



## Anatomical Changes Induced by 2, 4-D(2,4Dichlorophenoxy-Acetic Acid) Herbicide In *Hyptissuaveolens* Linn.

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### Abstract

*Hyptissuaveolens* Linn. belonging to Lamiaceae is one of the most dangerous alien weed plant species. It has invaded most of the land of India and has become a problem of weed of national concern. It has been attempted to eradicate this noxious weed by chemical weed control. However present study deals with the impact of weedicide 2, 4-D (2,4 Dichlorophenoxy-acetic acid) on the anatomy of the alien weed species *Hyptissuaveolens*. In this study 2, 4-D spray application on plant under study was carried out. Results revealed that 2, 4-D induced abnormal meristematic activities due to destruction and collapse of weed tissues in vascular cambium by dehydration.

**Key words:** herbicide, 2,4-D, *Hyptissuaveolens* Linn.

### Introduction:

Man creates new areas for cultivation of economic crops and weeds invade the crop field simultaneously. Weed is unwanted plants growing with economically important crop plants. Traditionally weed is control by manual and mechanical methods. But these methods are not so effective because these methods are expensive and time consuming practices. To overcome drawbacks of these traditional weed control methods, chemicals are employed to control the weed. It is commonly referred as chemical weed control. In this method herbicides, weedicides or agrochemicals constitute the principal component of weed management.

Among these, herbicide 2,4Dichlorophenoxy-acetic acid (2,4-D) has been used extensively in modern agricultural practices to control the weed. 2,4-D is a white to yellow crystalline power. Chemically it is chlorinated phenoxy acid compounds comprise a whole family of phytotoxic substances that are used as herbicides in the form of parent acids or their salts and esters. The type compound of this form is 2, 4-D it belongs to aromatic compound where phenyl ring is attached to oxygen which in turn is attached to a carboxylic group.

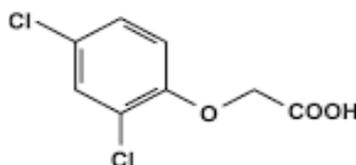


Figure. : 2,4- Dichlorophenoxy-acetic acid

To study the anatomical effect of this agrochemical, *Hyptissuaveolens* Linn. belonging to family Lamiaceae was used. Spray of aqueous solution 2,4- D of different concentrations were used to observed anatomical characterization.





Results of the study shows notable anatomical changes including cell proliferation, anomalous vascular cambial activities and crushed cortical region.

## Material and Methods:

Herbicide 2,4- D was sprayed in randomly designed plots of sized 2 X 2 square feet consisting of weed *Hyptissuaveolens* Linn. Were at the time of spraying each plot was covered on four sides by card board to avoid the contamination of different concentrations of the herbicide. For spraying, aqueous solution of 2,4- D various concentrations were prepared from 100 ppm -1000 ppm by Aspee-Poly sprayer of one liter capacity.

In order to study anatomical changes by spraying 2,4- D stems parts of the plant under study were collected and fixed in FAA (Formalin: Acetic Acid: Alcohol) solution for 24 hours and then preserved in 70% alcohol. Customary method was adopted for embedding plant material in paraffin. Section cutting was carried out at 8-10 micron, stained with safranin- light green and mounted in DPX. Microphotographs of various sections were taken for both control and 2,4-D treated plants under study.

## Results and discussion:

The anatomical characters after the beginning of spray for each treatment of stem were summarized and compared with those of the control. The observed features of the stem in transverse section were described.

### i) Control

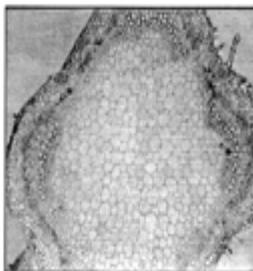


Figure.2- Control

Transverse section of stem in control showed ridges and and furrows. A single layered epidermis possesses multicellular epidermal hairs. Multilayer collenchymatus cortex ends with single layer endodermis followed by multilayered pericycle. Vascular bundle found embedded in ground tissue which was collateral and open (Fig. 1) there is a strip of extrastelar cambium which cut xylem in inner side and phloem in outer side, pith was thin walled, parenchymatus having well defined intercellular space.

### ii) Treated

Foliar application of 2,4-D enhanced thickness of the cuticle, stem showed notable anatomical changes after spray application of 2, 4- D in almost all concentration, at 800 ppm stem loosed its identity (Fig. 2) as compared to the control. The effect of high concentrations of 2,4-D foliar spray was found significant on epidermal cells. Hypodermal collenchymatus region was plasmolysed and distorted and finally epidermal cells lose their identity, ruptured and becomes fan shaped. (Fig. 2 and 3). Cambium showed abnormal meristematic activities at 600 ppm, phloem pushed towards the cortical region and get crushed. Xylem vessels were crushed at many places and cortical cells reduced and lost its identity (Fig. 4). Pith region cells proliferated towards the cortical region and cortex crushed. Vascular bundle was crushed, extrastelar strip was distorted. At nodal region, (Fig. 4 and 5) meristematic activities of endodermis and pith proliferation



cortical cells were damaged and formed lacunae. Longitudinal section of stem shown proliferated pith region and

