ORIGINAL RESEARCH PAPER

Environmental Science

ALLEOPATHIC IMPACT OF WITHANIA SOMNIFERA AND SOLANUM NIGRUM ON PINNISTEUM GLAUCUM (PEARL MILLET)

KEY WORDS: Withania somnifera , Solanum nigrum , Allelopathy, Pennisteum glaucum(pearl millet)

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ABSTRACT

Withania somnifera and *Solanum nigrum* are plants from Solanaceae family that possess medicinal properties .The Present study focuses on evaluation of their allelopathic potential.The seedling growth performance of pearl millet is highly affected in presence of leachates from the plants. The lower concentration (2.5%)of root exracts from *Solanum nigrum* increases root growth(Rg) of Pennisetum glaucum (pearl millet). Leaf extracts from *Withania somnifera* has a inhibitory effect on overall seedling growth.The current study highlights that *Withania somnifera and Solanum nigrum* have stimulate and inhibit the seedling growth in a dose dependant manner.

Introduction:

Allelopathy is any harmful as well as beneficial effect, biochemical and reciprocal interactions among plants [1].Allelopathic interactions are caused by allelochemicals, which are plant secondary metabolites [2]. The higher concentrations of allelochemicals usually stimulate or inhibit the growth of recipient plants and soil microorganisms or both.

Withania somnifera (Solanaceae), *W. somnifera* is mostly used in the herbal drugs and nutraceuticals for the prevention and treatment of various diseases and is therapeutically equivalent to Ginseng.[3] *Solanum nigrum* (Solanaceae) commonly known as black nightshade grows as a weed, found in the dry parts of India and other parts of the world. It has been used as a traditional folk medicine for treating pain, inflammation, fever and liver disorders.[4]These plants from the Solanaceae family have plethora of secondary metabolites with specific pharmacological prospects [5].

The present study is undertaken to focus on interaction of various plant extracts from *Withania somnifera* and *Solanum nigrum* on seedling growth performance of pearl millet.

Materials and Methods

2.1 Collection of Plant Materials:*Solanum nigrum* and *Withania somnifera* were collected from Ahmednagar district, Maharashtra state and identified [6]. Mature green leaves were collected from naturally growing

2.2 Preparation of Aqueous Extracts(leachates):10% aqueous extract was obtained by crushing the leaves ,shoot and root of *Withania somnifera* and *Solanum nigrum* under aseptic conditions The aqueous leachates were filtered through three layers of muslin cloth and Whatman no.1 filter paper [7] . Those filtrates were considered as a stock solution. For further seed germination bioassay the stock were diluted and used in concentration as2.5%(concI) , 5%(concII) and 7.5%(concIII)

2.3 Seed germination bioassays

For germination assays, viable seeds of *Pearl millet* were thoroughly washed with tap water to remove dirt and dust, and rinsed with a mild detergent solution for 5-7 min [8]. The seeds were surfacesterilized with 0.1% mercuric chloride (HgCl2) solution for 10 min and again washed with sterilized distilled water 4-7 times. For each treatment combination, there were three replicates of 10 seeds each. Pre-treated groups were placed in petri dishes on filter paper moistened with distilled water and leachate was Petri dishes were placed in a growth chamber for observation kept undisturbed for 10 d at 25 °C [9,10]. After 10 d observation was made and 2 ml leachate applied to each Petri plate for next 10 d. Treatment was given for 30days.The Data was recorded as radical length (Rg in cm) plumule length (Sg in cm)and Total seedling growth(Tsg in cm) after observation was calculated .

2.4 Data analysis :

Data presented are means of three replicatesand are significantly different at 0.05% P-level . Single factor ANOVA test followed by CD & Tukey's test was performed at significance level in different treatment.

Results and Discussion

3 .1.Effect of leachates from *Solanum nigrum* on seedling growth performance of Pearl millet(graph no 1,2,3)

Acqueous leachates of root , stem and leaves 2.5%, 5% and 7.5% concentrations for durations of five days of *Solanum nigrum*were tested on germination and seedling growth of Pearl Millet

3.11 Effect on Root growth(Rg) of Pearl millet:

A .Effect of root leachate of *Solanum nigrum* on Rg

Solanum nigrum root extract showed increase in root length(Rg) of pearl millet over control for conc I and II , but conc III inhibits the root growth as depicted in graph 1.Root Leachates of conc I and conc II promoted the Rg by 21.4% and 42% respectively but root leachates at a higher concentration inhibited Rg by 8.5%

B .Effect of stem leachate of *Solanum nigrum* Rg

Solanum nigrum stem leachate showed increase in root length(Rg) of pearl millet over control for conc I ,II and conc III as depicted in graph 2 .Stem leachate of conc II promoted Rg by 39.7%.

C .Effect of Leaf leachate of *Solanum nigrum* Rg

Solanum nigrum leaf extract showed increase in Rg of pearl millet over control for conc I and II , but conc III inhibits the root growth as depicted in graph 3 .

