



A Morphological and Anatomical Study of *Tamarix aphylla* (Tamaricaceae) in Iraq Central Region

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Abstract

The *Tamarix aphylla* is a wild perennial shrub with erect stems that are long and glabrous. They have leaves that are simple, alternate, sheathed, and the apex of the blade is acuminate. And a scaly clawed bract and the the inflorescences were simple, spike-like. The pistil consists of ovary pyramidal, 3 styles, and 3 stigmas. The androecium consists of five stamens that are antisepalous. The perianth was distinct with five sepals and five petals. The fruits were capsule-shaped, pyramidal, and smooth. The seed has an apical pappus of unicellular hygrosopic hairs; endosperm is absent. The anatomical study of the leaves contained a uniseriate epidermis consisting of one layer of elongated cells covered by a layer of papillary cuticle. The upper epidermis cells are larger than the lower epidermis cells, and the stomata were anomocytic. The mesophyll consists of one layer of palisade cells and several layers of irregular, spongy cells. The stem epidermis is uniseriate, which is a single row of circular to ovate cells covered by a layer of papillary cuticle. The cortex is composed of two tissues, collenchyma and parenchyma; lamellate collenchyma tissue consists of 1-2 layers of cells; and parenchyma tissue consists of several layers of cells. The vascular bundle was ovate. The pith tissue consisted of circular parenchyma cells that were thin-walled and occupied the central part of the stem.

Keywords: *Tamarix*, Anomocytic, Spike, Capsule.

1. Introduction

The family of Tamaricaceae contains 4 genera and 120 species [1]. The *Tamarix* genus is represented by 54 species [2]. It is believed that it contains 54–90 species [3, 4]. The genus is distributed in the Mediterranean, Iranian, and Indian regions [5]. The *Tamarix* genus is native to Africa and Eurasia in semi-desert regions and could be found in fresh-water areas in mild and semi-tropical regions [6, 7]. In Iraq, the genus is represented by 11 species (*T. aphylla*). *T. arceuthoides* *T. aucheriana* *T. brachystachys* *T. macrocarpa* *T. ramosissima* *T. aralensis* *T.*



pyncocarpa T. mascatensis T. kotschy T. androssowii [8]. *T. aphylla* is found in desert regions of Iraq, flowering in June–November, December, or later [8]. The species name derives from the ancient Greek Phyllon leaf, as mentioned by Carlos Linnaeus [9]. These plants are suitable for use as windbreaks, forest making, soil-preserving plants, and environmental plants and are of great importance in reforming the desert and improving the climate in arid regions [10]. It is important medically, as the extract of *T. aphylla* is used as an antioxidant [11]. anti-microbial [12]. Antifungal, inflammatory, and wound healing properties [13].in the treatment of fever, eye inflammation, and toothache [14].

2. Materials and Methods

T. phylla was collected from the middle region of Iraq, especially in desert regions. The samples were kept in a FAA solution (formalin acetic acid-alcohol) for 24 hours, then washed with ethanol-alcohol and kept in 70% alcohol [15]. Preparing the cross section of leaves and stems using the paraffin wax method [16]. After embedding, a microtome was used to section the tissue into 10 µm thick sections. Then slides were stained with fast green (1 g in 100 ml of alcohol) and Safranin (1 g in 100 ml of water) stain, loaded with DPX Distyrene plasticizer xylene. The slide was examined under a compound microscope (MEIJI TECHNO) and digital camera (Canon).

3. Results

3.1. Morphological study of *T. aphylla*

3.1.1. Stem

The stems are erect and long, smooth, brown-reddish to gray; the average diameter of the stem was 256 (120–450) mm, and the average length was 14330 (10000–1800) mm.

