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The distribution and current state of populations of *Colchicum fominii* Bordz. in Ukraine

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Distribution and current state of populations of *Colchicum fominii* Bordz. in Ukraine. — A. M. Gnatiuk, O. S. Dyatlova, S. Y. Dyatlov. — An analysis of literature about the nomenclature and distribution of the rare plant species *Colchicum fominii* Bordz. in southwestern Ukraine (Odesa oblast) was carried out. Several territories in both Artsyz and Tarutyne raions where *C. fominii* was recorded in 1982 and 1995 were investigated in 2016. A population last reported in the mid-1930s from Velyka Mykhailivka raion was revisited in 2007. A significant reduction in number of generative individuals was noted in 2016 in the population located between Nova Ivanivka and Delen villages, Artsyz raion (compared to observations in 1982 and 1995). Due to the fact that *C. fominii* is not recorded in any sites of the Nature Reserve Fund of Ukraine or of the Emerald Network, we propose the creation of two botanical nature reserves of local importance in Odesa oblast (between Nova Ivanivka and Delen villages, Artsyz raion and near Kardamycheve, Velyka Mykhailivka raion), where the contemporary populations of *C. fominii* are recorded and inclusion of these reserves into the Emerald Network.

Key words: *Colchicum fominii*, *Colchicum arenarium*, Emerald Network, Bern Convention, rare species, plants, Ukraine.

Introduction

Colchicum fominii Bordzilovski is a rare plant species, included into the Red Data Book of Ukraine (Red..., 2009). The species is also included into the annexes of the Habitats Directive and Bern Convention (Bilz, 2011). The plants are found on steep slopes with fescue-feathergrass communities, in woodlands and scrubs, in deciduous forest plantations and in windbreak hedgerows (Red..., 2009). Unfortunately, the species does not occur in the protected areas of Ukraine (Popova, 2004), nor the Emerald Network protected areas (Protsenko, 2011).

There are some discrepancies regarding the taxonomic status of this species. The species *C. fominii* was first recorded in Ukraine in the mid-1930s by the palaeontologist V. I. Burchak-Abramovich during his research in the region. The discovered plants were transferred to the Ukrainian botanist Y. I. Bordzylovsky, who described the plant as a new endemic species and named it after the famous Ukrainian botanist Oleksandr Fomin (Bordzilovs'kyj, 1938). A description and depiction of the flowering plant *C. fominii* are given in the publication "Flora of the UkrSSR" (Bordzilovs'kyj, 1950). It is believed that the plants were collected in the vicinity of Grebenyky village, Tyraspilsky raion, Moldavian ASSR (now Velyka Mykhailivka raion, Odesa oblast). A type specimen from the collection of Y. I. Bordzylovsky is not preserved in the Herbarium of M. G. Kholodnyi Institute of Botany, National Academy of Sciences of Ukraine (KW) (Krytzka et al., 2002). Only the neotype is stored: a specimen collected by S. Ye. Dyatlov in 1999 and passed to L. I. Krytska (labelled as collected in Grebenyky). We would like to point out that this specimen was collected by S. Ye. Dyatlov in Artsyz raion, and the information on the label is incorrect.

Investigating *C. fominii*, K. A. Zahariadi (Zahariadi, 1966) noted that the species differs from the closely related Pannonian psammophytic ('sand-loving') species *C. arenarium* Waldst. et Kit. by the virtue of its ecology and its leaves, which are covered by short papillae on the edges rather than being bare and smooth. Later, K. A. Zahariadi and Z. T. Artyushenko compared perianth tube sections

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and other morphological characters of *C. arenarium* Waldst. et Kit. *var. arenarium* and *C. arenarium* Waldst. et Kit. *var. fominii* (Bordz.) Zahar. et Artjusch., concluding that the latter taxon is only a variety of *C. arenarium* due to their similar ranges and similar structure of the perianth tube (Zachariadi, Artushenko, 1968).

