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Influence of water on birds and insect pests in the paddy fields of Kannur district, Kerala

Prabhakaran P. V.

prabharamanthali@gmail.com

Sree Narayana College, Kannur, Kerala

Dr. Aravindan Tharemmal

atharemmal@yahoo.com

Sree Narayana College, Kannur, Kerala

ABSTRACT

The vast water bodies of a paddy field attract avian fauna. These water bodies serve as feeding, breeding, nesting and roosting places for the birds. During the winter, migratory birds arrive the water bodies. Since Mundakan (Rhabhi) season coincided with the winter season, there was the highest number of birds in the paddy field. Most of the birds were insectivorous and carnivorous. Insectivorous birds consumed insect pests of paddy and as a result, the number of insect pests in the paddy field was less.

Keywords— Mundakan (Rhabhi), Fresh Water Paddy Field (FWPF), Coastal Paddy Field (CPF), Midland Laterite Hillock Paddy Field (MLHPF)

1. INTRODUCTION

Paddy fields are the silent victims of the so-called developmental boom in Kerala, especially in Kannur district. The area under paddy cultivation in Kerala during the agricultural year 2011-12 was 2, 08,160 Hectare. It has decreased by 5027 Hectare (2%) than the previous year 2010-11. Kannur contributed 2.76% to the state total with rice cultivation spread over 5740 Hectare. On analyzing the area of the state for the last 10 years, paddy cultivation was high during the agricultural year 2002-03 and the area was 3,10,521 Hectare. Paddy accounted to 7.82 % of the total cropped area in the state during 2011-12.

According to Ali, (1979) Baya Weaver (*Ploceus philippinus* Linnaeus, 1766) cut young leaf blades into strips during the vegetative phase of paddy crop. The food of Black-headed Munia (*Lonchura malacca* Linnaeus, 1766) and Spotted Munia (*Lonchura punctulata* Linnaeus, 1758) through crop analysis revealed that 82 percent consisted of vegetable matter, 46 percent paddy and 36 percent seeds of weed grass and the remaining 17 percent animal matter (Saha and Mukherjee, 1977). They also observed that large congregations of Munia in company with Baya Weaver invade nurseries of paddy as well as standing crop in pre-harvesting stage and cause considerable damage to paddy cultivation. Bhatnagar (1976) reported that Munia cause damage to rice crop by cutting away the leaves for nesting.

Baya Weaver, House sparrow (*Passer domesticus* Linnaeus, 1758) and Spotted Munia were noted in rice fields feeding on sown seeds (Dhindsa and Toor, 1980). They have estimated the extent of bird damage to the rice field.

Insectivorous and carnivorous species of birds are considered useful to agriculture since they keep a very potent check on insect and rodent pests of crops. It is interesting to note that only 2.1 percent of the total bird species found in India has been reported to inflict damage to crops (Dhindsa and Saini, 1994). As enemies of insects, birds stand supreme among vertebrates (Sweetman, 1958).

The food and feeding habits of nine species of birds in the paddy field were studied by Mathew et al (1980). In samples of roller stomach examined, beetles, grasshoppers and crickets were observed. Small green Bee eater (*Merops orientalis* Latham 1801) consumed a lot of hymenopterans but adult forms of Coleoptera, Odonata and Lepidoptera were equally numerous in its food. Black drongo (*Dicrurus macrocerus* Vieillot, 1817) was reported in all stages of cultivation and about 160 heads of *Leptocorisa acuta* were counted from the stomach of nine birds. When paddy is being harvested, drongos feed in close association with the common myna capturing the insects flushed out by the latter bird.

Mukherjee (1975) reported that much of the migratory birds like Whiskered tern (*Chlidonia shybrida* Pallas, 1811) and Spotted sandpiper (*Actitis macularius* Linnaeus, 1766) feed on many injurious pests of paddy. Wahiduzzaman et al (1997) studied the prey

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composition of black drongo in rice fields. They observed that its diet consists of both insect pests and predators and therefore drongo appears to exert a general stabilizing effect on arthropod community.

