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ALLELOPATHIC EFFECTS OF AQUEOUS EXTRACT OF PHYLLANTHUS AMARUS (L.) SCHUM AND THOUN. ON GERMINATION AND SEEDLING GROWTH OF VIGNA MUNGO (L.) HEPPEL. VAR. CO. 653

Alagesaboopathi C

Department of Botany, Government Arts College (Autonomous), Salem - 636 007, Tamilnadu, India

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ABSTRACT

In the present study, the allelopathic potential of *Phyllanthus amarus* (L.) Schum and Thoun. on seed germination and seedling progress of *Vigna mungo* (L.) Hepper. Var.CO. 653. Leaf and stem aqueous extracts of *Phyllanthus amarus* at 5, 10, 15, 20 and 25% concentrations were applied to produce their conclude on seed germination and seedling development of trial plant under laboratory conditions. Germination and seedling development trails were performed as CRD (Completely Randomized Design) with 3 replications. The aqueous (water) extracts from leaf and stem had inhibitory cause on seed germination of *Phyllanthus amarus*. The effects noted that the extracts brought about substantial inhibition in the germination of *Vigna mungo* seeds and in the development of its shoot length and root length extracts of *Phyllanthus amarus* declined the seed germination of *Vigna mungo* with raise in the extracts concentrations. The extracts also suppressed the root length, shoot length and dry weight of *Vigna mungo* seedling with raise in the extracts concentration compared with manage treatments. Aqueous extract of leaves noted the extreme inhibition while stem notable the minimum effect on *Vigna mungo*. These determination revealed that the inhibitory produce potency be due to the presence of the allelopathic phytochemicals in the extract of *Phyllanthus amarus* from the current study. *Phyllanthus amarus* leaf extracts were highest detrimental than stem extracts. The fact obtained could be utilized in the improvement of bioherbicide for future in the field.

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INTRODUCTION

Allelopathy can be defined as positive or negative agent of one plant on other through production of allelochemicals discharged in the environment (Thi *et al.*, 2015). Allelopathy is also regarded as a bio-chemical warfare. Plant with allelopathic efficiency can struggle against weed plants growing along with agricultural crops and affecting development and crop productivity (Asaduzzaman *et al.*, 2014; Cosimrio *et al.*, 2017).

Numerous plants including medicinal plant were announced to interact chemical with other plant species (Devkota *et al.*, 2013). Many aromatic and medicinal plants which cause and accumulate vast amounts of secondary metabolites possibly have announced effect on the development and distribution of flora in their environs but very short work has been done in these areas. Mathela (1994) reported that they secondary metabolites (glycosides, steroids, flavonoids and diterpenoids) of some medicinal and aromatic plants recorded for allelopathic

action. Likewise, Alagesaboopathi (2018) studied allelopathic effect of medicinal plant *Centella asiatica*, which showed inhibition in germination and seedling development *Oryza sativa*.

Allelopathic potential of medicinal Plant is peculiar attention in recent years (Han *et al.*, 2008). Fujii *et al.* (2003) evaluated the allelopathic potentialities of 239 medicinal species using the "Plant Box Method" and 223 species of them were found to decrease tested plant progress, whereas 17 species were enhancing lettuce root growth. Gilani *et al.* (2010) also surveyed allelopathic effects of 81 Japanese medicinal plants to find out reasonable candidates as real herbicides. Some plants may decrease germination, emergence and subsequent growth of other plants by exuding toxic substances. These substances are called allelochemicals or allelopathic chemicals and the manner is called allelopathy (Rice, 1984).

Allelopathic chemicals may be classified vastly among organs such as roots, leaves, stems, flowers, fruits, barks,

*Corresponding author: Alagesaboopathi C

Department of Botany, Government Arts College (Autonomous), Salem - 636 007, Tamilnadu, India

