

RARE PLANTS IN EX SITU COLLECTION IN BOTANIC GARDEN OF ŠIAULIAI UNIVERSITY

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Botanic gardens and other *ex-situ* facilities such as seed banks are among the most extensive yet underused plant conservation resources in the world. Botanic gardens are now undertaking activities that bridge the gap between *in situ* and *ex situ* conservation, with the living collections being used as source material for reintroduction programmes. One of the most important goal of Botanic garden of Šiauliai University is to conserve rare species in *ex situ* collections. Largest protected species are cumulated in Mountain plants, and in the Geography and systematic collections. In Mountain plants collection are 17 species of plants published in the list of threatened European plant species. Altogether in this section grow 75 rare and endemic species, mostly from the Alps, Pyrenees, Tatra. The plants are vanishing because of biological features of the species, climatic alternation, human activities, etc. Besides these species are very decorative and appreciated in the gardening. Most plants growing in Geography and systematic collection are rare in Lithuania. From 357 plants inscribed in Lithuanian Red Data book (2007) there grow 94 species. The species of the Lithuania's Red Book are divided into 5 categories, which correspond the old categories of international union of nature protection. There are growing 4% of extincted plants of 0 (Ex) category, 19% of 1 (E), 31% of 2 (V), 28% of 3 (R), 11% of 4 (I) and 6% of 5 (Rs) category. Priority is given to the species, which are on the line of disappearance and which can be saved only by using special safeguards. In the collection of Mountain plants from the 12 plant species of European Red List 4 species are grown in Botanic garden and their investigated adaptation level is good. In *ex situ* collection grow 16 species of the plants of I (E) category of Lithuanian Red Data book. High and good adaptation level was estimated to 7 species of these plants.

Key words: Conservation ex situ, rare plants, Botanic garden, species.

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INTRODUCTION

Botanic gardens and other *ex-situ* facilities such as seed banks are among the most extensive yet underused plant conservation resources in the world. Botanic gardens are now undertaking

activities that bridge the gap between *in situ* and *ex situ* conservation, with the living collections being used as source material for reintroduction programmes (Walter, Gillett 1997). In recent years *ex situ* conservation has become a much more precise science with a wonderful array of

tools. Many Botanic gardens today have areas of natural vegetation within their boundaries or in adjunct campuses (Guerrant et al. 2004).

The European flora is of global significance but many species are facing an ever increasing range of threats, including the growing challenge of climate change (Sharrock & Jones 2011). While various estimates have been made for the number of threatened plant species in Europe, an up-to-date European Red List for plants does not exist. Of the Global Strategy for Plant Conservation (GSPC) calls for “60% of threatened plant species to be conserved in *ex situ* collections”. To address this gap, BGCI has published a consolidated list of European threatened species as a step towards a formal Red List. Compiled on a database, this list consists of national Red List data from 30 European countries and includes over 16,000 country records covering around 9,600 species (Sharrock & Jones 2009). In Lithuania it is talking about protecting rare objects since 1959 when the law of nature protection was accredited. Since 1981 the Red Book is published as separate colourful edition. Department of the Environment publishes Lithuania’s Red Book not rarer as every 10 years. This book introduces the species of the protected plants in the Republic of Lithuania, their status, distribution, ecology and biology, profusion of these plants population, imminent danger to them, the condition of the protection of these plants (Department of Environment 2011). Since 1993 Department of the Environment of Lithuania publishes informative edition „Red Pages“. The information published in this edition is used to revise the list of species of protected plants included in the Red Book (Department of Environment 2011).

One of the most important goal of Botanic garden of Šiauliai University is to conserve rare species in *ex situ* collections. Largest protected species are cumulated in the Geography and systematic, and in Mountain plants collections. In Mountain plants collection are 17 species of plants published in the list of threatened European plant species. Altogether in this section grow 75 rare and endemic species, mostly from the Alps (Vainorienė 2010). In Botanic garden there are

also the groups of differently matured plants from natural biotopes grown and investigated *in situ* and *ex situ*. In 2006–2010, the observations of *Primula farinosa*, *Cruciata glabra* are pursued in *in situ* collections.

