Journal of Agricultural Extension and Rural Development Vol. 4(6), pp. 115-119, 5 April, 2012
Available online at http:// academicjournals.org/JAERD
DOI: 10.5897/JAERD11.069
ISSN- 2141 -2154 ©2012 Academic Journals

Full Length Research Paper

Allelopathic effect of aqueous extracts of different parts of *Tinospora cordifolia* (Willd.) Miers on some weed plants

K. M. Abdul Raoof * and M. B. Siddiqui

Department of Botany, Aligarh Muslim University, Aligarh-20 2002, India.

Accepted 14 February, 2012

The present study was conducted to investigate the allelopathic effects of *Tinospora cordifolia* weed on seed germination and seedling growth of weed plants (*Chenopodium album* L. *Chenopodium murale* L., *Cassia tora* L. and *Cassia sophera* L.). Leaf and stem aqueous extracts of *Tinospora* at 0.5, 1.0, 2.0 and 4.0% concentrations were applied to determine their effect on seed germination and seedling growth of test plants under laboratory conditions. The aqueous extracts from stem and leaf had inhibitory effect on seed germination of test plants. Aqueous extracts from leaf and stem inhibited root length, shoot length and dry weight. Root length, shoot length of weed species decreased progressively when plants were exposed to increasing concentration (0.5, 1, 2 and 4%). Aqueous extract of leaves shows the maximum inhibition while stem shows the least affect on weeds. The pH of aqueous extracts of different parts of *T. cordifolia* does not show any major change when the concentration increased.

Key words: Allelopathy, aqueous extract, *Chenopodium album, Chenopodium murale, Cassia tora, Cassia sophera, Tinospora cordifolia.*

INTRODUCTION

Tinospora cordifolia (Neem giloy) is a deciduous climbing shrub of the family Menispermaceae found throughout tropical India ascending to an altitude of 1000 feet in South Asia, Indonesia, Philippines, Thailand, Myanmar, China and in Srilanka worldwide. It prefers a wide range of soil, acid to alkaline and needs moderate level of soil moisture. Generally, it climbs up neem and mango trees. It is highly medicinal and its parts used to cure various diseases like, fever, cancer, leprosy, etc. and it is also an immune modulator and memory booster. De Candolle (1832) was probably the first person to suggest the possibility that many plants may excrete something from their roots which may be injurious to other plants. Molisch (1937) proposed the term ‘allelopathy’ for expressing the harmful effects that one plant species may have on another through the mechanism of chemical retardants escaping into the environment. The concept of allelopathy was further supported and developed by Bonner (1950), Grummer and Beyer (1960), Evenari (1961), Whittaker (1970), Pitman and Duke (1978) and Fischer et al. (1978). According to Lavabre (1991), allelopathic effects are controversial and still poorly understood. Allelochemicals (inhibitors) are produced by plants as end products, by-products and metabolites and are contained in the stem, leaves, roots, flowers, inflorescence, fruits and seeds of the plants. Of these plant parts, leaves seem to be the most consistent producers of these allelochemicals. The four ways in which allelochemicals escape from a plant are: (i) volatilization, during which the terpenes are released from the leaves of some plant species; (ii) leaching (which has shown that living or dead leaves of many plants contain growth inhibitors); (iii) exudation in which case roots of several crop and non-crop species release large quantities of organic compounds that inhibit the growth of other plants; and (iv)decomposition, through which allelochemicals are released from the plant residue. We conducted this research to determine the allelopathic activity of leaf and stem of *T. cordifoli.*

*Corresponding author. E-mail: abdulraoofkm@gmail.com, zaman.amu@gmail.com.

