



Understanding of Social and Mating Behaviour of Ostrich (*Struthio camelus*)

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ABSTRACT

The ostrich is the largest wild ratite bird. The head of ostrich is 1.8-2.75m above ground due to large legs. The ostrich is the largest vertebrate and achieves a speed of 60-65km/h. There are four extinct subspecies and limited to Africa. The preferred habitat in nature is the open area, small grass corners and open desert. They choose more open woodland and avoid areas of dense woodland and tall grass. In natural environment, ostrich is gregarious and lives in groups. This small crowd are led mature sire or dam. Walking, chasing and kantling are exhibited to protect the territories by males. Off springs are protected by adults from predator by mock injury. Other behaviours are yawning, stretching and thermoregulation. Frequency of mating is low in captivity. Mostly male-female ratio is 1:2 (Male: Female) kept in experiment and ostriches are selective in case of their mates and they might direct their courtship displays at humans rather than their mates, due to the presence of humans around in captivity. The breeding behaviour of ostriches is improved due to external application of L-carnitine-magnesium supplement.

Keywords: Ostrich, Mating, Behaviour, Courtship, Breeding

INTRODUCTION

Ostrich is the largest Ratite (flightless birds without keel bone) bird, 2.75m in height and 150kg in mass and its feathers are fluffy and symmetrical (Brown et al., 1982; Cramp et al., 1997; Deeming and Angel, 1996). The adult male bird has a grey colored neck with black and white wing primaries and tail feathers. The female has white to light grey wing primaries and tail feathers and body have color pattern dull brown to grey. Growing ostrich have mottled brown, yellow, cream color and orange with black quills on back while juvenile birds resemble the females (Brown et al., 1982 and Cramp et al., 1987). The head is 1.8-2.75m above the ground due to the combination of large legs. The eyes are 50mm in diameter. Ostrich is the largest vertebrate and has the ability to position his head to produce an image from in front of and below the eye (Brown et al., 1982). The large blind spots on above and behind the head are considered to shade the eye (Martin and Katzir, 1995). Ostriches spent

most of their time for eating standing and walking (Menon et al., 2014). Ostrich only runs in case of any danger and achieves a speed of 60-70km/h (Cramp et al., 1977). They can run and walk at a rate of 15-25 km per day (Patodkar et al., 2009). Ostrich is a digitigrades with two toes. Though ostrich can't fly, the presence of air sacs, pneumatized bones, strong pygostyle and presence of some wing bones give evidence that ostrich is evolved from flying ancestor (Cramp et al., 1977; Burning, 1991). Ostrich behaviour can study with three established methods like experimental behavior, comparative behavior and observational behavior (Jackson, 2009; Ahmed and Salih, 2012).

Habitats

The preferred habitat is open, short grass plains and semi-arid desert. They prefer more open woodland and avoid areas of dense woodland and tall grass. The bird tends to live in dry grassland and lowland areas (Brown et al., 1982; Unattributed, 2012). Currently, it was indicated

that the high food availability was more effective on group size of animals and place of habitat in southeastern of Brazil (De Azevedo et al., 2010). The ostriches of Southern Africa can be found in desert grassland, Karoo shrubland, coastal fynbos and semi-arid savanna (Dean et al., 1994). Coastal fynbos is unique to South Africa due to the presence of small shrub bushes of the Protea and Erica families (Chambers and Odendaal, 1996). Bird densities are approximately one per 5-20 km² but in protected areas their density is 0.8 bird km² (Brown et al., 1982).

Behaviour of ostrich

One feature of behaviour is that the ostrich bury their head in sand and this behaviour has no scientific background (Pocock, 1955). Instead there is a coincidence of ostrich's head to the horizon when lying or feeding (Sauer and Sauer, 1966a). Frequency of behaviour changes in winter and summers seasons reported by Ross and Deeming (1998) and McKeegan and Deeming (1997).

