Flora and Phytogeochorology of Lahij Governorate of Yemen: 1- Systematic Revision of Wild Legumes of the Family Fabaceae

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THE CURRENT study presents a revision of the family Fabaceae in the flora of Lahij Governorate, South Yemen. The recorded taxa were morphologically revised, life form, lifespan, and phytogeographical affinities were analyzed. Sixty-three taxa belonging to 20 genera of three subfamilies (Caesalpinioideae, Faboideae, and Mimosoideae) were recorded. For each species, accepted name, synonyms (if any), and local distribution are given. Keys to subfamilies, genera, species, and infra-specific taxa of species are provided. The recorded taxa consist of 76.19% perennials and 23.81% annuals. Phanerophytes, chamaephytes, and therophytes were the most frequent life forms. Phytogeographical analysis revealed that the Sudano-Zambezian elements are the most dominant, forming the major constituent (¼ of the recorded plants) of the legume floristic structure. The most diverse genera were Acacia s.l. (13 taxa), Indigofera (12 taxa), Tephrosia (7 taxa), Crotalaria, and Senecio (6 taxa each), accounting for about 69.84% of the total taxa recorded. Two species (Acacia hunteri Oliv. and Zygocarpum yemenense Thulin & Lavin) are endemic to Yemen. Besides, six species (Acacia edgeworthii T. Anders., Acacia johnwoodii Boulos, Calia purpurea (Picc.) Ait., Crotalaria salitiana Andrews, Indigastrum costatum subsp. goniodes (Hochst. ex Baker) Schrire, and Tephrosia heterophylla Vatke) are considered near endemics.

Keywords: Chorotype, Endemic, Fabaceae, Lahij, Near endemc, Yemen.

Introduction

Fabaceae (Leguminosae nom. alter.) are one of the largest families of angiosperms, consisting of ca. 770 genera and 19,500 species of trees, shrubs, and herbs distributed throughout the world (Mabberley, 2008; Christenhusz & Byng, 2016; LPWG, 2017).

Members of the family exhibit high economic value since the family includes medicinal, aromatic plants, several fiber plants, and many members which are used around the world for other economic aspects, such as food, timber, and horticulture. It is second to cereals in the human diet, and it is at the forefront of the plants utilized for grazing, oil production, gums, and dyes, with extraction from some species such as Acacia and Indigofera. Moreover, some types of nitrogen-fixing bacteria associated with their roots, contribute to enriching the soil nitrogen reserves and raising the productivity of other commercial plants (Pickersgill, 1996; Judd et al., 1999).

The flora of Yemen is characterized by high diversity and density, with ca. 2838 species, belongs to 1068 genera and 179 families of...
taxonomic importance as well as many endemic plants (461 endemic plants constituting 16% of the flora) making Yemen a fascinating botanical region (Al-Khulaidi, 2013). Species diversity is a result of considerable climatic changes in former periods, which enabled different species to survive in different ecological habitats (EPA, 2009). Moreover, the flora has affinities with the floras of the tropical African, Sudanese region, the Saharo-Arabian region, the Mediterranean countries, and the Irano-Turanian countries (Zohary, 1973; Gabali, 1995; Akhani, 2007).

To date, only a few studies have been concerned with the vascular plant flora of the southern Governorates of Yemen, especially at the levels of orders, families, and genera. The legume family is one of the most important and widespread families in Yemen, it ranked second after Poaceae in terms of the number of genera and species, comprising 81 genera and 277 species, of which 31 are endemic to Yemen (Al-Khulaidi, 2013). However, for some critical genera such as Astragalus, Indigofera, Rhynchosia, and Tephrosia the delimitation and identification are difficult for species (Lewis et al., 2005). This is a result of the scarcity of taxonomic surveys and studies in some geographical locations within Yemen due to its harsh topography and difficult access.

To the best of our knowledge, no previous study has examined the legume diversity in Lahij Governorate, which is an important hotspot of plant diversity in Yemen. The current study aims to identify the floristic diversity of the legume family in Lahij Governorate, perform a taxonomic re-evaluation of the genera and species of the family, and provide diagnostic morphological characteristics to distinguish between the genera and species of the family. It provides an updated identification key to all the legume species occurring in Lahij Governorate, Yemen.

**Materials and Methods**

**Study area**

This study was performed in Lahij Governorate, in the south-west of the Republic of Yemen. The study area is located between latitudes 12° 30’ and 14° 00’ N and longitudes 43° 30’ and 45° 30’ E. The center of Lahij Governorate (Al-Hawtah) is about 320 km from Sana’a (the capital of Yemen) (Fig. 1).

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The study area lies within the subtropical dry zone which is characterized by hot summers and warm winters (Walter et al., 1975). Meteorological data obtained from WWO (2020) from (2018–2019) showed that the average annual temperature is 29°C; January is the coldest winter month, with the maximum average temperature (25.5°C), whereas, June is the hottest month with the maximum average temperature (32.5°C). The average annual rainfall during the field survey (January–December 2018/2019) was 6.5 mm/year, with a monthly mean that ranges between 0.54 mm in April and 14.6 mm in June (Fig. 2).

Species identification

Plant specimens were collected at different times from the field by the first author (O. S. S. Al-Hawshabi) during intensive floristic surveys (four trips per month, increased to eight during the rainy months and the flowering season) of the study area between January 2018–May 2019. The collected taxa were identified and named according to the available literature (Thulin, 1983, 1993; Wood, 1997; Chaudhary, 2001; Chaudhary, 1999; Collenette, 1999; Boulos, 1999, 2009), and were updated according to APG III (2009) and POWO (2020), except for the genus Acacia s.l., remains as it was traditionally recognized, where some species are endemic to Yemen and needs further investigations. Voucher specimens were kept in the Herbarium of Biology Department, Faculty of Education, Aden University, Yemen.

Results

Floristic composition

A total of 63 taxa (including infraspecific taxa), belonging to 20 genera of three subfamilies (Caesalpinioideae, Faboideae, and Mimosoideae) of the family Fabaceae were recorded in the study area (Lahij Governorate). Two species were considered endemic to the study area (Zygocarpum yemenense (J.B.Gillett) Thulin & Lavin, and Acacia hunteri Oliv). On the other hand, six species considered near endemics (Acacia edgeworthii T. Anders., Acacia johnwoodii Boulos, Cadia purpurea (Picz.) Ait., Crotalaria saltiana Andrews, Indigastrum costatum subsp. goniodes (Hochst. ex Baker) Schrire, and Tephrosia heterophylla Vatke) (Fig. 3, Table 1).
### TABLE 1. List of wild legumes recorded in Lahij Governorate, Yemen along with their sub-families, habit, life span, life form, and chorotypes (Zohary, 1966, 1972; Wickens, 1976).