Table 1. pH value of different concentration of extracts from leaf and stem of *T. cordifolia.*

Extract concentration	Leaves	Stem
0.5	8.32	8.30
1.0	8.29	8.27
2.0	8.26	8.24
4.0	8.23	8.21

MATERIALS AND METHODS

Preparation of aqueous extract

T. cordifolia plants which grew naturally in Aligarh Muslim University campus. Leaf and stem were collected at their matured stage on June 15 and July 5, 2010, for the experiment. The parts were brought into the laboratory and each part of the fresh plant was cut into small pieces, shade dried and then ground separately with the help of electronic grinder and made to fine powder. 4 g powder of leaf and stem of *T. cordifolia* were dipped in 100 ml of distilled water and filtered through a muslin cloth followed by filter paper (No. 1 Whatman International, Maidstone, UK) after 24 h of soaking at room temperature and then further diluted so as to get 0.5 to 4% aqueous extract, respectively, as adopted from Singh et al. (1989).

Treatments and experimental design

Fresh seeds of weeds were collected from the agricultural field and road sides of the Aligarh Muslim University. The seeds were thoroughly washed in running water and soaked in distilled water for 12 h. Petri dishes were given a thorough washing with detergent using hot water as precautionary measures against pathogens and pollutants. Petri dishes of 9 cm diameter lined with filter paper were used for germination trial. There were 10 treatments including four concentration levels (0, 0.5, 1, 2 and 4%) of each leaf and stem extracts. Seeds and filter papers were moistened with 10 ml each of 0.5, 1, 2 and 4% aqueous extracts. 10 ml of distilled water was added to the untreated control (0%). The treatments were arranged in a completely randomized design (CRD) with three replicates kept at room temperature on a laboratory bench with 12 h supply of fluorescent light during the night. The entire experiment was repeated once.

Determination of pH

The pH of each extract was prepared from different parts of *T. cordifolia* and determined by immersing the electrode of a digital pH meter (EcoScan). The mean of five replicates were taken and presented.

Physical parameters

Germination counts were recorded daily for fifteen days. After fifteen days, the seedling root length (cm), shoot length (cm) and dry weight were determined (mg). The root and shoot length were determined manually while the dry weight with the help of 4 digit digital balance of Scientech, model ZSA 120, Colorado (USA).

Statistical analysis

After seven days, the seedling root length, shoot length and dry weight were determined. The data were subjected to one way analysis of variance and the mean values were separated at $P < 0.05$ applying 2-sample t-test. The statistical analysis was done using SPSS/PC version 10 software.

RESULTS AND DISCUSSION

As compared to the control (0%), the aqueous extracts of *Tinospora* from leaf and stem parts at 2 and 4% concentration levels exhibited significant ($P < 0.05$) inhibition on germination and seedling growth. Maximum reduction in germination was observed in *Cassia tora* (4%). The effect was in general, but more severe on *Chenopodium album* as compared to other weed plants. Among the different parts, leaves were the most allelopathic followed by stems. The inhibitory effect was concentration dependent (Figures 1 and 2). The inhibition effect was found to increase with increasing concentrations of different aqueous extracts (Sisodia and Siddiqui, 2008, 2009). The radicle length, plumule length and dry weight of seedlings were reduced significantly in response to all the *T. cordifolia* extracts. At 4% concentration of the leaves extract, in *C. album* the radicle length and plumule length were reduced by nearly 85 and 81% respectively (Figure 1). Generally, in studies with aqueous extracts, the observed inhibitory effect are attributed to change in pH raising concern about allelopathy and its ecological existence and relevance (Harper, 1977; Conway et al., 2002; Sisodia, 2008). In the present study, pH extracts (that is, stem and leaves) ranged from 8.21 to 8.32 (Table 1). Foliar leachates have been regarded to be most phytotoxic in nature (Xuan et al., 2004) probably owing to their proportionately greater biomass and with greater metabolic activity or production of more metabolites (Xuan et al., 2004). Some recent studies indicating the phytotoxic/ allelopathic effect of aqueous extracts of weeds include *Mikania micrantha* (Ismail and Kumar, 1996), *Cyperus rotundus* (Quayyaum et al., 2000a), *Cardaria draba* (Kiemnec and McInnis, 2002), *Parthenium hysterophorus* (Batish et al., 2002a; Singh et al., 2003a), *Brassica nigra* (Tawaha and Turk, 2003), *Raphanus raphanistrum* (Norsworthy, 2003), *Ageratum conyzoides* (Batish et al., 2002b; Singh et al., 2003b,c), *Lucerne* varities (Zhihua and Yixin, 2005), *Andrographis paniculata* (Alagesaboopathi, 2011), *Artistolochia esperanzae* (Gatti et al., 2010), *Baccharis dracunculifolia* (Gusman et al., 2008), *Calotropis procera*

