



## Petiole anatomical study for some species of *Astragalus* L. Sect. *Proselius* (Fabaceae family) in Iraq

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### Abstract

In this research cross sections of petioles in 3 species of *Astragalus* L. Sect. *Proselius* studied for a comparison of anatomical characters based on phylogeny in this section. The characters which employed in this study are as follows: Numbers of parenchymatous cell layers in pith, number of bundles, length of ventral axis, length of dorsiventral axis, diameter of ventral lateral vascular bundle (VLB) and diameter of dorsal median bundle (DMB), the Thickness of cuticle, epidermis, cortex. The results are suitable evidences for taxonomical differentiation in species in this section and can be use for delimiting small natural groups. Moreover, they are helpful characters for determining some complexes in this section.

Keywords: *Astragalus* L., Petiole, Anatomy, Fabaceae, Iraq.

### Introduction

The Fabaceae family consists of approximately 650 genera and 18,000 species, it is one of the largest Angiosperm families (Chaudhary *et al.*, 2007). *Astragalus* L., with about 3000 species worldwide, is the largest genus of flowering plants (Zaree and Podlech, 2005). The high variation of anatomical characters has made in frageneric classification uncertain and problematic. *Astragalus* L. belongs to the subfamily Papilionoideae in the family Leguminosae under the subtribe *Astragalinae* of the tribe *Galegeae*. The genus is most diverse in the Irano-Turkish region of South-Western Asia (1000-1500 sp.) (Sabaii and Zarre, 2007). The Sino-Himalayan Plateau of South Central Asia (550 sp.) and the Great Basin and Colorado Plateau of Western North America (450 sp.) (Townsend, and Guest, 1974). However, the centre of origin and diversity of *Astragalus* Eurasia, specially the drier mountainous parts of South-Western and South-Central Asia and the (Podlech, 1999). *Astragalus* is not only the largest in numbers rather it is also considered one of the most diverse and taxonomically difficult genera in legumes. The delimitation of taxa at various taxonomic ranks poses considerable taxonomic problems in the genus worldwide. It has been widely realized that at many places morphological characters alone are not sufficient to explain the systematic relationships among *Astragalus* species (Mehrabian *et al.*, 2007). In view of this, it has become now necessary to

utilize molecular marker other than morphology to solve the taxonomic ambiguities prevailing in the genus. The development of recent techniques in the fields of molecular biology and gene technology have been proved quite useful for rapid and accurate determination of phylogenetic relationships among plant (Pirani *et al.*, 2006). The natural gum tragacanth is made from several species of *Astragalus* occurring in the middle east, including *A. adscendens*, *A. gummifer*, *A. brachycalyx* and *A. tragacanthus*. Also *Astragalus propinquus* (syn. *A. membranaceus*) has a history of use as a herbal medicine used in systems of traditional Chinese medicine and Persian medicine. In traditional Chinese medicine *A. membranaceus* has been used to reinforce qi and strengthen the superficial resistance, and promote the discharge of pus and the growth of new tissue (Podlech and Zarre, 2013).

### Materials and Methods

This study was carried out on 3 species: *A. gudrunensis* Boiss. & Hausskn., *A. procerus* Boiss. & Hausskn., *A. tgridis* Boiss. which to be included in Sect. *Proselius* that distributed in Iraq. Petioles from approximately herbarium specimens of 3 species were surveyed. They were removed from herbarium specimens, We removed a part of the middle of mature petioles and smoothed by cooking in 5 min. Subsequently we fixed them in absolute FAA. After 24 hrs petioles were removed and washed with fresh water, then inserted in Ethanol

(70%). Cross sections were made by hand using commercial razor blades. The sections stained with carmen and methylene blue. Then we dehydrated them in ethanol gradient and finally toluene (99.5%). Later on mounted section on slides using Canada balsam and studied using an Olympus microscope.

### Results and Discussion

There are three kinds of tissue in each cross section, The parenchymatous tissue at the periphery of petiole, which is the exterior, and is by single cell-layer of epidermis, called cortex. In the centre of the petiole there is a primarily parenchymatous tissue called pith (Figure1). Vascular bundles are the third tissue. The length of ventral and dorsiventral axis, thickness of DMB (dorsal median bundle), VLBs (ventral lateral vascular bundle) and pith area, and number of bundles (first and second series) are measured in this research. Anatomical characters have been the subject of only a few researches on the systematics of this genus. Data has been represented in table 1. Cross sections of petioles are shown in. This structure is very variable in these species. Quantitative characters are as follows: The epidermis was uniseriate in all species with cuticle differed in thickness as the species differ. Petiole epidermis showed stomata, trichomes (glandular and eglandular) between ordinary cells, Ground tissue system represented by collenchyma and

chlorenchyma (below epidermis) and the mass area of this system was occupied by ordinary parenchyma. One of main differences among species was the number of lateral vascular bundles. These characteristics were suggested as an important trait for differentiating *Astragalus* L. species under study (Engle, 2012; Maassoumi and Ranjbar, 2010) studied gum conducting tissue in stem in Tragacanthic species. Engle (2000) studied many species of this genus with systematical approach (Table 2). A few studies have been carried out on the species of this (Ranjbar and Karamian, 2003).

