Abstract: Feeding ecology of birds was studied in subtropical and temperate region of Doda which lies in middle Himalayan chain of Pir Panchal range of Jammu and Kashmir, India. In the present study, a total 71 species of birds was documented from the study area belonging to 9 orders, 27 families and 12 sub families. Out of 71, 26 species were insectivores (I), 17 omnivores (O), 12 carnivores (C), 4 frugivores (F), 4 grainivores (G) and rest of the 8 species share more than one feeding guilds. This study therefore showed a remarkable variation in feeding ecology of birds in the region surveyed.

Keywords: Avifauna, Doda, Feeding ecology, Pir Panchal, Himalayas.

INTRODUCTION
Birds are warm blooded animals which maintain constant body temperature. These are considered as master of air (feathered biped). This description is apt and precise and cannot apply to other animal groups. These being the master of air have been viewed as an indicator of environmental quality. The colour pattern of feathers is one of the important taxonomic diagnostic tools used for their identification. The good colour vision enables them to located food to recognize other members of the species and to distinguish sex of each individual.

The birds perform a variety of functions in a natural ecosystem. Some birds like owls are nocturnal as they remain active at night and sleep during the day. Some birds are migratory in nature such as siberian cranes while some ones are non-migratory such as sarus crane. The Sarus crane is the only resident breeding crane pair that for life long. The sarus crane pair is an eternal symbol of unconditional love, devotion and good fortune with high degree of marital fidelity (Verma, 2016; Verma and Prakash, 2017; Prakash and Verma, 2016, 2019) and prefer to live in and around wetlands in association with human (Verma, 2018). The vultures, kites and crows act as scavengers and efficiently dispose the animal carcasses, decaying matter and thus preventing epidemics.
In agriculture, the role of birds is complex yet it is interesting and varied. It depends upon number of factors like their feeding nature and the extent to which they depend on crops, their age and physical conditions. As aves appear to be a climax group at the height of their evolutionary history, they undergo extensive adoptions in terms of feeding habits such as some are carnivores, insectivores, grainivores and omnivores.

As far as the study of birds in Jammu division is concerned there is no such detailed systematic study except Omaston (1927), Whistler (1949), Sahi (1985), Sahi and Sharma (2006), Wani and Sahi (2005) and Balwan and Saba (2020).

**Study Area:**
The study area, district Doda of Jammu and Kashmir is extended between 32°-53' and 34°-21' north longitude and 75°-1' and 76°-47' east longitude with an elevation ranges between 900 m to 4200 m above sea level. The study stations of district Doda include seven tehsils viz., Doda, Bhaderwah, Kishtwar, Ramban, Banilah, Thathri and Gandoh. It is located in Pir Panchal range of middle Himalayan Chain of North West Himalayas and is having a typical terrain. The lower parts of erstwhile district Doda experience a subtropical climatic condition which is characterized by hot and dry season, while upper reaches the Bhaderwah, Kalash Kund, Marmat, Padder, Marwah, Dachan etc. are comparatively cooler in summer with temperate type of climate. The mean maximum and minimum temperature during summer ranges between 36°C and 14°C respectively whereas during winter ranges between 6°C and -2°C respectively.

The forest is of temperate type including predominant evergreen tree species comprises of *Pinus roxburgii*, *Cedrus deodara* and *Quercus* spp. The predominant deciduous tree species comprises of *Alnus nitida*, *Aesculus indica*, *Ficus* spp. Besides large number of shrubs such as *Prunus utilis*, *Rhododendron arboreum*, *Punica granatum*, *pyrus pashia* etc., and herbs species such as *Clematis bacbellata*, *Lepidium sativum*, *Desmodium triflorus*, *Allium graffithianum*, etc. were present in the area studied.

**MATERIALS AND METHODS**
In order to record the feeding ecology of the birds; it is pertinent first to record the diversity of the bird. Author used following methods to record the diversity and feeding behavior of the birds:

1. **Line Transects Method:** This method is simple to use and offers greater flexibility. In this method the observer walks on the predetermined transects and records the birds which one sees or hears. All the birds sighted and calls of the birds which can be easily identified were recorded while sampling the birds. In the study area transects of 2 km were set at each station by keeping 50m width on each side. But this width sample varies at different places as birds are not visible due to foliage cover or because of terrain of the area. The general bird activities like feeding, flying, resting and nesting were recorded along with transect.

