



Article

Changes in the spontaneous flora of the Main Botanic Garden, Moscow, over 65 years

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Abstract

A checklist of the flora for the territory of the Main Botanic Garden of the Russian Academy of Sciences (Moscow), compiled by the authors, enumerates 856 taxa from 406 genera representing 94 families. Long-term changes in the floristic composition have been considered for the first time. The plant species listing is found to have been augmented by 54 taxa of the native flora, 283 escapees from cultivation and 40 alien adventive plants, resulting in 1.8 times as large a total as 65 years ago. Yet only a single species, *Adenocaulon adhaerescens*, has been found outside the Botanic Garden territory. The composition of 10 leading families differs considerably in the native and alien fractions of the Garden flora: while Compositae are at the top of the list in both parts, Gramineae, Cyperaceae, Caryophyllaceae and Polygonaceae are not as prominent in the alien fraction as they are in the native part of the flora. At the same time, Liliaceae, Boraginaceae and Umbelliferae play a more important part in the alien segment of the flora. Families specific exclusively to the native and alien parts of the flora are identified. Alien plants are grouped in accordance with their life forms and invasive status.

Keywords: alien species, botanic garden, invasion, spontaneous flora.

Introduction

It has become overwhelmingly obvious that prevention of initial naturalization, rather than subsequent control or eradication, constitutes the most efficient and cost-effective approach to combating invasive species (Burt *et al.*, 2007). One of the Aichi Biodiversity Targets, number 9 of 20 targets formulated in 2010 at the Conference on Biodiversity in Nagoya, Aichi Prefecture, Japan, is formulated as follows: “By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.”

The very first attempt to evaluate the role played by a botanic garden in adding alien plants to the native flora appears to have been made by Flahault (1899) in the Montpellier Botanic Garden, France. According to Flahault, 24 naturalized species had been recorded in the Garden in 1856 although, four decades later, none of those were observed to sustain

themselves without human intervention. Yet as of 1893, 57 more alien species were already naturalized in the Garden and spread so widely that they required constant eradication efforts. Seven of these disappeared by 1899, and 4 were not widespread anymore, yet 9 more species had escaped by then. Flahault concluded that these plants could not be considered fully naturalized, since none of them left the Botanical Garden grounds.

A similar analysis was produced in Russia by an amateur botanist L.P.Alexandrov, who demonstrated that Demidov's Botanic Garden had existed in place of Neskuchnyy Sad, a well-known public garden in Moscow. He then conducted a detailed botanical survey of the Garden territory. While Pallas had listed 2224 species, including conservatory plants, there in 1781, in 1922 there were only 270 species registered, nearly all of them native (Alexandrov and Nekrasova, 1923).

According to a well-known Moscow botanist (Kozhevnikov, 1935) botanical gardens did not play a significant role in the introduction of alien species to the native flora. He listed adventive and escaped plants in the Moscow University Botanic Garden, now a branch of Moscow University Botanic Garden at Prospekt Mira, and its surroundings. His checklist consisted of 222 species, of which 53 were alien. Kozhevnikov believed that spontaneous plants on the territory of a garden were represented mainly by waifs, that is, those plants that become naturalized only for a short time period and then disappear without a trace. There were only three species that he considered to be true escapees: *Dipsacus pilosus*, *Impatiens parviflora* and *Veronica persica*.

“There is no doubt that the urban environment prevents naturalization of plants from a botanic garden, and yet we have enough evidence to assume that this process may take place on a small scale, involving only certain species—those capable of intensive expansion” Kozhevnikov (1935).

Less than a century has passed, and the numbers of alien species now approach those of natives, while in terms of the area covered aliens may well surpass natives, especially on developed land.

Even as recently as 20 years ago, railroads served as the most important pathway for alien plants conquering new land (Ignatov *et al.*, 1990). Now the situation has changed so that the majority of invasive plants are those previously cultivated (Mayorov *et al.*, 2012). Thus a large percentage of invasive plant species in the USA (82% of 235 woody plants) have been deliberately imported as ornamentals (Reichard and White, 2001). Commercial nurseries, which sell ornamental plants including potentially invasive ones, have been playing a crucial

role in this process. In Belgium, for example, some 60 black-listed plants are still being commercially sold as ornamental (Halford *et al.*, 2010). Among the most popular plants offered for sale are *Robinia pseudoacacia*, *Amelanchier lamarckii*, *Quercus rubra* and *Acer negundo*. Even *Heracleum mantegazzianum* has made it into five catalogs. In Britain, ornamental horticulture has been recognized as the main pathway for the introduction of invasive plants. Dehnen-Schmutz *et al.* (2007) examined the correlation between the propagule pressure created by the presence of ornamental plants on the market and their ability to escape from cultivation and become established in the wild. Of 534 randomly selected, non-native ornamental species that were on sale in nineteenth-century Britain, 27% have since been recorded growing outside of cultivation, and 30% of the latter have become established. In addition to nurseries, botanic gardens and arboreta, garden clubs, horticultural societies' seed exchanges, seed trade businesses, the medicinal herb industry, aquarium shops, erosion control agents and other entities have been responsible for the introduction of new alien plants (as well as new genotypes) on a grand scale (Reichard and White, 2001).

Increasingly mounting evidence highlights the role botanic gardens might play in plant invasions across the globe. Botanic gardens, which are often located in global biodiversity hotspots, have been responsible for the early cultivation of most environmental weeds. For example, botanic garden collections have been inferred as sources for the introduction, early cultivation, or dissemination of 19 out of 34 plants listed to be among the world's worst invasive species (Hulme, 2011). Studies of the most widespread naturalized alien plants in Russia have demonstrated that all the studied annuals, such as *Conyza canadensis*, *Echinocystis lobata*, *Bidens frondosa*, *Chamomilla suaveolens* or *Galinsoga parviflora* had been escapees from botanic gardens (Vinogradova, 2004; 2006).

Due to increasing rates of plant invasions, the Congress of European Botanic Gardens EuroGard V (Helsinki, 2009) formulated new goals for botanic gardens: to assess the risk for plants in their collections becoming invasive; share information on experiences with invasive organisms; develop and implement guidelines, codes of conduct and appropriate practices to prevent the spread of alien species; undertake research on the spreading, control, management and risks posed by invasive alien species. A number of normative acts demonstrate the urgency of this problem (Vinogradova, 2013).

The rate at which new species escape cultivation does not appear to be changing at present, although, due to intensive anthropogenic disturbance of vegetation, even a single species-escapee may inflict significant damage to the economy and ecology of a region. For

instance, upon escaping from the grounds of the Botanical Garden in Oslo, *Vincetoxicum rossicum* and *Phedimus spurius* have expanded onto alkaline substrate, a habitat of rare and endangered species in Norway (Bjureke, 2010).

Spontaneous flora of the Berlin Botanic Garden was studied in detail (Graf and Rohner, 1984; Graf, 1986), though those data are now somewhat out of date. A detailed floristic survey of alien species has been conducted in two Warsaw botanic gardens, the Warsaw University Botanic Garden (5 hectares, founded in 1818) and the Botanic Garden of the Polish Academy of Sciences (40 hectares, founded in 1974). The total number of higher plant species in both gardens amounted to 675, 27% of which were escapees from cultivation (Galera, 2003; Sudnik-Wójcikowska and Galera, 2005). Data for six other Polish gardens (in Bydgoszcz, Poznań, Kraków, Łódź, Lublin and Wrocław) were included in the analyses, so that the augmented checklist of ergaziophytes (species escaping from cultivation) yielded 350 taxa—32% of the total number of species registered within territories of all the eight Polish botanic gardens, that is, 1092 taxa (Galera and Sudnik-Wójcikowska, 2004a). This listing, however, must have included those plants that can reproduce themselves without human intervention, though do not leave the introduction facility grounds. We could come to this conclusion upon making a comparison with another article by the same authors, where similar data were summarized for 70 botanic gardens in Central Europe, yet the checklist of alien weeds dwindled to just 187 species (Galera and Sudnik-Wójcikowska, 2004b). The Polish botanists traced expansion of a number of alien species across Central Europe and described five different pathways for plants to escape cultivation (Galera and Sudnik-Wójcikowska, 2005).

Other botanic gardens have also started their inventories of plants escaping cultivation. For example, in the Vienna Botanic Garden, the following species were noticed to be aggressively naturalizing: *Symphytum novi-belgii*, *Duchesnea indica*, *Eschscholzia californica*, *Lysimachia vulgaris*, *Solidago flexicaulis*, *S. graminea* and *Stachys affinis* (Lechner and Kiehn, 2010). Data have been published on plants escaping the Batumi Botanic Garden (Gvarishvili and Lomtadidze, 2013).

Recently a database has been created summarizing evidence on species naturalized within botanic gardens of 28 European countries with either Atlantic, Mediterranean, or continental climate (Jebb, 2009: www.botanicalgardens.ie). As of 2011, the database contained data on 640 species including information on their native ranges and rating of invasiveness on a 1 to 4 scale:

1 (ggg) — a highly invasive species that poses a threat to the integrity of regional vegetation;

2 (+++) — invasive;

3 (++) — potentially invasive;

4 (+) — a species capable of self-reproduction on botanic garden grounds, but demonstrating no tendency to escape any further.

Steadfast studies of plants escaping cultivation in Moscow (from the Moscow University Botanic Garden and Main Botanic Garden) were started by the authors about five years ago. Our observations have served the basis for the analysis of the naturalization extent of those species that have a tendency to escape from botanical institutions. Results are now published in a number of articles and a monograph entitled *An Illustrated Catalogue of Plants Escaping Cultivation in Moscow Botanic Gardens* (Mayorov and Vinogradova, 2013; Mayorov *et al.*, 2013). Within Russia, listings of species belonging to the alien fraction of the flora have been also published for the Tver University Botanic Garden (Notov and Notov, 2012), Voronezh University Botanic Garden (Lepeshkina and Mukovnina, 2005) and Kaliningrad University Botanic Garden (Gubareva and Glukhovskikh, 2013).

Even though inventories of naturalized species that have escaped cultivation are now started across the world, not much has been done so far for historic studies of naturalization dynamics. This kind of research is being conducted in the New York Botanic Garden (Nee, unpublished). In the Garden Archives, Nee (unpublished) has discovered an account of Old-World species naturalized in the Garden by 1933 produced by Small and Alexander. It names 57 woody plants (35 shrubs and 22 trees). Nowadays there are many more naturalized plants on the Garden grounds (including many herbaceous ones), the majority originating from Europe or adjacent western Asian countries. Examples of plants included on the preliminary list are *Saponaria officinalis* L., *Alliaria petiolata* (M.Bieb.) Cavara & Grande, *Brassica campestris* L. and *Coronilla varia* L.

We are not aware of any other sources of information on the dynamics of the flora within territories of introduction institutions. Apparently, in order to depict changes in the floristic composition, one has to have the initial inventory for comparison, which is by no means a common case. Therefore, our article is the first one to deal with changes in the floristic composition that have occurred on a botanic garden grounds over 65-70 years.

The Main Botanic Garden of the Russian Academy of Sciences was founded in 1945. It occupies an area of more than 330 hectares in the northern part of Moscow. The Yauza River

flows east of the Garden, so that two of its tributaries, the Likhoborka and Kamenka, cross the Garden grounds. The territory constitutes a drainage divide plateau whose eastern slope descends toward an ancient sand terrace. The entire territory lies within a single landscape defined as ridged and hilly plains of Smolensk Upland with sod-podzolic soils under spruce-hardwood and mixed forest (Kolosova and Churilova, 2004). Most of the Garden territory is covered with woods, featuring a 118-hectare oak grove at the centre. The vegetation has, of course, been modified by human activities. Frequent wood cutting, which occurred from the 18th century on, has produced secondary birch stands in place of oaks. Grazing has resulted in the formation of large openings devoid of woody vegetation (Russ. *polyana's*). Despite that, the grove constitutes the best preserved oak forest in and around Moscow with centuries-old oaks originating from seed, the understory of hazelnut, and a characteristic herbaceous layer of broad-leaved plants. The following associations have been identified: *Quercus robur – Populus tremula – Corylus avellana – Galeobdolon luteum*; *Quercus robur – Corylus avellana – Carex pilosa*; *Quercus robur – Corylus avellana – Mercurialis perennis*; *Quercus robur – Corylus avellana + Padus racemosa – Pulmonaria obscura*.

In addition to the oak and birch woods, there are some aspen- and pine-dominated lots and also alder and willow thickets with wetland herbaceous vegetation and sedge lowlands in the floodplains of both streams.

Large-scale collection-building was actually started only in 1949, although floristic and vegetation inventories had been conducted prior to the collection installation (Evtyukhova, 1949). That checklist enumerated a total of 485 species divided into 4 groups: 1 – wild native plants of Moscow Region (460 taxa); 2 – plants that had escaped from cultivation (10); 3 – unintentionally introduced alien species (5); 4 – deliberately planted (10 taxa). Herbarium samples collected by Evtyukhova are preserved in the Main Botanic Garden Herbarium (MHA), many identified by a well-known expert on the Russian flora, V.N.Voroshilov.

Over many years, numerous introductions took place in the garden. Among those introduced were plants belonging to the USSR flora, ornamental herbaceous plants originating within the Holarctic forest belt and woody plants of temperate zones from across the world. More than eight thousand taxa have been subject to introduction trials (Demidov *et al.*, 2005). Originally situated at a remote city margin, the Garden ended up in an urban environment, surrounded by transport arteries. Both of these influences, intensive introduction work and changes in microclimate have resulted in significant transformation of the floristic composition. The natural vegetation has been preserved only in the Oak Grove Sanctuary at the centre of the

Garden and in the open buffer zone surrounding the grove, which is kept free of plantings. Yet many new trails and paths have been formed even within this preserved area. All ponds in the grounds are man-made, which serves as proof that all of the pond plants have been escapees from cultivation rather than natural inhabitants of the territory.

Detailed surveys conducted in 2012–2013 accounted for 262 introduced species including escapees from cultivation that are widespread across the Garden grounds (Mayorov *et al.*, 2013) although herbarium holdings were not included in that count. A survey of herbarium holdings (MHA) has produced new evidence and resulted in many more introduced taxa joining the checklist.

One of the earliest collectors who started to pay attention and methodically preserve plants escaping cultivation in the Garden grounds was A.K.Skvortsov (1920 – 2008), who directed the scientific work at the Herbarium until the end of his life. This article is also based on collections made by G.P.Rysina, V.V.Makarov, N.V.Kostyleva, M.S.Ignatov, and others, including those contributed by the authors.

The goal of the article is to reveal changes in the native as well as introduced fraction of the flora within the territory of the Main Botanic Garden, based not just on the authors' collections but also on available herbarium samples, over the time period starting from the installation of the outdoor exhibits until the present. The authors are planning to eventually study the alien fraction of the flora in more detail.

Materials and methods

The contemporary checklist has been based on the herbarium specimens preserved in MHA as well as on the authors' observations made from 1990 to 2013.

The checklist with brief annotations is presented here below. Following Evtyukhova, we refer each taxon to one of three groups and designate this attribution by a letter in parentheses: (N) – a native plant of Moscow Region; (C) – an alien plant-escapee from cultivation; (W) – a weed or unintentionally introduced alien plant. Introduced plants that have not been found escaping are not included in the checklist (currently there are about five thousand introduced taxa in the outdoor collections – including species, varieties, and formas, but excluding cultivars). Species that were already included on the 1949 list are marked with an asterisk (*). Following the approach practiced in the International Database Euro+Med PlantBase (www.emplantbase.org), the authors do not segregate archeophytes into a separate group within the native flora. Since the changes that are being analyzed have occurred entirely within the contemporary time period, such division appears to be counterproductive. The scope of

families is mostly that of the Engler System (with some changes), as this system has been traditionally employed for introduction work in Russian botanic gardens (Czerepanov, 1995). For example, Liliaceae are treated in their traditional circumscription not only because the plants are morphologically similar, but also due to their common ability to reproduce vegetatively: via bulbs, bulb-like corms, or rhizomes, which is important when considering the history of species expansion.