<table>
<thead>
<tr>
<th>No.</th>
<th>Studied taxa</th>
<th>Habit</th>
<th>Life span</th>
<th>Life-form</th>
<th>Chorotype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Sub-family: Caesalpinioideae (9)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Delonix elata (L.) Gamble</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>2</td>
<td>Parkinsonia aculeata L.</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>NEO</td>
</tr>
<tr>
<td>3</td>
<td>Senna alexandrina Mill.</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>SA-SI + SU-ZA</td>
</tr>
<tr>
<td>4</td>
<td>Senna holorsericea (Fresen.) Greuter</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>SA-SI + SU-ZA</td>
</tr>
<tr>
<td>5</td>
<td><strong>Senna italica Mill.</strong></td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>IR-TR + ME + SA-SI + SU-ZA</td>
</tr>
<tr>
<td>6</td>
<td>Senna obtusifolia (L.) H.S.Irwin &amp; Barneby</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>NEO</td>
</tr>
<tr>
<td>7</td>
<td>Senna occidentalis (L.) Link</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>NEO</td>
</tr>
<tr>
<td>8</td>
<td>Senna sophera (L.) Roxb.</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>NEO</td>
</tr>
<tr>
<td>9</td>
<td>Tamarindus indica L.</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SU-ZA</td>
</tr>
<tr>
<td></td>
<td><strong>Subfamily: Faboideae (39)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>Astragalus vogelii (Webb) Bornm subsp. fatemensis (Choiv.) Maire</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>IR-TR + ME + SA-SI</td>
</tr>
<tr>
<td>11</td>
<td>* Cadia purpurea (Picc.) Ait.</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>12</td>
<td>Crotalaria incana L.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>NEO</td>
</tr>
<tr>
<td>13</td>
<td>Crotalaria microphylla Vahl.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>14</td>
<td>Crotalaria pycnostachya Benth.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>15</td>
<td>* Crotalaria saltiana Andrews</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>16</td>
<td>Crotalaria senegalensis (Pers.) Bacle ex DC.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>17</td>
<td>Crotalaria spinosa Hochst ex Benth.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>18</td>
<td>Galactia striata var. villosa (Wight &amp; Arn.) Verde.</td>
<td>Herb</td>
<td>Per</td>
<td>He</td>
<td>PAN</td>
</tr>
<tr>
<td>19</td>
<td>* Indigastrum costatum subsp. goniodes (Hochst. ex Baker) Schrire</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>20</td>
<td>Indigofera amorphoides Jaub. &amp; Spach.</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>21</td>
<td>Indigofera arabica Jaub. &amp; Spach</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>IR-TR + SA-AR + SU-ZA</td>
</tr>
<tr>
<td>22</td>
<td>Indigofera argentea Burm. f.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>IR-TR + ME + SA-SI + SU-ZA</td>
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<tr>
<td>23</td>
<td>Indigofera articulata Gouan</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>IR-TR + SA-AR + SU-ZA</td>
</tr>
<tr>
<td>24</td>
<td>Indigofera coerulea var. coerulea</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>IR-TR + SA-AR + SU-ZA</td>
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<tr>
<td>25</td>
<td>Indigofera coerulea var. occidentalis J.B.Gillett &amp; Ali</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>IR-TR + SA-AR + SU-ZA</td>
</tr>
<tr>
<td>26</td>
<td>Indigofera colutea var. colutea</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>PAN</td>
</tr>
<tr>
<td>27</td>
<td>Indigofera hochstetteri Baker</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>IR-TR + SA-AR + SU-ZA</td>
</tr>
<tr>
<td>28</td>
<td>Indigofera oblongifolia Forssk.</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>IR-TR + SA-SI + SU-ZA</td>
</tr>
<tr>
<td>29</td>
<td>Indigofera semitriguga Forssk.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>30</td>
<td>Indigofera spiniflora Hochst. ex Boiss.</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>31</td>
<td>Indigofera spinosa Forssk.</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>Ch</td>
<td>SA-AR + SU-ZA</td>
</tr>
</tbody>
</table>
### TABLE 1. Cont.

<table>
<thead>
<tr>
<th>No.</th>
<th>Studied taxa</th>
<th>Habit</th>
<th>Life span</th>
<th>Life-form</th>
<th>Chorotype</th>
</tr>
</thead>
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<tr>
<td>32</td>
<td>Melilotus albus Medik.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>COSM</td>
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<tr>
<td>33</td>
<td>Microcharis tritoides subsp. tritoides</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>34</td>
<td>Rhynchosia elegans A. Rich.</td>
<td>Herb</td>
<td>Per</td>
<td>He</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>35</td>
<td>Rhynchosia minima var. prostrata (Harv.) Meikle</td>
<td>Herb</td>
<td>Per</td>
<td>He</td>
<td>IR-TR + SA-AR + SU-ZA</td>
</tr>
<tr>
<td>36</td>
<td>Rhynchosia pulverulenta Stocks</td>
<td>Herb</td>
<td>Per</td>
<td>He</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>37</td>
<td>Rhynchosia schimperi Hochst. ex Boiss.</td>
<td>Sub-shrub</td>
<td>Per</td>
<td>He</td>
<td>IR-TR + SU-ZA</td>
</tr>
<tr>
<td>38</td>
<td>Sesbania leptocarpa DC.</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>39</td>
<td>Sesbania pachycarpa DC.</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>40</td>
<td>* Tephrosia heterophylla Vatke</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>41</td>
<td>Tephrosia nubica (Boiss.) Baker</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>42</td>
<td>Tephrosia pentaphylla (Roxb.) G.Don</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>43</td>
<td>Tephrosia pumila (Lam.) Pers.</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>PAN</td>
</tr>
<tr>
<td>44</td>
<td>Tephrosia purpurea (L.) Pers.</td>
<td>Herb</td>
<td>Per</td>
<td>Ch</td>
<td>PAN</td>
</tr>
<tr>
<td>45</td>
<td>Tephrosia subtriflora Hochst. ex Baker</td>
<td>Herb</td>
<td>Ann</td>
<td>Th</td>
<td>PAN</td>
</tr>
<tr>
<td>46</td>
<td>Tephrosia uniflora subsp. uniflora</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>47</td>
<td>* Zygocarpum yemenense (J.B.Gillett) Thulin &amp; Lavin</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>SU-ZA</td>
</tr>
</tbody>
</table>

