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Avian Interactions with some Crops During Pre and Postharvest Seasons in Kwadon, Gombe State

[1,2]Abubakar, B*., [3]Nsor, C. A., [2]Adamu, H., [2,4]Mayi, M., [2,5]Bashir, H. D., [1,2]Patrick, D. B., [1]Musa, A. M., [1,2]Umar, A. M., [1]Bala, U.

[1]Department of Science Laboratory Technology, Federal Polytechnic Kaltungo, Gombe State, Nigeria.

[2] Department of Biological Science, Gombe State University, Gombe State, Nigeria.

[3]Department of Zoology and Wildlife Ecology, Gombe State University, Gombe State, Nigeria.

[4]Zonal Advanced Space Technology Applications Laboratory Kashere, Gombe State.

[5]Industrial Training Fund, Gombe Area Office.

***Corresponding authors: bintaabubakar17@gmail.com**

ABSTRACT
Agricultural expansion and intensification are major drivers of bird species diversity loss, due to the conversion of natural habitats into farmlands. The aim of the study is to reveal the nature and frequency of avian interactions with some crops during pre and postharvest season in Kwadon, Gombe State. Five study sites were chosen based on the availability of required crop types. At each study site, eight crop fields were sampled randomly. Bird surveys were conducted before and after harvest using binocular and the ABC Bird of Africa field guide (2020) for visual and auditory identification. Point count method was adopted, with all birds within a 50-meter radius for 10-minute sampling period were recorded. Each site was visited four times in both preharvest and postharvest seasons, while each point monitored twice daily between 6:30am- 9:30am and 3:30pm- 6:30pm. A total of 2608 individuals from 41 species and 32 genera, 25 families and 13 orders were recorded. According to IUCN red list of threatened species (2025), 38 species were least concern, 2 species were unknown, and 1 specie was vulnerable. Passeriformes were the most diverse order, while Columbidae was the most abundant families. Dominant species were Piapiac 468, Cattle egret 390, Laughing dove 350. Birds-crops interaction are generally mutualistic (2382), compared to antagonistic behavior (226). Seasonal evaluation indicated that bird abundance was higher during postharvest season whereas the species richness was high during preharvest season. There is need for data driven evidence to guide conservation and reduce human wildlife conflict.

Keyword: Avian, Postharvest, Dominant species, Evaluation, Crops, Kwadon

INTRODUCTION
Agriculture and its incident intensification have been identified as a major contributor to the loss or decline in bird species diversity due to the conversion of natural habitats

into farmlands (Amissah *et al.*, 2024). Habitat characteristics are used to evaluate animal abundance and species-habitat associations (Spear, 2017). Birds tends to show distinction and other behavior peculiar to just a specific type and as such their adaptation, classification and survival is closely related to their behaviors, calls, nature of feeding and physiological adaptation (Taylor, 2019).

Changes in bird community structure are influence by factors including food availability and vegetation structure which directly affect the feeding guild assemblages in each habitat (Sohil & Sharma, 2020). These factors determine foraging opportunities for birds such that changes in these factors within a habitat could influence the population dynamics and assemblages of species living there (Hovick *et al.*, 2014). Studies conducted in forest–agricultural landscapes worldwide have shown that variation in agricultural land use can differently affect transition species as well as forest-dependent bird assemblages (Carrara *et al.*, 2015; García & Martínez, 2012). Further studies suggested that agricultural land cover affected by bird abundance and species could persist within agro-ecosystems (Munoz-Saez *et al.*, 2017).
Birds represent one of the widest terrestrial taxa, occupying nearly all habitat types across the Earth's terrestrial surface including urban environment (Lees *et al.*, 2022). Their adaptability enables many species to thrive in habitats that lack natural analogues. While some species include swifts and frigate birds, spend most of their lives in flight (Weimerskirch *et al.*, 2016), the majority of bird species occupy terrestrial habitat where species richness generally increases toward the equator due to favorable climatic conditions, water availability and habitat complexity. Avian pests have long been recognized as formidable challenges in agricultural ecosystems, particularly in cereal crop production (Odewumi & Audu, 2024). The aim of the study is to reveal the nature and frequency of avian interactions with some crops during pre and postharvest season in Kwadon, Gombe State.

