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Ecological and Socioeconomic Linkages of Birds of Ravi Riverine Habitats

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Abstract.- This paper investigates the ecological linkages of the bird species of selected riverine habitats of River Ravi including the livestock of the sample area. Livestock is a source of revenue generation through low cost milk and meat production for the local community through free grazing. The insects in the pastureland that are dislodged by the livestock movement, are eaten by Cattle egrets, Bank mynas and Black drongos. Bank mynas and Black drongos were estimated to consume insects approximately one sixth of their body weight per day. However Cattle egrets and Crested larks were found to consume insect biomass almost one third of their own body weight per day. The percentage of grasshoppers and beetles was found higher than other insects in the food of these birds. The quantity of eatable grass available in the habitat was linked to the extent of grasshoppers damage, that had direct affect on the milk and meat production from livestock of the area. The food plants, insects, birds, livestock, milk production and the economic benefits to the rural communities in these riverine habitats were found interlinked and interdependent.

Keywords: Riverine habitat, Ecological linkages, Insects, livestock.

INTRODUCTION

A variety of bird species are found in the riverine habitats. Disturbance created by humans is continuously changing these habitats (Arscott *et al*., 2002). Clearing of natural riverine habitats for human settlements and agricultural activity is resulting in the loss of original habitats in addition to creating some new habitats. For the proper management of these new Riverine habitats knowledge of the ecological linkages of these habitats is needed. This study investigates the ecological linkages of the bird species and the socio-economical aspects in the selected riverine habitats of River Ravi. It also presents the feeding behavior of selected bird species.

Description of study areas

Three areas were selected for the study.

1. Balloki Headworks was constructed in 1913. Two canals, Lower Bari Doab canal and Balloki-Sulemanki link canal are fed from this Headworks (Ahmad and Chaudhary, 1999). River Ravi was a perennial river. Now its flow is highly variable depending on the use of its water in India after the Indus Water Treaty of 1960 (Ahmad and Ali, 1998). The width of the old river bed (Beit) of River Ravi varies between less than 1 km to 3 km within the study area.

The reduction of flow in River Ravi is due to stoppage of river ravi water by India. River flow is supplemented by Link canals – Marala-Ravi and Qadarabad-Balloki Link canals, Upstream of Balloki Headworks. After the Indus water treaty, the flow of the river in non-flood season is confined to only a few shallow channels. The rest of the area usually becomes grassland and serves as free pastureland for domestic livestock. At Balloki Barrage marginal bunds were made to keep the flow of water permanently through the barrages. Additionally these bunds give protection from high floods to the surrounding villages, roads, canals and irrigation system. Spur bunds were also made with the bunds to protect these from possible damage of the high floods. The excavations for the construction of these bunds have led to the formation of permanent ponds, due to seepage or flood water. Wetland floral and faunal communities have established in these ponds. The river habitat has been degraded over the years, which has resulted in disappearance of wildlife such as hog deer and fishing cat (Manzoor, 2005). Historically crocodiles also occurred in the habitat. The palatable plants that grow in the river bed are heavily grazed by

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livestock. Most part of the old river bed of the River Ravi have come under agriculture and human residence. However, there is considerable amount of milk and meat supply from these habitats. There is no scientific management of the river bed land to enhance livestock grazing capacity.

2. Ravi Siphon: The BRB canal crosses River Ravi through a siphon upstream of Lahore.

3. Mohlanwal: It is a village, located 28 km south of Lahore along the river. Hudiara drain falls into River Ravi just upstream of Mohlanwal village (near Khurdpur village) and water here is nothing but foul odour water except during the flood season.

