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The Destruction of Feeding and Nesting Behaviors of Weaver-birds in Urban Crop-farms, Buea Municipality, Southwest Region, Cameroon

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ABSTRACT

Bird damage to agricultural crops has been a chronic problem in many parts of the world. Although considerable effort has been made in developed countries to solve local or regional bird damage problems, very little effort in fighting the bird pests is witnessed in developing countries. Majority of avian pests are weaver-birds which cause serious damage to cereals, maize, rice, sorghum, millet, palms, plantains, and wheat cultivated in many parts of Africa, and form a staple diet in many localities. The aim of this study was to assess the feeding behavior of weaver-birds in the key neighborhoods of Buea municipality. The research data collection program was done by a research team made up of four persons, the principal investigator and three other student colleagues. The three-month study witnessed a research data collection process, from 7:00am – 6:00pm each day, for a period of 6 days each week, Monday – Saturday. The team visited the key neighborhoods of the city on a daily bases to record observations on weaver-bird species, feeding activity, locations, and day-period. The study revealed a significant link between weaver-bird feeding on crop-part and crop species, $X^2 = 5.188$ df=4, $P<0.05$, and $X^2 = 15.620$ df=14, $P<0.05$ respectively. The study has shown a significant relationship between feeding and nesting behavior, $X^2 = 230.556$ df=7, P=0.000. However, nesting and feeding correlated significantly with the plant species in various neighborhoods, r = 0.607, P=0.000, and $X^2 = 7.164$ df=4, $P<0.05$ respectively. Additionally, the most affected crop-farms were found in Bomaka neighborhood (68.60%), a newly created neighborhood with less houses and more farmland while the least was Bokwango (3.72%), an old human residence. Nevertheless, feeding was more prominent on maize (*Zea mays*), oil palm (*Elaeis guineensis*), and plum (*Dacryodes edulis*), while nesting on sugar cane (*Saccharum officinarum),* banana (*Musa acuminate*), mango (*Mangifera indica*), orange (*Citrus sinensis*), and avocado (*Persea americana*). The eradication of pests such as weaver-birds in croplands has been a huge challenge to the agricultural and wildlife stakeholders in developing countries like Cameroon. Moreover, the high proliferation character of the pest is one of the key problems that has made its population control ineffective and difficult in sub Saharan Africa.

Keywords: Avian pests, Bird damage, Feeding activity, Crop-farms, Crop species

INTRODUCTION

Agriculture plays a prominent role in the economy and society in every country in sub Saharan Africa. Most countries in the region have the natural and human resources needed for strong and sustainable agricultural development and African governments generally put agriculture at the top of their development priorities. Yet agriculture is widely seen as under-performing in this region (World Bank (2007), and Inter Academy Council (2004)). Despite some improvements in recent years a huge human population depending on farming for a living are in poverty. Income gaps between farming and non-farming households still wide and a high percentage of both rural and urban populations suffer from malnutrition and food insecurity. It is an open question however whether these problems can be blamed on poor agricultural sector performance per se or on stagnant agricultural growth itself, as consequence of other factors that constrain economic growth.

Humid tropical areas have commanding agricultural potentials yet food crisis has become a common phenomenon in the region. Cameroon, often referred to as "Africa in miniature", is one of the most diversified countries in sub-Saharan Africa with respect to its agro-ecology: from a sudano-sahelian north to humid forests in the centre, south and east regions. The forests which represent about 40% percent of Cameroon's national territory form an important part of the Congo Basin characterized by a closed canopy tropical forest (Besong *et al*., 2009). Depending on the particular environment, major crops peculiar to most African countries such as rice, wheat, barley, maize, cassava, potatoes, plantains/bananas, yams, cocoa, and coffee etc. are produced in Cameroon. It can be said almost with certainty that the agricultural production systems practiced in Cameroon are similar to those of most African countries whereby the predominant practice of farming is to incorporate many crops on a portion of land in crop associations (ADB, 2002).

The activity pattern of birds in croplands is influenced by a number of factors such as crop type, non-crop physical structural arrangement and the agricultural practices (Rodenhouse et al., 1995). Shift in cultivation timing also significantly affects the activity pattern of cropland birds, which causes further reduction of the population of farmland birds (Jobin et al., 1996). An annual shift in the cultivation timing in India is dependent on the onset of the monsoon. The rainfall period affects bird breeding activities, habitat formation and food availability. In spite of the natural and atmospheric conditions, the increase in land use by humans for purposes other than agriculture influences bird habitat degradation rate, as these birds are sensitive to the changing pattern of agricultural practices (Lohr et al., 2002). Cropland birds have significantly adapted to the dynamic nature due to their unique metabolism and non-selective food habit (Järvinen, 1979). There has been an enormous deterioration in bird populations in the last 30 years and consequently many farmland birds are listed as endangered species (Donald et al., 2006). Considerable measures are required to protect bird biodiversity (Ranganathan et al., 2012). The trend of reduction in cropland area, agricultural intensity and bird biodiversity is not only common in Asia (Semwal et al., 2004), but research in other parts of the world such as North America (Brennan & Kuvlesky, 2005), Europe (Clay, 2004) and Africa (Söderström et al., 2003) also show an identical scenario.

