Plant & Fungal Research (2025) 8 (2): 64-69
https://doi.org/10.30546/2664-5297.2025.8.2.1039
ISSN 2617-8001 (print), ISSN 2664-5297 (online)

Morphological and bioecological characteristics of section *Campanula* (*Campanula* L., Campanulaceae Juss.) in Azerbaijan

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Abstract: This study presents findings on the morphological and bioecological characteristics of species from sec. *Campanula* subgen. *Campanula* (Campanulaceae). It covers data on their distribution within the flora of Azerbaijan and the Caucasus, status as geographical elements, and information about specimens newly collected and kept in the herbarium. The field research was conducted during 2018-2025 covering diverse regions of Azerbaijan. The data was also pooled up from the herbarium specimens and related relevant botanical literature. Four species belonging to this section were identified in the flora of Azerbaijan: *Campanula latifolia*, *C. odontosepala*, *C. rapunculoides*, and *C. bononiensis*. All species are perennial, herbaceous hemicryptophytes and display morphological adaptations corresponding to their specific habitats and ecological conditions.

Keywords: *bellflower, calyx, corolla, distribution, ecology, herbarium*

INTRODUCTION

The genus *Campanula* L., described in 1753, is one of the largest and taxonomically complex genera in the family Campanulaceae Juss. of the order Asterales, comprising approximately 580–600 species worldwide [Mansion et al., 2012]. About 110 species of the genus are found in the Caucasus region and in Caucasian flora *Campanula* is one of the 17 genera with the highest number of endemic species. The species of this genus are predominantly herbaceous and are primarily distributed across the temperate regions of the northern hemisphere. The highest endemism rate of this genus is in the Balkans, Eastern Mediterranean, the Caucasus, and Anatolia [Borsch et al., 2009; Zeraatkar, 2023]. The species of the genus are adapted to live in a variety of habitats (forests, meadows, on rocky habitats), but greatest diversity is found in the high mountains, subalpine and alpine zones Fedorov, 1961].

In Azerbaijan, the genus *Campanula* is represented by 42 species, of which one is endemic and nine are subendemic [Askerov, 2016]. These species are distributed across eight subgenera [Shvanova, Oganesian, 2008] including *Campanula*, *Scapiflorae* (Boiss.) Ogan., *Theodorovia* (Kolak.) Ogan., *Megalocalyx* Damboldt, *Roucela* (Dumort.) Damboldt, *Brachycodonia* (Fed.) Damboldt, *Rapunculus* (Boiss.) Charadze, *Gadellia* (Schulkina) Victorov. The morphology and taxonomy of this genus is very complex, there is no monograph on this genus, only A. Decandol compiled a summary of the family Campanulaceae Juss. in 1830 [Candolle A., 1830]. Modern research is mainly focused on molecular – phylogenetic studies of the *Campanula* species in order to clarify the phylogenetic relationships of the species. In these studies genomic DNA was extracted from silica-dried leaf and some regions of DNA (*trnK*/*matK*, *petD*, and *rpl16*) were amplified and sequenced. Sequences were aligned manually using PhyDE0992 and later versions [Borsch et al., 2009; Silakadze et al., 2019].

The species of the *Campanula* subgenus found in Azerbaijan flora are grouped into seven sections: *Involucratae* (Kolak.) Kolak., *Campanula*, Sibiricae (Fom.) Charad, *Cordifoliae* (Fom.) Charad., Symphyandriformes (Fom.) Charad., Petrocodonia (Fed.) Ogan., *Oreocodon* (Fed.) Ogan [Shvanova & Oganesian, 2008]. This paper focuses on four species belonging to the section *Campanula* of the subgenus *Campanula*, which are widespread across different botanical-geographical zones of Azerbaijan. Their distribution in the Caucasus region was also mentioned.