Social behaviour

Other than breeding behaviour, ostriches live in groups especially for water and food (Burger and Gochfeld, 1988; Bertram, 1992). The adult have no any specialized pattern for social behaviour and seen to be in herd of 10-20 ostriches (Sauer and Sauer, 1966a; Musi et al., 2008). There appears to be a social chain of command within these groups, headed by a mature sire or dam (Sauer and Sauer, 1966b; Unattributed, 2012). Gender pairing was observed in 1:1 to 1:4 ratios (Musi et al., 2008). It is reported that 80% of ostriches were seen with a single male and 20% engage in a relationship with more than one male ostrich in breeding season (Bertram, 1992; Blach et al., 2000). In natural habitats the ostriches live in a mixed community. They encounter the wide variety of other species of animals. Sauer (1970) investigated in Namibia on the interspecific behaviour of ostriches by knowing the results of contact of ostrich with mammals and birds. About 75% of the interspecific behaviours are largely neutral by avoiding and tolerating other species and avoiding close contact with other animals as well. Due to this shyness ostrich became a difficult species to observe in natural conditions (Bertram, 1992). Similarly, about 16% of encounters occurred due to the opposite behaviour against other species (Sauer, 1970).

Courtship and breeding

Sexual behaviour of adult ostriches in the social groups was studied by Sauer and Sauer (1966 a, b). It was observed that females showed pre-nuptial courtship by posturing in front of the potential mates. Females

showed violent behaviour against other females and young yearlings. Young yearling showed submissive behaviour by lowering head and neck in S-shape. The development of typical red flush beak, thigh, neck and shin skin in males and courtship behaviour developed later in males in contrast to females and it was also a slow process. Males exhibited dominant behaviour in mix-groups by posturing usually with tail held erect and violent against other members. The straight phallus is also distended from cloaca and showed to other birds. Males exhibited territories by making nest scrapes (Sauer and Sauer, 1966b). The territories vary between 11 to 19 km² though immature males hold smaller territories in Kenya (Bertram, 1992). There is comparatively little overlap between territories and this same area can be utilized by males in consecutive years. Walking, chasing and kantling are exhibited to protect the territories by males. In contrast females covered a mean range of at least 25 km² and they go through the territories of males, however, few males were completely avoided by some females. Courtship behaviour leads to copulation (Sauer and Sauer, 1966b) and booming sound of males help to draw the attention of females toward courtship behaviour. The both gender show synchronized feeding behaviour and this can be easily disturbed by off-grazing the animals. The next step is ritualized feeding by both birds at selected nest site. The male then walks with steps and fixed their neck by moving forward and backward and swing their wings. The male then drops to kantle the female on ground, sitting on its haunches with its wings held forward holding its neck over her back, at regular intervals moving both its head and neck from side to side with its head hitting her back at the completion of each sideways stroke. The female displays her precopulatory behaviour by fluttering her wings and holding them in forward position and lowering her head with support of her beak. This ends with the faeces of ostrich to the ground with her elevated tail and neck forward. The sire mounts on the female. Male stamps its feet various times on ground just earlier to mounting. Mounting involves the male sitting with a leg on each side and to the right side of the female. Before intromission repeated thrust of phallus are often required. During copulation the male performs a kantle (Male specific dance behaviour) show to culmination with its head being brought forward and a deep harsh grunt emitted. The female usually remains expressionless during the 30-60 s of mating though she may hold her head forward and clap her beak. There is a little post-copulation behaviour (Sauer, 1972). Peculiar sexual behaviour has been reported for large groups of male ostriches in Namibia (Sauer, 1972). Typical courtship behaviours included kantling

