İSTANBUL UNIVERSITY PRESS

RESEARCH ARTICLE / ARAŞTIRMA MAKALESİ
DOI: 10.26650/HT.2023.1239982
Herbarium Turcicum 2023;1:10-13

Illustration of Succulent Taxa from Amaranthaceae: Problems and Proposed Solutions

Amaranthaceae Familyasındaki Sukulent Taksonların Illüstrsasyonu: Sorunlar ve Çözüm Önerileri

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Citation/Atıf: Tug, G.N., & Baskose, I. (2023 Illustration of succulent taxa from amaranthaceae: problems and proposed solutions. *Herbarium Turcicum, 1,* 10–13. https://doi.org/10.26650/HT.2023.1239982

ABSTRACT

The illustration of each taxon in "Illustrated Flora of Turkey" is attached to a reference herbarium specimen. In most cases, the dried herbarium specimens provide suitable reference specimens, but especially for succulent taxa like Amaranthaceae/*Salicornia*, it is not possible to draw each three-dimensional structure without fresh or spirit specimens. The focus of this article is the problems faced during the illustration of succulent taxa of the Amaranthaceae family and the authors' attempts to solve these problems and to share their solutions.

Keywords: Botanical illustration, Amaranthaceae, succulent, *Salicornia*, spirit collections

ÖZ

Resimli Türkiye Florası projesi kapsamında Türkiye bitkilerinin tamamı ilüstrasyonun yapılacağı herbaryum örneğine bağlanarak çizilmektedir. Bir çok durumda kurutulmuş herbaryum örnekleri uygun referans materyal sağlamaktadır, ancak özellikle Amaranthaceae familyası gibi sukulent taksonların bulunduğu familyalarda kuru herbaryum örnekleri yeterli gelmemektedir. Bu gibi durumlarda canlı bitkiden veya alkol örneğinden çizim bilimsel olarak doğru bir çizimin yapılabilmesi için gerekli olmaktadır. Bu makale ile Amaranthaceae familyasındaki sukulent taksonların çizimlerinde karşılaşılan zorluklar ve bu zorlukların aşılması için yazarların çözüm önerileri paylaşılmaktadır.

Anahtar Kelimeler: Botanik illüstrasyon, Amaranthaceae, sukulent, *Salicornia*, alkol örneği

INTRODUCTION

The species of Amaranthaceae are mainly annual or perennial herbs, subshrubs, and shrubs, and, rarely, small trees. There are 10 Subfamilies: Amaranthoideae, Betoideae, Camphorosmaoideae, Chenopodioideae, Corispermoideae, Gomphrenoideaea, Polycnemoideae, Salicornioideae, Salsoloideaeae, and Suaedoideae. Because of their ecological preferences, especially in saline, arid and semi-arid areas, Salicornioideae and Suaedoideae are succulent and/or have articulated stems (Kühn et al., 1993). The changing ecological conditions result in great plasticity and variability, especially in the stem morphology of succulent or non-succulent plants. This article focuses on the succulent Amaranthaceae species, whose stems are terete, thick, often articulate, and mainly leafless and show mostly opposite branching (Kühn et al., 1993). The succulent species of the family are in the Salicornioideae subfamily and the genera *Salicornia* L., *Halocnemum* M.Bieb., *Halostachys* C.A.Mey., *Halopeplis* Bunge, *Kalidium* Moq., *Bienertia* Bunge, *Sarcocornia* A.J.Scott, *Microcnemum* Ung.-Sternb.

To explain the illustration-related problem without getting involved in the taxonomical ones, we concentrated on *Salicornia* to express the complexity and difficulty of the succulent structures, especially from herbarium material.

The members of Salicornieae tribe are characterized by reduced leaves and flowers, with simple and similar morphological

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Submitted/Başvuru: 20.01.2023 • **Revision Requested/Revizyon Talebi:** 15.02.2023 • **Last Revision Received/Son Revizyon:** 21.02.2023 • **Accepted/Kabul:** 21.02.2023 • **Published Online/Online Yayın:** 12.06.2023

structures. Morphological differentiation can only be possible with fresh specimens, especially in flowering or fruit bearing periods (Gehu et al., 1979). Also, the members of this tribe have a high degree of phenotypic plasticity.

Salicornia L. (glasswort, saltwort, samphire) is a well-known genus with succulent, articulated, and leafless stems and branches. In addition, the floral structure is specified with aggregated spike like inflorescences (Kadereit et al., 2007; Shepherd et al., 2005).

Salicornia members are gnarled, succulent, and annual herbaceous plants. Stems prostrate or erect, simple, or branched; stems are succulent, hairless, and articulated. Stem leaves are opposite, reduced, scale-like, glabrous, sessile, fused to each other at the base, and cover the stem like a sheath. Inflorescence is a branched spike. Perianth 2-4 lobed. The flowers are hermaphrodite, 1-3-flowered, fused with each other and with brackets, and partially embedded in the major axis of the inflorescence (Yaprak, 2008; Ball, 1967). In Turkey, the *Salicornia* genus has 6 species (Yaprak, 2012; 2022).