Our rating of invasive species status employs gradations devised within the European Botanic Gardens Consortium project *Sharing information and policy on the potentially invasive plants in botanic gardens* (www.botanicalgardens.ie). Category 1 is assigned to alien species that are common within as well as outside the Main Botanic Garden grounds; 2 – species actively spreading across the Garden territory that is free from collections or exhibits; 3 – species that have formed local naturalized populations outside collections or expositions; in cases of vegetative spread, those plants that can form persistent clones upon losing connection with mother-plants; 4 – species that have been encountered outside collection plots at least once (for example, according to herbarium data). Our list, however, does not include species that are capable of reproduction within the botanic garden, though having no tendency to escape any further (these would be also categorized with Group 4). Our previous research (Trulevich *et al.*, 2007; Vinogradova, 2006; Vinogradova, 2010) demonstrated that the latter category embraces more than 400 species.

Recognized life-forms (LF) include the following groupings (Table 1): T – tree; Sh – shrub or semi-shrub; PV - perennial capable of vegetative reproduction; NP - perennial not capable of vegetative reproduction; BI – biennial; A – annual. During further analysis, trees and shrubs were united in the group of woody plants, while biennials and annuals formed a group of short-lived terophytes.

Results

Table 1. Annotated Checklist of Spontaneous Plants in the Main Botanic Garden
 (SA – source: either native, escapee from cultivation, or inadvertently introduced alien; SI – status of invasiveness; LF – life-form)

#	Species Name	SA	SI	LF	First Herbarium Collection Date and Other Notes
Polypodiopsida					
Polypodiaceae s.l.					
1	<i>Athyrium filix-femina</i> (L.) Roth	N*		NP	

2	<i>Cystopteris fragilis</i> (L.) Bernh.	N*		NP	
3	<i>Dryopteris carthusiana</i> (Vill.) H.P.Fuchs	N*		NP	
4	<i>D. cristata</i> (L.) A. Gray	N*		NP	
5	<i>D. filix-mas</i> (L.) Schott	N*		NP	
6	<i>Gymnocarpium dryopteris</i> (L.) Newm.	N*		NP	
7	<i>Matteuccia struthiopteris</i> (L.) Tod.	C	3	PV	1974. Brookside in birch woods near European Flora Exhibit
8	<i>Phegopteris connectilis</i> (Michx.) Watt	N*		PV	
9	<i>Pteridium aquilinum</i> (L.) Kuhn	N*		PV	
10	<i>Thelypteris palustris</i> Schott	C	3	PV	1974. Brookside near European Flora Exhibit
Ophioglossaceae					
11	<i>Botrychium multifidum</i> (S.G.Gmel.) Rupr.	N*		NP	
Equisetopsida					
Equisetaceae					
12	<i>Equisetum arvense</i> L.	N*		PV	
13	<i>E. fluviatile</i> L.	N		PV	1946. Small wetland on bank of Likhoborka, M.Evtyukhova. 1960. Damp shady parts of birch grove, V.Makarov
14	<i>E. hyemale</i> L.	N*		PV	
15	<i>E. palustre</i> L.	N*		PV	
16	<i>E. pratense</i> Ehrh.	N*		PV	
17	<i>E. sylvaticum</i> L.	N*		PV	
Lycopodiopsida					
Lycopodiaceae					
18	<i>Lycopodium clavatum</i> L.	N*		PV	
Pinopsida					
Pinaceae					
19	<i>Larix sibirica</i> Ledeb.	N*		T	
20	<i>Picea abies</i> (L.) H.Karst.	N*		T	
21	<i>Pinus sylvestris</i> L.	N*		T	
Cupressaceae					
22	<i>Juniperus communis</i> L.	N*		T	
Angiospermae					
Monocotyledonae					
Typhaceae					
23	<i>Typha angustifolia</i> L.	C	3	PV	Ponds near Lab Building
24	<i>T. latifolia</i> L.	N*		PV	

Sparganiaceae					
25	<i>Sparganium minimum</i> Wallr.	N*		PV	
26	<i>S. emersum</i> Rehmann	N*		PV	
27	<i>S. erectum</i> L.	N*		PV	
Potamogetonaceae					
28	<i>Potamogeton berchtoldii</i> Fieber	N*		PV	
29	<i>P. crispus</i> L.	N*		PV	
30	<i>P. lucens</i> L.	N		PV	Ponds near Lab Building
Alismataceae					
31	<i>Alisma plantago-aquatica</i> L.	N*		NP	
32	<i>Sagittaria sagittifolia</i> L.	N*		PV	
Butomaceae					
33	<i>Butomus umbellatus</i> L.	C	3	NP	1968. Pondshore near Siberian Hill, Yu.Dmitriev
Hydrocharitaceae					
34	<i>Elodea canadensis</i> Michx.	W	2	PV	1968. Ditch in Dendrarium, Yu.Dmitriev
35	<i>Hydrilla verticillata</i> (L.f.) Royle	W	4	A	1972. In ponds en masse, A.K.Skvortsov
36	<i>Hydrocharis morsus-ranae</i> L.	N*		PV	
Gramineae					
37	<i>Agrostis canina</i> L.	N*		NP	
38	<i>A. capillaris</i> L.	N*		PV	
39	<i>A. gigantea</i> Roth	N*		PV	
40	<i>A. stolonifera</i> L.	N*		PV	
41	<i>Alopecurus aequalis</i> Sobol.	N*		A	
42	<i>A. geniculatus</i> L.	N*		A	
43	<i>A. pratensis</i> L.	N*		PV	
44	<i>Anthoxanthum odoratum</i> L.	N*		PV	
45	<i>Arrhenatherum elatius</i> (L.) P.Beauv. ex J.Presl & C.Presl	W	3	PV	1959. Birch forest margin, G.Rysina
46	<i>Brachypodium sylvaticum</i> (L.) P.Beauv.	N*		NP	
47	<i>Briza media</i> L.	N*		PV	
48	<i>Bromopsis benekenii</i> (Lange) Holub	N*		PV	
49	<i>B. inermis</i> (Leyss.) Holub	N*		PV	
50	<i>Bromus arvensis</i> L.	N*		A	
51	<i>B. commutatus</i> Schrad.	W	4	A	1985. In bed in front of Lab Building, Ignatov
52	<i>B. mollis</i> L.	N*		A	
53	<i>Calamagrostis arundinacea</i> (L.) Roth	N*		PV	
54	<i>C. canescens</i> (Weber) Roth	N*		PV	

55	<i>C. epigejos</i> (L.) Roth	N*		PV	
56	<i>Catabrosa aquatica</i> (L.) P.Beauv.	N*		PV	
57	<i>Cynosurus cristatus</i> L.	N*		NP	
58	<i>Dactylis glomerata</i> L.	N*		PV	
59	<i>Deschampsia cespitosa</i> (L.) P.Beauv.	N*		NP	
60	<i>Echinochloa crus-galli</i> (L.) P.Beauv.	N*		A	
61	<i>Elymus caninus</i> (L.) L.	N*		NP	
62	<i>E. fibrosus</i> (Schrenk) Tzvelev	W	4	PV	1955. In a lawn, V.N.Voroshilov
63	<i>Elytrigia repens</i> (L.) Nevski	N*		PV	
64	<i>Festuca gigantea</i> (L.) Vill.	N*		NP	
65	<i>F. ovina</i> L.	N*		NP	
66	<i>F. pratensis</i> Huds.	N*		PV	
67	<i>F. rubra</i> L.	N*		PV	
68	<i>Glyceria fluitans</i> (L.) R.Br.	N*		PV	
69	<i>G. maxima</i> (Hartm.) Holmb.	N*		PV	
70	<i>G. notata</i> Chevall.	N*		PV	
71	<i>Helictotrichon pratense</i> (L.) Pilg.	N*		PV	
72	<i>Hierochloë odorata</i> (L.) P.Beauv.	N*		PV	
73	<i>Lolium ×hybridum</i> Hausskn. (= <i>L.mutiflorum</i> Lam. × <i>L.perenne</i> L.)	W	3	NP	1961. V.Nekrasov. 1984. Shrub thickets near Exhibit Conservatory, V.V.Makarov
74	<i>Lolium perenne</i> L.	W*	3	NP	1946. Roadside weed, V.N.Voroshilov
75	<i>Melica nutans</i> L.	N*		NP	
76	<i>Milium effusum</i> L.	N*		NP	
77	<i>Nardus stricta</i> L.	N*		NP	
78	<i>Panicum miliaceum</i> L.	C	3	A	1961. Weed in bed, G.Rysina. 1981. Along main road, solitary, V.Makarov
79	<i>Phalaris canariensis</i> L.	C	4	A	1993. In bed at Building 4, near dumpster, V.Bochkin
80	<i>Phalaroides arundinacea</i> (L.) Rauschert	N*		PV	
81	<i>Phleum pratense</i> L.	N*		PV	
82	<i>Poa annua</i> L.	N*		A	
83	<i>P. bulbosa</i> L.	W	4	PV	1950. Path between beds in Flora Dept., M.V.Kultiasov
84	<i>P. compressa</i> L.	N*		PV	
85	<i>P. nemoralis</i> L.	N*		PV	
86	<i>P. palustris</i> L.	N*		PV	
87	<i>P. pratensis</i> L.	N*		PV	
88	<i>P. remota</i> Forselles	N*		PV	

89	<i>P. supina</i> Schrad.	W	2	PV	Quite widespread in sanctuaries in and around Moscow. Within MBG occurs along forest trails and roads, sometimes forming extensive groundcover at forest openings. Has been overlooked, as its habit is similar to that of <i>P. annua</i> L.
90	<i>P. trivialis</i> L.	N*		PV	
91	<i>Secale cereale</i> L.	C	4	A	1946. Weed, M.Evtyukhova
92	<i>Setaria pumila</i> (Poir.) Roem. & Schult.	N*		A	
93	<i>S. viridis</i> (L.) P.Beauv. s.l.	N*		A	
94	<i>Zizania aquatica</i> L.	C	3	A	1958. Pond, A.Nekrasov
95	<i>Z. latifolia</i> (Griseb.) Turcz. ex Stapf	C	2	PV	2002. Pondshore near Lab Building, N.Belyanina
Cyperaceae					
96	<i>Carex acuta</i> L.	N*		PV	
97	<i>C. canescens</i> L.	N*		NP	
98	<i>C. cespitosa</i> L.	N*		NP	
99	<i>C. contigua</i> Hoppe	N*		NP	
100	<i>C. crawfordii</i> Fernald	C	4	PV	1990. Weed in ornamental plant section near tuber storage. Inadvertently introduced from US with live material, V.D.Bochkin, M.Polonskaya
101	<i>C. diandra</i> Schrank	N*		NP	
102	<i>C. digitata</i> L.	N*		NP	
103	<i>C. ericetorum</i> Pollich	N*		NP	
104	<i>C. flava</i> L.	N*		NP	
105	<i>C. hirta</i> L.	N*		PV	
106	<i>C. juncella</i> (Fr.) Th.Fr.	N		PV	
107	<i>C. leporina</i> L.	N*		NP	
108	<i>C. nigra</i> (L.) Reichard	N*		PV	
109	<i>C. pallescens</i> L.	N*		NP	
110	<i>C. pilosa</i> Scop.	N*		PV	
111	<i>C. praecox</i> Schreb.	N		PV	
112	<i>C. pseudobrizoides</i> Clavaud	W	4	PV	1990. Flora Dept. Nursery, in shaded beds, N.Shevyréva
113	<i>C. rostrata</i> Stokes	N*		PV	
114	<i>C. sylvatica</i> Huds.	N*		NP	
115	<i>C. vesicaria</i> L.	N*		PV	
116	<i>C. vulpina</i> L.	N		PV	
117	<i>Eleocharis palustris</i> (L.) Roem. & Schult.	N*		PV	

118	<i>Schoenoplectus lacustris</i> (L.) Palla	N*		PV	
119	<i>Scirpus radicans</i> Schkuhr	N*		PV	
120	<i>S. sylvaticus</i> L.	N*		PV	
Acoraceae					
121	<i>Acorus calamus</i> L.	C	3	PV	
122	<i>Arum maculatum</i> L.	C	3	PV	Persistent near European Flora Exhibit and around Shade Garden
123	<i>Arisaema amurense</i> Maxim.	C	3	PV	Near Shade Garden
124	<i>Calla palustris</i> L.	N*		PV	
Lemnaceae					
125	<i>Lemna minor</i> L. s.l.	N*		PV	
126	<i>L. trisulca</i> L.	N*		PV	
127	<i>Spirodela polyrhiza</i> (L.) Schleid.	N*		PV	
128	<i>Wolffia arrhiza</i> (L.) Horkel ex Wimm.	W	3	PV	2011. In pond near Lab Building, S.R.Mayorov and Shcherbakov
Juncaceae					
129	<i>Juncus alpinoarticulatus</i> Chaix	N*		NP	
130	<i>J. articulatus</i> L.	N*		NP	
131	<i>J. bufonius</i> L.	N*		A	
132	<i>J. compressus</i> Jacq.	N*		PV	
133	<i>J. effusus</i> L.	N*		NP	
134	<i>J. filiformis</i> L.	N*		PV	
135	<i>J. ranarius</i> Songeon et E.P.Perrier	N		A	1959. Wet ditch, V.V.Makarov
136	<i>J. tenuis</i> Willd.	W*	2	PV	1946. Main Alley, M.Evtyukhova
137	<i>Luzula multiflora</i> (Ehrh.) Lej.	N*		NP	
138	<i>L. pallescens</i> Sw.	N*		NP	
139	<i>L. pilosa</i> (L.) Willd.	N*		NP	
Liliaceae					
140	<i>Allium altissimum</i> Regel	C	3	PV	Persistent in place of former Bulbous Plant Exhibit of Ornamental Plant Dept.
141	<i>A. oleraceum</i> L.	N*		NP	
142	<i>A. paradoxum</i> (M.Bieb.) G.Don	C	2	PV	1989. Woods at entrance to Flora Dept. Nursery, A.K.Skvortsov, V.D.Bochkin. 2013. Large naturalized populations near Flora of Caucasus Exhibit and Shade Garden
143	<i>A. rosenbachianum</i> Regel	C	4	PV	Persistent at Flora of Central Asia Exhibit
144	<i>A. schoenoprasum</i> L.	C	3	NP	Persistent near Shade Garden
145	<i>A. ursinum</i> L.	C	3	NP	Self-seeding near Native Plant Exhibit
146	<i>A. victorialis</i> L.	C	3	NP	2012-2013 observations: volunteer across the Flora of Caucasus Exhibit
147	<i>Chionodoxa luciliae</i> Boiss.	C	3	PV	1989. Persistent in lawn near Lab

					Building. M.S.Ignatov, V.D.Bochkin. Игнатов, В.Д. Бочкин. Currently is expanding across open space and lawns forming large (a few sq. m) clumps.
148	<i>Ch. forbesii</i> Baker	C	3	PV	In lawn near Lab Building
149	<i>Ch. sardensis</i> Whittall ex Barr et Sayden	C	3	PV	In lawn near Lab Building
150	<i>Convallaria majalis</i> L.	N*		PV	
151	<i>Gagea lutea</i> (L.) Ker-Gawl.	N*		PV	
152	<i>G. minima</i> (L.) Ker-Gawl.	N*		PV	
153	<i>Lilium martagon</i> L.	C	3	NP	1987. In birch woods opposite tuber storage, V.V.Makarov. Persisting individual plants have also been found recently (infrequent).
154	<i>Maianthemum bifolium</i> (L.) F.W.Schmidt	N*		PV	
155	<i>Muscari neglectum</i> Guss. ex Ten.	C	3	NP	1989. Weed in Flora Dept. exhibits, N.V.Kostyleva. Currently volunteering in lawns.
156	<i>Ornithogalum fimbriatum</i> Willd.	C	3	NP	Persistent for years in small quantities at trial plots of Flora Dept.
157	<i>O. umbellatum</i> L. s.l.	C	3	PV	Sometimes escapes
158	<i>Paris incompleta</i> M.Bieb.	C	3	PV	A few plants have been found close to Shade Garden
159	<i>P. quadrifolia</i> L.	N*		PV	
160	<i>Polygonatum hirtum</i> (Bosc ex Poir.) Pursh	C	3	PV	Escaped clones discovered in 2012 close to Shade Garden
161	<i>P. odoratum</i> (Mill.) Druce	N*		PV	
162	<i>P. verticillatum</i> (L.) All.	C	3	PV	A few juvenile plants found close to Shade Garden
163	<i>Puschkinia scilloides</i> Adams	C	3	PV	Escapes infrequently
164	<i>Scilla rosenii</i> K. Koch	C	3	NP	1989. A few plants first found astray in a lawn near Flora of Europe Exhibit by V.D.Bochkin; persisting until now
165	<i>S. siberica</i> Haw.	C	3	PV	1989. Large amounts in woods near Flora of Europe and Central Asia exhibits, V.D.Bochkin. Nowadays, at times produces aspect across open habitats as well as under forest canopy
166	<i>Trillium camtschatcense</i> Ker-Gawl.	C	4	NP	In woods near Flora Dept. Nursery, A.K.Skvortsov, V.D.Bochkin
167	<i>Tulipa biebersteiniana</i> Schult. et Schult. fil.	C	3	PV	Persists for many years at Flora Dept. Trial plots