MATERIALS AND METHODS

Study Area

The study was conducted in Kwadon farmland, Gombe State, Nigeria.

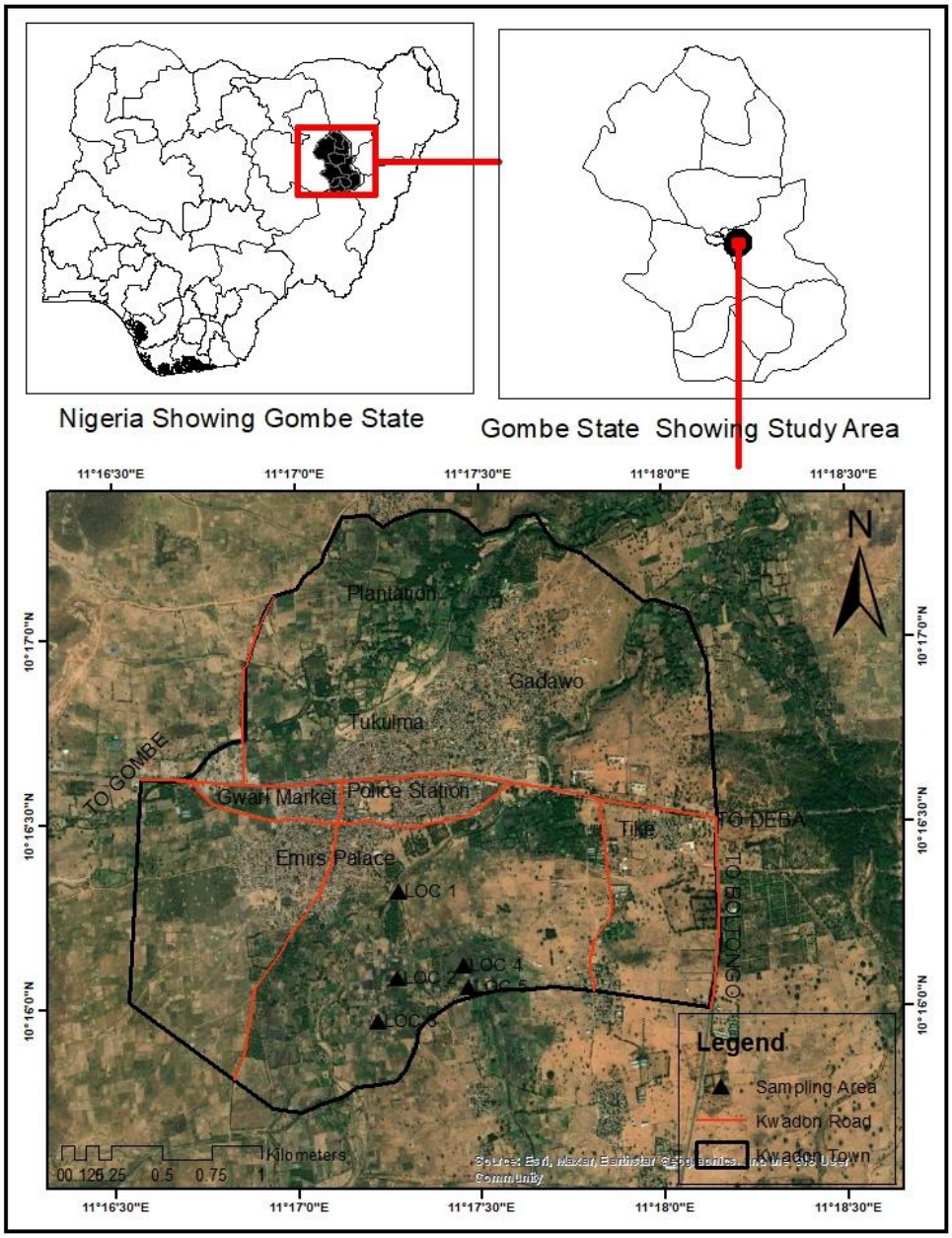

Figure 1: Map of the Study Area
Source: GIS Lab, Gombe State University

Methods

Five study sites were chosen based on the availability of all crop types required for the study. At each study site, eight crop fields were selected (maize, rice, spinach, beans, soyabeans, sesame leaves, sugarcane fields, and mixed crop of maize, rice, spinach, sesame leaves and beans, sugarcane, soyabeans fields). Each of the eight crop fields were sampled randomly.