Birds, sometimes numbering in millions, can cause serious damage to crops, and species of birds causing damage to agricultural crops in Africa include weaver-birds (*ploceidae*), waterfowl (*Antidae*), parrots (*Psittacidae*) and seed eaters (*Fringillidae*), and crops frequently attacked include rice, maize, sorghum and oil palm. The main losses result from feeding of the birds on maturing crops, but losses at storage sites can also occur through feeding activity of the birds.

Brugger and Jaeger (1982) reported that bird damage to cereal production began receiving international attention in the mid-1950s and early 1960s when African nations requested assistance from the United Nations. In the early 1970s, a United Nations Food and Agriculture Organization (FAO) project was established in about one dozen Sahelian countries to conduct research into the biology, ecology, and control of weaver-birds and other pest birds. Presently, Unite Nations-funded regional and national projects and government bird control units exist in both East and West Africa; emergency funds are also regularly allocated for control operations in several other countries. Although the adverse impact of bird pests on cereals is generally recognized, very little information on the actual magnitude of losses was available in any of the affected countries until very recently. Long term studies of weaver-birds' seasonal population fluctuations had suggested that the farmer could plan his cropping calendar to avoid planting that would prevent crop fruiting when the weaver-bird pest population was high (Bright and Ogunyemi, 2001a). The Southwest Region of Cameroon is known for its potentials in the production of major agricultural commodities, but farmers' yields from various are low, dwindling over time due to some major weaver-bird pests constraints.

MATERIALS AND METHODS

The description of study area

Buea municipality is found in the Southwest Region of Cameroon, located between longitude 9^0 16' E and latitude 4^0 9' N (fig.1) (Tanjong 2014; Fitton *et al* 1983). The municipality is bounded to the north by tropical forest on the slope of mount Cameroon (4100m above sea level). The population is estimated at about 300,000 people, of whom two-third live in the city of Buea, while the rest in villages. The settlement pattern forms a closed ring around the foot of the mountain with no permanent settlements on altitudes above 1500m. The indigenous people in the area are Bakweri, Bomboko, Balondo and Bakolle (Ekane, 2000). With an equatorial climate, temperature is moderate with a slight seasonal variation (rainy and dry season) (Tanjong 2014). The region is also very diverse in fauna with over 370 species of wildlife recorded. The sub-montane and montane habitats are part of Cameroon mountain endemic bird area. So far, 210 species of birds have been recorded, out of which 8 are threatened and 2 strictly endemic mount cameroon francolin (*Francolinus camerunensis*) and mount cameroon speirops (*Speirops melanocephalus*) Ekane (2000). Agriculture is the most important source of livelihood in the area accounting for about 80% of household income in most villages. Other sources of income include hunting, timber and non-timber forest products (NTFP) exploitation, petty trading, and cattle rearing (Tanjong 2014).

