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Araştırma Makalesi

Effect of Climate Changes on the Oestrus Incidence of Goats under Sub-tropical Climate Conditions of Turkey

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Abstract

Season is the main environmental factor controlling the annual breeding time in the subtropical animals. Some local breeds from subtropical latitudes, the season controls the annual reproductive rhythm as in breeds from temperate latitudes. Globally, climatic change has several effects on animal production. Many scientific studies suggest that the seasonal cycle of reproductive activity in both males and female is driven by an endogenous annual rhythm being synchronized by photoperiod which is directly affected by climate changes. In this respect, we described, in a general way, the climate changes between1975-2005 and how these changes affect animal reproduction cycle in terms of oestrus incidence under Mediterranean climate conditions of Turkey.

Key words: Goat, climate change, oestrus cycle, photoperiod, sub tropic climate

Keçilerde İklimsel Değişikliklerin Türkiye Subtropik İklim Koşullarında Kızgınlık Oluşumu Üzerine Etkileri

Özet

Mevsim tropik hayvanlarda yıllık olarak üreme zamanını kontrol eden temel bir çevresel faktördür. Yine mevsim, tropikal boylamlarda yetiştirilen kimi yerli ırkları etkilediği gibi ılıman boylamlarda yetiştirilen ırkların da yıllık üreme ritmini kontrol etmektedir. Global olarak iklim değişiklikleri hayvansal üretimi etkilemektedir. Yapılan birçok bilimsel araştırma dişi ve erkeklerde mevsime bağlı olan üreme aktivitelerinin iklim değişikliği tarafından etkilen fotoperiyot ile bağlantılı olarak senkronize edildiğini göstermiştir. Bu bağlamda genel olarak 1975-2005 yılları arsındaki ortalama iklim değişikliğini, bu değişikliğin Akdeniz iklim koşullarında yetiştirilen hayvanların üreme siklusu içerisinde kızgınlık oluşum yoğunluğunu ne düzeyde etkilediği ortaya konmuştur.

Anahtar kelimeler: Keçi, iklim değişikliği, kızgınlık siklusu, fotoperyot, subtropik iklim

Introduction

Animal bioclimatology is the science deals with the inter-relationships between climate, soil, plants and animals (Hafez, 1968). Impacts of climatic factors on farm animals are classified according to production, reproduction, morbidity and mortality. It is worth noting that the effect of climate on farm animals depends greatly on the severity and duration of climatic factor and animal adaptive mechanism. The effects on thermal environment on reproduction may take place through a direct action of the hyperthermia upper the reproductive tissues or through an indirect and subtler manner (Wolfensol et al., 2000).

Goats are seasonally poly-oestric animals. The length of the breeding season is a primarily the result of genetics and environmental interactions. Different climatic factors such as temperature and photoperiod regulate physiological response. In tropical goats the photoperiod is less important than factors like temperature, rainfall, vegetation and herbal growth (Riera, 1982). Generally the growth, reproduction, behavior and health of livestock are affected both by the environment and genetic make up. Atmospheric temperatures and humidity are some of the most important factors among the environmental factors.

In natural breeding systems, mating in small ruminants occurs in the autumn and birth in the late spring. Accordingly the intensive production systems have to control the timing of breeding within a year. However, the changes of estrus behavior from year to year depending on the atmospheric temperature and humidity in the natural environmental conditions are not well known today. The season is one of the important factors affecting reproduction in small ruminants. In natural breeding systems goats have a seasonal estrus behavior occurring largely between late summers to early autumn. But some breeds have exhibited estrus throughout the year such as the Boer and some European breeds (Devendra and Burns, 1970), whereas,

some of the goat breeds exhibit a short (August-October) and sometimes long breeding season (July-November), rarely during the winter (Al Khouri, 1996).

On the other hand, little information is available regarding to changes of the estrus season from year to year in goats in Turkey. There is not any study carried out in the Eastern Mediterranean region of Turkey (Cukurova Region) which displays the incidence of oestrus behavior of the goats raised in Adana province between 1975-2005. The objective of this study was to betray the effect of atmospheric temperature on the oestrus behavior of some crossbred goats raised in the Eastern Mediterranean region of Turkey.

Materials and Methods

This study was carried out at the Cukurova University, Faculty of Agriculture, Dairy Goat Research Farm in Adana province (Cukurova region), located in the East Mediterranean region of Turkey. The Cukurova region is between the latitude of 36º 59'N and longitude of 35º 18'E, at an altitude of 40 m and mean temperatures is 18.8 ^{o}C. The annual rainfall and relative humidity are 646 mm and % 66, respectively. Climatic data were obtained from reports prepared at Turkish State Meteorological Service.

