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# Allelopathic effect of *Spinacia oleracea* L. and *Psidium guajava* L. on *Vigna mungo* (L.) Hepper

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**ABSTRACT**

Blackgram (*Vigna mungo* (L.) Hepper) is an important pulse used for protein supplement in India and is cultivated throughout the nation. The varieties Vamban-2 and Vamban-3 are virus resistant and are commonly cultivated in Tamil Nadu. Allelopathy is a chemical interaction among plants and with other organisms. In the present study, the allelopathic interaction of spinach (*Spinacia oleracea* L.) and guava (*Psidium guajava* L.) with blackgram varieties Vamban-2 and Vamban-3 were tested using aqueous leaf extract. The interaction of these two tested species with the two varieties is negative and spinach was highly inhibitory than the other. The variety Vamban-2 was highly susceptible than Vamban-3.

**Keywords:** Flavonoids, inhibition, root, seed germination, shoot.

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## INTRODUCTION

Blackgram (*Vigna mungo* (L.) Hepper) originated in India, where it has been cultivated from ancient times and is one of the most highly prized pulses of India. The Coastal Andhra region in Andhra Pradesh and Tamil Nadu are famous for black gram after paddy. The varieties Vamban-2 and Vamban-3 are very common varieties used for cultivation in Tamil Nadu, these are resistant to mungbean yellow mosaic virus [1]. Allelopathy is the interaction among plants and is used for weed control nowadays instead of using chemical fertilizers. Plant secondary metabolites are responsible for such interaction among different plant species. This interaction is mostly negative in effect although positive results were reported with certain plant species at low concentration of plant residues or extracts [2-3]. Among the plant parts, leaves seem to be the most consistent producers of allelochemicals. Several chemicals can be released together and may exert toxicities in an additive or synergistic manner [4]. Allelopathy is also stated to have selectivity in effect [5] i.e. single plant need not be inhibited or induced by all allolopathic plants and the level of activity will also vary from species to species. Gaikwad *et al.* [6] reported that spinach (*Spinacia oleracea* L.) is very rich in the flavonoids and various flavonoids reported to be present are quercetin, myricetin, apigenin, luteolin, patulein, spinacetin, jaceidin, 4-glucuronide, 5,3,4-trihydroxy-3-methoxy-6,7-ethylenedioxyflavone-4-glucuronide, 5,4-dihydroxy-3,3-dimethoxy-6,7methylene-dioxy-flavone, 3,5,7,3,4-pentahydroxy-6-ethoxyflavone and the polyphenols isolated from this plant are para-coumaric acid, ferulic acid, ortho-coumaric acid. Leaves of guava (*Psidium guajava* L.) are rich in quercetin, avicularin and guaijaverin, terpenoids, coumarins and cyanogenic compounds [5]. Spinach belongs to the family Chenopodiaceae and guava belongs to the family Myrtaceae, both these plants are medicinally used for their flavonoids and are already known for their allelopathic potential. In the present study, the effect of spinach and guava is tested on germination and seedling growth of blackgram varieties Vamban-2 and Vamban-3 to check their effect at variety level.

## MATERIALS AND METHODS

Seeds of blackgram Var. Vamban-2, Vamban-3 were collected from Agricultural Office, Omalur, Salem and the work was carried out in the Department of Botany, Government Arts College, Salem-7. Middle leaves of spinach and guava were collected and shade dried for a period of 15 days and 10% aqueous leaf extract was collected and used as stock solution for various dilutions. Seed germination studies were done as explained earlier [7] using different dilutions (25%, 50%, 75%, 100%) of this extract and keeping distilled water as control. Seeds were soaked in aqueous leaf extract and control for 24hrs and then transferred to cotton wetted with respective solutions for seed germination. Seed germination was recorded after 2$^{nd}$ and 5$^{th}$ day of seed sowing and seedling growth (the length of shoot and root) was measured after 7$^{th}$ day of seed sowing.

## RESULTS AND DISCUSSION

In the present study leaf extracts of guava (*Psidium guajava* L.) and spinach (*Spinacia oleracea* L.) were tested for their allelopathy activity against blackgram (*Vigna mungo* (L.)

