



WILD ORCHIDS OF UKRAINE

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A SYNOPSIS OF THE WILD ORCHIDS OF UKRAINE WITH AN ANNOTATED CHECKLIST

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Forward

With this “Special Edition” the Native Orchid Conference, Inc. ventures outside its usual geographic realm. Our organization was founded to focus on the Native Orchids of the United States and Canada, but many of our members travel worldwide to study and photograph orchids outside that area.

We hope that you enjoy this venture into Europe and its native orchids and we welcome any related comments or suggestions. They should be forwarded to me at nativeorchids@gmail.com.

Regards,
R. Mark Rose, Founder
Native Orchid Conference, Inc.

Abstract

A synopsis and annotated checklist are provided to assist in research on the wild orchid flora of Ukraine. There are 86 orchid taxa (mostly species, but also subspecies and a few varieties), and most eastern European taxa are present. There are 36 potential hybrids based on occurrence of putative parents in Ukraine, and of these 16 have been reported. An introductory section includes information on topography, climate, vegetation, distribution patterns, history of study, and orchids featured on Ukrainian stamps and coins. There are six tabular lists. Table 1 (main text) is the current and annotated list of wild orchids of Ukraine. Table 2 (main text) is a list of hybrids of wild orchids reported in the Ukraine, as well as hybrids expected. Table 3 (main text) is an annotated list of excluded species. The 35 figures illustrate 67 taxa based on photos from Ukraine and the surrounding region. Over 100 references, most listed, were consulted to bring information up-to-date and to develop comprehensive annotated lists. Appendix Table 1 is a list of orchids (in Ukrainian and English) in the Ukrainian Red Book. Appendix Table 2 lists iNaturalist observations for various Ukrainian orchids to provide an idea of relative abundance. Appendix Table 3 is a list of possible additions to the wild orchids of Ukraine. Appendix Table 4 is a key to the genera.

Introduction

This synopsis and checklist are intended to assist in the study and conservation of Ukrainian orchids. It may also serve education and recreation as part of the basis for popular guides and for the growing interest in photography of orchids and other wildflowers. Since the coverage includes historical information, as well as some of the most recent important literature, it may be one of the useful starting points for tracking information.

Dedication. These pages are dedicated to, and intended to serve particularly, the botanists of Ukraine, who have persevered through very difficult times over a long period, and have studied and conserved their native flora, despite extreme hardship.

Methods

Most of the information here was gathered from literature searches using BIOSIS, SCOPUS, GOOGLE SCHOLAR, etc. Information was traced in reference lists and gathered from basic resources listed below. Photographs used are all either public domain or CC BY-NC 4.0. Many photos were obtained from iNaturalist (<https://www.inaturalist.org/>). Although we believe that the photos here are correctly identified, we were not able to examine all characteristics that are helpful for identification, such as leaf and stem characters in the genus *Dactylorhiza*. Photographs used were identified with identification keys (e.g. Appendix Table 4) and illustrations and descriptions in authoritative publications.

Some basic resources

Here we are primarily interested in identification, conservation, geography, and ecology. We have also made reference to some of the recent articles relating to studies of evolution and classification using DNA techniques (see review and update by Bateman 2021, 2022).

With particular regard to the Ukrainian orchid flora, the Ukraine Red Book (Didukh 2009) provides photographs and distribution maps for 68 taxa (mostly species) of Ukrainian orchids. Categories of information in this reference include: (1) taxonomic affiliation, (2) conservation status, (3) scientific significance, (4) range and distribution in Ukraine, (5) population size and structure, (6) reasons for change in numbers, (7) growing conditions, (8) general biomorphological characteristics, (9) population protection regime and protective measures, (10) breeding, and breeding in specially created conditions, (11) economic and commercial values, decorative and medicinal uses, and (12) source. With this extensive information, the Red Book is the best and most authoritative source for the region. The Red Book list (Appendix Table 1) is not quite the same as the annotated list (Table 1) which has more current names, reflects more recent taxonomy, and includes some new records. However, the Red Book list is especially useful in providing names in Ukrainian, along with official status determinations, and so much additional information.

Among the other publications with extensive information on the orchids of Ukraine, parts of Ukraine, or adjacent regions are:

Burda *et al.* (1997)

De Angelli and Anglescu (2020)

Efimov (2020)

Fateryga and Kreutz (2014)

Mosyakin & Fedoronchuk (1999)

Mosyakin and Timchenko (2006)

Onyshchenko *et al.* (2022)

Sobkov (1989, 2004)

Tatarenko *et al.* (2005)

Vakhrameeva *et al.* (2008)

Wulf (1930)

Yena (2012)

There are many books about European orchids. Some are exceptional large-format books with plates from the finest artwork. Others are detailed regional guides for various countries. Among the works relating to the orchids of Europe that we relied on as a basis are the following: Kuhn *et al.* (2019) is one of the most comprehensive and complete guides. The nomenclature and information on distribution and ecology is current. Davies *et al.* (1983) and Delforge (2006) are popular older references that contain valuable information that is not available elsewhere.

Kreutz (2004) provides a list of European orchids with places of publication of accepted names and synonyms. Another valuable source for nomenclatural information is Kew's "Plants of the World Online" https://powo.science.kew.org/?name_id=70185. Additionally "The Plant List" was a working list of all known plant species produced in response to Target 1 of the 2002-2010 Global Strategy for Plant Conservation (GSPC). Although The Plant List has been static since 2013, it was used as the starting point for the World Flora Online, with updated information at www.worldfloraonline.org.

The following references also provide helpful information on European orchids: Bateman (2001), Bateman *et al.* 2017, Bateman *et al.* (2013), Eccarius (2016), Hedrén (2001), Hedrén *et al.* (2007), Kretzschmar *et al.* (2007), Pedersen *et al.* (2007), Pridgeon *et al.* (2001), and Reinhammar (1998).

There are many very informative and spectacularly illustrated websites for European orchids. These often have links to other sites. Some that we recommend are:

European orchids and their hybrids - <http://guenther-blaich.de/index.htm#START>

Europas Orchideen - regional information in different languages - <http://www.camerallife.se/se>

John and Gerry's orchids of Britain and Europe - <http://www.orchidsofbritainand europe.co.uk/index.htm>

The Ukraine

Sometimes translated as "the borderland," Ukraine, in the eastern part of Eastern Europe, is bounded by Belarus and Russia on the north, Russia on the east, the Black Sea and Turkey on the south, and Romania, Moldova, Hungary, Slovakia and Poland on the west. The surface area is 603,700 km².

The landscape of Ukraine is variable with mountainous regions and flat plains. The higher montane regions include a portion of the chain of the Carpathian Mountains in the northwest, and the Crimea Mountains on the southwest side of the Crimea Peninsula (Figure 1).

The climate of Ukraine, according to the Köppen classification (Figure 2), is mostly warm summer, humid continental (Dfb). Across the south is a narrow band of hot summer, humid continental (Dfa). A band of cold, semi-arid, steppe (Bsk), exists in the south. In and around the Crimean Mountains is a small humid subtropical zone (Cfa) with Dfa and Dfb at higher elevations. The higher elevations of the eastern Carpathian Mountains are classified as subarctic (Dfc). Another view of climate that provides some additional detail is average temperature, which reveals a warmer area in the Hungarian border region, and a colder area in the extreme north.



Figure 1. Relief map of Ukraine. Carport, March 2010. CC BY-3.0.

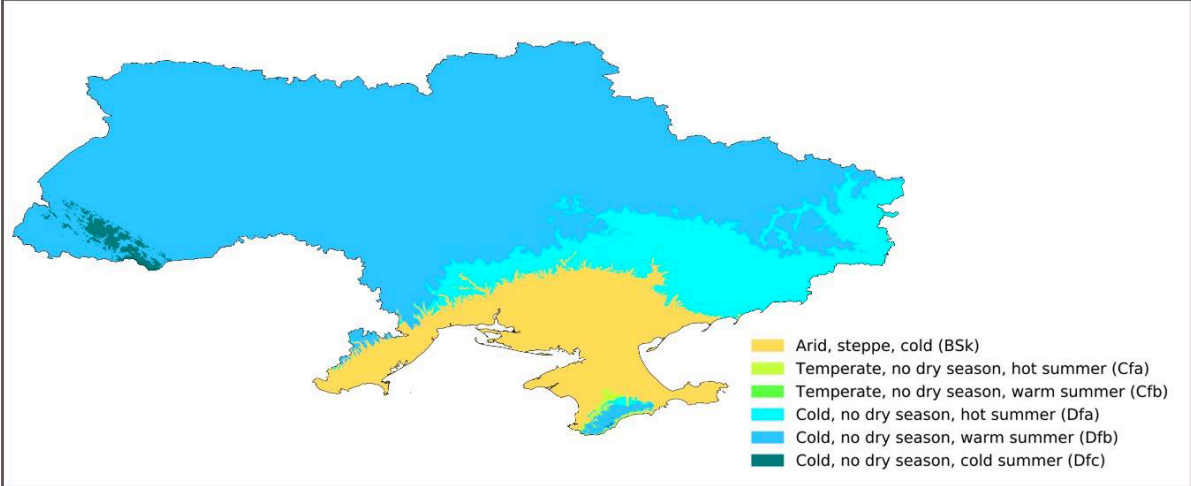


Figure 2. Köppen climate map of Ukraine 1980-2016 (Beck *et al.* 2018).

Orchids and Ecozones

The variation in climate and elevation contributes to a diverse flora. Different plants and different taxa of orchids are adapted to the different regions with different climates and elevations. This leads to regions of distinctive flora and fauna called ecozones or biogeographical regions. At least four major zones occur in the Ukraine based on the basic map of European biogeography (Figure 3).

Under natural conditions, almost half of Ukraine, mostly in the southeast, is relatively dry grasslands of the Pontic-Caspian steppe. Much of this is now an agricultural landscape. The original grasslands had trees in gallery forests and wetlands. The steppe extended into eastern Romania, to the west in Ukraine as a mixture steppe and woodland, and northeastward into Russia (and eastward to western Kazakhstan). Another region where the natural vegetation is steppe and oak woodland is in the extreme northwest in the Pannonian Basin on the Hungarian border (orange on the map - Figure 3). The steppe regions are periodically dry and, in some cases hot.

West and north of the steppe is mixed forest, locally, and northward with bogs and more boreal conditions dominated by conifers. The boreal forest orchids here include *Hammarbya paludosa*, *Goodyera repens* and *Neottia cordata*.

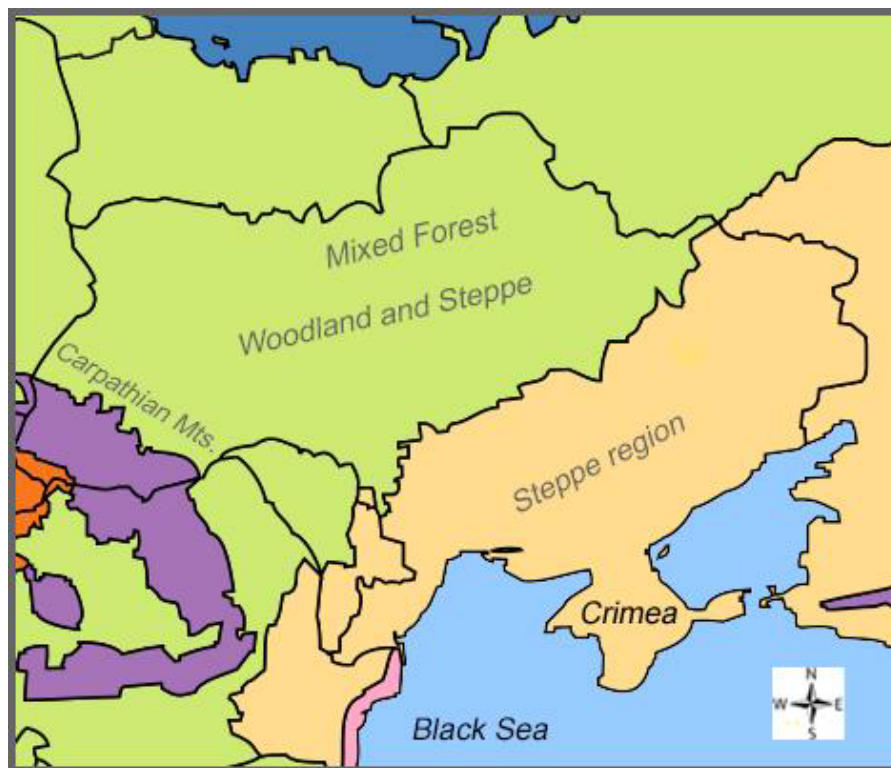


Figure 3. Biogeographic regions of the area of Ukraine from the European Environmental Association map, showing both country, and biogeographical region boundaries. CC-BY-3.0. See text for explanations.

The rugged area of the Carpathian Mountains in the southwest (purple on the map - Figure 3, Figure 4) has a variety of habitats including alpine and subalpine. Orchids confined (in Ukraine) to the cool forests and alpine meadows of this region include *Dactylorhiza majalis* subsp. *cordigera*, and *Gymnadenia conopsea*. *Traunsteinera globosa* (Figure 5) occurs in mountain areas (both Crimean Mountains and in the Carpathians), but also in a few other local areas.



Figure 4. The Carpathian Biosphere Reserve. Photo by Vian, 2014. CC BY-NC 4.0.



Figure 5. *Traunsteinera globosa*. A species that is largely confined to the mountain regions of Ukraine, occurring in both the Carpathians, and the Crimean Mountains. Ukrainian Carpathians, 4 July 2011, iNat.photo 59914144, by Viktoriya. CC BY-NC 4.0.

One of the most distinctive bioclimatic regions of Ukraine is the Crimean Peninsula. It is internationally recognized as Ukrainian territory occupied by the Russian Federation since 2014. The peninsula is on the northern coast of the Black Sea, almost entirely surrounded by the Black Sea, and the smaller Sea of Azov (Figures 1-3). It has an area of 27,000 km². The vascular flora of the Crimea includes 127 plant families, 760 genera and 2,536 species and subspecies, and there are 106 endemics, and 12 extinct taxa (Yena 2012: 201-204). The history of the study of the orchids of this region is outlined by Fateryga and Kreutz (2014). At least 44 species were reported (Knapp 1985), but a more current list is that of Fateryga *et al.* (2019) which lists 45 species and draws attention to the orchids found there but not in adjacent parts of Russia (Efimov 2020: 7, 4-6). A spectacular book about the orchids of the Crimean Peninsula (Fateryga *et al.* 2019) is available online (in Russian - see references). The photographs are exceptional and it is worth a look regardless of whether or not you speak Russian! The mountains of southwestern Crimea have many unusual habitats, some associated with the Mediterranean region (Knapp 1985). The Bee Orchids are well represented in the Crimea. Several taxa have been recently described from this region (Protopopova *et al.* 2017). Orchid taxa found only in the Crimean area of Ukraine (21 taxa) include:

<i>Anacamptis coriophora</i>	<i>Neotinea tridentata</i>
<i>Anacamptis laxiflora</i>	<i>Orchis mascula</i> subsp. <i>mascula</i>
<i>Anacamptis morio</i> subsp. <i>caucasica</i>	<i>Orchis pallens</i>
<i>Epipactis condensata</i>	<i>Orchis provincialis</i>
<i>Epipactis helleborine</i> subsp. <i>tremolsii</i>	<i>Orchis punctulata</i>
<i>Epipactis persica</i> subsp. <i>taurica</i>	<i>Orchis simia</i>
<i>Epipactis microphylla</i>	<i>Ophrys scolopax</i> subsp. <i>cornuta</i>
<i>Himantoglossum calcarata</i> subsp. <i>jankae</i>	<i>Ophrys scolopax</i> subsp. <i>scolopax</i>
<i>Himantoglossum caprinum</i>	<i>Ophrys sphegodes</i> subsp. <i>mammosa</i>
<i>Himantoglossum comperianum</i>	<i>Traunsteinera sphaerica</i>
<i>Limodorum abortivum</i>	

Geographic patterns

The following floristic affinities are noted in the orchid flora. This list is general and incomplete, but suggests some origins.

