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Impact of *Senna uniflora* leaf extract on germination and seedling growth of green gram

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Abstract

The study entitled “Impact of *Senna uniflora* Leaf Extract on Germination and Seedling Growth of Green Gram” was carried out during 2021-2022 at JSA College of Agriculture and Technology, Cuddalore, to investigate the allelopathic potential of plant part extracts of *Senna uniflora* on green gram (*Vigna radiata*). The experimental design followed a Randomized Block Design (RBD) with three replications and four treatments: leaf extract (T1), stem extract (T2), root extract (T3), and control (T4), using 50 g of plant part in 50 ml of distilled water. Among the treatments, leaf extract (T1) significantly suppressed the germination and seedling growth of green gram, reflected by reductions in shoot and root length, seedling biomass, and seedling vigour indices (SVI-I & SVI-II). The stem and root extracts (T2 and T3) did not produce any significant inhibitory effects when compared to the control. These findings suggest that *Senna uniflora* leaves contain potent allelochemicals capable of affecting early growth in green gram, highlighting their potential for natural weed management strategies.

Keywords: *Senna uniflora*, green gram (*Vigna mungo*), Allelopathy, Seedling vigour index Sustainable weed management.

Introduction

Pulses are important source of protein in India. Per capita requirement of pulses (60gm /day for male and 55gm/day for female is less than the availability (42gm). Globally India stands first in area and production of pulses. The productivity is only 650 kg/ha, which is far below the world average productivity of 909kg/ha. India has achieved first rank in World area (35%) and production (25%) under pulses. India has an area of about 24million ha of pulses producing 16.5million tonnes of pulses. This is 35% percent of the world area and 25% of world production (FAO, 2016) ^[1]. (Dr. J, Vasanthakumar (2016) ^[5]. Green gram is scientifically known as *Vigna radiata* is a plant species in the legume family and commonly called as mung bean, moong in India. India is its primary origin and is mainly and is mainly cultivated in East Asia, Southeast Asia and the Indian subcontinent. It is the third important pulse crop grown in nearly 16% of the total pulse area of the country, it also contains protein rich seed with 20-25% protein. The plants are cut and ploughed into the soil to enrich soil nitrogen.

India is the major producer of green gram in the world and it is grown about 4.5 million hectares with the total production of 2.5 million tonnes with a productivity of 548 kg/ha and contributing 10% to the total pulse production (According to Govt of India 3rd advance estimates, greengram production in 2020-21 is at 2.64 million tonnes. The consumption of Greengram was 22.5 lakh tonnes against the production of 21.45 lakh tonnes with the rest of the demand- supply gap was covered by importing around 1.08 lakh tonnes along with the opening stocks 2.10 lakh tonnes.

The *Senna uniflora* (Mill.) is an annual, woody & erect in nature. It is commonly known as one leaf senna / single flowered senna. The meaning of *Senna uniflora* (SEN-nuh—latin form of Arabic word for a thorny bush, yoo- nee-FLOR-uh—single flowered) and taxonomical classification of *Senna uniflora*, Kingdom - plantae, Phylum- Tracheophyta, Class- Equisetopsida C. Agardh, Order-Fabales, Family-Fabaceae, Genus-Senna, Species-*Senna uniflora* (Mill.) H.S. Irwin & Barneby.

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Phytochemical screening & allelopathy of *Senna uniflora*

LP Kothapalli(2017) ^[2] reported that presence of phytochemical screening of *Senna uniflora*. The leaf extract evaluate antioxidant activity which indicates that, of the *Senna uniflora* and it's gel formulation evaluated and can be used as a potent source of natural antioxidants ^[4].

T Jothirathinam, VD Victor(2016)studied about phytochemical screening and antimicrobial activity of *Senna uniflora*(Mill.) HS Irwin and Barneby, it provides the health application at affordable. The traditional medicines involve the use of plant extracts particularly the bioactive components present in it. The benzene and alcohol extracts of *Senna uniflora* showed that the whole plant was analysed for first and used for removal of copper from aqueous solution using *Senna uniflora* extract. JA Kumari, P Prasad (2018) ^[9] assessing the allelopathy and autotoxicity effects of *Senna uniflora* (Mill.).

