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Morphological Investigation of Genus *Ziziphus* Mill. (Rhamnaceae) in Saudi Arabia

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Abstract

The genus *Ziziphus* Mill. is a member of the Family Rhamnaceae and comprises of ca. 170 species distributed in tropical and subtropical regions. The species in the genus are of economic and medicinal importance. This study was conducted to identify the members of the genus in Saudi Arabia as well as morphological features that show delimitation in the genus. Field survey was conducted across the study area where 74 individuals were collected and used in the study; additionally, herbarium specimens were also employed. Both floral and vegetative parts which include habit, leaf, fruit and flowers were examined. The result showed that there is variation in morphological features among the species within the genus and the genus is represented by three species namely *Ziziphus nummularia*, *Z. mucronata*, and *Z. spina-christi* and two varieties *Z. spina-christi* var. *spina-christi*, *Z. spina-christi* var. *microphylla*.

Keywords

Morphological Features, Rhamnaceae, Saudi Arabia, Taxonomy, *Ziziphus*

1. Introduction

The genus *Ziziphus* belongs to the family Rhamnaceae and comprised of ca. 170 species distributed in tropics and subtropics regions of the world. Members of the genus are widely distributed that other genera in the Rhamnaceae. The species in the genus are of economic and medicinal importance. Several species of the genus *Ziziphus* were reported to be used in traditional medicine as well used in treatment of various diseases; they are used as an immune system stimulant, anti-inflammatory, antitumor, antioxidant, antimicrobial, anti hypoglycaemic, anti hypotensive and liver protective agent in different countries around the

world [1] [2] [3] [4]. The Rhamnaceae family has been shown to be represented in Saudi Arabia by four genera which are: *Ziziphus*, *Rhamnus*, *Berchemia* and *Sageretia* [5] [6] [7] [8].

Sidr is the local name of *Z. spina-christi*, as mentioned numerous times in the holy Qur'an, in the description of paradise when the sidr exists without thorns, in an impoverished garden description, and as a landmark in a heavenly or earthly landscape associated with a vision of the Prophet Mohammed [9].

There is a great diversity of vegetation in Saudi Arabia due to different climatic regimes, ranging from Mediterranean, arid and semiarid climates [10] and a wide variety of a habitat including high mountains, deep valleys, rocky deserts, meadows and coastal plains. There are about 2243 flowering plant species belonging to 837 genera from 142 families [6] [11] in the country.

Numerous highly sophisticated studies have been carried out for long time on the Flora and vegetation of Saudi Arabia. [5] recorded in her first publication "*An Illustrated Guide to the Flowers of Saudi Arabia*" two species and two varieties of the genus *Ziziphus* (*Z. nummularia*, *Z. spina-christi* and *Z. spina-christi* var. *inermis*). She reported that *Z. nummularia* is a shrub growing up to 2 m high, tangled, leafy and thorny and includes two forms of spines: one is erect or straight; and the other is curved; leaves are small oval, and has flowers 3 mm wide in greenish yellow, spicy scent, and orange fruits. *Z. spina-christi* is a shrubby tree growing up to 3 m tall; leafy branches are thorny; leaves are small and shiny; and it has flower 3 mm wide, greenish in clusters and have no scent. While, *Z. spina-christi* var. *inermis* is a tree growing up to 12 m high, leafy, without spines; leaves are long; flowers have a musty smell, pale greenish and 4 mm wide, mature fruit sweet tasting and apricot coloured. [5] stated that *Z. spina-christi* defers from the *spina-christi* var. *inermis* in its growth habit and has smaller glossy leaves. *Z. nummularia* is common in Buraidah, in the northern part of Saudi Arabia, whereas *Z. spina-christi* and *Z. spina-christi* var. *inermis* are distributed in Najran, Asir and South Hijaz regions. Later, [12] [13] recorded three species of *Ziziphus* in Saudi Arabia (*Z. spina-christi*, *Z. mucronata* and *Z. lotus*). He mentioned that *Z. spina-christi* species is widely distributed in north Hijaz, south Hijaz, southern region, eastern region, eastern and western Najd, north region, including Tabuk, Al Jauf and Sakakah areas, Nefud region, including the great northern Nefud area, Dahna' and Al-Qasim areas and Al-Rub' Al-Khali, representing most of the southern and south-eastern parts of Saudi Arabia, while *Z. mucronata* is distributed in south of Hijaz, and *Z. lotus* is restricted to Najd.

