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REVIEW OF THE GENUS *ACACIA* MILL. AND ITS ALLIED GENERA IN KINGDOM OF SAUDI ARABIA AND THEIR CONSERVATION STATUS

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Abstract

The genus *Acacia* Mill. (s. lat.), a member of the *Fabaceae*, subfamily *Mimosoideae* contains over 1500 known species. Recent molecular phylogenetic analysis has reclassified African *Acacia* into two genera: *Vachellia* and *Senegalia*. Within the Kingdom of Saudi Arabia (KSA) *Acacia* communities, represent one of the largest forest communities. This paper provides a comprehensive analytical review of the classification, relocation to the new genera, distribution, multifaceted uses, and current conservation status of *Acacia* species in KSA.

The genus naturally spans diverse biogeographical distribution across KSA, from flat dry forests to high mountainous regions like the Soudah mountains of Asir. Currently, approximately 14 known *Acacia* species, with about 10 species allocated to *Vachellia* (with globular inflorescences and true spines) and 4 to *Senegalia* (with spicate flowers and prickles). However, there is still a lack of precise information about the exact number of species, subspecies and varieties, taxonomic relations and their biogeographical distribution. The species of two genera offer substantial ecosystem services, including environmental protection, medicinal applications, desertification control, climate change mitigation, water catchment protection, and the provision of various wood and non-wood products. Significantly, *Acacia* (s. lat.) trees are positioned to play a pivotal role in achieving the ambitious Greening Saudi Initiative objectives, such as planting 10 billion trees. However, the conservation status of many species is unfortunately declining, primarily due to a complex array of forest disturbances. These include insect pests, such as bark beetles, seed borers, and desert locust (e.g., bark beetles alone caused over 21% damage to *Acacia* populations in Hail). Furthermore, invasive species like *Prosopis juliflora*, coupled with forest fires, human-induced disturbances, and the overarching impacts of climate change, exert heavy pressure on these vital forest ecosystems. To address these challenges and resolve the existing taxonomic ambiguities, this review strongly recommends further studies in phylogenetic analysis and conservation status.

Key words: *Acacia*; *Vachellia*; *Senegalia*; Conservation status; Greening Saudi Initiative globular inflorescences and true spines versus *Senegalia's* spicate flowers and prickles

Introduction

In general, due to the arid and hyper-arid climate of Kingdom of Saudi Arabia and a large desert area including the empty quarter (Rub' al Khali) desert the forest cover is low compared to the total land area (Anon., 2020). Nevertheless, the plant diversity is very high due to its unique geographical location, the very large area and great ecological diversity (plant diversity of Saudi Arabia, 2024). More than 2000 plant species belonging to more than 140 families were reported in KSA with more than 250 medicinal and aromatic plants (Plant Diversity of Saudi Arabia, 2024). There are three main forest ecological zones; the high altitudinal mountainous forest communities on the southwestern and central part of the country, the dry land terrestrial forests that cover the major area of the country and the coastal mangrove forests on the coasts of the Red Sea and Arabian Gulf (Chaudhary & Al-Jawaid, 2013).

The genus *Acacia* was first described by Philp Miller as early as 1754 (Doran *et al*., 1983). The first recorded *Acacia* species was *A. nilotica*. There are nearly 1500 known species of *Acacia* (Dyer, 2014). The natural range of the genus covers all continents, except Europe and Antarctica (Maslin *et al*., 2003). However, in 2011 the African *Acacia*s were re-named into two genera *Vachellia* and *Senegalia* (Kyalangalilwa *et al*., 2013). In the Kingdom of Saudi Arabia, *Acacia*s (s. lat.) represent the main part of arid zone forest vegetation community, the largest forest community (Chaudhary *et al*., 2013). Fourteen species of *Acacia*s (s. lat.) were reported in the KSA (Sheila, 1985; Chaudhary, 1983).

In the year 2012 *the Green Saudi Initiative* was announced. This is very ambitious initiative covering the period between 2021–2030 and following the vision 2030. The initiative highlights an overall sustainable goal for the current and future generation with three main target objectives: Greening Saudi, by planting about 10 billion trees, reducing carbon emissions to 278 million tons per annum and protecting about 30% of terrestrial and marine ecosystems.

In this regard, *Acacia* trees will have a very great role in contributing to the achievement of the initiative objectives. Due to their wide natural range, multiple uses and values and perfect resilience to the changing climatic conditions. This paper presents analytical review about the new placement of Saudi *Acacia* and its allied genera *Vachellia* and *Senegalia*, their distribution, uses, values and conservation status.

