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Research Article

Diversity and relative abundance of bird species in relation to season, vegetation cover at college campus, Barnala (Punjab)

Renu Bala[1*], Pragati Rani[2], Ankita[2]

[1]Associate Professor, Department of Zoology, S. D. College, Barnala-148101, Punjab, India.
[2]Student, Department of Zoology, S. D. College, Barnala-148101, Punjab, India.

[*]**Correspondence**
Renu Bala
renubs23@gmail.com

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Background: Bird diversity is strongly influenced by habitat structure and seasonal changes in resource availability, so such study helps assess how trees, which provide food, nesting sites for birds, contribute to sustaining avifaunal diversity in managed green spaces.

Methods: The present study was conducted at S. D. College, Barnala (Punjab), India (30.3654° N, 75.5372° E), which supports a diverse assemblage of tree species from April 2024 to September 2024 by the point count method. Species identification was performed with the help of field guides. The data of all observations in a month were pooled and relative abundance of birds in each month was calculated. Kruskal-wallis test was carried out to find if there was significant difference of bird diversity during different months.

Results: 30 species of birds distributed among 12 orders and 24 families have been recorded on 29 tree species from April to September, 2024 in the present study. The maximum species richness (22) was observed in the month of the April 2024 and July 2024. The order Passeriformes was the most dominant one out of total twelve orders of bird species observed. Relative abundance was found to be significantly different ($p<0.05$) in different months. Common Myna (*Acridotheres tristis*) showed maximum average relative abundance of 14.77 followed by Rose-ringed Parakeet (*Psittacula krameri*) and House Crow (*Corvus spendens*) with values12.35 and 9.02 respectively in the present study.

Conclusion: The study found that campus of S.D. College provides suitable habitat for birds and also shows that conserving diverse tree cover is crucial for sustaining bird populations in different months of year.

Keywords: *avian, diversity, abundance, richness, trees*

Introduction

Birds are among the most widely studied vertebrate groups due to their ecological importance, high visibility, recreational value and susceptibility to environmental change. They live in diverse habitats and play important roles in ecosystem functioning, including pollination, seed dispersal and pest control (Şekercioglu, 2006; Whelan et al., 2015). Tree species composition, structure, and phenology have a direct impact on bird community dynamics, influencing both diversity and relative abundance across seasons (MacArthur & MacArthur, 1961; Kattan & Murcia, 2003). Trees provide resources such as food, nesting sites, and shelter. Because deforestation, urbanisation, and monoculture plantations affect tree

variety and pheonology, preserving native tree assemblages is critical for avian diversity and ecosystem stability (Grimmett et al., 2011; Sundaramoorthy et al., 2020). Seasonal changes with time in flowering, fruiting, and leafing patterns create temporal variation in resource availability, which in turn governs fluctuations in bird species richness and abundance throughout the year (Blake & Loiselle, 2001). Birds represent a diverse group of species that occupy a wide variety of ecological niches and display interspecific differences in dietary and habitat preferences (Storchova & Horak, 2018). Planting mixtures of different tree species in close proximity provide suitable habitat for a greater number of bird species (Wesołowski & Martin, 2018). There are around 1314 species of avifauna in India (Oleti et al., 2010) which makes over 13% of the world's bird diversity (Grimmett & Inskipp, 2010). About 328 species of bird fauna are found in Punjab (Jerath & Chadha, 2006). Studying bird diversity and relative abundance in an area with particular tree diversity across different months offer valuable insights into habitat preferences, foraging strategies, and the ecological roles of avifauna (Herrando et al., 2003); provides valuable insights into habitat quality, resource availability, and the overall health of ecosystems (Bibby et al., 2000) and indicate community structure and ecological balance (Magurran, 2013). In light of these facts present study has been under taken.

Materials and methods

The present study was conducted at S. D. College, Barnala (Punjab), India (30.3654° N, 75.5372° E), which supports a diverse assemblage of tree species (Table 1). Avian surveys on trees in college campus were carried out from April 2024 to September 2024 daily during morning hours (7:00–9:00 AM) and evening hours (5:00–7:00 PM). The point count method (Bibby et al., 2000; Horak et al., 2013) was employed during each field visit. Birds were recorded by direct sighting, binoculars and photographed by using compact super zoom digital cameras. Species identification was performed with the help of field guides (Grimmet et al., 2011; Ali, & Fatehali. 2003). The data of all observations in a month were pooled and relative abundance of birds in each month was calculated. Kruskal-wallis test was carried out to find if there was significant difference of bird diversity during different months.

Relative abundance = ni/N × 100 where ni is the number of birds of i^{th} species and N is the total number of birds recorded.

Results

In college, vegetation primarily comprised of flowering shrubs, bushy herbs, and numerous trees, which are planted for aesthetic and environmental benefits. Total 29 tree species were observed during study period in college campus (Table 1).