In [6] [7], recorded four species *Ziziphus*, *Z. mucronata*, *Z. glabrata*, *Z. nummularia*, and *Z. spina-christi*. For *Z. spina-christi* she recorded three varieties: *Z. spina-christi* var. *divaricata*, *Z. spina-christi* var. *spina-christi* and *Z. spina-christi* var. *inermis*. Collenette recorded different places in Saudi Arabia that *Ziziphus* plants are distributed. She mentioned that *Z. mucronata* is occasional locally, it is existing in south of Saudi Arabia on Jabal Shada, Jabal Tallan,

mountain north of Bani Malik and near Jabal Fayfe, while *Z. glabrata* is a rare species, seen in Wadi Buwat, east of Jabal Radhwa, Wadi Akal and at the base of Jabal Anagayn. *Z. nummularia* is fairly common in the north. Whereas, *Z. spina-christi* var. *divaricata* was seen in the western edge of the Rub' al-Khali in Uruq Bani Ma'Arid, *Z. spina-christi* var. *inermis* is located in Asir, south Hijaz, while *Z. spina-christi* var. *spina-christi* is fairly common in south of Madinah. Moreover, [8] investigated five species of *Ziziphus*, *Z. mucronata*, *Z. spina-christi*, *Z. glabrata*, *Z. nummularia* and *Z. mauritiana* with a brief description for each species, key to species, vernacular name and the distribution localities of each *Ziziphus* species in Saudi Arabia. The main morphological features can be distinguished between deferent species based on [8] are the leaves, spines, colour of branches, fruits size and inflorescence characters. *Z. nummularia* defer from other species by its leaves finely pubescent, densely velvety or fulvous-tomentose beneath, fruits small, 7 - 8 mm across, intricately branched shrubby plants, while *Z. mauritiana* has densely whitish-tomentose in the lower leaf surface, fruits larger, 15 mm or more across or long and this species he said is cultivated in Saudi Arabia. Species *Z. mucronata* has glabrous leaves or glabrescent in the lower surfaces and having reddish or brownish branches' bark and few spins or non and its leaves are acute to acuminate. *Z. spina-christi* and *Z. glabrata* both having branches white-barked, but branches of *Z. spina-christi* has mostly pairs spines and its inflorescent are pubescent, while branches of *Z. glabrata* are spineless and its inflorescent are glabrous. [8] reported that *Z. mucronata* can be found in Asir, Jabal Shada north of Mikhwa south of Baha, Wadi Murabbat and Ad-Darb area, while *Z. spina-christi* species is wild and sometimes cultivated in Saudi Arabia and it is distributed in Jabal Fayfa, Hofuf, Riyadh and Bisha. *Z. glabrata* can be distributed only in tow locations around Madina, whereas *Z. nummularia* commonly exists in silty basins (the Rudhas) and in Majmaa, Raudhat al Kharaim, At-Taysia, Hafarat Al Batan and Tathleeth. *Z. mauritiana* is cultivated in Riyadh with other varieties. In [14], recognized *Z. spina-christi* in the "*Flora of Jabal Fayfa"*, South of Saudi Arabia. Following, [15] in the "*Flora of Jizan Region*" recorded *Z. spina-christi* and *Z. mucronata* species are distributed in Jizan providence. [9] recorded two species of *Ziziphus* in his book "*Flora of Eastern Saudi Arabia*" are distributed in eastern region. *Z. nummularia* and *Z. spina-christi*, also he mentioned about *Z. spina-christi* var. *inermis* Boiss. which is deciduous or weak spines trees and it being majority in north-eastern of Saudi Arabia. [9] indicated about distribution of *Z. nummularia* in silty basins of Summan, in north Summan in Rawdat Ma'qala and south Summan in DarbMazalij, whereas *Z. spina-christi* is often planted in villages and town and there is one uncertain recorded as wild trees in central costal lowlands in northwest Ghunan and spread in open sand desert.

