



## AVIFAUNAL DIVERSITY IN MUSTARD CROP

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### ABSTRACT

Avifaunal diversity in mustard (*Brassica spp.*) crop was studied from October 2020 to April 2021 in the agricultural field areas at two locations of district Ludhiana, Punjab. A total of 40 species were observed, with the most dominant order and family being Passeriformes (57%) and Passeridae (17.5%), respectively. Based on the status of birds, 75% were resident, 17.5% were resident migrant and 7.5% were migrant. As per IUCN status, all 40 species falls under least concern category. As the foraging guilds of the birds are overlapping resulting in some birds falling under two or more foraging guilds and as per their foraging habits, 52% were insectivorous, 14% were frugivorous, 11% granivorous, 9.5% feeding on small invertebrates, 8.5% phytophagous, 4% feeding on small vertebrates and 1% omnivorous. Based on the status of birds, 75% birds were resident, 17.5% were resident migrant and 7.5% were migrant.

**Key words:** Bird diversity, oil seed crop, phonological stages, insectivores, foraging guild, resident status, least concern, relative abundance, richness, evenness

Punjab is a state in northwest region covering 1.5% topographical space of India and at the same time gives food to 13-14% of population of India (McLaughlin 2011). Oilseed crops, accounted around 19% of worldwide area together with 2.7% of worldwide yield, hold the second most significant determining factor of Indian rural economy sector close to whole grains (Madhusudhan, 2015, Reddy and Emmanuel, 2017). Mustard is an essential Rabi season oil-rich seed plant, being a part of family Brassicaceae and belongs to genus *Brassica* and it need less water for finishing lifecycle, thus it is the most sustainable cropping system under rain fed cropping system (Anonymous, 2021). In an agroecosystem, birds serve a dual purpose therefore; they are useful and harmful. Birds are of huge worth to mankind due to their annihilation of bugs and seed of weeds, assume a critical part in the seed dispersal and flower pollination (Pitti et al., 2016; Mangan et al., 2017). Intensive agricultural practices and reduction in natural habitats leads to dependence of birds on agricultural crops for food and the significance of birds in agribusiness has been studied by Ali (1978). Birds are endothermic (warm-blooded), bipedal, egg-laying, padded, winged and vertebrate creatures. They have an incredible variety of conduct, shading, structure and size. There are 1306 species of birds reported from India, among them 72 (5.5%) are endemic, 26 are uncommon or incidental. Systematically, it cover-up 26 orders, 111 families and 492 genera (Pitti et al., 2016). The total avifauna in Punjab involves 328 types of bird (Jerath and Chadha, 2006). In addition to beneficial

aspects of birds there are harmful aspects are also there so it is fundamental for discovering economical and regularly accessible technique to decrease bird depredation in crops (Firake et al., 2016). The present work was undertaken to study the avifaunal diversity in mustard crop.

### MATERIALS AND METHODS

The present study was conducted in the selected mustard crop fields at two locations during Rabi season from October 2020 to April 2021. Location I (LI): Agricultural fields at Punjab Agricultural University campus (PAU), Ludhiana (75.44° E, 30.59° N, 229m above mean sea level. Location II (LII): University Seed Farm (USF), Ladhawal, Ludhiana (75. 49° E, 30.57° N, 189m above mean sea level). The crop was raised all according to cultural practices provided in Package and Practices for *Rabi* crops, Directorate of Extension, Punjab Agricultural University, Ludhiana (Anonymous 2021). Mustard seeds were sown by broadcasting method in standing water. No application of pesticide was done at any stage of the crop. Fields with half acre of area were selected in triplicates at both the locations at a distance of 500 m from each other at both locations. Prominent crops and plantations surrounding the selected fields at LI were wheat (*Triticum aestivum*), sunflower (*Helianthus annuus*), guava (*Psidium guajava*), kinnow (*Citrus sinensis*) and poplar (*Populus deltoids*) and at LII were wheat (*Triticum aestivum*), Bajra (*Pennisetum glaucum*),

potato (*Solanum tuberosum*) and sagwan (*Tectona grandis*). Observations were taken in the morning and evening depending upon the season, as birds has maximum activity during that time, on weekly basis. Species in the fields, on vegetations, on the ground and also utilizing perches like poles, electricity wires and trees around selected fields were recorded and identified based on visual observations which include their morphological characters such as color, size, wings, beak, shape and rest of body parts with the help of binocular (Nikon 10/50) and comparing with those described by Ali (2003). Standard nomenclature of birds was followed as per Manakadan and Pittie (2001). Birds were also categorized based on the foraging habits (Ali, 2003). The entire data of respective stages were pooled and community characteristics i.e. relative abundance, Shannon-Weiner Index of species diversity and species evenness were calculated (Krebs et al., 1985; Jerath and Chadha, 2006).

