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THE BREEDING BIOLOGY OF THE HOUSE SWIFT *APUS AFFINIS* (J. E. GRAY)

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INTRODUCTION

Review of Literature : Some works were done on the breeding biology of the Shag, *Phalacrocorax aristotelis* by Snow (1960) ; the breeding biology of Shell Duck, *Tadorna tadorna* (Linnaeus) by Hori (1964) etc. In Bangladesh, works on the breeding biology of the House Sparrow, *Passer domesticus* (Linnaeus) by Khan (1971), M. Sc. Thesis (unpublished), notes on the breeding record of Common Myna, *Acridotheres tristis tristis* (Linnaeus) by Rahman & Husain (1988), breeding biology of Magpie Robin, *Copsychus saularis* in Dhaka city by Hossain *et al.* (1988) have been done. In Gujarat (India) the breeding biology of the House Swift, *Apus affinis* (J. E. Gray) studied by Razack and Naik (1964). In Malaysia the breeding biology of the Asian Palm Swift, *Cypsiurus batasiensis* by Hails and Turner (1982). No work has been made on the breeding of the House Swift, *Apus affinis* in Bangladesh. So the present work is an attempt to collect as much information as possible on the breeding biology of the House Swift, *Apus affinis*.

WORKING PROCEDURE

The study was undertaken from August, 1975 to August, 1976 in Dhaka city. Two nesting areas, namely, Asiatic Society of Bangladesh and Jagannath Hall of University of Dhaka situated at the centre of Dhaka city were selected for observation. A total of 65 nests were found and given serial numbers with coloured painting ink. The nesting areas were visited regularly once in the morning and once in the

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afternoon to observe the nest building, laying, incubation, hatching etc. with the help of a pair of binoculars and inspecting the nests.

Four pairs of adults belonging to four different nests were trapped, weighed and colour-marked with paint as male and female on assumption and then released for further observation of activities with regard to nesting, incubating and feeding the youngs. After the breeding season, these four pairs were trapped again and dissected in the laboratory for confirmation of the sexes.

The eggs of each nest were marked with black permanent ink as 1, 2, 3 and 4 according to the sequence of laying. Since the eggs were laid at night, these markings were done on the following morning, when each egg was weighed with spring balance accurate to one gram and the dimention was taken with a fine-tipped divider and a scale graduated to one millimetre. The youngs were also marked with coloured thread in one leg for identification. Any loss of young was recorded, with the cause of loss and the date. Later on, all the information were analysed. The methods and analysis of data to prepare the tables in this work were based on the works of Razack and Naik (1968), Lack (1954), Snow (1969), Khan (1971) and Rahman & Husain (1988).

OBSERVATIONS and RESULTS

Nesting

Nesting areas :

The building of the Asiatic Society is prism shaped three storied with a corridor of about 3·5 metre passing through the two portions of the building. The main building of Jagannath Hall is U-shaped, east facing, three storied old building bissected by the main gate. The lawns and surroundings of these buildinge are ornamented with various types of bushes and trees and several other small buildings. A large water tank is situated at the south of the main building.

Nesting sites :

The House Swift used five kinds of nesting sites. The nesting sites were named according to the places where they were built, such as (i) ceiling nest—nest built against the ceiling, (ii) beam nest—nest built between the beam and the ceiling, (iii) arch nes—tnest built between the arch and the ceiling, (iv) wall nest—nest built between the wall and

the ceiling and (v) hole nest—nest built in the holes of the walls of the building. In both the areas nests of the ground floor were situated at a height of about 6 metres and in the first floor about 11 metres from the ground.

Table 1 : Showing the distribution of nests in different sites.

