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Effect of "Lakshmi Taru" (*Simarouba glauca* DC.) leaf extracts on germination and seedling growth of cow pea (*Vigna unguiculata* (L.) Walp.

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Abstract
"Lakshmi taru" (*Simarouba glauca*, DC.) or "paradise tree" has a long history of herbal medicine in many countries and belongs to the family *Simaroubaceae*, grabbed a wide attention and acceptance as the "cancer curing plant" or "magic plant". Aqueous leaf extracts of selected plant was prepared (1%, 3%, 5% and 10% concentration) and was tested on Cow pea (*Vigna unguiculata*, (L.) Walp.) under laboratory conditions to see the effect of extracts on seed germination and seedling growth. It was noted that *Simarouba glauca*, DC. has significant inhibition in germination on cow pea seeds and the percentage of inhibition increases with increase in concentration. In the case of seedling growth, 1% extract had a promotory effect on radicle of Cow pea, while others inhibit radicle growth. Hypocotyle growth of legume seedling was also showing almost similar effect as on radicle. Surprisingly 3% concentration also showed stimulation for seedling growth of cow pea as compared to 1% concentration. The reason for an inhibitory effect on germination percentage and stimulatory effect on seedling growth is due to the presence of different levels of various phytochemicals in the leaf extracts and further detailed analysis is recommended is to validate present findings.

Keywords: *Simarouba glauca*, phytochemicals, germination, inhibition

Introduction
History of "allelopathy" dates back when Theophrastus, Father of Botany, wrote how chickpea "exhausts" the soil and destroys weeds. Allelopathy is a form of chemical competition. The allelopathic plant is competing through "interference" chemicals. 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.

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.

Simarouba glauca, DC. is a flowering tree, native to Florida, *glauca* also known as paradise tree has a long history of herbal medicine in many countries and belongs to the family *Simaroubaceae*. The *Simaroubaceae* family includes 32 genera and more than 170 species of trees and brushes of pan tropical distribution [1]. It was widely used for treatment of cancer hence it is known as tree of solace of cancer [2, 3]. This species is famous for its vernacular name "Lakshmi taru". It was first introduced, in India, by National Bureau of Plant Genetic Resources in the Research Station at Amravathi, Maharashtra in 1960s and is now well flourished in Orissa, Maharashtra, Karnataka, Tamil Nadu, Kerala and also at introductory stage of plantation in other states like Gujarat, Rajasthan, Andhra Pradesh and West Bengal. All parts of the plant generate products that are useful in the production of food, fuel, manure, timber, medicine etc. The tree is well suited for the all the geographical regions of India. It reclaims wastelands, arrests soil erosion, and supports soil microbial life and increases ground water levels.

It is a multi-purpose evergreen tree receiving great interest as a promising energy crop and medicinal plant for the future. It has aroused great enthusiasm as miraculous tree of solace for cancer patients.

Even though, the number of scientific publications devoted to medicinal plants is growing exponentially and the number of reviews is increasing rapidly, there are only very few literature available exploring the potential of this plant species as an anti-cancerous plant. Syamasundar Joshi and Shantha Joshi, two retired agricultural scientists from Bangalore are the *Simarouba* pioneers in India who have been advocating the use of this tree in the treatment of cancer and various other health conditions.

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

Materials and methods

Selection of host plant

The *Vigna unguiculata*, (L.) Walp., commonly called "Cow Pea" 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. Cowpeas are grown in our country for human consumption and as a forage crop for livestock. 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.

Collection of Medicinal Plant

The leaves of *Simarouba glauca*, DC. 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 2 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 [4].

Methodology

Preparation of plant extracts

10 gram of each dried and powdered sample was taken. It was put separately 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 [4]. This constitute 10% of the extract. At the time of analysis, different concentrations such as 1%, 3%, 5% were prepared with respective solvent. All the four solutions were used for studies and were named as T_1, T_2, T_3 and T_4 for 1%, 3%, 5% and 10% extracts. Distilled water was taken as control and designated as C_1.

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. Ten 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 [5]. 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 hypocotyle measurement, after five days [6].

Seed Vigour Index (SVI)

Seed vigour index (SVI) was calculated for legume seeds following modified formula of abdul-baki and Anderson (1973).

SVI = germination percentage (%) * seedling length (cms.)

Results and discussion

Seed germination

Seed germination studies using the leaf extract of *Simarouba glauca*, DC on cow pea seeds showed significant inhibition in germination. All the four concentrations of dry leaf extract such as 1%, 3%, 5% and 10% of *Simarouba glauca*, DC. were showed inhibitory effect on legume seed germination. It was also observed that inhibitory effect of *Simarouba glauca*, DC. increases with increase in concentration. The maximum inhibition was observed in 10% of leaf extract, i.e. 7%. Among the 30 seeds used for study, 25 were germinated in 1% leaf extract (83.33%). The percentage of germination decreased to 30% (n = 06) with highest concentration of extract, *i.e.* 10%. Whereas seeds in 5% and 3% extracts showed an average germination of 50% (n = 15) and 56.67% (n = 17) respectively. All the nine seeds were germinated in control solution, showing 96.67% 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 *Simarouba glauca*, DC. is given in Fig 02 and 03. The leaf extracts of *Simarouba glauca*, DC. caused significant changes in radicle growth. As compared to the control, the aqueous leaf extracts of *Simarouba glauca*, DC. 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 3% 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 *Brassica chinensis*, *Lactuca sativa*, *Degitaria deacumbe*ns and *Mimosa pudica*, *which* were reported by Chou & Yao (1983) [7].

