Indian Journal of Plant Sciences ISSN: 2319-3824 (Online)
An Online International Journal Available at http://www.cibtech.org/jps.htm
2013 Vol. 2 (4) October-December, pp.10-13/Komal
Research Article

ALLELOPATHIC EFFECT OF *THEVETIA PERUVIANA* ON GROWTH OF *TRITICUM AESTIVUM*

***Komal Arora**
Department of Botany, DAV College, Jalandhar, Punjab 144008
**Author for Correspondence*

ABSTRACT
The present study was planned to elucidate the effect of common roadside plant *Thevetia peruviana* on growth of *Triticum aestivum* under laboratory conditions. The parameters of study included germination, seedling length, dry weight accumulation and anatomical changes in root tissues. A dose dependent decrease in germination and dry weight accumulation was observed with maximum effect on radicle length. The internal structure of roots of treated seedlings also showed alterations as compared to untreated seedlings thereby indicating inhibitory potential of *T. peruviana* on wheat seedlings.

Key Words: *Allelopathy, Thevetia peruviana, Triticum aestivum, Seedling Growth, Root Anatomy*

INTRODUCTION
The term allelopathy originated from the Greek word 'allelon' which means 'each other' and 'pathos' means 'suffering' (Molisch, 1937). It is defined as the effect of one plant on other plants through the release of chemical compounds in the environment. The chemicals released during allelopathic interactions are called allelochemicals (Whittaker and Feeny, 1971). These are considered to be secondary metabolites or waste products of main metabolic pathways in plants. These compounds are released into environment from various plant tissues by leaching, root exudation, volatilization and residue decomposition. The effect of such compounds on other organisms can be inhibitory expressed in the form of reduced growth or altered physiological activities or beneficial at subinhibitory doses called hormesis (Southman and Ehrlich, 1943).

Thevetia peruviana is an evergreen plant of family Apocyanaceae native to Tropical America. It has widely naturalized in the tropics and subtropics as an ornamental and weed species. It is a shrub or tree upto 10 m high. Leaves are alternate, lanceolate, 5 – 15 cm long, dark green and glossy above, paler below, hairless. Flowers with yellow fused corolla, 5 -7.5 cm long, tubular with slightly spreading lobes, stamens attached at the top of narrow part of tube; anthers 2-chambered and concealed by corolla scales; fruit succulent, green, turns yellow and finally black when ripe, 2 – 2.7 cm long containing up to four hairless seeds. All plant parts contain milky latex.

Extracts of *T. peruviana* are recommended in number of ailments in traditional Indian and Chinese medicine (Ji, 1999). Inhibitory effect of ethanol extracts of its leaves on HIV reverse transcriptase has also been reported by many workers (Tewtrakul *et al*., 2002). Floral and foliar extracts have also been reported to exhibit antibacterial, antitermite, antifungal and antimolluscicidal activities (Singh and Singh, 2005; Ambang *et al*., 2010). In a recent study, the effect of *T. peruviana* on *Parthneium hysterophorus* has also been reported (Pavithra *et al*., 2012).

In present study we have explored the inhibitory effect of *T. peruviana* dried leaves on seed germination, seedling growth and root anatomy.

MATERIALS AND METHODS
Plant material of *T. peruviana* (Pers.) K. Schum. was collected from different locations around DAV College, Jalandhar and shade dried. Leaves were powdered and stored in airtight jars till further used. Aqueous extracts of the leaves were prepared by dipping 10 gm of air dried *T. peruviana* material in 100 ml distilled water for 24 h at 25 ± 5°C. It was filtered through Whatmann filter paper no.1 and the volume of filtrate made to 100 ml (Dhawan and Narwal, 1994). Different dilutions of the extracts *i.e.* 5%, 2% and

1% were prepared from stock solution (10%, w/v). Healthy and viable seeds of *Triticum aestivum* L. were surface sterilized and soaked in distilled water for 24 h.

