Egypt. J. Anim. Prod., 17, No. 1, pp. 75-85 (1977)

Seasonal Variation in Estrous Activity in Ossimi and Rahmani Ewes

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THIS investigation was carried out on a total number of 29 Ossimi and 28 Rahmani ewes. These animals were made available from the sheep herd of this department. Ewes were divided, within each breed, with respect to their reproductive status into lambed ewes; ewes in their first week after lambing, and cyclic ewes; ewes lambed since a minimum period of six months. The purpose of the present work was to investigate seasonal variation of estrous activtity in the two tested breeds. Results obtained could be summerized in the following :

1) Ossimi and Rahmani ewes are polyestrous animals, nevertheless, they manifest seasonal fluctuation in estrous activity. Peak of activity was reached in summer and autumn. 2) Estrous activity was not associated with day length ($b = + 2.33 \pm 3.61$), however, it was related to ambient temperature ($b = + 1.64 \pm 0.71$). During the hottest seasons of the year, summer and autumn, estrous percentage was significantly ($P < 0.01$) higher than in other seasons. 3) Suckling was shown to be a powerful stimulus in delaying the first post-lambing estrous in Ossimi ewes (125.7 ± 20.0 days), but less effective in Rahmani ewes (62.6 ± 18.8 days). 4) Estrous duration was significantly ($P < 0.01$) longer in Rahmani (31.5 ± 1.7 hr) than in Ossimi (26.2 ± 1.9 hr). It was significantly ($P < 0.05$) shorter in winter and spring than in summer and autumn. 5) Average estrual cycle length for all tested ewes was 17.7 ± 0.3 days. Breed and season were without significant effect on the trait. 6) Average number of cycles displayed per ewe during the course of the study, which was very close to one year, was 11.4 ± 1.1 and 13.1 ± 0.4 cycles for Ossimi and Rahmani lambed ewes, respectively. In cyclic ewes, averages for the two respective breeds were 17.2 ± 0.8 and 17.2 ± 1.44 cycles. 7) Loss of time due to interruption of cyclicity accounted for 44.1% and 37.3% of the length of the observation period of Ossimi and Rahmani lambed ewes, respectively.

Evidence is rather strong implicating that both Ossimi and Rahmani ewes are polyestrous animals (Mounib *et at.*, 1956 and Labban and Ghali, 1969). Unclear, however, whether they manifest seasonal variation in their sexual activity or reproduce even the same all the year round. An answer for this particular problem will certainly help current efforts towards having three crops of lambs per two years, instead of the common practice of having only one annual cropper ewe. The purpose of the present research, therefore, was to study seasonal variation of estrous activity in two local breeds of sheep, Ossimi and Rahmani.

Material and Methods

Location of observations, animals and accommodation

This work was conducted at the Experimental Farm of this Department (Lat. 30° 03 North Long. 31° 15 East). Small Ossimi. (29 ewes) and Rahmani (28 ewes) flocks were used. The Ossimi flock comprised 19 recently lambed ewes and 10 cyclic ones. Number of lambed and cyclic ewes included in the Rahmani flock were 18 and 10, respectively. Animals were 3 to 6 years old when the experiment commenced in October 1975. At the time of heat detection, feeding and housing ewes were divided into two groups, unless otherwise they were pooled in one group. Two concrete semi-open sheds were used for accommodation. Their concrete floor was sprinkled with lime and covered with about 3 in. of rice straw which was changed, in the average, twice a week. No artificial light regime was practiced and ewes were subjected to the natural photoperiod.

Feeding and general husbandry

During winter and spring (December to July) ewes were allowed to graze Egyptian clover (*Trifolium alexandrinum*) for a period of about 6 hr a day. When green fodder was not available ewes grazed on the remains of different crops in neighbouring fields and were supplemented with co-op feed and wheat straw or rice straw. Summer grazing was practiced early in the morning and late in the after noon, thus to avoid high ambient temperatures of the mid-day. Animals were shorn twice a year in May and September. Lambs were allowed to suckle their dams for a period of four months. When young were lost during the suckling period, dams were either left without further nursing or used to subsidize their counterparts with multiple births.

Detection of heat

Two aproned rams, one for each group, were run with ewes 3 times a day at 8:00 a.m., 2:00 p.m. and 8:00 p.m. At each check, the ram was left to join tested ewes for a period of half an hour. Teaser rams were interchanged between the two experimental groups of ewes every month. Ewes were shown to be receptive to the ram by approach or contact were considered in heat. Ewes proved to be in estrus during a given heat check were temporarly separated apart from the flock till this particular heat check was over, therefore, they were allowed to re-join the flock. Post-partum ewes were checked for heat for the first time two weeks after lambing. Date of lambing was designated day 1. Mating was not allowed and heat was checked regularly every day for a period of about one year.

