

Polygala mazandaranica (Polygalaceae), a new species from Mazandaran Province, North Iran

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Abstract. *Polygala mazandaranica* is a new species collected from the Mirzakoochak forest in Amol, Mazandaran Province, North Iran. Non-anastomotic nerves of inner sepals, two-lobed stigma, sessile capsule and three-lobed caruncle of the seed identify the newly collected species. It is similar to *P. anatolica* and *P. platyptera* but differs by its habitat and some macro and micro morphological characters. A detailed morphological description of the new species, photographs and a comparison of the diagnostic characters with those of two other Hyrcanian species are provided. Furthermore, style and stigma are highlighted micromorphologically. An identification key for the Iranian taxa is presented.

Key words: Hyrcanian region, New endemic species, North Iran, *Polygala*

Introduction

Polygala Linnaeus is the largest genus of the nearly cosmopolitan (excluding Antarctica, the Arctic, New Zealand and the islands of Polynesia) (Cronquist & Takhtadzhian 1981) Polygalaceae family and Polygaleae tribe (Chodat 1891). It comprises ca. 450 species (Eriksen 1993, Persson 2001) of annual and perennial herbs, subshrubs or shrubs (Chodat 1891, Erikssen 1993, Pavia 1998) growing naturally in Eurasia (Donmez & al. 2015). Recent phylogenetic studies have shown that *Polygala* is polyphyletic and forms a clade that includes all genera from the Polygalae tribe (Persson 2001, Forest & al. 2007, Abbott 2011, Pastore 2017, Mota & al. 2019). The genus consists of 30 representatives of the flora of former USSR (Shishkin 1949). It has ca. 12 species in the flora of Turkey (Cullen 1965) and eight more species have been added by Peşmen (1980), Davis & al. (1988), Eren & al. (2008), and Donmez & al. (2015) and Donmez & Aydin (2018). *Polygala* comprises 14 representatives (including two Iranian endemics) in the area

covered by *Flora Iranica* (Chrtek & Krisa 1977). They include *P. platyptera* Bornm. & Gauba. from North and *P. kurdica* Townsend subsp. *bornmulleri* Chrtek & Krisa (1977) from West Iran. Jalilian (2005) reported seven species of the genus for the flora of Iran. Iranian species of *Polygala* belong to the Irano-Turanian (43%, 3 species), Saharo-Arabian (29%, 2 species), Hyrcanian, and Irano-Turanian-Euro-Siberian (14%, each with 1 species) phytogeographical elements (Jalilian 2005). *Polygala* species have bisexual flag flowers (conspicuous keel flowers) that show resemblance to those of the Fabaceae (Venkatesh 1956, Milby 1976, Eriksen 1993, Krüger & Pretorius 1997, Westerkamp & Weber 1997, Prenner 2004). They prefer limestone, dry stony cliffs and dry meadows with consolidated sandy-stony soil and stony mountain slopes (Shishkin 1949). The new species was collected during a bio systematical study of the genus by the first author, from a population of small pink flowers, found at 200–400 m a.s.l., near Amol city in Mazandaran Province (Fig. 1). *Polygala mazandaranica* was found in a muddy and soft humus-rich soil.

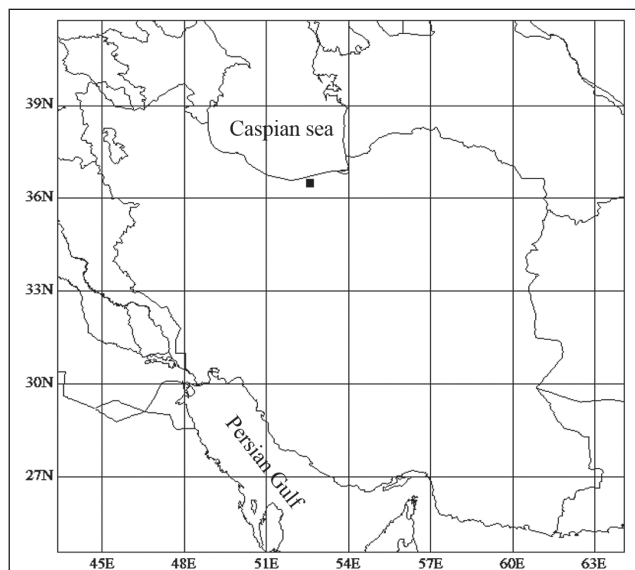


Fig. 1. Distribution map of *P. mazandarantica* (■) in Iran.

