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A Study of Reproductive Behavior in the Emu

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and Nicholas B. Anthony[¶]*

ABSTRACT

Members of a flock of male and female emus were observed in an ethological experiment designed to investigate trends in reproductive behavior exhibited during the North American mating season, which lasts from October to mid-March. Observations were made at dawn, noon, and dusk from December 1999 to mid-March 2000, and the only behaviors that were consistently expressed during these times were pecking, strutting, exclusive, and male and female sexual activities (defined in text). Though statistical significance was found between male strutting behavior and female sexual activity in the December observation period, no overall significance or significance at other observation periods was found between these two behaviors. No statistical significance was found between male pecking and female sexual behavior—overall or at separate observation periods. The emu also showed more incidences of mating activity at dawn and under cool temperature conditions. Exclusive behavior, however, was more prominent during the dusk observation period.

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Meet the Student-Author

I graduated from St. Joseph's Convent in Trinidad and Tobago, West Indies. In May 2000, I received my bachelor of science degree in poultry science, graduating magna cum laude. I was nominated for the Arkansas Alumni Award last year and was named Most Outstanding Sophomore by Gamma Sigma Delta in 1998. I've received the Lippert Ellis Award from Gamma Sigma Delta, the Randall Tyson Award, an Arkansas Feed Manufacturer's Scholarship, and a U of A Student Involvement Leadership Award.

I am currently pursuing a master's degree in biological sciences. My thesis will involve working with captive endangered animals from Trinidad and Tobago and investigating related reproductive efforts under way at various zoological institutions.

Understanding an animal's behavior patterns is integral to ensuring that in captivity, those animals remain healthy. Good reproductive performance is an indicator of a high degree of fitness. My emu study allowed me to investigate the sexual behavior of a captive species. As I intend to pursue a career dedicated to improving the quality of life of animals, especially those in captivity, this project was particularly relevant. I discovered that while it is incredibly challenging and rewarding to conduct a project dealing with animal behavior, it can also be entertaining in the most unexpected ways. As I describe in my paper, one of the emus I was observing became affectionate toward me!



Reema Persad

INTRODUCTION

Understanding the behavioral patterns and actions of ratites is integral in ensuring a captive existence that produces birds that are physically sound and in general good health. Good reproductive performance (evaluated by egg quantity and hatchability comparisons) is an indicator of a high degree of fitness. Sexual behavior (involving courtship, bonding, breeding, and egg-related behavior) is a precursor to evaluating good reproductive performance.

In the United States, the emu [*Dromaius novaehollandiae* (Latham)], a ratite, is monogamous in most situations (Jensen *et al.*, 1992) and exhibits a breeding season that extends approximately from October to March. In order to learn more about reproductive behavior in the emu, an ethological study was undertaken, in collaboration with the departments of Poultry Sciences and Biological Sciences. We investigated the mating behavior between emu pairs as well as the mating success of the male emu in a flock of 20 emus (10 males and 10 females) presently in residence at the University of Arkansas Poultry Research Farm.

However, because of extenuating circumstances, only the data from which trends in mating behavior could be inferred were collected during the study.

MATERIALS AND METHODS

An ethogram based on published information (Jensen *et al.*, 1992) was developed. All the terms and descriptions related to the specific behaviors investigated in this study were defined in order to standardize observations. The four main categories are described as follows:

Gender Identification Behavior:

Male Vocalization: produces grunting sound similar to hog vocalization

Female Vocalization: produces a drumming sound
Courtship Behavior:

Male Strutting: male cocks head backward and over back; also displays neck feathers

Male Pecking: pecks back of female to elicit attention and to encourage breeding

Exclusive Behavior: emu pair eat, walk, rest in a specific spot together

Sexual Behavior (initiated by male):

Male Sexual Activity: male squats behind female, puts legs outside hers so that his breast plate contacts her raised rump, raises his tail feathers into the air, and copulates

Female Sexual Activity: female squats on ground, leans forward, and waits

Rebuff: Incomplete mating activity whereby the female rises before the completion of the mating activity

Egg-Related Behavior:

Male Nesting Behavior: piling of available grass or straw

Incubation Activity: such as a male emu sitting on an egg

Other: any other sexual behaviors noted

This preformulated ethogram of sexual behaviors was validated during trial observation periods that were randomly performed in November and December 1999, with adjustments being made as necessary.

An observation blind of bales of hay (4 x 6 x 6 m) was built in the central region of the corral. A tarpaulin roof provided shelter from the elements, and eye-level spaces between the bales allowed viewing of the birds throughout the corral. The observer spent 5 minutes in the hay-blind before beginning the study in order to allow the birds' curiosity and anxiousness (that occurs upon entry of a stranger) to subside. During the daytime, using the naked eye and binoculars, the observer identified the emus by their numbered and colored legbands, as both males and females had been tagged in order to keep track of possible pair bonding relationships. Approximate gender identifications were made on the basis of characteristic sexual behaviors exhibited and on the distinctive vocalizations emitted by each sex.

