Phytotoxic activity of barley

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Recent work (1,2) has demonstrated the phytotoxic potential of cereal crops. We have quantified the release of allelochemicals by barley seedlings and the activity of the phytotoxins gramine and hordenine in bioassay (3). We have developed a hydroponic system to facilitate evaluation of the phytotoxic potential of substances released from barley roots.

Methods

Ten barley plants (cv. Triumph) were grown in an aerated hydroponic system with the roots and nutrient solution in the dark. Hoagland's solution, varied in strength to match plant growth, was used to fill glass containers which were periodically increased to a maximum of 2.51 as root mass increased. A similar system without barley plants was run. with stock Hoagland's solution as an additional treatment. During the experiment pH and electrical conductivity (EC) were monitored; samples of solutions were taken at intervals of 4 or 7 days for analysis. Samples (50m1) of the three solutions were passed through a 0.2?m membrane filter to remove debris and microorganisms. Sterilised, distilled water was used as a control. Five ml aliquots were added to two Whatman No.1 filter papers set up in 9cm sterile petri dishes. Sixteen surface-sterilised white mustard seeds were then placed evenly on the filter papers and allowed to grow for 3 days, when radicle length was measured. Bioassays were replicated four times.

Results and discussion

Radicle length of white mustard was significantly reduced by the hydroponic solution in which barley roots were grown from 7 - 75 days after transplanting (Fig.la). The reduction was particularly noticeable over the period up to 60 days from transplanting. The other solutions did not reduce radicle length of white mustard. EC ranged from 0 - 3.7mScm-^{2} but did not affect radicle length of white mustard, as indicated by the non-significant slopes of the lines (Fig.1b).

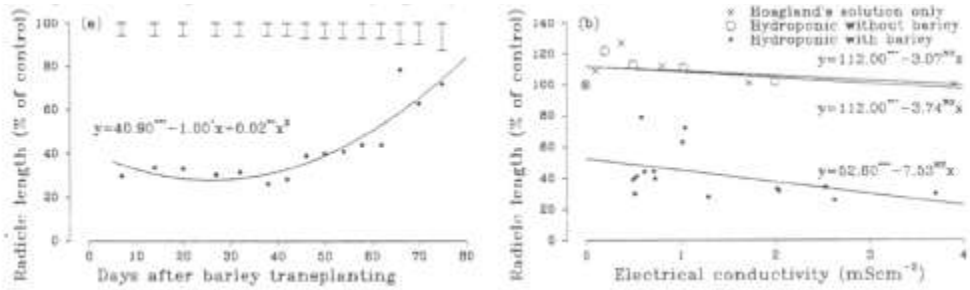

Figure 1: (a). Effects of barley growing in a hydroponic system on radicle length of white mustard; (b). Relationships between radicle length of white mustard and EC. Bars = 5% LSD; NS = not significant; * = P<0.05; ** = P<0.01; * * = P<0.001, by t-Test.

Inhibition of radicle elongation in white mustard depended on the presence of barley roots in hydroponic solution. Previous HPLC analysis showed that several organic compounds, including gramine and hordenine, were present in the solution. We conclude that radicle elongation of white mustard is inhibited by compounds in this organic fraction.

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2. Niemeyer, H.M. 1988. Euphytica 37:289-293.

3. Lovett, J.V. and Liu, De Li. 1987. Proc. 4th Aust. Agron. Conf. p.229.