**Subfamily: Mimosoideae (16)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Studied taxa</th>
<th>Habit</th>
<th>Life span</th>
<th>Life-form</th>
<th>Chorotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>Acacia asak (Forssk.) Willd.</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>49</td>
<td>* Acacia edgeworthii T. Anders.</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>50</td>
<td>Acacia ehrenbergiana Hayne</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>51</td>
<td>Acacia etbaica subsp. uncinata Brenan</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>52</td>
<td>Acacia hamulosa Benth.</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>53</td>
<td>* Acacia hunteri Oliv.</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>IR-TR + SA-AR + SU-ZA</td>
</tr>
<tr>
<td>54</td>
<td>* Acacia johnwoodii Boulos</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>55</td>
<td>Acacia laeta R. Br. ex Benth.</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>IR-TR + ME + SA-SI + SU-ZA</td>
</tr>
<tr>
<td>56</td>
<td>Acacia mellifera (Vahl) Benth.</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SA-AR + SU-ZA</td>
</tr>
<tr>
<td>57</td>
<td>Acacia nilotica (L.) Willd. ex Del. subsp. indica (Benth.) Brenan</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>PAL</td>
</tr>
<tr>
<td>58</td>
<td>Acacia nilotica (L.) Willd. ex Del. subsp. kraussiana (Benth.) Brenan</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SU-ZA</td>
</tr>
<tr>
<td>59</td>
<td>Acacia oerofota (Forssk.) Schweinf.</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>IR-TR + SA-AR + SU-ZA</td>
</tr>
<tr>
<td>60</td>
<td>Acacia tortilis (Forssk.) Hayne subsp. tortilis</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>SA-SI + SU-ZA</td>
</tr>
<tr>
<td>61</td>
<td>Leucaena leucocephala (Lam.) De Wit</td>
<td>Shrub</td>
<td>Per</td>
<td>Ph</td>
<td>NEO</td>
</tr>
<tr>
<td>62</td>
<td>Pithecellobium dulce (Roxb.) Benth.</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>NEO</td>
</tr>
<tr>
<td>63</td>
<td>Prosopis juliflora (Sw.) DC.</td>
<td>Tree</td>
<td>Per</td>
<td>Ph</td>
<td>NEO</td>
</tr>
</tbody>
</table>

The most common genera with a larger number of species were *Acacia* Mill. with 13 species (20.63%), *Indigofera* L. with 12 species (19.05%), *Tephrosia* Pers. with seven species (11.11%), *Crotalaria* L., and *Senna* Mill. with six species each (9.52%), and *Rhynchosia* Lour. with four species (6.35%) (Fig. 4, Table 1). Most of the species recorded during this survey were perennials with 48 species (76.19%) of the total recorded species, while the annuals were represented by 15 species (23.81%). Most of the plant species were herbs (49.21%), followed by trees (20.63%), sub-shrubs (15.87%), and shrubs (14.29%).

**Life-form spectra**

Wild legumes surveyed in the study area belongs to four life-forms. Phanerophytes [perennating buds well above the surface of the soil] and chamaephytes [perennating buds just above the surface of the soil] were the most frequent lifeforms (22 species and 21 species, respectively), followed by therophytes [annuals] (15 species), while hemicryptophytes [perennating buds at soil level] (Raunkiaer, 1934) were represented by five species (Fig. 5 A, Table 1).

**Phytogeographical affinities**

Chorological analysis of the 63 legume species recorded in this study classified them into three major phytogeographical groups: Monoregional, biregional, and pluriregional (Fig. 5 B, Table. 1). The mono-regional chorotype was represented by 16 species (25.40%), of Sudano-Zambezian affinities. The bi-regional chorotype was represented by 18 species (28.57% of the total flora). The Saharo-Arabian/Sudano-Zambezian chorotype represented by 14 species (22.22%), while three species (4.76%) originally came from the Saharo-Sindian/Sudano-Zambezian chorotype, and only one species (1.59%) belonging to the Irano-Turanian/Sudano-Zambezian chorotype (*Acacia tortilis* (Forssk.) Hayne subsp. *tortilis*).

The pluri-regional elements are represented by a total of 14 species (22.22%) of different affinities. These pluriregional species fall under four main chorotypes: Irano-Turanian/Saharo-Arabian/Sudano-Zambezian (nine taxa representing 14.29% of recorded taxa), Irano-Turanian/Mediterranean/Saharo-Sindian/Sudano-Zambezian (three taxa representing 4.76% of recorded taxa), and both the Irano-Turanian/Mediterranean/Saharo-Sindian and Irano-Turanian/Saharo-Sindian/Sudano-Zambezian regions were represented by one species (1.59% of recorded taxa). The remaining 15 taxa were distributed among Neotropical (8 species= 12.70%), Pantropical (5 species= 7.94%), Cosmopolitan, and Palaeotropical (one species each= 1.59%) chorotypes.

![Fig. 4. Heatmap of species numbers within the genera of wild legumes relative to the three sub-families of Fabaceae in Lahij Governorate, Yemen](image-url)
Artificial key to the subfamilies of Fabaceae recorded in Lahij Governorate

1. Flowers actinomorphic; perianth aestivation valvate or rarely imbricate; stamens 10 or usually more .................................................. 3. Mimosoideae

2. Corolla aestivation vexillary, posterior petal outermost. Petals 5 but anterior petals basally fused. Stamens monadelphous or diadelphous .............................................. 2. Faboideae

1. Subfamily: Caesalpinioideae

Four genera and nine species were recorded in the study area.

Artificial key to the genera of Caesalpinioideae recorded in Lahij Governorate

1a. Plant armed .................. 2. Parkinsonia
1b. Plant un-armèd .......................... 2
2a. Leaves unipinnate .................. 3
2b. Leaves bipinnate ..................... 1. Delonix
3a. Trees .......................... 4. Tamarindus
3b. Herbs or herbaceous shrubs .......... 3. Senna


= Poinciana elata L., Cent. Pl. II. 16 (1756).

See POWO (2020) for a list of further synonyms.

Native. Tree; usually grows on cliffs and steep rocky slopes above wadis (Kilian et al., 2004).


Introduced American species. Small spiny tree or shrub: naturalized, grows in clay and sandy soils in roadsides near villages in Lahij Governorate.


