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Species diversity of birds in the pulses cultivated lands of Mayiladuthurai Taluk, Nagappatinam District, Tamil Nadu during 2004 to 2006

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Abstract

The species diversity (H') of birds in the study area was related to the insects' abundance by comparing the yielding capacity of crop lands in natural and enclosed plots. Scan sampling (Altmann 1974) method was adopted to record birds and the method of Pradhan (1991) was followed to estimate insects' abundance. The study indicated the occurrence of 64 species of birds comprising omnivores, insectivores, carnivores, granivores, and frugivores. The species diversity (H') of birds ranged from 0.683 to 1.789 and the variations in the abundance of insects indicated no significant difference among seasons (P>0.05). The mean yielding capacity increased from 15.25 to 24.50% in the enclosed plots. A comparison of yield in natural and enclosed plots revealed an increase in yield ranging from 8.33 to 40.00%.

Key words: Agricultural ornithology, insect abundance, species diversity, yielding capacity

INTRODUCTION

Detailed information about population dynamics is not available even on the very common species of Indian birds. Exact knowledge on the population structure, natality, mortality, dispersal, etc, is almost non-existent. However, some studies have been conducted on seasonal changes in population density and other indices of a few species in agricultural habitats (Toor *et al*., 1986). Some estimates of density of breeding Weaver birds *Ploceus* spp. have been made in Andhra Pradesh (Mathew, 1976) and Punjab (Dhindsa, 1986). Asokan *et al*., (2009) have made a study on some of the common birds occupying the agricultural environments in Nagapattinam District, Tamil Nadu, India.

Available information on food and feeding habits of some common bird species in cultivated and natural habitats is quite good. Although some of this information is purely qualitative and preliminary, the rest is based on detailed analytical and quantitative studies. Mathew *et al*. (1978) analyzed the food and feeding habits of 9 species of birds affecting agriculture in India.

Recently, gut content analyses have been supplemented by field observation on the feeding behaviour and captivity experiments on food preference of the concerned species (Mathew, 1976; Mathew *et al*., 1978; Dhindsa and Toor, 1990; Saini and Dhindsa, 1993). When feeding ecology is studied to estimate the impact of a species on agriculture, gut content analyses alone do not serve the purpose. Field observations on the feeding behaviour must also be recorded to pinpoint the sources of various foods. For instance, Dhindsa and Toor (1990) found that rice was the principal food type in the guts of three species of Weaver birds *Ploceus* spp. in Punjab. However, field observations show that most of the rice grains taken by these birds are either left in the stored straw or shed during the crop harvest.

Another important aspect of the feeding ecology is food preference of the captive birds. Such studies will be helpful in the management of insect pest species in the crop lands (Cummings *et al*., 1987; Fairaizl and Pfeifer, 1988). The amount of food consumed by captive or wild birds could be used to assess the damage potential of a avian species (Avery 1979; Toor *et al*., 1986; Saini and Toor, 1991). Unfortunately, only a little work has been done in this direction. Mathew (1976) and Dhindsa and Toor (1990) studied the preferences of captive Baya Weaver bird *Ploceus philippinus* for different food types in Andhra Pradesh and Punjab, respectively. Both the studies provide conflicting results. The food preferences of the captive Rose-ringed Parakeets *Psittacula krameri* have also been studied (Simwat and Sidhu, 1974; Saini and Dhindsa, 1993). Thus the present work aims at describing the diversity in the pulses cultivated lands

STUDY AREA

The present investigation was carried out in an area of 150 km^2 (approximately) encompassing a 5 km (approximately) radius in and around , Mayiladuthurai ($11^0 18'$ N, latitude $79^0 5^0'$ E longitude) in the Cauvery Delta of Tamil Nadu.

MATERIALS AND METHODS

A field binocular was used for field observations. Birds were identified following Ali and Ripley (1969) . Scan sampling method as described by Altmann (1974) was followed for recording bird abundance

Calculation of Species Diversity

Shannon-Wiener (1949) diversity measure was used to calculate the diversity values.

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$$H' = - \text{“} Pi \log_2 Pi$$

where, H′ = Shannon-Wiener Diversity index and

Pi = Proportion of each category

Calculation of Species Richness

It refers to the number of species of birds recorded per unit area.

