UNIVERSITY OF VICTORIA
Victoria, British Columbia
Department of Biology

1. The action of Pl in maize seedlings.

Recent reports on Pl have been primarily concerned with its action in association with the cherry allele of the R locus to produce pericarp pigmentation (MGNL 43:201). The effects of Pl on plant color have been summarized by Briggs (J. Heredity 57:35-42). Briggs reports that A B Pl plants produce a strong purple, sunlight independent pigment in the plant, whereas A B pl produces a lesser "sun-red" pigmentation which requires sunlight to elicit pigment formation. We have previously reported an apparent repression or retardation of pigment formation in young seedlings by Pl (MGNL 46:172), and we now report more detailed information on this effect as a function of the maturity of the tissue. We have compared anthocyanin concentrations of the first four leaf sheaths in W22 Pl and pl stocks of r^g B; r^g B^b; r^rB; and r^r B^b, as well as Ecuador 1172 R^r Lc and r^g Lc. Lc is the leaf color factor extracted from the Ecuador 1172 strain and found to be distal to the R locus at a distance of between 1-2 map units from R.

Optical density measurements of leaf sheath pigments were made on several plants every week for a period of seven weeks. The first sample of each leaf sheath was taken just as the internode appeared from the surrounding leaf sheath and the sampling was continued until the leaf had lost its chlorophyll and was beginning to drop off. The amount of pigment reduction or enhancement by Pl appeared to be directly proportional to the amount of pigment present. That is, the amount of reduction or enhancement of pigment as a percentage of the total amount of pigment present was approximately the same for all stocks tested. For this reason the results from all stocks were pooled and the general pattern of effect is shown for the first four leaf sheaths in Figure 1.

There are several points to be noted from these graphs.

1) Pl appears to repress pigment formation in the young tissues of each of the first four leaf sheaths (Fig. 1).
2) If we consider the point in time when the Pl leaf sheath first becomes more pigmented than the pl sheath, then by

Fig. 1. Representation of the pooled pigmentation data for the first (a), second (b), third (c), and fourth (d) leaf sheaths as a function of the age of the leaf. The first sample from each leaf was taken as the ligule emerged from the leaf sheath of the overlapping leaf and the last sample when the chlorophyll was gone and the leaf was falling off. The solid line represents the Pl stocks, and the dotted line the pl stocks.

