

Appendix 1

The full names of the herbaria used in this study ([Thiers](#), 2017):

BSU (Herbarium of the Belgorod State University, Russia, Belgorod Oblast, Belgorod)

BRSU (Herbarium of the Bryansk State University, Russia, Bryansk)

GMU (Herbarium of the Mordovia State University, Russia, Republic of Mordovia, Saransk)

HERZ (Herbarium of the Alexander Herzen Pedagogical University, Russia, Saint Petersburg)

HMNR (Herbarium of the Mordovian State Nature Reserve, Russia, Republic of Mordovia, Pushta Settlement)

IBIW (Herbarium of the Papanin Institute for Biology of Inland Waters, Russian Academy of Sciences, Russia, Nekouz District, Yaroslavl Region, Borok)

IVGU (Herbarium of the Ivanovo State University, Russia, Ivanovo)

KURS (Herbarium of the Kursk State University, Russia, Kursk)

LE (Herbarium of the Komarov Botanical Institute of RAS, Russia, Saint Petersburg)

LECB (Herbarium of the Saint Petersburg University, Russia, Saint Petersburg)

MHA (Herbarium of the Main Botanical Garden of the Russian Academy of Sciences, Russia, Moscow)

MOSP (Herbarium of the Moscow State Pedagogical University, Russia, Moscow)

MW (Herbarium of the Moscow State University, Department of Ecology and Plant Geography, Faculty of Biology, Russia, Moscow)

MWG (Herbarium of the M.V. Lomonosov Moscow State University, Department of Biogeography, Faculty of Geography, Russia, Moscow)

NNSU (Herbarium of the Lobachevsky State University Nizhny Novgorod, Russia, Nizhni Novgorod)

OHHI (Herbarium of the Orel State University, Russia, Orel)

OKA (Herbarium of the Oksky State Biosphere Reserve, Russia, Ryazan Region, Ryazan)

PKM (Herbarium of the Penza State University, Russia, Penza)

PVB (Herbarium of the Institute of Ecology of the Volga River Basin of Russian Academy of Sciences, Russia, Togliatti)

RSU (Herbarium of the Ryazan State University, Russia, Ryazan Region, Ryazan)

RV (Herbarium of the Southern Federal University, Russia, Rostov Oblast, Rostov-on-Don)

RWBG (Herbarium of the Botanical Garden of the Southern Federal University, Russia, Rostov-on-Don)

SARAT (Herbarium of the Saratov State University, Russia, Saratov)

TVBG (Herbarium of the Tver State University, Russia, Tver)

TU (Herbarium of the University of Tartu, Estonia. Tartu)

TUL (Herbarium of the L.N. Tolstoy Tula State Pedagogical University, Russia, Tula)

UPSU (Herbarium of the Ulyanovsk State Pedagogical University, Russia, Ulyanovsk)

VOR (Herbarium of the Voronezh State University, Biology and Plant Ecology Department, Russia. Voronezh Region, Voronezh)

VORG (Herbarium of the Voronezh State University, Faculty of Geography and Geocology, Russia, Voronezh)

VU (Herbarium of the Voronezh State University, Russia, Lipetsk Region, Galichya Gora Reserve, Donskoye)

Herbarium of P.P. Semenov-Tyan-Shanskiy, Lipetsk State Pedagogical University, Russia, Lipetsk

Herbarium of the Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Russia, Moscow

Appendix 2

The alien aquatic plant species of European Russia. The taxonomy (World Flora Online, 2021), naturalization degree (Pyšek et al., 2004), and characteristics of population dynamics (personal observations) are provided.

1. *Azolla caroliniana* Willd. (Azollaceae) – Alien naturalized non-invasive plant. This species has been observed only in the Astrakhan (LV), where it was recorded for the first time in 2009 (Laktionov et al., 2014). The authors of this report suggested that the species invaded natural ecosystems from an aquarium culture.

