Endemic vascular plants in the Ukrainian Carpathians

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Abstract

Background

This dynamic dataset aims to gather all available data, extracted mostly from the preserved material deposited at the leading Ukrainian herbaria on the distribution of the endemic vascular plants in the Ukrainian Carpathians and adjacent territories. This dataset is created in the framework of mapping the distribution of the endemic plants and is aimed to unveil the patterns of their spatial distribution, ecological preferences and temporal trends in the flora of the Ukrainian Carpathians. A total of 76 species and subspecies of vascular plants belonging to 49 genera and 27 families are reported herein to occur in the Ukrainian Carpathians and close regions. Amongst the total number of reported 6,427 occurrence records, 1,961 records are georeferenced and supported with a translation of Cyrillic information into English. The remaining occurrence records will be georeferenced and translated into English in the near future, as well as the dataset being completed with new records obtained from the new sources.

New information

In total, 6,427 occurrence records of the endemic vascular plants distributed in the Ukrainian Carpathians were published.

Keywords

occurrence, herbarium material, chorology, mountain flora

Introduction

For years, the data about plant diversity in Ukraine were mostly published in Cyrillic languages (mostly Ukrainian and Russian) in local journals that are hard to find and read for foreign researchers. Simultaneously, most of the collected plant materials are deposited in the local Ukrainian herbaria that are complicated to access for different reasons (Novikov 2019). In 2020-2021, amongst the challenges for researchers working with herbarium collections globally were travel limitations caused by the pandemic situation (Baker 2020, Baldini 2020). However, in 2022, the war with Russia made natural history collections and herbaria, in particular, in Ukraine unavailable and catastrophically increased the risk of their damage and loss. The loss of specimens of Red-listed and endemic plant taxa deposited in the Ukrainian herbaria will be irreparable because some of them are already extinct in the flora of Ukraine and some were collected only occasionally many years before. The loss of such specimens can also corrupt the data on changes in the spatial distribution patterns of these taxa. Therefore, the actuality of databasing and digitisation of the Ukrainian herbaria and related information appears a crucial modern task providing a number of benefits for scientists worldwide, including fast and easy access, translation from local languages into English, long-term virtual preservation of specimens, crosslinking of specimens and collectors data etc. (Holovachov et al. 2014, Cantrill 2018, Hedrick et al. 2020).

The Ukrainian Carpathians Mts. represent one of the leading centres of biodiversity in Ukraine, with numerous endemic, rare and relict plant species. In particular, there occur 2532 species of vascular plants, which comprise near 49% of the entire flora of Ukraine (Mosyakin and Fedoronchuk 1999, Chopyk and Fedoronchuk 2015). Of this number, about 70 plant species and infraspecific taxa are endemic (Novikoff and Hurdu 2015) and 207 are listed in the Red Book of Ukraine (Didukh 2009, Didukh 2010). Taking into account the extreme value of the endemic plants for biodiversity investigations (see Casazza et al. 2008, Cañadas et al. 2014, Harrison and Noss 2017 for examples), the main aim of the current dataset was to provide free and open access to the data on distribution of the endemic vascular plants in the Ukrainian Carpathians.

The compilation of this dataset began in 2015. Since then, it has been continuously updated, based on the elaboration of new collections and publications, providing georeferenced and translated data from the verbatim herbarium labels and occurrences' reports.

General description

Purpose: The purpose of creating an online publication of this dataset is to secure the future of the Ukrainian collections and related data on endemic vascular plants distributed in the Ukrainian Carpathians. Making this dataset freely accessible and digitally available through GBIF ensures its virtual preservation and survival in case of the

involved collections' loss or damage. Moreover, this also pursues wider application of biodiversity data from Ukraine in international research projects, allowing the white spots on the world map to be covered.

Sampling methods

Description: The dataset contains information on 6,427 occurrences of endemic vascular plants from the Ukrainian Carpathians and some adjacent Ukrainian territories (Novikov and Sup-Novikova 2022).