The study aimed at investigating the effect of the climate changes throughout different years on oestrus incidence of goats raised in Dairy Goat Research Farm of Cukurova University. Reproduction data of 1317 crossbred and local goats (German Fawn, Saanen, Kilis and Hair goat) were used, for the period 1975-2005. Animals were fed concentrate diet and ad-libitum with alfalfa hay. The details of the flock management were described by Güney et al.(1992). Experimental animals were managed under semi-intensive conditions. All animals were housed and maintained in a semi-open shaded yard. The estrus behavior of does was tested by a teaser buck twice a day starting from July. These observations were recorded until the end of September.

Chi-square (χ^2) analysis was applied to analyze whether or the oestrus incidence of the goats statistically depends on the periods and/or the years. If it depends on, the contingency coefficients (%) for each contingency table were calculated to determine the degree of association between oestrus incidence and the periods or the years. Z-test was then utilized to determine any further differences between the ratio for oestrus densities in five years intervals (between 1975-1980; 1980-1985; 1985-1990; 1990-1995; 1995-2000; 2000- 2005, respectively) and between the periods (period I, period II, period III and period IV) (SPSS 10.0 V., 1999).

Results

Daily average temperatures of the Adana province for the periods at five year intervals are summarized in Table 1. The process of the normal onset of estrus between July and September is divided into 4 periods which are, 26July- 6August (Period I), 7August-17August (Period II), 18August- 28August (Period III) and 1 September – 15 September (Period IV).

Annual Variations of Oestrus Densities

Oestrus incidence of the goats used in the experiment is described as o*estrus density*. The estrus densities were estimated at five-year intervals and determined from 1970 to 2005 (Figure 1).

The highest oestrus incidence has been observed %100 in 1975, 2000 and 2005 (Figure 1). The ratio for oestrus densities between 1975-1980, 1980-1985 and 1990-1995 were found significantly different ($P< 0.01$), while between 1985-1990, 1995-2000 and 2000-2005 were found insignificant ($P> 0.05$) by means of *Z*-test.

In the second period differentiation of the estrus densities in 1975 to 1980; 1980 to 1985, 1990 to 1995 and 1995 to 2000 were found significant while between 2000-2005 were insignificant ($P>0.05$). In the third period similar to the second differentiation, the estrus densities in 1975 to 1980; 1980 to 1985, 1990 to 1995 and 1995 to 2000 were found significant, while 2000 to 2005 and 1985 to1990 were found insignificant ($P>0.01$). Ultimately, the results revealed the yearly differentiations between the estrus densities despite the use of indifferent calculations in the 3rd and 4th periods.

Table 1. Mean temperature of Adana province among years (^{o}C)

	Years						
Periods	1975	1980	1985	1990	1995	2000	2005
26 July - 6 Ag	24.4	23.5	22.3	23.1	23.2	24.5	23.2
7 Ag-17 Ag	22.9	23.8	24.3	23.7	23.3	25.4	22.7
18 Ag -26 Ag	21.9	23.9	23.4	23.9	23.4	25.3	23
1 Sep-15 Sep	21.4	21.2	22.9	21.7	21.8	21.2	18.7

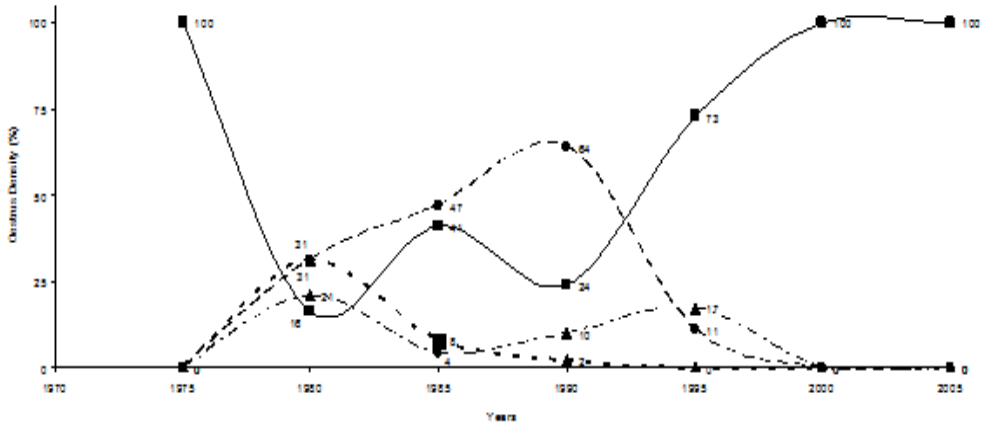

Figure 1. Oestrus densities of the goats among years

The correlation between the temperatures and the estrus densities within the periods

Figure 2, 3, 4 and 5 shows the relation between the atmospheric temperature and the estrus densities related to seasonal periods. The figures between two characters ranking from the first to the fourth period and contingency coefficients (%) for each χ^2 analysis are determined as 11.9 (P>0.05), 42.3 (P<0.01), 8.1 (P>0.05) and 57.4 (P<0.01), respectively. The confidence intervals have been found within 30%, of the values determined in the I. and III. periods which were found insignificant, while the significance level in the II. and IV. period were found very high.

