

## Effects of Seed Size and Water on Some Granivorous Birds Feeding in Jos Zoological Garden, Plateau State, Nigeria

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### Abstract

The effect of seed size and water on some grain-eating birds feeding in the Jos Zoological garden was determined. A total of 110 individual birds belonging to 10 species were encountered. Various grain types were put in 4 trays in the study site. The abundance of birds seen across trays varied significantly (Adjusted  $R^2 = 0.6908$ ,  $F_{107} = 3.721$ ,  $P - \text{value} = 0.01367$ ) while the abundance seen across sites showed no significant difference (Adjusted  $R^2 = 0.01725$ ,  $F_{109} = 2.931$ ,  $P - \text{value} = 0.08976$ ). There was correlation between bill size and the grain size. Finches were attracted to smaller grains and doves with larger bill were attracted to large grains, though they visited both the large and the small grains. Proximity to water during this research being rainy season did not influence the abundance of bird species. Accessibility influenced the abundance of bird species.

**Keywords:** Granivorous birds, seed size, bill size, feeding adaptation, Zoological Garden.

### 1. Introduction

A seed is a small embryonic plant enclosed in a covering called the seed coat, usually with some stored food. It is a product of the ripened ovule of gymnosperm and angiosperm plants which occur after fertilization and some growth within the mother plant (Rost *et al.* 1979). Plants seeds are important source of nutrients for animals across most ecosystems because they contain food storage organs and therefore are attractive food source for many animals. Seeds are highly concentrated localized nutrient source in relation to other plant parts. To attract birds, offer is made to different types of seeds in appropriate feeders, including both tube feeders and open trays that can accommodate large number of birds feeding. Granivorous birds often have specialized bills for picking their preferred seeds more efficiently. Granivores describes a diet that consists primarily though not exclusively of seeds and grain (Melisa, 2013). Grains are small, hard, dry seeds with or without attached hulls or fruit layer cultivated and harvested as food source for humans and animals (Babcock, 1976). Larger birds may have thicker, stronger bills to crack the shells of larger seeds where as Finches and Crossbills have thin, tapering tips to their bills that allow them to pry seeds out of pine cones and small flowers. These birds primarily eat seeds, fruit and other plant materials but may supplement their diet with insects and live food. Seeds are very diverse in size (Shannon and Brockman, 1996).

The bill of birds is well structured for seed handling. Bill structure has been documented and has been shown to affect foraging efficiency (Benkman, 1987) while handling ability is correlated with bill size (Abbott *et al.* 1975). Hypotheses have shown that choice of seed is affected by its profitability if availability of grain types is equal (Gluck 1985).

Seed preference of finches has shown that the major determinant of preference is ease of handling while number of calories per seed and the potential caloric intake rate per unit time for various grain types are less important in the determination of seed preference (Wilson, 1971).

There are three distinct types of bill in granivorous birds. They include: the conical finch type bill, the slender dove bill and the short, stout, hooked parrot bill (Maclean, 1993). Seed preferences by granivorous birds have shown correlations with bill size (Maclean, 1993). Preference as used in this study indicated how certain seeds were eaten more frequently than others which may as well be termed, the relative numbers of seeds eaten.

Birds from Semiarid regions may suffer dehydration during hot, dry seasons, with low food availability. During this period both energetic costs and water requirements for thermoregulation increase, limit the scope of activity. For granivorous birds feeding on dry seeds, this is a major challenge and availability of water may affect the value of food. Water availability could increase the value of a food patch when surrounding environment is poor, due to an increase in the martial value of the energy.

Correlations between bill morphology and seed selection are well documented for granivorous birds (Grant 1981, price 1987). Birds with differently shaped bill required different handling times for a range of seeds and this affect their feeding preferences (Derain 1959, 1964, Weiner 1995). Species with large bill husk large seeds faster than species with small bills, and husk some large seeds that cannot be husked by small species

(Grant 1981). Bird's type of beak determines the type of food that is easiest to eat. Different species that seem to have the same type of beak really are more different than we think and this helps them to not compete for the same type of food.