inflorescence, fruits and seeds sometimes found in just one or two of such organs (Zeng *et al.*, 2008). Alagesaboopathi (2016) reported that as the concentration of extracts of *Plumbago zeylanica* increased, the growth of the plant decreased, Alagesaboopathi (2016) observed that leaves and stem bark extracts of *Strychnos nux-vomica* significantly reduced germination and seedling growth in *Solanum trilobatum*. There are several reports allelochemicals from this plant negatively concern plants like *Prosopis juliflora*, *Calotropis procera*, *Centella asiatica*, *Artrmisia monosperma*, *Thumus vulgaris*, *Eucalyptus saligna*. (EI. Shabsy, 2017; Gulzar and Siddiqui, 2017; Alagesaboopathi, 2018; Ghadahh Hamad *et al.*, 2018; Stephen, F. Sikolia and Elizabeth Ayuma, 2018). *Phyllanthus amarus* Schum and Thonn. belongs to the family of Phyllanthaceae is found predominately distributed in India, Malaysia, China, Philippines, Tanzania, New Zealand, Cuba, Nigeria and other tropical regions. The plant is familiarly known as stone phyllanthu, sleeping plant, or carry me seed in English and Keelanelli in Tamil (Alagesaboopathi *et al.*, 2018). In the Indian manner of medication, the medicinal potentialities of this species have been known for lenthly time.

The plant possesses diabetes, constipation, flu, kidney disorders and ringworm, ulcers, chronic dysentery, frequent menstruation, jaundice, malaria related symptoms, hepatic and urolitic ailments. The plant mange jaundice (Alagesaboopathi *et al.*, 2018) antibacterial and antidiabetic (Cletus *et al.*, 2018), anti-typhoid (Adukpo *et al.*, 2010), antioxidant (Zain and Omar, 2018).

Vigna mungo (L.) Hepper Var. CO. 653 (Black gram) is belongs to the family of Fabaceae. Black gram is an herbaceous annual plant. In India it is usually grown as a Kharif crop where rainfall is 25-35 inches commonly cultivated in June - July and harvested within 3-4 months. Popularly cultivated in Tamilnadu, Andhra Pradesh, Karnataka, Maharashtra, Madhya Predesh, Uttar Pradesh, Punjab and West Bengal.

Pulses are an integral distribute of Indian Agriculture. Usefulness protein content in pulses is nearly three times as much as cereals, so they are lower source to overcome protein malnutrition among human beings. *Vigna mungao* Var. CO. 653 is one of the most familiar pulses in South East Asia.

Vigna mungo Var. CO. 653 is significant for its expensive phosphoric acid content. It contains protein, phosphorus, carbohydrates, riboflavin, thiamin, vitamin C and niacin. To the best of my knowledge there is no evidence about the effects of allelochemicals on the seed germination activities and subsequent seedling progress of *Vigna mungo* Var. CO. 653.

The aim of this research was to appraise for the first time the possible effects of the *Phyllanthus amarus* leaves and stem aqueous extract on the seed germination and seedling progress of *Vigna mungo* Var. CO. 653 plants. Hence, the current study was carried out to conclude the allelopathic causes *Phyllanthus amarus* extracts on *Vigna mungo* Var. CO. 653. This research was conducted under laboratory conditions.

MATERIALS AND METHODS

Samples from the complete fresh leaves and stem of *Phyllanthus amarus* were collected from the original habitats, Panamarathupatti, Salem District of Tamilnadu, India. The

recently collected leaves and stem were washed thoroughly in tap water shade dried at room temperature (30°C) for 10 days, then powdered in grinders and sieved. For leaf and stem extract, 25g leaf and stem powder was soaked in 100 ml double distilled water for 24 hrs to get 25% extract, by dilutions with double distilled water 5, 10, 15, 20 and 25 percentage concentrations of extracts were prepared.

Treatments and Experimental Design

Fresh seeds of *Vigna mungo* Var. CO. 653 were collected from Valapady, Salem district of Tamilnadu. The seeds of *Vigna mungo* (Tamil - Uluntu, English - Black gram) were surface sterilized with 0.2% mercuric chloride for 1 min. to remove the pathogens on the seeds. Then the seeds were to eliminate the mercuric chloride. The seeds were soaked in dissimilar concentrations (5,10, 15,20 and 25%) of extracts for 24 hrs. The experiment was done in polythene bags. Each polythene bags contained 10 uniform sized seeds, while distilled water was added to the untreated control (0%), which were irrigated with 10 ml distilled water on alternative days. The treatments were organized in a completely Randomized Design (CRD) with three replicates kept at room temperature on laboratory bench. The entire research was repeated once.

Physical parameters

Seed germination counts were recorded daily for ten days. After ten days, the seedling root length (cm), shoot length (cm), fresh weight and dry weight were determined (mg). The root and shoot length were concluded manually while the fresh weight and dry weight with the assist of 4 digital balance of Shizadzu Corporation (Japan).