MATERIALS AND METHODS

Field research. Specimens were collected during seasonal field trips (spring, summer, and early autumn) from 2018 to 2025 across the following botanical-geographical regions: Greater Caucasus (Guba, Gusar,

Received: 17.09.2025; Received in revised form: 01.10.2025; Accepted: 22.12.2025
Citation: Akbarova A.E., Salimov R.A. (2025) Morphological and bioecological characteristics of section *Campanula* (*Campanula* L., Campanulaceae Juss.) in Azerbaijan. *Plant & Fungal Research*, 8(2): 64-69.

Khizi), Lesser Caucasus (north (Gadabey), Kur plain (Tovuz, Ganja), Kur – Araz lowland (Aghsu), Ganikh – Ayrichay valley (Zagatala, Gakh), Gobustan (Shamakhi), Nakhchivan mountain, Diabar (Zuvand (Lerik)). These regions cover diverse climatic and altitudinal zones, ranging from lowland forests to subalpine meadows.

Herbarium studies. Herbarium materials about 85 specimens preserved in the Herbarium of the Institute of Botany (BAK) were analyzed. Specimens were verified taxonomically using diagnostic feastures, such as the shape, size and serrations of the leaves, as well as the presence or absence of hairs, the color and shape of flowers and also presence or absence of hairs, the shape of the calyx serrations and presence or absence of calyx appendages, and compared to the description of the type specimens in international floras [Flora of Turkiye, 1978; Caucasian Flora Conspectus, 2008; Flora USSR, 1957]. The taxonomic novelties were checked against World Flora Online [WFO, 2025, Catalogue of Life, 2025].

Microscopy. Micromorphological characteristics (leaf epidermis, calyx, and corolla structures) were examined using Stereo microscope (ZEISS Stemi 508, Germany). Diagnostic features such as trichome type, distribution, and corolla were analyzed to support taxonomic delimitation.

RESULTS AND DISCUSSION

Campanula latifolia L. – giant bellflower (Fig. 1, 5)
Description based on the materials from England, France and Switzerland [Shvanova, Oganesian, 2008]; *lectotypus* (Викторов, 2002: 214) Herb. Linn., № 221.44.

The perennial species shows wide distribution in Azerbaijan and was recorded in Greater Caucasus (Guba, east, west), Lesser Caucasus (north, center), Nakhchivan mountain. This species is found in upper forest and subalpine zones – in deciduous and mixed forests, subalpine high grasslands and thrives in shady to semi-shady environments. Flowering takes place in June-July, and fruiting in July-August. Earlier *C. latifolia* is also mentioned in Azerbaijan by A. Fedorov [1961], T.Talibov, A.Nasirova [2015]. According to P.H. Davis [1978] the plant belongs to the Euro – Siberian geographical element.

The root of the plant is fibrous with milky juice. Stem is straight, simple, glabrous or rather short - haired, longitudinally striped, up to 1 m in height and more. Leaves glabrous, sometimes rough, 7-12 cm in length, 3-6 cm in width, pale from the lower part, unevenly double-serrated along the edge. Basal leaves are ovate-oblong, heart-shaped from the base, have long petioles and longer teeth than the stem leaves. Lower stem leaves are short-petiolate, egg-shaped, and pointed. Upper stem leaves are sessile, relatively narrow, and almost entire. The flowers are large, straight, on peduncles and located in the axils of the upper leaves one by one, forming a narrow, almost spike-shaped and comparatively sparsely flowered raceme. Calyx is completely naked, large and pear-shaped, blackish in color. Teeth of the calyx are long, sharpened, widened towards the base, the edges are serrated and noticeably smaller than the corolla. Corolla is up to 6 cm long, purple, sometimes white and funnel-shaped, inside bearded with long soft hairs and divided into sharp, slightly curved parts that are not very deep. Stamens are widened at the base and bearded. The column is slightly smaller than the corolla and has 3 (rarely 2) stigmas. Corolla is egg-shaped, hanging down and opens with 3 holes. The seeds are ovoid and drooping, light yellow in color.

