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RESEARCH ARTICLE

Study of the breeding biology of Indian Myna, the most predominate bird species for the management of *Helicoverpa armigerae* Hubnr

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ABSTRACT

The experiment was conducted to study the breeding performance of Indian Myna (*Acridotheres tristis* L.) which is the most predominant bird species in the management of *Helicoverpa armigerae* Hubnr. The experiment was carried out at Mechanized Agriculture Farm, Ummedganj, Kota during the two consecutive years (2004-05 and 2005-06). During the course of study the breeding season extended from the first week of May to last week of August with peak period during dry weather of May and June. Average egg size was 2.71 × 1.97 cm, weight 5.77 g and volume 5.55 cc. The mean clutch size varied between 3.48 to 3.57. Average incubation period was between 13.7 to 13.10 days whereas, nestling period ranged between 23.25 to 23.80 days. Hatching success was higher in dry period as compared to wet period.

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INTRODUCTION

Voluminous work has been published on bio control of insect pests but little information is available on the role played by vertebrate predators, especially the birds. As a matter of fact, the first known successful importation of a vertebrate predator occurred in 1762 when the Indian Myna (*Acridotheres tristis*) was introduced from India to Mauritius to control the red locust, *Nomadocris septemfasciata* (Moutia and Mamet, 1946). Birds regulating the insect pests of crops were recorded in India as early as 1912 by Mason and Lefroy, who observed the food habits of several bird species and recorded that the food of Indian Myna chiefly consited of insect pests of crops. The preponderance and species diversity of birds are not uniform over time and space in the ecosystems in general, and in agro ecosystems in particular since the populations are influenced by several biotic as well as abiotic factors. Availability of food is one such biotic factor, which determines the size of the insect population, the composition of insectivorous bird species and ultimately also the reproductive success of the bird species in question. The irrigated agro-ecosystems determine the composition of tree species, bushes and the cropping pattern, while in rain fed or limited irrigated conditions the cropping pattern is more or less uniform and the bird species composition is restricted to a smaller number. Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops of the country. Being qualitatively and quantitatively rich in proteins, it provides an ideal dietary source of proteins to a large part of population (Bhati and Patel, 2001). Among several factors which adversely affect the production of chickpea, the damages caused by insect pests are important. About 60 insect species have been reported to feed on chickpea (Reed and Pawar, 1982). Gram pod borer, *Helicoverpa armigera* is the major pest, which has

been reported from almost all chickpea growing countries. The pest appears throughout the year on different crops, depending upon the cropping pattern. The gram pod borer has been recorded on over 20 crops and 180 wild hosts in India (Russel, 1982). Its high biotic potential, polyphagous food habit and suspected migratory behaviour make it a more serious pest. The use of synthetic insecticides has been an effective tool in the management of insect pest problems for the last four or five decades. However, the sole reliance on insecticides for combating the insect pest problems in crops has given rise to many environmental problems like pollution, destruction of beneficial insects, development of resistance to insecticides in insect pests, insecticide residues on crop plants and the resurgence of insect pests. The biological methods of pest control have a greater scope in economics of pest control and ecofriendly management. As enemies of insect pests birds stand supreme among vertebrates (Sweetman, 1958), due to their efficiency to capture and consume an enormous number of insects resulting in the control of local outbreaks at times. Several studies have shown that they play a dominant role in maintaining many insect pests at innocuous level in forest ecosystem (Tinbergen, 1960; Dickson, 1979; Torgersen and Campbell, 1982; Torgersen *et al*., 1984; Torgersen and Mason, 1987). Bird insect relationship in relation to insect pest management is the basis of present investigation Therefore, the study conducted on breeding performance of Indian Myna.

MATERIAL AND METHODS

The main objectives of the present study was to refine the breeding performance of Indian Myna. To fulfill this objective, study was carried out at Mechanized Agriculture Farm Ummedganj, Kota during the consecutive years 2004-05 and 2005-06. Statistically the experiment was designed in RBD with eight treatments and three replications.

