

## EFFECT OF SEASON ON SEMEN CHARACTERISTICS OF OSTRICH (*struthio camelus*)

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### ABSTRACT

A study on the effect of months and season on seminal attributes of ostrich were carried out. The descriptive statistics on semen characteristics viz., frequency of semen collection (days), volume (ml), pH, mass activity (%), motility (%), concentration ( $\times 10^9/\text{ml}$ ), live and total abnormal spermatozoa (%) were analyzed and the mean values were 17.36, 1.38, 7.28, 4.26, 79.21, 2.69, 85.71 and 15.30 respectively. The data from raw semen of ostrich during one year (January to December 2015) and four seasons namely winter, summer, southwest monsoon and northeast monsoon were evaluated. Overall the vital seminal attribute like spermatozoa motility, concentration, live and abnormal spermatozoa were better between January and September (breeding season) than October and December (non-breeding season). The winter and summer seasons had significantly ( $P \leq 0.01$ ) more frequent semen collection, mass activity, spermatozoa motility, concentration, live spermatozoa and lesser per cent abnormal spermatozoa than southwest and northeast monsoon seasons. A rise in quality attributes were noticed from winter to summer and fall from southwest to northeast monsoon season for all the semen characteristics except abnormal spermatozoa suggesting that ostrich is predominantly a winter and summer breeding species.

**Keywords:** ostrich, semen characteristics, seasonal effect.

### INTRODUCTION

Ostrich are very adaptable and can be farmed in almost all climatic conditions, but are ideally suited to dry and arid climate.

Ostrich are considered to be seasonal breeders, although they breed all year round (Degen *et al.*, 1994). Unpredictable egg production, unstable fertility, poor hatchability and poor chick survival are

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some of the major constraints in viable ostrich farming. The problem of unfertilized eggs has been identified as one of the most important limiting factors for the success of breeding programmes (Hemberger *et al.*, 2001) in ostrich. To achieve rapid and sustained genetic improvement, ostrich farming needs to adopt advanced reproductive technological tools in semen collection, quality assessment, semen handling and artificial insemination. As the reproductive performance of the male ostrich exerts considerable influence on the efficacy of the fertilization procedure, the assessment of semen quality with regard to seasonality would be a valuable instrument for evaluating fertility level in male ostrich. Hence, an experiment was carried out to study the effects of season on semen characteristics of ostrich.

## MATERIALS AND METHODS

This experiment was designed to study the effect of months and season on seminal attributes of nine individual ostrich aged between three to nine years at Post Graduate Research Institute in Animal Sciences, Tamil Nadu Veterinary and Animal Sciences University, Kattupakkam, Kanchipuram district in Tamil Nadu during 2015. The station is situated approximately at 12.5°N latitude and 80° to 81°E longitudes and at the height of 48 meter above mean sea level. Being nearer to East coast of India it enjoys a tropical maritime monsoon climate. During this study period, the average high and low temperature, relative humidity and the annual rainfall were recorded as 34.2°C, 23.2°C, 87.3 per cent and 1391 mm, respectively. This station gets most of its seasonal rainfall from the northeast

monsoon i.e. during October to December (Indian Metrological Department, Pune).

The birds were selected based on their phenotypic characters and mating behavior. The artificial cloaca (AC) as described by Malecki *et al.* (1997) was used for semen collection, after making slight modifications. The ostrich was allowed to mate naturally by following the teaser technique as described by Rybnik *et al.* (2007). The semen from each ostrich was collected during the early part of the day. Immediately after collection, the semen was evaluated for volume, colour, consistency, pH, mass activity, per cent motility, concentration, live and abnormal spermatozoa. To study the seasonal effect, the year was divided in to four seasons namely, winter (January and February), summer (March, April and May), southwest monsoon (June, July, August and September) and northeast monsoon (October, November and December (*Indian Metrological Department, Pune*)). The data were analysed by One-way ANOVA as per the procedure of Duncan's multiple comparison test (Duncan, 1955). Proportion data were converted to Arcsine values before ANOVA. Categorical data (semen colour and consistency) were analysed using Chi-square test. A value of  $P \leq 0.05$  was considered statistically significant.

