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ARTICLE

ALLELOPATHIC EFFECT OF *VITEX NEGUNDO* LEAF EXTRACTS ON COW PEA

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Abstract

There has long been observed an inhibitive response by plant species to certain neighbouring plants. The Greek philosopher and botanist, Theophrastus, noted this effect from cabbage as early as 300 BC. Since that time, others have documented similar plant interactions. In 1937, Austrian botanist, Hans Molisch, described this phenomenon as allelopathy, which he determined to be the result of biochemical interactions between An experiment was conducted to understand the influence of aqueous leaf extracts of *Vitex negundo*, L. on the growth of cow pea (*Vigna unguiculata*). Laboratory bioassay results showed that the percentage of inhibition increases with increase in concentration, from 46.67% to 100% in 1% and 10% of extract respectively. 1% showed promontory effect on both radicle and hypocotyle as compared to germination and growth in control seeds. but it showed marked inhibitory effect in all other treatments, except for hypocotyle on 5% extract. 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 *Vitex negundo*, L. for using a potential natural herbicide for alternative weed management strategy

Keywords: phytochemicals, germination, inhibition

Introduction

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. Allelopathy is a biological phenomenon by which an organism produces one or more chemical compounds that influence the germination, growth, survival, and reproduction of other organisms. These biochemicals are known as allelochemicals and can have beneficial (positive allelopathy) or detrimental (negative allelopathy) effects on the target organisms and the community. Allelochemicals are secondary metabolites which are not required for metabolism (i.e. growth, development and reproduction) of the allelopathic organism. Allelochemicals are a subset of secondary metabolites not required for metabolism of the host plant. Allelochemicals with negative effects are an important part of plant defense against herbivory (Fraenkel, 1959 and Stamp, 2003).

An allelopathic crop can potentially be used to control weeds by planting a variety with allelopathic qualities, either as a smother crop, in a rotational sequence, or when left as a residue or mulch, especially in low-till systems, to control subsequent weed growth. For example, in one study, rye mulch had suppressive effects on pigweed and common purslane, but had no effects on velvet leaf and common lamb squarters. A fall cover crop of forage radish had weed suppression effects on the following season's crop. In a multiseason field study, when applied as a soil amendment, mustard seed meal derived from white mustard (Sinapis alba) was effective for weed suppression in organic sweet onion, but crop injury was also significant.

Alternatively, application of allelopathic compounds before, along with, or after synthetic herbicides could increase the overall effect of both materials, thereby reducing application rates of synthetic herbicides. Some attempts have been reported on application of aqueous extracts of allelopathic plants on crops for weed suppression. In one study, an extract of brassica (*Brassica napus*), sorghum, and sunflower was used on rain-fed wheat to successfully reduce weed pressure. When an allelopathic plant water extract was tank-mixed with atrazine, a significant degree of weed control was achieved in wheat with a reduced dose of herbicide. Sunflower residues with a preplant herbicide (Treflan®) enhanced weed suppression in broad bean.

Objective of the study was to evaluate the effect of selected medicinal plant on a common legume seeds, and to find out the suitable concentration of leaf extract which inhibits seed germination. Aim was also to find suitable combinations of medicinal plant and legumes which can be suggested for companion cropping which can provide

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dual benefits to the farmers, one as herbicide and other as medicinal plant.

Materials and Methods

Host plant

The Cow pea, *Vigna unguiculata*, (L.) Walp., is an annual herbaceous legume from the genus Vigna. Due to its tolerance for sandy soil and low rainfall it is an important crop in the semi-arid regions across Africa and other countries. This legume crop was chosen for study due to its ability to produce a crop under semiarid conditions, its resistance to major insect and disease damage and it is widely used as the host plant in germination studies around the world. Seeds were purchased from Govt. Agricultural College, Vellayani, Thiruvananthapuram.

Medicinal Plant

The leaves of *Vitex negundo*, L. was collected from three different locations of Thiruvananthapuram. Collected leaves are shade dried for one to two weeks. Constant monitoring was carried out to avoid microbial contamination. The dried plant materials was taken and ground using motor and pestle to obtain a fine powder. The powder was further passed through a 02 mm sieve to obtain finer particles. The powdered samples were stored in a clean glassware container and stored in low temperature until needed for analysis (Das et al.. 2010).