Studies on the commom Myna, *Acridotheres tristis* :

Voluminous work has all ready been conducted by various scientists on breeding biology of Cattle egret, House sparrow and Bank Myna. A very little work or negligible study had been conducted in relation to breeding biology of commom Myna which is one of the predatory birds predating *Helicoverpa armigera*.

Breeding performance of commom Myna, *Acridotheres tristis*:

The study on the breeding performance of *A. tristis* was conducted in 2004-05 and 2005-06. About 44 natural nests or hole were selected near office building, wall of seed godown, *Acacia* trees and neem trees and embankment wall of railway bridge (near Mechanized Farm). These places were used as a safe site for egg lying by the Myna. All the selected nests or holes were marked with black oil paint before the initiation of egg laying. Observations were made on every second day. For taking observations of the nests or holes above 3 meter a bamboo ladder was used. Freshly laid egg's diameter was measured (with vernier calipers), weighed (with electronic balance), volume was worked out by measuring displacement of water volume using measuring cylinder and marked with permanent marker pen in the sequence. To work out incubation period and hatching sequence, the nestling period and overall reproductive success were recorded.

Studies on the nestling food :

Qualitative studies on the nestling food were carried out during the both years of study. Twenty chicks were randomly selected from marked holes (nest) and every chick neck collor was tied or wrapped by the thin electric copper wire. The copper wire was properly tight carefully so that they can easily breath but not intake food in stomach. When the food items fed by parents they immediately regurgitate food and these regurgitated foods were collected from selected holes or nest and examined in laboratory for their constituent.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Breeding biology of common Myna :

Breeding season :

The common Myna is mostly seasonal breeder. At Kota, it was observed to have single breeding season of about four months from the first week of May (3rd May) to last week of August (26th August). Here, the breeding season is defined as the period between the initiation of the first and the last clutches in the population. The two years of study reveled that the egg lying started on the 1st week of May and continued till the last week of August (Table 1 and 2). It was observed that, dry season with 46 to 76 per cent RH and 40°C maximum temperature were quite favourable for egg lying by the Myna and most of the breeding (70 %) was completed before July to August when heavy showers are received. Simwat and Sidhu (1794) observed that the Bank Myna made 1 to 2 breeding attempts in a season and according to Ali and Ripley (1983), they raised 2 to 3 broods. Tajdeep (2003), reported that the common Myna have two breeding season *viz.*, early September and in the beginning of May. It started first breeding from April to August in Punjab with the clutch size 2-5 eggs.

Nesting territory and breeding behaviour :

The common Myna does not define its feeding area during non-breeding season and forages either in pairs or in

Table 1 : Distribution of clutches with period during 2004-05

Period	Month	Week	No. of clutches with (No. of eggs)							Total eggs	Total no. of clutch	% clutch frequency
			1	2	3	4	5	6				
Dry	May	1	0	0	2	1	0	0		10	3	6.66
		2	0	1	2	2	0	0		16	5	11.11
		3	0	1	1	2	1	0	No. of eggs	18	5	11.11
		4	0	0	2	2	2	0		24	6	13.33
	June	1	0	1	1	2	1	0		18	5	11.11
		2	0	1	1	1	0	1		15	4	8.88
		3	0	0	0	1	1	0		9	2	4.44
		4	0	0	1	0	0	0		3	1	2.22
										113	31	68.86
Wet	July	1	0	0	1	2	0	0		11	3	6.66
		2	0	0	2	1	0	0		10	3	6.66
		3	0	0	0	1	0	0		4	1	2.22
		4	0	0	0	1	0	0	No. of clutches	4	1	2.22
	August	1	0	1	1	0	0	0		5	2	4.44
		2	0	0	1	0	0	0		3	1	2.22
		3	0	0	1	1	0	0		7	2	4.44
		4	0	0	0	1	0	0		4	1	2.22
Over all total % frequency of			0	5	16	18	5	1		48	14	31.08
clutch size				11.11	35.55	40.00	11.11	2.22		161	45	