2. *Nelumbo nucifera* Gaertn. (Nymphaeaceae) – Alien naturalized non-invasive plant. Previously, Laktionov et al. (2014) indicated it as a native species in the delta of the Volga River, and on the coast of Kalmykia (LV). According to the recent studies (Laktionov et al., 2019), the species was introduced in Astrakhan (LV) in the late 18th century from seeds obtained in India. Subsequently, it became distributed widely throughout this region. Then, by expanding the secondary range, it penetrated the Volga-Akhtuba floodplain and Kalmykia. In 2013, it was found in the Podgorensky district of Voronezh (CC), where it was potentially introduced by seeds or pieces of rhizomes and formed the large populations in that area (Agafonov et al., 2015).

3. *Nuphar advena* (Aiton) W.T. Aiton (Nymphaeaceae) – Alien casual plant. In the early 20th century, it was discovered by N.F. Zolotnitsky in the vicinity of Zvenigorod town (Moscow province) (CI), provided that the determination was correctly verified by Syreishchikov (1914). This finding has not been found anywhere else in European Russia. By 1947, *Nuphar advena* disappeared from where it was first discovered in European Russia (Kaden, 1951).

4. *Nymphaea* × *marliacea* Wildsmith (Nymphaeaceae) – Alien naturalized non-invasive plant. In 1960, the plant was introduced into the Lake Glubokoe in Ruzsky district, Moscow (CI) (Reshetnikova, 1997). It formed a clone, which currently exists in this location until present (Mayorov et al., 2012).

5. *Cabomba caroliniana* A. Gray (Cabombaceae) – Alien naturalized non-invasive plant. It was first discovered in European Russia in the 1990s (Shvetsov, 1997) in Moscow (CI), in the backwater of the Moskva River, where thermal waters discharged from CHP-9 (a combined heat and power station). The plant population likely originated here from an aquarium culture. *Cabomba caroliniana* currently presents in this location (Mayorov et al., 2012), although it does not bloom. It is not known from other sites in European Russia.

6. *Trapa natans* L. s. l. (Trapaceae) – Alien naturalized casual plant (the status of the species refers to the adventitious population in the Moscow region). It is a subtropical-tropical species, native to warm temperate parts of Eurasia and Africa. It invaded the southern portion of the broad-leaved forest zone in European Russia. In Central Russia, the northernmost natural populations of the species are observed in the west of the Tver (CI) (Western Dvina River basin), Bryansk (CI) (Dnieper River basin), Lipetsk (CC) (Don River basin), east of Moscow region and south of Ivanovo region (Volga River basin). However, under favorable conditions, *Trapa natans* is able to exist for a long time, even outside its normal geographical range. In late 1950s, it was found in the north of Moscow region. However, the anthropogenic origin of this population was proven later (Tikhomirov, 1964). Subsequently, this population was eliminated during irrigation and drainage actions. We assume that the long-existing population located in the Kozelsky district of Kaluga region (Reshetnikova et al., 2010) also represents an alien invasion. However, the special molecular genetic studies may shed the light on this hypothesis (Falahati-Anbaran et al., 2021).

7. *Elatine triandra* Schkuhr (Elatinaceae) – Alien casual plant. The plant species is located mainly in the forest zone to boundary with forest-steppe, where it lives in bottom and shallows in lakes and ponds with clean water. In summer 1931, the species was collected in the rice paddies near the Don River mouth, Rostov (LD) (Shcherbakov et al., 2017). Since then, this plant has only been found in the Volga-Akhtuba floodplain, outside the forest belt. However, in this location, *Elatine triandra* infested natural communities.

8. *Nymphoides peltata* (S.G. Gmel.) Kuntze (Menyanthaceae) – Alien casual plant (status refers to species populations of an alien origin). We think that the populations of *Nymphoides peltata* are native in the regions of the Lower Volga (LV) and the Lower Don (LD). It is possible that the population in the south of Bryansk (CI) is also native (Shcherbakov et al., 2018). Almost all other populations have the non-native origin. Usually this species is represented by the single populations in the surroundings of the within this region. biological stations, villages and other settlements.

