Triple-yolked eggs in domestic ducks: a rare occurrence

Attila Salamon*†, and John P. Kent†

ABSTRACT Multiple-yolked avian eggs, and especially triple-yolked (TY) eggs, are rare. Over two years, 48,224 duck eggs (*Anas platyrhynchos domesticus*) were individually candled and seven (0.0145%) TY eggs were identified in a commercial breeding and incubation environment. When compared with double-yolked eggs (Salamon and Kent, 2016) their mean weight, length, width and shape index did not differ, but their dimensions were greater than for single-yolked duck eggs. Yolk fertility in the TY eggs was low (33.33%), and this was attributed to smaller yolk size and early ovulation and/or follicle immaturity. By day 8 of incubation, fertile yolks were positioned next to the airspace. Egg 5 contained one fertile yolk, and the embryo developed to enter the airspace, was consuming all three yolks, but failed to hatch.

Key words: duck, fertility, incubation, triple-yolked egg, yolk position

INTRODUCTION

Multiple-yolked avian eggs are rare, with an estimated one in every 500 eggs being double-yolked (DY), and one in every 5,000 to 6,000 is triple-yolked (TY) (Romanoff and Romanoff, 1949). Studies on TY eggs are also rare, with Romanoff and Romanoff (1949) reporting studies on a total of four TY hen (*Gallus gallus domesticus*) eggs including a very large one, all containing proportionately more total yolk, but less albumen and shell than single-yolked (SY) eggs (Curtis, 1914; Clark, 1932; reviewed in Romanoff and Romanoff, 1949).

Here, TY eggs were identified during a larger study that compared DY and SY duck eggs (Salamon and Kent, 2014, 2016) through the incubation process. The objective of this study was to describe the incubation of TY eggs.

MATERIALS AND METHODS

A total of 48,224 eggs from a flock of ducks of the Aylesbury breed over a 2-year period (2008–2010) were studied at Ballyrichard (Arklow, Ireland; 52°50′5″ N, 6°7′49″ W). The flock was managed as described by Salamon and Kent (2016). TY eggs from 42 batches were identified before setting by individual candling. Eggs were set and managed as described in Salamon and Kent (2014).

RESULTS

Seven (0.0145%) TY eggs were identified, i.e., approximately one in every 6,900 eggs. Physical parameters are shown in Table 1. TY egg weight varied (93.2 to 136.5 g), with three lighter than 100 g, and four over 109 g. Length ranged from 70.27 to 82.35 mm, while the range of width was 49.25 to 56.21 mm and three different egg shapes were identified: ideal (n = 3), conical (n = 2) and biconical (n = 2).

Three yolk positions were identified in TY eggs (see Fig. 1); type A (Eggs 1, 2, 4, and 6), B (Eggs 5 and 7), and C (Egg 3). During incubation (from E2 to E8), yolk position remained the same in eggs with three infertile yolks (Eggs 2 and 7), while it changed in Egg 1 (from type A to B) in Egg 5 (from type B to C) with the fertile yolks positioned close to the airspace. The yolk movement suggests the absence of chalazae between the yolks. However, in 42.86% (3/7) of eggs (Eggs 2, 4, and 6) it was not possible to identify yolk position on E8, as those eggs were infected and their yolks were disintegrated. In TY eggs, 33.33% of all yolks (7/21) were...
Table 1. Physical parameters of triple-yolked (TY) eggs: egg weight on E2, length, width, shape index, shape; and the fertility of TY eggs on E8.

<table>
<thead>
<tr>
<th>Egg number</th>
<th>TY egg weight on E2 (g)</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Shape index (length/width)</th>
<th>Egg shape</th>
<th>Fertility on E8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>131.7</td>
<td>82.35</td>
<td>54.15</td>
<td>1.52</td>
<td>conical</td>
<td>3 fertile yolks (2 alive, 1 dead)</td>
</tr>
<tr>
<td>2</td>
<td>136.5</td>
<td>79.2</td>
<td>56.21</td>
<td>1.41</td>
<td>ideal</td>
<td>3 infertile yolks</td>
</tr>
<tr>
<td>3</td>
<td>97.2</td>
<td>76.94</td>
<td>48.84</td>
<td>1.58</td>
<td>biconical</td>
<td>1 fertile, 2 infertile yolks</td>
</tr>
<tr>
<td>4</td>
<td>109.6</td>
<td>74.42</td>
<td>51.15</td>
<td>1.45</td>
<td>ideal</td>
<td>1 fertile (dead), 2 infertile yolks</td>
</tr>
<tr>
<td>5</td>
<td>93.2</td>
<td>70.27</td>
<td>49.25</td>
<td>1.43</td>
<td>ideal</td>
<td>1 fertile, 2 infertile yolks</td>
</tr>
<tr>
<td>6</td>
<td>96.7</td>
<td>72.09</td>
<td>49.28</td>
<td>1.36</td>
<td>biconical</td>
<td>1 fertile (dead), 2 infertile yolks</td>
</tr>
<tr>
<td>7</td>
<td>120.4</td>
<td>78.85</td>
<td>53</td>
<td>1.49</td>
<td>conical</td>
<td>3 infertile yolks</td>
</tr>
</tbody>
</table>