Avg. clutch size 161/45 = 3.57

Table 2 : Distribution of clutches with period during 2005-06

Period	Month	Week	No. of clutches with (No. of eggs)							Total eggs	Total No. of clutch	% clutch frequency
			1	2	3	4	5	6				
Dry	May	1	0	1	0	0	0	0		2	1	2.43
		2	0	0	0	1	0	0		4	1	2.43
		3	0	0	2	2	0	0	No. of eggs	14	4	9.75
		4	0	1	1	2	0	0		13	4	9.75
	June	1	0	1	1	1	0	0		9	3	7.31
		2	0	0	1	3	1	0		20	5	12.19
		3	0	0	0	2	0	0		10	3	7.31
		4	0	1	1	1	0	0		9	3	7.31
										81	24	58.48
Wet	July	1	0	0	0	2	0	0		8	2	4.87
		2	0	1	1	2	0	0		13	4	9.75
		3	0	0	1	1	1	0	No. of clutches	12	3	7.31
		4	0	0	1	1	0	0		7	2	4.87
	August	1	0	0	1	1	1	0		12	3	7.31
		2	0	1	1	0	0	0		3	1	2.43
		3	0	0	0	1	0	0		4	1	2.43
		4	0	0	1	0	0	0		3	1	2.43
Over all total % frequency of			0	6	12	20	3	0		62	17	41.4
clutch size										143	41	
						Avg. clutch size				3.48		

small flocks. Courtship display started before the nest site selection, males perform head bowing display to their partners and raising the bristly feathers on foreheads. On approach of the breeding season, a pair selected a nesting holes and sticks around, frequently entering and coming out. One of the partners remains at the entrance of the hole and defends it against intruders. Whenever any predator or danger appears they emit a special type of long alarm call and subsequently all the birds fly away. Same type of breeding behaviour in Bank Myna was observed by Parashara (1989) during experimentation at Anand. Similarly, Ali and Ripley (1983) and Narang and Lamba (1984) also reported nesting behaviour of common Myna.

Breeding performance :

The egg :

The result in Table 3 shows that the length of the egg ranged from 2.40 to 3.10 cm with a mean of 2.70 cm while the width ranged between 1.70 to 2.20 cm with a mean of 1.97 cm. The variability in length was much prominent as compared to that of width. The variation in the size were also reflected on egg weight which varied from 4.80 to 7.20 g with an average of 5.77 g. Range of volume of 30 eggs was from 4.60 to 6.50 cc with an average of 5.55 cc. The data on egg weight and volume are being reported for the first time. The colour of the eggs of the common Myna is glossy blue with out marking (Plate 1a). The eggs are generally oval in shape, one end being broad and the other a little pointed. The shape of the eggs varied from egg to egg to same extent in the same clutch. The egg of Myna were smaller in size as compared to those reported by Ali and Ripley (1983).

Clutch size :

The common Myna lays an egg each day *i.e.* at an interval of nearly 24 hours units the clutch is completed. Simwat and Sidhu (1974) reposted that the clutch size of the Bank Myna as 2-5 eggs. The average clutch size was found to be 3.5 during 2005 and 4.48 during 2006.

Incubation period :

Incubation is the application of heat to eggs for the development of embryo. During the incubation, both sexes were found to sit on the eggs alternatively during day and night, facing the entrance. When one of the birds sits on eggs, the another partner either remains present in the vicinity of nest or go for foraging. The parents start attending the nest regularly right from the laying of the first egg. However, actual incubation might be taking place after the laying of the second egg. This was evident from consistent higher incubation period of the first egg (13.29 days) in 2005 and incubation period of third egg was 13.50 in 2006 (Table 4) compared to the incubation period of the remaining eggs (12.70 to 13.25 days). There was no yearly variation in incubation period. There was not much variation within the clutch also. Tajdeep (2003) also reported 13.30 days as incubation period for common Myna in Punjab. Slight variation in the incubation period between two district site could be due to the environmental factors like temperature which might have an influence on the incubation period (Sengupta, 1982).

