

Botrychium simplex E. Hitchc. (Ophioglossaceae) – a new species for the native flora of Ukraine

Ivan Yu. Parnikoza^{1*} & Zbigniew Celka²

¹Institute of Molecular Biology and Genetics NAS of Ukraine, Zabolotnoho 150, 03680 Kyiv, Ukraine

²Department of Plant Taxonomy, Faculty of Biology, Adam Mickiewicz University in Poznań, Umultowska 89, 61-614 Poznań, Poland

* corresponding author (e-mail: ivan.parnikoza@gmail.com)

Abstract. The work presents the results of herbarium survey that resulted in finding *Botrychium simplex* E. Hitchc. – a new for the native Ukrainian flora species of the family Ophioglossaceae. A specimen of this taxon was found in the National Herbarium of Ukraine in the M. G. Kholodny Institute of Botany of National Academy of Sciences of Ukraine in Kyiv (KW) among the specimens of *Botrychium lunaria* (L.) Sw. originating from the surroundings of Kharkiv. Thus, this finding indicates the most south-eastern locality of *B. simplex* in Europe found so far.

Key words: least moonwort, common moonwort, rare species, Ukraine, herbarium, Kyiv, KW

1. Introduction

The genus *Botrychium* Sw. is represented in the world flora by 25 species (Mabberley 2008), while in Europe by seven (Valentine & Moore 2007). The majority of European species of *Botrychium* belong to threatened taxa on the scale of whole Europe (e.g., Blitz *et al.* 2011), individual countries, e.g.: Belarus (Paszkov *et al.* 2005), Poland (Zarzycki & Szela 2006; Kaźmierczakowa *et al.* 2014), Lithuania (Rašomavičius 2007), Ukraine (Didukh 2009), and Germany (Ludwig & Schnittler 1996; floraweb.de), or regions, e.g.: Wielkopolska (Jackowiak *et al.* 2007), Kaliningrad oblast (Dedkov & Griszanov 2010), Dnipropetrovska oblast (Travlieiev 2010), Pskovskaya oblast (Istomin *et al.* 2014), Podkarpacie (Oklejewicz *et al.* 2015), and Novgorodskaya oblast (Vetkin *et al.* 2015).

In Ukraine, four species of *Botrychium* were found thus far: *B. lunaria* (L.) Sw., *B. matricariifolium* (Retz.) A. Braun ex W. D. J. Koch, *B. multifidum* (S. G. Gmel.) Rupr. i *B. virginianum* (L.) Sw. (Mosyakin & Fedorochuk 1999; Didukh 2000; Parnikoza 2010; Vasheka & Bezsmertna 2012). They all belong to threatened taxa in Ukrainian flora (e.g., Didukh 2009; Parnikoza & Celka 2016). Because of this, studies of different aspects of biology and chorology of *Botrychium*, and even more widely, the species of Ophioglossaceae,

have been conducted in Ukraine for over 10 years (see Parnikoza 2002, 2010; Chorney *et al.* 2004; Parnikoza & Tsukanova 2005; Melnik 2009, Bezsmertna & Heluta 2013; Votkalchuk *et al.* 2014; Parnikoza & Celka 2016). The aim of this work is to provide information on *Botrychium simplex*, a species not previously identified and listed in the native flora of Ukraine.

2. Material and methods

In the genus *Botrychium*, similarly like in many other genera, some gaps or mistakes in species identifications may occur. In case of *Botrychium simplex*, misidentification with *B. lunaria* may happen, especially, in the vegetative phase. The distinct differences appear in the spore production phase, when the sporophore part is developed: in *B. simplex* – the sporophore part branches off the trophophore part below the half length of leaf, while in *B. lunaria* – in the middle or above the leaf (Fig. 1). These traits were taken into account in the studies of Ophioglossaceae species in all more important Ukrainian herbaria. In total, nearly 200 herbarium specimens of *B. lunaria* and 400 of other species of this genus were studied in the following herbaria: Yu. Fedkovych Chernivtsi State University (CHER), V. N. Karazin National University (CWU), Donetsk Botanical Garden of the National Academy of Sciences of Ukraine (DNZ),

