

BREEDING SEASONALITY OF DAMASCUS GOATS UNDER EGYPTIAN CONDITIONS

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ABSTRACT: *This study was carried out on a Damascus goats flock raised under Egyptian conditions in El-Rahib farm which belonging to Animal Production Department, Faculty of Agriculture, Menoufia University, Shebin El-Kom, Egypt. The study in Damascus goats started from August 2010 to June 2014 to determine breeding seasonality through analyzing serum progesterone concentration and recording behavioral observations. The overall means of estrous cycle (EC) length was 20.43 ± 2.54 days and ranged from 13 to 26 days. The effect of body weight and parities on EC were significant ($p < 0.05$), while season and year of mating didn't had any significant effect on estrous cycle. Sixty-one percentages, 22 and 17 % of total estrous occurred in autumn, summer and winter, respectively. Mating season affected serum progesterone level of does ($p < 0.01$). Mean $\pm$ SD of serum progesterone concentrations was higher in autumn than in spring (3.35 ± 1.70 ng/ml vs. 20 ± 0.20 ng/ml). A total number of 45 estrous occurred in does during breeding season were detected using serum progesterone analysis. Teaser buck detected only about 80% of estrous activities observed by analyzing serum progesterone concentrations. Finally, it can be concluded that the breeding seasons in Damascus goats under Egyptian extensive production system were concentrated in summer, autumn and winter while it doesn't appear in spring months.*

Key words: *Damascus Goats, progesterone, Estrous cycle, extensive production, breeding season.*

INTRODUCTION

Goats and sheep are seasonal breeding species; at northern latitudes, they exhibit sexual activity during the fall of the year when light to dark ratios are decreasing (Cheminau *et al.*, 1992 and Delgadillo *et al.*, 2004). The Damascus goat is considered a seasonal breeder. The breeding season starts in late August and extends through mid-December (Mavrogenis, 1988).

Progesterone concentrations are used to monitor the luteal function, estrous cycle, and seasonality of reproduction, which reflect the development and regression of corpus luteum (Błaszczuk, *et al* 2000). This information is required in order to increase reproductive efficiencies (Jainudeen *et al.*, 2000). There is no available information on peripheral plasma progesterone concentration in relation to expression of behavioural estrus symptoms in goats. Photoperiod is the primary environmental factor controlling seasonal reproduction not only in sheep and goats but also in many

other mammalian species (Turek and Campbell, 1979). The present studies was, undertaken to measure peripheral progesterone concentrations during estrous cycle and study its relation occurrence of overt or silent estrus and determine the breeding seasonality in Damascus goats under Egyptian condition through estimation of serum progesterone level and breeding behavioral observations.

MATERIALS AND METHODS

1. Animals and management:

This study was carried out on a total number of 87 Damascus does raised under Egyptian conditions in El-Rahib farm of Animal Production Department, Faculty of Agriculture, Menoufia University, Shebin El-Kom, Egypt. Does age ranged from 2 to 8 years (1st-7th parities) with an average body weight of 44.85 kg at mating. The data were collected during the period between August 2010 to June 2014 and managed under extensive conditions (El Kaschab, 2010). Does were fed concentrate mixture (14%

crude protein), green fodder and roughage which was supplemented according to their requirements (NRC, 2007). Concentrate mixture was given once a day at 08:30 am, where roughage was offered two times at 09:00 am and at 16:30 pm.

First experiment:

Estrus behavior was observed twice a day (8:00 a.m. and 4:00 p.m.) using visual observation and a teaser buck. Does were considered in heat when they full standing to be mounted by the Buck. Estrus was checked daily

Second experiment :

A total number of 706 blood samples (5 ml) were collected from five does throughout one year starting on 1st June 2011 till 30th May 2012. Does were 2-7 years old with an average body weight of 43 kg in different parities (1st to 5th). Estrus behavioral activities were observed twice daily (8:00 a.m. and 4:00 p.m.) using teaser buck. Following the onset of first heat blood samples were collected daily during estrus cycle for one time using syringe without anticoagulant. Thereafter, blood samples were collected at 10 am every 3 days until complete experimental period. Blood samples were centrifuged within 1 h of collection at approximately 3000 rpm for 20 min. Blood serum were preserved in eppendorf tube (3 ml) and kept under -20 °C until hormonal analysis. Progesterone concentration (SPC) was estimated in serum by Eliza technique using the coated tube progesterone Elisa Kit (DRG Germany) which is a solid phase enzyme-linked Immunosorbent assay (ELIZA), the assay was carried out by ELIZA Reader (ELX 800 at Hospital of Minufiya University.

Day-length; was calculated (sunrise-sunset) throughout one year starting from 1 June 2011 till 30 May 2012 in Menoufia province.

Statistical analysis:

The obtained data of were analyzed using SPSS computer program (Statistical

Package for Social Science) version 11, (2001).

RESULTS AND DISCUSSION

1. Estrous cycle (EC):

The overall mean of estrous cycle (EC) length in Damascus goats studied was 20.43 ± 2.54 days and ranged from 13 to 26 days (Table, 1). These findings are in agreement those of Talebi *et al.*, (2011) who working on Angora goat and found that the average of estrous cycle was 20.3 days. However, it was longer than those reported by many workers in different goat breeds at different countries. Akusu and Ajala (2000); Khanum *et al.* (2008) and Hassan *et al.*, (2010) found that EC were ranged from 18.2 to 18.8 days.