Material and methods

The newly collected specimens were pressed and placed in the Guilan University Herbarium (GUH) and Yasouj University Herbarium. The new species was identified using different *Floras* (Boissier 1872, Shishkin 1964, Cullen 1965, Chrtek & Krisa 1977, Jalilian 2005) and articles published on new species (Eren & al. 2008, Raabe 2009, Siebert 2010, Donmez & al. 2015, Wahlert & al. 2017, Donmez & Aydin 2018). It was also compared with other species of genus *Polygala* in the Tehran University Herbarium (THU), Tehran University of Medical Sciences Herbarium (THE), Herbarium of the Agricultural Ministry of Iran (IRAN), and Herbarium of Animal and Natural Resources Research Center of Hormozgan. The photographs of the new species were taken by Samsung Galaxy J2 Pro mobile phone. For the photography of different parts, the authors used Dinolite digital microscope, AM-413TMT model, while the micrographs were prepared using scanning electron microscopy (SEM) at the Shahid Beheshti University. The distribution map (Fig. 1) was presented by means of Dmapw software version 7.2c (Morton 2004).

Results

Polygala mazandarantica Sarvi & Faghir, **sp. nov.** (Figs. 2-4)

Type: Iran. Mazandaran Province, Amol, Haraz road, Mirzakoochak forest, 36°30'77"N 52°36'58"E,

380 m a.s.l., 30 May 2019, Ali Sarvi (Guilan University Herbarium 8343, GUH).

A perennial, herbaceous plant; stems ascending, erect, with simple branches arising from the base, pubescent, 15 to 25 cm high; leaves alternate, with short petiole, the lower leaves 6 mm to 15 mm long and 3 mm to 6 mm wide, obovate with round apex, the upper ones rhomboid, 14 mm to 18 mm long and 7 mm to 10 mm wide, and lanceolate 16 mm to 20 mm long and 4 mm to 6 mm wide, with acute apex and short curved trichomes on margin; racemes axillary and terminal, lax, 1 cm to 15 cm long; bracts small, white to light-pink, persistent or deciduous 1.70 mm to 2.50 mm long and 0.35 mm to 0.55 mm wide; upper sepals gibbous, 2 mm to 3 mm long and 0.2 mm to 0.5 mm wide; inner sepals pink to magenta, 7 mm to 10 mm long and 2.5 mm to 4.5 mm wide, unequal in length, narrowly elliptic, with acute apex, with non-anastomotic veins; corolla pink to white, 6.5 mm to 8 mm long; floral appendages fimbriate, magenta to light-pink; filaments joint lengthwise, grouped into 2 lobes of four sessile anthers; style 4 mm to 5.5 mm long; stigma central, two-lobed, with lanate papilla; capsule glabrous, subsessile, abruptly contracted into a minute, obcordate or orbicular, 5 mm to 6 mm long and 3 mm to 4 mm wide, unequally winged, wings 0.5 mm to 1.5 mm wide; seeds ovate, 3–4 mm long and 1.6 mm to 2 mm wide, brownish, with simple hairs, 3-lobed caruncle.

Phenology: Flowering in March and fruiting in May.

Distribution and ecology: *Polygala mazandarantica* is a Hyrcanian element from a type locality in the Mazandaran Province, North Iran. Grows on muddy and humus-rich soil at 200–400 m a.s.l.

Etymology: *Polygala mazandarantica* is named after the province where it was found.

