GENETICALLY CAUSED DIFFERENCES IN SOLUBLE AUXIN-BINDING: CORRELATION WITH INTERNODE LENGTH AND CALLUS FORMATION

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In tissue culture studies with crop plants, one often is confronted with recalcitrant regeneration when hybrid lines or cultivars serve as starting material. In pea, the use of defined mutants resulted in a certain success of regenerating plants from callus tissues (7, 8) or somatic embryos from calli transferred to liquid medium (4, 6). These results indicate that success or failure of in vitro regeneration is determined in part by the genotype. Since attempts to use the potential of in vitro technology for crop improvement depend on the regeneration of intact plants from isolated and selected cells or protoplasts, the lack of complete understanding and control of this process is a key problem in most important crops, e.g. large seeded legumes such as pea. Thus, investigations were carried out in an attempt to correlate the known genetic control of in vitro behavior with observations on the molecular level of hormone recognition in plants.

The existence in pea of soluble cytoplasmic auxin-binding sites is well established (1, 2, 3, 5). Epicotyls of etiolated pea seedlings exhibit soluble auxin-binding with all characteristics required (or receptor function of these proteins. These proteins are a) specific for auxins, b) have a high affinity to bind active auxins, and c) show a time-dependent occurrence. One binding site (sABP1) is found in the cytosol of etiolated pea seedlings aged 7 days or more; a second site (sABP2) can be found in seedlings 9 days after germination (3). These two binding sites can further be distinguished by their different pi and their different dissociation constants.

In recent experiments it was demonstrated that in a recombinant derived from a cross between mutant 489C and the initial line (DGV) the second binding site was not expressed as in the parent lines (Fig. 1). Both soluble auxin-binding sites evidently were present in each of the two parental lines whereas only one was evident in recombinant R 1111. The internode length of the recombinant is twice that of DGV but the number of internodes is the same, so the height of the mutant in the field is about double that of the initial line (Loennig, pers. comm.). On the other hand, R 1111 reacts best in callus induction experiments. While calli formed from explants of non-elongated internodes (6 mm) of DGV and 489C after 3 days were 8.11 +/- 0.8 mm and 8.29 +/- 1.0 mm, the mean length of these calli in the recombinant was 9.27 +/- 1.2mm. From these data it is suggested that the different in vitro reaction reflects the differences observed with the soluble auxin-binding kinetics.

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[1/] Dedicated to Prof. Dr. W. Gottschalk on the occasion of his 65th birthday.

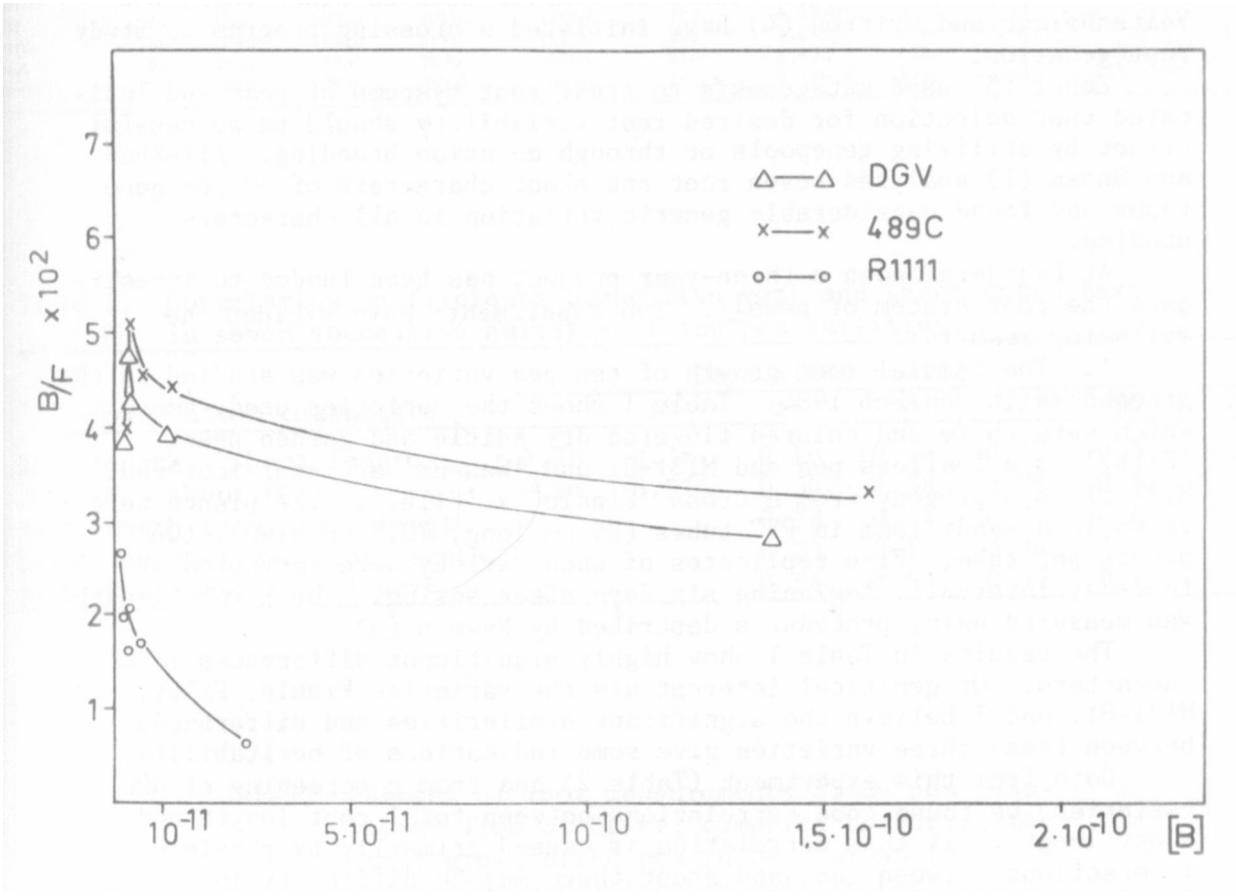

Fig. 1. Scatchard plots showing apparent cooperative binding of NAA in the cytosols of etiolated seedlings from two parent lines (Delta - DGV; x—x 489C), and the absence of cooperativity in the recombinant R 11.11 (o—o) (epicotyls were from 10-day-old etiolated seedlings).