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Effect of Agrochemical (2,4-D) on Anatomical Aspects of *Cassia tora* Linn

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Present investigation carried out in the botanical garden and research laboratory of the college. The herbicidal activities of agrochemical (2,4-D) on *Cassia tora* Linn. have been studied. The anatomical response might produce some light on the manner by which this compound affected on plants. The plants were sprayed with aqueous solution of different concentrations of herbicide from 50 to 1000 ppm. 2,4-D induced some anatomical changes like proliferation of cambium and phloem in the stem and root to form large masses of meristematic cells, due to the proliferation of cortical and pith cells after treatment become ruptured. In the leaves, desiccation of cells, proliferation of cambium in the midrib region, distortion of vascular elements and disorganization of mesophyll cells was common feature observed after 2,4-D treatment.

Key words: 2,4-D, Anatomy, *Cassia tora* Linn., Cambium, Phloem, Cortical cells and vascular elements.

Plants of *Cassia tora* Linn. were raised from seed collected from naturally growing plants of different places in Yavatmal District and its environs. They were allowed to grow three months till they attained the flowering and at this stage plants were spread with different concentrations of 2,4-D.

The aqueous solution of herbicide ranging from 50 to 1000 ppm was prepared. Ten pots of for each concentration (50 to 1000 ppm) containing 2 to 3 plants were sprayed. If 1000 ppm was found higher, the lower concentrations were tried to determine lethal dose. Spraying was done twice in an hour to make it more effective in the evening hours, when the wind was slow and temperature comparatively lower than of day. This help in less evaporation and more absorption of herbicide solution by the leaves. To avoided contamination of different concentration of herbicide, cardboard was used at the time of spraying application. Five pots were sprayed with water used as control. Field trials were conducted on naturally growing plants in randomly designed plots of size approximately 3X3 feet's.

To study the anatomical changes induced by herbicide, plants organs like root, stem, petiole and leaf of the treated as well as control plants were fixed in F:A:A (Formalin: Acetic acid: Alcohol) solution for 24 hours and stored at 70% alcohol. The plant material was embedded in paraffin wax following customary method (Sass, 1951). Section was cut at 9 to 12 microns. They were then stained and mounted in D. P. X. Microphotograph of various sections of both control treated plants were taken.

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RESULTS

The outer protective layer of the root is called epidermis or epiblema, the cortex was made up of parenchymatous cells. The endodermis and pericycle comprises a single layer of cells. The root showed secondary growth, the distinct metaxylem was observed with large vessels (Fig. 1).

The control stem showed defined outermost layer consist of single layered epidermis interrupted by stomata followed by cortex. The innermost layer of the cortex is the endodermis, it was divided into two parts, an outer zone was collenchymatous cells and inner parenchymatous cells containing chloroplast. The endodermis consisting of barrel-shaped elongated compact cells and pericycle is the region between the vascular bundles and the cortex, vascular elements which were arranged in ring and encloses large parenchymatous pith (Fig. 2).

The outermost layer of petiole was made up of single layer of barrel-shaped cells called epidermis. Hypodermis was multilayered made up of collenchymatous cells beneath the epidermis, just below the hypodermis ground tissue is found consists of thin walled parenchymatous cells. Vascular bundles consist of xylem towards upper side and phloem towards lower side (Fig. 3).

The leaf lamina was covered on both surfaces by a single layered epidermis composed of three types of tissue system, the epidermal, mesophyll and vascular. The mesophyll comprises upper palisade parenchyma and lower spongy parenchyma. The midrib comprises of parenchymatous tissues embedding vascular elements (Fig. 4).

Agrochemical 2,4-D induced anatomical changes in root, stem, petiole and leaf of *Cassia tora* Linn. at all concentrations.

The root at 75 and 150 ppm showed proliferated masses in the cortical region developed from the cells of cambium and phloem. However, at 225 and 300 ppm these proliferation masses grow in cortex, crushing its cells and forming lacunae. Subsequently, the pith, cortex and epidermis were disorganized and lost their identity (Fig. 5).

The stem at 75 and 150 ppm showed an abnormal meristematic activity of cambium. Owing to periclinal and anticlinal divisions of cambium, the phloem was published outward and crushed. At 225 and 300 ppm the phloem and rays cells get proliferated which results in the formation of meristematic masses. These masses of meristematic cells encroached over the fundamental parenchymatous cortex; disrupting it, pith cells were destroyed and lost their identity and finally ruptured the epidermis at many places (Fig. 6).

The petiole at 75 and 150 ppm showed proliferation of cambium and destruction of phloem parenchyma cells. Owing to this at 225 and 300 ppm due to the formation of meristematic masses, pressure exerted on the cortical cells, led to disorganization of cortex, endodermis and destruction of epidermis (Fig. 7).