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Discussion

Botanical history of the genus *Acacia*: The *Acacia* genus, commonly known as *Acacia* or *Wattles* belongs to the pea family *Fabaceae*, subfamily *Mimosoideae*. First described by Phillip Miller in 1754 (Doran *et al*., 1983). The first recorded *Acacia* was Egyptian thorn *Acacia* (*A. nilotica*). There are about **1500** known species of *Acacia* (Dyer, 2014). In Australia alone, there were over 1000 species of *Acacia* (s. lat.) (Richardson *et al*., 2023). In addition to over 130 species are native to African; about 100 species found in Madagascar; 270 species in America and 55 species in Asia-pacific region (International Dendrology Society, 2024). The natural range of the genus covers all continents, except Europe and Antarctica (Maslin *et al*., 2003). Recently the analysis of fossilized pods of *Acacia* revealed the occurrence of *Acacia* in the Southern lower altitude of China during the middle Miocene, suggesting a wide biogeographical distribution and diversification of *Acacia* (Wang *et al*., 2023). However, due to a very large number of species and a wide diversified natural range of the genus, there is a lot of debate and controversy on *Acacia* among the scientific community throughout history (Thiele, 2011). Until recently, a finding of molecular phylogenetic analysis of *Acacia* resulted in the placement of the African *Acacia* into two genera, namely *Vachellia* and *Senegalia* (Kyalangalilwa *et al*., 2013). This new classification of the genus was approved in the year 2011 during the 17th International Botanical Congress, held in Melbourne, Australia (Dyer, 2014). However, there is still some sort of disagreement about the way this was done (retaining the name *Acacia* for the Australian species) (Tropical Plants Database, 2024). The main differences between *Vachellia* and *Senegalia* are that *Vachellia* have globular head (capitate) inflorescence and spinescent stipules, while in *Senegalia* the inflorescence with spicate flowers and non-spinescent stipules (prickles) (Dyer, 2014). In the Kingdom of Saudi Arabia, *Acacias* represent the main part of dry zone forest vegetation community, the largest forest community (Chaudhary *et al*., 2022). There are about 14 native species of *Acacia* recorded in Saudi Arabia, in addition to *Faidherbia albida* (Chaudhary & Al-Jawaid1, 2013; Abdul Wali *et al*., 2016; Chaudhary, 1983; Sheila, 1985). The occurrence of the species extending from low-level flat areas to high altitudinal areas. Fayed and Zayed (1989), identified about 6 *Acacia*s in Makkah region (*A. raddiana, A. tortilis, A. ehrenbergiana, A. hamulosa, A. asak, A., and A. gerradii)*. While, Waly and Emad (2012) added two species to these 6 species in the same area (*A. etbaica and A. nubica*). In Al-Baha there are about 8 registered species, 6 of which are among the 17% widely distributed tree species in the area (*A. gerradii, A. asak, A. flava, A. origena, A. ebaica and A. tortilis*) (Abdul Wali *et al*., 2016). In Asir Region at the lower slope (400 – 1000 m) there are about 7 species of *Acacias*, in the area between 1000–1600 m there are 3 species, in 1600-2200 m there are 3 species while on the mountains between 2200 and 3100 m there is only one species (*Vachellia origena*) (Plant Diversity of Saudi Arabia, 2024).

Communities and biogeographical distribution of the genus *Acacia* in KSA: In the Kingdom of Saudi Arabia, *Acacia*s (s. lat.) represent the main part of arid zone forest vegetation community as well as part of mountainous forest community (Chaudhary & Al-Jawaid, 2013). It is the most widespread forest communities, stretching from low flat areas to high altitudinal areas (Waly & Emad, 2012). Some species like *V. tortilis*, V. *flava* and others are found in flat plains and along wadis and sand dunes while others found in very high altitudinal areas associated with *Junpierus procera* (*Vachellia origena*) (Table 1 & 2). The distribution of the different species in KSA were presented in (Fig. 1). *V. tortilis* is the species with widest natural range covering most regions of KSA. While others like *V. origena* are restricted to high altitudes and others Like *V. etbaica* and *S. hamulosa* are characteristics of lower slopes and rocky hills.

However, there is a lot of controversy in the literature about the different species, subspecies and varieties. According to the Anon., (2014), *V. Gerradii* have two varieties; *iraquensis* and *najddensis*, while in Chaudhary (1983) and Chaudhary and Al-Jawaid (2013), there is one subspecies (subsp. *Negevensis* and two varieties *negevensis* and *najdensis*) where according to Kew (Plants of the World Online, 2024) there is only one subspecies in KSA (Subspecies *najdensis*). For *V. johnwoodii*, Chaudhary *et al*., (2022), described *abyssinica* as syn. for *johnwoodii*, while Abdul Wali (2016) revealed that *abyssinica var. macroloba* was syn. for *johnwoodii*. The same way Chaudhary *et al*., (2022) describes *origena* as a new name for *negrii*, while Chaudhary and Al-Jawaid (2013), mentioned that *origena* was previously mistakenly identified as *negrii*. Therefore, in this review we did not include *abyssinica* and *negrii*. Thus, we reviewed a total of 14 species with *V. tortilis* having two subsp. (*raddiana* and *spirocarpa*).

