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Behavioural ethogram of the endangered greater Adjutant Stork *Leptoptilos dubius* (Gmelin)

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Abstract
The Greater Adjutant Stork *Leptoptilos dubius*, rare stork, is an IUCN Red list endangered bird, has now been confined only to Cambodia and in Assam and Bihar in India. This bird is facing high extinction threat due to rapid loss of habitat. No attempt was made to record the behavior of this bird during forage and breeding. Thus an attempt was made to present an ethogram of the species describing 36 individual behavior, grouped under 14 distinct categories: resting, alert, comfort, maintenance, locomotion, foraging, antagonistic, sexual, chick care, foraging and vocalization. The observation period had been confined to 64 weeks (2012 to 2016) during day time both at forage and nesting sites. All the behavioral characters were sketched in addition to videogram and normal photograph and presented in the text. The data recorded are the base line data, could be used in captive breeding as part of conservation and they may elucidate upon the formulation of strategy for both in situ and ex situ conservation.

Keywords: greater adjutant, ethogram, breeding, conservation

1. Introduction
The Greater Adjutant Stork *Leptoptilos dubius* is the most endangered stork (IUCN Red List criteria under A2bcd+3bcd+4bcd; C2a, version 3.1) and the population is in decreasing trend (Luthin 1987, IUCN 2010) [1, 2]. The Greater Adjutant Stork (GAS) once widely distributed in India, South and South East Asia, but currently known to be distributed and breed only in Assam and Bihar in India (Choudhury 2004; Mishra and Mandal 2009) [3, 4] and a very few in South East Asian countries (Luthin 1987, Clements *et al.*, 2007) [1, 5]. In India, Assam is considered as the stronghold of this species with the presence of about 75% of its estimated global population (Choudhury 2004) [3] against the breeding population in Bihar, a recent discovery and found to be stable (Mishra and Mandal 2009) [4]. Possibly the destroy and the disturbance of its traditional nesting colonies, has been responsible for fast decline of this species (Goswami and Pator 2007) [6].GAS is a big bird standing tall as as145-150 cm with maximum wing span of 2.5 m prefers to nest on very tall trees like *Anthrocephalous cadamba, Alstonia scolaris* etc, which are very common in this region.
Behavioral study of birds is very much essential to understand its life and their continuity, Thus an initial attempt to know about its behavior is to prepare a catalogue of the discrete species specific behavior pattern that form the basic behavioral repertory of the species, is an ethogram (Gokula 2011) [7], since an ethogram is a comprehensive description of characteristics behavior pattern of a species (Brown 1975) [8]. Therefore, preparation of an ethogram of direct observations on birds has been considered as fundamental to understand animal behavior (Martin and Bateson 2001) [9]. And as such, an ethogram of certain behavior might be of use for its quantification as well may allow the draws of comparison between two groups or within the groups (Xiao and Wang 2005) [10] of a species under differential circumstances upon which they spend their lives (Lehner 1996) [11]. Thus an ethogram might be an effective formulation for an *in-situ* and *ex-situ* conservation strategies (Pitra *et al.*, 20020 [12] for this endangered scavenger bird species, the Greater Adjutant Stork.

2. Methodology
2.1 Study Area
The investigation had been conducted within the Kamrup District of Assam, India in the period of 2012 to 2016. As well the study area was confined to garbage dumps and wetlands upon which the GAS used to forage. The village in Kamrup District has large numbers of Simul (*Bombax ceiba*), Satiana (*Alstonia Scolaris*), Dewa Cham (*Artocarpus lacocha*), Artocarpus hetrophylus and Kadam (Anthrocephalous cadamba), Moj (*Albijia lucida)* upon which the GAS used to build nest for breeding activities. Breeding behavior of GAS in terms ethogram were prepared from a tall bamboo platform The study was conducted in the village named *Dadara*, *Pachoriya* and *Singimari* ($26^0$13.31'9' N and $91^0$37.58 '6'E), in the Kamrup district of Assam, the World's highest density of Gas (Barman *et al*., 2009) [13]. The study is surrounded by a significant number of small and big wetlands in and around 10 km radius.