performed by males to males who did not respond. Sauer (1972) interpreted this as a way of releasing sexual tension prior to breeding or as a method of suppressing violent behaviour associated with a prolonged period of wet weather. Whether this interpretation is correct, it is not clear because kantling is a violent behaviour in male–male confrontations over terrain (Bertram, 1992). Since the behaviour was pragmatic in large groups of males within which it is occasionally difficult to distinguish birds by age, it is possible that the behaviour was being displayed by young, inexperienced males. The ostrich has a mutual nesting system which is widely described by Bertram (1992) and only momentarily reviewed here. Each territorial male digs a number of nest scrapes which he shows to any female which come into its territory. A major female pairs with the male and lays most of her eggs in the nest site she chooses in each territory. Other minor females in addition, visit the territory and may lay an egg within a previously established nest. These females may be ‘major’ females in another male’s territory. The typical number of minor females laying in a nest is three (ranges from one to five). Each ‘major’ hen generally contributes about 11 eggs (in the range of 9–14) to her laying nest and 26 eggs were laid in a clutch. This breeding design is reported for birds all the way through the natural range of the ostrich (Bertram, 1992; Musi et al., 20008; Patodkar et al., 2009) and consequently considered being typical of the species. In late afternoon and early evening eggs were laid (Sauer and Sauer, 1966b). Bertram (1992) reported that clutch build up over a period of up to 30 days. During the clutch time the nest is attended by both sexes (Sauer and Sauer, 1966b). Incubation is carried out by both males and females, with the male bird sitting during the night (Bertram, 1992). At the first sign of danger the birds depend on camouflage to hide them from predators, even though they perform diversion displays or attack potential predators if required (Sauer and Sauer, 1966b; Bertram, 1992). One strange feature of the ostrich breeding system is once the ‘major’ hen starts to incubate she rearranges the eggs and destroys several from the nest until approximately 19–20 eggs remain (Bertram, 1979, 1992). These eggs lie in a ring around the incubating bird and do not develop. Conversely to the view of Sauer and Sauer (1966b), the major hen actively destroys eggs laid in the nest by minor hens and retains her own. How she recognizes her own eggs is still not clear (Bertram, 1979).

Behaviour of offspring

Incubation period of ostrich s 42–44 days, during which time the chicks remain brooded by an adult although they start to utilize small stones during periods of

activity (Sauer and Sauer, 1966b). Chicks are difficult to track in grassland, once they leave the nest but parents of the chicks brood them as protection against the rudiments and predators (Bertram, 1992). Adults will pretend a ‘mock injury’ to divert a potential predator from the chicks (Brown et al., 1982; Bertram, 1992). Families of chicks are pooled into creches, which may number upto 300 birds and are overseen by a single pair of adult birds (Hurxthal, 1979). When groups of chicks gather there is a dynamic behavioural competition between the guardians of each group over which adults will take charge of the enlarged creche. Generally younger chicks are accepted into groups of older chicks, but not vice versa (Brown et al., 1982). By the time the chicks are a year old they have been neglected by the adults and spend their time in a dense peer group (Bertram, 1992).

Other behaviours

The behaviour of ostriches diverges according to the age and day period (Amado et al., 2011). Ostriches carry out a variety of maintenance activities including yawning and stretching (Sauer and Sauer, 1967). Yawning habitually precedes sleep, simultaneously stretching, takes place after waking. Ostriches are skilled at behavioural thermoregulation. Ostriches frequently preen feathers with their beaks (grooming behaviour) and they do this while walking, sitting, standing, or even in rainy days (Menon et al., 2014).

Thermoregulation is mechanisms by which warm-blooded birds try to constant their core temperature. For desert-adapted birds like the ostrich, the main problem is to avoid overheating. During hot weather they release heat by panting and by seeking shade (Louw, 1972).

Captive environment

Adults Behaviour

In a study carried out in South Africa, the behaviour of ostriches managed on ranches of natural vegetation surrounded by a boundary enclosure has been investigated and compared with sheep under the same circumstances. It was observed that 43% of the daylight hours were spent in walking, fighting and running by ostriches while sheep maintained at same conditions spend 19% of their time in performing the same activities (Milton and dean, 1995). Male ostriches perambulation boundary fences and even when provided with additional rations they forage from the veld. At stocking densities of 1–10 ha/bird/year, ostriches destroy the veld through path formation and trampling of vegetation (Milton and Dean, 1995; Unattributed, 2012). A simple time–activity plan over the period of daylight hours was recorded for a group of 120

adult ostriches (40:80 males: females) maintained in a 30 ha enclosure in Israel (Sambraus, 1994a). Ostrich 63% time spent on walking and standing. Sitting and lying averaged 18.7% and low in morning but increased in afternoon. Eating and drinking combined averaged 18.3% with a peak during the morning after the concentrate ration had been delivered to ostriches (Sambraus, 1994a).