How to differentiate between the *Acacia* species in the two genera in KSA: Fig. 2 summarizes the main features of identification and differentiation between the *Acacia*s in KSA. In general, according to the new separation of African *Acacia* into the genus *Vachellia* and genus *Senegalia*, there are about 14 *Acacias* (s. lat.), plus *F. albida*. They were relocated as follows: **10** species were placed into the *Vachellia* of which in **7** species the inflorescence was arranged in white or creamy or creamy-white globose heads, while **3** species with yellow capitate inflorescences. The other **4** species were placed into the genus *Senegalia* and all with white spicate inflorescence. In most of the KSA *Acacia*s the leaves are bipinnate, but the species differed in some characters such as the number of the pinnae and the leaf blade size. The thorns are either spinescence stipules (with spines) arising from the near leaf base or curved with two or three prickles arising from epidermis and are usually found in the nodes or may found in the stem (Timberlake *et al*., 1999). It was observed that in the species with straight spines or stipules usually have spherical cluster of flowers with some exceptions like *F. albida* with straight spines, but with spicate flowers. While the species with prickles usually their flowers are in cylindrical cluster, also with some exceptions like *V. tortilis* which have both straight and curve thorns but its flowers in head (Timberlake *et al*., 1999). Concerning the fruits, most of the *Acacia* species are with dehiscent pods, while few other species are with indehiscent pods. The fruits are widely differing in shape and size. In the same way, the seeds are widely variable in shape, size and color. In addition, the seeds of most *Acacia* have a seed coat dormancy. However, according to Ross (1973) the species with spicate inflorescence have small centrally located areoles, while those with capitate inflorescence have large areoles in the seed.