## RESULTS AND DISCUSSION

### Effect of month on frequency of semen collection and semen characteristics

The influence of month on frequency of semen collection and semen characteristics of ostrich are presented in Table 1.

Month showed no significant difference in frequency of semen collection. However, numerically more frequent semen collection was observed between February and August than between September and January. The semen volume obtained between April and August was higher than between September and March which concurs with the earlier findings of Rozenboim *et al.* (2003). The mean pH of semen did not show any significant difference between months studied. Effect of month on mass activity of semen observed in this study between January and June was higher than July and December, which agreed well with earlier findings of Rybnik *et al.* (2012) who have also observed maximum spermatozoa motility score in June, July and August than in September. Spermatozoa motility showed highly significant ( $P \leq 0.01$ ) difference between months and maximum spermatozoa motility was observed during January to June than July to December. Month had significant ( $P \leq 0.01$ ) effect on concentration of spermatozoa and highest value was observed between January and May; and lowest concentration was observed between June and December, which was comparable with Rybnik *et al.* (2012) who have found that the spermatozoa concentration in ostrich varied between months and increased significantly in June and July and then declined to intermediate values in August and September.

The effect of month had highly significant ( $P \leq 0.01$ ) influence on per cent live spermatozoa and more than 83.13 per cent live spermatozoa was obtained between January and July than August and December (82.22 per cent). Head, tail and total abnormalities showed

highly significant ( $P \leq 0.01$ ) difference among different months. The lowest head abnormality was observed between January and July (6.32 per cent) and the highest between August and December (8.24 per cent) which concurs with earlier findings of Rozenboim *et al.* (2003) who have observed significantly more abnormal spermatozoa at the beginning of breeding season.

### **Effect of season on frequency of semen collection and semen characteristics**

The summer season had more frequent semen collection than winter and southwest monsoon. The less frequent semen collection observed during northeast monsoon concurs with findings of Rybnik *et al.* (2012) in ostrich who have observed less libido or poor cooperation during middle and at the beginning of the breeding seasons than peak season. The mean semen volume observed during winter (1.21 ml), summer (1.33 ml), southwest monsoon (1.52 ml) and northeast monsoon (1.40 ml) seasons showed significant ( $P \leq 0.01$ ) variation and this seasonal change in semen volume was comparable with earlier findings of Walsangkar (2010) in ostrich. The highest per cent creamy white and thick consistency semen was observed during winter (97.36 and 90.73), followed by summer (94.91 and 85.22), southwest monsoon (81.35 and 72.66) and northeast monsoon (71.73 and 69.56) seasons, which indicates the influence of season on semen quality.

Significantly ( $P \leq 0.01$ ) higher mass activity score was observed in semen collected during summer (4.66) and winter (4.57) seasons than southwest (3.93) and northeast monsoon (3.85) seasons which

indicate the effect of season on mass activity. The mean per cent spermatozoa motility observed during winter (83.68) and summer (85.25) seasons were higher than southwest (74.83) and northeast monsoon (73.48) seasons, which is in agreement with the findings of Walsangkar (2010) in ostrich. Season had a highly significant ( $P \leq 0.01$ ) effect on concentration of spermatozoa. In this study, the spermatozoa concentration ( $\times 10^9/\text{ml}$ ) increased during northeast monsoon (2.57) and reached the peak during winter (3.20) season, then gradually declined during summer (2.88) and southwest monsoon seasons (2.27), which concurs with the findings of Walsangkar (2010) in ostrich.

Per cent live spermatozoa observed in this study was almost similar with the earlier findings of Walsangkar (2010) in ostrich, who have noticed a slight increase in livability from early to peak periods. The per cent abnormal spermatozoa were also influenced by season. The abnormal spermatozoa count showed a decreasing trend from winter (14.50) to summer (13.38), then increasing trend towards southwest (15.34) and northeast monsoon (18.35) seasons, which is in agreement with the findings of Walsangkar (2010) in ostrich.

The data observed in the current research support the influence of month on semen quality in ostrich, which may be due to differences in monthly temperature, length of day light or photoperiod and rainfall during different months, which are considered to be environmental causes that either entrain an endogenous rhythm or trigger the physiological changes.