Statistical analysis

After fifteen days, the seedling root length, shoot length, fresh weight and dry weight were decided. The information procured were analysed by factorial analysis of variance (ANOVA) to determine notable ($p < 0.05$).

RESULTS AND DISCUSSION

In the present research leaf and stem aqueous extract of *Phyllanthus amarus* inhibited the seed germination of *Vigna mungo* Var. CO. 653. The inhibitory determine was raised with increasing concentration of the extracts. Highest inhibitory effect was noteworthy with concentrated leaf extracts. Maximum inhibition (70%) was recorded with concentrated leaf extract. Leaf and stem aqueous extracts of *Phyllanthus amarus* on *Vigna mungo* Var. CO.653 notable a decrease reduction in entire parameter. The seed germination root and shoot length were inhibited in whole concentrations (Tables 1 - 2). The moderate in percent *Vigna mungo* seed germination in *Phyllanthus amarus* aqueous extract treatments ranged between 30 to 80% compared to 100% germination in the control. The lower in germination percentage of *Vigna mungo* Var. CO. 653 seed germination in the *Phyllanthus amarus* stem aqueous extract treatments ranged between 35 to 80% compared to 100% germination in the control (Tables 1-2).

The seed germination, root and shoot length was inhibited in whole concentrations (Tables 1-2). The lower was concentration dependent. The aqueous extracts of two extracts also delayed the shoot length of *Vigna mungo* Var.CO. 653

(Tables 1-2) (Figures 1-2). The degree of retardation also raised with increase in the concentrations of the extracts.

Statistical analysis at 5% level (t-test) revealed that apart from comparison between 5 and 25 g extract concentrations, there were no important differences in the development. Length of root in the varying extract concentrations as well as those of the control in leaf and stem extracts. The extracts *Phyllanthus amarus* also caused vital reduction in seedling growth of *Vigna mungo* Var.CO. 653. The extracts not only moderated the shoot and root length of *Vigna mungo* Var.CO. 653. seedlings but also decreased the fresh and dry weight. The reduction in the fresh and dry weight may be due to stunted scanty vegetative progress of *Vigna mungo* Var.CO. 653 seedling. This reduction may be due to phytotoxic action phytochemical constituents present in aqueous extracts of *Phyllanthus amarus*.

The outcomes of current study noted that the leaf and stem extracts of *P.amarus* was inhibitory in *Vigna mungo* Var. CO. 653. Alagesaboopathi (2016) reported that leaves, stem, and root extracts of *Plumbago zeylanica* significantly decreased germination and seedling development of *Andrographis paniculata*. Alike effects have been reported by Alagesaboopathi, (2018). Some modern investigations indicating the allelopathic / phytotoxic cause of aqueous extracts of medicinal plants include *Strychnos nux-vomica* (Alagesaboopathi *et al.*, 2018), *Withania somnifera* (Mandal *et al.*, 2018), *Andrographis paniculata*, *Ocimum tenuiflorum*, *Ruellia tuberosa* (Suwitchayanon *et al.*, 2017), and *Vitex negundo* (Kavitha *et al.*, 2017).

The aqueous leaf and stem extracts of *P.amarus* proved inhibitory causes on seed germination, shoot length, root length, fresh weight and dry weight of *Vigna mungo* Var.CO. 653. The *P. amarus* leaf and stem extracts inhibited the germination and growth of *Vigna mungo* Var.CO. 653 in the current research. Hence, they must have been sure for the inhibition of seed germination, development and dry mater accumulation of root and soot of the plant were progressively decreased with the raised in the concentration of the extract. Further studies are essential to isolate and characterize the supposed allelochemicals in *Phyllanthus amarus* and the interaction that could be indicative for the notable inhibition of seed germination and plant progress.