Insect collection

The insect categories available in the pulses cultivated lands were collected once in fifteen days from October 2005 to September 2006 using a standard sweep net. The method of Pradhan (1991) was followed for collecting the insects. The insects were collected between 15:00 and 18:00 hrs. Collections were avoided on cloudy and rainy days.

In each transect of 2 km length, 50 sweepings were made at random. The collected insects were identified and the frequency of each insect order was used to calculate their abundance (%) in different habitats.

To compare the extent of damage caused by birds to crops field trials were conducted in natural and enclosed plots

RESULTS

Diversity of birds in pulses cultivated lands

A total of 64 species of birds (44% passerine and 56% non-passerine birds) comprising 30 families and 13 orders were recorded in the study area during 2004-2006 (Table 1). Among 64 species of birds , 28 species belonged to the order Passeriformes, six each to Cuculiformes and Coraciiformes, five to Ciconiiformes, three each to Falconiformes, Galliformes and Charadriiformes, two each to Gruiformes, Columbiformes, Apodiformes and Piciformes and one each to Psittaciformes and Strigiformes. Out of these 64 species, 26 (40.6%) were omnivores, 21 (32.9%) insectivores, 13 (20.3%) carnivores and 2 (3.1%) each were granivores and frugivores.

Diversity values of bird species (H′) in nursery, flowering, fruting and harvest stages of pulses and post harvest stage of lands during 2004-2006 were given in table 2. During 2004-2005, the diversity (H′) value of birds in nursery lands was 0.762; that of flowering 1.695; fruiting 1.442; harvest 1.789 and post harvest 0.956. The Species diversity values were 0.683 in nursery lands; 1.434 in flowering; 1.538 in fruiting; 1.706 in harvest and 0.956 in post harvest stages during 2005-2006. In both years highest diversity values (H′) were recorded at harvest stages and lowest in seedling stages. There existed no significant difference in the bird diversity values(H′) ($P>0.05$) in various growing stages of pulses during 2004-2006 (Table 2).

Prey availability

The availability of various insect orders in the pulses cultivated lands during different seasons was given in table 3. The overall mean percent availability of various insect orders included Orthoptera (27.6%), Coleoptera (15.1%), Hymenoptera (14.6%), Hemiptera (11.1%), Lepidoptera (8.7%), Diptera (6.1%) and Odonata (6.0%).

During monsoon, the availability of Orthopteran insects was higher (26.8%) and that of Diptera was lower (4.9%). The availability of other insect orders *viz*., Coleoptera, Hymenoptera, Hemiptera, Lepidoptera and Odonata was 18.0%, 10.8%, 9.8%, 8.3% and 8.1% respectively. Percent availability of various insect orders in the pulses cultivated lands during post-monsoon included Orthoptera 33.9 %, Coleoptera 12.3%, Hemiptera 11.6%, Hymenoptera 11.1%, Diptera 7.2%, Lepidoptera 6.1% and Odonata 6.0%. During summer, Orthopteran insects (28.6%) were the most commonly available insects in the study area. The abundance of other insect orders in the study area included Coleoptera (13.7%), Hymenoptera (13.1%), Hemiptera (11.3%), Lepidoptera (10.4%), Diptera (6.7%) and Odonata (5.9%). During pre-monsoon, the availability of Hymenopteran insects was higher (23.2%) followed by Orthoptera (21.0%), Coleoptera (16.5%), Hemiptera (11.6%), Lepidoptera (10.1%), Diptera (5.7%) and Odonata (4.1%). Seasonal variations in the availability of prey categories were not significant ($P>0.05$).

The frequency of pulse panicles/bunches in ten different natural and enclosed plots during 2005-2006 was given in table 4. The yielding capacity of pulses was in general higher in enclosed plots than natural plots. The mean availability of panicles/bunches in natural and enclosed plots varied from 12.25 to 18.25 and from 15.25 to 24.50 respectively.

Data with regard to percent increase in the yield of pulses in natural and enclosed plots during the study period were given in table 5. The mean difference of yield between two plots was 29.50. The overall yielding capacity was greater in enclosed plots when compared to natural plots.