Bird Sampling Design
Bird surveys were conducted between May-July 2025 before harvest and further sampling between October 2025 after harvest. Birds were viewed with the help of binocular (8 x 40 m) and identified visually and auditory (through calls) using field guide (ABC) to birds of Africa (2020). Point count method was adopted. Each site was visited four times before harvest and four times after harvest, all birds within a 50-meter radius for 10-minute sampling period were identified and recorded. On each sampling day, each point was monitored twice a day (6:30am- 9:30am and 3:30pm- 6:30pm) in the morning and evening, respectively (Nsor *et al*., 2025). Each point was at least 200 meters from the other, to avoid recording same individual more than once (Nsor *et al*., 2025).

Data Collection
At each point, number of individuals, crop type, seasons (preharvest and postharvest), time of day (morning and evening), observed activity (foraging, perching, flying, feeding on crops).

Bird-crop interactions were categorized as mutual and antagonistic.

Data Analysis
Species diversity was estimated using Shannon-Wiener Index. Data were analyzed with SPSS using Parametric tests (Linear Regression, Chi-Square, Pearson Correlation) to evaluate the interaction between avian species and crops.

RESULTS
Checklist of Bird Species in Kwadon
A total of 2608 individuals from 41 species and 32 genera were recorded. According to IUCN red list of threatened species (2025), 38 species out of 41 species were least concern (LC), two species were unknown, and one specie was vulnerable (VU) see Table 1.

The most abundant species were Piapiac (*Ptilostomus afer*) (468), Cattle Egret (*Bubulcus ibis*) (399) and Laughing Dove (*Streptopelia senegalensis*) (350). Interestingly these species are Omnivorous, Insectivorous and granivorous respectively. *Lamprotornis* and *Streptopelia* were the most abundant genera with 4 species each (Table 1). *Cynniris cupreus*, *Galerida cristata* and *Vanellus spinosus* had 2 each while the rest had one representative species (Table 1).

Shannon-Weiner Diversity Index (H') was 1.163 (Appendix 1), indicating a moderate level of bird species diversity in the area.

Table 1: Checklist of Bird Species in Kwadon and Feeding Guild

S/N	Species	Scientific Name	Abundance	IUCN Status	Feeding guild
1	Abdim's Stork	*Ciconia abdimii*	49	LC	Insectivore
2	Abyssinian Roller	*Coracias abyssinicus*	46	LC	Insectivore

3	African Grey Hornbill	*Lophoceros nasutus*	3	LC	Omnivore
4	African Silverbill	*Euodice cantans*	2	LC	Granivore
5	African Thrush	*Turdus pelios*	4	LC	Omnivore
6	Black-Headed Lapwing	*Vanellus tectus*	55	LC	Invertebrates
7	Black-Winged Kite	*Elanus caeruleus*	25	LC	Carnivore
8	Bronze Mannikin	*Spermestes cucullate*	5	LC	Granivore
9	Brown Babbler	*Turdoides plabejus*	1	LC	Omnivore
10	Cattle Egret	*Bubulcus ibis*	399	LC	Insectivore
11	Chestnut-bellied Starling	*Lamprotornis pulcher*	17	LC	Omnivore
12	Common bulbul	*Pycnonotus barbatus*	19	LC	Omnivore
13	Copper sunbird	*Cynniris cupreus*	2	LC	Nectrinivore
14	Crested lark	*Galerida cristata*	21	LC	Omnivore
15	European Turtle dove	*Streptopelia turtur*	4	VU	Granivore
16	Greater blue eared Starling	*Lamprotornis chalybaeus*	25	LC	Omnivore
17	Grey headed sparrow	*Passer griseus*	8	LC	Granivore
18	Lanner Falcon	*Falco biarmicus*	9	LC	Carnivore
19	Laughing Dove	*Streptopelia senegalensis*	350	LC	Granivore
20	Long Tailed Glossy Starling	*Lamprotornis caudatus*	213	LC	Omnivore
21	Mourning	*Streptopelia*	236	LC	Granivore

