

Assessment of the Allelopathic Potential of an Invasive Alien Weed *Hyptis suaveolens* (L.) Poit. on Germination of *Oryza sativa* L.

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Abstract: *Hyptis suaveolens* (L.) Poit. is an invasive alien weed commonly known as “*Bana tulsi*” in Odisha belonging to the family Lamiaceae and widely distributed in different parts of India. The leaves of the plant have been reported to be used as stimulant, carminative, sudorific and also as a cure for parasitic cutaneous diseases besides the crude leaf extract is reported to be used against colic and stomach-ache. The leaves are the source of different alkaloids, terpenes and volatile oils having allelopathic effect. In view of this the present work was carried out with an aim to investigate the allelopathic effect upon germination of rice (*Oryza sativa* L.). The result indicated that the higher concentration of the leaf leachate could decrease the percentage of germination besides identified as a potential bio-herbicide.

Key words: Allelopathy, *Hyptis suaveoles*, *Oryza sativa*.

1. Introduction

Rice is the main staple food in the Asia and the Pacific region, providing almost 39% of calories [1]. In transplanted rice, uncontrolled weed growth caused 33%-45% reduction in grain yield of rice besides impairment of the quality of the grain. Rice (*Oryza sativa* L.) is traditionally grown in India by manual transplanting of seedlings into puddled soil. However, growers are shifting towards direct-seeded rice systems, which are considered more profitable and sustainable than flooded transplanted rice because they require less water and man days than the traditional method of transplanted rice [2].

Invasive alien weed species are the plants whose introduction or spread threatens the environment, the agricultural economy, human health and biodiversity of a region. A number of invasive alien weeds have been reported to have curative properties which are

utilized in the traditional systems of medicines. *Hyptis suaveolens* (L.) Poit. is used by the traditional population in several parts of the world to treat inflammation, gastric ulcer and infection and is used as a crude drug to relieve symptoms related with gastric ulcer or gastritis. *Hyptis* is a rigid annual herb of aggressive nature [3] and it contains several chemical constituents such as carbohydrate, phenol, tannin, saponin, alkaloid, steroid and flavonoid etc. which are responsible for its medicinal properties.

Allelopathy is defined as the direct or indirect harmful or beneficial effects of one plant on another through the release of certain chemical compounds into the environment [4]. In many cases, weeds are responsible to threaten the biodiversity of landscapes, forests, national parks and water bodies besides depletion of crop productivity and deteriorating environment. In opposite to negative impacts, weeds are also considered as valuable resource in view of their various uses [5, 6].

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2. Methodology

The leaves of *Hyptis suaveolens* (L.) Poit. were collected from Kapilash forest region of Dhenkanal district, Odisha, were shade dried and leachate was prepared by soaking 50 g of dried powdered leaves in 1,000 mL of distilled sterile water for 48 hrs at 26 ± 10 °C and normal pressure. The solutions were filtered through whatman No.1 filter paper and the leachate of 50 g in 1,000 mL was diluted to 40, 30, 20 and 10 g/L. The different dilutions of leachate were tested against the control (distilled water) on the growth of the test crop *Oryza sativa* L. obtained from National Rice Research Institute, Cuttack, India. Seeds of *Oryza sativa* L. were surface sterilized with 0.1% of mercuric chloride and washed thoroughly with distilled water. Fifty uniform sized seeds were placed in petridishes with different concentrations of leachate and one with control at a constant temperature at 26 °C. Seeds were irrigated with 30 mL of test solutions and distilled water twice a day. Each treatment was replicated five times. The number of seeds germinated in each treatment was counted on fourth day after sowing and the total germination percentage was calculated. Vigour index [7],

Tolerance index of seedlings [8] and percentage of phytotoxicity were also calculated.

3. Results and Discussion

The data on the effect of the leaf residues revealed that the percentage of germination was significantly decreased from 96.5% to 19.2% with the increase in leachate concentration of 0.0 to 50 g/L respectively. Similarly the radicle length of the seedling was also decreased from 5.6 cm to 0.2 cm with an increase in the concentration of the leachate i.e. 0.0 to 50 g/L respectively. Seedling vigour index was found to be decreased with the increase in the concentration of the leachate under use. Similarly the percentage of phytotoxicity was increased with increasing concentration of the leachate. The data of the present investigation are presented in Tables 1 and 2.

Reduction in plant growth was earlier reported under allelopathic stress [9-11]. Similar reports on the growth of tomato, radish, cucumber and barnyard grass being inhibited via water extract of *Lantana camara* [12], and inhibition in root initiation, number of roots and root length of hypocotyls of mung bean and pea was observed when treated with leaf extract

Table 1 Effect of aqueous extract of *Hyptis suaveolens* on seed germination of rice.

Treatments	No. of seed germinated	No. of seed shown	Percentage of germination	Percentage of inhibition
Control	96.4 ± 0.670	100	96.4	3.6
10 g/L	62 ± 0.567	100	62	38
20 g/L	43 ± 0.671	100	43	57
30 g/L	30.4 ± 0.671	100	30.4	69.6
40 g/L	23.2 ± 0.439	100	23.2	76.8
50 g/L	19.2 ± 0.439	100	19.2	80.8

Values of 5 replicate ± SEM.

Table 2 Effect of aqueous extract of *Hyptis suaveolens* on radicle length, seedling vigour index and percentage of phyto-toxicity in *Oryza sativa* L. after 4 days of treatment.

Treatments	Germination percentage	Radicle length (cm)	Seedling vigour index	Percentage of phyto-toxicity
Control	96.4	5.6 ± 0.136	539.84	0
10 g/L	62	3.1 ± 0.084	192.2	44.64
20 g/L	43	2.6 ± 0.068	111.8	53.57
30 g/L	30.4	1.5 ± 0.079	45.6	73.21
40 g/L	23.2	0.8 ± 0.067	18.56	85.71
50 g/L	19.2	0.2 ± 0.047	3.84	96.42

Values of 5 replicates ± SEM.

of *Eucalyptus urophylla* [13]. Literature also revealed about the inhibitory effect of the aqueous extract of five weed species namely *Alternanthera sessilis*, *Echinochola colona* L., *Tridax procumbens* L., *Parthenium hysterophorous* L. and *Cyprus tuborus* upon germination of crop plants like black gram, cluster bean, cotton, ladies finger and rice. The findings of the present study also confirmed the weedcidal effect of the aqueous extract of *Hyptis suaveolens* thereby showing its allelopathic potential [14].

4. Conclusion

The present investigation indicated that *Hyptis suaveolens* had a strong allelopathic effect upon germination of rice. An increasing trend in phytotoxicity was established with an increase in the concentration of the leachate. Hence it is recommended to be removed from crop field before sowing of seed or before plantation. The plant material under study could be a source of potential material for further isolation and identification of allelochemicals to be exploited as natural herbicides to control other weeds. The crude extract or residue of *Hyptis suaveolens* can be recommended to apply directly in the crop field as bio-herbicide.

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