Pak. J. Sci. Ind. Res. 2006 **49**(4) 296-298

Short Communication

The Effect of Aqueous Extracts from Leaf Leachates and the Soil Beneath *Chromoleana odorata* and *Euphorbia heterophylla* on the Germination of Cowpea Seeds

J. Kayode
Department of Plant Science, University of Ado-Ekiti, Ado-Ekiti, Nigeria

(received July 22, 2004; revised June 30, 2006; accepted July 13, 2006)

Abstract. This study examines the allelopathic effect of different concentrations of aqueous extracts obtained from the decomposed leaves and soil beneath *Chromoleana odorata* (siam weed) and *Euphorbia heterophyalla* (wild poinsettia) on the elongation of radicle and plumule of cowpea. All the extracts were found to retard the elongation of both radicle and plumule when compared to the control. Statistical analyses at 5% level, however, revealed that the degree of retardation was not significantly different. Extracts from the decomposed leaves of *C. odorata* and *E. heterophylla* brought about considerable slowing down of the rates of radicle elongation in cowpea. Also, while the extracts derived from soil beneath *C. odorata* resulted in mere reduction in the elongation of cowpea plumule, those derived from soil beneath *E. heterophylla* resulted in delayed germination of the plumule in addition to slowing down the rate of elongation.

Keywords: *Chromoleana odorata, Euphorbia heterophylla,* plant aqueous extracts, allelopathic effect, cowpea seed germination, leaf leachate inhibition

Weeds cause significant reductions in the yield of field crops, either through competition or by allelopathic interactions (Kayode, 1998). Most of the weeds have been found to contain phytotoxic substances, which cause significant reductions in the growth of plumule and redicle of various crops, such as maize, rice, tomato and cowpea (Ogbe *et al.,* 1994). Allelopathic studies conducted so far on weeds in Nigeria were those of Tijani-Eniola and Fawusi (1989), Gill *et al.* (1993) and Ogbe *et al.* (1994) on *Chromoleana odorata,* and of Kayode (1998; 2004a; 2004b), respectively, on *Euphorbia heterophylla, Calotropis procera* and *Aspilia africana.* All these studies were carried out on aqueous extracts obtained under laboratory conditions with relatively little or no efforts to demonstrate allelopathic effect of extracts obtained from the field. The present study was, therefore, undertaken to determine the allelophathic potential of these weeds using aqueous extracts obtained under field conditions, and the leachate extractions done for 24, 48 and 72 h.

Fresh leaves of *Chromoleana odorata and Euphorbia heterophylla* were collected from the campus of the University of Ado-Ekiti, Nigeria (7°40'N, 5°15'E), and 500 g each of these leaves were allowed to decompose under the soil for 30 days. After this period, 200 g of decomposed leaves of each plant species were immersed in one liter distilled water for periods of 24, 48 and 72 h. Soil samples were also collected at plough depth (15 cm) from beneath the canopy of each species. Soil leachates from beneath each species were prepared by immersing 200 g samples of the soil in one liter of distilled water for 24, 48 and 72 h. The leaf and soil leachate extracts were filtered, and the filtrates were used as the aqueous extracts to investigate their allelopathic effect.

E-mail: josmodkay@yahoo.com

Petri dishes were double-layered with Whatman # 1 filter papers and 5 cowpea seeds were placed in each petri dish. The filter papers were moistened daily with the three kinds of aqueous extracts (extraction period: 24, 48 and 72 h) of the decomposed leaves and soil leachates from beneath the two weed species. Extracts from each extraction period were replicated five times. Filter papers moistened with distilled water constituted the control. All the petri dishes were kept at room temperature in a growth chamber, and the plumule and radicle elongation measurements were recorded at 24 h intervals for 6 days. The results obtained from the extract-treated seeds were compared statistically (using t-test) with those obtained from the control.

