CHAPTER 1

STUDIES ON INFLUENCE OF *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH AND DEVELOPMENT OF WHEAT.
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*Lemna paucicostata* EXTRACTS ON
JUVENILE SEEDLING GROWTH AND
DEVELOPMENT OF WHEAT

Influence of water and ether extract suspended in water of *Lemna paucicostata* has been studied on growth and development of wheat seedlings employing Garrard's (1954) technique. The effect has been studied on wheat variety “Shekhar/K 7410”. Pre-soaking seed treatment for 6, 12 and 24 hrs. was given with *Lemna paucicostata* extracts to study the effect on germination, growth and development of wheat plants. The observations are recorded below.

6 HRS PRE-SOAKING SEED TREATMENT WITH WATER EXTRACT :

Length of Primary Root :

Observations on effect of pre-soaking seed treatment on length of primary root have been recorded in Table-1 and Graph 1. A perusal of data shows that different concentrations of water extract (1, 2 and 5 percent) exercise a sustained beneficial effect. Treatment
TABLE - 1: EFFECT OF 6 HRS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH.

**WATER EXTRACT**

<table>
<thead>
<tr>
<th>AGE OF SEEDLINGS</th>
<th>LENGTH OF PRIMARY ROOT (IN CM)</th>
<th>NUMBER OF SECONDARY ROOTS</th>
<th>LENGTH OF PLUMULE (IN CM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>48 HRS</td>
<td>3.05</td>
<td>3.81</td>
<td>4.67</td>
</tr>
<tr>
<td>72 HRS</td>
<td>4.69</td>
<td>4.94</td>
<td>6.13</td>
</tr>
<tr>
<td>96 HRS</td>
<td>5.04</td>
<td>6.78</td>
<td>7.82</td>
</tr>
</tbody>
</table>

C.D. = 1.25
DIFFERENCE : 96 HRS
5%-Control = 4.84

C.D. =1.14
DIFFERENCE : 96 HRS
5%-Control = 1.66

C.D. =0.68
DIFFERENCE : 96 HRS
5%-Control = 3.17

**ABBREVIATIONS USED** : C - Control and C.D.- Critical Difference.
GRAPH - 1: EFFECT OF 6 HOURS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH

WATER EXTRACT

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>48 HRS</th>
<th>72 HRS</th>
<th>96 HRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPR</td>
<td>CONTROL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LPR - LENGTH OF PRIMARY ROOT
NSR - NO. OF SECONDARY ROOTS
LP - LENGTH OF PLUMULE

48 HRS | 72 HRS | 96 HRS

In cm

In percent

LPR | NSR | LP
with 5 percent marks maximum promotion and the effect gradually decreases with decrease in concentration of extracts.

The increase in length of primary root is witnessed throughout the observation upto 96 hrs.

The results have been statistically analysed following analysis of variance method and the effect with 5 percent water extract has been found to be significant, at 5 percent error probability.

**Number of Secondary Roots:**

Results on response of number of secondary roots following pre-soaking seed treatment entered in Table-1 and Graph 1 show that treatment with different concentrations (1, 2 and 5 percent) exercise marked increase in number of secondary roots, developed in seedlings treated with 5 percent water extract. The beneficial effect of treatment was observed from the beginning of observations and was maintained in subsequent observations upto 96 hrs.

Statistical analysis of results shows that observed increase in number of secondary roots with 5 percent treatment is significant at 5 percent error probability.
Length of Plumule:

A perusal of data given in Table-1 and Graph-1 show that treatment with various concentrations (1, 2 and 5 percent) of water extract increases length of plumule throughout observations upto 96 hrs. Gradual increase in concentration of water extract applied brings about stimulated growth of plumule throughout the duration of experiment. However, treatment with 5 percent is maximum in effectiveness.

Statistical analysis of results was made following analysis of variance method. Observed increase in length of plumule with 5 percent water extract has been found to be significant at 5 percent error probability.

INFLUENCE OF 6 HRS PRE-SOAKING SEED TREATMENT WITH ETHER EXTRACT SUSPENDED IN WATER:

Length of Primary Root:

Observations on effect of pre-soaking seed treatment on length of primary root have been recorded in Table-2 and Graph-2. A perusal of data shows that different concentrations (1, 2 and 5 percent) of ether extract exercise a sustained beneficial effect. Treatment
with 5 percent marks maximum promotion and the effect gradually decreases with increase in concentration of extracts.

The results have been statistically analysed following analysis of variance method and the effect with 5 percent ether extract has been found to be significant at 5 percent error probability.

**Number of Secondary Roots:**

Results given in Table-2 and Graph-2 show that there is an overall reduction in the number of secondary roots with different concentration (1, 2 and 5 percent) of ether extract. Gradual increase in concentration of extract applied declines the number of secondary roots and 5 percent is maximum in effectiveness.