2. **Point Transect Method:** This method is used at zero speed for short duration of time (Verner, 1985). This method is useful in getting information regarding vegetation condition of area, height of occurrence of birds, number of individuals sighted, social association, species diversity, food habits and social behaviour.

3. **Identification of Birds:** Birds were identified with the help of colourful plates of Ali and Repley (1974), Ali (1996), Grimmet et al. (2011) and Grewal et al., (2003).

**RESULTS AND DISCUSSION:**
Keeping the feeding habits of the birds into consideration, an attempt has been made to categorize the birds into different feeding guilds as insectivores (feeds on insects), carnivores (feeds on animal matter like fishes, amphibians, reptiles etc.), frugivores (feeds on fruits), omnivores (feeds on all types of food including vegetable matter, insects and animal matter etc.) and granivores (feeds on grains). Out of 71, 26 species were insectivores, 17 species omnivores,
12 carnivores, 4 frugivores, 4 grainivores and rest of the 08 species share more than one feeding guilds (Fig.1).

Out of 26 insectivores birds (I) recorded, 6 species were represented by aerial insectivores (AI), 3 species were represented by terrestrial insectivores (TI), 3 species under story insectivores (UI), 5 trunk and bark feeders (T/BF), 4 species shore insect plover (SIP), 3 aquatic insectivores (AqI) while 2 species were represented by canopy insectivores (CI) (Fig 2).

Carnivores (C) feeding category is further subdivided into different categories and out of 12 carnivore species reported, 6 species were arboreal terrestrial carnivores (ATC), 3 terrestrial carnivores (TC) and 1 species serves both as ATC and arboreal aquatic carnivore (AAqC), 1 species was AAqC and diving carnivore (DC) includes 1 species (Fig.3).

Omnivores (O) bird species were represented by 17 species in the area studied whereas frugivores (F) and grainivores (G) were represented by 4 species each and 8 species share more than one feeding guilds.