Table 3 : Physical measurements of eggs of common Myna (2004-05 and 2005-06)

Particulars	Length (cm)	Width (cm)	Weight (g)	Volume
Minimum	2.400	1.70	4.80	4.60
Maximum	3.100	2.20	7.20	6.50
Mean	2.707	1.97	5.77	5.55
SD ±	0.187	0.115	0.707	0.483
N	30	30	30	30

Table 4 : Incubation period in days of eggs of Common Myna during 2004-05

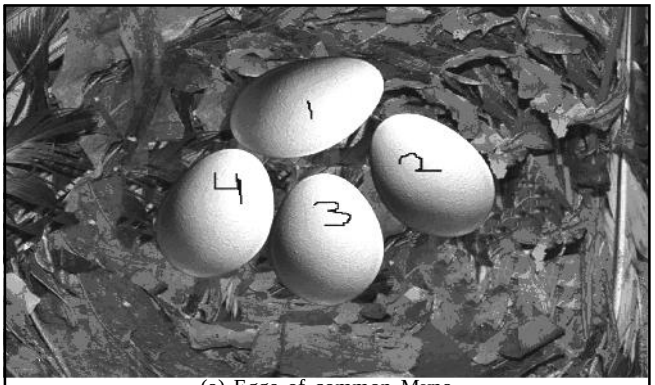
Particulars	Eggs sequence					Overall
	1	2	3	4	5	
Range	11-15	11-15	12-14	12-15	12-15	11-15
Mean	13.286	13.083	12.700	13.00	13.250	13.067
SD ±	1.069	1.084	0.823	1.225	1.258	1.031
N	14	12	10	5	4	45
Incubation period in days of eggs of common Myna during 2005-06						
Range	12-15	12-15	12-14	13-14	13-14	12-15
Mean	13.250	13.063	12.727	13.500	13.250	13.098
SD ±	0.856	0.854	0.647	0.577	0.500	0.781
N	16	16	11	4	4	51

Nestling period :

The newly hatched chicks are radish with closed eyes (Plate 1b), within 4 to 5 days they open their eyes and after this period they are drooping in the hand while handling. Nestling period is considered as the interval between the hatching of egg to the day chick leaves the nest (Table 5). The nestling period ranged 22-27 days, with an average of 23.79 days in 2005, while it was between 21-26 days with an average 23.25 days during 2006. Particularly during 2005 (Table 5) the nestling period of 1st and 2nd chick was much shorter than that of the last three chicks. This indicates that though the early hatched chicks might be ready to leave the nest, they wait for a day or two till the last chicks are prepared to do so. It was often confirmed that all the chicks leave their nest together with their parents. This is because the chicks are to be cared on the foraging ground also and the parents cannot afford to return to the nest to feed the remaining nestlings. Simwat and Sidhu (1974) also reported an even shorter nesting period (20.40 days) in Punjab. Tajdeep (2003) reported shorter nesting period (22.40 days) with 40.00 per cent nesting success.

Nesting period :

Nesting period is termed known as the interval of time between the egg laying of the first egg to the nest leaving by the last chick. The nesting period of common Myna was worked out sequence wise. It was found to be 36.50, 35.76, 34.78, 36.00



(a) Eggs of common Myna

(b) Chicks of common Myna

Plate 1: Eggs and chicks of common Myna

Table 5 : Nestling period of common Myna during 2004-05

Particulars	Eggs sequence					Overall
	1	2	3	4	5	
Range	22-26	22-27	22-25	23-26	23-24	22-27
Mean	23.583	24.455	23.111	24-500	23.333	23.795
SD±	1.240	1.572	1.054	1.291	0.577	1.341
N	12	11	9	4	3	39
Nestling period of common Myna during 2005-06						
Range	22-26	22-26	21-25	21-23	22-23	21-26
Mean	23.636	23.800	22.875	22.00	22.667	23.250
SD±	1.286	1.398	1.246	0.816	0.577	1.317
N	11	10	8	4	3	36

Table 6 : Nesting period of common Myna during 2004-05 (days)

Particulars	Eggs sequence					Overall
	1	2	3	4	5	
Range	34-38	33-39	32-38	32-38	33-35	32-39
Mean	36.500	35.757	34.778	36.000	34.333	35.667
SD±	1.243	2.102	1.787	2.828	1.155	1.883
N	12	11	9	4	3	39
Nesting period of common Myna during 2005-06 (days)						
Range	33-40	33-38	32-39	34-36	34-36	32-40
Mean	37.182	35.600	36.250	35.250	35.000	36.139
SD±	2.136	1.955	2.315	0.957	1.000	2.031
N	11	10	8	4	3	36

