ALLELOPATHIC EFFECTS OF *LANTANA CAMARA* AQUEOUS EXTRACT ON SEED GERMINATION AND SEEDLING GROWTH OF *TRIANTHEMA PORTULACASTRUM*

***S.JAWAHAR,C.KALAIYARASAN AND K.SUSEENDRAN**

DEPARTMENT OF AGRONOMY,FACULTY OF AGRICULTURE,

ANNAMALAI UNIVERSITY,

ANNAMALAI NAGAR,608002, TAMILNADU, INDIA.

jawa_au@yahoo.com

ABSTRACT:

An experiment was conducted during April 2010 at Annamalai University, India to study the allelopathic effects of *Lantana camara* aqueous extract on seed germination and seedling growth of *Trianthema portulacastrum*. The test was conducted in sterilized petridishes with a photoperiod of 9 days under room temperature (30°C ± 4). The effect of different concentrations (25, 50, 75 and 100 %) of *L. camara*aqueous extract were recorded and compared with distilled water. Results of experiment showed that different concentrations of aqueous extracts caused significant inhibitory effect on germination, root and shoot elongation ratio of receptor plant. Bioassays also indicated that the *L camara* aqueous extract at 50 % concentration had the stronger inhibitory effect on *Trianthema portulacastrum*and the effect decreased thereafter.

KEY WORD: *Allelopathic effect, Lantana camara, Trianthema portulacastrum,Germination and Growth.*

INTRODUCTION:

Horse purslane (*Trianthema portulacastrumL.*) is a much branched, prostrate andannual terrestrial weed of the Family Aizoaceae. An indigenous plant to South Africa hasbeen reported to be widely distributed in India, Srilanka, West Asia, Africa and TropicalAmerica. In India, horse purslane has been reported in the states of Uttar Pradesh, Punjab, Haryana, Rajasthan and Delhi and considered as a number one problematic terrestrial weed by virtue of its infestation in various agricultural and vegetable crops such as mustard, maize, pigeon pea, mung bean, potato, onion,cotton, soybean, pearl millet and sugarcane, especially during the rainy seasons (Aneja *et al.,*2000).

It is currently controlled mechanically and treatment with pre and post emergenceherbicides. Hand weeding and hoeing are common practices of controlling this weed inthe developing countries of the world; but this method is quite expensive and time consumingthus ineffective as new weed seeds

germinate after every hoeing and reinfest thecrop, thus using maximum soil nutrients. Moreover, hoeing is not possible during rainyseason and labor shortage due to paddy transplanting at that time further accentuates theproblem (Brar *et al*., 1995).

Although chemical herbicides are the most effective immediate solution to most weedproblems, increased and indiscriminate use of these resulted in resistant and resurgencein pests. Moreover, persistent residues of DDT and HCH highly poisonous to humanbeings have been found in vegetables, milk, butter, meat as well as in mother's milk(Schoreder and Muller-Scharer 1995). The recent upsurge in environmental awareness of the public, interest in organic food production and some problems with herbicide use, has led to a range of techniques and machines being developed for non-chemical weed control. Allelopathy could be an appropriate potential technology for this purpose.

Allelopathy is a new potential area of research dueto its implications in ecosystem. Allelopathy resultswhen living organisms produce bioactive compoundsand these compounds enter the environment andproduce direct or indirect effects on the growth anddevelopment of the same or other species (Seigler,1996).These bioactive compounds are also known asallelochemicals (Whittaker and Feeney, 1971) andare phytotoxic and suspected of causing germinationand growth inhibition. These compounds may bewater soluble that are released through leaching, root exudation as well as through decomposition ofplant residues. Different plants are reported tocontain allelochemicals, which influence seedgermination of other plants negatively or positivelyi.e. They either promote or suppress each other.

