UTILIZATION OF HYDROPHYTE GROWTH PROMOTING SUBSTANCES AND ITS CONSEQUENCE ON N.P.K. CONTENTS IN LENTIL PLANT LEAVES

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Wolffia arrhiza is known as noxious weed and rated as one of the ten major weeds growing country in South-East Asia, commonly infesting natural impounded water in India. Studies have been made for their utilization in multiple ways in developing countries. Aquatic weeds are known to cause problems to varied nature like covering of impounded water, hindrance of fisheries, choking of flowing water, suppressing growth of cultivated plants, making water impotable. Besides such problems they also supplement as sources of fodder, green manure and fish food. In view of the significance of noxious aquatic vegetation, a general consciousness among scientists working in different regions of South-East Asia was evolved to pinpoint problems associated with vast community of aquatic plants and explore possibilities of their utilization for benefit of mankind. Food legumes are amongst the earliest food crops cultivated by man. Their Significance is particularly high because of their complementary nutritional value to cereal dominated diets for masses in the developing countries. In addition to proteins, food legumes are source of several vitamins and mineral nutrients. The effect of growth promoting substances of W. arrhiza extract on N.P.K. contents in Lentil (Lens culinaris, variety D.P.L.,-15) was studied. Pre-soaking seed treatments for 24 hours were given with 1,2 and 5 percent ether and water extracts of W. arrhiza. N, P and K contents were increased in lentil leaves produced to the maximum extent in treatment of 24 hours with 5 percent ether and water extracts. Present finding are of both academic and economical significance of malnutrition in human beings, cattle and need practical adoption in agriculture of lentil by growers of commercial crop.

Out of variety of aquatic plants, duckweeds comprise simplest and smallest flowering plants relegated as botanical curiosities. They have been described as plants without known economic significance in the beginning but now their relevance as fish and duckfood has attracted attention. Nowinska and Rzesz (1972) pointed out the importance of W. arrhiza as a poor man's food for Polish, Burmese and Thai people. They reported on estimated yield of 265 tones of green matter per hectare and 2080 kg of protein per hectare. There are also reports of endogenous gibberellins in floating plants and turions of Wolffia floridana (Pieterse, Bhalla and Sabharwal 1971). It is known that gibberellins have an effect on dormancy and as such duckweeds may prove useful as experimental material for studying dormancy and also serve towards extraction of growth substances for utilization in agriculture. The duckweeds have been rated among ten major noxious weeds (Varshney and Singh 1973) causing major problems in forty-six districts, out of their total occurrence in 77 districts in India. Significance of duckweed in Kanpur is already reported earlier by Tiwari (2000, 2002). It is interesting to remark that estimated trends of duckweed infestations increased in 12 districts, a decline is marked only in one while in 8 districts a constant growth manifests. It may thus, be concluded that lemnoids harbor increased distribution and are potentially useful for their multiple values. Costanza et al. (2014) pointed changes in the global value of ecosystem services. The growth, distribution and periodicity of duckweeds of Kanpur were studied with a view to emphasize their significance by Shukla and Pandey (1979).

Literature excels in excellent experimental work of eminent scientists dealing with aquatic plants; still there are wide gaps in our knowledge to fully exploit W. arrhiza attributes likely to offer solution on an array of botanical quizzes. Extracts of W. arrhiza on vegetative growth (Tiwari 2003) and on yield of lentil studied earlier by Tiwari and Shukla(2007), and utilization of W.arrhiza extracts for improvement of dry weight and number of
nODULES IN LENTIL CROP REPORTED BY TIWARI (2017). PRESENT INVESTIGATION DEALS WITH UTILIZATION OF W. ARRHIZA PLANTS WITH SPECIAL REFERENCE TO NITROGEN, PHOSPHORUS AND POTASSIUM IN LENTIL LEAVES.

MATERIALS AND METHOD

The experimental material was collected from nature in healthy condition and plants of equal size and shape were carefully selected. Selected plants were vigorously washed in tap water to remove adhering debris and algae. Finally, the material was washed with distilled water and cultured in thoroughly acid and distilled water washed rectangular glass containers 2.5' long, 1'broad and 1.5' deep containing culture medium.

