



VISITING PATTERN OF COMMON BULBUL (*PYCNONOTUS BARBATUS*) ON DIFFERENT PLANT SPECIES FOUND IN FEDERAL COLLEGE OF FORESTRY, JOS.

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ABSTRACT

Common bulbuls consume seeds and disperse them. Loss of dispersal agents leads to reduced recruitment and elimination of plant species and inversely, loss of certain plants resources could lead to local elimination of some frugivores such as the Common bulbuls. This study was carried out to investigate the visiting pattern of Common bulbul (*Pycnonotus barbatus*). Ten transects of 100m was laid using stratified random sampling across two habitat types; riparian forest and farmlands. Along each transect, points were marked for focal observation with a distance of 150 metres between each transect. Time for observation in the morning was 6.00 – 8.00 am and in the evening 4.00 – 6.00pm. The identity of plants visited by Common bulbuls and its activities (foraging, perching and nesting), frequency of visit, time spent on the plant species and the habitat type were recorded. Mann-whitney U test and T-test was used for data analysis. The results showed that thirty-four plants were highly utilized by Common bulbul in the study site and they spend more time foraging (74.38%) than perching (25.62%). Common bulbul prefers farmland habitat (66.70%) than the riparian forest (33.30%). Furthermore, there was high variation between the category of timespent on plants ($P= 0.03$), these birds prefer to spend between 1-30 seconds maximum visiting a plant species, probably to avoid predation. it was observed that plants that were highly utilized had large yellow succulent fruits and these birds are generalists that prefer varied food sources on the farmlands.

Keywords: Common bulbul, Plants, Visitation, Utilization, Birds.

Introduction

The Common Bulbul (*Pycnonotus barbatus*) is a small passerine in the Pycnonotidae family, distributed in Africa, into the Middle East tropical Asia to Indonesia, and as far as Japan. A few island species occurs on the tropical islands of the Indian Ocean. It inhabits wooded habitats, secondary forests, urban areas, parks, and gardens (Fishpool and Tobias, 2005). In general bulbuls are resistant to human pressures on the environment and are tolerant to disturbed habitats. *P. barbatus* mainly eats fruits and seeds, and smaller amounts of invertebrates (Yang *et al.*, 2004). It is one of the most common and important

seed dispersal agents in anthropogenic open habitats in tropical Asia. The common bulbuls are medium – sized passerine birds. Forest species are known as greenbul, brownbul, leafloves, and bristlebills. There are over 150 species in 27 genera, some species are predominantly found in the rainforest (Corlett, 1998). The male and females are similar in appearance, although the male tends to be slightly larger, they are known to breed year-round (Lanet *al.*, 2013). They are generally monogamous. About five purple-pink eggs are laid in an open tree nests and incubated by the female. Incubating usually lasts between 11-14 day's and chicks fledge



after 12-16 days. These small birds form a complex and stable society and are very social even during breeding (Morrison *et al.*, 1990). Common Bulbul has an extremely large range in Nigeria, the bird species occur in different numbers of habitats within the country's vegetation that range from the mangrove along the coast in the south to the Sahel in the north (Borrow and Demey, 2012). This bird does not approach the thresholds for Vulnerable under the range size criterion (Del Hoyo *et al.*, 2005). They eat mainly fruit or insects, most can and do have a mixed diet. This flexibility may be critical during the dry season: since most bulbuls are non-migratory, they must take advantage of the food sources available within their range, which can mean shifting to feeding on more plant matter when insects are not as abundant (Beresford *et al.*, 2005).

It has been widely demonstrated that food abundance and distribution are the primary determinants of foraging behaviour in bird species (Lanet *et al.*, 2013). Optimal foraging behavior, however, may encompass other conflicting activities such as anti-predation behaviors that lead animals to trade food intake rate against other activities. Decision-making based on trade-offs may be influenced by the internal state of the animal (Krebs and Kacelnik, 1991). Closely related birds nearly always show differences in the frequency of use of foraging maneuvers (Liu *et al.*, 1992). Feeding is an essential activity in a bird's life which is indispensable for their survival, but the demands of food acquisition impose significant challenges to both the physiology and behavior of birds (Chen and Hsieh, 2002). The study of behavior and feeding ecology is thus imperative for understanding the species ecological adaptation to the environment and is also a crucial factor to be

considered while examining their economic status.

Little has been done to exclusively look into which species of plants are utilized by Common bulbul, but other studies have shown the visitation pattern of other birds and insect pollinators linked to their habitats (Waser and Price, 2016). Conservation of the Common bulbul is realizable by understanding its behavior, plant species they utilize for food, nest, foraging and perching sites.