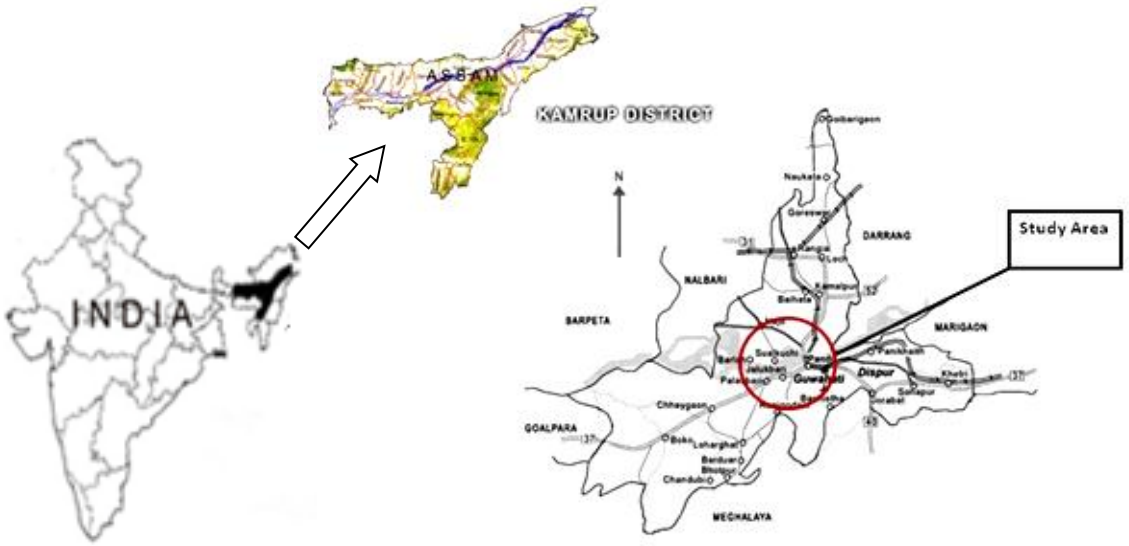

Fig 1: Study Area

2.2 Methods

The study was conducted for four consecutive breeding season (Sep to April) and nonbreeding season (May to Aug) from 2012 to 2016. Near approximation to the nesting colony (ies) had been constructed for observation on the GAS in the nest at the same height without disturbing the birds. The observation was made during breeding season of 6 A.M to 6 P.M twice in a week for 64 weeks. Similarly, study was done twice in a month wetlands and was observed with binoculars. In nesting colony, a 75 feet bamboo platform was constructed to study the breeding behavior on the nest from same level by maintaining caution that the birds did not get disturbed. Observation was recorded from 6 am to 6 pm during daylight time twice in week for 64 weeks. Similarly study was done twice in a month in wetlands and once in a month in garbage dump in both breeding and non-breeding season. The focal individual was observed with binoculars from duration of 5 to 10 minutes and in the intervals, the behavior was documented with sketch and photographs were taken as evidence. Information from literature was used to supplement descriptions. Courtship calls were recorded in microphone. Video was taken in almost each behavior. Stop watches were also used during certain behavior, whereas necessary.

3. Results

We describe 36 individual behavior grouped under 14 broad categories: 1) locomotion, 2) comfort and maintenance, 3) alert, 4) resting, 5) wing spreading, 6) ruffling, 7) bill gaping, 8) Pouch shaking and spreading, 9) foraging, 10) antagonistic, 11) sexual, 12) parental and 13) vocalizations 14) Defecation

Table 1: Various identified behaviours of Greater Adjutant stork

Sl. No	Broad categories of behaviours	Individual behaviours
1	Locomotion (Nerlekr *et al*.,2014)	i) Walking
		ii) Running
		iii) Flying
2	Comfort and maintenance (Patil *et al*. 2013)	iv) Stretching
		v) Scratching
		vi) Preening
		vii) Body fluffing
		viii) Bow stretching
		ix) Drying
3	Alert (Ate,2002; Nerlekar *et al*.,2014)	x) Alert
4	Resting (Ali 2002)	xi) Sitting
		xii) Standing (in nest or ground)
		xiii) Roosting and perching
5	Wing spreading (Patil *et al*.,2013)	xiv) Wing spreading sunning
		xv) Shading nest contents
		xvi) Spreading for courtship
6	Ruffling (Gokula 2011)	xvii) Ruffling
7	Bill gaping (Kumar, 1985)	xviii) Bill gaping
8	Pouch shaking and spreading (present study)	xix) Pouch shaking and spreading
9	Foraging(Mahammad ul Hassan 2008, Nerlekar, 2014)	xx) Foraging
10	Antagonistic behavior (Gokula, 2011)	xxi) Aggressive
		xxii) Non-aggressive