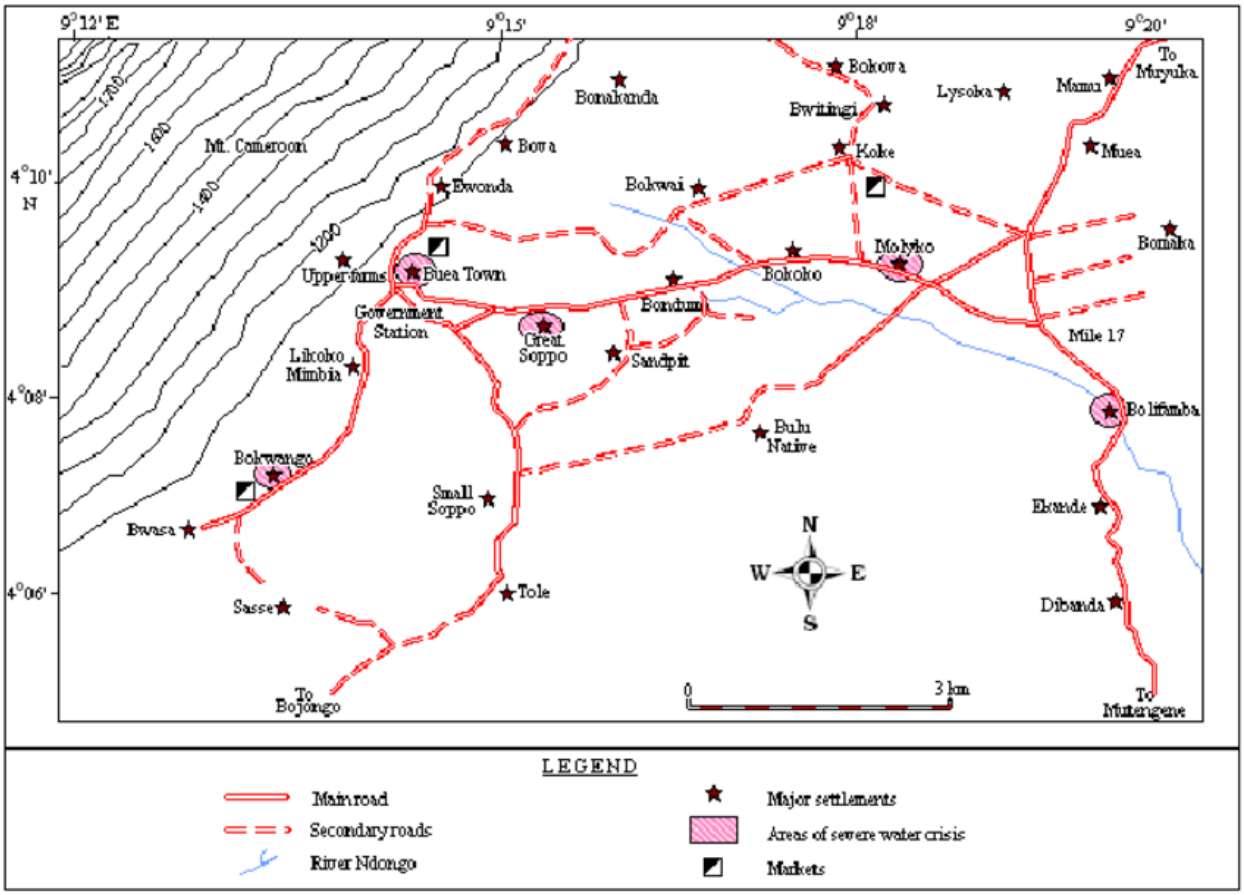

Figure 1: Map of Buea Municipality

Data collection method

The research data collection program was done by a research team made up of four persons, the principal investigator and three other student colleagues. The three-month study was carried out in Buea municipality, and the research data was collected between 7:00am – 6:00pm each day of the study, and was done 6 days each week, Monday – Saturday. The team visited all the neighborhoods of the city on a daily bases to record observations on bird species, feeding activity, locations, and day-period. A five-minute-spot-count method was used throughout the data collection period. Point counts (where the observer is sedentary at one place), is among the most frequently used techniques for monitoring terrestrial birds (Rosenstock et al. 2002). Bird population monitoring programs vary in how they are conducted. The Breeding Bird Survey (BBS), for example, is run in Britain and variants of it are used by 18 other European countries (Spurr 2005). Five-minute point-based distance counts are used in France that specify the area of the sampling site and the distance bands used around each point, (<25m, 25-100-m, and >100-m) (Spurr 2005).

Data analysis

The research data collected on check-sheets was analyzed by the use of SPSS version 20. And the main statistical model used was chi-square to test the relationships existing between the variables such as bird species, bird feeding and nesting activities, and the neighborhood location. Exploratory analysis was used to further examine the frequency of variables like bird activity, environmental condition, and bird species

RESULTS

The study showed the weaver-bird activity frequency of 51.63%, 45.35%, and 3.02% for *Ploceus luteolus*, *Ploceus cuculatus*, and *Ploceus melanocephalus* respectively (fig.2). These bird-pests were not only frequently observed in the study area but are among the dominant bird-pests in Cameroon, and other countries in sub Saharan African region. The birds' population is high and a nuisance to the local farming population, affecting their crop-farm yield on both seasonal and annual bases. The major problem farmers in the local and remote communities are facing is fighting the weaver-bird population. Unfortunately, the primitive approach involving the use of stone-throw, drumming, shouting, and hand-clap chasing rather seems to escalate the farmers' problems since weaver-birds immediately fly off to neighboring farms during the application of such methods.

