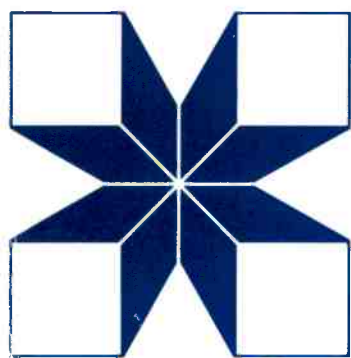


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**SMALL RUMINANTS
RESEARCH
AND DEVELOPMENT
IN THE NEAR EAST**

PROCEEDINGS OF A WORKSHOP

HELD IN CAIRO, EGYPT,

2-4 NOVEMBER 1988

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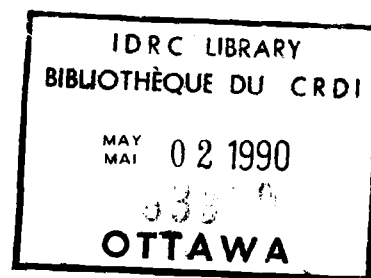
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**Proceedings of a workshop
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SEASONALITY OF REPRODUCTIVE ACTIVITY IN NATIVE SHEEP AND GOAT BREEDS AND THEIR CROSSES WITH INTRODUCED BREEDS.

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ABSTRACT

Many local sheep and goat breeds in the Near East can be considered as breeds of long breeding season or a typical non-seasonal breeds. They show cyclic activity throughout most of the year, with period of low activity or anoestrus limited to spring months. Differences in the degree of seasonality, however, are found between breeds raised at the same location or between flocks and individuals of the same breed. Seasonality in oestrous activity is more pronounced than that in ovarian activity, the difference between the two is mainly found during February-July. Seasonality is reported also in ovulation rate and breeding performance with lower figures obtained in spring mating than winter or autumn matings. Changes in daylength, although of small magnitude in the region, affect oestrous and ovarian activities in local sheep breeds with the effect being more pronounced on oestrous than ovarian activity.

Exotic breeds imported into the region, maintained almost similar degree of seasonality as in their countries of origin, which highlights the role of genetic control of seasonality in small ruminant breeds and indicates that such genetic control was not overcome by the changes in environmental conditions. There is evidence of heterosis in the cycling activity of crosses between local and imported breeds, which is more pronounced during periods of lower activity (February-July).

Seasonality in semen characteristics and libido of rams and bucks in different local and imported breeds and their crosses is generally less defined and less consistent than seasonality in female reproductive activity.

INTRODUCTION

Local sheep and goat breeds of high and medium latitudes (>40°) present marked seasonality of reproduction both in females (Hafez, 1952, Chemineau et al., 1987) and males (Corteel, 1977). In contrast, local breeds from low latitudes (tropics) demonstrate little or no seasonality at all. Between these two extreme ecozones, intermediate latitudes as in the subtropics and the Near East, are interesting because of their geographical situation. Improvement of lamb and kid production in this area through the utilization of either native breeds or their crosses with imported breeds is influenced by the degree of their seasonality. Understanding the seasonality of reproduction and its control under these conditions is particularly important for developing programmes in which more than one lamb/kid crop per year is desired. It is also important for the planning of mating seasons to fit with feed resources availability and marketing requirements.

SEASONALITY OF REPRODUCTION IN LOCAL SHEEP AND GOAT BREEDS

Oestrous and Ovarian Activities :