3.1.2. Leaf

The leaf is simple, alternate, and sheathed; it is green; the apex of the leaf is acuminate; the length of the leaf was 2.05 (1.4–3.5) mm; and the width was 1.13 (0.8–1.6) mm. **Figure (1A)**

3.1.3. Bract

The bract is scaly, with a clawed apex, violet-brown; the length was 0.8 (0.8–1.4) mm, and the width was 0.55 (0.5–0.6) mm. **Figure (1B)**

3.1.4. Inflorescences

They were simple spike – like inflorescences. The Perianth was distinct to 5 sepals and 5 petals. The androecium consists of 5 stamens antisepalous. The pistil consists of ovary pyramidal, 3 styles and 3 stigmas. **Figure (1C)**

3.1.5. Fruit

It was simple, dry, and capsule type, purple, pyramidal, smooth; the length was 3.9 (3.7–4) mm and the width was 1.77 (1.7–1.8) mm. **Figure (1D)**

3.1.6. Seed

The seed has an apical pappus of unicellular hygroscopic hairs, but no endosperm.

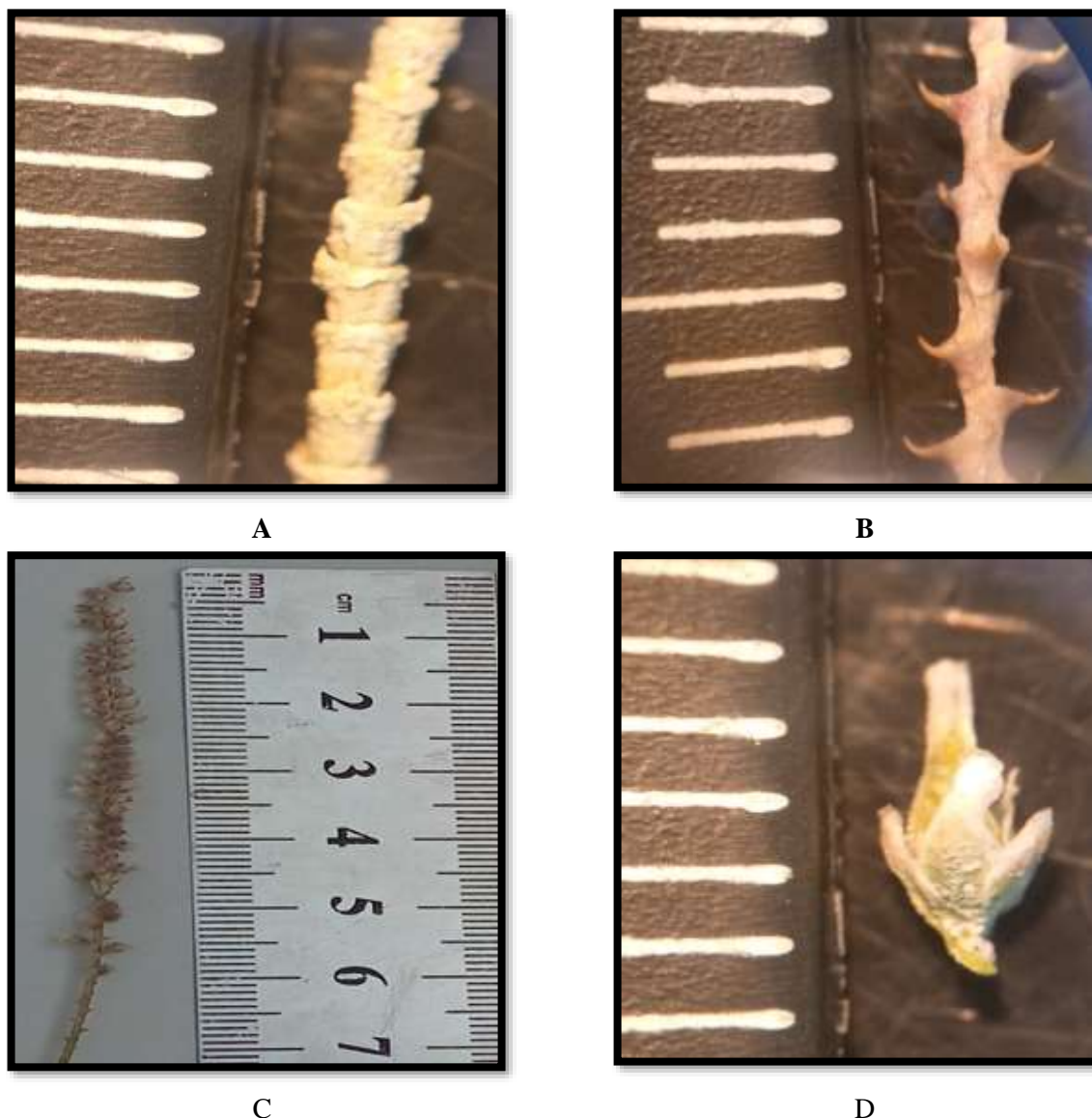


Figure 1. *T. aphylla* plant showing: A-Leaf, B- Bract, C- Inflorescence, D-Fruit

3.2. Anatomical study

The leaf is uniseriate, which is composed of a single row of elongated epidermal cells and covered by a papillary layer of cuticle $7.16 (4.3-8.6) \mu\text{m}$, and the upper epidermis cells are larger than the lower one and more, at $31.53 (21.5-38.7) \mu\text{m}$, while the lower epidermis layer was $28.66 (25.8-30.1) \mu\text{m}$. The length of the stomata of the upper epidermis is $55.9 (51.6-60.2) \mu\text{m}$ and the width is $55.9 (51.6-60.2) \mu\text{m}$; the length of the stomata in the lower epidermis is $54.4 (51.6-60.2) \mu\text{m}$ and the width is $41.5 (38.7-43) \mu\text{m}$, as shown in **Figure (2)**. Mesophyll tissue consists of several layers of irregular spongy cells and one layer of palisade cells, and thickness of the spongy layers was $116.1 (107.5-129) \mu\text{m}$ and the thickness of the columnar layer was $104.63 (86-120.4) \mu\text{m}$. The diameter of the vascular bundle was $81.7 (77.4-86) \mu\text{m}$ (**Figure 3**). The stem epidermis is uniseriate, which is a single row of circular to ovate cells covered by a layer of papillary cuticle. The thickness of the epidermis was $38.7 (34.4-43) \mu\text{m}$, cuticle thickness was $7.16 (4.3-8.6) \mu\text{m}$,

and cortex is composed of two tissues: collenchyma and parenchyma. Lamellate collenchyma tissue is composed of 1-2 layers of cells, and the thickness of collenchyma was 164.83 (129–193.5) μm . Parenchyma tissue consists of several layers of cells, and the thickness of parenchyma tissue is 86 (64.5–107.5) μm . The pith tissue, which was made up of thin-walled circular parenchyma cells, occupied the central part of the stem, as shown in **Figure (4)**.

