PHYTOTOXICITY OF PROFLURALIN TO *Rottboellia exaltata* L.f.

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ABSTRACT

The effect of a pre-emergence herbicide on the growth of *Rottboellia exaltata* L.f. was determined using different concentrations of profluralin or CGA-10832. Concentrations of 5, 10, 25 and 50 ppm induced inhibition of root and shoot growth accompanied by swelling of root tips and coleoptilar nodes. Abnormal enlargement of the cells was apparent in all swollen tissues. Multi-nuclearity of the cells in the pericyclic layer and increase in the number of root and leaf primordium initials were likewise observed.

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INTRODUCTION

Profluralin or CGA-10832 (N-(cyclopropyl methyl) -£-£-£- trifluoro-2, 6 dinitro-N-propyl-toluidine) is a pre-emergence herbicide that should be mechanically incorporated into the soil for maximum biological activity. It can be applied before planting, postplanting, or at layby. Crops found to be tolerant to profluralin include soybean, peanut, drybean, snapbean, gladiolus, okra, cabbage, carrot, cauliflower, fruits and nut crops (Weed Science Society of America 1974).

Grasses treated with profluralin exhibit swollen radicle tips while basal regions of the mesocotyl do not normally emerge above the soil surface (Klingman, 1975). Profluralin seems to be absorbed through the root and/or shoot tissue of newly germinating seedlings. The grass-killing property of this chemical was explored in preliminary field trials to control *Rottboellia exaltata* L. f.

R. exaltata is a tall growing annual grass weed of upland crops. It is widely distributed in the tropics and subtropics (Fernandez, 1963; Rehbein, 1963; and Rattray, 1960. Several names have been associated with this weed such as "aguingay" in the Philippines, "itchgrass" in Australia, "raoul" in Louisiana, "guineafowl grass" in Zambia and "kokoma grass" in Rhodesia.

Information on the effects of

profluralin on the anatomy of *R. exaltata* is important in assessing its herbicidal potential.

MATERIALS AND METHODS

The seeds of *R. exaltata* stored 9 months from harvest were dehulled and germinated on moist filter paper in the dark. Seedlings were established first in moist filter paper after which samples were taken during the desired ages of the seedlings and transferred to a Petri dish containing 10 ml of either distilled water or profluralin solution at 4 different concentrations (5, 10, 25 and 50 ppm). The seedlings were observed every 24 hr. Root and shoot lengths were measured before and after treatment with the herbicide.

For histological study, tissues from different ages of seedlings were collected, fixed in FAA (formalin, 5 ml; glacial acetic acid, 5 ml and 50% ethyl alcohol, 90 ml) and dehydrated through a graded series of tertiary butyl alcohol. Afterwards, the tissues were embedded in paraffin and sectioned at 10 to 15 micrometers. Slides were prepared following the safranin O-fast green schedule (Johansen, 1940).

Data on cell size were taken by getting the width and length of representative cells across the widest swollen portion of the coleoptilar node and the root tip. The same method was applied to the 1 cm apices of primary roots and shoots of seedlings treated with proluralin.

RESULTS AND DISCUSSION

Profluralin inhibited root and shoot growth in seedlings (Table 1). In all concentrations used, inhibition was accompanied by the swelling of the root tip and the coleoptilar node (Fig. 1). Seedlings treated at 2 and 3 days after germination showed curling or twisting of the roots. These findings are similar to those observed in trifluralin-treated corn and cucumber (Hacskaylo and Amato, 1968; Barrentine and Warren, 1971). In general, severe phytotoxicity symptoms were evident in younger seedlings in all concentrations. Anatomical examinations revealed that the swelling is caused by abnormal

Table 1. Increase in length (mm) of root and shoot of *Rottboellia exaltata* at varying ages of seedling treated with different concentrations of profluralin.

