Some Morphological and Nutritional Properties of Legumes under Natural Conditions

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Abstract: The legume species in the flowering time were harvested on 6500 da in campus area for every three days interval from beginning of March to end of July, 1999. Forty six legume species, subspecies or varieties were determined and sampled as different number for each species. Some morphological properties such as: growth form of species, color of flower, flowering period, number of stem on root, length of main stem and some chemical properties such as: crude protein ratio, crude ash ratio, Ca, Mg, K, Mn, Fe, Cu, Zn contents and K/(Ca + Mg) ratio were determined for all species. Samsun province is an important gene origin for the most legume species. Therefore, many differences in morphological properties were determined among the species. According to results of chemical properties, nutritional quality values of legume species were higher than the recommended standard values.

Key words: Legume, morphology, nutrition, natural conditions.

Introduction
Five subgene origins have been determined in Turkey which lies on intersection of near east and Mediterranean gene origins (Demir, 1980). Turkey is a very rich country for species, ecotype, genetic diversity and gene sources (Ozcan et al., 1995; Haliloğlu and Barkas, 1992; Dokuçoğlu, 1990). Migrations to Anatolia or having different civilizations for years increased genetic differences in Anatolia which is like a bridge between Asia and Europe. Samsun – Amasya – Tokat province is a subgene origin for many legume species which show much variance and distribution. Species, ecotypes and genetic diversities in heavy grazing pasture areas of Turkey decrease for years. According to Davi’s square system, the research area in this study is in A, square (Davis, 1970), and has been protected since early 1970’s. The research area in irregular topography is about 500 meter elevation and has sand, sandy clay and silty clay near coast, graybrown podzolic and brown soil on hillside and upland positions (Pamir and Ertenöz, 1974). Morphological structure and nutritional qualities among legume species grown in the research area show much variety due to different vegetations, soil types and protection of campus area for years. There is a strong relationship between morphological structure and nutritional qualities of forage crops (Aplıköz, 1991; Korkmaz et al., 1993). Soil has an important effect on mineral content of plants grown on it (Korkmaz et al., 1993). This study may be useful for determining nutritional qualities and some genetic properties for selection studies of legumes grown on areas having much biological diversity.

Materials and Methods
Legume species in the flowering time were picked up from 6500 da of campus area for each three days interval between March and June, 1999. Some properties for each legume sample such as: sampling area, diamet of stem, length, growing form, number of stem on root, color of flower and flowering period were reported. Classification of the plants were done according to Davis (1970) and the herbariums in the Laboratory of Biological Science Department in O.M.U. Growing forms of plants were evaluated according to angle between main stem and soil surface as follows (Anonymous, 2001):

- 0 - 30° is spreading
- 30 - 45° is semi – spreading
- 45 - 60° is semi – erect
- > 60° is erect

After the samples were dried at 78 °C in an oven until achieving constant weight, the legume samples were ground and mixed for crude protein, crude ash and mineral content analyses. Crude protein ratio was done according to Kjeldahl method (Kacer, 1972); mineral contents of samples were determined using Atomic Absorption Spectrophotometer after digesting the samples with HCOO₃-HNO₃ (1:4) according to Kacer (1972).

Results and Discussion
Morphological Properties: Some morphological properties such as: number of legume species, number of samples for each species, growing form of stem, color of flower, flowering period, number of stem on root and length of main stem are given in Table 1.

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Table 1. Some morphological properties of the legume species.

<table>
<thead>
<tr>
<th>Plant species</th>
<th>Sample</th>
<th>Growing form number</th>
<th>Colour of flowers</th>
<th>Roasting number of flowers</th>
<th>Number of branches on root</th>
<th>Length of main stem (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coriaria oxalacea L.</td>
<td>13</td>
<td>Spreading</td>
<td>White-purplish</td>
<td>10.05 - 25.05</td>
<td>7 - 13</td>
<td>80 - 80</td>
</tr>
<tr>
<td>Coriaria oxalacea Miller var. oxalacea</td>
<td>14</td>
<td>Semi-spreading</td>
<td>Yellow</td>
<td>16.05 - 15.05</td>
<td>1 - 5</td>
<td>70 - 80</td>
</tr>
<tr>
<td>Coriaria varia L. sp. Varia</td>
<td>17</td>
<td>Semi-spreading</td>
<td>Yellow</td>
<td>20.05 - 18.05</td>
<td>3 - 8</td>
<td>60 - 100</td>
</tr>
<tr>
<td>Gleditsia schottiana L.</td>
<td>12</td>
<td>Erect</td>
<td>White</td>
<td>16.04 - 10.06</td>
<td>1 - 5</td>
<td>70 - 100</td>
</tr>
<tr>
<td>Hamelacarpus cuneifolius (L.) Scw.</td>
<td>18</td>
<td>Semi-spreading</td>
<td>Yellow</td>
<td>20.04 - 16.06</td>
<td>4 - 11</td>
<td>40 - 66</td>
</tr>
<tr>
<td>Lathyrus nissolia L.</td>
<td>9</td>
<td>Erect; indeterminate</td>
<td>Yellow</td>
<td>15.05 - 10.06</td>
<td>1 - 5</td>
<td>150 - 160</td>
</tr>
<tr>
<td>Lathyrus nissolia L.</td>
<td>16</td>
<td>Semi-spreading</td>
<td>Cream</td>
<td>16.05 - 10.08</td>
<td>3 - 6</td>
<td>50 - 110</td>
</tr>
<tr>
<td>Lathyrus angustissimus L.</td>
<td>8</td>
<td>Erect</td>
<td>Pink - purplish</td>
<td>20.05 - 13.05</td>
<td>5 - 11</td>
<td>75 - 110</td>
</tr>
<tr>
<td>Lathyrus laxiflorus (Cel.) J.O.Kuntze, Sapp. laxiflorus</td>
<td>12</td>
<td>Semi-spreading</td>
<td>Purple</td>
<td>10.04 - 8.06</td>
<td>3 - 8</td>
<td>90 - 120</td>
</tr>
<tr>
<td>Lathyrus roseus L.</td>
<td>20</td>
<td>Semi-spreading</td>
<td>Dark red</td>
<td>26.04 - 16.06</td>
<td>6 - 10</td>
<td>30 - 60</td>
</tr>
<tr>
<td>Lathyrus angustissimus L.</td>
<td>17</td>
<td>Semi-spreading</td>
<td>White</td>
<td>18.04 - 12.06</td>
<td>4 - 10</td>
<td>40 - 120</td>
</tr>
<tr>
<td>Lathyrus angustissimus L.</td>
<td>22</td>
<td>Erect</td>
<td>Yellow</td>
<td>16.05 - 10.06</td>
<td>10 - 18</td>
<td>30 - 46</td>
</tr>
<tr>
<td>Lathyrus angustissimus L.</td>
<td>23</td>
<td>Semi-spreading</td>
<td>Yellow</td>
<td>10.06 - 9.06</td>
<td>60 - 80</td>
<td>30 - 60</td>
</tr>
</tbody>
</table>