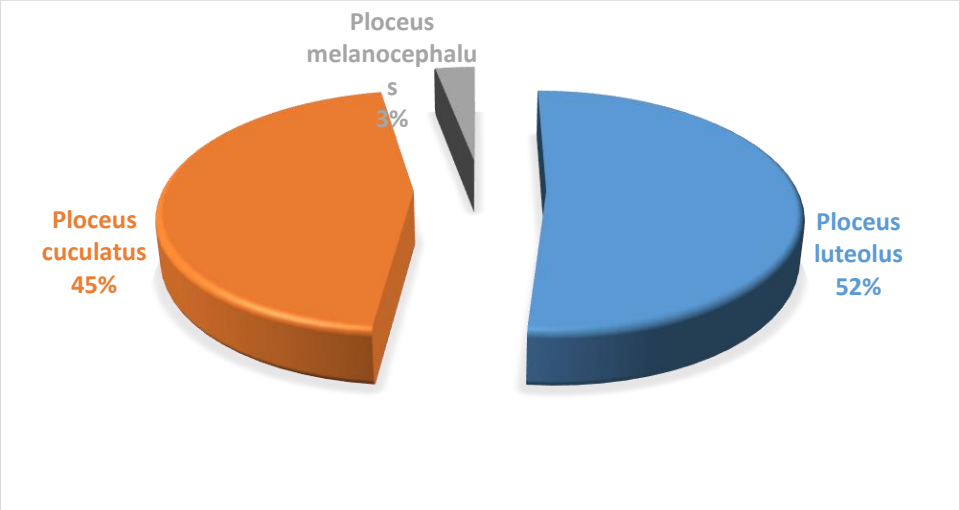

Fig. 2: Frequency of weaver bird species

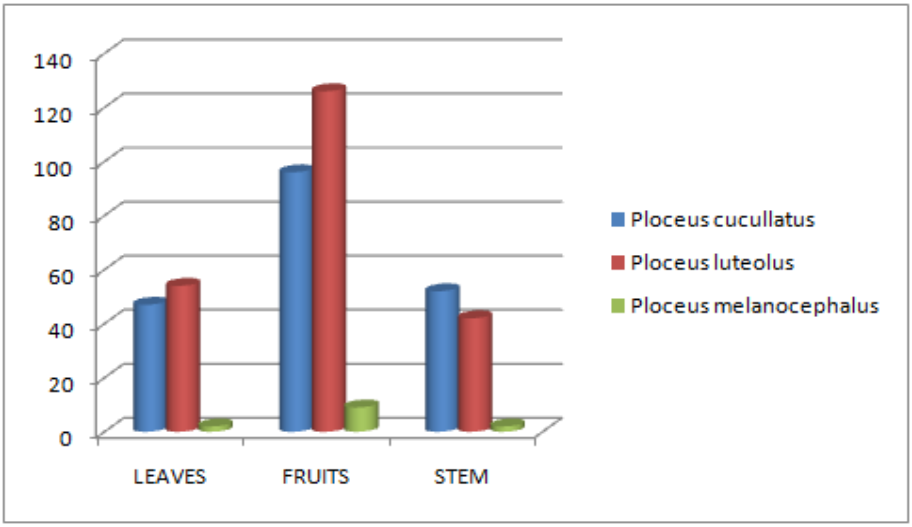

Fig.3: Weaver bird feeding activity and crop-part

There was a significant link between weaver-bird feeding on crop-part and crop species, X^2 = 5.188 df=4, P<0.05 (fig.3), and X^2 = 15.620 df=14, P<0.05 (fig.4) respectively. The study revealed that bird-feeding was more intensive on fruits, and the most affected crops were oil palm (*Elaeis guineensis*) 33%, avocado (*Persea Americana*) 21%, maize (*Zea mays*) 18% and mango (*Mangifera indica*) 16% respectively (fig.5). However, this feeding behavior might also depend on crop population dominance in the area. Most of the crop-farmers in this area cultivate these crops most, due to their high demand in the local markets. It was also observed that the weaver birds fed more on the fruits than leaves and stems, the simple reason might be based on the body physiology of these birds, requiring more carbohydrate and oil for metabolic energy production activity.

