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New Nesting Colony of Asian Openbill Stork in Bhagalpur City, Bihar, India

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Abstract

The birds build their nest to lay eggs and to raise their young ones. Nest building behaviour of birds is an instinct behaviour and may signal the reproductive performance of individual and physiologically stimulate a partner. The present study was carried out at the old campus of Bhagalpur Radio station, Aliganj in Bhagalpur, Bihar, and its adjoining areas to study the nesting behaviour of the Asian Openbill Stork (*Anastomus oscitans*). The study was conducted from May, 2023 to December, 2025. The results showed successful breeding and a gradual increase in the population of storks during the study period. The birds exhibited colonial nesting behaviour and preferred tall nesting trees located near human settlements and wetlands. They also showed strong site fidelity by returning to the same breeding site in next successive years and reusing old nests with minor modifications. Both male and female birds actively participated in parental care, ensuring successful rearing of chicks. Other behaviours like aerial display, allopreening, nest cushioning etc were also noted well during the breeding season. These observations indicate that the old campus of Bhagalpur Radio station may be an important breeding habitat for the Asian Openbill Stork. The findings of this study provides important information on the nesting ecology of the Asian Openbill Stork, which will be valuable for future research and will assist in the conservation and sustainable management of the species and its breeding habitats.

Keywords: Asian openbill stork, aerial display, nest building, nesting colony and breeding ecology

Introduction

Nest building behaviour of birds is an Instinct behaviour. It may signal the reproductive performance of individual and physiologically stimulate a partner. Nest building in birds is often associated with courtship and pair formation. (Pramanik et al., 2016). The birds build their nest to lay eggs and raise the young ones. Different species of birds build different types of nest and use various kinds of materials for this purpose (Ali, 2002; Choudhary and Ghosh, 2004). Nest design varies widely among different groups of birds, may be oval, circular, pendulous, plate like holes or cervices etc (Choudhary et al., 2008; Hansell, 2000 and Heenan, 2013). Nest construction and the selection of nesting sites are very important factors for successful breeding in birds. Selecting a slope and shelter site is also very crucial for successful breeding and it helps to lower the risk of predation (Grimmett et al., 2014 and Choudhary and Abdullah, 2023).

Asian open bill stork (*Anastomus oscitans*) is a wading bird in the stork family ciconidae. It is the smallest member of the stork family found in India. They have pale grey colour with black scapulas and remiges, black tail, Pinkish to grey legs and Swollen looking bill with a narrow gap between the mandibles (Ali, 2002; Ali and Ripley, 2002; Rasmussen and Anderton, 2012 and Anam et al., 2016). Wetlands habitat are vital for the Asian openbill stork. They are commonly seen in inland wetland, marshes, lakes, paddy field, and slow moving rivers. These habitats provide an abundance of their main food source snails. In addition they also feed on insects, frogs, fishes, and other small aquatic animals (pramanik et al., 2010; Elliott et al., 2020). These birds are

commonly found throughout the planes and peninsular regions of Indian subcontinent. They breed amidst or near water bodies and high breeding densities are found near rivers with regular flooded grassland. The Asian openbill stork is a resident colonial breeder forms monoclony or breed with same or other species of birds (heronry) like egret, herons, cormorant and storks (Choudhary et al., 2008; Pramanik et al., 2009 and 2016).

The Asian open Bill stork (AOS) generally breed during monsoon. In Bihar, Danapur military cantonment area in Patna is a largest breeding station for AOS where more than 10,000 birds assemble for breeding in the second or third week of May as reported by Choudhary et al., 2008. Though, there may be some other potential breeding sites for AOS in Bihar. But the proper documentation is still lacking.

The present investigation was carried out to study the nesting and breeding behaviour of AOS stork in the city of Bhagalpur, Bihar.

Materials and Methods

Study Area

The study was carried out between May, 2023 and December, 2025 at the old Bhagalpur Radio station (25.214467° N and 86.972721° E) and its surrounding areas. This site is located beside the Bhagalpur- Dumka road in Aliganj and It is approximately 2.5 Km away from Bhagalpur railway station. It is surrounded by agricultural lands. There are some smaller and larger wetlands present near the breeding site. River Ganga is flowing about 3.5 kms north to this breeding site.