Nesting sites	Total no. of nests	Nesting areas	
		Aasiatic society building	Jaganath hall
Ceiling nest	13	9	4
Beam nest	32	26	6
Arch nest	11	9	2
Wall nest	6	6	—
Hole nest	3	—	3
Total	65	50	15

Nesting materials:

The House Swift carried feathers of several species of birds e. g. *Corvus macrorhynchos*, *C. splendens*, *Milvus migrans*, *Psittaculs krameri*, *Oriolus xanthornus* and Domestic Fowl. Other nesting material were leaves of Onion, leaf bud of Gold Mohor, flowers of Graminae plant, seeds of *Anthocephalous kadamba*, pieces of white paper and rubber. The lining of the nest-cup was composed of either flowers of Graminae plant or down feathers of birds.

Collection of nesting material:

A constant watch was kept on one nest for two hours daily and two nests for one hour daily. The collection was rapid in the morning, gradually fell towards and again rose steadily towards afternoon, stopping suddenly later in the evening. The male was more active in the collection of nesting material than the female (Table 2).

Table 2 : Rate of collection of nesting material by pair no. 14 for 10 hours.

Collection of nesting material by	Rate of collection of nesting material in different hours										
	8 am. to 9 am.	9 am. to 10 am.	10 am. to 11 am.	11 am. to 12 am.	12 am. to 1 pm.	1pm. to 2 pm.	2 pm. to 3 pm.	3 pm. to 4 pm.	4 pm. to 5 pm.	5 pm. to 6 pm.	Ave-rag-e.
Male	2	10	9	5	2	1	4	5	8	7	6
Female	2	3	2	1	1	—	2	2	2	2	1·6

Nest building activities were not restricted to new nests only. New nests took more time and old nests took less time to be constructed and re-constructed.

After the breeding seasons the occupants used the nests as roosting place but at the beginning of the breeding season they only reconstructed the nests.

Eggs

Egg laying :

In the October-April breeding season, first egg laying started on 26th January and ended on 26th February. In the May-August breeding season, first egg laying started on 28th May and ended on 30th June. All the eggs were laid at night with an everage interval of 2·37 days. The two-egg clutches were proportionately more in the Oetober-April breeding season, but the three-egg clutches were proportionately more in the May-August season. Percentage of laying in the October-April season was maximum with clutch size 2, producing 49·2% and minimum with clutch size 4, producing 3·17%. Percentage of laying in the May-August breeding season was maximum with clutch-size 3, producing 63·52% and minimum with clutch-size 4, producing 4·7%. The mean clutch-size was 2·39 and 2·61 in the October-April and May-August breeding season respectively. All the pairs laid eggs only once in both the breeding seasons, with few exceptions in the October-April breeding season.

Nature of eggs :

The eggs were pure white just after laying, but became bluish white with the advancement of incubation. All the eggs were typically longish oval but a little pointed in the case of eggs having length of 25 mm. The length of eggs of both the seasons varied from 22 mm-27 mm with an average of 24·2 mm and the breadth varied from 13-16 mm with an average of 14·6 mm. The average weight of the eggs was 3·1g in the October-April and 3·3 g in the May-August breeding season.

Table 3 : Incubating and non-incubating (interval period) time by the female in nest No. 1 on the 10th day of incubation.

Time			Not incubating	Incubating
From		To	(in minutes)	(in minutes)
6 : 45	—	7 : 35	—	51
7 : 36	—	7 : 47	12	—
7 : 48	—	8 : 40	—	52
8 : 41	—	9 : 05	25	—
9 : 06	—	10 : 45	—	100
10 : 46	—	11 : 00	15	—
11 : 01	—	11 : 55	—	55
11 : 56	—	12 : 14	19	—
12 : 15	—	12 : 35	—	81
13 : 36	—	13 : 59	24	—
14 : 00	—	14 : 58	—	58
14 : 59	—	15 : 20	22	—
15 : 21	—	16 : 30	—	70
16 : 31	—	16 : 50	20	—
16 : 51	—	17 : 35	—	45
17 : 36	—	17 : 42	7	—
17 : 43	—	wholenight.	—	till morning.

Incubation :

Both the sexes were found to incubate the eggs. But the female took more interest in incubation. The male occasionally incubated the eggs which ranged from five to ten minutes at a stretch. Incubation of the eggs continued for the whole night but not for the whole day. The female went out at intervals only to take food. The incubation period in the day time ranged from 45 minutes to 100 minutes at a stretch (Table 3).