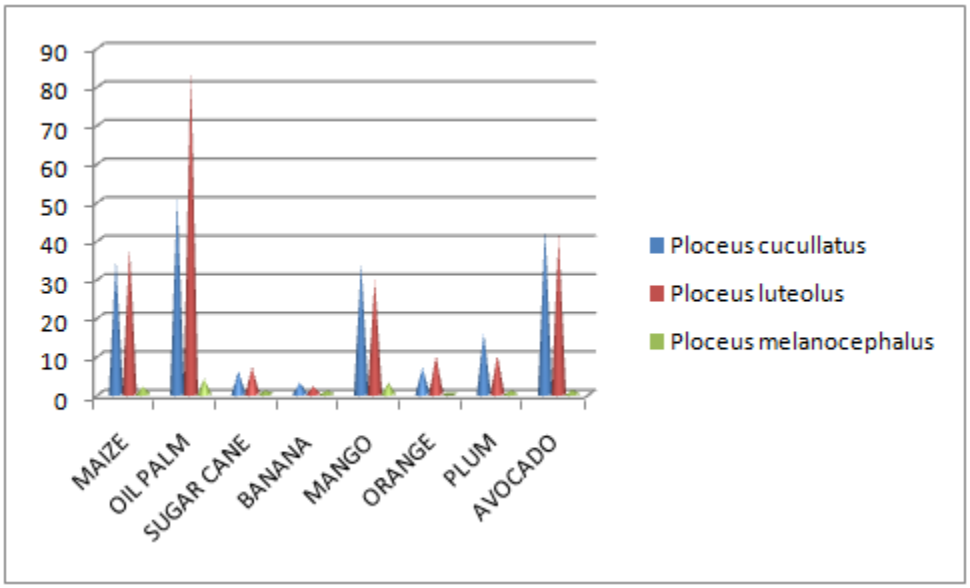

Fig.4: Weaver-bird feeding and crop species

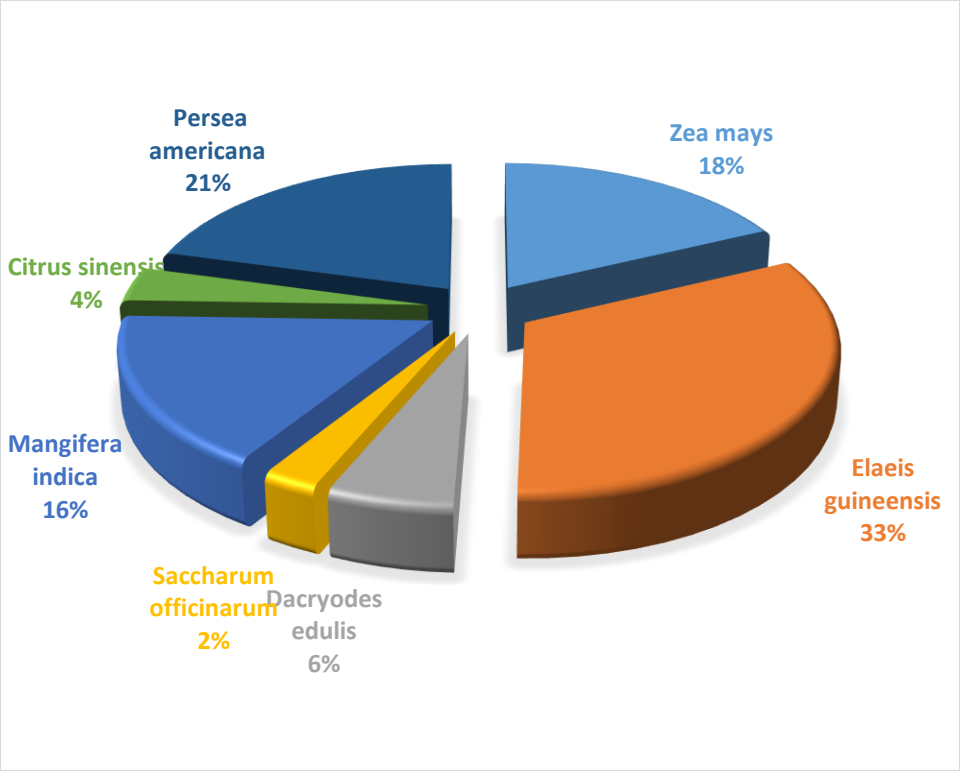

Fig. 5: frequency on plant-feeding

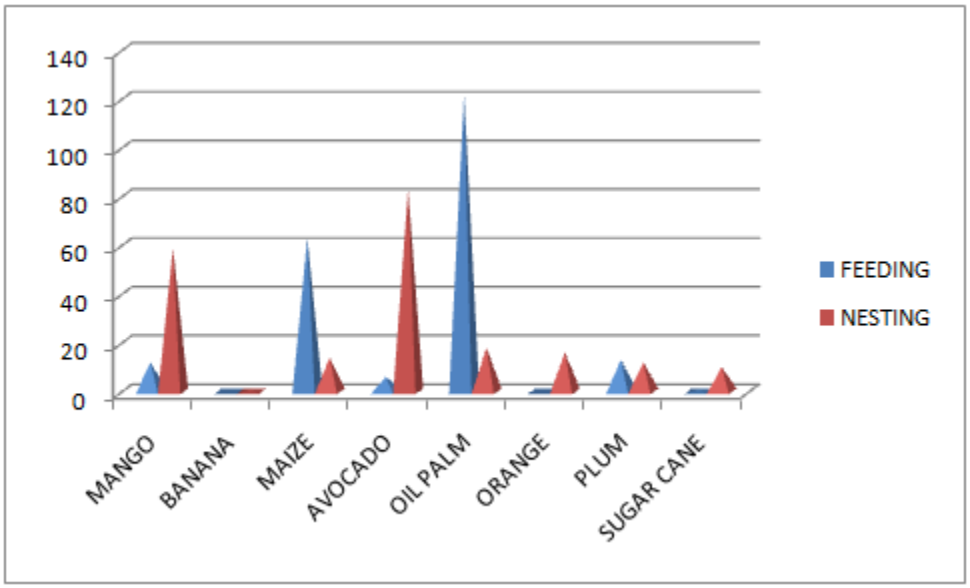

Fig.6: feeding and nesting activity

The study has shown a significant relationship between feeding and nesting behavior, $X^2 = 230.556$ df=7, P=0.000 (fig.6). Feeding and nesting behaviors were more frequently observed, 50% and 50% respectively than any other activity (fig.7). Though these two activities seemed simultaneous on all the crop species, oil palms and avocado trees were the most affected by feeding and nesting

activities. Weaver-bird nests are constructed with leaves, especially from the oil palms when feeding, and for this reason nesting and feeding behaviors were very associated. Nest-building is an energy demanding activity in birds and many other wildlife species, hence, its association with feeding is complementary.

