Studies On The Control Of Aquatic Weeds Of Orissa

Response of Pistia Stratiotes L., Spirodela Polyrhiza Schleid, and Ipomoea Aquatica Forsk to Hormone Herbicides

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INTRODUCTION

Next in importance to water hyacinth (*Eichhornia crassipes* (Mart.) Solms) in the waters of Orissa (Latitude 17°40'N to 22°33'N and Longitude 81°24'E to 87°26'E) are water lettuce (*Pistia stratiotes* L.), duckweed (*Spirodela polyrhiza* Schleid), *Hydrilla verticillata* Casp., *Ipomoea aquatica* Forsk., *Salvinia* sp., *Azolla* sp., and *Trapa bispinosa* Roxb. (8). Parija (6) noted that although the growth rate of water lettuce was more or less similar to that of water hyacinth, it spreads over the water surface more profusely than water hyacinth. Water lettuce is more sensitive to copper sulfate ($CuSO_4$) than water hyacinth. Concentrations of 0.006% of copper sulfate and kerosene at a rate of 4 liters on an area of 400 sq. ft. controlled water lettuce. Thomas and Srinivasan (9) killed water lettuce in 10 to 12 days by applying 0.2% MCPA (2-methyl, 4-chlorophenoxy acetic acid). The amine salts or low volatile esters of 2,4-D (2,4-dichlorophenoxyacetic acid) at ¼ lb/A in 150 gallons of water per acre have controlled the plant (1). Philipose (7) obtained control of water lettuce and *Ipomoea* in small-sized ponds and tanks with manual clearance at a cost of $20 per hectare. Chakravarti (2) in his review on weed control work done in India concluded that 0.05 to 2% concentrations of 2,4-D would control water hyacinth, water lettuce, and other aquatic weeds. Davison, Lawrence and Compton (3) recommended sodium arsenite to kill water lettuce and sodium arsenite, silvex or 2,4-D granules to kill duckweeds in ponds. This investigation concerns the control of three very common aquatic weeds of Orissa.

MATERIAL AND METHODS

Water lettuce and duckweed were collected from ponds in and around Cuttack (20°48'N Latitude and 85°56'E Longitude) and were placed in large water-filled pots. The plants were grown in the pots 2 to 6 days before herbicide treatment. *Ipomoea* experiments were conducted in a pond. The plants were sprayed once with various concentrations of the sodium salt of 2,4-D and 2,4,5-T (2,4,5-tricholorophenoxyacetic acid). In a second experiment the plants were sprayed on alternate days and in a third experiment, daily until the death of the plants.

RESULTS

Morphologically water lettuce responded quickly to both 2,4-D and 2,4,5-T. The highest concentration of 1000 ppmw produced brown spots on the leaves within 24 hours after application. The brown spots were observed on plants treated with 500, 250 and 100 ppmw after 48 hours. The brown spots gradually increased in size until the entire leaf turned completely yellow and then white. In contrast to water hyacinth (5) the leaves did not exhibit any drying. Disintegration of the leaves began 10 days after application of the herbicide.

A single spray of 2,4-D was effective only at a concentration of 1000 ppm and 25 days were necessary for control (Table I). 2,45-T was more effective and at concentrations of 1000, 500 and 250 ppm took 22, 34 and 40 days respectively to kill the plants.

Increasing the frequency of herbicide applications hastened the killing process (Table 1). 2,4-D and 2,4,5-T were effective at lower concentrations as the frequency of application was increased.

TABLE 1. EFFECT OF 2,4-D AND 2,4,5-T ON *Pistia stratiotes* L.

