

Evaluation of Biomorphological Diversity and Distribution of *Lathyrus* L. s. l. Species in Azerbaijan

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As a result of monitoring conducted under natural conditions, 13 seed samples and 80 herbarium specimens, belonging to 9 species of genus *Lathyrus* L. were collected in Azerbaijan in 2016. The article presents the results of the research on biomorphological diversity and dissemination based on their descriptor data.

Keywords: *Lathyrus* L., species, genus, Azerbaijan, ecological-botanical

INTRODUCTION

Lathyrus L. is one of the polymorphic varieties of legumes. *Lathyrus* L. species are valuable feed, medicinal and decorative plants. It contains lots of proteins and other biologically active ingredients, and its dry grass is well eaten. Sweet pea (*L. odoratus*) is a widely used ornamental plant (Sarker et al., 1997). Some species are melliferous. Meadow vetchling (*L. pratensis*) is a herbal plant (Grossheim, 1952; Karyagin, 1954).

Researchers divide 170 species of *Lathyrus* L. into (Kenicer, 2008; Lewis, 2005) 12 to 13 sections throughout the world (Chefranova, 1971, 1987; Asmussen et al., 1998; ILDIS, 2010; Kupicha, 1974, 1983; Leht, 2009). There are 24 species as wild with *Orobis* L. in Azerbaijan (Asgarov, 2011, 2016; Karyagin, 1954). One species is cultivated (*L. odoratus*). Five of the *Lathyrus* species spread in Azerbaijan were referred to as *Orobis* L. (Grossheim, 1952; Karyagin, 1954), which is currently not regarded as an independent species and is included in the composition of the *Lathyrus* species (Asgarov, 2011, 2016; Magulaev, 2005). Unlike the *Lathyrus* species, in *Orobis* L. species, the leaves are without cirrus, and instead of it, there is a protrusion at the end of the leaf. This sign is now regarded as the main characteristic of the *Lathyrus* species referred to the *Orobis* section (Asgarov, 2011, 2016; Grossheim, 1952; Fedchenko, 1948; Chefranova, 1971, 1987; Asmussen et Liston, 1998; Bässler, 1973).

Though A. Grossheim (Grossheim, 1952) gave information about the types of *Lathyrus* spread throughout the Caucasus and I. Karyagin (Karyagin, 1954), A. Asgarov (Asgarov, 2011, 2016) and other botanists in species spread in Azerbaijan in their works, the biomorphological diversity of the species, its intrinsic systematics have not been studied extensively, and the status of rare species has

not been evaluated in accordance with international requirements.

Herbs annual or perennial. Stem erect or climbing by means of tendrils, winged or wingless. Leaves paripinnate, with rachis terminating in a branched or simple tendril or a bristle, rarely phyllodic or reduced to modified stipules; stipules sagittate or semisagittate, usually smaller than leaflets, sometimes large and leaflike; leaflets 1- to many paired, elliptic, ovate, ovate-oblong, lanceolate, or linear; veins parallel, pinnate, or reticulate. Inflorescence an axillary, pedunculate, 1- to many flowered racemes. Calyx campanulate, unequally or equally toothed; teeth not leaflike, at least 2 teeth less than 2 as long as tube. Corolla purple, pink, yellow, or white, sometimes crimson, brick red, or orange. Staminal tube not oblique at apex; filaments filiform or distally dilated. Style linear or distal dilated, dorsally compressed, pubescent on upper side. Legume laterally compressed, dehiscent. Seeds 2 to many (Cherepanov, 1995; Davis, 1979; Maxted et al., 1988; Shehadeh, 2011; Yakovlev et al., 1996).

Cytological investigations have shown that all species were diploid with $2n = 14$ chromosomes, the basic chromosome number of $x=7$ is constant throughout the genus and that most of the species are diploid, with poliploids as rare exceptions (Leht, 2009; Badr, 2007; Sarker et al., 1997; Yamamoto et al., 1984).

MATERIALS AND METHODS

The materials for the study were collected during expeditions under the leadership of A.M.Asgarov at the Institute of Genetic Resources in 2016. Herbarium data and extensive literature information have also been analyzed. Comparative morphological, botanical - geographical, biomorphological, ecological, taxonomic, floristic-system-

atic, phytocenological methods were used in the study. In addition, the materials stored in the Herbarium Foundation of the Botanical Institute of ANAS and the Herbarium Foundation of the Institute of Genetic Resources of ANAS were investigated. The spreading of species has been given on the regionalization scheme adopted in the flora of Azerbaijan.