Statistical analysis of data shows that observed increase with 5 percent ether extract in number of secondary roots is significant at 5 percent error probability.

**Length of Plumule:**

A perusal of data given in Table-2 and Graph-2 show that treatment with various concentrations (1,
### Table 2: Effect of 6 Hrs Pre-soaking Seed Treatment with *Lemna paucicostata* Extracts on Juvenile Seedling Growth.

#### Ether Extract

<table>
<thead>
<tr>
<th>Age of Seedlings</th>
<th>Length of Primary Root (in cm)</th>
<th>Number of Secondary Roots</th>
<th>Length of Plumule (in cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>48 HRS</td>
<td>2.02</td>
<td>2.98</td>
<td>3.36</td>
</tr>
<tr>
<td>72 HRS</td>
<td>3.20</td>
<td>3.99</td>
<td>5.25</td>
</tr>
<tr>
<td>96 HRS</td>
<td>4.04</td>
<td>4.87</td>
<td>5.35</td>
</tr>
</tbody>
</table>

C.D. = 1.00  
Differences: 96 HRS  
5%-Control = 4.44

C.D. = 1.02  
Differences: 96 HRS  
5%-Control = 4.86

C.D. = 1.23  
Differences: 96 HRS  
5%-Control = 5.14

**Abbreviations Used:** C - Control and C.D. - Critical Difference.
GRAPH - 2: EFFECT OF 6 HOURS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH

ETHER EXTRACT

**LPR**

**NSR**

**LP**

C - CONTROL

48 HRS

72 HRS

96 HRS

LPR - LENGTH OF PRIMARY ROOT

NSR - NO. OF SECONDARY ROOTS

LP - LENGTH OF PLUMULE

48 HRS

72 HRS

96 HRS
2 and 5 percent) of ether extract decreases length of plumule. Gradual increase in concentration of ether extract applied brings about declined growth of plumule throughout the duration of experiment. However, treatment with 5 percent is maximum in effectiveness has been found to be significant at 5 percent error probability.

**INFLUENCE OF 12 HRS PRE-SOAKING SEED TREATMENT WITH WATER EXTRACT:**

**Length of Primary Root:**

A perusal of data entered in Table-3 and Graph-3 indicate that 1, 2 and 5 percent water extracts exercise a beneficial effect on length of primary root while 5 percent is minimum in effectiveness, 5 percent promotes length of primary root to the maximum extent. An overall stimulatory effect is apparent at different observation periods.

The results were statistically analysed following analysis of variance method and results suggest that treatment with 5 percent water extract exercises statistically significant promotion in length of primary root.
TABLE - 3:  EFFECT OF 12 HRS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH.

**WATER EXTRACT**

<table>
<thead>
<tr>
<th>AGE OF SEEDLINGS</th>
<th>LENGTH OF PRIMARY ROOT (IN CM)</th>
<th>NUMBER OF SECONDARY ROOTS</th>
<th>LENGTH OF PLUMULE (IN CM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>48 HRS</td>
<td>2.17</td>
<td>3.11</td>
<td>3.98</td>
</tr>
<tr>
<td>72 HRS</td>
<td>3.75</td>
<td>4.44</td>
<td>5.83</td>
</tr>
<tr>
<td>96 HRS</td>
<td>4.33</td>
<td>5.01</td>
<td>5.86</td>
</tr>
</tbody>
</table>

C.D. = 1.02  
DIFFERENCE: 96 HRS  
5%-Control = 4.61  

C.D. = 0.82  
DIFFERENCE: 96 HRS  
5%-Control = 2.21

C.D. = 1.26  
DIFFERENCE: 96 HRS  
5%-Control = 3.85

**ABBREVIATIONS USED**: C - Control and C.D. - Critical Difference.
GRAPH - 3: EFFECT OF 12 HOURS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH

**WATER EXTRACT**

- **LPR** - LENGTH OF PRIMARY ROOT
- **NSR** - NO. OF SECONDARY ROOTS
- **LP** - LENGTH OF PLUMULE

- **C** - CONTROL
- **48 HRS**
- **72 HRS**
- **96 HRS**

![Graphs showing growth changes](image-url)
**Number of Secondary Roots:**

Observations on response of number of secondary roots to pre-soaking seed treatment with 1, 2 and 5 percent water extracts are given in Table-3 and Graph-3. The data is suggestive that all treatments have a sustained beneficial effect on number of secondary roots. However, the emergence of number of secondary roots increases with gradual increase in concentration of water extract. Influence of 5 percent water extract is maximum.

The data has been statistically analysed following analysis of variance method and observed increase with 5 percent water extract has been found to be statistically significant at 5 percent error probability.