Species within genus *Ziziphus* can be featured by some characters such as growth habit, branches colour, the presence of pair of spines, leaf shape and the colour of fruit.

In Saudi Arabia, up to date there are no taxonomical studies on *Ziziphus* us-

ing morphological, anatomical characters or molecular phylogenies. In this study, we employed morphological features to study the taxonomy of the genus in Saudi Arabia in order to identify the species in the country and the morphological features that show delimitation of the genus.

2. Materials and Methods

2.1. Taxon Sampling

Field survey was conducted across the study area from 2014 to 2017, fresh samples of *Ziziphus* plants were collected from the field. A twig of 24 cm which contained both floral and vegetative part was collected from each plant and was pressed immediately in the field to maintain the morphological features such as fruit, flower and leaves of the plant for the analysis. The specimens were identified in the herbarium. In all 74 Samples were collected from 17 deferent localities of Saudi Arabia. For each plant, several duplicate herbarium specimens were made including leaves, flowers, and fruit and several parts of each sample were saved in 70% ethanol. Additionally, herbarium specimens from King Abdulaziz University and Edinburg herbarium were also used in the study.

For each sample in the field, important information such as the habit, the height of the plant, colour of each part, type of habitat, the bole circumference, accompanying plants and the geographical coordinate were recorded and some pictures for the hole plant and its parts were captured by using Nikon camera.

All of 74 collected samples and 22 herbarium samples were examined by using a Novex dissecting microscope and a ×10 hand lens. Measurements in centimetres or millimetres of 80 morphological characters of both vegetative and reproductive features were recorded.

2.2. Morphological Characters

In taxonomic studies, observation of plant in the field has an important value between or within groups or even in closely related species for determining the similarities and differences. Both the floral and vegetative parts were examined; the morphological features include leaves, fruits, stems and flowers.

3. Results

3.1. Plant Habit

- ***Growth habit*** **and** ***Bole circumference***: Habit of *Ziziphus* taxa is variable, shrubs usually with several stems up to 3 - 4 m in high, such as *Z. spina-christi* var. *microphylla* (**Figure 1(a)**) and *Z. nummularia*, or trees with single trunk. Tree high are ranged from 4 to 18 m as in *Z. spina-christi* var. *spina-christi* (**Figure 1(b-1)** and **Figure 1(b-2)**) and *Z. mucronata*.

3.2. Branch Characters

- ***Branch forming***: In some taxa of *Ziziphus* the branches having zigzag form

(Figure 2(a-1) and Figure 2(a-2)), while other taxa usually appearing as normal form to slightly zigzag of branches (Figure 2(b)).

- ***Branch surface***: The branches of *Ziziphus* plants may be glabrous (Figure 3(a)) in several taxa such as *Z. spina-christi* var. *microphylla*, *Z. spina-christi* var. *spina-christi* and *Z. mucronata*, or tomentose surface (Figure 3(b)) on the small branches in *Z. nummularia*.
- ***Colour of branches***: Branch colour shows an important character in Saudi Arabian *Ziziphus*. It is different from white colour in *Z. spina-christi* var. *microphylla* (Figure 4(a)), Paige to pale grey in *Z. spina-christi* var. *spina-christi* (Figure 4(b)) and *Z. nummularia* or reddish brown in *Z. mucronata* (Figure 4(c)).
- ***Spines***: The spines in *Ziziphus* plant usually in pairs, one erect and other curved. However, spines are missing in branches of some *Ziziphus* plants such as *Z. spina-christi* var. *spina-christi* (Figure 5(a)) and *Z. mucronata*, while other taxa of Saudi Arabian *Ziziphus* show permanent spines, which is *Z. spina-christi* var. *microphylla* (Figure 5(b)) and *Z. nummularia*.

