

July 22, 1941

My dear Henry,

I was delighted to have and to read your three most interesting letters on the numbers and gene frequencies found this year in Dominula.

You may be interested in some of the notes on the enclosed sheet, on which I have made out a lattice diagram for the six days covered by your catches and releases, as we did with Polyomatus.

As regards numbers, if we had had only the data for the first period, July 15 - 16, we should have an estimate of 732 for the numbers flying at this stage, while if we had only data from the 19th and 20th, in which I think 42 were released on the 19th and 66 captured on the 20th, with two recaptures among them, the estimate would be 1386. Since a chance negative deviation in the recaptures affects the estimate much more than a similar chance positive deviation, the straight average of such figures is not much use; but I think they can be rationally pooled in the way shown by the expression

$$\frac{61 \times 48 + 66 \times 42}{4 + 2}$$

which gives 950. in which we only ignore deaths and emergencies within these short periods.

If we treat each period as a single observation, i.e., 105

released on the 15th & 16th, and 112 captured on the 19th & 20th with 10 recaptures, the number estimated is 1176, which will, of course, be exaggerated by reason of emergences and deaths between the two periods, so that all your data this year on numbers are nicely consistent with the view that during the season the numbers flying at any one time may be nearly 1000, or, say 900 insects, while, of course, during the course of the season, some more than this, possibly 1500 or so, may emerge in all.

I am glad that I felt, prior to this year's catches, that the great regularity suggested by previous years was almost too good, even though the view of an increase in gene frequency as regular as usual were fully accepted. Testing the gene ratio in 1941 against 1940, I find χ^2 for one degree of freedom 3.39, which falls short of significance at the 5% level, though, as I have used its adjustment, which slightly over-corrects in most cases, the true figure may be rather near to significance. However, the data for 1940 was not so abundant as for this year and the year before, so I have next compared 1941 with the two years 1939 and 40 thrown together, and in this case χ^2 is 4.15, with the same adjustment, so that unless ^{you} ~~we~~ have been unlucky beyond the 5% level, there has been a real fall in gene frequency. I myself believe that such fluctuations are usual and to be expected, in that the genic advantage is likely to be considerably influenced by non-recurrent or accidental features in the particular weather sequence to which the generation has been exposed, e.g., 1940 was strikingly cold in January and February; ~~1941~~ 1941 more unusual in the very cold May.

It would not, therefore, be at all surprising if the apparent increase were resumed next year and, with some fluctuations, became definitely demonstrable over a run of five or ten years.

Alternatively, of course, it may be that the increase from 15 years ago has been almost completed, and that we are near the stability with something between 10 and 25% heterozygotes.

I have also made a χ^2 test of the curious contrast between Bretherton's larvae and yours, his being above last years standard, while yours agrees well with the captures of this year. On the straight comparison, and ignoring the ^{ratio among} ~~number of~~ captured, it appears that the difference is certainly significant. Is it possible that in making such a collection one may get a large proportion from a single brood? I suppose, though you may know better, that a ^{single} ~~single~~ brood may be composite in respect of paternity, in which case bimaculata larvae might occur from a small proportion of eggs ^{laid} by any medio-nigra female, so that a high proportion of heterozygotes would be accompanied in the same broods by a high proportion of bimaculatae.

Even if you do not manage to do more catching, this years work has been extraordinarily fruitful in both the aspects we had in mind, and in bringing to light both the discrepancies between the larval collections and that between successive years, which will be most valuable to bear in mind in making and interpreting future collections. I do most heartily congratulate you on all you have done.

Yours sincerely,