European: *Anacamptis morio*, *Cephalanthera rubra*, *Dactylorhiza majalis*, *Dactylorhiza sambucina*, *Platanthera chlorantha*.

East European: *Himantoglossum calcaratum* subsp. *jankae*, also some far eastern species at their eastern limit (see below under Far Eastern).

West European: *Gymnadenia odoratissima*, *Orchis mascula* subsp. *mascula*, *Spiranthes spiralis*.

South European: *Limodorum abortivum*.

Boreal: *Hammarbya paludosa*, *Goodyera repens*, *Neottia cordata*.

Far Eastern (western limit in Ukraine): *Cypripedium macranthos*, *Dactylorhiza incarnata* var. *cruenta*, *Hemipilia (Ponerorchis) cucullata*, *Spiranthes australis*.

Montane: *Dactylorhiza majalis* subsp. *cordigera*, *Traunsteinera globosa*, *Traunsteinera sphaerica*, *Pseudorchis albida* subsp. *albida*.

Western Mediterranean: *Dactylorhiza romana*, *Himantoglossum calcaratum* subsp. *jankae*, *Himantoglossum caprinum*, *Himantoglossum comperianum*, *Ophrys scolopax* subsp. *cornuta*, and *Ophrys sphegodes* subsp. *mammosa*.

Anatolian (Asia Minor - mostly Turkey): *Dactylorhiza iberica*, *Himantoglossum comperianum*, *Himantoglossum caprinum*.

Size of the orchid flora

Ukraine has 86 orchid taxa, mostly species, but including some subspecies and varieties (Table 1). These are distributed in 25 genera. Ten of these genera have only one taxon (see below where the list is arranged in taxonomic order i.e. the primitive to advanced order in most recent texts).

<i>Cypripedium</i> – 2	<i>Corallorhiza</i> – 1	<i>Traunsteinera</i> – 2
<i>Cephalanthera</i> – 3	<i>Goodyera</i> – 1	<i>Orchis</i> – 9
<i>Epipactis</i> – 15	<i>Spiranthes</i> – 2	<i>Neotinea</i> – 2
<i>Neottia</i> – 3	<i>Herminium</i> – 1	<i>Ophrys</i> – 5
<i>Limodorum</i> – 3	<i>Hemipilia</i> – 1	<i>Steveniella</i> – 1
<i>Epipogium</i> – 1	<i>Pseudorchis</i> – 1	<i>Himantoglossum</i> – 3
<i>Hammarbya</i> – 1	<i>Platanthera</i> – 2	<i>Anacamptis</i> – 7
<i>Liparis</i> – 1	<i>Gymnadenia</i> – 5	
<i>Malaxis</i> – 1	<i>Dactylorhiza</i> – 11	

At least 85 Orchid taxa have been reported from eastern Europe (Tatarenko *et al.* 2005). Thus Ukraine has most of the East European orchids. This is a relatively rich orchid flora for an essentially temperate region. For example: The United Kingdom has 56 taxa; the State of Michigan, U.S.A has 58 taxa; and Ontario, Canada has 67 taxa. Of the European Countries, those in the Mediterranean region have the largest orchid floras. Greece for example has 212 taxa (Petrou & Giannabouias 2010) but it is difficult to compare the orchid floras because of the varying species concepts of plant taxonomists. The Mediterranean region includes the Bee Orchids (*Ophrys*) which have been split into many taxa by some authors.

History of study

The authors of major lists have provided information on the history of the study of orchids in the regions covered (for example, see Efimov 2020). A substantial contribution to the study of Ukrainian orchids was made by Mykhaylo Zahulsky (Bogdan *et al.* 2004). He was a very committed curator of the Lviv National

University Herbarium where he worked as a Senior Research Scientist. Most of his thousands of orchid specimens are housed in the Lviv University Herbarium (LW). He was also an outstanding teacher, and organized many botanical excursions. His 90 publications, mostly concerning the occurrence, ecology and conservation of orchids, are listed online (https://www.zobodat.at/publikation_articles.php?id=114191).

Rare & Endangered species and Conservation

The Ukraine Red Book (Didukh 2009, AppendixTable 1, Figure 6) provides information on the status of 67 orchid taxa. The number of taxa in different categories is: ENDANGERED - 21, VULNERABLE - 27, RARE - 11, LEAST CONCERN - 7, NOT WELL KNOWN - 1. This suggests that most of the Ukrainian orchids are facing a high to very high risk of extinction in the wild (IUCN 2022: Table 2). In fact, 71.6% are at risk. Although it has the largest number of species of any vascular plant group, the orchid family is one of the most susceptible worldwide, and this level of susceptibility in Ukraine is not unusual.

There are several recent articles concerning the conservation of Ukrainian orchids. A study of rare species of the genus *Epipactis* in Ukraine found that a moderate degree of grazing, mowing, and recreation may result in a positive response from a population. Studies in various parts of Ukraine have resulted in recommendations for protective measures (Tymchenko 1996, 1999). Tatarenko *et al.* (2005) give an overview of orchid conservation in eastern Europe. Kull *et al.* (2016) recently studied factors influencing IUCN threat levels to orchids across Europe. Among the interesting discoveries was that nectarless and tuberous species are significantly more threatened than nectariferous and rhizomatous taxa.



Figure 6. Distribution map of *Dactylorhiza maculata* subsp. *fuchsii* (Common Spotted-orchid) in Ukraine. It is a species of "least concern." From Ukraine Red Book (Didukh 2009).

Salep

In parts of Turkey and Greece, tubers of native orchids are collected for the production of a beverage called Salep. It was more popular throughout much of Europe prior to the introduction of coffee and tea, but its popularity has increased recently. The geographic area from which tubers are collected has expanded in Albania, Greece, Iran and Turkey. The estimated harvests (6 million tubers harvested in Iran in 2014) are large and the increased harvest is not clearly sustainable (Kreziou *et al.* 2016). Ticktin *et al.* (2023) developed a dichotomous key based on 12 characteristics, which can be used to develop a sustainable harvest. The authors also considered biological characteristics of harvested species (*Anacamptis morio*, *A. pyramidalis*, *Dactylorhiza sambucina*, *Orchis italica*, and *O. mascula*).

Although the disturbance associated with harvesting may have some beneficial effects, there may be increasing negative impacts. At least one recent study has shown that current levels of collection are not significantly affecting abundance, but the authors recommend longer-term monitoring of orchid populations, and a more effective modeling of response to different harvesting pressures (Charitonidou *et al.* 2019).

Among the interesting statements in recent articles regarding Salep are: "We confirm that there is no scientific evidence, including pharmacological trials on humans, that can justify the claimed aphrodisiac and healthy effects", and "many Salep consumers were not aware that the product included material from threatened species" (Bazzicalupo *et al.* 2023).

Although harvesting for Salep has not yet been reported as a serious problem in Ukraine, it is used in adjacent Romania, and Turkey (on the opposite shore of the Black Sea), where consumption may be increasing.

Current abundance of wild orchids in the Ukraine

A general indication of the current status in the Ukraine may be obtained from the number iNaturalist observations for each species. iNaturalist began in 2008, and was increasing rapidly by 2012. It was large and influential after becoming a joint initiative of the California Academy of Sciences and the National Geographic Society in 2017. Most iNaturalist observations span the end of the last decade. As of 14 June 2023, there were 8,946 observations of orchids in Ukraine, representing 67 species and 393 observers. The species in descending order of number of observations are listed in Appendix Table 2.

The most abundant wild orchids are *Orchis purpurea* subsp. *purpurea*, *Epipactis helleborine* subsp. *helleborine*, and *Anacamptis morio* subsp. *morio*. Each of these has over 600 observations. Of the remaining 43 species (64%) the number of observations is less than 100. There are less than 10 observations for 16 species. Many taxa on our list are without any iNaturalist observations. Basically, a small proportion of orchids are common, but most are uncommon or rare. Of course the most species occur in diverse montane areas.

Stamps and coins

An appreciation of nature is reflected in Ukrainian coins and stamps. In 2016 the National Bank of Ukraine issued the latest coin in its continuing series, “Flora and Fauna of Ukraine.” This series of base metal and silver coins features endangered species of plants found in and around Ukraine. This particular coin has the Lady's-slipper Orchid (*Cypripedium calceolus*) on the obverse (Figure 7). It is in colour in the nickel-silver 2 grivna pieces, but without colour enhancement in the 10 grivna coin. This is not the first orchid on a Ukrainian coin. A Butterfly Orchid (*Platanthera bifolia*) was featured on a 2 grivna coin in 1999.

The most recent orchids on Ukrainian stamps were produced in 2015. These combined art and accurate illustrations of three species: *Ophrys sphegodes* subsp. *mammosa* (sub *O. taurica*), *Epipactis palustris*, and *Cephalanthera rubra* (Figure 8).



Figure 7. Lady's-slipper Orchid (*Cypripedium calceolus*) coin issued by Ukraine in 2016.



Figure 8. Ukrainian stamps with native wild orchids *Epipactis palustris*, *Ophrys sphegodes* subsp. *mammosa* (sub *O. taurica*), and *Cephalanthera rubra* issued in 2015.

Table 1. Annotated list of wild orchids of Ukraine

The list was largely compiled by Kühn *et al.* (2019) with additional information from national lists of Mosyakin & Fedoronchuk (1999) and Onyshchenko *et al.* (2022), regional lists of Efimov (2020), Fateryga *et al.* (2019, etc.), and from recent publications in journals (see references). Scientific and common names are mostly from Kühn *et al.* (2019). The order of the list is the standard order of many European guides (e.g., Kühn *et al.* 2019). Some synonyms used in some recent works are provided in annotations. At the end of each taxon entry are the IUCN (International Union for the Conservation of Nature) category abbreviations from Onyshchenko *et al.* (2022) in order of decreasing extinction risk: EX = extinct, EW = extinct in the wild, CR = critically endangered, EN = endangered, VU = vulnerable, NT = near threatened, LC = least concern, DD = data deficient, NE = not evaluated.

Hybrids are listed in Table 2. Excluded species are listed in Table 3. Possible additions are listed in Appendix Table 3. In some cases, a satisfactory common name is not available. Annotations relate to recent information on taxonomy, ecology and conservation.

Cypripedium calceolus L., LADY'S SLIPPER ORCHID. (Fig. 9a) For information on morphology, pollination and conservation in adjacent Romania, see Angelescu *et al.* (2021). The rare var. *citrina* Hergt (*f. flava* Rion), with pale yellow sepals and petals, once occurred in Romania (Angelescu *et al.* 2021: 28, Figures 3 & 4). Based on ecological niche modelling, there will be a 30-63% loss of habitat in Europe for this species by 2070 (Kolanowska & Jakubska-Busse 2020). Threat status across Europe is compared by Jakubska-Busse (2004). NT
LC

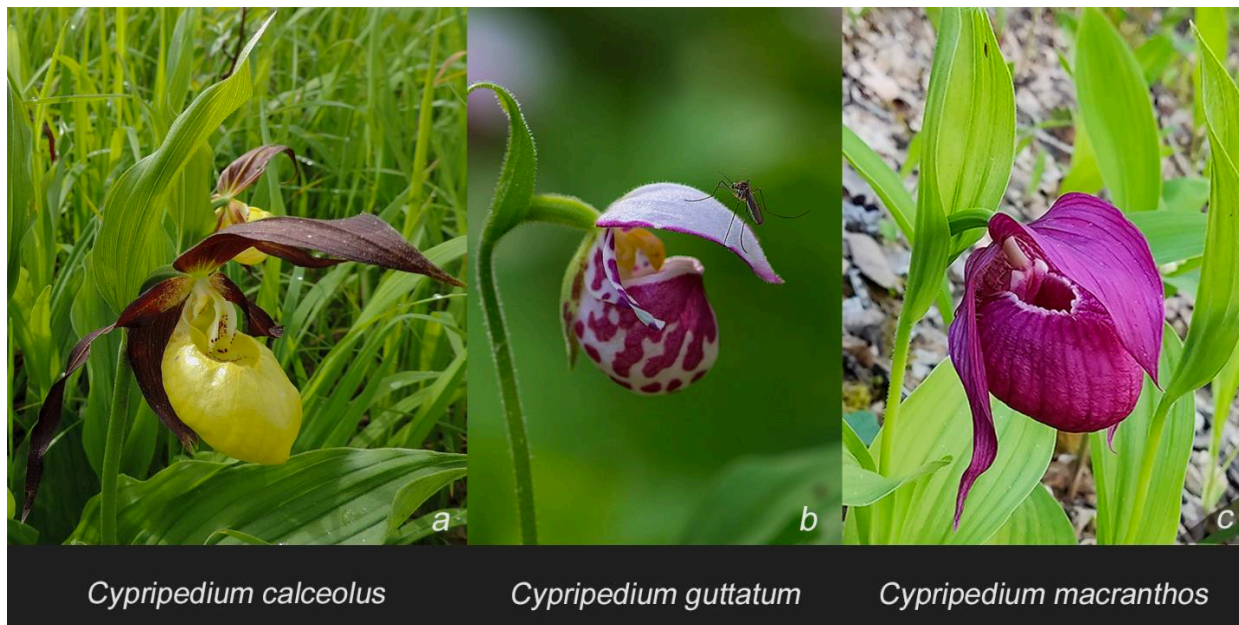


Figure 9. *Cypripedium* spp. in (and near) Ukraine (modified from iNaturalist). *Cypripedium calceolus* is well established. *Cypripedium guttatum* is excluded but occurs nearby, *Cypripedium macranthos* may be extirpated. a. Lviv, Ukraine, May 2019, iNat photo 206504751, by Petro Hryniuk. CC BY-NC 4.0. b. 100 km north of the northern border of Ukraine, 4 June 2022, iNat. photo 235763202, by Ivansilchenko. CC BY-NC 4.0. c. Chuvash, Russia, June 2022, iNat photo 206895819, by Alexander Yakovlev. CC BY-NC 4.0.

Cypripedium macranthos Sw., PURPLE LADY'S-SLIPPER. (Fig. 9c) There is a single unconfirmed (but not easily discounted) locality in northern Ukraine, extensively discussed by Efimov *et al.* (2020: 8). It is ca. 180 km from a region in European Russia with both *C. macranthos* and *C. ×ventricosa*. [EX?]

Cephalanthera damasonium (Mill.) Druce, WHITE HELLEBORINE. For ecological information on a new location on the Black Sea coast, see Popova (2015). LC LC

Cephalanthera longifolia (L.) Fritsch, SWORD-LEAVED HELLEBORINE. Dafni *et al.* (1981) found that orange papillae on the surface of the lip resemble pollen of *Cistus salviifolius* flowers, and have a similar color pattern. Solitary bees collecting pollen from the *Salvia* also visit and pollinate the orchid flowers, which have no reward. LC LC

Cephalanthera rubra (L.) Rich., RED HELLEBORINE. (Fig. 10) The flowers resemble *Campanula* in the bee visual spectrum. They lack nectar, but are pollinated by male bees which feed, rest, and wait for females on what they mistake for *Campanula*, which is a chief food (Nilsson 1983). LC LC



Figure 10. *Cephalanthera rubra*. Left, plants, Crimea, 8 July 2022, iNat. photo 224462464, by svetlanabogdanovich. CC BY-NC 4.0. Right, flowers. Crimea, 8 July 2022, iNat. photo 224462480, by svetlanabogdanovich. CC BY-NC 4.0.

