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**GERMINATION AND GROWTH RESPONSES OF GREENGRAM (VIGNA RADIATA (L.) R. WILCZEK) AND BLACKGRAM (VIGNA MUNGO (L.) HEPPER) AGAINST ALLELOPATHIC POTENTIAL OF VITEX NEGUNDO L.**

**KAVITHA.D.\*<sup>1</sup>, PRABHAKARAN.J.<sup>2</sup> AND K.ARUMUGAM <sup>2</sup>**

Department of Botany<sup>1</sup>, Botany Wing-DDE,<sup>2</sup> Annamalai University , Annamalai Nagar-608 002, Tamil Nadu,INDIA.



**KAVITHA.D**

Department of Botany Annamalai University , Annamalai Nagar-608 002, Tamil Nadu,INDIA.

**ABSTRACT**

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 potential 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., amino acid, 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, aqueous extracts, Blackgram, Greengram. *Vitex negundo*

## 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<sup>1</sup>. Allelochemicals released from plant parts are largely classified as secondary plant metabolites (such as alkaloids, isoprenoids, phenolics, flavonoids, terpenoids 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<sup>2</sup>.

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.<sup>3-6</sup> Allelopathic phenomenon has received much attention as shown by the numerous reports on the subject.<sup>7-13</sup> Hence, an attempt has been made to determine the allelopathic potential 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 al*<sup>14</sup> and Bhatt & Chouhan<sup>15</sup>. The matured leaves of *V.negundo* were collected, dried under shade for twenty five days, 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%) were prepared using distilled water and tested in seed germination experiments.

The seeds of green gram and black gram were surface sterilized with 0.2g HgCl<sub>2</sub> solution for 2 min. and then washed thoroughly with distilled water. For the germination study, 20 seeds were placed in sterilized Petridish (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 Petridish. 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<sup>16</sup>, aminoacid, <sup>17</sup>protein<sup>18</sup> and sugar<sup>19</sup> 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. 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 deacumbens* and *Mimosa pudica*(Chou&Yao)<sup>3</sup>.

The present results coincide with the findings of Jadhav,<sup>20</sup> in which, the higher concentrations of leaf extracts of *Terminalia tomentosa*, *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.<sup>21</sup> Swaminathan *et al.*<sup>22</sup> 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<sup>3</sup> and Kuo *et al.*<sup>23</sup> 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) 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 number of authors.<sup>13,24-27</sup>

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.<sup>28</sup> The biochemical constituents, Chlorophyll-a, Chlorophyll-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.<sup>1</sup> Padhy *et al.*<sup>14</sup> noticed that the leachates of *Eucalyptus globulus*

reduce the protein content in both the root and shoot of finger millet. 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.<sup>29</sup> These studies are in conformity with the present findings.

**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).**

Ext. Conc. (%)	C	2.5	5	10	15	20	25
<b>Germination Percentage</b>							
Gg.	100	100	100	95	80	74	52
Bg.	100	100	100	96	82	76	58
<b>Source of variation</b>							
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							
<b>Root length (cm/plant)</b>							
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
<b>Source of variation</b>							
Between Concentrations (Conc. X Conc.); SS:18.34, MS :3.05 Between Pulses (GgXBg) : SS : 0.225 ,MS:0.032, F- 95.12							
<b>Shoot length(cm/plant)</b>							
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
<b>Source of variation</b>							
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							
<b>Fresh Wt.(mg/plant)</b>							
Gg.	89	94	98	84	80	65	50
Bg.	92	100	112	89	83	67	54
<b>Source of variation</b>							
Between Concentrations (Conc. X Conc.); SS;3999.7, MS :666.6.3, Between Pulses (GgXBg): SS;147.50, MS:721.0, F- 31.64							
<b>Dry wt.(mg/plant)</b>							
Gg.	21	24	26	23	17	13	11
Bg.	24	29	31	20	20	17	15
<b>Source of variation</b>							
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.**  
**Biochemical constituent changes of Green gram and Black gram**  
**Under the treatments leaf extract of *V.negundo* (P < 0.5% Level).**

Extract Conc. (%)	C	2.5	5	10	15	20	25
<b>Chl.a</b>							
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
<i>Source of variation</i>							
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							
<b>Chl.b.(mg/g.f.wt.)</b>							
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
<i>Source of variation</i>							
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							
<b>Total Chl.(mg/g.f.wt.)</b>							
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
<i>Source of variation</i>							
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							
<b>Aminoacid (mg/g.f.wt.)</b>							
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
<i>Source of variation</i>							
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							
<b>Protein (mg/g.f.wt.)</b>							
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
<i>Source of variation</i>							
Between Concentrations (Conc. X Conc.); SS:31.420, MS :5.237,							
Between Pulses ( Gg XBg ): SS; 1.908, MS:0.272, F- 19.211							
<b>Total sugar (mg/g.f.wt.)</b>							
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
<i>Source of variation</i>							
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*

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.

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