	Collared Dove	*decipiens*			
22	Northern Red Bishop	*Euplectes franciscanus*	2	LC	Omnivore
23	Northern Redbilled Hornbill	*Tockus erythrorhynchus*	52	LC	Frugivore
24	Piapiac	*Ptilostomus afer*	468	LC	Omnivore
25	Pied Crow	*Corvus albus*	3	LC	Omnivore
26	Purple Starling	*Lamprotornis purpureus*	62	LC	Omnivore
27	Redbill Firefinch	*Lagonosticta senegala*	158		Granivore
28	Reed Cormorants	*Microcarbo africanus*	3		Carnivore/Piscivore
29	Scarlet Chested sunbird	*Chalcomitra senegalensis*	7	LC	Nectrinivore
30	Senegal Coucal	*Centropus senegalensis*	57	LC	Carnivore/Insectivore
31	Speckled Pigeon	*Columba guinea*	161	LC	Granivore
32	Spur-winged Lapwing	*Vanellus spinosus*	11	LC	Invertebrates
33	Sun Lark	*Galerida modesta*	2	LC	Omnivore
34	Tawny-flanked Prinia	*Prinia subflava*	1	LC	Invertebrates
35	Variable Sunbird	*Cynniris venustus*	3	LC	Nectrinivore
36	Village Weaver	*Ploceus cucullatus*	39	LC	Granivore
37	Vinaceous Dove	*Streptopelia vinacea*	1	LC	Granivore
38	White Throated Francolin	*Campocolinus albogularis*	4	LC	Omnivore
39	Yellow-Billed Shrike	*Lanius senator*	51	LC	Insectivore
40	Yellow-	*Laniarius*	28	LC	Frugivore

	Crowned Gonolek	*barbarous*			
41	Yellow-Fronted Tinkerbird	*Pogoniulus chrysoconus*	2	LC	Frugivore
	Total		2608		

Keys: LC (Least concern), VU (Vulnerable)

Figure 2 shows the species richness across taxonomic order. The most abundant order was Passeriformes with total of 23 species followed by Columbiformes with 5 species (Figure 2). Bucerotiformes and Charadriiformes had 2 representatives while others had one representative