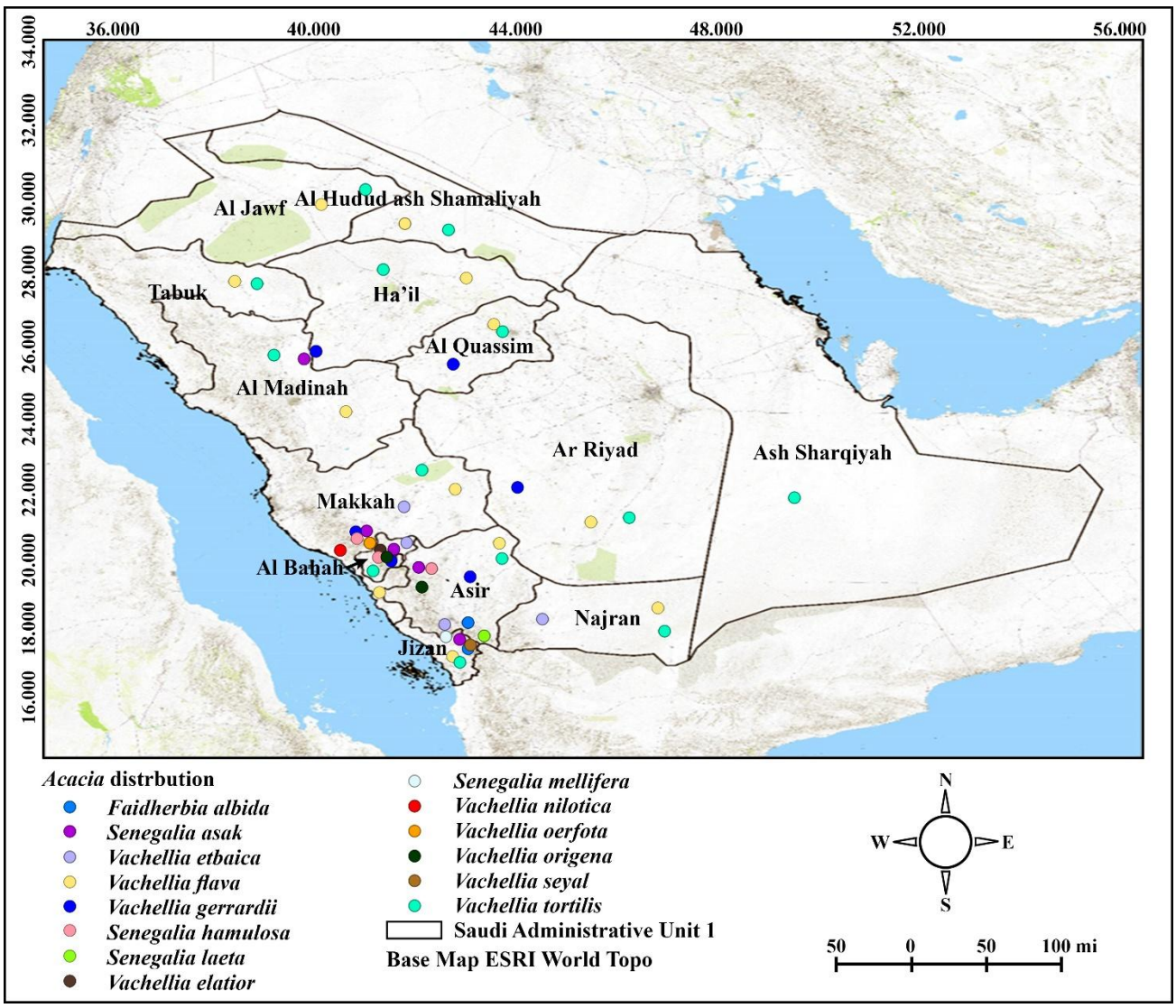

Fig. 1. Map of two genera (*Vachellia* and *Senegalia*) of *Acacia Species* distribution in Kingdom of Saudi Arabia based on varying elevations using the SRTM Digital Elevation Model (DEM) from Google Earth Engine (GEE) and analyzed with advanced QGIS Software.

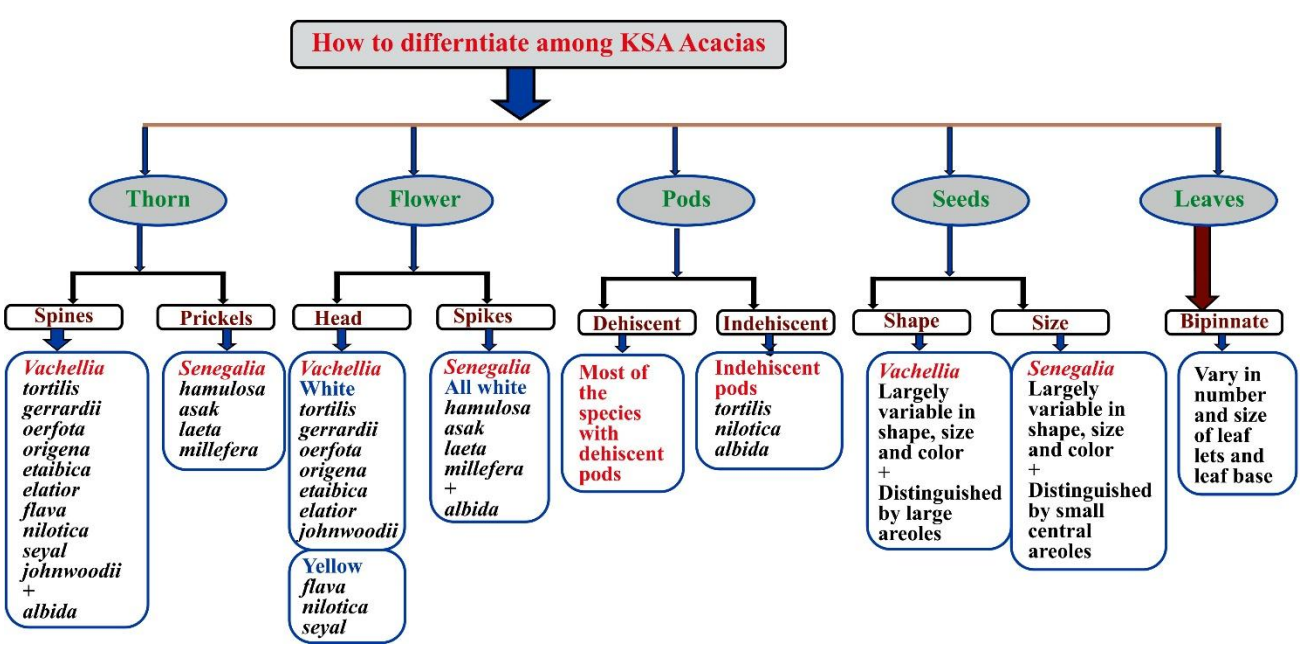

Fig. 2. Differentiation between the different species of the two genera (*Vachellia* and *Senegalia*) in the Kingdom of Saudi Arabia according to their morphological features (Thorns, Flowers, pods, Seeds and Leaves).

Table 1. Description and habitat of species, subspecies and varieties of the genus *Vachellia* found in Kingdom of Saudi Arabia.

