

A dendrological key for identification of acacia species growing in Saudi Arabia and Northern Sudan

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ABSTRCT. The present study is an attempt to facilitate the identification of acacia species growing in Saudi Arabia and Northern Sudan, that have many uses and values in both countries. The characteristic features of these species are recorded from field observations, color photographs and consulted forest tree literature of the two countries. Acacia features recorded from field and photographic data besides those extracted from literature are summarized and put into contrasting couplets, whereupon a dichotomous numbered key is developed by the way of elimination. The key identifies twenty seven acacia species and variety. It was developed that it could easily be computerized.

Introduction

The genus *Acacia* comprises over thousand species spread allover the world. Most of them grow in the arid and semi-arid regions, with an average temperature of 40-45 °C in summer and less than 5°C in winter. Acacias equipped with most of the features required to withstand severe climatic conditions, therefore they considered as the most successful "survivors" in the arid regions (Ibrahim and Aref, 2000; Aref, 2000). Acacias are among the widely spread species in both Saudi Arabia and Northern Sudan. More than twenty species are growing in the two countries. Most of these are indigenous and some are exotic, but well adapted to the sites of the two countries. Besides their wide distribution in the two countries, acacias have too many uses and values. Some are locally utilized while others are of high economical importance. Gum Arabic which is product of *Acacia senegal* stat. Synon (90%) and *Acacia seyal* Del. var. *seyal* (10%) is the most economically important product of all acacias. This commodity forms one of the pillars of the Sudan economy. However, many of the acacias produce gums but of low quality compared to Gum Arabic. Some of these gums, like that of *Acacia polyacantha* (Willd.) are of reasonable quality. Most of the acacias produce tannins. *Acacia nilotica* (L.) Willd. Ex Benth, for instance, produces more than 20% tannins especially from the green immature pods and this is used in tanning leathers in commercial tanneries of the Sudan (Sahni, 1968). All acacias are suitable materials for fuel, forage, soil fertility and soil conservation. They are also suitable for agroforestry e. g. *Acacia albida* Del. (*Acacia Faidherbia*) with millet crop in Western Sudan (Abd El-Hafiz, 2001). Many of these acacias give timbers that used in local buildings. Some acacias give valuable timbers such as *Acacia nilotica* and *Acacia polyacantha* which are sawn for railway sleepers. Timbers of *Acacia nilotica* and *Acacia albida* Del. (*Acacia Faidherbia*) are also used for local furniture. Most of the acacias are of medicinal benefits to Man and his livestock. *Acacia nilotica* pods is used for treating wounds and diarrhea, and Gum Arabic for treating kidney diseases, the latter is now adopted by the kidney unit in Khartoum, Ministry of Health (Elkhalifa, 1996). In addition, acacias form a good habitat for the honey bee that produce good quality honey: commercially known as acacia honey.

As acacias have numerous uses and values, widely spread in Saudi Arabia and Northern Sudan, and have many similarities among them that may cause some confusion, the present study elaborates on their identification. Due to the absence of simple speedy way for their identification, the study aims to develop a dichotomous key for such a purpose. It is intended to give a field guide to researchers and post-graduate students in forestry, botany and allied disciplines.

Materials and Methods

Site Characteristics

Saudi Arabia and Northern Sudan form the study area of the present research. Saudi Arabia, with an area of 2.5 million Km², is mainly desert and semi-desert besides the mountains of southwest region, scattered valleys and the western and eastern coasts (Aref and El-Juhany, 2000). While Sudan, with almost the same area of Saudi Arabia, is the largest country in Africa. It exhibits a wide range of variation in its topography, climate, soil and hydrology. Consequently, It includes many vegetational zones from the arid in the far north to the equatorial to the very south of the country (Ibrahim, 1996).

Distribution of acacias

As acacias generally grow in a wide range of habitats, accordingly, they are distributed within the two countries according to the variety of climates and soil. Some acacias such as *Acacia tortilis* (Forssk.) Hayne. (three varieties) and *Acacia ehrenbergiana* Hayne. are commonly found in central and north of Saudi Arabia (Aref, 2000), and in the north of the Sudan (Elkhalifa,1996). While *Acacia seyal* Del., *Acacia mellifera* (Vahl) Benth., and *Acacia laeta* R. Br. Ex Benth. are found in a wetter climate in the two countries. On the other hand, some species like *Acacia nilotica* (three varieties) and *Acacia albida* Del. (*Acacia Faidherbia*) are associated with rivers (in the Sudan) or valleys and lands of near water tables in Saudi Arabia. However, *Acacia albida* also grows on the foot-hills of the two countries. *Acacia asak* (Forssk.) Willd. and *Acacia etbaica* Schweinf. were also recorded on the foot-hill sites along the red sea coast south Jeddah (Vesey-Fitzgerld, 1955) and south and southwest Saudi Arabia (Aref, 2000). While the same above species (*i.e.* *Acacia mellifera* (Vahl) Benth., *Acacia tortilis* and *Acacia ehrenbergiana* Hayne. were recorded on similar sites north of Jeddah (Vesey-Fitzgerald, 1957). Batanouny (1979) also recorded *Acacia hamulosa* Benth. besides *Acacia tortilis* and *Acacia ehrenbergiana* along Jeddah-Mecca road in Saudi Arabia. Some of the acacias studied are confined to one of the countries such as *Acacia senegal* which found in the Gum Arabic belt that extends to the west and east of the River Nile in central Sudan.

