

Morphological and anatomical properties of *Lathyrus cilicicus* Hayek & Siehe (sect. *Platystylis*, Fabaceae) from the mediterranean region of Turkey

Ferhat Celep*, Hüseyin Çildir, Ahmet Kahraman, Musa Doğan, Evren Cabi

Middle East Technical University, Department of Biological Sciences, Ankara, Turkey

*Corresponding author: ferhat_celep@hotmail.com

Abstract

The morphology and anatomy of *Lathyrus cilicicus* Hayek & Siehe (Fabaceae) were studied in order to understand the usefulness of these characteristics for systematics purposes. *Lathyrus cilicicus* is a Mediterranean element which grows in macchie, cornfields and cliffs in the central portion of the Mediterranean region of Turkey. An expanded and amended description of the species is given. In the study, anatomical features of the species are reported for the first time. Anatomical studies have been carried out on transverse sections of roots, stems and leaves. Some anatomical characters such as the number of cortex layers and pith rays in the root, the number of collenchymatous cell layers in the stem and well developed sclerenchyma tissues in the leaf provide information of taxonomical significance.

Keywords: Anatomy; Endemic; Fabaceae; *Lathyrus cilicicus*; Morphology; Turkey.

Introduction

Lathyrus L. (the sweet peas) is one of the largest genera in the Fabaceae with approximately 160 annual and perennial species (Chtourou-Ghorbel et al., 2001; Lewis et al., 2005). *Lathyrus* is distributed throughout the temperature zones of the Northern Hemisphere and extends into temperate South America and tropical East Africa (Kenicer et al., 2005). *Lathyrus* species include food and fodder crops, ornamentals, soil nitrifiers, dune stabilizers, important agricultural weeds, and model organisms for genetic and ecological research (Kenicer et al., 2005). Doğan et al. (1992) assigned 54 Turkish species of *Lathyrus* into 10 sections based on a phenetic analysis of vegetative and floral characters. The section *Lathyrus* was defined in the narrow sense and the section *Cicercula* was re-established to include some species transferred from the section *Lathyrus*. The section *Gorgonia* was newly proposed. The section *Orobastrum* and a few species from the section *Lathyrus* were transferred into the section *Clymenum*, and the sections *Linearicarpus* and *Viciopsis* were merged with the section *Nissolia* (Badr et al., 2002). In 2002 and 2005, two molecular phylogenetic studies were conducted on the *Lathyrus* by Badr et al. and Kenicer et al., respectively. In the study, systematics relationships of the sections of the genus were extensively discussed. In Turkey, the genus is present composed of 80 taxa in the species, subspecies and varieties (Davis, 1970; Davis et al., 1988; Güneş and Özhatay, 2000; Genç and Şahin, 2008; Genç, 2009). Anatomical, palynological and seed morphological studies on some species of *Lathyrus* were conducted by several author (Aytuğ 1967, Aytuğ et al., 1971, Moore et al., 1991; Gaborrana et al., 1998; Güneş and Çırpıcı, 1998; Perveen and Qaiser, 1998; Krstić et al., 2002; Metcalfe and Chalk, 1957; Tosheva et al., 2004; Tosheva and Tonkov, 2005; Abou-El-Enain et al.,

2007; Güneş and Aytuğ, 2010; Güneş and Çırpıcı, 2010). As well as, similar studies were conducted on closely similar genus in the Fabaceae (Hossain et al., 2010a; 2010b). Anatomy of *L. cilicicus* has not been studied previously. Therefore, we aim to examine anatomical properties of *L. cilicicus* for the first time and give a comprehensive morphological description of its aerial parts.

Material and methods

Since 2009, a large number of *Lathyrus* specimens have been collected by H. Çildir, F. Celep and M. Doğan. Moreover, population size and phenological properties of the species were observed. The specimens of *Lathyrus cilicicus* were collected from Karaman, above Ermenek, 27 June 2009, 1350 m, M. Doğan, E. Cabi & F. Celep 1714 and were deposited in Department of Biological Sciences, Middle East Technical University, Ankara. The taxonomical description of the species followed Davis (1970). Anatomical investigations were performed using an average of 30 fresh specimens kept in 70% alcohol. The paraffin wax method was applied for preparing cross-sections of middle parts of mature roots, stems and leaf blades. The sections were stained with safranin-fast green (Johansen, 1944) with some modifications relating to staining time and amount of additions to the stains, and then they were mounted on slides using entellan. Slides were viewed and photographed with a Leica DM1000 light microscope. Sections were made with a Leica RM2125RT rotary microtome using the paraffin wax method and by hand using commercial razor blades.