Birds foraging can be affected by predators. An individual foraging under predation risk should take note of its time and its foraging effort (Brown, 1999). If risk increases, then an individual should devote less time to forage, especially in the riskiest location (Brown, 1999). However, when foraging, an individual must choose not only when and where to eat but also how long it should stay in a food patch (Lima & Dill, 1990).

This study seeks to determine whether proximity to water source, cover and the different grains on table has an effect on the choice, number and frequency of the different species of birds that visit a particular table with a particular type of grain.

## 2. Materials and Method

### 2.1. Field Survey

This study was carried out at the National Zoological Garden, Jos (090 52'N, 080 58'E) in July, 2013. The Jos Plateau is located within the Guinea Savanna region of Nigeria. It is located in central Nigeria The Zoo is rich in animals cutting across mammals, reptiles, aves and amphibians. Some of the representatives of the animal species are the lion, snakes, Ostriches, Porcupines, donkeys, horses and more.

The zoo has its surrounding bushes degraded by human activities mainly, farming, logging and grazing and it is hard to find a specific continuous habitat type without farmlands in between.

Four trays were arranged 2m away from each other. Each tray contains different grain sizes as will be preferred by different species of birds in relation to their bill size. The four grain types used for this research are shown in Table 1. Tray A had maize seeds (*Zea mays*), Tray B had guinea corn (*Sorghum saccharatum*), Tray C had millet (*Setaria italica*) and Tray D had acha (*Digitaria exilis*). The four types of seeds were chosen because of their availability and different shapes and sizes. They were also chosen because of their importance in the diet requirement of the birds. Comparison of seed size was done according to seed mass. The trays containing grains were kept for two weeks before the main recording started. Trays were filled with grains every morning and evening throughout the research period. Birds were identified with the aid of a field (Borrow & Demey, 2008).

Table 1: Grain types contained in the four trays as used for the research

Tray	Grain type	Scientific name
A	Maize	<i>Zea mays</i>
B	Guinea corn	<i>Sorghum saccharatum</i>
C	Millet	<i>Setaria italica</i>
D	Acha	<i>Digitaria exilis</i>

### 2.2 Statistical Analysis

Mean number of species from each tray and across sites was determined using R statistics version 2.15.2.

## 3. Results.

A total of ten (10) granivorous bird species were encountered during the study period (Table 2).

Table 2: Summary of birds seen in the trays placed in all sites

Species	Site 1				Site 2				Site 3			
	Tray A (No)	Tray B (No)	Tray C (No)	Tray D (No)	Tray A (No)	Tray B (No)	Tray C (No)	Tray D (No)	Tray A (No)	Tray B (No)	Tray C (No)	Tray D (No)
LGDV	√(20)	√(25)	√(16)	√(17)		√(9)	√(8)	√(1)				
VCDV	√(13)	(18)	√(4)	√(4)								
REDV	√(23)	√(21)	√(8)	√(14)		√(8)						
VIDG			√7	√8								
VLWV		√(11)	√(11)	√(12)								
CMBB		√(3)	√(7)	√(8)								
RCCB		√(12)	√(25)				√(22)	√(45)				
RBFF		√(4)	√(14)	√(34)			√(27)	√(81)				
GHSR		(30)	(38)	(50)								
RKFF		(5)	(6)	(25)			(8)	(14)				

√ = present,

LGDV=Laughing Dove, VIDG=Village Indigobird, VLWV=Village Weaver

VCDV=Vinaceous Dove, CMBB=Common Bulbul, RCCB=Red-cheeked Cordon-bleu

REDV=Red-eyed Dove, RBFF=Red-billed Firefinch, GHSR=Grey-headed Sparrow, RKFF=Rock Firefinch.

The abundance of birds seen across trays showed significant difference (Adjusted  $R^2 = 0.06908$

$F_{107} = 3.721$ , p-value = 0.01367, Fig. 1).

Tray D containing Acha had the highest mean number of granivores followed by Trays B (Guinea corn) and C (millet) while Tray A (maize) had the least shown in Figure 1.