DISCUSSION

Totally 64 species of birds belonged to 13 orders were recorded in the pulse cultivated lands. Among the 64 species, 38 belonged to Passeriformes, 6 each to Cuculiformes and Coraciiformes, 5 to Ciconiiformes, 3 each to Falconiformes, Galliformes and Charadriiformes. Balasundaram and Rathi (2004) reported 108 species of birds in agricultural lands of Thiruverumbur taluk in Thiruchirapalli district of Tamil Nadu. Nathan and Rajendiran (1982) reported 30 species of birds in the crop lands of Pondicherry region. Since the present work has been concentrated on pulse cultivated lands, the

Table 1: Systematic list of the birds recorded in the study area during 2004-2006

S. No	Order	Family	Common Name	Scientific Name	Feeding Habits
1	Ciconiiformes	Ardeidae	Little Egret	Egretta garzetta	CV
2	Ciconiiformes	Ardeidae	Large Egret	Casmerodius albus	CV
3	Ciconiiformes	Ardeidae	Cattle Egret	Bubulcus ibis	CV
4	Ciconiiformes	Ardeidae	Indian Pond Heron	Ardeola grayii	CV
5	Ciconiiformes	Ciconiidae	Asian Openbill Stork	Anastomus oscitans	CV
6	Falconiformes	Accipitridae	Black-shouldered Kite	Elanus caeruleus	CV
7	Falconiformes	Accipitridae	Black Kite	Milvus migrans	CV
8	Falconiformes	Accipitridae	Brahminy Kite	Haliastur indus	CV
9	Galliformes	Phasianidae	Grey Francolin	Francolinus pondicerianus	OM
10	Galliformes	Phasianidae	Red Jungle Fowl	Gallus gallus	OM
11	Galliformes	Phasianidae	Indian Peafowl	Pavo cristatus	OM
12	Gruiformes	Rallidae	White-breasted Waterhen	Amaurornis phoenicurus	OM
13	Gruiformes	Rallidae	Common Coot	Fulica atra	OM
14	Charadriiformes	Charadriidae	Yellow-wattled Lapwing	Vanellus malabaricus	IN
15	Charadriiformes	Charadriidae	Red-wattled Lapwing	Vanellus indicus	IN
16	Charadriiformes	Charadriidae	Common Sandpiper	Actitis hypoleucos	IN
17	Columbiformes	Columbidae	Blue Rock Pigeon	Columba livia	GR
18	Columbiformes	Columbidae	Spotted Dove	Streptopelia chinensis	GR
19	Psittaciformes	Psittacidae	Rose-ringed Parakeet	*Psittacula krameri*	FR
20	Cuculiformes	Cuculidae	Pied Crested Cuckoo	Clamator jacobinus	OM
21	Cuculiformes	Cuculidae	Brainfever Bird	Hierococcyx varius	OM
22	Cuculiformes	Cuculidae	Indian Cuckoo	Cuculus micropterus	OM
23	Cuculiformes	Cuculidae	Common Cuckoo	Cuculus canorus	OM
24	Cuculiformes	Cuculidae	Asian Koel	Eudynamys scolopacea	OM
25	Cuculiformes	Cuculidae	Greater Coucal	*Centropus sinensis*	CV
26	Strigiformes	Strigidae	Spotted Owlet	Athene brama	CV
27	Apodiformes	Apodidae	Asian Palm Swift	Cypsiurus balasiensis	IN
28	Apodiformes	Apodidae	House Swift	Apus affinis	IN
29	Coraciiformes	Alcedinidae	Small Blue Kingfisher	Alcedo atthis	CV
30	Coraciiformes	Alcedinidae	White-breasted Kingfisher	Halcyon smyrnensis	CV
31	Coraciiformes	Alcedinidae	Lesser Pied Kingfisher	*Ceryle rudis*	CV
32	Coraciiformes	Meropidae	Small Bee-eater	*Merops orientalis*	IN
33	Coraciiformes	Coraciidae	Indian Roller	*Coracias benghalensis*	IN
34	Coraciiformes	Upupidae	Common Hoopoe	Upupa epops	IN
35	Piciformes	Capitonidae	Copper-smith Barbet	Megalamia haemacephala	FR
36	Piciformes	Picidae	Lesser Golden-backed Woodpecker	Dinopium benghalense	OM
37	Passeriformes	Hirundinidae	Common Swallow	Hirundo rustica	IN
38	Passeriformes	Motacillidae	Large Pied Wagtail	Motacilla maderaspatensis	IN

