17 May 1932.

Dr. E.M. East,
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Dear Dr. East:

Many thanks for your letter of 5 May 1932, which came shortly after I had seen your short paper in _Genetics_.

(1) Using the theory set forth in your 1927 paper, and applying somewhat more fully, than in your recent note, the equations by which the constitution of each generation is derived from that of the last, I had satisfied myself that the "homozygous" or balanced lethal type of mid-styled plant, encountered by Mrs. Barlow and yourself, must upon that theory be really a rather exceptional type. Per mille of a stable population I found the 10 frequencies of the following table:

|   | +     | $M_1$ | $M_2$ | $M_1 M_2$ | $M_1/M_2$ |       |
|---|-------|-------|-------|-----------|-----------|-------|
| + | 381.6 | 135.0 | 135.0 | 5.8       | 6.3       | 282.2 |
| A | 221.5 | 53.0  | 53.0  | 2.4       | 6.3       | 336.2 |

Showing an excess of longs over mids, to which I am not
inclined to attach great importance, since the ~~progenies~~ *frequencies* in
Nature might be much disturbed by slight differences in
viability or fertility; but, what is more important, that
only a little more than 2 per cent. of mids, and less than
2 per cent. of shorts will be of the balanced lethal condition.
The coupling phase of double heterozygotes will be even
somewhat less abundant, and the great majority of mids, and
of shorts carrying mid, will be single heterozygotes.

Your new data evidently confirm this opinion.

(ii) The double heterozygotes in coupling throwing
(on 10 per cent. recombination) 55 per cent. mid, and 45 per
cent. long, would scarcely be distinguishable from single
heterozygotes, without breeding about 500 offspring, and even
large numbers do not clear away all ambiguity, if there is
a slight differential viability in the conditions of culture.
It does seem, however, that the two lethals theory could be
verified beyond doubt, by means of the fact that there should
be two common kinds of singly heterozygous mid, and two
corresponding kinds of short, and that these should be
distinguishable by the matings

$$M_1 \times M_1A \left.\begin{array}{c} \\ \\ \end{array}\right\} \text{1 Long} \quad \text{2 Mid} \quad \text{3 Short}$$
$$\text{or} \quad M_2 \times M_2A$$

while on the other hand

$$\left.\begin{array}{l} M_1 \times M_2 \wedge \\ M_2 \times M_1 \wedge \end{array}\right\}^{.} \quad \text{2 Long} \quad \textbf{3 Mid} \quad \textbf{4 Short}$$

Ignoring the shorts, the distinction between the 2 : 1 and the 3 : 1 ratios, though not too easy, would seem to be feasible, especially as one starts with whole groups of plants known to be of the same sort, either $M_1$ or $M_2$.

(iii) The fact in your new data which does suggest the annoying possibility that there was something wrong with your first suggestion, is the apparently homozygous mid plant which gave on crossing to long about 500 mids and 1 Long. Some interest attaches to this exceptional offspring, the seed parent was the apparently homozygous mid, so that it cannot be explained by stray pollen.. I hope it may be possible to test it genetically.

The beauty of the two lethals theory (I am a little unwilling to call them balanced lethals, as they are only balanced in about 1/80 of the population) makes me a little unwilling *reluctant* to give it up on account of this one apparently homozygous *plant* parent. I am therefore anxious to know (a) whether it is supported at all substantially, as some sentences in your recent note suggest by the behaviour of other plants, and (b) whether you are attracted by the suggestion that it is merely an $M_1/M_2$ plant with exceptionally close linkage

(iv) I was ~~attracted~~ *led* to work on the consequences of your theory of two lethals, by its interesting bearing on the advantage of closer linkage.   That I need not go into now, but it did lead me to consider the case of complete linkage between two lethal factors such as you postulated.   In this case $M_1M_2$ and $AM_1M_2$ become extinct, $M_1/M_2$ and $AM_1/M_2$ behave as homozygotes, and are still fairly rare, but the fact that there are two lethal factors and not one non-lethal, would still be demonstra~~ted~~ *ble* by the contrast of the 2 : 1, and the 3 : 1, ratios, in the matings of single heterozygotes.

Excuse a very long letter.   I am most anxious to have your views on (a) and (b).

Yours sincerely,