Table 1. Tree diversity at campus of S.D. College, Barnala from April 2024 to September 2024

S. No	Common name	Scientific name			
1	Arjun	*Terminalia arjuna*	16	Dharek	*Melia azedarach*
2	Amaltas	*Cassia fistula*	17	Gulmohar	*Deolnix regia*
3	Amla	*Phyllanthus emblica,*	18	Imli	*Tamarindus indica*
4	Ashoka	*Saracaindica*	19	Jamun	*Syzygium cumini*
5	Bael	*Aegle marmelos*	20	KanakChampa	*Pterospermum acerifolium*
6	Banyan	*Ficus bengalensis*	21	Kikar	*Vachellia nilotica*
7	Blackboard Tree	*Alstonia scholaris*	22	Lucky Bean Tree	*Putranjiva roxburghii*
8	Lasura	*Cordia myxa*	23	Safeda	*Eucalyptus globus*
9	Mahua	*Madhuca longifolia*	24	Sagwan	*Tectona grandis*
10	Mango	*Mangifera indica*	25	Sambhalu	*Chinese chastetree*
11	Monkey puzzle tree	*Araucaria araucana*	26	Sanjana	*Moringa oleifera*
12	Neem	*Azadirachta indica*	27	Shahtoot	*Morus alba*
13	Peepal	*Ficus religiosa*	28	Sitaphal	*Annona reticulata*
14	Pongamia	*Millettia pinnata*	29	Tahli	*Dalbergia sissoo*
15	Bottle brush	*Callistemon viminalis*			

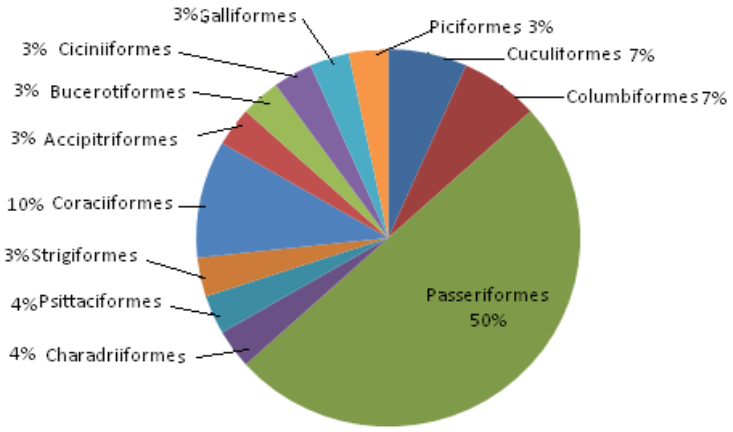

Figure 1. Avian species in different orders (%) in study area

On these trees, 30 species of birds distributed among 12 orders and 24 families have been recorded in the present study (Table 2). The maximum species richness (22) was observed in the month of the April 2024 and July 2024.

Table 2. Relative abundance of bird species at campus of S.D. College, Barnala from April, 2024 to September 2024

S. No.	Common name	Scientific name	April-24	May-24	June-24	July-24	Aug-24	Sept-24	Relative Abundance
1	**Black Kite** Order: Accipitriformes Family: Accipitridae	*Milvus migrans* (Boddaert, 1783)	1.82	-	-	1.82	-	1.72	1.79
2	**Common Hoopoe** Order: Bucerotoformes Family: Upupidae	*Upupa epops* (Linnaeus, 1758)	2.08	-	1.82	-	-	1.82	1.91
3	**Red Wattled Lapwing** Order: Charadriiformes Family: Charadriidae	*Vanellus indicus* (Boddaert, 1783)	2.08	3.64	7.14	3.85	5.08	2.08	3.98
4	**Cattle Egret** Order: Ciciniiformes Family: Ardeidae	*Bubulcus ibis* (Linnaeus,1758)	0.97	1.82	0.93	1.77	0.92	0.92	1.22
5	**Blue Rock Pigeon** Order: Columbiformes Family: Columbidae	*Columba livia* (Gmelin, 1789)	0.58	0.76	0.59	1.16	1.25	0.67	0.84
6	**Eurasian Collared Dove** Order: Columbiformes Family: Columbidae	*Streptopelia decaocto* (Frivaldszky, 1838)	4.17	1.82	5.36	3.85	1.69	6.25	3.85
7	**White Breasted Kingfisher** Order: Coraciiformes Family: Alcedinidae	*Halcyon smyrnensis* (Linnaeus, 1758)	-	1.82	-	1.92	3.39	-	2.38
8	The Indian roller **Order:** Coraciiformes **Family:** Coraciidae	*Coracias benghalensis* (Linnaeus, 1758)	-	-	-	1.82	-	-	1.82
9	**Green Bee Eater** Order: Coraciiformes Family: Meropidae	*Merops orientalis* (Latham,1802)	2.08	5.45	3.57	7.69	3.39	-	4.44
10	**Asian Koel** Order: Cuculiformes Family: Cuculidae	*Eudynamys scolopaceus* (Linnaeus, 1758)	2.08	1.82	3.57	1.92	1.69	-	2.22
11	**Greater Coucal** Order: Cuculiformes Family: Cuculidae	*Centropus sinensis* (Stephens, 1815)	0.5	-	-	-	-	-	0.08
12	**Indian Peafowl** Order: Galliformes Family: Phasianidae	*Pavo cristatus* (Linnaeus,1758)	0.25	-	-	-	-	-	0.04
13	**Common Tailor Bird Order: Passeriformes** Family: Cisticolidae	*Orthotomus sutorius* (Pennant, 1769)	0.97	-	0.93	-	0.92	-	0.94