Table 1 Effects of aqueous extract of *Phyllanthus amarus* Schum and Thoun leaves on germination and seedlings development of *Vigna mungo* Hepper Var.CO. 653

S.No.	Extract Concentration	Seed Germination (%)	Shoot Length (cm)	Root Length (cm)	Fresh Weight (g)	Dry Weight (g)
1	Control (0%)	100	22.1	17.8	1.62	0.47
2	5%	80	14.5	9.06	1.15	0.43
3	10%	60	12.01	8.5	1.12	0.38
4	15%	60	10.24	7.1	0.95	0.29
5	20%	50	7.3	6.2	0.80	0.24
6	25%	30	5.6	4.3	0.63	0.21

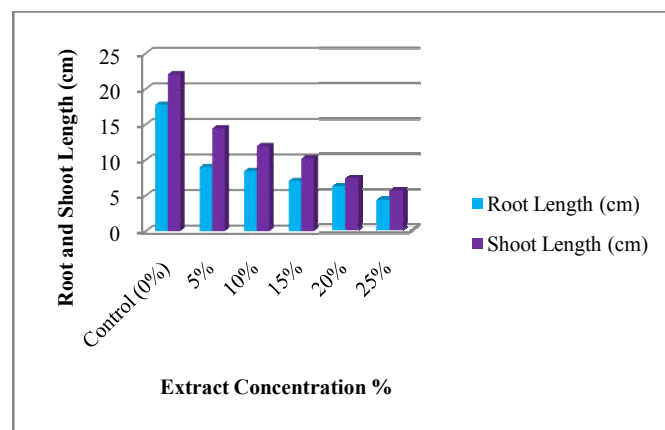


Figure 1 Effects of aqueous extract of *Phyllanthus amarus* Schum and Thoun leaves on germination and seedlings development of *Vigna mungo* Hepper Var.CO. 653.

Table 2 Effects of aqueous extract of *Phyllanthus amarus* Schum and Thoun stem on germination and seedlings development of *Vigna mungo* Hepper Var.CO. 653.

S.No.	Extract Concentration	Seed Germination (%)	Shoot Length (cm)	Root Length (cm)	Fresh Weight (g)	Dry Weight (g)
1	Control (0%)	100	16.8	22.5	2.96	0.50
2	5%	80	12.1	18.3	1.30	0.40
3	10%	70	10.4	15.2	1.11	0.30
4	15%	50	8.7	12.1	1.08	0.25
5	20%	40	5.1	9.2	0.90	0.18
6	25%	35	3.2	5.1	0.42	0.11

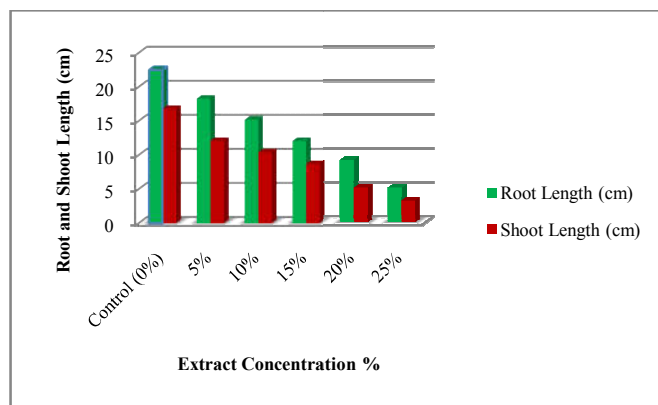


Figure 2 Effects of aqueous extract of *Phyllanthus amarus* Schum and Thoun stem on germination and seedlings development of *Vigna mungo* Hepper Var.CO. 653

CONCLUSION

The current research was conducted to probe allelopathic effects of *Phyllanthus amarus* (L.) Schum and Thoun. which noted inhibitory effects on seed germination, shoot length and root length of *Vigna mungo* (L.) Hepper. Var. CO. 653, leaf and stem aqueous extracts of *Phyllanthus amarus* at 5, 10, 15, 20 and 25% concentration were applied to verify their effect on seed germination and seedling growth of *Vigna mungo* Var.CO. 653 under laboratory conditions. Outcomes noteworthy that seed germination, root length, shoot length, fresh weight and dry weight of *Vigna mungo* Var. CO. 653. were importantly decreased by leaf and stem extracts compared with control treatments. Roots were extensive affected than shoots. Leaf extracts were highly reduced than stem extracts. These results revealed that the inhibitory and stimulatory potential cause capabilities may be due to the presence of the allelopathic

chemicals like glycosides, diterpenoids, alkaloids, phenols, terpenoids, tannins and steroids etc. in the aqueous leaf and stem extracts of *Phyllanthus amarus* from the current investigation.

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