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Allelopathic influence of *Vitex negundo* L. on germination and growth of Greengram (*Vigna radiata* (L.) R. Wilczek) and Blackgram(*Vigna mungo* (L.) Hepper).

D.Kavitha[*1], J.Prabhakaran ,K.Arumugam

Correspondence Author: D.Kavitha Department of Botany, Botany Wing-DDE, Annamalai University– 608 002,
Tamil Nadu.INDIA.
Email: mvragav444@yahoo.com

Allelopathy refers to the beneficial or harmful effects of one plant on another plant by the release of chemicals from plant parts by leaching, root exudation, volatilization, residue decomposition and other processes in both natural and agricultural systems. The present study has been made to evaluate the allelopathic influence of Vitex negundo L. against germination, growth and biochemical constituents changes of two pulses namely, green gram (Vigna radiata (L.) R.Wilczek) and blackgram (Vigna mungo (L.). Hepper). Various concentrations of (2.5, 5, 10, 15, 20 25%) aqueous leaf extracts were prepared from matured leaves of V. negundo and germination studies were conducted. The lower concentrations (2.5 and 5%) of leaf extracts stimulated the seed germination, growth and biochemical constituents (Chl., amin oacid, protein and total sugar) of black gram and green gram. In higher concentrations an inhibitory effect was observed in all the parameters studied in two pulses and the inhibitory effects were more prominent in green gram than black gram seedlings.

Key words: Allelopathic potential, *Vitex negundo*, aqueous extracts, Blackgram, Greengram.

INTRODUCTION

Allelopathy plays a significant role in agro-ecosystems, and affects the growth, quality and quantity of the products by the interactions among crops, weeds and trees. Generally, these interactions are deleterious to the receiver plants but may also provide a selective advantage to the donor (Rice,1984). Allelopchemicals released from plant parts are largely classified as secondary plant metabolites (such as alkaloids, isoprenoids, phenolics, flavonoids, terpanoids and gluconolates etc.). These chemicals are present virtually in all plant tissues, including leaves, flowers, fruits, stems, roots, rhizomes, seeds and pollen. Among the plant parts, leaves seem to be the most consistent producers of these allelochemicals. Several chemicals can be released together and may exert toxicities in an additive or synergistic manner (Putnam and Tang.,1986,). Many investigators reported that large number of metabolites occur in different parts of plant and may have stimulatory or inhibitory effects on seed germination and seedling growth of other plants. (Chou & Yao 1983; Gupta *et al.*,1992; Jayakumar and Manikandan,2005; Jeyasrinivas *et al.*, 2006). Allelopathic phenomenon has received much attention as shown by the numerous reports on the subject (Narwal *et al.*, 1998;Harper *et al.*, 2005;Reigosa *et al.*, 2006; Batlang and Shusha, 2007; Terzi, 2008; Abdul Latif Khan *et al.*, 2009. Aisha *et al.*,2010 and Komal,2011). Hence, an attempt has been made to determine the allelopathic influence of leaf extracts of *Vitex negundo* L. an aromatic shrub belonging to verbenaceae being used for green manure, medicine in ayurvedic,unani systems of medicine and as mosquito repellent in the rural areas of Tamil Nadu tested against the seed germination and seedling growth of green gram (*Vigna radiata*(L.) R.Wilczek) and blackgram (*Vigna mungo* (L.). Hepper)