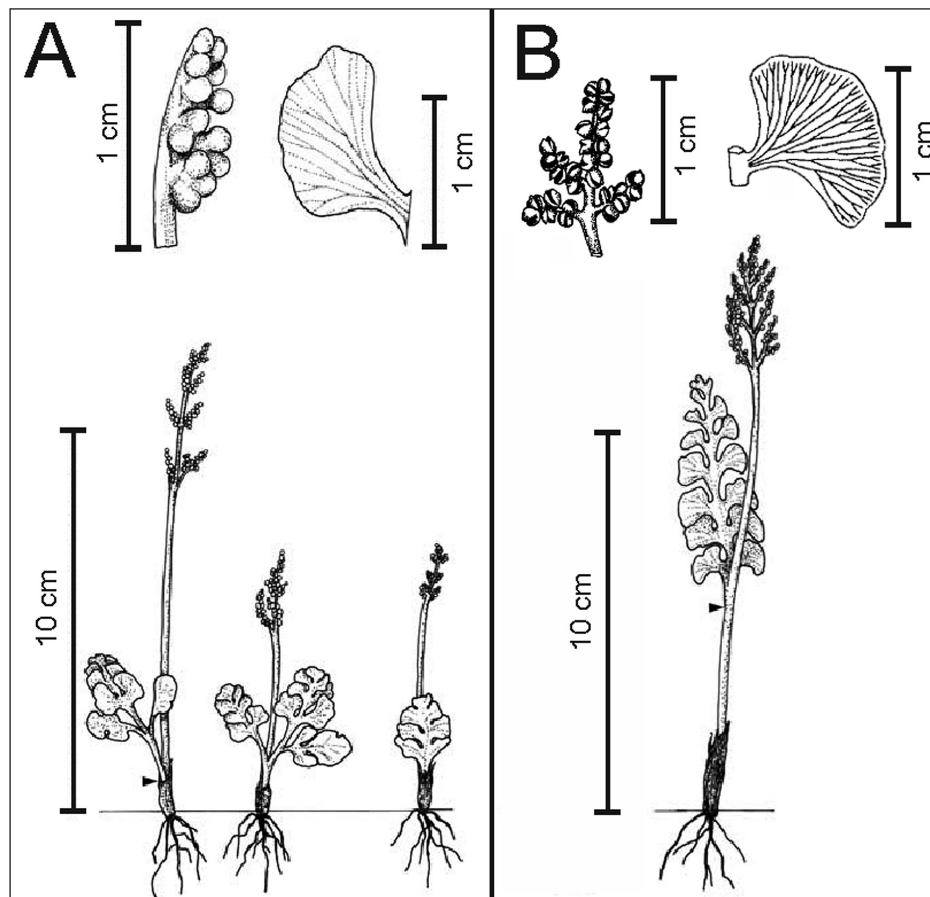


Fig. 1. The comparison of *Botrychium simplex* (A) and *B. lunaria* (B) according to Żukowski (2004, modified)

National Herbarium of Ukraine in the M. G. Kholodny Institute of Botany of National Academy of Sciences of Ukraine in Kyiv (KW), Ukrainian National Academy of Sciences in Kyiv (KWA), O. V. Fomin Botanical Garden of Taras Shevchenko National University of Kyiv (KWHU), M. M. Gryshko National Botanical Garden in Kyiv (KWU), Ivan Franko National University of Lviv (LW), Institute of Ecology of the Carpathians in Lviv (LWKS), Museum of Natural History in Lviv (LWS), I. I. Mechnikov State University of Odessa (MSUD) and The State Nikita Botanical Gardens in Yalta (YALT).

3. Results

A herbarium specimen identified as *B. lunaria*, but corresponding to the traits of *B. simplex* var. *simplex* (Fig. 1) was found in the National Herbarium of Ukraine in the M. G. Kholodny Institute of Botany of National Academy of Sciences of Ukraine in Kyiv (KW). *B. simplex* has not been reported from Ukraine so far.

