Allelopathic effect of leaf aqueous extract of *Ipomoea carnea subsp. fistulosa* on Green gram (*Vigna radiata*)

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Abstract

Ipomoea carnea subsp. fistulosa (bush morning glory) is an alien invasive weed species, Native of Latin America (CABI, 2022). *I. carnea subsp. fistulosa* can grow from aquatic ecosystem to xerophytic desert conditions (PROTA, 2017) and is a strong competitor for resources (nutrients and water), with the potential to outcompete native plants. A study was conducted to examine the allelopathic effect of aqueous leaf extract of *I. carnea subsp. fistulosa* on green gram. Aqueous leaf extracts with 5, 10, 15, 20 per cent concentration were treated with green gram seeds and kept for germination in petri plate and roll towel methods. Distilled water served as the control. Employed. The observation on germination percentage, root length, shoot length and DMP clearly indicated the potential allopathic inhibition of *I. carnea subsp. fistulosa* on green gram.

Key words – Allelopathy, Germination, Green gram, Ipomoea

1. Introduction

Biological invasion of alien invasive plants species is considered as one of the most serious threats to the native biological diversity (Millennium Ecosystem Assessment, 2005). *I. carnea subsp. fistulosa* is a broadleaved, perennial, woody shrub weed species propagated vegetatively as well as through seed. *I. carnea subsp. fistulosa* can grow up to 3 m height, axial parts puberulent, later glabrescent with milky sap. Ipomoea is capable of growing with equal ease on land, in water, and in regions of land-water interface. This extraordinary flexibility in terms of habitats gives *Ipomoea* an edge over other dreaded weeds which are either aquatic (e.g., water hyacinth, *Salvinia*), or terrestrial (e.g., *Lantana*, *Parthenium*). Infestation spans from South America, Africa, South Asia and parts of Australian continents of the globe. *I. carnea subsp. fistulosa* has been introduced worldwide as an ornamental and hedge plant. The species has escaped from cultivation to become naturalized and invasive mostly in undisturbed sites, riparian areas and wetlands, ponds and lakes. It is a strong competitor for resources (e.g., nutrients and water), with the potential to outcompete native plants.

Allelopathy of *I. carnea subsp. fistulosa* and other invasive plants has been suggested as a potent mechanism for their extraordinary success over native species (Callaway and Aschehoug, 2000). HPTLC analysis revealed the presence of flavonoids, phenols, tannins and terpenoids in *I. carnea subsp. fistulosa*. The quantity of total flavonoids and total phenols estimated in *I. carnea subsp. fistulosa* was 5.167 µg/ml and 9.717 µg/ml respectively, while, that of Terpenoids and tannic acid were 0.925 µg/ml and 2.078 µg/ml respectively (Jain *et al.,* 2017). The allelopathic potential of the aqueous extracts of root, stem, leaf and fruit of *I. carnea subsp. fistulosa* were examined on seed germination and seedling growth of *Portulaca oleracea* and *Echinochloa crusgalli* weeds which followed the order, leaf> fruit> root> stem (Sadek, 2015). Germination, plumule length, radicle length, and total dry matter of green gram seeds decreased with the increased concentration of *Parthenium hysterophorus L* leaf extract solution. Root growth was more strongly inhibited by the leaf extract than shoot growth (Parthasarathi *et al.,* 2012).

2. Materials and methods

A lab study was undertaken in Agricultural College and Research Institute, Madurai during 2022 to assess the allelopathic effect of *I. carnea subsp. fistulosa* leaf samples on germination of green gram. The leaf samples were collected from nearby infestation. Leaf extract was prepared by grinding one part leaf with two parts of distilled (1: 2 ratio). This extract was taken as 100 per cent stock solution. From this primary stock solution, 5, 10, 15 and 20 per cent serial dilutions were prepared. Green gram seeds were soaked in respective stock solutions and distilled water (control) for 3 hours totalling five treatments and replicated four times in Completely randomized design (CRD). Two sets of germination experiments were conducted *viz*., petri dish method and roll towel method with 25 seeds each. Seedling emergence count was taken on day one, two and three in petri dish method and on seventh day in roll towel method. The parameters such as radicle length, plumule length and dry matter production was observed on seventh day in roll towel method.

3. Results and discussion

Table 1. Percentage reduction in germination of green gram as influenced by leaf extract of

I. carnea subsp. fistulosa

Ipomea leaf extract	Days after sowing (Per cent reduction over control)			
	1 DAS	2 DAS	3 DAS	7 DAS
0%	0.00	0.00	0.00	0.00
5%	6.25	8.71	6.08	3.38
10%	8.77	11.27	14.75	5.98
15%	10.02	13.25	17.50	8.63
20%	13.38	16.40	19.25	9.25
SEd	**0.65**	**1.28**	**0.78**	**0.77**
CD(P =0.05)	**1.41**	**2.73**	**1.67**	**1.65**

Green gram germination was impeded by the leaf extract *of Ipomoea carnea subsp. fistulosa*. The level of inhibition increased with that of leaf extract concentration. On day one, 20 per cent leaf extract had registered 13.38 per cent reduction over control, which was followed by 15 per cent leaf extract (10.02 per cent reduction). Same trend was followed with 20 per cent leaf extract during second and third day of observation, registering 16.40 and 19.25 per cent reductions respectively. The decreasing trend in germination percentage got reduced as the passage of time with 9.25 and 8.63 per cent respectively with 20 per cent and 15 per cent leaf extract on seventh day in roll towel method. This is in agreement with the findings of Belz *et al.*, 2005 where increased concentration of *Parthenium hysterophorus L*. leaf extract resulted in significant decrease in germination, shoot and root growth confirming the allelopathic effect of *Parthenium.* However, the inhibition of germination by parthenin with increasing time of exposure was decremental.

