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Micromorphological, morphological and anatomical investigation of the *Lilium ledebourii* (Baker) Bioss.(Liliaceae) indigenous to Iran

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Abstract

This study presents investigations on the morphological, micromorphological and anatomical features of *Lilium ledebourii* (Baker) Bioss. an endemic rare and very attractive ornamental species in Iran. Visual, micromorphological and anatomical investigations were performed by comparing of the species with the Flora of Iran, scanning by electron microscopy (SEM) and sectioning of various organs, respectively. The studies have been revealed that there are some particular, unique properties in this species.

Keywords: *Lilium ledebourii* (Baker) Bioss; Anatomy; Morphology; Micromorphology; Endemic.

Introduction

Lilium ledebourii (Baker) Bioss., is distributed in the Damash of Ammarloo and Kalchooleh of Dorfak areas (ca. 2100) of guilan province in the north of Iran (Fig. 1). The genus *Lilium* L. (family; Liliaceae) includes about 100 species around the world which have been classified into five to ten subgenera that are geographically distributed in the northern hemisphere (Siljak-Yakovlev et al., 2003). *Lilium ledebourii* (Baker) Bioss. is the rarest lily and very attractive (Fig. 2). It is under careful surveillance. It is a perennial plant containing the corm which produces beautiful white flowers with sweet fragrance in June (Reshinger, 1989).Studies on morphological features of this unique plant were performed (Reshinger, 1989; Ghahreman, 1997). Some anatomical and micromorphological properties were reported by Farsam et al., (2003).
In this research some of the morphological, micromorphological and anatomical features of *Lilium ledebourii* (Baker) Bioss. were submitted for the first time.

Materials and Methods

Lilium ledebourii samples were collected from natural habitats (Damash of Amarloo area of Guilan province in the north of Iran) in the vegetative (May 2007) and generative (June-July 2007) stages. A distribution map of *Lilium ledebourii* (Baker) Bioss. is shown in Fig. 1. The materials necessary for anatomical and micromorphological studies were protected in 70% alcohol. Morphological studies were carried out on fresh samples and observed results were compared with the Flora of Iran (Ghahreman, 1997). Cross-sections of the stem, leaves and ovary and surface sections of stomata and trichoms (hairs) were taken manually for anatomical studies. The materials were stained with Kongorot (Congo red) and Methyl green and fixed with Glycerin-gelatin (Vardar, 1987). Anatomical samples were observed with a stereomicroscope and binocular light microscope. Furthermore, the micromorphological properties of gold-plated of the pollen grain have been investigated by SEM, LEO model. Suitable sections were taken for microscopic studies. All images were captured digitally using Fine Pix A350 camera attached to SA Iran light microscope. Identification

of different cells and tissues were fulfilled on the digital images of each specimen.

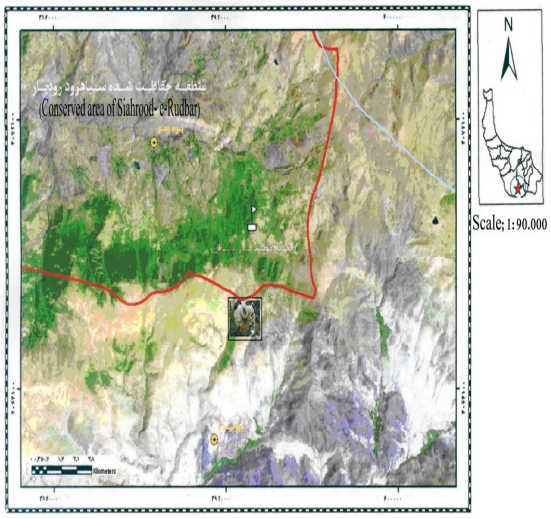

Fig 1. **Distribution map of *Lilium ledebourii* (Baker) Bioss. in Iran**

Fig2. Lilium ledebourii **(Baker) Bioss. (Susan-e-Chelcheragh) at the flowering stage (June 2007)**

Results and Discussion

Anatomical features

Cross-section from the stem of this taxon shows that there are the silica prickles on epiderm (Fig. 3).