The specimen of *B. simplex* found in the Kyiv herbarium originates from the surroundings of Kharkiv (Fig. 2). It was collected on 12 June 1828 and identified by Vasyl M. Chernaiiev, an Ukrainian botanist living in the years 1794-1871, who studied the flora of Kharkiv

surroundings and expanded the herbarium collection. A preserved specimen of *B. simplex* is in the reproductive stage and has both the sporophore and trophophore part. The size of plant is 9 cm. A specimen label contains the following information: legit: Chernaiiev, teste: G. Shyrayev, locality: moist sandy sites in the community with *Juncus ericetorum* Pollich (currently *Juncus capitatus* Weigel) on the Kharkiv river. According to information available to the authors, the locality of *B. simplex* in the vicinity of Kharkiv probably no longer exists. This site was completely transformed due to human activities.

4. Discussion

Botrychium simplex occurs in three varieties: var. *simplex*, var. *compositum* (Lasch) Milde and var. *tenebrosum* (A. A. Eaton) R. T. Clausen (Anderson 2006; Farrar 2006, 2011). *B. simplex* var. *tenebrosum* is sometimes raised to the rank of species – *B. tenebrosum* A. A. Eaton (np. Anderson 2006; Farrar 2011). Among the neighbouring countries of Ukraine, *B. simplex* occurs in Poland (Żukowski *et al.* 2014), Belarus (Parfenov 2009) and Russia (Bobrov 1974; Tzvelov 2000). In Poland, only *B. simplex* var. *simplex*