MATERIALS AND METHODS

Six visits were made to 2km area upstream of Balloki Headworks, five in the months of April, May, June, July and November 2005 and one in October 2006. Three visits were made to 2 km area of Ravi Siphon, two in April and one in December 2005. Two visits were made to Mohlanwal village, one in May 2005 and the other in January 2006. The total area of study was estimated by joint field team including myself, my supervisor and our field man, who is reliable in field methodology. Bird observations were made using binoculars. Strip of 1,500meter long and 150meter wide area was selected for bird's observation in all three selected habitats. Birds were identified in the field using field guide. A total of 59 specimens of four bird species were shot during different months of the study, between November 2005 to October 2006 from Balloki Headworks. These were cattle egret *Bubulcus ibis,* bank myna *Acridotheres ginginianus,* crested lark *Galerida cristata* and black drongo *Dicrurus macrocercus.* These were immediately weighed with an electronic balance. Food in the crops was scooped out after these were removed from the body. Weight of samples was measured with an electronic balance. Preservation of samples was done in 10% formaldehyde. Identification of the food contents was got done by Professor Shamshad Akbar from Government College University, Lahore. The average food consumed in one hour of a single bird species was calculated by adding the food of all the birds and divided by number of samples. To find the average daily food consumption, the average food consumed in one hour was multiplied by activity hours of the birds. For cattle egret, black drongo and bank myna six hours of activity were taken on the basis of observations made during the study (Three hours morning, one hour late morning and afternoon and two hours evening). Non-grazing time was not included *i.e.* only six hours of grazing period was considered. For crested lark, ten hours of activity were taken.

Insect sampling

To find out the percentage of insects in the habitat, sampling was carried out by sweep net of 0.5mm mesh size, up to 3 km upstream of Balloki Headworks. Six samples were collected from 100m long and 1.5 meter wide area. Insects were preserved in 10% formaldehyde for identification.

Plant sampling

Plants growing on the eastern and western sides of the river water channels were collected from Balloki Headworks. Sixteen circular quadrates of 11.8 ft (0.01 acre) radius were made with the help of a string on both sides. In total thirty-two circular quadrates (0.32 acres = 0.12 hectare) were made. The distance between the centers of two quadrates was estimated to be 20 meters. Plants were collected and identified by Dr. Zaheer-ud-Din Khan from Government College University, Lahore.

Relative abundance

Relative abundance of birds and plants was calculated by using the following formula:

$$\text{Relative abundance} = \frac{\text{Total Number of individuals of a species in all quadrates}}{\text{Total Number of individuals of all species in all quadrates}} \times 100$$

RESULTS

In total thirty-two species of birds were counted at Ravi Siphon, forty-seven from Balloki Headworks and twenty-six from Mohlanwal during different months of the 2005-2006. Yellow wagtails were found in abundance at Balloki Headworks. Its

relative abundance was calculated to be 33.8, that of house martin 31.1, white wagtail 16.2, common myna 4.72 and cattle egret 4.47. The relative abundance of purple sunbird was 8.75 which was the highest at Ravi Siphon. Relative abundance of little green bee eater was 6.49, blue tailed bee eater 5.08 and of short-toed lark, little brown dove and common myna 4.51. Relative abundance of bank myna was 21.2 at Mohlanwal village, common myna 8.8, blue tailed bee eater 7.6 and of red wattled lapwing was 7.2. Complete list of species observed with their relative abundance in all three selected habitats is given in Table I.

Socio-economics of the study area

Kana *Saccharum bengalense* is a source of income for the government, local communities and traders. It is harvested each year from the last week of December to February to make reed screens locally called "Sirkee". Kana *Saccharum bengalense* is used as thatching material in villages as well as for fuel in the local communities of Balloki Headworks. Approximately 150 people are involved in the Kana business. Eighty to one hundred bundles of Kana are obtained from one acre land. The bundle is locally called "Pula" and one Pula contains 200 Kanas. Price of one bundle is Rs.70 –100. One Sirkee is 8-12 feet wide and 15feet long, which is sold at about Rs 1½ to 2½ per square foot. One acre crop of Kana is sold for Rs.10,000. One person makes upto 50-80 square feet sirkees in one day and earns up to Rs. 200-250 per day (noted in 2006). The proportion of males and females involved in sirkee making is 30% and 70% respectively. The place where Kana is sold is called "Jhatharee adda''.

