

MORPHOLOGICAL, ANATOMICAL AND GEOGRAPHICAL DISTRIBUTION STUDIES OF SPECIES *Horwoodia dicksoniae* (Turrill) IN IRAQ

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ABSTRACT

This research aims to study the morphological anatomical characteristics and geographical distribution of the species *Horwoodia dicksoniae* (Turrill) belong to Brassicaceae family in Iraq. The results were revealed the morphological characteristics of the root, stem, leaves, fruits and seeds, abaxial surface of the leaf characterized by covered with simple hairs. The fruits were circular in shape with wide wing and have one seed. The seeds were conical shape and pustular surface configuration. The anatomical characteristics of the root, stem, and leaf were studied and the cross-section of the root was characterized by thick periderm layer and cortex layer consisting primarily of parenchyma cells, stem cross section was characterized by thick layer of cuticle, as well as epidermis layer that followed the cuticle layer was double epidermis, but the layer of phloem is composed of rectangular cells and arranged in a continuous ring. Cross section of leaf was bifacial, leaf contains palisade cells in the form of a rectangle at the top surface of the leaf and irregular spongy cells at the low surface and distinguish the middle vein of the leaf as a circular shape. The epidermis was characterized by an Anisocytic type. The study of geographical distribution has been shown that the species is widespread in the desert region of Iraq.

Key words: Brassicaceae, desert region, palisade layer, anisocytic type, simple hairs

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دراسة مظهرية وتشريحية وتوزيع جغرافي للنوع *Horwoodia dicksoniae* (Turrill) في العراق

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المستخلص

يهدف البحث الى دراسة صفات النبات المظهرية والتشريحية والتوزيع الجغرافي للنوع *Horwoodia dicksoniae* (Turrill) والعائد للعائلة الصليبية في العراق، درست الصفات المظهرية للجذر والساق والاوراق والازهار و الثمار والبذور، تميز سطح الورقة السفلي بانه مغطى بشعيرات بسيطة و كانت الثمار ذات شكل دائري وجناح عريض وتحتوي على بذرة واحدة اما البذور فكانت ذات شكل مخروطي وزخرفة سطحية ذات بثرات. وتمت دراسة الصفات التشريحية للجذر والساق والورقة وتميز المقطع العرضي للجذر بكونه ذو طبقة بشرة محيطية سميكة وطبقة قشرة مؤلفة بصورة اساسية من خلايا برنكيميية، أما مقطع الساق فقد تميز بانه محاط بطبقة الادمة السميكة فضلا عن كون طبقة البشرة التي تلي طبقة الادمة كانت ذات بشرة مضاعفة اما طبقة اللحاء فأنها مؤلفة من خلايا مستطيلة الشكل ومرتببة بشكل حلقة مستمرة. تميز مقطع الورقة بكونه ثنائي الوجه حيث تحتوي الورقة على خلايا عمادية ذات شكل مستطيل في السطح العلوي من الورقة وخلايا اسفنجية غير منتظمة الشكل في السطح السفلي منها وتميز العرق الوسطي للورقة بكونه ذو شكل دائري. تميزت بشرة النوع بوجود الطراز الثغري المتباين. أظهر التوزيع الجغرافي ان النوع واسع الانتشار في المنطقة الصحراوية من العراق.

الكلمات المفتاحية: العائلة الصليبية، المنطقة الصحراوية، الطبقة العمادية، الطراز المتباين، الشعيرات البسيطة

INTRODUCTION

Brassicaceae is one of the largest angiosperm families included 340 genera and 3709 species (20). The genus *Horwoodia* (Turrill) is a member of the family Brassicaceae. *Horwoodia* is known Arabic as Khuzama (13). Genus represented by one species in Iraq, Kuwait, and Saudi Arabia as mentioned by several researchers (11,13,16). *Horwoodia dicksoniae* (Turrill) it belongs to the Lepidieae tribe in Brassicaceae family. The flowers of this plant are extremely fragrant, with a nice sweet smell to most people. Give a sweet scent to camel milk that feeds heavily in the spring (11). The aerial parts of this plant have some of the chemical compounds, including tryptophane methyl ester as well as 1-feruloyl- β -D-glucopyranoside, therefore, the species exhibit good activity against *Aspergillus fumigates* and significant cytotoxic activity against human breast cancer, human liver cancer, and human lung carcinoma, so it's considered as one of an important medicinal herbs (3). Some morphological and anatomical information about the family was previously mentioned in some references (1,8,11,15). This study was aimed to provide more morphological and anatomical characteristics of vegetable organs of this species and to determine the distribution of *Horwoodia* plant in Iraq.

