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A New Distribution Area of the *Lathyrus undulatus* Boiss. (Fabaceae) in Türkiye and Taxonomic Contributions

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ABSTRACT
Lathyrus undulatus Boiss., an endemic species belongs to the Fabaceae family, is distributed in A1, A2, A3, A5 and B2 squares in the flora of Türkiye according to the literature records. In our researches, it has also been seen that the species is distributed in a narrow area at an altitude of 791-803 m around C2 Muğla: Menteşe, Yerkesik. *L. undulatus* has found for the first time by us in this locality and added as a new record for the C2 square with this study. By morphological examinations on the newly detected population, vegetative and generative characteristics such as stem, stipule, leaf, leaflets, inflorescence, peduncle, pedicel, flower, fruit, seed etc. have been revealed. The flowering time has been determined by conducting field studies on different dates. The morphological features of the new population have been compared with the descriptions of *L. undulatus* found in the Flora of Türkiye and the Flora Europaea, and similarities and differences have been revealed.

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ÖZET
Fabaceae familyasına ait endemik bir tür olan *Lathyrus undulatus* Boiss. literatür kayıtlarına göre Türkiye florasında A1, A2, A3, A5 ve B2 karelerinde yayılış göstermektedir. Yaptığımız araştırmalarda türün C2 Muğla: Menteşe, Yerkesik civarında 791-803 m rakımda, dar bir alanda da yayılış gösterdiği görülmüştür. *L. undulatus* bu lokalitede ilk defa tarafımızdan bulunmuş ve bu çalışma ile C2 karesine yeni bir kayıt olarak eklenmiştir. Yeni tespit edilen popülasyon üzerinde morfolojik inceleme yapılarak gövde, stipül, yaprak, yaprakçıklar, çiçek durumu, pedinkül, pedisel, çiçek, meyve, tohum gibi vejetatif ve generatif özellikleri ortaya konulmuştur. Farklı tarihlerde arazi çalışmaları yapılarak çiçeklenme zamanı belirlenmiştir. Yeni popülasyonun morfolojik özellikleri *L. undulatus*'un Türkiye ve Avrupa Florası'nda bulunan deskripsiyonları ile karşılaştırılarak benzerlik ve farklılıklar ortaya konulmuştur.

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INTRODUCTION
Lathyrus L., a genus from the Fabaceae family, is economically important. In Türkiye, the genus *Lathyrus* is typified by 79 taxa, 25 of which are endemic. (Davis, 1970; Davis et al., 1988; Güner et al., 2000; Genç and Şahin, 2008; Genç, 2009; Genç and Şahin, 2011; Güneş & Çırpıcı, 2012; Güneş, 2014; 2018; 2019). In different parts of the world, a few of these taxa are cultivated for different purposes. Their seeds are used as human foodstuff or the whole plant is used as fodder (Yamamoto et al., 1984; Campbell, 1997). In a study on the ethnobotanical use of plants, it was stated that the aerial parts of *L. undulatus* were also used as fodder (Kızılarslan & Özhatay,

2012). It has been stated that the tea of the plant is drunk due to its weakening feature and it is also eaten (Özkan, 2011).

L. undulatus species belongs to the genus *Lathyrus* is an endemic plant for Türkiye. Distribution areas of the species are A1 Kırklareli A2: İstanbul, Bursa, Kocaeli, Yalova A3: Sakarya, Düzce, Bolu A5: Sinop B2: Balıkesir, Kütahya in Türkiye. The species is found in different habitats such as under the deciduous forest, hedges, roadsides, slopes, field edges etc. (Davis, 1970; Aksoy & Uzun, 2011; Özkan, 2011; Kızılarslan & Özhatay, 2012; Tel, 2012; Güler, 2013; Güner & Akçiçek, 2014; Hekimoğlu, 2019; Öksüzoğlu, 2019; Açar & Satıl, 2021). In the work named Türkiye Bitkileri Listesi (Güner et al., 2012), it was stated that the *L. undulatus* also lived in the Konya section, which is a part of the Central Anatolian geographical region. However, no other work could be found indicating the squares or localities where the species is distributed in this section. Therefore, it has not been included in the map showing the distribution areas of the species.

Although it is registered in Flora Europaea, it is stated that the locality where the species is distributed is Türkiye (Tutin et al., 1968). In this study, it is aimed to add a newly detected distribution area of the species to the literature.

MATERIAL and METHODS

The materials of the study are the samples belong to the *L. undulatus* species. Samples were picked up from C2 Muğla: Menteşe, Yerkesik which is the natural spreading area of *L. undulatus* in May 2021. Flora of Türkiye (Davis, 1970) and Flora Europaea (Tutin et al., 1968) have been used for identification of the plant samples. In our study, the syntype specimen photograph of the *L. undulatus* (Anonymous, 2022) and the photographs taken by us in its natural habitat are also included.

The samples were examined and their morphological features such as stem, stipules, leaves, inflorescence, peduncles, pedicels, flowers, legumes etc. were determined. Plant parts like stipules, leaflets, calyx, corolla and legumes were examined using a stereo microscope and the measurements were made with digital caliper. It has been compared with the literature in terms of morphological features and flowering time. Whether or not the *L. undulatus* is new record to C2 square has been evaluated by investigating to the literature in this subject.

