

LINKAGE IN *PRIMULA SINENSIS*

A CORRECTION

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IN a recent paper by De Winton and Haldane (1935) on linkage in the diploid *Primula sinensis* I was responsible for an algebraical error. This does not appreciably affect the conclusions arrived at, but requires correction, as others may use the method there given for testing the homogeneity of cross-over frequencies or other ratios. The error occurs on p. 92. If we have $n+1$ families containing N individuals in all, of which Nc are cross-overs, and the r th family contains a_r individuals, of which x_r are cross-overs, then the measure of divergence

$$\begin{aligned}\chi^2 &= \sum \frac{(x_r - ca_r)^2}{ca_r} + \sum \frac{(x_r - ca_r)^2}{(1-c)a_r} \\ &= \frac{1}{c(1-c)} \sum \frac{(x_r - ca_r)^2}{a_r}.\end{aligned}$$

In order to calculate the sum rapidly we choose a simple decimal c' approximating to c . Then

$$\chi^2 = \frac{N}{Nc \cdot N(1-c)} \left\{ N \sum \frac{(x_r - c'a_r)^2}{a_r} - (Nc - Nc')^2 \right\},$$

which can rapidly be calculated, as Nc and $N(1-c)$ are the total numbers of cross-overs and non-cross-overs. This differs from the erroneous formula in that the value of χ^2 must be divided by $1-c$ and is thus somewhat increased. In the example given in Table XVII the value of χ^2 should be 1.848 instead of 1.569, whence $\xi = -1.129$, and $P = 0.808$.

I have recalculated Table II of the original paper, adding some further data obtained since publication. It will be seen that for 151 degrees of freedom $\chi^2 = 193.3$. The probability of so large a deviation is 0.0115, or one chance in 87. However, the high value of χ^2 is largely due to two of the 165 families. It can be concluded that there are almost certainly real deviations from constancy of linkage, but that these only occur in very few families. The variance is 1.28 times that expected. So the standard errors of the linkage values given should be increased by about 13 per cent. on the average. The conclusion that cross-over values are far less variable than single factor ratios is unshaken.

Since the paper of which this is a correction was published, the factor *pi* for recessive pistilloidy has been found by Miss De Winton to be

TABLE II

Tests for constancy of linkage

Factors	No. of families	χ^2	ξ
SB ♀	15	22.6	+1.405
SB ♂ ₃	16	24.6	+1.595
BG ♀	48	59.5	+1.259
BG ♂ ₃	15	17.8	+0.787
GL ♀	4	3.42	+0.436
GL ♂ ₃	3	0.176	-1.323
PF ♀	6	1.27	-1.529
PF ♂ ₃	8	14.0	+1.637
FCh ♀	17	11.7	-0.723
FCh ♂ ₃	11	20.5	+1.962
MY ♀	5	3.25	-0.056
YK ♀	6	3.97	-0.140
OMp ♀	6	8.67	+1.065
OMp ♂ ₃	4	1.80	-0.303
14	164	193.3	+2.274

linked with *o*, that for oak leaves, while *r*, the recessive factor for blue petal colour, appears to be independent of the third linkage group.

SUMMARY

A formula given in a former paper is corrected. The biological conclusions are unaltered.

REFERENCE

- DE WINTON, D. and HALDANE, J. B. S. (1935). "The genetics of *Primula sinensis*. III. Linkage in the diploid." *J. Genet.* **31**, 67-100.