Lantana camara is a native plant in tropical and subtropical America and is now widely distributed throughout the tropics, subtropics and warm temperate regions of the world. Lantana (*Lantana camara*) and creeping lantana (*Lantana montevidensis*) are shrubs that have been grown as ornamentals and are now major weeds in coastal and sub-coastal areas and it is a major weed along roadsides, riparian zones (river banks), fence-lines, forestry, pastures and waste areas. It also infests millions of hectares of grazing and cropping land in 47 countries and is regarded as one of the world's 10 worst weeds (Ghisalberti, 2000).However, it may produce and releases several phenolic acids, flavonoids, terpenes and terpenoids. Among these secondary metabolites, some are known allelochemicals inhibiting the growth of other organisms (Sharma *et al.,*1998). Keeping this above fact, the present investigation was carried out to study the allelopathic potentialof *Lantana camara* on *Trianthema portulacastrum*.

MATERIALS AND METHOD:

Collection of *Lantana camara* plant materials

Fresh leaves with orange or pink flowers were collected from garden land of Annamalai University Experimental Farm. The plant materials were chopped into small pieces with cutter. The materials were shade dried for about 7 days. The well-dried plant samples were ground and passed through 40-mesh screen and stored in a plastic container.

Collection of *Trianthema portulacastrum* seeds

Well mature *Trianthema portulacastrum* plants were collected from maize field during first week of April 2010 at the Annamalai University Experimental Farm. The plants were dried under sunlight for 2 days. The fallen seeds were collected and stored in a container with good aeration.

Preparation of *Lantana camara*aqueous extracts (LCAE)

The ground herbage was soaked in distilled water for 24 hours at room temperature in the ratio of 1g herbage: 20 ml water (Hussain and Gadoon,1981). The aqueous extract was obtained by filtering the mixture (herbage and water) through a Whatman No .42 filter paper and diluted with distilled water to prepare different concentrations according to the treatments.

Sowing of seeds

Petri dishes were given a thorough washing with detergent using hot water as precautionary measure against pathogens and pollutants. *Trianthema portulacastrum* seeds were cleaned manually and physical purity was ensured then the seeds were soaked in cold water for 12 hours.

LCAE was diluted with distilled water to prepare solutions of different concentrations(v/v): 25, 50, 75 and 100 % and in control treatment, distilled water was used. Ten seeds of *Trianthema portulacastrum* were sown in each petri dish of a 9 cm diameter and filter paper (Whatman No.42) were used as medium of germination. Four ml of solution was applied to dishes and control treatment received 4 ml of distilled water. Both treated and control petri dishes were kept moist continuously by adding distilled water whenever needed. The disheswere kept at room temperature ($30^{o}C \pm 4$) throughout the study. Germination counts were recorded on 3,5,7 and 9^{th} day after sowing (DAS). Root and shoot length were recorded with a measuring tap on 9^{th} DAS. The experiment was laid out in complete randomized block design with five replications.

Germination and growth records

The germination and elongation ratio were calculated by the following equations as suggested by Rho and Kil (1986).

$R = G/Gr \times 100$

Where, *R* is the relative germination ratio, *G* the germination ratio of tested plant, and *G*r is the germination ratio of control.

$Rs = Ms/Mc \times 100$

Where, *R*s is the relative elongation ratio of shoot, *M*s the mean shoot length of tested plant, *M*c is the mean length of control.

$Rr = M/Mc \times 100$

Where, *R*r is the relative elongation ratio of root and *M is* the mean root length of tested plant, *M*c is the mean length of control.

Statistical analysis

The experimental data were analyzed as per the procedure outlined by Gomez and Gomez (1984).The critical difference was worked out as five percent probability level for significant results.