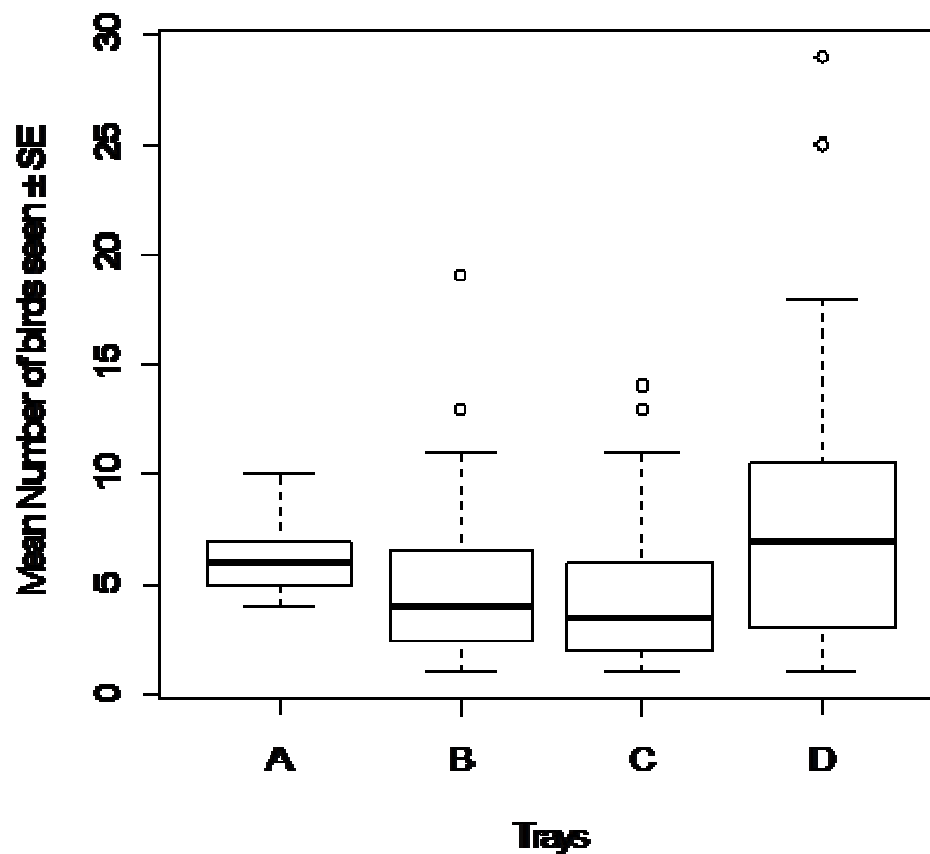


Figure 1: Mean number of pooled bird species seen across Trays

The abundance of birds seen across sites showed no significant difference (Adjusted  $R^2 = 0.01725$ ,  $F_{109} = 2.931$ ,  $p\text{-value} = 0.08976$ , Fig. 2). Though statistically there is no significant difference between the sites, but from the bar plots in Fig. 2, more birds were recorded in site 1 which was an open site compared to site 2 which was a closed site. No bird was seen in all the trays placed in site 3 which was closed habitat and near water body.