RESULTS and DISCUSSION

L. undulatus is a close species to *Lathyrus rotundifolius* Willd. taxonomically. In the European flora, *L. rotundifolius*; in the flora of Türkiye *L. rotundifolius* subsp. *miniatus* (Bieb. ex Stev.) Davis is distributed. *L. undulatus* is distributed intensively in the northwest of Türkiye (Figure 1) according to the literature.

Syntype specimen photograph (Anonymous, 2022) and the photographs of live specimen are given in Figure 2.

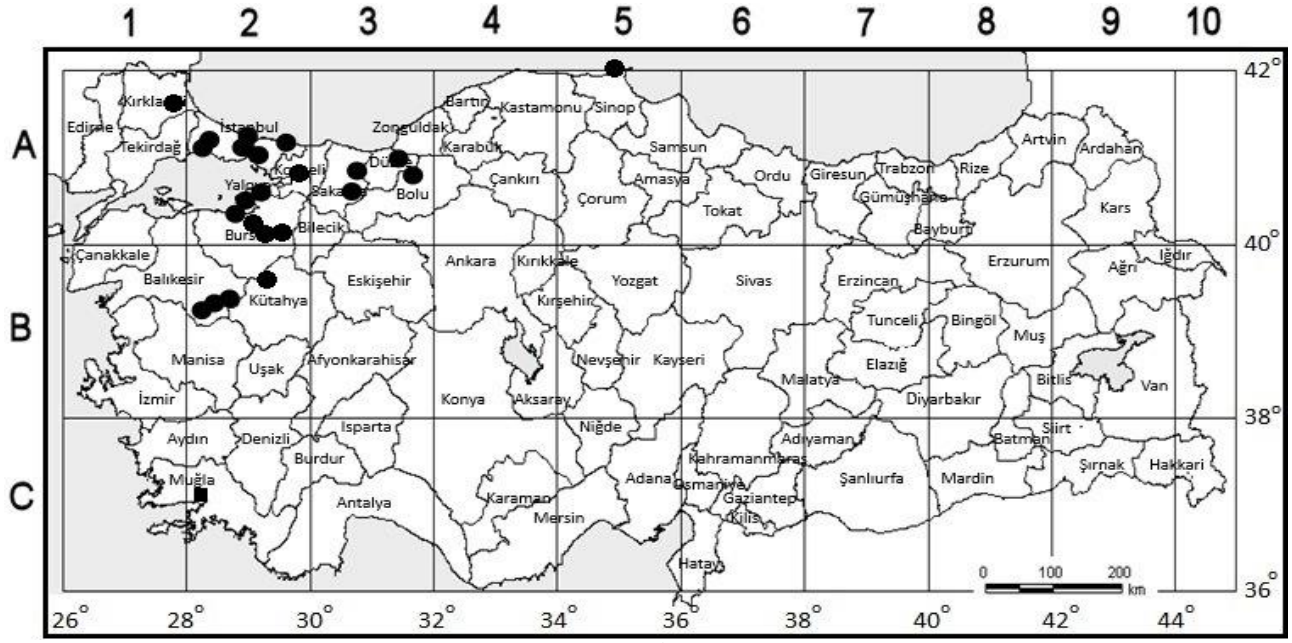

Figure 1. Distribution areas of *L. undulatus* in Türkiye (●Distribution areas according to the literature ■Newly detected distribution area)

Şekil 1. *Türkiye'de L. undulatus'un yayılış alanları (●Literatürde verilen yayılış alanları ■Yeni tespit edilen yayılış alanı)*

Figure 2. Syntype specimen of *L. undulatus* (a) and live specimen (b: habitus, c: flowers, d: legumes)
***Şekil 2**. L. undulatus'un sintip örneği (a) ve canlı örneği (b: genel görünüş, b: çiçekler, d: meyveler)*

An interesting new distribution area of the species has been determined with field surveys by us. In this research, it has been exhibited that the species also spread in a narrow area in C2 Muğla: Menteşe, Yerkesik (Figure 1). The species is distributed in the *Pinus brutia* Ten. forest in this locality. There are very few individuals in the population found in this newly detected locality. It has been determined by us that there are approximately 50 individuals in an area of approximately 1000 m². This population, which is already distributed in a narrow area, is exposed to grazing pressure. New field studies should be carried out to determine whether the distribution of the population is limited to this area.

It has been stated that *L. undulatus* is similar to *L. rotundifolius* in the Flora Europaea (Tutin et al., 1968) and to *L. rotundifolius* subsp. *miniatus* in the Flora of Türkiye (Davis, 1970). When samples of the newly detected *L. undulatus* population compared with the literature in terms of morphological characteristics, some similarities and differences were found.

The results of the examinations of the morphological characteristics performed on the species and the comparison with the literature data (Tutin et al., 1968; Davis, 1970) are given in Table 1.