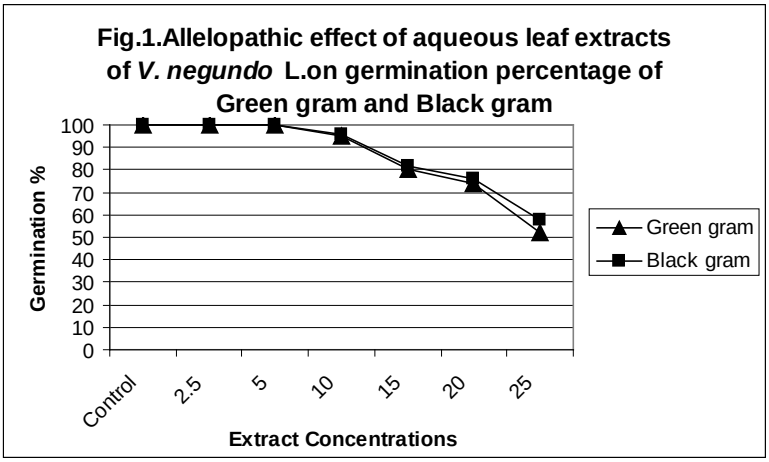
MATERIALS AND METHODS

Certified seeds of blackgram (Var.T9) and greengram (Var.CO-4) were procured from TNAU, Coimbatore, Tamil Nadu. The preparation of aqueous leaf extracts and germination studies were followed by the methods of Padhy *et a.,l* (2000) and Bhatt and Chouhan,(2000). The matured leaves of *V.negundo* were collected and dried under shade for twenty five days then ground into fine powder and stored in sealed plastic containers at room temperature until required.

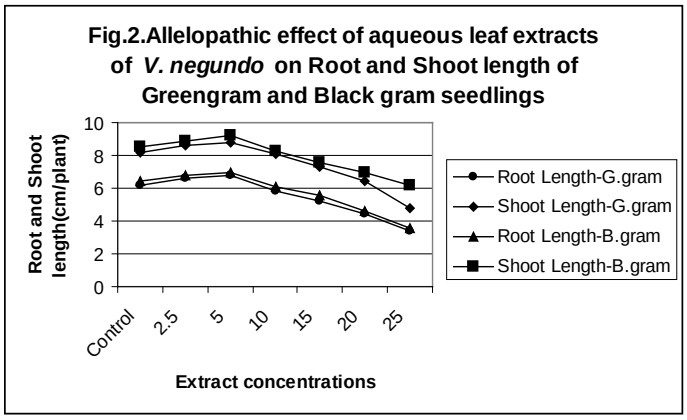
The aqueous extract was prepared by soaking 100g leaf powder in 1L. of distilled water and allowed for 48hours with occasional shaking. Then the extract was filtered through Whatman No.1 filter paper and was kept at 4°C for use in seed germination experiments, from this various concentrations of extracts (2.5,5,10,15,20and 25%) in distilled water were prepared and tested in seed germination experiments
The seeds of green gram and black gram were surface sterilized with 0.2g HgCl, solution for 2 min. and then washed thoroughly with distilled water. For the germination study, 20 seeds were placed in sterilized Petridishes (12mm) lined with two layers of filter paper followed by an underlying layer of sterilized cotton. On the first day 10 ml of aqueous leaf extracts was added in each treatment (2.5,5, 10, 15, 20,and 25%) on the Petridishes. Distilled water served as control. Afterwards the seeds were allowed to germinate at the maintained room temperature (30±2°C). Thereafter to keep the filter paper moist with aqueous leaf extracts /distilled water were added to Petri dish on 2,4,6 and 8 day after seed soaking. The emergence of radicle was taken as criterion for the germination of seeds. The seedling length, fresh and dry weight and chlorophyll (Arnon.1949), aminoacid (Moore and Stein,1948) protein (Lowry *et al.*,1951) sugar (Nelson, 1944) contents were estimated on 9th day old seedlings of green gram and black gram. All measurements were made on samples drawn replicated five times. The obtained data were statistically (ANOVA) analyzed to find out the significance **(**P < 0.5% Level) of the treatments.

