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Allelopathic potential of *Eclipta alba* (L.) Hassk. against crops (*Phaseolus aureus* Roxb. and *Oryza sativa* L.) and weeds (*Cassia tora* L. and *Cassia sophera* L.) plants

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Abstract

A petridish assay was carried out to study the allelopathic effect of aqueous extract of different parts of *E. alba* on seedling growth and dry biomass of crop (*Phaseolus aureus* and *Oryza sativa*) and weed (*Cassia tora* and *Cassia sophera*) plants. Aqueous extract of leaf, root and stem were prepared by soaking dried plant parts of *E. alba* in water (1:2 w/v) for a period of 24h. The aqueous extract from root, stem and leaf had no effect on seed germination of test plants. When compared to control, aqueous extract from leaf, stem and root significantly reduced growth and dry biomass of test plants. Weeds were more sensitive to extracts than crops. The negative effect of leaf extract on seedling growth and dry biomass were more pronounced followed by root and stem extract and overall effects of extracts were positively correlated with extract concentration (0.5%,1%,2% and 4%). The study therefore indicated the release of growth inhibitors (allelochemicals) which exhibited the allelopathic stress against seedling growth and dry biomass of test species.

Allelopathy refers to the production and exudation of compounds, including secondary metabolites, harmful to other species or their functions and influencing the growth and development of Agricultural and Biological systems[7,22]. These allelo-pathic effects are due to inhibitory substances (allelochem-icals) that are released directly from living plants into the environment through root exudation, leaching, volatilization, and passively liberated through the decomposition of plant residues[22]. Allelochemicals released and leached from the aerial and decomposed parts of donor plants finally enter into the soil. In many situations, the chemicals may reach other plants (receivers) through transport from the donor plants in the soil and may induce the inhibitory or stimulatory activity on the receiver plants. All plant parts including leaves, stems, pollen, flowers, roots, buds, rhizomes, seeds and fruits have been shown to contain allelochemicals, but leaves and roots are the most important source[2,23].

Eclipta alba (L.) Hassk. Is a small branched annual herbaceous plant belonging

to the family Asteraceae commomly known as bhringraj. It is native of Asia but has a general distribution in areas of Gangetic plans, in pasture lands, road sides, in marshes, rivers, lakes and on the foot hills of Himalayas[11,17]. *Eclipta alba* contains wide range of active principles which include coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, triterpenoids. The leaves contain stigmasterol, a-terthienylmethanol, wedelolactone, desmethylwedelolactone, and desmethywedelolactone-7-glucosides. Pharmocological activities shown in (table 1). Besides the above mentioned medicinal importance, *Eclipta alba* also shows the allelopathic behaviour. Its allelopathic effect has been demonstrated by several workers[6,19].

Mature leaves, stem, roots were collected separately from the *Eclipta alba* infested fields. The collected parts were dried, powdered and stored in polyethylene bags till further used. For each part, aqueous extracts of different concentrations (0.5%, 1%, 2% and 4%) were prepared and for this purpose, 10 seeds of each test plant were placed in a 15 cm Petri dish lined with a Whatman no. 1 filter paper, moistened with aqueous extract of respective concentration of each part or water (to serve as control). After 15 days, root length and shoot length and oven dry weight of the seedlings were measured.

Statistical analysis :

The data were subjected to ANOVA followed by Duncan's Multiple Range Test (DMRT) as per Duncan[5] and 2 sample t-test, wherever applicable.

Determination of pH :

The pH of each extract prepared from different parts of *E. alba* was determined by immersing the electrode of a digital ph meter (EcoScan). The determination was a mean of three replicates. (Table-2)

Effect of aqueous extract on root length of test plant :

As campared to control, the aqueous extract of exhibited significant reduction on the root length of test plants .Among the different parts, leaves were the most allelopathic followed by root and stem. In aqueous extract of leaf, (34.36%) reduction was observed in *P. aureus* and (94%) in *C. tora* at 4% concentration. When the set-up was subjected to the aqueous extract of stem, reduction in root length was increased with increasing concentration and it was maximum in *C. sophera* (88.18%) and minimum (30.73%) in *O. sativa* at 4%. Similarly in response to root extract, maximum reduction in root length was seen in *C. sophera* which reduced nearly (91.27%) followed by *C.tora* (85.65%) at 4% concentration (Fig 1.1).