Hepper) varieties V-3 (Vamban-3) and V-2 (Vamban-2) at seed germination and seedling growth stage. Seed germination rate decreased with both plant extracts and delay in seed germination was also observed where as 100% germination rate was observed in control at 2$^{nd}$ day of seed sowing in both the varieties. V-2 variety was severely affected than V-3. At 100% leaf extract of spinach there was no seed germination observed in V-2. Compared to spinach, the inhibitory effect of guava is less severe at precise dilutions (Table 1 and 2). Similar to our results, guava leaf extract is reported to inhibit the seed germination of lettuce [8], rice root exudation was reported to inhibit seed germination of spinach [9]. Condor and Indrea [10] stated that cultivation of red beet in the same land after spinach cultivation delayed the germination time, poor germination of red beet. In *Vigna radiata*, spinach and guava reduced the seed germination rate and also delayed seed germination [7]. The inhibition and delay of seed germination may result by release of phytotoxins (allelochemicals) from incorporated crop residues [11]. The length of root and shoot was taken as a measurement of seedling growth and expressed in cm. Effect of spinach and guava on root growth was expressed in Figure 1. There was a constant reduction in the length of the roots were observed with increase in the concentration of the extracts. The effect of spinach is more severe at specific concentrations than guava, it is evident that the length of root is very small at 50% and 75% treatments. Guava aqueous leaf extract of 10% initial concentration at 100% treatment had a severe inhibitory effect on the root growth of V-2 variety of blackgram. In V-3 variety, the root growth was reduced with increase in the concentration of the extract from 25% to 100%, but the effect was gradual with both plant extracts, though spinach had more influence than guava (Figure 2). Comparatively, V-3 variety had more tolerance than V-2 variety to both the leaf extracts at root growth (Figure 1 and 2). Similarly, allelopathic inhibition of root growth was observed in spinach by different rice varieties [9], in *Echinochloa crusgalli* L. by leaf and decomposing matters of rice [12]. The length of shoot in V-2 is affected in the similar manner as the root lengths were affected by spinach and guava leaf extracts. At 25% extract concentration, the inhibition was less and at 50 and 75% concentrations there were a severe inhibition in shoot growth was observed. Similar to root growth, the shoot growth was also affected high with spinach than guava. For comparison, inhibition of shoot growth rate with 100% guava extract is near equal to 75% spinach extract (Figure 3). In V-3, spinach reduced the shoot growth more than guava, but the growth reduction was gradual with gradual increase of extract concentration as in root growth. At 25% and 50% concentrations, the inhibition was less and at 75% extract concentration, the seedlings were roughly near half the length of control seedlings. At 100% extract concentrations, the shoot length of seedlings were ⅓ of control seedlings in guava extract treatment and less than ⅓ of control seedlings length in spinach extract treatment (Figure 4). Reduction of shoot length in spinach [9] and in *Echinochloa crusgalli* L. with rice [12] is previously reported. Dissimilar to our report, Dawood *et al*. [5] reported that the growth and yield of sunflower is induced by aqueous leaf extract of guava. From the above results, it is evident that V-3 variety has more tolerance to the aqueous leaf extracts of both spinach and guava than V-2 variety. Among the two plants tested, spinach is a potential inhibitor of black gram than guava both at germination and seedling growth stage. The presence of different flavonoids at the leaves in spinach may be the important factor for its inhibitory role. Though flavonoids are also reported from guava, these are not similar type to that is present in spinach and their concentration may also vary. Moreover, various environmental factors influence the production of allelochemicals and there is no common mode of action of these compounds on plants [5].

**Table 1: Effect of spinach and guava on seed germination on blackgram var. Vamban-2**

| Plant species | Percentage of seed germination | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2nd day | | | | | 5th day | | | | |
| | C | 25% | 50% | 75% | 100% | C | 25% | 50% | 75% | 100% |
| *S. oleracea* L. | 100 | 60 | 26.6 | 20 | - | 100 | 66.6 | 46.6 | 46.6 | - |
| *P. guajava* L. | 100 | 93.3 | 60 | 46.6 | 6.6 | 100 | 100 | 60 | 46.6 | 13.3 |

**Table 2: Effect of spinach and guava on seed in black gram var. Vamban-3**

| Plant species | Percentage of seed germination | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2nd day | | | | | 5th day | | | | |
| | C | 25% | 50% | 75% | 100% | C | 25% | 50% | 75% | 100% |
| *S. oleracea* L. | 100 | 80 | 60 | 53.3 | 26.6 | 100 | 86.6 | 73.3 | 60 | 26.6 |
| *P. guajava* L. | 100 | 86.6 | 66.6 | 53.3 | 40 | 100 | 86.6 | 73.3 | 53.3 | 40 |