Generally, a high level of cycling activity in local sheep breeds in the subtropics is maintained throughout most of the year, with a detectable drop during spring months. Aboul-Naga et al. (1987b) analyzed data of monthly oestrous activity obtained on Egyptian Ossimi (O) and Rahmani (R) breeds in 13 different trials (5 for R and 8 for O) reported by several investigators. The authors concluded that the two breeds showed oestrous activity all the year round without a clear anoestrous period but with a drop from February to July (Fig. 1). The observation that the period of low cycling activity or anoestrus being limited to spring months has been also reported in Barki ewes in Egypt (Rakha et al., 1988), in D'man and Sardi ewes in Morocco (Lahlou-Kassi and Boukhliq, 1988), in Awassi sheep in Israel (Amir and Volcani, 1965a) in Barbarine ewes in Tunisia (Khaldi, 1984) and in Chios sheep in Greece (Avdi, et al., 1988). Variation in the degree of seasonality of cycling activity has been reported, however, among local breeds raised at the same location. Aboul-Naga and Aboul-Ela (1987) reported that Rahmani ewes have more consistent oestrous activity than Ossimi. Mousa (1986) concluded that Awassi was more seasonal than both Ossimi and Rahmani, when raised at upper Egypt. D'man ewes were reported to be less seasonal than Sardi and Timhadit in Morocco (Lahlou - Kassi and Boukhliq, 1988) and Chios was reported to be less seasonal than Serres in Greece (Avdi et