Further, a raise and fall in quality attributes was noticed from winter and summer to southwest and northeast monsoon seasons for all the semen characteristics except abnormal spermatozoa suggesting that ostrich is predominantly a winter-summer breeding species in tropical climate.

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**Table 1. Effect of month on frequency of semen collection and semen characteristics (mean  $\pm$  SE) of ostrich**

Months (2015)	Frequency of semen collection (days)	Semen characteristics								
		Semen volume (ml)	pH	Mass activity score	Sperm motility (%)	Sperm concentration ( $\times 10^9$ /ml)	Live sperms (%)	Abnormal spermatozoa (%)		
								Head abnormality	Tail abnormality	Total abnormality
January (n=20)	17.66 $\pm$ 1.86	1.32 <sup>ab</sup> $\pm$ 0.16	7.20 $\pm$ 0.07	4.45 <sup>abc</sup> $\pm$ 0.15	82.00 <sup>abc</sup> $\pm$ 2.57	3.14 <sup>ab</sup> $\pm$ 0.16	86.87 <sup>abc</sup> $\pm$ 1.99	7.05 <sup>ab</sup> $\pm$ 0.48	7.96 <sup>ab</sup> $\pm$ 0.56	15.02 <sup>ab</sup> $\pm$ 0.98
February (n=18)	15.77 $\pm$ 2.75	1.08 <sup>b</sup> $\pm$ 0.11	7.14 $\pm$ 0.05	4.72 <sup>ab</sup> $\pm$ 0.13	85.56 <sup>ab</sup> $\pm$ 2.45	3.26 <sup>a</sup> $\pm$ 0.16	89.61 <sup>ab</sup> $\pm$ 2.17	6.15 <sup>ab</sup> $\pm$ 0.35	7.77 <sup>ab</sup> $\pm$ 0.61	13.92 <sup>ab</sup> $\pm$ 0.91
March (n=18)	15.95 $\pm$ 2.07	0.97 <sup>b</sup> $\pm$ 0.10	7.19 $\pm$ 0.06	4.77 <sup>a</sup> $\pm$ 0.10	87.22 <sup>a</sup> $\pm$ 1.29	2.83 <sup>abc</sup> $\pm$ 0.08	91.70 <sup>a</sup> $\pm$ 0.71	5.78 <sup>a</sup> $\pm$ 0.36	7.19 <sup>a</sup> $\pm$ 0.25	12.97 <sup>a</sup> $\pm$ 0.51
April (n=18)	16.68 $\pm$ 2.46	1.52 <sup>ab</sup> $\pm$ 0.18	7.17 $\pm$ 0.06	4.83 <sup>a</sup> $\pm$ 0.09	87.22 <sup>a</sup> $\pm$ 1.35	3.18 <sup>ab</sup> $\pm$ 0.08	92.00 <sup>a</sup> $\pm$ 0.86	5.70 <sup>a</sup> $\pm$ 0.22	7.01 <sup>a</sup> $\pm$ 0.36	12.71 <sup>a</sup> $\pm$ 0.48
May (n=23)	12.81 $\pm$ 3.64	1.46 <sup>ab</sup> $\pm$ 0.18	7.22 $\pm$ 0.07	4.43 <sup>abc</sup> $\pm$ 0.17	82.17 <sup>abc</sup> $\pm$ 2.88	2.68 <sup>abc</sup> $\pm$ 0.12	87.66 <sup>abc</sup> $\pm$ 2.45	6.43 <sup>ab</sup> $\pm$ 0.29	7.80 <sup>ab</sup> $\pm$ 0.48	14.23 <sup>ab</sup> $\pm$ 0.75
June (n=16)	19.60 $\pm$ 2.23	1.87 <sup>a</sup> $\pm$ 0.11	7.34 $\pm$ 0.11	4.12 <sup>abc</sup> $\pm$ 0.15	77.50 <sup>abcd</sup> $\pm$ 2.96	2.29 <sup>c</sup> $\pm$ 0.10	85.29 <sup>bc</sup> $\pm$ 2.77	6.43 <sup>ab</sup> $\pm$ 0.36	7.84 <sup>ab</sup> $\pm$ 0.48	14.18 <sup>ab</sup> $\pm$ 0.76
July (n=19)	15.58 $\pm$ 1.96	1.60 <sup>ab</sup> $\pm$ 0.09	7.32 $\pm$ 0.07	3.85 <sup>c</sup> $\pm$ 0.10	74.00 <sup>cd</sup> $\pm$ 2.45	2.19 <sup>c</sup> $\pm$ 0.08	83.13 <sup>abc</sup> $\pm$ 2.38	6.76 <sup>ab</sup> $\pm$ 0.43	7.91 <sup>ab</sup> $\pm$ 0.49	14.67 <sup>ab</sup> $\pm$ 0.90
August (n=11)	08.00 $\pm$ 3.46	1.30 <sup>ab</sup> $\pm$ 0.18	7.27 $\pm$ 0.14	3.81 <sup>c</sup> $\pm$ 0.18	73.31 <sup>cd</sup> $\pm$ 1.82	2.24 <sup>c</sup> $\pm$ 0.17	80.70 <sup>bc</sup> $\pm$ 1.58	8.44 <sup>bc</sup> $\pm$ 0.64	9.51 <sup>ab</sup> $\pm$ 0.91	17.95 <sup>bc</sup> $\pm$ 1.40
September (n=13)	20.50 $\pm$ 2.81	1.15 <sup>ab</sup> $\pm$ 0.20	7.46 $\pm$ 0.09	3.92 <sup>c</sup> $\pm$ 0.21	75.36 <sup>bcd</sup> $\pm$ 3.51	2.41 <sup>bc</sup> $\pm$ 0.25	81.23 <sup>bc</sup> $\pm$ 2.12	7.44 <sup>abc</sup> $\pm$ 0.66	8.14 <sup>ab</sup> $\pm$ 0.83	15.58 <sup>abc</sup> $\pm$ 1.39