11	Sexual behavior(Present study)	xxiii) Courtship and pair formation
		xxiv) Copulation
		xxv) Nest building
12	Parental (Mahammad ul Hassan, 2008; Nerlakar 2014)	xxvi) Incubation
		xxvii) Nest cleaning and eggs turning
		xxviii) Nest relief
		xxix) Chick care and feeding
		xxx) Begging behaviour
13	Vocalization (Present study)	xxxi) Vocalization during courtship
		xxxii) Vocalization during copulation
		xxxiii) Vocalization during nest relief
		xxxiv) Begging call by chicks
		xxxv) Vocalization during aggression in nest
14.	Defecation (Patil *et al*, 2013)	xxxvi) Defecation on nest and foraging grounds

3.1 Locomotion

Greater adjutant moves in the following ways and this behavior could be divided into three categories. (Fig-2, Fig 3).

i) Walking

Walking is very clumsy and performed largely near water bodies after or before foraging. The bird moves at an early pace while walking. Wings are often folded or sometimes slightly opens up when speed increases. It walks on feeding sites such as rubbish dump, land or in swallow water. (5 to 15 steps per minute). (Fig 2)

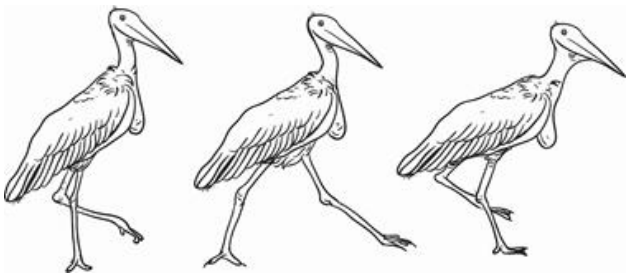

Fig 2: Walking steps of Greater Adjutant during foraging

ii) Running

The bird moves at a faster pace than walking. It is performed for a very short distance during fighting or taking off. Wings are largely opened while running. It is not a frequent behavior of this bird while they stay in the land. Very frequent during breeding period and least frequent during stay in land. (Fig3)

Fig 3: Running

iii) Flying

The Greater adjutant frequently flies which is the primary mode of locomotion period during breeding and non-breeding season. It is the primary mode of behavior of locomotion. They use short and rapid wings strokes to move in air for movement over garbage ground, wetlands and resting sites for forage, roosting, collection of nesting materials and nesting tree selection keep flying over the feeding site such as garbage dumps, wetlands and nesting trees in order to forage, roosting, collection of nesting material and nesting tree selection. They use short and rapid wing strokes to move in air for movement over garbage ground, wetlands and nesting sites for forage, roosting, collection of nesting materials and nesting tree selection. One play to another by propelling itself to wings, feet, in the form of hopping. (fig 4)

Fig 4: Flying

3.2 Comfort and maintenance

Comfort/maintenance involves all the actions concerned with maintaining the body surface related to comfort and maintenance of its body and nest. This behavior could be categorized as followings:

i) Stretching

Stretching occurs after the birds have been resting for an extended period or after prolonged incubation. A Greater adjutant may stretch its leg, wings or body. Stretching is performed in two ways: in one, one wing and leg on the same side are extended downward, with the feathers spread on the extended wing and the tail (wing and leg stretching) and in the other way, the Greater adjutant raises to a certain extent its wings and extend the neck horizontally (body stretching) (Fig 5)

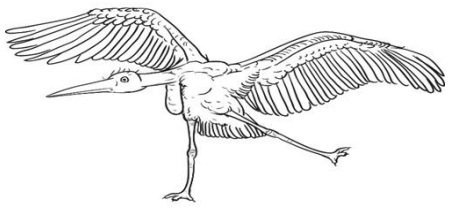

Fig 5: Stretching of wings and

ii) Scratching

Greater adjutant moves its weight onto one leg and scratches the surface of the body by the other leg. In this this process, the parts to be scratched are often drawn towards the scratching leg. Largely, neck, head and pouch are most often scratched. (Fig: 6)