Sampling description: Initially, 70 endemic and subendemic (i.e. mainly distributed in the Carpathian Mts., although with few occurrences outside their limits – Kliment et al. 2016, Mráz et al. 2016) species and subspecies of vascular plants were selected for the analysis (Novikoff and Hurdu 2015). Later, the initial list was critically revised, based on an analysis of protologues, distribution reports, other newly-available published sources and elaboration of herbarium material. As a result, the final checklist contains 76 taxa with 946 synonyms that were used for work at the herbaria and search of occurrences' reports in the publications. For published occurrences, we selected only those provided by reliable authors (e.g. well-known florists) in peer-reviewed journals and supported with coordinates or precise locality descriptions. The occurrences reported by Karel Domin in his Card Index, deposited at the Institute of Botany of SAS in Bratislava, also were partly taken into account, with the exception of doubtful or unclear indications of localities. Due to the high risk of misidentification of problematic taxa, we avoid clearly doubtful reports from persons without recognised expertise in botany.

Quality control: The gathered data were double-checked for the correctness of identification and indicated distribution area. In case of doubt or misidentification, specimens were re-identified or omitted from the analysis. In case of unusual reports from the new areas, such occurrences were additionally critically revised. In the case of identification of problematic taxa, special attention was paid to those specimens identified by narrow specialists only. Most of microtaxa (e.g. *Hieracium*, *Alchemilla* and *Pilosella*) and some stenoendemics were excluded from the work due to a high risk of their misidentification, unclear chorology and controversial taxonomical interpretation by different authors. The taxonomy, with minor exceptions, was verified and follows the POWO checklist (POWO 2022). Coordinates of the occurrences were extracted and verified manually, using the OpenStreetMap (OpenStreetMap contributors 2022) and QGIS (QGIS Development Team 2022) services.

Step description: The following steps were taken during the work with herbarium materials:

1. Routine photo capture of herbarium labels for selected taxa;
2. Taxonomic reconsideration of photographed specimens following recent taxonomy;

3. Extracting the locality, collector, date and other relevant (e.g. habitat information, identification history) information from the labels to the dataset using the DarwinCore standard;
4. Translation of the initial information from Cyrillic (i.e. Ukrainian and Russian) into English;
5. Georeferencing and verification of localities using recent and antique maps;
6. Quality check applying OpenRefine and QGIS (for outlets and coordinates' mistakes).

The following steps were taken during the work with literature reports:

1. Verification of the report authors on their authority;
2. Manual extraction of published data to the dataset following the DarwinCore standard;
3. Translation of the initial information from Cyrillic into English;
4. Georeferencing and verification of localities;
5. Data quality control.

Geographic coverage

Description: The occurrences from the Ukrainian Carpathians and adjacent Ukrainian territories were considered (Fig. 1). Most of the covered occurrences rely on the territory of Ukrainian Carpathian Mts. However, some taxa (e.g. *Symphytum cordatum*, *Aconitum moldavicum* and *Cardamine glanduligera*) are spread widely out of the Carpathians and can be found in adjacent regions. To represent the real distribution patterns of such subendemic taxa, their findings from the non-Carpathian regions were also taken into consideration.

Coordinates: 47.8 and 51.5 Latitude; 22.7 and 25.9 Longitude.

Taxonomic coverage

Description: All processed occurrences were identified to the level of the species or subspecies. As a result, the dataset contains 66 species and subspecies of endemic and subendemic vascular plants belonging to 49 genera and 27 families. Amongst them, only 17 species from 10 genera (i.e. 967 occurrences or 15% from the total number of databased occurrences) represent the class Liliopsida, while the rest of the taxa belongs to the class Magnoliopsida (Fig. 2).

Taxa included:

Rank	Scientific Name
kingdom	Plantae
phylum	Tracheophyta

class	Magnoliopsida
class	Liliopsida
order	Gentianales
order	Asparagales
order	Saxifragales
order	Poales
order	Asterales
order	Fabales
order	Lamiales
order	Brassicales
order	Caryophyllales
order	Apiales
order	Gentianales
order	Dipsacales
order	Ericales
order	Ranunculales
order	Boraginales
order	Malpighiales
family	Rubiaceae
family	Orchidaceae
family	Saxifragaceae
family	Poaceae
family	Asteraceae
family	Fabaceae
family	Iridaceae
family	Campanulaceae
family	Plantaginaceae
family	Brassicaceae
family	Caryophyllaceae
family	Asparagaceae
family	Lamiaceae