Leaf Leachates of conc I and conc II promoted the Rg by 9.3% and 6.7% respectively but root leachates at a higher concentration inhibited Rg by 66%

3.12Effect on Shoot growth (Sg) of Pearl millet:

A .Effect of root leachate of *Solanum nigrum* on Sg:

Solanum nigrum root extract showed increase in shoot length(Sg) of pearl millet over control for conc I and II , but conc III inhibits the shoot growth as depicted in graph 1.Root Leachates of conc I and conc II promoted the Rg by 14.7% and 21.7% respectively but root leachates at a higher concentration inhibited Sg by 5.9%

B .Effect of stem leachate of *Solanum nigrum* Sg:

Solanum nigrum stem leachate showed increase in shoot length(Sg) of pearl millet over control for conc I ,II and conc III as depicted in graph 2 .Stem leachate of conc II promoted Rg by 49.7%.

C .Effect of Leaf leachate of *Solanum nigrum* Sg:

Solanum nigrum leaf extract showed increase in Sg of pearl millet over control for conc I and II but conc III inhibits the shoot growth as depicted in graph 3 .Leaf Leachates of conc I and conc II promoted the Sg by 19.3% and 11.3% respectively but leaf leachates at a higher concentration inhibited Sg by 68%

3.13.Effect on Total seedling growth (TSg) of Pearl millet:
A .Effect of root leachate of *Solanum nigrum* on Tsg:
Solanum nigrum root extract showed increase in Total seedling growth (TSg) of pearl millet over control for conc I and II , but conc III inhibits the shoot growth as depicted in graph 1.Root Leachates of conc I and conc II promoted the TSg by 18.4% and 32.4% respectively but root leachates at a higher concentration inhibited TSg by 7.4%

B .Effect of stem leachate of *Solanum nigrum* Tsg
Solanum nigrum stem leachate showed increase in Total seedling growth (TSg) of pearl millet over control for conc I ,II and conc III as depicted in graph 2 .Stem leachate of conc II promoted Rg by 40.3%.

C .Effect of Leaf leachate of *Solanum nigrum* Tsg
Solanum nigrum leaf extract showed increase in TSg of pearl millet over control for conc I and II , but conc III inhibits the Total seedling growth (TSg)as depicted in graph 3 .Leaf Leachates of conc I and conc II promoted the TSg by 13.5% and 8.6% respectively but leaf leachates at a higher concentration inhibited TSg by 67%

3.2 Effect of leachates from *Withania somnifera* on seedling growth performance of Pearl millet (graph no 4,5,6)
Acqueous leachates of root , stem and leaves 2.5%, 5% and 7.5% concentrations for durations of five days of *Withania somnifera* were tested on germination and seedling growth of Pearl Millet

3.21 Effect on Root growth(Rg) of Pearl millet:
A .Effect of root leachate of *Withania somnifera* on Rg:
Withania somnifera root extract showed increase in root length(Rg) of pearl millet over control for conc I ,II and conc III as depicted in graph 4. Root Leachates of conc I highly promoted the Rg by 85.7%.The trend observed by root leachate in promoting the Rg was as follows: Conc I of root leachate > Conc II of root leachate > Conc III of root leachate

B .Effect of stem leachate of *Withania somnifera* Rg:
Withania somnifera stem leachate showed increase in root length(Rg) of pearl millet over control for conc I , but conc II and conc III inhibited the Rg as depicted in graph 5 .Stem leachate of conc I stimulated the Rg over control by 6% whereas conc II and conc III inhibited Rg by 22% and 37% respectively.

C .Effect of Leaf leachate of *Withania somnifera* Rg:
Withania somnifera leaf extract inhibited Rg of pearl millet over control for conc I, conc II and III as depicted in graph 6 .Leaf Leachates of conc I, conc II and III inhibited the Rg by 28 %, 37% and 43% respectively.

3.22 Effect on Shoot growth (Sg) of Pearl millet:
A .Effect of root leachate of *Withania somnifera* on Sg:
Withania somnifera root extract showed increase in shoot length(Sg) of pearl millet over control for conc I ,II and conc III as depicted in graph 4. Root Leachates of conc I highly promoted the Rg by 18.9%.The trend observed by root leachate in promoting the Rg was as follows: Conc I of root leachate > Conc II of root leachate > Conc III of root leachate

B .Effect of stem leachate of *Withania somnifera* Sg:
Withania somnifera stem leachate showed increase in shoot length(Sg) of pearl millet over control for conc I and II and conc III had inhibitory effect on Sg as depicted in graph 5 . Stem Leachates of conc I and conc II promoted the Sg by 17.9% and 12.3% respectively but stem leachates at a higher concentration inhibited Sg by 3%

C .Effect of Leaf leachate of *Withania somnifera* Sg:
Withania somnifera leaf extract inhibited Sg of pearl millet over control for conc I, conc II and III as depicted in graph 6 .Leaf Leachates of conc I, conc II and III inhibited the Sg by 33%, 41% and 46% respectively.