Fig 1: Road map of Bhagalpur showing the location of breeding site (star mark indicating Bhagalpur Radio station).



Fig 2: Satellite map of Bhagalpur showing the location of breeding site (star marks indicating nesting trees).



Fig 3: Nesting colony of Asian openbill stork at Bhagalpur Radio station, Aliganj

Methodology

All observations were made during the daylight from 6:30 am to 5:30 pm. The area was visited thrice a week during breeding season and once a week during non breeding season. Observation on birds and their diurnal activities were recorded primarily through direct visual method. Binoculars (Nikon 8 × 42) were also used at the time of study as per need (Choudhary and Jay, 2025).

Initially trees with active nest were identified. Each nesting trees was marked with white paint at

its base according to its assign number. Only trees with active nests were monitored and recorded. The observations were done from ground under the nesting trees from a considerable distance without disturbing the birds. Nest on the trees were counted with the naked eye and sometimes by using binoculars. All related activities like aerial display, pair formation, nest site selection, copulation, nest building, nursing the chicks etc, of AOS were carefully recorded for scientific documentation. Photographs and videos were captured by using digital camera (Nikon DSLR 5600 and Nikon b600) for photographic evidence.

Aerial display of AOS during different time of the day as well as in different months of breeding season were recorded carefully. Copulation was regarded as successful after complete cloacal contact (pramanik et al., 2016). The data were collected and tables were prepared, accordingly. Various nesting and breeding behaviours were studied and recorded in three successive breeding seasons from June 2023 to December 2025.

Results and Observations

Following observations were recorded and studied during the field study.

Nest Site Selection and Aerial Display

It was recorded that the AOS selected a particular area that is old Bhagalpur Radio station in Aliganj for their nesting and breeding purposes. They selected few large trees located in the campus of Radio station campus for their nesting purposes.

In the month of June It was noticed that AOS performed aerial display behaviour after coming to the nesting area. Aerial display phenomena more or less observed throughout the breeding season from last week of June to last week of November. this displays increased day after day up to the mating period. The storks were flying closely next to each other. Many times the stork tried to fly one above the other for the short distance. The birds fly very fast and reached to a long height. Sometimes they travel long distance, they reached in the sky within 20 to 25 seconds. The birds flew in the sky in a circular way or sometimes spirally and up and down. Sometimes they are not visible from naked eyes.

The flying birds form a group of about 15 to 30 birds within 4 to 8 minutes. It was also noticed that many groups (2 to 5) of AOS flew on separate site in the sky near above the nesting zone. All birds of the group did not come back together, rather they returned at the number of 4 to 6 birds together after 35 to 40 minutes recorded in all the three breeding seasons. Aerial displays took place from morning to mid day time. It

continued from 6:30 a.m. to 4:30 p.m. hours. Highest activity was recorded between 8:30 am to 1:30 pm. The birds that came together in the breeding site also showed the phenomenon and performed all the activities. After nest formation, both the partners did not fly together leaving the nest. Only one partner most probably male fly in the sky and join in aerial display and they return at their nest after taking nesting material or food for its partner, probably female by their bill after egg laying on the nest.

Pair formation

Pair formation took place during the aerial display behaviour usually after 7- 8 days. After aerial display and pair formation the birds return with mate on the same nesting tree from where the birds flew off. Sometimes they came back at new nesting site after display. Usually male choose the nesting site, after pair formation they occupied a fixed nesting place and stood side by side for about many hours (2 to 6 hours) and pierced their own body feather by their bill. It was also noticed that some birds leave that nesting place and selected another branch of tree after being chased by the another breeding birds but pair remain stable. Few birds that came in the breeding site did not get any mate and remain unpaired.