RESULTS AND DISCUSSION

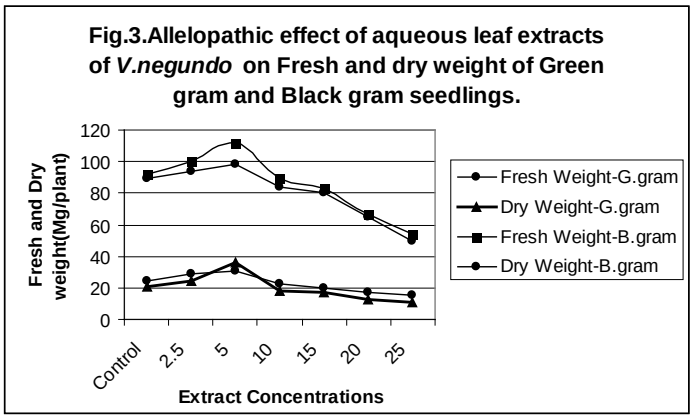
The results of the germination percentage, seedling growth and fresh and dry weight of green gram and blackgram seeds under aqueous leaf extracts treatments of *V.negundo* are given in Table-1&Fig.1. The leaf extracts of *V. negundo* caused significant changes in the germination percentage. As compared to the control, the aqueous leaf extracts of *V.negundo* at 2.5 and 5% concentration levels exhibited promotory effect on seed germination and seedling growth in both green gram and black gram. The inhibitory effect was concentration dependent. The inhibitory effect was found to increase with increasing concentrations of aqueous leaf extracts. Similar inhibitory effects caused by leaf aqueous extracts of *Vitex negundo* on *Brassica chinensis*, *Lactuca sativa*, *Degitaria deacumbe*ns and *Mimosa pudica* ,which were reported by Chou & Yao (1983).
The present results coincide with the findings of Jadhav,(2003).He reported that the higher concentrations of leaf extracts of *Terminalia tomentasa*, *Sapindus emarginatus* and *Vitex negundo* inhibited the growth of field crops. But at lower concentrations radicle growth of crop has been promoted. Phytotoxic effects may be caused by more than one chemical component present in the leaves and the crop species react differently to these compounds. Inhibition might have been presence of allelochemicals in the plant extracts (Chaturvedi and Jha,1992). Swaminathan *et al.,* (1989) reported that the potential compounds which are able to induce inhibitory effect on seed germination are identified as phenolic acids. The reason for an inhibitory and stimulatory effect on germination percentage due to the presence of different levels of following allelochemicals in the leaf extracts of *V. negundo,* namely p-hydroxy benzoic acid, p-coumaric acid, ferulic acid, vanilic acid, syringic acid and more than 10 flavonoids, which were reported by Chou and Yao (1983) and Kuo *et al*., (1998).



The different degree of stimulatory and retarding effect on germination percentage depend upon the concentrations of the treatments. Germination percentage was markedly inhibited more in green gram as compared to black gram seedlings.



The results of root and shoot length, fresh and dry weight of green gram and black gram seedlings (Table-1&Fig.2,3) revealed that the promotory effect was observed at 2.5 and 5% concentrations of aqueous leaf extracts and an inhibitory effect was obtained at 10, 15, 20 and 25% concentrations of the treatments. The maximum reduction of shoot and root length and biomass production of black gram and green gram seedlings was observed at 25% concentration of extracts. Similar results were reported by Kil and Yun (1992);Gill et al.,(1993);Ismail and Kumar (1996); and Bajwa et al., (1998). Jayakumar et al., (1998); Bhatt and Chauhan (2000) ;Aisha,et al.,(2010) and Monica et al.,(2011) recorded that aqueous extracts of Asarum europaeum L. inhibited the germination and growth of Lycopersicon esculentum and Maryam et al.,(2011) noticed that Papaver pavoninum showed an antagonistic effects on the germination and growth of maize and brassica crops.



The reduced germination and seedling growth inhibition have been attributed by presence of water soluble inhibitors. The extent of inhibitory and stimulatory effect of extracts varied with the plant species (Hussain and Abidi,1991).The biochemical constituents, Chlorophyll-a, Chloropghyll-b, total chlorophyll, aminoacid, protein and total sugar contents of both black gram and green gram seedlings (Table-2) were increased at 2.5 and 5% concentrations, thereafter all the biochemical contents were gradually declined at higher concentrations of extract. The differential effects were observed statistically in all the parameters tested in this study. The reason for the reduction of biochemical constituents in the seedlings might be the basic process such as respiration, chlorophyll production, hormonal balance, protein synthesis permeability and plant water relation may be altered in the crop by allelopathic compounds present in the extracts.(Rice,1984). Padhy et al.,(2000) noticed that the leachates of Eucalyptus globulus reduce the protein content in both the root and shoot of finger millet. Tripathi et al. (1998) studied the allelopathic activity of Tectona grandis, Albizia procera and Acacia nilotica on germination and growth of soybean, in which, the leaf extracts of all the three species at lower concentrations there was stimulatory effect on germination, growth, chlorophyll, protein, carbohydrates and proline contents of soybean,but in higher concentrations, there was a decreasing trend of all the parameters in the soybean. Allelochemicals that inhibit the growth of

some species at certain concentration might simulate the growth of the same and different species at different concentrations (Narwal,1994). Allelopathic inhibition is complex and can involve the interaction of different classes of chemicals like phenolic compounds, flavonoids, terpenoids, alkaloids, steroids, carbohydrates, and amino acids, with mixtures of different compounds sometimes having a greater allelopathic effect than individual compounds alone(James and Bala,2003).These studies are in conformity with the present findings.