Most plants growing in Geography and systematic collection are rare in Lithuania. From 357 plants inscribed in Lithuanian Red Data book (2007) there grow 94 species. The species of the Lithuania’s Red Book are divided into 5 categories, which correspond the old categories of international union of nature protection. There are growing 4% of extincted plants of 0 (Ex) category, 19% of 1 (E), 31% of 2 (V), 28% of 3 (R), 11% of 4 (I) and 6% of 5 (Rs) category. Priority is given to the species, which are on the line of disappearance and which can be saved only by using special safeguards.

MATERIAL AND METHODS

These alpine endemic and rare species, growing in our Botanic Garden, are identified according to Sharrock, Jones (2009). Investigated plants are grown up from the seeds received from Botanic gardens of European countries. The natural origin locations are known of 5 species (*Aetionema thomasianum*, *Iris marsica*, *Primula glaucescens*, *Saponaria lutea*, *Thaspi zaffranii*). The vanishing species of the plants are grown in the collection of Mountain plants since the year 2003-2008. 5 species (*Cytisus emeriflorus*, *Allium insubricum*, *Campanula incurva*, *Degenia velebitica*, *Thaspi zaffranii*) were included into the collection quite recently and their adaptational features have just started to be investigated.

The plants from Lithuania’s Red Book are grown in Botanic garden since 1997. In the section of rare and vanishing plants there are grown 18 species of 1 category, in the year 2010, 16 species of the plants were observed.

The plants of the rare Lithuanian and European species are observed in the spring when they recover and in the season of vegetation. In the time of the latter situation some important facts are registered, for example the beginning of the

season vegetation. As for research there was observed and qualified the condition of collected plants, performed viable species sampling by using perennial plants decorative – morphological and biological features valuation methodology. Also there was visually evaluated plant tolerance to cold, diseases and pests vulnerability, flowering intensity, productive processes, self-sow (3 points), and the decorative value of the species (5 points) (Vaideliene & Vaidelis 2003)

RESULTS AND DISCUSSION

It is the first time in Botanic garden when the plants were grouped by the list of threatened European plant and by Red data book of Lithuania (Rašomavičius 2007). In the collection of Mountain plants grow 17 species of the plants from the list of threatened European plant species (Table 1). These are rare, limited populated endemic species of the Alps, Pyrenees, Tatra, which are vanishing because of biological features of the species, climatic alternation, human activities, etc. Besides these species are very decorative and appreciated in the gardening.

Despite the evolutionary advantages of sexual reproduction, vegetative reproduction often predominates in arctic-alpine plants. This is because vegetative reproduction is less energy costly, and more likely to be successful in harsh arctic and alpine environments (Good & Millwar 2007).

The data of adaptation and growing in *ex situ* conditions European list and Red data book of Lithuania species are presented in Table 2.

Rare and threatened Europe's species *Primula glaucescens* or *Androsace cylindrica* subsp. *hirtella*, *Physoplexis comosa* plants develop and germinate viable seeds the best when growing under the cover. 4 threatened European plant species adapted well, namely *Aetionema thomasianum*, *Iris marsica*, *Saponaria lutea*, *Sempervivum pittonii*. *Aetionema thomasianum* blooms profusely and distinguishes by intense self seeding. 5 species of the plants (*Androsace cylindrica* subsp. *hirtella*, *Draba haynaldii*, *Iris marsica*, *Primula glaucescens*, *Sempervivum*

pittonii) reproduce in vegetative way.

There are numerous rare, endemic species growing in mountains (Forenbacher 2001, Vetaas *et al* 2002). Their cultivation is important on purpose to preserve species. The genus *Degenia* is a monotypic genus (one of the rarest on Mt Velebit), endemic, endangered and famous. *Degenia velebitica* is one of the 45 most endangered species in Europe, and one of the 250 most endangered in the world (Naumovski 2005). *Physoplexis comosa* is one of the rarity of European alpine flora, it is decorative plant with unusual inflorescence, growing on the limestone rocks (Jarmyn 2005).

