



Morphological, Anatomical Study and Geographical Distribution in Iraq of *Capparis spinosa* L.

Silva A. Zokian*

Department of Biology, College of Science, University of Baghdad, Baghdad, Iraq

Abstract

This study dealt with many of morphological, anatomical characteristics and geographical distribution of *Capparis spinosa* L. that grown wildly in Iraq, The species were compared to the adoption of field and herbarium specimens. A detailed morphological feature of the stem, leaf, fruit and seed were introduced. Anatomical studies reveal constant taxonomic characteristics such as the obvious cuticle on the epidermis of stems and leaves, developed cortex, pith and vascular tissue in stems. From an environmental perspective has been studied the habitat and the distribution of *C. spinosa* in Iraq that showed inhabit very dry places and had mesophytic and xerophytic habitat.

Keywords: *Capparis spinosa* L., Morphology, Anatomy, Geographical Distribution.

دراسة الخصائص المظهرية والتشريحية والتوزيع الجغرافي في العراق للنوع *Capparis spinosa* L.

سيلفا انترانيك زوكيان*

قسم علوم الحياة، كلية العلوم، جامعة ب.غ.ا. ، ..، العراق.

الخلاصة

تعاملت هذه الدراسة مع العديد من الخصائص المظهرية والتشريحية والتوزيع الجغرافي للنوع *Capparis spinosa* L. التي تنمو طبيعياً في العراق، وتمت مقارنة النوع اعتماداً على العينات الحقلية والمعشبة. درست صفات مظهرية مفصلة للساق، والورقة، والثمرة والبذرة. أظهرت الدراسات التشريحية خصائص تصنيفية ثابتة مثل وجود طبقة الكيوتيكول الواضحة على بشرة السيقان والأوراق، ووجود منطقة قشرة ولب وأنسجة وعائية متطورة. من الناحية البيئية تمت دراسة الموطن والتوزيع الجغرافي للنوع *C. spinosa* في العراق وبينت أنها تنمو في أماكن جافة جداً وشبه جافة.

Introduction

Capparaceae are a medium-sized family of approximately 40–45 genera and 700–900 species [1], whose members present considerable diversity in habit, fruit, and floral features. It is commonly known as the caper family, that belong to the order Brassicales [2]. As currently circumscribed, the family contains 33 genera and about 700 species. The largest genera are *Capparis* (about 150 species), *Maerua* (about 100 species), *Boscia* (37 species) and *Cadaba* (30 species). Capparaceae have long been considered closely related to and have often been included in Brassicaceae, the mustard family (APG, 1998), in part because both groups produce glucosinolate (mustard oil) compounds [3-5].

Capparis spinosa L. (caper, caper berry, caper bush) is one of few perennial shrubs that grow and flower entirely during summer. It is deciduous species that bears rounded fleshy leaves and big white to pinkish-white flowers [4-5]. A *caper* is also the pickled bud of this plant. Caper bush found practically everywhere in Iraq [6] and present in almost all the circum-Mediterranean countries and is

*Email:silvazokian@yahoo.com

included in the floristic composition of most of them but whether it is indigenous to this region is uncertain [7-9]. The flower buds contain glycosidem rutin, pectic acid and volatile emetic constituent and saponin [7]. Also this wild edible plants are rich source of phyto-chemicals, such as carotenoids, flavonoids and other phenolic compounds having high free-radical scavenging activity, which helps to reduce the risk of chronic diseases, such as cardiovascular disease, cancer, and age related neuronal degeneration [10]. Caper had many Common names: KABAR, SHAFALLAH, MAR GIR, MARA GIRA and KABARUK [11]. As [12 , 13] the physiological response of *Capparis spinosa* to drought is based upon osmotic adjustment, regulation of stomatal opening, modification of cell wall properties and extensive root system.

In this study we tried to identify the morphological, anatomical characters and provide the habitat and geographic distribution of *C.spinosa* in Iraq through study of herbarium specimens and living collections from fields of Baghdad .

Materials and method

Plant materials of *C.spinosa* used for this study were obtained from Baghdad university herbarium (BUH) and the newly collected specimens from different parts of Baghdad city through the year 2013-2014. The sample materials of anatomical analysis (stem and leaf) have been cross-sectioned by hand, so slides of stems and slides of both abaxial and adaxial sides of leaves were prepared and observed under light microscope (type Olympus). Photographs were taken from fields as well as Microphotographs were taken by using digital camera (model Sony Cyber-Shot T 700) fitted on dissecting microscope and light microscope. These photographs were useful for identification of morphological and anatomical features.

