

New distribution areas of some species of plants on the southern part of the Caspian coast

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Plant species were collected in the botanical-geographic regions of Lankaran-Mughan and Lankaran lowland located on the southern part of the Caspian coast. During the ecological-geobotanical studies we conducted on the southern part of the Caspian coast, we obtained information about the morphological features and systematic taxa of the wild flora of Lankaran-Mughan and Lankaran lowland botanical-geographical regions. In this article we describe the ecology and distribution of *Dianthus cyri* Fisch. & C. A. Mey., *Vicia ervilia* (L.) Willd., *Trigonella cancellata* Deef., *Cruciata articulata* (L.) Ehrend., *Triglochin maritimum* L., *Crypsis alopecuroides* (Pill. et Mitt.) Schard., *Poa masenderana* Freyn & Sint., *Nymphaea alba* L., *Arabis mollis* Stev., *Acer hyrcanum* Fisch., *Tamarix meyeri* Boiss., *Symphytum peregrinum* Ledeb., *Nonnea decurrens* (C. A. Mey.) G. Donfil., *Veronica ceratocarpa* C. A. Mey., *Campanula odontosepala* Boiss., *Achillea millefolium* L., *Carduus pycnostrix* C. A. May., *Centaurea hyrcanica* Bornm. These species are endemic, rare, endangered, and included in the "Red Book of Azerbaijan". In addition to being decorative, they have a certain significance as a raw material for human and veterinary medicine.

Keywords: phytocenosis; rare species of plants; rare flora; endemic plants; Caspian Sea; Azerbaijan.

Introduction

New areas of distribution of the mentioned species naturally growing in the Lankaran-Mughan and Lankaran plains have been determined. Therefore, the "Map of the new distribution area of some plant species in the territory of the botanical-geographic regions of the Caspian coast" has been charted. On the southern part of the Caspian coast, including the territory of poorly researched botanical-geographical regions, geobotanical studies, morphological features, and systematic taxonomic studies were conducted, since the floristic literature lacked data about the distribution of those species.

We identified the species in accordance with the herbarium funds of the Institute of Botany of the Azerbaijan National Academy of Sciences and the Department of Botany of the Baku State University, according to the studies of Grossheim (1967), Agadzhanov (1967), Askerov (2005, 2006, 2008, 2010, 2016), Hajiyev (2008), Gurbanov (2009). We also analyzed the data of such fundamental editions as "Flora of the USSR" (1960), "Flora of Azerbaijan" (1961) and Cherepanov (1995). We determined that certain species are new to the southern part of the Caspian Sea (Lankaran-Mughan and Lankaran lowlands).

According to the literature information, in the territory of the republic, *Dianthus cyri* Fisch. & C. A. Mey is found in the Great Caucasus (Guba mountain massif), Nakhchivan plain, Kura-Araz lowland, the Lankaran highlands, in forests and thickets from the lowland to the mountain belt, grassy and rocky places (Flora of Azerbaijan, 1961; Askerov, 2005; Gurbanov, 2009). The flora of the Caspian coast is very dynamic: the composition of local territories depends on balance of moisture and salts in soil, and also mechanical soil composition (Dimeyeva, 2013).

Below, we provide some morphological, systematic, and ecological traits of the plants included in this article.

Characteristics of rare plants

Dianthus cyri Fisch. & C. A. Mey. This is a member of the geographical grouping of Eastern, Central, and Southern Iran. In the ecological-

geobotanical studies we conducted on the southern part of the Caspian coast, the analysis of morphological traits and systematic taxonomic studies revealed that the stem of *D. cyri*, which is widespread in the wild flora of Lankaran-Mughan and Lankaran lowland botanical-geographic regions, is greyish, and reaches 10–30 centimeters length. The lower leaves are rosette-shaped and linear-lanceolate. Flowers are sessile. The calyx leaves are contiguous; below the calyx, there are 2–8 inflorescence leaves surrounding it. The ovary is in the upper position. The fruit is a multi-seeded capsule. It is an annual herb. It flowers in May and produces seeds in June. *Dianthus cyri* was recorded sparsely (1–2 locations) in the Juncusetum-Argu-socium formation belonging to the coastal sandy desert vegetation in the Lankaran-Mughan botanical-geographic region located in the southern part of the Caspian coast. It is a psammophyte and decorative plant. Area of collection: Salyan region, Shirvan National Park (Southeastern Shirvan plain), Caspian Sea coast, sandy beach, edge of the collector. 24 m above sea level. May 25, 2022.

