Chapter VIII

Evaluation of Mineral Contents
EVALUATION OF MINERAL CONTENTS

The present investigation deals with mineral contents of roots, shoots, and fruits of Clerodendrum phlomidis, Lycium babarum and Sida cordifolia.

Materials and Methods

The roots, shoots and fruits of all the three selected plant species taken for present investigation, were collected from Chohatan, Pachpadra and Sindari areas of Barmer district.

Plant parts of Clerodendrum phlomidis, Lycium babarum and Sida cordifolia were collected in polythene bags. The samples were dried powdered and then used for estimation of minerals i.e. Phosphorus, Calcium, Potassium and Sodium.

Estimation of Calcium and Phosphorus

For the estimation of Calcium and Phosphorus method given by Talpatra et al., (1940) was followed.

For the estimation of Calcium and Phosphorus 100 ml. of 50% hydrochloric acid was added to the ash in crucible and contents were heated in waterbath for 10 minutes. The contents were transferred to 250 ml. beaker along with the washing till the crucible was free of acid. The contents were heated for 30 minutes and after cooling, filtered through ashless Whatman's filter paper no. 42. The volume of filtered solution was made to 250 ml. with distilled water and kept as a stock solution for the estimation of Calcium and Phosphorus.
Procedure for Calcium Content Estimation

25 ml. of stock solution was taken in a beaker of 250 ml. 50 ml. of distilled water and 10 ml. of saturated ammonium oxalate was added. Two drops of alcoholic acid was also added. Acidity of solution was adjusted at the pH 4.6 by adding concentrated ammonia solution drop by drop till a brown coloured precipitate began to appear and then dilute ammonia solution was added till white coloured precipitate appeared.

The content of the beaker were kept overnight allowing the precipitate to settle down and on the next day the solution was filtered through Whatman filter paper number 40. The precipitate was washed several times with hot distilled water to remove excess oxalate. Precipitate was dissolved in 100 ml. distilled water and 10 ml. concentrated sulphuric acid. This solution was heated at 60-70°C for 30 minutes and filtered against N/10 potassium permanganate solution. The filtration was carried out until a stable pink colour appeared. The Calcium contents were calculated as follows:

\[
\text{ml. of KMnO}_4 \times 0.002 \times 10 \times 100
\]

\[
\frac{\text{Percentage of Calcium}}{\text{gm. of sample taken for ashing}}
\]

Where, 10 is the dilution factor.

Procedure for Phosphorus Content Estimation

From the stock solution of acid soluble ash 25 ml. aliquot was taken in 250 ml. of a beaker in which 10 ml. concentrated nitric acid and 10 ml. of
freshly prepared saturated Ammonium molybdate solution was added for precipitation. Yellow coloured precipitation of phospho-ammonium-molybdate began to appear. The beaker was kept overnight allowing the precipitate to settle down. Next day supernatant was filtered through Whatman filter paper number 42. The precipitate was washed with 2% nitric acid and then several times with 3% potassium nitrate solution for the removal of acid. The precipitate was dissolved in 20 ml. of N/7 sodium hydroxide and excess of sodium hydroxide was titrated against N/7 standard nitric acid solution. Phenolphthalein was used as indicator. Phosphorus contents were calculated as follows:

\[
\text{ml. of N/7 NaOH} \times 10 \times 0.0001925
\]

\[
\text{Percentage Phosphorus} = \frac{\text{-----------------------------} \times 100}{\text{gm. of sample taken for ashing}}
\]

Where, 10 is the dilution factor.

**Estimation of Potassium and Sodium**

For the estimation of Potassium and Sodium content, method given by Bhargava and Raghupathi (1993) was followed.

**Procedure for Potassium Content Estimation**

The plant sample was digested with triacid i.e. H$_2$SO$_4$, Perchloric acid and nitric acid (3:2:1) and made the volume in 100 ml volumetric flask. A series of standard of 0, 2, 4, 6, 8, and 10 ppm K solution was prepared by
taking 0, 2, 4, 6, and 10 ml of 100 ppm K solution in 100 ml flask respectively and made up their volume. The standard was feeded in flame photometer and took the reading. A standard curve was prepared concentrations verses flame photometer readings. The readings of unknown samples were noted by flame photometer and the concentration was found out with the help of standard curve.

**Calculation**

\[
\text{Volume of extract prepared} \\
\text{Concentration of K in plant sample} = R \times \frac{\text{Weight of sample}}{100} = R \times \frac{X}{100} \\
\text{Percent Potassium} = \frac{R}{X} \times \frac{100}{10000} = \frac{R}{X} \times \frac{1}{100} \\
\]

Where, \( X = \) Weight of plant sample.