Epipactis albensis Nováková & Rydlo. Recently discovered in the Transcarpathian Lowland of extreme northwestern Ukraine (Ljubka *et al.* 2014). Seven locations (Onyshchenko *et al.* 2022: 22). NT LC

Epipactis atrorubens (Hoffm.) Besser subsp. *atorrubens*, DARK-RED HELLEBORINE. (Fig. 11 b) Northwest corner only. See Tałaj and Brzosko (2008) and Jakubska-Busse and Kadej (2011) for information on pollination. LC LC

Epipactis condensata Boiss. ex D.P. Young, EASTERN VIOLET HELLEBORINE. Although not shown for Ukraine by Kühn *et al.* (2019: 55), the range of this Anatolian species was extended by Efimov (2008) to include Crimea.

Epipactis helleborine (L.) Crantz subsp. *helleborine*, BROAD-LEAVED HELLEBORINE. (Fig. 11 a) See Tałaj and Brzosko (2008) for information on pollination. LC LC

Epipactis helleborine (L.) Crantz subsp. *orbicularis* (K. Richt.) E. Klein. A recently described taxon reported as new to Ukraine in Crimea (Kreutz and Fateryga 2012; Fateryga and Kreutz 2014: 416 for publication details). Listed by Onyshchenko *et al.* (2022: 22). VU LC

Epipactis helleborine (L.) Crantz subsp. *tremolsii* (Paul) E. Klein, OPEN-FLOWERED HELLEBORINE. Only in Crimea. Evidently includes *E. levantina* and *E. turcica* (Kühn *et al.* 2019: 62). The latter was reported as new to Ukraine by Kreutz & Fateryga (2012).

Epipactis krymmontana Kreutz, Fateryga & Efimov. CRIMEAN MONTANE HELLEBORINE. A recently described taxon reported from Crimea (Fateryga and Kreutz 2014: 416 for publication details). "Might deserve taxonomic recognition" (Kühn *et al.* 2019: 55). Accepted by Onyshchenko *et al.* (2022: 22). Reported as *E. condensata* by Efimov (2008).

Epipactis leptochila (Godfery) Godfery subsp. *leptochila*, NARROW-LIPPED HELLEBORINE. Not indicated for Ukraine in Kühn *et al.* (2019: 69) but listed by Onyshchenko *et al.* (2022: 23). NT NT

Epipactis muelleri Godfery, MÜLLER'S HELLEBORINE. (Fig. 11 c) Reported from Crimea (Fateryga and Kreutz 2014). Onyshchenko *et al.* (2022: 22). Not in Kühn *et al.* (2019: 72). VU LC

Epipactis palustris (L.) Crantz, MARSH HELLEBORINE. (Fig. 11 d) See Tałaj and Brzosko (2008), Jakubska-Busse and Kadej (2011), Jacquemyn *et al.* (2014), and Jacquemyn and Brys (2015) for biological information. LC LC

Epipactis persica (Soó) Hausskn. ex Nannf. Only Crimea. NT LC

Epipactis persica (Soó) Nannf. subsp. *taurica* (Fateryga & Kreutz) Fateryga & Kreutz. A more robust and brighter plant in Crimea, and with a different habitat, previously *E. taurica* (Fateryga and Kreutz 2014). Included in *E. persica* s.l. by Onyshchenko *et al.* (2022: 23).

Epipactis purpurata Sm. subsp. *purpurata*, VIOLET HELLEBORINE. Reported from Crimea by Efimov (2008). For pollination see Jakubská-Busse and Kadej (2011). LC LC

Epipactis tallosii A. Molnár and Robatsch. A study by Süveges *et al.* (2019) suggests that the distribution area and number of populations of *E. tallosii* is much larger than previously assumed, and that Poplar plantations serve as suitable habitat islands in agricultural landscapes. The IUCN category of *E. tallosii* should be changed to Near Threatened (NT). This name has most recently been included as a synonym of *E. helleborine* subsp. *helleborine* (Kühn *et al.* 2019: 56), but is included here based on inclusion by Onyshchenko *et al.* (2022: 23). NT NT

Epipactis microphylla (Ehrh.) Sw. SMALL-LEAVED HELLEBORINE. Only Crimea. NT LC



Figure 11. *Epipactis* spp. in (and near) Ukraine (modified from iNaturalist). **a.** *Epipactis helleborine*. Crimea, 26 July 2020, iNat photo 87773838, by svetlana-bogdanovich. CC BY-NC 4.0. **b.** *Epipactis atrorubens*. Košice-okolie, Slovakia, 19 July 2015, iNat photo 2167498, by Paul Cools. CC BY-NC 4.0. **c.** *Epipactis muelleri*. Netherlands, 15 July 2013, iNat photo 185260526, by TOV Muusse. CC BY-NC 4.0. **d.** *Epipactis palustris*. Left Bank Forest Steppe zone of Ukraine, 9 July 2011, iNat. photo 174023384, by Uri Bengus. CC BY-NC 4.0.

Neottia (Listera) cordata (L.) R. Rich. LESSER TWAYBLADE. (Fig. 12) For information on occurrence in Ukraine see Andrienko (1983). For a useful review of biological data see Kotilinek *et al.* (2018). NT LC

Neottia (Listera) ovata (L.) Bluff & Fingerh. COMMON TWAYBLADE. (Fig. 12) LC LC

Neottia nidus-avis (L.) R. Rich. BIRD'S NEST ORCHID. (Fig. 12) For information on the biology of this species, see Jersáková *et al.* (2022). LC LC

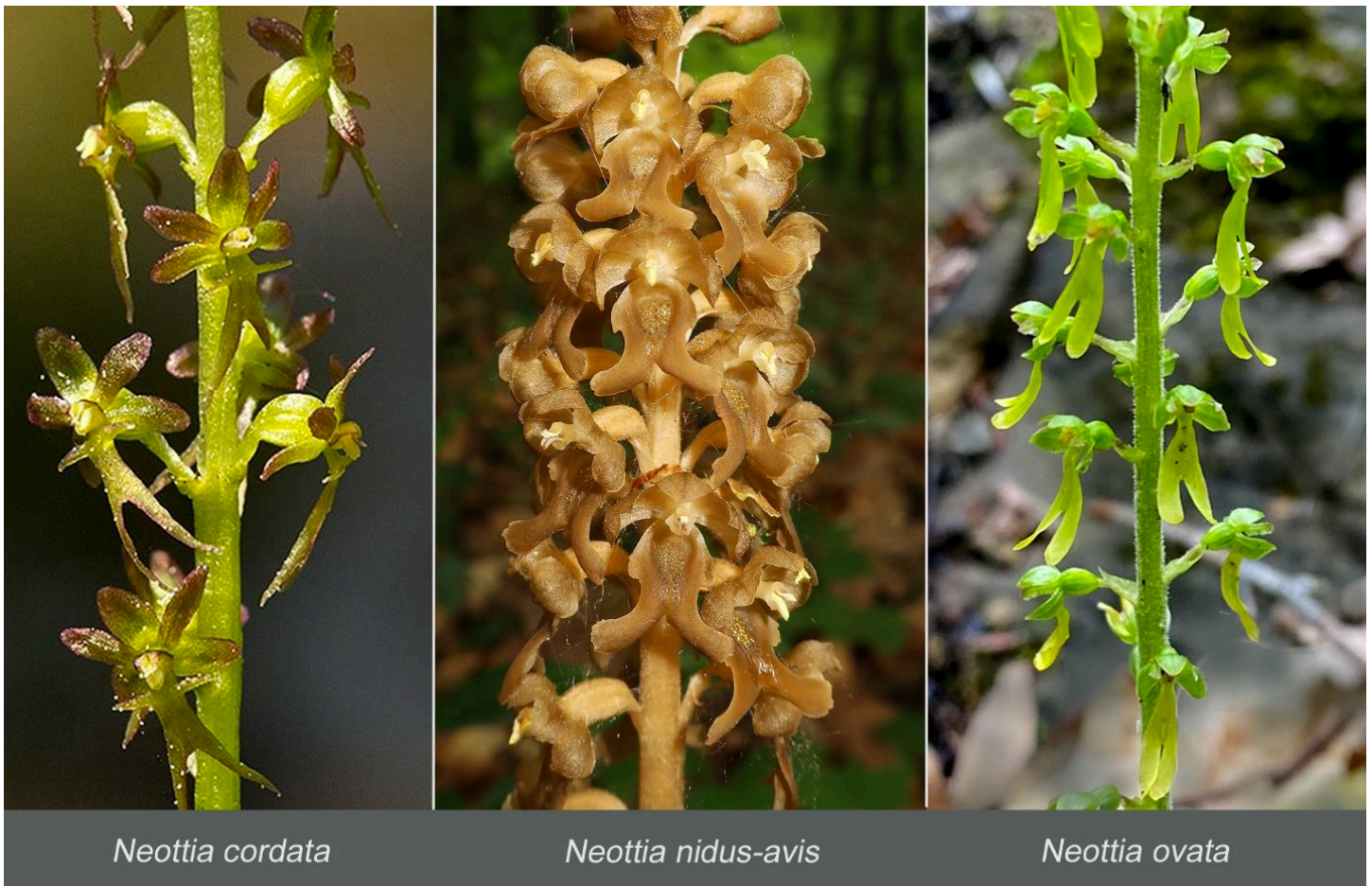


Figure 12. *Neottia* spp. in (and near) Ukraine (modified from iNaturalist). From left to right. *Neottia cordata*. Cherkess, Russia, 17 June 2015, iNat photo 221060848, by Aleksandr Levon. CC BY-NC 4.0. b. *Neottia nidus-avis*. Zakapathia Oblast, Ukraine, 1 May 2020, iNat photo 265091566, by Vlasta Loya. CC BY-NC 4.0. *Neottia ovata*. Crimea, Ukraine, 5 July 2021, iNat photo 81740015, by VyacheslavLuzanov. CC BY-NC 4.0.

Limodorum abortivum (L.) Sw. var. *abortivum*. VIOLET LIMODORE. (Fig. 13) Only in Crimea. LC LC

Limodorum abortivum (L.) Sw. var. *rubrum* H. Sund. ex Kreutz. Reported from Crimea; has reddish flowers (Fateryga and Kreutz 2014: 425, Figure 12).

Limodorum abortivum (L.) Sw. var. *viridis* Fateryga & Kreutz. This variety from Crimea has a completely green stem (Fateryga and Kreutz (2014: 414).



Figure 13. *Limodorum abortivum* in Ukraine (modified from iNaturalist). a. Bakhchsarais'kyi, Crimea, 1 July 2007, iNat photo 12870439, by Katarina Kasharina. CC BY-NC 4.0. b. Southwest Crimea, 10 May 2010, iNat. photo 157488716, by yuri bengus. CC BY-NC 4.0. c. Crimea, Ukraine, 5 June 2011, iNat photo 85629278, by vadim66. CC BY-NC 4.0.

Epipogium aphyllum Sw., GHOST ORCHID. (Fig. 14) See Taylor and Roberts (2011) for information on this unusual species that can flower underground and for which above-ground appearance is largely unpredictable. Breeding systems, see Jakubska-Busse (2014) and Krawczyk *et al.* (2016). EN LC



Figure 14. *Epipogium aphyllum* near Ukraine (modified from iNaturalist). **a.** Campania, Italy, Aug. 2019, iNat photo 47812201, by Alessio Becucci. CC BY-NC 4.0. **b.** Switzerland, July 2018, iNat photo 61956388, by Karsten Rohweder. CC BY-NC 4.0. **c.** Austria. 3 Aug. 2012, iNat photo 250600454, by Konrad and Roland Greinwald. CC BY-NC 4.0. **d.** Switzerland, August 2013, iNat photo 51003359, by Karsten Rohweder. CC BY-NC 4.0. **e.** France. July 2021, iNat photo 146419945, by Loicarnould. CC BY-NC 4.0. **f.** Caucasus Mountains, 18 July 2018, iNat photo 30035431, by Maxim I. Khomutobskiy. CC BY-NC 4.0.

Hammarbya paludosa (L.) Kuntze, BOG ORCHID. (Fig. 15 e, f, g) NT LC

Liparis loeselii (L.) Rich., FEN ORCHID. (Fig. 15 a) VU LC

Malaxis monophyllos (L.) Sw., ONE-LEAFED BOG ORCHID. (Fig. 16 c, d) VU LC

Bletilla striata (Thunb.) Rchb. f., CHINESE GROUND ORCHID. (Fig. 19) Reported from Crimea (Figure 19). The native range is Japan, Korea, Myanmar (Burma), and China. This orchid may have successfully established in the wild in Crimea, as it has in some temperate and subtropical parts of the U.S. (personal observation). It is reported as established in Italy (Celesti-Grapow 2009). It is well known in cultivation as a hardy species that can persist outdoors in the southern parts of Britain and North America.