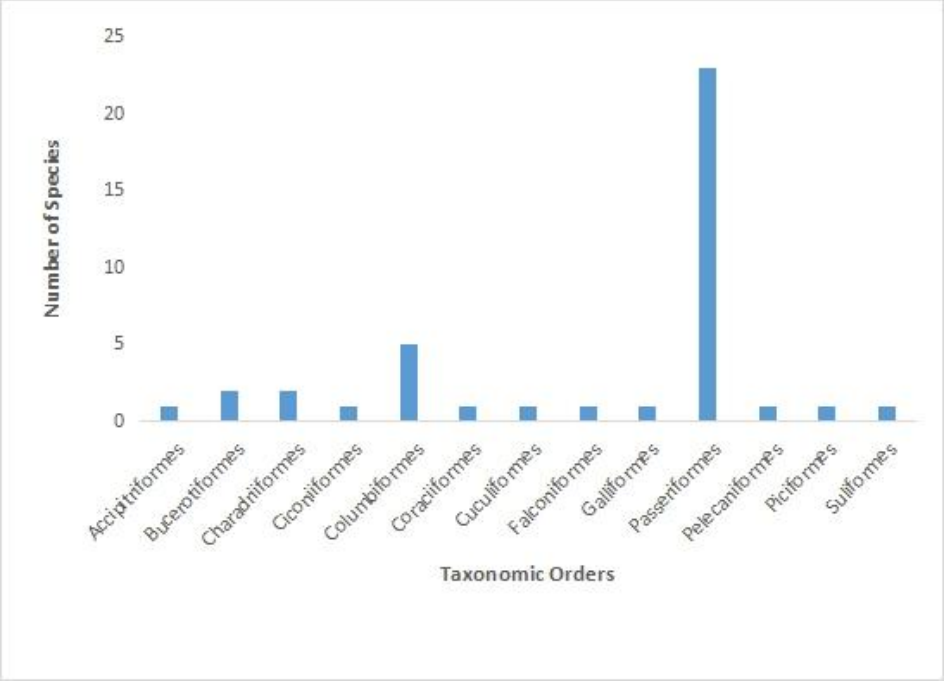

Figure 2: Species richness across taxonomic orders recorded in Kwadon, Gombe State

This result reveals the species abundance across family. The most abundant family was the Columbidae (5) (doves and pigeons) followed by Sturnidae with 4 species. (Figure 3). Estrildidae and Nectariniidae had 3 species whereas Alaudidae, Bucerotidae, Charadriidae, Corvidae, and Ploceidae each has 2 species and the rest had one specie as in figure 3.

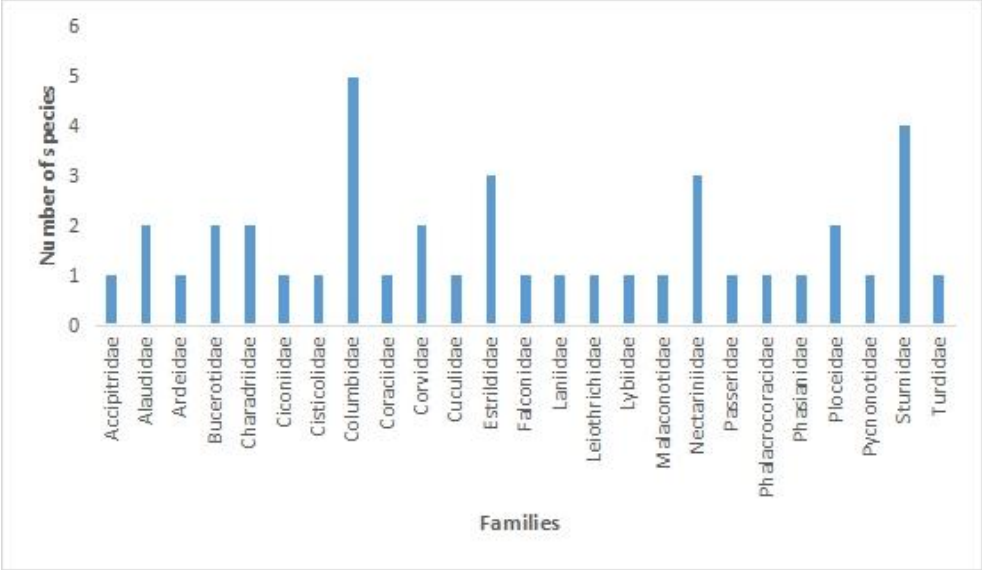

Figure 3: Species abundance across families in Kwadon, Gombe State

Pre and Postharvest Distribution and Abundance of Bird Species in the Study Area

These results summarized the seasonal (Pre and Postharvest) distribution and abundance of bird species in the study area (Figure 6 and 7). There was significant difference between session and habitat feature χ^2 (3, N=697), = 10.57, p=0.001). The post-harvest (1519) has the highest value of abundance as compared to preharvest (1089) with low number. The species richness during preharvest was high (35) than postharvest (22) as shown in the figure 4 below.