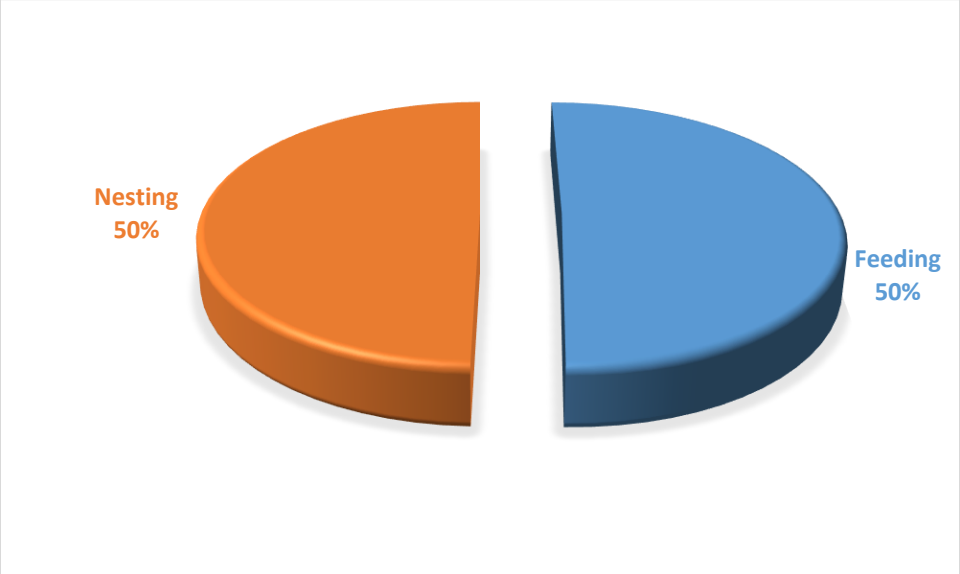

Fig. 7: The frequency of feeding and nesting

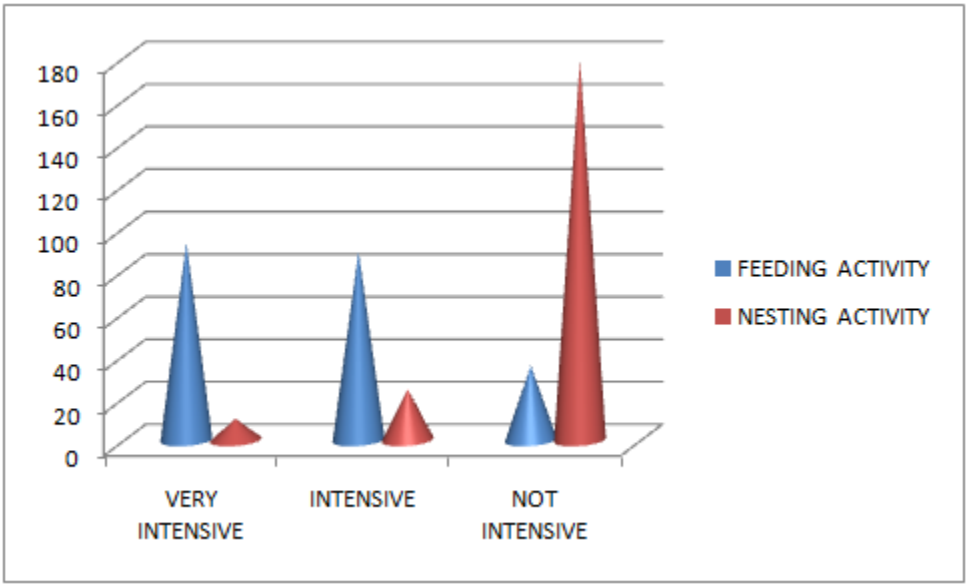

Fig. 8: Feeding and nesting intensity

A significant correlation was recorded on feeding and nesting intensity, r = 0.648, P=0.000 (fig. 8). Nest-construction behavior in weaver-birds might be innate but its intensity is be environmental, dependent on the availability of construction materials, time, and season. The importance of the bird-nest is strongly associated to their home, protection, socialization, and breeding, especially when migrated to new crop-farming areas. Nonetheless, their activities were witnessed more on farmlands located in human residential areas. The study also remarked that human noise and related activities did not disturb the feeding activity of these birds.

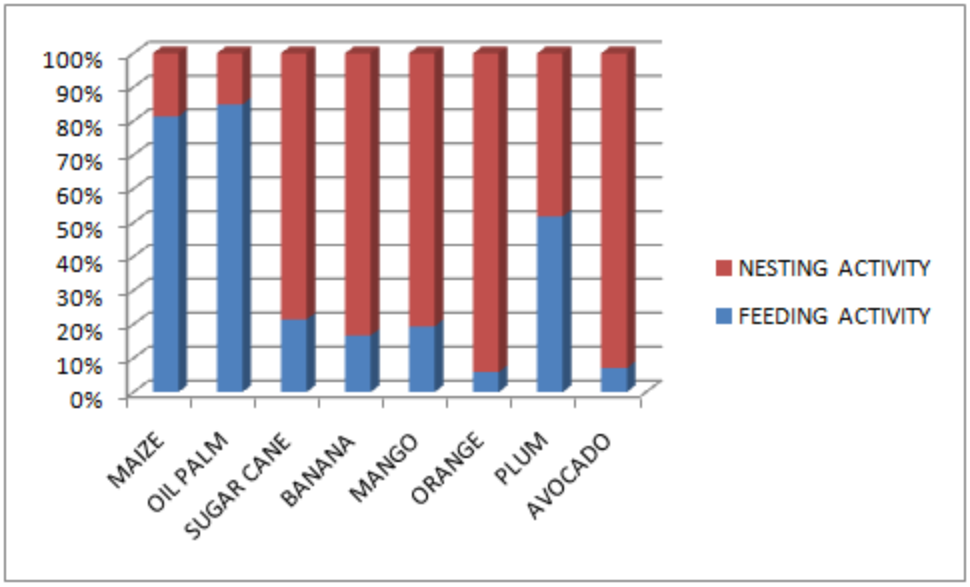

Fig.9: Bird feeding and nesting activity on crop species

Nesting and feeding correlated significantly on crop species in various neighborhoods, r = 0.607, P=0.000 (fig.9), and X^2 = 7.164 df=4, P<0.05 (fig. 10) respectively. The activities of birds were observed on all crops, ranging from maize to avocado. Nevertheless, feeding was more prominent on maize (*Zea mays*), oil palm (*Elaeis guineensis*), and plum (*Dacryodes edulis*), while nesting on sugar cane (*Saccharum officinarum)*, banana (*Musa acuminate*), mango (*Mangifera indica*), orange (*Citrus sinensis*), and avocado (*Persea americana*). However, the most affected farms were found in Bomaka neighborhood (69%), a newly created neighborhood with less houses and more farmland while the least was Bokwango (4%), an old human residence (fig. 11). The concentration of crop-farms in Bomaka area might be the main reason behind the feeding and nesting intensity.