The differential degree of inhibitory and stimulatory effects on germination and growth of seedlings may be due to the presence of allelochemicals at different level in the leaf extracts of V.negundo. It can be concluded that the higher concentrations leaf extracts inhibit the plant growth, hence, further experiments needed to isolate and identify the individual inhibitory substance present in leaves and other parts of V.negundo for using a potential natural herbicide for alternative weed management strategy.

***Table-1.Effect of aqueous leaf extract of V.negundo on germination and seedling growth of Green gram and Black gram*((P < 0.5% Level).**

Extract Conc. (%)	C	2.5	5	10	15	20	25
Germination Percentage							
Gg.	100	100	100	95	80	74	52
Bg.	100	100	100	96	82	76	58
Source of variation Between Concentrations (Conc. X Conc.); SS;3691.0, MS :615.3, Between Pulses (Gg X Bg): SS;25.0, MS:3.57, *F*- 172.0							
Root length (cm/plant)							
Gg.	6.2	6.6	6.8	5.8	5.2	4.4	3.4
Bg.	6.4	6.8	7.0	6.1	5.6	4.6	3.6
Source of variation Between Concentrations (Conc. X Conc.); SS:18.34, MS :3.05 Between Pulses (GgXBg) : SS : 0.225 ,MS:0.032, *F*- 95.12							
Shoot length(cm/plant)							
Gg.	8.2	8.6	8.8	8.1	7.3	6.4	4.8
Bg.	8.5	8.9	9.2	8.3	7.6	7.0	6.2
Source of variation Between Concentrations (Conc. X Conc.); SS:18.73.0, MS :3.12 Between Pulses (Gg X Bg) : SS; 1.39, MS:0.199, *F*- 15.66							
Fresh Wt.(mg/plant)							
Gg.	89	94	98	84	80	65	50
Bg.	92	100	112	89	83	67	54
Source of variation Between Concentrations (Conc. X Conc.); SS;3999.7, MS :666.6.3, Between Pulses (GgXBg): SS;147.50, MS:721.0, *F*- 31.64							
Dry wt.(mg/plant)							
Gg.	21	24	26	23	17	13	11
Bg.	24	29	31	20	20	17	15
Source of variation Between Concentrations (Conc. X Conc.); SS:388.71, MS :64.78, Between Pulses (GgXBg): SS; 62.5, MS:8.928, *F*- 7.256							

Gg-Green gram; Bg-Black gram,

***Table-2.*Effect of aqueous leaf extract of V. negundo on some biochemical constituent changes of Green gram and Black gram (P < 0.5% Level).**

Extract Conc. (%)	C	2.5	5	10	15	20	25
Chl.a							
Gg.	**0.69**	**0.71**	**0.74**	**0.64**	**0.58**	**0.52**	**0.48**
Bg.	**0.75**	**0.77**	**0.80**	**0.69**	**0.69**	**0.58**	**0.54**
Source of variation							
Between Concentrations (Conc. X Conc.); SS: 0.114, MS :0.019							
Between Pulses (Gg X Bg) ; SS: 0.130, MS:0.0023, *F*- 8.191							
Chl.b.(mg/g.f.wt.)							
Gg.	**0.32**	**0.34**	**0.35**	**0.26**	**0.24**	**0.21**	**0.19**
Bg.	**0.32**	**0.36**	**0.39**	**0.28**	**0.25**	**0.24**	**0.22**
Source of variation							
Between Concentrations (Conc. X Conc.); SS:0.048, MS :0.0082							
Between Pulses (Gg X Bg): SS; 0.0022, MS:0.0003, *F*- 26.57							
Total Chl.(mg/g.f.wt.).							
Gg.	**1.01**	**1.05**	**1.09**	**0.90**	**0.82**	**0.75**	**0.67**
Bg.	**1.07**	**1.13**	**1.19**	**0.97**	**0.89**	**0.82**	**0.76**
Source of variation							
Between Concentrations (Conc. X Conc.); SS-0.309, MS :0.021							
Between Pulses (Gg X Bg): SS; 0.021, MS:0.003, *F*- 16.82							
Aminoacid (mg/g.f.wt.)							
Gg.	**2.68**	**2.81**	**2.95**	**2.35**	**1.95**	**1.65**	**1.25**
Bg.	**3.11**	**3.32**	**3.65**	**2.45**	**2.12**	**1.85**	**1.72**
Source of variation							
Between Concentrations (Conc. X Conc.); SS-5.775, MS :96.25,							
Between Pulses (Gg X Bg): SS; 0.6174, MS:0.0882, *F*- 10.913							
Protein (mg/g.f.wt.)							
Gg.	**9.12**	**9.26**	**9.51**	**8.45**	**7.2**	**6.4**	**5.9**
Bg.	**9.72**	**9.95**	**10.12**	**8.68**	**7.85**	**5.25**	**6.8**
Source of variation							
Between Concentrations (Conc. X Conc.); SS:31.420, MS :5.237,							
Between Pulses (Gg XBg): SS; 1.908, MS:0.272, *F*- 19.211							
Total sugar (mg/g.f.wt.)							
Gg.	**18.12**	**18.58**	**19.2**	**16.8**	**14.8**	**12.2**	**11.75**
Bg.	**19.5**	**19.9**	**20.2**	**17.6**	**15.45**	**13.5**	**12.8**
Source of variation							
Between Concentrations (Conc. X Conc.); SS-113.24, MS :18.874,							
Between Pulses (Gg X Bg): SS; 4.250, MS:0.6072, *F*- 31.081							
Gg-Green gram; Bg-Black gram							