Allopreening

Allopreening voice recorded among the birds on the selected branch of nesting tree. During this process the paired birds touched each other bills and pecked their mates face, head, neck and feathers also. Both the partners stretched their neck together, a characteristic feature recorded in these birds. It was noticed that allopreening started just after pair formation. It took place on the nest before copulation. But in some birds it was also noticed during post laying period and continuous for about 80 to 100 seconds. The aggressive behaviour or chasing to another birds was observed throughout the breeding season.

Copulation

Copulation attempts (cloacal contact) between the pair birds were observed for few seconds mainly

on the branches of the selected nesting tree. After pair formation or mate choice they started nesting and involved in copulation. During copulation the male partner stood on the back of female with clattering their bill very fast and touched the bill on the neck of the female. The male birds continuously moves its wings up and down while mating. After successful cloacal contact male jumped of and stood. Both male and female stood side by side on the branch of the nesting trees. The female bird vibrated their own body feathers and pierced the body by its bill. The duration of the copulation was about 10 to 15 seconds as noticed by us. Few unsuccessful mating attempts were also noticed. The copulation attempts were recorded after allopreening from the second week of the month of June to first week of the month of September of the year. The frequency of the copulatory behaviour was more in the morning hour between 9 am to 12:00 am than in the afternoon (2:00 p.m. to 4:00 pm). The peak month of copulation period was July of every year. The copulatory behaviour in the AOS generally stopped after hatching. It was also noticed that the birds engaged in copulation were being disturbed by the birds of another nesting.

Nest Building

In the present investigation it was recorded that AOS selected 7 species of trees for their nesting purposes including Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Palmyra palm (*Borassus flabellifer*), Tamarind (*Tamarindus indica*), Banyan Tree (*Ficus benghalensis*), Peepal (*Ficus religiosa*) and Black Plum (*Syzygium cumini*). The initiation of nest building took place in the last week of June. Mostly the nest construction took place during morning and mid hours (8:30 a.m. to 1:00 p.m.). Peak activity of nest building was recorded between 9 to 12 hours. Both the partners started to collect nesting materials together after two to three days after pair formation. During the initial stage of nest construction, either the male or the female, and occasionally both partners together, gathered nesting materials. Both male and female actively participated in positioning the nesting materials on the branches. However, males contributed

more significantly to the collection and transportation of materials, whereas females were primarily responsible for manipulating and arranging them at the nest site. One partner probably male typically collected branches, sticks, and grasses and leaves from nearby trees like Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Tamarind (*Tamarindus indica*), Banyan Tree (*Ficus benghalensis*), Peepal (*Ficus religiosa*) and Black Plum (*Syzygium cumini*) carrying them in its bill and depositing them at the nesting location. After delivering the materials, probably male either departed to collect additional items or remained with the another partner probably female to assist in arranging them. Both partners jointly organized the materials to give the nest a definite circular structure and shape. Once the base of the nest was established, the female usually stood at the edge of the nest while the male continued to bring branches and green plant materials.

Incubation

Incubation began immediately after the laying of the first egg. Both male and female storks participated in the incubation process, although the female bird spent the majority of the time incubating the eggs. During this period, the male contributed by bringing nesting materials for nest maintenance and by collecting food for the female. It was noticed that the incubation period of AOS is 27 days with slide variation of 2 to 3 days.

Food Provision

Both parents participated in feeding the nestlings during the rearing stage of the young. The main food items were snails, small fishes, crabs and lizard as observed by us. The adults regurgitated food onto the base of the nest, from where the nestlings picked it up. This regurgitated food served as the primary source of nourishment for the chicks after hatching. During the early stage of development (1–3 weeks of age), the parents mainly provided the soft bodies of small snails as food. Food provisioning by the parents was observed until the chicks reached approximately

80 to 90 days. The nestlings displayed begging behaviour by spreading their wings, nodding their heads up and down, and producing vocal sounds. The begging calls of the chicks became deeper and lower in tone as they aged. The chicks continued begging for food as long as the parents remained near the nest.