In the October-April breeding season, 47·61% of the eggs were incubated for 26 days, 12·69% for 25 days and 1·58% for 24 days, the average being 25·70 days. In the May-August breeding season, 22·94% of the eggs were incubated for 24 days, 19·41% for 23 days and 17·64% for 22 days, and the average being 22·91 days (Table 4).

Table 4 : Incubation periods in days.

Breeding seasons	Incubation periods in days	No. of eggs hatched	% of hatching
October-April	24	2	1·58
	25	16	12·69
	26	60	47·61
May-August	22	30	17·64
	23	32	19·41
	24	39	22·94

Hatching

All the eggs hatched at night. In the October-April breeding season, out of 126 laid eggs 100 (79·36%) were available for hatching, of which 78 (61·9%) hatched. In the May-August breeding season, out of 170 laid eggs, 131 (77·05%) were available for hatching, of which 102 (60%) hatched (Table 5). In the October-April breeding season, the mean brood size was 1·95 and in the May-August breeding season it was 2·21 (Table 6).

Table 5 : Hatching success.

Breeding season	No. of Eggs laid	Eggs available for hatching	No. of eggs hatched	% of hatching success
October-April	126	100	78	61·90
May-August	170	131	102	60

There were 40 broods in 40 nests against 52 clutches of 46 nests in the October-April season. Of these 12 clutches in all failed to raise any brood. There were 46 broods in 46 nests as against 65 clutches in 65 nests in the May-August season. Of these, 19 clutches in all failed to raise any brood.

Table 6 : Brood size.

Breeding season	No. of broods with complete no. of nestlings of			Total no of. broods	Mean brood size
	1	2	3		
October-April	4	34	2	40	1·95
May-August	2	32	12	46	2·21

Post hatching

Types of food :

Both the parents shared the feeding activities. They brought various insects such as Zigzag leafhopper, fire bat, horse fly, pulse beetle, grasshopper, leaf-hopper, flower beetle, coreid bug, plant-hopper, dipterans, hymenopterans for their nestlings.

Time of feeding :

The number of feeding visits was the highest in the morning and lowest at noon in both the seasons (Table 7). The male's and female's average feeding visits per nestling with a brood size 1 were found to be 5 and 3 in the October-April ; and 6 and 2 in the May-August breeding season. The brood size 2 received 6 feeding visits from male and 3 from female per hour in the October-April ; and 7 from male and 3 from female in the May-August breeding season. The brood size 3 received 8 feeding visits from male and 2 from female per hour in the October-April ; and 8 from male and 3 from female per hour in the May-August season.

Table 7 : No. of feeding visits in the morning, noon, afternoon for one hour in nest No. 1.

Breeding season	Time	No. of feeding visits on (date) 15th March	16th March	17th March	18th March	19th March	Mean
October-April	7-8 A. M.	7	8	8	8	9	8
	12-1 P. M.	2	3	4	2	4	3
	4-5 P. M.	5	6	6	6	5	5·6
May-August	7-8 A. M.	7	8	9	9	9	8·4
	12-1 P. M.	3	3	4	4	3	3·4
	4-5 P. M.	6	6	6	7	7	6·4

The weight of newly hatched nestling varied from 1·7 to 2·0 g, the avarage being 1·86 g in the October-April ; the weight of newly hatched nestling varied from 1·8 2·1 g, the average being 1·98 g in the May-August breeding season. In the October-April season, the average individual nestling's weight was 28·1 g, ranging from 26·00 g to 30·5 g. In the May-August season, the average individual nestling's weight was 29·6 g ranging from 28·5 g to 31·00g.

