

Allelopathic Effect of *Syzygium Malaccense* on Seed Germination of Selected Crop Plants Found In India

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Abstract- Organic extract derived from the leaves of the edible plant, *Syzygium malaccense* was used to determine their allelopathic potential in relation to the seed germination of the crop plants; black mustard (*Brassica nigra*), chickpea (*Cicer arietinum*), mung bean (*Vigna radiata*), and big gram (*Vigna unguiculata*). The seeds of *Brassica nigra* and *Cicer arietinum* showed the highest susceptibility towards the extract. The methanolic extract of *S. malaccensis* induced 100% inhibition on the germination of *Brassica nigra* and *Cicer arietinum*. *Vigna unguiculata* and *Vigna radiata* were showed 80.23% and 86.33% inhibition respectively. The germination study was conducted using the petri dish method and the percentage of Inhibition of Germination (I) was calculated using specified equation. This results revealed the strong allelopathic potential of *Syzygium malaccense* which necessitates further studies to test its allelopathic effect under field condition and to identify the toxic principle, their quantification and efficacy in the soil.

Keywords: -- Allelopathy, germination, inhibition, *Syzygium malaccense*.

I. INTRODUCTION

The modern agricultural methods are able to increase food production along with serious hazards to the environment, humans and livestock (Bhadoria, 2011). The indiscriminate use of chemical herbicides leads to the production of herbicide resistant strains (Hong *et al.*, 2004). For the development of sustainable agriculture, researchers are now searching a natural mechanism for the destruction of weeds (Islam and Noguchi, 2012).

An ecofriendly weed management technology was evolved based on allelopathy, which is concerned with the interaction of plants by the release of chemical substances into the environment which may affect the growth and life processes of other community species (Willis, 2004; Machado, 2007). Allelochemicals can interfere with physiological reactions like photosynthesis, enzyme activity, nutrient uptake, ATP synthesis etc. (Blum, 2005; Einhellig, 2001). Recently, several efforts have been made to identify and isolate the allelopathic compounds from various sources and apply them as a tool for sustainable and eco-friendly weed control strategy. (Hong *et al.*, 2004; Bhadoria, 2011). *Syzygium malaccense* (L.) Merr. & Perry (Myrtaceae), is a flowering tree native to Malaysia, Indonesia and Australia. It is traditionally used as an antioxidant and anti carcinogen. This plant also possesses several medicinal properties including astringent,

antibiotic, antidiabetic and abortifacient. It is used for treating various ailments such as dysentery, thrush, coughs, headache and high blood pressure (Cai and Corke, 2000; Youdim *et al.*, 2000; Hagiwara *et al.*, 2001; Idham *et al.*, 2011; Morton, 1987).

To the best of our knowledge, no complete study has been performed on the allelopathic effect of *Syzygium malaccense* despite of their long history as potential medicinal plant. Therefore, the present study investigated the allelopathic effects of *Syzygium malaccense* on the germination of seeds of *Brassica nigra*, *Cicer arietinum*, *Vigna radiata*, and *Vigna unguiculata*.

II. MATERIALS AND METHODS

The present study was conducted in the Microbiology and Biochemistry laboratories of St. Thomas College, Pala. The plant was collected from Athirampuzha village in Kottayam District. The criterion for selection of plant species was random.

Preparation of crude extracts: As leaves of the plants contain more secondary metabolites, (Kubikova and Kokoska, 2003) only leaves were used for preliminary screening. Separated leaves from the collected plant were washed in tap water followed by distilled water. 20 grams of fresh leaves were extracted with 100ml of methanol and kept for 24 hours with intermittent shaking. This extract

was evaporated to dryness and redissolved in distilled water and was made upto 100ml of final volume, (20% w/v) considered as 100% stock solution. The stock solution was diluted with distilled water for preparing different concentrations of leaf extracts viz. 25, 50,100% (v/v) and used for seeds germination studies.

Seeds used for preliminary screening: Four types of seeds were used to test the allelopathic effect of the selected plants viz. *V.unguiculata*, *V.radiata*, *C.arietinum* and *B.nigra*. The criteria for the selection of the test seeds are easy availability, ease of handling and fast germination rate. Uniform sized healthy test seeds were surface sterilized with 1% sodium hypochlorite for 20 minutes before the experiment followed by rinsing with distilled water and blotted dry before being sowed.

Germination test: Ten seeds of each species were germinated in 15 cm petri dishes. The sterilized seeds were layered on sterile cotton and soaked with the methanolic extract. The plates were incubated at 28 °C in dark for seven days. Another plate with distilled water was kept as control. The number of seeds germinated was recorded daily from second day onwards. The seeds with visible radicle were considered as germinated (Turkey, 1969). The whole experiment was repeated three times and the average values were expressed. The percentage inhibition of germination has been calculated by using the equation, $I=100-(E_2 \times 100 / E_1)$; where, *I* represents Percentage inhibition, *E*₁ represents response of control plant and *E*₂ represents response of treated plant (Surendra and Pota, 1978).

III. RESULTS AND DISCUSSION

The study suggested the presence of allelochemicals in methanolic leaf extract of *S.malacansis* which inhibited the seed germination of all the tested species. Although *S.malacansis* allowed the seed germination of *V.radiata* and *V.unguiculata* to a certain extent, their seedlings were died or deformed after a few days.