Vicia ervilia (L.) Willd. Typical representative of the genus *Vicia* L. is *V. ervilia* (Fig. 1), as mentioned in the descriptive literature on the flora of the Caucasus and Azerbaijan (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967). It is spread in the Mediterranean coastal countries, Asia Minor, Iran, France, Italy, the Caucasus (East and South Transcaucasia) and Talysh. According to the literature (Hajiyev & Musayev, 1996; Askerov, 2006; Gurbanov, 2009), bitter vetch (*V. ervilia*) is distributed in Azerbaijan – the Greater Caucasus (Guba mountain massif), the south of the Lesser Caucasus, the Nakhchivan plain and Diabr, as well as in the lower-middle mountain belt, dry slopes and pastures. Geographical area – *V. ervilia* belongs to the Mediterranean flora. The stem of *V. ervilia* is 20–50 cm tall and flat. The leaves are oblong-linear and consist of 3–4 pairs of narrow leaflets: a hair develops on the last leaf. The flowers are small and gathered in a spike-type flower group. The crown is surrounded by stamens and pistils. There are 10 stamens, 9 of them are attached by the stamen filament, and one is free. The gynoeceum, or pistil, is an apocarp, a fruit formed from a leaf. The fruits are beans. Beans are oblong, three-to-four-seeded and egg-shaped. It is an annual herb. It flowers in May–June and its beans ripen in

July–August. In the Lankaran-Mugan botanical-geographical region located in the southern part of the Caspian coast *V. ervilia* was recorded in a single case (one location) in the Ephemereta-Artemisiosum-Suaedaosum formation of halophytic desert vegetation. It is resistant to drought and salt. It is a valuable fodder plant. It can be used to improve winter pastures. Area of collection: Salyan district, north of Shirvan National Park, between the main Shirvan collector, plain, grey grassy soil, 21 m above sea level. May 20, 2022.



Fig. 1. *Vicia ervilia*

Cruciata articulata (L.) Ehrend. According to the credible reports on the flora of the Caucasus and Azerbaijan, *C. articulata* (Fig. 2) is a species of the genus *Cruciata* Mill. that is found in the countries bordering the ancient Mediterranean Sea, Iran, the Balkan-Asia Minor, and the Caucasus (Eastern and Southern Transcaucasia). *Cruciata articulata* contains cruciasides, monoterpenoid glycosides and glycosylated biscoumarins (Liu et al., 2021a, 2021b) and is therefore used in folk medicine in many countries. *Cruciata articulata* occurs in Azerbaijan: Kura-Araz lowland, North and South Lesser Caucasus, the Nakhchivan lowland, Diabar and Lankaran highlands, according to the literature data. It is a representative of the West-Asian flora, and has the following morphological, systematic and ecological characteristics. *Cruciata articulata* has one or several stems, simple or ramified, straight, 3–15 cm tall and glabrous. The leaves have four densely joined petioles, are wide heart-shaped, 8–10 mm wide, sessile and veined in the lower part. The umbel is covered with 4–6 flowers and a short peduncle with bending leaves. The flowers are yellow, 1.5–2.0 mm in diameter; have an ovoid crown. The seeds are hairy and 2 mm in diameter. It is an annual plant. It flowers in March–May and produces seeds in June. *Cruciata articulata* is an ephemeral plant growing in seaside sandy or psammophyte desert vegetation of the Lankaran-Mugan botanical-geographic region in the southern part of the Caspian coast. It was recorded at one location. It is resistant to drought (xerophyte) and is not eaten by livestock. It is considered a harmful plant. Area of collection: Boyat municipality, Nefchala region; 10 m below sea level; April 30, 2022.

Triglochin maritima L. (Fig. 3) belongs to the genus *Triglochin* L. According to Grossheim (1967) on the flora of the Caucasus and Azerbaijan, it is distributed in the Mediterranean countries, the Caucasus, including the Fore-Caucasus, Dagestan, Eastern and Southern Transcaucasia. *Triglochin maritima* is broadly distributed on the sea coasts and shores of saline water bodies (Hill, 1900; Burke, 1942; Cook & Cleal, 1943). The plant contains cyanogenic glucosides (Eyjólfsson, 1970). The seed productivity, biomass and concentration of secondary metabolites in the plant tissue depend on soil salinity and its temperature (Masuda et al., 1999; Boestfleisch & Papenbrock, 2017). The lowest biomass of *T. maritimum* was seen on the coasts of the northern seas, whereas against the background of optimal heating of shore alluvium, the plant can become much taller (Sergienko et al., 2020). According to the literature (Flora of Azerbaijan, 1961), *T. maritima* plant is mainly distributed in Azerbaijan – Lesser Caucasus and Diabar – in humid places, swamps, riverbanks and

subalpine meadows. Geographical range: the Caucasian type of the flora has the morphological, systematic, and ecological traits listed below. The stem of *T. maritima* is 40–80 cm tall; the leaves around the root form a sheath from the base. The flowers are regular and bisexual. The inflorescence is raceme. The inflorescence consists of the upper and lower leaves. It is characterized by 6 stamens, and 6–8 carpels. The fruit is one-seeded. It is a perennial herb. It flowers in May and produces seeds in June–August. Coastal vegetation – in the southern part of the Caspian coast (Lankaran lowland), it is recorded in rare cases (1–2 points) in the *Phragmitetum-Carexosum* formation of wetland vegetation formed on the marshy soil. It is a swamp-dwelling plant. It can be used as fodder and a technical plant. Area of collection: Lankaran region, Ghzil-Aghaj Bay (Ghzil-Aghaj National Park). Karagush Lake. 27 m above sea level. May 28, 2022.