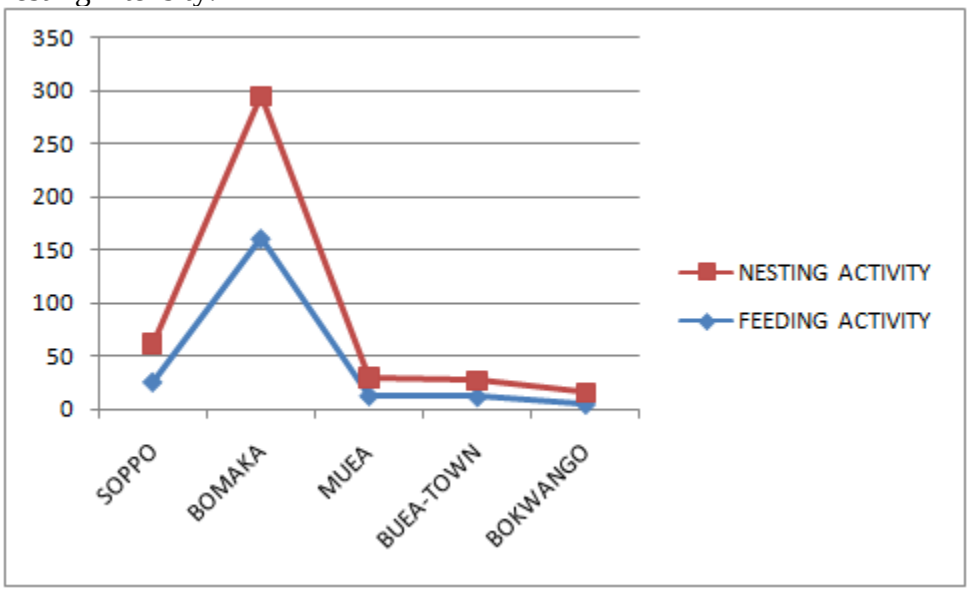

Fig. 10: Bird feeding activity and neighborhood

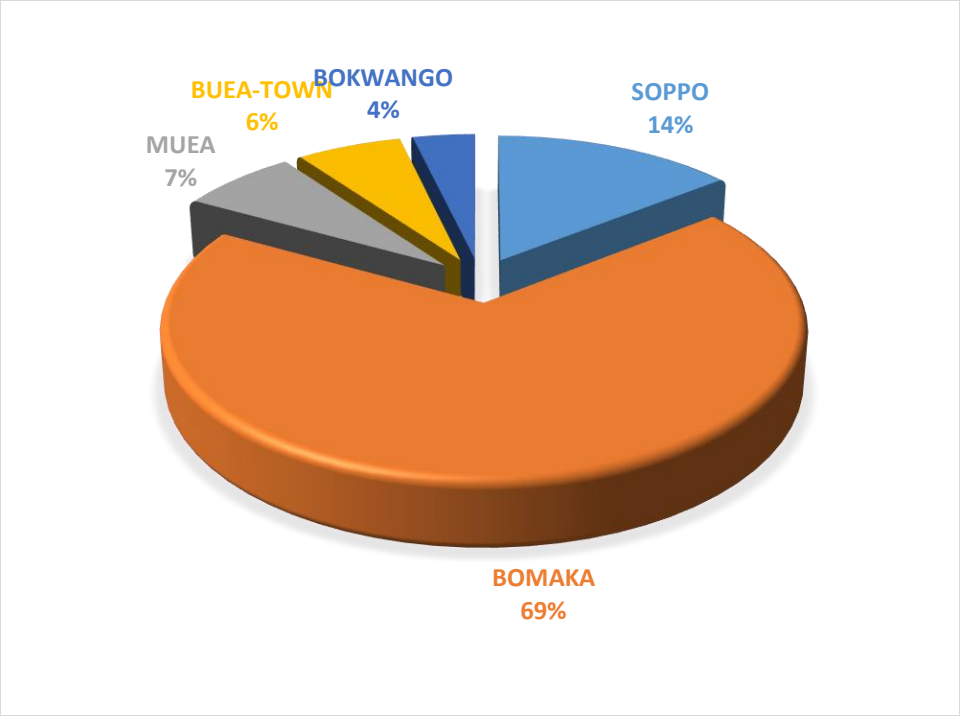

Fig. 11: Weaver-bird feeding activity in neighborhoods

DISCUSSION

Habitat destruction, fragmentation and loss have been observed due to increase of human population (Manhães and Ribeiro, 2005). Forests have been converted to urban settlement, agricultural field and pasture land, sometimes to open land. These human activities have an impact on bird species abundance, distribution and diversity due to isolation and fragmentation (Westphal et al., 2006). Decline in abundance and loss of species due to human interference have been observed in the tropics (Cordeiro, 2005). Bird damage to agricultural crops has been a chronic problem in many parts of the world. Although considerable effort has been done in highly developed countries to solve local or regional bird damage problems, only recently has a significant effort been made in the developing nations. In Africa, major research has been directed by the British, French, and German governments, through technical assistance programs, and more recently FAO (2007). In Cameroon, maize production contributes enormously to food security and employment and is the first most widely produced and consumed cereal with over 700.000 people involved in its cultivation (MINEPAT, 2008). The Southwest region has the highest yield potential for maize production in Cameroon (Ndam *et al.,* 2014). However, in the Region, actual average yields of maize are still low (1.67 tons/ha) as compared to the potential yields of 6 tons/ha (MINEPAT, 2008). Rapid rise in petroleum prices and a rapid global expansion of bio-fuel production from maize (Cassman, 2007), the price of maize rose by over 50% from 2001- 2007

(FAO, 2008), and the demand for maize is estimated to double in the next five years (Gowing and Palmer, 2008).

Maize production suffers from a number of constraints which include diseases, insect pests, decline in soil fertility, environmental degradation and weeds in infestation (DT Maize, 2012). Maize damage by vertebrate pests (e.g birds) is on the increase as agriculture becomes more intensified, due to large production brought about by the utilization potential of the crop (Olakojo, 2001). This situation is probably most serious in the tropics (Fiedler, 1994; Bekele and Leir, 1997) as more and more land becomes cultivated in an attempt to provide food for the ever increasing human population. Findings from various studies have revealed that bird and rodent pests appear to be the most serious pest of maize and related cereal crops (Singleton et al., 1999; Fayenuwo and Akande, 2002, Mwanjabe et al., 2002). Although rodents have been identified as the most important mammalian agricultural pests at the global level (Cuong et al., 2002), birds are known to damage or destroy many crops prior to harvesting, while the former are major pest for grain stored after harvest. These animal pests are responsible for substantial damage to food and cash crops, playing the role of reservoirs and carriers of zoonotic diseases in Africa.