In stock cultures, fronds were acclimatized before their use as inoculums in experimental work. The stock cultures were maintained at a temperature of 25 to 30°C with a pH range of 6.5 to 7.5. The cultures were placed in North-South direction near large size glass window of laboratory and were grown under normal sunlight.

Lentil variety D.P.L-15 were selected to study the effect. Genetically tested seeds were obtained from Indian Institute of Pulse Research, Kanpur. Seeds of approximately same size and weight were selected for experiment. The extraction of W. arrhiza were made in water or ether. As ether is injurious to plant growth, it was allowed to evaporate and growth-promoting substances were remain in water. Five millilitre of W. arrhiza by volume was taken and keep in a clean porcelain mortar with water or ether. In case of water extract sufficient water was added to make it 100 ml to have a five percent extract. In case of ether extract, ether was first allowed to evaporate and the suspension was then made to 100 ml in distilled water. 1, 2, and 5 percent extracts were made by further dilutions with distilled water. Fifty seeds were soaked in sterilized petridishes in different concentrations (1, 2 and 5 percent) of water and ether extracts of W. arrhiza and distilled water (control) for 24 hours. The effect of treatments was studied under soil-pot condition using garden soil.

Analytical-Plant Analysis- Dry matter yield was determined by drying the finely chopped and mixed plant samples in a forced drought over at 70°C for 24 hours to constant weight. The samples were taken out from the oven and placed in desiccators, cooled for about an hour and weighted for the determination of yield. Since the dry matter was required for the estimation of different nutrient elements, fresh matter kept for drying was thoroughly cleaned against any surface contamination by first washing with running tap water, rinsing with distilled water and absorbing surface water with clean white blotting sheets. The estimation of potassium, phosphorus were done in oven dry material. The dry matter was thoroughly powdered in pestle and mortar and 0.5 to 1.0 g and then dry material was digested with nitric- per chloric acids (Piper 1942), using 20 ml of nitric acid and 2 ml of per chloric acid per gm. of dry matter. The digestion was carried out to incipient drying stage in 100 ml corning glass. Erlenmeyer flasks on electric hot plate in a fume chamber. The digest was boiled with 20ml of glass distilled water for 5 minute and then made to a suitable volume. Potassium and phosphorus were determined by the method used by D.J.D. Nicholes at Long Aston Research station, Bristol and described by Wallace (1951).

Potassium- Potassium was measured turbid metrically. The turbidity produced at 20°C under standardized conditions described by Wallace (1951) was estimated in colorimeter using wave length 500-520nm. The turbidity produced was measured immediately.

Phosphorus- Phosphorus was determined by the molybdenum reduced phosphomolybidic acid blue colour method in H2SO4 system. The reluctant employed being hydroquinone and
sulphite. The blue colour was determined in colorimeter using wave length 500-520nm. The colour measurement was made with a half an hour of its development.

**Nitrogen**- Nitrogen was determined by Semi-microkjeldahl method. For estimation of nitrogen 100mg. dry matter was treated in cold for two hours with 2% salicylic acid in H$_2$SO$_4$. The salicylic acid was removed by heating with sodium thiosulphate. The sample was then digested by the method described by Chibnall *et al.* (1943). 3ml of nitrogen free sulphuric acid and 0.2 gm. of catalyst, prepared by grinding potassium sulphate, copper sulphate and sodium selenate was added. The digestion was carried out using digestive distillation flask until the digest had become blue. The digest was made to a suitable volume. The ammonia produced was distilled by steam distillation in Markham apparatus into a boric acid buffer in an ammonia free atmosphere and estimated by titration with $\frac{N}{140}$ sulphuric acid reported by Conway ‘O’ Malley indicator (Convey and ‘O’ Malley 1942).

**Statistical Analysis**- Entire data have been statistically analyzed and tested for significance at 5% probability levels, with kind suggestions of C.S.A. University of Agriculture and Technology, Kanpur.