14	**House Crow** **Order: Passeriformes** Family: Corvidae	*Corvus splendens* (Vieillot, 1817)	8.33	12.73	8.93	7.69	10.17	6.25	9.01
15	**Rufous treepie** Family: Corvidae	*Dendrocitta vagabunda* (Latham, 1790)	-	-	-	-	-	0.91	0.91
16	**Black Drongo** Family: Dicruridae	*Dicrurus macrocercus* (Vieillot, 1817)	3.64	5.45	3.64	3.85	1.79	3.64	3.67
17	**Wire-tailed swallow** Family: Hirundinidae	*Hirundo smithii* (Leach, 1818)	-	-	-	-	7.34	6.36	6.85
18	**Jungle Babbler** Family: Leiothrichidae	*Argya strata* (Dumont, 1823)	6.25	7.27	7.14	9.62	10.17	18.75	9.87
19	**White Wagtail** Family: Motacillidae	*Motacilla alba* (Linnaeus, 1758)	-	-			3.64	1.92	2.46
20	**Brown Rock Chat** *family Muscicapidae*.	*Oenanthe fusca* (Blyth, 1851)	4.17	5.45	1.79	7.69	5.08	8.33	5.42
21	**Indian Robin** Family: Muscicapidae	*Saxicoloides fulicatus* (Linnaeus, 1766)	-	-	-	0.92	-	-	0.92
22	**Oriental Magpie Robin** Family: Muscicapidae	*Copsychus saularis* (Linnaeus, 1758)	-	-	-	0.91	0.87	0.99	0.92
23	**Purple Sunbird** Family: Nectariniidae	*Cinnyris asiaticus* (Latham, 1790)	8.33	3.64	7.14	3.85	5.08	-	5.61
24	**House Sparrow** Family: Passeridae	*Passer domesticus* (Linnaeus, 1758)	8.33	3.64	5.36	9.62	6.78	6.25	6.66
25	**Red Vented Bulbul** Order: Passeriformes Family: Pycnonotidae	*Pycnonotus cafer* (Linnaeus, 1766)	4.17	5.45	1.79	5.77	1.69	4.17	3.84
26	**Asian Pied Starling** Order: Passeriformes Family: Sturnidae	*Gracupica contra* (Linnaeus, 1758)	2.08	-			-	-	2.00
27	**Common Myna** Order: Passeriformes Family: Sturnidae	*Acridotheres tristis* (Linnaeus, 1766)	14.58	10.91	16.07	13.46	16.95	16.67	14.77
28	**Lesser golden-backed** woodpecker Order: Piciformes Family: Picidae	*Dinopium benghalense* (Linnaeus, 1758)	0.97	-	-	-	-	0.92	0.94
29	**Rose Ringed Parakeet** Order: Psittaciformes Family: Psittaculidae	*Psittacula krameri* (Scopoli, 1769)	18.75	14.55	12.5	7.69	10.17	10.42	12.35
30	**Spotted Owlet** Order: Strigiformes Family: Strigidae	*Athene brama* (Temminck,1821)	-	1.82	-	-	-	-	0.33
	Species richness		**22**	**17**	**17**	**22**	**20**	**19**	