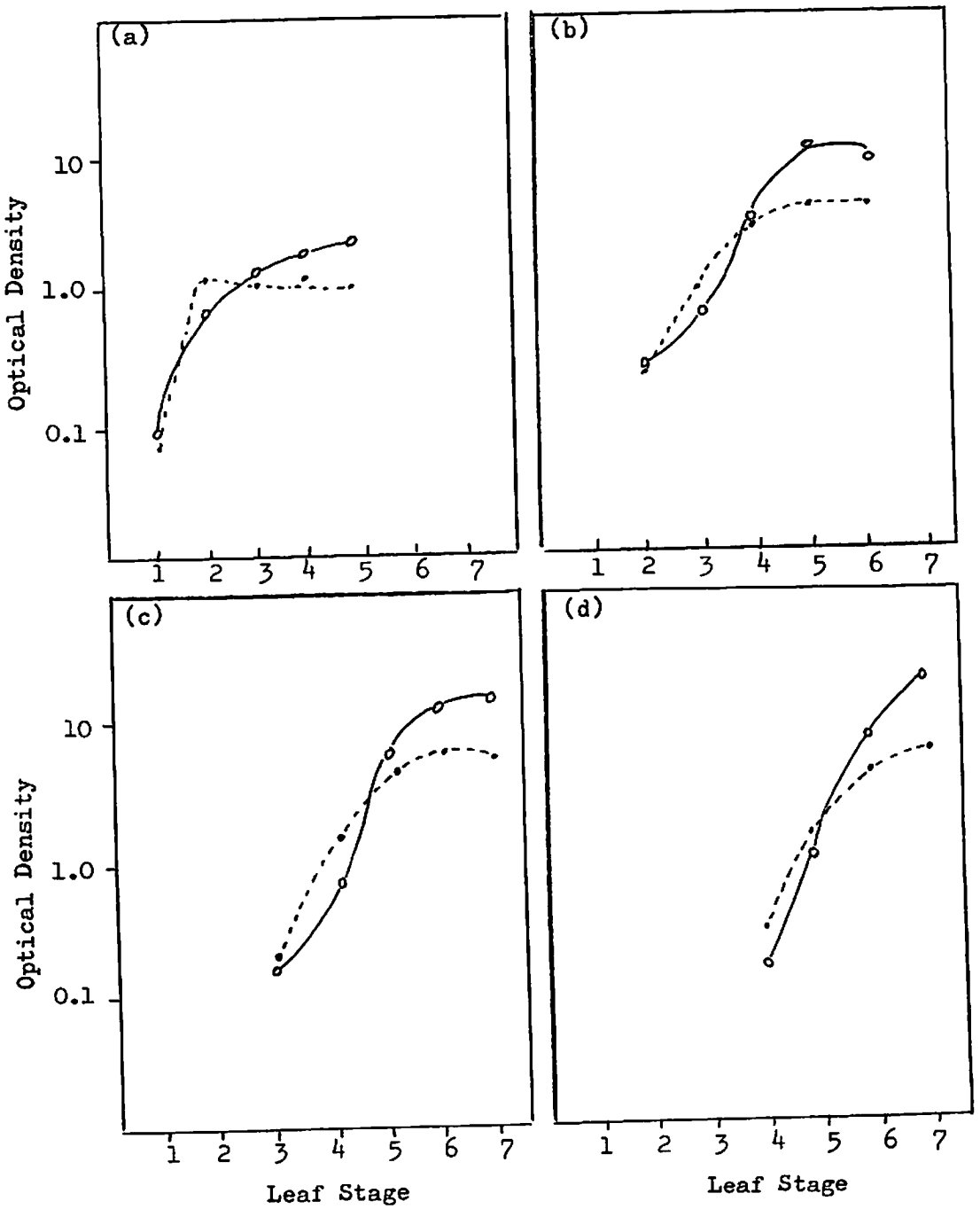


Fig. 2. Graph plotting length of time from germination to time when the Pl leaf sheath becomes more pigmented than the pl sheath, as a function of leaf tested.