The genus is represented by six species widely distributed in the study area; the key below distinguishes between them:

1a. Leaves with three pairs of leaflets .................................................. 4. S. obtusifolia
1b. Leaves with more than three pairs of leaflets .................................. 2
2a. Pods cylindrical to subcylindrical with convex valves ................................... 3
2b. Pods compressed flat, oblong, or oblong-falcate with or without flab-like crests valves .................................. 4

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3a. Leaflets in 3-7 pairs; peduncles 0.3-0.5 cm long; bracts acute.................. 5. S. occidentalis
3b. Leaflets in 8-12 pairs; peduncles 0.8–2.5 cm long; bracts ± obtuse ........... 6. S. sophera
4a. Leaflets lanceolate to elliptic, acute at apex ........................................ 1. S. alexandrina
4b. Leaflets obovate, rounded at apex ........................................ 5
5a. Pod glabrous, with a longitudinal crest in the middle ......................... 3. S. italica
5b. Pod pubescent, without a longitudinal crest in the middle .................... 2. S. holosericea

= Cassia acutifolia Delile, Descr. Egypte, Hist. Nat. 219, t. 27 (1813).
Native. Sub-shrub grows along sandy and gravelly drainage lines including the larger wadis.

= Cassia holosericea Fresen., Flora 22(1): 54 (1839).
See POWO (2020) for a list of further synonyms.

Native. Prostrate to erect woody perennial herb: growing on sandy and stony plains, it favors depressions where water accumulates, and is frequently found near irrigation channels.

See POWO (2020) for a list of further synonyms.

Native. Prostrate, woody, perennial herb growing in bushland, and semi-desert, usually found on open stony and sandy plains.

= Cassia tora var. obtusifolia (L.) Haines, Bot. Bihar & Orissa, 304 (1922).
= Emelista obtusifolia Raf., Sylva Tellur. 127 (1838).
= Senna toroides Roxb., Fl. Ind. ii. 341 (1832).

This introduced American species is an erect annual herb growing in waste ground, on roadsides, and field borders. It is abundant in high rainfall areas.

1.3.5. Senna occidentalis (L.) Link, Handbuch [Link] 2: 140 (1831).
See POWO (2020) for a list of further synonyms.

This introduced American species is an erect perennial herb growing in waste ground, field borders, in wadi beds, and along irrigation channels and alluvial plains.

1.3.6. Senna sophera (L.) Roxb., Fl. Ind. (Roxburgh) ii. 347 (1832).
= Cassia aegyptiaca Willd., Enum. Pl.: 442 (1809)
See POWO (2020) for a list of further synonyms.

This introduced American species is a subshrub, growing on roadsides and in waste ground and wadi beds.


1.4.1. Tamarindus indica L. (1753)
See POWO (2020) for a list of further synonyms.

Native. An evergreen tree is usually found near wadis, on open hillsides in high rainfall areas.

2. Subfamily: Faboideae

Shrubs and herbs (annual and perennial) recorded in the studied area included 39 taxa within 12 genera, among them 12 taxa belong to Indigofera.

Artificial key to the genera of Faboideae recorded
in Lahij Governorate

1a. Shrubs ........................................ 2
1b. Herbs or subshrubs .......................... 3

2a. Petals papilionaceous; pod constricted
between the seeds, jointed .................... 2. Zygocarpum
2b. Petals equal, not papilionaceous; pod
straight, flat, not jointed ..................... 2. Cadia

3a. Plants usually climbing, trailing or
spreading ........................................... 4
3b. Plants usually erect .......................... 6
4a. Leaves with 3-leaflets ....................... 5
4b. Leaves with 10–16 leaflets ....... 1. Astragalus

5a. Pod oblong, c. 0.8–2.2 cm long
................................................ 9. Rhynchosia
5b. Pod linear-oblong, more than 3 cm long ..
........................................................................ 4. Galactia

6a. Leaves 1-3 leaflets ......................... 7
6b. Leaves more than 3 leaflets ............... 9
7a. Flowers yellow; pod inflated
........................................................................ 3. Crotalaria
7b. Flowers white or red; pod not inflated .... 8
8a. Flowers white; pod small, ovoid
........................................................................ 7. Melilotus
8b. Flowers pink or red; pod tetragonal, straight,
erect ............................................... 8. Microcharis
9a. Leaves imparipinnate, with 3–17 leaflets
........................................................................ 5. Indigostrum
10b. Standard of flower glabrous outside
........................................................................ 5. Indigostrum
10a. Standard of flower pubescent outside
........................................................................ 11

11a. Flowers solitary in the leaf axils; pod
elongate .............................................. 11. Tephrosia
11b. Flowers in racemes; pod ovoid
........................................................................ 6. Indigofera


1.1. Astragalus vogelli subsp. fatemensis
(Choiv.) Maire, Mém. Soc. Hist. Nat. Afrique Nord
3: 126. (1933).

2.2. Cadia Forssk., Fl. Aegypt.-Arab. 90 (1775).


........................................................................ 2. Crotalaria

2a. Flowers solitary or paired in the leaf axils
........................................................................ 2. C. microphylla
2b. Flowers in racemes (rarely a few also in
the leaf axils) ........................................ 3
3a. Stipules absent .................................. 4. C. saltiana
3b. Stipules present ............................... 4
4a. Racemes short, about 5 cm long ........ 3.
4b. Racemes long, about 10–30 cm long .. 5
5a. Pod shortly stipitate, appressed pubescent
outside, 6–16 seeded ......................... 5. C. senegalensis
5b. Pod sessile, spreading pilose outside, hairs
not appressed, ± 40–50 seeded ........ 1. C. incana


2.3.1. Crotalaria incana L., Sp. Pl. 2: 716

........................................................................ 4. C. microphylla
2a. Flowers solitary or paired in the leaf axils
........................................................................ 2. C. microphylla
2b. Flowers in racemes (rarely a few also in
the leaf axils) ........................................ 3
3a. Stipules absent .................................. 4. C. saltiana
3b. Stipules present ............................... 4
4a. Racemes short, about 5 cm long ........ 3.
4b. Racemes long, about 10–30 cm long .. 5
5a. Pod shortly stipitate, appressed pubescent
outside, 6–16 seeded ......................... 5. C. senegalensis
5b. Pod sessile, spreading pilose outside, hairs
not appressed, ± 40–50 seeded ........ 1. C. incana

2.3.2. Crotalaria microphylla Vahl, Symb.
Bot. (Vahl) 1: 52 (1790).

Native. A prostrate annual herb is widely
distributed in semi-desert grassland, usually
on the sand.