Parental Care

After the first of eggs hatched both brooding and incubation were simultaneously done by parent. The shell and other materials were cleaned from the nest by both the parent. Except feeding time, constant brooding was noticed by parent upto age of one week of the nestling. Continuous attendance at the nest by parent birds were observed during the first two months of chick's life for fooding and protection from sunlight, rain and predators.

Nesting Ecology and Chick Development

The number of AOS nests recorded in the study area showed a consistent increasing trend over the three successive years of study period. A total of 212 nests were recorded in 2023, which increased to 333 nests in 2024 and 374 nests in 2025. Similarly, the number of chicks raised also increased from 519 in 2023 to 816 in 2024 and 916 in 2025. These observations indicated a gradual increase in the breeding population of AOS. Colonial nesting of the AOS was recorded on seven tree species. Among these, the Black Plum tree (*Syzygium cumini*) supported the highest number of nests, indicating its preference as a nesting substrate. Other important nesting tree species included Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Palmyra Palm (*Borassus flabellifer*), Tamarind (*Tamarindus indica*), Peepal (*Ficus religiosa*), and Banyan (*Ficus benghalensis*). Interestingly, in 2024 breeding season only, AOS built few nests on trees situated along roadsides, a behavior that was not observed in the 2023 and 2025 breeding seasons.

Breeding activities generally commenced with the onset of the monsoon in the month of June. From early June onwards, the selected nesting trees became active breeding sites, and nest construction increased steadily throughout the month. By the end of July, nearly all nests were completed, with the last week of June representing the peak period of nest-building activity. In addition to constructing new nests, the storks also reused a considerable number of nests from previous breeding seasons, suggesting site fidelity and repeated use of suitable nesting habitats.

Parental care was observed to be well developed in the AOS. Following the hatching of the first egg, the parents simultaneously performed incubation of the remaining eggs and brooding of the hatched nestlings. Both parents actively removed eggshells and other waste materials from the nest, thereby maintaining nest hygiene. Continuous brooding was observed throughout the first week after hatching, except during feeding periods. Both parents maintained continuous attendance at the nest during the first two months of the chick's life, providing food, protecting the nestlings from direct sunlight, rainfall, and potential predators, and ensuring their successful growth and survival.

Juvenile birds (55-60 days old) were observed leaping into the air from the nest floor fluttering their wings vigorously. Sometimes the juvenile birds took short flights from branch to branch or from tree to tree or in the air and returned to the nest. The breeding period of AOS was recorded between first week of June to last week of November. Nest construction begins between June 20-30 and the chicks start fledging around last week of October; the nests were left around December 10-15.

Plate 1 – Photographs of Nest building behaviour of the Asian openbill stork

	
Aerial display of AOS	Mating phase
	
Collection of nesting material	Transferring nesting materials
	
Incubation of eggs	Guarding the nest and hatchlings

	
Juveniles on the nest	Foraging and collecting food from nearby wetland

Photography by Jay Kumar Jay and D. N. Choudhary

Table-1: Study of Nest and Nesting trees in and around Radio station campus.

Sl. No.	Name of trees used for nesting		No. of trees	No. of nesting trees			No. of nest		
	Local Name	Scientific name		2023	2024	2025	2023	2024	2025
1.	Mango	<i>Mangifera indica</i>	02	1	1	2	23	35	86
2.	Neem	<i>Azadirachta indica</i>	02	1	2	1	26	79	48
3.	Peepal	<i>Ficus religiosa</i>	01	1	1	1	46	54	67
4.	Banyan	<i>Ficus benghalensis</i>	01	1	1	1	43	52	68
5.	Jamun	<i>Syzygium cumini</i>	02	2	2	2	74	85	90
6.	Tarmarind	<i>Tarmarindus indica</i>	01	0	1	0	00	28	00
7.	Palmyra palm	<i>Borassus flabellifer</i>	02	00	00	2	00	00	15
Total			11	06	08	09	212	333	374
Total number of chicks raised							519	816	916