Corallorhiza trifida Châtel. CORALROOT ORCHID. (Fig. 15 c, d) NT LC

Goodyera repens (L.) R.Br., CREEPING LADY'S-TRESSES. (Fig. 16 a, b) The whitish pencil markings on the leaves (Figure 16) were clear on all Ukrainian plants that we have seen, but they may be broader and more prominent on plants from northern Ukraine than from Crimea. LC LC

Spiranthes australis (R.Brown) Lindley, AUSTRAL LADY'S-TRESSES. (Fig. 17) Reported by Mosyakin & Fedoronchuk (1999: 46) and Onyshchenko *et al.* (2022: 24) as *Spiranthes amoena*, which is generally treated as a synonym of *S. australis*. The recent occurrences of this species in the Ukraine (Figure 17) are at the western limit of Eurasian distribution. Onyshchenko *et al.* (2022: 24) noted a single locality in Ukraine with 500 to 2000 plants. EN LC

Spiranthes spiralis (L.) Chevall. AUTUMN LADY'S-TRESSES. (Fig. 17) Listed by Onyshchenko *et al.* (2022: 24) with 100 to 500 plants in less than 10 locations. NT LC

Herminium monorchis (L.) R. Br., MUSK ORCHID. (Fig. 15 b) More than 40 plants decreasing (Onyshchenko *et al.* 2022: 23). For more information on this and related species which are centered in Himalaya see Raskoti *et al.* (2017). CR LC

Hemipilia cucullata (L.) Y. Tang, H. Peng. and T. Yukawa, NEOTTIANTHE. (Fig. 18) (*Neottianthe cucullata*, *Ponerorchis cucullata*). EN LC

Pseudorchis albida (L.) Á & D. Löve subsp. *albida*. SMALL WHITE ORCHID. (Fig. 17) In Ukraine largely confined to the Carpathian Mountains in the extreme southwest. See Jersákova *et al.* (2011) for a helpful review of taxonomy and separation of this from subsp. *straminea*. LC LC

Platanthera bifolia (L.) Rich., LESSER BUTTERFLY ORCHID. Some plants from Crimea have relatively short spurs and may be referable to var. *atropatenica* (B. Baumann *et al.*) P. Delforge. LC LC

Platanthera chlorantha (Custer) Rchb., GREATER BUTTERFLY ORCHID. LC LC

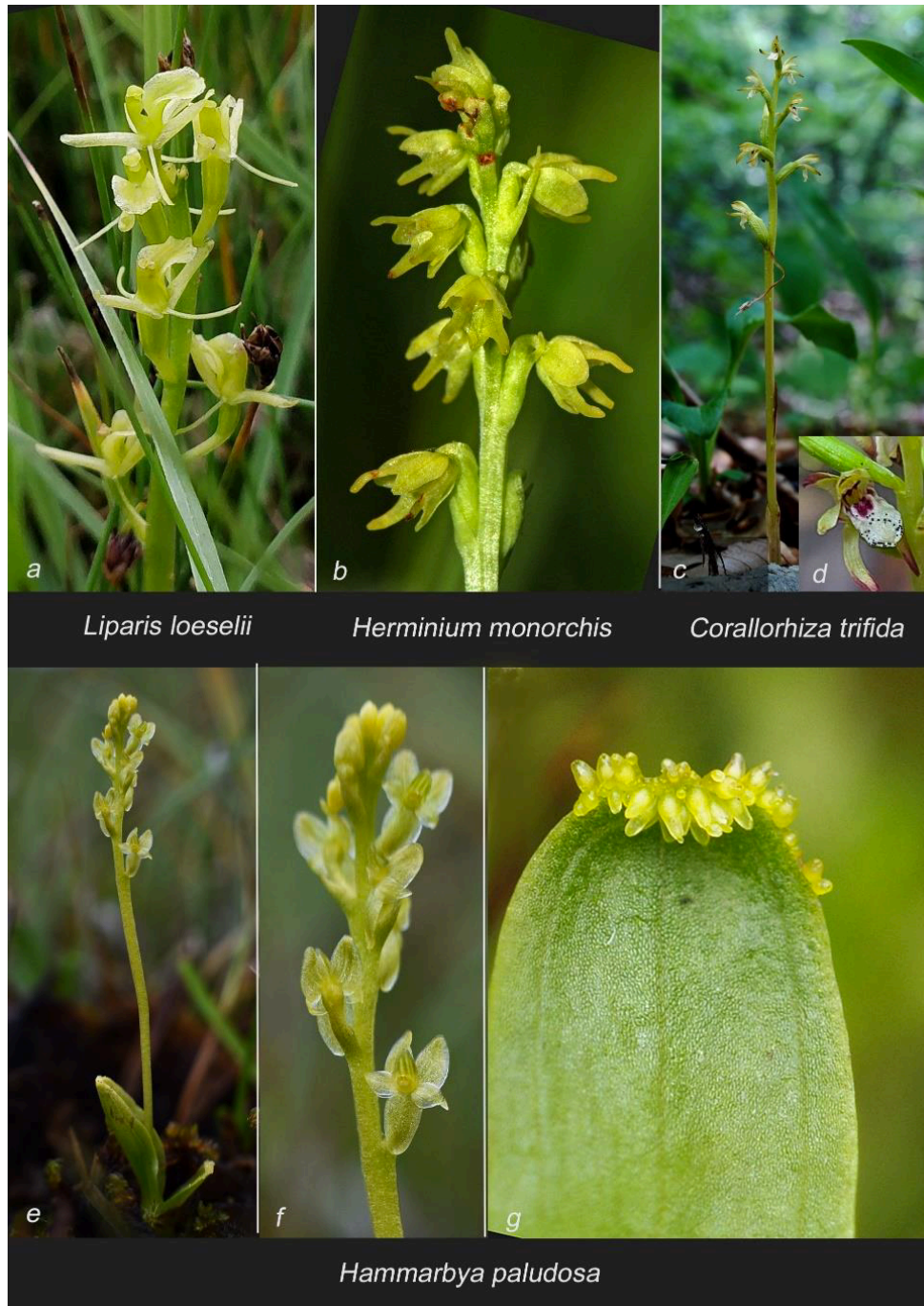


Figure 15. Monospecific genera in (and near) Ukraine (modified from iNaturalist). **a.** *Liparis loeselii*. Netherlands, July 2021, iNat photo 147012601, by dgcurrywheel. CC BY-NC 4.0. **b.** *Herminium monorchis*. Russia, 25 June 2010, iNat photo 31306057, by Vadim Prokhorov. CC BY-NC 4.0. **c.** *Corallorhiza trifida* (plant). Bakhchysarais'kyi, Crimea, Ukraine, 8 June 2022, iNat photo 264229331, by sapsan. CC BY-NC 4.0. **d.** *Corallorhiza trifida* (flower). Simferopol'kyi, Crimea, Ukraine, 21 June 2021, iNat photo 138076119, by svetlana Bogdanovich. CC BY-NC 4.0. **e.** *Hammarbya paludosa* (plant). Highland, Scotland, July 2021, iNat photo 141738706, by Calum McLennan. CC BY-NC 4.0. **f.** *Hammarbya paludosa* (inflorescence). Highland, Scotland, July 2021, iNat photo 141738642, by Calum McLennan. CC BY-NC 4.0. **g.** *Hammarbya paludosa* (adventitious embryos on leaf tip). North Holland, Netherlands, Sept. 2016, iNat photo 174817466, by TOV Muuse. CC BY-NC 4.0.



Figure 16. Monospecific genera in (and near) Ukraine (modified from iNaturalist). **a.** *Goodyera repens*. Bakhchysarais'kyi, Crimea, Ukraine, 28 June 2020, iNat photo 113006700, by sapsan. CC BY-NC 4.0. **b.** *Goodyera repens*. Bakhchysarais'kyi, Crimea, Ukraine, 28 June 2020, iNat photo 113006700, by sapsan. CC BY-NC 4.0. **c.** *Malaxis monophyllos* (plant). Italy, July 2020, iNat photo 84329283, by Luca Boscain. CC BY-NC 4.0. **d.** *Malaxis monophyllos* (inflorescence). Italy, July 2020, iNat photo 84329154, by Luca Boscain. CC BY-NC 4.0.



Figure 17. *Spiranthes* and *Pseudorchis* in (and near) Ukraine (modified from iNaturalist). *Spiranthes australis* (This species is at its western range limit in Ukraine). Lviv, 2 August 2022, iNat photo 129123968, by Petro_Hryniuk. CC BY-NC 4.0. *Spiranthes spiralis*. Baraolt Mts., Romania, 6 Sept. 2020, iNat. photo 128632532, by vio76. CC BY-NC 4.0. *Pseudorchis albida* var. *albida*. Vysoké Tatry, 15 July 2017, iNat. photo 38302423, by matthieu gauvain. CC BY-NC 4.0.



Figure 18. *Hemipilia cucullata* in and near Ukraine (modified from iNaturalist). **a.** Belarus, Aug. 2020, iNat photo 221976046, by stepdi. CC BY-NC 4.0. **b.** Tatarstan, Russia, 31 July 2022, iNat. photo 237878320, by Dmitry Zhukov. CC BY-NC 4.0. **c.** South of Moscow, Russia, 3 Aug. 2022, iNat photo 219719584, by Vladimir Arkhipov. CC BY-NC 4.0.



Figure 19. *Bletilla striata* in Ukraine (modified from iNaturalist). Crimea, Ukraine, 20 Aug. 1997, iNat photos 88021153 and 88021917 (left and right), by Aleksandr Levon. CC BY-NC 4.0.



Figure 20. *Platanthera* in Ukraine (modified from iNaturalist). **a.** *Platanthera bifolia* (flower from front). Alushtyns'ka, Crimea, 10 June 2022, iNat photo 264234697, by sapsan. CC BY-NC 4.0. **b.** *Platanthera chlorantha* (flower from oblique front). Sudats'ka, Ukraine, 16 June 2020, iNat photo 139683970, by vadim66. CC BY-NC 4.0. **c.** *Platanthera bifolia* (inflorescence). Alushtyns'ka, Crimea, 10 June 2022, iNat photo 264234632, by sapsan. CC BY-NC 4.0. **d.** *Platanthera chlorantha* (inflorescence). Crimea, Ukraine, 5 June 2021, iNat photo 134088910, by Vyacheslav Luzanov. CC BY-NC 4.0.



Gymnadenia austriaca

Gymnadenia carpatica

Figure 21. *Gymnadenia* in, and near Ukraine (modified from iNaturalist). Left to right. *Gymnadenia austriaca*. inflorescence, Neunkirchen, Austria, 2 July 2022. iNat photo 210910158, by Martin A. Prinz. CC BY-NC 4.0. *Gymnadenia carpatica*. inflorescence, Verkhovyns'kyi, Ivano-Frankivs'k, Ukraine, 2 July 2021, iNat photo 162395656, by Oleh Prylutskyi. CC BY-NC 4.0.



Gymnadenia conopsea

*Gymnadenia
odoratissima*

*Gymnadenia
densiflora*

Figure 22. *Gymnadenia* in, and near Ukraine (modified from iNaturalist). Left to right. *Gymnadenia conopsea*. Carpathians, Ukraine, 3 July 2022, iNat photo 213800748, by Olena Fomina. CC BY-NC 4.0. *Gymnadenia odoratissima*. Mošovce, Slovakia, 26 June 2018, iNat photo 20364526, by matind. CC BY-NC 4.0. *Gymnadenia densiflora*. Belluno, Veneto, Italy, 13 July 2018. iNat photo 194680647. by Keith Martin-Smith. CC BY-NC 4.0.

Gymnadenia austriaca (Teppner & E.Klein) P. Delforge, AUSTRIAN VANILLA ORCHID. (Fig. 21) (*Nigritella nigra* subsp. *austriaca*). Only extreme southwest mountains. See Kolanowska (2021) for projected decline due to climate change. Information on evolution and systematics was provided by Hedrén *et al.* (2018) who suggested that *Gymnadenia* and *Nigritella* may be monophyletic sister genera.

Gymnadenia carpatica (Zapal.) Teppner & E. Klein, CARPATHIAN VANILLA ORCHID. (Fig. 21) This is part of a group of complex taxa of high elevations extending from the Pyrenees, east across the Alps, and into the Carpathian Mountains. Kuhn *et al.* (2019: 116) treated *G. carpatica* as a possible synonym of *G. rhellicani*. This synonymy would extend the range of the latter into the Carpathians. It may also combine diploid sexually reproducing *G. carpatica* with polyploid and vegetatively reproducing (by adventitious embryony) *G. austriaca* (Teppner and Klein 1990, Teppner 1996). *Gymnadenia carpatica* is accepted here on the basis of the listing by Onyshchenko *et al.* (2022: 23) where reported as *Nigritella carpatica*. It was found in Ukraine for the first time in 1993 by Zahulskyy & Chorney (1993). Onyshchenko (2022: 22) reported that 60 plants in 2 populations were decreasing. CR CR

Gymnadenia conopsea (L.) R. Br., FRAGRANT ORCHID. (Fig. 22) Includes *Gymnadenia alpina* (Turcz. ex Rchb.f.) Czerep. This is one of several orchids that have increased as a result of a return to autumn cutting of hay meadows (Austad *et al.* 2016). LC LC

Gymnadenia densiflora (Walenb.) K. Richt., DENSE-FLOWERED FRAGRANT ORCHID. VU LC

Gymnadenia odoratissima (L.) Rich., SHORT-SPURRED FRAGRANT ORCHID. (Fig. 22) VU LC

Dactylorhiza iberica (M. Bieb. ex Willd.) Soó, CRIMEAN MARSH-ORCHID. (Fig. 23 e) NT LC

Dactylorhiza incarnata (L.) Soó var. *cruenta* (O.F. Müll.) Hyl. Hedrén and Nordström (2009) suggested that spotted leaves are an uncertain taxonomic character. DD LC

Dactylorhiza incarnata (L.) Soó var. *incarnata*, EARLY MARSH-ORCHID. (Fig. 23 b) Flower colour polymorphism in *D. incarnata* is not the same as in *D. sambucina*, where explained by increased pollination efficiency. The yellow-flowered form may be best treated as var. *ochroleuca* (Boll) Hylander (Hedrén and Nordström 2009). LC LC

Dactylorhiza maculata (L.) Soó subsp. *fuchsii* (Druce) Hyl., COMMON SPOTTED-ORCHID. Includes *D. hebridensis* (see Kühn *et al.* 2019: 144) which was listed separately by Mosyakin & Fedoronchuk (1999: 40). LC LC

Dactylorhiza maculata (L.) Soó subsp. *maculata*, HEATH SPOTTED-ORCHID. (Fig. 23 a) Includes var. *elodes* and var. *transilvanica*. LC LC

Dactylorhiza majalis (Rchb.) P.F. Hunt & Summerh. subsp. *cordigera* (Fr.) H. Sund. (Fig. 23 c) Only in the southwest. NT LC

Dactylorhiza majalis (Rchb.) P.F. Hunt & Summerh. subsp. *lapponica* (Laest. Ex Hartm.) H.Sund. Northwest only. Includes *D. traunsteineri* and *D. schurii*. CR LC

Dactylorhiza majalis (Rchb.) P.F. Hunt & Summerh. subsp. *majalis*, BROAD-LEAVED MARSH-ORCHID. (Fig. 23 d) LC LC

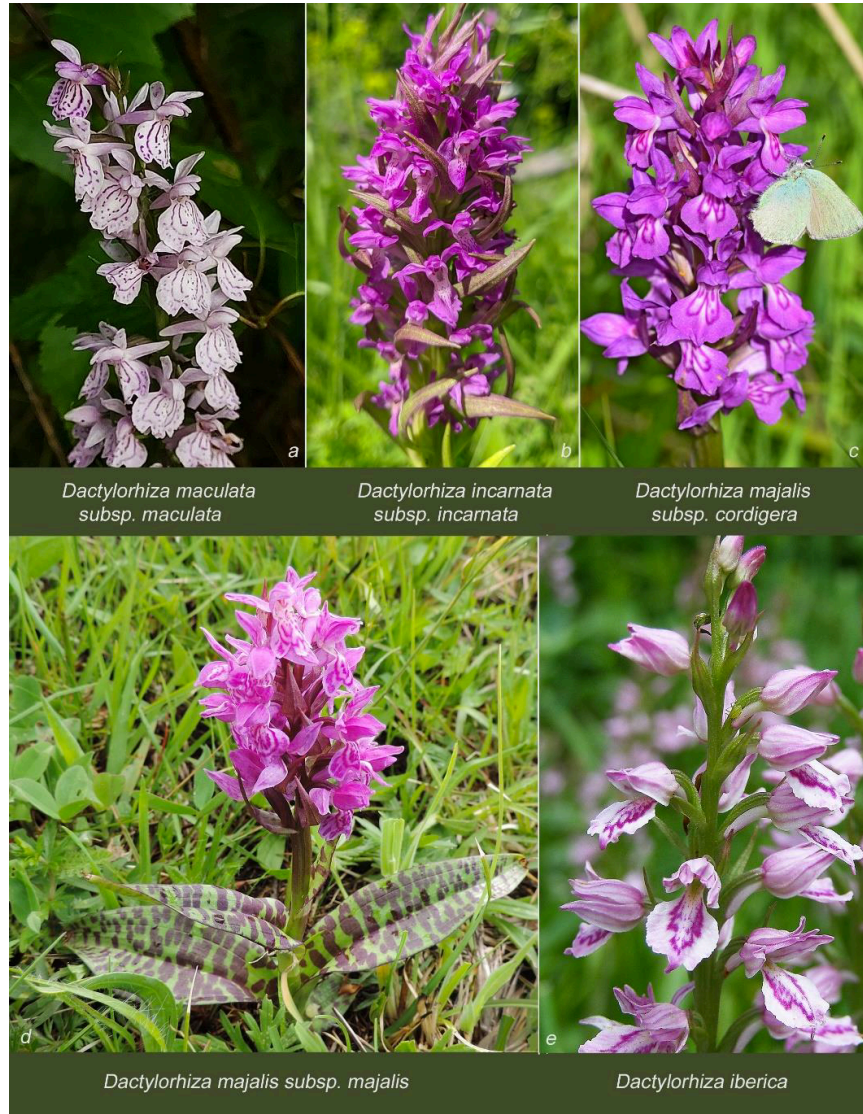


Figure 23. *Dactylorhiza* in, and near Ukraine (modified from iNaturalist). **a.** *Dactylorhiza maculata* subsp. *maculata*. Shepetivs'kyi, Khmel'nyts'kyi, Ukraine, 9 July 2022, iNat photo 231139047, by Alexander Baransky, CC BY-NC 4.0. **b.** *Dactylorhiza incarnata* var. *incarnata*. Alushtyns'ka, Crimea, Ukraine, 11 June 2021, iNat photo 135488176, by sveltana-bogdanovich. CC BY-NC 4.0. **c.** *Dactylorhiza majalis* subsp. *cordigera*. Greece, 27 May 2018, iNat photo 19197148, by Kostas Zontanos. The butterfly is the Green Hairstreak (*Callophrys rubi*). CC BY-NC 4.0. **d.** *Dactylorhiza majalis* subsp. *majalis* (plant), northwestern Ukraine, 4 June 2020, iNat photo 241201495, by Petro Hryniuk, CC BY-NC 4.0. **e.** *Dactylorhiza iberica*. Alushtyns'ka, Crimea, Ukraine, 22 June 2007, iNat photo 73413521, by sveltana-bogdanovich. CC BY-NC 4.0.