Singh and Dhamdhare (1986) observed that Common myna (*Acridotheres tristis* Linnaeus, 1766), black drongo, house sparrow and the Cattle egret (*Bubulcus ibis* Linnaeus, 1758) feed mainly on nymphs and adults of the acridid. A detailed observation on the insectivorous avian fauna visiting the rice ecosystem was carried out by Thirumurthi. (1980). Black drongos were found as the most predominant insect hunter catching prey by sudden girdling sweeps from perch. The common myna was noted as a ground forager in non-cropped, harvested fields. House Crows (*Corvus splendens* Vieillot, 1817) helped to eradicate the pupae and the soil insects at the time of ploughing and after harvest. In a study carried out by Nathan and Rajendran (1981) on the bird fauna of rice crop ecosystem in Pondichery, black drongo was noted as a purely insectivorous bird destroying injurious insects like stem borer moth, skippers, leaf rollers etc. The kingfisher especially, White breasted king fisher (*Halcyon smyrnensis* Linnaeus, 1758) noticed in rice fields appears to be important in their predatory habit on insects.

Pests constitute the most important biotic stress in rice fields. Over 800 insect species have been identified damaging the crop. A total of 221 species were reported feeding on rice plants from India (Dhaliwal and Arora, 1998). More than fifty species were recorded as pests from the rice tracts of Kerala. Despite a large number of species prevailing in the rice ecosystem, significant damage to the crop is caused only by 5-8 major pests, the intensity of damage inflicted being influenced by the agro-ecological conditions, variety and stage of the crop.

The yellow stem borer *Scirpophaga incertulas* (Walker), the rice bug *Leptocorisa acuta* (Thunberg), the brown plant hopper *Nilaparvata lugens* (Stal), the gall midge *Orseolia oryzae* (Wood-Mason), the leaf folder *Cnaphalocrocis medinalis* (Guenee), the case worm *Nymphula depunctalis* (Guenee), and the thrips *Baliothrips bififormis* (Bagnall) were considered as the major pests in various rice ecosystems of Kerala (Nair, 1978). These pests could cause considerable damage to the crop in certain areas at times when climatic conditions favoured their multiplication. The brown plant hopper, which appeared as a sporadic pest in India during 1958 and 1962, assumed serious proportion in the State from 1973 onwards. The gall midge too caused severe damage during the seventies. In the course of time, especially in the last two decades, the insect pest complex underwent enormous changes in their status, occurrence and intensity of damage in different locations and seasons.

The rice bug (Krishnakumar and Visalakshi, 1996), *Cnaphalocrocis medinalis*, *Scirpophaga incertulas*, *Nilaparvata lugens*, *Leptocorisa acuta*, *Nymphula depunctalis* (Ajayakumar, 2000), *Nilaparvata lugens* and *Sogatella furcifera* (Horvath) (Premila, 2003) and *Cnaphalocrocis medinalis* and *Leptocorisa acuta* (Smithagopan, 2004) were recorded as severe pests in Thiruvananthapuram district from time to time. *Leptocorisa acuta*, *Orseolia oryzae*, *Scirpophaga incertulas*, *Nymphula depunctalis* and *Leptocorisa acuta* dominated in the rice fields of Kollam district (Nandakumar et al, 2002), *Nilaparvata lugens* (Nair et al, 1980), *Cnaphalocrocis medinalis*, *Scirpophaga incertulas*, *Orseolia oryzae* and *Leptocorisa acuta* (Nalinakumari et al, 1996), *Sogatella furcifera* (Ambikadevi et al, 1998) and *Nilaparvata lugens* (Premila, 2003) were observed to be the important pests during different periods in Kuttanad, the rice bowl of Kerala. In a span of 30 years, *Orseolia oryzae*, *Scirpophaga incertulas* and *Cnaphalocrocis medinalis* occurred as major pests in Central Kerala (Nadarajan, 1996). Seasonal variation in the incidence of *Orseolia oryzae*, *Scirpophaga incertulas* and *Cnaphalocrocis medinalis* were reported from Palakkad district (Abraham and Nair, 1975; Thomas et al, 1975; Nair et al, 1980; Nadarajan, 1996, and KAU, 2001).

Growth stages of the crop too influence the pest status and intensity of the damage. Pest population was observed to be low during early stages of the crop and gradually increased and reached higher level during maximum tillering and flower initiation stages and then showed a declining trend (Nair, 1999; Nalinakumari and Remamony, 1999; Ajayakumar, 2000 and Smithagopan, 2004).

2. STUDY AREA

The insect pests of paddy, the natural enemy complex in the paddy field and the associated fauna and flora occurring in three different paddy ecosystems (fresh water, coastal and midland laterite hillock paddy ecosystem) of Kannur were surveyed for the entire crop period and classified into vegetative, reproductive and grain filling phases. Insect pests and birds were separately recorded for the three stages. The study was carried out in 3 different paddy field stations in Kannur district each having an area of approximately 0.5 hectares in extent.