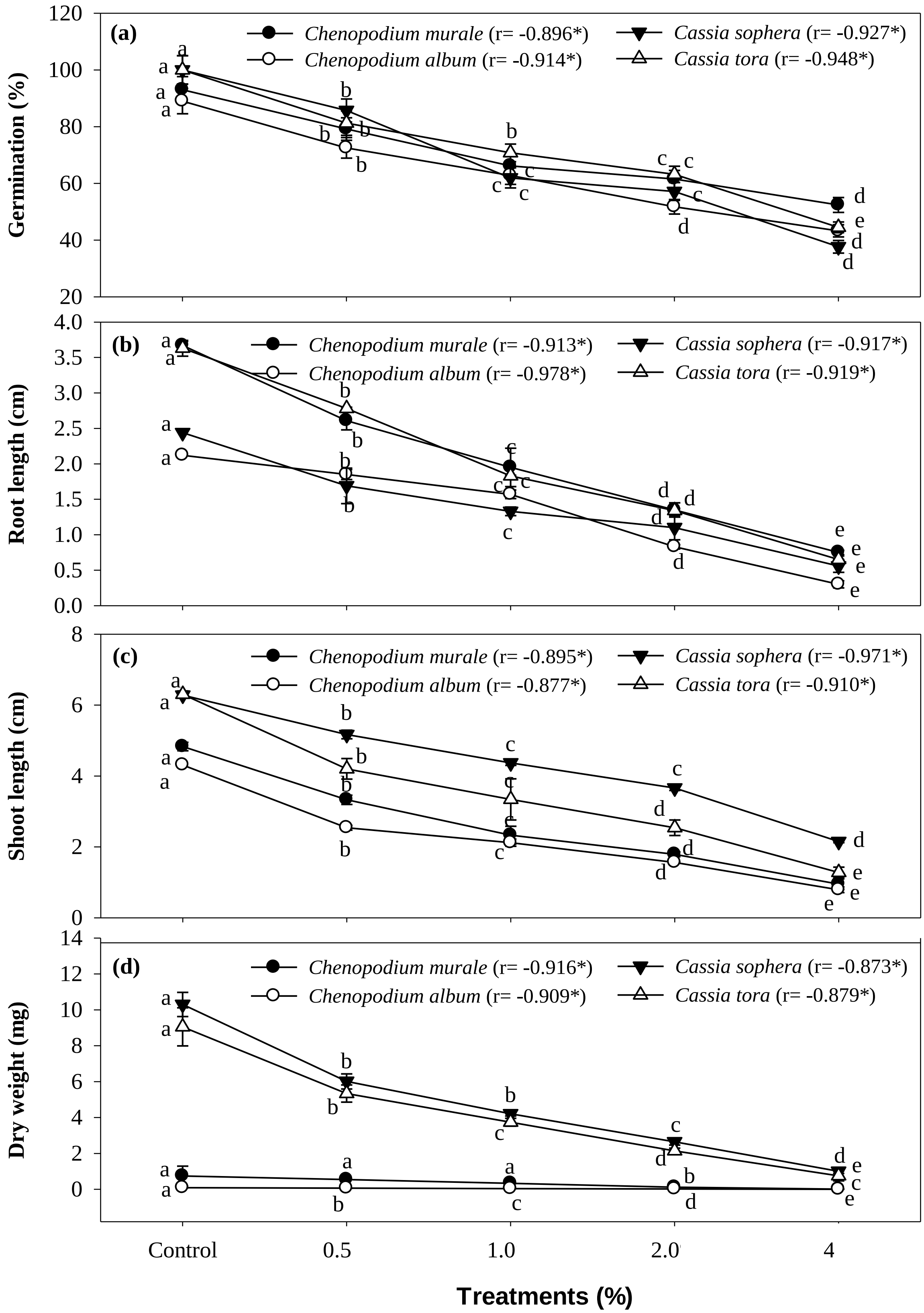

Figure 1. Effect of different concentration of aqueous extract of Leaf on (a) germination, (b) root length (c) shoot length and (d) dry weight of test plants. Different superscript symbols along a curve represent significant difference among themselves at $P < 0.05$ applying DMRT. r represent correlation coefficient. *represent significants significance of correlation at $P < 0.05$.

