



Aconitum lasiocarpum and *A. variegatum* (Ranunculaceae) populations near the eastern limits of their ranges in the lowlands of Ukraine

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Article info

Received 28.01.2023

Received in revised form 20.02.2023

Accepted 21.02.2023

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Introduction

Development of the scientific basis of the protection of floristic diversity is a relevant task of ecological surveys at the current stage. Special attention should be drawn to rare and threatened species of plants of the natural floras. Providing protection to them is possible based on integrated in detail studies of geographic distribution, habitats and modern state of populations (Melnyk et al., 2021). In the conditions of intense anthropogenic pressure on ecosystems, an urgent task, according to the Global Strategy of Plant Conservation, is monitoring the state of populations of endemic, relic and rare species, the ranges of which are represented by a low number of small populations (Williams et al., 2020; Holz et al., 2022). Special attention in phytosociological aspect should be paid to the studies of spatial and age structures of populations of rare and extinct species of natural floras (Ang & Song, 2022; Chen & Sun, 2022).

The scientific background for floristic diversity conservation is a relevant problem of botanical investigation. The rare and endangered species of natural floras need special attention. Providing their conservation is possible when based on a comprehensive study of geographical distribution, habitats and current state of populations. According to the Global Strategy

Melnyk, V. I., Baransky, O. R., Batochenko, V. M., Volodymyrets, V. O., Dovhopola, L. I., & Melnychenko, N. V. (2023). *Aconitum lasiocarpum* and *A. variegatum* (Ranunculaceae) populations near the eastern limits of their ranges in the lowlands of Ukraine. *Biosystems Diversity*, 31(1), 28–33. doi:10.15421/012304

The study of the ranges, habitats and current state of rare and threatened species of plants is a relevant task of ecological research. The paper presents the results of the study of habitats and current state of populations of two rare species of Ukrainian flora *Aconitum lasiocarpum* (Rchb.) Gáyer and *A. variegatum* L. (Ranunculaceae) in the lowlands of Ukraine. These species are members of the mountain element of the flora of lowlands of Ukraine and glacial relics, which descended from the Carpathians Mountains to the lowlands of Ukraine during glaciation. *Aconitum lasiocarpum* is a rare species of European flora, included to the Red Data Books of the Czech Republic and Slovakia, Poland and Ukraine. Unlike the well studied *A. lasiocarpum* populations in the main part of the range in the Carpathian Mountains, local populations of this species near the eastern limit of the range in the lowlands of Ukraine remain undescribed. In these exclaves of the range in the lowlands of Ukraine *A. lasiocarpum* is a glacial relic. Here it grows in alder forests *Ribo nigri-Alnetum* ordo *Alnion glutinosa* alliance. Lowland *A. lasiocarpum* populations consist of 1000–10000 adults with a significant number of young individuals. In the past lowland *A. lasiocarpum* populations occupied a much large area. Deforestation and drainage melioration led to reduction of the populations. Taking into account the low number of glacial relic populations at the eastern limit of the range of *A. lasiocarpum*, all localities of this species in the lowland part of the range in Ukraine must be taken under protection *in situ*. *Aconitum variegatum* L. grows in wet alder and oak forest and in areas with hazel shrubs. The populations of this species in lowlands of Ukraine occupy a very small area and are characterized by low numbers of individuals. In the past populations of this species in the lowlands of Ukraine occupied a larger area. As a rare species of the Ukrainian flora *A. variegatum* deserves to be included to the Red Data Book of Ukraine. We propose to protect the unique population of *A. variegatum* near Susk village in Rivne region as a botanical reserve.