Okra vayal (Fresh Water Paddy Field) is located in the Cheruthazham Village at 12° 04' N and 75° 15' E, about 25 km north of Kannur town. The altitude of the Okra vayal is about 10m above sea level.

Mundapuram Vayal (Coastal Paddy Field) is located in Cherukunnu Village at latitude 11°59'N and longitude 75°17'E about 17 km north of Kannur town. The altitude of the Mundapuram Vayal is about 3m above sea level. It is a coastal area.

Madayippara (Midland Laterite Hillock Paddy Field) is located in the Madayi village, at latitude 12°03' N and longitude 75°15'E, about 21 km north of Kannur town, the district headquarters of Kannur district in Kerala. The altitude of the Madayippara ranges from a minimum of 40 m to a maximum of 47m above sea level.

3. OBJECTIVES OF THE STUDY

- Identification of the animals and plants that inhabit or visit the rice field during the cultivation cycle, which passes through three growth phases of rice viz. Vegetative Growth Phase (VGP), Reproductive Phase (RP) and Grain Filling Stage (GFS).
- Study the entomofauna and their abundance with respect to their beneficial as well as harmful effects on different paddy farming practices.

- Finding out the correlation between insect pests and predators during three growth phases of rice in different types of farming systems.
- Suggesting insect management measures in paddy farming systems of the study area.
- Study the impact of other fauna on paddy farming practices.
- Study the impact of other flora on paddy farming practices.

4. METHODS

The paddy field proper (including nursery) was sampled once every two weeks for five months. Sampling was done in the morning. At each sampling site, invertebrate animals on the soil surface, vegetation and water were collected manually. Flying insects and those on vegetation were caught using a sweep net (mesh size: 1 mm). The diameter of the ring of the net was 30 cm and its circumference was 94.2 cm. Length of the net was 73 cm. Malay trap was also used for trapping insects. The insect capture was done from the vegetative growth phase (germination-panicle initiation), and reproductive phase (panicle development-flowering) to grain filling phase (milk grain-mature grain). Quadrat method was used for studying the population size and population density of insect fauna and weeds. 2m² quadrats were used for studying the insect fauna. For weeds, a metre square quadrat was used. Quadrats were placed within the paddy fields. The fauna caught were then classified into some classes: 1) insect pests (herbivore), 2) natural enemies of insect pests including predators like dragon flies, damsel flies, spiders, wasp and parasitoids like Ichneumonid wasp and 3) other insects. Animals collected were put into labelled plastic containers and brought to the laboratory for identification. Total count method was used for studying birds and they were observed from 8 am to 10 am. Birds were identified by using the books of Richard Grimmett et al (1999). “The book of Indian Birds” (Salim Ali, 1979) was used for getting more information regarding feeding guild of birds. Other vertebrates that could be visually observed were identified in the field itself. Others whose identity could not be made in the field were collected for later identification.

Weeds representative of the field proper were removed for identification on three occasions overall, with one sampling per phase.

5. RESULTS

The presence of vast water bodies adjacent to the Fresh Water Paddy Field (FWPF) attracted avian fauna. These water bodies served as feeding, breeding, nesting and roosting places for the birds. During winter season migratory birds arrived here. Mundakan (Rhabi) season coincided with the winter season. Due to these reasons, there was the highest number of birds in FWPF.

The number of species of birds in FWPF was 31. But in CPF the number was only 12. The number of insect pests of paddy in FWPF was 18. But this number in CPF was 25. Most of the birds were insectivorous and carnivorous. Almost all insectivorous birds observed were natural enemies of insect paddy pests. Insectivorous birds consumed insect pests of paddy and as a result, the number of insect pests in the FWPF was somewhat less when compared with Coastal Paddy Field (CPF). There were no water bodies adjacent to Midland Laterite Hillock Paddy Field (MLHPF) and the number of insect pests was least here when compared with FWPF and CPF.

Table 1: Status and feeding guild of Avian fauna in 3 Paddy Regions.