The results of different aqueous extracts from the decomposed leaves of *C. odorata* and *E. heterophylla* on radicle and plumule elongation of cowpea, respectively, are whown in Tables 1 and 2, which indicate that the extracts retarded elongation of both radicle and plumule when compared to the control. The degree of retardation, however, was not significantly different at 5% level. Also, the degree of inhibition between the varying extract concentrations in respect of each species was not significantly different from one another at 5% level. The

retardation in the elongation of cowpea radicle by extracts from decomposed leaves of *C. odorata* were not pronounced until after 48 h, at which stage of the growing period considerable slowing down of the radicle elongation occurred. Similar results were observed from the 24 h and 48 h extracts obtained from the decomposed leaves of both species.The slowing down of radicle growth of *E. heterophylla* manifested within the first 24 h in the case of 72 h leaf extracts. However, in both species, germination of the plumule was delayed and their growth was retarded.

Results from the different aqueous extracts obtained from soil beneath *C. odorata* (Table 3) and *E. heterophylla* (Table 4) showed marked reductions in the elongation of radicle and plumule when compared to the control. The degree of inhibition in respect of different extracts was not significantly different from one another for the extracts from the soil beneath the two species. Extracts from the soil beneath *C. odorata* resulted in mere reduction in the elongation of plumule, while the extracts from soil beneath *E. heterophylla* did not cause reduction alone, but also delayed plumule germination.

Table 1. Effect of different aqueous extracts from decomposed leaves of *Chromoleana odorata* on radicle and plumule elongation of germinating cowpea seeds

Plant part	Extraction time (h)	Growing period (h)					
		24	48	72	96	120	144
Radicle	control	1.0	4.4	7.8	13.6	16.4	21.9
(length: cm)	24	1.6	2.4	6.2	9.6	13.2	16.9
	48	1.0	2.4	5.0	8.5	11.8	15.9
	72	1.2	1.5	4.6	8.1	10.9	14.4
Plumule	control	-	0.4	1.5	2.8	4.0	5.8
(length: cm)	24	-	-	1.0	2.9	4.1	5.5
	48	-	-	1.2	2.9	4.1	5.5
	72	-	-	1.2	2.0	3.5	4.5

Table 2. Effect of different aqueous extracts from decomposed leaves of *Euphorbia heterophylla* on radicle and plumule elongation of germinating cowpea seeds

Plant part	Extraction time (h)	Growing period (h)					
		24	48	72	96	120	144
Radicle	control	1.0	4.4	7.8	13.6	16.4	21.9
(length: cm)	24	1.0	2.1	3.2	4.8	7.9	12.4
	48	1.2	2.3	3.3	4.7	7.8	12.0
	72	0.9	1.8	2.9	3.9	7.0	11.6
Plumule	control	-	0.4	1.5	2.8	4.0	5.8
(length: cm)	24	-	-	1.1	1.8	3.2	4.5
	48	-	-	1.0	1.7	3.0	4.2
	72	-	-	0.8	1.5	2.7	3.9

Table 3. Effect of different aqueous extracts from the soil beneath *Chromoleana odorata* on radicle and plumule elongation of germinating cowpea seeds

Plant part	Extraction time (h)	Growing period (h)					
		24	48	72	96	120	144
Radicle	control	1.0	4.4	7.8	13.6	16.4	21.9
(length: cm)	24	1.3	4.3	7.9	9.2	12.0	14.6
	48	1.4	4.2	6.4	7.9	10.4	12.8
	72	1.3	2.9	5.1	7.5	9.7	11.9
Plumule	control	-	0.4	1.5	2.8	4.0	5.8
(length: cm)	24	-	0.2	1.1	2.6	3.0	4.5
	48	-	0.1	1.4	2.2	3.0	4.2
	72	-	0.1	1.0	2.0	2.9	4.1

Table 4. Effect of different aqueous extracts from the soil beneath *Euphorbia heterophylla* on radicle and plumule elongation of germinating cowpea seeds