Farasah *Tamarix* is used for making baskets. Commercial over exploitation of tamarix has almost eliminated it from these habitats. Five acres of tamarix was estimated in Balloki Headworks while traces of degraded tamarix were observed on the banks of River Ravi at Ravi Siphon, at about ten acres.

Dib *Typha domingensis* provides roosting site to birds especially the transit migrants. In 10 hectare area of typha, roosting of more than 60,000 wagtails, martins, weaver birds and 8000 black starlings was observed on November 8, 2005. It is a source of income to government and the local communities. More than 70% of typha is harvested each year from mid September to mid November for handmade mats. It is annually auctioned by the government (Manzoor, 2005).

In all 19,000 buffaloes, 12,000 cows, and 2,500 goats/sheep graze within 3km upstream of Balloki Headworks. It was estimated that on an average, 1,050 buffaloes from the western side produce 8,400 liters of milk while 1,800 buffaloes from the eastern side produce 14,400 liters milk per day. This milk is sold for rupees 14/liter only. For cows it was estimated that about 75% produce milk while 25% do not produce milk. On an average, 3,000 cows from the western side produce 9,000 liters of milk while 6,000 cows from the eastern side produce 18,000 liters of milk per day. This milk is sold for rupees 13/ liter. Out of 2,500 goats/sheep only about 20% are sold during the year while remaining 80% are sold at the time of Eid ul Azha.

Livestock grazing in Mohlanwal habitat was estimated to be: cows 2,000, buffaloes 300 and sheep /goats 400-500. Total 1,000-1,200 liter milk per day was produced by the livestock and was transported to Lahore. Rest of the milk is used to make butter and curd for household consumption.

Food analysis study

Food analysis of fifty-nine specimens of four bird species (Cattle egret, bank myna, crested lark and black drongo*)* was studied with special reference to the livestock at Balloki Headworks during different months of the study. All these four bird species were found linked to livestock grazing in the study area.

Cattle egret

Analysis of crop contents of six cattle egrets was done from the samples taken on 26th November 2005. (24°C) between 5pm to 7pm. Average weight of cattle egret was 440gms. Insects were prominent in their diet. These included grasshoppers, *Chrotogonous*, beetles, mole crickets, mouse and a young frog were recorded (Fig. 1). Food intake of six cattle egrtes is given in Table I.

Table I.- Relative abundance of bird species in three selected habitats.