REFERENCES

1. Abdul Latif Khan, Huayun M, Hussain J, Khan H, Gilani SA, Watanabe KN, Jung, EH and In-Jung-Lee. Assessment of allelopathic potential of selected medicinal plants of Pakistan. *African J.Biotech* 2009; 8(6):1024-1029.

2. Aisha A, Uzma Hussain, Zubaida Yousaf Farah Khan and Aisha Umer. Evaluation of allelopathic action of some selected medicinal plant on lettuce seeds by using sandwich method. J.of Med. Plants Research, 2010;4(7):536-541.

3. Arnon, DI,. Copper enzymes in isolated chloroplast Polyphenol Oxidize in Beta vulgaris. J. Plant physiol., 1949;24:1-15. ()

4. Bajwa R, Javaid A and Haneef B. EM and VAM technology in Pakistan. Effect of co-inoculation of EM and VA mycorrhiza on plant growth and nutrient uptake in chickpea. Pakistan J. Phytopahol., 1998;10: 52-82.

5. Batlang U and Shusha DD. Allelopathic Activity of Sunflower (Helianthus annuus L.) on Growth and Nodulation of Bambara Groundnut (Vigna subterranean (L.) Verdc.) J. of Agronomy, 2007;6(4):541-547.

6. Bhat B P and Chauhan DS, Allelopahtic effects of Quercus Sp. on crops of Garhawal Himalaya. Allelopathy J, 2000;7(2):265-272.

7. Chatruvedi DP and Jha A N, Studies on allelopathic potential of an important agroforestry species. Forest Ecology and Management, 1992;53:91-98.

8. Chou C H and Yao C, Phytochemical adaptation coastal vegetation in Taiwan; Isolation, Identification and biological activities of compounds in Vitex negundo L. Bot, Bulletin of Acad. Sinica (TAIPEI) 1983;24: 155-168.

9. Gill,L S, Anoliefo AR and ldaoze UV, Allelopathic effects of aqueous extracts from stem and weed on the growth of cowpea. III-International workshop on Bio-control and management of Cananga odorato held in Cote and Tviove. (1993)

10. Gupta K, Khurana S, Sarmah MK and Narwall SS, Allelopathic effects of aqueous extracts of sweet potato vines on seed germination and seedling growth of winter crops. Proc. Int. symp. Allelopathy in Agroecosystem Eds. Tauro, P.and Narwall,S.S. 1992;38-40.

11. Harper JD, An M, Wu H and Kent JH, Proceedings of the 4th World Congress on Allelopathy: Establishing the Scientific Base. Charles Sturt University, Wagga, NSW, Australia. 21-26. International Allelopathy Society. (2005)

12. Hussain F and Abidi N, Allelopathy exhibited by Imperata cylindrica (L.)P. Beauv. Pakistan J. Bot. 1991;23:15-25.

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

14. Jadhav BB, Allelopathic effects of leaf leachates of different tree species. In:Abstract, II International Congress of Plant Physiology. 2003;292.

