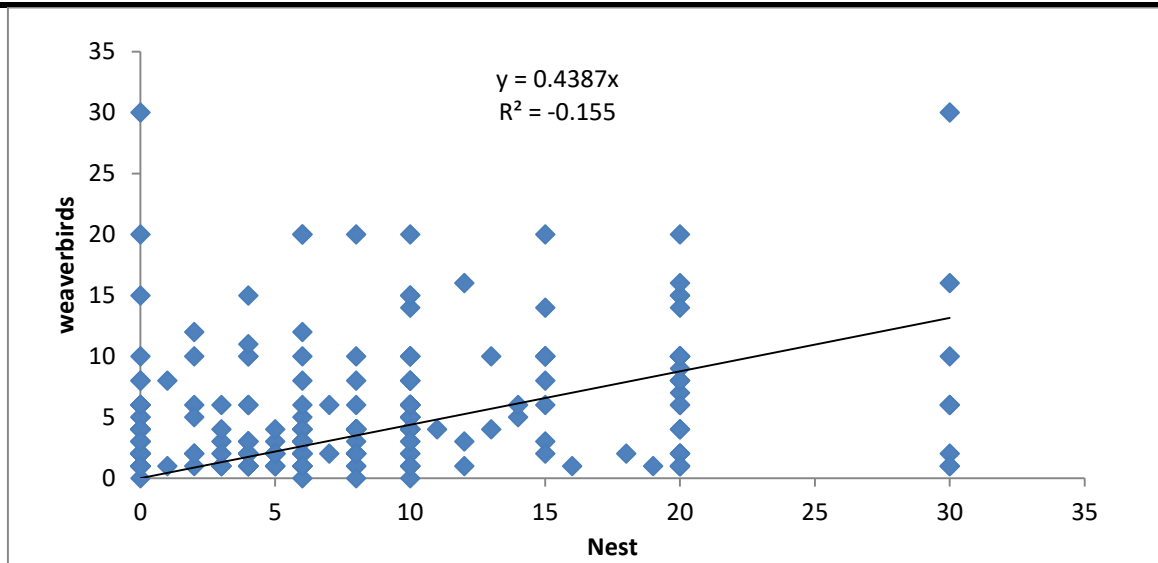


Fig.3: Relationship between weaver birds and nest population in the Wet Season

Identifying plant species used as materials used for Nest-building

Table 2 shows the plant-types on which weaverbirds were commonly observed nesting or picking nesting materials, oil-palm (22.9%), coco-nut (13.5%), maize (16.6%), Elephant-grass (10.7%), pear(8.5%), mango(9.4%) and plantain(10.0%). It was observed that nests are built on any moderately (table 2) tall trees (9-20 m), and some of these trees are of economic value (Mengesha *et al.*, 2011). They

include oil palm (*Elaeis guineensis*), coconut palm (*Cocos nucifera*), mango (*Mangifera indica*), plum (*Pygeum africanum*), Avocado (*Persea americana*) and sweet orange (*Citrus sp.*). Other commonly colonized plants found in the study area include bamboo (*Oxytenanthera abyssinica*) and Elephant Grass (*Pennisetum purpureum*), with plantains (*Musa paradisiaca*) and maize (*Zea mays*), as some of those economic crops in the study area (Funmilayo and Akande, 1976).

Table.2: Plant species weaverbirds perched on

Plant type and S.Name		Transect number						
C. Name	Scientific ame	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Total
Moringa	<i>Moringa oleifera</i>	7	2	0	0	0	0	10
		8.0%	3.9%	0.0%	0.0%	0.0%	0.0%	3.1%
Oil palm	<i>Elaeis guineensis</i>	20	18	7	9	9	10	73
		22.7%	35.3%	16.4%	16.4%	23.7%	21.3%	22.9%
Mango	<i>Mangifera indica</i>	12	5	3	3	2	5	30
		13.6%	9.8%	5.5%	5.5%	5.3%	10.6%	9.4%
		7	5	0	6	3	11	32
Plantain	<i>Musa paradisiaca</i> <i>Musa sapientum</i>	8.0%	9.8%	10.9%	10.9%	7.9%	23.4%	10.0%
Coco nut	<i>Cocos nucifera</i>	9	2	11	11	3	7	43
		10.2%	3.9%	20.0%	20.0%	7.9%	14.9%	13.5%
Maize	<i>Zea mays</i>	10	5	12	12	6	8	53
		11.4%	9.8%	21.8%	21.8%	15.8%	17.0%	16.6%
Plum tree	<i>Pygeum africanum</i>	6	4	1	4	1	1	17
		6.8%	7.8%	7.3%	7.3%	2.6%	2.1%	5.3%
Elephant	<i>Pennisetum</i>	12	5	0	4	9	4	34

grass	<i>purpureum</i>	13.6%	9.8%	7.3%	7.3%	23.7%	8.5%	10.7%
Avocado	<i>Persea americana</i>	5	5	5	6	5	1	27
		5.7%	9.8%	10.9%	10.9%	13.2%	2.1%	8.5%
Total		88	51	40	47	55	38	319
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Nests were built on any moderately tall (9-20 m) tree, plant percentages on which weaverbird extracted materials for nest-building were, oil palm (17.2%), coco nut (2.6%), maize(26.0%), Plantains (15.3%), Elephant grass(15.8%) and pear(2.6%) table 3.