## RESULTS AND DISCUSSION

The present study was conducted on mustard crop to study the avian diversity in different growth stages of crop and to assess the damage and evaluation of bird pest management methods. A total of 40 species of birds were observed during the study on the selected locations. Nearly, most of the birds belongs to order Passeriformes. Also, two members each from order Pelecaniformes, Ciconiiformes Coraciiformes, Columbiformes and Cuculiformes. Three members belongs to order Galliformes. Also, only, one member each from order Charadriiformes, Bucerotiformes and Psittaciformes. Majority of the birds are resident (75%) but 17.5 % were resident migrant and 7.5% were migrant. As per IUCN status, all forty bird species fall under least concern category (Kler and Kumar, 2015). The most dominant order and family was Passeriformes (57%) and Passeridae (17.5%) respectively. Based on the status of birds, 76% of the bird species observed were resident and 24% were resident migrant (Table 1). Birds were also categorized based on the foraging guilds (Ali, 2003). As the foraging guilds of the birds are overlapping which results in some birds were falling under two or more foraging guilds and as per their foraging habits, 52% were insectivorous, 14% were frugivorous, 11% granivorous, 9.5% feeding on small invertebrates, 8.5% phytophagous, 4% feeding on small vertebrates and 1% omnivorous (Table 1). Birds do have various dietary habits but for integrated pest management insectivorous birds are of farmer's interest. Dominant category of bird species present in Punjab are

insectivorous so they are dependent on insects as prey (Losey and Vaughan, 2006; Kler and Kumar, 2015).

Avian diversity in relation to phenological stages of the mustard crop revealed that maximum bird species belongs to order Passeriformes (22), three members were from order Galliformes, followed by two species were from each order like Pelecaniformes, Ciconiiformes, Coraciiformes, Columbiformes and Cuculiformes. Only one member was from each family such as Charadriiformes, Bucerotiformes and Psittaciformes (Table 2). As per their foraging guild, 35 insectivorous, 8 each under frugivorous, feeding on small invertebrates, 7 granivorous and 6 phytophagous and 1 omnivorous in feeding habits. Species richness was high in seedling stage and low during sowing stage where as species diversity was high in seedling stage while low in ripening stage. Kale et al. (2014) reported that in horticulture crop of pointed gourd Cattle Egret as well as Common Myna were seen predated the pest *Margaronia indica* and controlling the pest problem proving the benefits of insectivorous birds. Similarly at location II, 26 insectivorous, 7 frugivorous, 6 feeding small invertebrates, 5 granivorous, 4 phytophagous, 2 feeding on small vertebrates and 1 omnivorous bird species recorded. Maximum bird species belongs to order Passeriformes, followed by Muscicapidae. Species richness was maximum in vegetative and ripening stage while low in sowing and flowering stage. Species diversity was high in vegetative stage and low in sowing stage (Table 2).

The variable species richness and species diversity at different phenological stages of the crop at both locations was because of the presence of different types of vegetations as well as crops in the surrounding areas, as at location I there were different crops were present in surrounding fields whereas more uniform cropping pattern was observed at location II. Higher number of insectivorous birds were observed at both the locations (Table 2). Insectivorous birds were observed to be utilizing natural and artificial structures for perching purposes near the crop fields. They gleaned the fields from these perching places before foraging the crop. Other workers also observed such behavior that birds in crop fields which were supported by perches and insectivorous birds are height generalist which relies on structure of vegetation, abundance and distribution of prey; also, it affects their perch height selection (Narayana et al., 2014; Ali et al., 2010). Karp et al. (2013) revealed that a few avifaunal species can annihilate psyllids from woodland areas. Martin