**RESULTS AND DISCUSSION**

**Effect of Ether Extract of *W. arrhiza* on N, P and K percentage in leaves of lentil**-

**Nitrogen Content**- Increased in level of ether extract of *W. arrhiza* upto 5% level increases nitrogen contents in leaves of 30, 45, 60, 75, 90 and 105 days old lentil plant. As compared to control 5% level of ether extract showed significant ($P=0.05$) increased in nitrogen contents in leaves of 30, 45 and 75 days old plant. However increased in nitrogen contents at 5% level of ether extract at 60, 90 and 105 days old plant fail to reach the level of significance over control. 1 % over control, 2 over 1 and 5 over 2% level of extract showed significant ($P=0.05$) increased in nitrogen content of leaves of 30, 45 days old plant. However in 60, 75, 90 and 105 days old plant, value of nitrogen content was found insignificant. Maximum nitrogen contents in leaves 30, 45, 60, 75, 90 and 105 days old lentil plant was observed at 5% ether extract of *W. arrhiza* plant.

**Potassium Content**- Potassium contents of leaves of 30, 45, 60, 75, 90 and 105 days old lentil plant increases with the increase in level of ether extract of *W. arrhiza* plants up to 5% level. Significant ($P=0.05$) increased in potassium contents in leaves of all the age tested of plants was observed at 5% ether extract over control. In all the age tested of lentil plant show significant ($P=0.05$) increase potassium content at 1% over control, 2 over 1 and 5 over 2 % of level of ether extract, except at 1% over control in 90 and 105 days, 2 over 1% in 30, 60 and 105 in 30, 60 and 90 days where increase in potassium contents fails the reach the level of significant . However at control and 1% level of extract value of potassium content was found equal at 30 days growth of plant maximum potassium contents in leaves of 30, 45, 60, 75, 90 and 105 days old lentil plant was observed at 5% level of ether extract.

**Phosphorus Content**- Upto 5% level in increase in level of ether extract of *W. arrhiza* increased phosphorus content in leaves of 30, 45, 60, 75, 90 and 105 days growth of lentil plant. As compared to control 5% level of ether extract showed significant ($P=0.05$) increase in phosphorus contents in leaves of 30, 45, 60 and 75 days old plant and insignificant increased in phosphorus contents in leaves of 90 and 105 days old plant.1% over control at 30,60 and 105 days old plant showed insignificant, and at 45 days significant ($P=0.05$%) increase in phosphorus contents, 2 over 1% showed significant ($P=0.05$) increase at 30 and 45 days and insignificant increase at 60, 75, 90 and 105 days old plant, 5 over 2% at 45, 60 and 75 days
old plant showed significant (P=0.05) and at 30 and 105 days old plant insignificant increase in phosphorus contents. At 75 and 90 days growth value of phosphorus content at control and 1% and at 90 days growth value at 2 and 5% extract level showed equal value for phosphorus contents. Maximum value of phosphorus contents in leaves of 30, 45, 60, 75, 90 and 105 days old plant at 5% level of ether extract.

Effect of Water Extract of *W. arrhiza* on N, P and K percentage in leaves of Lentil

**Nitrogen Content**- Up to 5% increase water extract level of *W. arrhiza* increased nitrogen contents in leaves of 30, 45, 60, 75, 90 and 105 days old lentil plant. As compared to control, 5% water extract level showed significant (P=0.05) increase in nitrogen contents in leaves of all the days of growth tested of plants. Significant (P=0.05) increase in nitrogen contents in leaves of 45 and 105 days growth of plants observed at 1% over control, 2 over 1 and 5 over 2% of water extract level. However in leaves of 30, 60, 75 and 90 days growth of plants at 1% over control, 2 over 1 and 5 over 2% water extract increase in nitrogen contents was found to be insignificant. Maximum nitrogen contents in leaves of 30, 45, 60, 75 and 105 days growth of lentil plant was observed that 5% level of water extract of *W. arrhiza* plants

**Potassium Contents**- Potassium contents in leaves of 30, 45, 60, 75, 90 and 105 days old lentil plant increase with the increase in level of water extract upto 5% level of water extract of *W. arrhiza* plants. As compared to control 5% level of water extract showed significant (P=0.05) increase in potassium contents in level of 30, 45, 60, 75, 90 and 105 days growth of plants. Accept at 1% over controlling in 90 days, 2 over 1% in 60, 75 and 105 days and at 5 over 2% in 60, 90 and 105 days growth showed significant (P=0.05) increase in potassium contents of all other level over their preceding level in respective 30, 45, 60, 75, 90 and 105 days fails to show any significant increase in potassium contents. However values of potassium contents at control and 1% level of water extract were found equal in leaves of 60 days growth. Maximum potassium contents was observed 5% level of water extract of *W. arrhiza* in leaves of 30, 45, 60, 75, 90 and 105 days growth of lentil plants.