\( R = \) ppm potassium in plant sample from standard curve.

\[
\begin{align*}
100 & \quad 1 \quad 1 \\
\frac{X}{10000} & = \frac{R}{X} \times \frac{1}{100} \\
\end{align*}
\]

**Procedure for Sodium Content Estimation**

1 gm. of ground plant material was taken in 100 ml volumetric flask and added 10 ml of diacid mixture of HNO₃ and HClO₄ in 9:4 ratios. The flask was
heated on heating device in a digestion chamber, first at low and then at higher temperature until the production of red NO\textsubscript{2} fumes ceases. The contents were further evaporated until the volume was reduced to about 3 to 5 ml. The completion of digestion was confirmed when the liquid became colourless. Cooled the flask and added double distilled water and made the volume up to mark and filtered the solution. A series of standards of 0, 2, 4, 6, 8, and 10 ppm Na was prepared by taking 0, 2, 4, 6, 8, and 10 ml of 100 ppm Na solution in 100 ml flasks, respectively and made up their volume. The readings of standards were taken by flame photometer. Standard curve was prepared by plotting the concentration on x-axis and flame photometer readings on y-axis.

Readings of sample extract were also taken by flame photometer. The concentration of Na was found out from standard curve.

**Calculation**

Concentration of Sodium (ppm) = \( \frac{R \times \text{volume of extract prepared}}{X} \)

= \( \frac{R \times 100}{X} \)

Where, \( R \) = ppm Na in plant sample from standard curve.

\( X \) = weight of sample (gm)

\[
\begin{align*}
\text{Concentration of Na in percent} & = \frac{R \times 100 x}{10000} = \frac{R}{100} \\
& = \frac{R}{100}
\end{align*}
\]

**Results and Discussion**

Concentration of the mineral contents in the various plant parts (roots,
shoots and fruits) of all the selected plant species collected from three different sites i.e. Chohatan, Pachpadra and Sindari areas of Barmer district are presented in Table- 8.1 to 8.4.

Calcium content was observed maximum (1.71%) in the fruits of *Sida cordifolia* collected from Chohatan area and minimum (0.31%) in the roots of *Lycium barbarum* collected from the same area (Table- 8.1).

Concentration of phosphorus was observed maximum (1.17%) in the fruits of *Sida cordifolia* collected from Chohatan area and minimum (0.29%) in the shoots of *Clerodendrum phlomidis* collected from the Pachpadra area (Table- 8.2).

Maximum (2.28%) potassium contents was found in the fruits of *Lycium barbarum* collected from Pachpadra area while minimum (1.10%) in the roots of *Clerodendrum phlomidis* collected from Chohatan area (Table- 8.3).

Sodium content was found maximum (1.19%) in the fruits of *Sida cordifolia* collected from Pachpadra area while minimum (0.32%) in the roots of *Clerodendrum phlomidis* collected from Chohatan area (Table- 8.4).

The mineral contents in various arid zone plants have been studied by many workers.

Sethia *et al.* (1987) reported 0.124% phosphorus in leaves of *Heliotropium marifolium* and 7.80% calcium in leaves of *Heliotropium rarifolium*.

Mathur *et al.* (1988) reported mineral contents (Calcium and
Phosphorus) in various plant parts of *Zaleya redimita*, *Glinus lotoides* and *Blepharis sindica*.

Kapoor *et al.* (1988) estimated the mineral contents in roots, shoots and fruits of *Aerva tomentosa*.

Kapoor (1991) estimated Phosphorus and Calcium in different parts of *Fagonia cretica* and *Aerva tomentosa*.

Joshi and Krishna (1993) estimated minerals (Sodium, Potassium and Calcium) in the roots, stems and leaves of forage halophyte *Sporobolus madraspatamus* Bor. 66.87 meq g$^{-1}$ concentration of Sodium was found to be in roots, 12.21 meq g$^{-1}$ Potassium was observed in leaves and 54.44 meq g$^{-1}$ Calcium was found to be in the roots.

Rajput and Sen (1993) reported the mineral status (Sodium, Potassium and Calcium) in the stems and leaves of *Atriplex spp.* in Indian desert.

Singh and Sen (1993) estimated the mineral contents (Sodium, Potassium and Calcium) in *Tamarix spp.* in Indian arid zone. The amount of mineral contents was similar to the selected plant species.

Harsh and Ahmed (1995) estimated calcium and phosphorus from two terrestrial plant species growing in Rajasthan.