(a)

(b-1) (b-2)

Figure 1. Type of habit in *Ziziphus* plants in the field, **(a)** Shrub in *Z. spina-christi* var. *microphylla*. **(b-1)** and **(b-2)** Tree in *Z. spina-christi* var. *spina-christi*.

(a-1) (a-2)

(b)

Figure 2. Branches forming in Saudi Arabian *Ziziphus* plants, **(a)** Zigzag form. **(a-1)** In *Z. spina-christi* var. *microphylla*. **(a-2)** In *Z. nummularia*. **(b)** Normal form of branches in *Z. spina-christi* var. *spina-christi*.

(a)

(b)

Figure 3. Branch surface in *Ziziphus* plants, **(a)** Glabrous in *Z. spina-christi* var. *microphylla*. **(b)** Tomentose in *Z. nummularia*.

(a)

(b)

(c)

Figure 4. Variation colour of the branchlets of Saudi Arabian *Ziziphus* plants, **(a)** White in *Z. spina-christi* var. *microphylla*. **(b)** Paige to pale grey in *Z. spina-christi* var. *spina-christi*. **(c)** Reddish brown in *Z. mucronata* (*Z. mucronata* photo from Edinburgh herbarium specimen).

(a)

(b)

Figure 5. Shows the different branches of Saudi Arabian *Ziziphus* plants, **(a)** Spineless branches in *Z. spina-christi* var. *spina-christi*. **(b)** Thorny branches in *Z. spina-christi* var. *microphylla*.

3.3. Leaf Characters

- ***Leaf shape***: There is wide variation in *Ziziphus* leaf shape even sometimes in each specimen of the same taxa. The most frequently was ovate to elliptic in *Z. spina-christi* (**Figure 6(b)**) and ovate to orbicular in *Z. nummularia* (**Figure 6(c)**), while it lanceolate shape in *Z. spina-christi* aff. var. *spina-christi* (**Figure 6(a)**), however the wide ovate shape can be shown clearly in *Z. mucronata* (**Figure 6(d)**).
- ***Leaf apex***: Leaf apex has numerous variations among Saudi Arabian *Ziziphus* plants. It can be acute, rounded, retuse or apiculate in same specimens

Z. spina-christi and *Z. nummularia* (Figures 7(a)-(d)), while it has been recorded as acuminate in *Z. mucronata* (Figure 7(e)).

- ***Leaf colour in lower surface***: The leaf colour green in most of Saudi Arabian *Ziziphus* plants (Figure 8(a)), or pale green when it covers with hairs such as in *Z. nummularia* (Figure 8(b)).
- ***Upper surface of leaf***: Upper surface of Saudi Arabian *Ziziphus* are glabrous (Figure 9(a)) except in *Z. nummularia*, which covered with hairs (Figure 9(b)).
- ***Lower surface of leaf***: The lower leaf surface may be glabrous or puberulent around the veins in most Saudi Arabian taxa of *Ziziphus* (Figure 10(a)) or covered with hairs as in *Z. nummularia* (Figure 10(b)).
- ***Surface of leaf petiole***: In some of Saudi Arabian *Ziziphus* plants the leaf petioles are glabrous *Z. spina-christi* aff. var. *spina-christi* (Figure 11(a)), while in some taxa are covered with pubescent as in *Z. spina-christi* (Figure 11(b)) and in the *Z. nummularia*, the leaf petiole is covered with densely hairs (Figure 11(c)).
- ***Leaf margin***: The leaf margins in some of Saudi Arabian *Ziziphus* arranging between crenulate to serrulate as in *Z. spina-christi* (Figure 12(a)), leaves of some other taxa have entire margin as in *Z. nummularia* (Figure 12(b)).