Table 1. Avian diversity in mustard crop- Ludhiana (rabi, October 2020-April 2021)

| No. | Common name            | Scientific name                  | Order           | Family            | Status | Feeding habits |
|-----|------------------------|----------------------------------|-----------------|-------------------|--------|----------------|
| 1.  | Asian pied starling    | <i>Sturnus contra</i>            | Passeriformes   | Sturnidae         | R      | I, F           |
| 2.  | Bank myna              | <i>Acridotheres ginginianus</i>  | Passeriformes   | Sturnidae         | R      | I, F           |
| 3.  | Black drongo           | <i>Dicrurus macrocercus</i>      | Passeriformes   | Dicruridae        | R      | I              |
| 4.  | Black francolin        | <i>Francolinus francolinus</i>   | Galliformes     | Phasianidae       | R      | G, I           |
| 5.  | Black ibis             | <i>Pseudibis papillosa</i>       | Pelecaniformes  | Threskiornithidae | R      | I, G           |
| 6.  | Black kite             | <i>Milvus migrans</i>            | Ciconiiformes   | Accipitridae      | R      | I, R           |
| 7.  | Black redstart         | <i>Phoenicurus ochruros</i>      | Passeriformes   | Muscicapidae      | RM     | I              |
| 8.  | Black-winged Stilt     | <i>Himantopus himantopus</i>     | Charadriiformes | Recurvirostridae  | R      | I              |
| 9.  | Blue rock pigeon       | <i>Columbia livia</i>            | Columbiformes   | Columbidae        | R      | G              |
| 10. | Brainfever bird        | <i>Hierococyx varius</i>         | Cuculiformes    | Cuculidae         | R      | I, F           |
| 11. | Cattle egret           | <i>Bubulcus ibis</i>             | Pelecaniformes  | Ardeidae          | RM     | I, SI          |
| 12. | Common babbler         | <i>Turdoides caudatus</i>        | Passeriformes   | Silvidae          | R      | I, F           |
| 13. | Common hoopoe          | <i>Upupa epops</i>               | Bucerotiformes  | Upupidae          | RM     | I              |
| 14. | Common myna            | <i>Acridotheres tristis</i>      | Passeriformes   | Sturnidae         | R      | I, F           |
| 15. | Common starling        | <i>Sturnus vulgaris</i>          | Passeriformes   | Sturnidae         | M      | I, F           |
| 16. | Common tailor bird     | <i>Orthotomus sutorius</i>       | Passeriformes   | Cisticolidae      | R      | I, P           |
| 17. | Eurasian collared dove | <i>Streptopelia decaocto</i>     | Columbiformes   | Columbidae        | R      | G              |
| 18. | Greater coucal         | <i>Centropus sinensis</i>        | Cuculiformes    | Centropodidae     | RM     | I, SI, SV      |
| 19. | Greenish leaf-warbler  | <i>Phylloscopus trochiloides</i> | Passeriformes   | Silvidae          | M      | I              |
| 20. | Grey francolin         | <i>Francolinus pondicerianus</i> | Galliformes     | Phasianidae       | R      | G, I           |
| 21. | Grey wagtail           | <i>Motacilla cinerea</i>         | Passeriformes   | Passeridae        | M      | I, F           |
| 22. | House crow             | <i>Corvus splendens</i>          | Passeriformes   | Corvidae          | R      | O              |
| 23. | House sparrow          | <i>Passer domesticus</i>         | Passeriformes   | Passeridae        | R      | G, I           |
| 24. | Indian pea fowl        | <i>Pavo cristatus</i>            | Galliformes     | Phasianidae       | R      | G, P, I, SV    |
| 25. | Indian robin           | <i>Saxicoloides fulicata</i>     | Passeriformes   | Muscicapidae      | R      | I              |
| 26. | Indian roller          | <i>Coracias benghalensis</i>     | Coraciiformes   | Coraciidae        | R      | I              |
| 27. | Jungle babbler         | <i>Turdoides striatus</i>        | Passeriformes   | Silvidae          | R      | I, F           |
| 28. | Large pied wagtail     | <i>Motacilla maderaspatensis</i> | Passeriformes   | Passeridae        | R      | I, SI          |
| 29. | Oriental magpie robin  | <i>Copsychus saularias</i>       | Passeriformes   | Muscicapidae      | R      | I              |
| 30. | Oriental tree pipit    | <i>Anthus hodgsoni</i>           | Passeriformes   | Passeridae        | RM     | I, P           |
| 31. | Paddy field pipit      | <i>Anthus rufulus</i>            | Passeriformes   | Passeridae        | R      | I, P           |
| 32. | Pied bush chat         | <i>Saxicola caprata</i>          | Passeriformes   | Muscicapidae      | R      | I              |
| 33. | Red-vented bulbul      | <i>Pycnonotus cafer</i>          | Passeriformes   | Pycnonotidae      | R      | I, P, F        |
| 34. | Red-wattled lapwing    | <i>Vanellus indicus</i>          | Ciconiiformes   | Charadriidae      | R      | I, SI          |
| 35. | Rose-ringed parakeet   | <i>Psittacula krameri</i>        | Psittaciformes  | Psittacidae       | R      | F, P, G        |
| 36. | Rufous-backed shrike   | <i>Lanius schach</i>             | Passeriformes   | Lanidae           | R      | I              |
| 37. | Small bee-eater        | <i>Merops orientalis</i>         | Coraciiformes   | Meropidae         | R      | I              |
| 38. | White wagtail          | <i>Motacilla alba</i>            | Passeriformes   | Passeridae        | RM     | I, SI          |
| 39. | Wire-tailed Swallow    | <i>Hirundo smithii</i>           | Passeriformes   | Hirundinidae      | R      | I              |
| 40. | Yellow wagtail         | <i>Motacilla flava</i>           | Passeriformes   | Passeridae        | RM     | I, SI          |