Common bulbul is a good dispersal agent; loss of dispersal agents has been reported to lead to reduced recruitment and elimination of plant species in some forests (Benjamin *et al.*, 2007). Inversely, loss of certain fleshy-fruit plants has led to or could lead to local elimination of some frugivores such as the Common bulbuls (Bleher *et al.*, 2003). This study gives indebt knowledge of how Common bulbuls utilize some certain plants and the benefits they derive from plants across the habitat types found in the study site. The aim is to determine the visiting pattern of Common bulbuls on the plant community found in Federal College of Forestry, Jos.

Materials and Methods

This research was carried in Federal College of Forestry, Jos, Plateau state, composed of the Guinea Savannah vegetation zone of Nigeria. The study area still holds some of the natural vegetation of the Jos Plateau. The vegetation of the Jos Plateau is made up of mainly of scattered bush and grass, riparian forest, savannah and farmlands (Hulme, 2007). A total of ten transects of 100m was laid using stratified random sampling across two habitat types; riparian forest and farmlands. Along each transect, points were marked for focal observation with a distance



of 150m between each transect. Time for observation in the morning was between 6.00 – 8.00 am and in the evening between 4.00 – 6.00pm to check for the effect of time of day. Start time was also alternated between points. The identity of plants visited by Common bulbul, its activities (foraging, perching and nesting), the frequency of visit, the duration/ time spent on the plant species and the habitat type was recorded. A pair of oblivion binocular was used for observation (Yilangai *et al.*, 2014). Plants were identified with the aid of a fieldguide and taxonomist from the Herbarium unit, Federal College of Forestry, Jos.

Statistical Package for the Social Sciences (SPSS) was used. Data was not normally

distributed, so the Mann-whitney U test was used to understand the frequency of visit, duration and plants visited by Common bulbul. T-test was used to check for variation in activities, frequency and duration in the morning and evening and between the two habitat types.

Results and Discussion

Common bulbul visited thirty-four (34) plant species in the study site with the highest number of visits to *Eucalyptus toreliana*(16.4%) followed by *Mangifera indica*(10.9%) while the least plant visited was *Jathropha curcas* (0.1%) and *Stenobiumstans* (0.1%), Table 1.

Table 1: Plant species visited by Common bulbul across habitat types

Plant species	Habitat Types		Total	Percent
	Farmland	Riparian		
<i>Acacia sp.</i>	16	1	17	1.7
<i>Anacardiumoccidentalis</i>	36	28	64	6.3
<i>Bamboo spp</i>	0	12	12	1.2
<i>Bauhinia vahlii</i>	41	22	63	6.2
<i>Boungainvilleaformosa</i>	23	0	23	2.3
<i>Caesalpiniaagilliesii</i>	10	3	13	1.3
<i>Caesalpinia pulcherrima</i>	7	0	7	0.7
<i>Casaurinaequitifolia</i>	10	2	12	1.2
<i>Ceibapetandra</i>	7	0	7	0.7
<i>Citrus senensis</i>	21	1	22	2.2
<i>Corymbiatoreliana</i>	9	0	9	0.9
<i>Delonixregia</i>	8	18	26	2.6
<i>Durantarupens</i>	0	2	2	0.2
<i>Erythrophleumsuaveolens</i>	1	0	1	0.1
<i>Eucalyptus camaldulensis</i>	42	25	67	6.6
<i>Eucalyptus toreliana</i>	99	67	166	16.4
<i>Ficusbenjamina</i>	5	11	16	1.6
<i>Gliricidiasepium</i>	8	1	9	0.9
<i>Gmelinaarborea</i>	28	11	39	3.8



<i>Jacaranda mimosifolia</i>	16	15	31	3.1
<i>Jartrophacurcas</i>	1	0	1	0.1
<i>Khayasenegalensis</i>	9	8	17	1.7
<i>Lucinabuxifolia</i>	20	11	31	3.1
<i>Magniferaindica</i>	67	44	111	10.9
<i>Nuclealatifolia</i>	2	8	10	1.0
<i>Parkiabiglobosa</i>	20	0	20	2.0
<i>Perseaamericana</i>	16	0	16	1.6
<i>Pinuscarribea</i>	24	2	26	2.6
<i>Spathodeacampanulata</i>	12	9	21	2.1
<i>Stenobiumstans</i>	1	0	1	0.1
<i>Tectonagrandis</i>	19	13	32	3.2
<i>Terminaliamantaly</i>	9	14	23	2.3
<i>Thevetiaperuviana</i>	64	9	73	7.2
<i>Vitexdoniana</i>	26	1	27	2.7
Total	677	338	1015	100

Table 2 and 3 shows that the frequency of foraging was highest (74.38%) while the frequency for perching was least (25.62%)

although the difference between these two activities across the habitat types was not significant (P= 0.06).

