

A COMPARISON OF STOMATAL BEHAVIOR BEFORE AND AFTER FLOWERING IN THE ARGENTEUM MUTANT OF PISUM SATIVUM

Donkin, M. E., and E. S. Martin Plymouth Polytechnic

Plymouth, U. K.

Hull, T.

Rumleigh Experiment Station, Bere Alston, U. K.

The recently described Argenteum (.Arg) mutant of Pisum (4,5) has proved to be extremely useful for the investigation of stomatal physiology in the pea plant. This mutant, which is characterized by a silvery appearance of the leaves, has been shown to have extensive intercellular air spaces between the epidermis and the mesophyll tissue (2) which makes the epidermis easily removable for stomatal studies.

Some studies of the stomatal behavior of this mutant have been carried out (1,3) but so far as we know no work has been done on the stomatal response to flowering in Arg or indeed in any other variety of pea. This may be an important omission since during the process of flowering and pod production hormonal changes take place which may influence the behavior of the stomata and subsequently the overall physiology of the plant.

We have therefore carried out a designed experiment (details in legend to Fig. 1) in which the stomatal responses to light and CO₂ of detached epidermis were investigated in non-flowering and flowering Arg. plants. The results shown in Fig. 1 indicate that overall the stomatal apertures are reduced in the flowering plants. It is also apparent that the stomatal response to light is decreased in the flowering plants particularly in the absence of CO₂, but the response to CO₂ is similar in both flowering and non-flowering Arg plants. These conclusions were confirmed by subjecting the data to analysis of variance, which showed that there were large significant effects (P=0.001, df=7) of light, CO₂ and flowering, with a significant interaction between light and flowering (P=0.05, df=1,7), but no interaction between CO₂ and flowering.

Interpretation of these results is difficult since under these conditions we cannot separate an effect of age from an effect of flowering, the flowering plants being several weeks older. However, the leaves used for the flowering plants were not showing any signs of senescence. The most interesting feature would seem to be that of the effect of flowering on the light response of stomata without an effect on the CO₂ response. The explanation for these observations may lie in the sensitive balance of key hormones at this stage of development, since the ratio of the hormones IAA/ABA are known to affect stomatal opening.

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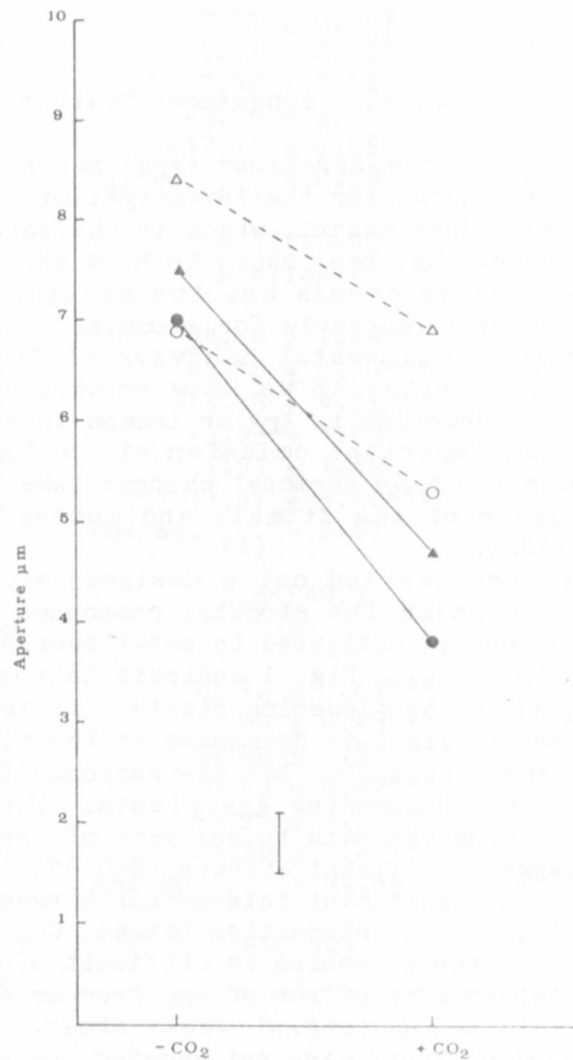


Fig. 1. Diagram to show the effects of light, CO₂, and flowering on stomatal aperture in detached epidermis of Argenteum.

Lower epidermis was detached from leaves of non-flowering (140 cm tall) plants or flowering plants (180 cm tall) of the Argenteum mutant of Plsum sativum. The epidermal strips were floated on 25 mM KCl in 10 mM MES buffer pH 6.15 in small Petri dishes which were illuminated from the bottom through a water bath at 25°C. The treatments applied in a randomized block design with two replicates were +/- light, +/-CO₂, and flowering or not-flowering. The diagram shows the mean apertures for each treatment and the bar represents the Least Significant Difference (P=0.05, df=7).

- ▲—▲ Dark, not-flowering
- Dark, flowering
- △---△ Light, not-flowering
- Light, flowering

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