ABSTRACT

Study was carried out for establishing the optimal sex ratio in Muscovy duck breeding. Four variants of the ratio of the male to the female individuals were tested: 1:5(I), 1:6(II), 1:7(III) and 1:8(IV). In the frames of each sex ratio (variant), two subgroups (sub-variants) were formed with the aim of establishing the effect of the hierarchy relations among the drakes on egg fertility: with one male in a group (A) and with more than one male in a group (B).

The highest egg fertility – 97.09 % was achieved at 1:5 sex ratio (with more than one drake in a group) and the lowest – 93.41 % at 1:8 sex ratio (with a single male in a group).

Significant decrease in egg fertility was registered when increasing the sex ratio to 1:8, that effect being displayed more weakly at more than one male in the group. When increasing the ratio, the presence of more than one drake in the family group exerted a positive influence on egg fertility, due to the preference of the males to certain females and the distribution of the rest of the females among the drakes placed in the hierarchy below the “alpha”, depending on their grade in the hierarchy order.

The most appropriate sex ratio for Muscovy duck species was 1:5, and, when there was shortage of the male reproduction material, 1:6 ratio was also acceptable, especially if more than one drakes were placed in the family group (effect of supporting the alpha).

KEY WORDS: Muscovy duck, sex ratio, hierarchial relations
INTRODUCTION

Establishing and maintaining the optimal sex ratio in agricultural poultry breeding affect the economic results of poultry breeding in two ways: by achieving maximal egg fertility and by the number of the drakes raised.

One of the characteristics of the Muscovy duck is the obviously expressed sexual dimorphism in the live weight. According to data of Stevens & Sauveur (1985) [15] it was reported as early as the 10-day age of the ducklings and according to Gerzilov (1999) [4] – at 3-4 weeks of age. After the 10th -12th week the live weight of the female ducklings was only about 65 % of the male ([2], [15], [11]). The male individuals, which had completed their growth reached 4.500 – 5.000 kg and over, while the females – hardly up to 2.200 - 3.000 kg [9]. That fact reflected on the necessity of bigger amounts of nutrient substances for maintaining life. Thus, during the reproductive period the Muscovy drake consumed about 250 – 280 g and during the non-reproductive period – about 200 g of combined forage daily, which was twice more compared to the daily consumption of the female individuals ([6], [13], [14]).

Optimizing the sex ratio played an important role for achieving the maximal egg fertility especially in cases, when the live weight of the male individuals significantly surpassed that of the female ones. In that relation the most often sex ratio applied in breeding of Muscovy duck species was 1:5 ([1], [10], [11], [12]), and, secondly - 1:4 ([7], [8], [13]). Wang and Xu (1989) [16] mentioned about bigger ratio, experimenting sex ratios from 1:4.3 to 1:10 for waterfowl species, obtaining egg fertility from 75.9 to 94.6 %.

The aim of the present study was to establish to what extent the increased sex ratio in breeding Muscovy duck species is effective.
species did not affect negatively the percentage of egg fertility, as well as the effect of the hierarchial relations among the male individuals on that characteristic.

MATERIAL AND METHODS

The experiments described in the present paper were carried out in 2002 in a private herd with 320 one-year old layers of Muscovy duck species (White variety), distributed according to the sex ratio in four experimental groups, each of them split into two subgroups (subvariants), following the scheme (Table 1).

Splitting each of the four major groups into two subgroups was necessitated by the second aim of the study, i.e. to follow up the effect of the hierarchial relations among the drakes on egg fertility.

All the formed 8 subgroups were bred applying the extensive production system in a semi-open building at a density of 2 ducks/m\(^2\). The groups with a single drake in the frames of each sexual ratio were separated and those with more than one male were bred together. All the year round the ducks had an unlimited access to grassy yards without water ponds, at a density of 1 duck/m\(^2\). During the reproduction period they were fed on combined forage based on cereals, soya and sunflower groats and additives containing 12 MJ of metabolizable energy (ME) and 16.0 % of crude protein.

All the eggs laid before and after the laying peak were included in the studies, as well as by 500 eggs from each subgroup, laid during the peak. Egg fertility was reported in a private hatchery using ovoscoping methods on the 9th day of the embryonic development.

RESULTS AND DISCUSSION

Table 2 presents data about the fertility of the Muscovy duck eggs depending on the sex ratio. In all the experimental groups the studied characteristic reached the highest values in the laying peak, the difference between the laying periods within the group being significant only in the subgroups of the first major group, at sex ratio of 1:5 (p<0.05). In all the other cases the difference was below or not more than 1 %. It means that egg fertility for that waterfowl species was hardly affected by the laying period. The conclusion mentioned was also confirmed by previous studies of the author (Nickolova, 2003).