The Lithuanian rare plants are grown in Geography and systematic collection. There are 18 species plants of I (E) category. Priority is given to the species, which are on the line of disappearance and which can be saved only by using special safeguards. Some of the plants included in Lithuanian Red List and grown in SU Botanic garden, for example *Aphanes arvensis* L., adapted well, self – seed annually and profusely multiply. *Aphanes arvensis* L. from *Rosaceae* family is subsumed to the category 0 (Ex). In 2010 were collected the 29 plant seeds among the category I (E), such are *Gnaphalium luteoalbum* L. and *Tofieldia calyculata* (L.) Wachenb. To this category is also subsumed extinct in the nature *Hydrocotyle vulgaris* L. among *Apiaceae* family. It grows in the swamps, damp forests. This species adapted well in Botanic garden since 2001, it grows in not swamp land area and widely expands near to ground by prostrate stems rooted beside joints. The plant multiplies not only in the vegetative way but also by seeds. In Botanic garden are also the groups of differently matured plants from natural biotopes grown and investigated *in situ* and *ex situ*. *Ophrys insectifera* L. natural growth place is calcareous soil, mostly carbonaceous middling wet low swamps and valleys of the rivers. In Lithuania there are known finding places of Radviliskis and Akmene district. Since the year 1997 in SU Botanic garden grows *Aster tripolium* L. which natural growing place is the seaside. The plant adapted well, blooms annually and matures seeds.

Table 1. The rare species plants list in Botanic garden of Šiauliai University Mountain plants collections

Species	Plant families	Year of receiving seeds	Distribution in the wild	The status of disappearance
<i>Aethionema thomasianum</i> Gay	<i>Brassicaceae</i> Burnett.	2005	France, Italy	V
<i>Adonis pyrenaica</i> DC.	<i>Ranunculaceae</i> Juss.	2003-2004	France, Spain	–
<i>Allium insubricum</i> Boiss. & Reuter	<i>Alliaceae</i> J. Agardh	2009	Italy	R
<i>Androsace cylindrica</i> ssp. <i>hirtella</i> DC.	<i>Primulaceae</i> Vent.	2008	France, Spain	–
<i>Campanula incurva</i> Aucher	<i>Campanulaceae</i> Juss.	2009	Greece	R
<i>Cytisus emeriflorus</i> Rchb.	<i>Fabaceae</i> Lindl.	2005	Italy, Switzerland	R
<i>Degenia velebitica</i> (Degen) Hayek	<i>Brassicaceae</i> Burnett.	2009	Croatia	V
<i>Draba haynaldii</i> Stur	<i>Brassicaceae</i> Burnett.	2004	Romania	V
<i>Eryngium spinalba</i> Vill.	<i>Apiaceae</i> Lindl.	2008	Italy	–
<i>Iris marsica</i> Ricci & Colasante	<i>Iridaceae</i> Juss.	2005	Italy	R
<i>Moltkia suffruticosa</i> (L.) Brand	<i>Boraginaceae</i> Juss.	2005	Italy	R
<i>Physoplexis comosa</i> (L.) Schur	<i>Campanulaceae</i> Juss.	2007	Austrija, Italy	R
<i>Primula glaucescens</i> Moretti s.l.	<i>Primulaceae</i> Vent.	2008	Italy	R
<i>Saponaria lutea</i> L.	<i>Caryophyllaceae</i> Juss.	2004	France, Italy, Switzerland	R
<i>Sempervivum pittonii</i> Schott, Nyman & Kotschy	<i>Crassulaceae</i> DC.	2003	Austrija	R
<i>Thaspi zaffranii</i> (F.K.Meyer) Greuter & Burdet	<i>Brassicaceae</i> Burnett.	2009	Greece, Crete	V
<i>Wulfenia baldaccii</i> Degen.	<i>Scrophulariaceae</i> Juss.	2006	Albania	Ex/E

Explanations:

E – Endangered species; V – Vulnerable species whose population figures and abundance is rapidly decreasing; R- Rare species with a small number of population due to their biological characteristics.