Fig 1. Habit of *Lathyrus cilicicus*. (Photo: Ferhat Celep)

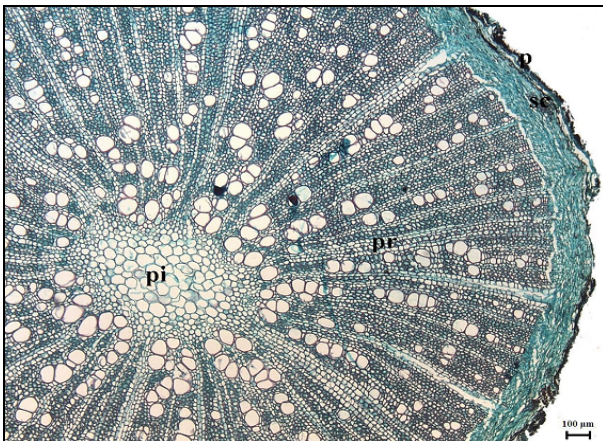


Fig 2. The transverse section of the root of *Lathyrus cilicicus*. sc – sclerenchymatous cells; p, periderm; pi, pith; pr, pith rays

Results

Morphological properties

(Fig. 1). It is a tall, erect and perennial plant. Stem wingless is approximately 40-150 cm height, sparsely pilose at the base of the stem and glabrous above. The leaves are linear-lanceolate, 70-160 x 3-10 mm, 5-parallel veined, lower leaves with one pair of leaflets, median leaves subdigitate, aristate. The stipules are linear-lanceolate and longer than the petiole. The inflorescence is raceme, peduncles 20-50 cm, laxly, 5-15 – flowered. The pedicels are (3-) 4-10 (-12) mm. The flowers are large, 22-32 mm, banner pinkish to purple, wings and keel whitish. The calyx is tubular to campanulate, 6-10 mm, glabrous. Calyx teeth subequal ca. 3 mm, broad and margins more or less membranous. The style is obovate to spatulate, 2-

4 mm wide, densely pilose. Legume linear-lanceolate, 40-90 x 4-9 mm, (3-) 5-13 pods, glabrous, more or less hook shaped.

Anatomical properties

Root anatomy

The transverse sections show that the periderm layer on the outermost surface is dark-coloured and breaking up or squashed cells. Under periderm, 1-2 -layered parenchymatic cortex is present. There are sclerenchyma groups on the well developed phloem. They have 8-10 cells. Between phloem and xylem, cambium layer seems to split up. The xylem rays consist of 2-5-layered cells (8.9-21.3 μm wide x 10.9-39.6 μm long). Pith cells are more or less orbicular and their dimensions are 18.0-99.9 μm wide x 16.4-79.4 μm long, It is placed in the center of the root. (Fig. 2)

Stem anatomy

The stem transverse sections are circular. The epidermis is one layered and mainly consists of rectangular cells (11.3-33.1 μm wide x 6.5-10.3 μm long) with a thin cuticle (2.4-4.0 μm thick). The upper and lower walls of the epidermis cells are thicker than the lateral walls. The cortex (59.5-88.7 μm thick) is composed of a few layers of oval or more or less rectangular parenchymatous cells. The collenchyma (19.1-30.0 μm thick) is composed of 2-3-layered cells and found in larger ribs. Above the phloem, many sclerenchymatous cells are present. They are found as more developed groups above larger vascular bundles. The centre of the stem is hole (Fig. 3).

Leaf anatomy

The transverse sections show that the upper and lower epidermises are made up of uniseriate, isodiametric or rectangular cells with a thin cuticle (2.6-4.0 μm thick). Cells of the upper epidermis (13.3-47.6 μm wide x 7.4-16.2 μm long) are wider than those of the lower epidermis (11.8-27.3 μm wide x 7.0-15.9 μm long). The leaf is amphistomatic and bifacial. The mesophyll thickness is 103.6-285.5 μm and consists of one layer of palisade parenchymatous cells (49.8-95.2 μm long x 14.9-19.8 μm wide) and three to five layers of spongy parenchymatous cells (17.1-35.0 μm long x 15.5-34.5 μm wide). The midrib is convex abaxially. Above the xylem and phloem, well-developed srenchyma tissue is present (Fig. 4).

Discussion

The present study provide useful information on the anatomy and morphology of *L. cilicicus*. Stem, leaf and inflorescence characteristics of *L. cilicicus* were evaluated and found to be more variable than those of reported in 'Flora of Turkey' (Davis, 1970). The root, stem and leaf anatomy of *Lathyrus cilicicus* are provided here for the first time. According to the literature, the presence or absence of the wing-like expansions on stems is taxonomical important for separating *Lathyrus* species (Davis, 1970). In the stem cross section of *L. cilicicus*, no wings were observed. Krstic et al. (2002) investigated stem and leaf anatomy of *L. latifolius* and noted that it had stems surrounding by two wings. In *L. cilicicus*, the epidermal cells