Campanula bononiensis L., Sp. Pl.: 234. 1753. – European bellflower or Bologna bellflower (Fig. 2, 5)

Described from Italy; lectotypus (Викторов, 2002: 202) Morison, 1680, Pl. Hist. Univ. Oxon. 2, sect. 5, tab. 4, fig. 38 [рис. "*Campanula* s. *cervicaria Bononensis*"] This perennial herbaceous species is distributed throughout Caucasus and Azerbaijan – from the lower mountain belt to the middle, sometimes upper mountain belt. It is found in dry meadows, forest glades, bushes, gardens. Flowering is observed in June-July (sometimes August) and fruiting is observed during July-August. Earlier this species is also mentioned in Azerbaijan by A. Fedorov [1961]. The plant belongs to the Euro-Siberian geographical element according to P.H. Davis [1978].

The root system of the plat is more or less fusiform and dense. The stem is straight, up to 70 cm long, rough, softly pubescent, simple or weakly branched. Leaves are egg-shaped, sharp, with a rough coating on both sides. It is gray in color from the lower part and dark green from the upper part, serrated, with sharp teeth. Basal leaves are petiolate. The stem leaves are sessile, and the upper leaves are clasping the stem. Flowers are numerous 2-2.5 cm long, drooping, on very small peduncles and clustered in a spike-like brush. Inflorescence is sometimes slightly branched. The calyx is bare or rough pubescent, oval in shape and blackish in color. The teeth of the calyx are sharp, more or less curved, scabrous, narrowly triangular-lanceolate, several times smaller than the corolla. The corolla is funnel-shaped,

Figure 1. *Campanula latifolia* L.: A) plant in nature; microscope view of the B) leaf, C) calyx, D) petal.

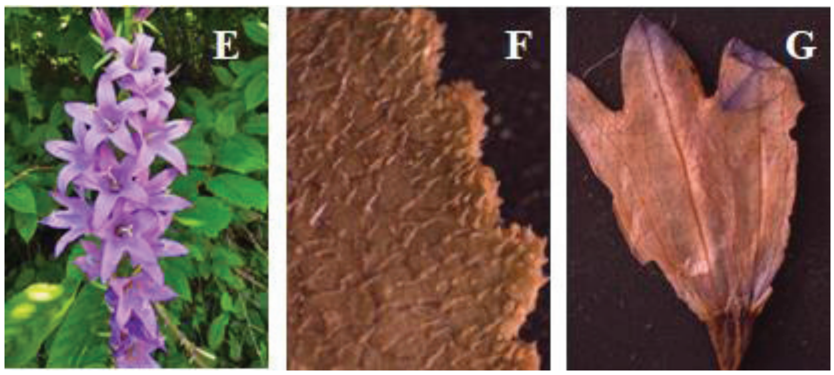

Figure 2. *Campanula bononiensis* L.: E) plant in nature, microscope view of the F) leaf, G) corolla.

blue-purple in color, naked on the outside, and bearded on the inside. Filaments of stamens are membranous at the base, widened and hairy. The column is equal to the length of the corolla, slightly hairy at the beginning and has 3 stigmas. Capsule is drooping, small and balloon-shaped.

Campanula odontosepala Boiss. – Odontosepalous bellflower (Fig. 3, 5)

Described from northern Iran [Shvanova, Oganesian, 2008]; Typus: "In sylvis excelsioribus Ghilani, № 4907.

This perennial herbaceous species is found in Lankaran highlands (Talysh). It is found in the forests of the lower mountain belt. Flowering and fruiting are observed in June-August. According to P.H. Davis [1978] the plant belongs to the Irano-Turanian geographical element.

Stems of the species are erect, bare, curvy, unbranched, leafy and up to 70-80 cm tall. The leaves are thin and

Figure 3. *Campanula odontosepala* Boiss.: H) plant in nature, I, J) microscope view of the leaf.

bare. Only the edges are ciliated. Sometimes it is very sparsely hairy along the veins from the lower part. All leaves are petiolate, egg-shaped and elongated. Base of leaves is oval or slightly heart-shaped. On the edges there are unequally serrated teeth located close to each other. Flowers are axillary, 1- 2 on curved peduncles. The teeth of the calyx are long, linear-lanceolate or linear, bent downwards, finely serrated and short curly ciliated. Corolla is bell-shaped and up to a third divided into blades. The ovary is bearded. The length of the corolla is up to 3 cm. The capsule is egg-shaped and drooping. The seeds are brown in color, elongated and bordered. Flowering and fruiting are observed in June-August.