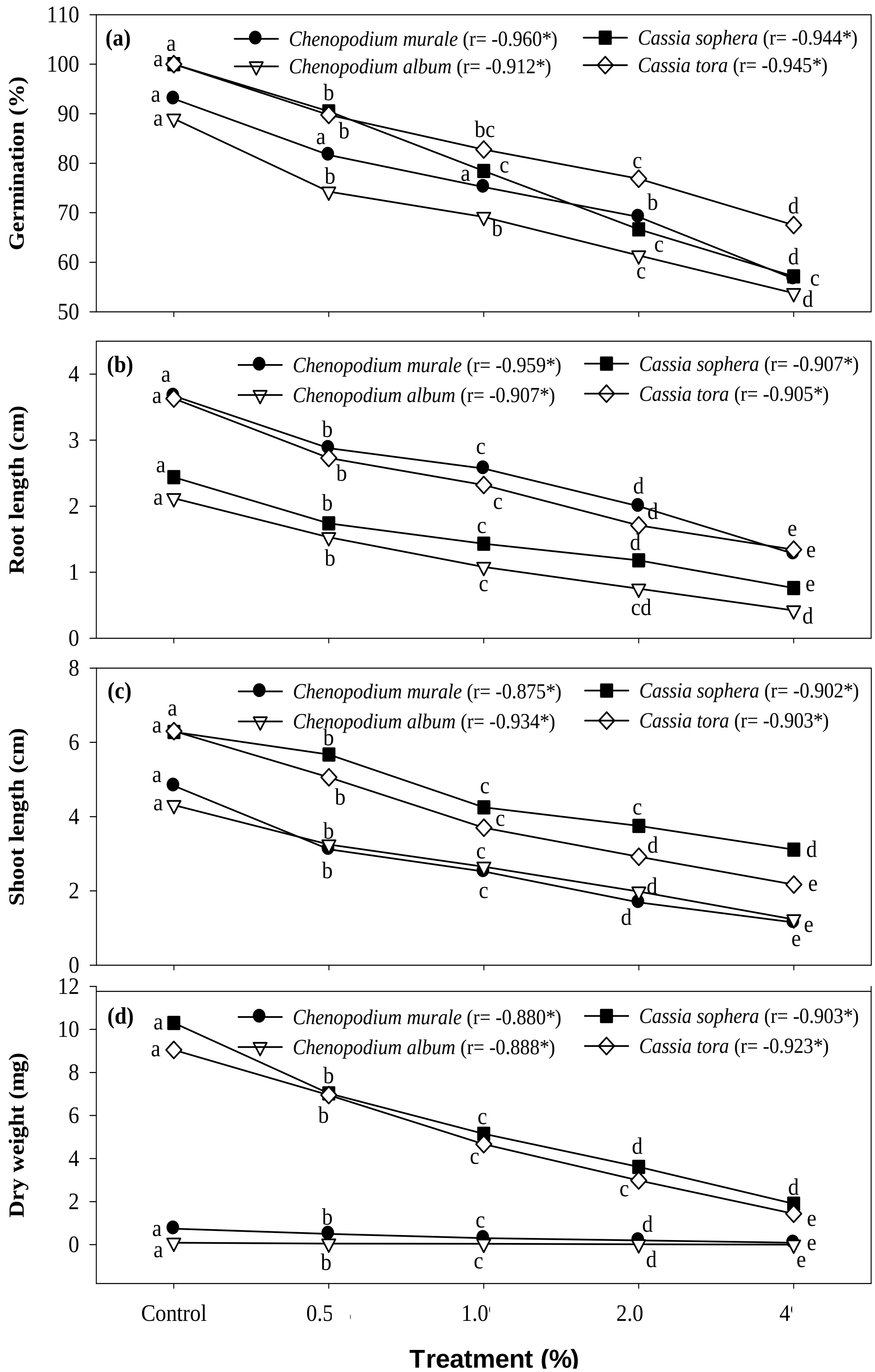

Figure 2. Effect of different concentration of aqueous extract of stem on (a) germination, (b) root length (c) shoot length and (d) dry weight of test plants. Different superscript symbols along a curve represent significant difference among themselves at P<0.05 applying DMRT. r represent correlation coefficient.*represent significants significance of correlation at P<0.05.

(Samreen et al., 2009) and *Chenopodium murale* (Batish et al., 2007). All these studies indicated the release of phototoxic chemicals during the preparation of aqueous extracts. Based on this, studies were further extended to explore the impact of *T. cordifolia* (especially) leaves, as they possessed greater phytotoxicity on the emergence and growth of weed.

ACKNOWLEDGEMENT

This research was carried out with financial support from UGC fellowship.

REFERENCES

Alagesaboopathi C (2011). Allelopathic effects of *Andrographis paniculata* Nees on germination of *Sesamum indicum* L. Asian J. Exp. Biol. Sci., 2(1): 147-150.

Batish DR, Singh HP, Pandher JK, Arora V, Kohli RK (2002a). Phytotoxic effect of *Parthenium* residues on the growth of radish and chickpea and selected soil properties. Weed Biol. Manage., 2: 73-78.

Batish DR, Tung P, Singh HP, Kohli RK (2002b). Phytotoxicity of sunflower residues against some summer season crops. J. Agron. Crop Sci. 188: 19-24.