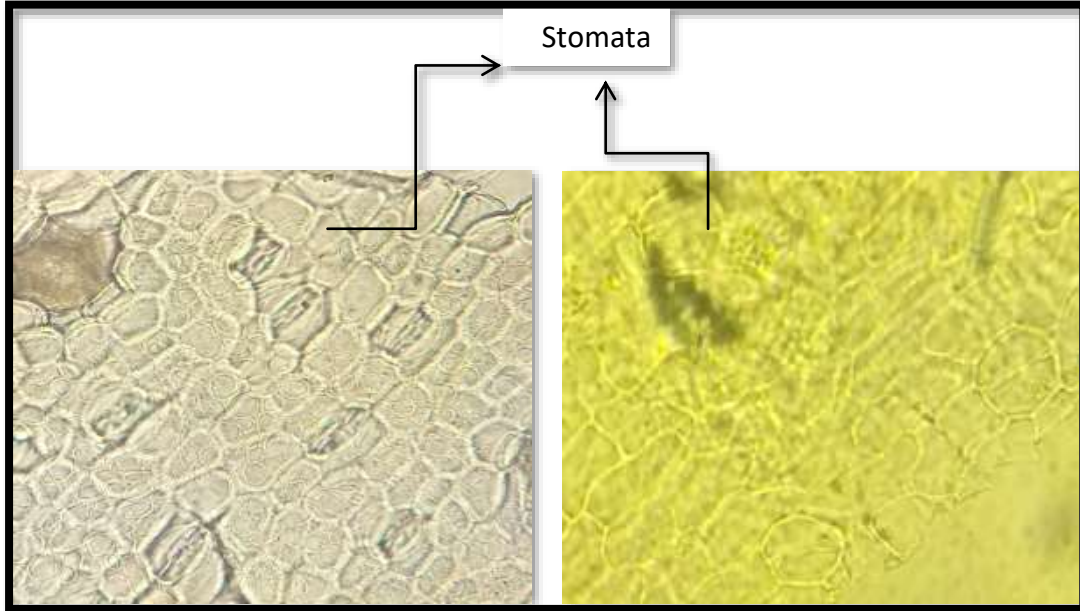


Figure 2 . The Stomata of leaf *T. aphylla* showing: A. In upper epidermis B. In lower epidermis, (10x).

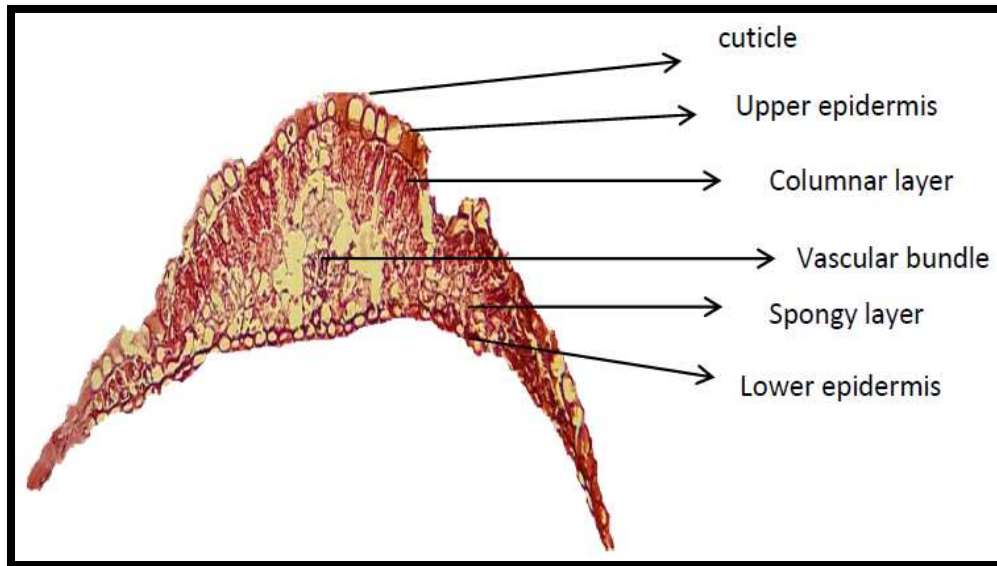


Figure 3. Cross section of leaf *T. aphylla*, (4x).