Majority of avian pests are weaver-birds which cause serious damage to cereals, maize, rice, sorghum, millet and wheat which are cultivated in many parts of Africa, and form the staple diet in many localities. The most notorious weaver-bird in crop damage, is the Quelea bird *(Quelea. quelea*), occuring in huge colonies of up to a million birds, has been known to have destroyed many cereal farms. Fields close to breeding or roosting sites are most susceptible to damage from these birds (FAO, 1991). The presence of trees, bushes or weeds in the vicinity of the field increase crop vulnerability because they provide birds with perches and nesting sites. Fields close to water sources (e.g. rivers or large irrigation canals) are more frequently damaged by birds because they supply drinking water to the birds (Manikowski, 1984). Rahayuninagsih *et al*., (2007), stated that bird community structures were known to be affected by several factors. Similarly, habitat diversity and change, seasonal variations in climate and natural resources have affected weaver-bird nest-building structure of the study area (Mengesha *et al*., 2011). 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).

Since the 1960s the "Green Revolution" has been increasing farming yields, mainly in developed nations, by increasing the total area of crop land, using new technologies such as tractors and combine harvesters to improve efficiency, by the development of new and more effective artificial fertilizers, pesticides and herbicides and by the development of new crop varieties, including genetically-engineered crops (Tilman et al., 2001; Green et al., 2005). This has greatly reduced world hunger, with a doubling of global food production between 1966 and 2001 (Green et al., 2005), but at an environmental price, with birds not being immune to the detrimental effects of this change from traditional farming systems to more modern, intensive forms of farming (Donald et al., 2006).

CONCLUSION

The feeding and nesting activities of weaver-birds in farmlands affect crop productivity through the stripping of leaves from plants such as oil palm, coco nut, maize and plantains which leads to the complete damage of the crop-plants in a long run; as they lack leaves for food production necessary for the plants' growth and sustenance. Defoliation leads to reduction in the fruit yielding capabilities of the crops, consequently could lead to death of these crops. Bird pests migrate over long distances to have a flexible diet in agricultural croplands, and their damage to cereal crops has been a chronic problem to African farmers for decades. However, production is usually faced with several constraints of which biotic constraints constitute a major concern. Weaver-birds are a key biotic factors that hinders production or seriously affect crop-yields in Buea municipality, and if quick action is not taken to minimize their effects there would be scarcity of maize and related crops. Until 2003, weaver-birds were rarely seen cutting pieces of leaves from banana or plantains in Cameroon. Generally, the birds use leaves of grasses, oil palm, coconut palm, and 'elephant grass' (*Pennisetum spp*) for nest-building during their breeding seasons. However, from 2005, more weaver-birds were observed on bananas and plantains in backyard gardens, small farms and even on commercial plantations. The eradication of pests such as weaver-birds in croplands has been a huge challenge to the agricultural and wildlife stakeholders in developing countries like Cameroon. Moreover, the high proliferation character of the pest is one of the key problems that has made its population control ineffective and difficult in sub Saharan Africa.

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