Dactylorhiza romana (Sebast.) Soó subsp. **romana**, ROMAN ORCHID. See the discussion of two different forms in Crimea in Fateryga and Kreutz (2014). For a study of reproduction in Crimea, see Lagutova *et al.* (1996). See Pederson (2006) for information on the *D. romana - sambucina* group. NT LC

Dactylorhiza sambucina (L.) Soó, ELDER-FLOWERED ORCHID. (Fig. 24) See Pederson (2006) for information on the *D. romana - sambucina* group. NT LC



Figure 24. *Dactylorhiza sambucina* colour variations. **Top row**, from left to right. Huesca, Spain, 1 June 2019, iNat photo 244924660, by Jeff Bisbee. CC BY-NC 4.0. Sofia, Bulgaria, 15 May 2022, iNat photo 200811378, by Lyuboslava Dimitrova - Lucy. CC BY-NC 4.0. Galda de Jos, Romania, 15 May 2022, iNat photo 212063868, Mihai Paul Constainescu. CC BY-NC 4.0. Halbav, Romania, 5 May 2021, iNat photo 127352937, by xulescu_g. CC BY-SA 4.0. **Bottom**, plants in natural habitat, Galda de Jos, Romania, 15 May 2022, iNat photo 212063868, Mihai Paul Constainescu. CC BY-NC 4.0.

Dactylorhiza viridis (L.) R.M. Bateman, Pridgeon & M.W. Chase, FROG ORCHID. (*Coeloglossum viride*). This orchid has declined in several European countries, but it has been found that management with July mowing (after seed dispersal), and winter grazing by sheep, can increase populations (Willems and Melser 1998). Devos *et al.* (2006a, b) suggested that *Coeloglossum* and *Dactylorhiza* should be treated as distinct genera. LC LC

Traunsteinera globosa (L.) Rchb., GLOBE ORCHID. (Fig. 25) Only in southwest. This species derives benefits from co-flowering magnet species, and may mimic a guild of fly-pollinated plants (*Knautia*, *Scabiosa*, *Valeriana*), but ecological dependence on the models remains to be tested (Jersáková *et al.* 2016). LC LC

Traunsteinera sphaerica (M.Bieb.) Schltr. (Fig. 25) Only in Crimea. The species of *Traunsteinera* are expected to lose critical habitat and pollinators due to climate change. It has been speculated that this one should be considered as an ecotype of *T. globosa* based on its similar environmental attributes (Kolanowska 2021).



Figure 25. *Traunsteinera* spp. in and near Ukraine. From left to right, *Traunsteinera sphaerica*, Karachay-Cherkess, Caucasus Mts., Russia, 20 July 2018, iNat photo 30035437, by Maxim Khomutovsky. CC BY-NC 4.0. *Traunsteinera globosa*. Transcarpathia, Ukraine, 4 July 2011, iNat photo 59914144, by Viktoria. CC BY-NC 4.0.

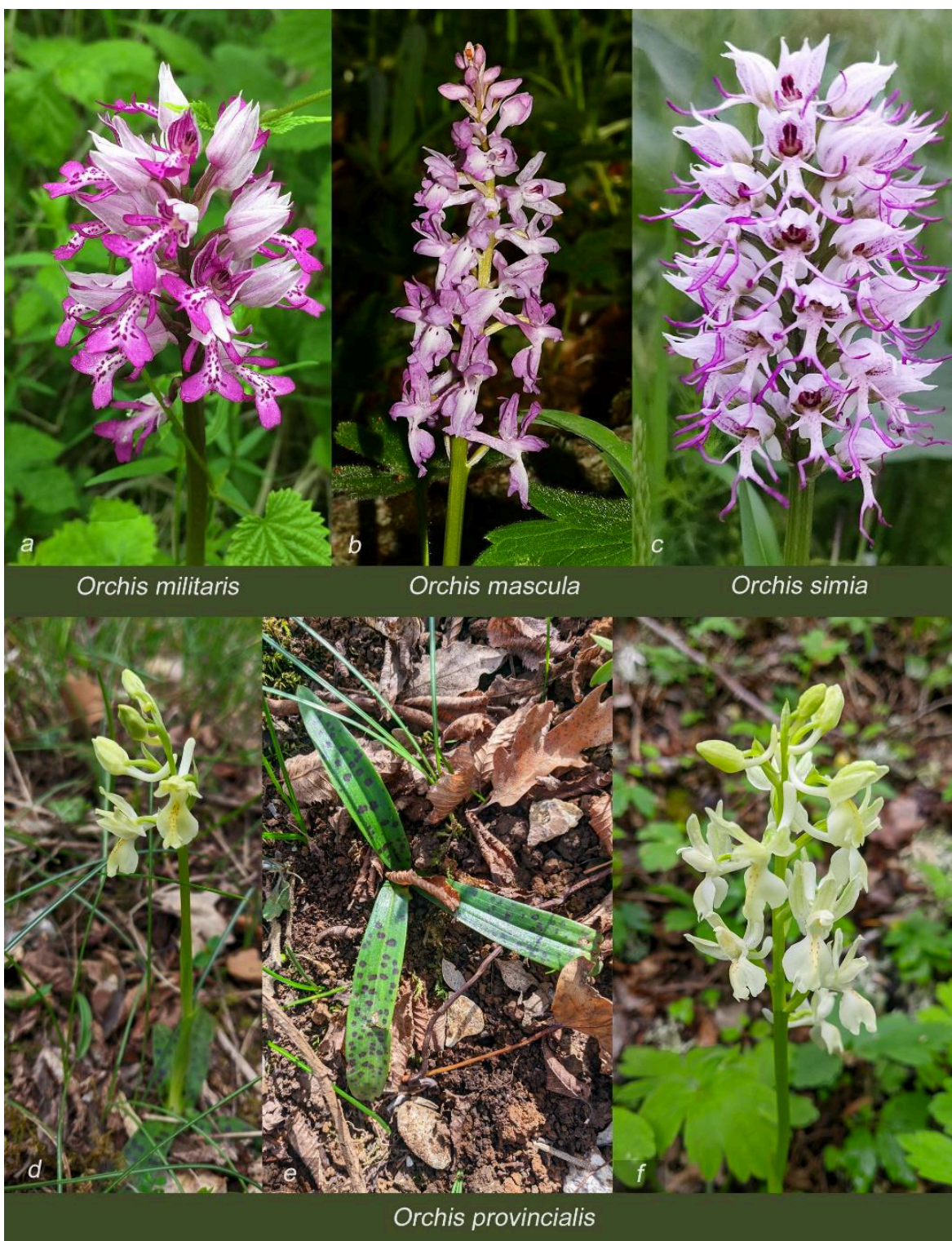


Figure 26. *Orchis* spp. in and near Ukraine. **a.** *Orchis militaris*. Rivne, Ukraine, 24 May 202, iNat photo 74692948, by viktorina. CC BY-NC 4.0. **b.** *Orchis mascula*. Crimea, 3 May 2020, iNat. photo 71815139, by Katerina Kashirina. CC BY-NC 4.0. **c.** *Orchis simia*. Sudats'ka, Crimea, 30 April 2022, iNat. photo 193902976, by svetlana-bogdanovich. CC BY-NC 4.0. **d - f.** *Orchis provincialis*. Alushtyns'ka Crimea, by svetlana-bogdanovich. CC BY-NC 4.0. **d.** 14 April 2023, iNat. photo 267812889. **e.** 4 April 2023, iNat. photo 264810049. **f.** 2 May 2022, iNat. photo 194646694.

Orchis mascula (L.) L. subsp. *speciosa* (Mutel) Hegi. SHOWY EARLY PURPLE ORCHID. Only in the southwest. Onyshchenko *et al.* (2022: 24) include this as *O. signifera* Vest, now included with the present taxon (Kew Index). NT LC

Orchis mascula (L.) L. var. *wanjkovii* (E. Wulff) Fateryga & Kreutz. This name is now generally treated as a synonym of *O. mascula* subsp. *mascula* but it may refer to a somewhat different, pink-flowered plant. Accepted by Onyshchenko *et al.* (2022: 24). DD NE

Orchis mascula (L.) L. subsp. *mascula*, EARLY PURPLE ORCHID. (Fig. 26 b) Only in Crimea. Includes *Orchis pinetorum*. LC LC

Orchis militaris L. subsp. *stevenii* (Rchb. f.) B. Baumann *et al.* (Fig. 26 a) "*Orchis militaris* L. is only represented by *O. militaris* L. subsp. *stevenii* (Rchb. f.) B. Baumann *et al.* (fig. 30-33). The typical *O. militaris* is distributed further north and is absent in the Crimea" (Fateryga and Kreutz 2014: 415). NT LC

Orchis pallens L. PALE-FLOWERED ORCHID. Only in Crimea. VU LC

Orchis provincialis Balb. ex Lam. & DC. PROVENÇAL ORCHID. (Fig. 26 d, e, f) Only in Crimea, 1000 plants, decreasing (Onyshchenko *et al.* 2022: 24). EN LC

Orchis punctulata Stevens ex Lindl. PUNCTATE ORCHID. Only in Crimea, 1000 plants, stable (Onyshchenko *et al.* 2022: 24). VU LC

Orchis purpurea Huds. subsp. *purpurea*, LADY ORCHID. (Fig. 36- inside back cover) Extreme southwest. LC LC

Orchis simia Lam. MONKEY ORCHID. (Fig. 26 c) Only in Crimea. LC LC

Neotinea tridentata (Scop.) R.M. Bateman, Pridgeon & M.W. Chase, TOOTHED ORCHID. Only in Crimea. (*Orchis tridentata*). LC LC

Neotinea ustulata (L.) R.M. Bateman, Pridgeon & M.W. Chase var. *ustulata*, BURNT-TIPPED ORCHID. VU LC

Ophrys apifera Huds. BEE ORCHID. (Fig. 28 a, b) This species is widespread in adjacent Romania where its distribution and habitats are described in detail by Szatmari (2016). Year-round (non-seasonal) grazing by horses, at low stocking intensity, was found to maintain high diversity in semi-dry calcareous grasslands, and to increase populations of *Ophrys apifera* (Köhler *et al.* 2016). EN LC

Ophrys insectifera L. FLY ORCHID. (Fig. 28 c, Fig. 35) RE LC

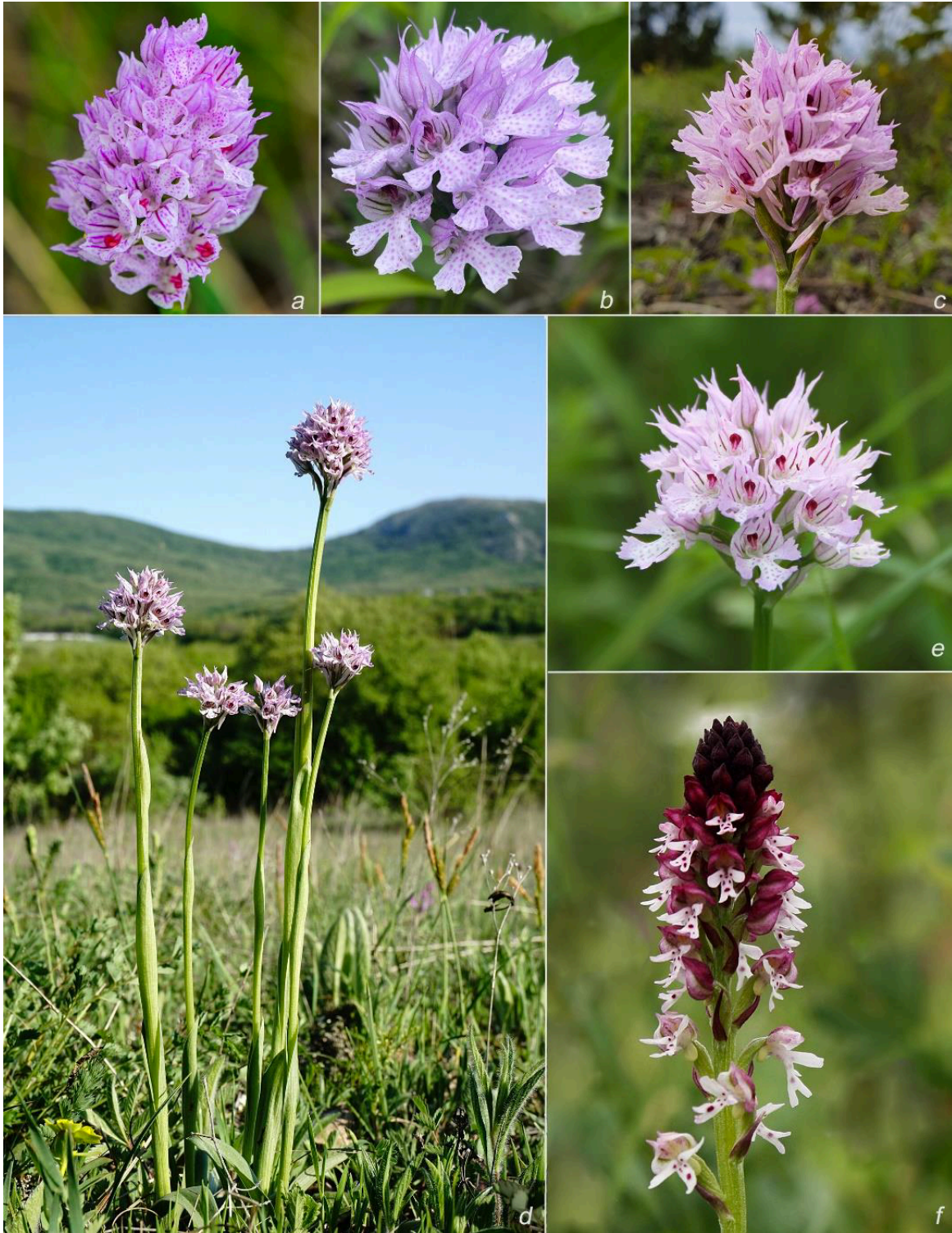


Figure 27. *Neotinea* spp. in and near Ukraine. **a-e.** *Neotinea tridentata*. Kirovs'kwi, Crimea, Ukraine, 8 May 2020, iNat photo 72727240, by Vyacheslav Luzanov. CC BY-NC 4.0. **b.** Balalklavs'kyi, Sevastopol', Crimea, 26 May 2022, iNat photo 203647761, by Vyacheslav Luzanov. CC BY-NC 4.0. **c.** Balalklavs'kyi, Sevastopol', Crimea, Ukraine, 18 May 2021, iNat photo 154701622, by Maxim I. Khomutovskiy. CC BY-NC 4.0. **d.** Habitat, Balalklavs'kyi, Sevastopol', Crimea, 14 May 2022, iNat photo 263933727, by Sapsan. CC BY-NC 4.0. **e.** Alushtyns'ka, Crimea, Ukraine, 11 May 2019, iNat photo 105700688, by uchsia-bogdannovich. CC BY-NC 4.0. **f.** *Neotinea ustulata*. Crimea, Ukraine, 6 July 2004, iNat photo 221054241, by Aleksandr Levon. CC BY-NC 4.0.