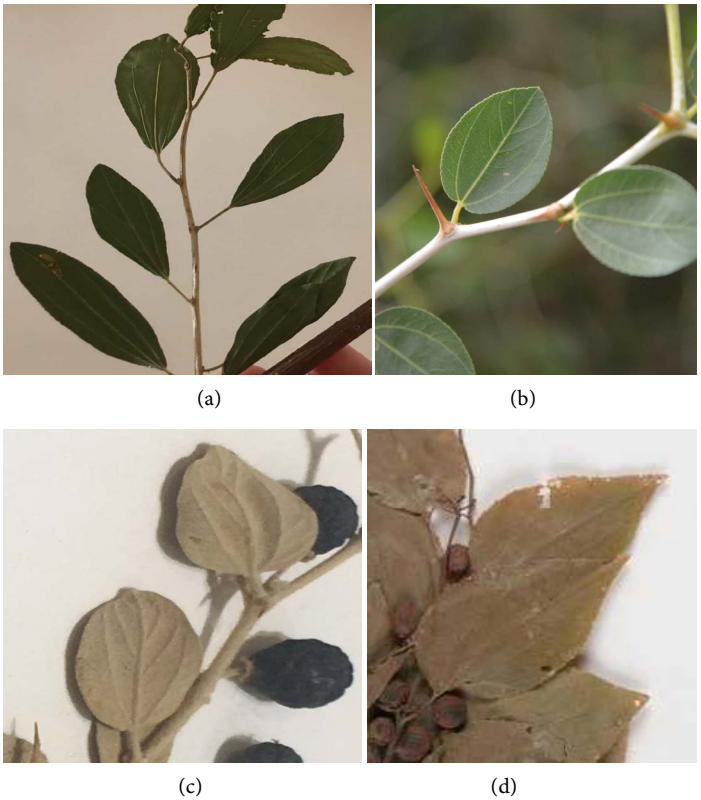
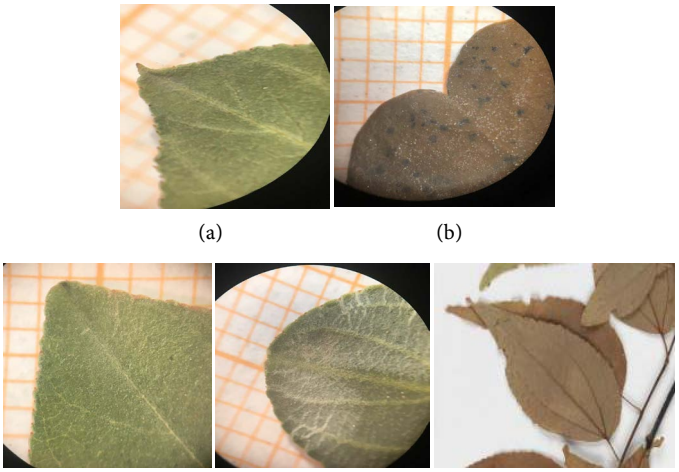


Figure 6. The different leaf shape of Saudi Arabian *Ziziphus* plants, **(a)** Lanceolate in *Z. spina-christi* aff. var. *spina-christi*. **(b)** Ovate to elliptic in *Z. spina-christi* var. *microphylla*. **(c)** Ovate to orbicular in *Z. nummularia*. **(d)** Wide ovate in *Z. mucronata* (*Z. mucronata* photo from Edinburgh herbarium specimen).



(a) (b)

(c) (d) (e)

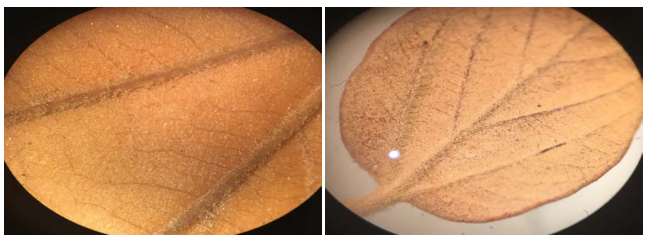
Figure 7. Leaf apex differences of Saudi Arabian *Ziziphus* plants, **(a)** Apiculate. **(b)** Retuse. **(c)** Acute. **(d)** Rounded, in both of *Z. spina-christi* varieties. **(e)** Acuminate apex in *Z. mucronata* (*Z. mucronata* picture from Edinburgh herbarium specimen).