15. James J F and Bala R, Allelopathy: How Plants Suppress Other Plants,IFAS, University of Florida, U.S.A. (2003)

16. Jayakumar M and Manikandan M, Allelopahthic potential of Acacia leucopholea on groundnut and sorghum. Proc. IV. world Allelopathy congress Charles sturt University Eds.: Harper,J.D.,Anand,M.and Kent,J. H., Australia. (2005)

17. Jayakumar M, Eyini M, Manikandan M and Kill BS, Allelopathic effect of extracts from Ficus bengalensis. Korean J. Ecol., 1998;21:133-137.

18. Jayasrinivas A, Senthil C, Chinnusamy and Prabukumar G, Allelopathic influence of weed species on the establishment of field crops. Allelopathy J., 2006;17(1):123-128.

19. Kil BS and Yun KW, Allelopathic effects of water extracts of Artemisia princes var. orientalis on selected plant species. J. Chem. Ecol., 1992;18:39-51.

20. Komal AS, Allelopathic influence of aqueous extracts of Cassia occidentalis L. on Triticum aestivum L. Life sciences Leaflets., 2011;18:723 –725.

21. Kuo VI, Chiu CY and Wue CH, Comparative allelopathic dominance of tropical vegetation in the Hengchun peninsula of southern Taiwan. In: Phytochemical Ecology. Allelochemicals mycotoxins and insects phremones and Allomones Eds.:Chou, C.H. and Walter, G. R.). Monograph. No.9303313 Taipei, China, Academica Sinica. (1998)

22. Lowry OH, Rosenberg NJ, Farr AL and Randall RJ, Protein measurement with folin phenol reagent. J. Biol. Chem. 1951;193; 265- 275.

23. Maryam Ehsan, Muhammad Ibrar, Niaz Ali, S Sarah Mubarak, Laboratory experiment to test Papaver pavoninum Fisch. and C. A. Mey. allelophathic effect against test species maize and brassica. J. Bio. & Env. Sci., 2011;1(5);49-56.

24. Monica M, Anca P, Lucia M, Zorica V, Georgeta M, Allelopathic potential pf Asarum europaeum toward Lycopersicon esculentum.Analele Universitatii din Oradea - Fascicula Biologie Tom, 2011;XVIII,:1.39-44.

25. Moore S and Stein WH, Photometric method for use in the Chromatography of aminoacids.J. Biol Chem. 1948;176;367-388.

26. Narwal SS, Hoagland, RE, Dilchy RH and Reigosa MJ,.Allelopathy in Ecological Agriculture and Forestry. In: Proceedings of the III International Congress on Allelopathy in Ecological Agriculture and Forestry,18-21August, Dharwad, India. (1998)

27. Narwal SS, Allelopathy in crop production. Scientific Publisher, Jodhpur, India, (1994)

28. Nelson N, A photometric adaptation of the Somogyi's method for the determination of reducing sugar Anal. Chem., 1944;31; 426-428.

29. Padhy B, Patinaik PK and Tripathy AK, Allelopathic potential of Eucalyptus leaf litter leachates on germination and seedling growth of finger millet. Allelopathy J., 2000;7: 69-78.

30. Putnam and Tang, Allelopathy:State of Science. In; Science of Allelopathy. Putnam,A.R. and Tang.C.S.Eds.Wiley, New York,1-9. (1986)

31. Reigosa MJ, Pedrol M, Gonzales L and Narwal SS, Allelopathy in Ecological Sustainable Agriculture In: Allelopathy:A physiological process with Ecological Implications. Reigosa, M.J., Pedrol, M. and Gonzales, L.(Eds.), Springer, Netherlands, 2006;537-564.

32. Rice EL, Allelopathy, 2nd Edition. Oriando, Florida; Academic press. (1984)

33. Swaminathan,C.,Vinayrai,R.S.and Suresh,K.K., Allelopathic activities of Acacia nilotica. J.of Tropical Forest Sci., 1989;2:56-60.

34. Terzi I, Allelopathic effects of Juglone and decomposed walnut leaf juice on muskmelon and cucumber seed germination and seedling growth. African J.Biotech. 2008;7(1):1870-1874.

35. Tripathi S, Tripathi A, Kori DC and Tiwari S, Effect of tree leaves aqueous extracts on germination and seedlings growth of soybean.Allelopathy J., 1998;5(1):75-82.