The interval between lambing and the first detected heat was referred to as post-lambing estrus interval (PLEI). Intervals between successive heats of not more than 26 days were known as estrual cycles. Cyclic ewes having intervals between successive heats of 27 to 37 days were assumed to have come

into silent heat, thus, they have double cycles with one hypothetical quiescent ovulation. Ewes failed to show estrus for a period of 38 to 57 days were considered to have triple cycles with two hypothetical ovulations intervening. Time loss attributed to silent heat (LSH) was obtained by deducing 17 days from intervals with assumed quiescent ovulation. Cyclic ewes that have not come into heat for a period of more than 57 days were considered to be in a state of long-term anestrus. Time loss due to anestrus (TLA) was obtained by subtracting 17 days from the length of each anestrus period. The sum of PLEI + LSH + TLA was referred to as total time loss. Number of ewes showing heat in a given month expressed as a percentage of the total ewes checked in this particular month was known as monthly estrus percentage (MEP).

Determination of estrus duration

Ewes were teased 6 times daily at equal intervals of 4 hr. This intensive heat checking was practiced for a total period of 4 months distributed on the four seasons of the year as follows : winter, February; spring, May; summer, August and autumn, November. The length of time between the check at which the ewe was first detected in heat and that after which no symptoms of estrus were further detected was calculated. Four hours were added to each calculated estimate to obtaine estrus duration.

Climatic data

Climatic data on ambient temperature, daylight hours and relative humidity were obtained from one of the stations belonging to the Egyptian Meteorological Administration. This station is about half a mile far from the experimental farm.

The year was arbitrarly divided into the four regular seasons : winter, December-February, spring, March - May; summer, June - August and autumn, September-November.

Statistical analysis

Chi-square test, ANOVA of unweighted means, sample regression coefficient and sample correlation coefficient were calculated according to Snedecor and Cochran (1967).

Results

Monthly estrus percentage

Monthly estrus percentage (MEP) for different breeds and seasons appeared in Table 1. Breed was without significant effect on the trait. Season, however, affected the trait significantly ($P<0.01$). The highest MEP values were recorded in summer and autumn and the lowest were that of winter and spring. As there was no breed effect on MEP, data were pooled (Table 2) for further statistical analysis. Sample regression coefficient of MEP on day length was not significant ($b = +2.33 \pm 3.61$). This signifies that MEP was not much associated with daylight hours. Meanwhile, it was related to ambient temperature ($b = +1.64 \pm 0.71$). The calculated value of b signifies that there was an average increase in MEP of 1.64 % 1° increase in ambient temperature. Regression of MEP on relative humidity was very low and statistically non-significant ($b = +0.60 \pm 0.73$).

TABLE 1. Seasonal variation in monthly estrus percentage (MEP) in Ossimi and Rahamani ewes

Season	Ossimi	Rahmani	Both breeds
	Mean (No.)	Mean (No.)	Mean (No.)
Winter	78.6 (56)	77.9 (68)	78.2[a] (124)
Spring	65.1 (63)	71.0 (76)	68.3[a] (139)
Summer	98.5 (65)	95.4 (65)	96.9[b] (130)
Autumn	93.3 (45)	95.4 (44)	94.4[b] (89)
All seasons	83.4[c] (229)	83.4[c] (253)	83.4 (482)

Means within the same column or within the same row having the same letter differ non-significanty from each other, otherwise they differ significantly at $P < 0.01$.

TABLE 2. Monthly variation in estrus percentage (MEP), pooled data of both tested breeds.

Month	MEP	Day length (hr)	Ambient temp. °C	Relative humidity
November . .	88.5 (26)	10.7	17.9	67.2
December . . .	88.9 (36)	10.2	14.0	69.1
January	81.4 (43)	10.5	12.1	64.7
February. . . .	66.7 (45)	11.1	14.3	59.2
March	45.4 (44)	12.0	16.9	57.1
April	75.5 (45)	12.9	21.2	51.3
May.	82.0 (50)	13.7	23.8	48.2
June.	95.2 (42)	14.0	26.4	50.5
July	95.4 (44)	13.9	27.9	59.6
August	100.0 (44)	13.1	27.2	63.2
September . .	95.5 (45)	12.3	26.4	62.0
October	100.0 (18)	11.4	24.1	65.5
Overall mean . .	83.4 (482)	12.1	21.0	59.5

Number of ewes is given in parenthesis.