Sr. No	Common name	Scientific name	Relative abundance		
			Balloki headworks	Siphon	Mohlanwal
1.	Little green bee eater	*Merops orientalis*	0.6	6.49	6.4
2.	Common myna	*Acridotheres tristis*	4.72	4.51	8.8
3	Indian robin	*Saxicoloides fulicata*	0.008	1.12	0.4
4	Black drongo	*Dicrurus macrocercus*	0.14	2.25	2.8
5	Indian roller/blue jay	*Coracias benghalensis*	0.04	0.56	0.8
6	Pond heron	*Ardeola grayii*	0.12	3.67	1.2
7	Golden oriole	*Oriolus oriolus*	0.03	3.10	2.4
	Red wattled lapwing	*Hoplopterus indicus*	0.22	1.12	7.2
8	Bank myna	*Acridotheres ginginianus*	0.16	4.23	21.2
9	Red turtle dove	*Streptopelia tranquebarica*	0.05	1.69	4.8
10	Pied kingfisher	*Ceryle rudis*	0.12	2.82	1.6
	Blue tailed bee eater	*Merops philippinus*		5.08	7.6
11	White breasted kingfisher	*Halcyon smyrnensis*	0.09	0.56	4
12	Golden backed wood pecker	*Dinopium benghalense*	0.01	0.28	0.8
13	Pied bush chat	*Saxicola caprata*	0.06	1.41	0.8
14	Purple sunbird	*Nectarinia asiatica*	0.21	8.75	
15	Little egret	*Egretta garzetta*	0.11	0.56	
16	Weaver bird	*Ploceus philippinus*	0.42	3.38	
17	Yellow throated sparrow	*Petronia xanthocollis*	0.09	2.25	
18	Crow pheasant	*Centropus sinensis*	0.008	1.12	
19	Crested lark	*Galerida cristata*	0.03	2.54	
20	Common babbler	*Turdoides caudatus*	0.36		3.2
21	Red vented bulbul	*Pyconotus cafer*	0.22		6.4
22	Jungle babbler	*Turdoides striatus*	0.008		4.8
23	Sparrow hawk	*Accipiter badius cenchroides*	0.008		0.8
24	House sparrow	*Passer domesticus*	1.10		2.4
25	Rose ringed parakeet	*Psittacula krameri*	0.05		4.8
26	Cattle egret	*Bubulcus ibis*	4.47		3.6
27	Rufous backed shrike	*Lanius schach*	0.008		0.8
28	House crow	*Corvus splendens*	0.05		
29	Honey buzzard	*Pernis apivorus*	0.03		
30	Stone chat	*Saxicola torquata*	0.03		
31	Red crimson breasted barbet	*Megalaima haemacephala*	0.02		
32	Bay backed shrike	*Lanius vittatus,*	0.008		
33	Night heron	*Nycticorax nycticorax*	2.27		
34	Grey heron	*Ardea cinerea*	0.03		
35	Pheasant tailed jacana	*Hydrophasianus chirurgus*	0.08		
36	Cormorant	*Phalacrocorax fuscicollis*	0.11		
37	House martin	*Delichon urbica*	31.1		
38	Common tern	*Sterna hirundo hirundo*	0.07		
39	Yellow wagtail	*Motacilla flava*	33.8		
40	White wagtail	*Motacilla alba*	16.9		
41	Indian pipit	*Anthus rufulus*	0.05		
42	Yellow eyed babbler	*Chrysomma sinense*	0.05		
43	Black bittern	*Ixobrychus flavicollis*	0.04		
44	Marsh harrier	*Circus aeruginosus*	0.01		
45	Little brown dove	*Streptopelia Senegalensis*	0.04	4.51	
46	Short toed lark	*Calandrella brachydactyla*		4.51	
47	Koel	*Eudynamis scolopacea*		1.12	
48	White throated munia	Enodice malabarica		5.08	
49	Asian paradise flycatcher	*Terpsiphone paradisi*			1.2
50	Indian tree pie	*Dendrocitta vagabunda*			0.8
51	Hoopoe	*Upupa epops*			0.4
52	Common sand piper	*Tringa hypoleucos*		3.38	
53	Shoveler	*Anas clypeata*		2.25	
54	Gargany	*Anas querquedula*		3.67	
55	Common teal	*Querquedula Crecca*		1.69	
56	Common moorhen	*Gallinula chloropus*		0.28	
57	White breasted moorhen	*Amaurornis phoenicurus*		0.56	
58	Grey hornbill	*Tockus nasutus*		1.12	