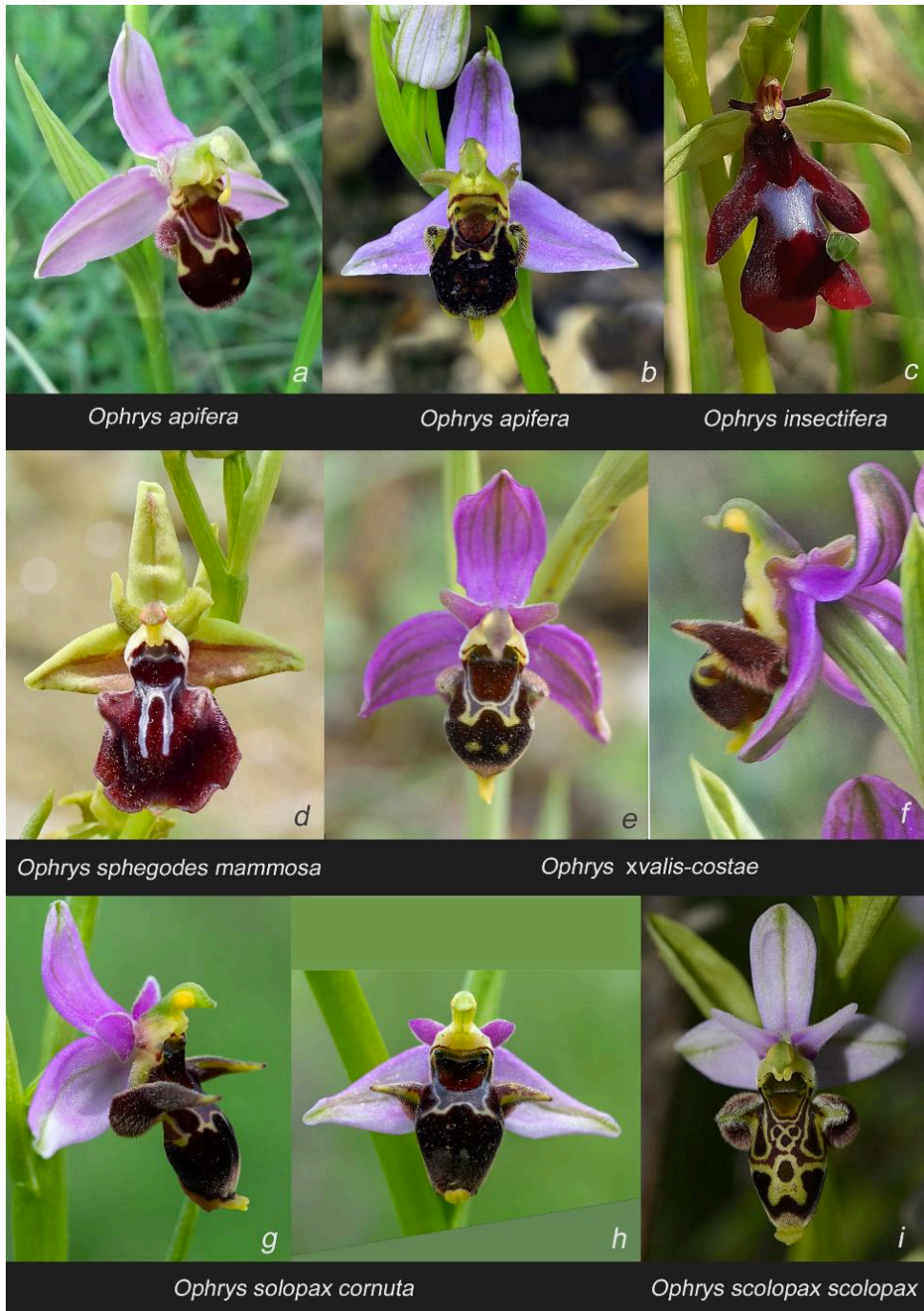


Figure 28. *Ophrys* species of Ukraine (modified from iNaturalist). **a.** *Ophrys apifera*. Crimea, 8 June 2022, iNat. photo 204414248, by Sergey Cherkasov. CC BY-NC 4.0. **b.** *Ophrys apifera*. Crimea, 9 June 2007, iNat. photo 220730660, by Alexandr Levon. CC BY-NC 4.0. **c.** *Ophrys insectifera*. Estonia, Alema Looduskaiteala, 19 June 2022, iNat. photo 258217554, by Sanderp. CC BY-NC 4.0. **d.** *Ophrys sphegodes* subsp. *mammosa*. Crimea, 17 May 2021, iNat. photo 177415786, by Вадим. CC BY-NC 4.0. **e, f.** *Ophrys xvalis-costae* (*apifera* × *oestrifera*). Crimea, 21 May 2020, iNat. photo 46734777, by Elena. CC BY-NC 4.0. **g, h.** *Ophrys scolopax* Cav. subsp. *cornuta* (*O. oestrifera*). Crimea, 19 May 2019, iNat. photo 10928960, by Maksim Stefanovich. CC BY-NC 4.0. **i.** *Ophrys scolopax* subsp. *scolopax*. France, Grospierres, 8 May 2014, iNat. photo 113028953, by Pascal Dubois. CC BY-NC 4.0.



Figure 29, *Ophrys* \times *aghemanni*. Sudats'ka, Crimea, Ukraine. 15 May 2021. Above. Habitat. iNat photo 181586813, by sapsan. Below. Flowers, iNat photo 181586698 by sapsan. Both CC BY-NC 4.0.



Figure 30. *Steveniella satyrioides* in Ukraine. **a.** Bakhchysarais'kyi, Crimea, Ukraine, 27 April 2022, iNat photo 195263938, by svelen. CC BY-NC 4.0. **b.** Crimea, Ukraine, 10 May 2021, iNat photo 128784177, by Vyacheslav Luzanov. CC BY-NC 4.0. **c.** Sudats'ka, Crimea, Ukraine, 15 May 2021, iNat photo 181586203, by Sapsan. CC BY-NC 4.0. **d.** Bakhchysarais'kyi, Crimea, Ukraine, 27 April 2022, iNat photo 195263702, by svelen. CC BY-NC 4.0. **e-f** (also c above). Sudats'ka, Crimea, Ukraine, 15 May 2021, iNat photo 181586110, by sapsan. CC BY-NC 4.0. **e.** iNat photo 181586110. **f.** iNat photo 181586109.

Ophrys scolopax Cav. subsp. *cornuta* (Steven) E.G. Camus in E.G. Camus, P. Bergon & A.A. Camus. (Fig. 28 g, h) Only in Crimea. Listed by Onyshchenko *et al.* (2022: 23) and Efimov (2020: 5) and Fateryga *et al.* (2018) as *O. oesterifera* which was not recognized by Kühn *et al.* (2019) and said to be identical to the present taxon (e.g., Davies *et al.* 1983: 173). Onyshchenko *et al.* (2022: 23) note a stable population of 5000 plants. NT LC

Ophrys scolopax Cav. subsp. *scolopax*, WOODCOCK ORCHID. (Fig. 28 i) Only in Crimea.

Ophrys sphegodes subsp. *mammosa* (Desf.) Soó *ex* Nelson. (Fig. 28 d- back cover) Only in Crimea. Reported by Onyshchenko *et al.* (2022: 24) and Mosyakin & Federonchuk (1999: 44) as *O. taurica*. 1000 plants, decreasing. See Sheiko & Kosakivska (2015) for micropropagation using callus tissue conservation *ex-situ*. For subsp. *sphogodes*, Hutchings (2010) suggested that site disturbance is beneficial to recruitment. VU NT

Steveniella satyrioides (Spreng.) Schltr. STEVENS ORCHID. (Fig. 30) In the Crimea, this nectarless orchid is pollinated by wasps (*Paravespula vulgaris* and *Dolichovespula sylvestris*) which are attracted to reddish-brown papillae at the base of the lip that may resemble prey (Nazarov 1995). The relationship of *Steveniella* has been widely debated, and it's similarity to *Anacamptis coriophora* and to species of *Ophrys* is notable. It has been recently considered to be a sister group to *Himantoglossum*. NT LC

Himantoglossum calcaratum (G. Beck) Schltr. subsp. *jankae* (Somlyay, Kreutz & Óvári) R.M. Bateman, Kreutz, and Óvári. (Fig. 31 c) Only in Crimea.

Himantoglossum caprinum (M. Bieb.) Spreng. (Fig. 31 b) Only in Crimea. LC LC

Himantoglossum comperianum (Steven) P. Delforge, COMPER'S ORCHID. (Fig. 31 a, d) (*Comparia compariana*). Only in Crimea. NT LC

Anacamptis coriophora (L.) R.M. Bateman, Pridgeon & M.W. Chase, subsp. *coriophora*, BUG ORCHID. (*Orchis coriophora*). The "sickly foetid scent" of the whole plant is described by Davies *et al.* (1983: 120), and is in direct contrast to that of subsp. *fragrans*. Includes *Orchis nervulosa*. NT LC

Anacamptis coriophora (L.) R.M. Bateman, Pridgeon & M.W. Chase subsp. *fragrans* (Pollini) R.M. Bateman, Pridgeon & M.W. Chase. FRAGRANT BUG ORCHID. (Fig. 32 f) (*Orchis fragrans*). Crimea and southeast. NT LC

Anacamptis laxiflora (Lam.) R.M. Bateman, Pridgeon & M.W. Chase subsp. *laxiflora*, LAX-FLOWERED ORCHID. (Fig. 32 c) Only in Crimea. NT LC

Anacamptis morio (L.) R.M. Bateman, Pridgeon & M.W. Chase subsp. *caucasica* (K. Koch) H. Kretzschmar, Eccarius & H. Dietr. "Crimea and the Northern Black Sea region" (Gaponenko *et al.* 2021).

Anacamptis morio (L.) R.M. Bateman, Pridgeon & M.W. Chase subsp. *morio* GREEN-WINGED ORCHID. (Front cover, Fig. 32 d, e) "Grows in the Ukrainian Carpathians and the Polissia" (Gaponenko *et al.* 2021). A uniquely large population of 250,000 to 300,000 individuals was recently found on the Left Bank (east side of Dnieper River) (Shevchyk *et al.* 2019). LC LC

Anacamptis palustris (Jacq.) R.M. Bateman, Pridgeon & M.W. Chase subsp. *elegans* (Heuff.) R.M. Bateman, Pridgeon & M.W. Chase. (Fig. 32 b) (*Orchis elegans*, *O. palustris*). Onyshchenko *et al.* (2022: 21) treat this as a synonym of *A. laxiflora*.

Anacamptis pyramidalis (L.) Rich. PYRAMID ORCHID. (Fig. 32 a) Crimea and central Ukraine. A recent study of pollination of this species in Crimea found that the nectarless flowers are pollinated by species of *Zygaena* (Lepidoptera) which are attracted by "the mimetic likeness of orchid inflorescences to the red inflorescences of food plants". Male insects were primary pollinators (Nazarov and Yefetov 1994). LC LC



Figure 31. *Himantoglossum* spp. in and near Ukraine. **a.** *Himantoglossum comperianum*. Bakhchysarais'kiyua, Crimea, Ukraine, 17 May 2020, iNat photo 73992997, by Vyacheslav Luzanov. CC BY-NC 4.0. **b.** *Himantoglossum caprinum*. Sudats'ka, Crimea, Ukraine, 19 June 2020, iNat photo 141952207, by Vadim66. CC BY-NC 4.0. **c.** *Himantoglossum calcaratum*. Rastište, Serbia, 1 July 2018, iNat photo 20636909, by David Lupin. CC BY-NC 4.0. **d.** *Himantoglossum comperianum*. Habitat, Southwest Crimea, 17 May 2021, iNat photo 181649235, by sapsan. CC BY-NC 4.0.



Figure 32. *Anacamptis* spp. in and near Ukraine. **a.** *Anacamptis pyramidalis*. Crimea, Ukraine, 26 June 2022, iNat photo 242510515, by Cambala. CC BY-NC 4.0. **b.** *Anacamptis palustris*. North central Ukraine. 8 June 2021, iNat photo 213794213, Tanya Bnezpala. CC BY-NC 4.0. **c.** *Anacamptis laxiflora*. Northeast of Kyiv, Ukraine, 2 June 2016, iNat photo 105706032, by Alexander Baransky. CC BY-NC 4.0. **d.** *Anacamptis morio* (white form). Sudats'ka, Crimea, Ukraine, 30 April 2022, iNat photo 193893029, by sevetlana-bogdannovich. CC BY-NC 4.0. **e.** *Anacamptis morio*. Crimea, Ukraine, 3 May 2022, iNat photo 194420566, Vyacheslav Luzanov. CC BY-NC 4.0. **f.** *Anacamptis coriophora*. Near Kharkiv, northeast Ukraine, 18 June 2011, iNat photo 158321660, by Yuri Bengus. CC BY-NC 4.0.

Table 2. Hybrids of wild orchids in the Ukraine.

This alphabetical list is likely very incomplete because hybrids are often not noticed, and/or difficult to identify due to closely resembling parents. Those expected based on the presence of parents in Ukraine, but not based on a report that we have seen, are without information on a report. These are known in other parts of Europe and are taken from Kühn *et al.* (2019).

Anacamptis × *alata* (Fleury) H. Kretzschmar, Eccarius & H. Dietr. (*Anacamptis laxiflora* × *A. morio*).

Anacamptis × *laniccaae* Kretzschmar, Eccarius & H. Dietr. (*Anacamptis morio* × *A. pyramidalis*).

Cypripedium × *ventricosum* Sw. (*Cypripedium calceolus* × *C. macranthos*). Efimov *et al.* (2020: 8) considered this reported hybrid as possible but very unlikely in Ukraine. Considered erroneously reported from Ukraine by Mosyakin & Federonchuk (1999: 40).

× *Dactylocamptis uechtriziana* (Hausskn.) B. Bock ex M. Peregrym et Kuzenko (*Dactylorhiza incarnata* × *Anacamptis palustris*). (Fig. 34) See Peregrym & Kuzenko (2010).

× *Dactylodenia lebrunii* (E.G. Camus) Peitz (*Dactylorhiza incarnata* × *Gymnadenia conopsea*).