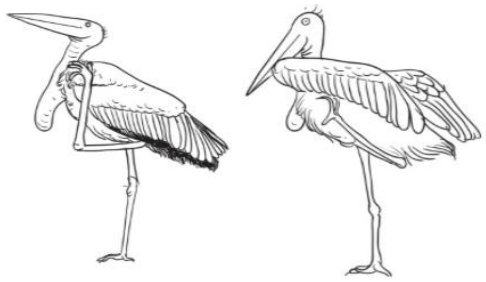

Fig 6: Scratching

iii) Preening

Preening involves the contact between the bill and the feathers. The GAS uses its bill to straighten the feathers on its breast, neck, tail, legs or wings. There are three types in the preening movement: the closed bill moves down through the feathers as if combing, vibrates when downing through the feathers, where the bill is moved slowly through the feathers with short, rapid biting movements. The Greater adjutant performs this behavior while sitting or standing. They predominantly preen its wings, back, sides and chest. The eyes are usually closed during preening. Eyes are open as soon as the bill is taken out of the feathers. The GAS also use to preen its partner and chicks on nests during different time of the day.

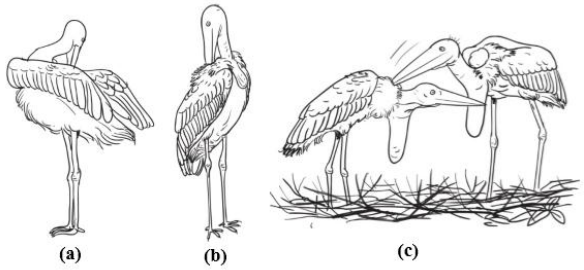

Fig 7: Preening

iv) Body fluffing

The feathers on the neck, wings and back are erected and then smoothed down. Body fluffing lasts only two to three seconds and its always followed by a gentle ruffling of the feathers.

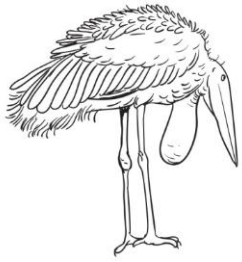

Fig 8: Body fluffing

v) Bow stretching

Both the wings and neck are stretched together, the neck is extended horizontally forward, the body and tail are slightly lowered and the wings are raised above the body.(fig 9)

Fig 9: Bow stretching

vi) Drying

Drying happens after the rain stops. It is found to be seen in feeding grounds, in nest or in roosting trees. Wings are dropped repeatedly and the feather are rubbed. The tail is observed to be raised vertically. (fig 10).

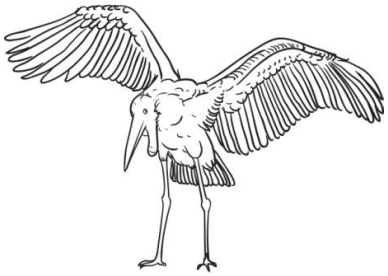

Fig 10: Drying

3.3 Alert

The bird remains motionless with its eyes open and with the neck fully extended in a posture of sitting or standing on the ground/nest. When it is in incubation period, it remains very alert most of the time keeping its eyes open and lying on the nest. Sometimes the Greater Adjutant raise one foot slightly off the ground when it was observed in garbage dump or in wetland. In the nest also, they are supposed to be alert sometimes keeping its eyes open and bending its one as shown in the. In this posture it appear to be focused on the direction of the threat. Alert behavior is often elicited by others including birds or may be human subject.

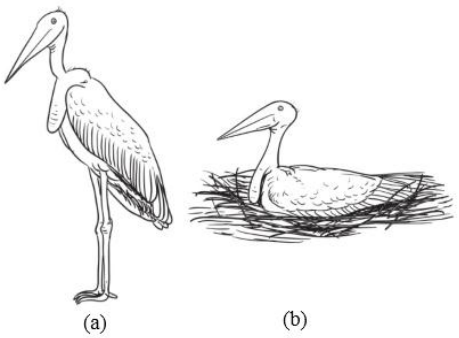

Fig 11: Alert

3.4 Resting
The Greater adjutant remains motionless with its eyes closed either in a position of sitting or standing on the ground or nest regarded as nesting. They may be:

i) Sitting
This behaviour is found in nest shown by both male and female along with chick. During incubation, female keeps sitting most of the time and after intervals it keeps, standing on the nest. Often the bird keeps resting in a nearby branch keeping observation upon the eggs or chicks, They may from any other predator. The birds also shows sitting behavior in a feeding site (fig 12)