Discussion

The genus *Polygala* has been arranged in to two subgeneruses in the *Flora Iranica* (Chrtek & Krisa 1977). *P. mazandarantica* belongs to subgenus *Polygala*??? due to its persisting calyx, corolla and staminal tube after flowering (Chrtek & Krisa 1977). This new species is identified by its morphological characters: heter-

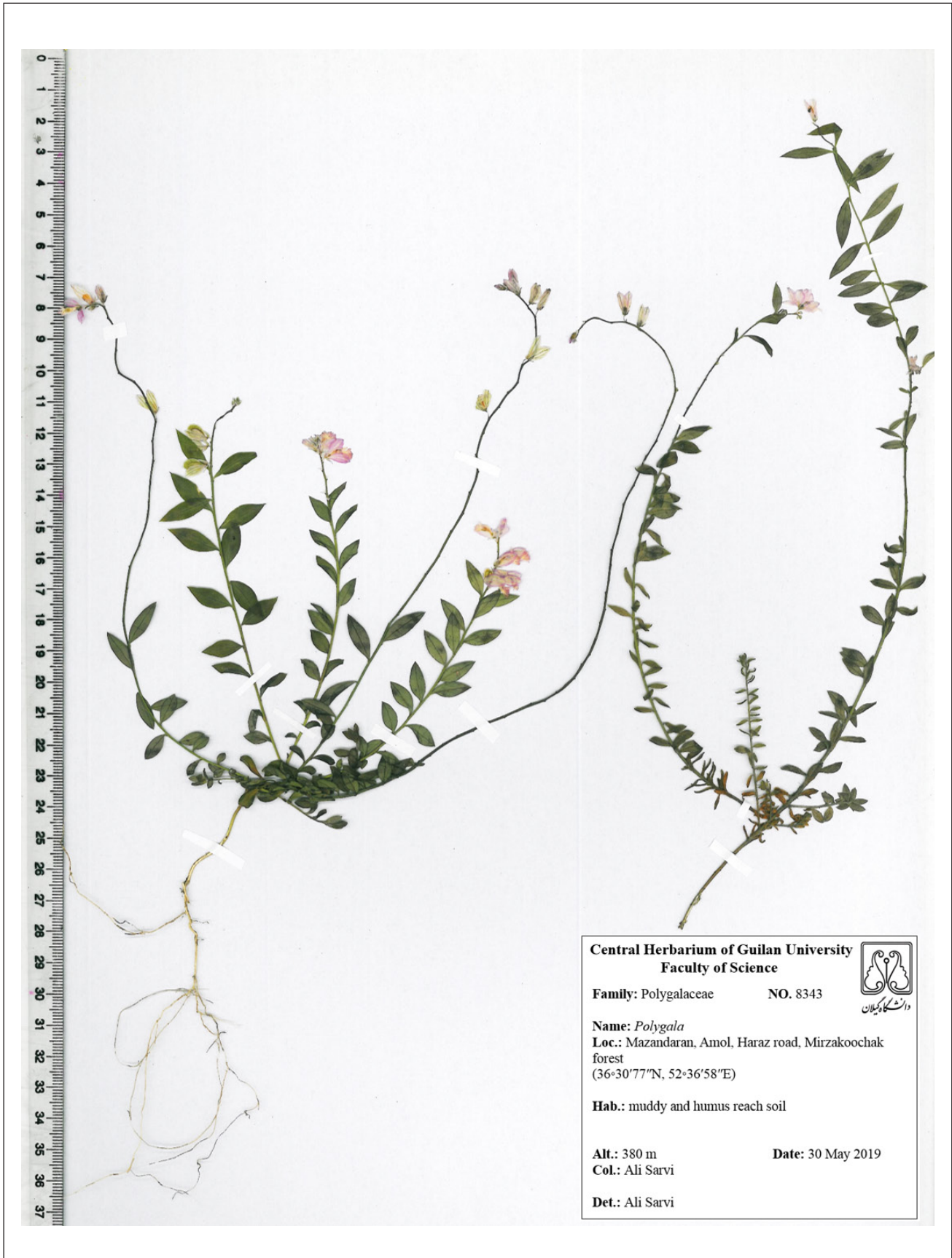


Fig. 2. *Polygala mazandaranica* (Holotype; 8343-GUH).