Spirit collections are a fairly common storage method for succulents, large fruits, and mushrooms that are not suitable for drying, pressing, or placing in an herbarium file. Because drying the samples can cause shrinkage, it is often possible to get more accurate measurements from materials preserved in spirit liquids. In addition, this method allows the three-dimensional arrangement of flower parts to be clearly observed and illustrated. (Bridson and Forman, 1999; Hodges, 1989). According to this method, samples are sometimes stored in 70% ethyl alcohol or Copenhagen Solution (70% industrial methylated spirits, 28% distilled water, and 2% glycerol). Alcohol is a good preservative and glycerol prevents samples from becoming too brittle.

With this article we would like to find answers to the following problems:

- Succulent species lose their three-dimensional shapes and it is not possible to draw them in scientifically correct form from the two-dimensional, dried out herbarium specimen.
- The inflorescence of the genus *Salicornia* has a specialized and reduced structure with minute flowers lacking in many floral components.
- Lack of spirit collections at Türkiye's herbaria.

MATERIALS AND METHODS

Two types of plant materials were used during this study: the spirit collection of Prof. Dr. Ahmet Emre Yaprak from the Tohumlu Bitkiler Sistematiği Lab, and dried herbarium materials from the Tohumlu Bitkiler Sistematiği Lab. Morphological illustrations are done with ink from spirit materials. The spirit collections and dried herbarium materials were compared in light of plant illustration.

DISCUSSION AND CONCLUSION

With the development of modern techniques, it is expected that interest in plant illustrations will decrease as a result of developments in photography and microscopy techniques. However, in Türkiye, scientific botanical illustration is gaining attention, particularly as a result of the project "Illustrated Flora of Turkey," which is attempting to illustrate every plant species in the country.

During illustration processes, technical problems specific to families or even genera can arise. The focus of this work is the problems that arise during the illustration of succulent taxa of the Amaranthaceae family and the authors' attempts to solve these problems and share their solutions.

The Amaranthaceae family consists of both succulent and non-succulent taxa. For the scientifically correct illustration of succulent and articulated taxa, the specimen should be precise, with all the specific characteristics.

The habitus and inflorescence of *Salicornia* sp. as a succulent taxon can be seen in Figure 1. It is clear that it is not easy to differentiate each taxon without specialization or exact knowledge of the structure. The determination process of the succulent and articulated taxa can only be done if the specimens are fresh or deposited in 70% ethanol solution.

The form of dried specimens of succulent taxa from Amaranthaceae, *Salicornia freitagii*, can be seen in Figure 2, and it is not easy to determine discriminative characteristics

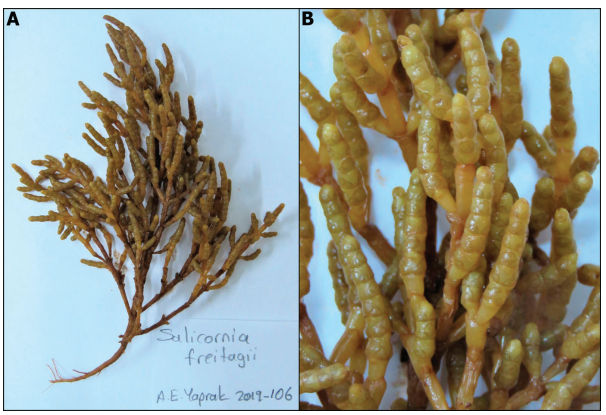

Figure 1. *Salicornia freitagii* specimen from spirit collection. A-habitus B-Inflorescence.

such as flowers and scale-like structures at each segment and three-dimensional structure of the specimen. For this reason, it is not possible to illustrate the scientifically correct form of succulent species of the Amaranthaceae family from dried herbarium specimens (Figure 2).

If it is not possible to draw the specimen when it is still fresh, spirit collections provide an opportunity to solve this problem. Specimens from spirit collections are very important and can be used to draw scientifically correct structures of reduced flowers and three-dimensional structures of shoots and branches. However, even at the biggest herbaria in Türkiye, the lack of spirit collections makes it difficult or impossible to compare the

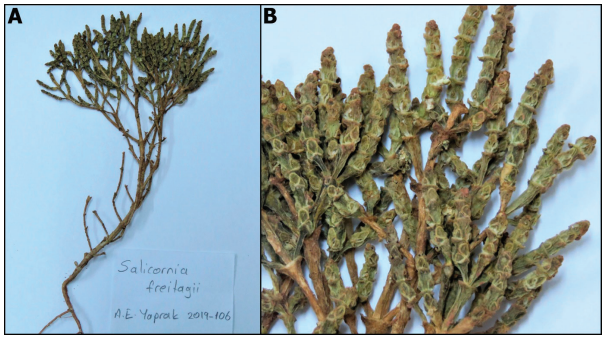

Figure 2. Dried herbarium specimen of *Salicornia freitagii*. A-habitus B-Infloresence.

specimen with the reference herbarium materials and to draw scientifically proper illustrations. In addition, succulence makes these taxa stay fresh for longer periods, and being kept at +4 °C during the illustration process can increase this duration.