On the other hand, the obtained result of the EC length was lower than that observed by many workers on Damascus goats in different countries. Zarkawi and Soukouti, (2001) and Teleb *et al* (2003) indicated that EC length was ranged from 21.1 to 21.3 days. Variations among different estimates of EC may be due to different management systems, breeds, nutrition, and environment.

Furthermore the effects of doe body weight and parities on EC were significant ($p < 0.05$), while season and year of mating didn't had any significant effect on estrous cycle length (Table 1). In this concern, Least square mean of EC was longer (21.12 ± 2.26 days) for heavy body weight does than those with significant difference medium body weight (19.26 ± 2.6 days) without.

The present study showed that EC was 20.68, 20.30 and 20.60 days for does mated in summer, autumn and winter, respectively. Also, LSM of estrous cycle were 20.47, 20.50 and 20, 12 days for does mated in year 2010, 2011 and 2012, respectively. All interactions among factors on estrous cycle were non-significant (Table 1). However, does in the 1st parity had significantly shorter estrous cycle (18.35 ± 2.37 days) than does in the other parities.

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Table (1): Least squares means $\pm$ Standard deviation (SD) for estrus Cycle (EC) in Damascus does.

Factors studied	No. of records	EC (days) $\bar{X} \pm SD$
Overall mean	94	20.43 $\pm$ 2.54
<u>Body weight (kg)</u> <u>Sig.</u>		*
Medium weight (29-39 kg)	35	19.26 $\pm$ 2.60 ^a
Heavy weight ($\geq$ 39 kg)	59	21.12 $\pm$ 2.26 ^b
<u>Parities</u> <u>Sig.</u>		*
First	20	18.35 $\pm$ 2.37 ^a
Second	11	20.00 $\pm$ 2.45 ^b
Third / fourth	29	20.86 $\pm$ 2.46 ^{ab}
$\geq$ fifth	34	21.41 $\pm$ 2.05 ^b
<u>Season of mating</u> <u>Sig</u>		NS
Summer	19	20.68 $\pm$ 2.39
Autumn	60	20.3 $\pm$ 2.4
winter	15	20.6 $\pm$ 2.38
<u>Year of mating</u> <u>Sig</u>		NS
2010	19	20.47 $\pm$ 2.87
2011	58	20.50 $\pm$ 2.51
2012	17	20.12 $\pm$ 2.37

NS = Not significant

*= significant ($p < 0.05$)

2. Distribution of estrous activities through

Fig. (1) Illustrates a number of 141 observations of estrous activities distributed through three years.

It is obvious that estrous activities were observed for the first time in summer (July),

then increased gradually until reached the peak in autumn (October), thereafter declined during winter months (February) with a number of 6, 33 and 4 activities, respectively. However no observations for estrous activities were observed during spring months.

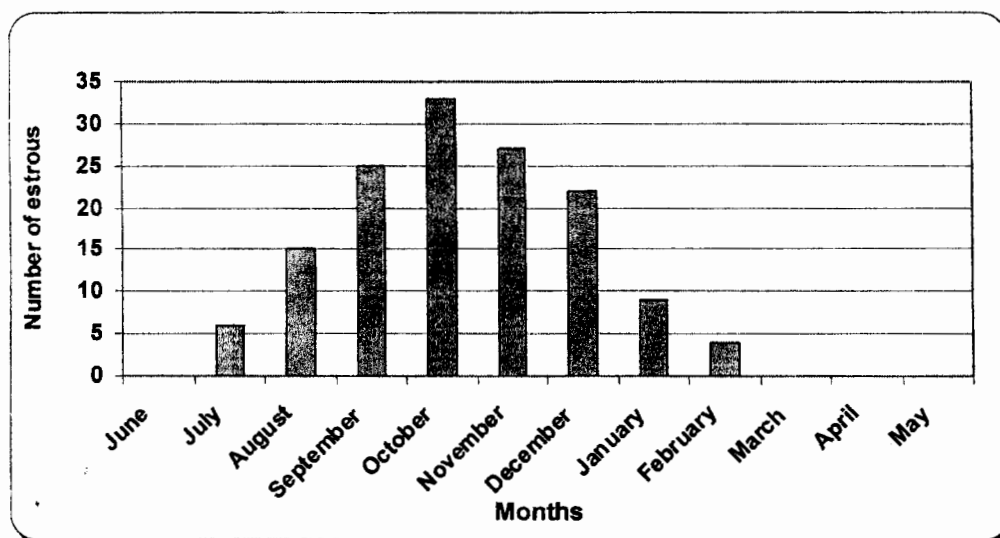


Fig. (1): Distribution of estrous activities through months of the year.

