ALLELOPATHIC EFFECT OF NYCTANTHES ARBOR-TRISTIS L. ON SEED GERMINATION

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Abstract - Methanolic extract derived from the leaves of the flowering plant Nyctanthes arbor - tristis, was used to determine its allelopathic potential in relation to the seed germination of various plants; Vigna radiata, Vigna unguiculata, Brassica nigra, Cicer arietinum, Lablab purpureus, Amaranthus dudius, Trichosanthes anguina, Chaseolus vulgaris, Oryza sativa, Cucumis sativus, Denincasa histida, Psophocarpus tetragonolobus, and Setaria italic. The extract induced almost 100% germination inhibition and all the tested seeds were attacked by fungi. Only the seeds of Chaseolus vulgaris showed slight resistance towards this extract. The germination study was conducted by the petri dish method. The results revealed the strong allelopathic potential of Nyctanthes arbor - tristis 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, Nyctanthes arbor - tristis

I. INTRODUCTION

To satisfy the food demand of the ever growing population, modern agriculture maximize the yield by improving the seed variety, irrigation methods and management of weeds and pests by using agrochemicals (Seth, 2000). Even these modern methods are able to meet the food demand, it is directly or indirectly affecting the quality of the food produce and also causes serious hazards to the environment, humans & livestocks (Bhadoria, 2011; Richard, 2010). The uninterrupted use of these agrochemicals also leads to the production of weedicide and pesticide resistant strains (Bhadoria, 2011; Fishel, 2007).

To overcome these problems, a cost effective and an ecofriendly weed management technology was evolved based on allelopathy (Mominul Islam and Hisashi Kato-Noguchi, 2012; Seyed Mehdi Razavi, 2011). Allelopathy is any direct or indirect, beneficial or harmful effect of one plant on the other including the microbes through the release of chemicals into the environment (Rice, 1984; Willis, 2004; Bais et al., 2003; Machado, 2007). These chemicals are known as allelochemicals, which are synthesized in plants as secondary metabolites (Todorova, 1996). These phytochemicals are indirectly affects the growth and development of surrounding biological systems and are released by plant degradation, leaching, root exudation, volatilization, residue decomposition etc. (Bertin et al., 2003; Weir et al., 2004; Rice, 1984). Allelochemicals can interfere with physiological reactions in plants like photosynthesis, water utilization, enzyme activity, nutrient uptake, ATP synthesis etc. (Blum, 2005; Reigosa et al., 1999; Einhellig, 2001).
Nyctanthes arbor - tristis Linn., (Oleaceae) a night flowering sad tree is well known in India and its neighbouring countries. This plant is also known as Pavizha malli (Malayalam), Night Jasmine (English) and Harsingar (Hindi) (Champa Rani et al, 2012). Every part of the plant has been used as traditional medicine for household remedies against various human ailments from antiquity and also for the development of some industrial products (Sasmal D et al., 2007; Kirtikar KR and Basu BD). This plant possess various medicinal properties like antihistaminic activity, CNS activities (hypnotic, anesthetics, tranquilising), analgesic, anti inflammatory, antipyretic, antiulcer, antidepressant and immunomodulatory. Amoebicidal, anthelmintic, antitrypanosomal, and antiviral activities are also reported (Sasmal D et al., 2007).
Nyctanthes arbor – tristis has several reported biological properties, though not yet has been explored for its allelopathic potential. Herein, for the first time, we report the allelopathic potential of the methanolic extract of Nyctanthes arbor – tristis leaves against the germination responses of various seeds.

II. DETAILS EXPERIMENTAL

2.1. Materials and Methods

Preparation of crude extracts: As leaves of the plants contain more secondary metabolites only leaves were used for extraction (Kubikova and Kokoska, 2003). Leaves were separated from the collected plants and are washed in tap water followed by distilled water**.** Small pieces of 20 grams fresh leaves were treated with 100ml of methanol and kept for 24hours. Intermittent shaking was given for maximum dissolution of compounds in the solvent. This methanolic extract was evaporated to dryness, redissolved in distilled water and was made up to100ml of final volume (20% w/v) considered as 100% stock solution. It is kept in low temperature until use to prevent the degradation of their allelochemicals. This stock solution was diluted with distilled water for preparing different concentrations

of leaf extracts viz. 25, 50,100% (v/v) and used for seed germination studies.