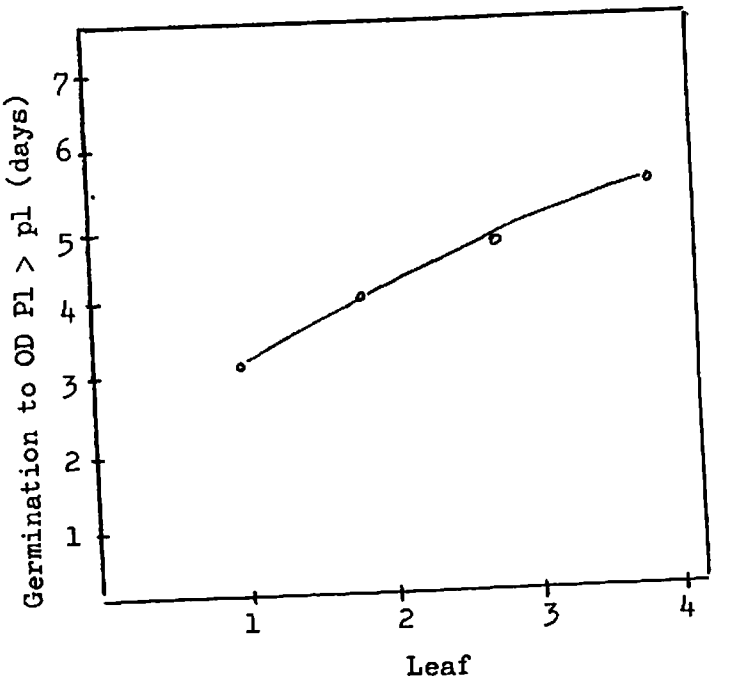
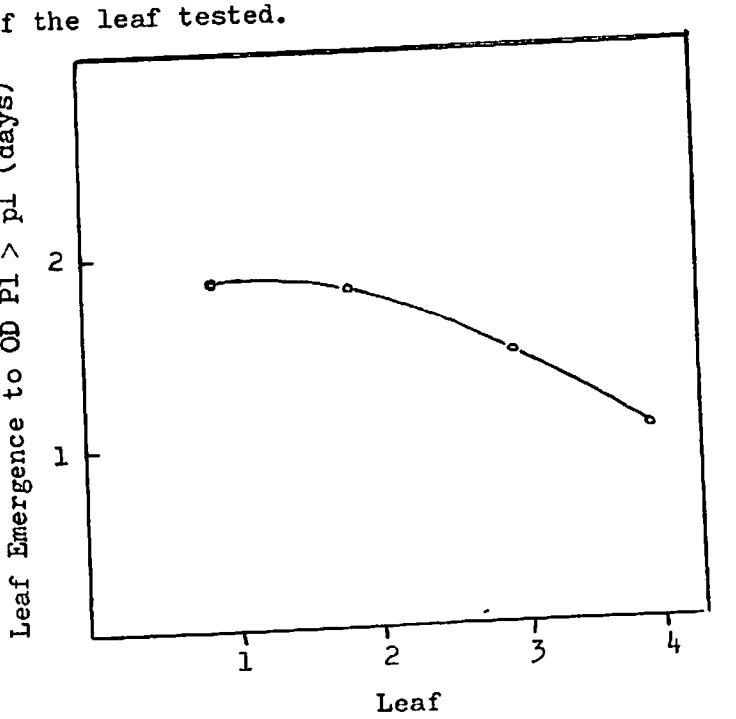


Fig. 3. Length of time from internode appearance to time when the Pl leaf sheath becomes more pigmented than the pl sheath, as a function of the leaf tested.



graphing the length of time to this point from germination as a function of the leaf tested, it can be seen (Fig. 2) that this time interval is not the same for each leaf. In fact, the curve shown in Figure 2 may be extrapolated to an asymptote at about the sixth leaf stage.

3) To emphasize the developmental aspects, Figure 3 plots the length of time from the internode appearance (youngest tissue sampled) to the point when the repression is reduced, as a function of the leaf tested. This plot demonstrates that in successive leaves, the reduction of the repression occurs in successively younger tissues. An extrapolation of this curve would predict reaching the X-axis at about the sixth leaf. In other words, in the sixth and subsequent leaf stages, no repression would be expected.

This early repression of pigment formation by Pl is most interesting in light of the fact that in both our stocks and those reviewed by Briggs, B Pl is more strongly pigmented than B pl in the mature plant. In addition, Briggs suggests that the B Pl pigment is light independent and B pl is light dependent. Sastry has also been able to show that pigment formation in the pericarp of R^{ch} stocks is light independent with Pl and light dependent with pl (MGNL 39:178). If this light interaction held true for all tissues, one would expect the pl plants to produce less pigment than Pl in all stages measured in this experiment, because the major part of these leaf sheaths are covered by overlapping leaf sheaths. This, however, is not the case and the decrease in the amount of pigment in the Pl stocks occurs in spite of any possible light interactions and not because of it.

Thus far, our data are not sufficient to propose a working model for the action of the Pl gene. It seems, however, that Pl action in the seedling stage is uniform for all genotypes tested, and it appears to act proportionately on any pigment being produced. Thus, any proposal for the mechanism of Pl action must explain the uniform action on all pigmenting genes, the repression of pigment formation in the seedlings, and the light independent action associated with it by Briggs. A more physiological approach is now being taken and it is hoped that subsequent investigations will reveal the mode of action of the Pl gene.

David Kyle
E. Derek Styles