MATERIALS AND METHODS

Plant samples were collected from the dried specimens which previously reserved at Iraqi herbarium, the morphological study was made by taking dimensions and observing the different features of all plant parts from the samples. Anatomical cross sections of the vegetative parts were prepared by freehand sectioning (5), the epidermis for both leaf and stem were peeled from the samples and stained with safranin 0.5%, then studied by Novex compound microscope and photographed by Sony digital camera, the magnification force was calculated based on the following equation:

Power zoom = Power of the eye lens \times The force of the objective lens \times Zoom camera power if any. Geographical distribution depends on informations of the labels of drying herbarium specimens in the University herbarium(BUH),Baghdad, and the National

herbarium of Iraq, ministry of Agriculture (BAG),Baghdad, Iraq.

RESULTS AND DISCUSSION

Morphological study " Figure 1"

Annual herb plant with a light brown taproot, plant branched from the base, stem cylindrical ascending to erect, (10-43)cm. The leaves petiolate and alternate arrangement, usually cuneate at bases, oblanceolate shapes with acuminate apices, pinnatifid margin, (34-70 \times 9-20) mm. The surface of leaves cover with simple hairs. The inflorescence was a raceme with many flowered, pedicel (4-6) mm. Calyx consist of four sepals which have lanceolate shape with light yellow color and covered with dense hairs; the sepals have acute apices and truncate bases, (4-6) mm. The sepals arranged in two rings; the inner sepals saccate at the base. The petal spatulate in shape and consist of narrow long claw and rounded limbs (11-15) mm, a light yellowish in color. Androecium Hexandria consist of six stamens two of them have short filaments (4-7) mm and the other has four long filaments (8-13) mm have a yellowish color, the anther has sagittate shape with yellowish color and dehiscing by a longitudinal slit. Gynoecium consist of an oblong ovary has a yellow color, one style, and capitate stigma (8-12) mm. The silicula fruit has orbicular shape broadly winged, cordate at the base and slightly emarginate at apex somewhat shining (15-23) mm, a light brownish in color and contain a single seed. The seeds conical in shape with yellowish orange, the seeds conical in shape with yellowish orange color (5-7.5) mm, surface sculpture for seed is pustular.



Figure 1. Morphological characters of *Horwoodia dicksoniae* , a: whole plant , b: root, c: leaf, d:inflorescence, e: flower, f: calyx, g: petal, h: androecium , i: gynoecium, j: fruit, k:seed, m: seed surface configuration

Anatomical study " Figures 2and 3"

The cross section of the root and stem was taken from the middle part of them. The current study showed that the root was covered outwardly with thick periderm (6-13.5) μm , cortex consists of parenchyma cells (43-60) μm , phloem consists of 5-7 layered of rectangular cells (124-200) μm , cortex followed by porous wood , wood fibers arranged radially (figure 2). Cross section of the stem showed double layered of epidermis composed of ovoid cells (25-32) μm , upper surface is enveloped with a thick cuticle (5-11) μm . The cortex is 7 layered and consist of chlorenchyma cells (90-130) μm , the pericycle is consists of 5-7 layered of sclerenchyma cells(286-327) μm , the phloem is 3-4 layered and consists of rectangular cells arranged in a continuous circle(23.5-30) μm , the cambium is thinning and consists of 2-3 impacted rows of cells (6– 8.9) μm , the center of stem represented by pith which consists of spherical parenchyma cells (figure 3B&b). Leaf section was enveloped by one layer of either upper and lower epidermis which consist of elongated cells(10-29.5) μm , the mesophyll was bifacial consist of 3 rows of rectangular palisade layer (127-550) μm and 3-4 rows of irregularly lobed spongy cells(95-260) μm , the midrib region was circular in shape and cover by one layer of the upper and lower epidermis, the cortex consists of parenchyma tissue only and surrounding the vascular bundle in midrib from upper up to under most (450-600) μm (figure 3C&D). The cuticle shown that the upper and lower leaf epidermises were covered by simple unicellular hairs(figure3E),the stem epidermis was glabrous, ordinary epidermal cells of leaf were polygonal and their anticlinal walls were curved in both upper and lower epidermis, stem epidermis cells were rectangular with oblique ending wall (figure 3F,G&H), the stomatal type was Anisocytic type, they existed on both sides of the leaf surface so it was amphistomatic, being more abundant on the lower surface.

