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EFFECT OF HERBICIDES ON THE RNA IN WEED SEEDLINGS

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ABSTRACT:
The effect of herbicides on macromolecular contents of seedlings was studied at the concentrations form 10 to 100 ppm , 100 to 40,000 ppm and 100 to 40,000 ppm of 2,4-D, glyphosate and stomp, respectively. The RNA contents of seedlings decreased gradually with the increased concentration of herbicides. The RNA content of control seedlings was observed 1.3×10^{-4}. In 2,4-D treated seedlings, RNA per seedling was 1.2×10^{-4}, 1×10^{-4}, 0.8×10^{-4}, 0.5×10^{-4}, 0.07×10^{-4} and 0.03×10^{-4} . Glyphosate treated seedlings, the percentage of RNA content per seedlings at 100, 1000, 5000, 10,000, 20,000 and 40,000 ppm were 1.2×10^{-4}, 1×10^{-4}, 0.8×10^{-4}, 0.7×10^{-4}, 0.5×10^{-4} and 0.3×10^{-4} , respectively. Following stomp treatment, RNA content per seedling at 100, 1000, 5000, 10,000, 20,000 and 40,000 ppm were 1.3×10^{-4}, 1.2×10^{-4}, 0.9×10^{-4}, 0.8×10^{-4}, 0.6×10^{-4} and 0.3×10^{-4}, respectively. Thus, in the present study, it is concluded that 2,4-D was more effective in inhibiting macromolecular synthesis while glyphosate and stomp have the less inhibitory effect on RNA as compared to 2,4-D.
Key words: 2,4-D; glyphosate; stomp; herbicide; *Sida acuta*;.

Introduction:

Weeds are harmful to every living organism directly or indirectly. Weeds have been reported to be quite harmful as they create health hazards both to the animals and human beings. It is very dangerous to field crops. It is one of the factors that reduce the crop yield. Weeds are responsible to cause allergies like hay fever, itching and poison irg. Weeds may poison or seriously slow down the weight gains of the livestock. They are found along the road side, railway rout, gardens, lawn, play grounds, in irrigation and drainage system and farm. They have tremendous growth; gain more nutrients and water form soil. The cultivated plants compete with that weed around it for soil, sunlight, nutrients, water and space. So it is very necessity to control the weeds. There are various methods of controlling it such as hand pulling, hoeing, spuldding, tillage and mowing. Among them, herbicide is one of the suitable and easiest methods to control the weeds. In order to have proper scientific knowledge of weed control, it is necessary to understand the mechanism of herbicides in relation to weeds. For that, it is necessary to observe their effects on protein. Such studies will be helpful to determine the proper dosages of herbicides to be used for eradication of obnoxious weeds.

Jethro Tull (1731) was the first person who used the word 'weed' in his famous book "Horse Hoeing Husbandry". According to him "A weed is a plant growing where it is not desired". Various learned men have defined weeds in different ways; Branchely (1920) defined it as, "A plant that grows so luxuriantly or plentifully that possesses more valuable nutritive property". Cumming (1977) said, "Weeds are plants but hey are weeds simply when they are growing where they are not wanted". Gupta and Lamba (1978) defined weeds as, "Weeds are the plants growing at places and its times when we wanted either some other plants to grow or no plants to grow at all". Thakur in 1984 said, "An undesirable, injurious, unsightly and troublesome plant which interferes with cultivated crop and affect human affairs".

Sida acuta is a common weed, belonging to family Malvaceae. It is a branched shrubby plant, growing up to the height of one foot. Its leaves are simple lanceolate. The flowers are yellow, solitary or occasionally in pairs. It is a pantropical weed and is found in agricultural fields, causing heavy damage to the crop plants. In the present study the effect of Stomp, (pendimethalin) - which is a broad-spectrum systemic herbicide, was studied on this weed.

Materials and Methods:

The seeds of *Sida acuta* Burm.f. were treated with different concentration of 2,4-D, glyphosate and stomp herbicides for 24 hours in test tube. After treatment, seeds were washed thoroughly with distilled water and kept for germination in petridishes with double layered moistened filter paper in laboratory conditions. Seeds soaked in distilled water for 24 hours were used as control. The treated and untreated seeds were allowed to grow for six days.

Each sample containing one-gram fresh weight of six days old seedlings were taken for extraction and estimation of protein. The number of seedlings per gram was conunted and noted every time. For RNA extraction, the method suggested by Schneider (1945) was adapted. The three replicates were used for each sample at each concentration of herbicides.

Results:

After treatment with 2,4-D, glyphosate and stomp RNA contents were found to be decreased as the concentration of herbicides increased.

2,4-D

RNA per seedling at 10,20,40,60, 80 and 100 ppm was 1.2×10^{-4}, 1.0×10^{-4}, 0.8×10^{-4}, 0.5×10^{-4}, 0.07×10^{-4} and 0.03×10^{-4} , respectively as against control 1.3×10^{-4} (table-1). The gradual decrease of RNA content was observed as concentration of herbicide increases.

Glyphosate

In percentage of RNA per seedling at 100, 1000, 5000, 10,000, 20,000 and 40,000 ppm was 1.2×10^{-4}, 1.0×10^{-4}, 0.8×10^{-4}, 0.7×10^{-4}, 0.5×10^{-4} and 0.3×10^{-4} , respectively as against control 1.3×10^{-4} (table-1). The content of RNA per seedling were decreased when concentration of herbicide increased.

Stomp

The content of RNA per seedling at 100, 1000, 5000, 10,000, 20,000 and 40,000 ppm was 1.3×10^{-4}, 1.2×10^{-4}, 0.9×10^{-4}, 0.8×10^{-4}, 0.6×10^{-4} and 0.3×10^{-4} , respectively while in control it was 1.3×10^{-4} (table-1). The gradual decrease of RNA content was also observed as concentration of herbicide increases.