This is the first systematic study on this section which is based on phylogeny. Zarrinkamar (1996) recognized two major patterns in petiole anatomy. The first group identified by small pith made up of thick walled parenchymatous cells along large amounts of sclerenchyma around the vascular bundle. The second group characterized by large pith composed of thin walled parenchymatous cells along small amounts of sclerenchyma around the vascular bundle. The results reveal that petiole anatomy is a suitable evidence for taxonomical differentiation in species level and some taxonomical complexes and delimiting small natural groups but not useful for circumscribing sections. Thus all of the evidences are necessary for grouping in section and its phylogenetical situation in other sections of *Astragalus* (Polhill, 2014).

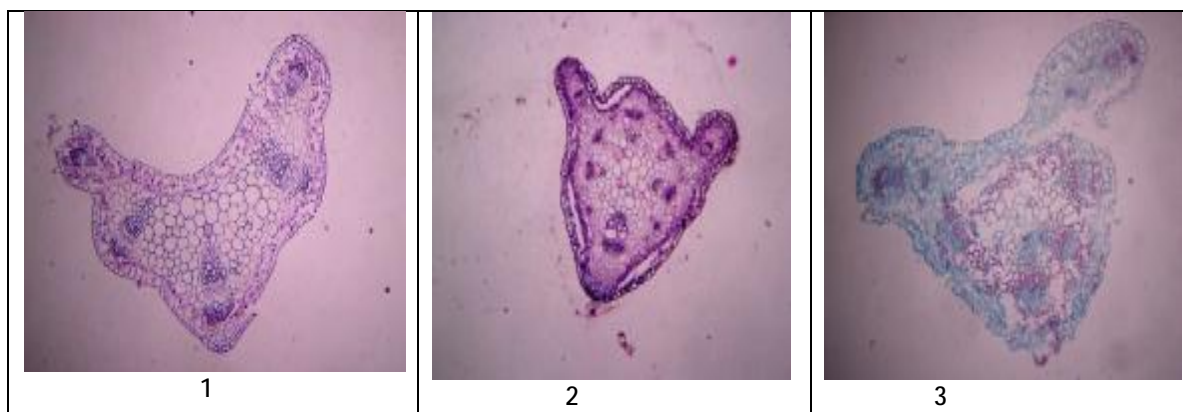


Figure (1): Cross section of the petiole anatomy in selected species of *Astragalus* sect. *proselii* 1: *A. gudrunensis* Boiss. & Hausskn ( 300X), 2: *A. procerus* Boiss. & Hausskn ( 310X), 3: *A. tgridis* Boiss.( 300X).

Table (1): Selected characters from petiole anatomy of *Astragalus* Sect. *proselius*

Species	Length of ventral axis (mm)	Length of dorsiventral axis (mm)	Diameter of DMB ( $\mu\text{m}$ )	Diameter of VLBS ( $\mu\text{m}$ )	Diameter of the pith (cell layers)	Number of bundles (first and second series)
<i>A. gudrunensis</i>	1.07	1.02	210	200	15	5
<i>A. procerus</i>	0.45	0.40	130	60	5	8
<i>A. tgridis</i>	0.80	0.82	160	130	16	9

Table (2): Characters of petiole cross section in *Astragalus* Sect. *proselius*

Species	Shape of petiole	Thickness of cuticle $\mu\text{m}$	Thickness of epidermis $\mu\text{m}$	Thickness of cortex		Shape of central vascular arch
				Collenchyma $\mu\text{m}$	Chlorenchyma $\mu\text{m}$	
<i>A. gudrunensis</i>	crescent	1-2 (1.5)	15-25 (20)	40-50 (45)	20-26 (23)	oval
<i>A. procerus</i>	deltoid	1.5-2 (1.75)	20-24 (22)	30-40 (35)	22-28 (25)	deltoid
<i>A. tgridis</i>	oval	1.5-2.5 (2)	18-22 (20)	35-45 (40)	23-33 (28)	Horse shoe

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