Key Development

Reliable manuals of forest trees in both Saudi Arabia and Sudan were consulted. These included Sahni (1968), Chaudhary (1983), Collenette (1985), El-Amin (1990) and Elkhalifa (1996). Field trips were carried out at different seasons and colored photographs were taken for the different organs of the different *Acacia* species. From the field observations, photographic data, and the literature reviewed, the characteristic features of each *Acacia* species and variety were detected. These features were then put into contrasting couplets, whereupon by the method of elimination, a dichotomous key was developed. The main botanical characters adopted for constructing the key were shown in table (1).

Table 1. Main characteristics used in developing the acacia key

Morphological organ	detailed morphological characters
Thorns	presence, number at node, length and straightness
Leaves	number of pinnae and leaflets and their sizes
Stem	single, multi; and size
Crown	shape, size
Inflorescence	type: head or racemose; color
Fruit	Pods shape, size, color and texture

Results

Depending on the botanical features detected from the field, photography work and literature, a dichotomous dendrological key was developed. The key identifies, by scientific name (and common local names when found) twenty seven *Acacia* species and varieties that grow in Saudi Arabia and Northern Sudan. The key is shown in table (2).

Discussion

According to the importance and wide distribution of acacias in Saudi Arabia and northern Sudan, and the lack of simple speedy way for their identification, the present work produces a dichotomous key for such a purpose. The key has been built on the characteristic, reproductive and/or vegetative features that detected from field observations, colored photographs taken and reliable relevant literature consulted. The key is believed to be simple, speedy and reliable, as it makes use of the distinctive morphological characters in a dichotomous nature. Its dichotomous nature should make it easy for computerization in an interactive program. It is hoped that the present key would be a guide to researchers and post-graduate students in the fields of forestry, botany and related disciplines. The dichotomous nature will make it possible for extension to include all acacia species growing the Sudan and all of the Arabian Peninsula. Moreover, it might be considered as a template for similar keys to come for other important genera and families in the region.

Table 2. A dendrological key for identification of acacias growing in Saudi Arabia and Northern Sudan

No.	Feature	Species
10	Spines short and curved (rarely straight) → 20 Spines long and straight → 100	
20	Spines claw-like, pinnae two pairs Trees larger in size, 2-3 pairs of pinnae, taller stem of crimson bark	<i>Acacia mellifera</i> (Vahl) Benth. [kitir] <i>Acacia laeta</i> R. Br. Ex Benth. [Shubahi]
30	Bark black, smooth, powdery, whitish * → 40	<i>Acacia polyacantha</i> (Willd.) [Kakamot]
40	Spines in 3's, pod pale brown and hairy * → 50	<i>Acacia senegal</i> (L.) [Hashab]
	Pod dark brown smooth and leathery	<i>Acacia asak</i> (Forssk.) Willd [Hasak]
50	White inflorescence, pod green-yellowish * → 60	<i>Acacia hamulosa</i> Benth.
60	Spines many and scattered	<i>Acacia ataxacantha</i> DC.
70	Spines short and straight, inflorescence globose, pods orange & twisted * → 80	<i>Acacia albida</i> Del. (<i>Faidherbia albida</i>) [Haraz]
80	Spines very small, inflorescence creamy * → 90	<i>Acacia etbaica</i> Schweinf.
90	Pods indehiscent and dark brown	<i>Acacia farnesiana</i> (L.) Willd. [Fotnah]
100	Inflorescence creamy, pods red and smooth	<i>Acacia negrii</i> Pichi.
110	Bark smooth and powdery, pod crescent-shaped → 120 * → 130	
120	Bark reddish Bark whitish or creamy	<i>Acacia seyal</i> var. <i>seyal</i> Del. [Talh] <i>Acacia seyal</i> var. <i>fistula</i> (Schweinf.) Oliv. [Talh abiad]
130	Many pinnae, long brown pods With blackish galls at the base of spines	<i>Acacia hockii</i> De Wild. <i>Acacia drepanolobium</i> (Harms ex sjostedt.)
140	Two types of spines, long and short * → 180	

Continue

No.	Feature	Species
150	Both types of spines straight, leaflets relatively large and many	
155	Tree crown dense, umbrella-shaped, and pod flat	<i>Acacia gerrardii</i> var. <i>negevensis</i> Zoh.
	Crown narrow, pod narrow and acute	<i>Acacia gerrardii</i> var. <i>nagednsis</i> Chaudhary.
160	Large tree, crown irregular, pods contorted	<i>Acacia tortilis</i> (Forssk.) Hayne. var. <i>radiana</i> (Savi) Brenan
170	Smaller, multi-stemmed, dark bark	<i>Acacia tortilis</i> (Forssk.) Hayne. var. <i>tortilis</i>
	Relatively larger tree, bark lighter in color	<i>Acacia tortilis</i> var. <i>spirocarpa</i> Hochst. Ex A. Rich. [Samar]
180	Tree with umbrella-shaped crown, long spines →190 *→ 210	
190	Spines >8 cm, pinnae >14 pairs	<i>Acacia siberana</i> [Kok]
	Narrow pods	<i>Acacia ehrenbergiana</i> Hayne. [Salam]
200	Pods necklace-like constricted between seeds →210 *→ 230	
210	Pods broadly constricted between seeds, bark relatively light in color	<i>Acacia nilotica</i> sub. <i>adansonii</i> [Sunt naili, Abu araida]
	Pods narrowly constricted between seeds →220	
220	Pods glabrous	<i>Acacia nilotica</i> sub. <i>nilotica</i> [Sunt naili, Abu lamaa]
	Pods tomentose	<i>Acacia nilotica</i> sub. <i>tomentosa</i> (L.) Willd. Ex Del. [Sunt naili, Abu gataifa]
230	Winged pods	<i>Acacia orefota</i> (Forssk.) Schweinf.
240	Tree branches in all directions, twigs with repellent smell	<i>Acacia nubica</i> Benth. [Laoot]
*→ 00 : Tree not like above [.....] : Local name		

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