Keywords: flora; systematic position; communities; glacial relic; mountain element; exclave; rare and endangered species; habitat; population; protection.

of Plant Conservation, it is necessary to prioritize the monitoring and conservation of endemic, relic, rare and endangered species, the ranges of which are represented by low numbers of small populations. *Aconitum lasiocarpum* (Rchb.) Gáyer and *A. variegatum* L. (Ranunculaceae) belongs to such species. *Aconitum lasiocarpum* is a rare species of the European flora included in the Red Data Books of the Czech Republic, Slovakia, Poland, Ukraine and the Polish Carpathians, in the IUCN Red List, Appendix II of the Bern Convention (Mitka, 2001, 2008; Melnyk & Batochenko, 2009; Novikov & Mitka, 2019). *Aconitum lasiocarpum*. The IUCN Red List of Threatened Species 2019:e.T129089723A129089823. <http://doi.org/10.2305/IUCN.UK.2019-1.RLTS.T129089723A129089823.en>. *Aconitum variegatum* is not included in Red Data Books, so far as it is widespread in the Central European mountains. However, near the eastern limit of its range in the lowlands of Ukraine it is as rare as *A. lasiocarpum* and deserves to be included in the Red Data Books of Ukraine.

Unlike the well studied *A. lasiocarpum* and *A. variegatum* populations in the Carpathian Mountains (Mitka, 2003; Novikov & Mitka, 2011, 2021; Mitka et al., 2021), the lowland populations near the eastern limits of the range remain undescribed in the scientific literature. The aim of this study is to describe the geographical distribution and habitats of *A. lasio-*

carpum and *A. variegatum* near the eastern limits of their range in the lowlands of Ukraine.

Materials and methods

The objects of our research were local populations of *A. lasiocarpum* and *A. variegatum* near the eastern limit of their range in the lowlands of Ukraine. The study was based on the materials of a field survey performed in 2000–2022 in Lviv, Volhyn and Rivne regions. Phytocoenological descriptions of the habitats and investigation of the populations conducted according to established methods (Rabotnov, 1983).

Analysis of geographical distribution and habitats of *A. lasiocarpum* and *A. variegatum* in Ukraine was carried out based on our expeditionary researches, literary and herbarium data, details of modern online resources Ukrainian biology materials of herbariums of the National Academy of Sciences (NAS) of Ukraine M. G. Kholodny Institute of Botany (KW), M. M. Gryshko National Botanical Garden of the NAS of Ukraine (KWH), Taras Shevchenko National University of Kyiv (KWU), Ivan Franko National University of Lviv (LW), National Museum of Natural History of the NAS of Ukraine in Lviv (LWS). Databases UkrBin and BGIF were also used.

Results

***A. lasiocarpum* (Rchb.) Gáyer.** Before our investigation *A. lasiocarpum* was known only from the Carpathian Mountains. We found two localities of this species for the first time in the lowlands in Ukraine. The first of them is situated in Male Polissia (Lower Polissia), the second is situated in the Podolian Upland (Fig. 1).

In Male Polissia *A. lasiocarpum* grows in the Ostroh Valley in the south of Rivne region. This narrow valley is the territory of greatest convergence (2–8 km) between the Volhynian and Podolian Uplands and the place of connection of Male Polissia with the main part of the Polesian lowland. The Ostroh Valley is a unique landscape ecotone, where a narrow strip of the Polesian landscapes, characteristic of the zone of mixed and deciduous forests in the bottom of the valley is surrounded by landscapes, characteristic of the forest steppe zone on the slopes of the valley. The large variety of ecological conditions has caused considerable diversity of vegetation. There is a full spectrum of trees typical for the lowlands of Ukraine: oak, hornbeam – oak, pine, ash and alder forest communities and, rare for this region, spruce, sessile oak and beech forests. Unique carbonate bog ecosystems are preserved in the bottom of the Ostroh Valley. Bushchanske Bog is the largest and richest in floristic diversity.



Fig. 1. Distribution of *A. lasiocarpum* in Ukraine (Melyk & Batochenko, 2009)

35 plant species of the Ostroh valley are included in the Red Data Book of Ukraine.

Here *A. lasiocarpum* (Fig. 3) grows in alder forest *Ribo nigri-Alnetum* ordo *Alnion glutinosa* alliance in the flood plain of the Zbitynka (Svitenska) River in Lubomyrske and Mostivske forestries in the vicinity of Klipec village, Dubno district and Mosty village, Zdolbunive district, Rivne region and occupied an area of nearly 300 ha. The soil is peaty-gley. The fo-

