

Prediction of perennial plant garden escapers by analyzing of *ex situ* plant collections

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INTRODUCTION

The introduction of new plant species into the territory will intensify not only with the rapid climate change but also with the economic growth of the regions and the consequences of human activities. One of the main reasons for alien plant distribution are trade, both World Wars, and logistics paths (Weber, 1998). The direct introduction of the herbal plants in the Botanic gardens has had many precedents when plants from the collections have escaped from garden territories and have naturalized as alien plants in the human-modified habitats (Hulme, 2011; van Kleunen et al., 2018).

One of the possibilities offered for saving the local flora – is restricting the introduction of new plant types in the local flora by first defining the potential invasion types in the collections and distributing information about them to nurseries and gardening organizations (Resolutions on the European Botanic Gardens Consortium, 2009). The work with new introducible taxa in collections: adaptation stage evaluations and the possible naturalization categorization needs to be done continuously in order to monitor possible escaper characteristic emergence. This helps protect the collections from the emergence of new weeds into the botanical gardens, thus putting barriers to distribution in the country.

The aim of the study is to identify ornamental herbal perennial plant garden escapers in the Riga region (Latvia) and taxa highly potential to become garden escapers.



Allium paradoxum *Aster umbellatus* *Boltonia asteroides* *Artemisia ludoviciana*



Asclepias syriaca *Collomia grandiflora* *Heliopsis helianthoides* *Kalimeris incissa*

RESULTS and DISCUSSION

Of 582 observed taxa 28 were found to exhibit good self-sowing in the Botanic Garden of the University of Latvia. Vegetative growth observations have identified them as integral garden weeds that can become garden escapers (Table 1).

Based on phenological data and observing plants growing in the collections over ten years, 28 taxa have been identified as integral garden weeds that can become garden escapers with the perspective of naturalizing in disturbed areas. Between them three new introduced species identified exhibited invasive potential in 2021: *Aster umbellatus*, *Boltonia asteroides*, *Kalimeris incissa*.

Field works in Riga District (Latvia) found nine taxa recorded for the first time outside cultivation area, which formed relatively stable, reproducing populations outside cultivation: *Allium paradoxum*, *Achillea ptarmica* cv. *Boule de Neige*, *Artemisia ludoviciana*, *Asclepias syriaca*, *Campanula lactiflora*, *Heliopsis helianthoides*, *Lathyrus latifolius*, *Phlox paniculata* and *Rudbeckia hirta*. Four of them: *Allium paradoxum*, *Artemisia ludoviciana*, *Asclepias syriaca*, *Heliopsis helianthoides* var. *scabra* were predicted as having potential to naturalize into the flora of Latvia, in 2010, but five - were categorized as adapted well in. Four species included in this list were found outside of the cultivation area, located in ruderal and semiruderal habitats: *Allium paradoxum*, *Artemisia ludoviciana*, *Asclepias syriaca*, *Heliopsis helianthoides* which demonstrates the adequacy of our testing methods to the real situation with new aliens ingrowth outside cultivation in Latvia.

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MATERIALS AND METHODS

The identification of ornamental herbal perennial plant garden escapers is based on the results of previously done analysis of the phenological observations of 582 taxa during 1995–1997 and 2009–2020 in the Botanic Garden of the University of Latvia. All taxa are alien for Latvia. The occasions of self – sowing, the type and rate of the expansion and garden habitat type were recorded, the active expansion intensity (vegetative and generative mobility) was sized too. The garden escapers were identified mainly by judgement of the intensity of self-sow, especially in neglected areas, that have stable populations with different age structures and occupied area increment (Fig.1).

The data of the taxa expansion outside the plantings in Riga District were collected between 2016 and 2019.



Figure 1. A) Neglected area in Botanical garden B) Urban desolved area

Table 1. Garden weeds and potential garden escapers

Nr.	Garden weeds, that can become the garden escapers	Year of including in the list
1	<i>Allium paradoxum</i> (M.Bieb.)G.Don**	2010
2	<i>Anaphalis margaritacea</i> (L.)Benth. et Hook.f.	2010
3	<i>Artemisia ludoviciana</i> Nutt.*	2010
4	<i>Asclepias syriaca</i> L.*	2010
5	<i>Aster umbellatus</i> Mill.	2019
6	<i>Boltonia asteroides</i> (L.) L'Her	2019
7	<i>Clematis vitalba</i> L.	2010
8	<i>Collomia grandiflora</i> Douglas ex Lindl.	2019
9	<i>Corydalis nobilis</i> (L.) Pers.	2010
10	<i>Cymbalaria muralis</i> Gottfr.Gaertn., B.Mey. et Scherb.	2010
11	<i>Eupatorium purpureum</i> L.	2019
12	<i>Festuca cinerea</i> Vill.	2019
13	<i>Helianthus x laetiflorus</i> Pers.	2010
14	<i>Heliopsis helianthoides</i> var. <i>scabra</i> (Dunal) Fernald*	2010
15	<i>Kalimeris incissa</i> (Fisch.)DC.	2021
16	<i>Montia sibirica</i> (L.) J.T.Howell	2010
17	<i>Oxyria digyna</i> (L.) Hill.	2021
18	<i>Pseudofumaria lutea</i> (L.)Borkh.	2010
19	<i>Pulmonaria rubra</i> Schott	2010
20	<i>Pulmonaria saccharate</i> Mill.	2019
21	<i>Rudbeckia laciniata</i> L.	2010
22	<i>Ruta graveolens</i> L.	2019
23	<i>Sedum spurium</i> M. Bieb.	2010
24	<i>Smilacina racemose</i> (L.) Desf.	2010
25	<i>Smilacina stellata</i> (L.) Desf.	2010
26	<i>Tellima grandiflora</i> (Pursh) Douglas ex Lindl.	2010
27	<i>Tradescantia virginiana</i> L.	2010
28	<i>Viola sororia</i> Willd.	2010

*,** publications see in REFERENCES