**Length of Plumule:**

A perusal of data given in Table-3 and Graph-3 show that treatment with various concentrations (1, 2 and 5 percent) of water extract increases length of plumule. Gradual increase in concentration of water extract applied brings about stimulated growth of plumule throughout the duration of experiment. However, treatment with 5 percent is maximum effectiveness.
The statistical analysis of results was made following analysis of variance method. Observed increase in length of plumule with 5 percent water extract has been found to be significant at 5 percent error probability.

INFLUENCE OF 12 HRS PRE-SOAKING SEED TREATMENT WITH ETHER EXTRACT SUSPENDED IN WATER:

Length of Primary Root:

A perusal of data entered in Table-4 and Graph-4 indicate that 1, 2 and 5 percent ether extracts exercise a gradual declined effect on length of primary root while 5 percent is minimum in effectiveness, 5 percent promotes length of primary root to the maximum extent.

The results were statistically analysed following analysis of variance method and results suggest that treatment with 5 percent ether extract exercises statistically significant promotion in length of primary root.

Number of Secondary Roots:

Results on response of number of secondary roots following pre-soaking seed treatment entered in
**TABLE - 4:** EFFECT OF 12 HRS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH.

**ETHER EXTRACT**

<table>
<thead>
<tr>
<th>AGE OF SEEDLINGS</th>
<th>LENGTH OF PRIMARY ROOT (IN CM)</th>
<th>NUMBER OF SECONDARY ROOTS</th>
<th>LENGTH OF PLUMULE (IN CM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>48 HRS</td>
<td>2.68</td>
<td>3.20</td>
<td>3.48</td>
</tr>
<tr>
<td>72 HRS</td>
<td>4.56</td>
<td>4.04</td>
<td>4.84</td>
</tr>
<tr>
<td>96 HRS</td>
<td>4.92</td>
<td>5.43</td>
<td>7.48</td>
</tr>
</tbody>
</table>

C.D. = 1.72  
DIFFERENCE: 96 HRS  
5% - Control = 4.70

C.D. = 0.71  
DIFFERENCE: 96 HRS  
5% - Control = 2.80

C.D. = 0.79  
DIFFERENCE: 96 HRS  
5% - Control = 2.63

**ABBREVIATIONS USED:** C - Control and C.D. - Critical Difference.
GRAPH - 4: EFFECT OF 12 HOURS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH

ETHER EXTRACT

- **C** - CONTROL
- **48 HRS**
- **72 HRS**
- **96 HRS**

**LPR** - LENGTH OF PRIMARY ROOT
**NSR** - NO. OF SECONDARY ROOTS
**LP** - LENGTH OF PLUMULE

48 HRS
72 HRS
96 HRS
Table-4 and Graph-4 show that treatment with different concentration (1, 2 and 5 percent) exercised marked decrease in the number of secondary roots in seedlings. The declined effect of treatment was observed from the beginning of observations and was maintained in subsequent observations upto 96 hrs.

The statistical analysis of results shows that observed increase in number of secondary roots with 5 percent treatment is significant.

**Length of Plumule :**

Observations given in Table-4 and Graph-4 show that various concentrations of ether extract exercises declined effect on length of plumule. With increase in concentration of ether extract a corresponding decrease in length of plumule is observed. However, 5 percent treatment is maximum in effectiveness. A gradual declined effect of treatment is maintained throughout the period of experiment.

The statistical analysis of data shows that effect of 5 percent ether extract is significant at 5 percent error probability.
INFLUENCE OF 24 HRS PRE-SOAKING SEED TREATMENT WITH WATER EXTRACT:

Length of Primary Root:

A perusal of Table 5 and Graph-5 indicate that while 1, 2 and 5 percent extracts promote the length of primary root over control 5 percent extract marks a deplition in length of primary root at the end of observation. However, 2 percent water extract has been distinctly stimulatory and promoted length of primary root to the maximum extent.

Statistical analysis of data suggested that observed increase in length of primary root with 2 percent water extract is significant at 5 percent error probability.

Number of Secondary Roots:

Results given in Table 5 and Graph-5 show that there is an increase in number of secondary roots from the beginning and the effect is maintained throughout the duration of experiment. While 2 percent extract exercises maximum increase in number of secondary roots, lowering or increase in concentration of extract correspondingly reduces the influence.
TABLE - 5: EFFECT OF 24 HRS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH.