family	Apiaceae
family	Gentianaceae
family	Crassulaceae
family	Caprifoliaceae
family	Oleaceae
family	Juncaceae
family	Rubiaceae
family	Primulaceae
family	Orobanchaceae
family	Ranunculaceae
family	Boraginaceae
family	Violaceae
family	Salicaceae
family	Linaceae
genus	*Galium*
genus	*Gymnadenia*
genus	*Chrysosplenium*
genus	*Sesleria*
genus	*Saussurea*
genus	*Lathyrus*
genus	*Crocus*
genus	*Phyteuma*
genus	*Plantago*
genus	*Campanula*
genus	*Noccaea*
genus	*Antennaria*
genus	*Koeleria*
genus	*Silene*
genus	*Doronicum*
genus	*Scilla*
genus	*Thymus*

genus	*Achillea*
genus	*Poa*
genus	*Festuca*
genus	*Heracleum*
genus	*Gentiana*
genus	*Cardamine*
genus	*Leucanthemum*
genus	*Trifolium*
genus	*Sempervivum*
genus	*Scabiosa*
genus	*Minuartia*
genus	*Syringa*
genus	*Luzula*
genus	*Sabulina*
genus	*Galium*
genus	*Genista*
genus	*Erysimum*
genus	*Soldanella*
genus	*Melampyrum*
genus	*Arabidopsis*
genus	*Alopecurus*
genus	*Ranunculus*
genus	*Pulmonaria*
genus	*Viola*
genus	*Scorzoneroides*
genus	*Centaurea*
genus	*Swertia*
genus	*Trisetum*
genus	*Euphrasia*
genus	*Salix*
genus	*Linum*

genus	*Symphytum*
species	*Galium album*
species	*Gymnadenia carpatica*
species	*Chrysosplenium alpinum*
species	*Sesleria bielzii*
species	*Saussurea porcii*
species	*Lathyrus transsylvanicus*
species	*Crocus banaticus*
species	*Phyteuma vagneri*
subspecies	*Plantago atrata* subsp. *carpatica*
species	*Campanula serrata*
species	*Sesleria heufleriana*
species	*Noccaea dacica*
species	*Antennaria carpatica*
subspecies	*Koeleria macrantha* subsp. *transsilvanica*
species	*Silene zawadskii*
species	*Doronicum carpaticum*
species	*Scilla kladnii*
species	*Thymus pulcherrimus*
subspecies	*Achillea oxyloba* subsp. *schurii*
species	*Poa rehmannii*
species	*Festuca porcii*
species	*Heracleum carpaticum*
species	*Gentiana laciniata*
species	*Cardamine glanduligera*
species	*Leucanthemum rotundifolium*
species	*Thymus alternans*
species	*Trifolium sarosiense*
subspecies	*Sempervivum carpathicum* subsp. *carpathicum*
subspecies	*Poa pannonica* subsp. *scabra*
species	*Scabiosa lucida*

subspecies	*Sempervivum globiferum* subsp. *preissianum*
species	*Minuartia pauciflora*
species	*Syringa josikaea*
species	*Festuca versicolor*
subspecies	*Luzula alpinopilosa* subsp. *obscura*
species	*Campanula carpatica*
species	*Sabulina oxypetala*
species	*Festuca carpatica*
species	*Galium transcarpaticum*
subspecies	*Genista tinctoria* subsp. *oligosperma*
species	*Erysimum witmannii*
species	*Campanula tatrae*
species	*Soldanella hungarica*
species	*Melampyrum saxosum*
subspecies	*Festuca amethystina* subsp. *orientalis*
species	*Poa carpatica*
species	*Arabidopsis neglecta*
subspecies	*Alopecurus pratensis* subsp. *laguriformis*
species	*Ranunculus carpaticus*
subspecies	*Heracleum sphondylium* subsp. *carpaticum*
species	*Phyteuma tetramerum*
species	*Pulmonaria filarszkyana*
species	*Viola declinata*
species	*Scorzoneroides pseudotaraxaci*
species	*Centaurea maramarosiensis*
subspecies	*Poa granitica* subsp. *disparilis*
species	*Silene dubia*
species	*Swertia perennis*
subspecies	*Centaurea phrygia* subsp. *carpatica*
species	*Trisetum fuscum*
species	*Erysimum witmannii*

species	*Euphrasia tatrae*
subspecies	*Salix retusa* subsp. *kitaibeliana*
species	*Linum extraaxillare*
species	*Ranunculus malinovskii*
species	*Symphytum cordatum*

Temporal coverage

Living time period: 1852-2020.