Initially, all 20 birds occupied the same corral, and their daily interactions were observed at noon, from 11:30 a.m. to 12:30 p.m. for the period of 1 December to 10 December, 1999. On 10 December at 9:00 p.m., when the birds had settled down in pairs for the night, the gates to individual pens were latched. Five pairs were thus isolated in five separate pens and the interactions of these pairs noted. The emu pairs were then released and allowed to mingle with the other 10 emus in the same corral from January 15th until the end of the study. Observations at noon (11:30 a.m. to 12:30 p.m.) for the period of 16 January to 25 January were then made. Also, hour-long observations were made at dawn from 6:30 to 7:30 a.m. and/or at dusk from 6:30 to 7:30 p.m. daily for the period of 1 February to 15 March (with the exception of 10 and 14 February). Throughout the study and for each observation day, data for ambient conditions (temperature, humidity, wind, and light) were ob-

tained from the Web site of the *Weather Underground Institute* (www.wunderground.com).

Standard correlation analysis was utilized to evaluate the relationship between (1) male strutting and the frequency of female sexual activity and (2) male pecking and the frequency of female sexual activity.

RESULTS AND DISCUSSION

For the observation periods combined, the correlation coefficient was not statistically significant for the relationship between male strutting and female sexual activity ($R = 0.129$, d.f. = 58, $P > 0.05$). However, in December, the correlation between these two activities was high and was therefore significant statistically ($R = 0.810$, d.f. = 7, $P < 0.01$). Yet there was no significant relationship in the other observation periods: January ($R = 0.370$, d.f. = 8, $P > 0.05$), February–March dawn ($R = -0.08$, d.f. = 19, $P > 0.05$) and February–March dusk ($R = 0.134$, d.f. = 18, $P > 0.05$).

In addition, results of the correlation analysis indicated that for all the observation periods combined, there was no overall statistical significance in the relationship between male pecking and female sexual activity ($R = 0.09$, d.f. = 46, $P > 0.05$). For the various observation periods, there was also no significant relationship between these two behaviors: December ($R = 0.23$, d.f. = 5, $P > 0.05$), January ($R = 0.053$, d.f. = 7, $P > 0.05$), February–March dawn ($R = 0.1$, d.f. = 19, $P > 0.05$) and February–March dusk ($R = -0.276$, d.f. = 15, $P > 0.05$).

In rebuff and non-rebuff situations, the average of both male and female sexual activities was calculated for each time period (Table 1). This value was then used in the calculation of the overall average for that particular time period. Therefore, the mean of the frequency of the midday sexual interactions was only 0.65 times/hour (Table 1), even though an outside observer noted that three complete matings occurred at midday on 7 March. The average frequency of dawn sexual activity was calculated to be 1.38 times/hour (Table 1), and the mean for the dusk couplings was 0.88 times/hour (Table 1). Fig. 1 shows the relationship between the time of day that the data were collected and the number of emu matings observed over the course of the entire study. Emu matings in this study were found to be more common in the early morning. Exclusive behavior was most common in late afternoon (27 incidences at noon, 21 at dawn, and 130 at dusk).

To obtain the ranges in the ambient temperatures during mating, the overall range of temperatures (-5.6

Table 1. Number of incidences of emu behavior by observation period.

	Noon	Dawn	Dusk
Total hours of observation	20	21	21
Male strutting	64	70	51
Male pecking	37	73	29
Exclusive behavior	27	21	130
Male sexual activity	13	31	20
Female sexual activity	13	27	17
Average sexual activity/hour ²	0.65	1.38	0.88

² (Male + Female/2) / Hours Observation.

to 22°C) was split evenly into three parts: Range 1 contained values greater than or equal to -5.6 but less than or equal to 3.6°C; range 2 contained values greater than 3.6 but less than or equal to 12.8°C; and range 3 contained values greater than 12.8 but less than or equal to 22°C. Fig. 2 illustrates that matings were most common in range 1 temperatures.

The original objective of this study was to find a relationship between sexual behavior demonstrations and reproductive performance. In order to achieve this goal, records of the interactions of individual birds were required—however, as the peak of activity occurred after dark, the birds could not be identified, even with the

use of a night-vision scope. The frequency of sexual activity was therefore recorded for birds that were merely identified as being male or female. From the data collected, however, several trends in emu reproductive behavior were noted.

Although male strutting was common in all periods (Table 1), it was statistically significant with female sexual activity only in December observations. This correspondence of male and female behavior in December at the beginning of our winter coincides with the inception of the breeding season on the Australian continent (Drenowatz, 1995) where their summer is our cold season.

As Fig. 1 illustrates, matings were most common at dawn, which was usually in the lowest temperature range. This correlates to the seasonal variances in temperature occurring in the wild that induce the “complex hormonal mechanisms that cause the bird to come into production” (Minnar and Minnar, 1992). These physiological changes may also be responsible for the increased frequency of rebuffs in the observations as the data collection (and the mating season) neared its end.