rest stand is formed by *Alnus glutinosa* (L.) Gaerth., with insignificant participation of *Betula pubescens* Ehrh., *Fraxinus excelsior* L., *Picea abies* (L.) Karst., *Pinus sylvestris* L., *Sorbus aucuparia* L. Sparse undergrowth consists of *Daphne mezereum* L., *Frangula alnus* L., *Etionymus europaeae* L., *Padus avium* Mill., *Ribes nigrum* L., *Sambucus nigra* L., *Sambucus racemosa* L., *Viburnum opulus* L. The grass-shrub layer is rich and diverse. Ferns *Dryopteris austriaca* (L.) A. Gray., *Dryopteris filix-mas* (L.) Shott and sedges *Carex appropinquata* Shum., *Carex inflata* Huds., *Carex riparia* Curt., *C. vesicaria* Minsh are an important component of this layer, *Oxalis acetosella* L., *Trientalis europaea* L., *Oxycoccus palustris* Pers., *Vaccinium uliginosum* L., grow on the bumps, *Calla palustris* Pers., *Comarum palustre* L., *Glyceria maxima* (Hirtm.) Hombe., *Glyceria fluitans* (L.) R. Br., *Naumburgia thyrsiflora* (L.) Reichenb. grow among the bumps in flooded depressions. *Ajuga reptans* L., *Equisetum hyemale* L., *Eupatorium cannabinum* L., *Geum rivale* L., *Lysimachia nummularia* L., *Lycopus europaeus* L., *Laserpidium latifolium* L., *Mercularia perennis* L., *Paris quadrifolia* L., *Sanguisorba officinalis* L., *Solanum dulcamara* L., *Veratrum lobelianum* Bernh grow on the ground. Some rare species of Ukrainian flora included in Red Data Book of Ukraine are *Cypripedium calceolus* L., *Dactylorhiza incarnata* (L.) Soó, *D. fuchsia* (Druce) Soó, *D. maculata* (L.) Soó, *D. majalis* (Rchb.) P. F. Thunt et Summerhajer, *Epipactis helleborine* (L.) Granz, *Huperzia selago* (L.) Bernh. ex Schrank et Mart., *Iris sibirica* L., *Ligularia sibirica* Cass., *Listera ovata* (L.) R. Br. and rare species for the lowlands of Ukraine *Aconitum lasiostomum* Rchb. ex Besser, *Astrantia major* L., *Geranium phaeum* L., *Equisetum telmateia* Ehrh., *Matteuccia struthiopteris* (L.) Fadaró also grow here together with *A. lasiocarpum*.



Fig. 2. Juvenile plants of *A. lasiocarpum*

Population size of *A. lasiocarpum* is near 10,000 adults. There is also a significant amount of young individuals (Fig. 2). In the past this population occupied a much larger area. This is evidenced by finds of some single plants of *A. lasiocarpum* for 5–10 km from the local population. Obviously, deforestation and drainage melioration led to reduction of the area of the population.

The second habitat of *A. lasiocarpum* in the lowlands of Ukraine is located upriver in the Western Bug valley (Koltiv hollow) in the Voronjaky massif of the Podolian upland in the vicinity of Sasiv, Kolhiv, Krugiv, Opaky, Verchobuzh villages, Zolochiv district, Lviv region. Landscape ecosystems and plant cover of this habitat of *A. lasiocarpum* are very similar to its habitat in the Ostroh Valley. Plant communities of *Pineto-Quercetum Caricosum (brisoideis)*, *Carpineto-Quercetum caricosum (brisoideis)*, *Carpineto-Querceto-Alnetum (glutinosae) asarosum* represent forest vegetation on the slopes of the hollow. Regional rare species of the Podolian Upland *A. lasiostromum* Rchb. ex Besser, *Astrantia major* L., *Geranium phaeum* L., *Equisetum telmateia* Ehrh., *Matteuccia struthiopteris* (L.). Tod are components of these forest communities. In the bottom of the hollow carbonate bogs have been preserved with unique

plant species included in the Red Data Book of Ukraine. *Carex davaliana* Swith., *Cladium mariscus* (L.) Pohl., *Dactylorhiza fuchsia*, *D. incarnata*, *D. majalis*, *Epipactis helleborine* (L.) Crantz, *E. palustris* (L.) Crantz, *Listera ovata* (L.) R. Br., *Pinguicula vulgaris* L., *Svertia palustris*, *Schoenus ferrugineus* L., *Tofieldia calyculata* (L.) Wahlenb. and a dune landscape ecosystem with rare species included in the Red Data Book of Ukraine *Carlina cirsoides* Klok., *Dracocephalum ruyshiana* L., *Gladiolus imbricatus* L., *Iris sibirica* L.