Conc. in ppm	Days taken from time of application to complete death					
	Single spray		Alternate day spray		Daily spray	
	2,4-D	2,4,5-T	2,4-D	2,4,5-T	2,4-D	2,4,5-T
5	----	----	----	----	----	33
10	----	----	----	----	----	30
25	----	----	----	----	----	25
50	----	----	----	----	----	20
100	----	----	----	----	----	8
250	----	40	25	23	21	6
500	----	34	22	20	16	6
1000	25	22	15	13	15	5

Brown spots appeared on the fronds of duckweed 24 hours after application of 2,4-D and 2,4,5-T. Fronds began to lose their lustre and in the next seven days the brown spots had enlarged and covered the entire frond. Disintegration of the fronds was complete in about 3 to 4 weeks.

Single applications of 2,4-D killed duckweed at concentrations of 1000, 500, 250 and 100 ppm in 28, 32, 33 and 41 days (Table 2). 2,4,5-T was effective at the same concentrations and killed the plants in 24, 28, 30 and 38 days

TABLE 2. EFFECT OF 2,4-D AND 2,4,5-T ON *Spirodela polyrhiza*.

Conc. in ppm	Days taken from time of application to complete death					
	Single spray		Alternate day spray		Daily spray	
	2,4-D	2,4,5-T	2,4-D	2,4,5-T	2,4-D	2,4,5-T
5	----	----	----	----	----	35
10	----	----	----	----	----	30
25	----	----	----	----	----	25
50	----	----	----	----	----	20
100	41	38	36	30	18	13
250	33	30	25	24	12	10
500	32	28	20	20	8	7
1000	28	24	15	15	6	6

respectively. Increasing the frequency of herbicide applications on duckweed caused a corresponding increase in effectiveness. Daily spraying was more effective than alternate-day spraying.

In the experimental pond, *Ipomoea aquatica* covered the entire pond. The plants were rooted in mud at the margins of the pond spread onto the interior water as a surface aquatic by profuse branching.

On *Ipomoea aquatica* 2,4,5-T was more effective than 2,4-D. Concentrations of 1000, 500 and 250 ppm took 8, 14 and 19 days respectively to kill the plants as compared to 11, 18 and 21 days taken by the equivalent concentrations of 2,4-D (Table 3). Leaves started yellowing and petioles bending 24 hours after herbicidal application and within the next 24 hours the petioles bent until they were almost flat on the water surface. Drying of the leaves started from the margin and proceeded towards the center after about 4 days.

TABLE 3. EFFECT OF 2,4-D AND 2,4,5-T ON *Ipomoea aquatica*.

Conc. in ppm	Days taken from time of application to complete death	
	Single spray	
	2,4-D	2,4,5-T
250	21	19
500	18	14
1000	11	8

DISCUSSION

2,4,5-T proved to be a more effective herbicide than 2,4-D on the 3 tested species. In a single treatment water lettuce was completely killed with a concentration of 1000 ppmw of 2,4,5-T in 22 days against 25 days with 2,4-D. At the same concentration duckweed was killed in 24 days as against 28 days, and *Ipomoea* in 8 days as against 11 days with a single spray. Hitchcock, Zimmerman, Kirkpatrick and Earle (4) reported 2,4-D to be more effective than 2,4,5-T on water hyacinth and other aquatic weeds.

In this study an increase in concentration resulted in a more rapid plant kill. The highest concentration, 1000 ppmw, proved to be the most lethal dose. From a practical standpoint a lower lethal dilution is preferable because it is more economical as well as less toxic to fish.

SUMMARY

The action of 2,4-D and 2,4,5-T was studied on *Pistia stratiotes, Spirodela polyrhiza* and *Ipomoea aquatica*. 2,4,5-T was found to be more effective than 2,4-D on these three aquatic weeds. 2,4-D and 2,4,5-T applied at 1000 ppmw killed *Pistia, Spirodela* and *Ipomoea* in 25, 28 and 11 days respectively. *Ipomoea* was found to be the most susceptible aquatic species to both 2,4-D and 2,4,5-T. Among the concentrations tried 1000 ppmw proved to be the most effective. Increasing the frequency of application to daily sprays hastened death by reducing the period from treatment initiation to complete death in the three aquatic weeds.

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