Figure 2 showed that the highest oestrus density (31%) has been observed at the lowest temperature in the first period (26 July - 6 August). We can point out that 31%goats showed oestrus behavior in the early mating season. Heat stress or climate changes have been shown to reduce reproductive efficiency, particularly, by reducing estrous expression/detection, impairing embryonic development and by decreasing conception rate (Younas et al., 1993; Jordan, 2003; Morton et al., 2007). Thereby, our above mentioned contention has been confirmed. On the other hand, an obvious decrease in oestrus density has been recorded with the increase of the atmospheric temperature (Figure 2). However, the increase of atmospheric temperature causes a decrease of reproductive traits which has been reported by many researchers in the past (Macfarlane, 1982; Shelton and Groff, 1971 and Devendra and Burns, 1970).

The oestrus density of the goats has been found quite higher than in the first period (Figure 3). The highest oestrus density has been recorded at a mean temperature of 24.1 ^{o}C. The effect of photoperiod has an important affect on the seasonality. Chi square analysis indicated that the oestrus density between 7 -17 August depends strongly on the atmospheric temperature with a significant level of 42.3% (P<0.01, Figure 3). However, the estrus season was neither influenced nor affected by the daily maximum temperature variations except the period II (X^2= 42.3%) (Figure 2, 3 and 4). Besides that, our findings related to atmospheric temperatures are in accordance with those of Amoah et al.(1990) and Chemineau et al.(1992).

The oestrus densities in the third period are mostly spread about between 23.3-23.9 ^{o}C (Figure 4) and oestrus density in the period III has been depended strongly on the atmospheric temperature with an insignificant level of 8.1% (p>0.05).

An important result of the present study has been observed in Figure 5. The highest oestrus densities have been recorded with 100% in September where we can point out the interaction of the photoperiod with oestrus behavior. Results indicated that the highest oestrus incidences were occurred in September when the mean temperature was recorded as, 21.1 ^{o}C in 1975, 1995, 2000 and 18.7 ^{o}C in 2005. Thus, the oestrus density in September depends highly on the atmospheric temperature with a significance level of 57.4 % (p<0.01, Figure 5). According to Amoah et al.(1996), the majority of the goat breeds in temperate regions start to breed after June or July reaching a peak from September to November when day lengths are relatively short. Furthermore, our view revealing, the relation between photoperiod and atmospheric temperatures in the seasonal estrus of the goats, which are in agreement with the findings of Al Khouri (1996), Amoah (1982), Veliz et al. (2002) and Chemineau et al. (1992).

Between February and June, there is a negligible ovarian cycling and reproductive activity (Amoah et al., 1996). Due to the controlled lighting, the breeding season of the goats can be manipulated. Chemineau et al.(1992), have stated that the seasonality of the estrus of Alpine goats was not modified when females were exposed to a simulated tropical photoperiod. Veliz et al.(2002) have indicated that the photoperiodic treatment of long days and melatonin are both effective factors in the anoestrus females. According to MacFarlane (1982), the breeding season is turned on by decreasing day length in goats from latitudes 80°-25°, whereas equatorial goats breed at any time of the year. Generally in temperate regions, the seasonality is ruled by the photoperiod. On the other hand, there is considerable evidence on the control of the annual mould in small ruminants by the change of the day length (Ryder and Stephenson, 1968).

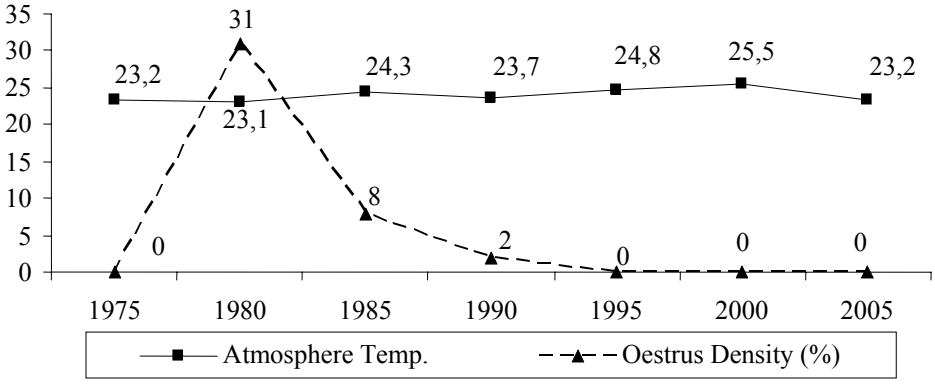

Figure 2. Variation between atmospheric temperature and oestrus density in period I among years (x^2= %11.9).