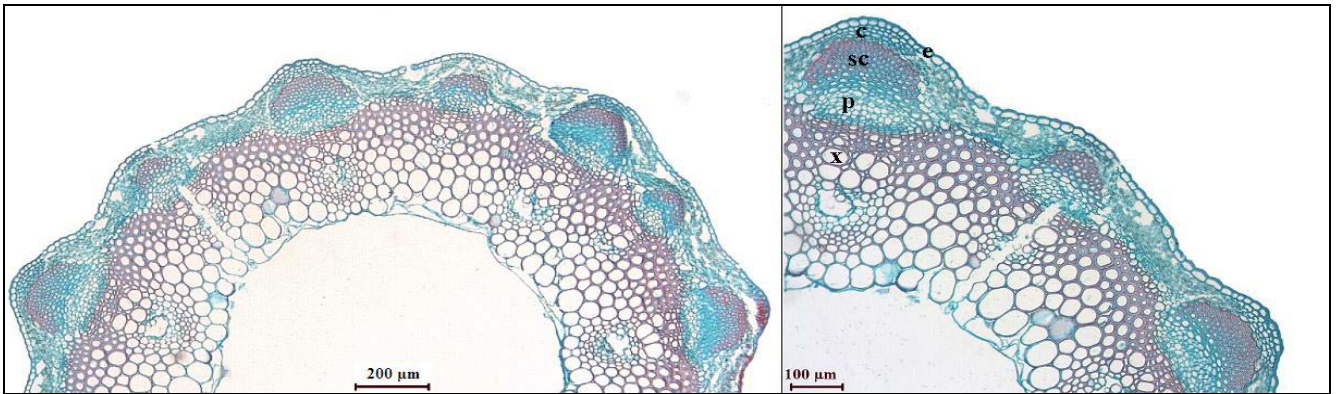


Fig 3. The transverse section of the stem of *Lathyrus cilicicus*. c, collenchymatous cells; e, epidermal cells; p, phloem; sc, sclerenchymatous cells; x, xylem

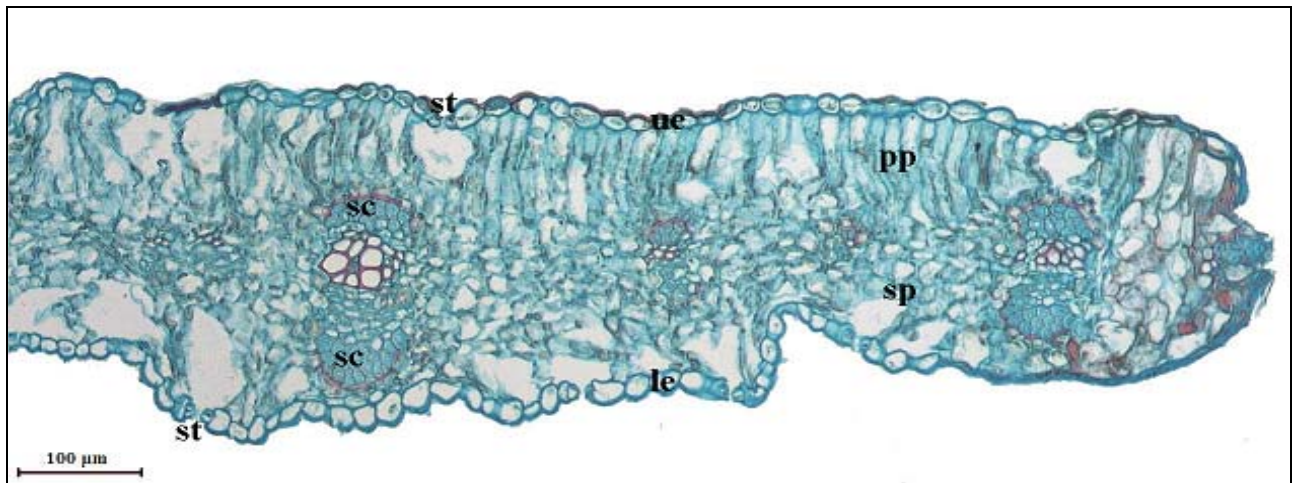


Fig 4. The transverse section of the leaf of *Lathyrus cilicicus*. le, lower epidermis; pp, palisade parenchyma; sc, sclerenchymatous cells; sp, spongy parenchyma; st, stoma; ue, upper epidermis

are 6.5-10.3 μm long, but in *L. latifolius*, they have 18.9-31.5 μm long. *L. cilicicus* (2.4-4.0 μm) has thinner cuticle than *L. latifolius* (5.0-6.3 μm). In leaf cross-section, *L. cilicicus* has wider upper epidermal cells (13.3-47.6 μm) than lower ones (11.8-27.3 μm), but *L. latifolius* has slightly wider lower epidermal cells (22.7-42.8 μm) than the upper ones (20.2-39.1 μm). Like *L. latifolius*, *L. cilicicus* has bifacial leaves and amphistomatic. Both species have one-layered palisade parenchyma cells in the mesophyll. In *L. latifolius* mesophyll has five to seven layers of spongy parenchyma cells while in *L. cilicicus* it has three to five layers of spongy cells. To sum up, the morphological properties of the species were variable to those reported by Davis (1970) in terms of stem, leaf, inflorescence, fruit and seed characteristics. On the other hand, anatomical features of the species is presented for the first time in this study. According to results, presence or absence of wing, thickness of epidermal cells and cuticle in the stem, dimension, and number of the mesophyll cells are one of the important anatomic characters for separating species. On the other hand, the anatomical studies on the genus are very limited, therefore more comparative studies are needed for future discussions.

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