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2,4dichlorophenoxy Acetic AcidInduced Response on the Morphology of Seedling Growth of *Malachra capitata* L.

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Abstract
Effect of herbicide on seed germination has been integrated. The seedlings have been reported to be the most responsive to herbicidal action, which results from a direct interference with cell division, enlargement or differentiation of the growing cells.The seed of *Malachra capitata* L. were treated with different concentrations (100, 200, 400, 600, 800 and 1000 ppm) of herbicide 2,4-D (2,4 dichlorophenoxy acetic acid). 2,4-D inhibited the linear growth of seedlings. There was progressive decrease in the growth of hypocotyl and radicle of seedling was found with increasing concentration of 2,4-D. The lethal dose in radicle and hypocotyl were found 600 and 800 ppm respectively. The pH value at control becomes more acidic. It was observed that the radicle started rotteningand injury progressed towards hypocotyl as concentration increases.
(Key Words: Herbicide, hypocotyl, radicle, linear growth, 2, 4-D, *Malachra capitata*)

Introduction

Plants are most valuable assets to mankind without which, he could not be survived. At the same time, we cannot afford the huge and arbitrary growth of the plant all over the land and water bodies due to which our day to day normal activities will be disturb. Weeds are plants in crop which detoriate crop production. It is also responsible for economical losses in the crop yields. Weeds also interfere in agricultural operations and eventually dropped the quality and production.Seed is sexually derived structure of spermatophyte, which can germinate to produce new plant, so the seed become the propagation unit of the plant quality of seeds can produced and improve the production. But the seeds of most crops are contaminated with weed seeds. Some weed species have life cycle similar to that of crops. The presence of even a handful of weed seeds may enough to start a serious infestation. Weed seeds planted in the crop rows are most difficult to control. To remove weed is at present challenging task and is important to kill the weed to protect the crops. The weed *Malachra capitata* Linn. belonging to family Malvaceae (Varn. Ranbhendi). It is troublesome weed growing in cropland, roadside, water seepage etc.it is distributed in Maharashtra State especially in Vidharbha.

2,4-D (2,4 dichlorophenoxy acetic acid) is a selective systemic post emergence herbicide used for control of many annual broad leaf weeds in cereal crops, sugarcane plantation crop and non-crop area. 2,4-D herbicide have inhibitory effect on the germination process of weeds and subsequently growth of plant collapse. It may be inhibitory in early germination and also in established seedlings. Marco *et al.* (2002) stated that the first detectable symptom after herbicide treatment is growth inhibition, followed by a noticeable yellowing (chlorosis) of treatment tissue. Five to Ten days after the treatment, the chlorosis turns into necrosis and the plants begin to die. With this view in mind, the present investigation was undertaken to study the effect of herbicide 2,4-D.

Material & Methods

A large number of seeds of *Malachra capitata* Linn. were allowed to germinate in petridishes lined with double layer filter paper. When the seedlings attained the length of 6-10 mm, ten seedlings having equal lengths were selected for herbicide treatment. The length of hypocotyl and radicle was measured in each case before treatment. Each set of ten seedlings were treated with different concentrations of 2,4-D ranging from 100 ppm to 1000 ppm for 24 hours at room temperature. For control one set of ten seedlings were kept in distilled water. When 100 ppm was not effective, higher concentrations were used to study the behaviour of seedlings.

After treatment seedlings were thoroughly washed with distilled water and allowed to grow for 72 hours in petridishes containing moistened filter paper. After 72 hours, the length of hypocotyl andradicle was measured separately in each seedling. Four replicates of each treatment were carried out. The lethal doses were assessed on the basis of growth of seedlings at this stage. The pH values of control and solutions of

herbicide were also determined by pH meter. Morphological abnormalities were recorded.

Results and Discussion

2,4-D inhibited the linear growth of seedlings of *Malachra capitata*. There was progressive decrease in the growth of hypocotyl and radicle of seedling was found with increasing concentrations of 2,4-D. The decrease in length of hypocotyl at 100, 200, 400, 600, 800 and 1000 ppm was 6.1, 6.0, 3.2, 2.4, 1.9 and 0.11 mm. respectively as against 23 mmin control (Table 1). Similarly the growth of radicle decreased to one fourth as compared to control. The decrease in length of radicle was 1.90, 1.12, 0.84, 0.42 and 0.21 mm at 100, 200, 400, 600 and 800 ppm. respectively (Table 1). The lethaldose in radicle and hypocotyl were found 600 and 800ppm respectively. The pH value at control, 600 ppm and 800 ppm concentration was 7.0, 5.4 and 5.3 respectively.