According to the literature, *L. undulatus* is distributed in the Euro-Siberian phytogeographic region. It has been stated that it may be an Euxine element (Davis, 1970). The locality of the newly detected population is quite far from the localities given in the literature and is in the Mediterranean phytogeographic region. The bird flight distances between the new locality and the localities specified in the literature is 300-700 km. It is interesting that such long distances exist between the new locality and the localities given in the literature.

According to the Flora Europaea, *L. undulatus* differs from *L. rotundifolius* in that the some morphological differences of leaflets, inflorescence, calyx and legume (Tutin et al., 1968). A similar situation applies to the Flora of Türkiye. *L. undulatus* differs from *L. rotundifolius* subsp. *miniatus* in that the some morphological disparities of stipules, leaflets, flowering time, calyx and seeds according to the Flora of Türkiye (Davis, 1970).

In this study, samples of the *L. undulatus* population in the newly detected locality were examined in terms of morphological features and compared with the literature. Some morphological features show differences with literature information. It can be thought that morphological differences may have occurred under different ecological conditions. It is necessary to examine the factors that may affect the distribution of the populations of the *L. undulatus*.

CONCLUSION

Living species are evaluated in 9 groups in terms of IUCN categories: E (Extinct), EW (Extinct in the Wild), CR (Critically Endangered), EN (Endangered), VU (Vulnerable), NT (Near Threatened), LC (Least Concern), DD (Data Deficient) and NE (Not Evaluated). Although not in the CR and EN categories, plants that are under high threat in nature in the medium term are in the VU category. In Red Data Book of Turkish Plants, *L. undulatus* was specified in VU category (Ekim et al., 2000). This species has most recently been assessed for The IUCN Red List of Threatened Species a few years ago and listed as EN globally (Rowe et al., 2019). The change of the IUCN category of *L. undulatus* from VU to EN means that presence in nature of the species is endangered.

Table 1. Comparison of the morphological properties
Çizelge 1*. Morfolojik özelliklerin karşılaştırılması*

	L. undulatus		
	Flora Europaea (Tutin et al., 1968)	Flora of Türkiye (Davis, 1970)	Newly detected population (C2 square)
Life form	Perennial	Perennial	Perennial
Stem	40-80 cm, glabrous, winged	100-250 cm, very glabrous, winged, climbing	30-100 cm, glabrous, winged,
Stipules	10-25 x 3-6 mm, oblong or lanceolate, hastate	Usually narrower than *L. rotundifolius* subsp. *miniatus*, ovate-lanceolate or lanceolate, semi-sagittate	10-25x2-4 mm, lanceolate, sagittate to hastate
Leaves	n.i.	With branched tendrils	Petiole 10-25 mm, narrowly winged; rachis ending usually strongly branched tendrils, sometimes simple tendril.
Leaflets	1 pair, 30-70 x 16-35 mm, elliptical to ovate, up to 4 times as long as wide, the margin undulate-crispate	1 pair, (1.5-)2-4 x longer than broad, crisply undulate-margined, broadly elliptic, rarely suborbicular, parallel-veined	1 pair, 25-75x10-42 mm, length up to 3 x as long as width, elliptic to suborbicular
Flowering Time	n.i.	April-June	April-June
Inflorescence	5-10 flowered	3-13 flowered	(1-)3-9 flowered
Peduncle	n.i.	Much longer than leaves	60-85(-130) mm (without raceme)
Pedicels	n.i.	n.i.	3-8 mm, shorter than calyx
Calyx	Teeth unequal, lowest tooth c. 1.5 times as long as upper 2	Calyx teeth more attenuate according to *L. rotundifolius* subsp. *miniatus*, lowest tooth being 1-1.5 x as long as the tube,	5-9 mm, lower teeth longer than the others
Corolla	15-22 mm, purple-pink	18-25 mm, deep pink	10-20 mm, deep pink
Legume	60-80 x 7-11 mm, glabrous	50-70 x 7-10 mm, linear, glabrous, upper suture narrowly 3-keeled	50-70x7-9 mm, linear, glabrous, upper suture narrowly 3-keeled
Seeds	8-10 reticulate-rugose; hilum 1/5 of the circumference	6-10, faintly reticulate-rugulose, hilum shorter according to *L. rotundifolius* subsp. *miniatus* (1/7 of the seed's perimeter)	Mature seeds could not be collected

n.i.: No information

As the threat to populations of this species increases, it will be in danger of extinction. The danger of extinction is a momentous threat to all living species. The level of this threat is even higher, especially for species with narrow distribution areas and known from few localities. Endemic plants adapted to living in special habitats are more susceptible to threat factors. In particular, the presence of a population of an endemic species in more localities in nature is significant both for the continuation of the generation of that species and for biodiversity. For the reasons mentioned above, it is very important that a new distribution area of *L. undulatus*, an endemic species, has been found. But grazing pressure on the population is a serious threat in this area. It is necessary to eliminate this threat or to conduct studies to reduce its effects.

The differences between the morphological properties of the new population and the literature information show the necessity of new studies. Anatomical, palynological, molecular etc. studies should be done on the species. The taxonomic status of the population can be re-evaluated according to the results of the studies to be carried out.

Author's Contributions

The contribution of the authors is equal.

Statement of Conflict of Interest

Authors have declared no conflict of interest.

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