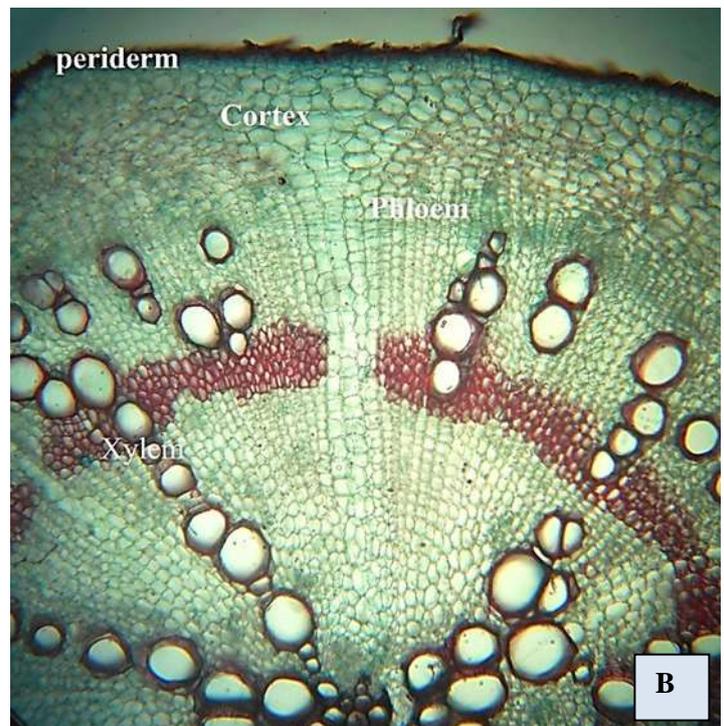
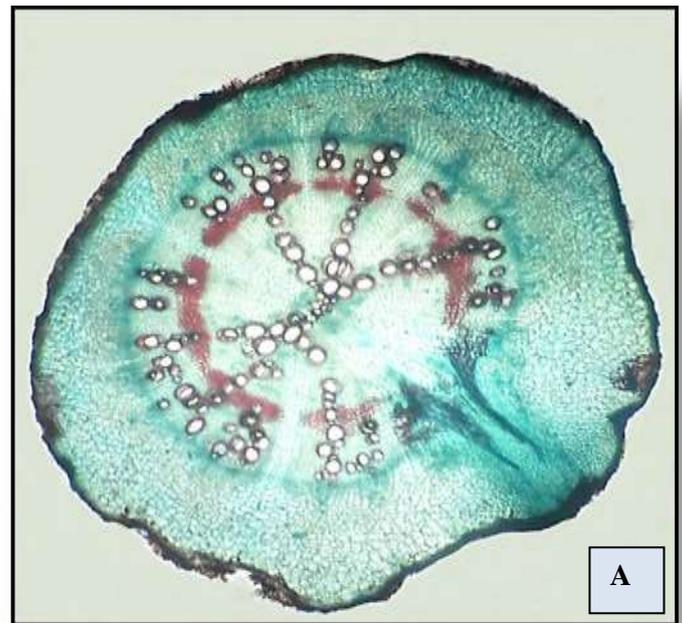


Figure 2. Cross section in *Horwoodia dicksoniae* root (A, a). The zoom power of the full cross (A) is 80 x and the magnifying part(a) 350 x