39	Passeriformes	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	IN
40	Passeriformes	Campephagidae	Small Minivet	Pericrocotus cinnamomeus	IN
41	Passeriformes	Pycnonotidae	Red-vented Bulbul	Pycnonotus cafer	OM
42	Passeriformes	Irenidae	Common Iora	Aegithina tiphia	OM
43	Passeriformes	Muscicapidae	Oriental Magpie Robin	Copsychus saularis	IN
44	Passeriformes	Muscicapidae	Indian Robin	*Saxicoloides fulicata*	IN
45	Passeriformes	Muscicapidae	Common Babbler	*Turdoides caudatus*	OM
46	Passeriformes	Muscicapidae	Ashy Prina	Prinia socialis	IN
47	Passeriformes	Muscicapidae	Paddy field Warbler	Acrocephalus agricola	IN
48	Passeriformes	Muscicapidae	Blyth's Reed Warbler	Acrocephalus dumetorum	IN
49	Passeriformes	Muscicapidae	Thick-billed Warbler	*Acrocephalus aedon*	IN
50	Passeriformes	Muscicapidae	Common Tailor Bird	Orthotomus sutorius	IN
51	Passeriformes	Muscicapidae	Asian Paradise Flycatcher	Terpsiphone paradise	IN
52	Passeriformes	Nectariniidae	Purple-rumped Sunbird	Nectarinia zeylonica	OM
53	Passeriformes	Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	OM
54	Passeriformes	Estrilidinae	White-throated Munia	Lonchura malabarica	OM
55	Passeriformes	Estrilidinae	Black-headed Munia	*Lonchura malacca*	OM
56	Passeriformes	Ploceidae	House Sparrow	Passer domesticus	OM
57	Passeriformes		Baya Weaver	*Ploceus philippinus*	OM
58	Passeriformes	Sturnidae	Brahminy Starling	Sturnus pagodarum	OM
59	Passeriformes	Sturnidae	Common Myna	*Acridotheres tristis*	OM
60	Passeriformes	Oriolidae	Eurasian Golden Oriole	*Oriolus oriolus*	OM
61	Passeriformes	Dicruridae	Black Drongo	*Dicrurus macrocercus*	IN
62	Passeriformes	Corvidae	Indian Tree pie	Dendrocitta vagabunda	OM
63	Passeriformes	Corvidae	House Crow	Corvus splendens	OM
64	Passeriformes	Corvidae	Jungle Crow	Corvus macrorhynchos	OM

Table 2: Species diversity (H') of birds in different stages of pulses cultivated lands

Year	Stages of pulses cultivation					ANOVA	
	Nursery	Flowering	Fruiting	Harvest	Post harvest	*F*	*P*
2004-2005	0.762(13)	1.695(9)	1.442(11)	1.789(8)	0.956(3)	1.889	0.241
2005-2006	0.683(14)	1.434(10)	1.538(10)	1.706(8)	0.956(5)		

Values in parentheses are number of species of birds

avian species richness could be considered high when compared to other regions.

The species diversity of birds (H') in the pulses cultivated lands fluctuated from 0.762 (nursery stage) to 1.789 (harvest stage) during 2004-05. More or less similar trend has been recorded during 2005-06 in the study area. At the same time, the number of bird species recorded in the nursery lands was higher than that of the harvest stage in both the years. Such a trend reveals that the prey availability in nursery lands is higher than in harvest stage of the crop land. Further, such a trend is noticed throughout the study period as evidenced by ANOVA (P>0.05).

Altogether, insects belonged to seven orders such as Orthoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera, Odonata, Diptera and 'Others' were sighted in the study area. Further, ANOVA indicates that there is no significant difference (P> 0.05) in the availability of insect prey among the four seasons. Kandoria *et al.* (1989) and Kuo (1999) stated that temperature is an important factor affecting the seasonal fluctuations of insects. During summer, the photoperiod is longer and so insects are active throughout the day. Cultivated crops and weeds in and around fields may affect the species diversity of insects (Rajagopal and Kareem, 1983; Shultz *et al.*, 1985; Singh *et al.*, 1990; Rohilla

Table 3: Abundance (%) of various insect orders in the pulses cultivated lands during different seasons.