A.Asgarova's (Asgarov, 2011, 2016) classification was used for species nomenclature, and Ch. Raunkier (Raunkier, 1937) and I.Serebryakov's (Serebryakov, 1964) classifications were used while analyzing life forms and other ecological features.

RESULTS AND DISCUSSION

In order to explore the *Lathyrus* species spread in the study area, 18 station located in various areas differentiated from one - another by certain eco-geographical features were chosen and each route was encoded.

Below is a brief description of the types of herbarium and seeds collected.

1. *Lathyrus aphaca* L. An annual plant.

2n = 14.

Distribution: All across Azerbaijan – GC (Greater Caucasus), LC (Lesser Caucasus), Kur-Araz, Talish and Nakhchivan.

Biotope: In crops, fields, gardens, roads and fences, bushings, forests, on the edge of irrigation canals, gravel, sands and so on.

2. *L.hirsutus* L. An annual plant. 2n=14.

Distribution: It is observed in GC, Kur-Araz, Talish, Nakhchivan.

Biotope: It grows in the plants, fields, bushes, and forests.

3. *L.miniatus* Bieb ex Stev. A perennial plant. 2n=14.

Distribution: It is found in GC, LC, Kur-Araz, Talish, Nakhchivan.

Biotope: It grows as weed in forests, bushes, edges of forests, fields, mountain meadows, and planting areas.

4. *L. pratensis* L. A perennial plant. 2n=14.

Distribution: It is spread in GC, LC, Kur – Araz, Talish and Nakhchivan.

Biotope: It grows in forests, bushes, gardens, edges of forests, fields, mountain meadows, and planting areas.

5. *L. laxiflorus* (Desf) O. Kuntze (*Orobis hirsutus* L.) – A perennial plant. 2n=14.

Distribution: It is spread in GC, LC and Talish.

Biotope: It grows in forests and bushes.

6. *L. tuberosus* L. A perennial plant. 2n=14.

Distribution: It is spread in GC, Kur – Araz and Nakhchivan.

Biotope: It grows in crops, vineyards, hedges and fields, irrigation canals, and bushes.

7. *L. sphaericus* Retz. An annual plant. 2n=14.

Distribution: It is spread in GC, LC, Kur – Araz, Talish and Nakhchivan.

Biotope: It grows in forests, bushes, on the edges of forests, stony slopes, and irrigation canals.

8. *L. cicera* L. An annual plant. 2n=14.

Distribution: It is found in GC, LC, Kur – Araz, Talish and Nakhchivan.

Biotope: It grows in gardens, vineyards, planting areas, fields, bushes, around irrigation canals, weed places, and river banks.

9. *L. annuus* L. An annual plant. 2n=14.

Distribution: It is found in GC, Kur – Araz and Talish.

Biotope: It grows in planting areas, gardens, on the edges of forests, bushes, roads and river banks.

The range of species is mapped through the DIVA-Gis software (Figure 1).

Some eco-geographical information of the species collected are given in the table below.

The ecological-botanical analysis of species collected in the study area was conducted on descriptors, ecological information – information on geographical latitude and longitude, height above sea level, type of rock, the degree of slope, and the edge of the slope is given.

In the ecological evaluation of the climatic parameters of *Lathyrus* species, it was determined that *L. hirsutus* was collected in the territory of Imishli region on minimum altitude height (10 m), and in Shahbuz region on maximum altitude, *L.miniatus* and *L. pratensis* (2253 m) from the Batabat plain.

The amount of annual precipitation, temperature ($T_{\min 1}$ - minimum temperature in January, $T_{\max 7}$ - maximum temperature for July and T_{oi} – average annual temperature) is based on PAST computer software and is as follows (Figure 2).

It was determined on average annual precipitation that *L. cicera* (345 mm) was collected from the territory of Mistan village, Lerik region on minimum precipitation and *L. miniatus* (612 mm) was collected from Khoshbulah village, Dashkesen region on maximum precipitation.