Fig. 3. *A. lasiocarpum* in the Ostroh Valley

The habitat of *A. lasiocarpum* in Koltiv hollow is the alder forest *Ribo-nigri-Alnetum* ordo *Alnion glutinosa* alliance in the floodplain of the bottom of the Koltiv hollow. Fragments of these forests of different ages occur within the hollow. The soil is peaty-gley.

The forest stand is formed by *Alnus glutinosa* with insignificant participation of *Acer platanoides* L., *Carpinus betulus* L., *Cerasus avium* (L.) Moench, *Fraxinus excelsior*, *Quercus robur*.

Sparse undergrowth consists of *Daphne mezereum* L., *Corylus avellana* L., *Rhamnus cathartica* L., *Ribes nigrum* L., *Rubus nessesensis* W. Hall. The grass layer is formed by *Aegopodium podagraria*, *Anemone nemorosa* L., *Anemone ranunculoides* L., *Asarum europaeum* L., *Caltha palustris* L., *Gagea lutea* (L.) Ker.-Gawl., *Galeobdolon luteum* L., *Isopyrum thalictroides* L., *Juncus effusum* L., *Lathraea squamaria* L., *Mercurialis perennis* L., *Molinia caerulea* (L.) Moench, *Pulmonaria obscura* Dumort., *Ranunculus cashubicus* L. and rare species included in the Red Data Book of Ukraine, *Allium ursinum* L., *Leucojum vernum* L. and rare species for flora of the lowlands of Ukraine *Aposeris foetida* (L.) Less., *Dentaria glandulosa* Waldst. & Kit. and *Primula elatior* (L.) Hill.

Population loci of *A. lasiocarpum* are fixed here in alder forests in the vicinity of Koltiv, Sasiv, Verchobuz villages. The population size is more than 1,000 adults with significant participation of young individuals.

Obviously, in the past this population occupied a much larger area. Deforestation and drainage melioration led to fragmentation of the population to separate loci.

***A. variegatum* L.** In the lowlands of Ukraine *A. variegatum* is known from Podolian, Volhynian and Roztochya Uplands and the Polesian Lowland.

In the Podolian Upland *A. variegatum* was recorded in Lviv region: in the vicinity of Derevach village Pustomyty district – LWS (collector Blocki, 1912); in Ternopil region: in the vicinity of Ratych village Zboriv district – LWS (coll. Lobarzewski, 1858); Zbarazh forestry, near village Rohovets – KW (coll. Hryn, 1940); in the vicinity of Roztoky village Kremets'kyi district – KWH (coll. Batochenko, 2009); Khmelnytskyi region: Kamianets-Podilskyi district, Tsybulivka village, forest near

stream – KWH (coll. Moroz, 1967); Vinnytsia region: near Murovani Kurylivci town – KW (coll. Montresor, 1888).

In the Volhynian Upland *A. variegatum* was recorded in the XIX century: Volhynian region, Lutsk district, Horokhiv town – KW (coll. Montresor, 1890); Lviv region, Sokalskyi district, Potorytsya village – LWS (coll. Dzieduszycki, 1897; col. Shauer, 1975); Rivne region: Dubno district, vicinity of Ptycha village – KW (coll. Pachoskii, 1897); Rivne district, Bila Krynytsya village (coll. Pachoskii, 1897), Ostroh town KW (coll. Shmalgauzen, 1895), Ostroh district, in the vicinity of Ozhenyn village KW (coll. Shmalgauzen, 1897).

Three localities were found with *A. variegatum* in Roztochchia Upland in Lviv region: in the vicinity of Lviv city – LWS (coll. Turczynski, 1880), in the vicinity of Nagoriany village near Lviv city – LWS (coll. Lobarzewski, 1875), near Yaniv town in Yavoriv's'kyi district – LWS (coll. Król, 1874; col. Blocki, 1910).

