International Journal of
Life Sciences
International Peer Reviewed Open Access Refereed Journal

Special Issue A 12: March 2018:189-191
UGC Approved Journal No 48951

Original Article Open Access

Anatomical changes induced by glyphosate herbicide in *Hyptis suaveolens* L.

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Manuscript details:

Available online on
http://www.ijlsci.in

ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

Editor: Dr. Arvind Chavhan

Cite this article as:
Dudhe SS and Khirade PD (2018) Anatomical changes induced by glyphosate herbicide in *Hyptis suaveolens* L, *Int. J. of. Life Sciences*, Special Issue, A12: 189-191.

ABSTRACT

The weed *Hyptis suaveolens* L. belonging to family Lamiaceae. It is growing in Maharashtra especially in vidarbha region and found growing luxuriantly on boundary of crop fields, on sides of railway tracks and road sides. Plants already grown in fields were sprayed with aqueous concentration of glyphosate herbicide at various concentration like 100-3000 ppm. 3000 ppm considered to be lethal dose for plant. Anatomical changes like desiccation of epidermal cells, lacunae were found in cortical cells of stem, leaf showed mesophyll cells of leaf lamina was desiccated and destruction of palisade and spongy cells, and petiole showed remarkable changes at lower to higher concentration like lacuna formed at phloem region, distortion and disorganization of cortical cells while root showed epidermis and cortical cells distorted due to cambial activity, as compare the control.

Key words: Herbicide, Glyphosate, Anatomical, *Hyptis suaveolens* L.

INTRODUCTION

Plants on the earth is a great asset to mankind, out of 2,50,000 plant species present in the world, nearly 200 species are found to be prominent weed causing severe losses in agricultural systems. Weeds are unwanted and undesirable plant, it interferes with the utilization of land and water resources and this affects human and animal welfare. Unwanted vegetation flourishes in field crops, forestry, industrial sites, railway lines, air field, water ways and non-cropped lands create several problems. Great crop losses also occur due to weed about 20 to 100 percent. The natural growth aggressiveness and high adaptability of weed always makes them winners in the competition race. Soil, water and mineral nutrients are basic need of crop and weed. Weeds take more water due to large extension of root system and absorption of more nutrients from soil. Weeds harbor insects and pests during off season and then later attack to the crop field after sowing and damage them. Several weeds grow in grassland and are hazardous to animals, as it contains more amounts of glucosides, lactones, alkaloids, oxalates, coumarins and tannins which are lethal to animals.

Thousands of sheep and beef cattle killed in U.S.A. every year due to presence of *Hologeton glomeratus*, a poisonous weed in crop field. Traditional approaches for weed control are manual method and mechanical method. Manual method by using handweeding, digging, cheeling, sickling and mowing and mechanically by using tillage, hoeing, inter row cultivation, ecofallow system, burning, flooding, mulching like this way weed control were taking place, but it is not so effective because it is expensive and time consuming practices. The success of biological weed control is so directly or indirectly action on crop plants. But mechanically and biologically urgently weed management does not take place so there is the last, quick and economically beneficial method is to control weed by chemically.

Employing chemicals for weed control referred as chemically weed control method, it is commonly referred as herbicides, weedicides or agrochemicals, it constitute the principal component of weed management. Glyphosate is a non-selective, systemic herbicide that can control most annual and perennial plants. It controls weeds by inhibiting the synthesis of aromatic amino acids necessary for protein formation in susceptible plants. Glyphosate is strongly adsorbed to soil particles, which prevents it from excessive leaching or from being taken-up from the soil by non-target plants. It is degraded primarily by microbial metabolism, but strong adsorption to soil can inhibit microbial metabolism and slow degradation.

Glyphosate is profitable not only in situations, where labor scarce and expensive but also where labor is plentiful and cheap because glyphosate can be applied for weed control in crop rows were cultivation is possible, pre-emergence weed control, avoid root damage during manual weeding, control many perennial weeds and weed control by ecofriendly and ecoenvermentally. Glyphosate is extensively tested for health and safety, low-cost, effective weed control, glyphosate herbicide economically and effectively controls broadleaf weeds growing in between rows of fruit and vegetable fields and on orchards floors. The weedicide is primarily used for weed control in many crops.

Monsanto discovered and held the patent for glyphosate, and was for many years, the only company that manufactured and sold this herbicide. The patent expired in 2000, however, and already several other companies are making and selling glyphosate formulations. Some of the current trade names include: Roundup Ultra®, Roundup Pro®, Accord, Honcho, Pondmaster, Protocol etc. Over 400 herbicides have been developed and registered in the world for weed control in agricultural and nonagricultural systems. By keeping these properties of glyphosate in mind this work has been undertaken.