2.3.3. Crotalaria pycnostachya Benth.,
London J. Bot. 2: 584 (1843).

........................................................................ 4. C. microphylla
........................................................................ 2. C. microphylla
2a. Flowers solitary or paired in the leaf axils
........................................................................ 2. C. microphylla
2b. Flowers in racemes (rarely a few also in
the leaf axils) ........................................ 3
3a. Stipules absent .................................. 4. C. saltiana
3b. Stipules present ............................... 4
4a. Racemes short, about 5 cm long ........ 3.
4b. Racemes long, about 10–30 cm long .. 5
5a. Pod shortly stipitate, appressed pubescent
outside, 6–16 seeded ......................... 5. C. senegalensis
5b. Pod sessile, spreading pilose outside, hairs
not appressed, ± 40–50 seeded ........ 1. C. incana

Six species are recorded from the study area, all but one of them is native. The artificial key below
distinguishes between them:

2.2. Cadia Forssk., Fl. Aegypt.-Arab. 90 (1775).


........................................................................ 2. Crotalaria

2a. Flowers solitary or paired in the leaf axils
........................................................................ 2. C. microphylla
2b. Flowers in racemes (rarely a few also in
the leaf axils) ........................................ 3
3a. Stipules absent .................................. 4. C. saltiana
3b. Stipules present ............................... 4
4a. Racemes short, about 5 cm long ........ 3.
4b. Racemes long, about 10–30 cm long .. 5
5a. Pod shortly stipitate, appressed pubescent
outside, 6–16 seeded ......................... 5. C. senegalensis
5b. Pod sessile, spreading pilose outside, hairs
not appressed, ± 40–50 seeded ........ 1. C. incana

This introduced American species is an erect
annual herb, growing on the escarpment, alluvial
soils close to cultivation and areas of good rainfall.

This introduced American species is an erect
annual herb, growing on the escarpment, alluvial
soils close to cultivation and areas of good rainfall.

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Native. A procumbent or erect annual herb, common on stony hillsides, on cultivated or waste ground, and in open scrub along the escarpment.


Native. An erect annual herb, growing on semi-desert scrub, often along wadis and on gravelly soils.


Native. Annual herb erect; growing on sandy plains.


Native. Bushy annual herb, growing on grassy earth banks around fields.


Introduced. Perennial climbing herb; weed of cultivation.


Native. Erect annual herb, growing in fields, slopes, clay soils mixed with gravel, roadsides, rocky grassland, and stony ground in areas of average to good rainfall.


Widely distributed in the study area, 12 species are recorded from the study area, all of them are considered native.

The artificial key below distinguishes between them.

1a. Plant armed ........................................ 2
1b. Plant unarmed ..................................... 3

2a. Inflorescence rachis orange, pod not torulose .............................................. 11. *I. spinosa*
2b. Inflorescence rachis green; pod strongly torulose ........................................ 10. *I. spinoflora*

3a. All plant parts with stalked glands .............................................. 6. *I. colutea*
3b. All plant parts lacking stalked glands (trichomes typically medifixed (T-shaped)) ...... 4

4a. Leaf-rhachis up to 0.6–3.5 cm long including petiole ........................................ 5
4b. Leaf-rhachis up to 4–11 cm long including petiole ........................................ 9
5a. Stamens c. 3 mm long ........................................ 7. *I. hochstetteri*
5b. Stamens 1.3–1.5 mm long; pod 1–4-seeded .... 5. *I. amorphoides*

6a. Calyx 2–3 mm long; pod 5–9 seeded .......... 8. *I. arabica*
6b. Calyx 1.3–1.5 mm long; pod 1–4 seeded ... 10. *I. oblongifolia*

9a. Pod up to 6 mm long, not torulose ........ 1. *I. amorphoides*
9b. Pod up to 15 mm long, torulose .... 5. *I. coerulae*

Native. Perennial herb, procumbent, often growing on the escarpment, high plateau, rocky plain, exposed hillsides, and rock crevices.

2.6.3. *Indigofera argentea* Burm.f., Fl. Ind. (N. L. Burman) 171 (1768).
Native. Erect annual herb growing on dunes in great abundance after rain.

Native. Erect shrubby perennial to about 75 cm tall, growing in roadsides and field in the silt plain.

Two varieties occur in Lahij Governorate
1a. Leaflets glabrous adaxial .... var. *coerulea*
1b. Leaflets hairy on both sides....... var. *occidentalis*

2.6.5. *Indigofera coerulea* Roxb., Fl. Ind. (Roxburgh) 3: 377, 864 (1832).
Native. Erect shrubby perennial herb to about 75 cm tall, growing in roadsides and field in the silt plain.

2.6.5.1. *Indigofera coerulea* var. *coerulea* Roxb., Fl. Ind. (Roxburgh) 3: 377, 864 (1832).

This variety is not mentioned in POWO (2020), but it occurs in Yemen (Al-Khulaidi, 2000).

See POWO (2020) for a list of further synonyms.
Native. Erect or spreading annual herb, becoming weedy on roadsides, fields, disturbed rocky ground, preferring areas of good rainfall.

See POWO (2020) for a list of further synonyms.
Native. Decumbent annual herb, found in grassland on the escarpment, sandy and stony ground, often in field borders.

= *Indigofera argentea* Buch.-Ham. ex Roxb., Hort. Bengal. 57; Fl. Ind. iii. 374 (1832).
Native. Undershrub. A widespread plant on silt and stony plains.

Native. Procumbent annual herb, a rare plant of dunes near the sea.

Native. A spiny undershrub, growing in semi-desert grassland, on clay soils, also on slopes in clay soils mixed with gravel.

Native. A spiny undershrub, growing in semi-desert grassland, on sand and stony hills.


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\[= Melilotus vulgaris \text{ Willd., Enum. Pl. [Wildenow] 2: 790 (1809).}\]

\[= Melilotus leucanthus \text{ Koch ex DC., Fl. Franc. [de Candolle & Lamarck], ed. 3. 6: 564 (1815).}\]

\[= Melilotus melanospermus \text{ Besser ex Ser., Prodr. [A. P. de Candolle] 2: 186 (1825).}\]

\[= Melilotus argutus \text{ Rchb., Fl. Germ. Excurs. 499 (1832).}\]

Native. Annual herb erect, often growing as a garden weed. Considered native – might it occur in gardens because of its medicinal properties – also for forage.