Status: R- Resident; RM- Resident Migrant; M- Migrant ; Food habit: I- Insectivorous; G- Granivorous; F- Fruits; P- Plants; SI- Small Invertebrates; SV- Small vertebrates; O-Omnivorous (Kler and Kumar, 2015)

Table 2. Relative abundance (%) of avian species- vs. phenological stages of mustard crop

| S. No.               | Birds                  | Sowing Stage |       | Seedling Stage |       | Vegetative Stage |       | Flowering Stage |       | Ripening Stage |       |
|----------------------|------------------------|--------------|-------|----------------|-------|------------------|-------|-----------------|-------|----------------|-------|
|                      |                        | L1           | L2    | L1             | L2    | L1               | L2    | L1              | L2    | L1             | L2    |
| 1.                   | Asian pied starling    | 5.69         | 3.98  | 3.99           | 4.86  | 5.58             | 2.77  | 5.40            | 10.17 | -              | -     |
| 2.                   | Bank myna              | 1.65         | -     | -              | -     | -                | -     | -               | -     | 1.39           | -     |
| 3.                   | Black drongo           | 6.86         | 7.79  | 5.91           | 3.23  | 4.11             | 4.98  | -               | 9.46  | 4.92           | 2.08  |
| 4.                   | Black francolin        | -            | -     | 1.00           | -     | -                | -     | -               | -     | -              | -     |
| 5.                   | Black ibis             | -            | -     | 1.90           | -     | -                | -     | -               | -     | -              | -     |
| 6.                   | Black kite             | -            | -     | 4.59           | 3.05  | 4.86             | 3.16  | -               | -     | 2.97           | 2.11  |
| 7.                   | Black redstart         | -            | -     | -              | -     | 0.83             | 3.21  | -               | -     | 2.03           | 1.51  |
| 8.                   | Black-winged Stilt     | -            | -     | -              | -     | 1.15             | 4.38  | -               | -     | -              | 6.88  |
| 9.                   | Blue rock pigeon       | 8.51         | 9.78  | -              | -     | -                | -     | 6.02            | 8.38  | -              | -     |
| 10.                  | Brain fever bird       | -            | -     | 0.66           | -     | -                | -     | -               | -     | -              | -     |
| 11.                  | Cattle egret           | -            | -     | -              | -     | 5.09             | -     | 7.78            | 8.16  | 2.40           | 2.17  |
| 12.                  | Common babbler         | -            | 5.49  | -              | 3.44  | -                | -     | -               | -     | -              | -     |
| 13.                  | Common hoopoe          | -            | -     | 1.24           | 2.81  | 0.98             | 2.05  | -               | -     | -              | 4.51  |
| 14.                  | Common myna            | 20.08        | 11.85 | 14.01          | 10.06 | 14.12            | 9.14  | 12.67           | 12.60 | 16.03          | 4.39  |
| 15.                  | Common starling        | -            | -     | -              | -     | 1.63             | -     | -               | -     | -              | -     |
| 16.                  | Common tailor bird     | 1.40         | -     | -              | -     | -                | -     | -               | -     | 2.10           | -     |
| 17.                  | Eurasian collared dove | 5.88         | 3.74  | 7.43           | 5.25  | -                | 5.54  | 7.30            | 8.38  | 6.90           | 10.30 |
| 18.                  | Greater coucal         | -            | -     | -              | -     | 1.44             | 1.61  | -               | -     | -              | -     |
| 19.                  | Greenish leaf-warbler  | -            | -     | -              | -     | -                | -     | 1.40            | -     | -              | -     |
| 20.                  | Grey francolin         | -            | -     | 2.69           | 5.60  | -                | -     | 6.67            | -     | 4.29           | 5.36  |
| 21.                  | Grey wagtail           | 9.34         | 9.14  | 3.98           | 5.99  | 5.49             | 4.54  | 2.33            | -     | -              | -     |
| 22.                  | House crow             | 9.30         | 15.59 | 13.87          | 10.85 | 14.09            | 14.13 | 10.65           | 7.95  | 11.96          | 6.05  |
| 23.                  | House sparrow          | -            | -     | -              | -     | -                | -     | -               | -     | 1.60           | 1.94  |
