

BREEDING ECOLOGY OF BLACK IBIS *PSEUDIBIS PAPILLOSA* IN AGRO ECOSYSTEM OF PUNJAB, INDIA

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ABSTRACT : The Black Ibis *Pseudibis papillosa* is wide spread bird species in Indian subcontinent, occurring almost all over India. Vast literature on breeding ecology of wading birds exists, but Ibises are much less explored. Very little is known about the breeding ecology of Black Ibis. In the light of this the present study on the breeding ecology of Black Ibis was under taken in the agricultural field areas of Punjab Agricultural University, Ludhiana during 2014-16. A total six nests of Black Ibis were recorded during the study. One nest was recorded in the month of November 2015 and remaining five nests were recorded from March 2016 to July 2016. All six nests were recorded on the trees of *Eucalyptus sp.* The average height of the trees having nest and height of nests was 32.5 ± 1.56 and 23.0 ± 1.85 m, respectively. Courtship and pairing was performed at roosting sites. Mating was performed 3-4 times a day at roosting and nesting sites. Helping activities by the helper ibis was also recorded during the construction of nest. Utilization of nesting material from old Ibis nest to build new nest was also recorded. Clutch sizes ranges from 2 to 3 eggs. Incubation and feeding to nestlings were done by both parents by 4-5 change over within a day. Young ones were always under surveillance of at least one parent. After the age of 45-50 days the young one were able to perform flight activity and feeds in the fields. In the present study it was concluded that the breeding period of Black Ibis ranges from March to November in agro ecosystem of Punjab. March to May is the peak breeding period of Black Ibis in Punjab. Average duration of successful breeding cycle of Black Ibis ranges from 83-95 days starting from courtship to flight of young ones.

Key words : Black Ibis *Pseudibis papillosa*, breeding ecology, clutch size, feeding activities.

INTRODUCTION

The republic of India, with a geographical land area of 32,87,263 sq. km, ranks among the top ten countries in the world in term of most number of bird species, covering 2.2% of world's terrestrial landmass, India is known to harbor about 12.5% of its avifauna. The India checklist acknowledges inclusion of 1263 species of birds including 61 (4.8%) endemic to India (Praveen *et al.*, 2016). Black Ibis (*Pseudibis papillosa*) is an important bird species of agricultural ecosystem. It is wide spread in Indian subcontinent, occurring almost all over India, Pakistan, Nepal, Bangladesh and China and is popularly known as "farmer's friend" as it feed on large number of insects pests (Ali, 2004). The Punjab state (latitude 29°33' to 32°32' North and longitude 73°55' to 76°50' East; average elevation of 300 m above mean sea level) is an intensive agricultural state (100% cropping intensity) having Paddy-Wheat cropping cycle as dominant cropping cycle. Net area sown in the state was 82.4% out of which 99% area was irrigated area, which leads to formation of an agricultural ecosystem having semi-aquatic sub-habitat for birds most of the year especially during paddy crops (Sharma and Chahal, 2016). Vast literature on breeding

ecology of wading birds exists, but Ibises are much less explored. Very little is known about the breeding ecology of Black Ibis. In the light of this the present study was under taken about the breeding ecology of Black Ibis.

Breeding habitat is of prime importance for the fitness of birds species and progeny (Martin, 1988; Boulinier, 1996). In a given species, nest site quality varies in space and time at different scales due to different environmental factors affecting reproductive success (Wiens, 1976). In some ibises, reduced reproductive success was recorded due to poor nest site selection (Burger and Miller, 1977; Frederick, 1986; 1987). Kushlan (1976) reported role of availability of feeding sites in nest site selection in White Ibis. Nests made at the places not easily accessible to predators, such as cliffs, tall trees, thick vegetation, have high breeding success (Ames and Merserau, 1964; Simmons and Smith, 1985; Burger, 1984; Martin and Rooper, 1988; Dunham, 1990; Li and Martin, 1991; Alonso *et al.*, 1991; Watson, 1992; Kelly, 1993). During breeding season, the female Ibis occupies the perch near to its future nesting site at the roosting tree and male bird occupies the top branch of that roosting tree. During rainy season the Black Ibis preferred roosting in outskirts of

rural and urban areas due to availability of feeding material in grazing fields and agriculture farms but in winter season, they shifted themselves to roosting sites close to human habitation and their number also increased per roosting tree due to aggregation as the bird had communal roosting (Soni, 2008). Nest site selection of colonial ibises nesting in mixed species heronries was studied by Kushlan (1976), Burger and Miller (1977) and Burger (1978a, 1978b, 1979). However, nesting requirements of the Black ibis is poorly known except brief accounts given by Ali and Ripley (1983), Lathigara (1989), Hancock *et al* (1992), Soni and Sharma (2008), Soni (2008). No study was done on the Breeding biology of Black Ibis in agro ecosystem of Punjab. During the present work breeding ecology of the Black Ibis was studied to understand the factors affecting selection of nesting habitat and nest tree and its implications for management of the species for conservation purpose.