Native. Perennial woody herb, erect or decumbent. A rare plant of gravelly plain and semi-desert grassland.


Four taxa are recorded from the study area, all of them native. The artificial key below distinguishes between them.

1a. Style glabrous; seeds ellipsoid ... 1. *S. leptocarpa*

1b. Style pubescent; seeds cube-shaped ... 2. *S. pachycarpa*


Two species occur in Lahij Governorate, both native.

1a. Style glabrous; seeds ellipsoid ... 1. *S. leptocarpa*

1b. Style pubescent; seeds cube-shaped ... 2. *S. pachycarpa*


This variety is mentioned in the Flora of Yemen by Al-Khulaidi (2000).

Native. Perennial climbing or prostrate herb, in grassland or bushland, often on alluvial soils and escarpments.


\[= \text{Rhynchosia rhombifolia} \text{ Blatt. & Hallb., J. Bombay Nat. Hist. Soc. 26: 242 (1918).}\]

Native. Erect or climbing woody herb, growing on scrub-covered roadside banks and in clay soils mixed with sand.


\[= \text{Rhynchosia arenaria} \text{ Blatt. & Hallb., J. Bombay Nat. Hist. Soc. 26: 243 (1918).}\]

\[= \text{Rhynchosia cliffordii} \text{ Hutch. & E.A.Bruce, Bull. Misc. Inform. Kew 1941(2): 121 (1942).}\]

Native. Prostrate or spreading shrub or subshrub, growing in stony or sandy ground.


Two species occur in Lahij Governorate, both native.

1a. Style glabrous; seeds ellipsoid ... 1. *S. leptocarpa*

1b. Style pubescent; seeds cube-shaped ... 2. *S. pachycarpa*
2a. Stem life form erect, smooth .............. 3  
  
*Tephrosia pumila*  
3a. Leaflets pubescent or tomentose on both surfaces ............................................. 4  
3b. Leaflets glabrous above, silvery beneath. 6  
4a. Flowers 2-3 in the leaf axils ............. 8.  
4b. Flowers >3 in racemes .......................... 5  
5a. Pod densely long white tomentose, ovoid ............................................................... 2.  
5b. Pod strigose or spreading pubescent, linear .......................................................... 5.  
6a. Leaflets usually 5 .................. 3.  
6b. Leaflets usually 7 or more ............. 7  
7a. Pod 2-3cm long, with 5-9 seeds .......................... 6.  
7b. Pod 4.5-5cm long, with 9-13 seeds .............................................................. 7.  

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2.11.1.  
= *Tephrosia simplicifolia* Franch., Sert. Somal. 28 (1882).  

Native. Perennial herb, prostrate or erect; widespread on open well-drained hillsides and rocky plains on the escarpment, or high plateau, in the central escarpment of *Euphorbia* scrub and on limestone hills.  

2.11.2.  

Native. Erect, bushy perennial growing on stony outcrops and gravel banks.  

2.11.3.  
*Tephrosia pentaphylla* (Roxb.) G.Don, Hort. Brit. [Sweet], ed. 3. 170, no. 32 (1839).  
= *Galega pentaphylla* Roxb., Fl. Ind. (Roxburgh) 3: 384 (1832).  

Native. Woody, ascending perennial herb, growing in irrigated fields, in canals, valley scrub, and on limestone dip slope.  

2.11.4.  


Native. Perennial herb procumbent grows on the escarpment, usually in partial shade on banks round fields or in scrub in areas of good rainfall.  

2.11.5.  
= *Cracea purpurea* L., Sp. Pl. 2: 753 (1753).  

Native. Perennial herb, woody below, growing in grassland and cultivated areas, sandy places, sometimes frequent on dunes after rain.  

2.11.6.  
= *Tephrosia sulphurea* Chiov. Fl. Somalia 1: 142 (1929)  

Native. Prostrate or ascending annual herb, grows in stony plain and on rocky slopes.  

2.11.7.  

Native. Perennial herb, woody, spreading to erect, usually rare on the sand and stony steppe, more frequent on exposed rocky slopes in the foothills.  

One subspecies occur in Lahij Governorate  

2.11.7.1.  
*Tephrosia uniflora* subsp. uniflora  

See POWO (2020) for a list of further synonyms.  

Native. Procumbent perennial herb, known from dunes.  

2.12.  

A single species, endemic to the area.  

2.12.1.  
Shrub up to 3 m high, widespread on the escarpment, in areas of good rainfall.

3. Subfamily: Mimosoideae

Shrubs and trees, sixteen species belonging to four genera are recorded in the studied area, among them, 13 species belong to the genus Acacia as traditionally recognized. The characters below distinguish between the four genera.

Artificial key to the genera of Mimosoideae recorded in Lahij Governorate

1a. Plant armed ............................................ 2
1b. Plant unarmed ..................................... 2.

2a. Pinnae and leaflets in one pair
2b. Pinnae and/or leaflets in more than one pair

3a. Stamens 10 only …................ 4. Prosopis
3b. Stamens numerous .............. 1.

Acacia


Shrubs or trees with 13 taxa represented in the study area, all of them native. Although the name Acacia has officially been changed to Vachellia or Senegalia for these species we prefer to retain the traditional Acacia, where some endemic species are not following the new taxonomy and needs further investigations. Thus, we cited the new names in the synonymy.

Artificial key to the Acacia species recorded in the study area

1a. Inflorescence a head ......................... 2
1b. Inflorescence a spike ......................... 8
2a. Flowers yellow ....................................... 3
2b. Flowers white or cream ............................ 4

3a. Pod glabrous, falcate, slightly constricted between the seeds at maturity ... 3. A. ehrenbergiana
3b. Pod ±tomentose, straight or slightly curved, regularly constricted between the seeds ........................................ 10. A. nilotica

4a. Shrubs to 1.5-2m tall ............................... 5
4b. Trees or rarely shrubs to 6-10m tall .... 6

5a. Branchlets red or purple-brown, pubescent, becoming glabrous with age ........................................ 2. A. edgeworthii
5b. Branchlets white, pubescent .......... 11. A. oerfota

6a. Pinnae usually more than 10 pairs, leaflets more than 30 pairs .... ... 7. A. johnwoodii
6b. Pinnae usually less than 10 pairs, leaflets 6-30 pairs ................................................................. 7

7a. Pod glabrous, straight ... 4. A. etbaica subsp. uncinata
7b. Pod pubescent, spirally twisted .... 12. A. tortilis subsp. tortilis