Age of Seedling (days)	Increment in Root and Shoot Lengths (mm) Concentration of Profluralin (ppm)									
	0		5		10		25		50	
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
7	10.0	23.0	4.3	3.5	3.6	2.8	2.7	2.6	2.6	2.4
8	19.4	29.8	3.7	6.8	3.5	5.8	3.5	5.9	3.9	6.4
9	18.4	45.5	4.1	10.8	3.6	13.1	3.7	11.9	2.9	11.4
10	8.0	28.8	3.2	16.2	3.2	17.4	3.0	18.8	5.3	16.6

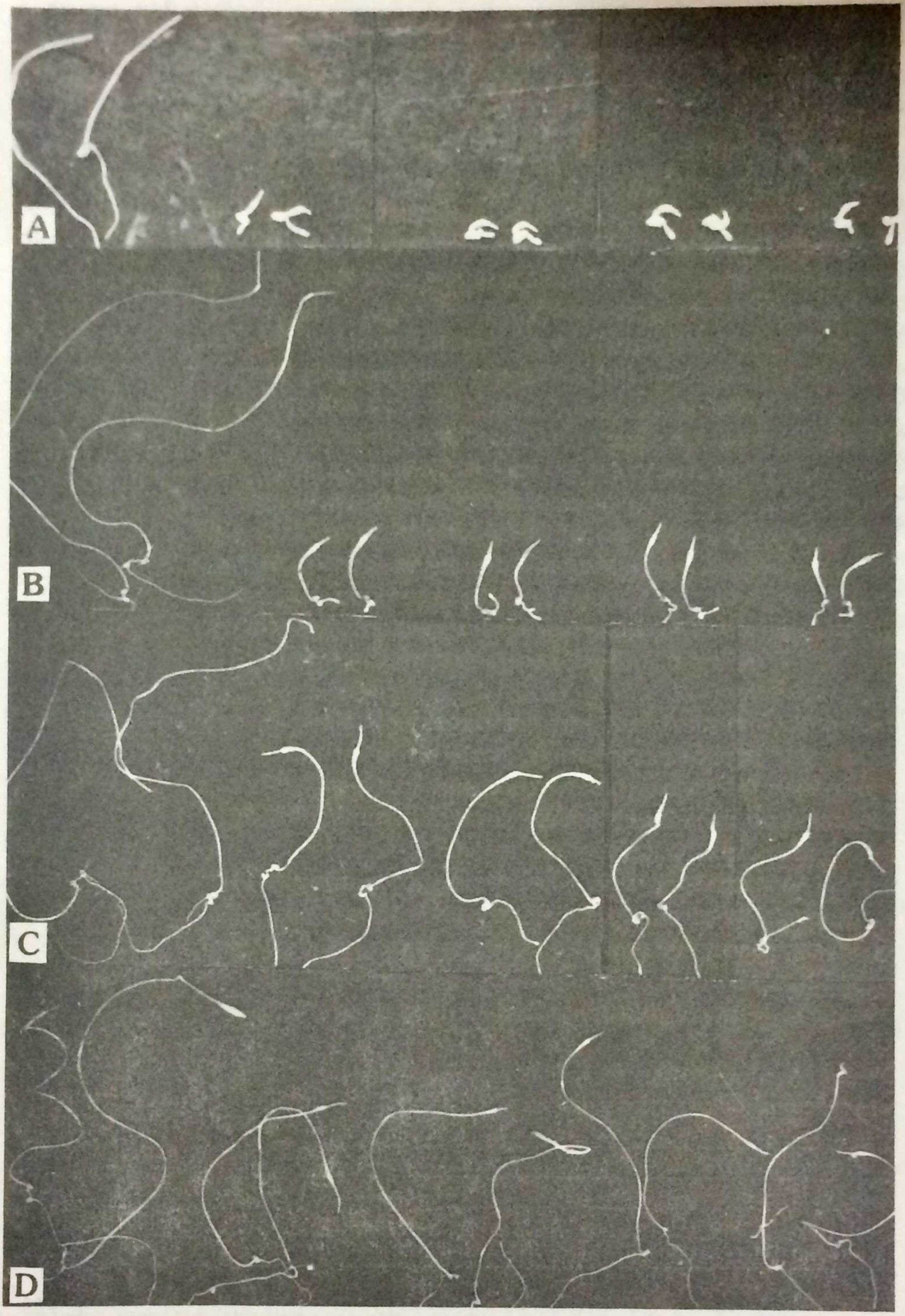

Fig. 1. *Rottboellia exaltata* treated with different concentrations of profluralin at varying ages (A) 7 days (B) 8 days (C) 9 days (D) 10 days. Left to right: Profluralin at 0, 5, 10, 25 and 50 ppm.