Fig 12: Sitting

ii) Standing (in nest or ground)
Standing in a nest is also a part of resting behavior performed by both male, female and juveniles. Even during in its foraging activities, they often use to stand. (fig 13)

Fig 13: Standing

iii) Roosting and Perching
In the nesting colony, the nesting pair of Greater adjutant keeps moving to the nearby roosting trees and takes rest. The GAS rest on a branch with breast feathers puffed but remains alert with open eyes. (fig 14a and b)

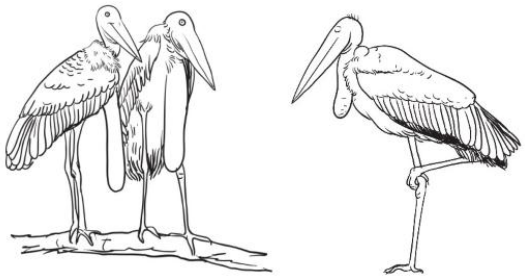

Fig 14: (A) Roosting (B) perching

3.5 Wing spreading
This behavior could be categories into following three categories.

i) Wing-spread sunning
The GAS spread its wings horizontal to the grounds either in feeding sites or in their nest in a bright sunny day but very common during both and non breeding season (fig 15).
.

Fig 15: Sunning

ii) Shading nest contents
The birds spread their wings fully or in a semi circular pattern to protect the eggs or young ones from the sun rays, most common during breeding season. (fig 16)

Fig 16: Shading

iii) Spreading for courtship
The Greater adjutant also spread their wings for about 10 second during courtship displays which is related to balancing and social display.

3.6 Ruffling
The bird shows a wave like movement and shakes its body followed by fanning its tail and feathers.

3.7 Bill gaping
The mouth is kept briefly opened wide for a period 1 min and the pouch is extended and it is generally done after stretching (fig 17)

Fig 17: Bill gaping

3.8 Pouch shaking and spreading

The GAS extends and retracts its pouch either after feeding young's or after foraging, while the pouch is also observed to be shacked during these activities.

Fig 18: Pouch shaking

3.9 Foraging

The GAS is a scavenger and carnivorous bird mostly feeds on carrions, fishes, rodents, mollusks, snakes and frogs etc. They use to forage upon garbage dumps and wetlands either in colony or individually. They forage both colonially and individually.

The Greater adjutant is an opportunistic feeder. In the wetlands, the Greater adjutant normally feeds by moving on the water surface and dipping its bill down into the water column. When the prey is captured, the forager raises its head well above the water surface to swallow. When a prey item is reached to its optimal positon, the bird snaps it with bill. This process is observed to be repeated for several times.

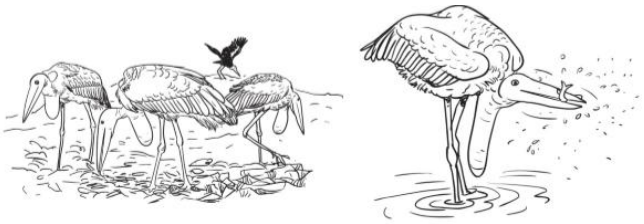

Fig 19: Foraging

3.10 Antagonistic behavior

This could be categorized in two different categories.

i) Aggressive

It includes one bird chasing the other. Aggressive displacement is observed during territory establishment during nesting time and as well during foraging. The birds chase each other even during the time of flying particularly just before landing. This behavior is a mode of competition. In nesting trees, both sexes shows aggressive towards the intruders. During any encounter in nest or in branches of nesting trees, the GAS slightly jerks the head in the other direction of other animal and claps the bill rapidly which is also known as bill clapping. (fig 20)

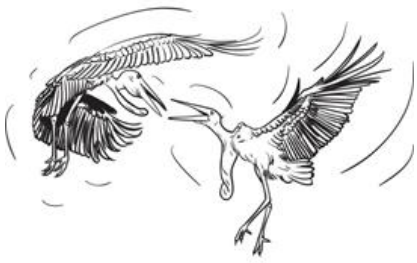

Fig 20: Aggressive behaviour

ii) Non aggressive

In nonaggressive displacement, the GAS walks towards another, causing the second bird to leave its position and to move elsewhere.

