Allelopathic Evaluation of *Thlaspi arvense* L. Aqueous Leachates on Jowar *(Sorghum bicolor* L.)

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ABSTRACT: *: Allelopathy is the direct or indirect effect of one plant on another through release of substances in the environment and occurs widely in natural plant communities. The secondary metabolites or natural products involved in allelopathy are called allelochemicals and can be produced in different parts of the plants. The purpose of this study was to evaluate the allelopathic activity of medicinal plant weed Thlaspi arvense L. on jowar (Sorghum bicolor L.) crop. Laboratory bioassay was conducted and biochemical parameters were determined. The root, stem and leaf leachates inhibited the germination percentage and seedling growth of jowar. The allelopathic effect varied in each of the tests and this depends upon type of plant material used for bioassay. However, the magnitude of inhibition of leachates followed the order leaf > root > stem. The hypocotyl length was more affected than radical growth in all three types of leachates. The leaf leachates not only reduced seed germination but also have pronounced decrease in seedling growth of jowar. The plant was chemically analyzed for the presence and confirmation of Allyl isothiocynate by HPTLC method. The inhibitory effects of Thlaspi arvense L. on jowar may be due to the presence of Allyl isothiocynate as allelochemical in the leachates.*

Key Words: *Allelopathy, Thlaspi arvense, Sorghum bicolor.*

INTRODUCTION

The concept that one plant can influence the growth of another is well known in agriculture. The secondary metabolites produced by plants (donor) when released in to the environment play a vital role in ecology, physiology and growth of another plants (recipient) in their vicinity. Many a times, leached chemicals from the plants have allelopathic influence on the germination and growth of subsequent crops (Bansal,G.L.and Bhan, V.M. 1993,Bhatt, B.P. and Chauhan, D.S., 2000,Narwal, S.S., 1994, Prasad, M.N.V. and Subhashini, P., 1994,Rice, E.L., 1979). Leachates are the removal of substances from plants by the action of aqueous solvents (Tukey, 1962). All plants seem to be leachable, although the degree depends on type of tissue, stage of maturity and type, amount and duration of precipitation (Tukey, 1962). A large diversity of allelopathic compounds are leached, both organic and inorganic compounds such as phenolic acids, terpenoids and alkaloids (Tukey, 1964).

Thlaspi arvense is belonging to family Brassicaceae. In vernacular it is known as 'Putali' or Ranmohari. It grows on waste places as a weed of cultivated land where it can be a serious pest (Triska, 1975 and Clapham etal.1962). It is reported as medicinal plant. It is used as Antibacterial, Antitode; Anti-inflamatory, Antirheumatic, Blood tonic, Diaphoretic, Expectorant, Febrifuge, Hepatic, Ophthalmic and tonic (Uphof, 1959 and Usher, 1974). The young leaves are edible and are used as raw or cooked. They should always be harvested before the plant comes in to flower or they will be very bitter (Launert, 1981). Even the young leaves have a somewhat bitter flavour and aroma, and are not to everyone's taste (Launert, 1981 and Harrington, 1967). Use with caution since large doses can cause a decrease in white blood cells, nausea, and dizziness. The seed contains 20-30% of semidrying oil; it is used for lighting (Komarov, 1968). They can be added in small quantities to salads and other foods (Launert, 1981 and Facciola, 1990).They can also be cooked in soups or used as a potherb; they taste somewhat like mustard but with a hint of Onion (Facciola, 1990). The seeds are ground in to a powder and used as a mustard substitute (Tanaka, 1976 and Facciola, 1990). The seed contain abundant oil glycosides when they acted upon the enzymes, mustard oil or similar substances are liberated. Allyl isothiocynate is undoubtedly responsible for the gastric disorders in livestock. If eaten by livestock, it can produce an off flavor in both meat and milk.

Mathela et.al. (1994) reported that the secondary metabolites of many medicinal plants are responsible for allelopathic activity. We want to find out the allelopathic potential of medicinal weed plant succeeding crop. This investigation was aimed to study the behavior of phytochemicals present in *Thlaspi arvense* L. leachates on germination and seedling growth of jowar.

MATERIAL AND METHODS

Leachates Bioassay:

Healthy and mature *Thlaspi arvense* L. plants were collected from agricultural fields of Baramati tahasil in Pune district (M.S.). The freshly collected plants were washed with distilled water so as to remove soil particles and used for bioassays. The Petriplates bioassay consisted three factors (a) soaking periods of plants for preparing leachates (48, 72h), (b) aqueous leachates of three parts of *Thlaspi arvense* and (c) two concentrations (25, 50%). The collected plants were separated and chopped into 2-3cm long pieces. Fresh leaves, stem and roots at 100g each were soaked separately in 250ml distilled water in two different sets i.e. set A(soaked for 48h) and set B (soaked for 72h). The leachates were filtered through Whatman No. 1 filter paper and 100ml of each leachates was diluted to 25 and 50% using distilled water. The leachates were stored at 4°C and used up to 7 days.