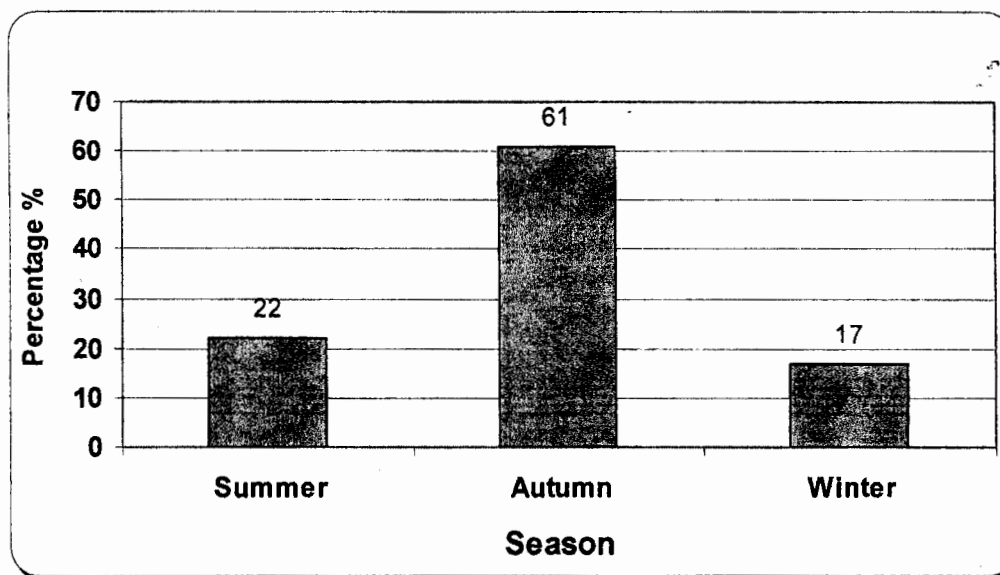


Fig. (2): Seasonality of estrous activities (in %).

The results showed that estrous percentage was the highest incidence in autumn which was 61% of total estrous while it was the lowest in winter (17%) Fig. (2). This result is in agreement with those reported by Mahmoud (2010) who working on Damascus goats and showed that estrous activity occur in autumn and winter and not in spring and early summer.

On the other hand, these results were not completely consisted publications of

Damascus goats in different countries. Papachristoforou *et al* (2000) observed that reproductive cycles started in the second half of September and continued until the end of March. El-Shafie (1997) found that in winter season both Baladi and Damascus goats showed no estrous behavioral symptoms. AlKhouri (1996) observed that the estrous activity exhibit a short breeding season (August–October) and sometimes long one (July–November) and rarely

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demonstrating estrus during winter (December and January).

3. Progesterone concentration (SPC) during estrous cycle period

Table (2) and Fig. (3) illustrated the average of serum progesterone concentrations SPC distribution during normal estrous period. The serum progesterone concentrations during estrous

cycle in Damascus goats begin to increase from the mean basal value of 0.53 ± 0.11 ng/ml on the first day to 3.65 ± 0.98 ng/ml on 7th day of estrous cycle and reach the peak value of 6.81 ± 0.56 ng/ml on 14th day. From 15th day, a decline was observed in SPC values until the end of the cycle when it reached 0.99 ± 0.62 ng/ml (day 21). At the end day of the estrous cycle 22th, SPC reached a value of 0.57 ± 0.10 ng/ml which suggests beginning of new cycle.

Table (2): Means $\pm$ SD of serum progesterone concentration (SPC) during estrous period.

Days of Estrous	SPC $\bar{X} \pm SD$ ng/ml	Days of Estrous	SPC $\bar{X} \pm SD$ ng/ml
1	0.53 ± 0.11	12	6.62 ± 0.69
2	0.94 ± 0.33	13	6.45 ± 0.75
3	1.32 ± 0.37	14	6.81 ± 0.56
4	1.86 ± 0.50	15	6.22 ± 0.49
5	2.59 ± 0.86	16	5.15 ± 1.15
6	2.99 ± 1.07	17	3.64 ± 1.31
7	3.65 ± 0.98	18	2.93 ± 1.27
8	4.39 ± 0.75	19	2.02 ± 0.88
9	5.21 ± 1.04	20	1.57 ± 0.66
10	5.50 ± 0.86	21	0.99 ± 0.62
11	6.08 ± 0.55	22	0.57 ± 0.10

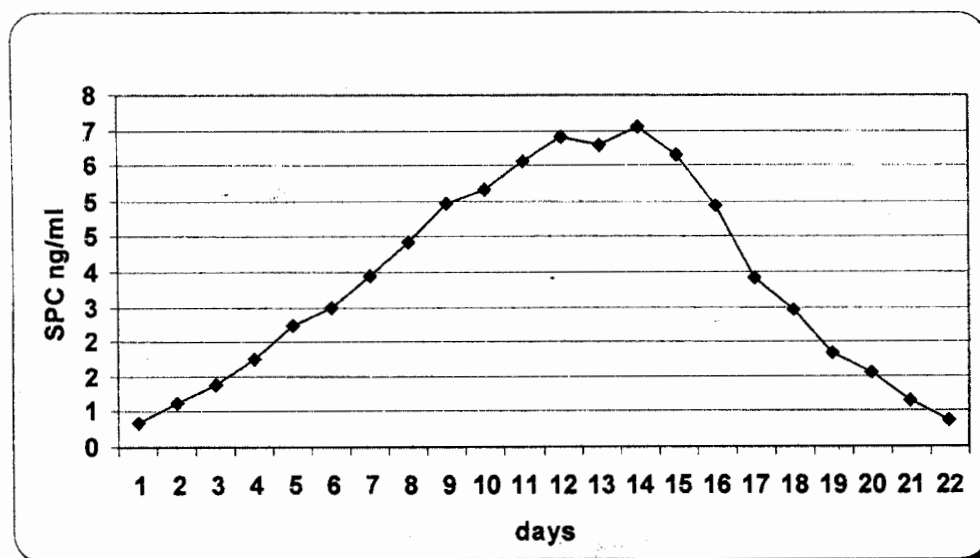


Fig. (3): Distribution of SPC during normal estrous period.