L.miniatus and *L. pratensis* (-11°C) were observed in Shahbuz region, Batabat pasture on minimum temperature in January and *L.aphaca*, *L. hirsutus* (30.3°C) in Bilasuvar region, Bilasuvar – Iran highway, *L.aphaca*, *L.hirsutus* (30.3°C) on maximum temperature. Minimum average annual temperature was in Shahbuz region, Batabat pasture (-0,2°C), and maximum average annual temperature was in Bilasuvar – Iran highway (9.4°C).

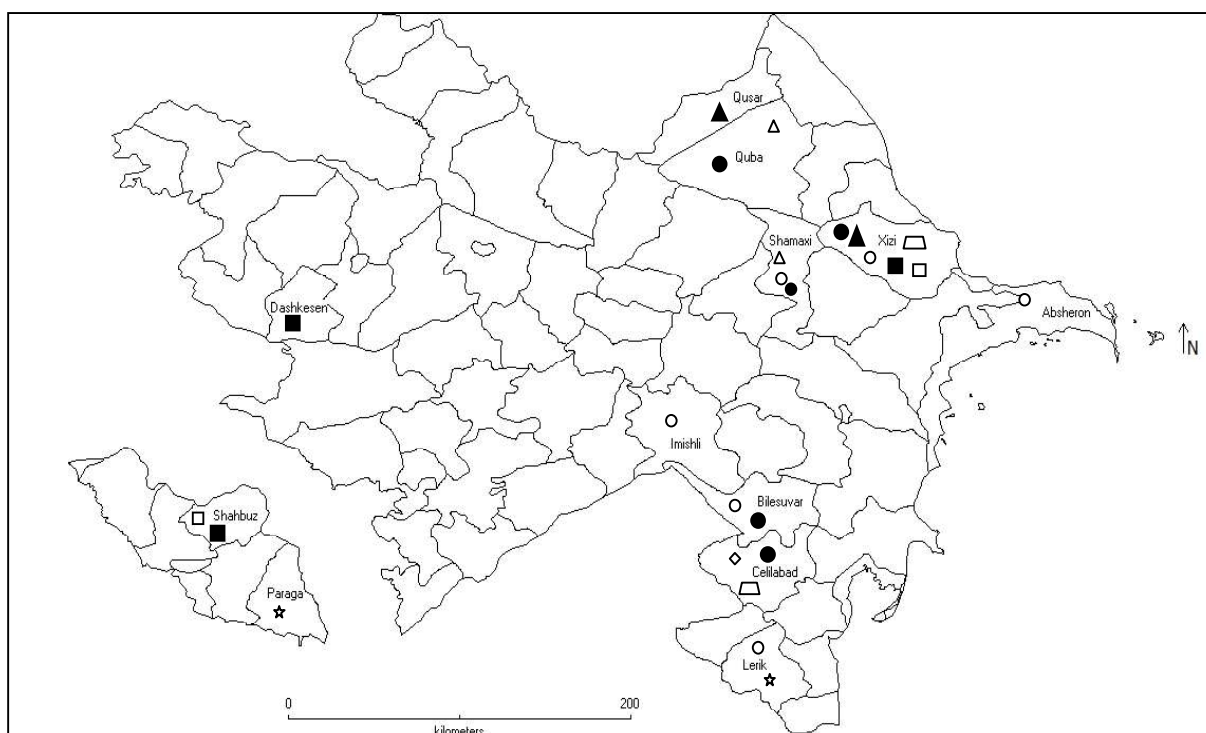


Figure 1. Areas of distribution of species which herbarium and seeds are collected
 ● - *L. aphaca*; ○ - *L. hirsutus*; ■ - *L. miniatus*; □ - *L. pratensis*; ▲ - *L. laxiflorus*;
 △ - *L. tuberosus*; □ - *L. sphaericus*; ☆ - *L. cicera*; ◇ - *L. annuus*;

Table 1. Coordinates of *Lathyrus* species found and ecological information on them