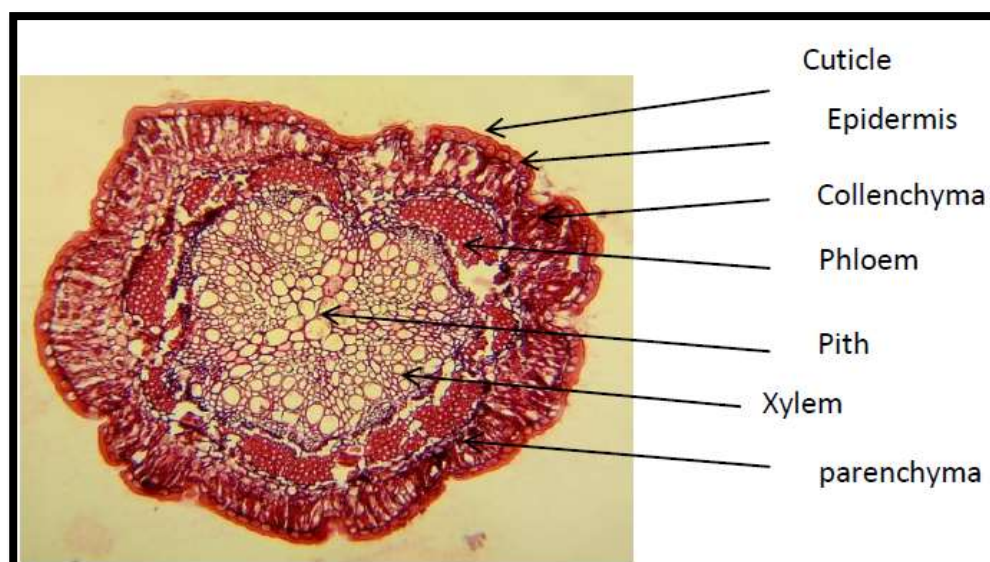


Figure 4. Cross section of the stem *T. aphylla* (4x).

4. Discussion

There are many researches mentioned the anatomical features of Iraq flora [17]. The anatomical study significantly affected the taxonomic process, evidence of anatomical characteristics was considered to be of high value, no less important than the morphological trait. It may be more important than being less affected by the surrounding environmental conditions [18, 19, 20]. The morphological characteristics are distinguished by their ease of observation and their frequent changes compared to other characteristics, which has given them increased importance [21, 22, 23]. These researches aimed to enrich Iraqi studies with the exact morphological character, as well as the anatomical features of the stem and leaf as having application in the field of phylogenetic relationships [24]. In the morphological study of stem, leaf, bract, inflorescences, fruit and seed *Tamarix aphylla*, it was observed when compared with the study of [6] they are similar, but the measurements are different. There are no enough studies to compare our anatomical study of the leaf and stem, because most of the studies dealt with study of the salt crystals of epidermis, as well as studies on the type of bacteria that grow on the epidermis of the leaf [25; 26]. Stem studies dealt with the texture of the wood accurately, but our study was general about cross section of the stem [27]. The anatomical study significantly affected the taxonomic process; evidence of anatomical characteristics was considered to be of high value, no less important than the morphological trait. It may be more important than being less affected by the surrounding environmental conditions [18; 28]. The morphological characteristics are distinguished by their ease of observation and their frequent changes compared to other characteristics, which has given them increased importance [21; 29]. This research aimed to enrich Iraqi studies with the exact morphological character as well as the anatomical features of the stem and leaf, which have application in the field of phylogenetic relationships [24]. In the morphological study of stem, leaf, bract, inflorescences, fruit, and seed *Tamarix aphylla*, it was observed that when compared with the study of [6], they are similar, but the measurements are different. We did not find studies to compare our anatomical study of the leaf and stem because most of the studies dealt with the study of the salt crystals of the epidermis as well as the type of bacteria that grow on the epidermis of the leaf. In the stem studies, we dealt

with the texture of the wood accurately, but our study was general about the cross section of stem [30].

5. Conclusions

The study concluded that the pistil is a cone-shaped ovary, with 3 pistil stems, and 3 stigmas. Studies of leaf morphology have a cuticle, a layer of elongated cells covered by a papillary cuticle. The mesophyll consists of one layer of palisade cells and several layers of active sponge cells. The epidermis is undifferentiated and consists of a single row of round to oval cells, covered by a papillary cuticle. The pith tissue is a round, thin-walled parenchyma located in the center of the stem.

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Conflict of Interest

There are no conflicts of interest.

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