Time of Oviposition under Asymmetric Skeleton Photoperiods in the Domestic Fowl

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Materials and Methods

The experiment was performed in a windowless house using 450 pullets of White Leghorn at 32 weeks of age. The birds were divided randomly into two groups. The birds in group 1 were reared under the following asymmetric skeleton photoperiods formed from a 9 hour main light period and a 1 hour light pulse scanning the dark period; 9L:15D (9 hour light and 15 hour darkness, light-on at 08:00), 9L:1D:1L:13D, 9L:4D:1L:10D, 9L:7D:1L:7D, 9L:10D:1L:4D, 9L:13D:1L:1D and 9L:15D. The birds in group 2 were reared under the same asymmetric skeleton photoperiods in a reversal of the order of group 1. Each photoperiod was treated for three weeks. Temperature was maintained at 24±2°C.

Time of oviposition of each bird was recorded by the automated recording system. The records of ovipositions for the first one week of acclimation period were not used. Mean time of oviposition was calculated as the polar angle of the mean vector in which each time of oviposition was represented as a unit vector. Percentage of eggs laid in a modal 8-hour
Results and Discussion

Mean time of oviposition and percentage of eggs laid in the modal 8 hours in each treatment are shown in Table 1. Percentage of eggs laid in the modal 8 hours in groups 1 and 2 was over 80% in each treatment, therefore oviposition rhythm was synchronized to each photoperiod fairly well. Mean time of oviposition in group 1 was retarded 68 minutes by the change from 9L:15D to 9L:4D:1L:10D, but in 9L:7D:1L:7D it was about the same time in 9L:15D, then it was advanced 66 minutes by the change from 9L:7D:1L:7D to 9L:10D:1L:4D. The time difference of the mean time of oviposition between the first and the last 9L:15D seems to be caused by the aging effect. In group 2 it was similar to group 1.

The phase response for the timing of oviposition to a 1 hour light pulse which is modified by the aging effect is shown in Fig. 1. Under the photoperiod of 9L:7D:1L:7D which is divided into two equal dark periods by a 1 hour light pulse the phase response for the timing of oviposition is almost zero. If the time measurement of bird is rough and influenced by the previous treatment, the phase shift for the timing of oviposition would not occur at 9L:7D:1L:7D. Therefore, it is suggested that bird can measure the difference of the length of the two dark periods very precisely without being affected by a previous treatment.

Mongin reported that under symmetric skeleton photoperiod of 2L:10L:2L:10D most ovipositions occurred in the first 10 hour dark period and that with a gradual increase of the first dark period a complete phase shift for the timing of oviposition was observed at 2L:11.15D:2L:8.45D. As the birds in his experiment did not distinguish the difference of

<table>
<thead>
<tr>
<th>Group</th>
<th>Light regimen</th>
<th>Mean oviposition time (Clock hour)</th>
<th>Percentage of eggs laid in the modal 8 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9L : 15D*</td>
<td>10 : 25</td>
<td>81.1</td>
</tr>
<tr>
<td></td>
<td>9L : 1D : 1L : 13D</td>
<td>11 : 23</td>
<td>82.6</td>
</tr>
<tr>
<td></td>
<td>9L : 4D : 1L : 10D</td>
<td>11 : 33</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td>9L : 7D : 1L : 7D</td>
<td>10 : 33</td>
<td>82.3</td>
</tr>
<tr>
<td></td>
<td>9L : 10D : 1L : 4D</td>
<td>9 : 27</td>
<td>83.5</td>
</tr>
<tr>
<td></td>
<td>9L : 13D : 1L : 1D</td>
<td>9 : 58</td>
<td>84.4</td>
</tr>
<tr>
<td></td>
<td>9L : 15D</td>
<td>10 : 41</td>
<td>85.9</td>
</tr>
<tr>
<td>2</td>
<td>9L : 15D</td>
<td>10 : 16</td>
<td>83.2</td>
</tr>
<tr>
<td></td>
<td>9L : 13D : 1L : 1D</td>
<td>9 : 35</td>
<td>83.3</td>
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<td></td>
<td>9L : 10D : 1L : 4D</td>
<td>9 : 23</td>
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<tr>
<td></td>
<td>9L : 1D : 1L : 13D</td>
<td>11 : 15</td>
<td>86.0</td>
</tr>
<tr>
<td></td>
<td>9L : 15D</td>
<td>10 : 26</td>
<td>86.4</td>
</tr>
</tbody>
</table>

* Light on at 08:00 hours
the length of the two dark periods precisely, it seems that the birds were affected by other environmental factor(s) influencing oviposition rhythm.

It is suggested that bird can distinguish the difference of the length of the two dark periods under asymmetric skeleton photoperiod very precisely.

Summary

The experiment was performed in order to investigate the phase response of oviposition to a shorter light pulse and the precision of distinction of the length of the two dark periods under asymmetric skeleton photoperiods. 450 White Leghorn hens of 32 weeks of age were divided into two groups and treated the following asymmetric skeleton photoperiods; 9L:15D (light-on at 08:00), 9L:1D:1L:13D, 9L:4D:1L:10D, 9L:7D:1L:7D, 9L:10D:1L:4D, 9L:13D:1L:1D and 9L:15D. The order of the treatments in groups 1 and 2 was reversed. Each photoperiod was treated for three weeks and time of oviposition of each bird was recorded.

The phase response for the timing of oviposition to a 1 hour light pulse was 30 to 40 minutes under the photoperiods with two unequal dark periods, but the photoperiod of 9L:7D:1L:7D which is divided into equal dark periods the phase response was almost zero irrespective of the previous treatment. It is suggested that bird can distinguish the difference of the length of the two dark periods under asymmetric skeleton photoperiods very precisely.

Literature

非相称枠光周期下における鶏の放卵時刻について

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鶏の光パルスに対する鶏の放卵時刻の位相反応は、9L:15Dを基準とすると、2つの暗期の長さが異なる場合には40分～70分であったが、2つの暗期の長さが等しい9L:7D:1L:7Dの下では、直前の処理とは関係なく位相反応はほとんど0であった。このことから、鶏は非相称枠光周期下における2つの暗期の長さを直前の処理の影響をうけることなく、きわめて正確に認識することができるものと考えられた。