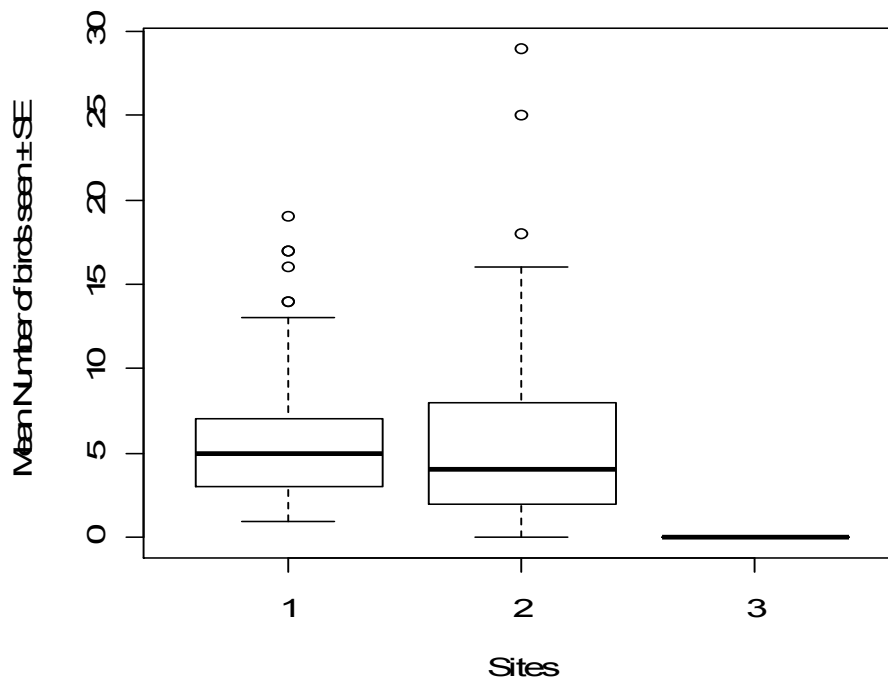


Figure 2: Mean number of pooled bird species seen across sites in Jos zoological Garden

In Tray A containing maize seeds, three species of granivorous birds were seen. They include the Laughing Dove, Red-eyed Dove and Vinaceous Dove (Figure 3). In Tray B containing guinea corn, Grey-headed Sparrow has the highest abundance followed by Laughing Dove and Red-eyed Dove. Other birds with smaller bill length were not seen (Figure 4). In Tray C with millet, whose grains are smaller than A and B, all the ten species were seen with the Grey-headed Sparrow having the highest abundance (Figure 5). Tray D which contains Acha being the smallest seed recorded all the ten species with Red-billed Firefinch having the highest abundance followed by Red-cheeked Cordon –bleu all having smaller bills compared to the other species recorded (Figure 6).

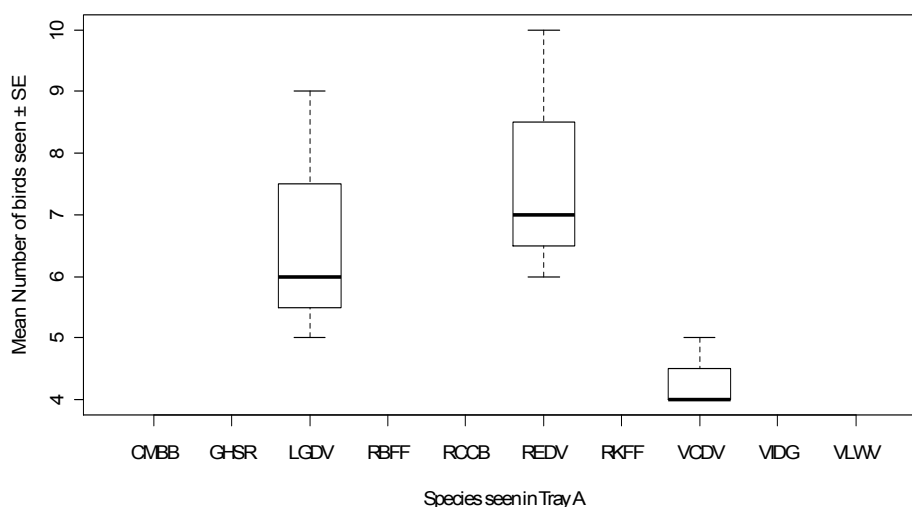


Figure 3: Mean number of bird species seen in Tray A

**Legend:** CMBB= Common Bulbul; GHSR=Grey-headed Sparrow, LDDV=Laughing Dove; RBFF=Red-billed Firefinch; RCCB=Red-cheeked Cordon-blue; REDV=Red-eyed Dove; RKFF=Rock Firefinch; VCDV=Venaceous Dove; VIDG=Village Indigo Bird; VLWV=Village Weaver