Fig. 2. *Cruciata articulata*



Fig. 3. *Triglochin maritimum*

Crypsis alopecuroides (Piller et Mitterp.) Schrad. (Fig. 4) belongs to the genus *Crypsis*, as mentioned by Grossheim (1967), in the flora of the Caucasus and Azerbaijan, it is widespread in the Mediterranean countries, most regions of Europe, Western Siberia, Central Asia and the Caucasus. The species was also found in North Africa and the Near East. The species is also distributed in America, in the West of the United States, where it is common on sandy soils around water bodies (Tsvelev & Probatova, 2019). It typically grows on fresh, mostly alluvial sands, pebble, in river floodplains and shores of water bodies, solonetz, and on roadsides. The literature (Flora of Azerbaijan, 1961) states that *C. alopecuroides* is a plant that is found in the Azerbaijan's Kura-Araz lowland, Nakhchivan plain, humid sandy areas up to the lower mountain belt, on the edge of

suturats, and siliceous soils. Geographical range: European species of foxtail pricklegrass has the following morphological, systematic and ecological characteristics. The grass-forming, recumbent, and ascending smooth stems of *C. alopecuroides* reach heights of 10–20 cm. Long-pointed, hard, alternately arranged, bluish-green, scaly and hair-covered leaves characterise this plant. It is an annual herb. It blossoms in June through July and produces seeds in August and September. The foxtail pricklegrass was found singly (one location) in the *Argusietum-Convulvulosum* formation of the coastal sandy (psammophyte) desert vegetation in the southern part of the Caspian coast, as well as in the Lankaran-Mugan botanical-geographical region. It is well consumed by cattle as a fodder plant. Area of collection: Nefchala district, south of Shirvan state reserve. Caspian Sea coast. 22 m above sea level. June 15, 2022.



Fig. 4. *Crysopsis alopecuroides*

Poa masenderana Freyn & Sint. (Fig. 5) belongs to the genus *Poa* L. The species is distributed only in the Caucasus, as mentioned by Grossheim (1967) regarding the flora of the Caucasus and Azerbaijan. The *P. masenderana* plant, which is also found in Diabar, is said to be widespread in the shaded forests of the Greater Caucasus's Lankaran mountain ranges and Guba mountain massif. Geographical area: *P. masenderana* typical of the Hyrkan-flora type has the following morphological, systematic and ecological characteristics. *Poa masenderana* has a glabrous stem and is 20–45 cm tall. It forms a sparse lawn with creeping stems. The leaves are flat-pointed. The panicle is curved and has few spikes. It is a perennial herb. It flowers in May–June and produces seeds in July. *Poa masenderana* is found singly (1 location) in the *Alnuseta-Carpinetum-Parrotiosum* formation spreading in the forest-yellow type soil in the Lankaran lowland botanical-geographic region located in the southern part of the Caspian coast. It is a fodder plant. Area of collection: Astar region, south of Hyrkan National Park. Forest phytocenosis of Suvash-Alasha administrative-territorial division, 1–2 km away from Astarachay. 200 m above sea level. May 20, 2022.



Fig. 5. *Poa masenderana*

Nymphaea alba L. (Fig. 6) belongs to the genus *Nymphaea* L. It is distributed in the Caucasus, including the Fore-Caucasus and Eastern Transcaucasia, as mentioned by Grossheim (1967) regarding the flora of the Caucasus and Azerbaijan. The roots of *N. alba* exert notable antifungal, antitumoral and antioxidant properties (Cudalbeanu et al., 2019). *Nymphaea alba* is critical for the existence of complex communities of aquatic invertebrates (Van der Velde, 1986; Delbecque & Suykerbuyk, 1988). This species is characterised by polymorphism of populations in the basins of various river ecosystems (Nierbauer et al., 2014). According to Askerov (2005), *N. alba* is distributed in stagnant and weakly flowing waters in Azerbaijan – Kura-Araz plain. Geographical range: white waterlily belongs to the European type, has the following morphological, systematic and ecological characteristics. Rhizomes, broad, spherical leaves, and long stems are all characteristics of *N. alba*. Rhizomes are also thick. Large, heart-shaped leaves with a diameter of up to 10–30 cm are attached to a thick, long stalk that contains air spaces. Above the water, white flowers blossom. It flowers in two ways. There are four sepal leaves, occasionally five, each whitish-green on the inside and green on the outside. The leaves of the calyx are shed once the flower opens. There are many spiral white petals. The petals show a large number of stamens, and the pollen is of pale golden colour. The female, also known as the gynoecium, is a syncarp made up of several fruit leaves. The ovary is small and deeply connected in the receptacle. The fruit has several seeds. The pulp rots and the seeds fall to the water as the fruit ripens. It is an aquatic perennial plant. It flowers from May to August and produces fruit from August to September. *Nymphaea alba* is a rare (1–2 locations) plant found in the *Typhaetum-Phragmitosum* formation of wetland vegetation in the southern part of the Caspian coast (in the Lankaran botanical-geographical region) in the backwaters of the Ghzil-Ghizilaghaj National Park (on meadow-swamp soils). The “Red Book of Azerbaijan” contains the name *Nymphaea alba* L., which is rare and endangered. It is a plant that is used as pool ornamentation. Area of collection: Masalli region, Ghzil-Aghaj bay, oxbow area between the mouth of the Akusha River. 10 m below sea level. June 15, 2022.