Estrus duration, post-lambing estrus interval and estrous cycle length

Data on estrus duration are shown in Table 3. ANOVA of unweighted cell means indicated that breed ($P<0.01$) and season ($P<0.05$) exerted a significant effect on the trait. Average estrus duration in Rahmani ewes was 5.3 hr longer than in Ossimi ewes. In summr and autumn, estrus duration was longer than in winter and spring. The overall average duration of estrus was 28.9 ± 2.6 hr.

For both combined breeds, the first post-lambing heat was manifested after an average interval of 94.2 ± 28.0 days (Table 4). Rahmani ewes came into heat after a significantly ($P<0.05$) shorter post-lambing interval (62.6 ± 18.8 days) than did their Ossimi counterparts (125.7 ± 20.0 days). Age of dam at lambing was without significant effect on this reproductive parameter.

The overall mean of estrual cycle length was 17.7 ± 0.3 days (Table 5). Cycle length was being affected non-significantly by breed and season. The modal length was 18.0 days and the range was between 12.0 and 187.0 days. The variation around the mean was very small as 79.1% of cycles fell within the length of 17 to 20days (Table 6). Short cycles of less than 17 days in length accounted for 9.1% of the total. Percentage of cycles longer than 20 days was obviously low (11.7 %).

Average number of cycles displayed per ewe during the course of the study; which was very close to one year (355.1 days for Ossimi and 351.4 days for Rahmani); differed according to the reproductive status of the animal when trials were intiated. For lambed ewes, the average was 11.4 ± 1.1 cycles in Ossimi versus 13.1 ± 0.4 cycles for Rahmani. For cyclic ewes, averages for the two respective breeds were 17.2 ± 0.8 and 17.2 ± 1.44 cycles.

Total time loss

As shown in Table 7, average total time loss per lambed ewe was 156.6 ± 20.3 days for Ossimi and 131.2 ± 15.7 days. Difference between means was not statistically significant. Total time loss accounted for 44.1%, in Ossimi, and 37.3%, in Rahmani, of the total length of the observation period (about one year). In Ossimi ewes, a considerable amount of total time loss was due to post-lambing anesturs (123.2 days). Sample regression coefficient of total time loss on post-lambing anestrus ($b = + 0.7283 \pm 0.0554$) did show that there was an average increase of 0.73 day per each day increase in post-lambing anestrus interval. Loss of time due to delayed manifestation of post-lambing estrus in Rahmani ewes averaged 63.9 days. In this breed, regression of total time loss on post-lambing anestrus was not significant ($b = + 0.7095 \pm 0.3617$). Other sources leading to the interruption of reproductive cyclicity; silent heat and long-term anesturs, became rather important (Table 7).

TABLE 3. **Seasonal effects on estrus duration (hr) in Ossimi and Rahmani ewes.**

Season	Ossimi	Rahmani	Both breeds
	Mean ± S.E.	Mean ± S.E.	Mean± S.E
Winter	19.5 ± 1.8 (9)	31.1 ± 4.5 (9)	25.3 ± 1.5[a] (18)
Spring	26.0 ± 3.0 (9)	27.5 ± 2.3 (15)	26.7 ± 1.4[a] (24)
Summer	31.4 ± 1.7 (16)	32.9 ± 2.0 (21)	32.1 ± 1.1[b] (37)
Autumn	27.7 ± 1.8 (16)	34.8 ± 1.6 (21)	31.3 ± 1.1[b] (37)
All seasons	26.2 ± 1.9[c] (50)	31.5 ± 1.7[d] (66)	28.9 ± 2.6 (116)

Number of periods studied is given in parenthesis.

Means within the column or within the row having the same letter differ non-significantly from each other, otherwise they differ significantly at $P < 0.01$ for breed effect and at $P < 0.05$ for season effect.

TABLE 4. **Breed and age effect on post-lambing estrus interval length (day).**

Age group (year)	Ossimi	Rahmani	Both breeds
	Mean ± S.E.	Mean ± S.E.	Mean ± S.E.
Less than 4	105.8 ± 30.1 (9)	65.8 ± 15.5 (10)	85.8 ± 18.2[a] (19)
4 or more	145.7 ± 43.7 (7)	59.4 ± 8.5 (8)	102.5 ± 20.5[a] (15)
All age groups	125.7 ∓ 20.0[b] (16)	62.6 ± 18.8[c] (18)	94.2 ± 28.0 (34)

Number of ewes is given in parenthesis.

Means within the column or the row having the same letter differ non-significantly from each other, otherwise they differ significantly at $P < 0.05$.