In the Polesian Lowland *A. variegatum* was recorded mainly in Male Polissia in Lviv region. It was found in the vicinity of Peniaky village Zolochin district – LWS (coll. Dzieduszycki, 1857), between Brody town and Stanislavchik village – LWS (coll. Lobarzewski, 1858), near Jasna forestry near Brody town LW (coll. Motyka, 1947); in the vicinity of Zhulychi village in Zolochiv district – UkrBin (coll. Jurichko, 2018), in Suchodilskyi Forest in the vicinity of Ponykovytsya village in Zolochiv district – KWH (coll. Schelest, 1957), Sokal district in the vicinity of Kariv village in oak – alder forest – LWS (coll. Kuziarin, 1959). In Rivne region localities of *A. variegatum* were found in Dubno district in the vicinity of Maidan village – LW, KWH (col. Volodymyrets, 1992; col. Batochenko & Melnyk, 1994). In Khmelnytskyi region *A. variegatum* was recorded in Netishyn village, Slavuta district, in alder forest – KW (coll. Diduch, 2009). In Zhytomyr Polissia *A. variegatum* was found only in Zhytomyr region, Zhytomyr district, in the vicinity of Ivnytsya village – KW (coll. Pachoskii, 1897).

Two localities with *A. variegatum* was recorded in Volhynian Polissia, confirmed by herbarium and literary data: 3 km to the east of Kovel town in alder forest and 1.2 km to the west of Kivertsi town near the motorway Kovel-Manevychi in alder forest – KWH, KW (coll. Romanuk, 1980; coll. Marchenko, 1987).

We found two new localities for *A. variegatum* in Volhynian Polissia. In Mokretske forestry, 1 km to the south-east of Zamosty village in Volodymyr district, Volhynian region and in the north vicinity of Susk village, Derazhne community of Rivne district (former Kostopil district), Rivne region.

In a new site in Volhynian region *A. variegatum* grows in old oak forest on the slope of first floodplain terrace on the left bank of Turia River. This oak forest is located among the pine forest on the terrace and birch-alder forest in the floodplain of the river. The tree stand is represented by old *Quercus robur* L. in I layer and *Carpinus betulus* L. and *Pinus sylvestris* L. in II layer. Shrub layer is represented by *Corylus avellana* L. and *Euonymus europaeum* L. The herb layer is open. Its projective cover is 40%. It is formed by *Anemone nemorosa* L., *A. ranunculoides* L., *Arunco dioicus* (Walt.) Fern., *Asarum europaeum* L., *Betonica officinalis* L., *Cruciata glabra* (L.) Opiz, *Dryopteris carthusiana* (Vill.) H. P. Fuchs, *Gagea lutea* (L.) Ker Gawl., *Hepatica nobilis* Mill., *Isopyrum thalictroides* L., *Lathyrus vernus* (L.) Bernh., *Luzula pilosa* (L.) Willd., *Melica nutans* L., *Poa nemoralis* L., *Pulmonaria obscura* Dumort., *Ranunculus auricomus* L., *Viola mirabilis* L.

A small population of *A. variegatum* occupied an area of 70 m² and consists of 6 generative and 3 juvenile plants.

There is a population of *A. variegatum* in the north vicinity of Susk village, Derazhne community of Rivne district (Fig. 4). Habitat of *A. variegatum* is limited to right I floodplain terrace cusp of the Horyn River. A feature of the geological structure of this area is the presence of powerful chalk deposits. It is overlapped by insignificant glacial sediments. The soil is rendzina.

The vegetation is represented by shrub chiefly formed by *Corylus avellana* L. (Fig. 5) with single individuals of *Euonymus verrucosus* Scop., and *Prunus padus* L. *Corylus avellana* L. shrubs are well developed, reaching a height of 5 m. Among the shrubs there are single trees of *Tilia cordata* Mill., *Ulmus laevis* Pall. The herb layer is open. Projective cover is 40%. It is formed by *Aegopodium podagraria* L.,

Asarum europaeum L., *Campanula trachelium* L., *Circaea lutetiana* L., *Clinopodium vulgare* L., *Eupatorium cannabinum* L., *Primula veris* L., *Rubus saxatilis* L., *Sanicula europaea* L., *Viola mirabilis* L., *Viola odorata* L. Two species of *Aconitum* (*A. lasiostomum* Rchb. ex Besser and *A. variegatum* L.) are dominants of plant cover of this terrace cusp: the first on the lower part of the slope; the second on the upper part of the slope.