Materials and Methods

The experiment was carried out at JSA College of Agriculture and Technology (TNAU Affiliated), Thittagudi, Tamilnadu, India during 2021-2022 to study and evaluate the allelopathic chemical screening of aqueous extract of leaf, stem and root of *Senna uniflora*.

Experiment Details

Leaf, stem, root of the *Senna uniflora* plant were collected from the field of JSA College of Agriculture and Technology, and the study was carried out at the Agronomy lab. Thus the plants parts were collected and initially cleaned off from dirt and other materials and then plant parts were soaked separately in distilled water

For leaf extract; 50g leaf sample were crushed and soaked in 50ml of distilled water.

For stem extract; 50g stem sample were crushed and soaked in 50ml of distilled water.

For root extract; 50g root sample were crushed and soaked in 50ml of distilled water.

After 24 hours, the aqueous extracts were filtered and tested for Allelopathic effect of each plant parts by using the seeds of green gram to check whether the extracts induces seedling germination or inhibition.

The seeds were tested for germination by using the method of roll towel method and then tested using the extracts of plant parts (leaf, stem, root & distilled water served as a control)and the extracts were pouring into the germination sheets as fresh aqueous extracts for every 24 hours to avoid drying up.

After 7 days, observed the germinated seedlings of the green gram and black gram of each extracts and control. Fresh weight & dry weight of the seedlings were taken from the germinated seedlings, whereas the fresh weight is taken immediately along with it after that the germinated seedlings were dried by using hot air oven @100 °C. The dried weight also measured.

Treatment details

Table 1: Treatment details

Treatment	Extracts of plant parts	Distilled water
(T1)Leaf extract	50g leaf sample	50ml
(T2)Stem extract	50g stem sample	50ml
(T3)Root extract	50g root sample	50ml
(T4)Distilled water	-	50ml

Observation recorded

Germination percentage (%)

The seeds were considered as germinated when it's radicle was about 2mm long, and the germination percentage was determined by counting the number of germinated seeds on the 7th day after sowing (DAS). After final count, Germination percentage (GP%) was calculated by using the following formula expressed as percent.

Germination percentage (%) = number of germinated seeds/number of seeds kept for germination ×100

Shoot length (cm)

After 7 DAS, seedlings from each extracts were carefully removed and the Seedling shoot length was measured from the collar region to the top of the longest leaf and expressed as cm.

Root length(cm)

The root length of the seedlings was measured from the base of the stem to the tip of the longest root and expressed as cm.

Fresh weight(mg)

After measuring the root length and shoot length of the seedlings, the fresh weight should be measured by using the weighing balance and expressed as mg.

Dry weight(mg)

After that the seedlings was placed on hot air oven to drying up, then the dry weight of the seedlings were measured by using weighing balance and expressed as mg.

Seedling vigour index I - [standard germination% × seedling length (cm)]

Seedling vigour index II - [standard germination% × seedling dry weight (mg)]

The vigour index of the seedlings was calculated using the following formula proposed by Abdul- Baki and Anderson (1973) and expressed as percent were evaluated.

Response Index (RI) were determined as follows (Richardson and Williamson, 1988)

If $T > C$, $RI = 1 - (C/T)$, If $T = C$, then $RI = 0$, If $T < C$, then $RI = (T/C) - 1$

Whereas, T is treatment and C is control. A negative RI reflects in output of seedling (germination (%), shoot length (cm), root length (cm), fresh weight (mg), and dry weight (mg)) of black gram & green gram seedlings in treatment relative to output in control.

Results

Germination Percentage (%)

From the experiment for germination, we use the seeds of Black gram and green gram. Moreover all the seeds which are kept for the germination test were germinated, except the seeds which are kept in the solution of leaf extract(T1). The highest germinating of seedlings was recorded in stem extract(T2) & root extract (T3) of both the seedlings of Black gram (100%) and Green gram (100%). The lowest germinating of seedlings

was recorded in leaf extract(T1) of the seedlings of in green gram (80%). The overall germination percentage of green gram also recorded as 93.33% and in control(T4) was recorded as 100%.