**Figure 1: Effect of spinach and guava on root growth of black gram var. Vamban-2**

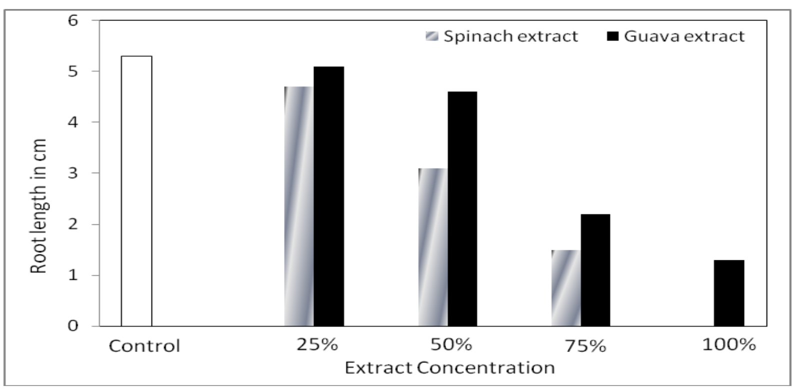



**Figure 2: Effect of spinach and guava on root growth of black gram var. Vamban-3**

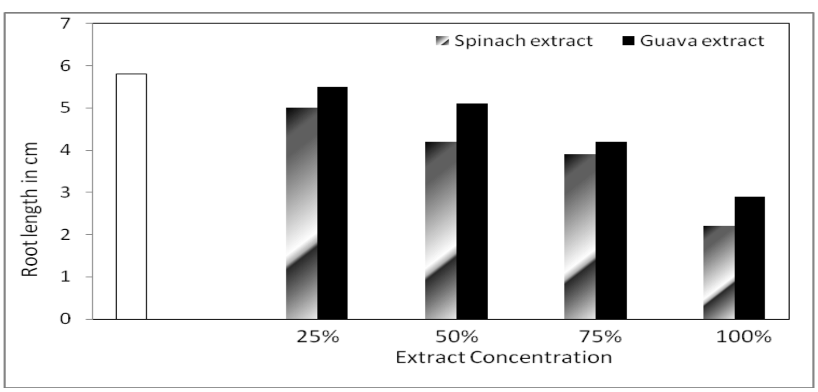


Figure 3: Effect of spinach and guava on shoot growth of black gram var. Vamban-2

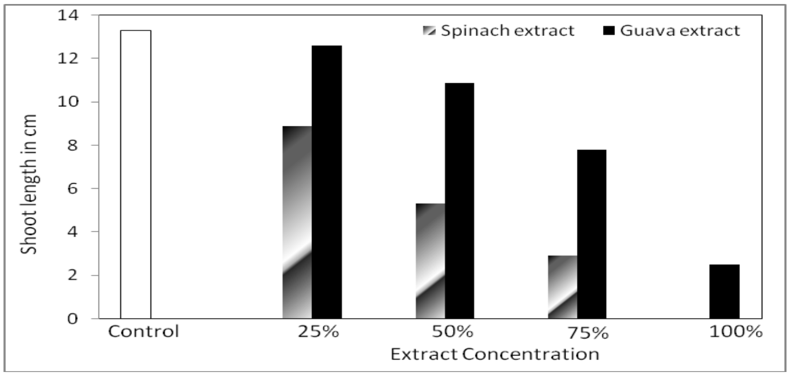
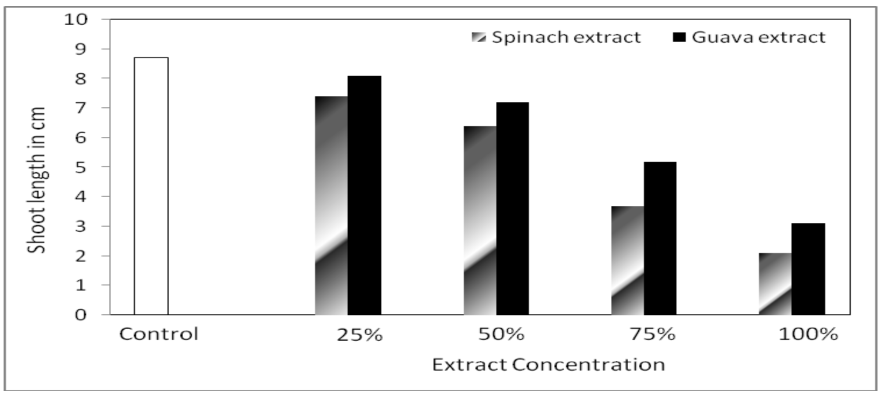



Figure 4: Effect of spinach and guava on shoot growth of black gram var. Vamban-3

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