Various growth studies were conducted under laboratory conditions. Each Petri dish (9 cm diameter) was lined with Whatmann no. 1 filter paper and made wet by 6 ml of respective extract concentration or distilled water in case of control. Ten imbibed seeds of *T. aestivum* were placed equidistantly on filter paper and the Petri dishes were covered with glass covering. They were incubated for seven days at standard conditions of light and dark (16/8 h) and relative humidity 85% at 10°C. On eighth day all seedlings were observed for germination studies *i.e.* seedling length and dry weight accumulation per seedling. Roots of treated (10%, w/v) and control seedlings were fixed in Alcohol: Glacial Acetic Acid (3: 1) for 18 hrs and shifted to 70% alcohol till further used for free hand sectioning of root tissues. Various sections were cut 1 cm above the tip portion and observed under MIPS integrated Olympus microscope. The whole set of experiment was repeated thrice and all parameters were expressed as mean values.

RESULTS AND DISCUSSION

Aqueous extracts could not inhibit seed germination completely even at highest concentration with maximum inhibition at 10% concentration i.e. 20% per Petri.

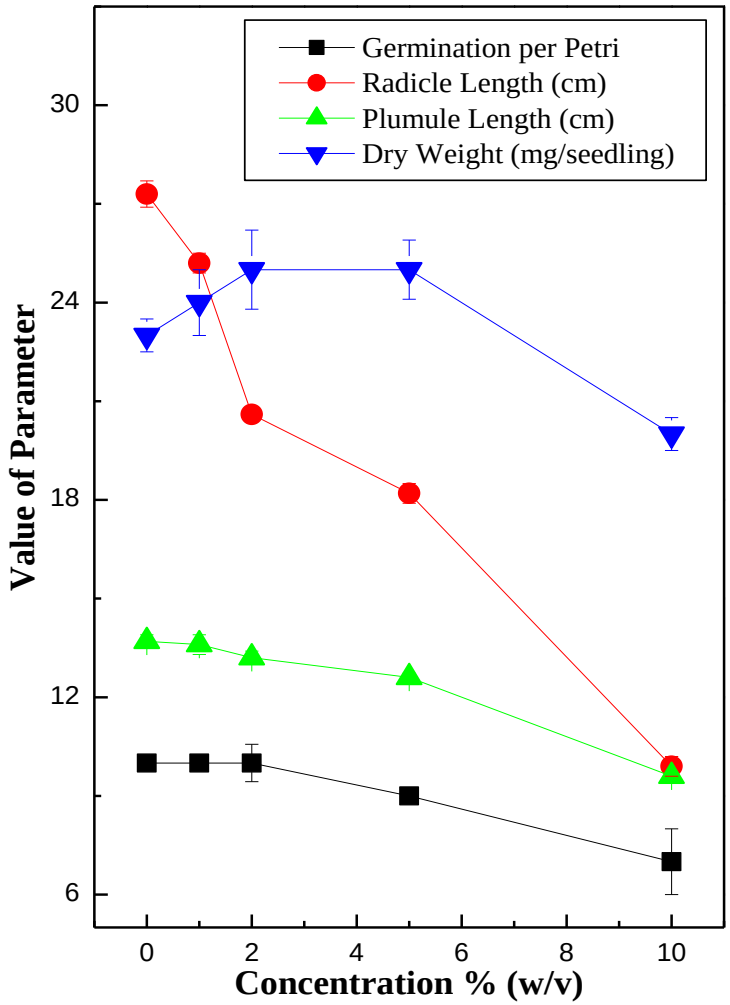

Figure 1: Effect of *Thevetia peruviana* leaf extracts on seedling growth of *Triticum aestivum*

