World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:8, No:11, 2014

Morpho-Anatomical and Ecological Studies on Endemic of *Fritillaria oranensis* Pomel. from the Mounts of Tessala (Western Algeria)

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International Science Index, Materials and Metallurgical Engineering Vol:8, No:11, 2014 waset.org/Publication/9999821

Abstract*—Fritillaria oranensis* (*Liliaceae*) was described in 1874 by pomel from Algeria. Plant samples have been collected from the mount of Tessala (Sidi-Bel-Abbes). The morphological features of various organs of the plant are described in detail. In the morphological part of the study, features of various organs of the plants such as stem and leaf were determined and illustrated. Ecological studies provide information about the physical and chemical structure of soil types in Tessala Mountain. The aim of this original investigation is to put forth ecological and anatomical features of these species for the first time, but at the same time given detailed account of the morphological characteristics of the stem and leaf of *Fritillaria oranensis*.

***Keywords*—**Anatomy, ecology, Liliaceae,morphology, *Fritillaria oranensis* Pomel.

I. Introduction

THE genus *Fritillaria* belongs to the family *Liliaceae*, sub-family of *Lilioideae*, tribe *Lilieae* [1] and includes approximately 140 species of appendix bulbous perennial distributed in the northern hemisphere, particularly in North America, in Asia, the countries of the Mediterranean region and in the western region of North America [2]. Despite its wide dissemination, this kind is still little known as the aspects of its autoecology and its biology as the note [3]. From the point of view fragility, its taxa are considered to be Vulnerable with the possibility to go in the category sozologic (VU), which means put in danger of varieties to ornamental value belongs to the genus *Fritillaria* [4].

The species *F. oranensis* is regarded as a rare species and endemic endangered in western Algeria or it is present only in the mounts of Tessala (Sidi-Bel-Abbes). According to our field observations this species its category could be reclassified as Critically Endangered (CE) [5]. The genus occupies different habitats but mostly prefers calcareous and siliceous. The species is confined in various habitats, in formations of maquis at altitudes ranging from 300 to 1200 m within the associations bushy.

F. oranensis has recently experienced a reduction in its area of distribution in the Mediterranean region; the species has been reported in northern Algeria in mount of Aurous, Ksar, Gamra, Aouaria [6], the Traras of Tlemcen, mounts of Meddad to Theniet el Had [7] .

However, no work has been done on *F. oranensis* genus of *Liliaceae*; Anatomical and ecological studies were made for the first time. Therefore, the present investigation has been undertaken to study the anatomical features of leaf and stem of the population of this taxa, in order to increase the knowledge of Algerian flora and to contribute to botanical, ecological and therapeutic quality.

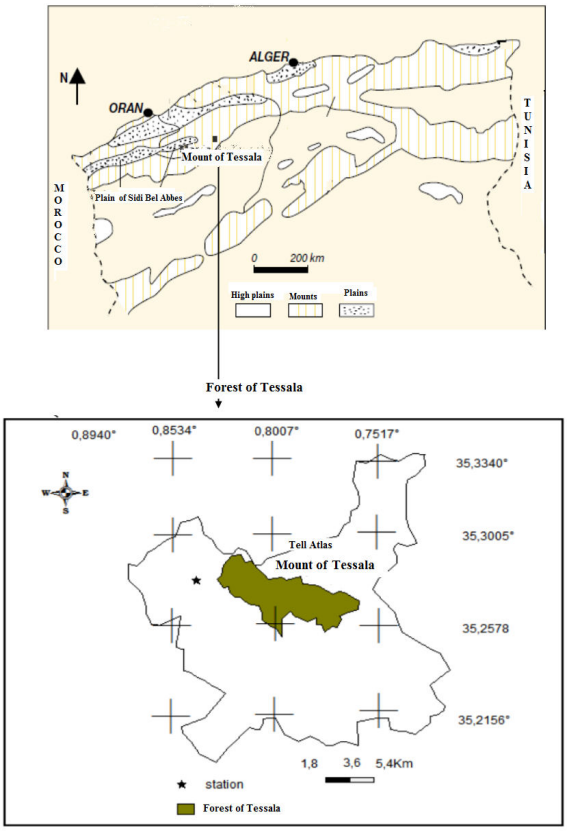


Fig. 1 Location map of the station to study

II. Material and Methods

Plant samples of *F. oranensis* for our study material were collected during flowering period (March 2014), from the following locations: mount Tessala at altitude to 808 m, (35°17'N, 0°42'W) (Fig. 1). Identification was made according to flora of Algeria [7]. Anatomical features of *F.oranensis*

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have not been investigated until now.

The materials necessary for anatomical studies have been collected from natural habitat and materials were fixed for about 24 to 72 hours then stored in 70% alcohol.

The usual method of dehydration and infiltration were followed using ethanol-xylene series. Fragments of leaves and stems were dehydrated in alcohol series, cleared in alcohol-xylene mixtures as outlined by [8] and embedded in paraffin.

The serial sections of 10- 13 µm thickness were cut using Jung rotary microtome sections were stained with safranin and counter stained fast green. Photomicrographs were taken on Leitz microscope.