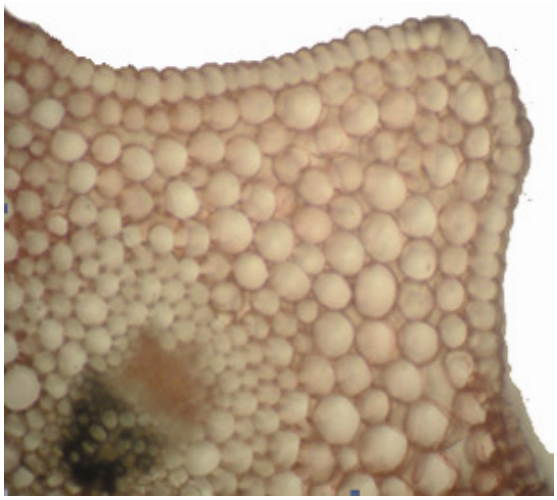

Fig 3. **The cross- section of stem containing silica prickle (x10)**

Silica hairs exist on some of these silica prickles (Fig. 4). Silica cells were observed in some of other plants especially Poaceae and Cyperaceae families (Lawton, 1980; Metcalfe, 1963). There are no the endodermis, pericycle and cambium.

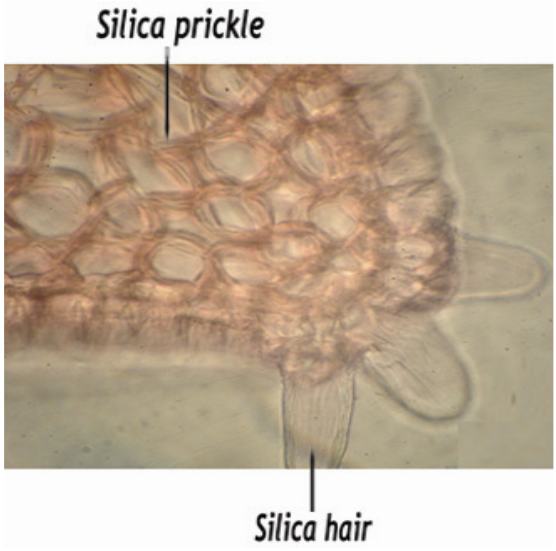

Fig4. **The cross- section of a silica prickle containing silica hairs (x40)**

In the cross-sections of leaves, isolateral or equifacial, the lower epidermis and margin of leaves are containing of silica hairs (Fig. 5).

Fig5. **The cross-section of a part of the leaf containing the unicellular glandular hairs (x10)**

Glandular trichoms (silica hairs) are very dense on the margin of leaf. Eglandular hairs are unicellular and very little (Fig. 6).

Fig6. **Eglandular hairs of the leaf on the lower epidermis (x40)**

Glandular (silica hairs) and eglandular trichomes was not seen the upper epidermis. The presence of silica hairs on this species was not seen. The glandular and eglandular hairs have used as taxonomical characters. The cross-sections of ovaries showed that placentation type is axial (Fig. 7). The axial placentation was observed in the most monocotyledons, Malvaceae, Boraginaceae, Cucurbitaceae and so on. In the surface sections of leaves, stomata are Ranunculeous type and anomocytic (Fig. 8), which confirms the results