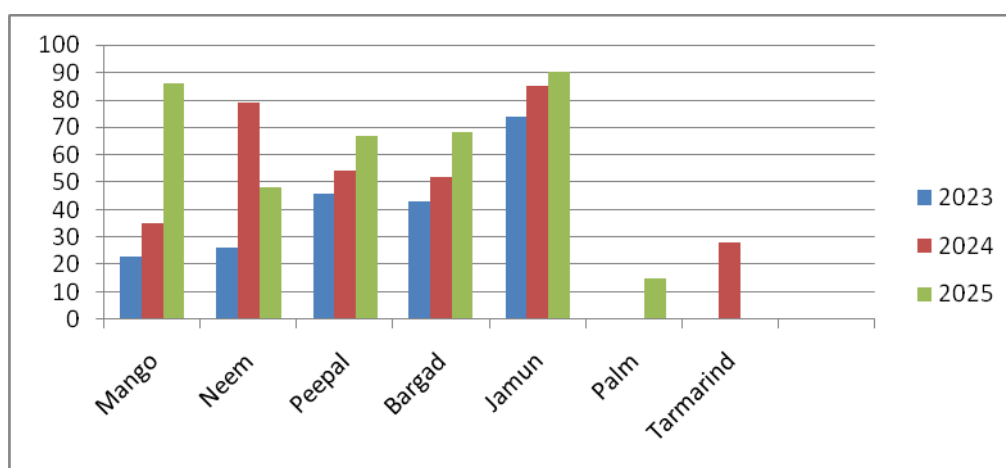


Fig 4: Graph showing total number of nest in different tree species in three consecutive year, 2023-2025

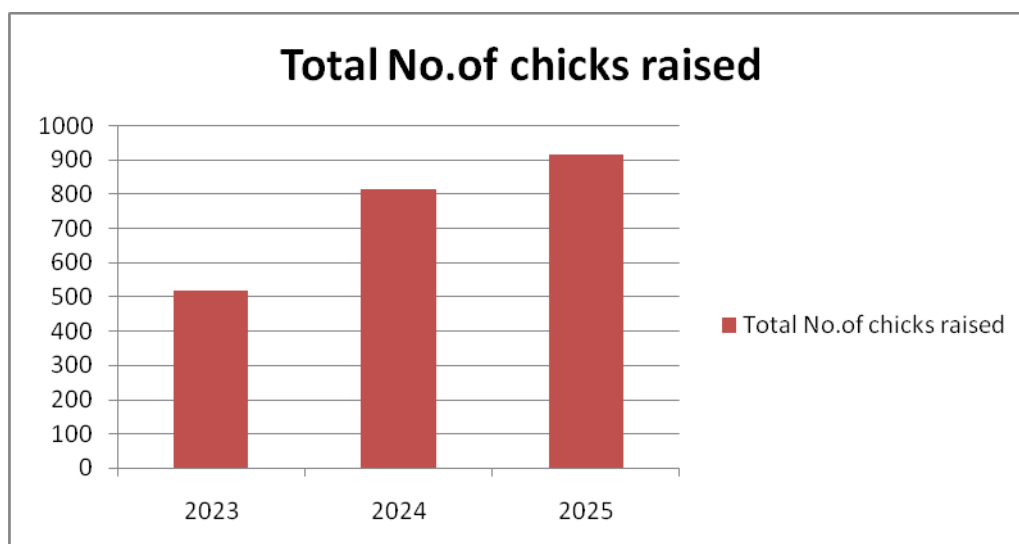


Fig 5: Graph showing total number of chicks raised in three consecutive years, 2023- 2025

Discussion

The present study clearly revealed that the AOS are colonial breeders and they build their nests on large trees like Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Palmyra palm (*Borassus flabellifer*), Tamarind (*Tamarindus indica*), Banyan Tree (*Ficus benghalensis*), Peepal (*Ficus religiosa*) and Black Plum (*Syzygium cumini*). They generally breed in colony either on a single or on some adjacent trees for getting much protection from predators (Choudhary 2004; Choudhary et al., 2012 and 2022). It was a mono colony of Asian openbill stork only. All the nesting tree species selected by AOS were native in nature and were larger in size. All these trees have thick size branches and was offering adequate space and support to the nest (Choudhary and Abdullah, 2023).