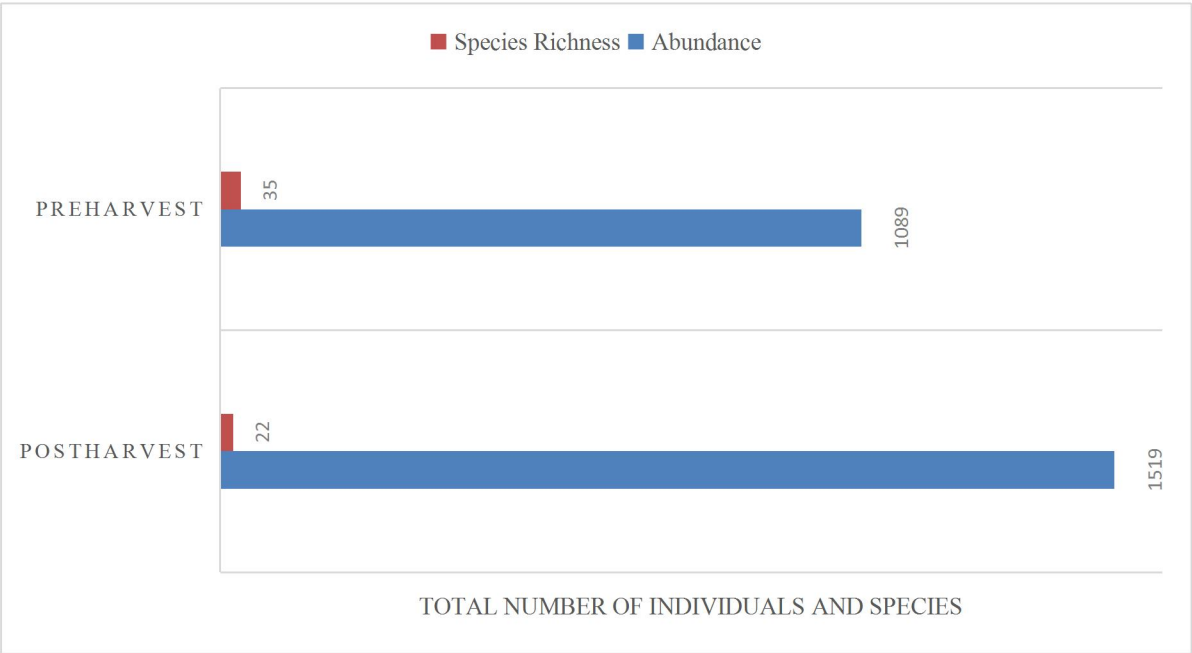

Figure 4: Seasonal Distribution and Abundance of Species

This figure (5) below revealed the habitat used by bird during pre and postharvest. The highest habitat used by birds was ground by 787 individuals during postharvest than preharvest with 582 individuals, whereas cultivated crops recorded highest number of individual (494) in postharvest compared cultivated crops in preharvest 85. The habitat features used by bird (trees) was high in preharvest (254) while in postharvest recorded low number of individual (97) and then sky was used by 168 bird species during preharvest than postharvest with low number (141) as shown in the figure 5.

