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BRIEF COMMUNICATION

Assessment of the allelopathic potential of *Ageratum conyzoides*

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Abstract

The allelopathic potential of *Ageratum conyzoides*, which is one of the most dominant weeds in upland-crop areas of Southeast Asia, was investigated under laboratory conditions. The residue obtained from an aqueous acetone extract of the plant shoots inhibited the germination and the growth of roots and shoots of *Amaranthus caudatus*, *Digitaria sanguinalis* and *Lactuca sativa*. The concentration-dependent responses of the test plants suggest that the residue of *Ageratum conyzoides* might contain allelochemical(s).

Additional key words: *Amaranthus caudatus*, *Digitaria sanguinalis*, *Lactuca sativa*, tropical weed management.

In spite of the heavy use of chemical herbicides to control the weeds, crop yield loss from weeds remains high (*e.g.*, Rice 1984, Duke 1986, Putnam and Tang 1986). The negative effects of commercial herbicide use on environmental contamination and human health make necessary to diversify weed management options (*e.g.*, Duke 1986, Einhellig 1996, Olofsdotter *et al.* 1995). The control of weeds through allelopathy is one strategy to reduce herbicide dependency (Duke 1986, Putnam 1988, Einhellig 1996, Seigler 1996).

Evidence for allelopathy has accumulated in the literature over many years and many kinds of allelochemicals have been isolated and characterized from various plants (Bell 1981, Duke 1986, Putnam and Tang 1986, Gross and Parthier 1994, Seigler 1996). However, little information is available about the allelopathic potential of tropical and subtropical plants. *Ageratum conyzoides*, an annual member of the *Asteraceae*, is one of the most dominant weeds in upland-crop areas in Southeast Asia. It was of interest to test the allelopathic potential of this species under laboratory conditions.

Shoots of *Ageratum conyzoides* Linn. were harvested from an experimental field at Chiang Mai University, Thailand, washed thoroughly with tap water and rinsed with distilled water. After blotting dry with filter paper, the shoots (500 g fresh mass) were homogenized in 2.5 dm^3 of 70 % (v/v) cold aqueous acetone and the homogenate was filtered through filter paper (No 1, *Whatman*). The residue was homogenized again with 2.5 dm^3 of 50 % (v/v) cold aqueous acetone, and filtered. The two filtrates were combined and concentrated at 35 °C *in vacuo*, yielding brown residue (7.8 g). The residue was dissolved in a small volume of mixture of acetone and water. Then, aliquot of the solution was added to sterilized quartz sand (25 g) and dried according to the method of Shilling *et al.* (1992). The quartz sand was put into a 9-cm Petri dish and moistened with 10 cm^3 of distilled water. The concentration of the residue was 0, 0.1, 0.3, 1.0, 3.0 and 10.0 mg cm^{-3} (= 0, 1, 3... mg Petri $dish^{-1}$)

Three species, *Amaranthus caudatus* L., *Digitaria sanguinalis* L., and lettuce (*Lactuca sativa* L. cv. Grand Rapids) were chosen for bioassay as test plants because of their known germination behaviors. Seeds were sterilized in a 2 % (m/v) solution of sodium hypochlorite for 15 min and rinsed in distilled water four times. Fifty seeds of each species were separately sown on quartz

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Abbreviations: I_{25} - concentrations required for 25 % inhibition in the assay.

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sand in Petri dishes and allowed to germinate in the darkat 25 °C for 3 d. Then the germinated seeds were counted and the percentage germination was calculated by reference to that of control seeds which had been treated with plain solution without residue.