In order to study whether these leachates of medicinal plant weed used show allelopathic effect on test crop, surface sterilized 10 seeds of jowar (*Sorghum bilor* L.) were placed in sterilized Petridish (11cm diameter) containing Whatman No. 1 filter paper. 10 ml of each leachates solution were used for moistening filter paper. Each Petridish containing 10 seeds of jowar were kept in triplicate at room temperature (28 ± 2°C). A Petridish containing Whatman No.1 filter paper moistened with distilled water served as control. These Petridishes were wrapped by brown paper so as to avoid direct sunlight. The seeds were allowed to germinate for 8 days. Germination was recorded on 7th day, using emergence of radical as criteria for germination count. On 8th day, seedling length in terms of hypocotyls and radical length were recorded.

Phytochemical Tests:

Preliminary photochemical tests were carried out for the confirmation of Starch (Peach and Tracy, 1955), Proteins (Trease and Evans, 1972), Tannins (Trease and Evans, 1972), Saponins (Trease and Evans, 1972), Reducing sugars and Anthroquinones (Fransworth et al., 1960) in water extractives, while Alkaloids, Glycosides and Flavanoids in alcoholic extractives.

High Performance Thin Layer Chromatography (HPTLC) Analysis:

The allelochemicals constituents were also confirmed with the help of HPTLC method (Passera et.al., 1964). HPTLC is a versatile separation technique included various steps as given below:

i) Selection of HPTLC plates and sorbent
ii) Sample preparation.
iii) Application of sample
iv) Development (separation)
v) Detection including post-chromatographic derivable
vi) Quantitation
vii) Documentation

RESULTS AND DISCUSSION

Root, stem and leaves leachates of Thlaspi caused significant reduction in seed germination and seedling growth of test crop. The higher inhibitory effect was found in leaf leachates as compared to stem and root leachates. The hypocotyl length was more affected than radical growth in all three types of leachates. The leaf leachates not only reduced seed germination but also have pronounced decrease in seedling growth of jowar. In stem and root leachates the seed germinations were reduced to 50 % and 60 % respectively. However, the magnitude of inhibition of leachates followed the order: leaf > root > stem.

The leachates of *Thlaspi arvense* also caused significant reduction in seed germination and seedling growth of jowar. The inhibition was similar in both soaking periods and concentrated leaf leachates caused maximum reduction. The reduction of germination percentage was correlated with reduced seedling growth. The leaf and root leachates of *Thlaspi arvense* inhibited seed germination as well as reduced seedling growth of jowar. This may be due to phytotoxic activity of phytochemicals present in aqueous leachates of *Thlaspi arvense.* The degree of inhibition depends on the concentration of leachates even in soaking period of 72hours. Among all the test leachates, dilute stem leachates had no significant inhibitory effects in both the soaking periods.

Phytochemical analysis of *Thlaspi arvense* has revealed that root, stem and leaves extract with water and alcohol shows presence of Saponins and Alkaloids respectively. However, Starch, Proteins, Tannins, Anthroquinones, Reducing Sugars and Flavanoids are not detected in any part. Aqueous extracts and leaves leachates were found more inhibitory on seed germination and seedling growth of test crop. The root and leaf extract remarkedly suppresses hypocotyl elongation than radical length at various concentrations. Phytochemical studies indicated that leaf contains Saponins, Glycosides and Alkaloids.

These phytochemicals might be responsible for allelopathic potential of the weed. The dark brown colour of leachates also indicates the presence of simple Phenolics, which are commonly, identified allelochemicals in higher plants (Rice, E.L. 1979).

CONCLUSION

With the help of HPTLC technique Allyl isothiocynate was identified and confirmed from *Thlaspi arvense* leaves. However, all the above said phytochemicals were phytotoxic. These results revealed that the leachates of *Thlaspi arvense* contain water soluble phytotoxic chemicals and when released cause inhibitory effects on neighboring plants. Hence precautions should be taken while growing the jowar crop in *Thlaspi arvense* fields. The leachates of decomposed leaf litter present in the field after its harvest, may cause a major damage to succeeding crops, hence leaf litter should be completely removed before sowing the next crop.

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Table No. 1: Table showing Results of Inhibitory effect of Leachates of *Thlaspi arvense* L.

Type of leachates	Germination (%)	Average Seedling length of Jowar (cm)	
		Radical	Hypocotyl
Control	94.86	8.320	5.410
Root	60.73	0.316	0.200
Stem	50.50	0.140	0.380
Leaf	44.82	0.162	0.340

Graph no: 1 Showing inhibitory effects of Leachates of *Thlaspi arvense* L.