Table 1: RNA contents of the seedlings of *Sida acuta* Burm.f. following treatment of herbicides.

Herbicides	Conc. in ppm	Protein per dry seedling (mg)	Standard error (±)
	Control	1.3×10^{-4}	0.04×10^{-4}
2,4-D	10	1.2×10^{-4}	0.04×10^{-4}
	20	1.0×10^{-4}	0.09×10^{-4}
	40	0.8×10^{-4}	0.02×10^{-4}
	60	0.5×10^{-4}	0.04×10^{-4}
	80	0.07×10^{-4}	0.04×10^{-4}
	100	0.03×10^{-4}	0.004×10^{-4}
Glyphosate	100	1.2×10^{-4}	0.04×10^{-4}
	1000	1.0×10^{-4}	0.20×10^{-4}
	5000	0.8×10^{-4}	0.47×10^{-4}
	10,000	0.7×10^{-4}	0.47×10^{-4}
	20,000	0.5×10^{-4}	0.47×10^{-4}
	40,000	0.3×10^{-4}	0.47×10^{-4}
Stomp	100	1.3×10^{-4}	0.04×10^{-4}
	1000	1.2×10^{-4}	0.04×10^{-4}
	5000	0.9×10^{-4}	0.14×10^{-4}

	10,000	0.8×10^{-4}	0.04×10^{-4}
	20,000	0.6×10^{-4}	0.09×10^{-4}
	40,000	0.3×10^{-4}	0.04×10^{-4}

Discussion:

2,4-D

In 2,4-D treated seedling the RNA content decreased gradually with the increase in concentrations. Many workers have noticed decrease in RNA content of seedling after 2,4-D treatment. Key and Shannon *et al*. (1964) observed decrease in RNA in soybean seedlings with 2,4-D treatment. Key (1963) in corn and Shannon *et al*. (1964) in mesocotyl tissue of *Zea mays* found inhibition of RNA synthesis with 2,4-D treatment. Fites (1964) reported decrease in DNA and RNA content in soybean tissue following 2,4-D treatment. Moreland *et al*. (1969) noticed effect of 22 different weedicides on RNA and protein synthesis in maize mesocotyl and soybean hypocotyls and found that 14 of herbicides inhibited RNA and protein synthesis in vitro. Chen *et al*. (1972) observed progressive decrease in RNA levels in wheat by treatment with 2,4-D, 2,4,5-T, Dicamba and Picloram. Chand and Roy (1981) in *Nigella sativa*. Fedtke (1982) reported inhibition of RNA synthesis in corn plant roots by 2,4-D in dark and light conditions. Srinivasu and Bakale (1989a) noticed that at 10 and 50 ppm of 2,4-D, the RNA content increased gradually and later on at higher doses, it decreased with the increasing concentrations in *Parthenium hysterophorus*. Jain (1993) in *Chenopodium album*, Gopal (1993) in *Crotalaria juncea*, Kulkarni (1998) in *Crotalaria medicaginea*, Tulankar (1998) in *Amaranthus lividis*, Kamble (1999) in *Hibiscus cannabinus*, Dudhe (2002) in *Hyptis suaveoluns*, Taduwadi (2002) in *Cleome viscosa* and Kamble Sanjay (2006) in *Hibiscus cannabinus* reported inhibition of RNA by 2,4-D.

Glyphosate

This herbicide was effective on macromolecular synthesis of seedlings of *Sida acuta* Burm.f. The gradual decrease in nucleic acids and protein content was observed from 100 to 40,000 ppm. Many earlier workers noticed the inhibition of DNA and RNA synthesis following glyphosate treatment. Pillai *et al*. (1978) in soybean root reported that inhibit the uptake and incorporation of 14^c-thymindine into DNA, 14^c-uridine into RNA and 14^c-leucine into protein. Brecke (1976) in bean reported that decreased incorporation of 14c-uracil into DNA. Tymonko (1978) reported that at 10^{-3} M inhibited RNA content by 33% in enzymatically isolated soybean leaf cells. Cole *et al*. (1983), noticed inhibition of macromolecular synthesis (DNA, RNA and Protein) in single node buds of *Agrophyrum repens* partly due to inhibition of 14^0-precursor uptake. Further, they concluded that glyphosate may partially exert its influence on bud development by regulating entry of assimilates bud. Jain (1993) in *Chenopodium album*, Bobde (1993) in *Crotalaria juncea*, Kulkarni (1998) in *Crotalaria medicaginea*, Tulankar (1998) in *Amaranthus lividis*, Kamble (1999) in *Hibiscus cannabinus*, Dudhe (2002) in *Hyptis suaveoluns* and Kamble Sanjay (2006) in *Hibiscus cannabinus* also noticed decrease in the percentage of DNA and RNA in seedlings after the treatment of 2,4-D.

Stomp

Lighnowski (1969) reported that 10^{-5}M trifluralin had no significant effect on RNA content of wheat root tips. Gruenhagen and Moreland (1971) and Moreland *et al*. (1969) reported that trifluralin at 0.7×10^{-4} M did not affect RNA synthesis or ATP content of excised soybean hypocotyls. Penner and Early (1972) reported that the trifluralin and butralin applied at 10^{-5} M to corn seedlings reduced RNA synthesis. Dukes and Biswas (1967) reported increase in nucleic acid contents with trifluralin at low concentration in sweet potato and peanut plants, but at higher concentrations, there was gradual decrease in the nucleic acid content.

The foregoing discussion indicates that 2,4-D, glyphosate and stomp decrease RNA content of seedlings of *Sida acuta* Burm.f.

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