RESULTS AND DISCUSSION:

The overall study suggests that the *Lantana camara* aqueous extract at their different concentrations have adverse effects on the seed germination and seedling growth of *Trianthema portulacastrum* at varying degree. The inhibitoryeffect of lantana camara aqueous extract on the seed germination is given in Fig.1.*LCAE* at 50 % concentration recorded the minimum relative germination ratio of *Trianthemaportulacastrum*on 3,5,7 and 9th DAS respectively, which was 73.34,58.89,60.00 and 60.48 % decreased over control. The delay or inhibition on RGR might be due to the presence of phytotoxins in *lantana camara* aqueous extract (Jain *et al.,*1989 and Saxena,2000). Increasing levels of LCAE did not show much positive influence on RGR of *Trianthema portulacastrum* on 3, 5, 7 and 9th DAS due to higher concentration of allelochemicals found in *LCAE*, which may stimulated the germination of this weed.

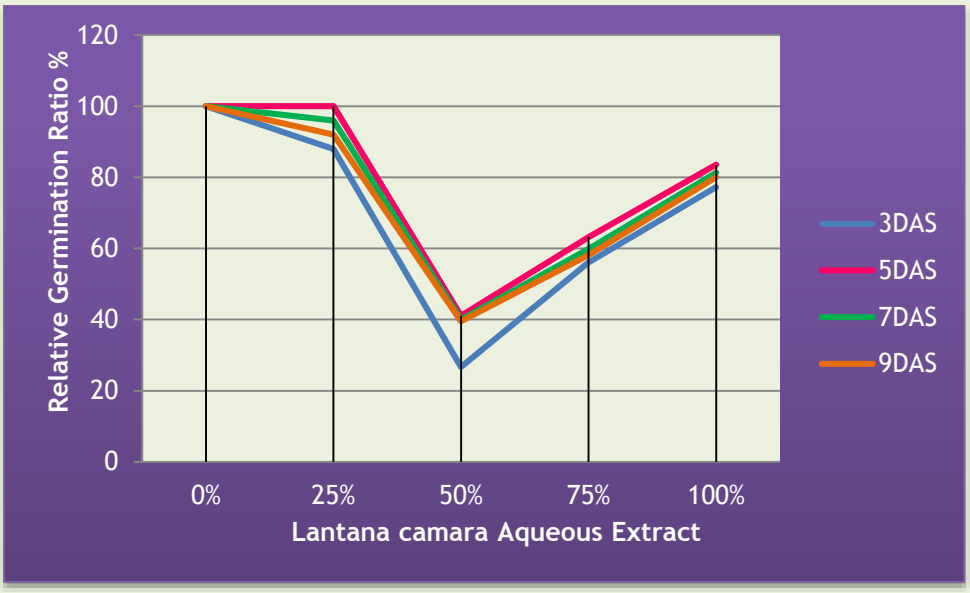

Fig.1. Effect of *L. camara*aqueous extract on RGR of *Trianthema portulacastrum*

The lesser root and shoot elongation ratio were observedat50 % concentration of *LCAE*on 9th DAS (Fig.2). The minimum values of root and shoot elongation ratio of *Trianthema portulacastrum*could due to allelopathic effects of *lantana camara.*Sharma et al. (1998) and Ghisalberti (2000) earlier reported similar results. This is lined with the findings of Kong *et al.*(2006), who reported that the allelochemicals from *lantana camara* viz., Lantadene A and Lantadene B were significantly inhibited the growth of water hyacinth.Hence, the present study shows that *lantana camara* aqueous extract contain inhibitors probably allelochemicals for germination and growth of *Trianthema portulacastrum*. Further field investigations are needed with graded levels of*Lantana camara* on weed management in food crops, either in the form of compost oras green leaf manure.