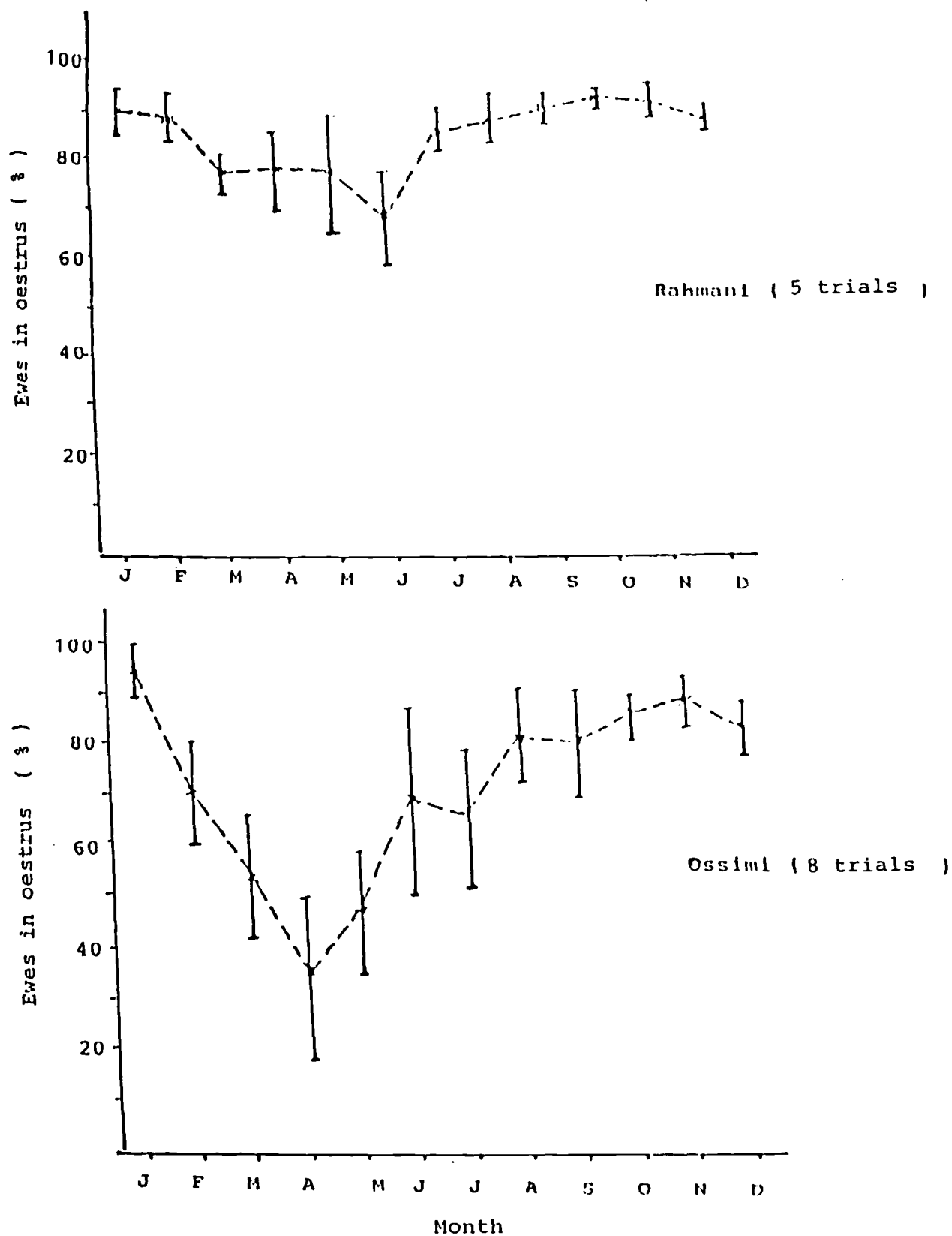


Figure 1 : Monthly percent of ewes in oestrous for the two local Egyptian breeds.

al., 1988). Within breed flock to flock variation was also reported in both Ossimi and Rahmani ewes (Aboul-Naga and Aboul-Ela, 1984 and 1987), but this is restricted usually to the period from February to July. Individual variation within flocks in the seasonality of oestrous activity has been reported. Aboul-Naga et al. (1987a) found that about one third of 29 R ewes studied continued to have ovarian activity all the year round. With such individual variation, Aboul-Naga and Aboul-Ela (1987) recommended the selection for more consistent cycling activity in local ewes for improving their general reproductive performance. Rahmani ewes which were the earliest to show oestrus after spring lambing were significantly of better reproductive performance than those which were the latest to show oestrus (Aboul-Naga et al., 1987b).

In almost all investigations where both oestrous and ovarian activities were studied, seasonality in oestrous activity was more pronounced than in ovarian activity (Khaldi, 1984, Aboul-Naga et al., 1987a, Avdi et al., 1988, Lahlou-Kassi and Boukhliq, 1988). It could be concluded that expression of oestrous symptoms is inadequate criterion for measuring cycling activity in subtropical local sheep breeds. Cyclicity is better assessed through monitoring ovarian function using clinical methods as blood progesterone concentration measurements or laparoscopy. Seasonality of cycling activity has been reported also in local goat breeds. Damascus goats in Cyprus present interesting characteristics of reproduction (Constantinou, 1981). In a limited group of does recorded for oestrus incidence for a whole year, regular activity of oestrous behaviour occurred only in autumn, sporadic oestrous periods were observed until the end of January and in July, oestrous activity ceased again until the middle of September. In the Nile Delta (Northern Egypt), Egyptian Nubian "Zaraibi" goats demonstrated an anoestrous season from February to June with a marked drop in the percentage of does in oestrus in March and a few number of does (<30%) showing oestrus in April-May (Aboul-Ela et al., 1988, Fig. 2A). In Upper Egypt, Baladi goats (local goats of unprecisely defined characteristics) demonstrated very low seasonal variation in oestrous activity (F. El-Hommosy, Unpublished data) where percentage of does in oestrus per month decreased to 50 and 58% in March and June, respectively, and remained at > 80% during other months (Fig. 2B).

Similar results were observed in Baladi does raised in the western part of the Nile Delta (Younis et al., 1988). On the other hand, in another study performed by the Egyptian Animal Production Research Institute (Unpublished data) Baladi does raised at Mid-Delta exhibited clear anoestrous