However, *C. fominii* is considered a separate species in the "Flora of USSR" (Tsvelev, 1979), in a checklist by S. K. Cherepanov (Cherepanov, 1995), in the European Red List of Globally Threatened Animals and Plants (European..., 1991) and World IUCN Red List (Walter, Gillett, 1998), the Red Lists for Moldova (Cartea roşie a Republicii Moldova..., 2002) and Romania (Arii speciale pentru…, 2007), in a summary "Vascular Plants of Ukraine..." (Mosyakin, Fedoronchuck, 1999) and in an authoritative identification guide to the Romanian flora (Sârbu et al., 2013). A detailed morphological investigation by G. G. Oganezova revealed the presence of different types of nectaries and certain differences in the structure of the connectives between *C. fominii* and *C. arenarium*. For this reason and based on the degree of geographical isolation, G. G. Oganezova considered necessary to retain species status for *C. fominii* (Oganesova, 2011).

Nevertheless, more and more modern botanists include *C. fominii* within *C. arenarium* based on research by K. Persson, considering that the differences are insufficient to warrant species status (Persson, 2007, Cartea..., 2015; Bilz, 2011).

Colchicum arenarium s. l. is found in Hungary, Moldova, Romania, Croatia, Serbia, Slovakia, and Ukraine. The greatest number of localities are in Hungary, while in other countries the species is rare. In Hungary, it grows on the plains between the Danube and Tisa rivers. Two localities are known in Slovakia: at Komarno and the National Nature Reserve Čenkovská (though only the latter site is confirmed). Information is lacking about the presence of populations in Serbia and Croatia (Bilz, 2011).

At the end of the 1980s, three localities of *C. fominii* were recorded in Moldova: Ryshkanivka Park in Chişinău (Parcul Rişcani), Cimişlia District, and near Căuşeni city. The number of plants at each site was low, approximately 1–2 flowering plants on 1 m^2 (Geideman, Nikolaeva, 1975; Geideman et al., 1982). Later studies confirmed the presence of the species in the vicinity of Comrat city (Chirsova village), in Chişinău (Kuchurgan river basin), and in the Budjak Reserve. A population of 70–100 plants (with a density of 0.2 individuals/m^2) was recorded in the surroundings of Comrat city in associations consisting of cereals and motley grass (Cartea..., 2002). The species occurred on a stepped slope under canopy of *Robinia pseudoacacia* L. and shrubs in the surroundings of Chişinău in Ryshkovsky forest park. The species occurs in the Budjak Medicinal Plants Reserve near Dezghingea village (Comrat District) in small numbers, in a community of steppe plants with *Stipa capillata* L. It also occurs in the south, at Ciucur-Mingir village, Cimişlia district (Chebotar, 1989). Besides the abovementioned localities, several others are mentioned for Moldova: Cimişlia, Gagauzia Autonomous Territorial Unit, Chişinău surroundings, and in Leova district (Cartea.., 2015).

In Romania, *C. fominii* is recorded as a component of steppe phytocoenoses in two localities near Dobruja: in protected areas Măgurelle Nord-Vest (near Topolog village) and Recifii Jurasics Cheia, whereas *C. arenarium* s. str. is recorded from one locality in the western continental part of the Banat region (Zahariadi, 1966; Sârbu, 2007).

In Ukraine, *Colchicum fominii* is located on the eastern edge of its natural range. Information on the state of Ukrainian populations is scarce. Our goal was to determine the presence and the current state of populations of the species in Ukraine, to investigate the size of those populations, to analyse the negative factors affecting the plants, and to suggest measures to protect the species.

Material and methods

The species distribution was studied using a combination of literature reviews and field research. The density of generative individuals was investigated in autumn.

We recognize the close affinity of plants from Ukraine with *C. arenarium*; however, in the current publication we consider *C. fominii* as an independent taxon in the genus. This correlates with the data

of G. G. Oganezova (Oganezova, 2011); the same name is given in the summary "Vascular Plants of Ukraine..." (Mosyakin, Fedoronchuck, 1999) and in the latest edition of the Red Data Book of Ukraine (Diduch, 2009).