TABLE 5. **Seasonal influence on the estrual cycle length (day) of Ossimi and Rahmani ewes.**

Season	Ossimi	Rahmani	Both breeds
	Mean ± S.E.	Mean ± S.E.	Mean ± S.E.
Winter	18.3 ± 0.2 (38)	17.6 ± 0.4 (53)	17.9 ± 0.1[a] (91)
Spring	17.4 ± 0.3 (51)	17.3 ± 0.3 (54)	17.4 ± 0.1[a] (105)
Summer	18.2 ± 0.2 (91)	17.6 ± 0.1 (99)	17.9 ± 0.1[a] (190)
Autumn	17.9 ± 0.3 (33)	17.3 ± 0.1 (37)	17.6 ± 0.1[a] (70)
All seasons	17.9 ± 0.2[b] (213)	17.4 0. ±2[b] (243)	17.7 ± 0.3 (456)

Number of cycles studied is given in parenthesis.

Means within the column or within the row having the same letter differ non-significantly from each other.

Cycles of more than 26 days in length or those occurring at two consecutive seasons were excluded.

TABLE 6. **Frequency distribution of estrous cycle length.**

Class interval (days)	Ossimi		Rahmani		Both breeds	
	No.	%	No.	%	No.	%
12 or less	3	1.2	5	1.8	8	1.5
13 — 16.	13	5.3	27	9.8	40	7.6
17 — 20.	202	81.8	210	76.6	412	79.1
21 — 24.	5	2·0	4	1.5	9	1.7
25 — 28.	4	1.6	1	0.4	5	1.0
29 or more	20	8.1	27	9.8	47	9.0

TABLE 7. **Time loss per lambed ewe (day).**

Source of time loss	Ossimi	Rahmani
Anestrus due to silent heat	10.7	22.5
Long-term anestrus	22.6	44.9
Lactation anestrus	123.5	63.9
Total time loss	156.6	131.2
Observation period length	355.1	351.4
Percentage of time loss	44.1	37.3

Figures of this table were calculated using complete records of lambed ewes.

Discussion

Breeding season

Results of Tables 1 and 2 clearly show that Ossimi and Rahmani ewes are polyestrous sheep. They can be bred any time of the year, nevertheless, they manifest seasonal variation in monthly estrus percentage (MEP). Maximum sexual activity was achieved in summer and autumn. These are the seasons of the longest day length, the highest ambient temperature and less

availability of feed particularly green fodder. Eventhough, the general practice in this country is to breed sheep during summer months in order to have one lamb crop a year in autumn. The lambing season is conceded with favourable climate and adequancy of diet. Still questionable, however, is the effect of high ambient temperature of the mating season on subsequent embryo survival rate. Several sheep investigaters (Yeates, 1953; Dutt *et al.*, 1959; Alliston *et al.*, 1961; Woody *et al.*, 1962 and Thwaites, 1967) established that elevated temperature early in pregnancy could cause embryonic mortality, mortality reaching 100% in some experiments with heat stressed ewes.

Data reported here give evidence that both tested breeds do not sexually react to light as do sheep of British origin (Marshall, 1937; Sykes and Cole, 1944; Yeates, 1949 and Hafez, 1952). This conclusion was indicated by the non-significant coefficient regression of monthly estrus percentage on day length. In this respect, Ossimi and Rahmani sheep are similar to breeds of sheep raised in tropics. It is claimed that under tropical conditions, where day length is kept almost constant at about 12 hr and 30 min, sexual activity in sheep is not photoperiodically regulated, in the same manner characteristic of other breeds living under conditions of seasonal daylight changes (Hafez, 1952). It should be mentioned that seasonal variation in daylight hours in this country is very small, the difference between the longest and the shortest day length is about 3.8 hr.

Ambient temperature, rather than day length, was shown to be the electromagnetic stimulus associated with seasonal reproductive rhythms in Ossimi and Rahmani sheep. The regression of monthly estrus percentage on ambient temperature is significant at $P<0.05$. Difference between average ambient temperature of the hottest day and the coldest day is about 15.8°. Thus, an exteroceptive stimulus monitoring reproductive cyclicity of sheep in one locality, when becoming almost constant in another locality, members of the species do not respond to it, as usual as when it is variable. They shift to react to the most changeable stimulus in their environment to maintain their seasonal reproductive periodicity. Possibly for this reason Clegg *et al.* (1964) observed a cyclical pattern of increasing and decreasing sexual activity in Hamphsire ewes, in spite of the fact they were kept for three years under a constant light-dark duration. Lack of the effect of blinding upon seasonal changes in estrus activity in sheep (Clegg *et al.*, 1964) is a further evidence supporting the present theory.