Table 2: Summary on the Activities of common bulbuls on the plant species

Activities on plant	Frequency	Percent
Perching	260	25.62
Foraging	755	74.38
Total	1015	100

Table 3: Independent T tests Analyses on activities on plant

	Levene's Test for Equality of Variances				t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% CI of the Diff.	
								Lower	Upper
Time (secs)	12.799	0.000	-1.888	1013	0.059 ^{ns}	-2.891	1.531	-5.896	0.114

Figure 1 below shows the activities of common bulbul across habitat types and in each habitat type respectively, with farmland

observed to have more activities than the riparian forest; Perching (162 and 98), foraging (515 and 240) respectively.

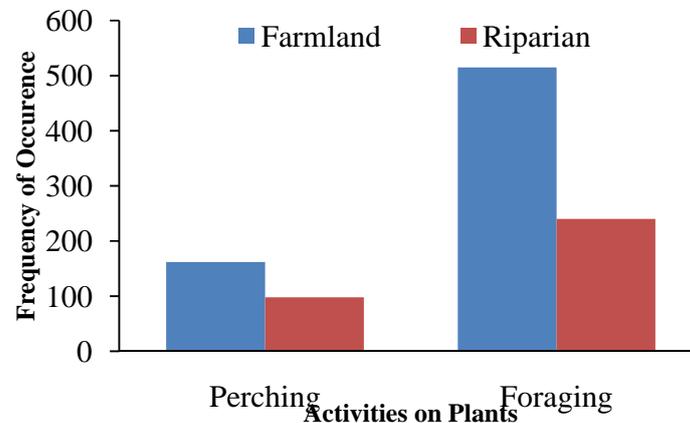


Figure 1: Activities of common bulbul on plants across habitat types

Table 4 below showed that the farmland (66.70%) is visited by common bulbul more than the riparian forest (33.30%).

Table 4: Summary on frequency of visit to the habitat types

Habitat	Frequency	Percent
Farmland	677	66.70
Riparian	338	33.30
Total	1015	100

Table 5, shows that time spent on plants is mostly between 1-30 seconds and time spent on *Eucalyptus torelliana* and *Mangifera indica* was highest (16.35 and 10.94% respectively).

Table 5: Time spent on each plant species (seconds)

Plant species	Time range (seconds)			Total	Percent
	1-30secs	91-120secs	121secs and above		
<i>Acacia sp.</i>	17	0	0	17	1.67
<i>Anacardium occidentale</i>	63	1	0	64	6.31
<i>Bamboo spp</i>	11	0	1	12	1.18
<i>Bauhinia vahlii</i>	62	1	0	63	6.21
<i>Boungainvillea formosa</i>	23	0	0	23	2.27
<i>Caesalpinia gilliesii</i>	13	0	0	13	1.28
<i>Caesalpinia pulcherrima</i>	7	0	0	7	0.69
<i>Casaurinae quitifolia</i>	12	0	0	12	1.18
<i>Ceiba petandra</i>	7	0	0	7	0.69
<i>Citrus senensis</i>	22	0	0	22	2.17



<i>Corymbiatoreliana</i>	8	0	1	9	0.89
<i>Delonixregia</i>	26	0	0	26	2.56
<i>Durantarupens</i>	2	0	0	2	0.20
<i>Erythrophleumsuaveolens</i>	1	0	0	1	0.10
<i>Eucalyptus camaldulensis</i>	65	1	1	67	6.60
<i>Eucalyptus toreliana</i>	164	0	2	166	16.35
<i>Ficusbenjamina</i>	14	2	0	16	1.58
<i>Gliricidiasepium</i>	9	0	0	9	0.89
<i>Gmelinaarborea</i>	38	0	1	39	3.84
<i>Jacaranda mimosifolia</i>	31	0	0	31	3.05
<i>Jartrophacurcas</i>	1	0	0	1	0.10
<i>Khayasenegalensis</i>	16	0	1	17	1.67
<i>Lucinabuxifolia</i>	29	0	2	31	3.05
<i>Magniferaindica</i>	109	1	1	111	10.94
<i>Nuclealatifolia</i>	10	0	0	10	0.99
<i>Parkiabiglobosa</i>	20	0	0	20	1.97
<i>Perseaamericana</i>	16	0	0	16	1.58
<i>Pinuscarribea</i>	26	0	0	26	2.56
<i>Spathodeacampanulata</i>	21	0	0	21	2.07
<i>Stenobiumstans</i>	1	0	0	1	0.10
<i>Tectonagrandis</i>	31	1	0	32	3.15
<i>Terminaliamantaly</i>	23	0	0	23	2.27
<i>Thevetiaperuviana</i>	72	1	0	73	7.19
<i>Vitexdoniana</i>	27	0	0	27	2.66
Total	997	8	10	1015	100

Table 6 showed that there was variation in time spent on each plant species (P=0.03).