The leaf was severely injured at all concentrations of 2,4-D. at 75 and 150 ppm leaf showed desiccation of tissues and lost cellular identity of epidermis. In midrib the destruction of phloem cells were observed. At 225 and 300 ppm the mesophyll cells of the leaflets also disorganized (Fig. 8).

DISCUSSION

This agrochemical induced some anatomical changes in stem, root, leaves and petiole at all concentrations.

In root, 2,4-D induced certain anatomical changes such as formation of huge masses of meristematic cells developed from cambium and phloem, destruction of cortical and pith cells were observed at all concentrations. Similar results were reported by Tukey *et al*. (1945) on Bind weed, Leroux (1957) and Kilpatrick *et al*. (1963) on *Nigella spp*. and *Trifolium spp*., Audus (1964) on some weeds, Callahan and Engel (1965) on *Agrostis spp*., Kolhe (1976) on *Tephrosia hamiltonii, Solanum surattense* and *Celosia argentea*, Hadke (1980) on *Psoralea corylifolia* and *Euphorbia geniculata*, Deshmukh (1981) on *Cassia occidentalis, Corchorus olitorius* and *Lagasca mollis*, Srinivasu (1986) on *Parthenium hysterophorus*, Bobde (1993) on *Crotalaria juncea*, Jain (1993) on *Chenopodium album* and Gopal (1993) on *Medicago sativa,* Kulkarni (1998) on *Crotalaria medicaginea* and Kamble (1999 and 2008) on *Hibiscus cannabinus* due to application of 2,4-D.