168	<i>T. greigii</i> Regel	C	4	PV	1984. Weed in Flora Dept. exhibits, N.V.Kostyleva
169	<i>T. × hybrida</i> hort.	C	3	PV	On compost piles in management area
170	<i>T. kaufmanniana</i> Regel	C	3	PV	1983. Weed in Flora Dept. exhibits, N.V.Kostyleva
171	<i>Veratrum lobelianum</i> Bernh.	N		NP	
Amaryllidaceae					
172	<i>Galanthus nivalis</i> L.	C	3	NP	
173	<i>Leucojum vernum</i> L.	C	3	NP	
174	<i>Narcissus ×incomparabilis</i> Mill.	C	3	PV	Persistent wherever it has been cultivated
175	<i>N. poeticus</i> L.	C	3	PV	
176	<i>N. pseudonarcissus</i> L.	C	3	PV	
Iridaceae					
177	<i>Crocus vernus</i> (L.) Hill	C	3	PV	1988. Lawn in front of forcing hothouses, V.D.Bochkin. Still escapes into lawns, where it forms persistent colonies
178	<i>Gladiolus imbricatus</i> L.	C	4	NP	2012. Flora Dept. Nursery, N.V.Kostyleva
179	<i>Iris pseudacorus</i> L.	C	3	PV	Pond shores. Petals lemon-yellow
180	<i>I. sibirica</i> L.	C	3	NP	1976. Small damp depression at birch woods margin, V.Makarov, T.Sofeikova
Orchidaceae					
181	<i>Dactylorhiza fuchsii</i> (Druce) Soó	N*		NP	
182	<i>D. incarnata</i> (L.) Soó	N*		NP	
183	<i>Epipactis helleborine</i> (L.) Crantz	N		NP	
184	<i>Listera ovata</i> (L.) R. Br.	N*		NP	
185	<i>Neottia nidus-avis</i> (L.) Rich.	N*		NP	
186	<i>Platanthera bifolia</i> (L.) Rich.	N*		NP	
Dicotyledoneae					
Salicaceae					
187	<i>Populus ×canescens</i> (Aiton) Smith (<i>=P.alba × P.tremula</i>)	C	3	T	
188	<i>P. tremula</i> L.	N*		T	
189	<i>Salix alba</i> L.	N*		T	
190	<i>S. aurita</i> L.	N*		Sh	
191	<i>S. caprea</i> L.	N*		Sh	
192	<i>S. cinerea</i> L.	N*		Sh	
193	<i>S. gmelinii</i> Pall.	N*		Sh	
194	<i>S. euxina</i> I.V.Belyaeva (<i>S. fragilis</i> auct., non L.)	W*	2	T	
195	<i>S. ×fragilis</i> L. (<i>= S. rubens</i> Schrank ; <i>= S.alba × S.euxina</i>)	W	2	T	

196	<i>S. myrsinifolia</i> Salisb.	N*		Sh	
197	<i>S. pentandra</i> L.	N*		T	
198	<i>S. starkeana</i> Willd.	N*		Sh	
199	<i>S. triandra</i> L.	N*		Sh	
Juglandaceae					
200	<i>Juglans mandshurica</i> Maxim.	C	2	T	Young naturalized trees in Dendrarium and at Oak Grove margin
201	<i>J. regia</i> L.	C	4	T	1984. Plant at least 3 years old in disturbed pine woods along road toward Collections Greenhouse, V.V.Makarov. 1986. A 5-year-old frost-bitten tree along Botanicheskaya St., V.V.Makarov
202	<i>J.×sinensis</i> (C.DC.) Dode (<i>J. regia</i> × <i>J. mandschurica</i>)	C	3	T	Solitary 2-year-old seedling in alley connecting Lab Building and Collections Greenhouse
Betulaceae					
203	<i>Alnus glutinosa</i> (L.) Gaertn.	N*		T	
204	<i>A. incana</i> (L.) Moench	N*		T	
205	<i>Betula pubescens</i> Ehrh.	N*		T	
206	<i>B. verrucosa</i> Ehrh.	N*		T	
207	<i>Corylus avellana</i> L.	N*		Sh	
Fagaceae					
208	<i>Quercus robur</i> L.	N*		T	
209	<i>Q. rubra</i> L.	C	3	T	Abundant saplings at exhibit in Dendrarium
Ulmaceae					
210	<i>Ulmus laevis</i> Pall.	N*		T	
211	<i>U. scabra</i> Mill.	N*		T	
Cannabaceae					
212	<i>Cannabis sativa</i> L.	W	3	A	1964. At waste places, V.V.Makarov
213	<i>Humulus lupulus</i> L.	N*		PV	
Urticaceae					
214	<i>Parietaria officinalis</i> L.	C	3	PV	2012. Weed in nursery of Flora Dept., N.V.Kostyleva
215	<i>Urtica dioica</i> L.	N*		PV	
216	<i>U. urens</i> L.	N*		A	
Aristolochiaceae					
217	<i>Asarum europaeum</i> L.	N*		PV	
Polygonaceae					
218	<i>Aconogonon alpinum</i> (All.) Schur	C	3	PV	1985 and 1989. Weed in Flora Dept. exhibits, N.V.Kostyleva. Occasionally becoming weedy

219	<i>A. weyrichii</i> (F.Schmidt) H.Hara	C	3	PV	1983. Weed in Flora Dept. exhibits, N.V.Kostyleva
220	<i>Bistorta major</i> Gray	N*		NP	
221	<i>Fallopia convolvulus</i> (L.) Á.Löve	N*		A	
222	<i>F. dumetorum</i> (L.) Holub	N*		A	
223	<i>Persicaria amphibia</i> (L.) Delarbre	N*		PV	
224	<i>P. hydropiper</i> (L.) Delarbre	N*		A	
225	<i>P. lapathifolia</i> (L.) Delarbre	N*		A	
226	<i>P. maculosa</i> Gray	N*		A	
227	<i>P. minor</i> (Huds.) Opiz	N*		A	
228	<i>Polygonum aviculare</i> L. s. l.	N*		A	
229	<i>P. ×neglectum</i> Besser	N*		A	
230	<i>Reynoutria ×bohemica</i> Chrtek & Chrtková	C	2	PV	In Dendrarium and at Oak Grove margins. A variegated clone with white-and-green leaves has been discovered
231	<i>R. japonica</i> Houtt.	C	3	PV	
232	<i>R. sachalinensis</i> (F.Schmidt) Nakai	C	3	PV	
233	<i>Rumex acetosa</i> L.	N*		NP	
234	<i>R. acetosella</i> L.	N*		PV	
235	<i>R. aquaticus</i> L.	N*		NP	
236	<i>R. confertus</i> Willd.	N*		NP	
237	<i>R. crispus</i> L.	N		NP	
238	<i>R. hydrolapathum</i> Huds.	N		NP	
239	<i>R. longifolius</i> DC.	N		NP	
240	<i>R. maritimus</i> L.	N*		A	
241	<i>R. obtusifolius</i> L.	N*		NP	
242	<i>R. thyrsiflorus</i> Fingerh.	N*		NP	
Chenopodiaceae					
243	<i>Atriplex hastata</i> L.	W	3	A	1946. In rather damp situation in tall herbaceous vegetation on bank of Kamenka, V.N.Voroshilov. 1961 and 1984. Collections in waste habitats
244	<i>A. patula</i> L.	N*		A	
245	<i>A. sagittata</i> Borkh.	N*		A	
246	<i>Chenopodium album</i> L.	N*		A	
247	<i>Ch. bonus-henricus</i> L.	N*		NP	
248	<i>Ch. glaucum</i> L.	N*		A	
249	<i>Ch. polyspermum</i> L.	N*		A	
250	<i>Ch. rubrum</i> L.	N*		A	
Amaranthaceae					
251	<i>Amaranthus albus</i> L.	W*	3	A	1946. In potato bed, V.N.Voroshilov Never found later on

252	<i>A. cruentus</i> L.	C	3	A	1964. Weed in beds, V.V.Makarov
253	<i>A. retroflexus</i> L.	W*	3	A	1961. Vacant lot, G.P.Rysina
Nyctaginaceae					
254	<i>Oxybaphus nyctagineus</i> (Michx.) Sweet	C	4	NP	1981,1983,1985. Weed in Native Flora Dept. Nursery (species not cultivated there)
Caryophyllaceae					
255	<i>Arenaria serpyllifolia</i> L.	N		A	
256	<i>Cerastium fontanum</i> Baumg.	N*		NP	
257	<i>Coronaria flos-cuculi</i> (L.) A.Braun	N*		NP	
258	<i>Dianthus barbatus</i> L.	W*		PV	
259	<i>D. deltoides</i> L.	N*		NP	
260	<i>D. fischeri</i> Spreng.	N*		NP	
261	<i>Gypsophila muralis</i> L.	N		A	
262	<i>Melandrium album</i> (Mill.) Garcke	N*		NP	
263	<i>Moehringia trinervia</i> (L.) Clairv.	N*		A	
264	<i>Myosoton aquaticum</i> (L.) Moench	N*		A	
265	<i>Sagina procumbens</i> L.	N*		NP	
266	<i>Silene latifolia</i> Poir.	N*		NP	
267	<i>S. viscaria</i> (L.) Borkh.	N*		NP	
268	<i>S. vulgaris</i> (Moench) Garcke	N		NP	
269	<i>Spergula arvensis</i> L.	N*		A	
270	<i>Spergularia rubra</i> (L.) J.Presl & C.Presl	N*		A	
271	<i>Stellaria graminea</i> L.	N*		PV	
272	<i>S. holostea</i> L.	N*		PV	
273	<i>S. media</i> (L.) Vill. s.l.	N*		BI	
274	<i>S. nemorum</i> L.	N*		A	
275	<i>S. palustris</i> Ehrh. ex Hoffm.	N*		NP	
276	<i>Vaccaria hispanica</i> (Mill.) Rauschert	C	4	A	1960. Weed in sandy places, V.V.Makarov
Nymphaeaceae					
277	<i>Nymphaea candida</i> C.Presl	N		PV	
278	<i>Nuphar lutea</i> (L.) Sm.	N		PV	
Ceratophyllaceae					
279	<i>Ceratophyllum demersum</i> L.	N		PV	
Paeoniaceae					
280	<i>Paeonia anomala</i> L.	C	3	NP	Scattered plants found near Native Flora Exhibit
Ranunculaceae					
281	<i>Aconitum septentrionale</i> Koelle	N*		NP	
282	<i>Actaea rubra</i> (Aiton) Willd.	C	3	NP	2012-2013. A few naturalized plants of

					white-fruited form found near Shade Garden
283	<i>Anemone nemorosa</i> L.	N		PV	
284	<i>A. ranunculoides</i> L.	N*		PV	
285	<i>Aquilegia vulgaris</i> L.	C	3	NP	
286	<i>Caltha palustris</i> L.	N*		NP	
287	<i>Clematis brevicaudata</i> DC.	C	4	PV	1985. Rubbish-strewn pine stand near Exhibition of National Economic Achievements fence, V.V.Makarov
288	<i>Delphinium</i> sp.	C	4	NP	1989. Weed in Flora Dept. Exhibits, N.V.Kostyleva
289	<i>Eranthis hyemalis</i> (L.) Salisb.	C	3	NP	
290	<i>Ficaria verna</i> Huds.	N*		PV	
291	<i>Isopyrum thalictroides</i> L.	C	2	PV	1986. Outside Useful Wild Plants Exhibit. Recently has escaped Flora of Europe Exhibit forming extensive thickets nearby
292	<i>Myosurus minimus</i> L.	N*		A	
293	<i>Ranunculus acris</i> L.	N*		NP	
294	<i>R. auricomus</i> L. s. l.	N*		NP	
295	<i>R. bulbosus</i> L.	W*	4	NP	
296	<i>R. cassubicus</i> L. s. l.	N*		NP	
297	<i>R. flammula</i> L.	N*		PV	
298	<i>R. illyricus</i> L.	C	3	PV	
299	<i>R. lanuginosus</i> L.	C	3	NP	Near Flora Dept. exhibits
300	<i>R. platanifolius</i> L.	C	3	NP	1986. Weed in Flora of Caucasus Exhibit, N.V.Kostyleva
301	<i>R. polyanthemos</i> L.	N*		NP	
302	<i>R. repens</i> L.	N*		PV	
303	<i>R. sceleratus</i> L.	N*		A	
304	<i>Thalictrum aquilegiifolium</i> L.	N*		NP	
305	<i>Th. lucidum</i> L.	N*		NP	
306	<i>Trollius europaeus</i> L.	N*		NP	
Berberidaceae					
307	<i>Berberis thunbergii</i> DC.	C	3	Sh	
308	<i>Epimedium</i> sp.	C	3	NP	
309	<i>Podophyllum hexandrum</i> Royle	C	3	NP	
Menispermaceae					
310	<i>Menispermum dauricum</i> DC.	C	3	NP	2013. Vegetatively spreading for more than 3 m away from mother-plant in Shade Garden, V.D.Bochkin
Papaveraceae					

311	<i>Chelidonium majus</i> L.	N*		NP	
312	<i>Hylomecon japonica</i> (Thunb.) Prantl	C	3	NP	2013. A few plants discovered near Shade Garden
313	<i>Papaver carmeli</i> Feinbrun	C	4	A	1985. Flora of Caucasus Exhibit, V.V.Makarov
314	<i>P. clavatum</i> Boiss. & Hausskn. ex Boiss.	C	4	A	1989. Lilac area near Collections Greenhouse, on mulch surrounding a lilac, V.D.Bochkin
315	<i>P. paucifoliatum</i> (Trautv.) Fedde	C	3	NP	1989. Weed in Native Flora Exhibit, N.V.Kostyleva
316	<i>P. rhoeas</i> L.	C	3	A	1987. Northwestern corner of Garden, at underground line construction site, V.V.Makarov
317	<i>P. somniferum</i> L.	W	3	A	1960. Lawn near tuber storage, V.V.Makarov
Fumariaceae					
318	<i>Corydalis bracteata</i> (Steph. ex DC.) Pers.	C	2	NP	Capable of self-seeding
319	<i>C. capnoides</i> (L.) Pers.	C	3	A	1983, 1989. Native Flora Dept.
320	<i>C. caucasica</i> DC.	C	3	NP	Capable of self-seeding; escaping plants mostly white-flowered
321	<i>C. marschalliana</i> Pers.	C	3	NP	Naturalized population has persisted for many years (inflorescences not only yellow, but also pink and lilac)
322	<i>C. nobilis</i> (L.) Pers.	C	3	NP	Self-seeding abundantly
323	<i>C. ochotensis</i> Turcz.	C	3	A	1981, 1985. Rubbish-strewn pine stand near Exhibition of National Economic Achievements fence. 1987. Flora of Caucasus Exhibit
324	<i>C. solida</i> (L.) Clairv.	N*		NP	
325	<i>Fumaria officinalis</i> L.	N		A	
Cruciferae					
326	<i>Alliaria petiolata</i> (Bieb.) Cavara & Grande	N		BI	
327	<i>Arabidopsis thaliana</i> (L.) Heynh.	N		A	
328	<i>Arabis caucasica</i> Willd.	C	4	PV	1990. Lawn on slope near tuber storage, V.D.Bochkin. Capable of self-seeding
329	<i>A. glabra</i> (L.) Bernh.	N*		A	
330	<i>A. procurrens</i> Waldst. & Kit.	C	4	NP	
331	<i>Barbarea arcuata</i> (Opiz ex J. & C. Presl) Rchb.	N*		A	
332	<i>Berteroa incana</i> (L.) DC.	N*		NP	
333	<i>Brassica campestris</i> L.	N*		A	