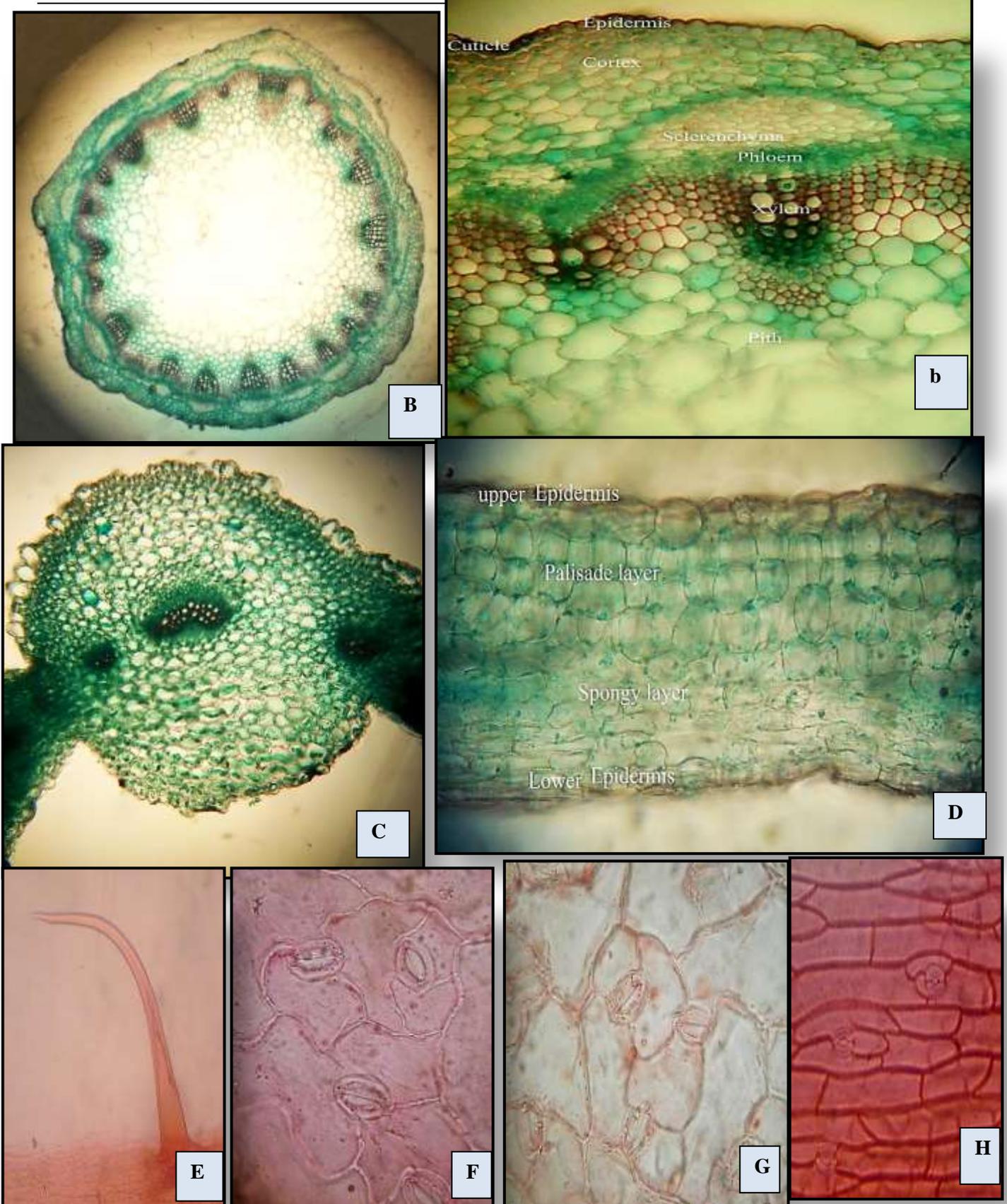


Figure 3. Anatomical characters of *Horwoodia dicksoniae* (B, b), stem cross section . The zoom power of the full cross (B) is 80 x and the magnifying part(b) 350x , C: leaf midrib longitudinal section power zoom (300x) ,D: leaf lamina section power zoom(400x) . Cuticular characters, E: Simple unicellular hairs Power zoom (720X)

F: Upper leaf epidermis ,G:Lower leaf epidermis, H :Stem epidermis power zoom (640x)

Habitat and geographical distribution

The genus is widely distributed in the Desert plateau region of Iraq (Southern desert distinct (DSD) and Western desert District (DWD); and the genus is not recorded in another region

of Iraq (Table 1 and Figure 4). The habitat of the genus is represented in sandy desert soils, in open depressions with deep sandy soil, wadi beds, sometimes in loose silty soil with stones.