Preparation of plant extracts

10 gram of dried and powdered sample was taken. It was put in 100 ml. of distilled water. Mixed well and extracted for 24 hours on a stirrer with continuous stirring. After extraction, the extracts were filtered through Whatman No.1 filter paper, centrifuged the filtrate for clarification, stored for further investigations (Das et al.. 2010). This constitute 10% of the extract. At the time of analysis, different concentrations such as 1%, 3%, 5% and 10% were prepared with respective solvent. All the four solutions were used for studies and were named as V1, V2, V3 and V4 for 1%, 3%, 5% and 10% extracts of *Vitex negundo*, L. respectively. Distilled water was taken as control and designated as C1.

Germination studies

Germination study was conducted in a 90 cm. diameter Petri dish lined with one layer of Whatman filter paper no. 1, moisten with five ml of distilled water (control) or the extract (1%, 3%, 5% and 10%), on second day additional one ml of the extract was added. For each treatment three replicates were kept. Fifteen seeds were kept for germination in each petriplate. Petri dishes were kept at room temperature, and daily observations were recorded. A seed is considered germinated when the radicle is protruded up to 2mm . Seed germination and seedling growth were recorded.

Seed Germination

Rate of germination was calculated using following formula.

Seed germination (%) =100 (n/N)

Where n is the number of seed germinated and N is the total number of seeds.

Seedling Growth

Seedling growth- Seedling growth was assessed by root and hypocotyle length measurement When the seedling produced two leaves, they were taken to count of radicle and

Results and Discussion

Seed Germination

All the four concentrations of dry leaf extract such as 1%, 3%, 5% and 10% of *Vitex negundo*, L., were showed inhibitory effect on legume seed germination. It was also observed that inhibitory effect increases with increase in concentration. Among the 15 seeds used for study, eight were germinated in 1% leaf extract (53.33%). The percentage of germination decreased to 20% (n = 03) with 05% extract. Whereas seeds in 10% extract showed complete inhibition with 0% germination (n = 00). Here also all the eleven seeds were germinated in control solution, showing 100% germination (Fig. 01)

Seedling Growth

The results of the seedling growth of Cow pea (*Vigna unguiculata*, (L.) Walp.) seeds under aqueous leaf extracts treatments of *Vitex negundo*, L., is given in Fig 02 and 03. The leaf extracts of *Vitex negundo*, L. caused significant changes in radicle growth. As compared to the control, the aqueous leaf extracts of *Vitex negundo*, L., at 1% concentration level, exhibited promotory effect on radicle growth in Cow pea. The inhibitory effect was concentration dependent. The inhibitory effect was found to increase with increasing concentrations of aqueous leaf extracts.

Hypocotyle growth of legume seedling was also showing almost similar effect as on radicle. Cow pea show stimulatory effect with treatment, which shows more growth of hypocotyle length than control. A surprisingly 5% concentration also showed stimulation for seedling growth of cow pea as compared to 1% concentration. Similar inhibitory effects caused by leaf aqueous extracts of *Vitex negundo* on B*rassica chinensis, Lactuca sativa, Degitaria deacumbens* and *Mimosa pudica*, which were reported by Chou & Yao (1983).

The present results coincide with the findings of Jadhav. 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. The reason for an inhibitory effect on germination percentage and stimulatory effect on seedling growth is due to the presence of different levels of following chemicals in the leaf extracts