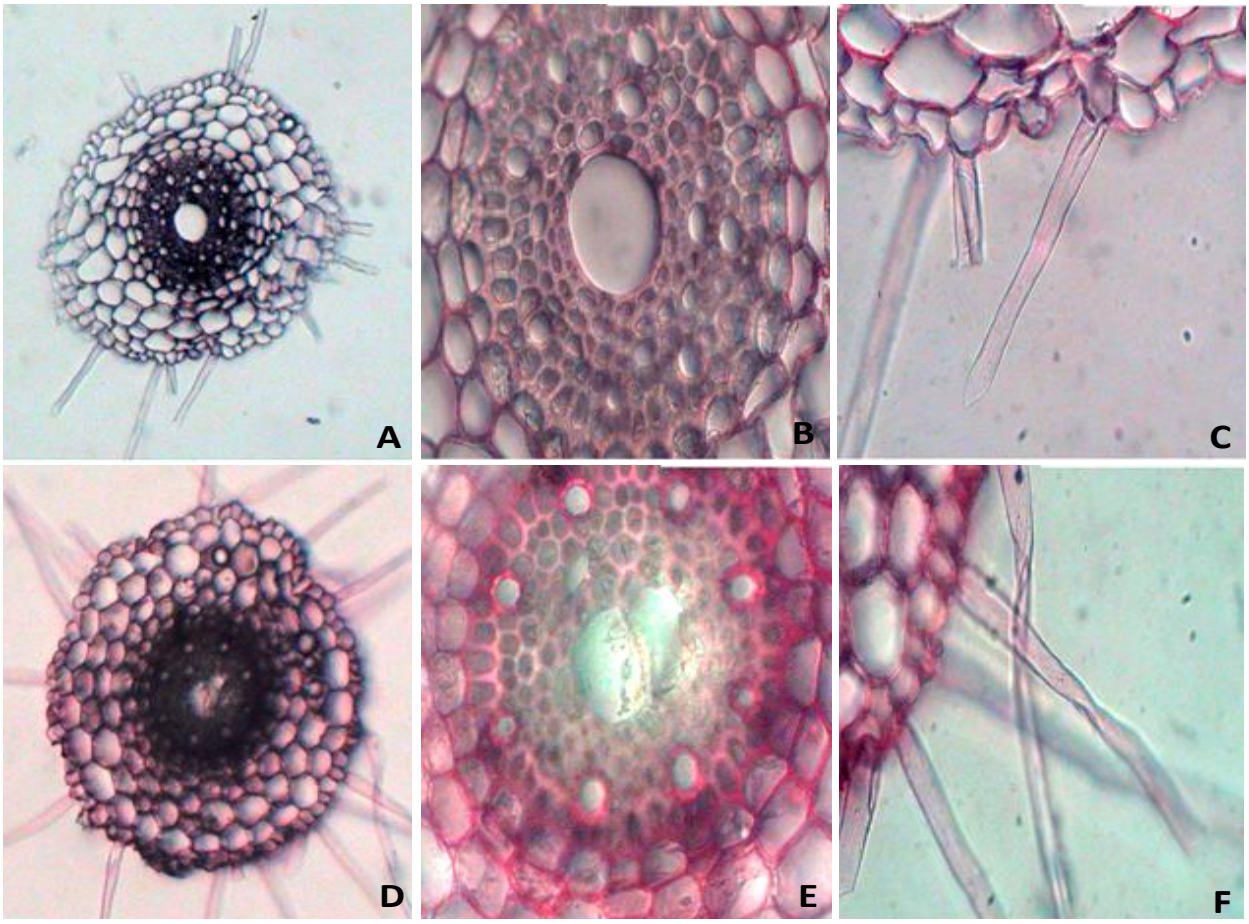

Figure 2: Effect of *Thevetia peruviana* leaf extracts on internal structure of treated wheat roots. A – C: Control root, A- T.S root (10X), B- Stelar region, C- Root hairs; D – F: Treated root, D- T.S root (10X), E- Stelar region and F- Root hairs.

Radicle length was affected more with maximum reduction to 36.62% as compared to 70.07% in plumule length at highest concentration (Figure 1). However, Dry weight was not much affected with increasing concentration. The anatomical sections of *T. aestivum* roots clearly elucidated altered cell structure of cortical cells and root hairs. In control roots, root hairs were intact and elongated, however, in treated roots, they were short but abundant. The diametric growth of roots also increased which may be attributed to increased layers of cortical cells (Figure 2). No other changes could be observed in treated roots.