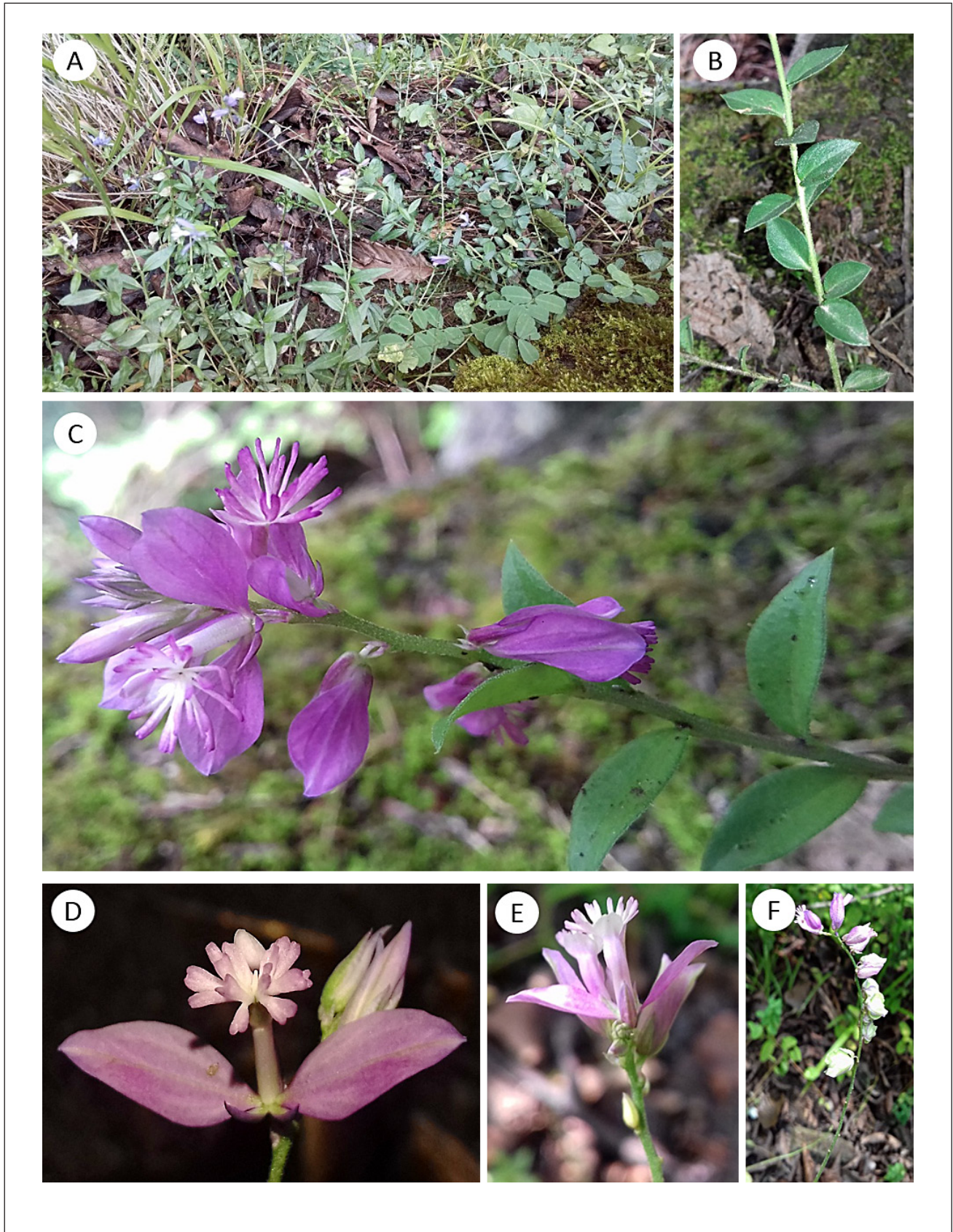


Fig. 3. *Polygala mazandarunica* (Holotype; 8343-GUH). A – Habit; B – Ascending stem and alternate leaves; C – Terminal raceme inflorescence; D – Flower with fimbriate floral appendages; E – Tubular corolla; F – Axillary raceme inflorescence.