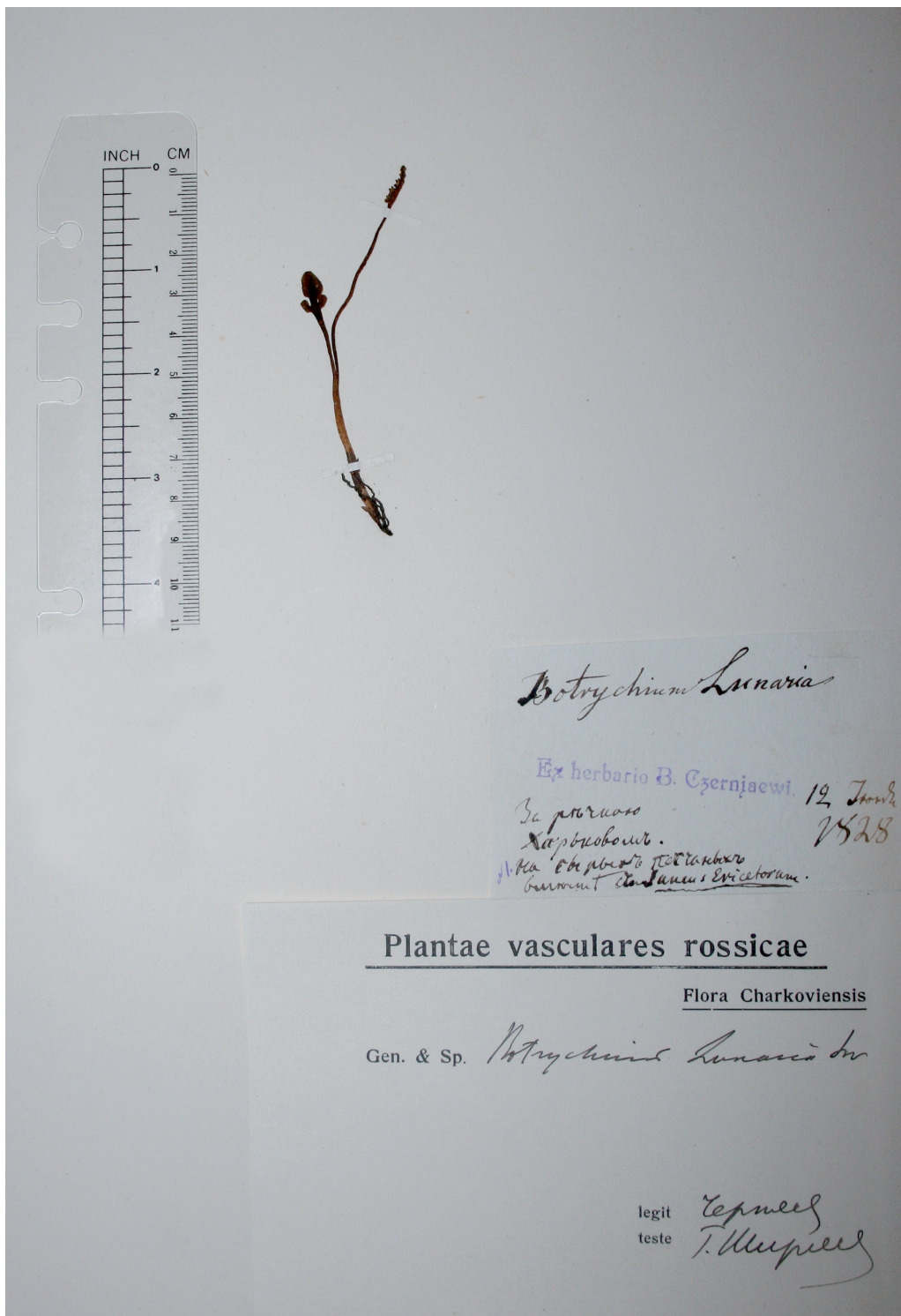


Fig. 2. Herbarium voucher of *Botrychium simplex* E. Hitchc. from the National Herbarium of Ukraine in the M. G. Kholodny Institute of Botany of National Academy of Sciences of Ukraine in Kyiv (KW)

was reported (Żukowski *et al.* 2014); in case of other countries, varieties were not specified.

B. simplex is a circumboreal-oceanic species (Zajac & Zajac 2009). It occurs in Europe, North America and Japan (Meusel *et al.* 1965; Hultén & Fries 1986). In Europe it is one of rarest species of the genus *Botrychium* (Jalas & Suominen 1972), found in the scattered locali-

ties from Scandinavia to Corsica and from France to Belarus (Hultén & Fries 1986). A disjunct locality in the vicinity of Kharkiv is the most south-east location of the species in the European part of its range (Fig. 3). The nearest localities of *B. simplex* were recorded in Belarus – south of Minsk (Parfienov 2009), and in Poland – Pakość in the Iłża Foothills (Żukowski *et al.*