As can be seen from Figures 1 and 3, the three-dimensional structure can easily be understood from spirit collection and provide convenience during illustration.

It is also better to evaluate the floral structure of the genus *Salicornia,* which is much reduced, from fresh specimens or spirit collections. The structure and parts of inflorescence of the *Salicornia* species can be seen in Figure 4, where fertile spikes and general flower structure were drawn. The illustrated fertile segments of three species, *S. emerici*, *S. freitagii*, and *S. dolychostachia*, are very similar to each other and can be differentiated by the sizes of their central and lateral flowers, and also the prominence of their scaleous borders, which are a reduced leaf at the upper parts of their fertile segments.

In light of all this information, we can conclude that the lack of spirit collections, especially for succulent taxa in Türkiye, is a weakness of Turkish herbaria. As with most succulent plants, it is not easy to illustrate the exact details of a specimen from a dried herbarium specimen. In some cases, dried specimens placed in hot water for 24 hours may regain their succulent structure, but according to the authors' experiences and trials with the succulent Chenopodiacea species, this process did not yield any positive results. During the preparation of "Illustrated flora of Turkey," all the species should be illustrated with water color or ink. As the illustrators of the family Amaranthaceae (s.l.) in "Illustrated Flora of Turkey," to deal with the succulent structures, we used specimens preserved in 70% alcohol or fresh specimens that were dried as an herbarium specimen after illustration.

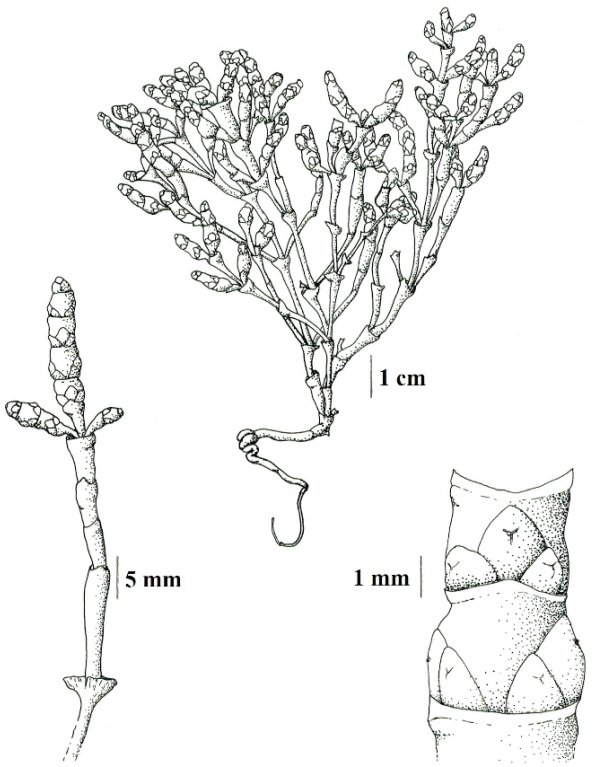

Figure 3. Illustration of *Salicornia freitagii* species from spirit specimen.

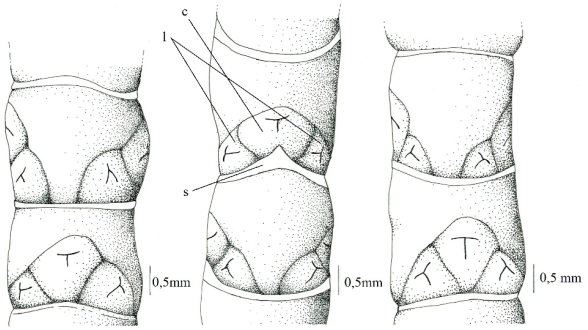

Figure 4. Flower of three different *Salicornia* species; *S. emerici*, *S. freitagii* and *S. dolychostachia* (from left respectively). c central flower, l lateral flower.

Acknowledgement: The authors would like to thank Prof. Dr. Ahmet Emre Yaprak for his kind help and support for the spirit and dried specimens.

Peer Review: Externally peer-reviewed.

Author Contributions: Conception/Design of Study- G.N.T., İ.B.; Data Acquisition- G.N.T., İ.B.; Data Analysis/Interpretation- G.N.T., İ.B.; Drafting Manuscript- G.N.T., İ.B.; Critical Revision of Manuscript- G.N.T., İ.B.; Final Approval and Accountability- G.N.T., İ.B.

Conflict of Interest: Authors declared no conflict of interest.

Financial Disclosure: Authors declared no financial support.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları: Çalışma Konsepti/Tasarım- G.N.T., İ.B.; Veri Toplama- G.N.T., İ.B.; Veri Analizi/Yorumlama- G.N.T., İ.B.; Yazı Taslağı- G.N.T., İ.B.; İçeriğin Eleştirel İncelemesi- G.N.T., İ.B.; Son Onay ve Sorumluluk- G.N.T., İ.B.

Çıkar Çatışması: Yazarlar çıkar çatışması beyan etmemişlerdir.

Finansal Destek: Yazarlar finansal destek beyan etmemişlerdir.

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