Campanula rapunculoides L., Sp. Pl.: 234. 1753. – creeping bellflower (Fig. 4, 5)

syn: *Campanula grossheimii* Kharadze in Zametki Sist. Geogr. Rast. 15: 29. 1949

Description based on the materials from from Switzerland and France; Lectotypus (Damboldt, 1979: 16) :Herb. Linn., № 221.30 (LINN. photo!)

This perennial herbaceous plant is widespread throughout Azerbaijan – from the lower mountain belt to the subalpine belt. It is found in the forests and glades, bushes, meadows, gardens, on cliffs and rocks of river banks, preferring moist soils with good drainage. Flowering occurs in June-August and fruiting in July-September. Before *C. rapunculoides* is also mentioned in Azerbaijan by A. Fedorov [1961], T. Talibov, A. Nasirova [2015]. The species belong to the Euro-Siberian geographical element accodring to P.H. Davis [1978].

The root of the plant is dense and branched. Sometimes long underground shoots are formed. The stem is 30-100 cm high, simple, straight, weakly ribbed, bare, and covered with hard, short hairs, which gives it

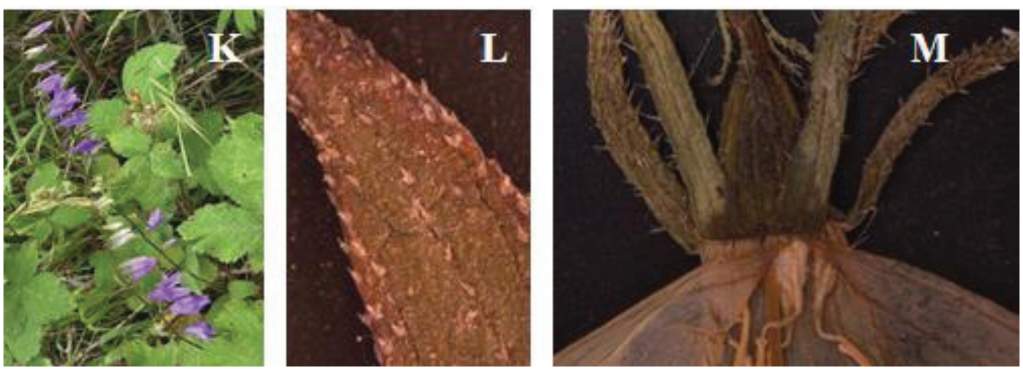

Figure 4. *Campanula rapunculoides* L.: K) plant in nature, microscope view of the L) leaf, M) calyx.