**Phosphorus Content**- Increase in phosphorus content in leaves of 30, 45, 60, 75, 90 and 105 days growth of lentil plant was observed with increase in water extract of *W. arrhiza* up to 5% level. As compared to control 5% level of water extract showed significant (P=0.05) increase in phosphorus contents in leaves of 30, 45, 60, 75, 90 and 105 days old plant. 1% over control in leaves of 30 and 45 days growth, 2 over 1% in 30 days growth, and 5 over 2% level in 30 and 75 days growth of plant showed significant (P=0.05) increase in phosphorus content. All other levels over their respected preceding level showed in significant increase in

Table 1: Effect of Ether Extract of *W. arrhiza* on Nitrogen, Potassium and Phosphorus Percentage in leaves of Lentil

<table>
<thead>
<tr>
<th>Days of Growth</th>
<th>Percent Nitrogen</th>
<th>Percent Potassium</th>
<th>Percent Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C 1 2 5 C.D.at 5%</td>
<td>C 1 2 5 C.D.at 5%</td>
<td>C 1 2 5 C.D.at 5%</td>
</tr>
<tr>
<td>30</td>
<td>1.03 1.61 1.07 C.D. at 0.01</td>
<td>0.192 0.192 0.194 0.196</td>
<td>0.004 0.112 0.115 0.119 0.121 0.004</td>
</tr>
<tr>
<td>45</td>
<td>1.09 1.10 1.12 1.13 0.01</td>
<td>0.198 0.200 0.204 0.207 0.001</td>
<td>0.114 0.117 0.120 0.123 0.126 0.001</td>
</tr>
<tr>
<td>60</td>
<td>1.15 1.18 1.18 1.19 0.04</td>
<td>0.212 0.219 0.220 0.222 0.004</td>
<td>0.119 0.121 0.123 0.129 0.131 0.004</td>
</tr>
<tr>
<td>75</td>
<td>1.23 1.24 1.26 1.27 0.04</td>
<td>0.215 0.220 0.227 0.231 0.004</td>
<td>0.124 0.124 0.125 0.130 0.004</td>
</tr>
<tr>
<td>90</td>
<td>1.17 1.17 1.19 1.19 0.04</td>
<td>0.211 0.213 0.219 0.221 0.004</td>
<td>0.119 0.119 0.120 0.120 0.004</td>
</tr>
<tr>
<td>105</td>
<td>1.01 1.04 1.07 1.08 0.04</td>
<td>0.207 0.209 0.212 0.216 0.004</td>
<td>0.108 0.109 0.110 0.111 0.004</td>
</tr>
</tbody>
</table>
phosphorus content in leaves of all the age of plants tested. 1% and control in 90 days and 1% in 75 days and 5 and 2% in 105 days growth of plants showed equal value for phosphorus in 5% level of water extract of *W. arrhiza* plants in levels of 30, 45, 60, 75, 90 and 105 days growth of lentil plants showed maximum phosphorus contents.

**DISCUSSION**

Based on parameter (Hillman, 1961) and preliminary observations made (Shukla, Pandey and Shukla, 1973) parameter of study set up as described earlier for present investigation, bore fruits and revealed interesting results. They provided a new dimension of importance to lemnoids. Security of wetlands and its agricultural and socio-economical significance is reported by Tiwari et al. (2009). The utility of duckweeds in obtaining extracts to be employed in agriculture has further multiplied their importance. A correlative discussion of observations made during present investigation and facts recorded elsewhere in the literature would provide a conceptual synthesis of subject matter. On the basis of increase of N, P and K water extract was found better then ether extract of *W. arrhiza*.

**CONCLUSION**

Large infestation of *W. arrhiza* plants with its known noxious importance is also endowed with great potential to multiply yield and alter quality of lentil crop. The findings are of paramount academic and applied significance, and are proven with promising possibilities for utilization of *W. arrhiza* extracts by growers of commercial crop of lentil for higher and better quality lentil production.

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