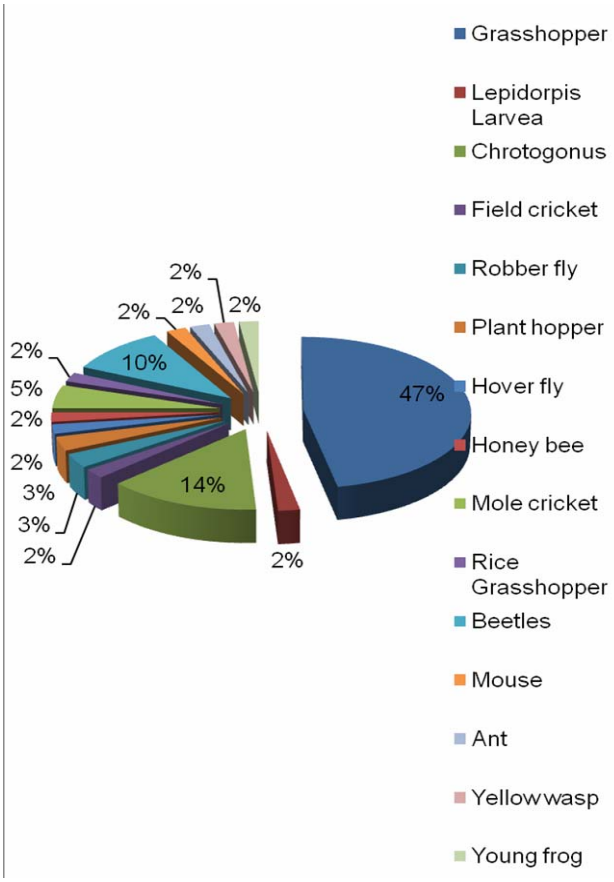

Fig. 1. Percentage of Insects from crops of Cattle egret.

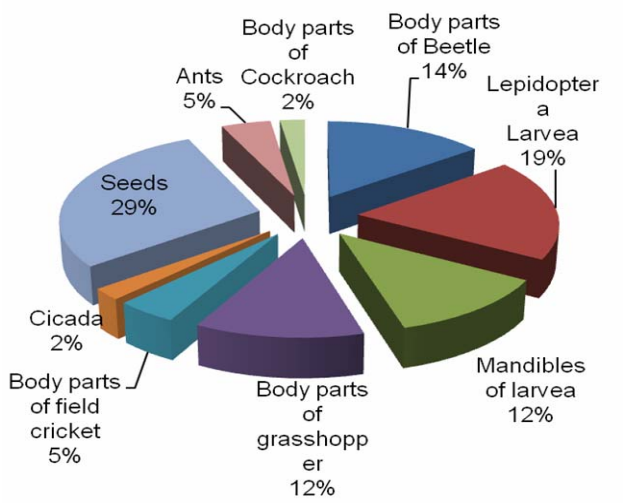

Fig. 2. Percentage of insects from crops of Bank mynas.

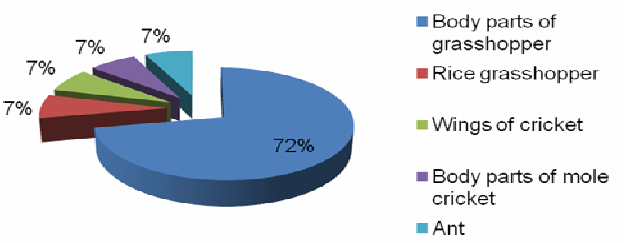

Fig. 3. Percentage of insects from crops of Black drongos.

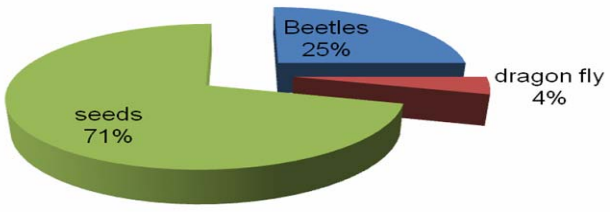

Fig. 4. Percentage of insects from crops of Crested larks.

Bank myna

Analysis of crop contents of thirty-seven Bank mynas was done by the samples taken on 19th May 2006. between 7.30-11.30am (32°C). Twenty specimens of Bank myna had consumed seeds, lepidoptera larvae, beetles, grasshoppers, field crickets and cockroaches (Fig. 2). Four crops were empty while thirteen had unidentifiable material but no insects or seeds (Table II).

Black drongo

Analysis of crop contents of 11 Black drongos in samples taken on 8th June 2006. (41°C) showed body parts of grasshoppers, rice grasshoppers, body parts of cricket and mole cricket (Fig. 3). Food intake of Black Drongos is given in Table III.