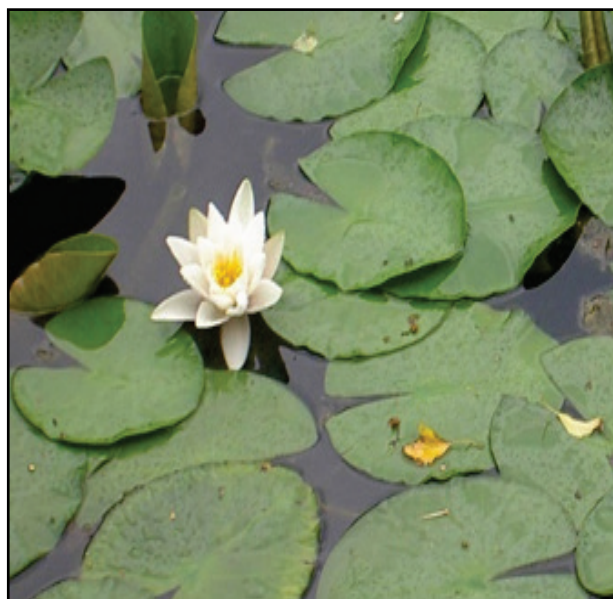


Fig. 6. *Nymphaea alba*

Arabis mollis Stev. (Fig. 7) species belongs to the genus *Arabis* L. It is distributed in Northern Iran and the Caucasus (Talish), as mentioned in the descriptive literature on the flora of the Caucasus and Azerbaijan. According to the literature, *A. mollis* is distributed in Azerbaijan: Lankaran highlands, Diabar, including humid slopes starting from the plain to the middle and upper mountain belt. Geographical area: *A. mollis* species belonging to the Caucasian type, and has the following morphological, systematic and ecological characteristics. *Arabis mollis* stem is thin, cylindrical, solid, hardened at the base, 20–40 cm high. The round-lanceolate leaves are sessile to the stem, connected at the base. It has many flowers, petals are 5 mm long, whitish-yellow. The calyx is composed of

four calyx leaves, while four free petals arranged in a circle make up the crown. The fruits have horn-like projections, two valves that open from the base to the tip. It is a perennial herb. It flowers in June–July and produces seeds in July–August. Rarely, *A. mollis* has been found in the *Centauretum-Cynodonosum* formation in the Lankaran lowland and on the southern part of the Caspian coast (1–2 locations). It is a good plant for both nectar and forage. It is advised to utilize it as a decorative plant in floriculture. Area of collection: Astara district, pasture area of Shiyekaran municipality, 2–3 km away from the Astara River. 26 m above sea level. June 20, 2022.



Fig. 7. *Arabis mollis*

Trigonella cancellata Desf. (Fig. 8) from the genus *Trigonella* L. It is distributed in Europe, Siberia, Central Asia, Iran and the Caucasus, as well as in Dagestan, Eastern and Southern Transcaucasia, as mentioned in the descriptive literature (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967) on the flora of the Caucasus and Azerbaijan. *Trigonella* genus is represented by 34 taxa in Turkey (Akan et al., 2020). *Trigonella cancellata* in Turkey grows on stony places, steppe, 1,250–2,250 m above sea level. The species is distributed in Turkey, southern Russia, the Caucasus, Northern Iran, Transcaucasia, Turkestan. As an element of the Turanian flora, this species is included in the IUCN Red List (CR category). Akan et al. (2020) reported that this species grows naturally only in Eastern Anatolia. It is close to *T. spinosa*, but the peduncle of *T. spinosa* length is 0–3 mm, while it is 1–3 cm in *T. cancellata*. *Trigonella cancellata* is distributed in Azerbaijan: Bozghir Plateau, Kura Plain, Lesser Caucasus, Nakhchivan Highlands, Diabar, on dry and stony slopes up to the middle mountain belt. The stem of *T. cancellata* is ramified and straight, 15–30 cm tall. The leaves are inverted, ovate and serrated. They are 2–3 cm long, the flower stalk is slender. The umbrella-shaped inflorescence comprises 3–5 flowers. The yellow calyx is 3–4 mm long. The ovary is located in the upper part. The pod is wrinkled, slender, arched, and bent. The brown seed has a rounded, cylindrical shape. It is an annual herb. In April through May, it blossoms, and in June, it bears seeds. *Trigonella cancellata* is found rarely (1–2 points) in the Ghzil-Aghaj (Almuseta) formation, which is formed in forest yellow soil, located in the southern part of the Caspian coast (in the botanical-geographical district of the Lankaran plain) within the Hyrkan National Park. It is a high-quality fodder plant. It can be used to improve the vegetation. Area of collection: Astara region, Istisu river bank. The area of Zungulash municipality. 220 m above sea level. May 20, 2022.