Effect of aqueous extract on shoot length of test plant :

In leaf extract, the maximum effect was observed in *C. tora* (85.81%) at 4% concentration. Similarly, very strong effect was seen at highest concentration (4%) and among all the test plants, about 41.92% to 80.93% reduction was observed in stem extract. When treated with root extract, maximum reduction in shoot length was seen in *C. tora* (82.4%) and minimum in *P. aureus* (43.85%) at 4%

concentration (Fig 1.2).

Effect of aqueous extract on dry biomass:

The content of dry biomass decreased with increasing concentration in all test plants. In leaf extract, the reduction of percentage was 60.75% in *P. aureus*, 51.46% in *O.sativa*, 89.93% in C. *sophera* and 87.15% in *C. tora* at 4% concentration respectively. In contrast to the control grown plants, those grown in aqueous extract of stem, the reduction was observed in all test plants about 57.13% to 85.57% at 4% concentration. In root extract, maximum effect on dry biomass was observed in *C. sophera* (1.05±0.005mg) and minimum

Table-1: Pharmacological activities of chemical constituents

S.No	Chemical constituents	Pharmacological activities	References
1	Wedelolactone	Antihepatotoxic, Antibacterial, Trypsin Inhibitor, Antivenom	Vianna-da-silva (2003), Uddin *et al*., (2010), Karthikumar *et al*., (2007)
2	Eclalbosaponins	Hair revitalizing, Antiproliferative, Antigiardial	Sawangjaroen *et al*., (2005), Gupta *et al*., (2005)
3	Desmethylwedelo-lactone	Antihepatotoxic, Antihaemorrhage, Antivenom, Dye (cosmetic)	Mukherjee and podder (1976), Vianna-da-silva (2003), Meena *et al*. (2010)
5	Eclalbatin	Antioxidant	Tewtrakul *et al*., (2007)
6	Ecliptalbine, verazine	Lipid lowering, Analgesic	Maged *et al*., (1998)

Table-2: Values of pH in different concentration of extracts of leaves, stem, roots of *E.alba*

Extract concentration	Leaves	Stem	Root
0.5	7.68	6.57	7.29
1.0	7.60	6.49	7.24
2.0	7.63	6.46	7.21
4.0	7.59	6.39	7.19