Batish DR, Lavanya, K. Singh, HP, Kohli RK (2007). Root mediated allelopathic interference of Nettle-leaved Goosefoot (*Chenopodium murale*) on wheat (*Triticum aestivum*). J. Agron. Crop Sci., 193: 37-44.

Bonner J (1950). The role of toxic substances in interaction of higher plants. Bot. Rev. 16: 51-65.

Conway WC, Smith LM, Bergan JF (2002). Potential allelopathic interference by the exotic Chinese tallow tree (*Sapium sebiferum*). Am. Midl. Nat., 148: 43-53.

De Candolle MAP (1832). Physiologie Vegetable. Bechet Jeune, Lib., Fac. Med., Paris. Tomme-III pp. 1474-1475.

Evenari M (1961). Chemical influence of other plants (allelopathy) Handbook of plant physiol., 16: 691-736.

Fischer RF, Woods RA, Glavicic MR (1978). Allelopathic effects of goldrod and ashes on young sugar maple. Canadian J. Res., 8: 1-9.

Gatti AB, Ferreira AG, Arduin M, Perez SCGA (2010). Allelopathic effects of aqueous extracts of *Artistolochia esperanzae* O.Kuntze on development of *Sesamum indicum* L. seedlings. Acta Bot. Bras., 24(2): 454-461.

Grummer G, Beyer H (1960). The influence exerted by species of flax by means of toxic substances. In. Harper JL (ed.). The Biology of Weeds. Blackwell, Oxford pp.153-157

Gusman GS, Bittencourt AHC, Vestena S (2008). Allelopathy of *Baccharis drancunculifolia* DC. On the germination and development of cultivated species. Acta Scientiarum Biol. Sci., 30: 119-125.

Harper LL (1977). Population Biology of Plants. London: Academic Press pp. 273-278.