Table 1. Behaviour pattern in captivity as reported by Berendsen (1995)

Behaviour	Time spent
Drinking	1.1 %
Drinking	26 %
Walking / Running	15 %
Resting	2.7 %
Standing	18 %
Preening	0.06 %
Fence pecking	3 %
Courtship	1%
Aggressive behaviour	1.9%

More complete time–activity plans are accessible for breeding ostriches maintained during summer season (Ross and Deeming, 1998) and winter (Deeming, 1998a). Six behaviours dominated in behaviour are standing, pacing, walking, sitting, feeding (concentrate ration) and foraging (pasture). During summer months, trios and pairs shows the major differences in behaviours (McKeegan and Deeming, 1997). Females gave less speeded and walked as compare to females, while the female has spent more time on foraging and feeding than males (McKeegan and Deeming, 1997). Eleven males and 22 females maintained in two larger groups, showed largely comparable results, though in males the frequency of pacing was greatly abridged, with an increase in standing and sitting (McKeegan and Deeming, 1997). These differences were accredited to territoriality by males (McKeegan and Deeming, 1997; Berendsen, 1995). Little behaviour was affected by the time of day though the frequency of feeding increased, and the frequency of foraging decreased, in the period instantaneously after food delivery. In all group sizes the incidence of sitting behaviour was the highest just before sunset (McKeegan and Deeming, 1997). Sitting was observed at a more recurrent rate than in Britain, and females sat for more time than males. Standing was alike for both sexes whereas the frequency of pacing was over twofold as much in males than females. The frequency of foraging in females was nearly three times higher than in males. The frequency of other behaviours was equivalent in the two

sexes. Feeding time was higher in morning but foraging time is higher after afternoon. This was accredited to the management for providing food during the morning and the ostriches' supplementation diet with grazing in the afternoon (Deeming, 1998a). The effects of particular climatic conditions on ostrich behaviour have been investigated during spring and winter months in Britain (Deeming, 1997b, 1998b). During periods of rain, energetic behaviours such as pacing and foraging were decreased but feeding on concentrate ration was not considerably affected. In the spring, adult males and females spent over 50% of their time sitting during rain whereas only 10–20% during dry weather (Deeming, 1997b). The increase in sitting behaviour was due to the rainfall rather than temperature though the birds generally chose to sit in the rain instead of shelter (Deeming, 1997b). Such behaviour has been pragmatic in ostriches in Germany (Berendsen, 1995). It was observed that in dry conditions (during spring months), feeding and foraging takes only 25–30% of the pragmatic behaviours. During both spring and winter months, when the birds were not yet breeding, there were no sex differences in behaviour (Deeming, 1997b, 1998b). The effects of snow on behaviour have not been reported, but during icy conditions ostriches emerge to walk more vigilantly (Reiner et al., 1996).

Social behaviour in captivity

In Namibia, Sambraus (1995) studied the social structure of three groups of nine to ten adult ostriches of mixed sex (Male: Female; 4:6). In each of the three groups the alpha and beta positions in the social pecking order were held by older male birds even though being male did not assure a high position in the social structure. Females usually take lower positions in the ranking order. Little is known about agonistic behaviours in farming ostriches. Aggression against females by juvenile males has been described by Stewart (1994) and violence by adult birds is normally directed towards younger chicks (Bolwig, 1973).

Courtship behaviour in captivity

The pattern of courtship behaviour of captive ostriches is closely related to wild behaviour (Musi et al., 2008; Bubier et al., 1998). Incidence of mating by ostriches in captivity in Britain is low, with only 20 attempts at copulation being recorded in 99 hours of observations (McKeegan and Deeming, 1997). The courtship and coupling trend was higher after sunrise (Sambraus, 1994b). The mated female ostriches store spermatozoa in the oviduct tubules and release them

during fertile period which contained a maximum of six fertilized eggs (Patodkar et al., 2009).