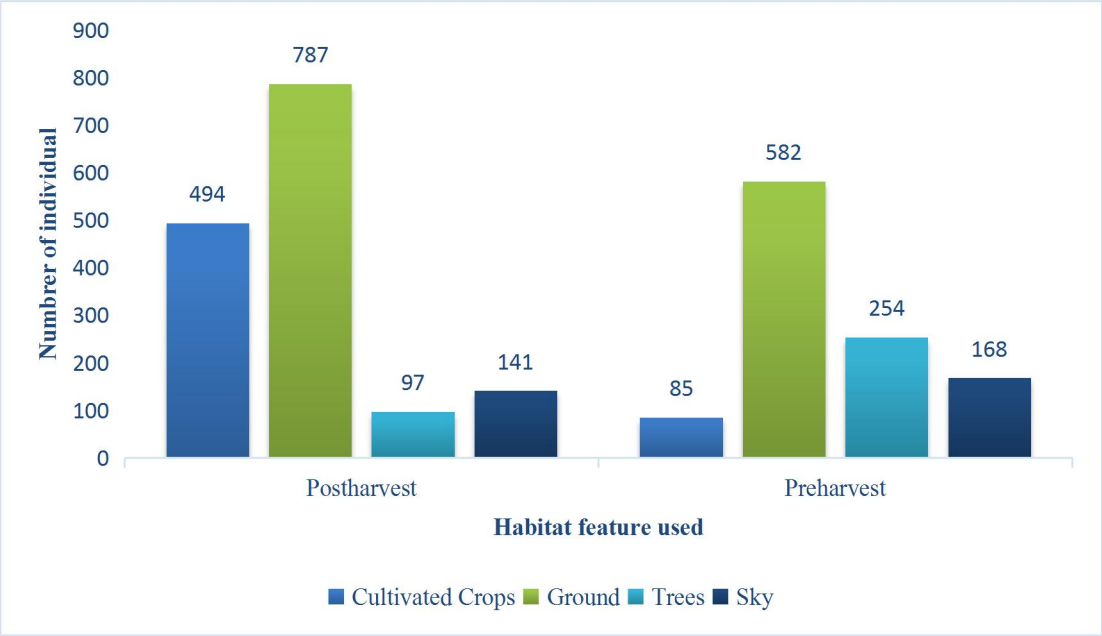

Figure 5: Habitat Features (Crops) Used by Birds during Pre and Postharvest Season

Bird Specie Behavior and Interaction with Crops

The result of the study showed the nature of interaction (antagonistic or mutual) between birds and crops. Chi-Square test indicated the association between crop type and behavior. There was high number of mutual behaviors (2382) compared to antagonistic behavior (226) (Figure 6).

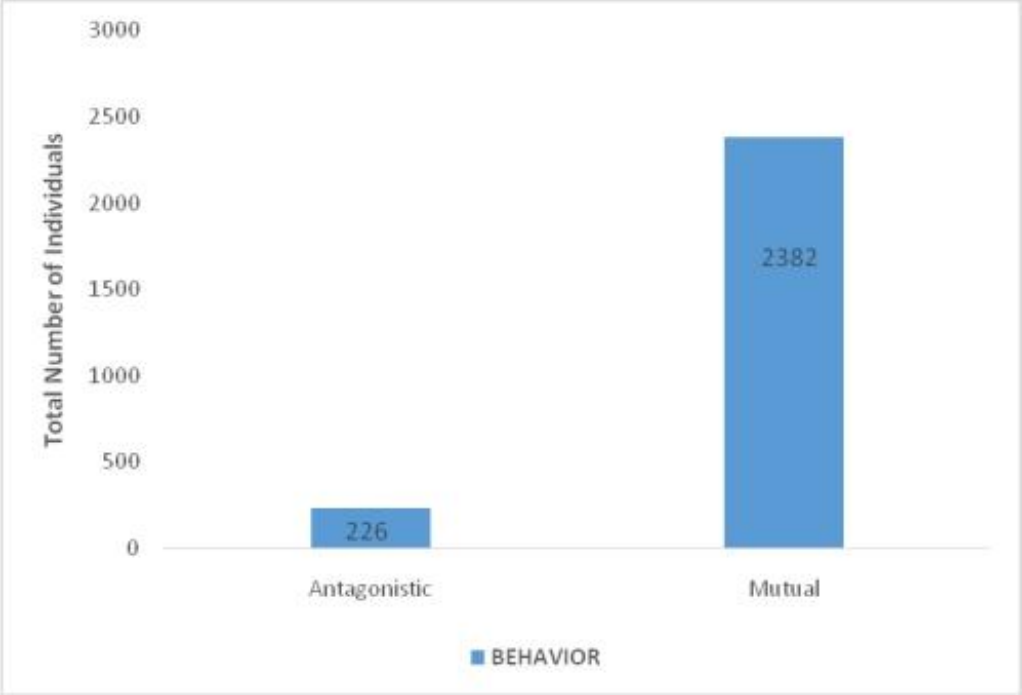

Figure 6: Bird species behavior and Interactions with crops in Kwadon, Gombe State

DISCUSSION

The findings of the study of birds in Kwadon agricultural landscape showed a total of 2608 individuals belonging to 41 species, 32 genera, 25 families and 13 orders. The result of this study is similar to the findings of Shiferaw & Yazezew, (2021), who recorded a total of 45 bird species categorized under nine orders and 21 families at Ansas Dam and surrounding Debre Berhan Town, Ethiopian farmland habitats sites during both wet and dry seasons.