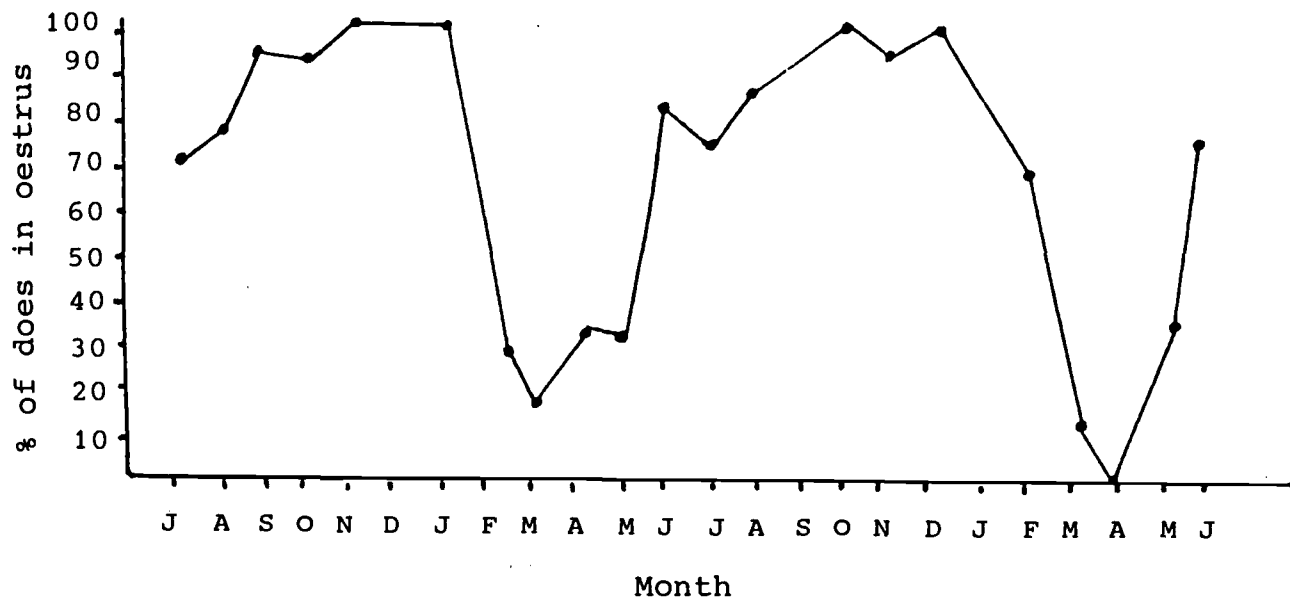


Figure: 2A. Monthly percentages of does in oestrus for Egyptian Nubian goats raised at north Delta, Egypt.

(After Aboul-Ela et al, 1988)