Shoot length (cm)

Shoot length of the seedling which are kept for germination was recorded from the different treatments. Leaf extract (T1) for black gram seedlings the shoot length was about 8.15 cm and for green gram seedlings the shoot length was about 6.78 cm. Stem extract (T2) for green gram seedlings the shoot length was about 12.06 cm. Root extract (T3) for green gram seedlings the shoot

length was about 12.94 cm. For the control, the shoot length was in green gram as(9.7 cm).

Root length(cm)

Among the different treatments the root length of the seedlings which was kept for germination was recorded. leaf extract (T1) for green gram seedling the root length was about 2.82 cm. Stem extract (T2) for green gram seedling the root length was about 7.36 cm. Root extract (T3) for green gram seedling the root length was about 8.04 cm. Control (T4) for green gram seedling the root length was about 9cm.

Table 1: Inhibitory effect of *Senna uniflora* parts on green gram

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Fresh weight (mg)	Dry weight (mg)	Seedling vigour index-I	Seedling vigour index-II
Green gram	93.33±6.66	10.59±1.923	6.07±1.638	0.272±0.022	0.023±0.000	1555.4378	2.14659
Distilled water	100±0	9.97±0.27	7.55±1.45	0.28±0.015	0.026±0.002	1752	2.6

Table 2: Response index values for allelopathic effect of *Senna uniflora* parts on green gram

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Fresh weight (mg)	Dry weight (mg)
Green gram	93.33±6.66	10.59±1.923	6.07±1.638	0.272±0.022	0.023±0.000
Distilled water	100±0	9.97±0.27	7.55±1.45	0.28±0.015	0.026±0.002



Extract preparation of *Senna uniflora*



Extracts of *Senna uniflora* parts & its germination on green gram



Discussion

Allelopathic Effect of *Senna uniflora* on germination percentage

Among the different treatment of plant extract were prepared and used for germinating the seeds of green gram. The highest germination percentage was recorded in control(T4), and the germination of seedlings were moreover equal in all the treatments. the lowest germination percentage was recorded in leaf extract (T1). The stem(T2) and root extracts(T3) didn't made any allelopathic effect on the germination of green gram when compared to the leaf extract. Increase in the presence of more allelochemicals which may possess decrease in the germination percentage.

The allelochemicals present in the leaf which made the seeds unable to germinate and the germinated seedlings were showed as more inhibited growth in the seedlings of green gram. This represents the presence of allelochemicals in the leaf than the other parts of *Senna uniflora*.

Allelopathic effect of *Senna uniflora* on seedling length

When compared to different treatments of plant extract the seedling growth were recorded higher in root extract(T3) than the control(T4) in the seedlings of green gram. the lowest seedling length was recorded in shoot length as well as root length of leaf extract (T1). The leaf extract were showed more inhibitory effect on the root length than the shoot length in both the seedlings of green gram. This represents the allelochemicals which inhibit more on the root region of the seedlings.

Allelopathic effect of *Senna uniflora* on seedling vigour

There may be decrease in the seedling vigour when the concentration of allelochemical is in higher rate. From this study, the seedling vigour is lower in green gram, this may be due to the presence of allelochemicals in leaf extract & the highest seedling vigour is recorded in the control. This represents the seedling vigour of green gram > control was shown.

Conclusion

Based on the experiment conducted on (i.e) seedling growth on *Vigna radiata*, it is observed that the allelochemicals are present in *Senna uniflora* which inhibits the growth of seedlings. As a result of this the germination%, seedling length and vigour index were seen to be less when seedlings are grown using leaf, stem and root extracts of *Senna uniflora* than the seedlings grown using control (i.e) water.

Hence it is concluded that the *Senna uniflora* has allelopathic effect on the other crops and suppress their growth. All the parts of the plant has allelochemicals, the highest amount of allelochemicals is present in the leaf portion. Range - leaf > stem > root.

Researches show that the allelochemicals present in *Senna* are used as bioherbicide for the eradication of *Parthenium hysterophorus*. Hence in future a bioherbicide can be prepared from *Senna uniflora* and can be used for controlling *Parthenium hysterophorus*.

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