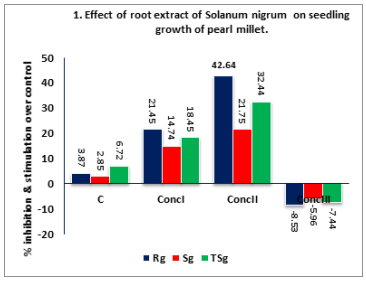
3.33.Effect on Total seedling growth (TSg) of Pearl millet:
A .Effect of root leachate of *Withania somnifera* on Tsg
Withania somnifera root extract showed increase in Total seedling growth (TSg) of pearl millet over control for conc I ,II and conc III as depicted in graph 4. Root Leachates of conc I highly promoted the Rg by 55.7%.The trend observed by root leachate in promoting the Rg was as follows: Conc I of root leachate > Conc II of root leachate > Conc III of root leachate

B .Effect of stem leachate of *Withania somnifera* Tsg
Withania somnifera stem extract showed increase in Total seedling growth (TSg) of pearl millet over control for conc I ,II and conc III as depicted in graph 5. Stem Leachates stimulatory effect on TSg forall the three concentration is 55%, 23% and 2% respectively.

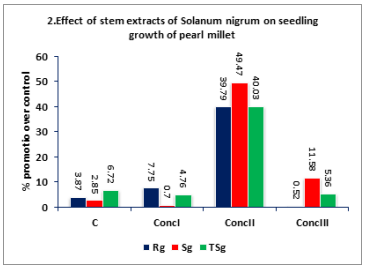
C .Effect of leaf leachate of *Withania somnifera* Tsg
Withania somnifera leaf extract showed inhibitory effect on TSg of pearl millet over control for conc I, II and conc III as depicted in graph 6 . .Leaf Leachates of conc I, conc II and III inhibited the TSg by 31 %, 39% and 44% respectively.

The study helps to understand that the leachates of *Withania somnifera* and *Solanum nigrum* contains allelochemicals which at lower concentration stimulate the Rg ,Sg and TSg but as the concentration of the leachate is increased it shows a inhibitory effect on seedling growth performance. Allelochemicals suppress the mitotic activity of young cells, resulting in inhibition of seedling growth and the effect is dose dependant[11]. Germination is the most critical stage in the establishment of crop *Withania root* extract has shown a stimulatory effect on the germination of the test plant whereas as its leaf extract has shown inihibitory effect at a very high concentration. The extract of the plant could suppress the seed germination of weeds for a longer period, which might be due to chemical inhibitors or allelochemicals existing in them [12].

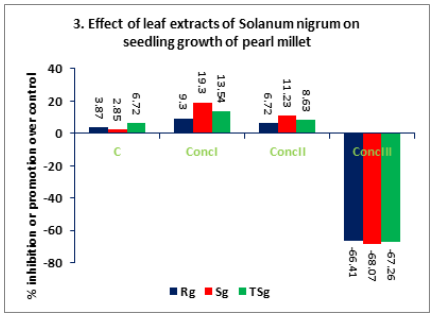
The results of present investigations are in agreement with the above findings as *Withania somnifera and Solanum nigrum* possess a variety of allelochemicals in leaves, stem and roots.In the present study, germination of pearl millet was effected by all the S nigrum and *Withania somnifera* extracts whereas leaf extract was more inhibitory. The greater inhibitory effect of aqueous extract of aerial parts on germination and growth of test species has also been reported in other plant species [13,14].



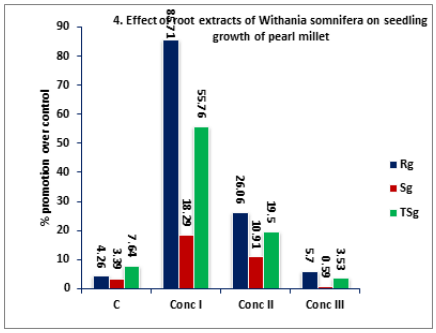
Graph no 1 . Effect of root extract of Solanum nigrum on seedling growth of pearl millet.



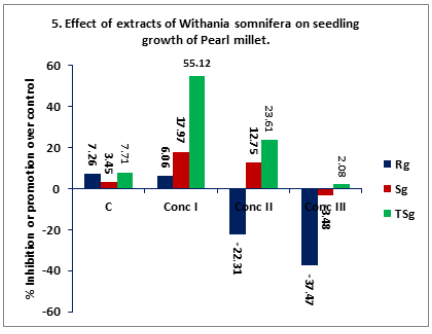
Graph No 2.Effect of stem extracts of Solanum nigrum on seedling growth of pearl millet



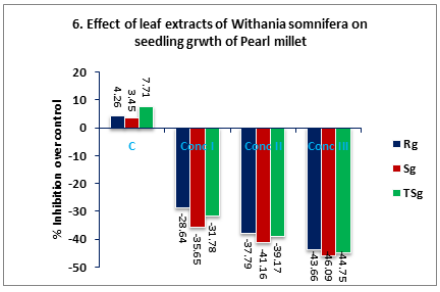
Graph No 3. Effect of leaf extracts of Solanum nigrum on seedling growth of pearl millet



Graph no 4.Effect of root extracts of Withania somnifera on seedling growth of pearl millet



Graph no 5. Effect of extracts of Withania somnifera on seedling growth of Pearl millet.



Graph no 6 Effect of leaf extracts of Withania somnifera on seedling growth of Pearl millet

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