3.11 Sexual behaviour

During breeding season of GAS, the gular pouch appears to be bright and white and black bands on the feather are noted to be observed in the form of ridge. Sexual dimorphism not found but in nest male could be identified as the male is taller and bigger than its female counterpart.

The Greater adjutant keep contracting and exhibiting their gular pouch from time to time. Sexual dimorphism is not found in this bird. But in the nest, male can be identified which is slightly bigger in size which could be identified when it positioned itself at the top during copulation.

Sexual behaviors could be categorized as followings:

i) Courtship and pair formation

The male GAS creates territory on a potential nesting site where the nest would be built. He does frequent bill clattering pointing the bill upward or downward or horizontal. We observed head up down display, head sways and bill clapping. In this behavior, the male initially expand gular pouch and wobbles vigorously. Then this is followed up by swing up of head of the male up and down and side ways often the bills are also taken to back and down. After head sway and bill clap, both sexes are found to bow each other as a mode of acknowledgement. After this event, some males take flight and do some circling in the air above the nest for a few second. The partner at the nest performs again head sway, bill clap and bow activities when the male returns to the nest from its flight.

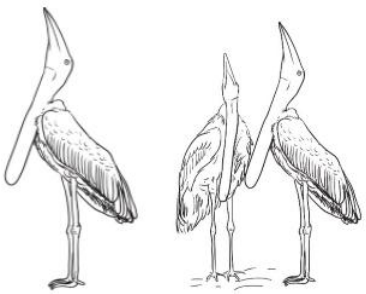

Fig 21: Courtship

ii) Copulation

Just immediately after courtship, mating occurs either in the nest or nest branches. Even they mate in nearby roosting trees that too occasional.. Both the partners comes close to each other and the male lift one of his leg on the back of female and climb over the bird with both legs. The female bend down on her knees giving a submissive position. The male stands over the female just for a while and then sits over the female and does the cloacal contact. Immediately, the male preens the female neck and touches the upper part of the bill of the female. The male holds the females upper part of the bill and the bill clattering sound performed by both. At this time, both spread its wings together. Mating behavior is initiated by male but the female accept it. In many cases, the female also rejects the mating just after the male stands up over the female's body. Sometimes mating is followed by preening (fig 22a, b)

Fig 22a,b: Copulation

iii) Nest building

The GAS involves in nest building activities just after courtship. Both the partners participate in nest material collection and nest building while the female spends more time in nest and male spend more time in nesting material collection during the breeding season. Nest materials like bamboo sticks are collected from the nearby paddy field fencings areas. Twigs or branches from other trees are collected from nearby trees (fig 23).

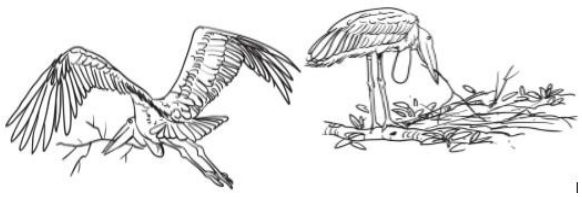

Fig 23: Nesting

3.12 Parental

Parental behaviors could be categorized as follows:

i) Incubation

The GAS starts the incubation as soon as the first egg is laid. Eggs are laid asynchronously. Both sexes participate in incubation yet the female participate for more time. The posture adopted by incubating parents is shown in the figure.

Fig 24: Incubation

ii) Nest cleaning and eggs turning

Nest cleaning and egg turning are done frequently by both the partners. In this behaviour both the sexes keep cleaning the nest and regulate the temperature. Egg turning is also a very important behaviour where both the sexes participate and turn the egg to regulate the surface temperature.

Fig 25: nest clearing

iii) Nest relief

Nest relief means leaving the nest time to time for various reasons like nesting material collection and food collection by the parents is a continuous parents. Since incubation is done by both partners, so nest relief is an alternative even from both the partners. While relieving one member from the nest, both members bow to each other and sway their head right and left side for several times. This is a very common behavior in Greater adjutant during the breeding period.

iv) Chick care and feeding

When a hatchling comes out itself from the egg shell, the parents perform the up-down display as a greeting ceremony. The young hatchlings were given small fishes or foods by regurgitation. When the chicks are 20 days old, the birds give them slightly bigger fishes of almost 10 inches long. The 30 days old chicks were given bigger sized fishes or foods collected from the garbage dump. In two nests, we observed a parent birds dripping liquid through its mandibles to the mouth of the 2 days old chicks. The chicks also drink water through demand and it observed that many times parents through enough water over the chicks to serve the purpose of cleaning also.