Table.3: Plant species used by weaver birds for nesting in Ekona farming area

Plant	Sc. name	Frequency	Percentage(%)	Used as Nest materials
Moringa	<i>Moringa oleifera</i>	4	0.7%	-
Oil palm	<i>Elaeis guineensis</i>	99	17.2%	√
Coco nuts	<i>Cocos nucifera</i>	15	2.6%	√
Mango	<i>Mangifera indica</i>	77	3.6%	-
Plantains	<i>Musa paradisiaca</i>	88	15.3%	√
	<i>Musa sapientum</i>			
Plum tree	<i>Pygeum africanum</i>	8	1.4%	-
Maize	<i>Zea mays</i>	150	26.0%	√
Elephant grass	<i>Pennisetum</i>	91	15.8%	√
	<i>purpureum</i>			
Sun flower	<i>Helianthus annuus</i>	23	4.0%	-
Pear	<i>Persea americana</i>	15	2.6%	√
Paw paw	<i>Carica papaya</i>	6	1.0%	-
Total		576	100	

[√]= plants commonly used as nesting materials

Nest-building and weather

It was observed that nest-building was more during the sunny weather than during the rainy weather, and very low nest-building activity was observed during a cloudy weather condition, with percentages at 54.57%, 42.86%, and 2.7% for cloudy weather conditions (fig.4).

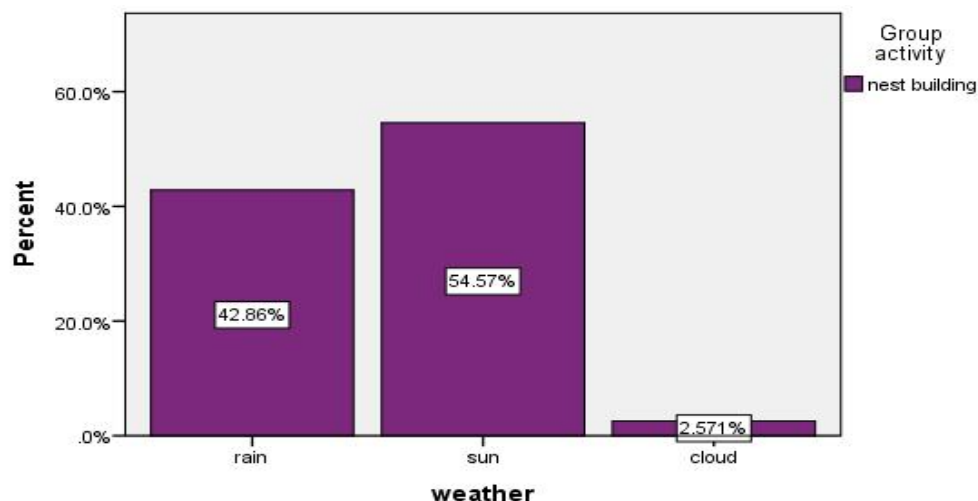


Fig.4: Nest-building and weather

Relationship between nest-building and plant-type

It was observed that nest-building has a strong relationship with some crops amongst other activities carried out by the weaver birds (fig.4). Nests were observed more on Maize plants (n=165), oil palms (n=114) and plantains (n=94). Moreover, the results revealed a significant relationship between nest-building and plant-type ($X^2 = 69.1040$, $df = 28$, $P < 0.05$), table 4.

Table.4: Relationship between nest building and plant type

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	69.104	28	.000
Likelihood Ratio	71.643	28	.000
Linear-by-Linear Association	4.604	1	.032
N of Valid Cases	576		

Table.5: Relationship between weaver bird activity and time of the day

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	830.752	44	.000
Likelihood Ratio	703.484	44	.000
Linear-by-Linear Association	.016	1	.899
N of Valid Cases	576		

From analysis, it was realized that there was significant relationship ($X^2 = 830.752$, $df = 44$, $P = 0.000$) between activity and period of the day.

IV. DISCUSSION

In many avian species, understanding the factors influencing nesting ecology can give vital insight in determining the means of handling the population. Other life cycle elements may also come into play, one of which is adult survival, however, nest-building has the greatest effect on recruitment, and is also the most easily studied and managed. Understanding the influences on nest-building is important for conservation purposes, and for predicting how a population of weaver bird in Ekona farming area may be affected by a disturbance. In many species it has been observed that nest-building declines after the breeding season. This reduction in number of nests may have a number of causes, including a decrease in food availability for nestlings, an increase in predation pressure, or a decline in habitat quality. It would seem that breeding as early as possible would be ideal, but the breeding female is constrained by low food availability (Perrins 1965).

