A GENERAL DESCRIPTION OF POD DEVELOPMENT IN PISUM SATIVUM

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As with other systems, the usual approach adopted in studying pea fruit development is to investigate the process in a particular line, minimizing variation and building up a detailed description of that line. Only rarely do workers attempt to consider more than one or two varieties. From these studies an extrapolation is made to describe the general features of the species. No serious criticism of such an approach is implied here and often it is the only one feasible. However, as has been often pointed out, especially by geneticists, Pisum is such a diverse "species" that no one line can be taken as typical. In the study partly described here we have attempted to accomodate this diversity.

We surveyed changes in pod components in a wide range of genotypes in order to gain an appreciation of the variation and also to make a sensible selection of lines for more detailed study. However, in processing the results it became clear that by pooling them they could be used to provide an alternative general description of pod development in Pisum. The mean values for six fruit parameters measured throughout development are presented in Fig. la-f. All plants were held in a controlled environment room (15C, 16h/15klx day). For each point values from up to 35 genotypes were pooled. Thus each point includes components from very different pods including yellow (gp), purple (A Pu Pur), thick (n), and parchmentless (p V, P v, or p v) types. Statistical treatment of these points, e.g. with standard error or standard deviation of the mean, seemed inappropriate as they obviously were not derived from a normally distributed population, Median rather than mean values could have been presented to give a generally similar pattern of results.

The average growth of the pods ran ahead of the seeds (Fig. la) reaching an apparent dry weight maximum at day 24. The growth of the seed was apparently exponential over the complete time course and dry weight increase continued well beyond day 32.

Changes in the mean space within the pod, excluding seed volume, are presented in Fig. lb. Space increased most rapidly between days 16 and 24, After this period seed expansion progressively reduced available space. Mean CO_2 concentrations (Fig. lc) were maintained at relatively low, though still well above atmospheric, levels until day 20. Over this period the photosynthetic activity of the pod wall would be utilizing most of the CO_2 produced by respiration in the small seeds. After this time, CO increased dramatically, doubling between days 16 and 32. This reflected both increased respiration in the growing seeds and the decline in the concentration of systems associated with GO utilization in the aging pods (Figs. ld-f).

The average changes in pod components presented in Figs. 1d—1f exhibited similar patterns of decline. Up until day 24 this can largely be explained by a diluting effect as the pods grew. However, it continued even when pod growth ceased and at least over the 24- to 32-day phase must have been associated with pod senescence. There was a particular similarity in the decline of RuBPc (Fig. 1e) and chlorophyll (Fig. ld).

Both exhibited a shallow reverse sigmoid and showed a significant correlation at the 0.01 level. Such close correlation between these two chloroplastic components is not surprising and is encountered in the similar senescing leaf system. The fall in average PEPc levels (Fig. 1f) exhibited a near linear decline with respect to time.

Although the results presented in Figs, 1a-f have been derived in an unusual manner they do show generally similar trends to those produced from detailed studies of particular lines (e.g. 1,2). We believe they provide a more comprehensive description of the pea as a species with respect to fruit development albeit over a restricted timescale. There is insufficient space in this report to discuss the significance of the above averaged changes to the functioning of the pod in Pisum. However, we would be grateful to receive comments on this general approach.

1. Flinn, A. M. and J. S. Pate. 1968. Ann. Bot. 32:479-495.
2. Price, D. N. and C. L. Hedley. 1980. Ann. Bot. 45:283-294.