Mean (+SD) 112.19 (+17.66) 76.30 (+4.27) 51.70 (+2.84) 1.48 (+0.06)

Figure 1. Yolk positions as identified in triple-yolked eggs. AS: airspace.

Three eggs remained in the incubator after fertility check on E8. Egg 3 became infected and was removed on E12. Egg 1 was incubated up to E17, when the two remaining live embryos died. Egg 5 was incubated and transferred to the hatcher on E26. The one embryo of Egg 5 entered the airspace, but did not hatch and was examined post-mortem on E30 of incubation. The embryo was relatively large compared those from SY eggs with a larger abdomen and two yolk sacs attached, one about pea sized and the other about three times pea size.

DISCUSSION

The finding that one in every 6,900 duck eggs was TY is comparable to findings in domestic fowl (Curtis, 1914; reviewed in Romanoff and Romanoff, 1949), and the relatively small egg size suggests that they were produced at the onset of laying (Curtis, 1914; Clark, 1932, reviewed in Romanoff and Romanoff, 1949).

Variation in egg weight has been observed in DY duck eggs. However, 41.73% of such DY eggs were similar in weight to SY eggs (Salamon and Kent, 2016). Interestingly, the mean egg weight, length, width, and shape index of TY duck eggs did not differ from those of DY duck eggs, but were greater than those of SY duck eggs (for means of DY and SY duck eggs, see Salamon and Kent, 2016). Further, TY duck eggs were ideal, conical, and biconical shaped and these were the most common shapes in DY eggs (Salamon and Kent, 2016).

Curtis (1914) also showed that the proportions of the internal contents of the TY hen eggs did not differ from those in DY eggs, but differed from SY eggs by having proportionally more yolk and less albumen. However, the individual yolks in the TY eggs were smaller than those in SY and DY eggs (Curtis, 1914), which complements the finding of Salamon and Kent (2013) comparing the internal contents of SY and DY duck eggs and further strengthens the view that DY and TY eggs are produced by young birds at the onset of laying (Romanoff and Romanoff, 1949; Salamon and Kent, 2016).

The fertility in the TY egg yolks was only 33.33% and is similar to that of DY hen eggs (27.3%);
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Fechheimer and Jaffe, 1966), but lower than yolk fertility in DY (51.9%) and SY duck eggs (89.98%; Salamon and Kent, 2016), and DY (62.5%) and SY broiler breeder eggs (98.44%; Fasenko et al., 2000). Yolks in DY duck eggs are smaller than in SY duck eggs (Salamon and Kent, 2013) and have a lower chance of achieving fertilization that was attributed to early ovulation and/or follicle immaturity (Salamon and Kent, 2016). The small size—within the normal SY duck egg weight range (75 to 104.9 g; Salamon and Kent, 2016)—of TY duck eggs and an associated small yolk size should explain the low fertility of TY duck eggs found here.

Two TY eggs were incubated long enough to record egg weight-loss data that was similar to that of DY duck eggs (Salamon, 2015). The one live embryo in Egg 5 entered the airspace on E26 and was transferred to the hatcher. It did not hatch and the post-mortem examination showed that the embryo was internalizing all three yolks, but did not complete this process. Thus, it is possible that a single embryo in TY eggs may reach the point of hatching, as found in DY eggs (domestic fowl, Monkman, 1963; Burke et al., 1997; Fasenko et al., 2000; duck, Salamon and Kent, 2014). It was suggested that there may be an optimal egg weight range to facilitate successful hatching in DY and SY eggs (Monkman, 1963; Salamon and Kent, 2014) and this may also apply to the rare TY duck egg, as Egg 5 was within the ‘optimal’ weight range. However, the relative excess of yolk and/or lack of albumen in DY and TY eggs must also be considered in the context of embryo development and as a constraint on successful hatching.

REFERENCES