Results and discussion

In Ukraine, localities with *C. fominii* were recorded only in Odesa oblast. However, K. A. Zakhariadi and Z. T. Artyushenko noted that the record of *C. umbrosum* Stev. in the surroundings of Kherson city by G. Chernyachovska was mistaken and *C. arenarium* var. *fominii* probably occurs there instead (Zachariadi, Artushenko, 1968). Currently, there is no confirmation that *C. arenarium* occurs in surroundings of Kherson city.

For a long time only two localities of *C. fominii* were known in Ukraine: the surroundings of Kardamycheve and Grebenyky villages (Bordzilovsky, 1950; Takhtajan, 1975; Shelyag-Sosonko, 1996; Vinichenko, 2006) and the species is not mentioned in the identification guide to the embryophytes of Ukraine (Dobrochaeva et al., 1987).

In 1968, K. A. Zakhariadi collected plants of *C. fominii* from the following localities in Odesa oblast: Zadunayivka village (Artsyz raion), Kyrnychky village (Izmail raion) and Berezyne village (Tarutyne raion) (Zachariadi, Artushenko, 1968).

In August 1982, *C. fominii* was recorded in a wooded plantation between Nova Ivanivka and Delen villages in Artsyz raion (Dyatlov, 1985). This location (Nova Ivanivka village area) was later mentioned in a short communication but without precise coordinates (Kovalenko et al., 1987). The density of *C. fominii* between Nova Ivanivka and Delen villages, Artsyz raion was an average of 8.7 ind./m^2. These data were confirmed in early September 1995, when S. Ye. Dyatlov and O. O. Kovtun visited the site and recorded *C. fominii* (Fig. 1). In 1995, vegetative reproduction of *C. fominii* was noted in this population.

Information on the presence of *C. fominii* near Vilne and Rivne villages is also given in a publication by S. G. Kovalenko et al. (Kovalenko et al., 1987). V. I. Melnyk (2010) then mentioned that the species occurs in the surroundings of Maloyaroslavets Druhy village. In a review of the protected species of plants recorded in Odesa oblast, O. M. Popova noted the following localities for *C. fominii* based on a literature review: Delen–Nova Ivanivka, Grebenyky, Kardamycheve, Vilne–Rivne, Maloyaroslavets Druhy (Popova, 2002). The author mentioned later that 12 localities of *C. fominii* exist in Odesa oblast (Popova, 2004).

In May 2007, a locality of the species was confirmed in the surroundings of Kardamycheve village, on the right bank of the Kuchurgan river. The plants were recorded in a thinned plantation of *Juglans regia* L.

Field observations indicated that the maximum density of plants was 25 ind./m^2 (7 generative ind./m^2). The mean density was 14.3 ± 2.3 ind./m^2 (Gnatiuk, 2008 a, b, 2009).

The Red Data Book of Ukraine indicates that the species occurs in the basins of the Kirgizh, Kohylnyk (Cogîlnic), and Kuchurhan rivers, and data about local populations in Nova Ivanivka, Aleny (Delen village is probably meant), Vilne, Grebenyky, and Kardamycheve villages of Odesa oblast are also indicated. The populations are noted as being of a compact diffuse structure or of a group structure, persistent, and the density of plants is more than 20 ind./m^2 (Red..., 2009).

In 2017, a book was published (Onyshchenko, 2017), the aim of which was to identify the Important Plant Areas (IPAs), a network of the best sites for plant conservation in Ukraine using consistent criteria. Two IPAs were identified where the presence of *C. fominii* is a criterion for selection. These are Kuchurgan (Rozdilna raion, Velyka Mykhailivka raion) and Kohylnyk Slopes (Tarutyne raion).

During fieldwork in autumn 2013, E. I. Ivanenko identified the presence of *C. fominii* near the following localities in Odesa oblast: Velyka Mykhailivka raion — Kardamycheve village; Tarutyne raion — Pidhirne, Maloyaroslavets Druhy, and Krasne villages; Artsyz raion — Vesely Kut, Teplytsia, Nova Ivanivka, and Delen villages (Ivanenko, 2014). All known localities of *C. fominii* from the published data and our own investigations are mapped (Fig. 2).