334	<i>Bunias orientalis</i> L.	N*		NP	
335	<i>Capsella bursa-pastoris</i> (L.) Medik.	N*		A	
336	<i>Cardamine amara</i> L.	N*		PV	
337	<i>C. hirsuta</i> L.	C	4	A	
338	<i>C. impatiens</i> L.	N*		A	
339	<i>C. leucantha</i> (Tausch) O.E.Schulz	C	3	NP	A few scattered naturalized individuals near Shade Garden under basswood canopy
340	<i>C. pratensis</i> L. s.l.	N*		NP	
341	<i>Chorispora tenella</i> (Pall.) DC.	W	4	A	1973. On peat pile, A.Manin
342	<i>Dentaria bulbifera</i> L.	C	3	PV	
343	<i>D. glandulosa</i> Waldst. et Kit.	C	2	PV	Spreading across shaded wood lots, forming clumps sized a few sq. m each
344	<i>D. quinquefolia</i> Bieb.	C	2	PV	Actively spreading across Dendrarium and Oak Grove
345	<i>Descurainia sophia</i> (L.) Webb ex Prantl	N*		A	
346	<i>Draba nemorosa</i> L.	N		A	
347	<i>Erophila verna</i> (L.) DC.	N		A	
348	<i>Erysimum cheiranthoides</i> L.	N*		A	
349	<i>E. cuspidatum</i> (Bieb.) DC.	C	4	NP	1984. Flora of Caucasus Exhibit, V.V.Makarov
350	<i>E. hieracifolium</i> L.	N		A	
351	<i>Hesperis matronalis</i> L.	C	3	NP	1987. Flora of Caucasus Exhibit, V.V.Makarov
352	<i>H. sibirica</i> L.	C	3	NP	1992. Flora Dept. Exhibits, N.V.Kostyleva
353	<i>H. transcaucasica</i> Tzvelev	C	4	NP	1987. Near Flora of Caucasus Exhibit, V.V.Makarov
354	<i>Iberis amara</i> L.	C	4	A	
355	<i>Isatis tinctoria</i> L.	C	4	NP	1986. Former Flora of Caucasus lot, under an oak, V.D.Bochkin
356	<i>Lepidium densiflorum</i> Schrad.	W	3	A	1961. Quarry behind Flora of Central Asia Exhibit, A.A.Nekrasova
357	<i>L. latifolium</i> L.	W*	3	NP	
358	<i>L. perfoliatum</i> L.	C	4	A	1949. Weed in Flora Dept. Lots, M.Evtyukhova
359	<i>L. ruderale</i> L.	N*		A	
360	<i>L. sativum</i> L.	C	4	A	1994. Near Collections Greenhouse, V.Bochkin
361	<i>Lobularia maritima</i> (L.) Desv.	C	4	A	1961. Pine stand, G.P.Rysina
362	<i>Lunaria rediviva</i> L.	C	2	NP	Actively spreading across Dendrarium

					and Oak Grove, occasionally forming extensive clumps
363	<i>Malcolmia africana</i> (L.) R.Br.	C	4	A	1961. Adventive in pine stand, G.P.Rysina
364	<i>Matthiola bicornis</i> (Sm.) DC.	C	4	A	1961. Roadside weed
365	<i>Pachyphragma macrophyllum</i> (Hoffm.) N.Busch	C	3	PV	Naturalized near Shade Garden and in gully near Flora of Caucasus Exhibit
366	<i>Raphanus raphanistrum</i> L.	N*		A	
367	<i>R. sativus</i> L.	N*		A	
368	<i>Rorippa amphibia</i> (L.) Besser	N*		PV	
369	<i>R. anceps</i> (Wahlenb.) Rchb.	N*		PV	
370	<i>R. armoracioides</i> (Tausch) Fuss	N		PV	
371	<i>R. palustris</i> (L.) Besser	N*		A	
372	<i>R. sylvestris</i> (L.) Besser	N		PV	
373	<i>Sinapis arvensis</i> L.	N*		A	
374	<i>Sisymbrium loeselii</i> L.	N*		A	
375	<i>S. officinale</i> (L.) Scop.	N*		A	
376	<i>Thlaspi arvense</i> L.	N*		A	
Crassulaceae					
377	<i>Sedum acre</i> L.	N*		PV	
378	<i>S. aizoon</i> L.	C	3	NP	1981. Rubbish-strewn pine stand near Exhibition of National Economic Achievements fence, V.V.Makarov. Abundantly self-seeding and often occurs outside exhibits
379	<i>S. erythrostictum</i> Miq.	C	4	NP	1987. Meadow between Lab Building and fence (species had not been grown there), V.V.Makarov
380	<i>S. hispanicum</i> L.	C	4	A	1981. Weed in Central Asia Exhibit, V.V.Makarov. 1985. Thymus collection, M.S.Ignatov
381	<i>S. hybridum</i> L.	C	3	PV	1981. Rubbish-strewn pine stand near Exhibition of National Economic Achievements fence in eastern part of Garden, V.V.Makarov
382	<i>S. pallidum</i> M.Bieb.	C	3	NP	Self-seeding in autumn, forming green carpet by wintertime
383	<i>S. stoloniferum</i> S.G.Gmel.	C	2	PV	Encountered outside exhibits since 1987. Shade-tolerant and grows well under forest canopy
384	<i>S. telephium</i> L.	N*		NP	
Saxifragaceae					

385	<i>Astilbe chinensis</i> (Maxim.) Franch. & Sav.	C	3	NP	
386	<i>Chrysosplenium alternifolium</i> L.	N*		NP	
387	<i>Tellima grandiflora</i> (Pursh) Douglas ex Lindl.	C	3	NP	Feral plants discovered near Shade Garden
Grossulariaceae					
388	<i>Grossularia reclinata</i> (L.) Mill.	C	3	Sh	1976. Mixed pine stand along road starting at former bulb lot, V.V.Makarov
389	<i>Ribes nigrum</i> L.	N*		Sh	
390	<i>R. rubrum</i> L.	C*	3	Sh	1981. Rubbish-strewn pine stand near Exhibition of National Economic Achievements fence in eastern part of Garden, V.V.Makarov
391	<i>R. spicatum</i> E.Robson	N*		Sh	
Rosaceae					
392	<i>Agrimonia eupatoria</i> L.	N*		NP	
393	<i>Alchemilla acutiloba</i> Opiz	N*		NP	
394	<i>A. baltica</i> Sam. ex Juz.	N*		NP	
395	<i>A. cymatophylla</i> Juz.	N*		NP	
396	<i>A. gibberulosa</i> H.Lindb.	N*		NP	
397	<i>A. glabricaulis</i> H.Lindb.	N*		NP	
398	<i>A. glaucescens</i> Wallr.	N*		NP	
399	<i>A. hebescens</i> Juz.	N*		NP	
400	<i>A. heptagona</i> Juz.	N*		NP	
401	<i>A. hirsuticaulis</i> H.Lindb.	N*		NP	
402	<i>A. micans</i> Buser	N*		NP	
403	<i>A. mollis</i> (Buser) Rothm.	C	4	NP	
404	<i>A. monticola</i> Opiz	N*		NP	
405	<i>A. propinqua</i> H.Lindb. ex Alexandrov & Nekr.	N*		NP	
406	<i>A. sarmatica</i> Juz.	N*		NP	
407	<i>A. semilunaris</i> Alech.	N*		NP	
408	<i>A. subcrenata</i> Buser	N*		NP	
409	<i>Amelanchier spicata</i> (Lam.) K.Koch	C*	3	Sh	
410	<i>Aruncus dioicus</i> (Walter) Fernald	C	3	NP	Naturalized plants have been encountered outside Flora of Europe Exhibit, outside Flora of Caucasus Exhibit, and at Shade Garden margins
411	<i>Chaenomeles japonica</i> (Thunb.) Lindl. ex Spach	C	3	Sh	2013. Naturalized clump consisting of a few individuals found in roadside lawn along Main Alley in Dendrarium
412	<i>Comarum palustre</i> L.	N*		Sh	

413	<i>Cotoneaster acutifolius</i> Turcz.	C	3	Sh	1981. Birch woods along road from Lab Building to Greehnhouse, V.V.Makarov
414	<i>Crataegus monogyna</i> Jacq.	C	3	T	1987. 5-year old saplings were discovered in the northeastern corner of Garden by V.V.Makarov
415	<i>C. nigra</i> Waldst. & Kit.	C	4	T	1984. Near Collections Greenhouse, V.V.Makarov
416	<i>C. pentagyna</i> Waldst. & Kit.	C	4	T	1984. Along Garden fence, V.V.Makarov and M.S.Ignatov
417	<i>C. pinnatifida</i> Bunge	C	4	T	1984. Along Garden fence, V.V.Makarov
418	<i>C. sanguinea</i> Pall.	C*	4	T	
419	<i>C. submollis</i> Sarg.	C	3	T	1982. Along Garden fence, V.V.Makarov
420	<i>Duchesnea indica</i> (Andr.) Teschem.	C*	4	PV	1945. Alien weed in Oak Grove, V.Yevtyukova. Was never found later on
421	<i>Filipendula camtschatica</i> (Pall.) Maxim.	C	3	PV	Some few found naturalized near Flora of Europe Exhibit and near Shade Garden
422	<i>F. ulmaria</i> (L.) Maxim.	N*		PV	
423	<i>Fragaria × ananassa</i> (Weston) Duchesne ex Rozier	C	3	PV	
424	<i>F. moschata</i> (Duchesne) Weston	N*		NP	
425	<i>F. vesca</i> L.	N*		PV	
426	<i>F. viridis</i> Duchesne ex Weston	C	3	NP	1950. In Flora Dept. lot, Shilov
427	<i>Geum × intermedium</i> Ehrh.	N*		NP	
428	<i>G. macrophyllum</i> Willd.	W	1	NP	First finds 1981-1986. Abundant across the entire Garden territory; hybridizes with native <i>G. urbanum</i>
429	<i>G. rivale</i> L.	N*		NP	
430	<i>G. urbanum</i> L.	N*		NP	
431	<i>Malus baccata</i> (L.) Borkh.	C	3	T	2000. Volunteer plant, A.K.Skvortsov
432	<i>M. domestica</i> Borkh.	C*	3	T	
433	<i>M. sylvestris</i> (L.) Mill.	N*		T	
434	<i>Padus avium</i> Mill.	N*		Sh	
435	<i>Potentilla anserina</i> L.	N*		PV	
436	<i>P. argentea</i> L.	N*		NP	
437	<i>P. centigrana</i> Maxim.	C	3	PV	
438	<i>P. erecta</i> (L.) Raeusch.	N*		NP	
439	<i>P. goldbachii</i> Rupr.	N*		NP	
440	<i>P. intermedia</i> L.	N*		NP	
441	<i>P. recta</i> L.	C	3	NP	1982. Lawn in front of Collections Greenhouse, V.V.Makarov and M.S.Ignatov. Self-seeding and capable of escaping

442	<i>Prunus avium</i> (L.) L.	W	3	T	Mature tall (up to 15 m) trees along alley in preserved Oak Grove
443	<i>P. cerasus</i> L.	C	3	T	1981. Birch woods between Lab Building and greenhouse, V.V.Makarov
444	<i>P. domestica</i> L.	C*	3	T	
445	<i>Pyrus communis</i> L.	C*	3	T	
446	<i>Rosa cinnamomea</i> L.	N*		Sh	
447	<i>Rubus caesius</i> L.	N		Sh	
448	<i>R. caucasicus</i> Focke	C	3	Sh	Escapes en masse from the Flora of Caucasus Exhibit
449	<i>R. idaeus</i> L.	N*		Sh	
450	<i>R. saxatilis</i> L.	N*		PV	
451	<i>Sorbus aucuparia</i> L.	N*		T	
Leguminosae					
452	<i>Anthyllis vulneraria</i> L.	N		BI	
453	<i>Astragalus cicer</i> L.	N		PV	
454	<i>A. falcatus</i> Lam.	C	3	NP	1985. Weed in Native Flora exhibits, N.V.Kostyleva
455	<i>Caragana arborescens</i> Lam.	C	3	Sh	Originally listed by Yevtyukova as «planted», but already in 1946 was collected in the wild, along forest road by F.Leontyev
456	<i>Galega orientalis</i> Lam.	C	2	PV	Escapes en masse from the Flora of Caucasus Exhibit
457	<i>Lathyrus niger</i> (L.) Bernh.	C	4	NP	2011. Flora Dept. nursery, N.V.Kostyleva
458	<i>L. pisiformis</i> L.	C	3	NP	1984. Weed in Flora Dept. trial plots, in honeysuckles, V.V.Makarov
459	<i>L. pratensis</i> L.	N*		NP	
460	<i>L. sylvestris</i> L.	N*		NP	
461	<i>L. vernus</i> (L.) Bernh.	N*		NP	
462	<i>Lotus corniculatus</i> L.	N*		NP	
463	<i>Medicago falcata</i> L.	N*		NP	
464	<i>M. lupulina</i> L.	N*		A	
465	<i>Melilotus albus</i> (L.) Medik.	N*		BI	
466	<i>M. officinalis</i> (L.) Pall.	N*		BI	
467	<i>Robinia pseudoacacia</i> L.	C	3	T	1984. Under larches near Lab Building, V.V.Makarov. For years authors have been watching current-year seedlings in asphalt cracks along walls of Building 4
468	<i>Trifolium ambiguum</i> M.Bieb.	C	4	BI	1987. Weed in Flora of Caucasus exhibits. Has not been relocated
469	<i>T. arvense</i> L.	N*		A	

470	<i>T. aureum</i> Pollich	N*		A	
471	<i>T. hybridum</i> L.	N*		NP	
472	<i>T. medium</i> L.	N*		PV	
473	<i>T. montanum</i> L.	N*		NP	
474	<i>T. pratense</i> L.	N*		NP	
475	<i>T. repens</i> L.	N*		PV	
476	<i>T. spadiceum</i> L.	N*		A	
477	<i>Trigonella caerulea</i> (L.) Ser.	C	4	A	1961, 1964. With other weeds in disturbed habitats
478	<i>Vicia cracca</i> L.	N*		NP	
479	<i>V. dumetorum</i> L.	C	3	NP	Persistent clones near Native Plant Exhibit
480	<i>V. picta</i> Fisch. & C.A.Mey.	C	3	NP	1985. Flora of Caucasus Exhibit, V.D.Bochkin
481	<i>V. pisiformis</i> L.	C	3	NP	1983, 1985, 1992. Native Plant Exhibit
482	<i>V. sepium</i> L.	N*		NP	
483	<i>V. sylvatica</i> L.	N*		NP	
484	<i>V. tenuifolia</i> Roth	C	4	NP	1985. Weed in trial plots of honeysuckle, V.V.Makarov

Geraniaceae

485	<i>Erodium cicutarium</i> L`Her.	N*		A	
486	<i>Geranium gracile</i> Ledeb. ex Nordm.	C	3	NP	Spreading from Flora of Caucasus area along paths and across abutting forest territories
487	<i>G. palustre</i> L.	N*		NP	
488	<i>G. phaeum</i> L.	C	2	NP	Has been spreading at margins of Dendrarium and Oak Grove
489	<i>G. pratense</i> L.	N*		NP	
490	<i>G.pusillum</i> L.	N		A	
491	<i>G. psilostemon</i> Ledeb.	C	3	NP	2012. Found naturalized near Native Flora Exhibit
492	<i>G. pyrenaicum</i> Burm.f.	C	3	BI	In lawn near Flora of Caucasus Exhibit and near the new conservatory
493	<i>G.robertianum</i> L.	N		BI	
494	<i>G. rotundifolium</i> L.	C	4	BI	1964. Roadside in disturbed pine stand, occasional, V.V.Makarov
495	<i>G.sibiricum</i> L.	N		NP	
496	<i>G. sylvaticum</i> L.	N*		NP	