The increased frequency of exclusivity in the late evening observations may be due to the increased amount of roosting activities occurring as the birds start settling down for the night.

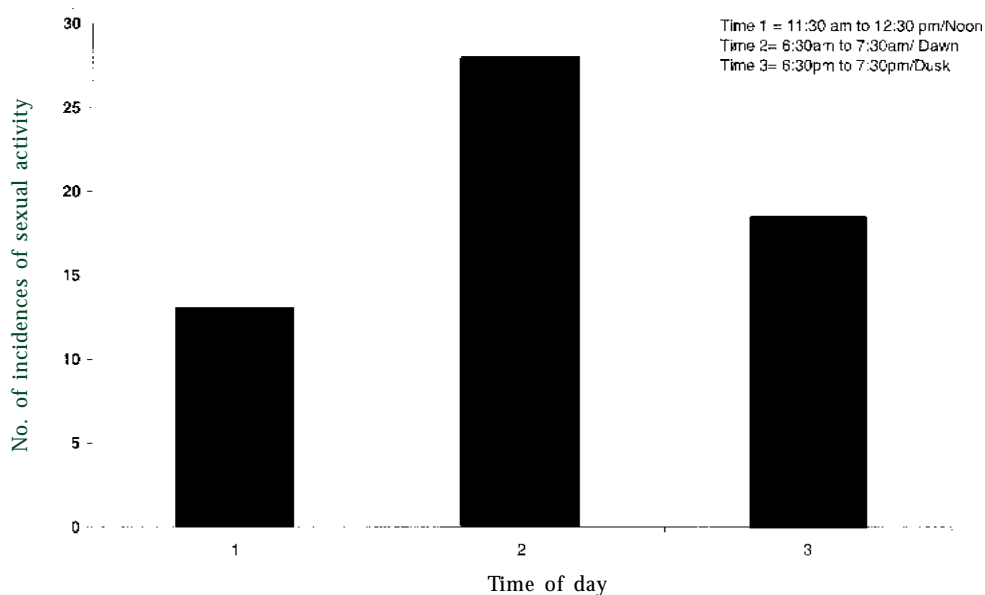


Fig. 1. Time of day versus number of incidences of sexual activity observed from December 1999 to March 2000.

No egg-related behavior was observed. However, it must be noted that at most a couple of days after being laid eggs were often collected from the pens and incubated, an activity that may contribute to the lack of incubation attempts by the male emus.

Two male emus were also removed from the study. The first was eliminated as a result of injuries sustained during an escape attempt. The second one repeatedly tried to peck the observer in the lower-back in an apparent attempt to encourage breeding activity. This latter emu may have imprinted upon human beings during an earlier stage of life, for it was noted to chase away other male emus and was not observed attempting to mate with any of the female emus in the pen.

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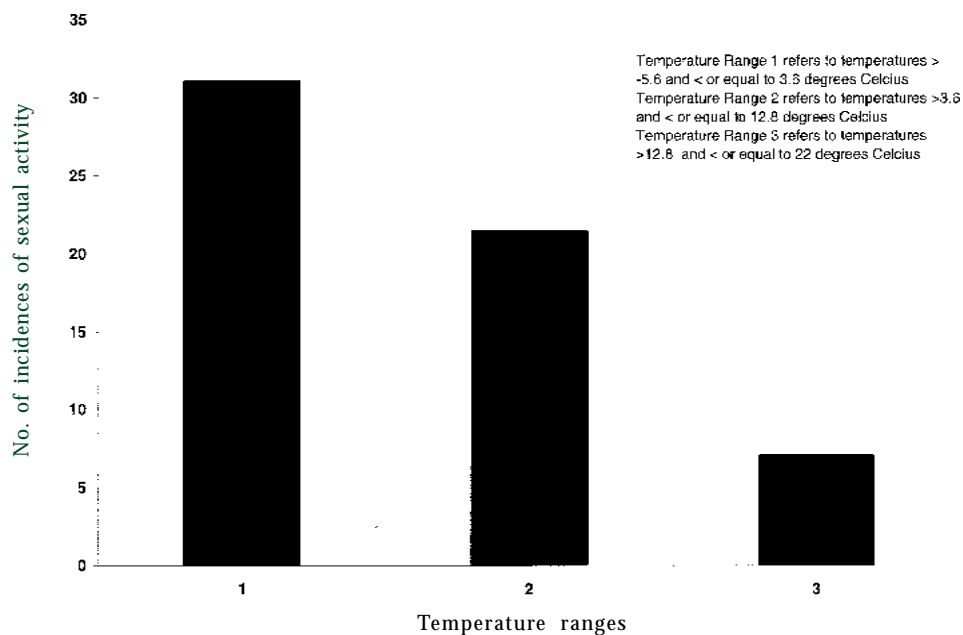


Fig. 2. Temperature range versus number of incidences of sexual activity observed from December 1999 to March 2000.