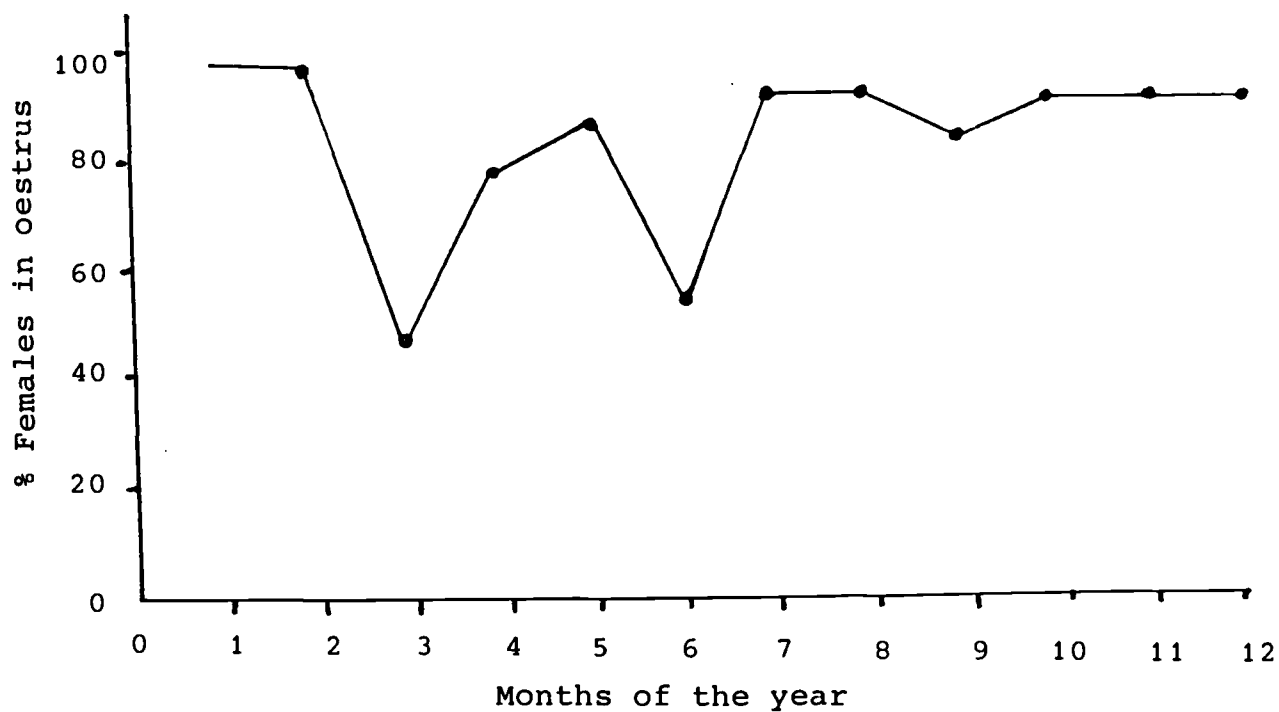


Figure: 2B. Monthly percentages of does in oestrus for Baladi goats raised at upper Egypt.

(After F. El-Hommossy, Unpublished data)

period during March-June, with clear individual variation. These results indicate differences in the seasonality of cycling activity between local goat breeds raised in the same country and between flocks and individuals of the same breed, similar to the situation in local sheep breeds. Conclusion on the seasonality of local sheep and goat breeds, therefore, cannot be generalized.

Compared to the trials reported on oestrous and ovarian activities of local breeds, few studies are available on the seasonality of ovulation rate. Aboul-Naga and Aboul-Ela (1987) reported that ovulation rate in both O and R ewes was lowest in May (1.19 and 1.29 for O and R, respectively) compared to the corresponding values recorded in January (1.33 and 1.50) and September (1.32 and 1.57). Seasonality in R, being more prolific, is more pronounced than in O. In Barbarine sheep in Tunisia, Khaldi (1984) reported that ovulation rate showed a peak in autumn months reaching 1.65 in October while it was less than 1.3 during the period of December - July. In Greece, seasonality in ovulation rate was reported to be more pronounced in Chios a very prolific breed, than Serres of lower prolificacy (Avdi et al., 1988). It ranged from 1.2 and 2.3 in March to 1.8 and 4.1 in October in Serres and Chios, respectively.

BREEDING PERFORMANCE

Detectable seasonal variation was also reported in the breeding performance of local sheep breeds. In a recent study, Aboul-Naga et al. (1987b) concluded that under accelerated lambing system of 1 crop each 8 months with mating seasons in September, May and January, over 18 successive crops, September mating showed consistently the best performance expressed as number of lambs born for both O and R breeds. In that study, seasonal variation was more pronounced when expressed as fertility traits (per ewe exposed) than as prolificacy traits (per ewe lambed). Differences in litter size at birth per ewe exposed between September and May mating seasons was 36 and 29% in R and O, respectively. The relatively larger seasonal variation in litter size in R than O is consistent with the corresponding variation in ovulation rate for the two breeds.

MALE REPRODUCTION

Fewer experiments were generally performed concerning seasonal variation in reproductive activity in male than in female small ruminants. Aboul-Naga et al. (1980) compared semen characteristics of Rahmani rams in both autumn

(September) and spring (May). Semen collected in spring was of better quality 1 (larger volume, higher concentration, better motility and lower abnormality).

Seasonal differences in semen quality can be attributed, as for cycling activity in the ewe, to both meteorological and nutritional factors. It is quite often that ambient temperature during summer days in the Near East region exceeds 30° C which is the upper for spermatogenesis. Exposure to long days is known to adversely affect sperm output and semen characteristics (Ortavant et al., 1985).