S. No	Avian fauna	Status	Feeding Guild	CPF	FWPF	MLHPF
1	Blue Rock Pigeon <i>Columba livia</i> (J.F. Gmelin, 1789)	R	G	-	+	+
2	Spotted Dove <i>Streptopelia chinensis</i> (Scopoli, 1786)	R	G	-	+	+
3	White-breasted Waterhen <i>Amaurornis phoenicurus</i> (Pennant, 1769)	R	I	+	+	-
4	Openbill Stork, <i>Anastomus oscitans</i> (Boddaert, 1783)	R	C	-	+	-
5	Black Bittern <i>Ixobrychus flavicollis</i> (Latham, 1790)	R	A	+	-	-
6	Black-crowned Night Heron <i>Nycticorax nycticorax</i> (Linnaeus, 1758)	R	C	-	+	-
7	Indian Pond Heron <i>Ardeola grayii</i> (Sykes, 1832)	R	C	-	+	-
8	Cattle Egret <i>Bubulcus ibis</i> (Linnaeus, 1758)	LM	C	+	+	--
9	Grey Heron <i>Ardea cinerea</i> Linnaeus, 1758	R	A	+	-	-
10	Purple Heron <i>Ardea purpurea</i> Linnaeus, 1766	R	A	+	-	-
11	Large Egret <i>Ardea alba</i> (Linnaeus, 1758)	LM	A	+	+	-
12	Median Egret, <i>Ardea intermedia</i> (Wagler, 1829)	LM	A	+	+	-
13	Little Egret <i>Egretta garzetta</i> (Linnaeus, 1766)	LM	A	+	-	-
14	Little Cormorant <i>Microcarbo niger</i> (Vieillot, 1817)	R	A	+	-	-

15	Little Ringed Plover <i>Charadrius dubius</i> (Scopoli, 1786)	BV	A	-	+	-
16	Red-wattled Lapwing <i>Vanellus indicus</i> (Boddaert, 1783)	R	I	+	+	-
17	Spotted Sandpiper <i>Tringa glareola</i> (Linnaeus, 1758)	M	A	-	+	-
18	Western Marsh Harrier <i>Circus aeruginosus</i> (Linnaeus, 1758)	M	C	-	+	-
19	White-bellied Sea Eagle <i>Haliaeetus leucogaster</i> (J.F.Gmelin,1788)	R	C	-	+	-
20	Brahminy Kite <i>Haliastur indus</i> (Boddaert, 1783)	R	C	-	+	-
21	Black Kite <i>Milvus migrans</i> (Boddaert, 1783)	R	C	-	+	-
22	Blue-tailed Bee-eater <i>Merops philippinus</i> (Linnaeus,1767)	M	I	-	+	+
23	Common Kingfisher <i>Alcedo atthis</i> (Linnaeus, 1758)	R	A	-	-	+
24	Stork-billed Kingfisher <i>Pelargopsis capensis</i> (Linnaeus, 1766)	R	C	-	+	-
25	White-breasted Kingfisher <i>Halcyon smyrnensis</i> (Linnaeus, 1758)	R	C	-	+	-
26	Plum-headed Parakeet <i>Psittacula cyanocephala</i> (Linnaeus, 1766)	R	G	-	+	-
27	Ashy Swallow-shrike <i>Artamus fuscus</i> (Vieillot, 1817)	R	I	-	+	-
28	Black drongo <i>Dicrurus macrocercus</i> (Vieillot,1817)	R	I	-	+	-
29	Indian Treepie <i>Dendrocitta vagabunda</i> (Latham, 1790)	R	I	-	+	-
30	Baya Weaver <i>Ploceus philippinus</i> (Linnaeus, 1766)	R	G	-	+	-
31	Black-headed Munia <i>Lonchura malacca</i> (Linnaeus, 1766)	R	G	+	+	-
32	Paddy field Pipit <i>Anthus rufulus</i> (Vieillot, 1818)	R	I	-	+	-
33	Malabar Crested Lark <i>Galerida malabarica</i> (Scopoli, 1786)	R	G	-	+	+
34	Ashy Wren Warbler <i>Prinia socialis</i> (Sykes, 1832)	R	I	-	+	-
35	Red-rumped Swallow <i>Cecropisdaurica</i> (Laxmann, 1769)	R	I	-	+	-
36	Wire-tailed Swallow <i>Hirundo smithii</i> (Leach, 1818)	R	I	-	+	-
37	Common Swallow <i>Hirundo rustica</i> (Linnaeus, 1758)	R	I	-	+	-
38	Common Myna <i>Acridotheres tristis</i> (Linnaeus, 1766)	R	O	+	+	-
TOTAL				12	32	5

CPF: Coastal Paddy Field; FWPF: Fresh Water Paddy Field; MLHPF: Midland Laterite Hillock Paddy Field, BV: Breeding Visitor, R: Resident, M: Migratory, LM: Local Migrant, A: Aquatic feeder, I: Insectivore, G: Granivore, C: Carnivore, O: Omnivore, +: Present, -: Absent.