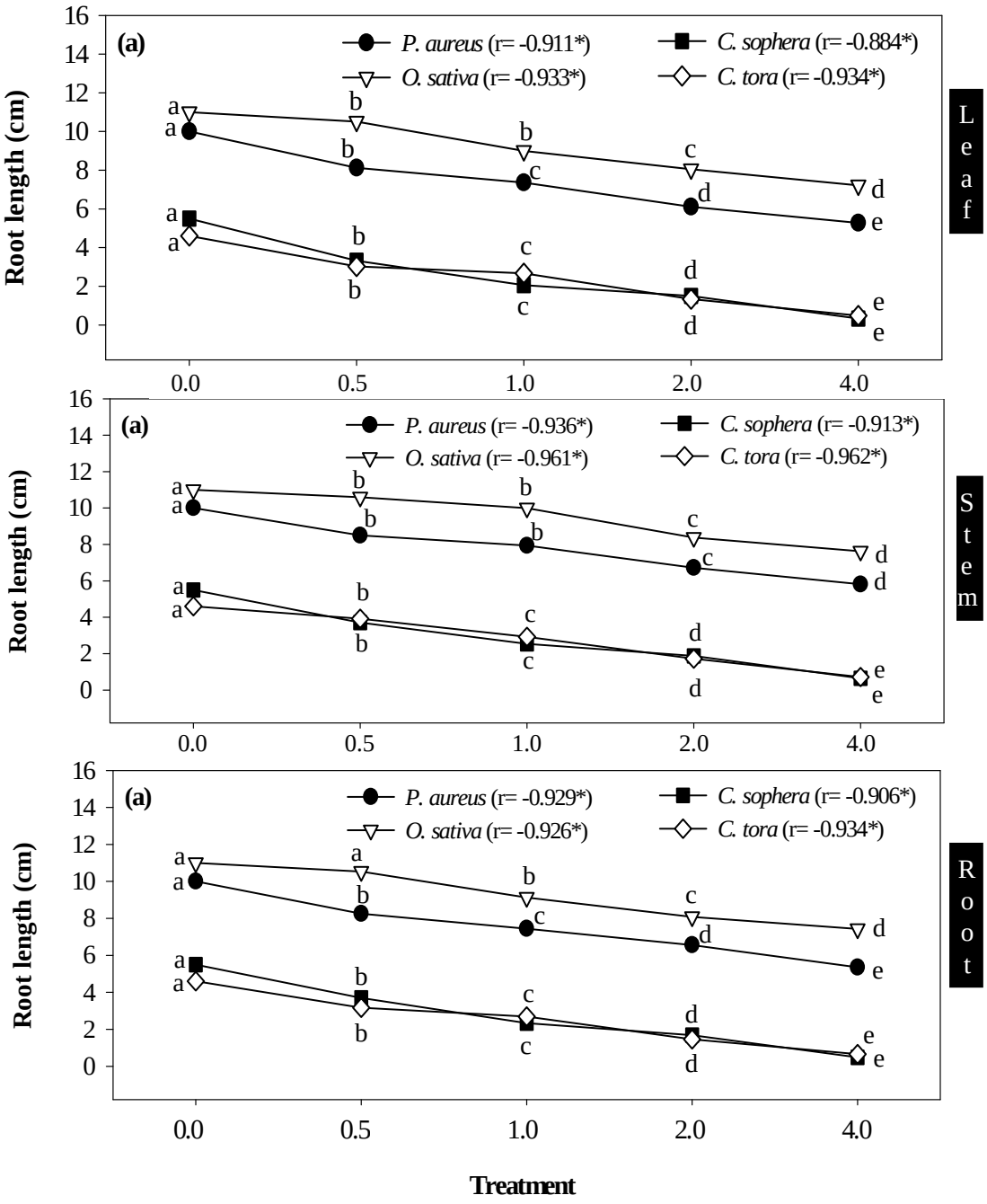

Fig. 1.1: Effect of different concentration of aqueous extract of Leaf, stem and root on root length of test plant

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 and P<0.01 respectively.