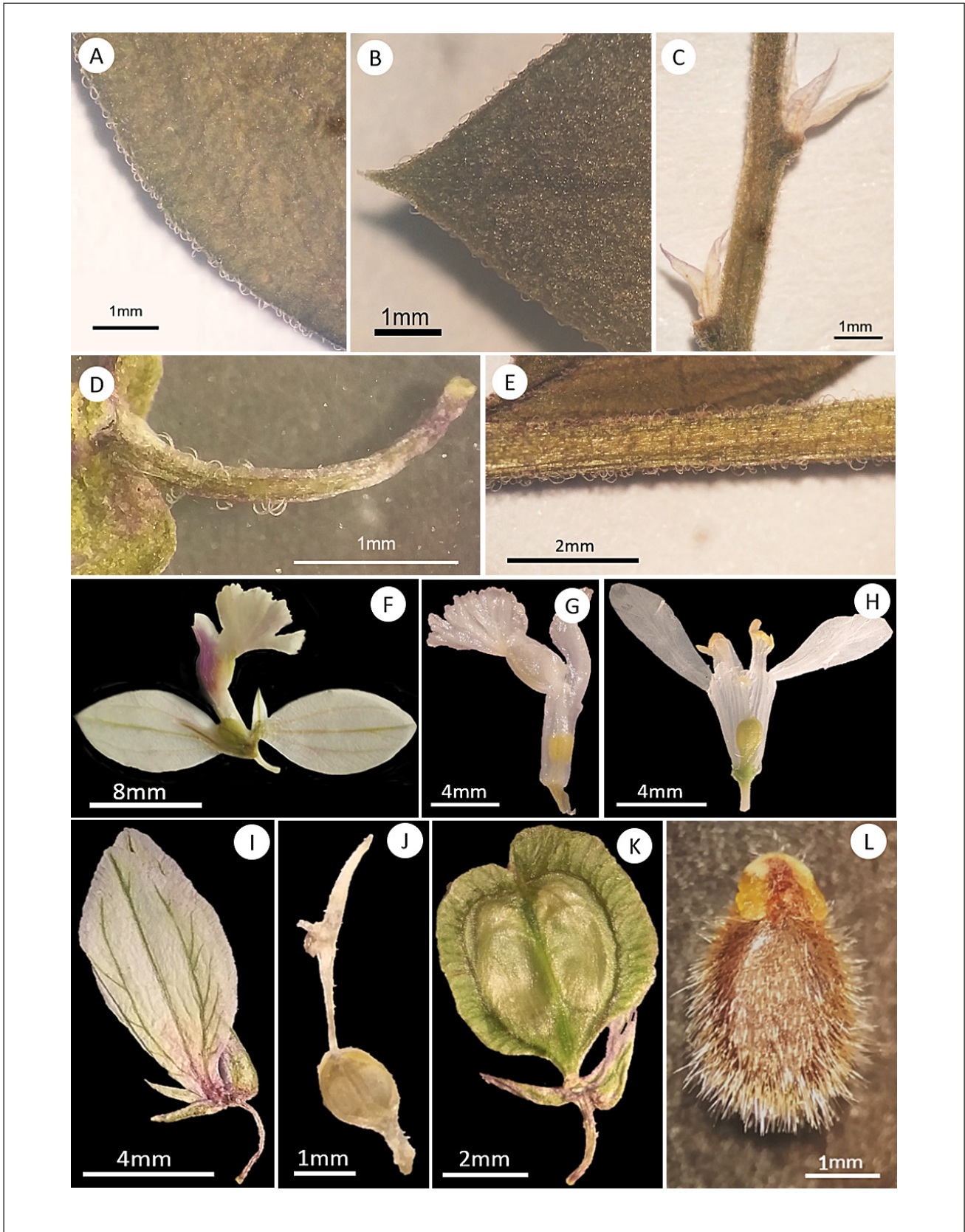


Fig. 4. *Polygala mazandarunica*: **A** – Small curved trichomes on the leaf blade margin; **B** – Acute apex of leaf; **C** – Small pink bracts; **D** – Few curved trichomes on peduncle; **E** – Short curved trichomes of stem; **F** – Flower; **G** – Tubular corolla and fimbriate floral appendages; **H** – Joint filaments grouped into two lobes; **I** – Non-anastomotic veins on inner sepal; **J** – Pistil; **K** – Mature capsule with two seeds; **L** – Seed.