No.	Scientific name	Common name	Local name	Description	Habitat
1.	***Vachellia tortilis*** (forssk.) Galasso & Banfi. subsp. raddiana (Savi) Kyal. & Boatwr.	Umbrella Thorn	Samur, Sayal	A tree 7-21 m high. Stipules spinescent, hooked or straight. Leaves compound. Flowers: Capitate, white. Fruit: pods spirally twisted or coiled and constricted.	Found from the east coast to the west coast except for the deep sands and very high mountains. In the southwest, the western plains and the southern wadis it forms wood kind of vegetation.
	subsp. spirocarpa (Hochst. ex. A.Rich.) Kya l. & Boatwr.		Samur	Shrub 4-7 m high. Spines all straight. Leaves: compound. Flowers: Capitate, white. Fruit; Pod spiral and compressed.	
2.	***Vachellia flava*** (Forssk.) Kyal. & Boatwr.		Salam	Many-stemmed shrubs 1-5 m high. Barks with flakes. Stipules spinescent straight, with shorter spines. Leaves: compound. Flowers: Capitate, yellow. Fruit: Pods with thin sheet.	Widely distributed in central, western, southern, northern parts at top of sand dunes, wadis and lower slopes of mountains
3.	***Vachellia gerradii*** (Benth.) P.J.H. Hurter subsp. *najdensis* **[?]**	Red Thorn; Grey-haired *Acacia*	Talh Nagdy, Sunt waraqi, Shabaan	A tree 7 -15m tall. Spines are stout straight and short. Leaves compound bipinnate. Flowers: white balls and sweet –scented. Fruit: Pods narrow falcate.	Widely distributed in KSA along wadis and water flow, shallow channels as well high areas. In Al-Baha area as high as 2000 m; also in high areas of Asir and Al-Taif
4.	***Vachellia oerfota*** *var. oerfota* (Forssk.) Kyal. & Boatwr.	Orfort	Urfut	A shrub or tree 1-5m tall. Thorns short, conical and thick. Leaves: Compound	Found in areas as high as 2700 amsl in southwest, west and far north
				Flowers: White -cream –green heads, capitate several together. Fruit: Pods usually straight. Broken branches emit a nasty nitrogenous smell characteristics of this species	A wide – spread shrub in restricted localities south of Makkah at all altitudes to 6,200ft. Near Jabal Mershid, 40 km east of Qunfudahah; in hard sand 50ft.
5.	***Vachellia origena*** (Hundle) Kyal. & Boatwr.		Talh Kanhabl, Asiri	A tree up to 6m tall. Thorns: Long Leaves: Compound. Flowers: white Spherical in heads. Fruit: Flat pods.	In Asir region; it is *Acacia* found in the highest altitude areas (up to 2700 m) sometimes associated with *Juniperus procera* in Jabal Soudah of Abha region; found in Al-Baha
6.	***Vachellia etbaica*** (Schweinf.) Kyal. & Boatwr.		Qardh or Algard	Shrubs or small trees 2.4 m high. Thorns: Straight and short. Leaves: Compound. Flowers: Capitate, white. Fruit: Pods shiny.	Found in western slops between 900 – 1500 amsl in Taif, Asir and Al-baha
7.	***Vachellia elatior*** (Brenan) Kyal. & Boatwr.	River *Acacia*	Sunt Nahri	A tree 7 m high. Thorns: White, straight and long. Leaves: Compound. Flowers: In spherical heads. White to pale yellow. Fruit: Pods straight or slightly falcate	NW of Abha, at the edge of a small sandy wadi among the foothills 1500ft.
8.	***Vachellia. seyal*** (Delile) P.J. Hurter var. seyal (Delile) P.J. Hurter var. fistula (schweinf.) Kyal & Boatwr.	Red *Acacia*, Shittim wood, Shittah tree	Seyal or Talh	Trees 3-17m high Spines long, white. Leaves: Compound. Flowers: Capitate, yellow. Fruit: pods falcate. Without inflated spines and green white or red bark.	Reported in Jazan area and Fayfa mountains
9.	***Vachellia nilotica*** *var. tomentosa* (L.) P. J.H. Hurter & Mabb.	Babul *Acacia*, Egyptian *Acacia*, Sunt Al Arabi	Sunt Arabi, Garad	Trees 5-15 m high. Stipules spinescent, straight. Leaves: Compound. Flowers: Capitate, yellow. Fruit: Variable pods	Southwest Saudi Arabia
10.	***Vachellia johnwoodii*** (Boulos) Ragup., Seigler, Ebinger & Maslin		Talh Sayal	A tree up to 16m tall. Thorns are aligned in straight pairs at nodes. Leaves are in pinnae pairs. Flowers: Arranged in white spherical heads. Fruit: Pods dehiscent.	Southwest Saudi Arabia; Abha region; Al-baha area, Jazan, Tohama and Asir, Al-Madinah.

Sources: (Chaudhary *et al*., 2022; Chaudhary & Al-Jawaid1, 2013; Abdul Wali *et al*., 2016; Sheila, 1985; Chaudhary, 1983)

Benefits and value of the species of *Acacia*: In the Kingdom of Saudi Arabia, both genera (*Vachellia* and *Senegalia*) represent the main part of arid zone forest ecosystems, the largest forest community in addition the mountainous areas of south-west of the country (Chaudhary *et al*., 2022). Tables 3 & 4 highlight some of the uses and values of the two genera.