Code of place where it was collected	Name of species collected	Date of collection	Place of collection and biotope	Type of rock	Degree of slope	The edge of the slope	Type of soil	Geographic latitude and longitude	The height from sea level (m)
1	2	3	4	5	6	7	8	9	10
AZE16St ₁	<i>Lathyrus miniatus</i>	19.04.16	Khizi region, upper part of Bayahmadyurd village	-	E 6	N	CY	N 40°55'142; E 48°57'280	1079
AZE16St ₃	<i>L. miniatus</i>	19.04.16	Khizi region, between the village of Bakhishli	-	L 2	S	CY, SA	N 40°54'908; E 49°00'928	602
AZE16Ab ₁	<i>L. hirsutus</i>	24.05.16	Absheron district, Institute of Agriculture	-	L 2	-	SC	N 40°31'951; E 049°52'576	12,5
AZE16A ₂	<i>L. hirsutus</i>	09.06.16	territory of Imishli region	BA	L 2	-	CY	N 39° 45' 222; E 047° 53' 896	10
AZE16G ₅	<i>L. hirsutus</i> , <i>L. aphaca</i> ,	09.06.16	Bilasuvar region, Bilasuvar – Iran highway	-	L 2	-	CG	N 39° 26' 463; E 48° 31' 126	13
AZE16A ₈	<i>L. aphaca</i> , <i>L. annuus</i>	12.06.16	Jalilabad region, Sulucheshma village.	-	U 3	S	CY	N 39° 12' 406; E 048° 25' 630	139
AZE16B ₁	<i>L. hirsutus</i>	22. 06.16	Lerik region, Galasar village	-	E 6	W	SA	N 38°41'415; E 048°23'790	1350
AZE16B ₂	<i>L. cicera</i>	24. 06.16	Lerik region, Mistan village	BA	U 3	E	GR	N 38°39'003; E 048°24'940	1723
AZE16Q ₄	<i>L. aphaca</i>	14.07.16	Guba region, Digah village	-	R 4	S	SC	N 41°22'324; E 048°30'161	658
AZE16Q ₁	<i>L. aphaca</i>	12.07.16	Guba region. Vladimirovka village	-	O 5	S	SC; GR	N 41° 23' 08; E 048° 32' 211	545

1	2	3	4	5	6	7	8	9	10
AZE16Q ₅	<i>L. laxiflorus</i>	14.07.16	entrance of Gusar region	-	L 2	-	SC	N 41° 26' 067; E 048° 27' 090	675
AZE16E ₅	<i>L. miniatus</i> , <i>L. sphaericus</i> <i>L. laxiflorus</i> <i>L. aphaca</i>	05.07.16	Khizi region, bottom part of Vardah village, way to Durbur pasture	-	O 5	N	CY	N 40° 53' 402; E 48° 56' 959	991
AZE16E ₆	<i>L. hirsutus</i>	06.07.16	Khizi region, the edge of way to Altigaj, bank of Atachay	BA	O 5	W	CY	N 40° 53' 07; E 48° 57' 06	927
AZE16E ₈	<i>L. pratensis</i>	06.07.16	Khizi region, territory of Chistiyy – Klyuch	L	E 6	N	CY	N 40° 49' 27; E 48° 52' 43	1529
AZE16D ₃	<i>L. miniatus</i>	13.07.16	Dashkesen region, Khosbulag village	-	O 5	W	SC	N 40° 30' 719; E 046° 05' 012	1527
AZE16D ₆	<i>L. tuberosus</i> , <i>L. hirsutus</i> <i>L. aphaca</i>	17.07.16 03.07.16	Shamakhi region, Shamakhi – Aghsu road	-	L 2	W	SC	N 40° 38' 550; E 048° 28' 450	794
AZE16E ₁	<i>L. cicera</i>	21.07.16	Ordubad region, Paragha village	L	E 6	S	CY	N 39° 5' 10; E 45° 55' 13	1644
AZE16E ₂	<i>L. pratensis</i> , <i>L. miniatus</i>	22.07.16	Shahbuz region, Batabat pasture, surrounding of Lake Batabat	L	O 5	S	SC	N 39° 32' 4; E 45° 47' 23	2253

Type of rock: BA - basalt; L- granite;

Degree of slope: L 2 - flat 0°-3°; R 4 – hill 8-16%; U 3 – wavy 3°-8°; O 5- mountainous 3°-45°; E 6- steep slope >45°;

The edge of the slope: S – south; W – west; N – north; E – east;

Type of soil: clay – CY; clay-gravel – CG; sandy – SA; sandy-clay – SC; gravel – GR.