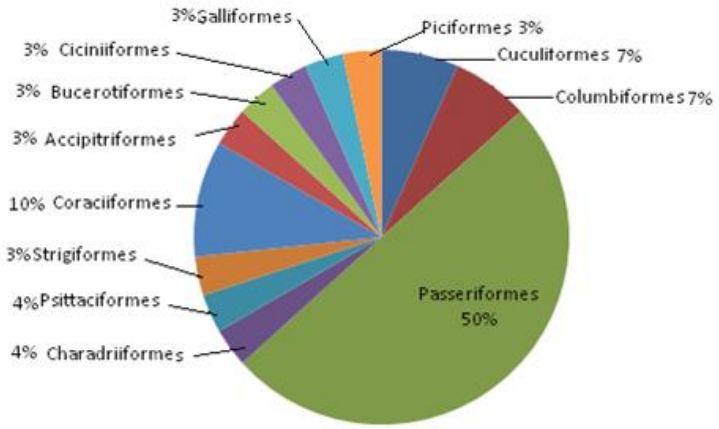

Figure 1. Avian species in different orders (%) in study area

Statistically, Kruskal Wallis test was carried out to find the difference in relative abundance of birds in different months. High **Chi-Square values (65–84 range)** suggests strong deviations from equal distribution. It was concluded that relative abundance was significantly different ($p<0.05$) in different months (**Asymp. Sig. = 0.000)** (Table 2).

Table 2. Non-parametric procedure (Kruskal-Wallis test) showing difference in relative abundance in different months

Month	April-24	May-24	June-24	July-24	Aug-24	Sept-24
Chi-Square	83.681	83.724	65.722	76.463	77.928	77.776
Df.	23	23	23	23	23	23
Asymp. Sig.	.000	.000	.000	.000	.000	.000

Kruskal Wallis Test; Grouping Variable: Month

Maximum number of observed species belonged to Order Passeriformes with 15 species out of 12 orders observed. Similar observation has been reported by Kiran et al., 2022 and Chhikara et al., 2024 in their study area. Common Myna (*Acridotheres tristis*) showed maximum average relative abundance of 14.77 followed by Rose-ringed Parakeet (*Psittacula krameri*) and House Crow (*Corvus spendens*) with values12.35 and 9.02 respectively in the present study. Common myna showed highest relative abundance in months of August followed by September and its cavity nests made in neem, gulmohar and peepal trees were also observed. Similar to present observation, Dhandhukia & Patel, 2012 has also reported that common myna favoured neem, peepal, kamachili and yellow oleander for nesting in natural nests. Between April and July 2024, it was observed that Eurasian Collared Dove chose trees such as Shahtoot, Kikar, Dharek, Neem, Amaltas, Neem, Ashoka tree for nesting. Six nests in all were found. Its relative abundance has been found to be 3.85. In the present study, 3 nests of cattle egret were seen on *Acacia* spp from June to July of 2024. These observations are in conformity with other workers like Bachir et al. (2008) who have given that the nesting season ran from April to July and Dalia (2018) has reported that 75% of Cattle Egret nests on *Acacia nilotica*. Its relative abundance has been found to be 1.22. By the second week of June 2024, there was just one house crow nest visible on a Bottlebrush tree. Dry sticks were used to build the nest, but it appeared that once it was completed, no birds were seen around, which means it was abandoned. Due to the availability of both city and village waste, which serves as an accessible supply of food, studies have indicated that house Crows prefer periurban environments for living and breeding as also has been reported by others (Kaur et al., 2015). From the second week of September, two Rose-ringed Parakeet nests were seen in pre-existing cavities in the Gulmohar tree. Similar observation in relation to tree preferences were also made by other workers (Kler et al., 2015; Kaur & Kumar, 2018). The bird population is impacted by a tree's ability to produce food. For many omnivorous birds and the majority of frugivores, ficus trees offer an alternate food source. For the purpose of nesting, birds are extremely intimately related to trees. Similar findings have been reported in Indian studies (ShankarRaman, 2006; Grimmett et al., 2011).

Conclusion

The present study observed 30 avian species belonging to 24 families on different trees from April 2024 to September 2024 which shows that campus of S.D. College, Barnala provides a suitable environment to support bird diversity. The order Passeriformes was the most dominant order out of the total eleven orders of bird species observed. Maximum spices richness (22) was recorded in months of July and September. Common Myna, Rose-ringed Parakeet Jungle Babbler and House Crow, were the most abundant birds recorded on different tree species. The Indian roller, spotted owlet, *Rufous treepie* Indian robin were observed month of July while great coucal and Indian peafowl were observed in April. The relative abundance patterns indicated that indigenous tree species significantly influence the distribution of bird species by providing food resources, shelter, and nesting habitats. So, conserving tree diversity is essential for maintaining bird populations which ensures the ecological balance of the landscape. Further work is required to find out tree specific avian relative abundance.

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Author contributions

Renu Bala led the study and was primarily responsible for designing the research, conducting field surveys, analysing the data, and preparing the manuscript. Pragati Rani and Ankita contributed by photographing the bird species

encountered during the surveys and assisting in compiling and formatting the references. All authors reviewed and approved the final manuscript.

Conflict of interests

The authors declare no competing interests.

Ethics approval

Not Required.

AI tool usage declaration

The authors declare that no AI and associated tools are used for writing scientific content in this article.

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