Lemna gibba L. (Araceae) was reported as an introduced species in European Russia (Ignatov et al., 1990; Hüssner, 2012). Interestingly, in the mid-20th century the range limit of this species occurred approximately along the border of the steppe and forest zones in European Russia, due to climatic factors (Landolt, 1986). *Lemna gibba* was also known to the north of this border, including Moscow (CI) (Rychin, 1948) and Yaroslavl (CI) (Tsynger, 1885), Republic of Karelia (N) (Fedorov, 1979). We hypothesize that the wide distribution of this species in the forest zone, in recent decades (Maevskiy, 2014) is most likely associated with the climate change, but not with the human activity directly. So, we consider *Lemna gibba* as a range-expanding native species, rather than the alien species in most regions, including the Udmurtia (VV) (Kapitonova, 2011, 2015, 2019).

9. *L. minuta* Kunth (Araceae) – Alien invasive but not harmful. In European Russia, this plant was found for the first time in the early 21st century in the water bodies of the Sura River valley (the Chuvash Republic), and Penza (MV) (Petrova, 2006). It was also found in the Republic of Mordovia (Vargot et al., 2012), in the Pekhorka River, near the eastern borders of Moscow (CI) (Mayorov et al., 2012), in the southeast of Vladimir (CI) (Seregin, 2012), and near Astrakhan, LV (Laktionov et al., 2014). Currently *Lemna minuta* keeps being spread from aquariums, and expanding its secondary range in the Lipetsk, Tver and Yaroslavl (CC, CI) (Maevskiy, 2014).

10. *Pistia stratiotes* L. (Araceae) – Alien casual plant. The plant is used in the aquatic ornamental design, and for the biological wastewater treatment. The populations of *Pistia stratiotes* may survive for several seasons in the non-freezing waters, but disappears after the first winter, if the water reservoir is frozen. For example, we observed this species in the Pekhorka River, Moscow (CI), where the warm wastewaters are discharged (Mayorov et al., 2012). This alien plant has also been found escaped from the culture near Voronezh (CC) (Grigoryevskaya et al., 2004), in Samara (MV) (Saxonov, Senator, 2012) and Astrakhan (LV) (Skvortsov, 2006). In 2013, the flow of the Seversky Donets River brought *Pistia stratiotes* to the Rostov (LD) from Ukraine in large quantity (Shcherbakov et al., 2017).

11. *Wolffia arrhiza* (L.) Horkel ex Wimm. (Araceae) – Alien naturalized non-invasive plant (status refers to the populations of alien origin). In European Russia, there are two types of these populations: 1) introduced into water bodies from aquariums with the subsequent expansion its secondary range; 2) invaded from Europe as a result of the expansion of the native range due to the climate change. The population from Voronezh (CC) was recorded in early 1980s (Khlyzova, 1984) is alien. It was potentially introduced to the Voronezh River from aquarium culture. It spread later along the Voronezh River and its basin in the Lipetsk (CC) (Alexandrova et al., 1996) and Tambov (CC) (Sukhorukov, 2010). The Khoper-Medveditsa populations are most likely native, where this species was discovered for the first time in the mid-1950s in the Khopersky State Nature Reserve (Krasovskaya, 1955). Later, it spread further down the Khoper River and the Medveditsa River to Volgograd (LV) (Skvortsov, 2006). As it expanded its native range, *Wolffia arrhiza* invaded the Dniepr River basin in Bryansk (CI), where it was found in 1999 (Braslavskaya, 2000). Further expansion occurred later (Shcherbakov et al., 2018). The origin of the occurrences of this species in four other regions (Moscow (CI), Vladimir (CI), Kursk (CC), Samara (MV)) is still unknown. In 2011 *Wolffia arrhiza* was found simultaneously in several locations in Moscow city and Moscow region (CI) (Mayorov et al., 2012), as well as near the borders with Vladimir region (CI) (Seregin, 2012). These new findings are waiting for their explanation. We suggested that the scenario of introducing of *Wolffia arrhiza* in all these places from aquariums is less likely than by birds. The small- and medium-sized waterfowl species are the usual agents of diaspore penetration for this species. As these birds do not have permanent migration routes in Central Russia (K.V. Avilova, personal communication), we cannot determine if these populations came from the Dnieper River or from the Don River basins. The appearance of *Wolffia arrhiza* populations in Oboyan village vicinity (Kursk region) is even more difficult interpret. It was first found in this location in the early 20th century (Sukachev, 1903). It was rediscovered second time in the same location after almost 100 years (Poluyanov, 2005). This leaves three possibilities: 1) the population existed in that location over this period; 2) diaspores were brought in from the Bryansk region; 3) diaspores were brought from the Voronezh or Lipetsk regions. The record from Samara region (Plaksina, 2001) was not confirmed by herbarium data. Therefore, the status of this species in Samara region remains unknown (Saksonov, Senator 2012).