Crested lark

Analysis of crop contents of five Crested larks was done by the samples taken on 2nd, 4th, 7th, 8th October 2006, between 8am to 1.30pm. Crested larks consumed seeds, beetles and dragonflies (Fig. 4). Food intake of crested larks is given in Table IV.

Table II.- Food intake of cattle egret (*Bubulcus ibis*).

Sr. No.	Weight of bird (g)	Weight of food in the crop (g)	Food analysis	Estimated daily food intake (g)
1	450	18.342	6 Grasshopper, 1Lepidoptera larvae	110.04
2	470	23.583	6 Chrotogonus, 1 Grasshopper, 1 Field cricket, 2 Robber fly	141.48
3	420	28.982	18 grasshoppers, 2 plant hopper, 1 hover fly	173.88
4	420	13.848	1 honeybee, 3 mole cricket, 4 beetles, 1 grasshopper, 1 rice grasshopper	83.088
5	370	6.713	2 beetles, Chrotogonus (1 adult, 1 nymph)	40.278
6	500	43.453	1 mouse, 1 ant, 2 grasshoppers, 1 yellow wasp, 1 spider, young frog	272.7

Plant sampling

Plant Sampling was done upto 3 km upstream of Balloki Headworks to estimate the palatable grasses present in grassland beyond the edge of wetland. Plant samples were collected from 0.32 acres (0.12 hectare) plots. Plants collected in the sample included *Poa annua, Oxalis esrniculata, Sissymbrium irio, Ranunculus muricatus, Cannabis sativa* and *Fumaria indica*.

Insect sampling

Sweep net was used to find the population of insects in pastureland at Balloki Headworks. Grasshoppers were present in large proportion (60%), beetles (12%), spiders (11%) and ants (8%).

DISCUSSION

Most of the human settlements in the study areas were found economically linked to the livestock, agriculture and aquatic flora growing along the peripheries of the ponds.

The ecological and socio-economic values of Kana were studied. Kana was estimated to be found in approximately eighty acres in Balloki Headworks study area. It was used for making sirkee which is used for thatching roofs of houses in villages. It provides nesting and roosting places for many bird species such as pied bush chat, Indian prinia, black drongo, common babbler and jungle babbler. In February, Kana is set on fire to burn its leaves to make its harvesting/cutting easy. As a result some nests, eggs and nestlings of early breeding birds are lost. Insects are burnt along with the burning of Kana, which are the food of black starlings and black drongos.

A large proportion of cattle and buffaloes graze in the selected habitats. In Balloki Headworks only 15% buffaloes produce 8 liter milk/buffalo /day. 75% cows produce 3 liter milk/cow/day which is sold at cheap rates. Due to free pasturing and almost nil stall feeding of milk dairy livestock and calves, the milk and meat production cost was not high. Moreover, grazing was usually by one or two persons per herd.

Food analysis study revealed that the four bird species were mostly insectivorous. Insects dislodged by movement of grazing animals were caught by these birds. Most insects found in food of bird species were vegetation eaters such as grasshoppers, beetles and larvae (Tables II-V).

Cattle egret is ecologically linked to grazing cattle. These were seen in close association with cattle at Balloki Barrage. The number of cattle egrets observed with grazing cattle varied but averaged three to four per animal. Egrets move very near to the cattle, picking insects from the grass when disturbed by the feet of grazing cattle. Similar behavior of cattle egret was documented by Snoody (1969), Fogarty and Hetrick (1973), Ali (1979), Whistler (1986), Akhlaq (1987) and Roberts (1992). Cattle egrets that associated with cattle in the study area caught prey items at a faster rate and apparently consumed less energy to achieve this (Seedikkoya *et al*., 2005). This association appears to be an example of facultative commensalism (Rand, 1954; Heatwole, 1965). Previous studies by Ikeda (1956), Snoody (1969), Fogarty and Hetrick (1973), Ali

Table III.- Food intake of bank myna (*Acridotheres ginginianus*).