**WATER EXTRACT**

<table>
<thead>
<tr>
<th>AGE OF SEEDLINGS</th>
<th>LENGTH OF PRIMARY ROOT (IN CM)</th>
<th>NUMBER OF SECONDARY ROOTS</th>
<th>LENGTH OF PLUMULE (IN CM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>48 HRS</td>
<td>2.97</td>
<td>3.11</td>
<td>4.19</td>
</tr>
<tr>
<td>72 HRS</td>
<td>3.76</td>
<td>4.21</td>
<td>7.54</td>
</tr>
<tr>
<td>96 HRS</td>
<td>4.93</td>
<td>5.17</td>
<td>7.73</td>
</tr>
</tbody>
</table>

| C.D. = 1.25 | C.D. = 0.83 | C.D. = 0.89 |
| DIFFERENCE : 96 HRS | DIFFERENCE : 96 HRS | DIFFERENCE : 96 HRS |
| 2%-Control = 2.80 | 2%-Control = 1.88 | 2%-Control = 4.20 |

**ABBREVIATIONS USED**: C - Control and C.D. - Critical Difference.
GRAPH - 5:  EFFECT OF 24 HOURS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH

**WATER EXTRACT**

**LPR**

**NSR**

**LP**

- **C** - CONTROL
- **48 HRS**
- **72 HRS**
- **96 HRS**

**LPR** - LENGTH OF PRIMARY ROOT
**NSR** - NO. OF SECONDARY ROOTS
**LP** - LENGTH OF PLUMULE

- **48 HRS**
- **72 HRS**
- **96 HRS**
The data was statistically analysed following analysis of variance method and the effect of 2 percent water extract at 96 hrs has been found to be significant at 5 percent error probability.

**Length of Plumule:**

Results given in Table 5 and Graph-5 show that length of plumule increase to the maximum extent with 2 percent water extract. Other concentrations (1 and 5 percent) of water extract although stimulatory are effective to lesser extent than 2 percent. The beneficial effect of treatment is maintained throughout experimental period.

Statistical analysis of data shows that increase in length of plumule with 2 percent over normal untreated seedlings is significant at 5 percent error probability.

**INFLUENCE OF 24 HRS PRE-SOAKING SEED TREATMENT WITH ETHER EXTRACT SUSPENDED IN WATER:**

**Length of Primary Root:**

An examination of data given in Table 6 and Graph-6 show that there is an increase in length of primary root with 5 percent of ether extract suspended in water. Treatment with 5 percent ether extract
## TABLE 6: EFFECT OF 24 HRS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH.

### ETHER EXTRACT

<table>
<thead>
<tr>
<th>AGE OF SEEDLINGS</th>
<th>LENGTH OF PRIMARY ROOT (IN CM)</th>
<th>NUMBER OF SECONDARY ROOTS</th>
<th>LENGTH OF PLUMULE (IN CM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>48 HRS</td>
<td>2.82</td>
<td>3.04</td>
<td>3.69</td>
</tr>
<tr>
<td>72 HRS</td>
<td>3.37</td>
<td>4.01</td>
<td>4.73</td>
</tr>
<tr>
<td>96 HRS</td>
<td>4.03</td>
<td>4.89</td>
<td>6.47</td>
</tr>
</tbody>
</table>

C.D. = 0.80
DIFFERENCE: 96 HRS
5%-Control = 2.67

C.D. = 0.39
DIFFERENCE: 96 HRS
5%-Control = 2.80

C.D. = 0.74
DIFFERENCE: 96 HRS
5%-Control = 3.39

**ABBREVIATIONS USED:** C - Control and C.D. - Critical Difference.
GRAPH - 6: EFFECT OF 24 HOURS PRE-SOAKING SEED TREATMENT WITH *Lemna paucicostata* EXTRACTS ON JUVENILE SEEDLING GROWTH

**ETHER EXTRACT**

- **C**: Control
- **48 HRS**: 48 hours
- **72 HRS**: 72 hours
- **96 HRS**: 96 hours

**Variables**

- **LPR**: Length of primary root
- **NSR**: Number of secondary roots
- **LP**: Length of plumule

**Graphs**

- **LPR**
- **NSR**
- **LP**

**Axes**

- Y-axis: Length in cm
- X-axis: Concentration (C, 1%, 2%, 5%)

**Bar Chart**

- **In percent**
  - **LPR**
  - **NSR**
  - **LP**

**Legend**

- **48 HRS**: Shaded
- **72 HRS**: Light gray
- **96 HRS**: Solid black
suspended in water increases length of primary root to the maximum extent. Lowering as well as increase in concentration of ether extract gradually reduces the effect.

Results obtained were statistically analysed and the data showed that observed increases with 5 percent ether extract suspended in water is significant.

**Number of Secondary Roots:**

Observations given in Table-6 and Graph-6 indicate that various concentrations of ether extract multiply number of secondary roots over control. Maximum number of secondary roots has found in treatment with 5 percent ether extract suspended in water. Both higher or lower concentrations that 5 percent deplete number of secondary roots.

The results were statistically analysed following analysis of variance method and observed increase in number of secondary roots has been found significant at 5 percent error probability.

**Length of Plumule:**

Observation given in Table-6 and Graph-6 show that length of plumule increases to the maximum