Acer hyrcanum Fisch. & C. A. Mey (Fig. 9) is specific to the genus of maple (*Acer* L.), is widespread in most regions of Asia Minor, Northern Iran and the Caucasus, as mentioned in the descriptive literature (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967) on the wild flora of the Caucasus and Azerbaijan. The species is locally distributed in Iran, where it is protected (Naseri et al., 2018). *Acer hyrcanum* is found across Azerbaijan, including the Diabar (Zuvand) botanical-geographic region, the Alazan-Eyriчай valley, the Nakhchivan Autonomous

Republic, and the Lankaran highlands (Askerov, 2006). This species can be found on dry slopes and calcareous or carbonate soils from the lower mountain belt to the upper mountain belt. Geographical area: as a rare plant species of Azerbaijan, *A. hyrcanum*, which is a member of the Hyrkan type of flora, has the following morphological, systematic, and ecological traits. *Acer hyrcanum* grows up to 20 m tall and has a 30 cm diameter. Young shoots are bare and reddish-brown in hue. The bark of the trunk is dark grey-brown and covered with cracks. The shoots are brown. The leaves are dense and five-lobed, covered with yellowish hairs, and later become bare. It is 10–12 cm wide, 5–10 cm long and has a heart-shaped lamina. Its lobes are wide, oblong-ovate, blunt and sharp-serrated. Sepal leaves are bare, inverted ovoid, 3–5 mm long. The petals are small, yellowish, and slightly longer than the calyx leaves. In July, it blossoms, and in September, it produces fruit. In the *Almuseta-Carpinetum-Parrotiosum* formation of the Lankaran lowland, which is found in the southern portion of the Caspian coast, it was only found once (one location). It is an ornamental plant. Seeds and root cuttings are used for reproduction. Area of collection: Astara region, Erchivan forest. 1–2 km away from Astaracay. 42 m above sea level. July 25, 2022.



Fig. 8. *Trigonella cancellata*



Fig. 9. *Acer hyrcanum*

Tamarix meyeri Boiss. (Fig. 10) belongs to the genus *Tamarix* L. It is distributed in Eurasia, Southern Europe, Central Asia, North-East Africa and the Caucasus (Southern and Eastern Transcaucasia), as mentioned in

the descriptive literature (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967) on the flora of the Caucasus and Azerbaijan. *Tamarix meyeri* is a quite ecologically flexible species, able to form dense thickets (Hultine & Dudley, 2013; Magomedov & Gasanov, 2014). The species has been recorded in Western Europe (Venturella et al., 2012). According to the published sources, the *T. meyeri* plant is found in Azerbaijan's Kur-Araz plain and Nakhchivan plain in sand dunes, riparian woodland, and river valleys (banks) (Flora of Azerbaijan, 1961; Askerov, 2005; Mammadov et al., 2014). The following morphological, systematic, and ecological traits apply to the geographical area of *T. meyeri*, which belongs to the North-Iran type. *Tamarix meyeri* is up to 5 m tall and woody. The bark of the trunk is black and dark-brown. The leaves are small and scaly. The flowers are bisexual with 4–5 sepals, the crown is white or pink. The fruit is a capsule. It is a shrub. The fruit ripens in July and August after it blossoms in April and May. It is recorded as a subdominant species in the *Tamarixeta-Alhagietum-Cynodonosum* formation of the scrub-grass vegetation on the southern part of the Caspian coast, two locations. The branches and leaves of the shrub contain compounds. It is an ornamental and honey-producing shrub. It is advised to use it for strengthening coastal sand dunes and reclaiming saline soils. Area of collection: Masalli district, estuary of Vileshchay. Area flowing into Ghzil-Aghaj Bay. The border of Ghzil-Aghaj administrative-territorial district. 24 m above sea level. April 25, 2022.