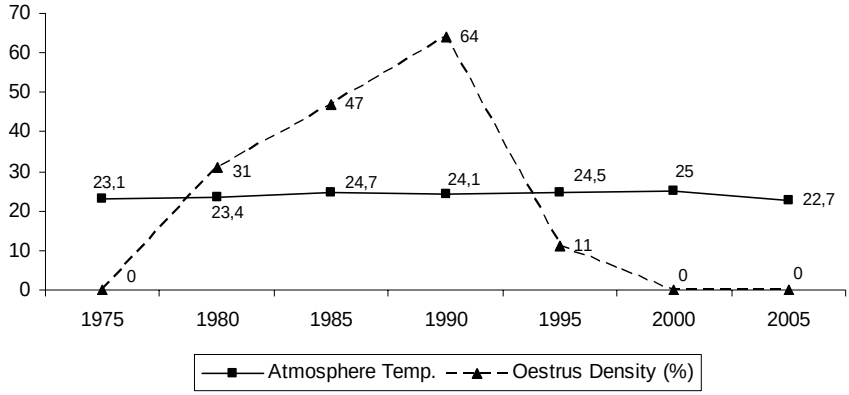

Figure 3. Variation between atmospheric temperature and oestrus density in period II among years (x^2= 42.3%).

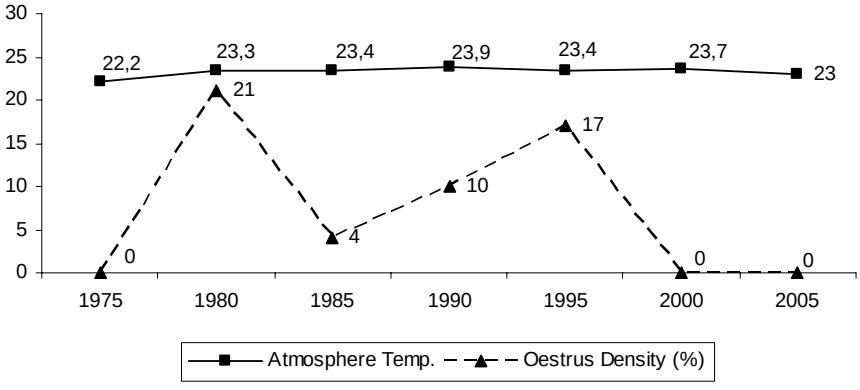

Figure 4. Variation between atmospheric temperature and oestrus density in period III among years (x^2= 8.1 %).

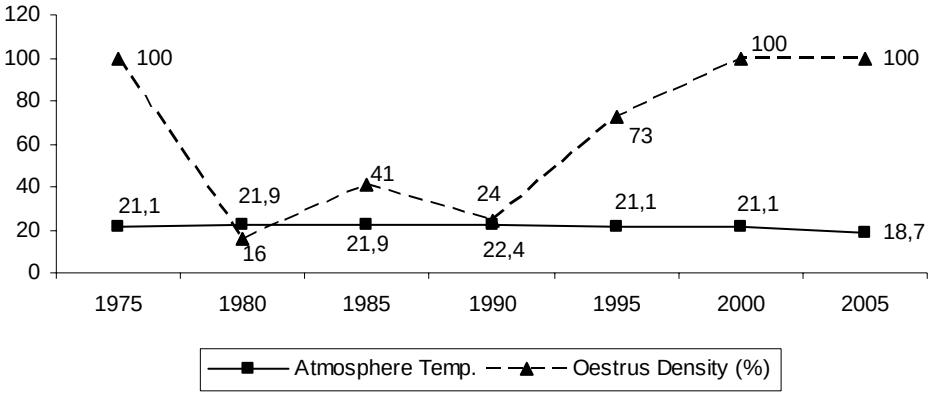

Figure 5. Variation between atmospheric temperature and oestrus density in period IV among years (x^2= %57.4).

It seems impossible to separate the view which emphasizes the relation of estrus with day lengths and photoperiods. This indicates, the need for further research regarding the photoperiods and significant relation between the shedding of fibers and estrus which is reported by Ryder and Stephenson (1968).

Conclusion

This study has been output some new information of oestrus incidence of goats raised in the Mediterranean region of Turkey with respect to atmospheric temperatures variations. An interaction between atmospheric temperature and oestrus incidence has been determined according to the recorded data since 1975. It has been determined that oestrus onset has been slipped to September which was occurring in August in the past due to the climate changes. At the periods 26 July – 15 September, the estrus densities were reaching to the peak levels when the atmospheric temperatures were decreasing within years. Until now, there were no studies related to historical changes between the atmospheric temperatures and productivity of goats pointing out an interaction relation. Nevertheless, seasonal and non-seasonal estrus onset is considered as a breed dependent character and needs to be handled from this statement separately for the future studies.

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