× *Dactylodenia legrandiana* (E.G. Camus) Peitz (*Dactylorhiza maculata* subsp. *maculata* × *Gymnadenia conopsea*).

× *Dactylodenia lawalreei* P. Delforge & D. Tyteca (*Dactylorhiza fuchsii* × *Gymnadenia odoratissima*).

Dactylorhiza × *aschersoniana* (Hausskn.) Borsos & Soó (*Dactylorhiza incarnata* × *D. majalis*) Mosyakin & Federonchuk (1999: 40). The hybrid name may refer to subsp. *cruenta* of *D. incarnata*.

Dactylorhiza × *carnea* (E.G. Camus ex Fourny) Soó (*Dactylorhiza incarnata* × *maculata*).

Dactylorhiza × *kerneriorum* (Soó) Soó (*Dactylorhiza fuchsii* × *D. incarnata*). Mosyakin & Federonchuk (1999: 40).

Dactylorhiza maculata subsp. *fuchsii* × *D. majalis* subsp. *lapponica*.

Dactylorhiza × *ruppertii* (M. Schultze) Borsos & Soó (*Dactylorhiza majalis* × *D. sambucina*).

Dactylorhiza × *townsendiana* (Rouy) Soó (*Dactylorhiza maculata* subsp. *maculata* × *D. majalis* subsp. *majalis*).

Dactylorhiza × *transiens* (Druce) Soó (*Dactylorhiza fuchsii* × *D. maculata*) Mosyakin & Federonchuk (1999: 41).

Dactylorhiza × *weissenbachiana* Perko (*Dactylorhiza incarnata* × *D. majalis* subsp. *lapponica*).

Epipactis ×*schmalhausenii* Richt. (*Epipactis atrorubens* × *E. helleborine*). Mosyakin & Federonchuk (1999: 41).

×*Gymnanacamptis anacamptis* (F. Wilms.) (*Anacamptis pyramidalis* × *Gymnadenia conopsea*).

×*Gymnanacamptis odoratissima* Wildh. (*Anacamptis pyramidalis* × *Gymnadenia odoratissima*).

Gymnadenia ×*intermedia* Peterm. (*Gymnadenia conopsea* × *odoratissima*) Mosyakin & Federonchuk (1999: 42).

×*Gymplatanthera chodatii* (Lendn. ex Beauverd) E. G. Camus, Bergeron & A. Camus (*Platanthera bifolia* × *Gymnadenia conopsea*).

Neotinea ×*dietrichiana* (Bogenh.) H.Kretzschmar (*Neotinea tridentata* × *N. ustulata*).



Figure 33. Most frequently reported hybrids (from Appendix Table 2) in Ukraine (photos from various parts of Europe). *Orchis* ×*angusticruris* (*O. purpurea* × *simia*) which has the heavily marked helmet and lip of *O. purpurea*. Alta Val Tidone, Italy, 2 May 2023, iNat photo 275565791, by giusi_co. CC BY-NC 4.0. *Orchis* ×*calliantha* (*O. punctulata* × *simia*) which has yellow from *O. punctulata*, but reddish-purple and narrow lip segments of *O. simia*. Western Crimea, 30 April 2022. iNat photo 195119144, by sevelen. CC BY-NC 4.0. *Orchis* ×*wulffiana* (*O. punctulata* × *purpurea*) which has falcate petals and yellow flowers of *O. punctulata*, but broad terminal lip and purple color of *O. purpurea*. Russia, Black Sea, 3 May 2022, iNat photo 196829170 by Krylenko VV. CC BY-NC 4.0.



Figure 34. *×Dactylocampsis uechritziana* (*Dactylorhiza incarnata* × *Anacamptis palustris*) in Ukraine (modified from iNaturalist). 20 km south Kharkiv, 15 June 2009, iNat photo 112897043 (inflorescence), 112897234 (plant), by Mykyta Peregrym. CC BY-NC 4.0.

Ophrys ×*aghemanii* J. Renz. (Fig. 29) Fateryga *et al.* (2022: 47) reported *Ophrys* ×*aghemanii* Renz from Crimea and suggested that the name should be applied to all of the hybrids of *O. mammosa* and *O. oestrifera*. Thus, it is no longer "unplaced" as suggested by Kew's very useful "Plants of the World Online".

Ophrys ×*albertiana* E.G. Camus (*Ophrys apifera* × *O. fuciflora* subsp. *fuciflora*).

Ophrys ×*minuticauda* Duffort (*Ophrys apifera* × *O. scolopax* subsp. *scolopax*).

Ophrys ×*mastii* P. Delforge (*Ophrys fuciflora* × *O. insectifera*).

Ophrys ×*valis-costae* Kumpel (*O. apifera* × *O. oestrifera*). (Fig. 28 e, f) Reported for the Crimea for the first time by Fateryga *et al.* (2018). If *O. oestrifera* is considered part of *O. scolopax* subsp. *cornuta*, this hybrid name may be incorrect.

Orchis ×*angusticuris* Franch. (Fig. 33) (*Orchis purpurea* × *O. simia*) Mosyakin & Federonchuk (1999: 44).

Orchis × *beyrichii* (Rchb. f.) A. Kern. (*Orchis militaris* × *O. simia*).

Orchis × *calliantha* Renz & Tauberheim (*O. punctulata* × *O. simia*). (Fig. 33) Southwest Crimea (iNat).

Orchis × *hybrida* (Lindl.) Boenn. ex Rchb. (*Orchis militaris* × *O. purpurea*) Mosyakin & Fedoronchuk (1999: 44).

Orchis × *jailae* Soó (*Orchis provincialis* × *O. signifera*) Mosyakin & Fedoronchuk (1999: 44).

Orchis × *kisslingii* G. Beck (*Orchis pallens* × *O. signifera*) Mosyakin & Fedoronchuk (1999: 44).

Orchis × *lorenziana* Brügger, Beitr. Kenntn. (*Orchis mascula* × *O. pallens*).

Orchis × *penzigiana* A. Camus (*Orchis mascula* × *O. provincialis*).

Orchis × *plessidiaca* Renz (*Orchis pallens* × *O. provincialis*) Mosyakin & Fedoronchuk (1999: 45).

Orchis × *wulffiana* Soó (*Orchis punctulata* × *O. purpurea*) (Fig. 33) Mosyakin & Fedoronchuk (1999: 46).

Platanthera × *hybrida* Brügger (*Platanthera bifolia* × *P. chlorantha*). HYBRID BUTTERFLY ORCHID. For ecology of a new location on the Black Sea outside Crimea see Popova (2015). Bateman and Sexton (2008). For other details see <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:651782-1>.

Table 3. Excluded taxa

Anacamptis morio (L.) R.M. Bateman, Pridgeon & M.W. Chase subsp. *picta* (Loisel.) Jacquet & Scappat. Reported by Mosyakin & Fedoronchuk (1999: 45) and Onyshchenko (2022: 22), but it may be a western Mediterranean taxon, and the nearest location to Ukraine may be southern France (Kühn *et al.* 1999: 382).

Cypripedium guttatum Sw. SPOTTED LADY'S-SLIPPER. (Fig. 9) Although reported from Ukraine in some guides (Kühn *et al.* 2019: 41), presence in Ukraine (and Belarus) is considered doubtful based on a study of primary data (Efimov *et al.* 2022: 13-14). It is known from 23 of 44 regions of European Russia, and occurs within 100 km of the northern border of Ukraine. It is considered a "possible addition".

Dactylorhiza incarnata (L.) Soó var. *ochroleuca* (Boll) Hyl. Reported from western Ukraine but unconfirmed (Mosyakin & Fedoronchuk 1999: 41). Occurs near border of Ukraine in western Poland (Kühn *et al.* 2019: 140).

Orchis anthropophora (L.) All., MAN ORCHID. Noted by Mosyakin & Fedoronchuk (1999: 39 *sub Aceras anthropophorum*) that the record for northwestern Ukraine could not be substantiated, and the species does not occur near to Ukraine (Kuhn *et al.* 2019: 173).

Orchis militaris L., MILITARY ORCHID. Not present (Fateryga and Kreutz 2014: 415)

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APPENDICES

Appendix Table 1. Ukrainian Red Book list of Orchids (68 species)

(from Didukh 2009, IUCN 2022). Name (Ukrainian), Scientific Name (Latin, bold), and status (English)

Чорнянка (нігрителя) карпатська,

Nigritella carpatica, ENDANGERED

Язичок зелений,

Coeloglossum viride, RARE

Траунштейнера куляста,

Traunsteinera globosa, VULNERABLE

Стевеніелла сатириєподібна,

Steveniella satyrioides, ENDANGERED

Скручений спіральний,

Spiranthes spiralis, ENDANGERED

Скручений приємний,

Spiranthes amoena, ENDANGERED

Ремнепелюстник козячий,

Himantoglossum caprinum, VULNERABLE

Псевдорхіс білуватий (лейкорхіс білуватий),

Pseudorchis albida, VULNERABLE

Плодоріжка салепова (зозулинець салеповий),

Anacamptis morio, VULNERABLE

Плодоріжка розмальована (зозулинець розмальований),

Anacamptis picta, VULNERABLE

Плодоріжка рідкоквіткова (зозулинець рідкоквітковий),

Anacamptis laxiflora, VULNERABLE

Плодоріжка пірамідальна (анакампт пірамідальний),

Anacamptis pyramidalis, VULNERABLE

Плодоріжка запашна (зозулинець запашний, анакампт запашний),

Anacamptis fragrans, VULNERABLE

Плодоріжка болотна (зозулинець болотний),

Anacamptis palustris, VULNERABLE

Плодоріжка блощична (зозулинець блощичний)

Anacamptis coriophora, VULNERABLE

- Офрис оводоносна,
Ophrys oestrifera, ENDANGERED
- Офрис кримська,
Ophrys taurica, ENDANGERED
- Офрис комахоносна,
Ophrys insectifera, ENDANGERED
- Офрис бджолоносна,
Ophrys apifera, ENDANGERED
- Неотінея тризубчаста (зозулинець тризубчастий),
Neotinea tridentata, ENDANGERED
- Неотінея обпалена (зозулинець обпалений),
Neotinea ustulata, ENDANGERED
- Неотіанта каптурувата,
Neottianthe cucullata, ENDANGERED
- Надбородник безлистий,
Eripogium aphyllum, ENDANGERED
- М'якух болотний (хаммарбія болотна),
Hammarbya paludosa, ENDANGERED
- Любка зеленоквіткова,
Platanthera chlorantha, LEAST CONCERN
- Любка дволиста,
Platanthera bifolia, LEAST CONCERN
- Лімодор недорозвинений,
Limodorum abortivum, LEAST CONCERN
- Коручка чемерникоподібна (коручка широколиста),
Eripactis helleborine, LEAST CONCERN
- Коручка темно-червона,
Eripactis atrorubens, VULNERABLE
- Коручка пурпурова,
Eripactis purpurata, RARE
- Коручка ельбська (коручка пізньоквітуча),
Eripactis albensis, RARE
- Коручка дрібнолиста,
Eripactis microphylla, RARE
- Коручка болотна,
Eripactis palustris, VULNERABLE

- Коральковець тричінадрізаний,
Corallorhiza trifida, RARE
- Комперія кримська, комперія Компера,
Comperia comperiana, ENDANGERED
- Зозульки Фукса (пальчатокорінник Фукса),
Dactylorhiza fuchsii, LEAST CONCERN
- Зозульки Траунштейнера (пальчатокорінник Траунштейнера),
Dactylorhiza traunsteineri, RARE
- Зозульки трансильванські (пальчатокорінник трансильванський),
Dactylorhiza transsilvanica, ENDANGERED
- Зозульки травневі (пальчатокорінник травневий),
Dactylorhiza majalis, RARE
- Зозульки серценосні (пальчатокорінник серценосний),
Dactylorhiza cordigera, VULNERABLE
- Зозульки римські (пальчатокорінник римський),
Dactylorhiza romana, VULNERABLE
- Зозульки плямисті (пальчатокорінник плямистий),
Dactylorhiza maculata, VULNERABLE
- Зозульки м'ясочервоні (пальчатокорінник м'ясочервоний),
Dactylorhiza incarnata, VULNERABLE
- Зозульки іберійські (пальчатокорінник іберійський),
Dactylorhiza iberica, RARE
- Зозульки бузинові (пальчатокорінник бузиновий),
Dactylorhiza sambucina, VULNERABLE
- Зозулині черевички справжні,
Cypripedium calceolus, VULNERABLE
- Зозулині сльози яйцеподібні,
Listera ovata, LEAST CONCERN
- Зозулині сльози серцелисті,
Listera cordata, VULNERABLE
- Зозулинець шоломоносний,
Orchis militaris, VULNERABLE
- Зозулинець чоловічий,
Orchis mascula, VULNERABLE
- Зозулинець пурпуровий,
Orchis purpurea, VULNERABLE

- Зозулинець прованський,
Orchis provincialis, ENDANGERED
- Зозулинець прикрашений,
Orchis signifera, ENDANGERED
- Зозулинець мавпячий,
Orchis simia, VULNERABLE
- Зозулинець дрібнокрапчастий,
Orchis punctulata, ENDANGERED
- Зозулинець Ванькова,
Orchis wanjkowii, NOT WELL KNOWN
- Зозулинець блідий,
Orchis pallens, ENDANGERED
- Жировик Льозеля,
Liparis loeselii, VULNERABLE
- Гудієра повзуча,
Goodyera repens, VULNERABLE
- Гніздівка звичайна,
Neottia nidus-avis, LEAST CONCERN
- Глевчак однолистий (малаксис однолистий),
Malaxis monophyllos, VULNERABLE
- Булатка червона,
Cephalanthera rubra, RARE
- Булатка довголиста,
Cephalanthera longifolia, RARE
- Булатка великоквіткова,
Cephalanthera damasonium, RARE
- Бровник однобульбовий (гермінії однобульбовий),
Herminium monorchis, ENDANGERED
- Билинець щільноквітковий,
Gymnadenia densiflora, VULNERABLE
- Билинець найзапашніший,
Gymnadenia odoratissima, ENDANGERED
- Билинець довгорогий,
Gymnadenia conopsea, VULNERABLE

Appendix Table 2. The number of iNaturalist observations for taxa of Ukrainian orchids listed in Table 2. The species are listed in descending order of observation number. The total number of observations as of April 2023 was 8,247.