Dose dependent inhibition of growth of maize seedlings due to *T. peruviana* treatment may be attributed to the allelopathic influence of chemicals released by leaf extracts. Radicle length decreased more as compared to plumule length which may be due to early exposure of radicle to plant extracts as compared to plumule during seed germination. The reduction in seedling length may be attributed to interference of allelochemicals in major physiological processes of plant metabolism viz. Respiration and photosynthesis (Meissner *et al*., 1979). These observations are supported by Pavithra *et al.*, (2012), who studied the allelopathic effect of *T. peruviana* on *Parthenium.* In order to elucidate the mode of action of natural plant products at cellular level, microscopic studies have been a very useful tool which can easily reveal subtle changes by comparing treated and untreated tissues (Dooris *et al*., 1988; Kupidlowska *et al*., 1994). Therefore, the microscopic study of root tissue further aided in the allelopathic impact of *T. peruviana* on *T. aestivum*. The diameter of treated roots increased which may be due to increased area of cortical cells

and increased cell width. This can be attributed to either retardation of auxin induced growth or destabilization of cell walls due to enhanced activity of cell wall peroxidases (Hoshi *et al*., 1994; Gonzales and Rojas, 1999).

T. peruviana suppressed the growth of *T. aestivum* seedlings significantly thereby elucidating strong allelopathic potential of this plant which can be correlated with the content of secondary metabolites in future studies.

ACKNOWLEDGEMENT

The financial support from Department of Biotechnology, Government of India, New Delhi, India in the form of DBT Star college grant is greatly acknowledged.

REFERENCES

Ambang Z, Ngoh JP, Essono G, Bekolo N, Chewachong G and Asseng CC (2010). Effect of *Thevetia peruviana* seeds extract on in vitro growth of four strains of *Phytophthora megakarya*. *Plant Omics Journal* **3**(3) 70-76.

Dhawan SR and Narwal SS (1994). Critical assessment of allelopathy bioassays in India. *Proceedings of International Symposium, Allelopathy in Sustainable Agriculture, Forestry and Environment,* Indian society of Allelopathy, IARI, New Delhi.

Dooris GM, Dooris PM and Martin DF (1988). Effect of a naturally occurring growth inhibitor on the ultrastructure of hydrilla. *Journal of Aquatic Plant Management* **26** 72-73.

Gonzales LF and Rojas MC (1999). Role of wall peroxidases in oat growth inhibition by DIMBOA. *Phytochemistry* **50** 931-937.

Hoshi, SM, Usui K, Ishizuka K, Kosemura S, Yamamura S and Hasegawa K (1994). Structure activity relationships of benzoxazolinones with respect to auxin-induced growth and auxin-binding protein. *Phytochemistry* **37** 297–300.

Ji YB (1999). Pharmacological action and application of anticancer traditional Chinese medicine. Heilongjiang Science Press: Heilongjiang, China.

Kuplidlowska E, Dobrzynska K, Parys E and Zobel AM (1994). Effect of coumarin and xantotoxin on mitochondrial structure, oxygen uptake, and succinate dehydrogenase activity in onion root cells. *Journal of Chemical Ecology* **20** 2471-2480.

Meissner R, Nel PC and Smith NSH (1979). *Proceedings of 3rd National Weed Conference South Africa* 39-52.

Molisch H (1937). *Der Einfluss einer Pflanze auf die andere – Allelpathie*. Fischer, Jena.

Pavithra GS, Anusha M and Rajyalakshmi M (2012). Effect of *Thevetia peruviana* extracts on in-vitro and in-vivo cultures of *Parthenium hysterophorus* L. *Journal of Crop Science* **3**(3) 83-86.

Singh A and Singh S (2005). Molluscicidal evaluation of three common plants from India. *Fitoterpia* **76**(7-8) 747-751.

Southman CM and Ehrlich J (1943). Effects of extract of western red-cedar heartwood on certain wood-decaying fungi in culture. *Phytopathology Journal* **33** 517-524.

Tewtrakul S, Nakamura N, Hattori M, Fujiwara T and Supavita T (2002). Flavanone and Flavonol Glycosides from the Leaves of *Thevetia peruviana* and their HIV-1 Reverse Transcriptase and HIV-1 Integrase Inhibitory Activity. *Chemical and Pharmaceutical Bulletin* **50**(5) 630-635.

Whittaker RH and Feeny PP (1971). Allelochemics: Chemical interactions between species. *Science* **171** 757-770.