Results and discussion

Habitat and duration

C.spinosa grow spontaneously in fields of Baghdad University- Jadiriyah campus and many regions of Baghdad city in open fields, as well as in cracks and crevices of rocks and stone walls in many regions of Iraq. Plants grow well in nutrient poor soils. Mature plants develop large extensive root systems that penetrate deeply into the earth. They are wind-tolerant, and grow in very dry hot climate. Also, investigations showed that dry heat and strong sunlight are the preferred environment for caper plants. Duration of *C.spinosa* in Baghdad city is from April to December. In time, it is growing from May to October, i.e. entirely during the prolonged summer drought [12].

Morphological study of the vegetative parts

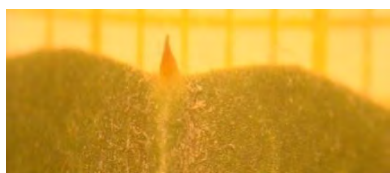
C.spinosa shrub had many prostrate-branched reach up to two meters. Morphological study of stems revealed many important characteristics. They had tiny spines, serpent-like when young, dry and brittle when old and branches were green or yellowish green, almost straight and glabrous. Leaves had alternative arrangement, variable in their texture, orbicular to elliptic, base rounded and apex mucronate with hairy integument on the abaxial surface, while the adaxial surface showed no such hairy integument, as shown in figure 1-b,c . Leaves length ranged from 19- 42 mm while their width range 19-39 mm, while petiole length was 3-8 mm. The stipule of the leaves had been modified to spines as adaptation to their habitat. The spines could reach to 3-4 mm in length, slightly curved as shown in figure 1- d. Flowers were white, solitary, the number of the sepals were 4 and they were sub equal , the number of the petals were 4 they were white broadly ovate to sub orbicular, anther filaments were purple, slender, longer than the petals while number of filaments could reach to 50-60, figure 1-a . Fruit was berry 12-15×25-40 mm in diameter, ellipsoid, ovoid or obovoid, the pericarp was thin, split when open at maturity to reveal bloody reddish matrix, which embedded seeds, figure 1-e. The seeds are 2-2.5×3.5-3.8 mm in diameter, globose, smooth and brown. Oblong – ovoid to rather abruptly figure 1-f .



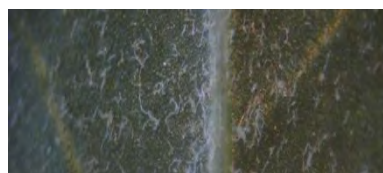
(a) Field *C. spinosa* showing flower



(b) Leaf of *C. spinosa* Small square= (1mm)



(c) Mucronate apex and the integument surface on the abaxial surface of the leaf of *C. spinosa* under dissecting microscope (2x)



(d) Spines of *Capparis spinosa*(2x)



(e) Fruit of *C. spinosa*



(f) Seed of *C. spinosa*

Figure 1-Field *C. spinosa* showing a- flower and stem, b,c- leaf, d- Spine , e- fruit and f- seed characteristics.

Anatomical study of the vegetative parts

The results of stem anatomy of *C.spinosa* showed important characteristics. The epidermis had arranged cells, and distinct cortex region that had small cells may reached to 140-150 μm . The vascular bundle were well developed with ring porous to semi ring porous xylem the diameter of vessels ranged between $1.25 \pm 0.30 \mu\text{m}$ to $1.65 \pm 0.45 \mu\text{m}$ as shown in figure 1-a . This results are one of factors that explain the increased capacity of *C.spinosa* to maintain the satisfactory water balance under limited water resource that agreed with [12, 14] results. Leaves were isobilateral with uniseriate upper and lower epidermis; cells were arranged tightly and had same wall thickness. The palisade layer of mesophyll cells were one or two layers and three or four layers in mature leaves, in time [12,14] pointed that mature leaves might had around seven to eight layers of mesophyll cells. Leaf xylem were more developed in mature leaves with lignified phloem. The mesophyll consist of palisade cells distributed on both sides of the leaf, while a sponge layer cells in the middle, as shown in figure 2-b, This finding agrees with previous studies [12,14] revealed that xerophytes have relatively small leaves, multi-cell walls, and well developed palisade mesophyll cell can effectively enhance the photosynthesis of *C.spinosa*. The stomata 8-10 μm wide \times 25-30 μm long were uniformly distributed on both leaf surfaces and the stomatal complex was anomocytic, figure 2-c. These results supports[15] findings which declared the wide distribution of stomata promoted evapotranspiration and had strong cooling effect on leaf temperature. Also, [12] explain that the relatively small and thick leaves, the multilayered mesophyll, the thick outermost epidermis cell wall of *C.spinosa* constitute features of xerophytes, the presence of stomata on both leaf surfaces shortens the distance of CO_2 diffusion to mesophyll cells. In time [12] stated that stomatal density in the adaxial epidermis of *C.spinosa* 25% higher than the abaxial; this is not unexpected, since perfect amphistomaty is rare, and this may result in differences in stomatal conductance between adaxial and abaxial surface of mature leaf.