(a) (b)

Figure 8. Different colour in lower surface of Saudi Arabian *Ziziphus* plants, **(a)** Green in *Z. spina-christi*. **(b)** Pale green: in *Z. nummularia*.

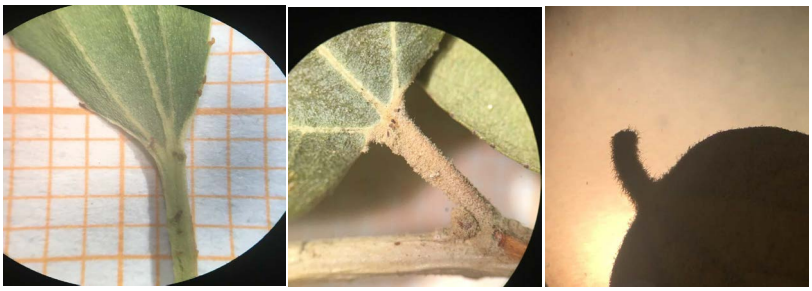
(a) (b)

Figure 9. Shows the upper surface of Saudi Arabian *Ziziphus* plants, **(a)** Glabrous in *Z. spina-christi*. **(b)** Hairs on upper surface in *Z. nummularia*.



(a) (b)

Figure 10. Diversity surface in lower leaf surface of Saudi Arabian *Ziziphus* plants, **(a)** Glabrous or puberulent around the veins in *Z. spina-christi* var. *spina-christi*. **(b)** Hairs cover all lower surface in *Z. nummularia*.



(a) (b) (c)

Figure 11. Variation surface of leaf petiole of Saudi Arabian *Ziziphus* plants, **(a)** Glabrous in *Z. spina-christi* aff. var. *spina-christi*. **(b)** Pubescent in *Z. spina-christi*. **(c)** Hairs covering all the petiole in *Z. nummularia*.

(a) (b)

Figure 12. Differ of the leaf margin of Saudi Arabian *Ziziphus* plants, **(a)** Crenulate to serrulate leaf margin in *Z. spina-christi*. **(b)** Entire margin in *Z. nummularia*.

3.4. Flower Characters

- ***Ovary surface***: The surface around the base of style (above of ovary) may be glabrous (**Figure 13(a)**) or covered with hairs in the same taxa (**Figure 13(b)**).

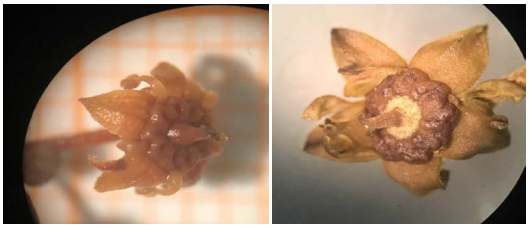
3.5. Fruit Characters

The shape of fruit is globular in all species of Saudi Arabian *Ziziphus*, while the differences are among the colours.

- ***Fruit colour***: The fruit colour of Saudi Arabian *Ziziphus* plants often is yellow to reddish-orange (**Figure 14(a)** and **Figure 14(b)**), while it is reddish (**Figure 14(c)**) in *Z. mucronata*.

4. Discussion

There are some characteristics features of Saudi Arabian *Ziziphus* taxa which can be used to distinguish the species within the genus; the characters include habit, colour of branches, leaf shape and size and colour of the fruits. Based on this, the genus *Ziziphus* is represented by three species in Saudi Arabia (**Figure 15**): *Ziziphus nummularia*, *Z. mucronata* and *Z. spina-christi*. The species *Z. spina-christi* represented by two verities: *Z. spina-christi* var. *spina-christi*, *Z. spina-christi* var. *microphylla* and one affinities of *Z. spina-christi* var. *spina-christi*.



(a) (b)

Figure 13. Variation surface around the base of style (above of ovary) of Saudi Arabian *Ziziphus* plants, **(a)** Glabrous. **(b)** Hairs cover surface around the base of style.