Oxalidaceae

497	<i>Oxalis acetosella</i> L.	N*		PV	
498	<i>O. corniculata</i> L.	C	3	A	Occasional weed in flower beds
499	<i>O. stricta</i> L.	W	2	A	Common and spreading in flower beds,

					areas with mineralized soil, sometimes also in lawns
500	<i>O. tetraphylla</i> Cav.	C	4	NP	
Linaceae					
501	<i>Linum catharticum</i> L.	N*		A	
502	<i>L. usitatissimum</i> L.	C	4	A	1960. Weed in lawn near tuber storage, V.V.Makarov
Polygalaceae					
503	<i>Polygala amarella</i> Crantz	N*		NP	
504	<i>P. comosa</i> Schkuhr	N*		NP	
505	<i>P. vulgaris</i> L.	N*		NP	
Euphorbiaceae					
506	<i>Euphorbia cyparissias</i> L.	C	3	NP	Naturalized in management area
507	<i>E. virgata</i> Waldst. et Kit.	N*		PV	
508	<i>E.lingulata</i> Heuff.	C	4	A	1987. Juniper plantings near Lab Building, V.V.Makarov
509	<i>E. peplus</i> L.	W	3	A	Lawn weed
510	<i>E. platyphyllos</i> L.	C	4	A	
511	<i>Mercurialis perennis</i> L.	N*		PV	
Callitrichaceae					
512	<i>Callitrichie cophocarpa</i> Sendtn. Ex Hegelm.	N		A	
513	<i>C. hermaphroditica</i> L.	N		A	
514	<i>C. palustris</i> L.	N*		A	
Buxaceae					
515	<i>Pachysandra terminalis</i> Siebold & Zucc.	C	3	PV	A few individuals near Shade Garden, perhaps introduced with mulch
Celastraceae					
516	<i>Euonymus europaeus</i> L.	C	2	Sh	1984. First finds of plants originating from seed; currently across entire Dendrarium
517	<i>E. maackii</i> Rupr.	C	3	Sh	1981. Along road from Lab Building to Collections Greenhouse, V.V.Makarov. 1986. Near Lab Building, V.V.Makarov
518	<i>E. nanus</i> M.Bieb.	C	3	Sh	Found naturalized not far from Shade Garden
519	<i>E. verrucosus</i> Scop.	N*		Sh	
Aceraceae					
520	<i>Acer campestre</i> L.	C	3	T	
521	<i>A. ginnala</i> Maxim.	C	3	T	
522	<i>A. negundo</i> L.	W*	1	T	
523	<i>A. platanoides</i> L.	N*		T	

524	<i>A. pseudoplatanus</i> L.	C	3	T	Numeral saplings and seedlings near Flora of Caucasus Exhibit
525	<i>A. tataricum</i> L.	C	3	T	
Hippocastanaceae					
526	<i>Aesculus hippocastanum</i> L.	C	3	T	Scattered saplings in Dendrarium
Balsaminaceae					
527	<i>Impatiens glandulifera</i> Royle	W	1	A	
528	<i>I. noli-tangere</i> L.	N*		A	
529	<i>I. parviflora</i> DC.	W*	1	A	
Rhamnaceae					
530	<i>Frangula alnus</i> Mill.	N*		Sh	
Vitaceae					
531	<i>Ampelopsis brevipedunculata</i> (Maxim.) Trautv.	C	3	PV	1984. Naturalized near Collections Greenhouse, V.V.Makarov
532	<i>Parthenocissus vitacea</i> (Knerr) Hitchc.	C	2	PV	1981. Disturbed pine stand in eastern part of Garden, V.V.Makarov. Currently occurs outside exhibits in Dendrarium, at small pond, near old buildings (covers at least 10 × 10 m area)
Tiliaceae					
533	<i>Tilia cordata</i> Mill.	N*		T	
534	<i>T. platyphyllos</i> Scop.	C	3	T	
Malvaceae					
535	<i>Alcea rosea</i> L.	C	3	NP	Volunteering near Lab Building
536	<i>Hibiscus trionum</i> L.	C	4	A	1961, 1963, 1974, 1981. Solitary plants at waste places and in pine stand
537	<i>Lavatera thuringiaca</i> L.	C	3	NP	1985. Edge of plantings along Likhoborka R., amidst Flora Dept. Exhibits, Makarov, Ignatov
538	<i>Malva ambigua</i> Guss.	C	4	BI	1982. Weed in Flora of Caucasus Exhibit, N.V.Kostyleva
539	<i>M. mauritiana</i> L.	C	4	A	1981. Disturbed pine stand in eastern part of Garden, V.V.Makarov
540	<i>M. pusilla</i> Sm.	N		A	
541	<i>M. verticillata</i> L.	C	4	A	1964. On soil piles, abundant, V.V.Makarov
Guttiferae					
542	<i>Hypericum gebleri</i> Ledeb.	C	4	NP	
543	<i>H. maculatum</i> L.	N*		NP	
544	<i>H. perforatum</i> L.	N*		NP	
Violaceae					
545	<i>Viola arvensis</i> Murray	N		A	

546	<i>V. canina</i> L.	N*		NP	
547	<i>V. collina</i> Besser	N*		NP	
548	<i>V. epipsila</i> Ledeb.	N*		PV	
549	<i>V. hirta</i> L.	N*		NP	
550	<i>V. mirabilis</i> L.	N*		NP	
551	<i>V. montana</i> L.	C	4	NP	1960. Birch stand border, G.P.Rysina
552	<i>V. odorata</i> L.	C	2	PV	1977. In Oak Grove, adjacent to Shade Plants Collection, V.V.Makarov. Currently naturalized at Dendrarium margins
553	<i>V. palustris</i> L.	N		PV	
554	<i>V. riviniana</i> Rchb.	N		NP	
555	<i>V. rupestris</i> F.W.Schmidt	N*		NP	
556	<i>V. tricolor</i> L.	N*		A	
Thymelaeaceae					
557	<i>Daphne mezereum</i> L.	N*		Sh	
Elaeagnaceae					
558	<i>Hippophae rhamnoides</i> L.	C	3	T	
Lythraceae					
559	<i>Lythrum salicaria</i> L.	N*		PV	
560	<i>Peplis portula</i> L.	N*		A	
Onagraceae					
561	<i>Chamaenerion angustifolium</i> (L.) Scop.	N*		PV	
562	<i>Circaeа lutetiana</i> L.	C	2	PV	Escaped from Shade Garden and produced extensive patches at preserved Oak Grove openings and in Dendrarium
563	<i>Epilobium adenocaulon</i> Hausskn.	W	2	BI	
564	<i>E. hirsutum</i> L.	N*		NP	
565	<i>E. montanum</i> L.	N*		NP	
566	<i>E. palustre</i> L.	N*		PV	
567	<i>E. parviflorum</i> (Schreb.) Schreb.	N*		NP	
568	<i>E. pseudorubescens</i> A.K.Skvortsov	W	2	BI	
569	<i>E. roseum</i> (Schreb.) Schreb.	N*		NP	
570	<i>E. smyrnaeum</i> Boiss.	N*		NP	
571	<i>Oenothera biennis</i> L.	C	3	BI	1961. Bank of Likhoborka R., G.P.Rysina
Haloragaceae					
572	<i>Myriophyllum spicatum</i> L.	N		PV	
573	<i>M. verticillatum</i> L.	N		PV	
Araliaceae					
574	<i>Aralia elata</i> (Miq.) Seem.	C	3	Sh	Plants have been found near Shade

					Garden, under dense linden canopy
Umbelliferae					
575	<i>Aegopodium podagraria</i> L.	N*		PV	
576	<i>Angelica miqueliana</i> Maxim.	C	4	BI	1981. Solitary large plant in disturbed pine stand in eastern part of Garden, V.V.Makarov
577	<i>A. sylvestris</i> L.	N*		BI	
578	<i>Anethum graveolens</i> L.	C	4	A	1985. Weed at Flora Dept. Nursery, V.V.Makarov, M.S.Ignatov
579	<i>Anthriscus sylvestris</i> (L.) Hoffm.	N*		NP	
580	<i>Astrantia major</i> L.	C	3	NP	1985. As escapee from cultivation, V.D.Bochkin. Now fully naturalized at Oak Grove and Dendrarium margins
581	<i>Bupleurum longifolium</i> L.	C	4	NP	1988. Weed in Flora Dept. exhibits, N.V.Kostyleva
582	<i>Carum carvi</i> L.	N*		BI	
583	<i>Chaerophyllum aromaticum</i> L.	N*		PV	
584	<i>Ch. aureum</i> L.	C	2	PV	1982. As escapee from cultivation. Now fully naturalized around Native Plants Exhibit
585	<i>Cicuta virosa</i> L.	N*		NP	
586	<i>Conium maculatum</i> L.	N		BI	
587	<i>Coriandrum sativum</i> L.	C	4	A	1964. Abundant, weedy on soil piles in western part of Garden, V.V.Makarov
588	<i>Heracleum asperum</i> (Hoffm.) Bieb.	C	4	NP	1985. Escapee from cultivation at Flora of Caucasus Exhibit, V.V.Makarov
589	<i>H. lehmannianum</i> Bunge	C	4	NP	1981. Weed at Plants of Central Asia Exhibit, V.V.Makarov
590	<i>H. mantegazzianum</i> Sommier & Levier	W	3	NP	Solitary individuals along Garden fence
591	<i>H. sibiricum</i> L.	N*		NP	
592	<i>H. sosnowskyi</i> Manden.	W	1	NP	Across the entire territory, not infrequently in large clumps
593	<i>H. sphondylium</i> L.	C	4	NP	1986. Garden of Continuous Flowering, at margin, near Exhibition of Economic Achievements fence, V.V.Makarov
594	<i>Oenanthe aquatica</i> (L.) Poir.	N*		A	
595	<i>Osmorhiza aristata</i> (Thunb.) Rydb.	C	3	BI	
596	<i>Myrrhis odorata</i> Scop.	C	2	NP	Naturalized micro-populations found near Native Plants Exhibit
597	<i>Pastinaca sativa</i> L.	N*		BI	
598	<i>Pimpinella saxifraga</i> L.	N*		NP	

599	<i>Sanicula europaea</i> L.	N*		NP	
600	<i>Selinum carvifolia</i> (L.) L.	N*		BI	
601	<i>Torilis japonica</i> (Houtt.) DC.	N		A	
Cornaceae					
602	<i>Cornus alba</i> L.	C	2	Sh	Self-seeding, especially along paths, and also spreads vegetatively
Pyrolaceae					
603	<i>Pyrola rotundifolia</i> L.	N*		PV	
Ericaceae					
604	<i>Vaccinium myrtillus</i> L.	N*		Sh	
605	<i>V. vitis-idaea</i> L.	N*		Sh	
Primulaceae					
606	<i>Androsace filiformis</i> Retz.	N*		A	
607	<i>Hottonia palustris</i> L.	N		PV	
608	<i>Lysimachia nummularia</i> L.	N*		PV	
609	<i>L. punctata</i> L.	C	3	PV	Naturalized plants found in management area
610	<i>L. vulgaris</i> L.	N*		PV	
611	<i>Naumburgia thyrsiflora</i> (L.) Rchb.	N*		PV	
612	<i>Primula veris</i> L.	N*		NP	
613	<i>P. vulgaris</i> Huds.	C	2	NP	Naturalized populations of local descent have been formed
614	<i>Trientalis europaea</i> L.	N*		PV	
Oleaceae					
615	<i>Fraxinus pennsylvanica</i> Marshall	C	3	T	Occasional along Garden fence and in Dendrarium
616	<i>Ligustrum vulgare</i> L.	C	4	T	Scattered young plants have been reported
617	<i>Syringa josikaea</i> J.Jacq. ex. Rchb.	C	3	Sh	1981. Plants from seed not far from extensive old plantings near Garden fence, V.V.Makarov
Menyanthaceae					
618	<i>Menyanthes trifoliata</i> L.	N*		PV	
619	<i>Nymphoides peltata</i> (S.G.Gmel.) Kuntze	C	4	PV	1968. Fully naturalized from very old plantings, Yu.S.Dmitriyev
Apocynaceae					
620	<i>Vinca herbacea</i> Waldst. & Kit.	C	3	PV	Naturalized at the foot of former rockery
621	<i>V. minor</i> L.	C	2	Sh	1986. In woods surrounding plots of useful wild plants, naturalized from cultivation, few, V.V.Makarov. Occasionally have escaped since and formed stable perennial clones

Convolvulaceae					
622	<i>Calystegia inflata</i> G.Don	C	3	PV	1970. Weedy in nurseries and along fence, A.K.Skvortsov
623	<i>C. sepium</i> (L.) R.Br.	N		PV	
624	<i>Convolvulus arvensis</i> L.	N*		PV	
625	<i>Ipomoea purpurea</i> (L.) Roth	C	4	A	
Cuscutaceae					
626	<i>Cuscuta campestris</i> Yunck.	W	4	A	1948. On Korean chrysanthemums in Ornamental Plant Exhibit. Never found anymore after 1960 (Ignatov et al. 1990)
627	<i>C. europaea</i> L.	N*		A	
Boraginaceae					
628	<i>Anchusa officinalis</i> L.	C	3	BI	1984–1987. Collected a few times as weed in Flora of Caucasus Exhibit and trial plots
629	<i>Brachybotrys paridiformis</i> Maxim. ex Oliv.	C	4	PV	2012. Naturalized plants found near Shade Garden
630	<i>Brunnera macrophylla</i> I.M.Johnst.	C	3	PV	A few plants found near European Flora Exhibit
631	<i>B. sibirica</i> Steven	C	2	PV	1986. Escaped to woods near Ornamental Plant Dept., V.D.Bochkin. Now naturalized in waste places
632	<i>Echium amoenum</i> Fisch. & C.A.Mey.	C	4	BI	
633	<i>E. biebersteinii</i> (Lacaita) Dorbrocz.	C	4	BI	
634	<i>Lappula squarrosa</i> (Retz.) Dumort.	N*		A	
635	<i>Myosotis arvensis</i> (L.) Hill	N*		A	
636	<i>M. caespitosa</i> K.F.Schultz	N*		A	
637	<i>M. discolor</i> Pers.	C	4	A	1990. Weed in Flora Dept. Nursery, N.A.Shevyreva
638	<i>M. scorpioides</i> L.	N*		A	
639	<i>M. sparsiflora</i> J.C.Mikan ex Pohl	N*		A	
640	<i>M. sylvatica</i> Ehrh. ex Hoffm.	C	3	PV	1976. Near bulbiferous plant lot, V.Makarov and T.Sofeikova
641	<i>Pulmonaria obscura</i> Dumort.	N*		NP	
642	<i>Symphytum asperum</i> Lepech.	C	2	PV	1962. Weed near Flora Dept. Exhibits, A.A.Nekrasov. Now actively expanding at Flora of Caucasus Exhibit; scattered groups at Oak Grove margins
643	<i>S. caucasicum</i> M.Bieb.	C	2	PV	Occasionally forms extensive clumps at openings
644	<i>S. cordatum</i> Willd.	C	3	PV	Escaping plants found on shady forest

					lots near Flora of Europe Exhibit, in Garden of Continuous Flowering, and, more abundantly, around Shade Garden
645	<i>S. × hidcotense</i> P.D.Sell	C	3	PV	
646	<i>S. grandiflorum</i> DC.	C	3	PV	2013. At forest margin along road behind New Collections Greenhouse, V.D.Bochkin
647	<i>S. officinale</i> L.	N*		NP	
648	<i>S. tauricum</i> Willd.	C	3	NP	1986. Flora of Caucasus old exhibit, V.D.Bochkin
649	<i>S. tuberosum</i> L.	C	3	NP	1992. First naturalized populations found. Now escaped near Shade Garden and in Dendrarium
650	<i>S. × uplandicum</i> Nyman	C	3	PV	Relatively rare
Labiatae					
651	<i>Agastache rugosa</i> (Fisch. & C.A.Mey.) Kuntze	C	4	NP	Weed of waste ground in Likhoborka R. floodplain, near lots of Cultivated Plants Dept.
652	<i>Ajuga reptans</i> L.	N*		PV	
653	<i>Ballota nigra</i> L.	N		NP	
654	<i>Betonica officinalis</i> L.	N*		NP	
655	<i>Calamintha grandiflora</i> (L.) Moench	C	4	NP	1983. Weed in Flora Dept. Exhibit, N.V.Kostyleva
656	<i>Clinopodium vulgare</i> L.	N*		NP	
657	<i>Elsholtzia ciliata</i> (Thunb.) Hyl.	C	4	A	1985. Rubbish-strewn pine stand near Exhibition of National Economic Achievements fence, M.Ignatov, V.Makarov
658	<i>Galeobdolon luteum</i> Huds.	N*		PV	
659	<i>Galeopsis bifida</i> Boenn.	N*		A	
660	<i>G. ladanum</i> L.	N		A	
661	<i>G. speciosa</i> Mill.	N*		A	
662	<i>G. tetrahit</i> L.	N*		A	
663	<i>Glechoma hederacea</i> L.	N*		PV	
664	<i>Lamium album</i> L.	N*		PV	
665	<i>L. maculatum</i> (L.) L.	N*		PV	
666	<i>L. purpureum</i> L.	N*		A	
667	<i>Leonurus glaucescens</i> Bunge	W	4	BI	1961. Weed in pine stand, G.P.Rysina
668	<i>L. villosus</i> Desf.	N*		PV	
669	<i>Lycopus europaeus</i> L.	N*		PV	
670	<i>Mentha arvensis</i> L.	N*		PV	
671	<i>M. × carinthiaca</i> Host. (<i>M. arvensis</i>)	C	3	PV	1984. Weed at Flora of Caucasus Exhibit,