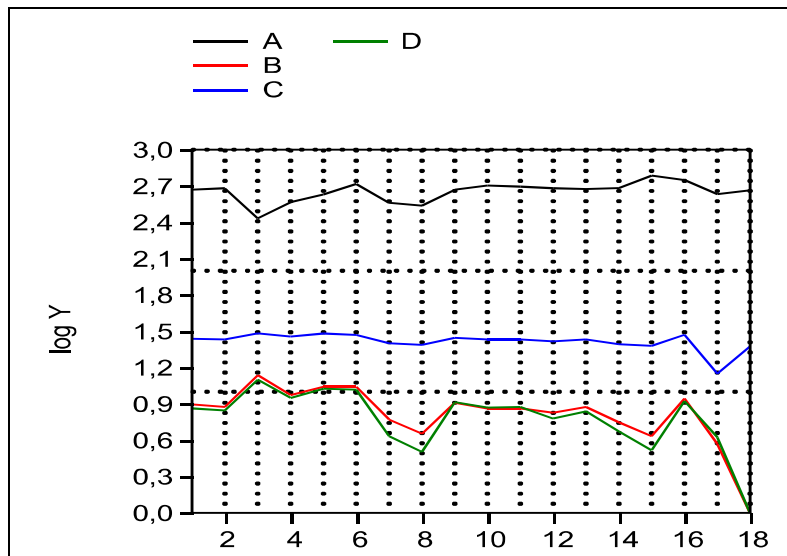


Figure 2. Relation of collected species to precipitation and temperature
A – amount of precipitation; B - T_{\min} ; C - T_{\max} ; D- T_{or}

Different herbarium samples collected by use for the fenetic (taximetric) analysis of *Lathyrus* species were reviewed. At least two examples of each population have been studied and each population is labeled as the single Operational Taxonomic Unit (OTU). For the morphological analysis of plants, 8 quantitative characteristics (plant height, number of leaflets, length, width, number of legumes, length, width, number of seeds) were selected.

The measurements were made at least 2-3 copies of each population, and the average value was calculated. Based on the results obtained, the taximetric (fenetic) analysis was carried out using the method of Cluster Analysis (CA). The analyzes were conducted through the SSPS Win (SPSS version 16.0) software.