Soil samples collected from the locality during the month of March at a depth of between 0–20 cm. Soil samples were brought to the laboratory in the polyethylene bags, air dried and sieved by using 2 mm sieve. pH, total salt, Conductivity, $CaCO_3$, texture, nitrogen , potassium , phosphorus and organic matter were determined according to the methods outlined in detail in the Table I.

III. Results

A. Morphological Properties

The *F. oranensis* is a rare plant endemic belonging to the family *Liliaceae*, herbaceous perennial, hermaphroditic, leafy stem whose height may reach 50 cm. The rod is drawn up and fine, and the bulb is almost smooth spherical and small with a diameter of 1 cm. Alternating leaves linear-lanceolate. Flower bell-shaped is the more often lonely, campanulate, leaning, measuring up to 3 cm. Perianth with six tepals oblong-obtuse, of blackish purple and has six yellow stamens with a long stigma and a net end. The fruit is a capsule drawn up, large, prismatic, largely truncated on the structural angles and six faces alternately closer, more complete superiorly by three lobes rounded, truncated at the base (Fig. 2).

Examined specimens: (Type locality) Algeria. Sidi-Bel-Abbes, Tessala mountain, 808 m, 19.03.2014.

Flowering period: January-March.

Distribution in Algeria: western

B. Anatomical Properties

For the anatomical investigations, samples were taken from the plants stem and leaves (Fig. 2).

Stem

Transverse section taken from the middle part of stem was observed as follows (Fig. 3). The epidermis is composed of small orbicular cells. The cortex comprises parenchyma and sclerenchyma. The 4-6 layered parenchymas consist of oval or orbicular cells and is outer side of cortex. The sclerenchyma is 4-5 layered and inner side of cortex. The vascular bundles are more numerous in the vascular cylinder.

Leaf

Transverse section of the lamina and surface preparations of both epidermises revealed Figs. 4 (a), (b). In transverse section, the upper and lower epidermises comprise uniseriate, almost square and orbicular cells.

The upper epidermises cells are larger than lower epidermises cells. Both epidermises are covered with almost thick cuticle. The stomata occur on the surface of both sides, being more abundant on the lower surface. They are located on the same level is prepared improperly. The leaf is isolateral, mesophyll consists of 9-10 layered cells (Fig. 4 (b)), oval or slightly elongated. Vascular bundles are uniseriate and different size in the mesophyll cells.

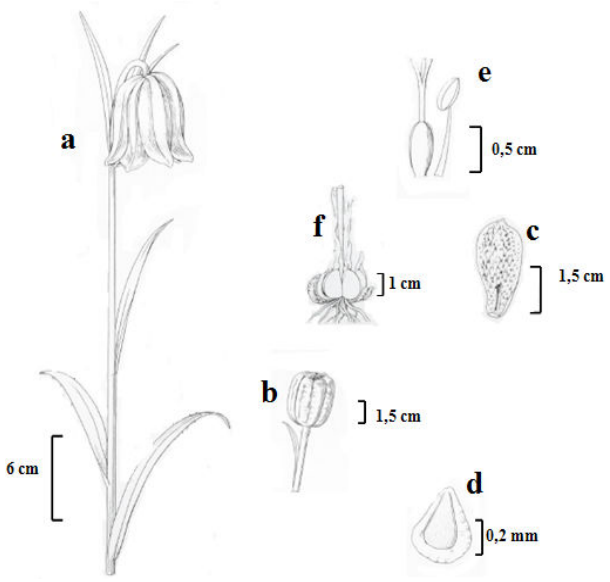


Fig. 2 General appearance and details of floral organs of *F. oranensis* a: whole plant, b: capsule, c: tepal, d: seed, e: stamen and gynoecium, f: bulb

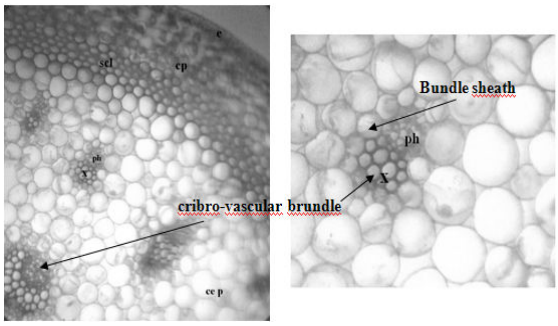


Fig. 3 Cross Section of stem (parenchyma and cribro-vascular brundle) (10x10) e: epidermis, scl: sclerenchyma, cp: cortex parenchyma, ph: phloem, x: xylem, ce p: central epidermis

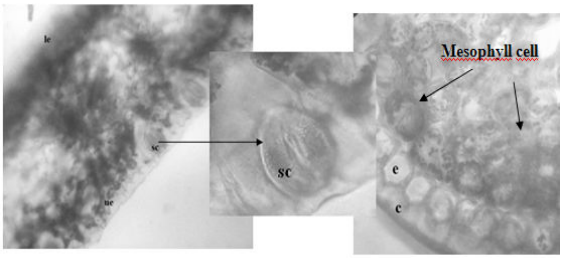


Fig. 4 (a) Cross Section of leaf (10x10) ue: upper epidermis, e: epidermis, c: cuticule, ms: mesophyll, le: lower epidermis, sc: stoma cell