8a. Leaves: petiole and rachis together less than 1 cm long .................. 6. A. hunteri
8b. Leaves: petiole and rachis together more than 1 cm long ................................................. 9

9a. Pinna-pairs only two per leaf, leaflets only one, rarely two pair (s) per pinna ........................................ 9. A. mellifera
9b. Pinna-pairs per leaf more than 2, leaflets per pinna >2 .............................. 10

10a. Stem prickles in pairs or rarely in threes, hooked ........................................ 8. A. laeta
10b. Stem prickles usually in threes ...... 11

11a. Lateral prickles curved upwards; pinnae abaxial surface with a recurved small prickle on the rachis at or just below the apex .......... 5. A. hamulosa
11b. Lateral prickles horizontal or slightly curved upwards; pinnae abaxial surface not prickly ........................................ 1. A. asak

= Mimosa asak Forssk., Fl. Aegypt.-Arab. 176 (1775).
Native. Small tree, growing on mountain escarpments, steep rocky slopes, cliffs, rocky gullies, rocky hillside, and sandy soils.

= Acacia erythraea Chiov., Fl. Somala 1: 163 (1929).
= Acacia humifusa Chiov., Fl. Somala 1: 163 (1929).

Native. Spreading shrub, in bushland, semi-desert, scrub, dunes, on sandy soils mixed with gravel and stony steppe.

3.1.3. Acacia ehrenbergiana Hayne, Getreue Darstell. Gew. 10: t. 29 (1827)
= Mimosa flavida Forssk., Fl. Aegypt.-Arab. 176 (1775), nom. illeg.

Native. Large shrub stems many from the base; growing in foothills, wadis, sandy plains, and gravel plains.


Native. Tree, growing on open slopes and drier areas of the mountain escarpment.

= Acacia paradoxa Chiov., Fl. Somala 1: 165 (1929).

Native. Shrub, growing on stony plains, stony steppe, and on escarpments.

3.1.6. Acacia hunteri Oliv., Hooker’s Icon. Pl. 14: t. 1350 (1881).

The accepted name by POWO (2020) for that species needs more investigations as the plant is endemic to Yemen, and no previous work dealt with it.

Native. Shrub, growing on stony plains, wadis, near arable land, and sandy soils mixed with gravel.


Native. Tree up to 10 m, growing on rocky hillsides and plains, the edge of cultivation, wadi beds, and valley forests.

Accepted name: Senegalia laeta (R.Br. ex Benth.) Seigler & Ebinger, Phytologia 91(1): 27 (2009).

Native. Small tree growing on escarpment, hillsides, and in sandy plains mixed with gravel.

Accepted name: Senegalia mellifera (Vahl) Seigler & Ebinger, Phytologia 92(1): 94 (2010).

Native. Small tree, growing on escarpment, hillsides, and in sandy plains mixed with gravel.


Two subspecies are found in the study area

1a. Pods strongly constricted in between the seeds, green at maturity, pubescent or glabrous …………………. A. nilotica subsp. indica

1b. Pods shallow crenate to straight-sided (not strongly constricted between seeds), black at maturity, minutely pubescent ……………….. A. nilotica subsp. kraussiana

= Acacia arabica var. indica Benth., London J. Bot. 1: 500 (1842).

Native in POWO (2020). Tree; naturalized.

1.1.1.2. Acacia nilotica subsp. kraussiana (Benth.) Brenan, Kew Bulletin 12(1): 84 (1957)

Native in POWO (2020). Tree; naturalized.
  \[=\text{Acacia arabica var. kraussiana}\] Benth., London J. Bot. 1: 500 (1842).

Native. Small tree, growing around fields and on stony plains.


\[=\text{Mimosa oerfota}\] Forssk., Fl. Aegypt.-Arab. 177 (1775).

Native. Shrub, common on gravel, stony plain, dry hills, and rocky slopes.

1.1.11. \textit{Acacia tortilis} (Forssk.) Hayne, Getreue Darstell. Gew. 10: t. 31 (1827)


\[=\text{Mimosa tortilis}\] Forssk., Fl. Aegypt.-Arab. 176 (1775).

1.1.12. \textit{Acacia tortilis} subsp. \textit{tortilis}

\textbf{Accepted name: Vachellia tortilis} subsp. \textit{tortilis}\n
Native. Tree growing in foothills of the escarpments, gravel plains, along wadis and sandy regions.


3.2.1. \textit{Leucaena leucocephala} (Lam.) de Wit, Taxon 10: 54 (1961).


\[=\text{Acacia leucocephala}\] (Lam.) Link, Enum. Hort. Berol. Alt. 2: 444 (1822).

Introduced American species. Shrub, naturalized, found in wadis near villages.


Introduced American species. Small tree, naturalized, found in wadis and arable land.

3.4. \textit{Prosopis} L., Mant. Pl. 10 (1767).


\[=\text{Mimosa juliflora}\] Sw., Prodr. [O. P. Swartz] 85 (1788).

See POWO (2020) for a list of further synonyms.

Introduced American species. Small tree naturalized near waterholes, along wadis, and on roadsides.

\section*{Discussion}

There is a dearth of studies on the Flora of the southern governorates of Yemen: Abyan, Aden, Al-Mahra, Hadramout, Lahij, and Shabwah (Kilian et al., 2002). Thus, the diversity and phytogeographical distribution of their vascular plants are barely known. In the current study, a floristic analysis of wild legume species from Lahij Governorate includes a total of 63 taxa (including infraspecific taxa), belonging to 20 genera of three subfamilies (Caesalpinioideae, Faboideae, and Mimosoideae) of the family Fabaceae (Table 1). Despite the large number of species recorded in the study area, the share of endemism is too little. Only two species (3.17\%) are endemic to the study area. Moreover, six species are considered near endemics, present in ecogeographical boundaries of two or five countries regardless of their political boundaries (Shaltout et al., 2018) (Fig. 3). The flora of Yemen is like that of the neighboring regions such as Jabal Fayfa, south-west Saudi Arabia. The presence of endemic and near-endemic legume species in the flora of Lahij Governorate, South Yemen might be caused by the constant humidity- laden breezes from the Red Sea on the west-facing slopes, which contain many micro hotspots appropriate for the maintenance of these plants (Abbas et al., 2020).