Khodke and Gahukar (1998) reported the Phosphorus contents in chilli fruits.

Harsh and Maheshwari (2000) observed calcium and phosphorus contents in some arid zone plants of Bikaner, Rajasthan.
Kapoor and Ritu (2001) reported the calcium and phosphorus from leaves of *Moringa oleigera, Pithocellobium duce* and *Pongamia pinnata*.

Maheshwari (2001) estimated phosphorus and calcium in different parts of *Crotalaria burhia, Capparis decidua* and *Ziziphus mauritiana* in different seasons.

Ritu (2001) reported the mineral contents (calcium, phosphorus, potassium and sodium) in the different part of *Heliotropicum curassaricum, Parthenium hysterophorus* and *Lantana camara* growing in the Indira Gandhi Canal irrigated area of Bikaner.

Harsh (2002) estimated phosphorus, calcium, sodium and potassium in different parts of *Abutilon indicum, Aerva persica, Euphorbia microphylla* and *Glinus lotoides* in different seasons.

Shahid (2002) reported the mineral status (Potassium and Calcium) in roots, shoots and fruits of *Acacia nilotica, Acacia senegal, Maytenus emarginata, Parkinsonia aculeata* and *Prosopis cineraria*.

Ranga (2002) reported the mineral status (Sodium, Phosphorus, Potassium and Calcium) in roots, shoots and fruits of *Launaea procumbens, Pulicaria crispa, Sonchus asper* and *Xanthium strumarium*.

Godara (2002) reported the mineral contents (Na, K, Ca, P) in roots, shoots and fruits of some halophytes plant species like *Chenopodium murale, Haloxylon recurvum, Salsola baryosma* and *Suaeda fruticosa*.

Kapoor and Kalla (2003) estimated mineral contents in some tree
species growing in canal irrigated area of Western Rajasthan.

Goswami and Rao (2004) estimated the calcium and phosphorus contents in various parts of some Thar desert trees.

Khatri (2005) reported the mineral contents (Calcium, Phosphorus, Sodium, Potassium) in roots, shoots and fruits of some medicinal herbal plants *Abutilon indicum, Barleria prionitis* and *Solanum nigrum*.

Gir (2006) has reported the mineral contents (Na, K, Ca, P) in roots, shoots and fruits of *Bacopa monnieri, Chenopodium album* and *Portulaca oleracea* growing in waterlogged area of Hanumangarh district.

Khatri (2007) has reported the mineral contents (Na, K, Ca, P) in roots, shoots and fruits of *Aerva persica, Salsola baryosma, Suaeda fruticosa* and *Tephrosia purpurea* growing in Tal Chhapar area of Churu district.

Singh (2008) has reported the mineral contents (Na, K, Ca, P) in roots, shoots and fruits of *Achyranthes aspera, Cocculus pendulus* and *Phyllanthus niruri* growing in Jhunjhunu district.

Soni (2008) has evaluated the mineral contents from some arid tree species growing in Bikaner district.

Arya *et al.* (2009) have estimated the mineral contents from some halophytes of western Rajasthan.

Elhassan *et al.*, (2010) evaluated the mineral contents (K, Ca, Mn, Fe, Cu and Zn) of fruits of *Grewia* species.

Lakhera (2012) has estimated the mineral contents (Na, K, Ca, P) in
roots, shoots and fruits of *Euphorbia hirta*, *Glinus lotoides* and *Rhynchosia minima* growing in Jodhpur District of Rajasthan.

Prajapati (2012) has evaluated the mineral contents (Na, K, Ca, P) in roots, shoots and fruits of *Ailanthus excelsa*, *Pongamia pinnata* and *Salvadora oleoides* growing in Sikar District of Rajasthan.

Kapoor and Mishra (2013) estimated the mineral contents in roots, shoots and fruits of some Cappridaceous plant species like *Capparis decidua*, *Cleome gynandra* and *Cleome viscosa* of north-west Rajasthan.

Kapoor and Acharya (2013) evaluated the mineral contents in roots, shoots and fruits of some Tiliaceous plant species like *Corchorus depressus*, *Corchorus tridens* and *Grewia tenax* of arid region of Rajasthan.

Kapoor and Pandita (2013) evaluated the mineral contents in roots, shoots and fruits of some exotic tree species like *Colophospermum mopane*, *Holoptelea integrifolia*, *Kigelia pinnata* and *Putranjiva roxburghii* growing in Rajasthan desert.