Table 2: Insect pest species in 3 Regions

S. No	Insect pest species	Scientific name	CPF	FWPF	MLHPF
1.	Rice leaf roller	<i>Cnaphalocrocis medinalis</i>	+	+	+
2.	Rice stem borer	<i>Scirpophaga incertulas</i>	+	-	-
3.	Rice case worm	<i>Nymphula depunctalis</i>	+	-	-
4.	Green horned Caterpillar	<i>Melanitis leda ismene</i>	+	+	+
5.	Rice skipper	<i>Pelopidas mathias</i>	+	-	-
6.	Green hairy caterpillar	<i>Rivula basalis</i>	+	+	-
7.	Rice bug	<i>Leptocoris acuta</i>	+	+	+
8.	Rice hispa	<i>Di cladispa armigera</i>	+	-	+
9.	Rice leptispa	<i>Leptispa pygmaea</i>	+	+	-
10.	Gregareous blue Beetle	<i>Haltica cyanea</i>	+	-	-

11.	Spotted Leaf beetle	<i>Oides affinis</i>	+	+	+
12.	Pumpkin Beetle	<i>Aulacophora lewisi</i>	+	-	+
13.	Rice grass hopper	<i>Hieroglyphus banian</i>	+	+	+
14.	Mole cricket	<i>Gryllotalpa africana</i>	+	+	-
15.	Rice root weevil	<i>Echinocnema oryzae</i>	+	-	-
16.	White rice leaf Hopper	<i>Cicadella spectra</i>	+	+	+
17.	Striped bug	<i>Tetroda histeroides</i>	+	-	-
18.	Red spotted ear head bug	<i>Menida histrio</i>	+	+	+
19.	Pentatomid bug		+	-	-
20.	Rice seedling fly	<i>Atherigona exigua</i>	+	+	+
21.	Whorl maggot	<i>Hydrellia sp</i>	+	-	-
22.	Gall midge	<i>Orseolia oryzae</i>	+	-	-
23.	Brown Plant Hopper	<i>Nilaparvata lugens</i>	+	-	-
24.	Awl Butterfly	<i>Hasora sp</i>	-	-	+
25.	Rice mealy bug	<i>Heterococcus rehi</i>	-	-	+
26.	Long horned grass Hopper	<i>Conocephalus pallidus</i>	+	+	-
27.	Rice swift butterfly	<i>Borbo cinnara</i>	-	+	+
28.	Yellow hairy cater pillar	<i>Psalis pennatula</i>	-	+	-
29.	Green grass hopper	<i>Attractomorpha crenulata</i>	-	+	-
30.	Bush hopper	<i>Ampittia discorides</i>	-	+	-
31.	Green Leaf hopper	<i>Nephotettix nigropictus</i>	-	+	-
32.	White backed rice plant hopper	<i>Sogatella furcifera</i>	-	+	-
Total			24	18	13

+: Present, -: Absent

Table 3: Number of species of Birds and Pests of rice in different Paddy regions.

Paddy regions	No of species of Birds	No of species of Pests of Paddy
CPF	12	24
FWPF	32	18
MLHPF	5	13

CPF=Coastal Paddy Field; FWPF= Fresh Water Paddy Field; MLHPF=Midland Laterite Hillock Paddy Field.

6. DISCUSSION

- A number of avian species was highest (32) in FWPF (Region 1) and lowest (5) in MLHPF (Region 3). A number of avian species was 12 in CPF (Region 2).
- The absence of water in the Midland Laterite Hillock Paddy Field (Region 3) favoured the excess growth of weeds. But in the other two regions (FWPF and CPF), the weed growth was less because these regions were filled with water upto a certain extent during the south west monsoon. This observation was in conformity with Bambaradeniya et.al, 1998.
- The weeds of the paddy field proper were dominated by the monocot families of Poaceae and Cyperaceae while weeds in the field bunds were dominated by dicot families of Asteraceae and Euphorbiaceae. The weeds provide an alternate habitat to insects in particular. (Bambaradeniya et. al, 1998).
- The presence of water in the field appears to inhibit the growth of weeds, which are largely terrestrial or semi-aquatic species. (Bambaradeniya et.al, 1998).

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