Sr.No	Weight of bird (g)	Weight of food in the crop (g)	Food analysis	Estimated daily food intake (g)
1	75	2	Front wings and head of beetle	12
2	81.5	3	Unidentifiable material	18
3	71	1	Mandibles of larvae	6
4	70.5	2	Unidentifiable material	12
5	78	3.5	Unidentifiable material	21
6	78	3g	One thrip	18
7	82	3.5	3 legs of grasshopper and wings of grasshopper, Lepidoptera larvae , abdomen of field cricket ,Cicada abdomen.	21
8	66.5	2	Seeds of some crops	12
9	70	2.5	Mandibles of grasshopper, beetle wings.	15
10	66.5	1.5	Unidentifiable material	9
11	65.5	1.5	Unidentifiable material	9
12	68	1	Beetle wings, head of ant	6
13	67.5	2	Unidentifiable material	12
14	80	Empty	Empty	0
15	72.5	1.5	One ant	9
16	74.5	2.5	Unidentifiable material	15
17	70	Empty	Empty	0
18	74	2.5	Unidentifiable material	15
19	69	Empty	Empty	0
20	69.5	5	4 Lepidoptera larvae	30
21	67.5	1 g	Ant and mandible of grasshopper	6
22	72	2	Unidentifiable material	12
23	71	Empty	Empty	0
24	70	2	Head of beetle	12
25	77	2.5	Wings of grasshopper	15
26	79	1	Unidentifiable material	6
27	88.5	3	Unidentifiable material	18
28	79	3	Wings and head of beetle	18
29	74.5	2 g	16 seeds of some bean	12
30	82	2.5	Unidentifiable material	15
31	72	1.5	Lepidoptera larvae , Beetle	9
32	75	2.5	Head of Lepidoptera larvae	15
33	76	2.5	One beetle	15
34	73	2.5	Abdomen of cockroach	15
35	75	1.5	Unidentifiable material	9
36	68.5	2	Legs of field cricket	12
37	81	4	Lepidoptera larvae	24

(1979), Whistler (1986), Akhlaq (1987) and Roberts (1992) reported cattle egret to be an insectivorous bird. In a similar study done by Mukerjee (1971) stomach analysis of 318 birds collected from West Bengal in the Sunderbans revealed mainly an insect diet. While another study done by Fogarty and Hetrick (1973) in Florida revealed that nearly 90 percent of the foods identified from 841 stomachs were common pasture insects varieties likely to be disturbed by cattle. It was estimated that on an average egret weighing 440g consumes 22.5g of insects in one hour. In six hours of activity it might consume 135g of insects. On average an egret weighing 440g may consume almost one third of its own weight of insect food.

Bank myna was observed to be ecologically linked to domestic livestock (cows and buffaloes). These birds feed mostly on ground, searching for the insects. It rides or follows grazing livestock to get benefit of the disturbance caused to insects by

Table IV.- Food intake of black drongo (*Dicrurus macrocercus).*

S.No.	Weight of bird (g)	Weight of food in the crop (g)	Food analysis	Estimated daily food intake (g)
1	52.5	1	Wings of grasshopper	6
2	50	1g	Head and wings of rice grasshopper	6
3	54	1.5	Wings of grasshopper	9
4	47.5	1	Wings of cricket	6
5	55	1	Wings and legs of grasshopper	6
6	51	1.5	Grasshopper	9
7	51	1	Legs and wings of grasshopper	6
8	57.5	2.5	3 grasshoppers	15
9	48.5	1	Head of black ant	6
10	48	1	Wings of grasshopper	6
11	46	2	Body parts of mole cricket.	12