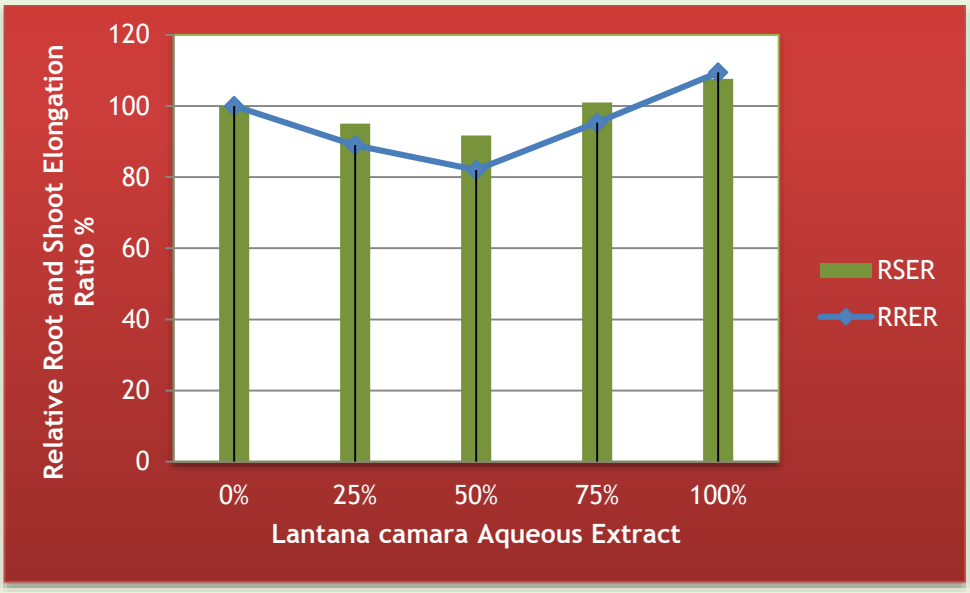

Fig.2. Effect of *L. camara*aqueous extract on RRER and RSER of*Trianthema portulacastrum*

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REFRENCES:

Aneja,K.R, S. A. Khan and S. Kaushal.2000. Management of Horse purslane (*Trianthema portulacastrum* L.) with Gibbago trianthemae Simmons in India. Proceedings of the X International Symposium on Biological Control of Weeds 4-14 July 1999, Montana State University, Bozeman, Montana, USA,Neal R. Spencer [ed.]. pp. 27-33.

Brar, A.S., R.J.S. Thind and L.S. Brar. 1995. Integrated weed control in upland cotton (*Gossypium hirsutum L.*). Indian J.Weed Sci. 27(3 and 4): 138-143.

Ghisalberti, E.L., 2000. *Lantana camara* (Verbenaceae). Fitoterapia 71,467–486.

Gomes, K.A. and A.A.Gomez.1984. Statistical procedures for agricultural research. 2 nd edn. Wiley, New York, pp 357-423

Hussain, F. and M.A. Gadoon,1981. Allelopathic effects of Sorghum vulgare Pers. Oecologia (13erl),51: 284-288.

Jain,R,M.Singh and D.J.Dezman.1989.Qualitative and quantitative characterization of phenolic compound from lantana (*L.camara*) leaves. Weed Sci 37: 302–307

Kong,C.H.,P.Wang,C.X.Zhang,M.X.Zhang and F.Hu.2006.Herbicidal potential of allelochemicals form *Lantana camara* against *Eichhornia crassipes* and the alga Microsystis aeruginosa.Weed Res.46:290-295.

Rho, B. J. and B.S.Kil.1986. Influence of phytotoxication from Pinus rigida on the selected plants. Journal of Natural Science, 5: 19-27.

Saxena,M.K.2000. Aqueous leachate of *Lantana camara* kills water hyacinth. J Chem Ecol,26: 2435–2447.

Schroeder D. and H.Müller-Schärer.1995.Biological control of weeds and its prospectives in Europe. Medical Facultade Landbouw, Universdat Gent 60, 117–123.

Seigler, D.S. 1996. Chemistry and mechanisms of allelopathic interactions. Agronomy Journal 88:876-885.

Sharma, O.P., H.Paul and S.Mallar and R. K.Dawra. 1988. A review of the noxious plant *Lantana camara*. Toxicon 26: 975-987.

Whittaker,R.H.and P.P.Feeney.1971.Allelochemicals – chemical interactions between species. Science, 171, 757-770.