ophylly, small pink flowers in a lax raceme inflorescence, fimbriate floral appendages, non-anastomosing veins of inner sepals, two groups of four filaments with sessile anthers, two-lobed stigma, subsessile capsule, and ovate, brownish seed (Figs 4 & 6). The new species resembles the Iranian endemics *P. anatolica* Boiss. & Heldr. (1853) and *P. platyptera* Bornm. & Gauba (1942) (Jalilian 2005, Chrtek & Krisa 1977) by its pink or magenta flowers and ascending stem. The three allied species grow in the Hyrcanian region of North Iran. However, the latter two mostly prefer as habitat rocky and stony slopes of higher altitudes (0 to 2500 m a.s.l.) (Jalilian 2005), while *P. mazandarani* grows at low altitudes (200–400 m a.s.l.) in humus-rich soils.

P. anatolica has characteristically lanceolate to linear leaves, two groups of anastomotic nerves on inner sepals (Fig. 6), a stipitate capsule with mostly equal wings and a two-lobed caruncle. Ovate petiole leaves with acute apex (fig. 7), a group of anastomotic nerves on inner sepals (Fig. 6), purple sepals, alternately broad crown-like floral appendages, sessile capsule with unequal wings, and an elliptic seed with indistinct caruncle lobes are the diagnostic characters of *P. platyptera*. Such morphological evidence was used by the authors earlier for separating the different species of the genus (Cullen 1965, Chrtek & Krisa 1977, Jalilian 2005). Furthermore, the three allied species show different micro and macro morphological characters of the style. They include style curvature, ornamentation, stigma position, number of lobes, and papilla types (Fig. 5). *P. mazandarani* is characterized by its apical curvature style with striate-corrugated ornamentation and a two-lobed central stigma with lanate papilla. *P. platyptera* is distinguished for its style with a curvature at apex and zigzag-corrugated ornamentation and one-lobed, subcentral stigma with pilose papilla. *P. anatolica* is also differentiated by its style with a curvature at base and striate ornamentation, and one-lobed, subapical stigma with lanate papilla (Table 1).

Several species of *Polygala* reported as slow-growing herbs have a low yield (Jiang & al. 2016) and are classified as Endangered (Donmez & al. 2015 and Donmez & Aydin 2018). *Polygala irregularis* Boiss. (1842), *P. kurdica* and *P. monspeliaca* L. (1753) represent three Rare Iranian species (Ghahraman & Atar 1999, Jalilian 2005) with restricted growing areas (Chrtek & Krisa 1977, Jalilian 2005). Unfortunately,

the observed anthropogenic activities, especially urbanization and overgrazing, damage or destroy the habitat of the newly collected species. Therefore, more attention should be paid to saving its populations.

An identification key is presented below based on diagnostic micro and macro morphological characters.

Identification key for the taxa in Iran

- 1- Annuals, inner sepals glabrous, apex acute
 *P. monspeliaca*
- Perennials, inner sepals ciliate or glabrous, apex obtuse or acute 2
- 2- Stems prostrate, leaves sessile, capsule and inner sepals glabrous 3
- Stems ascending-erect, capsule ciliate or glabrous, inner sepals ciliate 4
- 3- Upper leaves obtuse at apex, corolla purple, seed ovoid *P. kurdica*
- Upper leaves acute at apex, corolla bluish-lilac, seed narrowly ovoid
 *P. hohenackeriana*
- 4- Capsule ciliate
 *P. erioptera*
- Capsule glabrous 5
- 5- Corolla white, veined, green, inner sepals obtuse at apex *P. irregularis*
- Corolla purple, magenta or pale-pink, without veins, inner sepals acute at apex
 6
- 6- Inner sepal veins not anastomotic, stigma two-lobed *P. mazandarani*
- Inner sepal veins anastomotic, stigma one-lobed 7
- 7- Inner sepals pink to magenta, filaments united near apex, stigma subapical, capsule stipitate
 *P. anatolica*
- Inner sepals purple, filaments joint lengthwise, stigma subcentral, capsule sessile *P. platyptera*