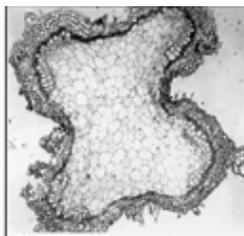


Fig. 3

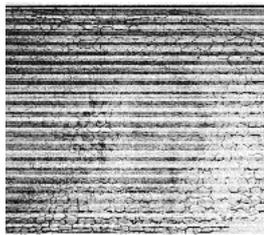


Fig.4



Fig.5



Fig. 6

The present study revealed that the anatomical features of stem *Hyptissuaveolens* Linn after the beginning of spray were affected by 2,4-D treatments in contrast with those of the control. Treated stem of plant under study showed proliferation of pericycle and phloem forming meristematic masses and disorganization of cortical cells. At all concentrations ruptured epidermis was observed, pith cells lost their identity by forming lacuna. These findings are in agreement with the generalization of

Eames (1950) and Muni (1960). Rubin and Gritsaenka (1968) reported in *Amaranthus retroflexus* and *Chenopodium album* reported the proliferation of cambium tissue after treatment with phenoxy acid in stem. Similar observations supports the findings of Dnyansagar and Khosla (1968) on *Cassia tora*, Hadke (1980) on *Psoralea corylifolia* and *Euphorbia geniculata*, Bobde (1993) on *Crotalaria juncea*, Jain (1993) on *Chenopodium album*, Gopal (1993) on *Medicago sativa*, Kulkarni (1998) on *Crotalaria medicaginea*, Kamble (1999, 2008 and) on *Hibiscus cannabinus*, Doagey et al., (2013) and Kamble (2013) on *Cassia tora*. Moreover, auxin compounds like 2,4-D might have toxicity on xylem and phloem which inhibits translocation of water and food supply properly. Cell loosens its activity to tolerate the toxicity of herbicides which desiccate the epidermis and leads to death of weed (Tukey et al., 1945 and Bobde, 1993).

## Conclusion:

From the results of our study, it can be concluded that foliar application of 2,4-D may affect some anatomical characteristics of the stem of *Hyptissuaveolens* Linn leading to death of plant at 1000 ppm.



## References:

- Bobde, S. N. (1993):** Comparative effect of herbicides on *Crotalaria juncea* Linn. Ph. D. Thesis, Nagpur Univ. Nagpur.
- Dnyansager, V. R. and Khosla S. N. (1968):** Effect of 2,4-D spray on the anatomical characters of some weeds. Proc. Ind. Acad. Sci. **703**: Pp 287-294.
- Doaigey, A.R., Al-Whaibi M.H., Siddiqui M.H., AlSahli A.A. and El-Zaidy M.E. (2013):** Effect of GA<sub>3</sub> and 2,4-D foliar application on the anatomy of date palm (*Phoenix dactylifera* L.) seedling leaf. Saudi J. Biol. Sci. **20**(2): Pp 141-147.
- Eames, A. J. (1950):** Destruction of phloem in young bean plants after treatment with 2,4-D Amer J. Bot Vol **37**: Pp 840-847
- Gopal, K. R. (1993):** Herbicidal effects on cytomorphology of weed *Medicago sativa* Linn. Ph. D. Thesis, Nagpur University, Nagpur.
- Hadke, S. M. (1980):** Effect of herbicides on cytomorphology of weeds *Psoralea corylifolia*, *Parthenium hysterophorus* and *Euphorbia geniculata*. Ph. D. Thesis. Nagpur University, Nagpur.
- Jain, S. B. (1993):** Cytomorphological effects of weedicides on weed *Chenopodium album*. Ph. D. Thesis. Nagpur University, Nagpur.
- Kamble, S. I. (1999):** Effect of herbicides on cytomorphology and macromolecular synthesis of *Hibiscus cannabinus* Linn. Ph. D. Thesis, Nagpur University, Nagpur.
- Kamble, S. I. (2008):** Effect of spray application of 2,4-D on anatomical characters of *Hibiscus cannabinus* Linn. Biosci. Biotech. Res. Asia. Vol **5**(1): Pp 401-406.
- Kamble, S. I. (2013):** Effect of Agrochemical (2,4-D) on Anatomical Aspects of *Cassia tora* Linn. Biosci. Biotech. Res. Asia, Vol. **10** (2): Pp 885-889.
- Kulkarni, G. B. (1998):** Effect of agrochemicals on *Crotalaria medicaginea* var. *luxurians*. Ph. D. Thesis. Dr. Babsaheb Ambedkar Marathwada University, Aurangabad.
- Muni, A. P. (1960):** Investigation on the anatomy of weed and selective weed control. Ph. D. Diss. Bose institute, university, Calcutta.
- Rubin, S. S. and Gritsaenka A. M. (1968):** The effect of 2,4-D on the structure of plants. Bot. Gaz. **53**: Pp 377-378.
- Tuky, H. B., Hamner C. L. and Imhofe B. (1945):** Histological changes in bind weed and sow thistle foliar application of 2,4-D in herbicidal concentrations. Bot. Gaz. **107**: Pp 62-73

