



Allelopathic Effect of Chir Pine Needle Litter on Seedling Growth of Little Seed Canary Grass

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ABSTRACT

The allelopathic potential of Chir Pine litter was investigated under laboratory conditions. The aqueous extracts of needle litter of Chir Pine inhibited the Radicle and plumule growth of Little seed canary grass, a weed. The test plant shows the concentration dependent response. The weed suppressing activity suggests that the Chir Pine litter may be utilized for management of weeds.

KEYWORDS: Chir Pine; Allelopathy; Weed management

1. Introduction

Allelopathy is the chemical mechanism of plant interference characterized by reduction in plant emergence or growth, affecting performance of at least some individuals in association (Putnam 1988). It involves the ecological communications between species (Coder 1999). Allelopathy plays a significant role in forest ecosystems (Wardle et al., 1998) Allelopathic chemicals can be conveyed by trees and affect seed germination, root growth, shoot growth, symbiotic effectiveness, microorganism-based soil transformations, pathological infections, insect injury scope and scale, and environmental stress impacts (Coder 1999). Many forest tree species exert allelopathic effects against either herbaceous species or woody species or both. Plants on the forest floor are constantly exposed to allelochemical in their rooting environment which have ecological consequences like problems of natural regeneration, reforestation, and management (Fisher 1980; Melkania 1982). Stress or exotic species introduction could increase allelopathic interference (Blanco, 2010). Conifer forest ecosystems show strong allelopathic influence (Singh et al 1999). Poor understory vegetation in case of Pinus spp. has been attributed to allelopathy (Kil et al. 1991). Kil and Yim (1983) reported that toxic substances released from Pinus densiflora inhibited seed germination and growth of other species in the forest. An allelopathic substance was isolated from Pinus densiflora which was considered to contribute to inhibition of growth of some test plants (Kato-Noguchi et al, 2009).

Chir Pine (Pinus roxburghii Sargent ; family Pinaceae), native to Himalaya, is commonly planted pine in India. There accumulates a carpet of needles on the forest floor which might release allelochemicals and influence the growth of neighbouring species.

This paper describes the allelopathic effect of Chir Pine needle litter extracts on early growth of little seed canarygrass (Phalaris minor Retz; family Poaceae). The allelopathic influence of bark powder of Chir Pine has been reported in earlier work (Sharma, 2013).

2. Materials and Methods

The litter of Chir Pine was collected from a Chir Pine forest of Himachal Pradesh, India, shade dried and pulverized.

Aqueous extracts of concentration 0.5 %, 1%, 2% and 4% of litter powder were prepared. Pure distilled water served as control. Seeds of little seed canary grass were dipped in distilled water for imbibitions. 20 seeds of test weed were placed in 15 cm diameter Petridish, lined with filter paper and moistened with 10 ml of respective solution or distilled water (control). For each treatment, 3 replicates were maintained. The replicates were kept in completely randomized manner. Germination and growth in terms of radicle and plumule length and biomass of seedlings after one week were recorded. Data was analyzed by one-way ANOVA.

3. Results and discussion

Germination bioassays are used commonly to test target sensitivity to allelochemicals (Pellisier, 1993). The germination was reduced by 30% in 4% concentration of litter extract whereas in

all other treatments the germination rate was unaffected as compared to control, in general. However a significant reduction in growth of seedlings in terms length of radicle and plumule and seedling biomass was observed. There was reduction of 14%, 17%, 41%, and 59% in radicle length in 0.5%, 1%, 2% and 4% treatments respectively as compared to control. Similar trend of inhibition was observed in plumule length. The inhibition of 6 %, 14 %, 28% and 41% was noticed in 0.5%, 1%, 2% and 4% extract treatments respectively in comparison to control. The biomass of seedlings reduced by 28%, 32%, 41% and 43% in 0.5%, 1%, 2% and 4% treatments. The declining trend of growth in all parameters corresponds to concentration of the extracts. The needle litter of Chir Pine contains allelochemicals which suppressed the growth of target plant. The allelochemicals contained in the litter leaches out and also released during decomposition which will have allelopathic influence on plants growing in vicinity in natural conditions. This preliminary study necessitates the investigation of nature of allelochemicals in needles of Chir Pine and their mode of action. The accumulated litter on the forest floor of Chir Pine may prove to be a useful bioresource for weed management. Allelopathy is one strategy to reduce the dependence on herbicides (Kato- Naguchi, 2003) A few preliminary studies have reported the allelopathic effects of extracts of Chir Pine on some crop plants (Khosla et al., 1981; Melkania et al., 1982). The allelopathic effect of Chir Pine litter on different forest trees and crops vis a vis their weeds would be helpful for sustainable weed management by using the litter as mulch or formulating natural herbicides.

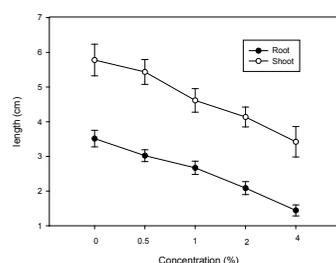


Figure1. The effect of aqueous extracts of needle litter of Chir Pine on radicle and plumule length of little seed canary grass. The vertical bars represents standard error

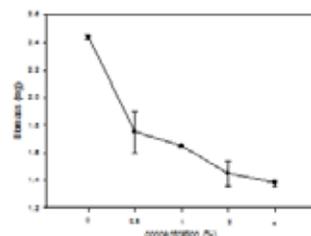


Figure2. The effect of aqueous extracts of needle litter of Chir Pine

on biomass of little seed canary grass. The bar represents standard error.

Acknowledgements

The author is thankful to UGC, New Delhi for financial assistance in the form of a Minor Research Project.

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