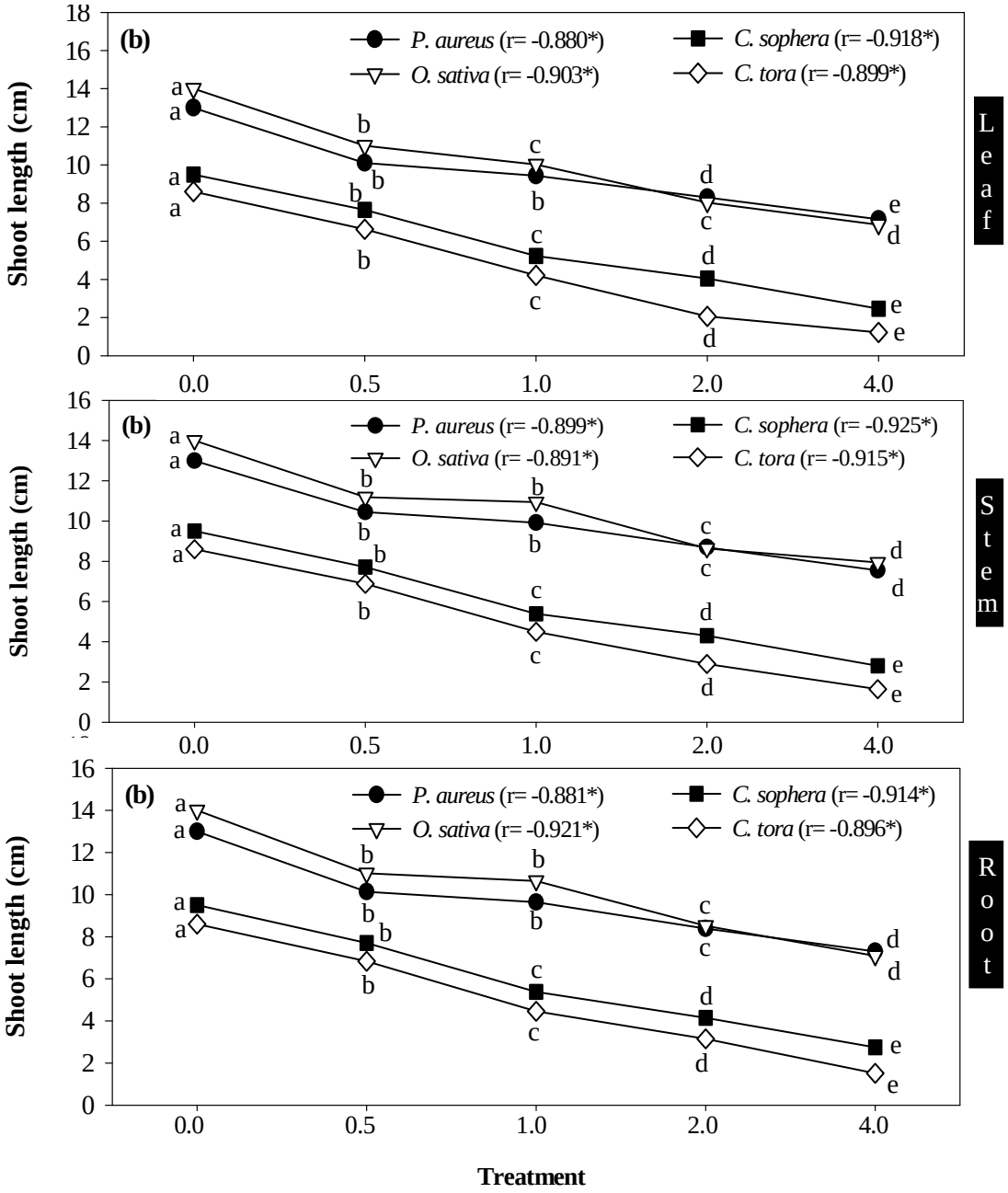

Fig. 1.2: Effect of different concentration of aqueous extract of Leaf , stem and root on shoot length of test plant. Different superscript symbols along a curve represent significant difference among themselves at P<0.05 applying DMRT

r represent correlation coefficient *represent significants significance of correlation at P<0.05 and P<0.01 respectively.

