

March 13, 1940

Dear Ford,

Would it suit you, instead of making any such addition as an appendix, to let me add a footnote such as that enclosed to your histograms of frequency distribution? I send also F Fabergé's drawing of the set of diagrams for your approval and annotation.

I have sent your page 53 explanation of plate and your plan to the Cambridge Press, asking them whether they prefer to reproduce in colours from the actual specimens or from paintings.

I forget what I said to you before, but I think now the paper should go into Volume X, No. 3, appearing about next September.

Yours sincerely,

E. S. M. ...
Annals of Entomology 10
(1942) p. 251-2
- J. H. B.

Footnote

In reproducing the frequency distribution of Mr Ford's broods of Abraxas grossulariata I have ventured to introduce an innovation in the stars which indicate the approximate dividing lines between thr three principal genotypes. This is an indication of which I have often felt the need in examining genetical distributions.

The method of placing them requires no theoretical justification, since their aim is merely to guide the eye. It is essential, however, that such indications should be placed, not arbitrarily according to the preconceptions of the author, but by an objective rule applied to the actual frequency distribution observed. The rule which first suggests itself, that of marking the actual quartiles, is, however, unsatisfactory, since the positions so obtained are greatly affected by errors of random sampling whenever, as frequently happens, the division points fall in sparsely occupied portions of the distribution. Less capricious and equally objective placings may be found by averaging points $1\frac{1}{2}$ standard deviations above and below the empirical quartiles.

For example, with a progeny of 63 insects the quartiles fall at 15.75 and 47.25. The standard error of ^{each of} these is 3.437. We therefore locate the positions corresponding with 15.75 ± 5.156 , i.e., 10.594 and 20.906. In the actual distribution of (35 broods), 2 and 3 ^(F. & E.) these correspond with

the colour stage values 1.383 and 3.344, the mean of which, 2.364, gives the position of the star indicating the boundary between the heterozygotes and the non-mutant homozygotes. As a matter of experience deviates of $\pm 1\frac{1}{2}$ standard deviations usually indicate the required position satisfactorily; for since nearly $7/8$ ths of a normal curve lies in the central range of three standard deviations, we may expect the true point to lie between the positions averaged in seven cases out of eight. The ^{occurrence} ~~position~~ of actual gaps in such diagrams is usually somewhat ^{fortuitous} ~~capricious~~, since their existence or non-existence may depend on the presence or absence of a single insect. The position of the stars is intended to be influenced by the observed characters of a number of insects in the relevant region.

R.A.F.