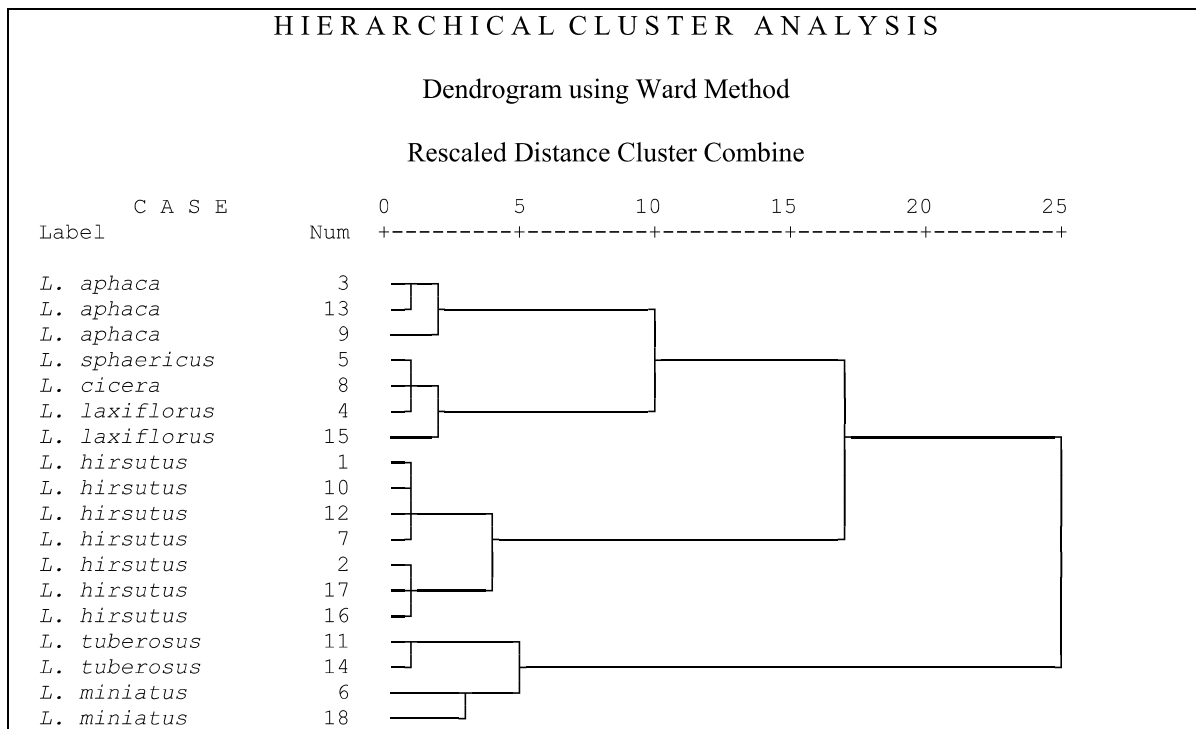


Fig. 3. Single Integrated Cluster Analysis of morphological signs in *Lathyrus* species.

The taximetric (fenetic) relationship between the *Lathyrus* species is shown in the Fig 3. Three main clusters were observed at the 15th level. The first cluster is composed of *L. aphaca*, *L. sphaericus*, the second cluster *L. cicera*, *L. laxiflorus*, and *L. hirsutus*. The third cluster is associated with *L. tuberosus*, *L. miniatus*, spread across different areas. Three main clusters were differentiated from one – another for their signs.

The first cluster is divided into 2 subgroups. The first and second subgroups are characterized by *L. aphaca* samples.

The second cluster is divided into 4 subgroups. The first subgroup includes *L. sphaericus*, *L. laxiflorus* and *L. cicera*. There are different opinions about the status of this species. According to Chefranova (Chefranova, 1971, 1987) *L. cicera* - *Cicercula* (Medik) includes in Czefr.sub – genus and the other species belong to *Orobus* (L.) Peterm. sub-genus. According to the system of Kupicha (Kupicha, 1974, 1983), Asmussen and Liston (Asmussen and Liston, 1998) it is included in the sections of *L. sphaericus* - *Lineacarpus*, *L. cicera* - *Lathyrus*, *L. laxiflorus* – *Pratensis*. The species are concentrated in this subgroup due to the similarities in the morphological signs (the height of the plant and the number of leaflets). Further research is required to be conducted in order to confirm this area. The second subgroup includes *L. laxiflorus*. The third and fourth subgroups relates to *L. hirsutus* samples spread across different territories.

The third cluster is divided into 2 subgroups. The first subgroup includes *L. tuberosus*, second subgroup *L. miniatus* samples. These species belong to the *Lathyrus* subgenus. The species is concentrated in the *Lathyrus* section, depending on the system of Kupicha (Kupicha, 1974, 1983), Asmussen et Liston (Asmussen et Liston, 1998). According to Chefranova (Chefranova, 1971, 1987), the species belong to the *Lathyrus* subgenus.

In our research, species are in line with the systematic proposed by Chefranova (Chefranova, 1971, 1987).

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Azərbaycanda Gülülçə (*Lathyrus* L. s. l.) Növlərinin Yayılması Və Biomorfoloji Müxtəlifliyinin Qiymətləndirilməsi

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2016-cı ildə təbiətdə aparılan monitorinqlər nəticəsində Azərbaycanda 18 marşrut üzrə Gülülçə (*Lathyrus* L. s. l.) cinsinin 9 növü, 13 populyasiyanı əhatə edən toxum və 80 herbari nüsxəsi toplanılmışdır. Məqalədə onların descriptor məlumatları əsasında biomorfoloji müxtəlifliyinin qiymətləndirilməsi və yayılması haqda məlumat verilir.

Açar sözlər: *Gülülçə, növ, cins, Azərbaycan, ekoloji-botaniki*

Распространение Видов Рода *Lathyrus* L. s.l. В Азербайджане И Оценка Их Биоморфологического Разнообразия

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В результате мониторингов, проведенных в природных условиях в 2016 году в Азербайджане, были собраны 13 образцов семян и 80 гербарных экземпляров, относящихся к 9 видам рода Чины (*Lathyrus* L.s. l.). В статье приводятся результаты исследований по оценкам биоморфологического разнообразия и распространению видов чины на основе дескрипторных данных.

Ключевые слова: *Lathyrus* L., вид, род, Азербайджан, эко-ботанический