In a study which compared rates in the presence and absence of humans, high rates of copulation were reported in ostriches in the presence of a human standing and adjoining to the enclosure fence (Bubier et al., 1998). Breeding enclosures can be small and hold a pair or trio of birds in the farming conditions. In Europe some enclosures hold large groups of ostriches in a 1:2 (Male: Female) ratio. Large breeding camps in South Africa and Israel are established with 150–200 birds (1:2; Male: Female). In the present systems, the birds were left free to select their own mates (Hicks-Allredge, 1996). Deeming and Angel (1996) showed that the pairs or group of three ostriches in Britain are more productive than larger groups. Behavioural troubles with view to the choice and number of mates have been recommended by numerous authors to cause a problem in commercial production (Stewart, 1994; Hicks-Allredge, 1996; Deeming, 1997a), although few studies back up these assertions. In Britain, ostriches in pens containing one male with two females had low egg production and fertility, both of which drastically enhanced when one of the females in each pen died (Deeming and Angel, 1996). In Israel, farming ostriches displayed abnormal courtship behaviours, with females both exhibiting and trying to mount other females (Sambraus, 1994b). Kante displaying by a female to another female in a neighboring enclosure has been observed in Britain (Deeming and Angel, 1996). The significance of these unreliable reports is not clear, but it is clear that mate selection in captive ostriches needs further investigation.

The courtship reaction of ostriches to humans can be very noticeable. In a study by Bubier et al. (1998), birds were observed for 10 min periods from remote locations where the birds could not see the human, and then for 10 min periods with the human standing after that fence. Male kantling and wing swinging and female pleading for did not occur during data sessions when the ostriches were under observation from a distance and were only observed when the human was next to the barrier (Unattributed, 2009). Adult birds were also observed for 10 min periods before and after disclosure to a human next to the perimeter. No considerable differences in the courtship behaviours in these periods were observed telling that contact with humans did not excite courtship behaviour afterward, although the frequency of copulation whilst the human was present was higher than observed before or after contact. This study suggests that ostriches reared on farms may be interested in humans. If this is the case, this would cause problems at maturity when adult ostriches

might then direct their courtship displays at humans rather than at mates, as observed in this study. Lambrechts and Cloete (1998), who split pairs of adult ostriches into two groups of ten based on whether they had produced less than 30 eggs, or more than 60 eggs, in the preceding breeding season. Observations over a period of 6 months during the breeding season revealed that consumption of concentrate feed by males was significantly higher in the low productivity group, whereas the frequency of mating in this group was considerably lower. The behaviour of breeding adult ostriches is reported to be affected by external application of L-carnitine–magnesium supplement (Lambrechts et al., 1998). When it is compared with birds in the control group, incidence of sitting was lower in both sexes in the treatment group. The occurrence of mating in males and the frequency of foraging in females were also notably increased by variety of food. Although the treatment was premeditated to affect the energy metabolism of the birds, the full importance of these results needs further exploration.

CONCLUSION

Authors concluded that the behaviour of ostrich is difficult to observe during natural conditions because ostrich is a shy animal. Ostrich exhibits territorial behaviour and consumes fresh natural vegetation during natural environment. Their offspring's were protected by them from predators in natural condition while they show aggression toward younger chicks in captivity. They exhibit thermoregulation behaviour in natural environment. During captivity ostrich can also eat concentrate ration. Incidence of mating was low in captivity as compared to natural environment. In short, Ostriches experience stress in captivity which increases their feeding requirements. Paradoxically the same stress makes them less likely to feed. Hence natural conditions appear best to elicit a normal behaviour. However, further studies are needed to explore its social and mating behaviours parameters.

Consent to publish

All authors have agreement for publishing this article and have no objection.

Authors' contribution

All authors have equal contribution.

Competing interests

The authors declare that they have no competing interests.

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