Fig. 10. *Tamarix meyeri*

Symphytum peregrinum Ledeb. (Fig. 11) is a species of the genus *Symphytum* L., as mentioned by Grossheim (1967) on the flora of the Caucasus and Azerbaijan. It is widespread in Europe in mild climate, countries around the Mediterranean Sea, Western Asia and the Caucasus. The species of the *Symphytum* genus are broadly used in the traditional medicine of many countries (Sitton & Chaouat, 1989). Many species have insignificant morphological and physiological differences. At the same time, some species were recorded to have notable differences within a population (Gadella & Kliphuis, 1969, 1972; Zeeden, 2007). *Symphytum peregrinum* is found in the Azerbaijan's Greater and Lesser Caucasus, Nakhchivan AR, and Lankaran highlands. It grows in humid areas from the lowland (plain) to the middle mountain belt, along riverbanks, in meadows, and among bushes at the edges of forests. Geographical region: the Caucasian type of *S. peregrinum* exhibits the morphological, systematic, and ecological characteristics listed below. *Symphytum peregrinum* is characterized by its upright, dense and fleshy root, grey on the outside and white on the inside. The trunk is 20–70 cm high, covered with hairs. The leaves are narrowed from the base, and the tip is sharp ovate; its upper surface is covered with hairs, and its lower side is covered with soft white hairs, it is greyish-green. The lower leaves and the upper leaves are sessile. The flowers are located in pairs at the ends of the branches. The calyx consists of 5 contiguous calyx leaves, the crown of 5 petals, forming a tube. The crown first turns purple (red-red), and then blue (sometimes white). The fruit is 4 mm long, shiny-black and nut-like. It is a perennial

herb. The fruit ripens in July and August, and it blossoms in June through July. It occurs infrequently (1–2 locations) in the *Tamarixeta-Phragmitetum-Juncosum* formation of wetland vegetation on the Lankaran plain, which lies on the southern portion of the Caspian coast. Area of collection: Masalli district, Tazakend administrative-territorial district. The border of Ghzil-Aghaj Bay. Grass-swamp land. 27 m above sea level. June 20, 2022.



Fig. 11. *Symphytum peregrinum*

Nonea decurrens (C. A. Mey.) G. Donfil. from the genus *Nonea* Medik., species is found in the countries around the Mediterranean Sea, including North Africa, Western Asia, Europe, and the Caucasus, according to the descriptive literature (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967), on the flora of the Caucasus, and Azerbaijan (Southern Transcaucasia). *Nonea decurrens* plant is found in forests, shrubs, rock crevices, stony and gravelly locations, meadows, and all botanically and geographically distinct regions of Azerbaijan, from the plains to the alpine belt (Flora of Azerbaijan, 1961). Geographical area: belonging to the Pontic-Sarmatian type, it has the following morphological, systematic and ecological characteristics. *Nonea decurrens* root is thickened, creeping rhizome, the height reaches 20–50 cm. The stem is stiff, flat, and slightly greyish, and it has glandular hairs on it. It has rosette-shaped, curled lanceolate stem leaves. The flowers are arranged in a panicle cluster. The corolla is funnel-shaped, black, pink, or yellow, and the calyx is tubular-bell-shaped. The fruit is a balloon-like and reniform nut that is divided into four nutlets. It is a perennial herb. It blossoms in April–May and bears fruit in August. A single case (one location) was noted in the *Tamarixeta-Alhagietum-Cynodonosum* formation of the grass-grass vegetation along the southern portion of the Caspian shore in the Lankaran plain. The plant is dangerous. Area of collection: land plot of Shirinsu-Gumbashi municipality, Lankaran region. The border of Masalli administrative district; the side of the highway. 27 m above sea level. May 28, 2022.

Veronica ceratocarpa C. A. May., representative of the genus *Veronica* L., is found throughout Asia, Europe, Central Asia, the Caucasus, as well as South and East Transcaucasia, according to the descriptions of the flora of the Caucasus, and Azerbaijan in the descriptive literature (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967). Moreover, *V. ceratocarpa* occurs in Eastern Turkey and Northwest Iran (Elenevsky, 1978). *Veronica ceratocarpa* is distributed in Azerbaijan: the Guba mountain massif of the Greater Caucasus, the north of the Lesser Caucasus, the Lankaran highlands, as well as in the lower-middle mountain belt, forests, bushes and meadows (in different ecological conditions) within the limits of those botanical-geographical regions (Flora of Azerbaijan, 1961; Askerov, 2006; Gurbanov, 2009). This species of speedwell, which produces horn-shaped fruits and is a representative of the Colchid-Hyrkan type, has the following morphological, systematic,