MATERIALS AND METHODS

The present study on the breeding ecology of Black Ibis was undertaken at agricultural area of Punjab Agricultural University (PAU), Ludhiana (30° 53' 59.81" N and 75° 47' 32.10" E) from September 2014 to July 2016. This location was further divided into four different site i.e. site I which include fruit crops, agricultural crops and tree plantation; Site II includes mainly agricultural area having few trees; Site III includes agricultural fields, water bodies and tree plantation and Site IV includes agricultural fields and small trees. These four sites were different in some respects having different crops, trees and water bodies. Point counted method was used for taking the observation about Black Ibis. Identification of birds was done on the basis of visual observations of their morphological characteristics by using binocular and comparing them with those described by Ali (2004). Observations were taken from 6:00-10.00 am and from 5.00 -7.00 pm in summer and from 7.00 -11.00 am in morning and from 4.00 -6.00 pm in evening during winter. Instruments used during the study were digital camera (Nikon P 500), Bushnell (8X42) Binocular for observing birds and Ravi Altimeter for measuring tree and nest height. The nests were constantly monitored 5 to 6 consecutive days in a week during breeding season.

RESULTS AND DISCUSSION

A total of 21 bird species were recorded during the study. Annual abundance of Black Ibis was 11.79%. A total of six nests were located during the study. Out of these six nests, four nests were present at site III and two at site I. All the nests were observed on *Eucalyptus* spp. tree (Table 1). Out of these six nests five nests were

newly constructed and one nest was old reused nest. Nesting site selection was done on the basis of feeding sites, feeding material, foraging and roosting sites available in that particular habitat. Nesting sites, nesting height, egg laying, hatching, incubation and rearing of young one were observed (Table 1). Out of these six nests observed, only four nests were successful, one nest was destroyed by House Crow and one nest was destroyed by the heavy rain. Nest 1 was observed in the month of November 2015 at site III. This nest was on the tertiary branch of Eucalyptus tree (36 m) and the nest was at the height of 29 m. Only activity performed by both the parents was the adjustment of eggs using beak was observed. After a week this nest was destroyed by House Crow. Nest 2 was observed in the month of March 2016 and was on the same Eucalyptus tree as that of Nest 1. This nest was about 4-5 days old, because this nest was observed during incubating stage. This nest was old nest, reconstructed by the Black Ibis as this nest was earlier used by House Crow. Three nestlings were observed in this nest. This nest was destroyed by the heavy wind and rain in the month of May 2016. Nest 3 was located at site I on tertiary branch of Eucalyptus tree (27m) at a height of 22 m. This nest was newly constructed. This nest was later on abandoned by the Black Ibis. Only nesting site selection, collection of nesting material and construction of nest was observed. Later this nest was discarded by the ibises. On the other near by tree the nest of House Crow (*Corvus splendens*), Common Myna (*Acridotherestrictis*) and Eurasian collar dove (*Streptopelia decaocto*) was present. Nest 4 was observed in the month of April 2016 at site III but on primary branch of a different Eucalyptus tree (33m) at a height of 23m. Two newly hatched nestling were observed initially in this nest so we can presume that the nest was about 35-40 days old. Nest 5 was also observed in the month of May 2016 at site I on the primary branch Eucalyptus tree (27m) at a height of 16 m. Two nestling of about 5-7 days old were observed in this nest. Feeding to nestlings, parental care and flight of nestling was observed at this nest. Nest 6 was observed at site III, in the month of July 2016 on tertiary branch of Eucalyptus tree (36m) at a height of 19 m (Table 1). No nest was observed at site II and IV as there was less tree plantation and high anthropogenic activities at these sites. Different breeding activities like courtship and pairing, mating, nesting site selection, egg laying, incubation, hatching, feeding to nestling, parental care and flight of nestling was observed at different nests (Table 1). Courtship and pairing was observed at the roosting sites. One Ibis was observed shaking soft twigs of the trees in the presence

Table 1 : Observations on the breeding ecology of Black Ibis.

Breeding activities	Nest 1	Nest 2	Nest 3	Nest 4	Nest 5	Nest 6
Nest location	Site III	Site III	Site I	Site III	Site I	Site III
Detection of nest	Nov 2015	March 2016	April 2016	May 2016	May 2016	May 2016
Nesting Tree	Eucalyptus	Eucalyptus	Eucalyptus	Eucalyptus	Eucalyptus	Eucalyptus
Tree Height (meter)	36	36	27	33	27	36
Nest height (meter)	29	29	22	23	16	19
Nesting Branch	Tertiary	Tertiary	Tertiary	Primary	Primary	Tertiary
Site selection (days)	2	1	2	2	2	1
Preparation of nest (days)	2-3	2	2-3	2-3	2-3	3
Nest status	New nest	Old nest	New nest	New nest	New nest	New nest
Nesting material	Twigs and leaves of local tree	Twigs and leaves of local tree	Twigs and leaves of local tree	Twigs, leaves and feathers	Twigs, leaves and feathers	Twigs and leaves of local tree
Clutch Size	-	3	-	2	2	2
Young ones	-	3	-	2	2	2
Egg laying	-	3-5 days	-	-	-	-
Incubation period	-	32days	-	-	-	30 days
Feeding to nestling	-	4-5 days	-	30 days	32 days	15 days
Flight of young one	-	-	-	2 days	-	-
Nest Status at the end of season	Destroyed by House Crow	Destroyed by heavy rain	Nest abandoned	Intact	intact	intact

Table 2 : Breeding ecology of Black Ibis.