Table 7 : Reproductive success of common Myna during 2004-05

Period	No. of eggs under observation	Eggs hatched (%)	Eggs mortality (%)	Hatching failure (%)	Nesting mortality (%)	Fledging success (%)	Overall breeding success (%)
Dry (May-June)	55	69.09 (38)	21.81 (12)	9.09 (5)	34.21 (13)	65.79 (25)	65.79 (25/55)
Wet (July-August)	46	54.34 (25)	17.39 (8)	28.26 (13)	32.00 (8)	68.00 (17)	36.95 (7/46)
Reproductive success of common Myna during 2005-06							
Dry (May-June)	75	69.33 (52)	18.67 (14)	12.00 (9)	34.61 (18)	65.39 (34)	45.33 (34/75)
Wet (July-August)	55	38.18 (21)	29.09 (16)	32.73 (18)	23.81 (5)	76.19 (16)	29.09 (16/55)

and 34.33 days for egg number 1, 2, 3, 4 and 5, respectively with an average of 35.67 days in 2005 (Table 6). While it was 37.18, 35.60, 36.25, 35.25 and 35.00 days for egg number, 1, 2, 3, 4 and 5, respectively with an average of 36.14 days in 2006 (Table 6). Simwat and Sidhu (1974) have also reported 33.7 days while Tejdeep (2003) report 34.00 days as nesting period in Punjab.

Reproductive success :

The reproductive success of the common Myna was worked out during both the years and data are presented in Table 7. The data were analyzed separately for dry and wet seasons to identify the variations. The data clearly showed consistent influence of dry and wet weather on reproductive success during both the years. Hatching success was consistently high during dry period 69 per cent for both the years, as compared to the wet period (54.34 and 38.18 % in 2005 and 2006, respectively). Egg mortality was higher in dry season during 2005, which could be due to the damage caused while measuring the eggs. During 2006 the eggs were not measured and hence percentage of mortality was higher during wet period (natural cause). Similarly, hatching failure was low and consistent during dry period (9.09 and 12.00 per cent in respective years) compared to the wet period (28.26 and 32.73 %). During wet period, rainwater entered in many nests, which might have led to the cooling of eggs. Though there were a few clutches laid during wet season, fledging success (%) was higher compared to dry season. However, overall breeding performance of the common Myna was significantly higher during dry season.

Conclusion :

Based on the results of two years field experiments, the breeding season of the common Myna, *A. tristis* L. revealed that it had a single breeding season of about four months from the 1st week of May to the last week of August (26th August). The two years of study revealed that the egg lying started on the 1st week of May and continued till the last week of August. However, intensive breeding was started in the 1st week of the May in 2004-05 and in the 3rd week of May during 2005-06. Only one to two clutches were laid in the last three weeks of August during both the years. Frequency of clutches observed during both the years showed that 68.86 and 58.48 per cent clutches were laid during dry period (May - June) in 2004-05 and 2005-06, respectively. While only 31.08 and 41.40 per cent clutches were initiated in wet season (July - August). The common Myna has adopted well to living in town and village, it is robut bird with a fearless manner, identified by a white wing patch. Their nesting sites were mostly found on wall of seed godowns, seed processing plant wall, neem trees and embankment wall of railway bridge near the study area. The egg of common Myna is glossy blue without marking and generally oval in shape. The mean average length, width and weight were observed 2.70 cm, 1.97 cm and 5.77 g, respectively during study period. The average clutch size of 3.57 and 3.48 during 2004-05 and 2005-06, respectively. The highest frequency of clutches with 4 eggs (40.00 % in 2004-05 and 20.00 % in 2005-06). The average incubation period was 13.7 days in 2004-05 and 13.10 days in 2005-06. While nestling period were 23.80 and 23.25 days, respectively during 2004-05 and 2005-06. The nesting period was 35.67 during 2004-05 and 36.14 days during 2005-06.

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