Loss or infertility of eggs :

Out of 126 eggs laid in the October-April breeding seasson, 48 were lost or infertile. This loss included 22(17·46%) ejected by the House Swifts, 22(17·46%) infertile and 4(3·17%) damaged during handling. Out of 170 eggs laid in the May-August breeding season, 68 were lost or infertile. This loss included 30(17·64%) ejected by the House Swifts, 29(17·05%) infertile and 9(5·29%) damaged during handling. 2 clutches were completely infertile while 13 clutches were partially fertile in the October-April breeding season. 7 clutches were completely infertile while 7 clutches were partially fertile in the May-August breeding season.

Loss of nestlings :

In the October-April breeding season, out of 78 nestlings in two areas, 54 were lost ; and in the May-August season, out of 102 nestlings, 60 were lost during the feeding period due to starvation and fall-off (Table 8).

Table 8 : Causes of nestling losses.

Breeding season	Total No. of broods	Total No. of nestlings	No. and percentage of nestlings failed to fledge due to :		Total loss
			Starvation	Fall off	
October-April	40	78	21(26·92%)	33(42·3%)	54(69·23%)
May-August	46	102	27(26·47%)	33(32·35%)	60(58·8%5)

DISCUSSION

Nesting

Nesting site :

Referring to the nesting habit of *Apus affinis* (J. E. Gray) in South Africa, Siegfried (1968) cites Brooks and Vernon who found in three storied buildings. But Siegfried

(1968) does not mention the exact floor or floors where the nests were built. In the present case, the nests were found in the ground floor of Asiatic Society building, and ground and first floors of Jagannath Hall (North) though the majority (80%) of the same was in the first floor.

However, there were at least five kinds of nesting sites such as (i) ceiling nest, (ii) beam nest, (iii) arch nest, (iv) wall nest and (v) hole nest in both the breeding seasons to the places where the nests were built. It may be pointed out that the "ceiling-beam", "ceiling-wall" and "ceiling-arch" sites from "L" shaped spaces which give firm support on two sides. The birds seem to take the advantage of this arrangement, as 75·3% of the nests were situated at these "Angles".

Nesting material :

The House Swifts carried mainly the feathers of different birds as their nest building material. The nest cup was lined mainly with flowers of the Graminae plant.

Egg laying :

The egg laying started from January 26th and continued till February 26th in the October-April breeding season. The laying was maximum in February with 60·3% eggs and it was minimum in January with 39·6% eggs.

During the May-August breeding season, egg laying started from 28th May and continued till June 30th. The laying was maximum in June with 95·8% and it was minimum in May with 4·1% eggs.

Clutch size :

The clutch size of the House Swift varied from 2 to 3 eggs, a four-egg clutch was rarelylaid. This is in agreement with the obesrvations of the other workers, that several species of *Apus* do not lay more than 4 eggs in a clutch (Morean 1942, Lack and Lack 1951). The clutch size showed difference from the observations of Razack and Naik (1964) who noted clutch size 1.

Interval of laying :

The interval between the laying of successive eggs was different for the two

and three egg clutches in different breeding seasons. But according to Razack and Naik (1964) the interval was about the same for the two and three egg clutches in different breeding season. Lack (1954) observed that the weather had some effect on the interval of laying in *Apus apus* (Sweinoe). But the present authors did not find any effect of the weather on the interval of laying of *Apus affinis*.

Egg :

The average weight of eggs was 3·1 g in the October-April and 3·3 g in the May-August breeding season.

Incubation :

The incubation period in the October-April breeding season varied from 24 to 26 days, the average being 25·7 days. The incubation period in the May-August breeding season varied from 22 to 24 days, the average being 22·92 days. But according to Razack and Naik (1964) the variations were 18-26 days in Boroda of Gujarat, India. Both the sexes took part in incubation which was also mentioned by Ali (1979).

On an avarage from the 16th day after laying, the eggs were found to loss weight that varied between 0·2 and 0·85 g. Wallace (1963), referring to birds in general, said that this loss of weight of eggs prior to hatching was due to evaporation with continued incubation and with rising temperature.