	L. × <i>M.suaveolens</i> Ehrh.)				source unknown, V.V.Makarov
672	<i>M. × gentilis</i> L. (<i>M. arvensis</i> L. × <i>M.spicata</i> L.)	C	4	PV	1974. Pond shore at Flora of Europe Exhibit, fully naturalized plantings of 1950's, V.V.Makarov
673	<i>M. longifolia</i> (L.) L.	C	3	PV	1981. Rubbish-strewn pine stand in eastern part of Garden, abundant, adventive, V.V.Makarov
674	<i>M. spicata</i> L.	C	4	PV	1972,1984. Along ditch near Flora of Caucasus Exhibit, V.V.Makarov
675	<i>Nepeta cataria</i> L.	C	3	NP	Occasionally escapes
676	<i>Origanum vulgare</i> L.	N*		PV	
677	<i>Phlomis tuberosa</i> L.	C	3	NP	
678	<i>Prunella vulgaris</i> L.	N*		NP	
679	<i>Salvia glutinosa</i> L.	C	2	NP	
680	<i>S. verticillata</i> L.	W*	4	NP	
681	<i>Satureja laxiflora</i> K.Koch	C	4	A	1985. Weed at Useful Wild Plants Exhibit, V.V.Makarov
682	<i>Scutellaria altissima</i> L.	C	3	PV	Escapes under tree canopy and in half shade; especially abundant near Flora of Caucasus Exhibit
683	<i>S. galericulata</i> L.	N*		PV	
684	<i>Stachys palustris</i> L.	N*		PV	
685	<i>S. sylvatica</i> L.	N*		PV	
686	<i>Teucrium botrys</i> L.	C	4	NP	
687	<i>Thymus pulegioides</i> L.	C	3	PV	1986. Escaped to lawn adjacent to Useful Wild Plants Exhibit, V.V.Makarov
Solanaceae					
688	<i>Physalis alkekengi</i> L.	C	3	PV	Rarely at waste places
689	<i>Petunia × hybrida</i> (Hook.f.) Vilm.	C	4	A	Found between steps on staircase of Lab Building
690	<i>Scopolia carniolica</i> Jacq.	C	2	NP	Feral micro-populations near Shade Garden, Flora of Europe, and Flora of Caucasus exhibits
691	<i>Solanum dulcamara</i> L.	N*		Sh	
692	<i>S. lycopersicum</i> L.	C	3	A	
693	<i>S. nigrum</i> L.	N*		A	
Scrophulariaceae					
694	<i>Antirrhinum majus</i> L.	C	4	A	
695	<i>Euphrasia stricta</i> J.P.Wolff ex J.F.Lehm.	N*		A	
696	<i>E.gracilis</i> Phil.	N*		A	
697	<i>Linaria vulgaris</i> Mill.	N		PV	

698	<i>Melampyrum nemorosum</i> L.	N*		A	
699	<i>M. pratense</i> L.	N*		A	
700	<i>Rhinanthus angustifolius</i> C.C.Gmel.	N*		A	
701	<i>Rh. minor</i> L.	N		A	
702	<i>Scrophularia altaica</i> Murray	C	4	NP	1981. A few collections at disturbed wood lots near Useful Wild Plants Exhibit and in rubbish-strewn pine stand in eastern part of Garden
703	<i>S. nodosa</i> L.	N*		NP	
704	<i>S. umbrosa</i> Dumort.	C	4	NP	1974. Pond shore at Flora of Europe Exhibit, fully naturalized old plantings of 1950's, V.V.Makarov
705	<i>Verbascum blattaria</i> L.	C	4	BI	1987. Weed in Flora Dept. Exhibits, N.V.Kostyleva
706	<i>V. nigrum</i> L.	N		NP	
707	<i>V. phlomoides</i> L.	C	3	BI	1983. Weed in Flora Dept. exhibits, N.V.Kostyleva.
708	<i>Veronica acinifolia</i> L.	C	4	NP	1977. Weedy in nursery, A.K.Skvortsov
709	<i>V. anagallis-aquatica</i> L.	N*		PV	
710	<i>V. arvensis</i> L.	N		A	
711	<i>V. beccabunga</i> L.	N*		PV	
712	<i>V. chamaedrys</i> L. s. l.	N*		NP	
713	<i>V. filiformis</i> Sm.	W	1	PV	1981. Weedy on Useful Wild Plant plots, Ye.Ye.Gogina. Now occasionally prevailing in lawns, displacing even grasses
714	<i>V. intercedens</i> Bornm.	C	4	A	1991. Weedy in nursery, A.K.Skvortsov
715	<i>V. longifolia</i> L.	N*		NP	
716	<i>V. officinalis</i> L.	N*		PV	
717	<i>V. peregrina</i> L.	C	3	A	Weed occurring at bare-soil areas
718	<i>V. persica</i> Poir. ex Lam.	W	3	A	In beds, at areas with damaged vegetation cover, along curb stones, on trails
719	<i>V. scutellata</i> L.	N*		NP	
720	<i>V. serpyllifolia</i> L.	N*		NP	
721	<i>V. teucrium</i> L.	N*		NP	
722	<i>V. umbrosa</i> M.Bieb.	C	4	PV	1990. Weed in Flora Dept. exhibits, N.V.Kostyleva
Lentibulariaceae					
723	<i>Utricularia vulgaris</i> L.	N		PV	
Plantaginaceae					
724	<i>Plantago uliginosa</i> F.W.Schmidt	N*		NP	
725	<i>P. lanceolata</i> L.	N*		NP	

726	<i>P. major</i> L.	N*		NP	
727	<i>P. media</i> L.	N*		NP	
Rubiaceae					
728	<i>Galium aparine</i> L.	N*		A	
729	<i>G. boreale</i> L.	N*		PV	
730	<i>G. mollugo</i> L.	N*		NP	
731	<i>G. palustre</i> L.	N*		PV	
732	<i>G. rivale</i> (Sm.) Griseb.	N*		PV	
733	<i>G. spurium</i> L.	N		A	
734	<i>G. uliginosum</i> L.	N*		PV	
735	<i>G. verum</i> L.	N*		NP	
Caprifoliaceae					
736	<i>Lonicera nigra</i> L.	C	3	Sh	
737	<i>L. xylosteum</i> L.	N*		Sh	
738	<i>Sambucus ebulus</i> L.	C	4	PV	
739	<i>S. nigra</i> L.	C	3	Sh	1973. From that time on found in larch plantings near Lab Building
740	<i>S. racemosa</i> L.	C*	2	Sh	
741	<i>Symporicarpos albus</i> (L.) S.F.Blake	C	3	Sh	Occasional at Oak Grove margins
742	<i>Viburnum lantana</i> L.	C	3	Sh	Self-seeding, occurring outside exhibits
743	<i>V. opulus</i> L.	N*		Sh	
Adoxaceae					
744	<i>Adoxa moschatellina</i> L.	N*		PV	
Valerianaceae					
745	<i>Valeriana alliariifolia</i> Adams	C	3	NP	Grows abundantly, yet not actively spreading
746	<i>V. armena</i> P.A.Smirn.	C	4	NP	1984. Along ditch near Flora of Caucasus Exhibit; escapes from exhibits and becomes naturalized nearby, V.V.Makarov
747	<i>V. officinalis</i> L.	N*		NP	
748	<i>V. sambucifolia</i> J.C.Mikan f. ex Pohl	C	4	NP	
Dipsacaceae					
749	<i>Cephalaria gigantea</i> (Ledeb.) Bobrov	C	2	NP	Self-seeding, escaping from the Flora of Caucasus Exhibit
750	<i>Dipsacus pilosus</i> L.	C	3	BI	Has been weedy in the garden from 1990 on
751	<i>Knautia arvensis</i> (L.) Coult.	N*		NP	
752	<i>Succisa pratensis</i> Moench	N*		NP	
Cucurbitaceae					

753	<i>Bryonia alba</i> L.	C	3	PV	1981, 1987. In Thuja plantings near Lab Building (had been there for two previous years), V.V.Makarov
754	<i>Echinocystis lobata</i> (Michx.) Torr. & A.Gray	W	2	A	
755	<i>Schizopepon bryoniifolius</i> Maxim.	C	4	NP	Encountered multiple times from 1981 near Flora Dept. exhibits; recently has not been found
756	<i>Thladiantha dubia</i> Bunge	C	4	PV	Was growing spontaneously at Garden entrance, in Thuja plantings; recently has not been found
Campanulaceae					
757	<i>Campanula bononiensis</i> L.	C	3	NP	1983. Occasional across lawn near tuber storage, definitely spontaneous, V.V.Makarov
758	<i>C. cervicaria</i> L.	N*		BI	
759	<i>C. cordifolia</i> K.Koch	C	4	NP	
760	<i>C. glomerata</i> L.	N*		NP	
761	<i>C. lactiflora</i> M.Bieb.	C	3	NP	1983. Weed in Flora Dept. exhibits, N.V.Kostyleva
762	<i>C. latifolia</i> L.	N*		NP	
763	<i>C. patula</i> L.	N*		NP	
764	<i>C. persicifolia</i> L.	N*		NP	
765	<i>C. rapunculoides</i> L.	N*		PV	
766	<i>C. rapunculus</i> L.	C	4	BI	1996. Weed in Flora Dept. exhibits, N.V.Kostyleva
767	<i>C. rotundifolia</i> L.	N*		NP	
768	<i>C. sarmatica</i> Ker Gawl.	C	4	NP	1991. Weed in Flora Dept. exhibits, N.V.Kostyleva
769	<i>C. trachelium</i> L.	N*		NP	
770	<i>Phyteuma spicatum</i> L.	C	3	NP	2000. Weed in Flora Dept. nursery, N.V.Kostyleva
Compositae					
771	<i>Achillea cartilaginea</i> Ledeb. ex Rchb.	N*		PV	
772	<i>A. millefolium</i> L.	N*		NP	
773	<i>Adenocaulon adhaerescens</i> Maxim.	C	1	NP	En masse along trails across entire Garden. The only species known for sure to have escaped from the Garden, now found at a few locations in Moscow
774	<i>Antennaria dioica</i> (L.) Gaertn.	N*		PV	
775	<i>Anthemis rigescens</i> Willd.	C	4	A	1983. Weed in Flora Dept. exhibits, N.V.Kostyleva

776	<i>Arctium tomentosum</i> Mill.	N*		BI	
777	<i>Artemisia absinthium</i> L.	N*		NP	
778	<i>A. campestris</i> L.	N*		NP	
779	<i>A. vulgaris</i> L.	N*		PV	
780	<i>Bellis perennis</i> L.	C*	2	NP	
781	<i>Bidens cernua</i> L.	N*		A	
782	<i>B. frondosa</i> L.	W	1	A	1987. In northwestern corner of Garden, at underground line construction site, V.V.Makarov
783	<i>B. tripartita</i> L.	N*		A	
784	<i>Cacalia hastata</i> L.	C	3	NP	Self-seeding and escaping easily, though occurring close to mother-plants located at Far East Exhibit
785	<i>Carduus acanthoides</i> L.	N		BI	
786	<i>C. crispus</i> L.	N*		BI	
787	<i>Centaurea cyanus</i> L.	N		A	
788	<i>C. jacea</i> L.	N*		NP	
789	<i>C. phrygia</i> L.	N*		NP	
790	<i>C. scabiosa</i> L.	N*		NP	
791	<i>Cicerbita macrophylla</i> (Willd.) Wallr.	C	3	NP	2013. A stray colony in woods not far from Shade Garden, V.D.Bochkin and S.R.Mayorov
792	<i>Cichorium intybus</i> L.	N*		NP	
793	<i>Cirsium arvense</i> (L.) Scop.	N*		PV	
794	<i>C. heterophyllum</i> (L.) Hill	N*		NP	
795	<i>C. oleraceum</i> (L.) Scop.	N*		NP	
796	<i>C. setosum</i> (Willd.) Besser ex M.Bieb.	N*		PV	
797	<i>C. vulgare</i> (Savi) Ten.	N*		BI	
798	<i>Conyza canadensis</i> (L.) Cronquist	W*	1	A	
799	<i>Crepis paludosa</i> (L.) Moench	N*		NP	
800	<i>C. tectorum</i> L.	N*		A	
801	<i>Doronicum orientale</i> Hoffm.	C	3	PV	2013. Trial plot of Flora Dept., under walnuts, along road near fence, V.D.Bochkin
802	<i>Erigeron acris</i> L.	N*		NP	
803	<i>E. annuus</i> (L.) Pers.	W	1	A	
804	<i>Galinsoga quadriradiata</i> Ruiz & Pav.	W*	1	A	
805	<i>G. parviflora</i> Cav.	W*	2	A	
806	<i>Gnaphalium sylvaticum</i> L.	N*		NP	
807	<i>G. uliginosum</i> L.	N*		A	

808	<i>Hieracium prenanthoides</i> Vill. s.l.	C	4	NP	1985. Weed in Flora Dept. exhibits, N.V.Kostyleva
809	<i>H. sylvularum</i> Jord. ex Boreau	C	3	NP	Has been found in small amounts at wood margins
810	<i>H. umbellatum</i> L.	N*		PV	
811	<i>Inula britannica</i> L.	N*		PV	
812	<i>I. helenium</i> L.	C	3	NP	1981. Weed in Flora of Central Asia Exhibit, V.V.Makarov. Now has naturalized across entire garden, self-seeding
813	<i>Lactuca serriola</i> L.	N*		NP	
814	<i>Lapsana communis</i> L.	N*		NP	
815	<i>Leontodon autumnalis</i> L.	N*		NP	
816	<i>L. hispidus</i> L.	N*		NP	
817	<i>Leucanthemum vulgare</i> Lam.	N*		NP	
818	<i>Matricaria discoidea</i> DC.	W*	2	A	
819	<i>Mycelis muralis</i> (L.) Dumort.	N		A	
820	<i>Petasites albus</i> (L.) Gaertn.	C	3	PV	Escapes, spreading along gulley bottom
821	<i>P. giganteus</i> F.Schmidt ex Maxim.	C	3	PV	Spring of 2013. A few generative shoots found 100 m away from Shade Garden
822	<i>P. hybridus</i> (L.) Gaertn., B.Mey. & Scherb.	C	3	PV	Intensively expanding at moist places
823	<i>Picris hieracioides</i> L.	N*		NP	
824	<i>Pilosella aurantiaca</i> (L.) F.W.Schultz & Sch.Bip.	C	3	PV	1981. Weed at Flora of Central Asia Exhibit, V.V.Makarov
825	<i>P. ×flagellaris</i> (Willd.) Arv.-Touv. (= <i>P. caespitosa</i> (Dumort.) P.D.Sell & C.West × <i>P. officinarum</i> Vaill. ex F.W.Schultz & Sch.Bip.).	N		PV	
826	<i>P. ×glomerata</i> (Froel.) Fr.s.l. (= <i>Hieracium × ambiguum</i> Ehrh., = <i>Pilosella caespitosa</i> (Dumort.) P.D.Sell & C.West × <i>P. cymosa</i> F.W.Schultz & Sch.Bip.)	N		NP	
827	<i>P. lactucella</i> (Wallr.) P.D.Sell & C.West (= <i>Hieracium auricula</i> auct.)	N*		PV	
828	<i>P. officinarum</i> Vaill. ex F.W.Schultz & Sch.Bip. (= <i>Hieracium pilosella</i> L.)	N*		PV	
829	<i>P. onegensis</i> Norrl. (= <i>Hieracium pratense</i> Tausch s.l.)	N*		PV	
830	<i>P. ×paragoga</i> (Naeg. & Peter) Soják (= <i>Hieracium lactucella</i>	N		PV	