Seeds used for inhibition assay: Thirteen types of seeds were used to test the allelopathic effect of Nyctanthes arbor - tristis. The seeds used for the inhibition studies are Vigna radiata, Vigna unguiculata, Brassica nigra, Cicer arietinum, Lablab purpureus, Amaranthus dudius, Trichosanthes anguina, Chaseolus vulgaris, Oryza sativa, Cucumis sativus, Denincasa histida, Psophocarpus tetragonolobus, and Setaria italic. The selection of test seeds was based on their easy availability and fast germination rate. Healthy and uniform sized seeds were surface sterilized with 1% sodium hypochlorite for 20 minutes to prevent fungal infection followed by rinsing with distilled water and blotted dry before being sowed.

Germination Test: Petri plate method was used for seed germination inhibition assay. Five sterilized seeds of each test group were treated with Nyctanthes arbor - tristis. Seeds treated with distilled water were served as control. The distilled water was used periodically for moistening the seeds. The petriplates were kept under natural light and dark cycle (Rice, 1984) and grown up to six days. The number of seeds germinated was recorded daily from second day onwards. The seeds with visible radicle were considered as germinated (Turkey, 1969).

III. RESULTS AND DISCUSSION

In order to evaluate the efficacy of allelopathic potential of methanolic leaf extract of Nyctanthes arbor-tristis, it was good to perform an experiment using different types of seeds. All the tested seeds were attacked by fungi and showed almost 100% inhibition in germination. Only the seeds of Chaseolus vulgaris showed slight resistance towards this extract [Figure 1]. The readily visible effects of allelochemicals include inhibited or retarded germination rate, swollen seeds, reduced root and shoot growth, discoloration of seeds and lack of root hairs (Rice, 1974).

The allelopathic activity of Nyctanthes arbor-tristis has not been studied earlier. However, the allelopathic activity of several other plants has been reported on the germination of some of the seeds used in this experiment. The germination and growth response of Vigna radiata (L) was inhibited by Azadirachta indica and Tectona grandis L. (Sruthy et al., 2014: Leela and Arumugam, 2014). Sethuraman and Sanjayan observed the bio – herbicidal effects of Typha angustifolia L. extracts on seed germination and seedling growth of Vigna mungo (L). (Sethuraman & Sanjayan, 2013). Seed germination inhibition was observed in green gram and garden grass by the phytotoxic activity of Eucalyptus (Delmoral & Muller, 1969). Previous experiments revealed the allelopathic effects of Parthenium hysterophorus on the germination of cowpea, blackgram, green gram, horsegram and pigeon pea (Sasikumar et al., 2002).

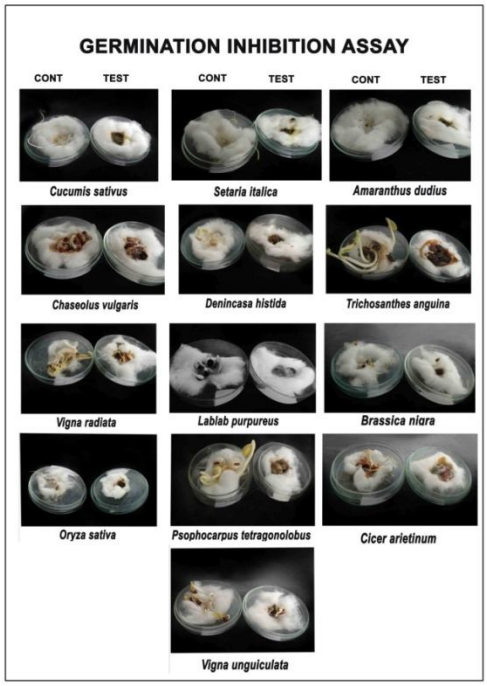

Figure 1. Germination inhibition of Nyctanthes arbor -tristis extract on selected seeds

CONCLUSION

The present study proved the herbicidal potential of the plant, Nyctanthes arbor-tristis Linn. The methanolic leaf extract of this plant exhibited significant allelopathic potential in vitro, as assessed by its germination inhibition activity towards various seeds. This information can provide a strong insight about the allelopathic compound present in the plant Nyctanthes arbor- tristis which leads to the identification of a new natural herbicide.

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