and ecological traits. The stem of *V. ceratocarpa* is 10–30 cm tall, has creeping yellow roots, covered with hairs. Leaves – inverted or broadly ovate, with short petioles, toothed edges. The flowers are collected in clusters. The calyx consists of four calyx leaves. The crown is four-petaled and blue; the main part forms a tube. There are two stamens. Cartilage consists of two fruit leaves, the ovary is in the upper position; and the fruit is a two-carpel and multi-seeded capsule. The herb grows annually. In April, it blossoms, and in June, it bears seeds. We have identified the *Polyurusetum-Cynodonosum* formation of the shrub-grass vegetation in the Lankaran Plain, which is situated on the southern section of the Caspian coast, for the first time (one location). It is an ornamental plant. It is regarded as a plant that harms livestock. Area of collection: shrub area used by Shelekaran municipality (at the foot of the forest), Astara region. 1–2 km distance from the Lankaran-Astara highway. Podzol-yellow soil. 26 m above sea level. April 30, 2022.

Campanula odontosepala Boiss., a representative of the *Campanula* L. genus, according to the descriptive literature (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967) on the flora of the Commonwealth of Independent States, Caucasus, and Azerbaijan, is found in Europe, America, Asia, Iran, Mediterranean coastal countries, and Caucasus (Southern Transcaucasia). In Azerbaijan, namely in the Nakhchivan and Lankaran highlands, the *Campanula odontosepala* plant is found in a variety of habitats, including subalpine meadows, woodlands, and dry slopes (Askerov, 2006). It is primarily found in the lower mountain zone (belt). This species of the serrated-leaf *Campanula* belonging to the European type has the following morphological, systematic and ecological characteristics. The roots of *C. odontosepala* are thickened, it has 40–80 cm-tall glabrous stem is straight, curved, and non-ramified. The thin, sessile or stalked leaves are placed alternately. Regular, bisexual, and arranged in flower groups, the flowers can also be found alone or in small clusters. It has bell-shaped flowers. The female calyx, which has five teeth starting at the top, is adjacent to the ovary. There are five stamens. The ovary is situated in the lower position and the female's column passes through the tube created by the anthers; there are many ovaries. The ovary has three to five locules. The fruit is a capsule. The brown seeds of the calyx remain adjacent to the fruit. It is an annual herb. It blossoms in July and bears seeds between August and September. The scrub vegetation of the *Rubuseta-Centauretum-Cynodonosum* formation, a new formation for the region, is sporadic along the Southern Caspian shore (Botanical-Geographical Region of the Lankaran Plain) (1–2 locations). It serves as an ornamental plant in floriculture. Area of collection: Astara district, Shakhgach municipality weaving area. Seaside. Sand. Between the Astara-Lankaran highway and the Caspian Sea. The mouth of the Tangerud River. 24 m above sea level. July 15, 2022.

Achillea millefolium L. (Fig. 12) belonging to the genus *Achillea* L., is distributed in Europe, Asia, Siberia, Central Asia and the Caucasus, as mentioned in the descriptive literature on the flora of the Caucasus and Azerbaijan (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967). Yarrow herb is broadly applied in both folk medicine (Marković, 2019) and official medicine (Greger & Hofer, 1989; Sevindik et al., 2016; Volkova et al., 2021) in many countries around the world. The plant contains a large amount of biologically active compounds (Ulubelen et al., 1990; Ali et al., 2017), the concentration of which ranges depending on temperature, light, moisture and soil fertility (Bélanger & Dextraze, 1993; Afsharypour et al., 1996; Mockute & Judzentiene, 2003; Kowal & Pic, 2015). *Achillea millefolium* is found in the Nakhchivan and Lankaran highlands, from the middle mountain belt to subalpine meadows, in forests and bushes, as well as in the Guba mountain massif of the Greater Caucasus, the east and west, and the north of the Lesser Caucasus (Askerov, 2008). The species of the common yarrow has the following morphological, systematic and ecological characteristics. *Achillea millefolium* stem is unbranched. It has a stem of up to 20–70 cm height. It has a slender rhizome and develops above-ground corns, including the stem of the plant, which is grey-green and covered with silky hairs. The leaves are alternately arranged on the stem and have two to three layers of feathery sections. The leaves on the lower part of the stem are long-stalked, the middle and upper leaves are lanceolate, 7 cm long and 1.5 cm wide, sessile, and black spots appear on them. Also, the flower forms flat-topped inflorescences at the end of the stem. They are 3–5 mm long, 2–3 mm

wide and elongated ovoid-shaped. The fruit is an oblong seed. The seeds are 1.5 mm long, 1 mm wide, with compressed margins, with reverse egg shape. It is a perennial herb. It bears fruits from June to October and blooms from May to September. It is sporadic (1–2 locations), found in the *Almuseta-Carpinetum-Parrotiosum* formation of forest vegetation on the southern part of the Caspian coast (on the area of Lankaran lowland botanical-geographic region). Plants produce essential oils, and are used in folk medicine. Area of collection: Lankaran district, border of Khanbulanchay reservoir and Hyrkan National Park. Forestry. 120 cm above sea level. June 10, 2022.