	P.D.Sell & C.West × <i>H.officinarum</i> Vaill. × <i>H. praealta</i> (Vill. ex Gochnat) F.W.Schultz & Sch.Bip.				
831	<i>P. praealta</i> (Vill. ex Gochnat) F.W.Schultz & Sch.Bip.	N*		PV	
832	<i>Rudbeckia hirta</i> L.	C	3	BI	
833	<i>R. nitida</i> Nutt.	C	4	PV	
834	<i>Senecio fluviatilis</i> Wallr.	N		PV	
835	<i>S. grandidentatus</i> Ledeb.	C	4	PV	1960. At pond shore, Nekrasov
836	<i>S. nemorensis</i> L. s.l.	C	3	PV	Found outside collection plantings, near fence at Flora of Europe Exhibit
837	<i>S. vulgaris</i> L.	N*		A	
838	<i>Silphium perfoliatum</i> L.	C	3	NP	From 1978 grows outside exhibit at waste places
839	<i>Solidago canadensis</i> L.	C	2	NP	1980. Had escaped long before 1980 in multiple places, V.V.Makarov. Now occasional across entire Garden, abundant in maintenance area, at place of former plantings
840	<i>S. gigantea</i> Aiton	W	1	PV	Copious in maintenance area, not infrequent on shores of water bodies and at moist places in Dendrarium and Oak Grove
841	<i>S. virgaurea</i> L.	N*		NP	
842	<i>Sonchus arvensis</i> L.	N*		PV	
843	<i>S. asper</i> (L.) Hill	N*		A	
844	<i>S. oleraceus</i> L.	N*		A	
845	<i>Symphyotrichum</i> × <i>salignum</i> (Willd.) G.L.Nesom	C	2	PV	Occurs across entire territory in open areas and half shade
846	<i>S. lanceolatum</i> (Willd.) G.L.Nesom	W	2	PV	
847	<i>Tanacetum balsamita</i> L.	C	4	PV	1982. Persisting from former cultivation plot on maintenance territory, N.V.Kosyleva
848	<i>T. macrophyllum</i> (Waldst. et Kit.) Sch.Bip.	C	4	NP	1993. Dendrarium, in Caragana collection, Yu.Ye.Belyayeva
849	<i>T. partheniifolium</i> (Willd.) Sch.Bip.	C	3	NP	1985. At Flora Dept. Exhibits, N.V.Kostyleva
850	<i>T. vulgare</i> L.	N*		PV	
851	<i>Taraxacum officinale</i> Wigg.	N*		NP	
852	<i>Telekia speciosa</i> (Schreb.) Baumg.	C	2	PV	At wood margins and along paths across entire Garden
853	<i>Tragopogon orientalis</i> L.	N*		BI	
854	<i>T. pratensis</i> L.	N		BI	

855	<i>Tripleurospermum inodorum</i> (L.) Sch.Bip.	N*		A	
856	<i>Tussilago farfara</i> L.	N*		PV	

Discussion

There are 10 planted species that are mentioned on the 1949 list: *Populus alba* L., *P. balsamifera* L., *P. nigra* L., *P. suaveolens* Fisch., *Spiraea chamaedryfolia* L., *S. salicifolia* L., *Caragana arborescens* Lam., *Fraxinus excelsior* L., *Acer negundo* L. and *Larix sibirica* Ledeb. Except for *Caragana arborescens* and *Acer negundo* which have become naturalized, these have not been included in the analysis. Taxonomic revision of the list has revealed changes in priority names for 77 species over the 65-year period. Four species have changed taxonomic rank, three of them becoming subspecies: *Agrostis stolonizans* Besser (=*Agrostis stolonifera* subsp. *stolonizans* (Besser ex Schult. & Schult. f.) Soó), *Atriplex hastifolia* Salisb. (=*Atriplex patula* subsp. *hastata* (L.) H.M.Hall & Clem.) and *Polygonum nodosum* Pers. (=*Persicaria lapathifolia* subsp. *nodosa* A.Löve). *Rhinanthus crista-galli* L. and *Rh. major* were included into polymorphic species *Rh. angustifolius* C.C.Gmel. Others (*Carex gracilis* Curt., *Luzula campestris* (L.) DC., and *Primula officinalis* (L.) Jacq.) are believed to have been listed by mistake: most probably *Carex nigra* was collected as *C. gracilis*, *Luzula multiflora* as *L. campestris*, and *Primula veris* as *P. officinalis* (there are respective herbarium collections in MBA dating back to that time). After exclusion of the named species, the total number of species on the initial list becomes 479 (belonging to 248 genera and 69 families).

Only 11 species were reported as escaped on the initial list: *Amelanchier spicata*, *Bellis perennis*, *Crataegus sanguinea*, *Dianthus barbatus*, *Malus domestica* Baumg., *Pyrus communis*, *Prunus domestica*, *Ribes rubrum*, *Sambucus racemosa*, *Duchesnea indica* and *Ranunculus bulbosus*. Of these, the first nine species had been found in places of dwellings, and the latter two, according to the list compiler, had been escapees from plantings made by Duke Sheremetev, either from his garden or greenhouses, which contained many ornamental plants. Nearly all of these plants have persisted on the Garden territory until now. The only exceptions are *Ranunculus bulbosus* and *Duchesnea indica*, which have not been relocated despite special searches.

In the initial overview by Evtyukhova, eight species were regarded as inadvertently introduced. Two of these, *Lepidium latifolium* and *Salvia verticillata*, are wild plants of the

chernozem belt spreading along railroads and disturbed habitats. Others (*Amaranthus albus*, *Galinsoga parviflora*, *G. quadriradiata*, *Matricaria discoidea*, *Conyza canadensis* and *Elodea canadensis*) were categorised as alien species actively naturalizing across the entire Moscow Region. Curiously, a number of alien species (*Impatiens parviflora*, *Lolium perenne*, *Juncus tenuis*, *Salix euxina*, *Dianthus barbatus*, *Ranunculus bulbosus*, *Acer negundo* and *Amaranthus retroflexus*) used to be regarded as legitimate members of the Moscow native flora and were assigned to Group 1. In our listing they are definitely considered alien. The authors have not been able to relocate *Amaranthus albus* and *Lepidium latifolium* in the Main Botanic Garden. *Elodea canadensis* has largely lost its ability to spread.

The contemporary listing enumerates 856 species from 406 genera and 94 families, which means that over the 65-year period the flora has been augmented by 377 species. Of these, 54 are natives, 283 are escapees from cultivation, and 40 are alien weeds (Fig. 1). The rate of new alien species appearance on the grounds has been, according to our calculations, 5–6 taxa per year. The portion of ergasiophytes (escapees from cultivation) is 33%, which is very close to the 32% obtained by Galera (2003) in the course of floristic studies in Polish botanic gardens.

We believe that the native plant list has grown due to long-term observations of the flora, while the initial list was based on only one or two years of obesrvations. The fact that during the 65 years no new natives were found among woody plants supports our opinion. Hence with respect to the native flora, the dynamics can be explained by the subjective nature of assessments. Additionally, the treatment of some species has changed: while listed in 1949 sensu lato, they are now understood in a more narrow sense.

Seventeen families are represented in the flora entirely by alien plants: Amaryllidaceae, Iridaceae, Juglandaceae, Amaranthaceae, Nyctaginaceae, Paeoniaceae, Menispermaceae, Berberidaceae, Buxaceae, Hippocastanaceae, Vitaceae, Elaeagnaceae, Araliaceae, Cornaceae, Oleaceae, Apocynaceae and Cucurbitaceae. All families of Polypodiopsida, Equisetopsida, Lycopodiopsida and Pinopsida are represented exclusively by native plants. Among angiosperms, 22 families are completely native: Sparganiaceae, Potamogetonaceae, Alismataceae, Butomaceae, Orchidaceae, Betulaceae, Ulmaceae, Aristolochiaceae, Nymphaeaceae, Ceratophyllaceae, Polygalaceae, Callitrichaceae, Rhamnaceae, Thymelaeaceae, Lythraceae, Haloragaceae, Pyrolaceae, Ericaceae, Lentibulariaceae, Plantaginaceae, Rubiaceae and Adoxaceae.

The ten leading families in the native fraction of the flora are Compositae (54 species), Gramineae (47), Rosaceae (35), Cruciferae (28), Cyperaceae (23), Labiatae (21), Leguminosae (21), Polygonaceae (21), Caryophyllaceae (20) and Scrophulariaceae (18). The fraction of alien plants embraces the escapees from cultivation as well as inadvertently introduced plants (groups 2 and 3). The ten leading families in this fraction are Compositae (32 species), Rosaceae (25), Liliaceae (24), Cruciferae (23), Labiatae (16), Boraginaceae (16), Umbelliferae (13), Gramineae (12), Leguminosae (12) and Scrophulariaceae (11).

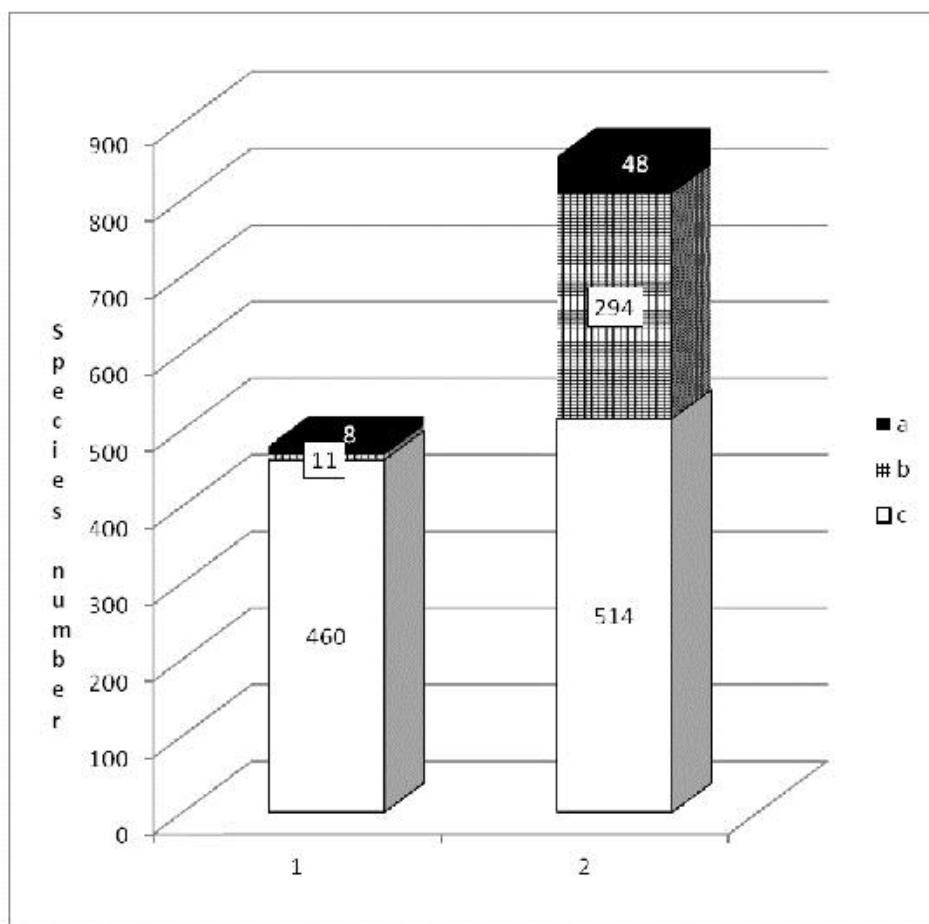


Fig. 1. Changes in the floristic composition on the territory of the Main Botanic Garden, Russian Academy of Sciences. 1 – composition as of 1949; 2 – composition as of 2014; a – alien weeds; b – species-escapees from cultivation; c – native species

Life-form spectrum of the native flora fraction is similar to that of escapees from the cultivation fraction in many respects. Perennials capable of spreading vegetatively are the most prominent (37 and 35%, respectively). Herbaceous plants incapable of spreading vegetatively are the second important (31% in both groups). Next are terophytes (24 and 18%) and finally woody plants (8 and 16%). The fraction of alien weeds yields a different

proportion: more than half (52%) in this group are annuals and short-lived perennials, that is, terophytes; perennials incapable of spreading vegetatively take second place (27%), followed by perennials capable of spreading vegetatively (13%). Woody plants constitute the smallest percentage: 8% (Fig. 2).

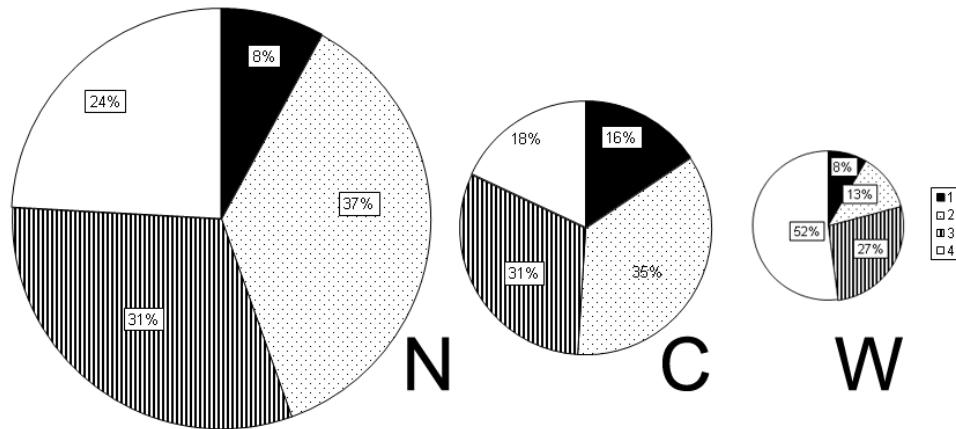


Fig. 2. Life-form analysis of checklist for Main Botanic Garden, Russian Academy of Sciences. N – native species; C – escapees from cultivation; W – alien weeds. 1 – woody species, 2 – perennials capable of spreading vegetatively, 3 – perennials incapable of spreading vegetatively, 4 – annuals and short-lived perennials

The analysis of alien plant invasiveness is presented in Table 2. The transformers group (Status 1) is represented by 12 species, of which only one has escaped from cultivation in the Garden, while the rest are intruders from the outside. The invasive species group (Status 2) consists of 44 species, two-thirds of which have escaped cultivation. The group of potentially invasive plants (Status 3) constitutes 184 species, 92% of which are escapees from cultivation. The group of aliens encountered in the Garden only once (Status 4) includes 102 species, the majority of which (90%) are also escapees from cultivation.

Assessments of invasiveness potential for naturalized plants demonstrate low significance of the Main Botanic Garden collections as a contributor to the alien fraction of the local flora. Most plants that manage to escape the collections occur as solitary individuals or in unstable populations. Among the species that have escaped beyond exhibits, there are 33 that have invasiveness status 1 or 2. Yearly monitoring and direct elimination of plants when they are found outside collections or exhibits should be enough for effective control. Only a single plant has been known to be a true escapee from the Main Botanic Garden grounds, *Adenocaulon adhaerescens*. The Garden is, supposedly, a source of *Geum macrophyllum*, which has been spreading across Moscow Region. However, that plant had been previously

inadvertently introduced to the Garden as a weed. Rather than species escaping from the Garden, more than 20 species are known to have invaded the Garden territory as alien noxious weeds (*Bidens frondosa*, *Erigeron annuus*, *Impatiens glandulifera* and others).