Stem of plant showed proliferation

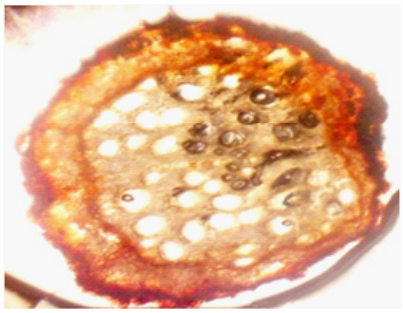

Fig. 1. Root, T. S. of control. X= 50

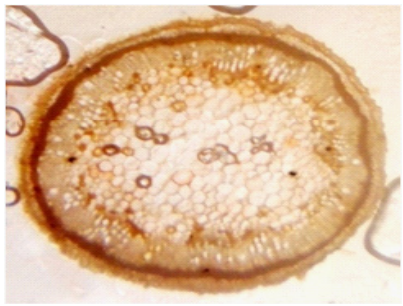

Fig. 2. Stem, T. S. of control. X= 50

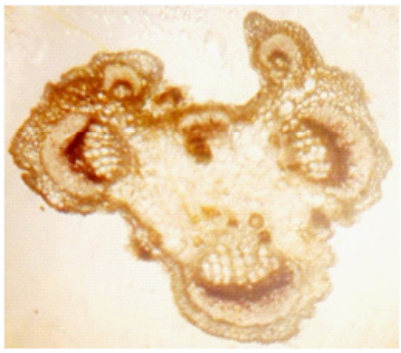

Fig. 3. Petiole, T. S. of control. X= 50

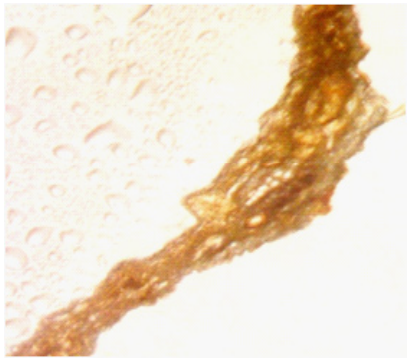

Fig. 4. Leaf, T. S. of control. X= 50

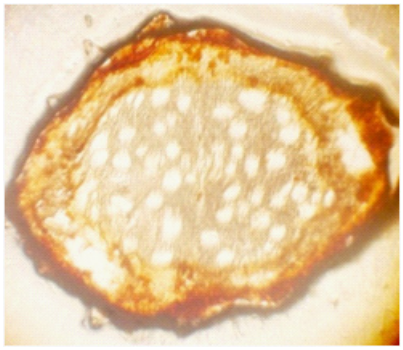

Fig. 5. Root, T. S. at 300 ppm of 2,4-D. X= 50

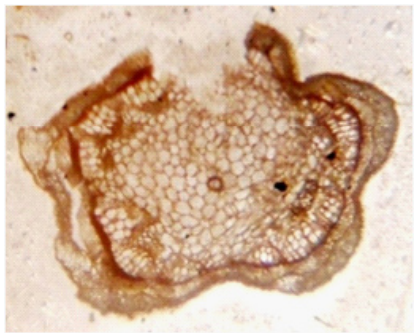

Fig. 6. Stem, T. S. at 300 ppm of 2,4-D. X= 50

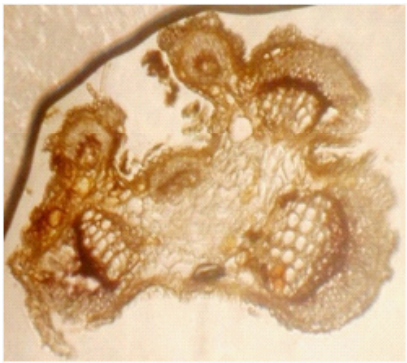

Fig. 7. Petiole, T. S. at 300 ppm of 2,4-D. X=50

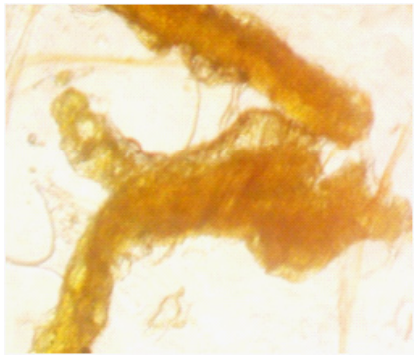

Fig. 8. Leaf, T. S. at 300 ppm of 2,4-D. X= 50

of phloem forming meristematic masses and disorganization of cortical cells were observed. In addition to it ruptured epidermis was observed at all concentrations and pith cells were destroyed and lost their identity. Gritasenta (1968) on *Amaranthus retroflexus* and *Chenopodium album* reported proliferation of cambium tissue due to 2,4-D. similar results have been reported by Dnyansagar and Khosla (1968) on *Cassia tora*, Hadke (1980) on *Psoralea corylifolia* and *Euphorbia geniculata*, Deshmukh (1981) on *Cassia occidentalis*, *Corchorus olitorius* and *Lagasca mollis*, Srinivasu (1986) on *Parthenium hysterophorus*, Bobde (1993) on *Crotalaria juncea*, Jain (1993) on *Chenopodium album*, Gopal (1993) on *Medicago sativa*, Kulkarni (1998) on *Crotalaria medicaginea* and Kamble (1999 and 2008) on *Hibiscus cannabinus*.

The petiole showed proliferation of cambium, destruction of phloem cells, disorganization of cortex and endodermis in the present study. Many workers like Bradley *et al.* (1968) on *Aprico spp*. Dnyansagar and Khosla (1969) on *Cassia tora*, Kolhe (1979) on *Tephrosia hamiltonii, Solanum surattense* and *Celosia argentea*, Hadke (1981) on *Psoralea corylifolia* and *Euphorbia geniculata*, Deshmukh (1981) on *Cassia occidentalis, Corchorus olitorius* and *Lagasca mollis*, Srinivasu (1986) on *Parthenium hysterophorus*, Bobde (1993) on *Crotalaria juncea*, Jain (1993) on *Chenopodium album* Gopal (1993) on *Medicago sativa*, Kulkarni (1998) on *Crotalaria juncea* and Kamble (1999 and 2008) on *Hibiscus cannabinus* reported similar reports.

In leaves disorganization of mesophyll and destruction of phloem cell in midrib was occurred due to application of 2,4-D. Loustalot and Muzik (1953) on *Stizolobium decringianum* reported destruction in mesophyll cells. Similarly, Scifres and Mc Cary (1968) on *Vernonia spp*., Bakale (1976) on *Alternanthera polygonoides* and *Cressa cretica*, White and Hemphill (1972) on Tobacco, Bakale and Dnyansagar (1977) on *Xanthium strumarium*, Kolhe (1979) on *Tephrosia hamiltonii, Solanum surattense* and *Celosia argentea*, Hadke (1980) on *Psoralea corylifolia* and *Euphorbia geniculata*, Deshmukh (1981) on *Cassia occidentalis, Corchorus olitorius* and *Lagasca mollis*, Srinivasu (1986) on *Parthenium hysterophorus*, Bobde (1993) on *Crotalaria juncea*, Jain (1993) on *Chenopodium album*, Gopal (1993) on *Medicago sativa* reported disorganization of mesophyll and destruction of phloem in mid vein and Kamble (1999 and 2008) on *Hibiscus cannabinus*.

In the present investigation, death of weed probably could occur due to proliferation and disorganization of mesophyll cells in leaves. Distortion of plant apices and splitting of outer tissue of roots and heavy meristematic activity was observed due to application of 2,4-D.

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