Plant part	Extraction time (h)	Growing period (h)					
		24	48	72	96	120	144
Radicle	control	1.0	4.4	7.8	13.6	16.4	21.9
(length: cm)	24	0.8	1.4	2.2	3.6	6.5	9.8
	48	0.9	1.9	2.8	4.5	7.2	10.4
	72	1.4	1.8	3.0	4.3	7.1	10.2
Plumule	control	-	0.4	1.5	2.8	4.0	5.8
(length: cm)	24	-	-	0.6	1.4	2.6	3.9
	48	-	-	0.7	2.1	3.4	4.5
	72	-	-	0.5	1.1	2.3	3.8

The results of this study do not differ from those reported earlier from the laboratory-derived aqueous leaf extracts of *C. odorata* (Ogbe *et al.,* 1994), and *E. heterophylla* (Kayode, 1998), or even for other weeds, such as *Cyperus rotundus* (Adams and Azini, 1991), *Pluchea lanceolata* (Inderjit, 1994) and *Calotropis procera* (Kayode, 2004a; Idu and Omonhinmic, 1998). Both the radicle and the plumule were adversely affected by the extracts from the decomposed leaves and the soil extract from beneath the two species of weeds studied. Thus, the assertion that allelopathy might have played a prominent role in the spatial distribution, colonization and suppressive abilities of these weeds cannot be over-emphasised. Consequently, the reports that discrepancies abound between results obtained from laboratory-derived extracts and extracts derived from the field (Suresh and Rai, 1987; Koul, 1990; Kayode, 1997) may not be true for all plant species. These authors had investigated the allelopatrthic potential of *Eucalyptus, Leucaena* and *Gliricidia,* respectively, all of which are agroforestry tree species.

References

Adams, S.M., Azini, R. 1991. Effects of purple nutsedge (*Cyperus rotundus*) leaf extract on germination and seedling growth of wheat (W. Pavon). *Pak. J. Weed Sci.* **4:** 56-61.

Gill, L.S., Anoliefo, G.O., Iduoze, U.V. 1993. Allelopathic effect of aqueous extract of siam weed on growth of cowpea. *Chromoleana Newsletter* **8:** 1-4.

Idu, M., Omonhinmic, C.A. 1998. Allelopathic effect of *Calotropis procera* on the germination of *Helianthus annuus* seeds. *Comp. Newsletter* **32:** 31-36.

Inderjit, Dakshini, K.M.M. 1994. Allelopathic effect of *Pluchea lanceolata* (Asteraceae) on characteristics of four soils and tomato and mustard growth. *American J. Botany* **81:** 799-804.

Kayode, J. 2004a. Allelopathic effect of aqueous extracts of *Calotropis procera* on germination and seedling growth of maize. *Pak. J. Sci. Ind. Res.* **47:** 69-72.

Kayode, J. 2004b. Allelopathic potentials of aqueous extracts of *Aspilia africana* on the growth of maize. *J. Biol. Phy. Sci.* **2:** 108-111.

Kayode, J. 1998. Allelopathic effect of aqueous extracts of *Euphorbia heterophylla* L. on radicle and plumule growth of cowpea (*Vigna unguiculata* L.). *Biosci. Res. Commun.* **10:** 23-26.

Kayode, J. 1997. A study on the allelopathic potential of *Gliricidia sepium* on cowpea. *Biosci. Res. Commun.* **9:** 231-233.

Koul, V.K. 1990. The effect of soil beneath *Leucaena leucocephala* and its decomposed leaves on germination of rice. *Leucaena Res. Rep.* **11:** 54-55.

Ogbe, F.M.O., Gill, L.S., Iserhien, E.O.O. 1994. Effect of aqueous extracts of *Chromoleana odorata* L. on radicle and plumule growth and seedling height of maize, *Zea mays* L. *Comp. Newsl.* **25:** 31-38.

Tijani-Eniola, H.A., Fawusi, O.A. 1989. Allelopathic activities of crude methanol extract of siam weed and wild poinsettia on seed germination and seedling growth of tomato. *Nig. J. Weed Sci.* **2:** 15-20.

Suresh, K.K., Rai, R.S.V. 1987. Studies on the allelopathic effects of some agroforestry tree species. *International Tree Crops Journal* **4:** 109-115.