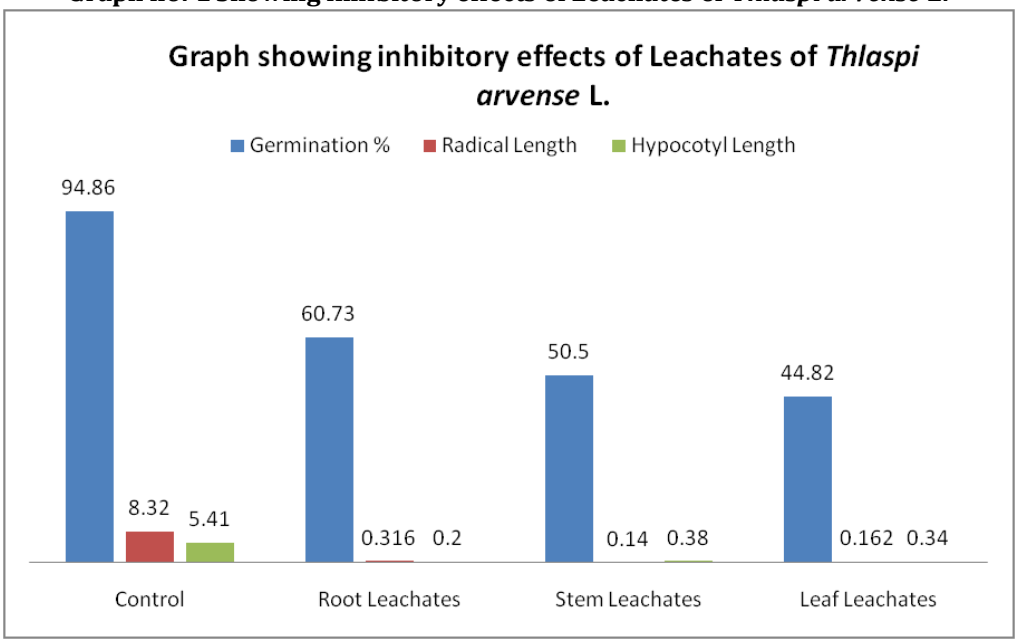

Table No. 2: Table showing Results of Photochemical Tests of *Thlaspi arvense* L.

Test	Root	Stem	Leaves
A)Water Extracts			
Starch	-ve	-ve	-ve
Proteins	-ve	-ve	-ve
Tannins	-ve	-ve	-ve
Saponines	+ve	+ve	+ve
Anthroquinones	-ve	-ve	-ve
Reducing Sugars	-ve	-ve	-ve

B) Alcohol Extracts			
Flavanoids	-ve	-ve	-ve
Alkaloids	+ve	+ve	+ve
Dragendorff'sReagent	+ve	+ve	+ve
Mayer'sreagent	-ve	-ve	-ve
Wagner'sreagent	-ve	-ve	-ve

Fig no: 1.Agriculture Field showing Dominance of Medicinal Plant Weed *Thlaspi arvense* L.

Fig no: 2. Habit of *Thlaspi arvense* L.

Fig no: 3. lowering of *Thlaspi arvense* L.

Detection of Allyl isothiocynainte
***Thlaspi arvense* L.**

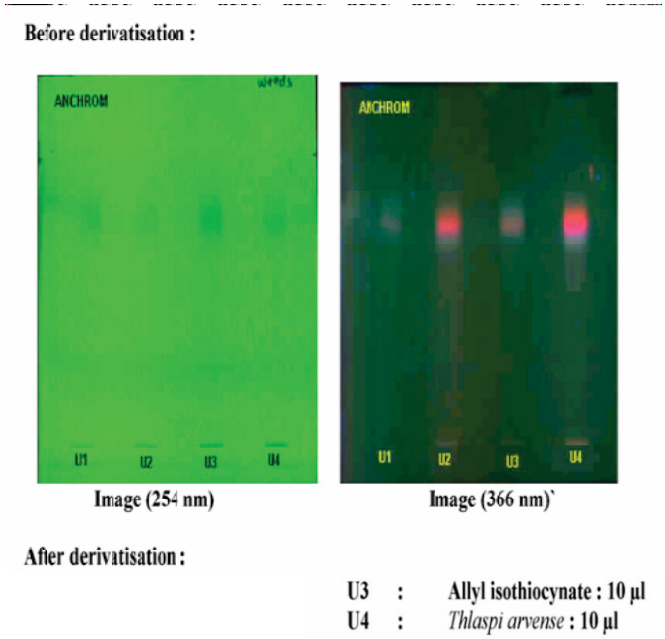

Fig no: 4 HPTLC plate showing detection of Allyl isothiocynate from *Thlaspi arvense* L.

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