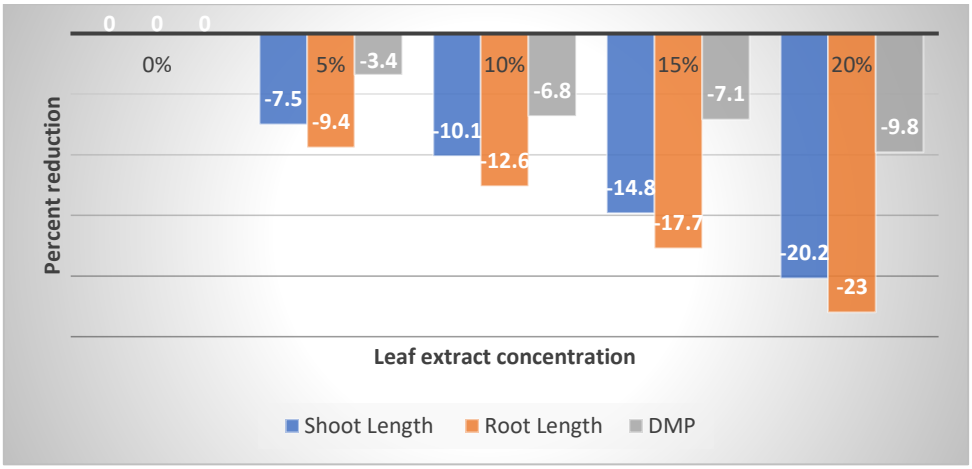

Fig. 1. Shoot length, root length and DMP (Percent reduction over control) of green gram on 7 DAS (Roll towel method)

Shoot length, root length and dry matter production of green gram seedlings got affected by the allelopathic effect of *I. carnea subsp. fistulosa* which is illustrated in Fig. 1. During seventh day, 5, 10, 15, 20 per cent leaf extracts registered 7.5, 10.1, 14.8, 20.2 per cent reduction in root length and shoot length also followed the same trend. The allelopathic effect increased with the concentration of leaf extract, 20 per cent leaf extract had registered a maximum reduction of 23 per cent over control. The inhibitory effect was more pronounced in root length rather than shoot length which is similar to the allelopathic effect of in *I. carnea subsp. fistulosa* plant extract on *Portulaca oleracea* and *Echinochloa crusgalli* as reported by Sadek, 2015. Parthasarathi *et al.,* 2012 also observed allelopathic effect of *Parthenium hysterophorus L*. leaf extract on green gram. Dry matter production also got affected along the concentration gradientand the extent of reduction was 3.4, 6.8, 7.1, 9.8 per cent in 5, 10, 15, 20 per cent leaf extract solutions respectively.

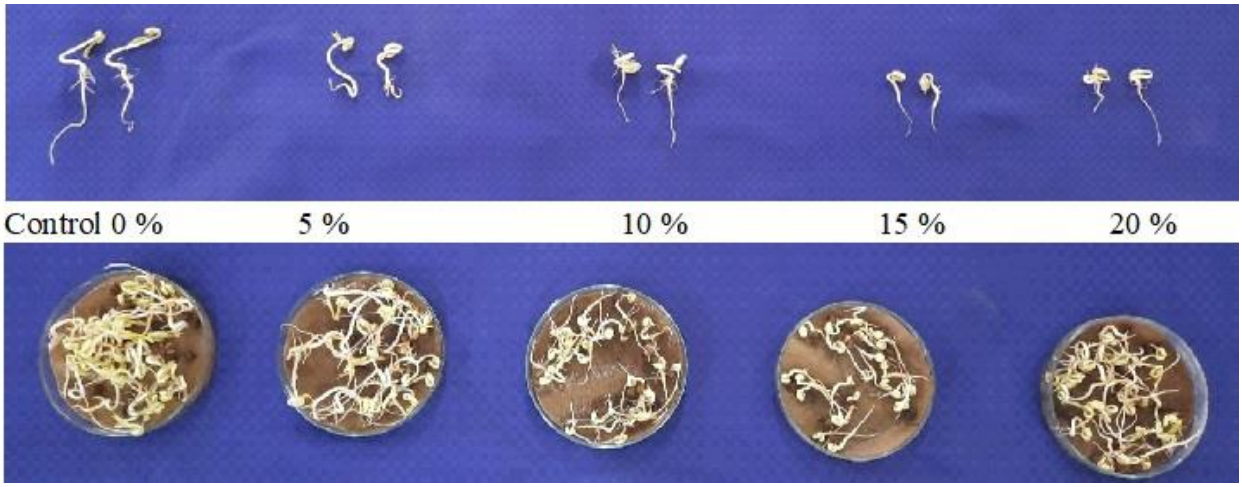

Fig. 2. Effect of *Ipomoea carnea subsp. fistulosa* leaf extract on green gram germination on 3 DAS

4. Conclusion

From the results of the experiment, it could be concluded that, the inhibitory effect of Ipomoea *carnea subsp. fistulosa* increased with the concentration of leaf extract. The germination, shoot length, root length and dry matter production of green gram got affected by allelopathic potential of Ipomoea *carnea subsp. fistulosa*.

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