In growth studies seeds of the test species were allow to germinate on filter paper (No. 2, *Whatman*) in the dark at 25 °C for 3 d. Then, the 30 germinated seeds of each species were separately arranged on quartz sand in Petri dishes, and incubated in the dark at 25 °C for 2 d. The residue was added as described above. The shoot and root lengths of the seedlings was then measured and the

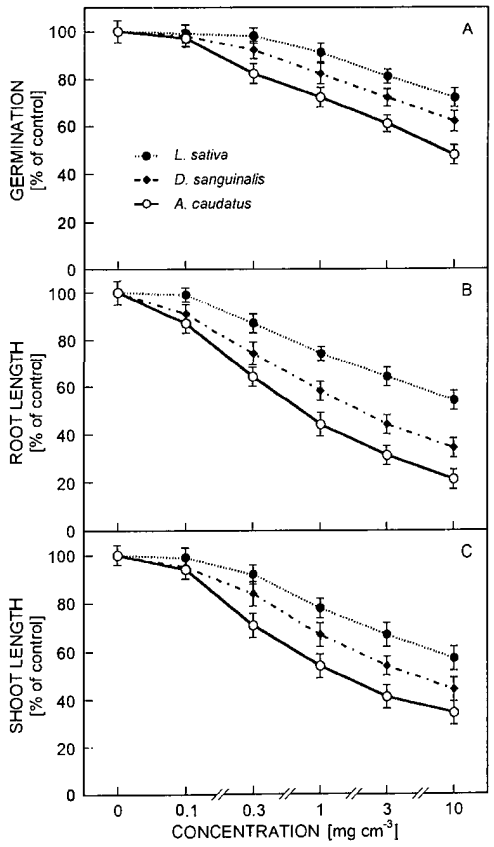

Fig. 1. Effects of residue obtained from shoot extract of *Ageratum conyzoides* on germination (*A*), root growth (*B*), and shoot growth (*C*) of test plants. Means ± SE, n = 150. Germination rate of control plants was 72 ± 6, 71 ± 7 and 88 ± 5 %, root length of control plants was 14.4 ± 1.1, 15.4 ± 1.6 and 23.3 ± 1.9 mm, and shoot length of control plants was 9.4 ± 1.1, 11.3 ± 1.5 and 17.3 ± 1.6 mm for *A. caudatus*, *D. sanguinalis*, and *L. sativa*, respectively.

percentage length of seedlings was calculated by reference to the length of control plants.

The residue of *Ageratum conyzoides* suppressed the germination at concentrations greater than 0.3 mg cm^{-3} for *A. caudatus* and *D. sanguinalis*, and 1.0 mg cm^{-3} for *L. sativa* seeds (Fig. 1). When the percentage germination rate was plotted against the logarithm of the concentration, the response curves of the test plants were linear between 10 and 50 %, 10 and 40 % and 10 and 30 % inhibition for *A. caudatus*, *D. sanguinalis* and *L. sativa*, respectively. The concentrations required for 25 % inhibition in the assay (defined as I_{25}) were 0.68, 1.30 and 6.90 mg cm^{-3} for *A. caudatus*, *D. sanguinalis* and *L. sativa*, respectively.

When the root length was plotted against the logarithm of the concentration, the response curves were linear between 10 and 70 %, 10 and 60 % and 10 and 40 % inhibition for *A. caudatus*, *D. sanguinalis* and *L. sativa*, respectively, and corresponding I_{25} values were 0.18, 0.29 and 0.95 mg cm^{-3}.

The residue inhibited shoot growth to a less efficient than root growth, the I_{25} values in the assay being 0.26, 0.59, and 1.50 mg cm^{-3} for *A. caudatus*, *D. sanguinalis*, and *L. sativa*, respectively. This observation agrees with that of Stachon and Zimdahl (1980), who found ethanol extract of *Cirsium arvense* L. was more inhibitory to *Cucumis sativis* roots than to shoots.

The residue obtained from shoot extract of *Ageratum conyzoides* inhibited the germination, and root and shoot growth in order *L. sativa*, *D. sanguinalis*, and *A. caudatus* (Fig. 1). In the same test plants, the effectiveness of the residue on root growth was greatest, followed by the shoot growth and seed germination. The results are in agreement with previous observations that the activity of either water-extracts or weed residues was directly related to the concentration used (Caussanel 1979, Chung and Miller 1995, Babu and Kandasamy 1997). Such concentration-dependent responses of the test plants suggest that the residue of *Ageratum conyzoides* might contain allelochemical(s).

The present research suggests that, although the experiment was accomplished under laboratory condition and further investigation in field is essential, *Ageratum conyzoides* may have potent allelochemical(s) and the residue of the plant can work as weed inhibiting agents, which might reduce application of the commercial herbicide.

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