The obtained was similar to those reported by many researchers on Damascus goats. Teleb *et al.* (2003); Anas *et al.* (2010) indicated that means of SPC in Damascus does during normal estrous cycles was < 1.0 ng/ml on 0 day of estrus, then it rose gradually until reached > 1.0 ng/ml by 8 days of estrus, while the peak level occurred (5.86 ± 1.73 ng/ml) on day 16 of the cycle.

However Talebi *et al.* (2011) who working on Iranian Angora, observed that the progesterone serum concentrations during estrous cycle started to increase from the mean basal value of 0.5 ± 0.03 ng /ml on day 0 to 6.88 ± 0.95 ng /ml on day 6 of estrous cycle and reached the peak value of 12.8 ± 0.61 ng/ ml on day 12. From day 15, a decline was observed in SPC values until the end of the cycle.

In the present study SPC ranged from (0.53 to 0.57ng/ml) in first day of estrous. This is in agreement with many researchers in different goat breeds in different countries. Bhattacharyya *et al.*(1993) and Nandy *et al.*(2001) indicated that average of SPC were ranged from value 0.55 to 0.59 ng/ml on first day of estrous.

Average of peak SPC was 6.81 ± 0.56 ng/ml on 14th day of the estrous cycle. This result was lower than those observed by many workers in different goat breeds. Khanum *et al* (2008) and Talebi *et al.* (2011) reported that SPC ranged from 7.7 to 12.8 ng/ml on 14th day of the cycles. On the other hand, this result was higher than findings of Anas *et al.* (2010) who working in Damascus goats and found that average of peak SPC was 5.86 ± 1.73 ng/ml on 16th day of the cycle.

Variations among the different estimates of progesterone concentration during

estrous may be due to different environmental conditions, particularly in terms of climatic temperatures and the day/night relationships (Photoperiod). In addition to, the numbers of does studied, management systems and breeds could be playing for these variations.

4. The relationship between behavioral aspects Buck teaser and Progesterone level

As well known Progesterone concentrations (SPC) were used to monitor the luteal function, estrous cycle, and seasonality of reproduction, where they reflect the development and regression of the corpus luteum (Błaszczuk *et al* 2000). So, SPC can be used to predict ovulation and detect estrus, (Błaszczuk *et al.* 2004 and Proserpi *et al.*, 2006) as well as to diagnose follicular cysts (Medan *et al.* 2004).

It is obvious from (Fig 4) that the anoestrus period exhibit in Damascus goats during spring was indicated by very low level of SPC. Thereafter SPC followed by a sharp increase in late summer (August month) with a peak of reproductive activities (estrous, ovarian activity and levels SPC concentration) on autumn continues to late winter.

To study the relationship between mating season and serum progesterone concentration 706 blood samples were analyzed in Damascus goats (Table 3). Means $\pm$ SD of SPC was significantly higher ($p < 0.01$) in autumn (3.35 ± 1.70 ng/ml) while it reached the lowest level in spring (1.20 ± 0.20 ng/ml). The differences between winter and summer were not significant, while they were significant ($p < 0.01$) among spring, autumn and both of winter and summer.

Table (3): Seasonal effect on serum progesterone concentrations.

Season	Number of blood samples	Minimum value ng/ml	Maximum value ng/ml	$\pm$ SD $\bar{X}$	Sig
Winter	144	1.30	4.61	2.29 ± 0.82^b	**
Spring	163	0.81	1.72	1.20 ± 0.20^c	
Summer	200	0.38	7.18	2.52 ± 1.89^b	
Autumn	199	0.30	7.12	3.35 ± 1.70^a	