Breeding activity	No of days
Courtship and pairing	2-3 days
Preparation of nest	2-4 days
Mating	2-3 days
Laying of egg	3-5 days
Incubation of egg	30-32 days
Feeding to nestling	42-45 days
Flight from nest	2-3 days
Total time period	83-95 days

of others on a roost and give loud calls like “klaaklaaa”. On hearing the call, a direct flight of the probable partner towards the caller was recorded. This marks the initiation of pair formation. Soon after “getting together” they started billing, rattling their long bills together and moving their head from side to side and up and down. Both the sexes were noticed to give soft call note, shake each other’s bill, and made quick bill contacts. Nesting site selection was done by both the parents. Tallest tree in that particular location was selected for the nest site. After the selection of nest site collecting of nesting material, construction of nest and mating was performed by parents. Mating was performed 4-5 times in a day. Mating was performed at the nest and at the roosting sites. Other breeding activities was also recorded at the roosting site like courtship and pair formation, making

loud call for female attraction and fluffing of feathers. Egg laying was done within a week of a successful mating. Incubation was observed by both the parents by performing changeover for 5-6 time in a day. During changeover first parents feeds something to incubating parent and then start incubating itself and then incubating parent fly for feeding. Incubation period was observed to be 35-40 days. Clutch size was observed to be 2-3. After the hatching of eggs nestlings were always in surveillance of at least one parents and feeding was done for 45-50 days. Feeding was also done by both parents by performing changeover 4-5 times in a day. Feeding to nestlings was also done by both parents. Young one moves continuously behind the parents. Young one imitate all the activity *i.e.* movements and feeding done by parents. Young ones and adults feeds on insects, other prey present in the fields. Flight of young one was recorded about 50 days after the hatching (Table 2).

During this study it was observed that the Black Ibis prefer to build nest near the site where feeding niches and feeding materials were high. This is reason for the presence of four nests at site III and two at site I. Site I and III have comparably small field area but mosaic of habitat supporting the presence of insects, small crustaceans, small invertebrates and small reptiles due to the presence of small water bodies and large

Eucalyptus trees. Site II and IV provide large area but the feeding sites and large tree were less at these site along with bird pest management practices used at this site, so the feeding sites to Black Ibis were less in these area. It was recorded during the study that the breeding activity of Black Ibis was ranged from the March to November. Some worker reported that the breeding activity of Black Ibis is from March to October (Ali, 2004; Soni, 2008; Soni and Sharma, 2008; Soni *et al*, 2010). Only one nest of Black Ibis was recorded to be partially destroyed and then occupied by the House Crow during this study. Many bird species are reported to occupy previously used nesting area (Catchpole, 1972; Greenwood and Harvey, 1976; Harvey *et al*, 1979; Newton, 1979, 1982; Aumann, 1989; Warkentin *et al*, 1991). The presence of four nests at site III and two at site I indicate about the breeding site fidelity behaviour of the Black Ibis during the study. It is probably because of the familiarity to an area which may permit to take advantages of favorable foraging, predator avoidance and nesting site that enhance reproductive success (Hinde, 1956; Greenwood and Harvey, 1982). Breeding site fidelity was more often observed in the successful individuals than the unsuccessful one (Darley *et al*, 1977; Newton, 1982; Coulson and Thomas, 1983; Shields, 1984; Gavin and Bollinger, 1988; Gauthier, 1990; Beletskey and Orians, 1991). After pair formation nesting site selections and nest formation was occurred. Construction of new nest was done in 2-4 days. Helper Ibis also observed during construction of nest. Stealing of nesting material from other nest was also recorded during the study. Stealing of nest material was also recorded occasionally in some ibises by other workers (Urban, 1974; Sahin, 1982). Feeding was done about 45-50 days and after this when young ones were grow they were able to fly and feed their selves. Because, Ibis do not accumulate enough reserve food in their body as compared to high daily energy expenditure; constant food intake is essential on day to day basis to fulfill energy demand (Soni *et al*, 2010). To conclude we can say that the breeding activities of Black Ibis take place in 83-95 days (Table 2). As this bird feed on harmful insect, these birds can be used as bio control agent. Their abundance or status was not precisely recorded in Punjab so further continuing future study on bio-ecology of this bird in different agro ecosystem will be need of the hour.

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