(a-1) (a-2)

(b)

Figure 14. Fruit colour of Saudi Arabian *Ziziphus* plants, **(a-1)** and **(a-2)**: yellow to reddish-orange in *Z. spina-christi*. **(b)** Reddish in *Z. mucronata* (photo from: https://www.google.com).

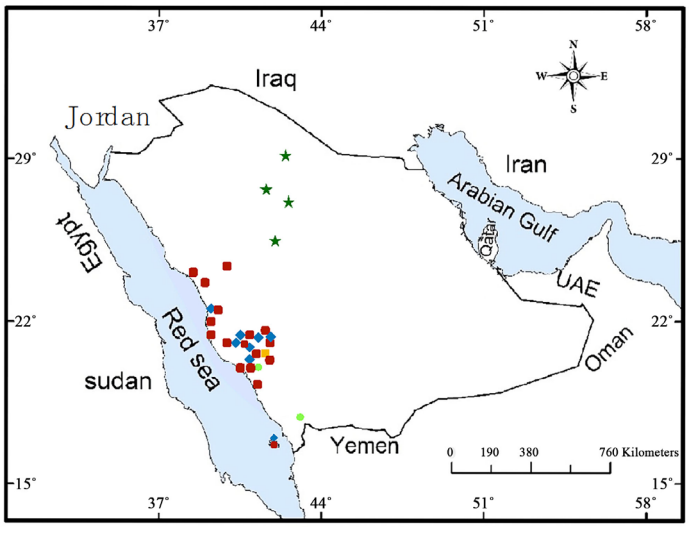


Figure 15. Distribution map of *Ziziphus* plant in Saudi Arabia: ★ *Z. nummularia*, ● *Z. mucronate*, ■ *Z. spina-christi* var. *spina-christi*, ◆ *Z. spina-christi* var. *microphylla*, ■ *Z. spina-christi* aff. var. *spina-christi*.

The habit of *Z. spina-christi* var. *spina-christi* mostly trees or sometimes shrubby like, grow up to 15 m with single trunk (**Figure 1(b-1)** and **Figure 1(b-2)**), these features were also reported by several authors [1] [8] [16] [17]. Branches usually normal or slightly zigzag in some branches (**Figure 2(b)**), was also reported by [1]; branch colour is paige to pale grey (**Figure 4(b)**). Several authors used the colour of branch and the surface of branch to define the differences between the species of *Ziziphus* plant. Particularly in *Z. spina-christi*, which distinguish by the glabrous white branchlets in [1] [17], or straw coloured in [16], while [8] motioned that the branches are greyish-white colour. Spines are existing in some branches while other branches appear spineless (**Figure 5(a)**), both of [8] [16] mentioned that *Z. spina-christi* usually have pair of spines, one erect and the other curved but sometimes unarmed or missing the spines. The leaf shape ovate to elliptic or elliptical as in *Z. spina-christi* var. *microphylla* (**Figure 6(b)**), this agree with the finding by [1] [8] [16] [17]. The apex of leaves shows a wide variation in the same specimen (**Figures 7(a)-(d)**). [1] mentioned that leaf apex is rounded or retuse, [8] [16] stated that the leaf apex is acute to rounded and [17] mentioned it optuse to mucronate. This study indicated that the lower surface of leaf is green (**Figure 8(a)**) with puberulent around the veins (**Figure 10(a)**), and the surface of the upper of leaf is glabrous (**Figure 9(a)**) [1] [16] stated that the lower surface usually glabrous or pubescent on the midrib and [8] cited it as glabrous or sparsely pubescent on the midrib. The leaf petiole varies between glabrescent or pubescent (**Figure 11(b)**), and the margin of leaf is crenulate to serrulate (**Figure 12(a)**), that also agree with [1] [16], while [17] indicate the margin is crenate and [8] recorded it as entire or obscurely serrulate. The fruits colour is yellow to reddish-orange (**Figure 14(a-1)** and **Figure 14(a-2)**), as recorded by [8] [16], while [1] mentioned it brown to yellow or reddish and [17] reported it as dark red-brown.