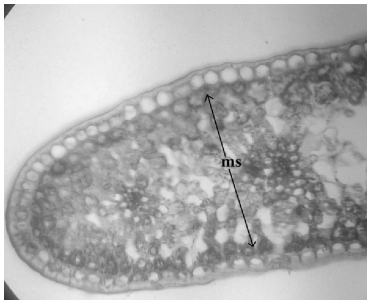


Fig. 4 (b) The leaf mesophyll cells (10x10)

C. Distribution

This species is distributed in Western Algeria at 808 m on Tessala Mountain in Sidi-Bel-Abbes, Generally it grows on the mountainous slopes, and on limestone rocks.

D. Soil Characteristics

F. oranensis prefers soils with a pH between 7.1(medium alkaline) and 7.79 (highly alkaline) non saline, silty-clay textured, with 51.42% $CaCO_3$ (rich in $CaCO_3$). The soils supporting these plants are rich in nitrogen (0.301%), potassium (0.60%) and organic matter content with 3.16 % and finally phosphorus with 0.086%. Texture silty-clay; soil pH varied between 7.1 and 7.79 indicating that *F. oranensis* could grow both in acid and slightly alkaline soil (Table I).

TABLE I
SOIL CHARACTERISTICS OF *F. ORANENSIS*

	Sample area 1	Sample area 2	Sample area 3
soil depth		0-20 cm	
pH	7,1	7,5	7,79
Conductivity(mS/cm)	0,15	0,14	0,21
Humidity (H%)	7,85	8,04	6,7
$CaCO_3$ (%)	42,85	51,42	50
Organic matter (%)	2,75	3,16	2,40
Carbon C%	1,59	1,83	1,39
clay	24,33	32,65	23,24
silt	49,45	50	44,25
sand	21,22	19	23
P%	0,086	0,079	0,040
K%	0,60	0,56	0,40
N%	0,210	0,301	0,186

IV. DISCUSSION

In this study, we examined the morpho-anatomical and ecological characters of *F. oranensis* which are reported at first time in the present paper. *F. oranensis* lives in a habitat very binding which associated drought, low quantity of elements purposes and low water capacity. Thus, among the faculties of adaptation of this plant include an adaptation anatomy and morphology of the system of the rod (cuticle thick).

The thickening of the cuticle is certainly an obstacle to vagaries external; this is a means of adapting leaves to difficult climatic conditions in the region of Tessala; these plants, with their thick cuticle consumed with great parsimony provision of accumulated water in the wet season.

Fig. 4 (a) shows transfer section of leaf show the following anatomical features, epidermis is covered over by a thick cuticle; Stomata occur on both the epidermal layers. The ground tissue is characterized by fairly thick walled cells which were round in shape and is traversed by a number of vascular bundles. The stomata are present on upper and lower surfaces of *F. oranensis* but they are more abundant on the lower surface; [9] has observed that the stomata, were present on both surfaces of all the species examined in the *Liliaceae* but stomatal frequencies on the upper surface are greater than those of the lower surface. In contrary in our studies stomatal frequency is more on the lower surface. The vascular bundles are clearly seen in transfer section of stem (Fig. 3).

The results of analysis of soil samples under *F. oranensis* in area of Tessala are summarized in the table which follows (Table I). They confirm the observations made on the ground. All soil samples have a texture silt-clay. The horizons have a clotted structure, porosity average, consistency lasts, presence of limestone concretions; moist condition, color 10YR3/6 (pale brown); the three sites are substrates of shallow imposed by the emergence of the parent rock. The dominant texture of horizons is silt-clay soils with a rate which varies between 44% and 50%. All soils are basic with a pH which varies between 7 and 8; it is a characteristic common to all the floors of the station due to the presence of limestone. All of the samples have values of salinity which vary between 0.15% and 0.21%. These soils are non-saline. The rate of organic matter is high under the *F. oranensis* and to point out the carbon content is constant for the 3 sites. The substrates are usually rich in calcium carbonate; the percentage varies between 42% and 50%. This strong content is linked to the nature of the parent rock which is limestone.

The humidity and the exposure are key factors and appear to be the discriminating parameters in the station to study, acting directly on the behavior and of the optimal habitat of the species.

From one point of view edaphic requirement, this species has a large plasticity and ecological amplitude very wide. It is accommodated to various types of substrates and colonized as well the lime that the silica substrates (shales). However, the species is endemic to the limestone substrate. However, *F. oranensis* likes soils rich in organic matter, potassium and nitrogen.

There is not any reference available dealing with the anatomy of these anatomical characters show possible ecological adaptations to various climates. The present studies were carried out to consolidate information on anatomical features of stem and leaves of *F. oranensis*. In this study, the anatomical characteristics of *F. oranensis* were studied to provide opportunities for further studies.

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