The study of the effect of 2,4-D on linear growth of seedlings of *Malachra capitata* revealed that the growth of seedlings was inhibited at very low concentrations. At higher doses there was severe reduction in the linear growth of seedlings. The observation confirms the effect recorded by several workers. Hammer *et al.* (1946) reported that seedlings of *Phasgolus vulgaris* and *Pisum sativum* were inhibited at 10 ppm and the growth was almost checked. Allard *et al.* (1946), Johnson and Muzik (1960) observed inhibited of roots in wheat.Wu and Kozlowski (1970) observed abnormal seedlings development at 50 and 100ppm in *Pinus resinosa*. Eversan and Dunham (1951) also observed in some weeds and crop plants.

The radicles were found to be more susceptible to 2,4-D than hypocotyl as the growth of seedling completely checked. This susceptibility of the radicle might be because of the severe injury to its meristematic region. Similarfindings was reported by Muni (1960) and he attributed phloem destruction due to pressure from the surrounding proliferating parenchyma and to direct exposure to 2,4-D in case where the cortex was thin and easily destroyed so that the toxicant can diffuse directly into the phloem resulting from early killing of the cortex.

Bakale and Dnyansagar (1974) reported complete inhibition of seedling growth of *Alternanthera polygonoides, Cressa cretica* and *Xanthium strumarium* occurred at 400 ppm of 2,4-D. They further stated that the radicle was more susceptible to 2,4-D than hypocotyl. Such types of result have also been reported by Khosla (1969) in *Achyranthus aspera* and *Cassia tora*. Kolhe (1978) in *Tephrosiahamiltonii, Solanum surattense* and *Celosia argentea*, Deshmukh (1981) in *Corchorus olitorious, Cassia occidentalis* and *Lagasca mollis*.

No lateral roots were developed right from 100 to 400 ppm of 2,4-D. It was generally observed that first the radicle started rottening and injury progressed towards hypocotyl as concentration increases. Radicle turned from creamy white to brown in colour at 600 ppm and later it becomes rottened. The swelling of radicle and hypocotyl was gradual from 100 ppm to sublethal concentrations i.e., 400 and 600 ppm, respectively (Fig.1). At 200 ppm and above, concentration approaching lethality induced rottening effects of cotyledon (which turn to brownish black in colour) in all seedlings. Mahakhode (2010) observed that 2,4-D acts as strong inhibitory agent on early seedling growth. This inhibitory activity may due to its phototoxicity, interfering the metabolic pathway which helps to control the emergence of radicle. Herbicide uptake probably affected the cell division and cell elongation which ultimately resulted in the decrease in the length of seedlings. In the present study, the value of pH from control to 400 ppm ranged from 7.5 to 5.3 i.e. solution become more acidic. Therefore, it may be concluded that as pH solution increases towards acidic medium the higher concentrations inhibit the linear growth of radicle and hypocotyl. Several investigators have correlated the inhibition of root growth with the pH values of different concentrations of herbicides. Audus (1949) reported inhibition of root growth of *Lipidium sativum* by 2,4-D on the basis of pH of herbicide solution. Similar observations have been reported by Bakale (1972), Jain (1993), Bobde (1993), Tulankar (1998) in many weeds. They inferred that as concentrations of 2,4-D solution was increase from lower to higher values, it become more acidic and linear growth of radicle of some dicotyledonous weeds was checked more severely. Srinivasu (1986) and Gopal (1993) reported that linear growth of radicle and hypocotyl in some dicotyledonous weeds progressively decreased as the pH of 2,4-D solution increased towards acidity.

Conclusion

From the above discussion, it was concluded that 2,4-D inhibited the linear growth of the seedlings. The radicle was found more susceptible than hypocotyl. It wasalso revealed that pH plays an important role in the effect of herbicides on the growthof seedlings. The herbicide 2,4-D produced morphological changes such as swelling of hypocotyl and radicle,rottening effect of radicle and cotyledon in all seedlings.

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Table 1. Effect of different concentrations of 2,4-D on linear growth (in mm) of hypocotyl and radicle after 72 hours.

Herbicide	Concentration in ppm	Increase in hypocotyllength (mm)	Standard error (±)	Increase in radicle length (mm)	Standard error (±)
	Control	23mm	0.193	10mm	0.119
2,4-D	100	6.1	0.0527	1.90	0.008
	200	6.0	0.057	1.12	0.007
	400	3.2	0.1527	0.84	0.005
	600	2.4	0.05	0.42	0.005
	800	1.9	0.088	0.21	0.0057
	1000	0.11	0.1991	--	--

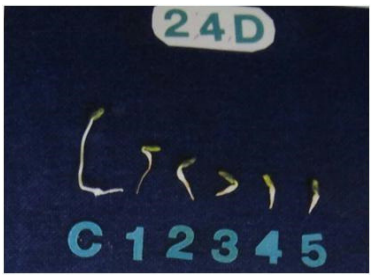

Figure 1: C-Control. 1, 2, 3, 4 and 5- Seedlings treated with 2,4-D at 100, 200, 400, 600 and 800 ppm respectively showing progressive inhibition of growth.

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