12. *W. globosa* (Roxb.) Hartog et Plas (Araceae) – Alien casual plant. In European Russia, it was discovered for the first time in the Pekhorka River near Lyubertsy (Moscow, CI), where *Wolffia globosa* was potentially introduced from the aquarium culture. The abundance of this population reached its maximum in 2009–2010, when plants could be observed throughout the entire watercourse of the Pekhorka River along Lyubertsy to its mouth (Mayorov et al.,

2012). After that its population began to decline. Starting from 2014, we did not observe this plant in the Pekhorka River. More recently the species was found in the Matyr reservoir near Lipetsk (CC) (Maevskiy, 2014). However, the current status of this population is unknown.

13. *Egeria densa* Planch. (Hydrocharitaceae) – Alien naturalized non-invasive plant. In European Russia, it was first observed in the Pekhorka River near the village Otyabrskiy, Lyubertsy district, Moscow (CI), in 1983 (Mayorov et al., 2012). Its population was represented by the fragments of the stems drifting downstream. *Egeria densa* potentially was introduced into this stream from aquarium culture. One year later, it was reported widely spread in the Pekhorka River near Lyubertsy (CI). By 2000 it expanded its range along the whole watercourse of the Pekhorka River from the Lyubertsy sewage treatment station to its mouth (Mayorov et al., 2012). To date, the species continues to form dense growths in this location. Several individual plants have been found in the Moscow River, but they seemed not surviving well. *Egeria densa* was discovered in one of the ponds in Moscow city in summer 1995, but did not survive the winter season (Mayorov et al., 2012). *Egeria densa* was collected in the town of Shakhty, Rostov (LD) in 1991 (Shcherbakov et al., 2017).

14. *Elodea canadensis* Michx. (Hydrocharitaceae) – Alien invasive transformer plant. It is one of the few invasive species with the well tracable distribution both globally and nationally. It invaded European Russia in the early 1880s. Nowadays, *Elodea canadensis* has invaded almost all locations suitable of supporting this species. The invasion stages of this plant species and the current status of its populations were described in detail in Vinogradova et al. (2009).

15. *E. nuttallii* (Planch.) H. St. John (Hydrocharitaceae) – Alien invasive but not harmful. It is an invasive species that began active invasion in Europe in the late 1940s. It is currently observed in most countries in the continental Europe (Hüssner, 2012). In European Russia, it was found for the first time in 2017 in the Karachevsky district, Bryansk (CI), where this population survived the first winter without loss (Panasenko, Shcherbakov, 2018).

16. *Hydrilla verticillata* (L. f.) Royle (Hydrocharitaceae) – Alien casual plant. From 1972 to 1982, it was observed in the ponds of the Main Botanical Garden, Russian Academy of Science, Moscow (CI). According to Skvortsov (1982), it was not purposely grown there. Later the population disappeared from this location (Mayorov et al., 2012). In 1989, the plant specimen was collected in Rostov-on-Don (LD) (Shcherbakov et al., 2017). However, the current status of this population is unknown. Perhaps, *Hydrilla verticillata* will be found in the Smolensk, Pskov or Leningrad regions, because it has occurred frequently in the north of the Vitebsk region, Belarus (Parfenov, 2013).

17. *Najas graminea* Delive (Hydrocharitaceae) – Alien naturalized non-invasive plant. It is a segetal weed in the rice paddies. In these ecotopes, it was found in the LV macro region in

the Astrakhan (Skvortsov, 2006) and in the Lower Don macro region in LD (Shcherbakov et al., 2017).