Fig. 1. *Colchicum fominii* in the forest strip between Nova Ivanivka and Delen villages, Artsyz raion, in 1995 (*a, b*) and 2016 (*c, d*): *a* — plants (general view), *b* — mass flowering of *C. fominii* and its researchers O. Kovtun and S. Dyatlov; *c* — flower, *d* — habitat. Photo by O. Kovtun (*a, b*) and O. Dyatlova (*c, d*).

Рис. 1. *Colchicum fominii* у лісосмузі між сс. Нова Іванівка та Делень Арцизького району в 1995 (*a, b*) та 2016 (*c, d*): *a* — загальний вигляд рослин, *b* — масове цвітіння *C. fominii* та його дослідники О. Ковтун та С. Дятлов; *c* — рослина, *d* — місцезростання. Фото О. Ковтуна (*a, b*) та О. Дятлової (*c, d*).

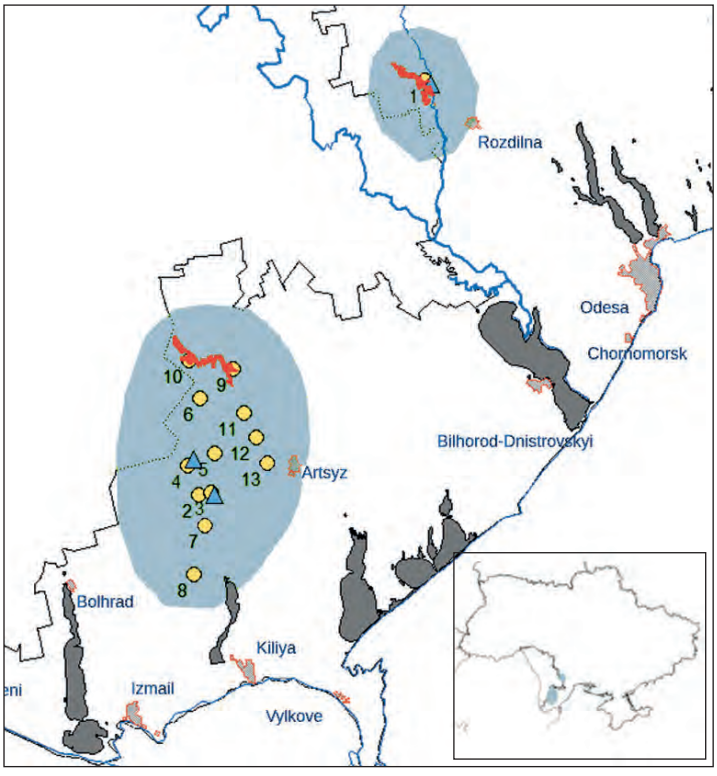

Fig. 2. Localities of *C. fominii* in Odesa oblast. Blue triangles: recent records by authors in 2007 and 2016, yellow dots: records from literature; red areas are the Important Plant Areas where *C. fominii* is a criterion of selection (Onyshchenko, 2017). On the sidebar: map of Ukraine with area *C. fominii* range.

Рис. 2. Локалітети *C. fominii* в Одеській обл. Сині трикутники — підтверджені авторами знахідки у 2007 та 2016 р., жовті точки — знахідки за даними літератури, червоні області — Важливі Ботанічні Території, які визначено на основі знаходження *C. fominii* (Onyshchenko, 2017). На врізці — карта Україні з позначенням регіону поширення *C. fominii*.