Estrus and post-lambing estrus interval

Estrus length reported here for Ossimi and Rahmani ewes fell within the range of means reviewed by Hafez (1952) for several domesticated breeds of sheep, kept in different localities. In the average, estrus was significantly ($P<0.01$) longer in Rahmani than in Ossimi (Table 3). Seasonal variation in the length of estrus was obvious in Ossimi rather in Rahmani. Estrus was long in seasons with high sexual activity (summer and autumn) than in other seasons of the year (Table 3). These trends on estrus duration, however, should be confirmed by using a comparatively larger data.

Suckling appeared to be a powerful stimulus in delaying post-lambing estrus in Ossimi ewes (Table 4). Essentilally, 43.8% of them did not come into heat while suckling. Post-lambing ovarian activity in Rahmani ewes was less affected by the same stimulus of the same duration. The vast majority of ewes (94.1%) exhibited estrus during the nursing period. Thus, the two breeds under the same environment behaved differently.

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التغيرات الموسمية فى النشاط الشبقى للنعاج الاوسيمى والرحمانى .

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أن الغرض من هذا البحث هو دراسة التغيرات الموسمية فى النشاط الشبقى للنعاج الأوسيمى والرحمانى واستعمل لذلك قطيع صغير من الأغنام ضم ٢٩ نعجة أوسيمى (١٩نعجة حديثة الوضع ، ١٠ نعاج مضى على ولادتها أكثر من ستة شهور) ، كما اشتمل على ٢٨ نعجة رحمانى (١٨ نعجة حديثة الوضع ، ١٠ نعاج وضعت منذ أكثر من ستة شهور) . كانت تختبر النعاج المسلوك الشبقى ثلاث مرات يوميا بانتظام ولمدة تقرب من السنة تركت خلالها النعاج بدون تلقيح .

تتلخص النتائج المتحصل عليها فى الآتى :

النعاج الأوسيمى والرحمانى هى حيوانات عديدة ، دورة الشبق يمكن تلقيحها فى أى وقت من السنة ، الا أنها أظهرت تفاوتا معنويا فى نشاطها الشبقى . فكان عاليا خلال الصيف (٩٨ر٥٪) والخريف (٩٣ر٣٪) ومنخفضا نسبيا فى الشتاء (٧٨ر٦٪) والربيع (٦٥ر١٪) .

لا توجد علاقة معنوية بين النشاط الشبقى وطول النهار الضوئى واتضح أن النشاط الشبقى مرتبطا ارتباطا له دلالة احصائية مع درجة حرارة الجو ، فكان عاليا حينما تكون درجة الحرارة عالية وانخفض فى المواسم ذات درجة الحرارة الجوية المنخفضة .

كان للرضاعة تأثير مثبط على النشاط الشبقى فى الأغنام الأوسيمى التى أظهرت الشبق الأول بعد الوضع بفترة قدرها ١٢٥ر٧ ± ٢٠ر يوما. وكان تأثير الرضاعة أقل وضوحا على حدوث الشبق الأول بعد الوضع فى النعاج الرحمانى (٦٢ر٦ ± ١٨ر٨ يوما) .

متوسط طول دور الشبق فى الاغنام الأوسيمى هو ٢٦ر٢ ± ١ر٩ ساعة . وفى الأغنام الرحمانى كان الدورة ٣١ر٥ ± ١ر٧ ساعة . كان متوسط طول الدورة فى الصيف والخريف أطول منه فى الشتاء والربيع .

متوسط طول دورة الشبق للقطيع التجريبى هو ١٧ر٦ ± ١ر يوما. وكان لنوع النعاج وفصل السنة تأثير غير معنوى على طول هذه الصفة .

كانت نسبة دورات الشبق التى يتراوح طولها من ١٧ الى ٢٠ يوما هـو ٨ر٨١٪ من دورات الشبق التى أظهرتها النعاج الأوسيمى مقابل ٦ر٧٦٪ للنعاج الرحمانى .

توقف السلوك الشبقى للنعاج الأوسيمى خلال مدة خمسة شهورتمثل ار٤٤٪ من طول فترة الدراسة (حوالى عام) . وكانت أسباب التوقف ترجع بالدرجة لأولى الى غياب الشبق الاول بعد الوضع . أما فى النعاج الرحمانى فبلغ مجموع فترة التوقف حـوالى أربعة شهور تمثـل حـوالى ٣ر٣٧ من طول فترة الملاحظة . وترجع أسباب التوقف الى عدة عوامل ترتب حسب أهميتها كالتالى : غياب النشاط الشبقى بعد الوضع ، الهدوء الجنسى الطويل والتبويض الصامت .