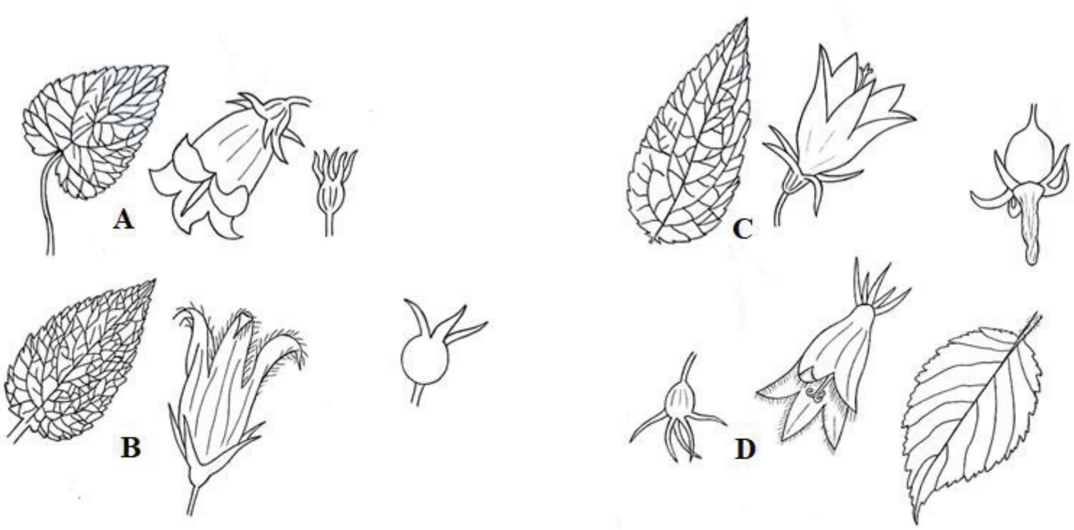

Figure 5. Schematic representation of a leaf, flower and capsule of A.) *C. bononiensis*, B) *C. latifolia*, C) *C. rapunculoides*, D) *C. odontosepala.*

a rough appearance. Basal and lower stem leaves are long-petiolate, heart-shaped-ovate or oblong-heart-shaped-ovate. The leaves in the middle part of the stem are egg-shaped with a blunt base. The upper leaves are lanceolate, sessile, and all unequal and usually sharply jagged. Inflorescence is long, brush-shaped and one-sided. The flowers are about 2-2.5 cm long, with a short flower stalk, drooping downwards and blue-violet in color, and are located singly. Capsule is obconical, hairy, with linear – lanceolate recurved teeth. The corolla is funnel – bell shaped, the edges are ciliated and divided up to 1/3 into ovoid, pointed lobes. Calyx has no appendages. Capsule opens from the base.

CONCLUSION

The section *Campanula* of the subgenus *Campanula* is represented in Azerbaijan by four morphologically and ecologically distinct species. These taxa occupy a wide ecological range – from humid Hyrcanian forests to dry subalpine meadows – demonstrating remarkable adaptability. Two of these species are found throughout Azerbaijan. Morphological characteristics such as leaf structure, calyx shape, and corolla pubescence are critical for accurate identification and taxonomic status. This study enhances the understanding of the genus in the region and provides a foundation for future ecological, phylogenetic, and conservation research.

REFERENCE

Askerov A.M. (2016) Plant World of Azerbaijan. Baku: TEAS Press, 306 p. [Əsgərov A.M. (2016) Azərbaycanın Bitki Aləmi. Bakı: TEAS Press nəşriyyat evi, 2016, 306 s.]

Borsch T., Korotkova N., Raus T., Lobin W., Lohne C. (2009) The petD group II intron as a species level marker: utility for tree inference and species identification in the diverse genus *Campanula* (Campanulaceae). *Willdenowia*, 39: 7-33.

Candolle A.P.P. de. Monographie des Campanulees. Paris: Chez Mme. Veuve Desray, 1830, 384 p.

Catalogue of Life (2025-10-10 XR). Catalogue of Life Foundation, Amsterdam, Netherlands. https://doi.org/10.48580/dgtpl

Davis P.H. (1978) Flora of Turkey and the East Aegean Islands. Edinburg: at the University Press, vol. 6, 825 p.

Fedorov A.A. (1961) Flora of Azerbaijan. Baku: Pub. house of Acad. Sci. Azerb. SSR., vol. VIII, 1961, 126 p. [Федоров А.А. Флора Азербайджана. (1961) Баку: Изд. Акад. Наук Азерб. ССР., Т. VIII, 126 с.]

Mansion G. et all. (2012) How to handle speciose clades? Mass taxon-sampling as a strategy towards illuminating the natural history of *Campanula* (Campanuloideae). *PLoS One*, 7: e50076.

Red Book of the Republic of Azerbaijan. Flora. (2023) Third publication. Baku: Imak, 334 p. [Azərbaycan Respublikasının Qırmızı Kitabı. Flora. (2023) Üçüncü nəşr. Bakı: Imak, 334 s.]