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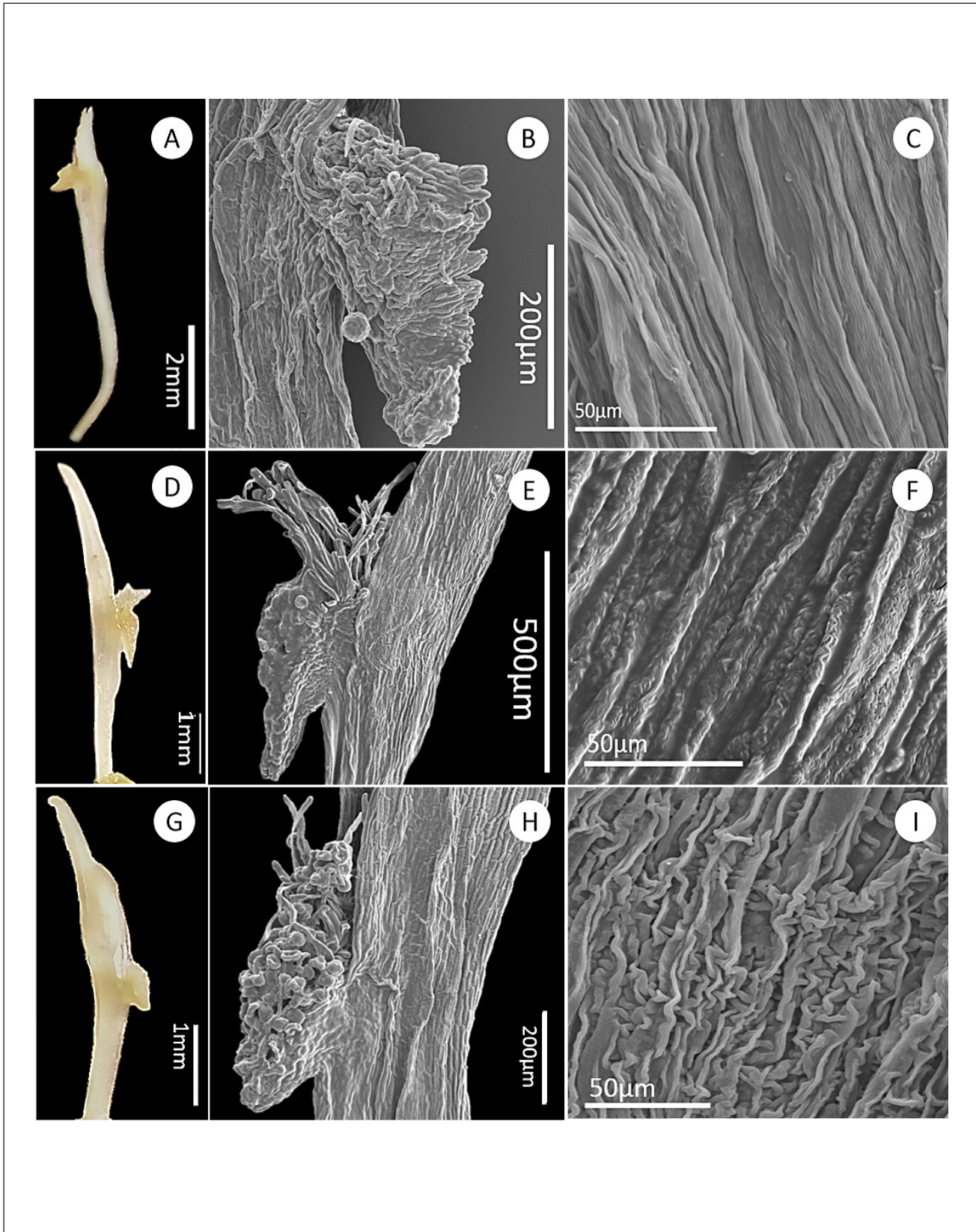