Fig. 4. *A. variegatum* in the Horyn river basin near Susk village (Rivne region)



Fig. 5. Hazel shrubs – habitat of *A. variegatum* in Polesian Lowland (Rivne region)

This *A. variegatum* population has the appearance of a narrow ribbon 1000×20 m² and consists of nearly 1,000 individuals.

The coordinates of the new localities of both species and some population indicators are given in Table 1.

Table 1
New localities of *A. lasiocarpum* and *A. variegatum* in Ukraine

Localities	Latitude	Longitude	Coe-nosis	Square, m ²	Number of plants
<i>A. lasiocarpum</i>					
Vicinity of Klipets – Mosty village, Rivne region	50.287293	26.116650	alder forest	100 000	~10 000
Vicinity of Koltiv, Sasiv, Verchobuzh villages, Lviv region	49.853843	25.077782	alder forest	100 000	~1000
<i>A. variegatum</i>					
Vicinity of Susk village, Rivne region	50.805711	26.137234	hazel shrubs	20 000	~1000
Vicinity of Zamosty village, Volhyn region	50.973653	24.344423	oak-pine forest	70	9

Discussion

Aconitum lasiocarpum (Rchb.) Gáyer. was considered as an endemic of the flora of the Carpathian Mountains (Kmeťová & Feráková, 1999). However, in a more detailed study of its geographical distribution it was found that the range of this species covers not only the Carpathian Mountains, but also the surrounding lowlands in Ukraine (Mitka, 2003; Melnyk et al., 2009).

Endemic to the Carpathian Mountains is only *A. lasiocarpum lasiocarpum*. Another subspecies *A. lasiocarpum kotulae* (Pavl.) Starmühl is a plains – mountain subspecies (Mitka, 2003).

The main part of the range of *A. lasiocarpum* was the Western and Eastern Carpathians. In the Southern Carpathians only one locality was recorded, in Christian Mt near Brasov town in Romania. In the Western Carpathians it grows in the Tatra Mountains, in the Western and Low Beskids (Slovakia, Poland). In the Eastern Carpathians *A. lasiocarpum* grows in the Vihorlat Mountains (Slovakia), in the Western Bieszczady, Sanok-Turka Mountains, Przemysl Foothills (Poland), in Maramares and Rodna Mountains (Romania) in the Eastern Beskids, Chyvychny, Chornogora, Gorgany, Svydovets, Marmurosh Mountains and Low Polonyna (Ukraine). There are near 40 localities of *A. lasiocarpum* in the Ukrainian Carpathians (Mitka, 2003; Novikov, 2011; Wolanin, 2012).

Two lowland exclaves of *A. lasiocarpum*, hundreds of kilometers away from the main part of the range in Carpathians Mountains are described in detail in a previous section of this article.

Aconitum lasiocarpum is a mountain element of lowlands flora in the sense of Szafer (1930), who means by this species of plants with the main part of their range in the Carpathian Mountains and exclaves in the lowlands in western Ukraine. He assigns 118 species of this element (for example, *A. variegatum* L., *Abies alba* Mill., *Aposeris foetida* (L.) Less., *Crocus heuffelianus* Herb., *Helleborus purpurascens* Waldst. & Kit., *Lathyrus laevigatus* (Waldst. et Kit.) Fritsch, *Leucocjum vernum* L., *Primula vulgaris* Huds.). Szafer (1930) indicated a migratory origin of lowland populations of these species from the Carpathian Mountains during glaciations and refers it to glacial relics (Szafer, 1930).

Barbarych (1966), Kahalo (1990), Melnyk (2002) indicated the centers of preservation of glacial relics in the Western Bug and Stry valleys upstream and in the Ostroh Valley, where *A. lasiocarpum* grows.

So far, phytogeographical data has shown that *A. lasiocarpum* is a typical member of the mountain element of the lowland flora of Ukraine and a glacial relic.