Effect of *S. malacansis* extract on the germination of selected test seeds

The study revealed that the methanolic extract of *S.malacansis* significantly inhibited the seed germination of all the test plant species (Fig. 1 and 2). The highest concentration of the extract displayed 100% inhibition of seed germination in *B.nigra* and *C.arietinum*, and 80.23% and 86.33% inhibition in *V.unguiculata* and *V.radiata* respectively (Table-1).

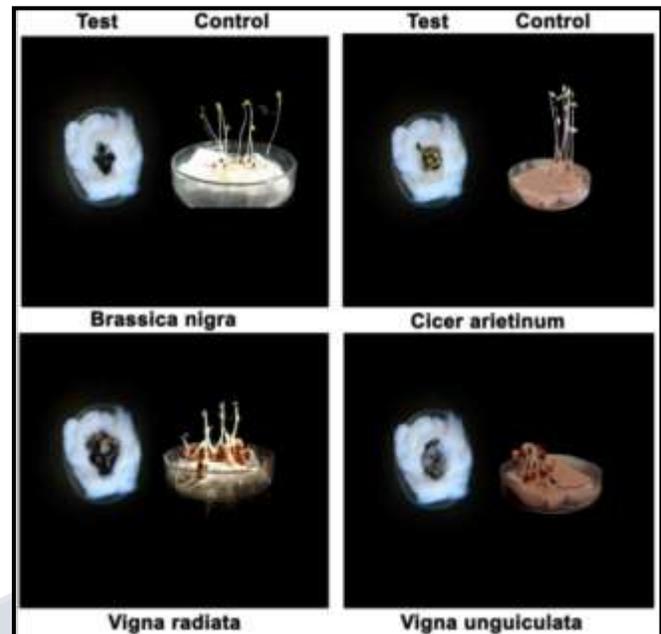


Figure 1: Inhibition of *S.malacansis* extract on selected seeds

Extract (v/v %)	<i>V.unguiculata</i>	<i>V.radiata</i>	<i>B.nigra</i>	<i>C.arietinum</i>
25	33.47±1.76	43.41±1.22	54.48±1.82	58.43±1.94
50	52.67±2.41	68.41±3.02	72.81±1.94	79.62±1.89
100	80.23±2.86	86.33±3.14	100.00±0.00	100.00±0.00

Table 1: Seed germination inhibition by *S.malacansis* methanol extract.

± indicates standard deviation of the data.

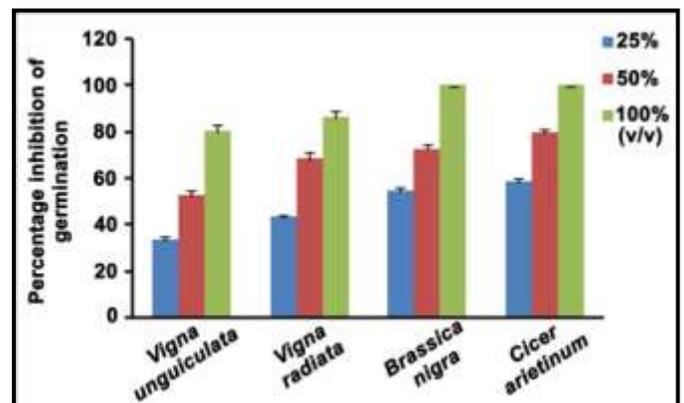


Figure 2: Percentage inhibition of *S.malacansis* extract on selected seeds

Although this is the first study reporting the allelopathic activity of *S.malacansis* towards other plants, its larvicidal and molluscicidal activity were previously

reported by another group of researchers (Marques deet *al*, 2006). Besides, other species of the same plant also displayed allelopathic activity. *Syzygium cumini* showed allelopathic activity against germination and seedling growth of one of the most serious weeds of wheat, *Phalaris minor* Retz. (Javaid. *etal.*, 2006). The allelopathic activity of *S.cumini* against the two most frequent seed borne fungi of wheat, *Alternaria alternata* and *Fusarium solani* was also reported (Shafique *etal.*, 2007). They also reported the suppressive ability of aqueous leaf extracts of *S.cumini* against germination and seedling growth of *Parthenium hysterophorus* L. in 2005.

There were many reports about the allelopathic susceptibility of green gram, black gram etc. Aqueous leaf extracts of *Azadirachta indica* displayed inhibitory effects on the seed germination of *V.radiata*. (Shruthi, 2014). The germination and growth response of *V. radiata* was also inhibited by leaf extracts of *Tectona grandis* L. (Leela and Arumugam , 2014). Delmoral and Muller, 1969 reported a reduction in germination of green gram and garden grass by *Eucalyptus globules*. Experiments revealed the allelopathic effects of *Parthenium hysterophorus* containing phenolic compounds on the germination of green gram, cowpea, black gram, horse gram and pigeon pea (Sasikumar *et al.*, 2002).

IV CONCLUSION

The present study suggested that the methanol extract of *S.malacansis* exhibits strong phytotoxicity and possesses allelochemicals to suppress the growth of other plant species. Comparatively, *B.nigra* and *C.arietinum* displayed more susceptibility than *Vigna* species. All the results were obtained under laboratory conditions. However, further study is needed to explain the allelopathic mechanism and to identify the active principle/s, which might provide chemical basis for the development of bio-herbicides for environment friendly sustainable crop production systems. It may also be investigated to test their efficacy as weeds, pests and disease control agents.

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