The most abundant species were Piapiac, Cattle egret and Laughing Dove. Avolio *et al.* (2019) suggested that dominant species is known as species with high abundance proportion to another species in the community.

The Shannon- Weiner diversity index (H') recorded was 1.163 indicating moderate level of bird species diversity in the study area. This value is lower than that H′ = 1.78 reported by Shiferaw & Yazezew (2021), farmland habitat during the wet season which would reflect differences in sampling season, vegetation complexity.

The study revealed higher species richness across taxonomic order were the Passeriformes, Similar survey quite like that of Shiferaw & Yazezew (2021), Highest number of species of the order of Passeriformes were recorded at Ansas Dam and surrounding farmland site, in Debre Berhan Town, Ethiopia. The most abundant family was the Columbidae (doves and pigeons) which is line with the findings of Xiao *et al.* (2023), the family had highest number of bird species due to composition of a wider range of bird species feeding on variety of guilds.

Results revealed the seasonal (Pre and Postharvest) distribution and abundance of bird species in the study area. The postharvest has the highest value of abundance compared to preharvest with low number. This result is not in line with the finding of Zufiaurre *et*

al. (2017) who suggested before harvest, plant resources such as flowers, fruits, and seeds. The species richness was higher during preharvest season compared to postharvest season with least number. Similar finding by Amissah *et al.* (2024) reported that bird species richness was higher in the preharvest period which may be influenced by the unique resources available to a wider variety of birds during both periods. The highest habitat used by birds was ground during postharvest compared to cultivated crops with least number during preharvest. Furthermore, crop types differ in cultivation approaches in terms of pesticide application, tillage, and harvest timing (Hoffmann *et al.*, 2018; Hološková *et al.,* 2023). Amissah *et al.* (2024) suggested that the prevailing field conditions such as crops, stubbles, bare ground, weeds, and vertical structures during these two periods influences bird assemblages through the provision of cover, perch, and food resources.

The result of the study showed the nature of interaction (antagonistic or mutual) between birds and crops. There was significant difference between bird species behavior and interaction with crops. There was high number of mutual behaviors compared to antagonistic behaviors. Similar study (Carrete *et al.*, 2022) recorded a total of 1,189 interactions between 135parrots and 107 palm species around the world, including antagonistic behavior whereby parrots eating or destroying the non-reproductive parts (4%), and mutual behavior such as consuming flowers (11%), preying on fruits and seeds (30%), consuming the pulp (25%), and dispersing fruits or seeds (30%).

CONCLUSION

This study documented the first checklist of farmland birds (41) in Kwadon. According to IUCN red list of threatened species (2025), 38 species out of 41 species were least concern (LC), two species were unknown, and one specie was vulnerable (VU). The study revealed higher species richness across taxonomic order. Passeriformes were the most diverse order, while the most abundant and species rich families were the Columbidae (doves and pigeons) followed by Sturnidae. Kwadon farmland supports a moderate species diversity dominated by adaptable species such as Piapiac (*Ptilostomus afer*), Cattle egret (*Bubulcus ibis*), Laughing dove (*Streptopelia senegalensis*). Birds-crops interaction are generally mutualistic, although antagonistic behavior does occur meaning crop damage was minimal. Seasonal evaluation indicated that bird abundance was higher during the postharvest season due to available food resources whereas the species richness was high during preharvest season when vegetation complexity and insect availability were higher, the highest habitat used by birds was ground during postharvest compared to cultivated crops with least number during preharvest. There is need for data driven evidence to guide conservation and reduce human wildlife conflict.

CONFLICTS OF INTERESTS

The authors declare no conflicts of interests

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