Notes: The dataset covers material collected and reported from 1852 till 2020. However, the most intensive records were made in the period between 1945 and 1975. During these thirty years, 3,013 or ca. 47% from the total number of observations were made (Fig. 3).

Usage licence

Usage licence: Open Data Commons Attribution License

Data resources

Data package title: Endemic vascular plants of the Ukrainian Carpathians

Resource link: https://www.gbif.org/dataset/f14ffffd-5fd1-440d-a4c5-07ddce62ff26

Alternative identifiers: https://doi.org/10.15468/5hrh87

Number of data sets: 1

Data set name: Endemic vascular plants of the Ukrainian Carpathians

Character set: utf8

Download URL: https://www.gbif.org/dataset/f14ffffd-5fd1-440d-a4c5-07ddce62ff26

Data format: Darwin Core

Description: The tab-delimited CSV formated dataset (Novikov and Sup-Novikova 2022) is created with the application of Darwin Core standards and contains all available data on the distribution of endemic vascular plants in the Ukrainian Carpathians and adjacent territories.

Column label	Column description

occurrenceID	An unique identifier for the Occurrence (as opposed to a particular digital record of the occurrence).
basisOfRecord	The specific nature of the data record, for example, preserved specimen or field observation.
collectionCode	Unique code of collection (e.g. herbarium) for depositing the identified specimen.
catalogNumber	An identifier for the record within the collection.
scientificName	The full scientific name of the taxon including at least the genus and species epithets and, in some cases, including the subspecies epithet.
taxonRank	The taxonomic rank of the most specific name in the scientificName.
recordedBy	A person, group or organisation responsible for recording the original Occurrence.
verbatimEventDate	The date of record as it appears in the original publication or specimen's label.
EventDate	The date during which an event (e.g. collection of the specimen, photographing of the plant or its registering in the field in any other way), occurred.
day	The day when occurrence was recorded.
month	The month when occurrence was recorded.
year	The year when occurrence was recorded.
fieldNumber	An identifier given to the specimen in the field by the collector.
identifiedBy	A list of names of people, who assigned the Taxon to the subject.
dateIdentified	The date on which the subject was determined as representing the Taxon.
identificationRemarks	Comments or notes about the Identification.
decimalLatitude	The geographic latitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic centre of a Location.
decimalLongitude	The geographic longitude (in decimal degrees, using the spatial reference system given in geodeticDatum) of the geographic centre of a Location.
coordinateUncertaintyInMetres	The horizontal distance (in metres) from the given decimalLatitude and decimalLongitude describing the smallest circle containing the whole of the Location.
geodeticDatum	The ellipsoid, geodetic datum or spatial reference system (SRS) upon which the geographic coordinates given in decimalLatitude and decimalLongitude are based. In our case, it is always WGS84.
verbatimElevation	The original description of the elevation (altitude, usually above sea level) of the Location.
countryCode	The standard code (ISO 3166-1-alpha-2) for the country in which the Location occurs.
country	The name of the country in which the Location occurs.

locality	The specific description of the place where the specimen was registered or collected.
verbatimLocality	The original textual description of the place where the specimen was registered or collected.
fieldNotes	The original text of notes taken in the field about the specimen by the collector.
associatedReferences	A list (concatenated and separated) of identifiers (publication, bibliographic reference, global unique identifier, URI) of literature associated with the Occurrence.
kingdom	The full scientific name of the kingdom in which the taxon is classified. In our case, it is always Plantae.
language	The language of the resource. In our case, herbarium labels contained information in different languages and sometimes different languages were even combined on a single label. To simplify the work with data, we indicated the languages applied for the data.
minimumElevationInMetres	The lower limit of the range of elevation (altitude, usually above sea level), in metres.
maximumElevationInMetres	The upper limit of the range of elevation (altitude, usually above sea level), in metres.
institutionCode	The acronym in use by the institution having custody of the object(s) or information referred to in the record. We followed the GBIF register of institutions and collections for acronyms.