The stripping of leaves from plant species such as oil-palm, coco-nut, maize and plantains leads to the complete damage

of the plants in a long run, as they lack leaves for food production necessary for the plant growth and sustenance. Defoliation leads first to reduction in the fruit yielding capabilities of the trees and later the death of the trees (Funmilayo, 1973). The tearing down of rejected nest implies the need for materials for the construction of another in its place. This is done constantly as the female weaver will reject a nest, which therefore leads to more damages to crops in the process of acquiring more material to construct new nest. Estimates of physical losses, however, underestimate true economic losses as they do not account for costs entailed by the supply response adjustments that farmers make when faced with pests. Farms nearer to trees with extensive canopies and branches in Ekona farms were observed more attacked because of the weaverbirds colonization of these trees. In the study area, farmers identified weaverbirds as a major pest on maize, plantains and palms, hence, applied a number of traditional methods used in managing the menace from the birds. Guarding, human scaring which was used most by the

farmers, definitely consumed the time of their family, but this however was not probably included in their estimate costing of control expenditure, similar to findings from De Mey *et al.*, (2013) which explains that direct economic impacts, bird damage also has substantial social consequences. On the one hand, farmers who scare birds in the field are socially separated from their family for a long time. On the other hand, traditional bird scaring is frequently undertaken by children who sometimes miss school, and in doing so, jeopardizes the key education objectives such as universal primary enrolment (De Mey *et al.*, 2012).

Nest-building and the nesting materials

Weaverbirds normally use only fresh, green, flexible materials to weave their nests. The outer shell is woven by the male, into long strips torn from the leaves of elephant grass or palms. At one of the colony sites in the study area, the nest-shell was woven with strips of leaves from oil palm and maize, and lined with cassava leaves (table 3). When freshly completed the nest is approximately 18 cm long and weighs 30 g. The entrance of the nest faces downwards or sometimes sideways and is about 8 cm x 8 cm wide (Yisau *et al* 2014). Many nests are left uncompleted while many completed ones are destroyed after some time and again re-built or totally abandoned. The number of nests present in the colony tree at any one time reflects the turnover rate between nests built and nests destroyed. After a week or two a male will usually tear down a nest that has been consistently ignored or rejected by inspecting females and build a fresh model in its place (Collias and Collias, 1964).

Nest-building, weather and seasonality

Weaver bird nest-building characteristics are affected by seasonality aspects and weather conditions (fig. 4), this is in agreement with Rahayuninagsih *et al.*, (2007) who found bird community structures be affected by several factors. Similarly, habitat diversity and changes, seasonal variations in climate and natural resources have affected weaver bird building structure of the study area. Thus, higher nest-building in the disturbed habitat and lower in the undisturbed habitat could be attributed to the difference in the vegetation community structure of the two habitats that determine food, water and cover availability (Mengesha *et al.*, 2011). The disturbed habitat had diverse crop plant species mixed with the remnant original vegetation community. This could be the reason for high bird species richness in this habitat (Mengesha *et al.*, 2011). There was increase in nest-building activities during the wet season as compared to the dry season in transect 3 and transect 5

which had undisturbed vegetation, unlike the disturbed habitat (transect 4, transect 3, transect 2 and transect 1) that were located within the agricultural farms and human settlement were remarkable with increase nesting activities in the dry season more than the rainy season. This might be due to the seasonal variation in the structure and types of plant communities that contributed to the availability of nesting material and the presence of weaverbirds in the study area. On the other hand, alteration of the shrub, tree and canopy layers might have caused a reduction in the total nesting resource availability for the weaver birds (Ukmar *et al.*, 2007). The presence of more preferred trees species for nesting in this study contributed the huge number of the weaverbird population in the farms as compared to the findings of Inah, *et al.*, (1999) who noted that the presence of the birds' population could be influenced by a high agricultural activity taking place in the farming area. The observed colonization of some oil-palm, mango and coconut trees in transect 4 and transect 6 could be as a result of their location within and close to farms, which confirms the findings of Lahti and Lahti (2002).

V. CONCLUSION

The high ability of birds to survive in many parts of the world, even areas of extreme environmental conditions is based on their adaptability, intelligence, sight, and flight flexibility. In addition, the feeding ecology of birds is very diverse, and their feeding strategy has been survived during food scarcity by resistant long flight from one place to another and continent to continent. However, the population increase of the weaver birds in certain countries has presented challenges with severe financial implication in the agro-industry. And, the most seriously affected are the local farmers who would often not be able to afford the cost of preventing these bird-pests from visiting their farms. The study of the weaver birds' invasion and nest-building success in Ekona farming area has revealed that most of the nests were weaved and built with plantain, maize and palm leaves, materials harvested from the same farms. Moreover, the nest-building activities were high during the bright sunny weather and the dry season. The peasant farmers whose main survival force is the crop-farms are often seriously impoverished by the poor crop-harvest. Furthermore, the plantain and palm stems anchoring most of the nest and the nest-building activities would often wither, increasing more chances of unsustainable cultivation.

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