October (n=11)	23.06 ± 2.60	1.18 <sup>ab</sup> ± 0.17	7.45 ± 0.08	3.72 <sup>c</sup> ± 0.19	74.09 <sup>cd</sup> ± 2.41	2.27 <sup>c</sup> ± 0.19	80.69 <sup>bc</sup> ± 1.81	7.66 <sup>abc</sup> ± 0.77	9.06 <sup>ab</sup> ± 0.72	16.73 <sup>abc</sup> ± 1.19
November (n=18)	18.95 ± 2.70	1.37 <sup>ab</sup> ± 0.21	7.42 ± 0.11	3.77 <sup>c</sup> ± 0.17	70.83 <sup>d</sup> ± 3.29	2.96 <sup>abc</sup> ± 0.31	80.67 <sup>bc</sup> ± 3.41	8.23 <sup>bc</sup> ± 0.58	9.59 <sup>ab</sup> ± 0.63	17.82 <sup>bc</sup> ± 1.15
December (n=17)	19.28 ± 2.51	1.58 <sup>ab</sup> ± 0.12	7.32 ± 0.07	4.00 <sup>bc</sup> ± 0.14	75.88 <sup>bcd</sup> ± 3.10	2.33 <sup>c</sup> ± 0.18	82.83 <sup>abc</sup> ± 2.28	9.43 <sup>c</sup> ± 0.73	10.53 <sup>b</sup> ± 0.80	19.96 <sup>c</sup> ± 1.39
<b>Overall mean (n=202)</b>	<b>17.36 ± 0.79</b>	<b>1.38 ± 0.05</b>	<b>7.28 ± 0.02</b>	<b>4.26 ± 0.04</b>	<b>79.21 ± 0.85</b>	<b>2.69 ± 0.05</b>	<b>85.71 ± 0.73</b>	<b>7.022 ± 0.16</b>	<b>8.27 ± 0.18</b>	<b>15.30 ± 0.31</b>
<b>F value</b>	1.797	2.536	1.753	7.246	6.451	6.801	4.299	5.578	3.284	4.833
<b>Significance</b>	NS	**	NS	**	**	**	**	**	**	**

n=No. of ejaculate/month; Means bearing different superscripts within the same column differ significantly; \*\*Highly significant ( $P \leq 0.01$ ); NS- Not significant.