Additional information

This dataset does not include the data on distribution of the genus *Aconitum* representatives because such data were published before, in 2021 and available as a separate dataset (Novikov 2021). We decided not to include the data on *Aconitum* distribution to avoid duplication of the same records.

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Author contributions

Andriy Novikov initiated the dataset creation, filled it with new records and maintained, parsed information from the herbarium labels, verified data, identified taxa, worked on georeferencing and wrote the paper. Mariia Sup-Novikova parsed information from the herbarium labels, resolved georeferencing issues, maintained the dataset and worked on the paper.

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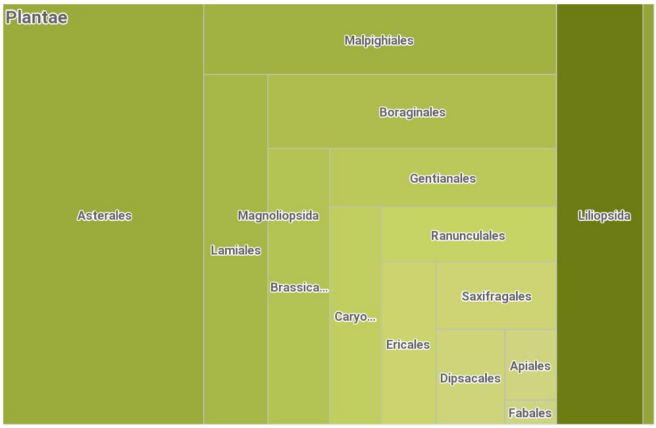

Figure 2.

Taxonomic coverage of the dataset.

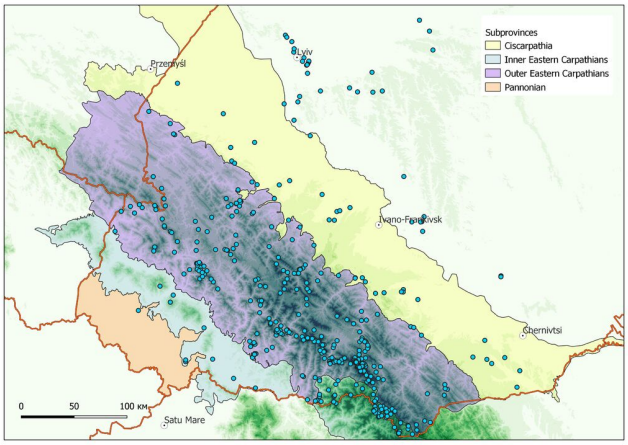

Figure 1.

Distribution of georeferenced occurrences of the endemic vascular plants in the Ukrainian Carpathians and adjacent territories.

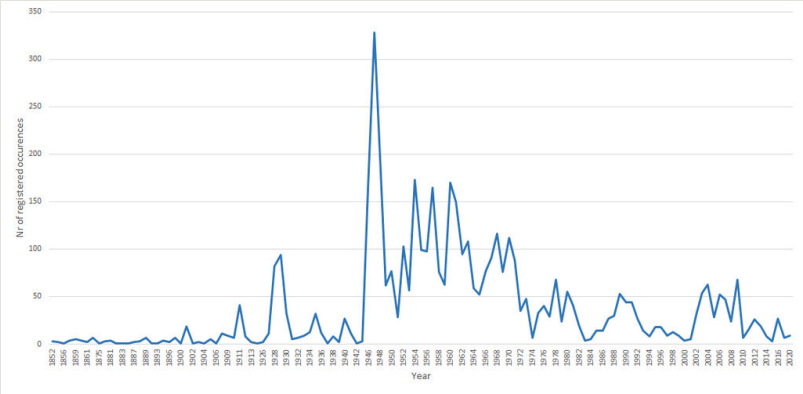

Figure 3.

The number of registered occurrences per year in the dataset.