enlargement of the cells in all tissues. The cells which were in the pericyclic layer of the root tip contained one to several nuclei.

Table 2 shows the differences in the size of the cells in roots and shoots of untreated and treated seedlings. As the concentration of the herbicide was increased, the affected apices of the treated seedlings became progressively longer and wider than the untreated ones. Cells in the root and shoot of seedlings treated with 50 ppm were twice as long and thrice as wide as those of the untreated seedlings. The same effect was observed in all stages of seedling growth. These findings are similar to the mode of action of trifluralin which inhibited growth of seedling apices. Characteristically, the apices increased in diameter or exhibited a swollen meristematic region (Klingman, 1975).

Table 3 shows the increase in the number of lateral root and leaf primordium initials as the concentration of profluralin was increased. Profluralin disrupted cell division in the root primordium initials; hence, multinuclearity was observed. No multinuclearity was noticed in any stage of growth. Cell enlargement in the shoot was found in the cells of the mesocotyl, coleoptile and developing leaves. The main apical region did not seem to be affected by the herbicide treatment.

R. exaltata is apparently very susceptible to profluralin. Almost the same degree of phytotoxicity can be induced by the application of 5 to 50 ppm of the chemical at any

Table 2. Effect of different concentrations of profluralin on the length (L) and width (W) of root and shoot cells of **Rottboellia exaltata** at varying ages of seedling.

Age of Seedling (days)	Ave. Size of Root Cells (in μ) Concentration of Profluralin (in ppm)									
	0		5		10		25		50	
	L	W	L	W	L	W	L	W	L	W
7	109.7	95.2	139.1	153.7	197.6	248.9	226.9	190.4	248.9	280.2
8	271.6	97.9	335.5	139.1	387.9	212.5	563.6	300.1	563.4	296.5
9	310.6	84.1	585.6	322.1	490.4	316.7	556.3	263.3	636.8	256.2
10	220.3	76.9	417.4	344.0	439.2	314.7	578.2	366.0	445.5	234.2
Age of Seedling (days)	**Ave. Size of Shoot Cells (in μ) Concentration of Profluralin (in ppm)**									
	0		5		10		25		50	
	L	W	L	W	L	W	L	W	L	W
7	109.8	73.2	117.1	139.1	131.8	175.7	204.9	146.4	226.9	219.6
8	261.2	118.9	483.2	212.3	239.2	249.0	563.6	446.5	527.0	358.5
9	247.5	90.2	614.9	417.2	475.8	314.8	541.7	329.4	497.8	270.8
10	101.8	263.7	146.4	314.8	183.0	459.8	292.8	534.4	307.4	

Table 3. Effect of different concentrations of profluralin on the formation of lateral root primordia initials (LRP) and lateral leaf primordia initials (LLP) of *Rottboellia exaltata* at varying ages of seedling.

Age of Seedling (days)	Number of Lateral Primordia Initials									
	Concentration of Profluralin (ppm)									
	0		5		10		25		50	
	LRP	LLP	LRP	LLP	LRP	LLP	LRP	LLP	LRP	LLP
7	0	O	O	3	3	4	4	5	7	6
8	0	0	3	2	4	5	6	6	9	4
9	0	0	2	1	4	2	8	3	9	4
10	0	0	3	1	4	2	6	3	8	5

of the growth stages considered. Under field conditions, satisfactory control of *Rottboellia* can be achieved if profluralin concentration in the soil can be maintained at 5 ppm or higher during the critical period of weed competition with the crop.

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