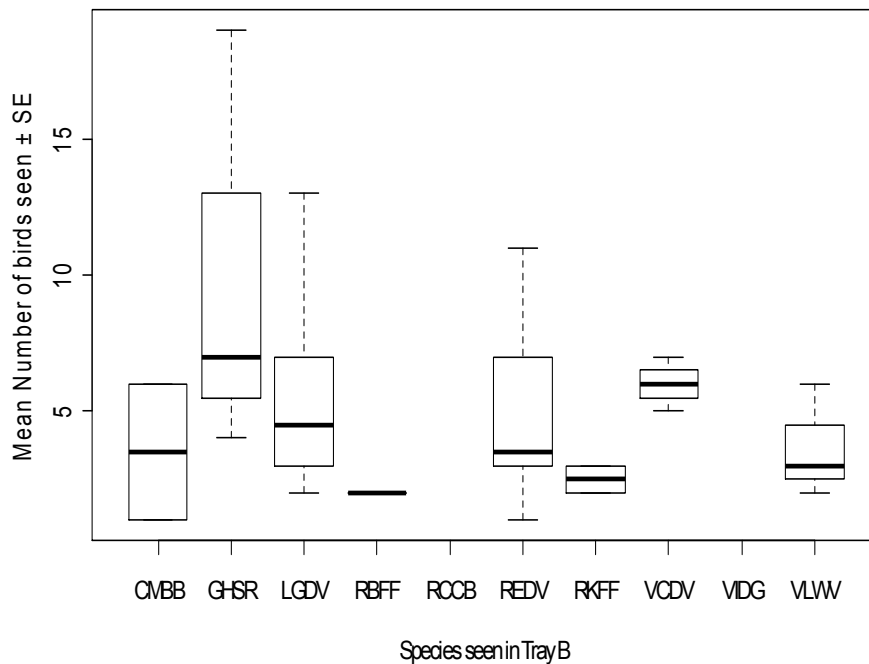


Figure 4: Mean number of bird species seen in Tray B

**Legend:** CMBB= Common Bulbul; GHSR=Grey-headed Sparrow, LDDV=Laughing Dove; RBFF=Red-billed Firefinch; RCCB=Red-cheeked Cordon-blue; REDV=Red-eyed Dove; RKFF=Rock Firefinch; VCDV=Venaceous Dove; VIDG=Village Indigo Bird; VLWV=Village Weaver

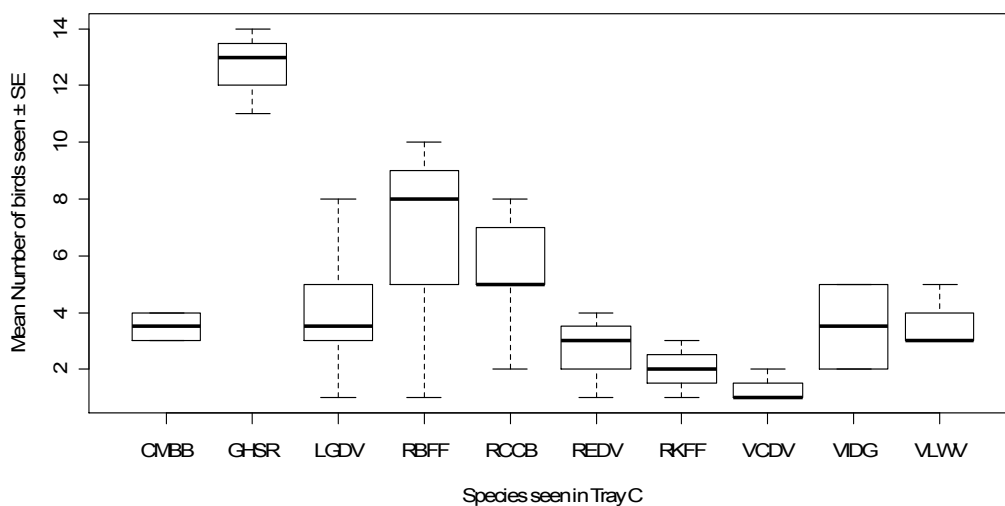


Figure 5: Mean number of bird species seen in Tray C

**Legend:** CMBB= Common Bulbul; GHSR=Grey-headed Sparrow, LDDV=Laughing Dove; RBFF=Red-billed Firefinch; RCCB=Red-cheeked Cordon-blue; REDV=Red-eyed Dove; RKFF=Rock Firefinch; VCDV=Venaceous Dove; VIDG=Village Indigo Bird; VLWV=Village Weaver