**= significant ($p < 0.01$)

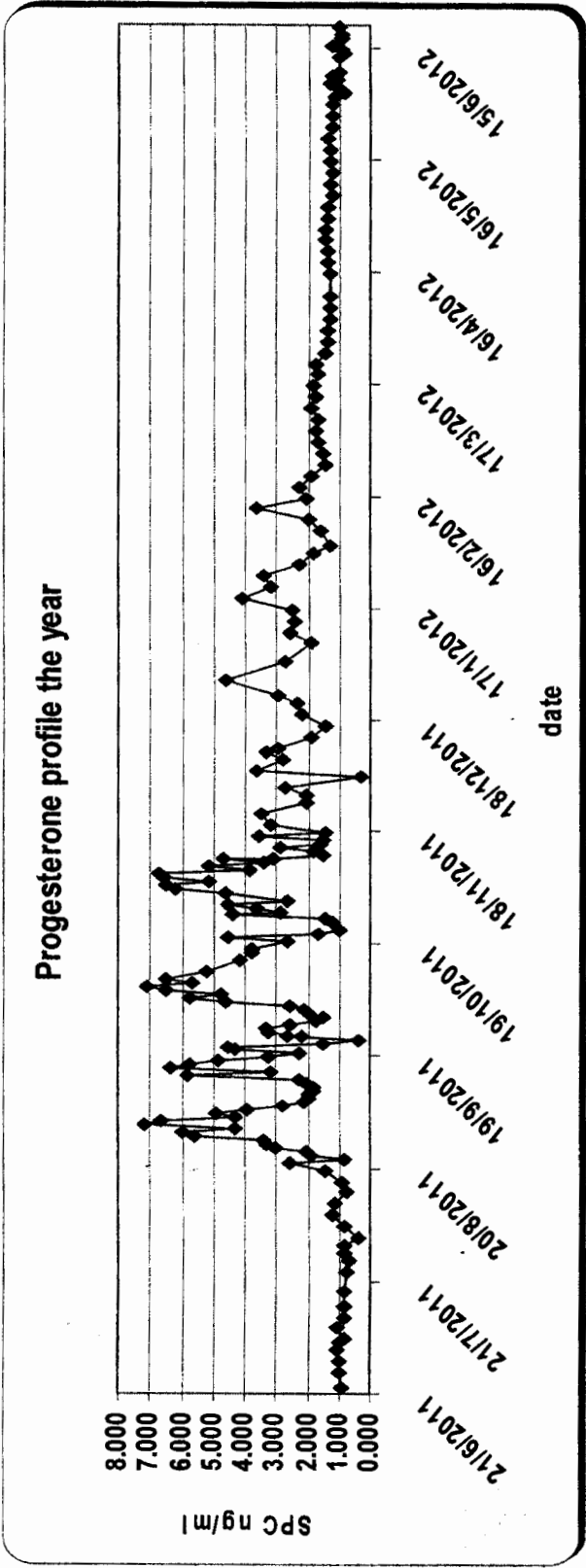


Fig. (4): Distribution of serum progesterone in Damascus goats through months of the year.

The average of serum progesterone profile of does during summer months the year was demonstrated in Fig. (6) and Table (4).

In June and July low level of SPC was observed (0.99 ± 0.13 ng/ml and 0.86 ± 0.11 ng/ml, respectively. In parallel process, teaser buck didn't detect any estrous activities in does in this period which could be due to ovarian inactivity.

In September, average of SPC was 3.04 ± 1.47 ng/ml and ranged between 0.35 to 6.33 ng/ml. On the other hand four estrous observed in does with teaser buck which agreed with serum progesterone levels. In summer, about 20% of total estrous (45) was observed when estrous in summer months. This result is similar with those observed by Mahmoud (2010) who indicated that the estrous activity in Damascus does occurred in autumn and winter and didn't occur in spring and early summer. On the other hand, this result disagrees with those reported by Papachristoforou *et al* (2000) who showed that reproductive cycles in adult Damascus goats started in the second half of September and continued until the end of March. Zarkawi and Al-Masri (2002)

found that the anoestrus period exhibit in Damascus goats during August which was also indicated by very low concentrations of progesterone. Fig (7) and Table (4) illustrated the average SPC during autumn months in does. Twenty-four estrous activities were observed in does with teaser buck which correspond to serum progesterone analysis.

The average of SPC in does was 3.91 ± 1.16 ng/ml in October, 3.58 ± 1.18 ng/ml in November and 2.59 ± 1.51 ng/ml in December months (Table 4). About 53.3% of total estrous activities (45) were observed in autumn months. It was obvious that sexual activity increased in autumn, with decreasing day-length Fig (5). This was confirmed by the hypothesis of Mavrogenis (1988), Papachristoforou *et al* (2000) and Zarkawi and Al-Masri (2002) who working on Damascus goats and found that sexual activity increased with beginning September. Also, Greyling (2000), Misztal *et al.* (2002) and Delgadillo *et al* (2004) working on different breeds of goats concluded that the breeding season starts in September when day length is declining.

Table (4): Means $\pm$ SD of serum progesterone concentrations during months of the year.

Month	Number of blood samples	SPC ng/ ml $\bar{X} \pm SD$	Minimum	Maximum
January	46	2.68 ± 0.69	1.84	4.08
February	45	1.96 ± 0.69	1.30	3.60
March	55	1.64 ± 0.17	1.36	1.87
April	45	1.34 ± 0.05	1.25	1.41
May	50	1.26 ± 0.05	1.22	1.34
June	63	0.99 ± 0.13	0.81	1.25
July	55	0.86 ± 0.11	0.71	1.03
August	70	2.81 ± 1.15	0.38	7.8
September	87	3.04 ± 1.47	0.35	6.33
October	71	3.91 ± 1.16	0.99	7.12
November	66	3.58 ± 1.18	1.41	6.75
December	50	2.59 ± 1.51	0.30	4.61