Galal et al. (1978) studied semen collected twice weekly during two month collection periods in the four geographical seasons. They reported that semen of Ossimi rams was of better quality in autumn and spring than in winter and summer. Mohamed (1978) observed that the highest semen quality and the strongest libido expression during summer and the lowest in winter in O and R breeds. In Awassi rams with regular semen collections, Amir and Volcani (1965b) reported that ejaculate volume was maximum in autumn and lowest in spring while the opposite was for sperm concentration. However, the authors did not find such seasonal differences to be distinct in rams without regular semen collection as those kept normally in the flock. In another study on Awassi rams, Juma and Dessouky (1969) reported that ejaculate volume and motility were lowest in winter and highest in summer. The noticeable variation in the results obtained in different studies on a particular breed could be attributed, among other factors, to the method used for studying seasonality in semen characteristics (frequency and method of collection, ram management and feeding). In addition, it has been reported in many studies that different traits used to assess semen quality behave differently in their seasonal variation (Amir and Volcani, 1965b, Galal et al., 1978, Aboul-Naga et al., 1980). The lack of single criterion that reflects gonadal activity in the male makes the evaluation in studying seasonal variation in male reproduction relatively more difficult than in females. We suggest that testicular volume and the total number of live normal sperms may fulfill this requirement.

In goats, Ashmawi (1979) working on Baladi buck in Egypt, reported significant effects of season on some sexual behaviour parameters but not on others. Although some behavioural characteristics in that study appeared not varying significantly with season, a tendency existed for higher activity in autumn than in spring. Male Damascus goats raised in Egypt showed significant seasonal variation in their sexual activity and semen traits, (El-Wishy et al., 1971, El-Saidy, 1988) where better performance was reported

in autumn and the lowest was that of spring.

It seems from those results that trend of seasonal variation in male reproduction of native breeds is clearer in goats than in sheep.

EFFECTS OF ENVIRONMENTAL FACTORS ON SEASONALITY OF REPRODUCTION

Among the different environmental cues which act on reproductive activity (photoperiod, temperature, social relationships, feeding conditions), some appear to play an important role on seasonality of reproduction while some others only modulate reproductive activity. Moreover, the effects of these factors appear to be different depending on the considered breed and its geographical origin.

Photoperiod

Under high and mid latitudes, photoperiod is the main cue which controls seasonal breeding in both sexes of small ruminants. In sheep and goat breeds of these zones, short or decreasing daylength stimulates sexual activity and long or increasing daylength inhibits it (Chemineau et al., 1988).

Only few trials were reported on the effect of photoperiod on oestrous and ovarian activities in local sheep breeds. Aboul-Naga et al. (1987a) found that changes in daylength, albeit of small magnitude (3.7 h) are a major factor influencing the seasonality of oestrous and ovarian activity in Rahmani sheep. Simulating the autumn daylength changes in spring caused an increase in oestrous and ovarian activities by about 40-50% and 30-45%, respectively, as compared to a control group. It seems that there is breed difference in the effect of daylength changes on cyclic activity in subtropical sheep. Mousa (1986) reported that the effect of light treatment was more pronounced in the relatively more seasonal Awassi than Ossimi. In Morocco, Lahlou-Kassi and Boukhliq (1988) reported that increasing daylength caused a decrease in oestrous activity in D'man while Sardi ewes were not markedly affected. It is of interest to note that in both studies conducted in Egypt (Aboul-Naga et al., 1987a) and Morocco (Lahlou-Kassi and Boukhliq, 1988) the effect of photoperiod was more pronounced on oestrous activity than on ovarian activity. To our knowledge, there is no report on the effect of experimentally manipulated photoperiod on reproductive activity in local goat breeds in the subtropics.