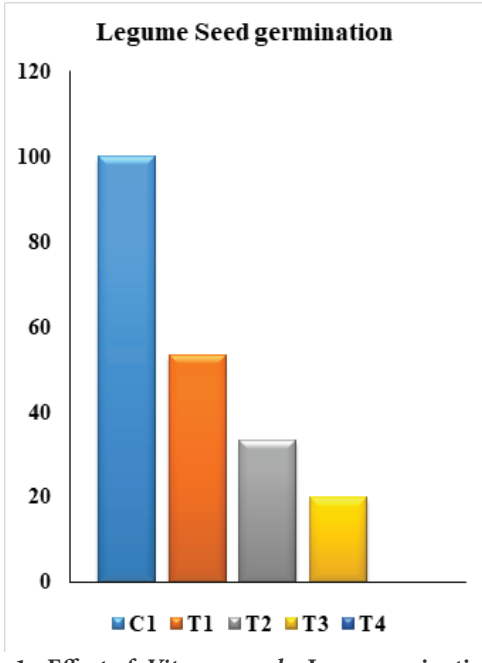

Figure 1 - Effect of *Vitex negundo*, L. on germination of Cow pea (*Vigna unguiculata*, (L.) Walp.)

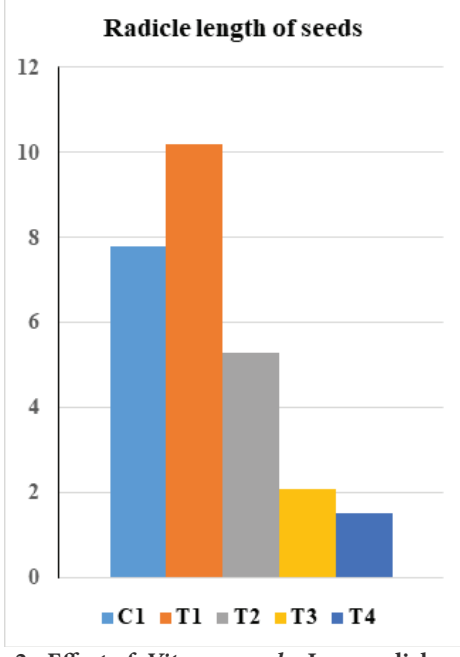

Figure 2 - Effect of *Vitex negundo*, L. on radicle growth of Cow pea (*Vigna unguiculata*, (L.) Walp.)

Conclusion

The introduction of many exotic plant species affected our biodiversity which is a major threat. Seed germination studies using the leaf extract (1%, 3%, 5% and 10%) of *Vitex*

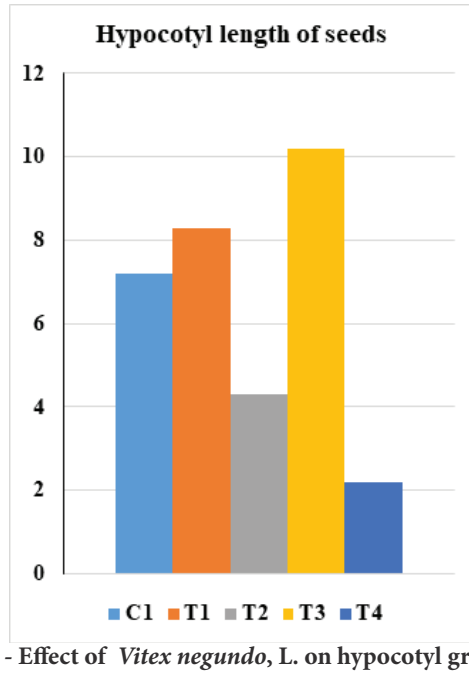

Figure 3 - Effect of *Vitex negundo*, L. on hypocotyl growth of Cow pea (*Vigna unguiculata*, (L.) Walp.)

negundo, L. on cow pea seeds showed significant inhibition in germination and the percentage of inhibition increases with increase in concentration, from 46.67% to 100% in 1% and 10% of extract respectively. 1% showed promontory effect on both radicle and hypocotyle. All legume seeds shows stimulation with treatment (1%) as compared to germination and growth in control seeds. but it showed marked inhibitory effect in all other treatments, except for hypocotyle on 5% extract. The reason for an inhibitory effect on germination percentage and stimulatory effect on seedling growth is due to the presence of different levels of different chemicals in the leaf extracts *Vitex negundo*, L. Hence, further studies are needed to isolate and identify the individual inhibitory substance present in leaves and other parts of *Vitex negundo*, L. for using it as a potential natural herbicide for alternative weed management strategy.

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