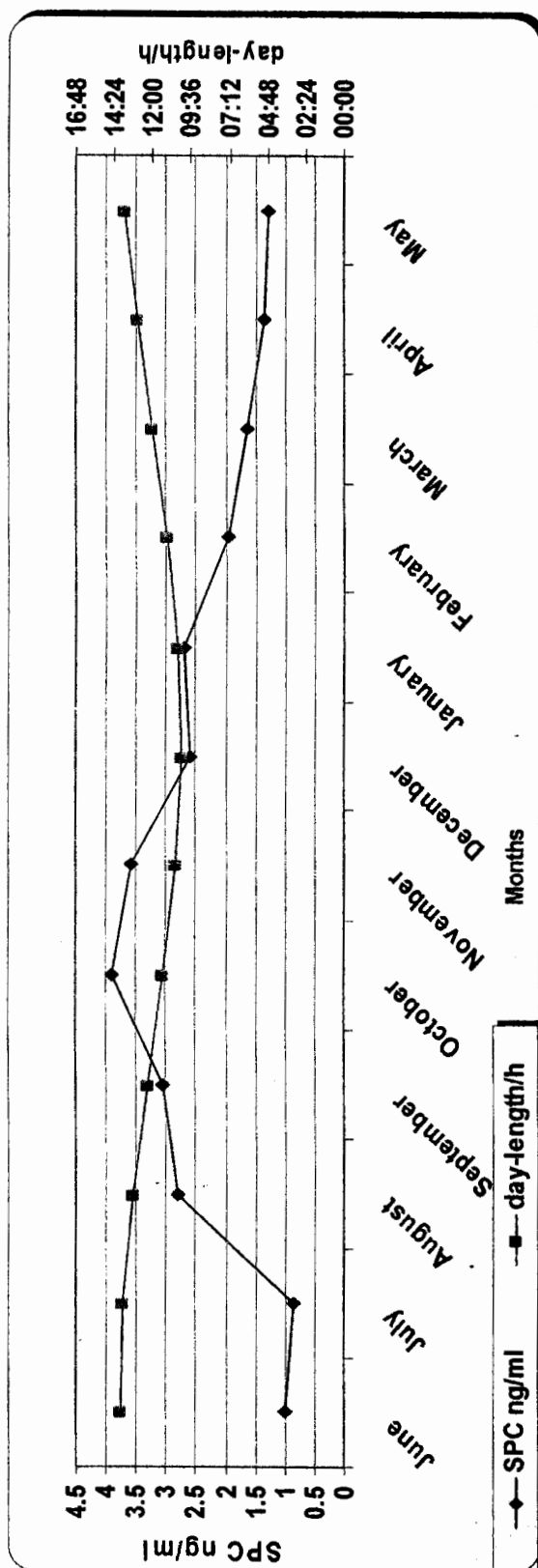


Fig. (5): Distribution of serum progesterone and day-length in Damascus goats through month of year.

TP: Estrus observation by teaser buck

PE: Estrus discovered by hormone



Fig. (6): Average of progesterone profile in Damascus goats during summer months.

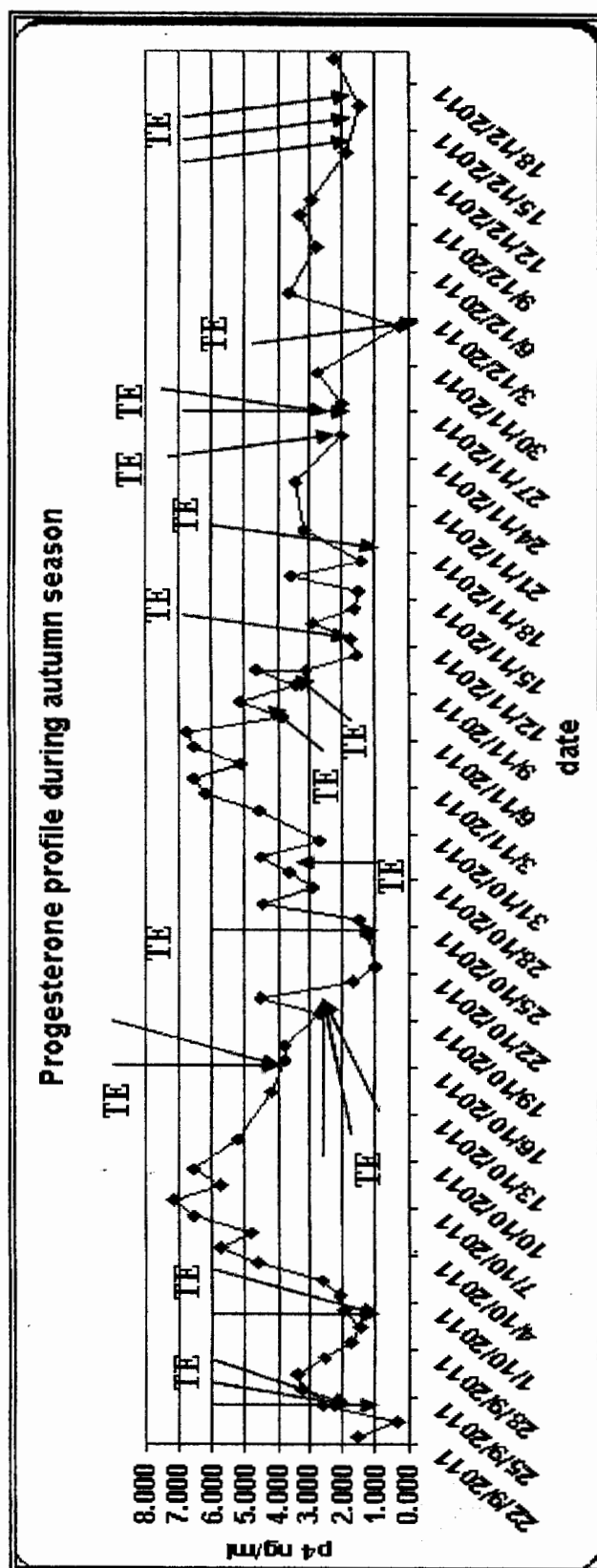


Fig. (7): Average of progesterone profile in Damascus goats during autumn months.

In August, the level of progesterone in serum of does was 2.81 ± 1.15 ng/ml and ranged from 0.38 to 7.8 ng/ml. In parallel process teaser buck observed estrous activities in three does at 16-23 and 24th days of the same month, while, teaser buck don't discover two estrous in does which detected by blood hormone at 3rd, 24th days in August.

Fig (8) and Table (4) illustrated the average distribution of SPC in Damascus goats during winter months. Only five estrous activities were observed in does by teaser buck while seven estrus were estimated by progesterone analysis. This result is similar with that reported by Teleb *et al.* (2003) who reported that in Damascus does, the postpartum period is composed of a period of anestrous and a period of cyclic ovarian activity with one, two or three ovulations without a behavioral estrus activities. Plasma progesterone profiles indicated the start of ovarian activity (silent ovulations) many months before the onset of the breeding season.