The number of nest and chicks of AOS were found gradually increasing every year. This showed an increasing trend may be due to their successful breeding (Barmans and Sharma, 2020) or may be due to presence of suitable nesting trees and availability of foraging grounds near the breeding sites. (Choudhary et al., 2011, 2014 and 2026.).

The arrival of AOS in the breeding sites was found periodic and seasonal. The birds started

arriving in the breeding area in Bhagalpur, Bihar in the month of first week of June and became indulged in pair formation and nest building. The bird selected the Bhagalpur Radio station located beside the Bhagalpur Dumka highway among the human habitation irrespective of anthropogenic disturbances and noise pollution. Selection of nest site is often considered as an important determinant of reproductive success in bird species and major selective factor favouring colonial nesting (Lack, 1968; Kumar and Kumar, 2015). The other important factor affecting the nest site selection was ability of nesting trees and foraging grounds (Suryavanshi et al., 2019; Choudhary and Abdullah, 2023).

Aerial display by this bird was observed regularly during the breeding season and highest activity was noticed before egg laying period between first week of June to second week of July may be due to represent sign of hierarchical status and the social structure of the group or it may be a means of special communication among birds (Parmanik et al., 2016).

The AOS choosed their mate within seven to eight days of the aerial display. This pair formation behaviour as noticed in these storks actually leads to activate the storks for breeding and to form the colony (Parmanik et al, 2009; Mahapatra et al., 2015 ; Bordoloi et al., 2024;

Paul and zorapi 2025). Allopreening special behaviour observed in these storks four copulation. These phenomena may establish a strong reproductive affinity between paired birds or to enhance the chances of copulation or mating.

Mating was recorded in pre egg laying or early stage of incubation for successful transfer of sperms into female genitalia to assure fertilization. The total number of nest in three consecutive years are 212 in 2023, 333 in 2024 and 374 in 2025 respectively. Similarly the chicks raised by these storks are 519 in 2023, 816 in 2024 and 916 in 2025 respectively. The data showed an increasing trend every year in this particular area in Bhagalpur Radio station and its surrounding areas. This significant increase in the nest, chicks and birds may be due to availability of suitable nesting trees in around the Bhagalpur Radio station Campus, suitable climate and availability of plenty of food and water from the nearby wetlands .(Mishra et al.,2009 ; Choudhary et al., 2014). Most of the nesting trees are located inside the Bhagalpur Radio station campus where entry of local person are prohibited. Hence, birds are getting very less disturbance further the nesting trees which are located outside the campus having few nests on these trees in 2024. But in the next year the birds did not use those trees for their nesting and choose the trees for their nesting which are located inside the campus, perhaps to avoid disturbances caused by the traffic and vehicles or to get security in the campus (Choudhary and Abdullah, 2023).

Conclusion

This investigation provides the first comprehensive base line data of AOS nesting patterns in Bhagalpur, Bihar. Around 400 to 700 birds arrive this area for breeding every year. The study showed that the AOS are breeding successfully and their number is increasing every year in this particular breeding site. AOS are colonial breeders and they are very selective for their nest site and nesting trees. They mostly preferred those places for their nesting and breeding which are located near human habitation

and water resources like rivers and wetlands. The incubation period of AOS is ranges between 25 to 27 days and the breeding seasons of AOS in district Bhagalpur, Bihar was estimated between June 1st week to mid of November. These birds again appeared in their old breeding site in the next breeding season and also adopted the abundant nest with slide modification for egg laying. Parental care is taken more or less by both the parent birds.

Based on the study few recommendations are made which should be implemented while making a better future management plan to conserve this eco friendly species. More and more large nesting trees must be planted. Insecticides, pesticides and fertilizers should not be used in the agricultural fields. The wetlands located near the building sites should be conserved and may be avoided from drying.

Author's Contribution

First and second author surveyed the study area and collected the data. Third author designed the work and prepared the manuscript.

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