18. *N. major* All. (Hydrocharitaceae) – Alien casual plant (status of the species refers to the alien populations in Moscow region and Udmurt Republic). This plant is confined to the river channels and floodplains. Over the past 50 years, *Najas major* expanded its range in European Russia naturally (Panasenko, Anishchenko, 2018). Outside the modern native range, there are alien populations in Moscow (CI) (Mayorov et al., 2012) and the Udmurt Republic (VV) (Kapitonova, 2011, 2015, 2019). The diaspores of *Najas major* were potentially brought there with river sand delivered from locations of its native origin.

19. *Vallisneria americana* Michx. (Hydrocharitaceae) – Alien naturalized non-invasive plant. In 2010, the plant was found in the Pekhorka River under the spillway of the Lyubertsy sewage treatment station near Moscow (CI) (Mayorov et al., 2012). It was likely introduced to this area by the diaspores from aquarium culture. Since then it has formed a large population, although its distribution is localized by the spillway surroundings and does not invade the riverbed.

20. *V. spiralis* L. (Hydrocharitaceae) – Alien casual plant (status refers to species populations of alien origin). Currently, the northern border of the native range of the species extended to the south of the Voronezh (CC) (Khlyzova et al., 2008) and Saratov (MV) (Skvortsov, 2006). Outside this area, it is known in cooling ponds of thermal and nuclear power stations (Katanskaya, 1979) and ironworks (Shcherbakov, 1999). Usually the species invades from aquarium culture. The lack of data on the occurrence of *Vallisneria spiralis* in the NW might be explained by the lack of the most recent hydrobotanical studies in these regions.

21. *Sagittaria latifolia* Willd. (Alismataceae) – Alien naturalized non-invasive plant. The species was introduced in Lake Vyalye on the border of the Gatchina and Luga districts (Leningrad, NW) (Fedorov, 1979), where it persisted for some time. At present, there is no information on the growth of this species in European Russia beyond the culture conditions.

22. *S. platyphylla* (Engelm.) J.G. Sm. (Alismataceae) – Alien naturalized non-invasive plant. In 2002, it was discovered for the first time in Moscow (CI) in the Pekhorka River near the Lyubertsy and near its mouth in the Ramensky district (Mayorov et al., 2012). This population remains intact near the spillway of the Lyubertsy sewage treatment station and in the riverbed downstream. The groups of plants can be found downstream and their numbers can vary highly year by year.

– *S. trifolia* L. (Alismataceae) – It is indicated as invasive for the Astrakhan (LV) (Laktionov et al., 2014). The study of herbarium material and literature sources showed that this

plant is indigenous and is located on the border of its range both in the LV and LD (Shcherbakov et al., 2017).

23. *Hydrocleys nymphoides* (Humb. et Bonpl. ex Willd.) Buchenau (Alismataceae) – Alien casual plant. It was observed from 2009 to 2012 in the treatment facilities on area 50 m × 3–4 m near the Nizhny Novgorod (VV). After the reconstruction of the treatment facilities, the local population disappeared (Zarubo, Mayorov, 2020).

24. *Potamogeton nodosus* Poir. (Potamogetonaceae) – Alien naturalized non-invasive plant (status of the species applies only to alien populations). According to Maevskiy (1964), the range of this species did not extend beyond the borders of the steppe zone in the mid-20th century. However, in the early 21st century, the range started shifting to the north due to climate change (Shcherbakov et al., 2008). Currently, *Potamogeton nodosus* is reported from Smolensk, Bryansk, Tula and Ryazan regions (CI) of the Russian Federation, and the Ulyanovsk region, Republic of Mordovia (MV). Several alien populations have been found on the north from these regions. One of them is located near the southeastern outskirts of Moscow and in the adjacent parts of Moscow region (CI), where species diaspores were probably transported along with the river sand (Mayorov et al., 2012). One more location of alien origin is situated near the Balakhninskaya power station, the Nizhny Novgorod (VV).