At all the phases of egg laying the differences between subgroups A and B in the same sex ratio were within the limits of about 0.5 % in average and they were statistically insignificant, however, they were in favour of the groups with more than one drake. The tendency was most obvious for the biggest sex ratio and in the period of the laying peak. It could be explained by the big number of ova to be fertilized in the phase of the laying peak and the big number of females per male in subgroups A.

At the same time the bigger number of males in the group (subgroups B) in the frames of the sex ratio had a positive effect on egg fertility because the females not preferred by the “alpha” drakes, were distributed among the males placed lower in the hierarchy. What is more that distribution of the females was a result of three factors: personal preferences of the male to certain ducks (they...
In the first case of a bigger sex ratio (subgroups A), the individual potency of the drake was very close for the separate subgroups in the frames of the same sex ratio. We think that effect is only possible when there are enough area for the waterfowl. The results discussed below confirm that assumption. The differences were significant at: a, *** - p<0.001; b, ** - p<0.01; c, * - p<0.05.

Table 2. Muscovy duck egg fertility (%) depending on the sex ratio

<table>
<thead>
<tr>
<th>Group</th>
<th>Sex ratio</th>
<th>Period</th>
<th>1:8</th>
<th>1:7</th>
<th>1:6</th>
<th>1:5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1:8</td>
<td>93.78</td>
<td>96.64</td>
<td>94.82</td>
<td>95.78</td>
<td>95.84</td>
</tr>
<tr>
<td></td>
<td>1:7</td>
<td>95.58</td>
<td>98.37</td>
<td>93.67</td>
<td>95.94</td>
<td>96.53</td>
</tr>
<tr>
<td></td>
<td>1:6</td>
<td>96.64</td>
<td>97.37</td>
<td>96.84</td>
<td>96.18</td>
<td>96.53</td>
</tr>
<tr>
<td></td>
<td>1:5</td>
<td>97.93%</td>
<td>97.93%</td>
<td>97.93%</td>
<td>97.93%</td>
<td>97.93%</td>
</tr>
</tbody>
</table>

After the egg laying peak the highest percentage of fertile eggs was obtained at male to female sex ratio of 1:5, the values were small and statistically insignificant, with an exception of the difference between second and fourth group (p<0.05).

The results of the egg fertility were more than one male and one female in the frames of the group, resulting from the interaction of the experimental purpose, while in the subgroups of more than one male in the same sex ratio, varying between values 95.84% and 95.81% respectively. The reduction by about 0.96% at the sex ratio of 1:7, was mathematically proven. Only when the drakes of the lower order and, most probably, they preferred by the "alphas", were distributed among the drakes of the tower order after not more than 3 – 5 days. They remained non-fertilized for not more than 3 – 5 days. It was reported in the rest of the experimental groups, the negative effect of the more ducks per drake and the preferences of the male to a certain number of the females was reported. As a result of the "non-preferred" females were more rarely fertilized and egg fertility was near zero.

In the second case (subgroups B), the females non-preferred by the "alphas", were distributed among the drakes of the tower order, and they remained non-fertilized for not more than 3 – 5 days. That was reported in the rest of the experimental groups, the negative effect of the more ducks per drake and the preferences of the male to a certain number of the females was reported. As a result of the "non-preferred" females were more rarely fertilized and egg fertility was near zero.
EFFECT OF THE SEX RATIO ON THE EGG FERTILITY OF MUSCOVY DUCK (CAIRINA MOSHCATA)

371


CONCLUSIONS
1. The highest egg fertility for the reproductive season was established at sex ratio of 1:5 - 97.09 % (for more than one male in the group) and the lowest – at 1:8 - 93.41 % (one male in the group).
2. Significant decrease in egg fertility (93.41 %) was reported at increasing the sex ratio to 1:8, the effect being slightly expressed at more than one drake in the group.
3. At increasing the sex ratio the presence of more than one male in the group played a positive role on egg fertility due to the distribution of the females non-preferred by the “alpha” drakes among the males placed lower in the hierarchy.
4. The most appropriate sex ratio for Muscovy duck species is 1:5, and, when there is a shortage of male reproduction material, 1:6 ratio is also admissible, especially when more than one drake are included in the family group (an effect of helping the alpha).

REFERENCES