Nestling :

The food-begging call and the highly vascularized buccal cavity of nestling probably acted as releasers to the parents for feeding the young. Both the sexes took part in brooding the youngs, but the female was more active than the male. There appears to be some co-relation between the increase in weight and the opening of eyes, that is, the eyes opened when the nestlings weighed between 9 and 12 g in both the breeding seasons.

Feeding :

Various winged insects were the food material of youngs. These were caught during flight with open mandibles of the swifts. As the youngs were too small to take food without others help, parents fed them directly dropping food from their gullet in the open

mouth of the nestlings. When the parents entered the nest with food, a competition took place among the hungry nestlings. Therefore, the strongest young had the food first and then the less stronger and so on.

Breeding success :

The percentage of total breeding success was 19·04% (Table 9) which was much lower than those of hatching and fledging successes which were 61·9% and 30·7% respectively in the October-April breeding season. The percentage of total breeding success was 24·7% (Table 9) which was much lower than those of hatching and fledging successes which were 60% and 41·1% respectively in the May-August breeding season.

Table 9 : Showing the breeding success.

Breeding seasons	Total No. of eggs laid	Total No. of eggs hatched	No. of nestlings leaving the nests	Percentage of breeding success (in relation to laying)
October-April	126	78(61·90%)	24	19·04
May-August	170	102(60·00%)	42	24·70

The higher percentage of breeding success in the May-August breeding season than that in the October-April breeding season was probably due to the favourable climatic conditions and abundance of food for the nestlings.

SUMMARY

A study was made on the breeding biology of the House Swift, *Apus affinis* (J. E. Gray) from August, 1975 to August, 1976, in two areas of Dhaka city. The bird was found to be a resident species, nesting in colonies. The swift was found to have two breeding seasons in a year. Total breeding success was 19%, 19·04% in the October-April and 24·7% in May-August breeding season. Ejection and infertility were the main causes of egg failure and fall-off and starvation were the main causes of loss of nestlings.

REFERENCES

Ali, S. 1979. *The Book of Indian Birds.* Bombay Natural History Society, Oxford University Press.

Hails, C. J. and Turner, A. K. 1982. The breeding biology of the Asian Palm Swift, *Cypsiurus balasiensis. Ibis.* 126 : 74-81.

Hori, T. 1964. The breeding biology of the Shel Duck, *Tadorna tadorna* Linnaeus. *Ibis.* Vol. 106. No. 3.

Hossain, M. A., Khan, A. R. and Rahman, M. K. 1988. Breeding biology of Magpie, Robin, *Copsychus saularis* in Dhaka city, Bangladesh. J. Sci. Res. 6 (1 & 2) 35-42.

Khan, A. R. 1971. The breeding biology of the House Sparrow, *Passer domesticus.* M. Sc. Thesis (unpublished). Dept. of Zoology, Univ. of Dhaka.

Lack, D. and Lack, E. 1951. The breeding biology of the Swift, *Apus apus. Ibis*, 93 : 501-546.

Lack, D. 1954. *The Natural Regulation of Animal Numbers.* Oxford University Press, London.

Morean, R. E. 1942. *Coleoptera affinis. Ostrich*, 13 : 137-141.

Rahman, M. K. and Husain, K. Z. 1988. Notes on the breeding record of Common Myna, *Acridotheres tristis tristis* Linnaeus. Bangladesh. J. Zool. 16(2) ; 155-157.

Razack, A. and Naik, R. M. 1964. Breeding biology of the House Swift, *Apus affinis* (J. E. Gray). *Pavo*, Vol, 6. Nos. 1 & 2. pp. 31-58.

Siegfrid, W. R. 1968. Little Swift, *Apus affinis* breeding at Stellenbosch (South Africa). *Ostrich*, 39 (1) ; 39.

Snow, D. 1960. The breeding Biology of Shag, *Pralacrocorax aristotelis* on the Island of Lundy, British Channel. *Ibis.* 102 : 554-575.

Wallace, G. J. 1963. *An Introduction to Ornithology.* 2nd ed. The MacMillan Co. Collier-MacMillan Ltd. London.