Fig 26: Chick feeding

v) Begging behaviour

The chicks are observed to do begging display from when they are just two days old. The chick sit on their tarsi, lean

forward, cock the tail and partially spread the wings. They peck their parents bill and many times even try to thrush their own bill into parents throat. This continues until it gets foods from the parents or any other response from the parents. (fig 27a and b)

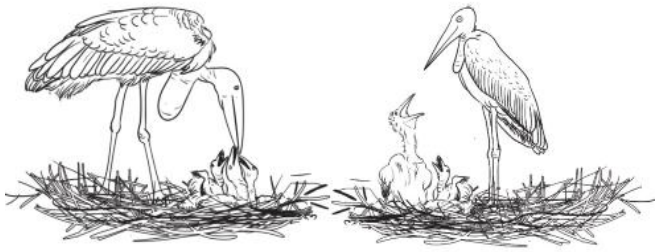

Fig 27: Chick begging (a), chick begging (b)

3.13 Vocalization

The GAS is generally silent, though adult grunts and chicks often croack and hiss to attract the attention of their parents. Adults emit grunts or croacks during antagonistic behaviour, nest relief, courtship and copulation. It also occasionally screams before fleeing when any potential predator intrudes their nests. During social display, courtship, copulation, nest relief etc, the GAS does head up and down display and they would do a sound like "W-e-in-h" followed by bill clattering. The bill clattering sounds like clapping two bamboo or wooden pieces one over another sounding like *taak*, *taak*, *taak*. The bill at this time remains vertically pointed towards the sky and the bill clattering would stop only after the bill was brought down below the horizontal.

3.14 Defecation

Defecation on nest and foraging ground

Greater Adjutants excretes faecal matters frequently observed both in breeding and non breeding period. In nest, they are found to defecate on their legs, nests and faecal matters fall down the grounds.

4. Discussion

The ethogram representation for 35 different activities against GAS (Table 1) have been described for the first time, may elucidates a new aspects for conservational approach. These may be inclusive of behavioural research on captive breeding, foraging, predation, movement, social behavior, mating pattern which in turn may attribute to greater extend for assessment of conservation related problem (Angeloni *et al*. 2008) [20], may extend benefit for *in situ* and *ex situ* conservation measures and for better understanding on sensory ecology (Swaisgood, 2010) [21] in the form of walk as recorded for GAS.

The locomotory behavior has been assumed to be related with that of the forages and running,is certainly an association for breeding purposes. Locomotion in stork includes walking, hopping, running (fig 3), flying (fig 4) etc. and all are working in tandem for continuing its behavior which are identical in nature with the activity of wood stork (Kahl1966) [22] and other Ciconiiformes (Bochenski and Jenzak 2006) [23] and spotbilled Pelican (Gokula 2011) [7], various types of behavior recorded during the study might be related to specific needs of their habitat uses as well as for nest formation. The ethogram of Great Indian Bustard might be an equivalent assessment for this study (Rahmani 1989, Patil *et al*., 2013) [24, 16]. The ethogram for Alert (Fig 11a, b) might be an expression of Anxiety –Stretch- Display, which extends as a warning signal to other individuals (Kahl 1972) [25].