As unique enclaves of the range of *A. lasiocarpum* near the eastern limit of its range, the two lowland populations of *A. lasiocarpum* need protection. It must be included in the nearby National Natural parks Pivniczne Podilla in Lviv region and Derman-Ostroh in Rivne region.

Aconitum variegatum L. is a Central European, mainly mountain species. Its range covers the Pyrenees, Alps, Balkans, Sudetes, Carpathian Mountains and adjacent lowlands in Poland and Ukraine. In Poland the

mountain part of the range includes the Sudetes and Western and Eastern Carpathians. There are lowland exclaves in Malopolska and the Lublin Highlands. According to Szafer (1930) and Zajac (1996) *A. variegatum* is a representative of the mountain element of Polish lowland flora, which descended from the mountains to the lowlands during glaciation and is a glacial relic.

Like *A. lasiocarpum*, *A. variegatum* is represented in Ukraine by two subspecies. The mountain subspecies *A. variegatum nasutum* (Fischer ex Rchb.) Götz. grows in the Carpathians and the plain-mountain subspecies *A. variegatum variegatum*, grows mainly in the lowlands of Western Ukraine (Novikov, 2022). Genus *Aconitum* of the Ukrainian Carpathians and adjacent territories. Version 1.5. Ukrainian Nature Conservation Group (NGO). Occurrence dataset <https://doi.org/10.15468/n37j8x>; BGIF,

2023). Novikov (<https://doi.org/10.15468/n37j8x>) remarked that there is only one Carpathian locality of *A. variegatum variegatum*, which is confirmed by herbarium specimen from vicinity of Vorohta town – LW (Woloschak, 1888), other localities belong to *A. variegatum nasutum*.

According to the schematic map of *A. variegatum* distribution in Ukraine in Ecoflora of Ukraine (Didukh et al., 2004), only 9 localities are given: 4 for the Ukrainian Carpathians and 5 for the lowlands. From the commencement of floristic investigation to our days in the lowlands of Ukraine 40 localities were recorded for *A. variegatum*, including the Ukrainian Carpathians 9 localities, Roztochchia 3 localities, Podolian Upland 11 localities, Male Polissia 5 localities, Volhynian Upland 7 localities, Volhynian Polissia 4 localities and Zhytomyr Polissia 1. The list of localities is given in a previous section and shown on the schematic map (Fig. 6).