About 26.7% of total estrous (45) was occurred in winter months. The average of SPC were 2.68 ± 0.69 ng/ml, 1.96 ± 0.69 ng/ml and 1.64 ± 0.17 ng/ml for November, January and March months, respectively (Table 4). It was obvious that levels of serum progesterone in does decreased with advancing in winter months. This result agrees with those observed by many researchers on Damascus goats in different countries.

Papachristoforou *et al.* (2000) indicated that, the last ovulatory cycles of season were recorded in February or March and the animals entered into seasonal anoestrus until the following autumn. Also, Zarkawi and Al-Masri (2002), Anas *et al.* (2010) and (Mahmoud (2010) indicated that the estrous activity of Damascus does occur in autumn and winter and did not occur in spring and early summer.

On the other hand, these results were disagreeing with those reported on Damascus goats. In Egypt, El-Shafie (1997)

found that both Baladi and Damascus goats showed no estrous behavioral symptoms in winter season. AlKhouri (1996) reported rarely demonstrating estrus during winter (December and January).

The average distribution of SPC in does during spring months are illustrated in Fig (9) and showed in Table (4). Means of serum progesterone concentration were 1.34 ± 0.051 , 1.26 ± 0.045 and 0.99 ± 0.131 ng/ml for April, May and June month, respectively. Estrous activities in does did not observe during spring months. This means that ovarian activity during spring is lacked. This result is similar with several workers on Damascus goats in different countries. Mavrogenis (1988), Papachristoforou *et al.* (2000), Zarkawi and Al-Masri (2002), Anas *et al.* (2010) and (Mahmoud (2010) did not indicated any estrous activities in spring season.

5. Discussion and final conclusion

The seasonality of Damascus goat didn't characterized by extremes in photoperiodic changes between seasons (longest day is 14 h 30 min in June, shortest day 9 h 48 min in December (Papachristoforou *et al.* 2000). The breeding season in Damascus goats under extensive production system in Egypt can be concentrated in summer, autumn and winter while it doesn't appear in spring months. A gestation period of 148 days makes it possible for a doe to give birth more than one birth a year. But because of the seasonality of anestrous does do not cycle after spring kidding until late summer or early fall resulting in just one kid crop per year. According to the present results, the doe could be to push to come into estrus and breed to kid in the breeding season and produce three kids in two years (8-month interval). A possible breeding scheme would be to breed in January, then again in September. Out-of-season breeding programs help producers attempting to increase the profitability of their operations by increasing the supply of cabrito to the marketplace on a year-round basis. Goats generally respond more favorably than

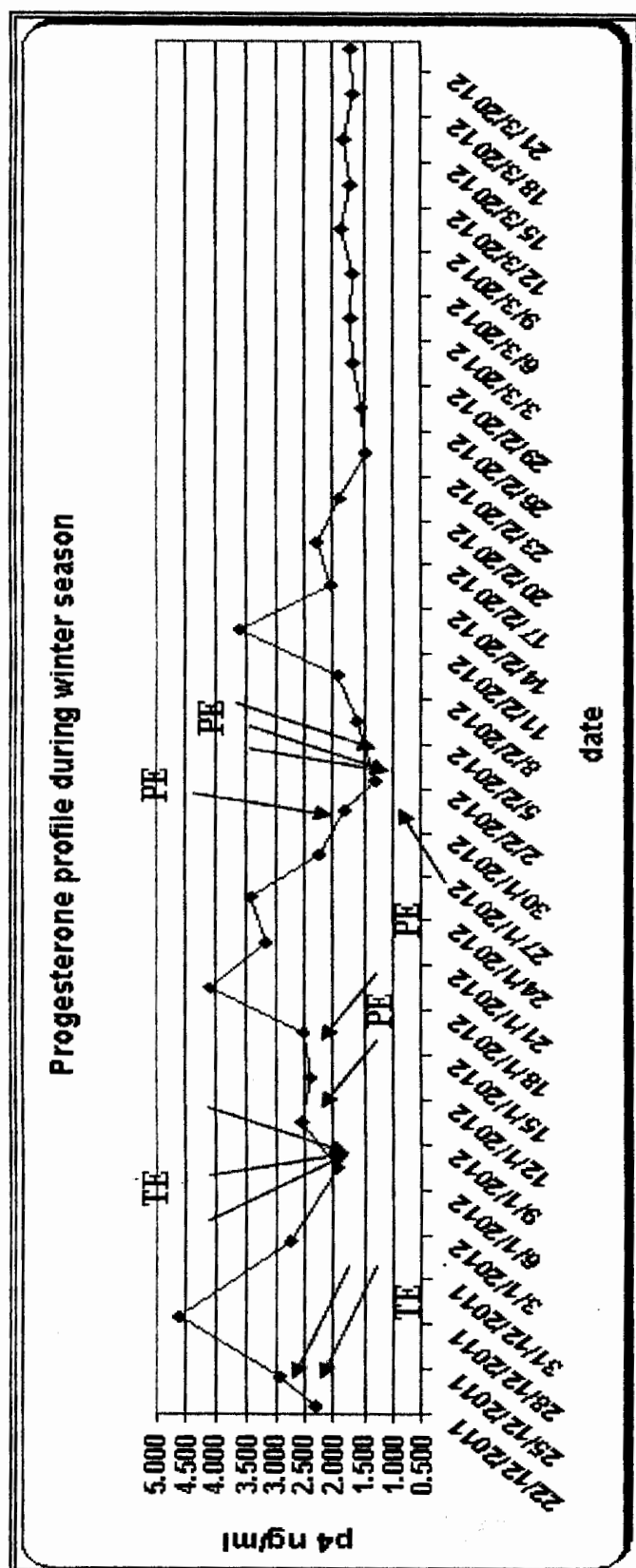


Fig. (8): Average of progesterone profile in Damascus goats during winter months.

