A Serological Estimate of Monozygotic Twinning in Sheep

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It has long been recognized that monozygous (MZ) twinning is a rare event in domestic sheep (*Ovis aries*). Johansson³, in a study of 5,088 twin pairs from all breeds of Swedish sheep, found 2,685 male-female pairs. By application of the formula:

\[ \text{MZ twin pairs} = \text{total pairs} - (2 \times \text{no. of MF pairs}) \]

his estimate of monozygotic twin pairs was -282. Comparable studies by Chapman and Lush¹ produced additional evidence for the scarcity of MZ twins in sheep. This paper reports the results of an investigation of the blood types of 117 like-sexed pairs of sheep and discusses the utility of serological tests in helping to identify monozygous twins.

**Materials and Methods**

White-faced western range sheep at three experiment stations (Davis and Hopland, California, and Dubois, Idaho) were bloodtyped with reagents belonging to seven blood group systems (A, B, C, D, M, R-O, and X-Z). Blood group factors of the complex B-system were detected by the use of 16 reagents. The details of the genetic background of these sheep and of the bloodtyping reagents and procedures used in this study have been reported by Stansfield *et al.*⁴.
Results

A total of 180 pairs at Dubois and 73 twin pairs in the Davis and Hopland flocks were examined during 1962 for identical sex and blood types. The results of this study appear in Table 1. Using Johansson's method on the material in this study, the number of expected monozygotic twins is -5 in the Davis and Hopland flocks and -26 in the Dubois flocks. The observed ratio MM :MF :FF pairs of twins for the pooled data is not significantly different from a 1:2: 1 ratio at the 5 percent level (\(x^2 = 4.75, 0.10 < P > 0.05\)). Johansson's data showed a 5.5 percent dearth in monozygotic twins, compared with a 12.3 percent dearth in the pooled data of the present study.

Discussion

Identical blood types alone are not proof of monozygosity, but can be used as an important adjunct to morphological criteria in making such determinations. No data were available on the anatomical similarity of the like-sexed twins in this study. However, in most cases it would be unlikely for the blood of like-sexed twins to show identical reactions to all 27 of the bloodtyping reagents. The frequency of monozygosity determined by serological identity is thus an upper limit, since identical blood types can occur in like-as well as unlike-sexed twins by chance alone. In the Davis and Hopland flocks, none of the like-sexed twins had identical blood types, and therefore they all must have been dizygous twins. In the Dubois flocks, however, the upper limit of monozygous twinning is estimated to be 10.4 percent, i.e. less than 11 out of every 100 like-sexed twin pairs could be monozygous. Some of the Rambouillet flocks at Dubois were inbred as much as 41 percent, thus increasing the chance of finding identical blood groups even among dizygous, like-sexed twins at this station.

The paucity of monozygous twin births may not accurately reflect the embryonic incidence of monozygosity. Helming\(^2\) examined 675 sheep fetuses and found among them one pair of twins whose dam had an ovary with only one corpus luteum, indicating a monozygous origin for her pair of twins. Stormont and colleagues (unpublished) studied one pair of presumptive MZ sheep twins that were maintained at the University of California Davis Experiment Station for 11 years. By no criteria, which
included exchange of skin grafts, blood-typing with all the available ovine blood-typing reagents, electrophoretic tests for hemoglobins and transferrins, was it possible to exclude monozygosity. However, in the case of all other ovine twins whose blood has been submitted to Stormont's laboratory for monozygosity tests, it has been possible to exclude monozygosity. Thus, monozygosity probably does occur occasionally in sheep. The negative estimates of monozygosity, which have consistently been found in sheep twins, suggest that twins of unlike-sex have a selective advantage over twins of like-sex.

Table 1. Identical blood types in like-sexed twin pairs

<table>
<thead>
<tr>
<th>Location</th>
<th>Total no. of twin pairs</th>
<th>No. of MF pairs</th>
<th>No. of MM pairs</th>
<th>No. of FF pairs</th>
<th>No. of like-sexed pairs with identical blood types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis-Hopland</td>
<td>73</td>
<td>39</td>
<td>12</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Dubois</td>
<td>180</td>
<td>103</td>
<td>38</td>
<td>39</td>
<td>8</td>
</tr>
<tr>
<td>Totals</td>
<td>253</td>
<td>142</td>
<td>50</td>
<td>61</td>
<td>8</td>
</tr>
</tbody>
</table>

Summary

An estimate of monozygosity in like-sexed twins based on sex data alone was zero. Serological estimates of the upper limit to monozygous twinning among like-sexed pairs ranged from zero to 10.4 percent in the three flocks studied.

Literature Cited