Table 2. Life forms and invasive status of alien plants in the Main Botanic Garden, Russian Academy of Sciences

	C – Escapees from Cultivation					W – Alien Weeds					Total
	T+Sh	NP	PV	A+BI	Total	T+Sh	NP	PV	A+BI	Total	
1		1			1	1	2	2	6	11	12
2	5	10	17		32	2		4	6	12	44
3	35	60	58	16	169	1	4	2	8	15	184
4	6	32	16	38	92		2	3	5	10	102
Σ	46	103	91	54	294	4	8	11	25	48	342

It is worth noting that more than 300 species have been self-reproducing in the Garden within the collection plots, while not exhibiting any tendency to escape. These species can be assigned status 4 (Trulevich *et al.*, 2007). More than 40 species of those listed as potentially invasive in the *Illustrated Catalogue* (Mayorov *et al.*, 2013) have been known to escape within the territory of Moscow University Botanic Garden; therefore, they are likely to soon also form spontaneous populations in the Main Botanic Garden. These are the following plants:

Aceraceae: *Acer mandshuricum* Maxim.; Araceae: *Arum alpinum* Schott & Kotschy; Boraginaceae: *Sympytum azureum* H.C.Hall; Caprifoliaceae: *Lonicera involucrata* (Richardson) Banks ex Spreng.; Caryophyllaceae: *Petrorhagia saxifraga* (L.) Link; Celastraceae: *Celastrus orbiculatus* Thunb.; Compositae: *Guizotia abyssinica* (L.f.) Cass.; Crassulaceae: *Sedum sexangulare* L.; Cruciferae: *Sisymbrium strictissimum* L.; Dipsacaceae: *Dipsacus fullonum* L., *D. laciniatus* L.; Euphorbiaceae: *Acalypha australis* L., *Flueggea suffruticosa* (Pall.) Baill.; Fumariaceae: *Corydalis ambigua* Cham. & Schldl.; Labiate: *Calamintha nepeta* (L.) Savi, *Lallemantia peltata* (L.) Fisch. & C.A.Mey., *Melissa officinalis* L., *Nepeta × faassenii* Bergmans ex Stearn, *Satureja hortensis* L., *Stachys byzantina* K.Koch;

Liliaceae: *Erythronium dens-canis* L., *Hyacinthoides hispanica* (Mill.) Rothm., *Polygonatum × hybridum* Brügger; Oleaceae: *Syringa vulgaris* L.; Papaveraceae: *Papaver decaisnei* Hochst. & Steud. ex Elkan, *P. pinnatifidum* Moris; Phytolaccaceae: *Phytolacca acinosa* Roxb.; Primulaceae: *Lysimachia verticillaris* Spreng.; Ranunculaceae: *Ficaria ficarioides* (Bory & Chaub.) Halacsy, *Helleborus orientalis* Lam.; Rosaceae: *Crataegus pinnatifida* Bunge, *Potentilla micrantha* Ram. ex DC.; Scrophulariaceae: *Digitalis grandiflora* Mill.; Solanaceae: *Datura stramonium* L., *Nicandra physaloides* (L.) Gaertn., *Nicotiana × sanderae* W.Watson; Umbelliferae: *Angelica purpurascens* (Avé-Lall.) Gilli, *Anthriscus cerefolium* (L.) Hoffm., *Gasparrinia peucedanoides* (Bieb.) Thell., *Laser trilobum* (L.) Borkh., *Laserpitium hispidum* M.Bieb., *Pimpinella major* (L.) Huds., *Seseli buchtormense* (Fisch.) W.D.J.Koch.

Keeping escaped plants at bay in botanic gardens is extremely challenging. An attempt to control the spreading *Impatiens glandulifera* and *Solidago gigantea* undertaken in the Main Botanic Garden in 2007–2009 was unsuccessful (Vinogradova, 2011). Control of annuals and short-lived perennials is most difficult, as these plants form soil seed banks. In order to avoid the introduction of noxious weeds into cultivation, plants are to be evaluated for their invasive capabilities prior to introduction and subsequently controlled during the initial stage of their spreading. This may prevent the appearance of new aggressors among plants.

Conclusions

Over the 65 years that have passed from the founding of the Main Botanic Garden collections, the list of the Garden flora has become 1.8 times as large. The checklist was augmented by 54 native species (due to more complete coverage of survey over time), 283 escapees from cultivation, and 40 alien weeds. 40% of taxa found growing spontaneously within the garden territory are alien plants; of these, 33% are escapees from cultivation, while the rest are alien weeds. Only a single plant is documented to have escaped and established outside the Garden territory, that is *Adenocaulon adhaerescens*.

Even though the family composition spectra differ considerably in the native and alien part of the flora, Compositae are the leading family in both parts. In the alien fraction, Gramineae yield their leading status, moving from the second place down to the eighth or ninth. As to the families Cyperaceae, Caryophyllaceae and Polygonaceae, they are not even within the ten leading families. On the other hand, Liliaceae, whose members are widely cultivated, enter the group of ten leading families along with Boraginaceae and Umbelliferae.

Differentiating families are listed for the native and alien flora fraction. Twenty-eight families are represented exclusively by natives, while 17 families are entirely alien.

Life form spectra are practically similar in the native and escapee fractions of the Garden flora, while the group of unintentionally introduced aliens differs by a more prominent position of terophytes.

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References

- Alexandrov, L.P and Nekrasova, V.L.** 1923. Neskuchnyi sad i yego rastitel'nost' [Neskuchnyi Garden and its vegetation]. Moscow: M. & S.Sabashnikov Publishers. (In Russian)
- Bjureke, K.** 2010. We have introduced some of them. Do we take the responsibility to eradicate them? In: Addressing global change: a new agenda for botanic gardens. Proceedings of the 4th Global Botanic Gardens Congress. Dublin: National Botanic Gardens of Ireland: 56–57.
- Burt, J.W., Muir, A.A., Piovia-Scott, J., Veblen, K.E., Chang, A.L., Grossman, J.D. and Weiskel, H.W.** 2007. Preventing horticultural introductions of invasive plants: potential efficacy of voluntary initiatives. Biol. Invasions 9: 909–923.
- Czerepanov, S.K.** 1995. Sosudistyye rasteniya Rossii i sopredel'nykh gosudarstv. [Vascular plants of Russia and adjacent countries (within borders of the former USSR)]. St. Petersburg: Mir i semya. (In Russian)
- Dehnen-Schmutz, K., Touza, Ju., Perrings, C. and Williamson, M.** 2007. The Horticultural Trade and Ornamental Plant Invasions in Britain. Conserv. Biol. 21(1): 224–231.
- Demidov, A.S., Kuzmin, Z.E. and Shatko, V.G.** 2005. Glavnyjj botanicheskijj sad im. N.V.Tsitsina (istoriya, stanovleniye I dostizheniya). [Tsitsin Main Botanic Garden (history, establishment, and achievements)] Moscow: GBS RAN and Tula: IPP Grif & Co. (In Russian)
- Euro+Med PlantBase. The Information resource for Euro-Mediterranean plant diversity.** <http://www.emplantbase.org/home.html> (accessed 04 Nov 2014).

European Botanic Gardens Consortium. Sharing information and policy on the potentially invasive plants in Botanic Gardens <http://www.botanicgardens.eu/aliens.htm> (accessed 8 May 2014).

Evtyukhova, M.A. 1949. Flora I rastitel'nost' territorii Glavnogo botanicheskogo sada Akademii nauk SSSR. [Flora and vegetation of the Main Botanic Garden USSR Academy of Sciences] Trudy Glavn. Bot. Sada 1: 63–86. (In Russian)

Flahault, C. 1899. La naturalisation et les plantes naturalisees en France. Bull. Soc. Bot. France, 46: XCI–CVIII.

Galera, H. 2003. Rośliny występujące spontanicznie w polskich ogrodach botanicznych—przegląd listy florystycznej. // Biul. Ogrodów Bot. 12: 31 – 82. (In Polish)

Galera, H. and Sudnik-Wójcikowska, B. 2004a. The structure and differentiation of the synanthropic flora of the botanical gardens in Poland. Acta Soc. Bot. Poloniae 73(2): 121–128.

Galera, H. and Sudnik-Wójcikowska, B. 2004b. Historyczne notowania chwastów związanych z działalnością ogrodów botanicznych Europy Centralnej. Fragm. Flor. Geobot. Polonica 11(2): 293–317.

Galera, H. and Sudnik-Wójcikowska, B. 2005. The spread of alien plants as a side effect of the activity of botanical gardens — dispersal models. In: Ecology and Management of Alien Plants Invasions. Proceedings of the 8th International Conference 2005. Katowice, Polska: 57.

Gvarishvili, N. and Lomtadidze, N. 2013. Kolleksiya botanicheskogo sada kak istochnik invasivnykh vidov. In: Rol' botanicheskikh sadov v sokhranenii biorasnoobraziya rastenij. Materialy yubilejnojj mezhdunarodnojj nauchno-prakticheskoy konferentsii, posvyashchennojj 100-letiju Batumskogo Botanicheskogo sada. [Botanic garden collection as a source of invasive species. In: Role of botanic gardens in preservation of plant diversity. Proceedings of commemorative international theoretical-practical conference dedicated to 100th anniversary of the Batumi Botanic Garden, Batumi, Georgia, 8–13 May 2013.] Batumi, Part 1: P. 69–71. (In Russian)

Graf, A. 1986. Flora und Vegetation der Friedhöfe in Berlin West. Verh. Berliner Bot. Vereins 5: 1–183.

Graf A. and Rohner, M.-S. 1984. Wiesen im Botanischen Garten Berlin-Dahlem. Verh. Berliner Bot. Vereins. 1984. Vol.3. S. 3–23.

Gubareva, I.Yu. and Glukhovskikh, E.A. 2013. Vliyanije introduktsii rastenij na raznoobraziye estestvennojj flory i rastitel'nosti Kaliningradskoj oblasti. [Effects of plant introduction on native flora and vegetation diversity in Kaliningrad Region.] In: Rol'

botanicheskikh sadov v sokhranenii biorasnoobraziya rastenijj. Materialy yubilejnogo mezhdunarodnogo nauchno-prakticheskogo konferentsii, posvyashchennoj 100-letiyu Batumskogo Botanicheskogo sada. [Botanic garden collection as a source of invasive species. In: Role of botanic gardens in preservation of plant diversity. Proceedings of commemorative international theoretical-practical conference dedicated to 100th anniversary of the Batumi Botanic Garden, Batumi, Georgia, 8–13 May 2013.] Batumi, Part 1: P. 66–69. (In Russian)

Halford, M., Heemers, L., Mathys, C. and Mahy, G., 2010. Preventing introductions of invasive alien plants in Belgium: a LIFE “Information & Communication” project dedicated to the ornamental sector. In: Biological invasions in a changing world. From science to management. Proceedings of the 6th NEOBIOTA Conference, 14–17 September 2010. Copenhagen: University of Copenhagen.

Hulme, P. 2011. Addressing the threat to biodiversity from botanic gardens. *Trends Ecol. Evol.* 26(4): 168–174.

Ignatov, M.S., Makarov, V.V. and Chichev, A.V. 1990. Konspekt flory adventivnykh rastenijj Moskovskoj oblasti. In: Skvortsov, A.K. (red.) *Floristicheskiye issledovaniya v Moskovskoj oblasti*. [Checklist of adventive plants in the flora of Moscow Region. In: Skvortsov, A.K. (ed.). *Floristic studies in Moscow Region*]. Moscow: Nauka: 5–105. (In Russian)

Jebb, M. 2009. Managing the invasive alien plants problem. Botanical gardens in the age of climate change. EuroGard V. Helsinki.

Kolosova, N.N. and Churilova, E.A. 2004. *Atlas. Moskovskaya oblast'* [Atlas. Moscow Region]. Moscow: Prosveshcheniye. (In Russian)

Kozhevnikov, A.V. 1935. Sornaya I adventivnaya flora Moskovskogo Botanicheskogo sada. [Weedy and adventive flora of the Moscow Botanic Garden] Byull. Mosk. Obshch. Isp. Prir., Otd. Biol. 44(4): 193–203. (In Russian)

Lechner, M. and Kiehn, M. 2010. Assessing invasive potential of plant species cultivated in Botanic Gardens in Central Europe. Conference Programme & Book of Abstracts. In: Addressing global change: a new agenda for botanic gardens. Proceedings of the 4th Global Botanic Gardens Congress. 2010. Dublin: National Botanic Gardens of Ireland: 126–127.

Lepeshkina, L.A. and Mukovnina, Z.P. 2005. Adventivnaya flora Botanicheskogo sada i stepen' yevo naturalizatsii. In: *Botanicheskiye sady kak tsentry sokhraneniya bioraznoobraziya I ratsionalnogo ispol'zovaniya rastitel'nykh resursov*. Materiyaly Mezhdunarodnogo Nauchnogo Konferentsii, Moskva, 2005. [Adventive flora of the Botanic Garden and the extent of its

naturalization. In: Botanic gardens as centers of biodiversity preservation and rational exploitation of plant resources. Proceedings of International Scientific Conference, Moscow, 2005]. Moscow: 300–302. (In Russian)

Mayorov, S.R., Bochkin, V.D., Nasimovich, Yu.A. and Shcherbakov, A.V. 2012. Adventivnaya flora Moskvy i Moskovskoj oblasti. [Adventive flora of Moscow and Moscow Region]. Moscow: Tovarishchestvo nauchnykh izdaniy KMK. (In Russian)

Mayorov, S.R. and Vinogradova, Yu.K. 2013. Naturalizatsiya rastenij v botanicheskikh sadakh g. Moskvy. [Plant naturalization in botanic gardens of the City of Moscow] Vestn. Udmurtsk. Univ., Ser. Biol. Nauki o zemle 2: 12–16 . (In Russian)

Mayorov, S.R., Vinogradova, Yu.K. and Bochkin, V.D. 2013. Illustrirovannyj katalog rastenij, dichayushhhikh v botanicheskikh sadakh Moskvy. [Illustrated catalogue of plants escaping in Moscow botanic gardens]. Moscow: Phyton XXI. (In Russian)

Nee, M. The native and naturalized Flora of the New York Botanical Garden. (unpublished).

Notov, A.A. and Notov, V.A. 2012. Nekotoryye resultaty analiza invazionnojj aktivnosti vidov v botanicheskem sadu Tverskogo gosudarstvennogo universiteta. In: Baranova, O.G. and Puzyrev, A.N. (eds.) Problemy izuchenija adventivnojj I sinantropnojj flor Rossii I stran blizhnego zarubezhia. Materialy IV mezhdunarognoj nauchnojj konferentsii [Invasiveness of species in the Tver State University Botanic Garden: Some results of the analysis. In: Baranova, O.G. and Puzyrev, A.N. (eds.) Challenges of adventive and synanthropic flora studies in Russia and adjacent countries. Proceedings of the 4th International Scientific Conference, Moscow—Izhevsk: Computer Science Institute: 154–157. (In Russian).

Reichard, S. and White, P. 2001. Horticulture as a Pathway of Invasive Plant Introductions in the United States. BioScience 51(2): 103–113.

Sudnik-Wójcikowska, B. and Galera, H. 2005 Floristic differences in some anthropogenic habitats in Warsaw. Ann. Bot. Fennici 42: 185–193.

Trulevich, N.V., Alferova, Z.R. Vinogradova, Yu.K., Gutovskaya, N.I., Dvorakovskaya, V.M., Kostyleva, N.V. Kuklina, A.G., Pavlova, I.V., Shatko, V.G. and Shvetsov, A.N. 2007. Botaniko-geograficheskiye expozitsii rastenij prirodnojj flory. Itogi sokhraneniya bioresursov ex situ. [Botanic-Geographic exhibits of native plants. Results of botanical resources preservation ex situ]. Moscow: GEOS. (In Russian)

Vinogradova, Yu.K. 2004. Prognozirovaniye invazionnykh protsessov v botanicheskikh sadakh. In: Zhizn' v garmonii: botanicheskiye sady I obshhestvo. Materialy mezhdunarodnoj konferentsii, Tver', 2004. [Predicting invasions in botanic gardens. Harmonic living: Botanic

gardens and the society. Proceedings of international conference. Tver, 2004]. Tver': 25–27.
(In Russian)

Vinogradova, Yu.K. 2006. Problema monitoringa potentsial'nykh ergaziophitov. In: Adventivnaya I sinantropnaya flora Rossii I stran blizhnego zarubezhia: sostoyaniye I perspektivy. [The challenge of potential ergasiophytes monitoring. In: Adventive and synanthropic flora of Russia and adjacent countries: present status and future] Izhevsk: 29–31.

Vinogradova, Yu.K. 2010. Monitoring on potential ergasiophyte species in botanical gardens of Russia. Conference Programme & Book of Abstracts. In the Proceedings of 4th Global Botanic Gardens Congress. Addressing global change: a new agenda for botanic gardens. 13th — 18th June 2010, Dublin. Dublin: National Botanic Gardens of Ireland: 140–141.

Vinogradova, Yu.K. 2011. Experiments on reduction of abundance of invasive species (*Impatiens glandulifera*, *Solidago gigantea*, *Adenocaulon adhaerescens*). Bridging the gap between scientific knowledge and management practice. In the Proceedings of the 11th International Conference on the Ecology and Management of Alien Plant Invasions. Hungary. Szombathely: 111.

Vinogradova, Yu.K. 2013. Control of invasive alien species expansion — a new goal for a botanic garden. In: Gardens in Naumtsev, I. (ed.) Our Hearts. Tver: Polypress Publishers: 207–214.