Self defence chemicals of barley

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The reputation of barley as a "smother crop" has been attributed to competition for environmental resources such as water and plant nutrients. However, in the absence of competition barley can still inhibit germination and growth of important weeds. This activity has been equated with the release of two alkaloids, gramine and hordenine (1). Although identified the alkaloids have not, to date, been quantified. Production of phytotoxic chemicals by crop plant accessions and cultivars varies, for example, in oats (2); such variation might provide the basis for a new selection criterion.

Methods

Barley (cv. Triumph) was grown on moist filter papers under controlled conditions for up to 6 days. Seedlings were harvested each day, the filter paper washed with distilled water and washings collected for GC-MS analysis (3). A series of hordenine and gramine standards was also prepared and analysed.

To verify the toxicity of the alkaloids, barley seedlings were germinated under controlled conditions and white mustard seeds added simultaneously (Day 0) and at Days 2, 4 and 6 after sowing barley. Mustard seedlings were germinated for 36h before measuring radicle length.

Results and Discussion

Gramine and hordenine were released by germinating seedlings of barley at least until Day 6 (Table 1), peak production occurring on Days 4 and 5.

Table 1. Concentrations (ppm) of alkaloids released by germinating barley.

Day	1	2	3	24	5	6
Gramine	0.58	0.02	1.30	2.00	22.55	2.51
Hordenine	0.88	0.82	16.35	48.01	42.97	10.71

Mustard seedlings sustained the greatest damage in the presence of barley at Day 4 (Table 2), corresponding to maximum alkaloid release.

Table 2. Radicle length (mm) of white mustard seedlings germinated with and without barley.

Days after barley sown 0 2 4 6 Mustard + barley 8.57 AB b 5.20 BC c 2.20 C c 4.63 BC c Mustard (control) 11.03 A ab 12.27 A a (Capital and lower case letters = significant differences at 1% and 5% respectively).

The capacity of plants to defend themselves, chemically, against competition by weeds and other organisms, is attracting current interest (4). The chemicals may be genetically manipulable, offering the potential to enhance them in cultivars and to gain a self defence advantage.

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