Shvanova V.V., Oganesian V.E. (2008) Caucasian Flora Conspectus. Saint – Petersburg –Moscow: KMK Scientific Press., vol. 3(1), 469 p. [Шванова В.В., Оганесян М.Э. (2008) Конспект Флоры Кавказа. Санкт – Петербург – Москва: Товарищество научных изданий КМК., Т.3(1), 469 с.]

Silakadze N., Kilian N., Korotkova N., Mosulishvili M., Borsch T. (2019) Multiple evolutionary origins of high mountain bellflowers with solitary flowers and calyx scales render a core Caucasian clade of the Scapiflorae group (Campanulaceae). *Syst. Biodivers.*, 17(7): 690.

Talibov T., Nasirova A. (2015) Flora of the Nakhchivan Autonomous Republic – Campanulaceae Juss. Baku: AF Polygraph Printing House, 130 p. [Talıbov T., Nəsirova Ə. (2015) Naxçıvan Muxtar Respublikasının Florası – Campanulaceae Juss. Bakı: AF Poliqraf mətbəəsi, 130 s.]

Victorov V.P. (2002) Taxonomic summary of the genus *Campanula* L. (Campanulaceae) in Russia and neighboring countries. Novosti sist. vyssh. Rast., 34: 197 [Викторов В.П. (2002) Таксономический конспект рода *Campanula* L. (Campanulaceae) России и сопредельных государств. Новости сист. высш. раст., 34: 197]

WFO (2025): *World Flora Online*. Published on the Internet; http://www.worldfloraonline.org. Accessed on: 14 Nov 2025

Zeraatkar A., Khajoei F. Nasab. (2023) Taxonomic notes on some species of *Campanula* section *Oreocodon*. *Phytotaxa,* 618 (3): 283-290.

Azərbaycanda *Campanula* seksiyasının morfoloji və bioekoloji xüsusiyyətləri (*Campanula* L., Campanulaceae Juss.)

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Bu tədqiqatda *Campanula* (Campanulaceae) yarımcinsinin *Campanula* seksiyasından olan növlərin morfoloji və bioekoloji xüsusiyyətlərinin nəticələri təqdim olunur. Həmçinin onların Azərbaycan florasında və Qafqazda yayılması, coğrafi elementləri və yeni toplanmış və herbari fondunda saxlanılan nüsxələr haqqında məlumatlar göstərilmişdir. Çöl tədqiqatları 2018-2025–ci illərdə Azərbaycanın müxtəlif regionlarında aparılmışdır. Məlumatlar həmçinin herbari materiallarının və müvafiq botaniki ədəbiyyatlardan əldə edilmişdir. Azərbaycan florasında bu seksiyaya aid olan dörd növə rast gəlinir: *Campanula latifolia*, *C. odontosepala*, *C. rapunculoides*, *C. bononiensis*. Bütün növlər çoxillik, otşəkilli hemikriptofitlərdir və xüsusi yaşayış yerlərinə və ekoloji şəraitə əsasən morfoloji uyğunlaşmalar göstərirlər.
Açar sözlər: *zəngçiçəyi, kasacıq, çiçək tacı, yayılma, ekologiya, herbari*

Морфологическая и биоэкологическая характеристика секции *Campanula* в Азербайджане (*Campanula* L., Campanulaceae Juss.)

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В данной работе изучены морфологические и биоэкологические характеристики видов из секция *Campanula*, подрод. *Campanula* (Campanulaceae). Представленное данные об их распространении во флоре Азербайджана и Кавказа, географические элементы, а также информация о новых и хранящихся в гербарии образцах. Полевые исследования проводились с 2018 по 2025 год в различных районах Азербайджана. Также использовались данные гербарных образцов и соответствующей ботанической литературой. Во флоре Азербайджана выявлено четыре вида, принадлежащих к этой секции: *Campanula latifolia*, *C. odontosepala*, *C. rapunculoides* и *C. bononiensis*. Все виды являются многолетними, травянистыми гемикриптофитами и проявляют морфологические адаптации, соответствующие конкретным местообитаниям и экологическим условиям.
Ключевые слова: *колокольчик, чашечка цветка, вечник цветка, распространение, экология, гербарий*