The storks show the greatest number of ritualized social displays during the period of pair-formation and courtship. Many such displays are species-specific and presumably largely genetically determined. Certainly they appear as valuable information in assessing relationships and differences between species and genera as are morphological characters. Even a hatchling comes out itself from the egg shell, the parents perform the Up-Down Display as a greeting ceremony (Tortosa and Villafuerte 1999) [26]. In most aspects of display and behaviour, the species of *Leptoptilos* might be similar to other species of storks (Kahl, 1966) [22]. Yet during courtship, and occasionally later, females typically lend near lone male on nest sites and approach them in the balancing posture. In this display, a female GAS stands with its body nearly horizontal bill pointed downward, and wings held widely spread was observed (Fig). It has also been found that female bends her legs, lowers her head and neck, and clatters the mandibles loudly five to six times while lifting the bill forward and upward with a slight "scooping " motion (Fig). After pair-formation, all three species of *Leptoptilos* give frequent up-downs whenever one member of the pair returns to the nest after an absence. In the Marabou, the bird first throws its head upward with the bill nearly vertical and utters a series of loud, high pitched squeals and deep-throated "moo's" (Kahl 1966) [22]. In our studies, we avoided study of courtship behaviour from the bamboo Platform to avoid possible disturbances. We observed them from ground during the initial stages of courtship behaviours. We found the copulation period varies from 30 to 35 seconds (n=50). In one particular case, male stood over the female for at least one minute and then the copulation was rejected. The male tried for copulation for at least three times and every time it was rejected by the female Ciconidae. Varying degrees of wing spreading (Fig13) are shown by at least 13 species of storks under different conditions. In some storks (e.g. *Ciconia nigra*, *Euxenura galeata*, *Ephippiorhynchus senegalensis*, and *]abiru mycteria*) Kahl (1966) [22] found that wing spreading is done for performing three functions a) thermoregulations –during warm weather storks often spread their wings for extended period. Undoubtedly such spreading of the wings helps to reduce hyperthermia by exposing the thinly feathered areas under the wings and allowing the loss of body heat by convection and radiation, when the air temperature is lower than body temperature. Usually such cooling postures are accompanied by panting (thermoregulation behavior), erection of the upper-back feathers, and urohydrosis (excreting on the legs as a thermoregulatory mechanism). b) Feather treatments - In addition to the warming and drying effects in the sunning postures discussed above, the sun's radiation may also have other beneficial effects on the plumage itself. In the sunning postures of *Leptoptilos crumeniferus*, the birds often altered their postures, depending on the time of day, so that the wings were held in a position that was approximately perpendicular to the rays of the sun--as if the birds were attempting to absorb

a maximum amount of radiant energy (Schneider, 1952, Kahl, 1966, 1992) [27, 22, 25] c) Shading nest content -Most storks at times stood in the nest so that the shadow cast by their body protected the eggs or small young from the direct rays of the sun. In Greater adjutant shading, was observed with as a regular behavior after laying eggs. Earlier Austin (1961) [28] had suggested that spread-wing postures in cormorants might be related to balance. In storks, balancing seems to be an obvious cause of certain short-term spreading of the wings. Immediately after landing, when standing or walking on un-stable branches, or when perched in gusty winds, storks often hold their wings temporarily open for balance. Balancing movements differ from those described above in that they are generally of shorter duration, are often related to locomotion (landing or walking) and usually alternate or coincide with other postures related to the maintenance of bodily equilibrium. The form and context of most spread-wing social displays in storks suggest an evolutionary derivation from balancing or flight intention movements (Kahl 1966) [22]. In our study, three distinct types of wing spreading behaviour were recorded. a) Wing spreading for sun bathing b) shading nest contents, and c) wing spreading for balancing in courtship (Fig). However, the function of feather treatment as mentioned by Kahl (1966) [22] could not be performed. In our study we found preening is one of the predominant behavior in both adults and chicks. We observed the different types of sleeping behavior of chicks which were not mentioned in this behavioral ethogram.

Begging call was a very important behavior of parental care where parents responded to the chicks only after they heard the begging call. Parents often give food to the chick only in response to the begging call. In response to the begging call the parents regurgitates food from the stomach and share with them. Often the parents share greeting display with frequent bill clattering to the hatchlings, which in fact come out of the shell, as a performance of greeting display (Bochenski and Jerzak 2006) [23].

Urohydrolysis in stork is a very distinct behahiour in stork (Kahl 1966) [22]. With the higher degree of ambient temperature is high and the sun is intensively shining, the stork is observed to defecate on their legs and their excrements too. This behavior for stork has well been noted both in breeding period as well during wintering among the adult and young ones (Kahl 1972) [25]. Also exhaling with open bill and deep breathing as observed, allows the stork bird to prevent loss of energy. Defecation of GAS through out the day on its nest, legs during nesting and in certain male just before mounting had been recorded. Thus the present study might be of base line information for GAS, yet demand further in depth study.

5. References

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