The present results coincide with the findings of Jadhav [8]. 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 [9]. 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 of *Simarouba glauca*, DC., namely ailanthionone, benzoquinone, canthin, glaucarubolone, melianone, simaroubidin, simarolide, etc [10, 11].

Seed Vigour Index

Seed vigure index of the Cow pea (*Vigna unguiculata*, (L.) Walp.) seeds against *Simarouba glauca*, DC. leaf treatment gives the total effect of *reatment on seed germination and seedling growth. All legume seeds shows stimulation (Fig. 4) with treatment (1%) as compared to germination and growth in control seeds. but it showed marked inhibitory effect in all other treatments. 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 [12].

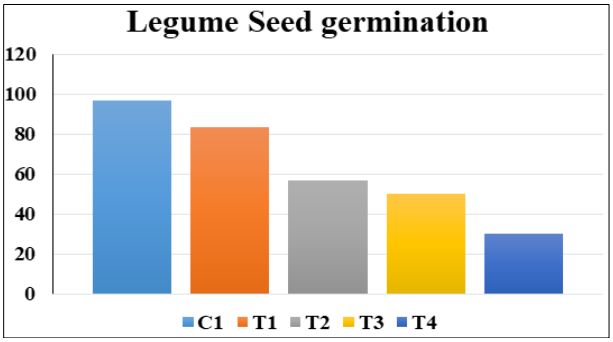

Fig 1: Effect of *Simarouba glauca*, DC. On germination of Cow pea (*Vigna unguiculata*, (L.) Walp.)

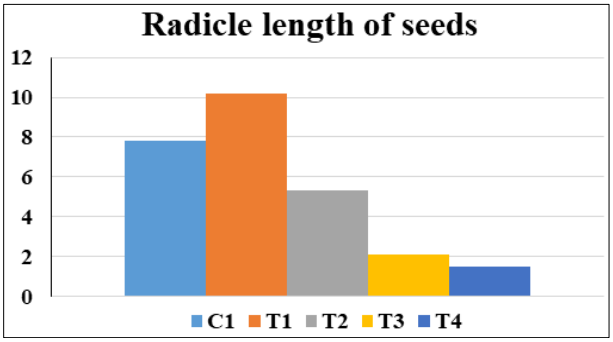

Fig 2: Effect of *Simarouba glauca*, DC. on radicle growth of Cow pea (*Vigna unguiculata*, (L.) Walp.)

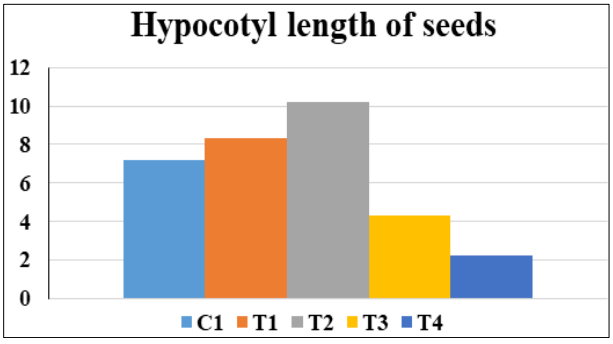

Fig 3: Effect of *Simarouba glauca*, DC. on hypocotyl growth of Cow pea (*Vigna unguiculata*, (L.) Walp.)

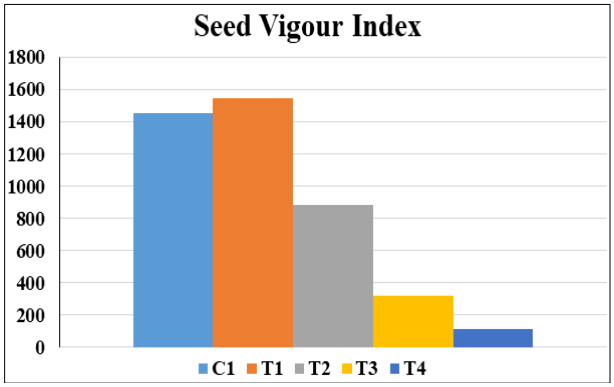

Fig 4: SVI of Cow pea (*Vigna unguiculata*, (L.) Walp.) under the influence of *Simarouba glauca*, DC. leaf extract

Conclusion

The introduction of many exotic plant species affected our biodiversity which is a major threat. Seed germination studies using the leaf extract (%, 3%, 5% and 10%) of *Simarouba glauca*, DC. on cow pea seeds showed significant inhibition in germination and the percentage of inhibition increases with increase in concentration, from 16.33% to 70% 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. 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 of *Simarouba glauca*, DC. Hhence, further studies are needed to isolate and identify the individual inhibitory substance present in leaves and other parts of *Simarouba glauca*, DC. For using it as a potential natural herbicide for alternative weed management strategy.

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