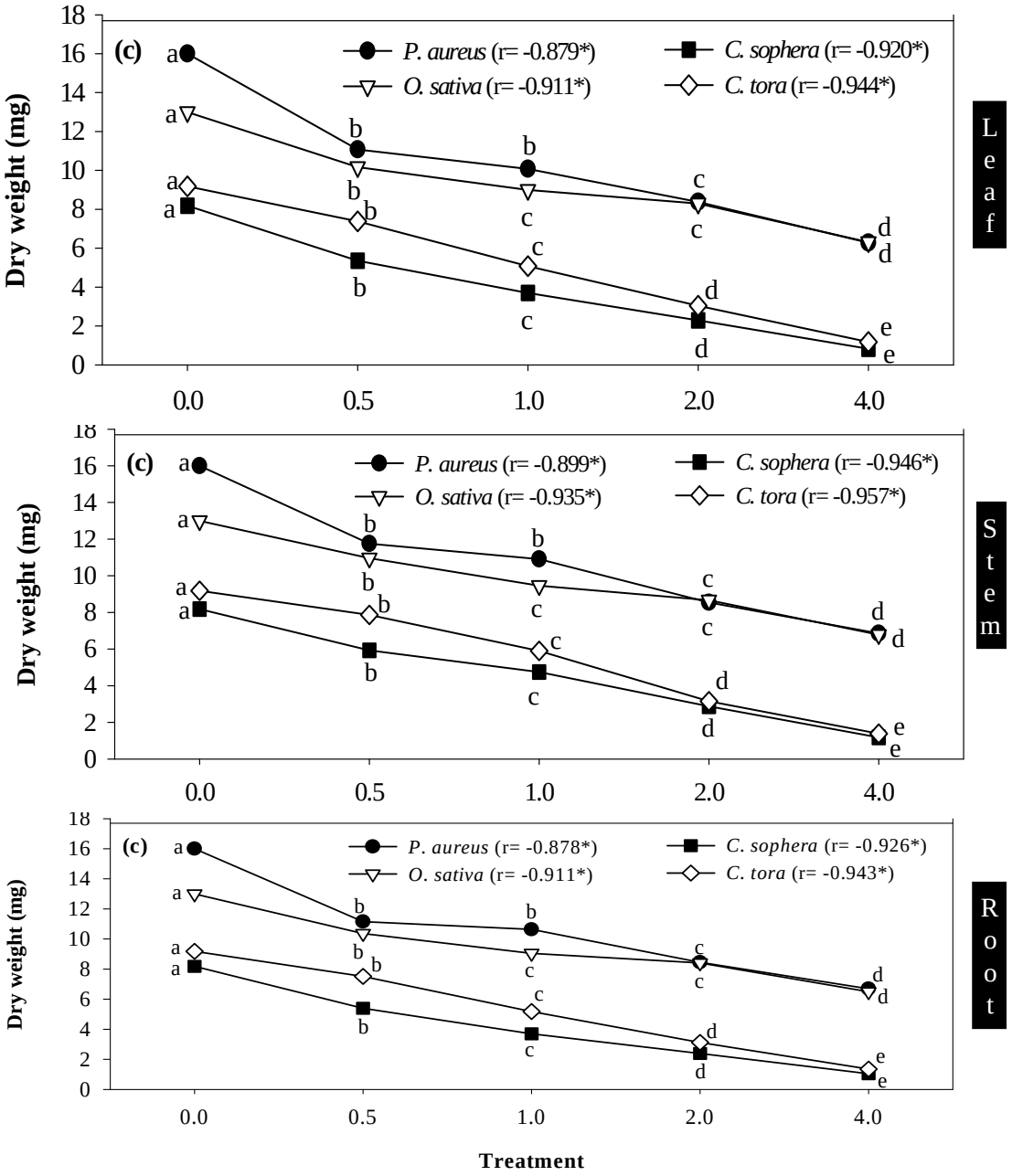

Fig. 1.3: Effect of different concentration of aqueous extract of Leaf , stem and root on dry biomass of test plant. Different superscript symbols along a curve represent significant difference among themselves at P<0.05 applying DMRT

r represent correlation coefficient *represent significants significance of correlation at P<0.05 and P<0.01 respectively

in *P.aureus* (6.69±0.33mg) at higher concentration (4%) (Fig 1.3).

It is clear from the study that different parts of *E. alba* exhibited phytotoxic potential through their aqueous extracts, though the magnitude of phytotoxicity varied with plant part (leaves, stem and root). The study, therefore, indicated that some growth inhibitors (allelochemicals) which exhibited the allelopathic stress against seedling growth and dry biomass of test species, *C. tora, C. sophera, O. sativa* and *P. aureus.* Some recent studies indicating the phytotoxic or allelopathic effect of aqueous extract of weeds include *Mikania micrantha, Hyptis suaveolens, Lantana camara*[24-26], *Croton bonplandianum*[30,31], *Cyperus rotundus*[21], Chinese fir leaves[8], *Andrographis paniculata*[1], *Chenopodium murale*[4], *Ageratum conyzoides, Ambrosia trifida* and *Lantana camara*[14], *Lantana camara*[10] and *Oryza sativa*[20]. All these studies indicated that the release of phytotoxic chemicals during the preparation of aqueous extracts which suppressed the seedling growth and dry biomass of test species. The results also showed that increasing concentration of extract generally enhanced inhibition as the same was reported by Some workers[3,13,28,29]. In the present study, pH of extracts ranged from 6.39 to 7.68. Therefore, on the basis of this observation following conclusions can be made:

- Different parts of *E. alba* exhibit differential phytotoxicity and the degree of phytotoxicity with respect to plant was in the order:
  Leaves > Roots > Stem
- Leaves being more in biomass per plant contributed relatively more towards phytotoxicity compared to other parts of the plant.
- Phytotoxicity of aqueous extract was concentration dependent.
- The more pronounced negative effect on seedling growth and dry biomass was on weeds than on crops.

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References :

1. Alagesaboopathi, C. (2011) *Asian J. Exp. Biol. Sci., 2*(1): 147-154.
2. Alam, S.M., S.A. Ala, A.R. Azmi, M.A. Khan and R. Ansari (2001) *J. Biological Sci., 1:* 308-315.N J. EXP
3. Ashrafi, Z.Y., S. Sadeghi, H.R. Mashhadi, and M.A. Hassan (2008) *J. Agric. Technol., 4:* 219–229.
4. Batish, D. R., K. Lavanya, H.P. Singh, and R.K. Kohli (2007) *Plant-Growth-Regul., 5*1(2): 119-128.
5. Duncan, D.B. (1955) *Biometrics, 11:* 1-42.
6. Dyonli, Traore, H., Sereme and P. Sankara (2010) *Asian Journal of Crop Sciences, 2*(3): 147-154.
7. Elmore, R. and L. Abendroth (2007) *Dept. Agr. Int. Crop Mng.*
8. Guo Chang, D., C. Guan Qiu, L. SuZu, W. Ai Ping, and H. Ming Hui (2007) *J. Fuj. Agri. Fores. Uni. Nat. Sci. Edi., 36*(2): 134-137.
9. Gupta M., U.K. Mazumdera, P.K. Haldar, C.C. Kandar, L. Manikanda and G.P. Senthil (2005) Anticancer Activity of *Indigofera aspalathoides* and *Wedelia calendulaceae* in Swiss Albino Mice.