Prey items	Season					ANOVA	
	MON2005	POM2006	SUM2006	PRM2006	Overall	*F*	*P*
Orthoptera	26.8 ± 0.7	33.9 ± 2.8	28.6 ± 1.8	21.0 ± 3.1	27.6 ± 5.3	3.00	0.095
Hemiptera	9.8 ± 0.6	11.6 ± 1.0	11.3 ± 1.1	11.6 ± 1.7	11.1 ± 0.9	0.76	0.549
Coleoptera	18.0 ± 0.9	12.3 ± 1.0	13.7 ± 0.9	16.5 ± 0.9	15.1 ± 2.6	0.80	0.526
Lepidoptera	8.3 ± 0.6	6.1 ± 0.5	10.4 ± 1.3	10.1 ± 1.2	8.7 ± 2.0	1.83	0.221
Hymenoptera	10.8 ± 0.9	11.1 ± 0.9	13.1 ± 0.6	23.2 ± 1.0	14.6 ± 5.9	3.03	0.093
Odonata	8.1 ± 0.6	6.0 ± 0.5	5.9 ± 1.9	4.1 ± 1.3	6.0 ± 1.6	1.14	0.390
Diptera	4.9 ± 0.4	7.2 ± 0.6	6.7 ± 1.0	5.7 ± 0.8	6.1 ± 1.0	1.05	0.423
Others	13.2 ± 1.0	11.7 ± 1.0	10.3 ± 1.2	7.7 ± 0.9	10.7 ± 2.3	0.69	0.584

MON – Monsoon; POM – Post-monsoon; SUM – Summer; PRM – Pre-monsoon

Table 4: A comparison of yielding capacity of pulses in natural and enclosed plots during 2005-2006

PlotNo.	Frequency ofpanicles / bunches in natural plots				Mean ± SD	Frequency ofpanicles / bunches in enclosed plots				Mean ± SD
1	12	13	8	16	12.25 ± 3.30	16	18	19	18	15.25 ± 4.99
2	21	15	11	16	15.75 ± 4.11	18	23	15	19	18.75 ± 3.30
3	18	19	20	13	17.50 ± 3.11	23	28	30	17	24.50 ± 5.80
4	20	15	19	17	17.75 ± 2.22	20	18	15	14	16.75 ± 2.75
5	22	20	18	13	18.25 ± 3.86	17	23	20	21	20.25 ± 2.50
6	15	16	12	17	15.00 ± 2.16	18	18	19	15	17.50 ± 1.73
7	18	15	19	20	18.00 ± 2.16	21	18	18	21	19.50 ± 1.73
8	15	23	16	11	16.25 ± 4.99	18	26	17	21	20.50 ± 4.04
9	18	16	10	16	15.00 ± 3.46	20	18	20	18	19.00 ± 1.15
10	21	17	12	20	17.50 ± 4.04	25	21	15	22	20.75 ± 4.19

Table 5: Mean difference and percentage increase in yield of pulses in natural and enclosed plots during 2005-2006

PlotNo.	Mean yieldin natural plots	Mean yield in enclosed plots	Mean difference	Percent increase in yield
1	12.25	15.25	3.00	24.49
2	15.75	18.75	3.00	19.05
3	17.50	24.50	7.00	40.00
4	17.75	16.75	-1.00	-5.63
5	18.25	20.25	2.00	10.96
6	15.00	17.50	2.50	16.67
7	18.00	19.50	1.50	8.33
8	16.25	20.50	4.25	26.15
9	15.00	19.00	4.00	26.67
10	17.50	20.75	3.25	18.57

et al., 1996). In the study area, paddy and pulses were the major crop associated with more number of insects during summer and post-monsoon. Lattin (1993) and Hutheson and Jones (1999) noted that terrestrial arthropod diversity could be influenced by vegetation types and density.

The mean frequency of panicles/ bunches was high in enclosed plots. The mean yield was also high in enclosed plots and the percentage increase in yield was from -5.63 to 40.00%. The results reveal that in general, the percentage increase in yield could be from 8.33 to 40.0 % except in one plot which showed a negative trend (-5.63%). Thus, prey abundance and distribution, vegetation structure and plant species composition interact to create unique foraging opportunities which vary among bird species as reported by Holmes and Schultz (1988) among warblers

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