Table 2. The rare and protected plants adaptation data in Botanic garden of Šiauliai University

Plant name	Procreation by seeds			Vegetative reproduction			Tolerance to low temperature			Flowering intensity			Affected by diseases and pests			General evaluation					
	1	2	3	4	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5
Rare and threatened Europe's species																					
Points																					
<i>Aetionema thomasi-nianum</i>				+	+					+			+			+				+	
<i>Adonis pyrenaica</i>		+			+					+		+				+				+	
<i>Androsace cylindrica</i> subsp. <i>hirtella</i>			+			+				+			+			+				+	
<i>Draba haynaldii</i>			+			+				+			+			+				+	
<i>Eryngium spinalba</i>		+			+					+			+			+			+		
<i>Iris marsica</i>			+			+				+		+				+				+	
<i>Moltkia suffruticosa</i>		+			+					+			+			+			+		
<i>Physoplexis comosa</i>		+			+				+			+				+			+		
<i>Primula glaucescens</i>			+			+			+				+			+				+	
<i>Saponaria lutea</i>			+		+					+			+			+				+	
<i>Sempervivum pittonii</i>		+				+				+			+			+				+	
<i>Wulfenia baldaccii</i>		+			+					+			+			+			+		
Rare I (E) category Lithuanian Red book species																					
<i>Aster tripolium</i> L.				+	+					+			+			+				+	
<i>Cephalanthera longifolia</i> (L.) Fritsch	+				+					+			+			+				+	
<i>Cephalanthera rubra</i> (L.) Rich.	+				+					+			+			+				+	
<i>Dianthus armeria</i> L.			+		+					+			+			+				+	
<i>Dianthus superbus</i> L.			+		+					+			+			+				+	
<i>Dracocephalum ruyschiana</i> L.				+		+				+			+			+				+	
<i>Galium triflorum</i> Michx.				+		+				+			+			+				+	
<i>Glaux maritima</i> L.	+							+			+			+		+				+	
<i>Gnaphalium luteoalbum</i> L.			+		+					+			+			+				+	
<i>Hydrocotyle vulgaris</i> L.			+				+			+			+			+					+
<i>Isopyrum thalictroides</i> L.		+				+				+			+			+				+	
<i>Melittis melissophyllum</i> L.				+	+					+			+			+					+
<i>Ophrys insectifera</i> L.	+				+					+			+			+				+	

<i>Teucrium scordium</i> L.		+					+		+				+			+			+
<i>Tofieldia calyculata</i> (L.) Wahlenb.			+		+				+				+					+	
<i>Viola persicifolia</i> Schreb.					+	+				+									+

Explanations:

1. Procreation by seeds (points): 1 – Don't ripening seeds, 2 – not yearly ripening seeds, 3 – yearly ripening seeds, no self-sow, 4 – yearly ripening seeds, there is self-sow.
2. Vegetative reproduction (points): 1 – don't vegetative reproduction, 2 – (1 – 2 suckers, 3 – (3 and more suckers).
3. Tolerance to low temperature (points): 1 – plants were destroyed by frost, 2 – strong cold affects partly, 3 – frost and cold don't affect.
4. Flowering intensity (points): 1 – don't flower, 2 – flower in single blossoms, 3 – abundant flowering.
5. Affected by diseases and pests (points): 1 – affected in mass, yearly, 2 – affect rarely, not in mass, 3 – don't affect.
6. General evaluation (points): 1 – condition is very bad, 2 – bad, 3 – satisfactory, 4 – good, 5 – in very good condition.

5 (31 %) plants of the I (E) category have a high adaptation potential and yearly ripen seeds to the self-sow. 5 (31 %) plants yearly ripen seeds, but do not self-sow and 4 (25 %) plants yearly ripen seeds and reproduce vegetatively. In SU Botanical garden there are some plants which do not ripen seeds and do not reproduce. These are 3 (19 %) species of *Orchidaceae* family plants. 12 (75 %) plants flower abundantly, 4 (25 %) flower in single blossoms. In winter in SU Botanical garden all the plants of Lithuanian Red Book are covered. 11 (69 %) plants tolerate low temperature, strong cold partly affects 5 (31 %) plants, but in vegetation period they still regenerate. General evaluation of 9 (56 %) plants is satisfactory, 4 (25 %) is good, 3 (19 %) is in a very good condition. No plants were affected by diseases and pests.

CONCLUSIONS

In Mountain collection of Botanic garden of Siauliai University are 17 species of plants published in the list of threatened European plant species. From the 12 plant species of European Red List 4 species are grown in Botanic garden and their investigated adaptation level is good.

Ex situ in Botanic garden of Siauliai University are grown 94 species of plants from 357 plants

inscribed in Lithuanian Red Data book (2003). In *ex situ* collection grow 16 species of the plants of I (E) category of Lithuanian Red Data book. High and good adaptation level was estimated to 7 species of these plants.

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