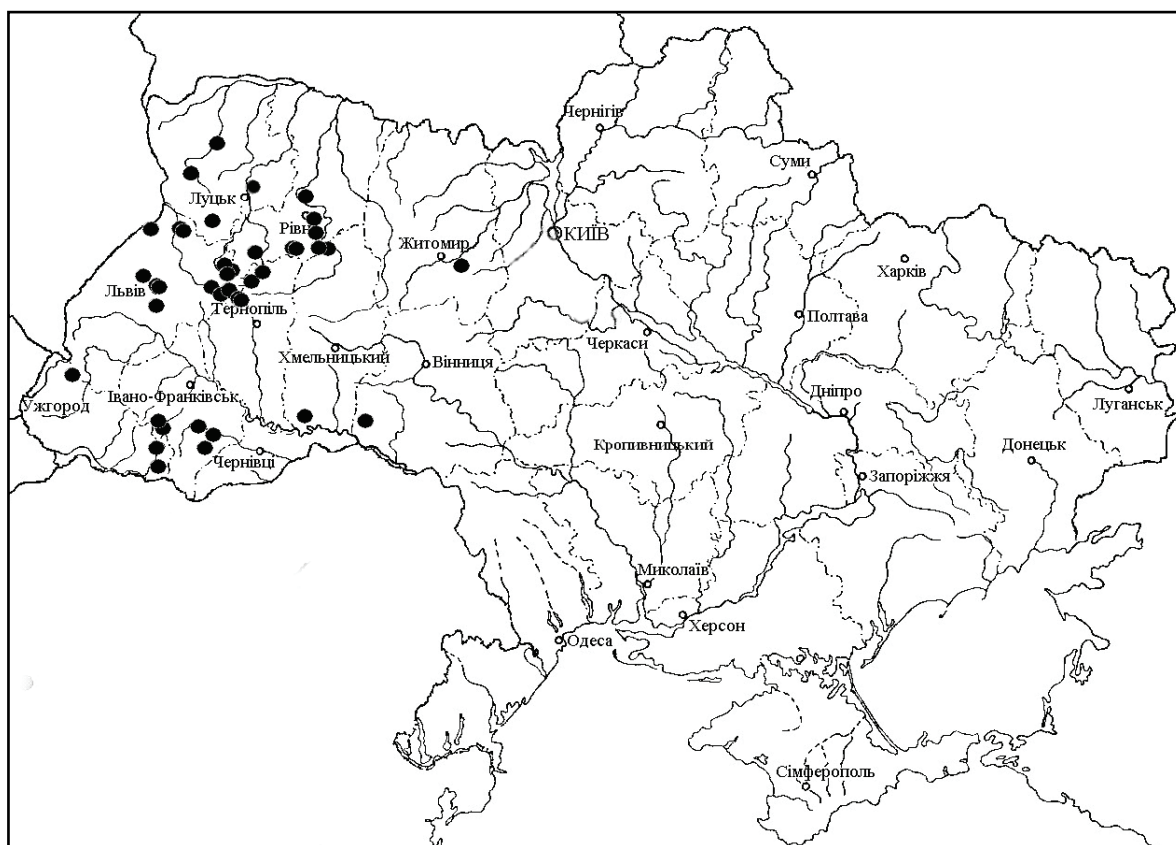


Fig. 6. Distribution of *A. variegatum* in Ukraine

Like *A. lasiocarpum*, *A. variegatum* is a representative of the mountain element of Ukrainian lowlands flora and a glacial relic, which “descended” from the Carpathian Mountains to adjoining lowland territories (Szafer, 1930). Unlike *A. lasiocarpum*, *A. variegatum* migrated from the Carpathians across Molopolska and Lublin Highlands to the Volhynian-Podolian Upland, Roztochchia and Polesian Lowland. As a rare and endangered species, glacial relic of Ukrainian flora, recorded only in 40 localities in Ukraine, *A. variegatum* deserves to be included in the Red Data Book. Every population of this species in our country deserves protection.

Marchenko et al. (1992), propose to protect populations of *A. variegatum* in the Volhynian region. We have developed a scientific rationale for organization of a botanical reserve for protection of the population of *A. variegatum* in the vicinity of Susk village in Rivne region.

Conclusions

Aconitum lasiocarpum (Rchb.) Gayer, and *A. variegatum* L. (Ranunculaceae) are rare and endangered species of Ukrainian flora. Their ranges occupy mainly the mountains of Central Europe with enclaves in the lowlands of Ukraine near the eastern limits of their ranges. These species are members of the mountain element of lowland flora of Ukraine and glacial relics, which “descended” from the Carpathian Mountains to the

lowlands of Ukraine during glaciation. Near the eastern limits of their ranges in the lowlands of Ukraine *A. lasiocarpum* and *A. variegatum* grow in wet alder forest (*A. lasiocarpum*) and in alder, oak forests and hazel shrubs (*A. variegatum*).

Populations of *A. lasiocarpum* and *A. variegatum*, preserved in the lowlands of Ukraine, are very small and characterized by low numbers of individuals. In the past, lowland populations of these species occupied a much larger area. Deforestation and drainage melioration led to reduction of populations.

As a rare and endangered species of Ukrainian flora *A. lasiocarpum* is included in the Red Data Book of Ukraine (2009). *Aconitum variegatum* in Ukraine is as rare as *A. lasiocarpum* and deserves to be included into the Red Data Book of Ukraine.

Local populations of *A. lasiocarpum* and *A. variegatum* preserved in the lowlands of Ukraine need protection. Both lowland populations of *A. lasiocarpum* must be included in nearby Natural National Parks “Pivniczne Podilla” in Lviv region and “Dermansko-Ostrojskij” in Rivne region. We have developed a scientific rationale for protection of *A. variegatum* in the vicinity of Susk village in Rivne region.

The authors would like to express their gratitude to Dr. Josef Mitka for his monograph on the genus *Aconitum* and for the unique opportunity for discussion about the

problem of investigating *Aconitum* species and keeper of the Department of Botany of Ivan Franko National University of Lviv Dr. Vitaly Goncharenko for his assistance.

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