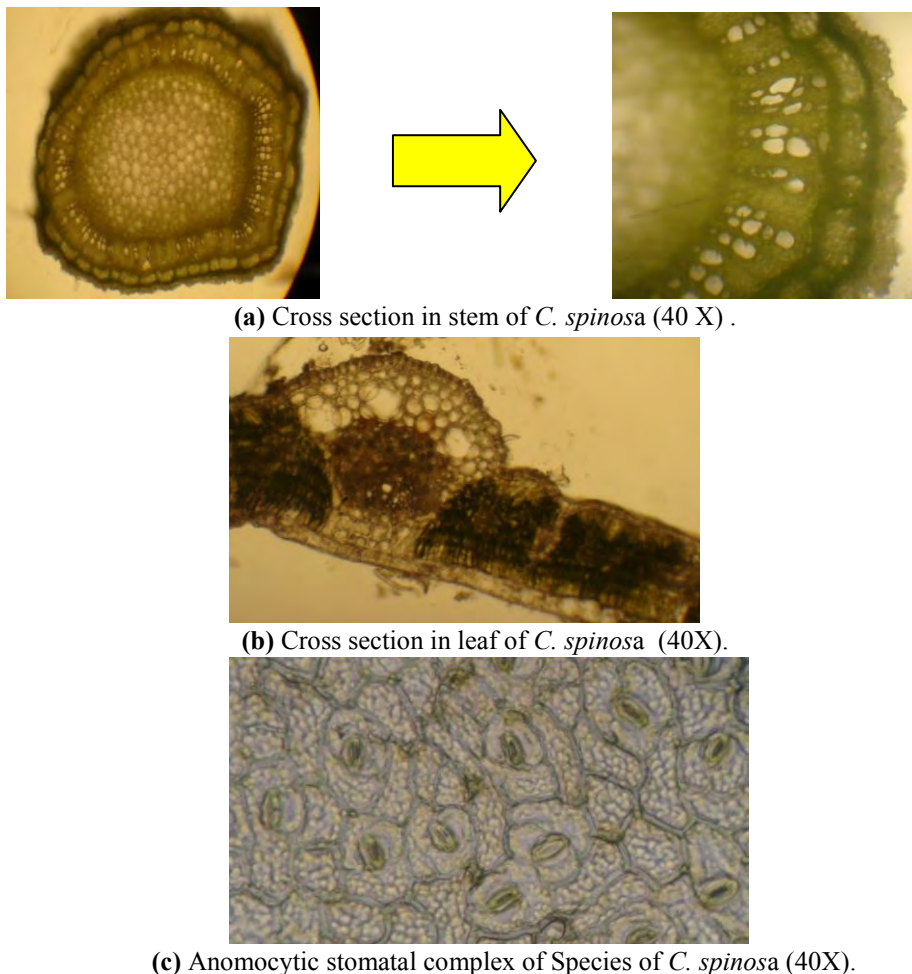


Figure 2-Cross section in leaf of *C. spinosa*: a- Stem, b- leaf, c- stomatal complex

Geographical distribution in Iraq

Study of BUH specimens showed that *C.spinosa* distributed repetitively in middle and northern parts of Iraq particularly was quite common in DWD, Ramadi province grown on rocks and near Therthar lake ; MJS Jabal Sinjar District, repetitively on Sinjar mountains; FNI Nieneveh District in Mosoul ; FAI Arbil District, near roads and near great zab in Aski kelleK and Gali Ali Beg; MAM in Amadiya District; FKI Kirkuk District; LEA, Baquba and Diyalla; LCA, in Abu-Ghraib west of Baghdad, Jadiriyah in University of Baghdad distributed in fields; and in Hilla on roads and wastes areas ; and in LBA Basra Liwa. According to [9,12] global *C.spinosa* distributed in South Europe, Cyprus, Syria, Lebanon, Palastine, Jordan, Egypt, Turkey Caucas, Iran, West Pakistan, Afghanistan, North West India, Asia and tropical Africa.

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