Drivers and trends in disturbance of *Acacia* communities: This review showed that many disturbances were recorded in the *Acacia* forest ecosystems. Among the most disturbing agents are insects' pests such as bark beetles (Alanazi *et al*., 2022), seed borers (Elfeel & Abohassan, 2016), desert locust (Anon., 2022). In Hail region northern of Saudi Arabia, a beetle's infestation on *Acacia* forest's population composed of three main species *A. gerradii* (dominant), *A. ehrenbergiana* and *A. raddiana* caused more than 21% damage on individuals of this population (Alanazi *et al*., 2022; Van Lierop *et al*., 2015). In Europe and North America, insect pests seem to be one of the most frequent forest disturbing agents (Bastit *et al*., 2023). Moreover, the impacts of insect pests are increasing with the increase of climate change (Alanazi *et al*., 2024; Guégan *et al*., 2023). Among major disturbances in Saudi Arabia terrestrial ecosystems are invasive species (Thomas *et al*., 2016), such as *Prosopis juliflora* and *Rhaza stricta* (AlZubaidi *et al*., 2022). In addition, to forest fires (Aref *et al*., 2011), humans induced disturbances, climate change and others. All these factors exerted heavy impacts on *Acacia* forests. Deforesting and forest degradation by various interacting agencies has a very high impact on forest ecosystems especially in arid lands which necessitate the need for ecological forest restoration actions (Chen *et al*., 2023). In areas where conditions are favorable, the *Acacia* restoration can be done through assisted natural regeneration. Assisted natural regeneration enhances biodiversity recovery, community structure (Rajapakshe *et al.*, 2024), as well as biomass and carbon stock (Joshi *et al*., 2024). Evaluation of many *Acacia* species suggested that *Acacia*s are potential for restoration in KSA (Al-Ghamdi *et al*., 2020). For a successful action for restoration a thorough ecosystem assessment is needed, including population structure, phylogenetic analysis, pattern of regeneration, soil seed bank as well as forest disturbance factors. Following by a high-quality seedlings production, suitable regeneration methods and proper arid land planting techniques such as water micro-catchments (Oweis, 2022; Owino *et al*., 2021).

Table 2. Description and habitat of species, subspecies and varieties of the genus *Senegalia* in addition to *Faidherbia albida* found in Kingdom of Saudi Arabia.

No.	Scientific name	Common name	Local name	Description	Habitat
1.	***Senegalia. asak*** (Forssk.) Kyal. & Boatwr.		Asak, Dhahian, Dhahia,Dhabian	A tree or shrub up to 10m.Thorns: Variable short, straight or re-curved. Leaves: Compound. Flowers: White –pale yellow on spikes. Fruit straight flat pods.	Found in altitudes from 300 up to 1700 around Asir and Sarwat Mountains; Al-Baha; Al-Taif; Jazan
2.	***Senegalia hamulosa*** (Benth.) Boatwr		Gatad, Katad	Shrub 3m high. Prickles: In threes. Leaves: compound. Flowers: Pedunculate spikes, white up to 6 cm long including the peduncle. Fruit: Pods wide and slightly twisted	Widely distributed in Hijaz and Asir in rocky and lower slope
3.	***Senegalia laeta*** (R. Br. ex Benth.) Seigler & Ebinger	Black-hooked *Acacia*	Sunt Saeed	Shrubs 2-6m high Prickles: In pairs Leaves: Compound Flowers: Spicate, white. Fruit: Pods flat and straight.	Southern Asir In narrow channel of wide sandy wadi. 4400ft.
4.	***Senegalia mellifera*** (M. Vahl.) Seigler & Ebinger	Black Thorn	Sunt Masal,	Shrubs 1-9 m high. Prickles: in pairs and hooked Leaves: Compound. Flowers: creamy-white - spicate, or cylindrical heads like. Fruit: Pods straight	Southern Asir In hard sand. 600ft.
5.	***Faidherbia albida*** (Delile) A. Chev.	Apple-ring *Acacia*	Haraz, Sunt Abyad	Large trees up to 30 m high. Stipules spinescent, straight. Leaves: Compound Flowers: Cylindrical spikes, white to creamy white. Fruit: Pods falcate curled or spiral.	In southwest KSA. rocky ground at edge of juniper forest.6500ft.

Sources: (Chaudhary *et al.,* 2022; Chaudhary & Al-Jowaid1, 2013; Abdul Wali *et al.,* 2016; Sheila, 1985; Chaudhary, 1983).

Table 3. Multiple uses and values of genus *Vachellia* in the Kingdom of Saudi Arabia.