METHODOLOGY

Hyptis suaveolens L. belonging to family Lamiaceae. It is weed growing in Maharashtra especially in vidarbha region; it is found growing luxuriantly on boundary of crop fields, on sides of railway tracks and road sides. Plants already grown in field were sprayed with aqueous concentration of herbicide glyphosate at various concentrations like 100-3000 ppm by aspee-poly sprayer of 1 liter capacity by making randomly designed plots of size approximately 2/2 square feet at the evening at low temperature. For anatomical study the plant parts like stem, leaf, petiole and root were collected and fixed in F. A. A. (Formaline: Acetic Acid: Absolute Alcohol) solution for 24 hours stored in 70% alcohol. Plant material embedded in paraffin wax and sections were cut at 8-10 microns and stained with safranine- light green and mount in DPX. Microphotographs of treated and control plants were taken.

RESULTS AND DISCUSSION

Plants sprayed with glyphosate showed anatomical changes from 400 ppm concentration, desiccation of epidermal cells at nodal region, pith parenchyma becomes meristematic and cortical cells distorted. At 1000 ppm showed phloem distortion. Swelling of leaf lamina, mesophyll cells and spongy parenchyma distorted at 400ppm, illdeloped vascular and transfusion tissue were recorded at higher concentration. Petiole showed remarkable response at lower concentration to higher concentration, at 100 lower concentration cambium strip divide and lacunae formed at phloem region while at higher concentration 1500 ppm distortion and disorganization of epidermis and cortical cells. Root did not showed prominent remarkable changes at 100ppp except 2500ppm where cortical cells crowed due to cambial dividing activity, epidermal cells desiccated and distorted.

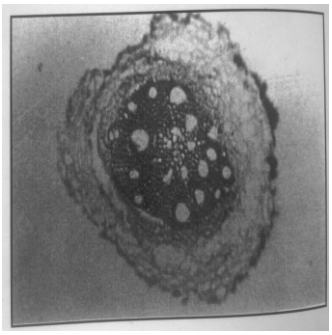

Fig 1. T.S. root - control

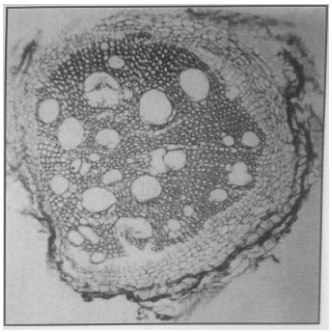

Fig 2. T.S. of root at 2500 ppm

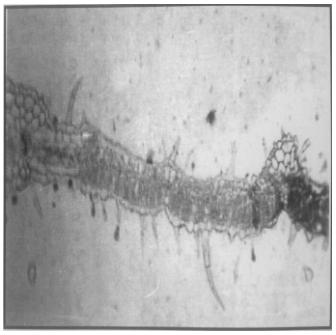

Fig 3. T.S. of root at 2500 ppm

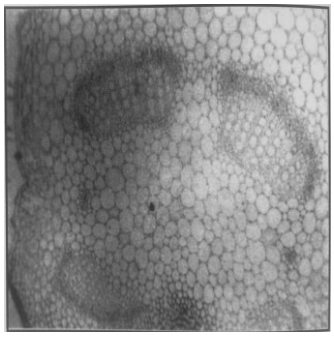

Fig 4. T.S. petiole - control

Herbicide glyphosate induces anatomical changes after spray on *Hyptis suaveolens* L. plant of stem, leaf, petiole and root, Schrubbers et al. (2014) in *Coffea Arabica.* In stem proliferation of cambium strip and phloem, epidermal breakage, lacuanae noted in phloem region, similar results were stated earlier by Tulankar (1998) in *Amaranthus lividus* this result might be due to meristematic activity of pericycle and lacunae due to toxicity of herbicide.

Leaf showed reduction in size of vascular bundle, proliferation of parenchyma, reduced mesophyll cells irregular in shape found. Earlier worker Canal et al. (1990) reported disorganization of vascular bundle, similar result were reported by Tulankar (1998) in *Amaranthus lividus.* Leaf anatomical changes showed plasmolized cells, epidermal disruption, distorted cells, hyperplesia, cell collapsing and necrotic tissue reported by Lailla et al. (2016). Petiole of weed showed notable abnormalities desiccation of cortical cells, destruction of phloem region, epidermal breakage, earlier Tulankar (1998) in *Amaranthus lividus.* In root, proliferation of cambium and phloem resulted destruction of cortex, similar results reported by Vaughn and Dukes (1986) in *Glycine max.*

CONCLUSION

Herbicide glyphosate induce proliferation of phloem in cortex ultimately ruptures the epidermis. Proliferation of secondary phloem in cortical region leads desiccation of root. In leaves depletion of chloroplast results in desiccation. These changes might be due to the physiological and biochemical toxicity of glyphosate.

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