Note: Erect or spreading depending on conditions.

Research Council (NRC, 1984) recommended that forage crops should contain 3.1 g/kg of Ca concentration for beef cattle. Obtained results for Ca concentration in this study were higher than these recommended values.

Mg concentrations in the legume species were between 0.65 and 0.05% Mg. Mg concentrations in forage crops are recommended as 0.2% for ruminants by Tajeda et al. (1985) and 1 g/kg for beef cattle by the NRC (1984). Except Lathyrus annuus L. and Psorales bituminosa L., all the species have rich Mg concentration in nutritional quality for animals. But, Loreta et al. (1988) reported that 0.18 - 0.20% of Mg concentration in forage crops would not be adequate for ruminants if the plants have 1.28-1.34% of K concentration. All species had higher K concentration. K concentration varied between 3.96 and 1.23%. These results were higher than suggested values of K by Tajeda et al. (1985) and 6.5 g/kg by the NRC (1984). But, high K concentration may cause Mg deficiency (Loreta et al., 1988).

K/(Ca + Mg) ratio in forage crops consumed by ruminants was recommended as less than 2.2 (Mayland et al., 1979; Kidambi et al., 1985; Korkmaz et al., 1993). More than 2.2 of K/(Ca + Mg) ratio indicates potential tetany of risk (Ward, 1968). All species had lower K/(Ca + Mg) ratio than 2.2 in this study because of legume species. Mg content in legumes is generally higher than that in cereals (Gencikan, 1985).
Therefore, increasing Mg content in legumes most probably caused a lower K/(Ca + Mg) ratio. Fe content in forage crops for ruminants is recommended at least around 50 ppm (Periguid, 1970; Lamand, 1976). Fe concentration in all species were higher than this suggested value. The results for Fe content in this study were similar to the reports of previous studies about legume forage crops done in this area by Korkmaz et al. (1993). Application of high amount of N fertilizer causes a decrease in Fe contents of legumes (Rybach, 1977; Acar et al., 1993). Higher iron concentrations in all species were obtained in this study because of collecting legume species from uncultivated natural flora. In addition to unfertilized conditions, Fe content of legume species in other studies has been found higher than the other crops (Loe, 1986; Boila et al., 1985). Zn content in the samples varied between 127.00 and 20.81 ppm. Recommended Zn contents for forage crops consumed by ruminants are around 10 ppm by Danbara et al. (1985), 50 ppm by Periguid (1970) and Lamand (1975), and 30 mg/kg by NRC (1984). Zn deficiency in forage crops may cause infertility, anemia or suppressed immune response in animals (Hidiroglu and Knipfel, 1994). Furthermore, Zn contents have complex and scarcely understandable effect on the male reproductive systems (Kidiamb et al., 1989).

Cu contents in the samples varied between 34.46 and 5.04 ppm. Recommended Cu content in fresh forage crops are 10 ppm by Periguid (1970), and Lamand (1975), 8 ppm by Rybach (1977); 5 ppm by Kozlochvsky (1977), and 8 mg/kg by NRC (1984). All the species had higher Cu content than the suggested value by Kozlochvsky (1977). Also, Cu deficiency may cause infertility, anemia or suppressed immune response in animals like Zn (McMurray, 1980), Mn concentration in forage crops is recommended around 50 ppm for excess consumption conditions (Periguid, 1970; Lamand, 1976). Mn concentration of the species varied between 117.73 and 19.48 ppm and most samples had lower Mn concentration than 50 ppm of critical value. Excess Mn concentration may cause to decrease the appetite in animals (Danbara et al., 1983).

References
Acar et al.: Morphological and nutritional properties of legumes