<i>Orchis purpurea</i> subsp. <i>purpurea</i>	670
<i>Epipactis helleborine</i> subsp. <i>helleborine</i>	654
<i>Anacamptis morio</i> subsp. <i>morio</i>	618
<i>Neottia nidus-avis</i>	489
<i>Anacamptis pyramidalis</i>	412
<i>Cephalanthera damasonium</i>	411
<i>Orchis simia</i>	409
<i>Limnorchis abortivum</i> . var. <i>abortivum</i> .	370
<i>Neotinea tridentata</i>	346
<i>Platanthera chlorantha</i>	337
<i>Ophrys scolopax</i> subsp. <i>cornuta</i> (as <i>O. oestriifera</i>)	276
<i>Dactylorhiza incarnata incarnata</i>	254
<i>Himantoglossum comperianum</i>	241
<i>Cephalanthera longifolia</i>	239
<i>Neottia (Listera) ovata</i>	219
<i>Himantoglossum caprinum</i>	214
<i>Cephalanthera rubra</i>	189
<i>Anacamptis palustris</i> subsp. <i>elegans</i>	157
<i>Platanthera bifolia</i>	151
<i>Orchis punctulata</i>	149
<i>Gymnadenia conopsea</i>	144
<i>Dactylorhiza romana</i> subsp. <i>romana</i>	125
<i>Ophrys sphegodes</i> subsp. <i>mammosa</i>	116
<i>Orchis mascula</i> subsp. <i>mascula</i>	109
<i>Anacamptis coriophora</i>	99
<i>Dactylorhiza majalis</i> subsp. <i>majalis</i>	82
<i>Epipactis palustris</i>	72
<i>Epipactis microphylla</i>	59
<i>Steveniella satyrioides</i>	53
<i>Ophrys apifera</i>	45
<i>Orchis militaris</i> subsp. <i>stevenii</i>	41
<i>Epipactis persica</i>	36

<i>Goodyera repens</i>	35
<i>Dactylorhiza maculata fuchsii</i>	32
<i>Epipactis krymmontana</i>	30
<i>Dactylorhiza iberica</i>	29
<i>Dactylorhiza viridis</i>	29
<i>Cypripedium calceolus</i>	29
<i>Dactylorhiza sambucina</i>	25
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<i>Orchis</i> × <i>angusticurris</i>	23
<i>Epipactis muelleri</i>	22
<i>Dactylorhiza maculata</i> subsp. <i>maculata</i>	22
<i>Epipactis leptochila</i>	19
<i>Orchis provincialis</i>	19
<i>Epipactis purpurata</i> subsp. <i>purpurata</i>	17
<i>Corallorhiza trifida</i>	15
<i>Neotinea ustulata</i> var. <i>ustulata</i>	15
<i>Traunsteinera globosa</i>	15
<i>Orchis</i> × <i>calliantha</i>	13
<i>Anacamptis</i> subsp. <i>laxiflora</i>	10
<i>Orchis pallens</i>	7
<i>Ophrys</i> × <i>aghemanii</i>	6
<i>Epipactis atrorubens</i>	4
<i>Dactylorhiza majalis</i> subsp. <i>cordigera</i>	4
<i>Liparis loeselii</i>	3
<i>Hemipilia cucullata</i>	2
<i>Gymnadenia rhellicani</i>	2
<i>Gymnadenia carpatica</i>	2
<i>Neottia (Listera) cordata</i>	1
<i>Malaxis monophyllos</i>	1
<i>Spiranthes australis</i>	1
<i>Bletilla striata</i>	1
<i>Orchis</i> × <i>hybrida</i>	1
<i>Ophrys apifera</i> × <i>oestrifera</i> (<i>vallis-costae</i>)	1
<i>Platanthera</i> × <i>hybrida</i>	1
× <i>Dactylocamptis</i>	1
<i>Cypripedium macranthos</i>	-

<i>Epipactis helleborine</i> subsp. <i>orbicularis</i>	-
<i>Epipactis helleborine</i> subsp. <i>tremolsii</i>	-
<i>Epipactis persica</i> subsp. <i>taurica</i>	-
<i>Epipactis tallosii</i>	-
<i>Limodorum abortivum</i> var. <i>rubrum</i>	-
<i>Limodorum abortivum</i> var. <i>viridi</i>	-
<i>Epipogium aphyllum</i>	-
<i>Hammarbya paludosa</i>	-
<i>Spiranthes spiralis</i>	-
<i>Herminium monorchis</i>	-
<i>Pseudorchis albida</i> subsp. <i>albida</i> .	-
<i>Gymnadenia austriaca</i>	-
<i>Gymnadenia densiflora</i>	-
<i>Gymnadenia odoratissima</i>	-
<i>Dactylorhiza incarnata</i> <i>cruenta</i>	-
<i>Dactylorhiza majalis</i> subsp. <i>lapponica</i>	-
<i>Traunsteinera sphaerica</i>	-
<i>Orchis mascula</i> subsp. <i>speciosa</i>	-
<i>Orchis mascula</i> var. <i>wanjkovii</i>	-
<i>Ophrys insectifera</i>	-
<i>Ophrys scolopax</i> subsp. <i>scolopax</i>	-
<i>Himantoglossum calcaratum</i>	-
<i>Anacamptis coriophora</i> subsp. <i>fragrans</i>	-
<i>Anacamptis morio</i> subsp. <i>caucasica</i>	-

Appendix Table 3. Possible additions to the wild orchids of Ukraine

Anacamptis palustris (Jacq.) R.M. Bateman, Pridgeon & M.W. Chase subsp. ***palustris***. Possible in extreme southwest. On the Polish and Hungarian borders Kühn *et al.* 2019: 360).

Chamorchis alpina (L.) Rich., ALPINE ORCHID. Possible in extreme southwest. At the Slovakian border (Kühn *et al.* 2019: 170).

Cypripedium guttatum Sw. SPOTTED LADY'S-SLIPPER. See Table 3.

Dactylorhiza incarnata (L.) Soó var. *ochroeuca* (Boll) Hyl. See Table 3.

Dactylorhiza maculata (L.) Soó subsp. *saccifera* (Brongn.) Dilic. Possibly in Ukraine. On the boundary with Romania (Kühn *et al.* 2019: 147).

Dactylorhiza maculata (L.) Soó subsp. *saccifera* (Brongn.) Dilic. Possibly in Ukraine. On the boundary with Romania (Kühn *et al.* 2019: 147).

Dactylorhiza majalis (Rchb.) P.F.Hunt & Summerh. subsp. *baltica* (Klinge) H.Sund. On the northwestern boundary with Belarus (Kühn *et al.* 2019: 148).

Dactylorhiza urvilleana (Steud.) H. Baumann & Künkele. Possibly in eastern Crimea where very close to occurrence in Russia (Kühn *et al.* 2019: 168).

Gymnadenia minuta (Crantz) Hayek, RED VANILLA ORCHID. Known from the southern Carpathians in Romania.

Neotinea ustulata (L.) R.M. Bateman, Pridgeon & M.W. Chase var. *aestivalis* (Kümpel) Tali, M.F. Fay & R.M. Bateman, LATE BURNT-TIPPED ORCHID. Occurs in Romania.

Ophrys fuciflora (F.W. Schmidt.) Moench, LATE SPIDER ORCHID. Occurs in Slovakia near the southwestern border of Ukraine (Kühn *et al.* 2019: 277).

Orchis purpurea Huds. subsp. *caucasica* (Regel) B. & H.Baumann, R.Lorenz & R.Peter ? Occurs in Russia near eastern Crimea (Kühn *et al.* 2019: 179).

Pseudorchis albida (L.) Á & D. Löve subsp. *straminea* (Fernald) Á & D. Löve, YELLOW-FLOWERED SMALL WHITE ORCHID. Occurs in Slovakia near the southwestern border of Ukraine (Kühn *et al.* 2019: 99).

Spiranthes aestivalis (Poir.) Rich., SUMMER LADY'S-TRESSES. Occurs in Slovakia and Hungary near the Ukraine border (Kühn *et al.* 2019: 99).

Appendix Table 4. Key to the Genera

This key identifies genera based only on their member species that occur in Ukraine. As a consequence, it is not reliable in identifying the genera *per se*. Where there is only one species in the genus in the Ukraine (or only one species with a key feature), the species name is also included. In some cases there is no difficulty in recognizing individual species representing a few large genera, but the genera themselves are an identification challenge. A generic key is still useful in understanding major patterns of variation. This key emphasizes floral characters but includes some other characters where they are helpful. *Chamorchis* is not in bold because it has not yet been found in Ukraine.

1a. Plants without foliage leaves	2
1b. Plants with foliage leaves	5
2a. Spur as long as or longer than lip	3
2b. Spur absent or shorter than lip	4
3a. Spur directed upwards; flower not resupinate	<i>Epigogium aphyllum</i>
3b. Spur directed downward; flower resupinate	<i>Limodorum abortivum</i>
4a. Flowers brown; lip two-lobed	<i>Neottia nidus-avis</i>
4b. Flowers green or yellow with white; lip three-lobed, lateral lobes inconspicuous	<i>Corallorhiza trifida</i>
5a. Lip formed into a basal, or terminal pouch or cup	6
5b. Lip without a pouch or cup	8
6a. Pouch terminal, including all of lip	<i>Cypripedium</i>
6b. Pouch (hypochile) basal with a terminal lamina (epichile)	7
7a. Leaves in a basal rosette, often reticulated with light green	<i>Goodyera repens</i>
7b. Leaves ascending the stem	<i>Epipactis</i>
8a. Lip with 4-6 prominent ridges	9
8b. Lip lacking 4-6 prominent ridges	10
9a. Lip strongly narrowed near the middle into a basal and distal portion	<i>Cephalanthera</i>
9b. Lip not strongly narrowed, but with three lobes, the basal lobes forming a tube	<i>Bletilla striata</i>
10a. Part of the lip fuzzy, brown and convex	<i>Ophrys</i>
10b. Lip not fuzzy, brown, or convex in part	11
11a. Flowers closely arranged in an elongate spiral	<i>Spiranthes</i>
11b. Flowers not closely arranged in an elongate spiral	12
12a. Plants with small green or yellowish-green flowers	13
12b. Plants with medium-sized or large flowers of various colours	19
13a. Plants with 2 opposite leaves high up on the stem	<i>Neottia (Listera)</i>
13b. Plants with leaves in various positions and numbers on the stem	14
14a. Leaves basal from pseudobulbs (mostly buried in <i>Malaxis</i>)	15
14b. Leaves basal ascending stem from underground tubers (no pseudobulbs)	17
15a. Lip at least 4 mm long; petals linear; lip lowermost (resupinate)	<i>Liparis loeselii</i>
15b. Lip less than 2.5 mm long, petals oval or linear; lip uppermost (360° ovary twist)	16

16a. Petals oval, inconspicuous, strongly reflexed; lip acute, with dark green lines	<i>Hammarbya paludosa</i>
16b. Petals linear, spreading backward; lip acuminate, solid green	<i>Malaxis monophyllos</i>
17a. Leaves linear, all basal: lip oval, obscurely 3-lobed	<i>Chamorchis alpina</i>
17b. Leaves oblong-ovate, lanceolate, ascending the stem, or basal	18
18a. Linear tips of petals, and linear tip of the lip, which much exceed the sepals, give the inflorescence a spiny appearance	<i>Herminium monorchis</i>
18b. Petals oval, without linear tips, but inflorescences still appear slightly spiny as a result of the prominently three-lobed lip	<i>Pseudorchis albida</i>
19a. Sepals and petals with spatulate tips	<i>Traunsteinera</i>
19b. Sepals and petals lacking spatulate tips	20
20a. Central lobe of lip greatly elongated and terminally or basally divided	<i>Himantoglossum</i>
20b. Central lobe of lip not greatly elongated	21
21a. Lip entire	22
21b. Lip 3-lobed (obscurely so in some <i>Dactylorhiza iberica</i>)	23
22a. Inflorescence elongate; lip strap-shaped and broadly rounded at tip; flowers white	<i>Platanthera</i>
22b. Inflorescence globose or pyramidal, terminal part of lip triangular and acute	<i>Gymnadenia</i> (Vanilla Orchid group)
23a. Foliage leaves 2, basal, and oblong, broadly oval, or lanceolate, often lying flat on the ground	<i>Hemipilla cucullata</i>
23b. Foliage leaves more than 2	24
24a. Flowers with all sepals and lateral petals joined to form a hood (galea) over the lip	25
24b. Flowers with some or all sepals and petals, spreading, not forming a hood	28
25a. Spurs very short, as wide as long	26
25b. Spurs longer than wide, pointed, rounded, truncate, or very slightly bifid at tip	27
26a. Spurs (below or behind flower) triangular, deeply bifid and somewhat pointed (best seen in flower bud)	<i>Steveniella satyrioides</i>
26b. Spurs (below or behind flower) rounded and sac-like (scrotiform), shallowly divided (best seen in flower bud)	<i>Dactylorhiza viridis</i>
27a. Divisions of central lobe of lip relatively short and broad	<i>Neotinia</i>
27b. Divisions of central lobe of relatively long and narrow	<i>Orchis</i> (<i>O. militaris</i> subgroup)
28a. Central lobe of lip pointed	<i>Dactylorhiza</i> (in part)
28b. Central lobe of lip broadly rounded, truncate or bilobed	29

- 29a.** Floral bracts thin, membranous, and inconspicuous *Orchis* (*O. mascula* subgroup)
29b. Floral bracts (at least the lower) thick green, leaf-like, and conspicuous **31**
- 31a.** Lip with prominent basal ridges; leaves never spotted or banded *Anacamptis*
31b. Lip without prominent basal ridges; leaves sometimes spotted or banded **32**
- 32a.** Leaves spotted or banded, or plain green; flowers marked with spots or stripes; flowers longer than wide in frontal view due to a relatively long lip and ascending, reflexed lateral sepals *Dactylorhiza* (in part)
32b. Leaves plain green; flowers not marked with spots or stripes; flowers wider than long in frontal view due to a relatively short lip and horizontal lateral sepals *Gymnadenia*

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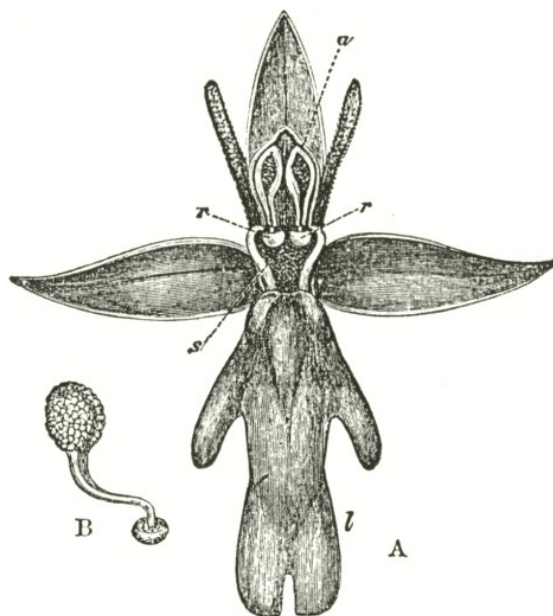
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Traunsteinera sphaerica, 9, 10, 32, 32



Some may say that these are “**just colour variations,**” but they are also wonders of nature, and the raw material for evolution. Charles Darwin was deeply interested in “chance variation” and his work on the evolution of orchids played a key role in his arguments for evolution by natural selection. It was full of experiments that supported his hypotheses explaining a great deal about life on earth. Darwin’s friend, Thomas Huxley, said; “Who has ever dreamed of finding a utilitarian purpose in the forms and colours of flowers?”



Figure 36. Colour variations of *Orchis purpurea* in Ukraine. All photos are from Crimea. **a.** 7 May 2023, iNat photo 277154436, by Kassusha. CC BY-NC 4.0. **b.** 26 May 2022, iNat photo 203648012, by Vyacheslav Luzanov. CC BY-NC 4.0. **c.** 5 May 2022, iNat photo 195 263502 by Iyamin Aleksey. CC BY-NC 4.0.

Opposite page: Figure 35. Fly Orchid (*Ophrys insectifera*) from Charles Darwin’s “On the various contrivances by which British and foreign orchids are fertilized by insects and the good effects of intercrossing,” first issue, first edition, John Murray, London (1862: Capt. II, 46, Fig. 5)

“A. Flower viewed in front: the two upper petals are almost cylindrical and hairy: the two rostellum stand a little in advance of the bases of the anther cells (actually a single rostellum); but this is not shown from the foreshortening of the drawing. a. anther; r; rostellum, s, stigma, l, labellum. B. One of the two pollinia removed from its anther-cell and viewed laterally.” The latter illustrates the doubly bent caudicle of *O. insectifera* which replaces the basal hinged depression in other species.

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