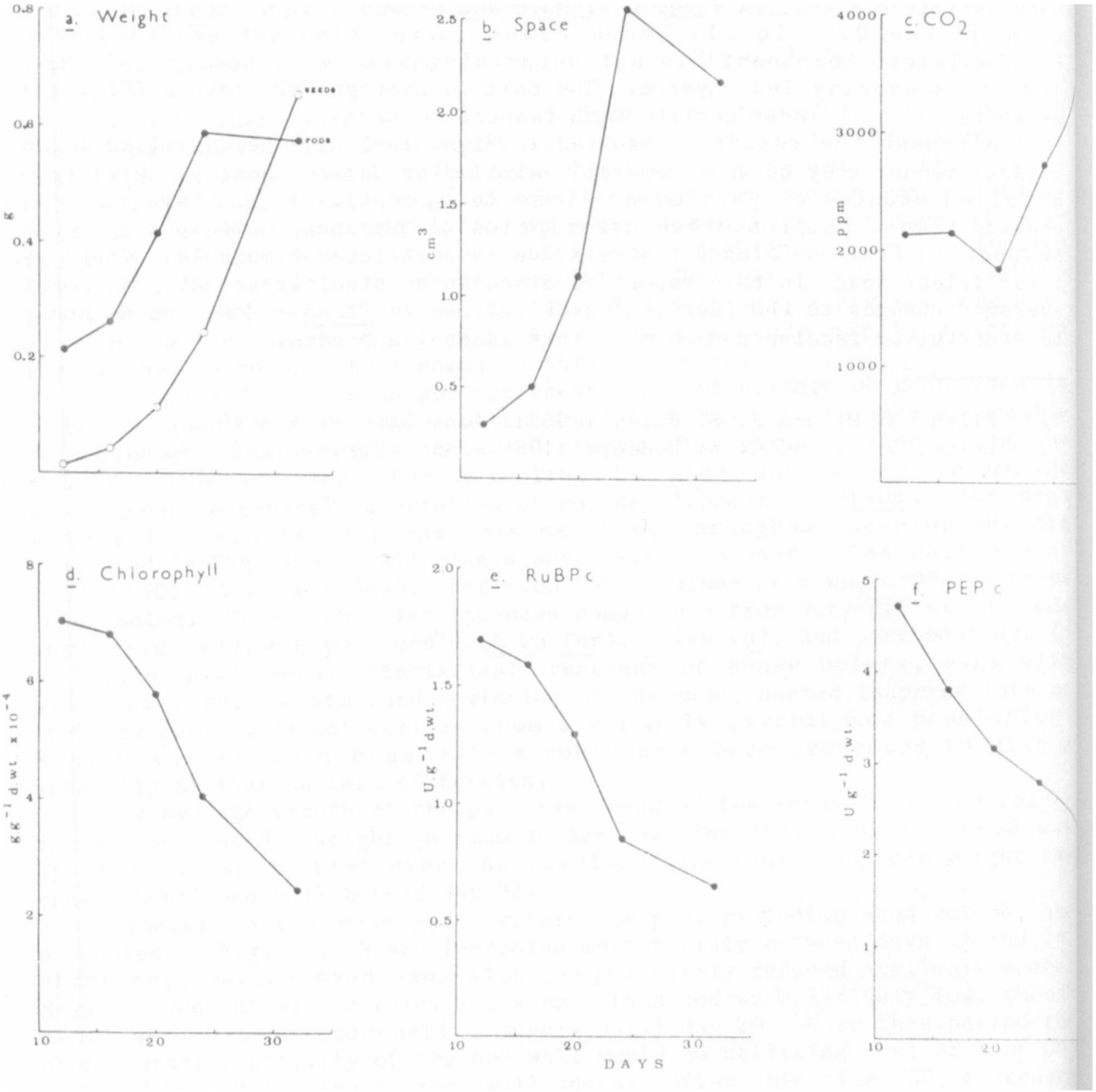

Fig. 1. Changes in the pod components of Pisum sativum. The points represent the average values from up to 15 lines and are timed from the date of anthesis.

a) Dry weight (g) of pods and seeds.
h) Volumes (cm) of the internal space of pods.
c) CO_2 concentrations (ppm) in pod spaces.
d) Chlorophyll concentrations ($g.g^{-1}$ dry weight).
e) Ribulose-1,5-biphosphate carboxylase (RuBPc) concentrations ($U.g^{-1}$ dry weight).
f) Phosphoenolpyruvate carboxylase (PEPc) concentrations ($U.g^{-1}$ dry weight).

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