Ismail BS, Kumar A (1996). Effects of aqueous extracts and residues decomposition of *Mikania micrantha* H.B.K. on selected crops. Allelopathy. J. 3: 195-206.

Kaul V (1967). Distibution and dispersal of *Croton sparsiflorus* Morong. J. Ind. Bot. Soc., 46: 154-159.

Kiemnec GL, McInnis ML (2002). Hoary cress (*Cardaria draba*) root extract reduces germination and root growth of five plant species. Weed Technol., 16: 231-234.

Lavabre EM (1991). Weed control. McMillan Education Ltd., London. pp. 169-178.

Mersie W, Singh M (1987). Allelopathic effect of Parthenium (*Parthenium hysterophorus* L.) extract and residue on some agronomic crops and weeds. J. Chem. Ecol., 13: 1739-1749.

Molisch H (1937). Der Einfluss einer pflanze auf die andere. Allelopathic Fischer, Jena pp. 64-67.

Norsworthy JK (2003). Allelopathic potential of wild radish (*Raphanus raphanistrum*). Weed Technol., 17: 07-313.

Pitman AR, WB Duke (1978). Allelopathy in agroecosystems. Annu. Rev. Phytopathol,, 16: 431-451.

Quayyum HA, Mallik AU, Leach DM, Gottardo C (2000). Growth inhibitory effects of nutgrass (*Cyperus rotundus*) on rice (*Oryza sativa*) seedlings. J. Chem. Ecol., 26: 2221-2231.

Samreen U, Hussain F, Sher Z (2009). Allelopathic potential of *Calotropis procera* (Ait.) Ait. Pak. J. Pl. Sci., 15: 7-14.

Singh SP, Pal UR, Luka K (1989). Allelopathic effect of three serious weeds of Nigerian Savana on germination and seedling vigour of soybean and maize. J. Agron. Crop Sci., 162: 236-240

Singh HP, Batish DR, Pandher JK, Kohli RK (2003a). Assessment of allelopathic properties of *Parthenium hysterophorus* residues. Agric. Ecosyst. Environ., 95: 537-541.

Singh HP, Batish DR, Kaur S, Kohli RK (2003b). Phytotoxic interference of *Ageratum conyzoides* with wheat (*Triticum aestivum).* J. Agron. Crop Sci., 189: 341-346.

Singh HP, Batish DR, Kaur S, Kohli RK (2003c). Phytotoxic interference of *Ageratum conyzoides*: Role of residue. In Proceedings of Asian Pacific Weed Science Society Conference. Weed Science Society of Philippines. 19: 739-744.

Sisodia S, Siddiqui MB (2008). Allelopathic effect of *Lantana camara* on *Bidens pilosa.* Vegetos. 20(1): 29-32.

Sisodia S, Siddiqui MB (2009). Allelopathic potential of rhizosphere soil of *Croton bonplandianum* on growth and establishment of some crop and weed plants. Afr. J. Agric. Res., 4(5): 461-467.

Sisodia S (2008). "Allelopathic effect of *Croton bonplandianum* Baill. towards some weed and crop plants". PhD thesis, Department of Botany, Aligarh Muslim University, Aligarh pp.181-194.

Tawaha AM, Turk MA (2003). Allelopathic effects of black mustard (*Brassica nigra*) on germination and growth of wild barley (*Hordeum sponataneum*). J. Agron. Crop Sci. 189: 298-303.

Whittaker RH (1970). The biochemical ecology of higher plants IN: Chemical Ecology. (eds). Sondheimer E, Simeone JB. Academic Press, New York, Pp. 43-70

Xuan TD, Shinjichi T, Hong NH, Khann TD, Min CI (2004). Assessment of phytotoxic action of *Ageratum conyzoides* L. (Bill goat weed) on weeds. Crop Prot.1:1-8.

ZhiHua L, YiXin S (2005). Studies on allelopathic effects of aqueous extracts of roots of different Lucerne varieties. Grass. China. 27(4): 39-46.