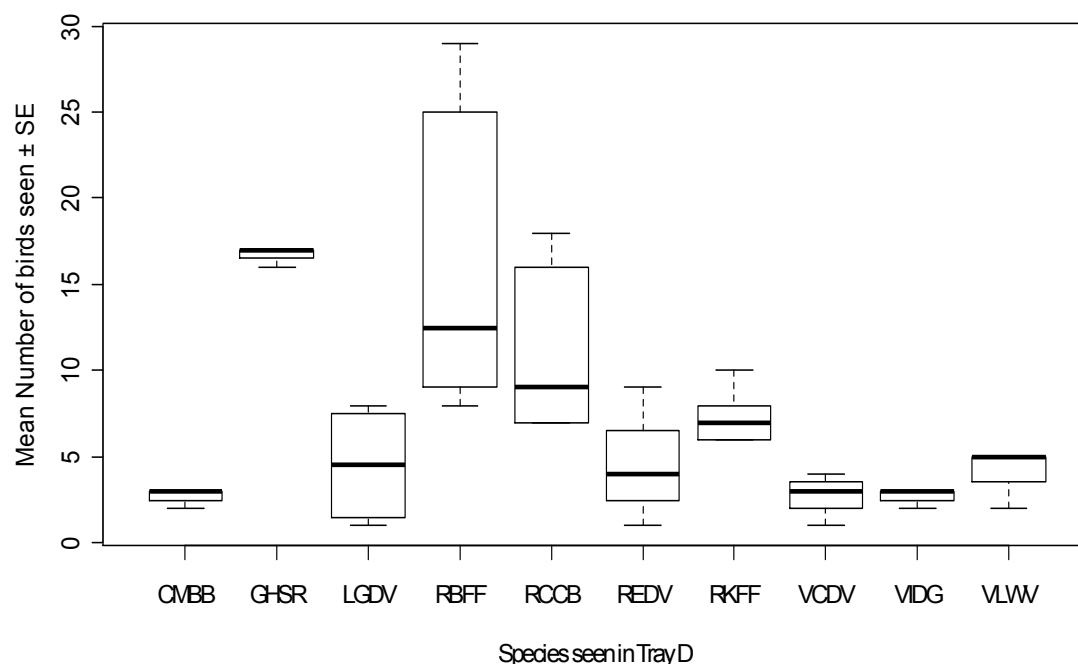


Figure 6: Mean number of bird species seen in Tray D

**Legend:** CMBB= Common Bulbul; GHSR=Grey-headed Sparrow, LDDV=Laughing Dove; RBFF=Red-billed Firefinch; RCCB=Red-cheeked Cordon-blue; REDV=Red-eyed Dove; RKFF=Rock Firefinch; VCDV=Venaceous Dove; VIDG=Village Indigo Bird; VLWV=Village Weaver

#### 4. Discussion

Tray D had the highest abundance of birds probably because of the small seeds which is easily picked by most of the species and the softness of the seed husk. Therefore the birds may have preferred feeding on such grains considering their small bills.

Site 1 had the highest abundance of bird visits than site 2 probably because site 1 was an open site and was easily accessed by the birds. Accessibility of food is therefore one of the factors that may influence bird visits. No bird was seen in site 3 during this research. Water did not have any significant influence on the abundance of the birds probably because the research was carried out during the rainy season.

Only doves were attracted to Tray A, containing maize grain, probably because the other species have smaller bill size and cannot feed on the large maize grains. In Tray B, in addition to the doves, grey-headed sparrow was seen whose bill size is medium in size and may be able to pick guinea corn seeds. In Tray C containing millet, all the ten species were attracted with Grey-headed Sparrow having the highest mean abundance.

In Tray D containing Acha, all the ten species were sited with Red-billed Firefinch having the highest mean abundance followed by Red-cheeked Cordon-bleu, probably because of the correlation of their small bill size with the small grains in the tray. This is agree with the findings Weiner (1995). They documented that species with small bills are attracted to small seeds and large-billed species husk larger seeds faster than species with small bills. This therefore implies that bill size determine the type of food eaten by a species.

#### 5. Conclusion

The result obtained from this research shows that certain seeds attract specific birds. The size of the bill determines the type of food eaten by a bird. The result also showed that birds prefer open environment with thorn bushes for easy food accessibility than a closed environment. Proximity to water does not influence bird's abundance during the rainy season.

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