In Yemen, members of the family Fabaceae are well represented. Al-Khulaidi (2013) recognized 81 genera encompassing 277 species belonging to the former three subfamilies. Thus, the recorded taxa from Lahij Governorate represent 22.74\% of the total published species in the Flora of Yemen. This high number of wild/native legume taxa may
be due to the presence of a mosaic environment in the study area, forming a distinct number of habitats each with unique features regarding topographic differences, soil composition, water resources, in addition to human and animal interference (Alshammari & Sharawy, 2010; Osman et al., 2014). Moreover, Faboideae is the dominant subfamily, represented by 12 genera and 37 species (Table 2).

These results conform with those of Al-Hawshabi et al. (2017). Moreover, Acacia (13 taxa), Indigofera (12 taxa), Tephrosia (7 taxa), Crotalaria, and Senna (6 taxa each), are the most species-rich genera (Fig. 4). These results are consistent with the previous studies in the flora of Yemen (Gabali & Al-Gifri, 1990; Ibrahim, 2006; Al-Hawshabi, 2017; Al-Hawshabi et al., 2017). This can be attributed to their efficient seed dispersal capabilities and wide ecological range of tolerance.

Unlike the flora of other areas of Yemen, two-thirds (76.19%) of the wild/native legume flora of Lahij Governorate is represented by perennials while annuals were represented by 23.81% of the total taxa recorded. The dominance of perennial taxa may be attributed to the rather low rainfall, which is not enough to sustain many annuals. Instead, perennials are adapted to the extreme habitats of the area, which then offers a characteristic physiognomy to the plant cover (Shaltout et al., 2010; Abdel Khalik et al., 2013; El-Amier, 2016).

Wild legumes of Lahij Governorate exhibit a great diversity of life forms. The life-form spectrum is predominantly phanerophytes and chamaephytes (34.92% and 33.33%, respectively), followed by therophytes (23.81%) and hemicyrptophytes (7.94%). The dominance of phanerophytes and chamaephytes over other life forms may be in response to the high altitude, topography, landform, hot dry climate, and variation in rainfall in addition to urbanization activities (El-Ghani & Fawzy, 2006; Shaltout et al., 2010; Alshammari, 2013). Therophytes are short-lived plants characterized by their high growth rate which enables them to resist biotic influence, their ability to set numerous seeds, their genetic and morphological plasticity under a high level of disturbance, hot dry climate, lack of rainfall, and topographic variation (Barbero et al., 1990; Shaltout & Al-Sodany, 2008). This trend of lifeform spectra is similar to that of other regions of Yemen (Al-Hawshabi, 2017; Al-Hawshabi et al., 2017).

Phytogeographical analysis of the 63 legume taxa surveyed in the study area revealed that the monoregional elements of the Sudano-Zambezian chorotype (25.40%) are the most dominant, forming the major constituent (%) of the recorded plants of the floristic structure in Lahij Governorate, followed by the biregional elements of the Saharo-Arabian/Sudano-Zambezian chorotypes (22.22%), and the Irano-Turanian/ Saharo-Arabian/Sudano-Zambezian chorotypes (14.29%) (Fig. 5 C). Similar results were obtained in different studies of the flora of Yemen (Al-Hawshabi, 2017). Moreover, Wicke (1976), recognized five subregions within the Sudano-Zambezian region; of these the South Arabian subregion is an extension of the Sudano-Zambesian including parts of southern Saudi Arabia and Yemen bordering the coasts of the Red Sea and the Gulf of Aden. This combination of different chorological elements with uneven numbers of plant taxa can be attributed to various factors such as diversity of habitats, topography, water availability, and the capability of certain legume taxa to penetrate the study area from different adjacent phytogeographical regions.

**TABLE 2. Number of genera and species of the subfamilies of Fabaceae reported by different authors concerned with the flora of Yemen**

<table>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Caesalpinioideae</td>
<td>No. genera</td>
<td>2</td>
<td>5</td>
<td>11</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>No. species</td>
<td>6</td>
<td>9</td>
<td>33</td>
<td>3</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Faboideae</td>
<td>No. genera</td>
<td>9</td>
<td>14</td>
<td>60</td>
<td>4</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>No. species</td>
<td>18</td>
<td>30</td>
<td>172</td>
<td>6</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>Mimosoideae</td>
<td>No. genera</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>No. species</td>
<td>11</td>
<td>17</td>
<td>39</td>
<td>4</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

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Conclusion

The study revised the family Fabaceae/Leguminosae in the flora of Lahij Governorate, South Yemen. A total of 63 taxa (including infraspecific taxa), belonging to 20 genera of three subfamilies (Caesalpinioideae, Faboideae, and Mimosoideae) were recorded. New keys were added for plant taxonomists to aid the accurate identification of wild legumes in the flora of Yemen. Plant names were updated except for the genus *Acacia* s.l., which remains as it was traditionally recognized as some species are endemic to Yemen and await future systematic and phylogenetic studies.

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Conflict of interests: The authors declare that there are no conflicts of interest regarding the publication of this paper.

Authors contribution: Othman Saad Saeed Al-Hawshabi: Conception, design, field trips, and writing the results. Ahmed K. Osman: Writing original draft preparation, review, and editing. Mohamed O. Badry: Formal analysis, writing original draft preparation, and approved the final version to be submitted for publication. All authors discussed the results and contributed to the final manuscript

Ethical approval: Not applicable.

References


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zungenen (، online. 6 (J.B.Gillett) Thulin subsp. Annonacae و "1973 و العناصر السودانية الزامبية هي الأكثر سيطرة، وتشكل المكون الرئيسي من النباتات المسجلة(. كانت لكل نوع مسجل، تم إعطاء الاسم المقبول والمرادفات )إن وجدت( والتوزيع المحلي. تم توفير مفاتيح مراجعة التصنيف للعينات المسجلة بشكل منهجي وتم تحليل أشكال الحياة والعمر والصلات الجغرافية

Zygocarpum yemenense Wood Wickens
Indigastrum costatum
Acacia edgeworthii
Cadia purpurea (Picc.) Ait
Tephrosia yemenica
Senna Crotalaria
Zygocarpum yemenense (J.B.Gillett) Thulin و Acacia hunteri Oliv. و Acacia edgeworthii T. (Lavin Crotalaria 3 Cadia purpurea (Picc.) Ait و Acacia johnwoodii Boulos و Anders Indigastrum costatum subsp. gonioides (Hochst. ex Baker) و Salitana Andrews

تتناول الدراصات الحالية مراجعة تصنيفية للبقوليات البرية في فترة مراهقة للنباتات في محافظة لحج اليمنية: 1- مراجعة تصنيفية للبقوليات البرية من الفصيلة البقلوية


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