Table V.- Food intake of crested lark (*Galerida cristata).*

Date	Time	Weight of bird (g)	Weight of food in the crop	Food analysis	Estimated daily food intake (g)
2-10-06	8:10am	24.5	0.7	2 beetles	7
2-10-06	9:30am	26.5	0.9	1 dragon fly, broken pieces of beetle	9
4-10-06	11:6am	25	1.1	20 seeds	11
7-10-06	2:40pm	26	0.7	2 beetles	7
8-10-06	1:20pm	23.5	0.6	2 beetles	6

animal hooves. Similar behavior of bank myna has been documented by Ali and Ripley (1983), Roberts (1992) and Masood (2004). In studies by Mason and Lefroy (1912) stomach contents of eight birds in Bihar (north central India) were collected in late June and late August and found the birds to be insectivorous. Insect remains were largely recovered. Presence of insects and seeds in the diet of bank myna has been previously documented by Ali (1979) and Roberts (1992). The feeding behavior of bank myna comprises of variety of materials increasing the chances for this specie to exploit all habitats. Mynas were observed finding and eating roasted insects from ashes after the reed fire. It was estimated that bank myna weighing about 73.7g consumes 2.12g of food in one hour. In six hours of activity it might consume 12.7g of insects. Thus consuming the insect food averaging about one sixth of its body weight.

Black drongo is a bird of open country, usually perching on telegraph wires or attending the grazing cattle. It rides on the backs of grazing cattle and dives to eat flying insects disturbed by the cattle movement. Many black drongos were observed feeding on flying insects as the reeds were set on fire. Larger insects such as grasshoppers, crickets and dragonflies are first dismembered and then eaten (Ali, 1979; Roberts, 1991). Studies by Akhlaq (1987) and Roberts (1992) also mention that this specie mostly consumes insects. It is reported to be highly beneficial to agriculture by the vast quantities of injurious insects it destroys (Ali, 1979). Mason and Lefroy (1912) also found that Black drongo consumed insects, which included grasshoppers and mole crickets in the largest proportion. It was estimated that on an average the black drongo weighing 51g consumes 1.3g of insects in one hour. In six hours of activity it might consume 7.8g of insects. A black drongo weighing 51g may consume at least one sixth of its own weight of insect food.

Crested lark is an insectivorous bird found in barren land where cattle graze. It feeds on the ground while running rapidly and stopping suddenly to capture insects with beak on grassy areas and

beneath stones. They hunt in the vicinity of animal farms from village to village pecking at the dung of domestic animals (Ali, 1979; Whistler, 1986). The food analysis has shown the presence of seeds in the diet of crested lark which have been previously documented by Ali (1979), Akhlaq (1987) and Robert (1992). It was estimated that crested lark weighing 25.1g consumes 0.9g of insect food in one hour. In ten hours of activity it might consume 9 g of insects. Thus consuming insect food on the average almost one third of its own body weight.

Relative abundance of the plant samples collected showed that *Cynodon dactylon* (Bermuda grass) was present in highest percentage which is a palatable grass (Husnain and Usmani, 2006). *Kahi Sacchrum spontaneum*, Maize, Kikar *Acacia nilotica*, Ber *Ziziphus mauritiana* and sorghum were also used as fodder at Balloki Headworks. Additional fodder was given to the livestock in Mohlanwal village.

The insect samples showed that grasshoppers were present in the largest proportion in the pasture land of Balloki Headworks. The grasshopper eats the blades of the grass usually from the lower part or middle to the ground, thus causing damage to the vegetation. It eats almost equal to its own weight per day.

CONCLUSIONS

Grasshoppers cause considerable damage to the forage species of plants. This results in reduction of forage for livestock, consequently affecting the milk and meat production of the area. Four bird species (cattle egret, bank myna, black drongo, crested lark) are linked to the livestock and insects for their diet. The insects are linked to the vegetation in the study areas, while if the population of insects increases, it will adversely affect the grasses upon which livestock graze. This is likely to affect the livestock resulting in reduction of meat and milk supply in the area, adversely affecting the local community.

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