Fig. 12. *Achillea millefolium*

Carduus hystrix C. A. May. (Fig. 13) from the genus *Carduus* L. The species is distributed in Eurasia, Africa, America, Australia, Mediterranean coastal countries, Northern Iran and Caucasus (Talish), as mentioned in the descriptive literature on the flora of the Caucasus and Azerbaijan (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967). According to the published information, *C. hystrix* plants can be found in Azerbaijan's Lankaran Highlands and Diabar on dry clayey, stony, gravelly slopes, between rock outcrops, and in bushes (up to the subalpine zone). The species belongs to the Iranian type, has the morphological, systematic, and ecological characteristics listed below. *Carduus hystrix* stem is 50–70 cm high. The leaves are round-lanceolate, the lower part is whitish, 3–5 cm wide. The leaves are 20–30 mm long. Its flowers are yellow, purple and pink. The seeds are hairy, 4 mm in diameter and 20 mm long. A biennial herb. It blossoms in June through July and bears seeds in July through August. It grows as a weed. In the *Parrotieta* formation of the forest vegetation of the Lankaran lowland (near the border of Hirkan National Park), in the southern part of the Caspian coast, *C. hystrix* was found only once (1 point). Lankaran region, the forest 1–2 km from the administrative-territorial municipality of Mikolan – the coast of Lankaranchay. Podzol-yellow soil. 150 m above sea level. June 10, 2018.

Centaurea hyrcanica Bomm. according to the literature (Flora of the USSR, 1960; Flora of Azerbaijan, 1961; Grossheim, 1967), on the flora of the Commonwealth of Independent States, the Caucasus, and Azerbaijan, *C. hyrcanica* is a typical representative of the genus *Centaurea* L., distributed in Eurasia, North America, Africa, countries around the Mediterranean Sea, Central Asia, North Iran, and the Caucasus. *Centaurea hyrcanica* plants are found in bushes and forests in the lower-middle zone of Azerbaijan and the highlands of Lankaran (Askerov, 2008). *Centaurea hyrcanica*, an endemic plant species of Azerbaijan that belongs to the Iranian type, has the morphological, systematic, and ecological traits listed below. *Centaurea hyrcanica* has a straight stem, many branches, and the height of 30–60 cm. The sessile, ovate, oblong-lanceolate, or ellipse-oblong leaves near the stem and beneath the stem are also present. The leaves are linear, light-brown or purple, and the sheath is 6–8 mm wide. The seeds are 3 mm long, scaly, and grey. It is a perennial herb.

It blossoms in June through July and bears seeds in July through August. In the *Rubuseta-Centauretum-Cynodonosum* formation in the Lankaran lowland botanical-geographic region on the southern part of the Caspian coast, *C. hyrcanica* is listed as a subdominant species of the phytocenosis with the abundance of 1–2 locations. It is a harmful plant. The species is included in “The Red Book”. Astara region, Alasha village, bushy pasture area. Edge of Astaracay. Istisu river bank. 275 m above sea level. June 20, 2022.



Fig. 13. *Carduus hystrix*

Conclusion

All the hypotheses put forward before the research are consistent with the findings. Finding and researching new species in the studied region serves as a foundation for future research in this field. These researched species are endemic, rare, endangered, and included in the “Red Book of Azerbaijan”, and also are ornamental, fodder and medicinal plants which bear essential oils, alkaloids and are used as food, etc. The Department of Botany at Baku State University’s Herbarium Fund stores the herbariums of the aforementioned plant species.

The Ministry of Agriculture of the Republic of Azerbaijan is considered to be in a position to benefit from the initiatives related to productivity, food quality, capacity, effective use, and strengthening of semi-desert, desert, and thicket-meadow phytocenoses on the Caspian coast. The State Service on Property Issues Under the Ministry of Economy of the Republic of Azerbaijan can use the “Geobotanical map of the natural vegetation of the coastal zone of the Caspian Sea in the territory of Azerbaijan”, as well as indicators on the productivity and quality of natural fodder for the economic evaluation of lands in the cadastre.

These species are also endemic, rare, relict, and are included in the “Red Book”. The books “Flora of Azerbaijan”, “Identification guide to Plants”, “Vegetation Map of Azerbaijan”, “Red”, and “Yashil”, as well as the “General scheme of natural fodder areas of Azerbaijan” and “Botanical of the Republic of Azerbaijan”, published according to the findings of ecological and phytocenological studies of the flora of the Caspian coast. They can be used in the creation of the geographical zoning map.

The Samur-Yalama, Absheron, Shirvan, Kizilagac, and Hirkan National Parks are situated on the Caspian coast in Azerbaijan. Information on their flora and vegetation, as well as suggestions for the preservation of biological diversity, can be useful to the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan.

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