No.	Species	Uses	Part used	Reference
1.	*Vachellia tortilis*	Many parts		Hnini *et al.,* 2023
		Traditional medicinal uses		
		Rehabilitation, sand dunes fixation, water catchment	Leaves	ElShamy *et al.,* 2024
		Antioxidant activity		
		Honey production		AlGamdi & Ansari, 2020
		Anticancer and antimicrobial	Pollen, Aerial parts	Alajmi *et al.,* 2017
2.	*Vachellia flava*	Anti-inflammatory; diuretic	Plant	Arbonnier, 2004
		Live fence	Plant	
3.	*Vachellia gerradii*	Antioxidant	Leaves	Aldhahrani & Althobaiti, 2019
		Coughs	Bark	
		Asthma	Bark	Arbonnier, 2004
		Antiseptic; emetic	Plant	
		Bilharzia, pains	Root	
4.	*Vachellia oerfota* var. *oerfota*	Poultice Scorpion bite, Rheumatism, Back pains, Anthrax and Emetic	Leaves, Roots, Stems, Ash and bark	Elsafori, 2006
		Traditional medicinal uses		
		Rheumatism	Bark	
			Bark	Tropical Plants Database, 2024
5.	*Vachellia origena*	High quality honey	Pollen	Abdul wali *et al.,* 2016
		Medicinal uses		
		Browsing tree	Bark	
		Fuel	Bark exudate	
			Wood	
6.	*Vachellia etbaica*	Antimicrobial & cytotoxic activity	Leaves	Kayed *et al.,* 2021
		Silver nano particles antimicrobial property	Leaves	Kalam *et al.,* 2021
				Elghaly, 2021
7.	*Vachellia elatoir*	Diarrhoea, coughs	Bark	Tropical Plants Database, 2024
8.	*Vachellia seyal*	Emulsifier, stabilizer, dietary fibre, prebiotic	Gum	Antoine-Michard *et al.,* 2023
			Wood	Elgorashi *et al.,* 2022
		Smoke, Shelterbelts, Charcoal	Plant, Wood, Bark	Arbonnier, 2004
		Colic, Agroforestry	Plant	
9.	*Vachellia nilotica*	Tannin	Pods	Shakil *et al.*, 2023; Ndiwe *et al.,* 2019
		Resin biocure		Mewoli *et al.,* 2023
		Railway sleepers		
		Furniture	Pods	Rather *et al*., 2015
		Traditional medicine	Wood	
		Furniture	Fruit, bark	
		Riverbank erosion control Anti-inflammatory	Plant	Arbonnier, 2004
		Anti- hepatitis	Bark, root, fruit	Ahovegbe *et al.,* 2021
		Astringent	Root	Arbonnier, 2004
		Tooth decay		
10.	*Vachellia johnwoodii*	Phytochemicals content	Leaves	Khan *et al.,* 2022

Table 4. Multiple uses and values of genus *Senegalia* in addition to, *Faidherbia albida* in the Kingdom of Saudi Arabia.

No.	Species	Uses	Part used	Reference
1.	*Senegalia asak*	Browsing	Leaves	Abdul Wali *et al.,* 2016
		Feul	Wood	
		Medicine	Bark, gum	
2.	*Senegalia haumlosa*	Anticancer and antimicrobial	Aerial parts	Alajmi *et al.,* 2017
3.	Senegalia laeta	Antioxidant activity	Leaves	Elshamy *et al.,* 2024
		Anticancer and antimicrobial	Aerial parts	Alajmi *et al.,* 2017
		Asthma	Bark	Arbonnier, 2004
4.	*Senegalia mellifera*	Live Fence	Plant	Arbonnier, 2004
		Syphilis	Bark	
5.	*Faidherbia albida*	Antioxidant activity	Leaves	Elshamy *et al.,* 2024
		Agroforestry	Pollens	
		Honey production		