Social Relationships :

Inter-individual relationships could strongly act on seasonal reproductive ability of females. Presence of lambs/kids and sudden re-introduction of males (so-called "male effect") are able to change oestrous and ovarian activities. Suckling causes a delay in the onset of first post-partum oestrus. Sudden re-introduction of bucks after a period of complete separation induces, in an ovulatory females in shallow anoestrus, synchronous onset of first ovulation within few days (Chemineau, 1987). Similar results were reported also in Rahmani sheep (Hassan et al., 1988). However, in goats the first ovulations are not always associated with oestrous behaviour and most of them are followed by short life span, corpora lutea. It seems also that there is a "female effect" on breeding activity in the male. Amir and Volcani (1965b) noted that the pattern of seasonality in semen characteristics of Awassi rams separated from ewes differed from that of rams with ewes in the flock.

Age :

The only information available on the effect of age on seasonality of cyclic activity of small ruminants in the subtropics is that reported by Khaldi (1984) on Barbarine sheep. He found that seasonality in both oestrous and ovarian activities was much more pronounced in ewes lambs than in adult ewes.

SEASONALITY OF REPRODUCTION IN INTRODUCED TEMPERATE BREEDS AND THEIR CROSSES WITH NATIVE BREEDS.

Many attempts were made in the Near East to cross local sheep with exotic breeds, mainly to improve lamb production. However, only few trials were reported on the seasonality of reproduction of introduced pure breeds. The results reported by Aboul-Naga et al. (1985) on seasonality of oestrous activity of Fleisch Mutton Merino bred in Egypt for more than 15 years indicated that almost all ewes had anoestrous period during April, May and June which is similar to the performance of Merino ewes in Australia and Britain. Suffolk ewes produced in a flock imported into Egypt (Aboul-Naga et al. 1985) and bred for many generations had a distinct breeding season (from August to January) similar to that found in its home country. These results were supported by the findings of Aboul-Naga et al. (1984) and Aboul-Ela et al. (1987) who compared the performance of Finn ewes raised in Finland with their half-sibs imported into Egypt. The breeding season was similar in the two

groups starting on 4th October \pm 3.2d and 10 October \pm 4.9 d in Egypt and Finland, respectively, while it ended on 31 May \pm 4.8 d and 13 May \pm 14.9 d in the two countries, respectively. Both groups showed also similar degree of seasonality in ovulation rate. It is important to note that the similarity in seasonality of cyclic activity was found despite large and sizable differences between the two groups in the physiological traits related to thermo regulation and metabolic activity (Aboul-Ela et al., 1987). The results of the aforementioned studies demonstrate clearly the importance of inherited physiological rhythm that control seasonality of oestrous and ovarian activity in these breeds, and that the drastic changes in environmental conditions were not able to over-ride this inherited rhythm.

Similar to the situation in sheep, when transferred to low latitudes, temperate breeds of goats maintained their seasonality. French Alpine does transferred into a tropical (West Indies, Cognie, 1971) or a subtropical climate (Aboul-Naga and Aboul-Ela, unpublished data), or artificially maintained in a light-proofed building under a "simulated tropical" photoperiod (Chemineau et al., 1988) began their ovulatory and oestrous activity in September and stopped in February-March. However, the careful examination, during three consecutive years (Chemineau et al., unpublished results) of the characteristics of the sexual season in "simulated tropical" (11-13 h of light, Tr) compared to "simulated temperate" (8-16 h of light, Te) environment indicated that : (a) total duration of the sexual season was 18 to 49 d longer (varying between years) in Tr than Te does, (b) oestrus without associated ovulation and ovulation without oestrus occurred more frequently in Tr than Te (34 v. 8% and 31 av. 18%, respectively), (c) incidence of short cycles (mean duration 7 days) was also higher in Tr than Te does (36 v. 14%), (d) ovulation rate appeared slightly lower in Tr than Te goats (1.67 v. 1.81). This characteristic of seasonality seems to be mainly of genetic origin as it persisted over the generations.

In rams, Amir and Volcani (1955b) studied the seasonal changes in semen characteristics of German Mutton Merino, Corriedale, Border-Leicester and Dorset Horn breeds from which semen was collected regularly throughout the year. They found that the seasonal variations in semen characteristics in the studied breeds were parallel to the respective degree of seasonality reported for them at their countries of origin. This indicates the genetic role in controlling seasonality of male reproduction under the prevailing natural environment.

