«Research Note»

Effect of Cyclic Environmental Temperatures upon Oviposition Patterns in Domestic Fowl

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Introduction

Several workers reported that the time of oviposition can be altered by manipulating light and darkness and that under constant illumination oviposition are distributed throughout 24 hours¹⁻³⁾. PAYNE *et al.*⁴⁾ and BHATTI and MORRIS⁵⁾ found a similar effect due to variation in environmental temperature. BHATTI and MORRIS⁵⁾ concluded that thermoperiods can have subsidiary effect even in the presence of a clear light-dark cycle and if the light to dark ratio is altered substantially there comes a point at which the influence of cyclic temperature becomes dominant. Because little is known about the effect of thermoperiod on egg laying pattern, this study was undertaken to obtain further information.

Materials and Methods

One hundred and twenty White Leghorn hens (8-month-old) were used in this study. The birds were placed in individual cages in temperature controlled room in Zootron facilities of National Institute of Animal Industry. Feed (CP: 15.5%, ME: 2.48 kcal/g) and water were provided *ad libitum*, and no regular feeding time adopted. The hens were kept on a continuous illumination. Light intensity was 500 lux at the level of the cage floor. The hens were subjected to the following temperature schemes: 1) 33°C constant, 2) 27-33°C cyclic, 3) 21-33°C cyclic, 4) 15-33°C cyclic. A period of 2 weeks was allowed for adaptation before treatment response was studied. On cyclic temperature treatments, the maximum temperature was attained at 12:00 and then immediately began to decline to the minimum temperature at 24:00 (Fig. 1). Relative humidity was held constant at $60 \pm 5\%$. The floor of the cage was sloped to allow an egg to roll toward the front of the cage and strike a trip-bar attached to a microswitch to record oviposition time. The signals from the microswitches were directed to the mini-computer system (OKITAC 40/50, Oki Electric Co., LTD.), and the time of oviposition were recorded on a magnetic disk.

Results and Discussion

The results of this study are illustrated in Fig. 1. The distributions of oviposition times under cyclic temperature regimens may almost correspond to the pattern of temperature change, while the oviposition times were equally distributed throughout 24 hr. under con-

Fig. 1 Distribution of oviposition time under constant and cyclic temperature regimens.

Estimated normal distribution curve (—) and temperature cycle (----) were superimposed.

stant temperature regimen. When temperature were cycled diurnally, the frequency distribution was increased by increasing temperature and decreased by decreasing temperature. These results were equivalent to the findings of PAYNE *et al.*⁴⁾, CAIN and WILSON⁶⁾ and BHATTI and MORRIS⁵⁾ who showed that the eggs were laid in the hot phase with a temperature cycles and continuous illumination. It appears from these results that the thermoperiodic signal, like photoperiodic signal, is effective as a Zeitgeber (time giver) for entraining oviposition rhythms.

While previous reports^{4,5)} suggest that the temperature cycles with large difference, more than 10°C, in hot and cool phase are effective in synchronizing the oviposition time, the results in present experiment indicate that the diurnal temperature cycles with small differences (6°C) in the two phases are effective in altering the oviposition pattern. Thus, the distribution pattern of oviposition time may have been influenced by the temperature range. Namely, as the temperature range become narrower, the distribution curve have a tendency to become gentler. However, no differences in oviposition pattern were observed between two treatments (21-33°C, 15-33°C). These similarity presented here may suggested that the thermal effects of diurnal temperature fluctuation on oviposition are almost equivalent, be-

cause minimum temperatures (15, 21°C) at both cycled temperatures are within the range of the zone of thermoneutrality⁷⁾. Interestingly, regardless of the temperature cycles, oviposition peak occurred 2-3 hours prior to temperature peak.

Summary

To study the effect of cyclic environmental temperature on oviposition pattern, one hundred and twenty White Leghorn hens were maintained at temperatures of 33, 27-33, 21-33, 15-33°C with continuous light. When the temperatures were cycled diurnally, the frequency distribution of oviposition time was increased by increasing temperature and decreased by decreasing temperature. The distribution pattern of oviposition time may have been influenced by the temperature range. However, no differences in oviposition pattern were observed between two treatments (21-33°C, 15-33°C). Also, present results indicate that regardless of the temperature cycles, oviposition peak occurred 2-3 hours prior to temperature peak.

Literatures

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環境温度の周期的変化がニワトリの放卵 パターンにおよぼす影響

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8ヶ月齢の白色レグホーン産卵鶏を用い，周期的変温環境が，ニワトリの放卵時刻におよぼす影響について検討した。ニワトリは24時間連続照明下で，33°Cの一定ならびに27～33°C，21～33°Cおよび15～33°Cの変温条件に感作した。定温条件下では，放卵時刻は24時間に亘ってほぼ均一に分布したが，変温条件下では，いずれも環境温度の上昇とともに放卵頻度が高まり，また下降とともに放卵頻度も低下するという，環境温度の上昇下降にはほぼ一致した分布を示した。また，温度較差が放卵分布にも影響し，温度較差の拡がりにつれて分布の「尖度」

が大きくなる傾向がみられた。しかし，21～33°Cと15～33°Cでは，それぞれ12°Cと18°Cの温度較差があるにもかかわらず，放卵分布のパターンには殆んど差は認められなかった。この原因として，両温度条件の下限温度(21°C，15°C)が，ともに熱的中性圏にあることが考えられた。放卵分布のピークは，いずれの変温条件下においても温度周期のピーク時刻(12:00)より2～3時間前に現われた。

(家禽会誌，22，327～330，1985)