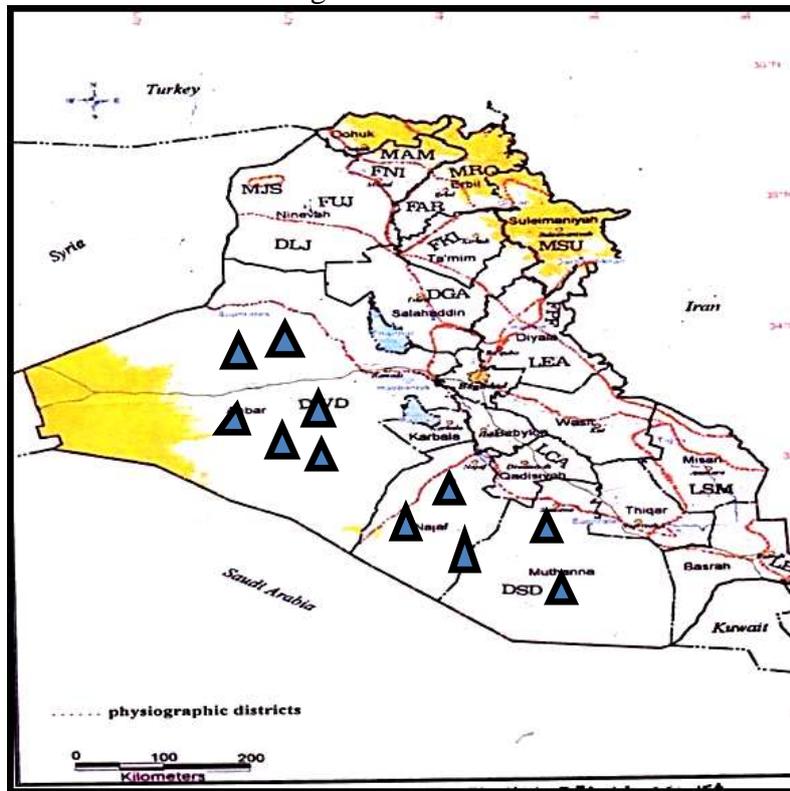


Figure 4. Distribution of *Horwoodia dicksoniae* Iraqi districts

Table1. Geographical distribution of *H.dicksoniae* in different regions of two Iraqi districts

Districts	Regions	
Western desert District (DWD) (n:18)	45 km north west of Ramadi	15 km north of Rutba
	Haditha 65 km from	10 km from Hauran valley
	Nukhaib	
	Hor Abo Dibs	5 km east of Ramadi
(Southern desert distinct (DSD) (n:30)	AL- Qaser valley near Ana	Side road of Kerbela
	25 km north east of Samah	95 km from Waksa to Aidaha
	Jumaima police station	Mid way between Shabicha and Nukhaib
	20km north west of Salman	69 km from Shabicha to Salman
	200 m south of Jabal Sanam	1km north of Zubair
155m east of Khadar al – Mai	150m south of Tal al- Laham	

Morphological and anatomical features of the *Horwoodia* were examined as separate features. The results of morphological studies, in general, were in line with the description of the genus in the flora of Iraq (13) but with additional details and characters with the diagnostic value of the genus was calyx consist of four sepals which have lanceolate shape and the inner sepals saccate at the base, The silicula fruit has orbicular shape broadly winged somewhat shining with light brownish in color. The seed conical in shape and surface

sculpture for seed is pustular. In addition, many researchers adduced that the features of fruit and seeds have valuable making easy for the classification of *Horwoodia* and its family. In our study morphological features were utilized to classify this genus as a moderate method. In line with this, Abdel kalik (2) utilized morphological features in the classification of this species. In line with this (14) similar morphological characteristics were used in the classification of this species to demonstrate the significant morphological

characteristics in the classification of members of Brassicaceae. Metcalfe and Chalk (15) provided information on the general anatomical features of the Cruciferae family. There was no information about the anatomical construction of this species. The anatomical results of this study showed the first detailed description of *Horwoodia*, where the study of the cross section of the root showed that the root is covered from the outside with a thick periderm due to secondary growth. Cross-sectional description of stem shows that the epidermis is double layers and is covered with a thick cuticle that is a good feature for genus diagnosis. The cortex is wide, the pericycle is distinguished by sclerenchyma cells which is one of the features character of the family and its width difference considered as a good feature between different genera and species of the Cruciferae family as mentioned by (5), the phloem arranged in a continuous circle. An anatomical study on the leaf showed the mesophyll consists of 3 rows of palisade parenchyma and 3-4 rows of spongy parenchyma, These anatomical features observed on the leaves correspond with those (4,6,7,17,19). The study of the Epidermal showed that the upper and lower epidermis was covered with simple unicellular hairs and that the stomata are mainly of Anisocytic type and are present in both the surfaces of the leaf as well as the stem. Ordinary epidermal cells showed that the anticlinal walls were curved on both surfaces of the leaves and this is consistent with the view as mentioned by Stace (18). The study showed the geographical distribution of the plant's ability to grow in the desert region of Iraq, indicating plant adaptation to growth in dry environmental conditions. It has grown in different soil types such as sandy soils and silty soil with stones. More than ever, other researchers support our finding (12). From the results, we can conclude the importance of all morphological and anatomical characteristics in determining the genus of plants and distinguishing them from the genera of other families, in addition to determining the common character of *H.dicksoniae* and other family plants. The current study showed for the first time the anatomical characters of *H.dicksoniae*. Moreover, we can use this data

in the process of updating the information of Iraqi flora

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