| 24.                  | Indian peafowl         | 3.41         | -     | 3.06           | -     | -                | -     | -               | -     | 3.14           | -     |
| 25.                  | Indian robin           | -            | -     | -              | -     | -                | -     | -               | -     | -              | 4.31  |
| 26.                  | Indian roller          | 2.06         | 5.01  | -              | -     | -                | -     | -               | -     | -              | 3.02  |
| 27.                  | Jungle babbler         | 1.40         | -     | 2.03           | -     | -                | -     | 4.71            | 9.45  | -              | -     |
| 28.                  | Large pied wagtail     | -            | -     | 5.02           | 7.13  | 6.62             | 4.76  | 1.18            | -     | -              | -     |
| 29.                  | Oriental magpie robin  | -            | -     | -              | -     | 2.64             | 2.99  | -               | -     | -              | -     |
| 30.                  | Oriental tree pipit    | -            | -     | -              | -     | -                | -     | 1.18            | -     | -              | -     |
| 31.                  | Paddy field pipit      | 3.41         | 8.35  | 1.17           | 2.68  | 3.16             | 4.10  | 2.07            | 7.66  | -              | -     |
| 32.                  | Pied bush chat         | -            | -     | 1.66           | 5.46  | 1.02             | 9.48  | 4.64            | 6.73  | 1.46           | 3.88  |
| 33.                  | Red-vented bulbul      | -            | -     | 1.52           | 3.20  | -                | -     | -               | 6.44  | 3.18           | -     |
| 34.                  | Red-wattled lapwing    | 7.42         | 7.79  | 7.17           | 2.94  | 6.40             | 2.05  | 4.58            | 4.58  | 6.54           | 3.36  |
| 35.                  | Rose-ringed parakeet   | -            | -     | -              | -     | -                | -     | -               | -     | 25.94          | 30.67 |
| 36.                  | Rufous-backed shrike   | -            | -     | -              | -     | 1.69             | 3.44  | -               | -     | 1.39           | 5.11  |
| 37.                  | Small bee-eater        | -            | -     | -              | -     | -                | -     | 1.18            | -     | -              | -     |
| 38.                  | White Wagtail          | 12.32        | 11.46 | 13.95          | 17.65 | 13.89            | 11.52 | 10.86           | -     | -              | -     |
| 39.                  | Wire-tailed Swallow    | -            | -     | -              | -     | -                | -     | -               | -     | 1.65           | -     |
| 40.                  | Yellow Wagtail         | -            | -     | 3.15           | 5.80  | 5.20             | 6.15  | 3.36            | -     | -              | -     |
| Species richness     |                        | 16           | 12    | 22             | 17    | 20               | 19    | 18              | 12    | 18             | 17    |
| Shannon-Weiner Index |                        | 2.47         | 2.40  | 2.71           | 2.67  | 2.67             | 2.77  | 2.59            | 2.46  | 2.43           | 2.51  |
| Species evenness     |                        | 0.91         | 0.97  | 0.88           | 0.94  | 0.89             | 0.94  | 0.92            | 0.99  | 0.84           | 0.85  |

and Li (1992) had specified that bee-eaters, black drongos and white-breasted kingfishers are biological control specialists against white grub. Sahito et al. (2010) reported that avifaunal richness in *Brassica* genotypes such as gobhi sarson, raya and hyaola as 11, 13 and 16, correspondingly at the starting phase of siliquae formation in the Punjab. Sekercioglu (2006) highlighted the environment administrations furnished by birds for the management of pest in farming. Kler and Kumar (2015) reported that hemipterans as well as coleopterans make up the chief diet of insectivorous birds. Sekercioglu (2006) recommended that farm birds not really need to ingest considerable insect pest to have a substantial effect the population size. They figured out that 40% of the larva that protected from the attack of predators by ejecting food, passed on prior to changing into a butterfly, regardless of effectively enduring the first assault. Martin et al. (2013) led meta-investigation of hierarchical falls brought about by birds of prey and confirmed the discoveries that plants make the most of birds that eliminate their herbivorous all through a different environment as well as climatic regions. The present study has provided baseline data of avian species in mustard crop along with their foraging guilds. Higher relative abundance of insectivorous birds in mustard crop fields do have positive role in controlling insect pests.

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