Kapoor and Purohit (2013) estimated the mineral contents in roots, shoots and fruits of *Clitoria ternatea*, *Sesbania bispinosa* and *Tephrosia purpurea* of Rajasthan desert.

Kapoor and Bansal (2013) evaluated the mineral contents in roots, shoots and fruits of *Acacia tortilis*, *Prosopis cineraria*, *Salvadora persica* and *Tecomella undulata* growing in Nagaur district of Rajasthan.

Kapoor and Arora (2014) have estimated the mineral contents (Na, K,
Ca, P) in roots, shoots and fruits of *Crotalaria burhia*, *Euphorbia caducifolia* and *Leptadenia pyrotechnica* growing in Jaisalmer District of Rajasthan.

Kapoor and Kumar (2015) have recently estimated the mineral contents (Na, K, Ca, P) in stems, leaves and fruits of *Butea monosperma*, *Cassia fistula* and *Madhuka indica* growing in Sirohi district of Rajasthan.

On the basis of above findings it can be concluded that all the selected plant species growing in Chohatan, Pachpadra and Sindari areas of Barmer district can be a good source of feed and fodder for the livestock.
TABLE - 8.1
Calcium contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)

<table>
<thead>
<tr>
<th>Plants</th>
<th>Roots</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td><em>Clerodendrum phlomidis</em></td>
<td>0.42</td>
<td>0.54</td>
<td>0.59</td>
<td>0.57</td>
<td>0.69</td>
<td>0.75</td>
<td>0.68</td>
<td>0.76</td>
</tr>
<tr>
<td><em>Lycium babarum</em></td>
<td>0.31</td>
<td>0.88</td>
<td>0.58</td>
<td>0.41</td>
<td>0.47</td>
<td>0.67</td>
<td>0.81</td>
<td>0.79</td>
</tr>
<tr>
<td><em>Sida cordifolia</em></td>
<td>0.72</td>
<td>0.85</td>
<td>0.64</td>
<td>0.78</td>
<td>0.80</td>
<td>0.91</td>
<td>1.71</td>
<td>1.26</td>
</tr>
</tbody>
</table>

I - Chohatan          II - Pachpadra    III - Sindari
GRAPH - 8.1

Calcium contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)
### TABLE - 8.2

Phosphorus contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)

<table>
<thead>
<tr>
<th>Plants</th>
<th>Roots</th>
<th>Shoots</th>
<th>Fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td><em>Clerodendrum phlomidis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.62</td>
<td>0.74</td>
<td>0.68</td>
</tr>
<tr>
<td><em>Lycium babarum</em></td>
<td>0.47</td>
<td>0.82</td>
<td>0.56</td>
</tr>
<tr>
<td><em>Sida cordifolia</em></td>
<td>0.79</td>
<td>0.80</td>
<td>0.62</td>
</tr>
</tbody>
</table>

I - Chohatan
II - Pachpadra
III - Sindari
Graph - 8.2

Phosphorus contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)


TABLE - 8.3
Potassium contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)

<table>
<thead>
<tr>
<th>Plants</th>
<th>Roots</th>
<th>Shoots</th>
<th>Fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td><em>Clerodendrum phlomidis</em></td>
<td>1.10</td>
<td>1.22</td>
<td>1.26</td>
</tr>
<tr>
<td><em>Lycium babarum</em></td>
<td>1.62</td>
<td>1.70</td>
<td>1.68</td>
</tr>
<tr>
<td><em>Sida cordifolia</em></td>
<td>1.72</td>
<td>1.85</td>
<td>2.04</td>
</tr>
</tbody>
</table>

I - Chohatan        II - Pachpadra        III - Sindari
Potassium contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)
### TABLE - 8.4
Sodium contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)

<table>
<thead>
<tr>
<th>Plants</th>
<th>Roots</th>
<th></th>
<th>Shoots</th>
<th></th>
<th>Fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td><em>Clerodendrum</em></td>
<td>0.32</td>
<td>0.44</td>
<td>0.39</td>
<td>0.52</td>
<td>0.48</td>
</tr>
<tr>
<td><em>phlomidis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lycium babarum</em></td>
<td>0.39</td>
<td>0.80</td>
<td>0.62</td>
<td>0.48</td>
<td>0.43</td>
</tr>
<tr>
<td><em>Sida cordifolia</em></td>
<td>0.52</td>
<td>0.76</td>
<td>0.61</td>
<td>0.72</td>
<td>0.88</td>
</tr>
</tbody>
</table>

I - Chohatan II - Pachpadra III - Sindari
Sodium contents of Various Parts of Selected Plant Species (Percentage on dry matter basis)