The localities of *C. fominii* in Artsyz, Tarutyne, Izmailsky, and Velyka Mykhailivka raions: 1 — Kardamycheve (Velyka Mykhailivka r.); 2 — Nova Ivanivka (Artsyz r.); 3 — between Delen and Nova Ivanivka villages (Artsyz r.); 4 — Vilne (Tarutyne r.); 5 — Rivne (Tarutyne r.); 6 — Maloyaroslavets Druhyy (Tarutyne r.); 7 — Zadunayivka (Artsyz r.); 8 — Kyrnychky (Izmailsky r.); 9 — Berezyne (Tarutyne r.); 10 — Pidhirne (Tarutyne r.); 11 — Krasne (Tarutyne r.); 12 — Veselyy Kut (Artsyz r.); 13 — Teplytsya (Artsyz r.).

In September 2016, we visited the localities in Artsyz, Tarutyne, and Velyka Mykhailivka raions:

1) Surroundings of Grebenyky village, Velyka Mykhailivka raion, near Grebenyky geological nature monument of local importance. *C. fominii* was not recorded in 2016 (3.09.2016). Nor was it found at this location in 2007.
2) Between Nova Ivanivka and Delen villages, Artsyz raion, in a thinned forest plantation (Fig. 1 *c, d*). The species occurred sporadically at this locality: 1 generative individual per 20 m^2 (17.09.2016).
3) The surroundings of Vilne village, Tarutyne raion. Single records (17.09.2016).
4) In the surroundings of Rivne village, Tarutyne raion, the species was not found. *Stipa capillata* was recorded among other rare species (17.09.2016).

The current locations with *C. fominii* in Ukraine are situated near the following villages: Kardamycheve, Grebenyky, Nova Ivanivka, Delen, Vilne, Rivne, Maloyaroslavets Druhy, Zadunayivka, Kyrnychky, Berezyne, Pidhirne, Krasne, Vesely Kut, Teplytsya. Grebenyky and Kardamycheve is probably one locality, situated "near Grebenyky, on a steep slope in the Kuchurhan river valley near Kardamycheve," as described in the "Flora of the UkrSSR" (Bordzilovsky, 1950).

Controlled cattle grazing might improve conditions for *C. fominii* by maintaining an open sward.

According to long-term hydrometeorological data, the north-western part of the Black Sea coast shows a tendency towards increased average annual air temperature, especially in the summer (Voloshkevich et al., 2013). The flowering of *C. fominii* lasts from August to September at high daytime temperature (often in excess of 30° C). Observations of populations of *C. fominii* in the wild show that the number of generative individuals appears to be gradually decreasing. The reduction in number of generative individuals has a negative influence on population viability as fewer seeds are set for the following year, leading to further decreases.

We suggest that several factors could be detrimental to the existence of populations of *C. fominii*, such as ploughing, deforestation and climate change.

The high temperatures during flowering probably have a negative influence on populations. Significant causes of habitat degradation in this case may include ploughing of grasslands and tree felling within plantations. To save this unique plant species in its natural habitat, detailed investigations of all known sites in Ukraine are needed, particularly of the age and spatial structure of populations, population dynamics, and the biological and ecological characteristics of the species in order to inform the optimal protection of the species at these locations.

The creation of protected areas at these locations will help to save the species in the wild. In particular, to save two populations of *C. fominii* at the forest plantation between Nova Ivanivka and Delen villages, Artsyz raion and in the surroundings of Kardamycheve village, Velyka Mykhailivka raion, botanical reserves of local importance should be created. We also suggest including these two sites into the Emerald Network.

Conclusions

1) According to the literature and our personal field observations, *C. fominii* is reliably recorded only in Odesa oblast, Ukraine in a total of 12 localities (in Artsyz, Tarutyne, Izmail, and Velyka Mykhailivka raions).
2) According to our investigations in 1982 and 2016, a significant decrease in the number of generative plants occurred in the population in Artsyz raion (between Nova Ivanivka and Delen villages). In 1982, the density of plants was an average of 8.7 ind./m^2, whereas in 2016 it was only 1 ind./ 20 m^2.
3) In order to protect the two isolated populations, the existence of which was confirmed in 2007 and 2016, the creation of botanical reserves of local importance in Artsyz and Velyka Mykhailivka raions of Odesa oblast is proposed.

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