Table 6: Independent T test on time spent (seconds) across each plant species

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% CI of the Diff.	
								Lower	Upper
Time (secs)	15.727	0.000	-2.138	1013	0.033*	-3.120	1.459	-5.983	-0.257

Table 7 below shows that there were more visits by common bulbul in the morning (57.44%) than in the evening (42.56%).



Table 7: Descriptive Statistics for effect of time of day

Time of the day	N	Mean	Std. Deviation	Std. Error Mean
Morning	583	5.10	17.81	0.74
Evening	432	8.22	28.52	1.37

This result shows that about 34 plants were utilized by Common bulbul in the study area. The highest number of visits was to *Eucalyptus toreliana* (16.4%) followed by *Mangifera indica* (10.9%) while the least plant visited was *Jathrophacurcas* (0.1%) and *Stenobiumstans* (0.1%), Table 1. This can be attributed to the presence of large and fleshy fruits on *Eucalyptus toreliana* and *Mangifera indica* during the period of study as Common bulbul is a frugivorous and insectivorous bird. This agrees with Hinsley and Bellamy (2000) who emphasized the need to have spurces of fruit in a habitat so as to maintain frugivory. This vegetation which possesses fruits also increases the abundance of arthropods and other food sources which attracts common bulbul to visit (Thomas and Marshall 1999). Utilization of *Eucalyptus toreliana* and *Mangifera indica* may be attributed to the adaptive features of the Common bulbul to select fruits and the sweet smelling and yellow colour of both fruits which attract frugivores. It was observed that interspecific difference in fleshy fruits characteristics results in plant species having different visitors of avian fruit utilizers. Valido *et al.* (2011) discovered that frugivorous animals can use visual stimuli to indicate nutritional rewards and this can be particularly, fruit colour (Schaeffer *et al.*, 2006).

Willson and Whelan (1990) further explained that birds select fruits of certain colours because of their conspicuousness to the forager, colours indicate fruit maturity and facilitates food recognition sources which may be the reason why *Eucalyptus toreliana* and

Mangifera indica which have the same fruit colour at maturity was highly utilized. The texture of both fruits is fleshy and succulent which helps frugivores to chew and the fruit yield could also be a factor as resource availability (both plants have numerous fruits on a tree) also encourages high visitation rates, although this was not measured during the study, Jordano (1998) also explained the fine-tuned abilities of the birds to discriminate for specific nutrient combinations which may be attributed to the preference amongst and between different plant species.

The activities observed were foraging and perching (74.38% and 25.62% respectively), table 2 and 3; with the highest activity being foraging which suggests that common bulbul as keystone species in the study site, known to be frugivorous and insectivorous hence serve as important dispersers of fruits consumed by them.

Frequency of visit was higher in the farmland (66.70%) as compared to the riparian forest (33.30%). This could be as a result of varied resources in the farmlands such as fruits, insects, seeds and so on, since Common bulbul are known to be generalist birds hence will require different food sources and as well as moderate vegetation cover to protect them from predators while feeding or perching. This agrees with the findings by Kambai *et al.* (2017) who observed that birds prefer habitat with varied food sources and cover for protection habitats such as farmlands with trees than the riparian forest which has too much cover that does not allow enough sunlight and insects.



Duration of time spent during their activities was highest between 1- 30 seconds and more time was spent on *Eucalyptus toreliana* and *Mangifera indica* (16.35% and 10.94% respectively) while less time was spent visiting *Jathrophacurcas* and *Erythrophleumsuavolens* (0.10% each). This suggests that Common bulbuls spends less time foraging so as to avoid been exposed to predators and they feed on bigger, more fleshy and succulent fruits so as to consume a lot (gain energy) within a limited time. Time spent on different plant species was significant ($P=0.03$) which suggests that there is variation in plant choice. Plants like *Erythrophleumsuavolens* known to be toxic to animals may be the reason why common bulbul doesnot feed on it but prefers to perch on the big tree for protection on rare occasions. Common bulbuls prefer to feed in the mornings (57.44%) than evenings (42.56%) which are as a result of effect of time of day to avoid being hunted upon and may be due to temperature as postulated by Hayworth and Weathers (1984).

Conclusion

At the end of the research it was observed that plants that were highly utilized had large, yellow succulent fruits which attracted Common bulbuls to visit. Also, it further buttressed the point that the birds are generalist, they prefer varied food sources on the farmlands (grains, insects, fruits and nectar from the trees to forage on). This can help in the regeneration potential of the study site as they are keystone species needed for dispersal hence the need to conserve them. Futhermore, these birds spend less time foraging and prefer to forage in large trees with big fruits to avoid being exposed to predators and gain energy fast which could also be the reason why they prefer foraging in the early hours of

the day (morning) when it is safer than the late hours (evening).

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