In Merino rams which were born and reared locally in Egypt, Galal et al. (1978) concluded that semen quality and libido were better in autumn and spring than in summer and winter, similar to the native Ossimi. Finn rams imported into Egypt (F. Hassan, personal communication) showed some seasonality in semen characteristics with high percentage of abnormal and dead sperms in summer months, especially August, which was mainly attributed to the prevailing high ambient temperature. As in the female, Alpine bucks imported into Egypt (Mousa, 1987) presented marked seasonal variation in semen characteristics, similar to what is observed in Europe.

CROSSBREEDING WITH NATIVE BREEDS

Only limited trials were carried out to investigate the seasonality of oestrous and ovarian activity in crossbreds between local and exotic breeds in the subtropics. In most of these trials, there was evidence of heterosis in the cyclic activity and reproductive performance. Crossbreds between Ossimi and each of Suffolk and Merino were reported to have higher and less seasonal oestrous activity than their respective pure breed parents (Aboul-Naga et al., 1985), with the 50% Suffolk and 1/4 Merino having the best performance. The percentage increase in the actual incidence of oestrus over the expected contribution of pure breed parents throughout the year averaged 24 and 47% in 75% and 50% Suffolk and were 45, 43, and 68% in 3/4, 1/2 and 1/4 Merino, respectively. This superiority was mainly during March-August while the differences were minimum during September-February, the common breeding season for most sheep breeds.

Schindler and Amir (1985) reported pooled estimates of lambing percentage of Finn x Merino and Finn x Awassi crosses under accelerated lambing system of 3 crops/2 yr, being 58.6, 81.9, and 83.3% for June, December-January and September matings, respectively, although no attempt was made in that study to distinguish between the two groups of crossbreds. Under accelerated lambing system in Egypt, with mating season in January, May and September, Aboul-Naga and Aboul-Ela (1988) reported lower fertility and prolificacy for Suffolk x Ossimi crossbreds in May mating compared to September and January matings. Similarly, Aboul-Naga et al. (1988) reported lower conception rate and lower prolificacy (lamb born per ewe lambing) in May mating season than September and January in different crosses between Finn and Ossimi and Rahmani subtropical breeds. This summed up to a difference of about 39% in number of lambs born per ewe exposed between May mating in

one hand and September and January matings on the other. Differences of similar magnitude were also reported by Goot et al. (1984) in Finn x Awassi crosses. Aboul-Naga et al. (1988) reported that seasonality of prolificacy in crossbreds between Finn and each of Ossimi land Rahmani was much more pronounced than that of fertility. In crossbreds between Anglo Nubian and Baladi goats in upper Egypt (El-Hommosy, unpublished data) oestrous activity was higher and continued for longer period than the Anglo-Nubian but less than the Baladi. In the crossbred, a period of anoestrus was observed from January to July 76 while in the pure Baladi always more than 50% of the does showed oestrus.

Information on the seasonality of reproductive activity in crossbred rams between exotic and native breeds are scarce. Galal et al. (1978) working on Merino x Ossimi, reported significant breed x season interaction. Most of the differences between seasons in different grades of crosses were not consistent from one semen trait to another.

CONCLUSIONS

Most native sheep and goat breeds in the Near East show a drop in oestrous and ovarian activity during spring months. However, description of the nature of this seasonality cannot be generalized. Breed, flock and individual variations have been reported with the seasonality being more pronounced in oestrous than ovarian activity. Hence, clinical methods should be used to distinguish between them. The prevailing small changes in photoperiod in the Near East can affect cyclic activity with the effect being more pronounced on oestrous than ovarian activity. Despite this relatively small effect, control of seasonality seems to be mainly of genetic origin, as indicated by the maintenance of seasonal reproduction in temperate breeds imported into the subtropics, and the heterosis in the seasonality in crosses between native and imported temperature breeds. Seasonality in reproductive functions in the male is less defined than in females, particularly in sheep.

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