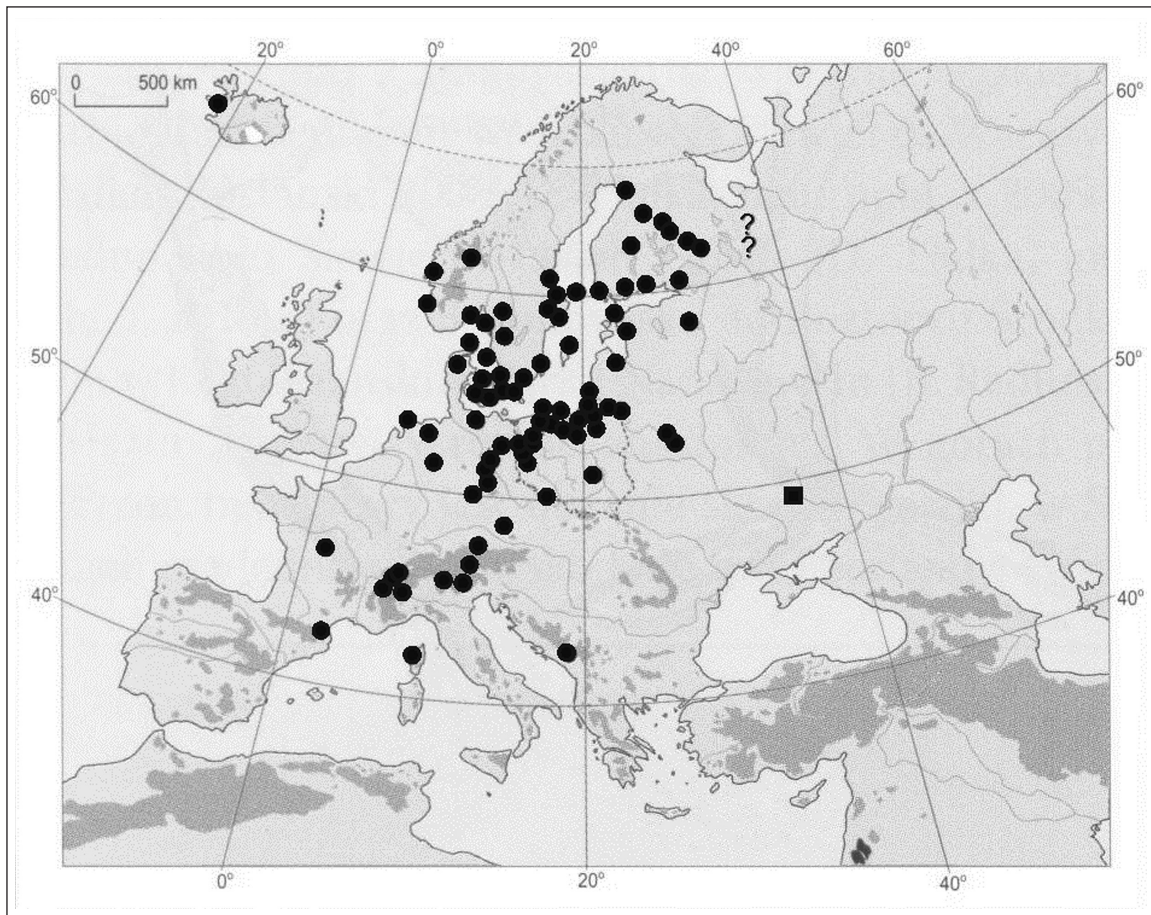


Fig. 3. Distribution of *Botrychium simplex* in Europe (after Żukowski *et al.* 2014, modified).

Explanations: ■ – a new locality in the vicinity of Kharkiv, ● – other European localities, ? – uncertain localities

2014). In Belarus, there are 2 localities – one of them was observed for the last time in 2006 (M. Dzhus, pers. comm. 2014). In Poland, the data on 25 localities of *B. simplex* were collected so far. Most recently, the species was noted in the Pomerania region, near Lipnica and Wierzchowo, in the 80th of the 20th century. Despite many searches in the recent years, it has not been observed in Poland since then. In Russia, *B. simplex* was reported from the Pskov and St. Petersburg Oblasts (Tzvelov 2000).

In the European Union, *B. simplex* is classified as a Near Threatened (NT) species (Bilz *et al.* 2011). In individual countries of Central and Eastern Europe it is recognized as a highly threatened or extinct taxon. In Czech Republic and Poland, the species is listed as extinct (Grulich 2012; Żukowski *et al.* 2014), while in Belarus (Paszkov *et al.* 2005), Lithuania (Rašomavičius 2007), Germany (Ludwig & Schnittler 1996; floraweb.de) and Russia (Dedkov & Griszanov 2010; Istomin *et al.* 2014) it is considered a threatened taxon.

B. simplex is reported mostly from acidic, non-calcareous habitats. It is a constituent of Nardus

grasslands and heaths (e.g., Dostál 1984; Chrtková 1988; Bennert *et al.* 2014; Żukowski *et al.* 2014). In Belarus, the species occurs in dry and peaty meadows (M. Dzhus pers. comm. 2014; Parfienov 2009), while in North America – in dry fields, marshes, bogs, swamps and along roadside ditches (Wagner & Wagner 1993; Anderson 2006).

Finding this rare, on the European scale, species in the Ukrainian herbarium collection provides the basis for searching in the field. Field observations of the species' preferred habitats are essential. These habitats should be preserved and, if possible, protected. *B. simplex* should also be listed in the Ukrainian Red Data Book in the category not defined – an Ukrainian analogue of Data Deficient (DD) category of IUCN, because further studies may result in finding this species in herbarium collections and, maybe, in the field.

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