Fig. 5. Style and stigma in comparison of three Hyrcanian species of *Polygala* in N Iran – *P. anatolica*: **A** - Style in lateral view with subapical stigma; **B** - One-lobed stigma from (lateral view); **C** - Style with striate ornamentation. *P. mazandaranica*: **D** - Style, lateral view of central stigma; **E** - Two-lobed stigmas, lateral view; **F** - Style with striate and corrugated ornamentation. *P. platyptera*: **G** - Style, lateral view of subcentral stigma; **H** - One-lobed stigma, lateral view (pollen grains attached to stigma); **I** - Style with zigzag and corrugated ornamentation.

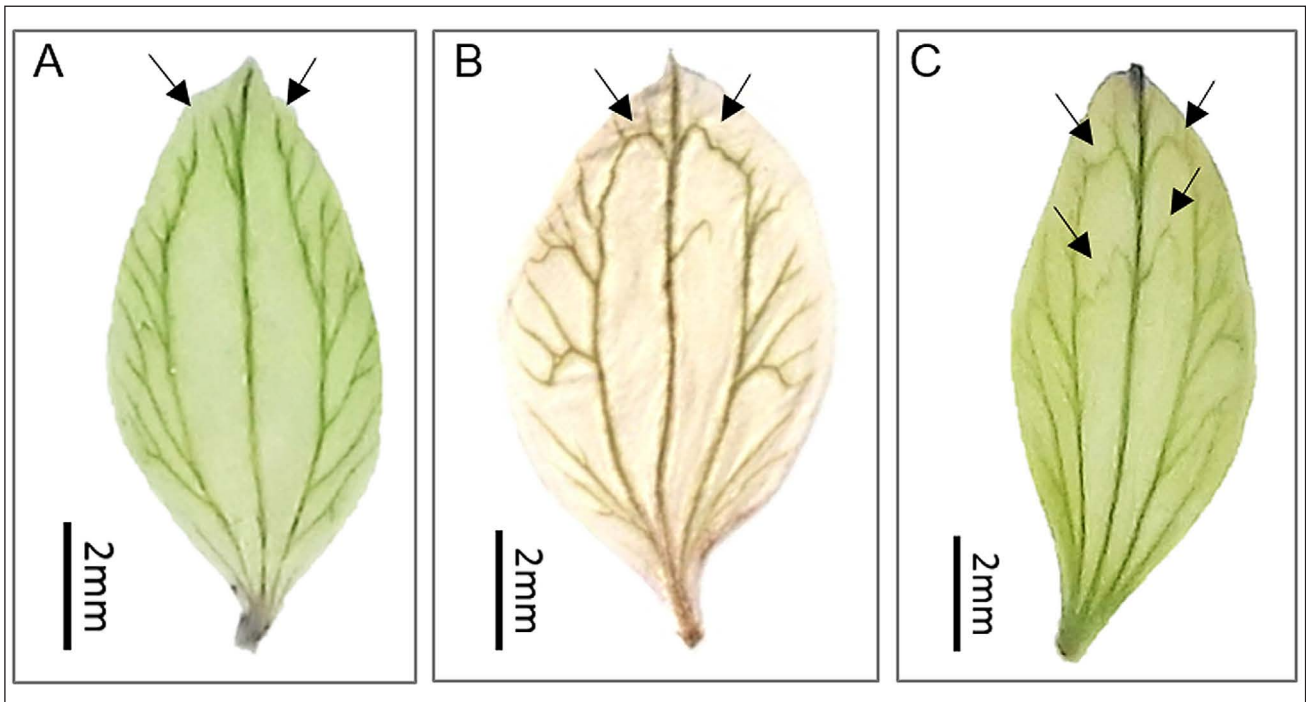


Fig. 6. Inner sepal veins pattern in comparison of three Hyrcanian species of *Polygala*. A – Non-anastomotic veins in *P. mazandarunica*; B – A group of anastomosis veins in *P. platyptera*; C – Two groups of anastomosis veins in *P. anatolica*.



Fig. 7. Petiolate leaves of *P. mazandarunica*.

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