Iranian journal of pharmaceutical research, *6*(2): 141-45.

10. Hossain, M.K. and N.M.D. Alam (2010) *Pak istan Journal of Weed Science Research, 16,* (2): 217-226.
11. Jadhav, V.M., R.M. Thorat, V. J. Kadam, and K.P. Salaskar (2009) *Journal of Pharmacy Research, 2*(8): 1129-12.
12. Karthikumar, S., K. Vigneswari, and K. Jegatheesan (2007) *Scientific Research and Essay, 2* (4): 101-104.
13. Kayode, J. and J.M. Ayeni (2009) *Ethanobotanical leaflets., 13:* 343-50.
14. Kong, C. H. (2010) *Weed Biology and Management., 10:* 73–80.
15. Maged, S.A.K., D. Brian, B. Bahler, S. Malone, C.M.W. Marga, F.V. Troon, J.H. David, W.I. Bursuker, O.K.M. Neddermann, O.W.M. Stephen and G.I.K. David (1998) *J. Nat. Prod., 61*(10): 1202-08.
16. Meena, A.K., M.M. Rao, K. Kaur and P. Panda (2010) *Int J. Ph. Sci. and Res., 1*(3): 207-10.
17. Mithun, N.M. and S. Shashidhara (2010) *Pharmacologyonline 1:* 345-357.
18. Mukherjee D. R. and H. Poddar (1976) *The antiseptic, 10:* 541.
19. Pawinde, E.Z., P. Sereme, V. Leth and P. Sankara (2008) *Asian Journal of Plant Pathology, 2* (1): 40-47.
20. Punjani, B.L., K.M. Patel and U.A. Patel (2006) *Allelopathy J., 18*(2): 339-344.
21. Quayyum, H.A., A.U. Mallik, D.M. Leach and C. Gottardo (2000) *J. Chem. Ecol., 26:* 2221-2231.
22. Rice, E.L. (1984) Allelopathy 2nd edition. Orlando, Florida: Academic Press Inc., pp. 422.
23. Rizvi, S.J.H. and V. Rizvi (1992) Allelopathy: Basic and Applied Aspects., Chapman and Hall, London.
24. Sawangjaroen, N., S. Subhadhirasakul, S. Phongpaichit, C. Siripanth, K. Jamjaroen and K. Sawangjaroen (2005) *Parasitol Res., 95*(1): 17-21.
25. Sisodia, S. and M.B. Siddiqui (2007a) *Vegetos, 20*(1): 29-32.
26. Sisodia, S. and M.B. Siddiqui (2007b) *Ind. J. App. P. Biol., 22*(2): 399-402.
27. Sisodia, S. and M.B. Siddiqui. (2007c). *Ind. J. App. P. Biol. 22*(2).
28. Sisodia, S., and M.B. Siddiqui (2008) *VEGETOS, 20*(1): 29-32.
29. Sisodia, S. and M.B. Siddiqui (2009) *Afr. J. Agric. Res., 4*(5): 461-467.
30. Sisodia, S. and M.B. Siddiqui (2010) *Journal of Agricultural Extension and Rural Development., 2*(1): 022-028.
31. Sisodia, S., M.B. Siddiqui, and G.P. Singh (2010) *Research Journal of Agricultural Sciences, 1*(3): 215-218.
32. Tewtrakul, S., S. Subhadhirasakul, S. Cheenpracha and C. Karalai (2007) *Phytother Res., 21*(11): 1092-95.
33. Uddin, N., A. Rahman, N.A. Uddin, S. Rana, R. Akter and A.M. Chowdhury, (2010) *Int. J. Biol. Med. Res., 1*(4): 341-46.
34. Vianna-da-silva, N.M., M. Ram, A.J.M. Da silva, P.R.R. Costa, and P.A. Melo (2003) *J. Venom. Anim.Toxins Incl. Trop. Dis., 9*(2): 381.
35. Wagner, H., B. Geyer, Y. Kiso, H. Hikino, and G.S. Rao (1986) *Planta Med., 5:* 370-74.