Z. spina-christi var. *microphylla* is impenetrable shrubs usually with many stems (**Figure 1(a)**) this agreed with findings of [18] since they cited this taxon as much branched shrub forming impenetrable thickets. The branches usually zigzag (**Figure 2(a-1)**), glabrous (**Figure 3(a)**). The branches are white in colour (**Figure 4(a)**), which disagreed with [18], since they reported it as reddish-brown. Spines are existing in the hole of branches and scarcely missing in other branches (**Figure 5(b)**). Leaves are ovate to elliptic (**Figure 6(b)**), this is also reported by [18]. The apex of leaves shows a wide variation in the same specimen as in *Z. spina-christi* var. *spina-christi* (**Figures 7(a)-(d)**), which disagreed with what [18] recorded as rounded.

Ziziphus spina-christi aff. var. *spina-christi* is distinguished from *Z. spina-christi* var. *spina-christi* by its size of flowers. Leaves in *Z. spina-christi* aff. var. *spina-christi* are lanceolate with acute base (**Figure 6(a)**), and the petiole is glabrous (**Figure 11(a)**), while they are pubescent in *Z. spina-christi* var. *spina-christi* (**Figure 11(b)**). Flower size in *Z. spina-christi* aff. var. *spina-christi* is 7.5 - 8 mm, which is clearly bigger than the size of *Z. spina-christi* var. *spina-christi* (5 - 6.5 mm).

Ziziphus mucronata is a shrub or tree about 8 - 10 m or taller, and the colour of branches are reddish to brownish (**Figure 4(c)**), Leaves are wide ovate (**Figure 6(d)**), These characters are also recorded by [8] [16] [17]. The apex of leaf is distinguished as acuminate (**Figure 7(e)**). Beside this character, [16] [17] reported acute apex, while [8] reported that leaf apex can be acummate or apiculate. Leaf surface is glabrous or puberoulous on petiole and midrib. [8] [17] mentioned that leaf surface is glabrous in both sides. The margin of leaf recorded serrulate to crenulated. Fruits reddish colour (**Figure 14(b)**), which agreed with [8] [16], while [17] reported it as dark red brown.

In *Z. nummularia*, [8] mentioned it as intricately shrubs up to 3 m, much branches, while [19] reported it as thorny shrub that have many-stemmed. The branches noticed clearly as zigzag shape, (**Figure 2(a-2)**), with tomentose branches (**Figure 3(b)**). Having zigzag branch in some species is reported for the first time in this study previous studies only they mentioned that the branches are hairy to white-tomentose as in [19], tomentose in young branches as in [8], and [20] pointed that the branches are tomentose. The leaves are ovate to orbicular (**Figure 6(c)**) which agreed clearly with [8] [19] [20]. The colour of lower surface of leaves is pale green (**Figure 8(b)**), upper surface of leaf (**Figure 9(b)**) and lower surface (**Figure 10(b)**) are covered with hairs. [19] mentioned that *Z. nummularia* is covered by densely pubescent on the upper surface and densely velvety tomentose on beneath. [20] cited it hairy or tomentose in both side, while [8] recorded it as pubescent in both side but more densely in beneath. The leaf petiole surface is hairy (**Figure 11(c)**) which mentioned also by [19] as tomentose petiole, and the margin of leaves is entire (**Figure 12(b)**), that agreed with [8] [19] [20].

5. Conclusion

This current study provides an accurate observation for the morphological characteristics which are effective in Saudi Arabian *Ziziphus* taxa identification. This investigation study indicated that there are three species of genus *Ziziphus* are distributed naturally in Saudi Arabia: *Ziziphus nummularia*, *Z. mucronata*, and *Z. spina-christi*. The species *Z. spina-christi* is represented by two well-defined varieties: *Z. spina-christi* var. *spina-christi*, *Z. spina-christi* var. *microphylla* and one plant affinities to *Z. spina-christi* var. *spina-christi*, which needs more study to clarify it.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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