| S. No | Name of the Bird Species                  | Feeding guilds along with substrate preference                  |
|-------|------------------------------------------|---------------------------------------------------------------|
| 1.    | Pariah Kite                              | Arboreal Terrestrial Carnivore (ATC)                          |
| 2.    | Himalayan Long Billed Vulture            | Terrestrial Carnivore (TC)                                    |
| 3.    | Himalayan Griffon Vulture               | Terrestrial Carnivore (TC)                                    |
| 4.    | White Backed Vulture                    | Terrestrial Carnivore (TC)                                    |
| 5.    | Long Legged Buzzard                      | Arboreal Terrestrial Carnivore (ATC)                          |
| 6.    | Monal Pheasant                           | Omnivores (O)                                                 |
| 7.    | Cheer Pheasant                           | Omnivores (O)                                                 |
| 8.    | Kaleej Pheasant                          | Omnivores (O)                                                 |
| 9.    | The Chukar                               | Omnivores (O)                                                 |
| 10.   | Blue Rock Pigeon                         | Omnivores (O)                                                 |
| 11.   | Rufous Turtle Dove                       | Grainivore (G)                                                |
| 12.   | Indian Spotted Dove                      | Grainivore (G)                                                |
| 13.   | Indian Ring Dove                         | Grainivore (G)                                                |
| 14.   | Black Drongo                             | Grainivore (G)                                                |
| 15.   | Indian Golden Oriole                     | Omnivores (O)                                                 |
| 16.   | Rufous Backed Shrike                     | Arboreal Terrestrial Carnivore (ATC)                          |
| 17.   | Great Grey Shrike                        | Arboreal Terrestrial Carnivore (ATC)                          |
| 18.   | Rose Ringed Parakeet                     | Frugivore (F)                                                 |
| 19.   | Blossom Headed Parakeet                  | Frugivore (F)                                                 |
| 20.   | Lorikeet                                 | Frugivores (F)                                                |
| 21.   | Northern Spotted Owlet                   | Arboreal Terrestrial Carnivore (ATC)                          |
| 22.   | Barred Jungle Owlet                      | Arboreal Terrestrial Carnivore (ATC)                          |
| 23.   | Himalayan Pied Kingfisher                | Arboreal and Aquatic Carnivore (AAqC)                         |
| 24.   | White Breasted Kingfisher                | Arboreal and Aquatic Carnivore (AAqC)                         |
| 25.   | European Hoopoe                          | Omnivores (O)                                                 |
| 26.   | Himalayan Great Barbet                   | Frugivores (F)                                                |
| 27.   | Mahratta Woodpecker                      | Trunk and Bark Feeder (T/BF)                                  |
|   | Species                          | Feeder Type                      |
|---|----------------------------------|----------------------------------|
| 28.| Lesser Golden Backed Woodpecker | Trunk and Bark Feeder (T/BF)     |
| 29.| Streak Throated Woodpecker      | Trunk and Bark Feeder (T/BF)     |
| 30.| Grey Headed Woodpecker          | Trunk and Bark Feeder (T/BF)     |
| 31.| Common Myna                     | Omnivores (O)                    |
| 32.| Jungle Crow                     | Omnivores (O)                    |
| 33.| North Western Tree Pie          | Omnivores (O)                    |
| 34.| Yellow Billed Blue Magpie       | Omnivores (O)                    |
| 35.| Long Tailed Minivet             | Canopy Insectivores (CI)         |
| 36.| Red Rumped Swallow              | Aerial Insectivores (AI)         |
| 37.| Wire Tailed Swallow             | Aerial Insectivores (AI)         |
| 38.| White Wagtail                   | Shore Insect Plover/Terrestrial Insectivores (SIP/TI) |
| 39.| Indian Pied Wagtail             | Shore Insect Plover/Terrestrial Insectivores (SIP/TI) |
| 40.| Yellow Wagtail                  | Shore Insect Plover/Terrestrial Insectivores (SIP/TI) |
| 41.| Grey Wagtail                    | Shore Insect Plover/Terrestrial Insectivores (SIP/TI) |
| 42.| Indian White Eye                | Canopy Insectivores (CI)         |
| 43.| Purple Sunbird                  | Canopy Insectivores (CI)         |
| 44.| House Sparrow                   | Omnivores (O)                    |
| 45.| Baya Weaver                     | Omnivores (O)                    |
| 46.| Spotted Munia                   | Omnivores (O)                    |
| 47.| Grey Tit                        | Canopy Insectivores (CI)         |
| 48.| Black Throated Tit              | Canopy Insectivores (CI)         |
| 49.| Himalayan Brown Dipper          | Aquatic Insectivores/Diving Carnivores (AqI/DC) |
| 50.| Himalayan Tree Creeper          | Trunk /Bark Feeder (T/BF)        |
| 51.| Jungle Babbler                  | Understory Insectivores (UI)     |
| 52.| Paradise Flycatcher             | Aerial Insectivores (AI)         |
| 53.| Veriditor Flycatcher            | Aerial Insectivores (AI)         |
| 54.| Himalayan Whistling Thrush      | Omnivores (O)                    |
| 55.| Grey Bush Chat                  | Frugivores Insectivores (FI)     |
| 56.| Indian Magpie Robin             | Frugivores Insectivores (FI)     |
| 57.| White Capped Redstart           | Aquatic Insectivores (AqI)       |
| 58.| Plumbeous Water Redstart        | Aquatic Insectivores (AqI)       |
| 59.| Blue Fronted Redstart           | Aquatic Insectivores/Terrestrial Insectivores (AqI/TI) |
| 60.| Spotted Fork Tail               | Aquatic Insectivores (AqI)       |
| 61.| Blue Throat                     | Understory Insectivores (UI)     |
| 62.| White Cheeked Bulbul            | Frugivores, Insectivores (FI)    |
| 63.| Black Bulbul                    | Frugivores, Insectivores (FI)    |
| 64.| Blue Capped Rock Thrush         | Understory Insectivores (UI)     |
| 65.| Asian Brown Flycatcher          | Aerial Insectivores (AI)         |
| 66.| Himalayan Cinnamon Tree Sparrow | Omnivores (O)                    |
| No. | Species                  | Feeding Guilds       |
|-----|-------------------------|----------------------|
| 67. | Rufous Sibia            | Insectivores Frugivores (IF) |
| 68. | Rock Bunting            | Omnivores (O)        |
| 69. | Green Backed Tit        | Canopy Insectivore (CI) |
| 70. | Great Cormorant         | Aquatic Carnivore (AqC) |
| 71. | Common Wood Shrike      | Terrestrial Insectivore (TI) |

Fig. 1: Percentage of bird species showing different feeding guilds.

Fig. 2: Relative proportion of different feeding guilds shown by insectivorous birds.

Fig. 3: Relative proportion of different feeding guilds shown by carnivorous birds.
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