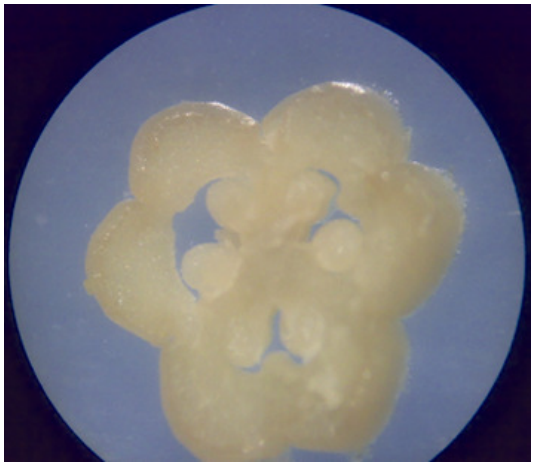

Fig7. **The cross-section of ovaries with the axial placentation (x40)**

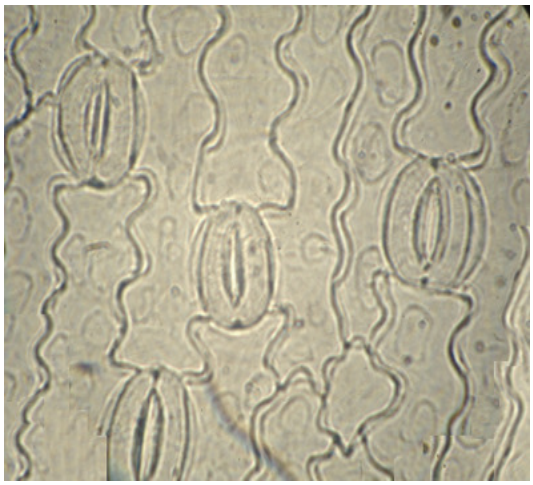

Fig8. **The stomata from the lower epidermal peeling of the leaf (x40)**

obtained by Farsam et al. (2003). Anomocytic stomata were also described in some species of Boraginaceae, Ranunculaceae, Geraniaceae and so on. There is no stoma on the upper epidermis. Stomata index is 20 for the lower epidermis.

Micromorphological features

The micromorphological features of pollen grain observed by SEM are as follows: pollen type: monocolpate, pollen shape: boat like, apertures: colpi and long with an end of more or less pointed, pollen length: 107-110 µM (permagna) (Fig. 9).
These results are almost similar to results obtained by Iwanami et al. (1988) with study on *Lilium longiflorum.*

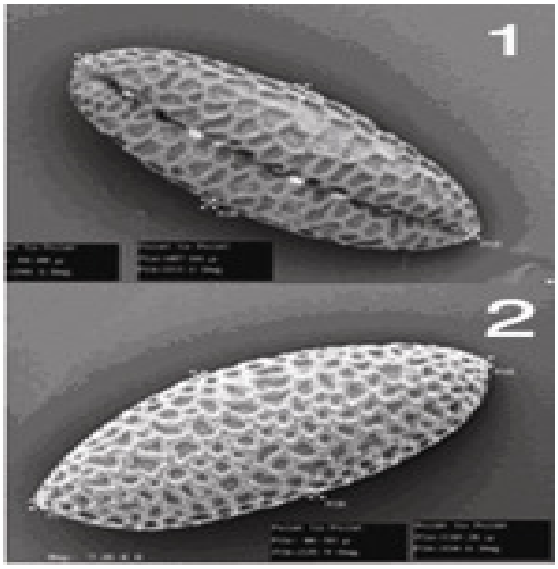

Fig9. **Photomicrographs of pollen grains under SEM (x726), 1- the view of ventral surface, 2- the view of dorsal surface**

Morphological features

The results obtained from morphological studies were generally consistent with the description given in the Flora of Iran (Ghahreman, 1997). Some of morphological features that have not been reported as follows: *Lilium ledebourii* has the contractile roots. These roots apparently are the basis of the stem. *Leontodon* L., *Taraxacum officinale,* some herbaceousdicots and monocots have contractile roots that pull the plant deeper into the soil. Many Lily bulbs are pulled a little deeper into the soil each year as new sets of contractile roots are developed. The bulbs continue to be pulled down until an area of relatively stable temperatures is reached. In the other words, temperature fluctuations at the surface determine how long the contracting will continue (Altman and Waisel, 1998). The stem includes the silica prickles. Also, the lower surface especially margin of the leaf is covered with shorts dense silica hairs (Fig. 10). These are unicellular glandular hairs. Conjunction of filament to anther is often the basifixed type and rarely the medifixed type.

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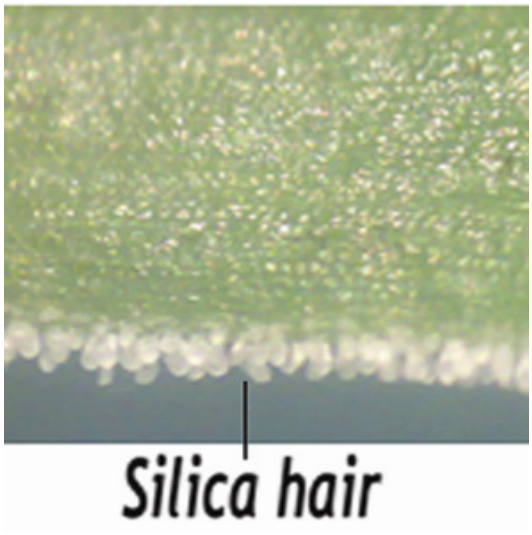

Fig10. **Unicellular silica hairs on the margin of the leaf (x10)**

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