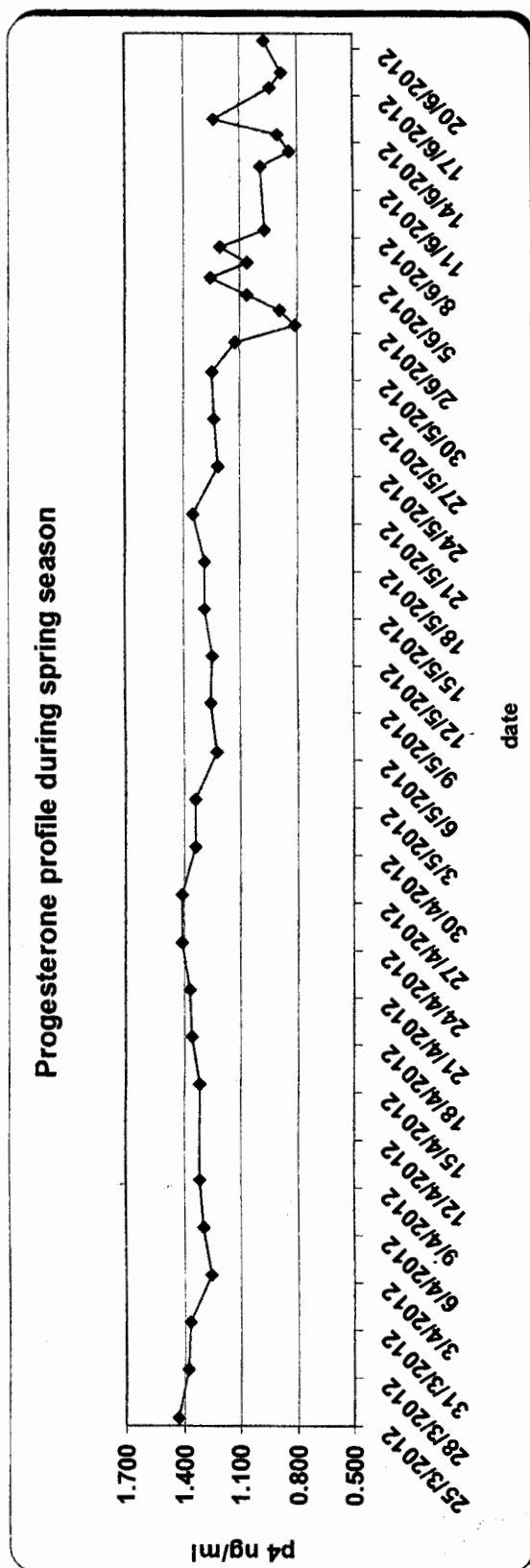


Fig. (9): Average of progesterone profile in Damascus goats during spring months.

sheep to out-of-season breeding. Plasma progesterone concentration which measured during various physiologic stages is one of the most important parameters of the reproductive status of a doe. However teaser Buck could be detected only about 80% of estrous activities determined by analyzing serum progesterone concentrations.

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موسمية التناسل في الماعز الدمشقي تحت الظروف المصرية

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الملخص العربي

أجريت هذه الدراسة على قطيع الماعز الدمشقي في مزرعة الراهب التابعة لقسم الإنتاج الحيواني، كلية الزراعة، جامعة المنوفية حيث إستمرت من أغسطس ٢٠١٠ حتى يونيو ٢٠١٤. وتهدف الدراسة الى تحديد موسم التناسل عن طريق قياس مستوى هرمون البروجسترون مع المراقبة السلوكية. كان المتوسط العام لدورة الشياح $20.43 \pm$ يوم بمدى من ١٣ إلى ٢٦ يوم. كان تأثير وزن الجسم وترتيب الموسم على دورة الشياح معنوى بينما لا يوجد تأثير مع موسم وسنة التلقيح. كانت نسبة الشياح ٦١%، ٢٢% و ١٧% من إجمالى الشياح فى فصل الخريف و

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الصيف وفصل الشتاء على التوالي. كان تأثير موسم التناسل على مستوى هرمون البروجستيرون معنوى. بلغ متوسط هرمون البروجستيرون إلى اقصاه فى فصل الخريف 3.35 ± 1.70 ng/ml مقارنة بفصل الربيع كان الأقل 1.20 ± 0.20 ng/ml. كان إجمالى عدد دورات الشياح التى تم أكتشافها بواسطة تركيز مستوى هرمون البروجستيرون ٤٥ دورة فقط حوالى ٣٦ دورة شياح تم أكتشافها عن طريق التيس لذلك كانت كفاءة التيس فى أكتشاف الشياح ٨٠%. يمكن أن نستنتج بأن موسم التناسل فى الماعز الدمشقى تحت ظروف الإنتاج غير المكثف فى مصر تركز فى أشهر الصيف و الخريف والشتاء ولم تظهر أى علامات شياح فى أشهر الربيع.

الكلمات الإسترشادية: الماعز الدمشقى، البروجستيرون، دورة الشياح، الإنتاج غير المكثف، موصل التناسل