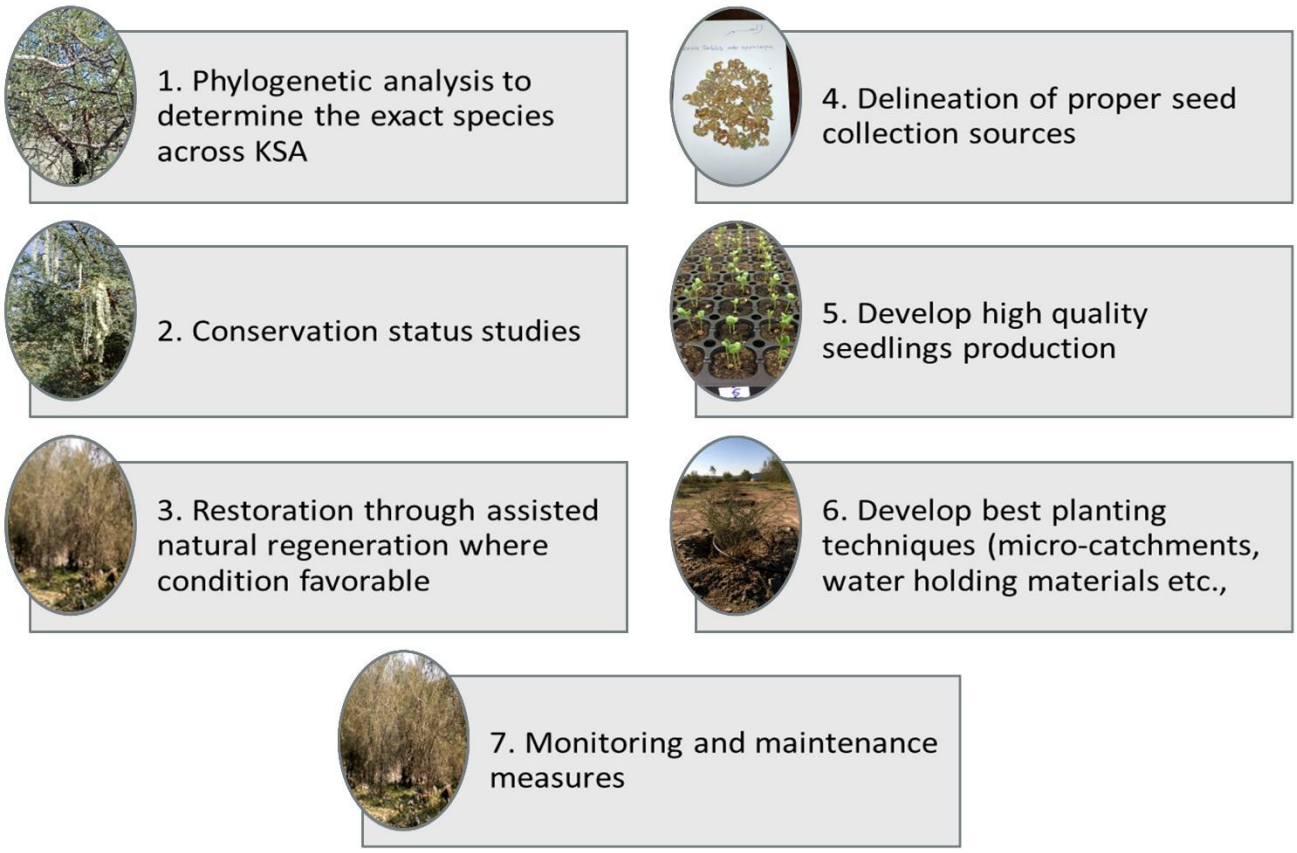

Fig. 3. Suggested steps to be followed for further studies in the two genera (*Vachellia* & *Senegalia)* for conservation, restoration or rehabilitation in KSA.

Conclusion and Perspectives

The review consistently highlights the fundamental ecological importance of the two genera *Vachellia* and *Senegalia* (previously placed under *Acacia* s. lat.) as the largest forest communities in the Kingdom of Saudi Arabia (KSA), thriving across diverse environments from arid plains to high mountainous regions. Approximately 10 of the 14 historically known *Acacia* species in KSA now belong to *Vachellia*, while 4 belong to *Senegalia*. *V. tortilis* is the species with the widest range, while *V. origena* is found at the highest altitude. Morphological distinctions, such as *Vachellia's* globular inflorescences and true spines versus *Senegalia's* spicate flowers and prickles, aid in their differentiation. These genera possess significant multipurpose values, offering environmental, medicinal, and economic benefits. They are crucial for combating desertification, mitigating climate change, and hold immense potential to contribute to KSA's ambitious Green Saudi Initiative objectives, including planting 10 billion trees and protecting 30% of the terrestrial and marine ecosystems. However, there are many uncertainties related to the exact number of species, subspecies and varieties and their exact natural range and extend and magnitude of variation among and within different populations. In addition, the conservation status of many species is declining. This decline is driven by various factors, including insect pests (e.g., bark beetles, seed borers), invasive species (e.g., *Prosopis juliflora* and *Rhaza stricta*), forest fires, human disturbances, and the overarching effects of climate change.

To address these critical challenges and unlock the full potential of these genera for KSA's ecological future, a concerted and integrated research and conservation strategy is imperatively needed including:

- Robust phylogenetic analysis is highly recommended to definitively determine the exact number of species and their precise taxonomic relationships across Saudi Arabia, resolving existing controversies.
- Comprehensive conservation status studies are essential to quantify their decline and inform targeted restoration, rehabilitation or protection strategies.
- Further studies are recommended on assisted natural regeneration (ANR), high-quality seedling production, and proper arid land planting techniques, such as water micro-catchments, to ensure successful restoration or rehabilitation and contribute to large-scale greening initiatives. The following chart (Fig. 3) shows suggested further studies and investigations.

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