25. *Eichhornia crassipes* (Mart.) Solms (Pontederiaceae) – Alien casual plant. It is a tropical plant species. In European Russia, it is sometimes used as a bioremediator on sewage treatment stations, as well as an ornamental plant. Potentially it escapes from the decorative ponds to the natural water bodies. It was found in Moscow (CI) and its vicinities (Mayorov et al., 2012). It died out even before ice formation because of its termophilic preferences.

26. *Monochoria korsakowii* Regel et Maack (Pontederiaceae) – Alien casual plant. In 1997, this segetal rice weed was found in the vicinity of town Kamyzyak, Astrakhan (LV) (Klinkova, Sagalaev, 1999; Skvortsov, 2006).

– *Zannichellia repens* Boen (Zannichelliaceae) – a cosmopolitan species with the native range covering, among others, European Russia (Fedorov, 1979).

Appendix 3

The most important locations of alien aquatic plant species in European Russia (citations of the original herbarium vouchers of the Herbarium Collections (Appendix 1) of European Russia, site Seregin A.P. (ed.). Digital Herbarium of Moscow State University: Electronic resource. Moscow: Moscow State University, 2021. Access mode: <https://plant.depo.msu.ru>. (date of access 11.11.2021), data of the publications).

***Azolla caroliniana* (Azollaceae)**

LV

1) Astrakhan region, Narimanov district, Solyanka settlement, along shores and shallow of chanell Solyanka, 20.10.2009, A. Laktionov, N. Vostrikova, G. Sokolova, S. Kosobokova (AGU, MW, IBIW; Laktionov et al., 2014).

2) Along shores of shallow chanells Konga and Serebryanaya volozhka, Astrakhan city, Ya. Zakoryagina, A. Laktionov, G. Sokolova (oral communication) (Laktionov et al., 2014).

***Nuphar advena* (Nymphaeaceae)**

CI

There is an only record of the species from Moscow region: “Wild in the River (Authors’ comment: Storozhka River – left tributary of Moscow River) near Savvinsky monastery of Zvenigorod County. It has determined and checked by N.F. Zolotnitskiy” (Syreishchikov, 1914). Later, it have not been re-discovered.

***Nymphaea × marliacea* (Nymphaeaceae)**

CI

1) Moscow region, Ruzskiy district, near Glubokoe Lake. In the lake near the footbridge of the biological station. Introduced. Large population (about 10–15 m²). 18.07.1994. N.M. Reshetnikova (MHA). Plants with large pink flowers were introduced in the lake Glubokoe in 1960 (Reshetnikova, 1997).

2) N 55°03,33’’– E 31°51,56’’. Moscow region, Solnechnogorsky district, Lopatovo settlement. Pond. In shallow water. Depth 1 m. One plant. 10.08.2013. V.D. Bochkin (MHA).

***Cabomba caroliniana* (Ranunculaceae)**

CI

1) Moscow region (Shvetsov, 1997).

2) Moscow, Kozhukhovskiy backwater, near the shore from side of the Nagatinskaya floodplain, a few branches, 20.09.2003, Yu.A. Nasimovich (MHA).

3) 55°42,000’N, 37°40,105’ E. Moscow region, border of Nagatinskiy and Yuzhnoportoviy municipal districts, near the western shore of Kozhukhovskiy backwater of Moscow River, spots in depth of ≈0.6 m, 03.09.2011, A. Shcherbakov, N. Shcherbakova (MW, MHA, IBIW).

***Lemna minuta* (Araceae)**

CI

- 1) 55°39,739' N, 37°58,285' E. Moscow region, Lyubertsy district, 300 m north Krasnovo settlement, Pekhorka River, above *Egeria densa* thickets, under right bank, in mass, 23.09.2008, A. Shcherbakov, S. Mayorov (MW).
- 2) 55°40,498' N, 37°57,757' E. Moscow region, Lyubertsy district, Pekhorka River above the bridge of the Moscow – Kazan railway, above *Egeria densa* thickets, in mass, 30.08.2008, S. Mayorov, A. Shcherbakov (MW).
- 3) 55°40'22" N, 37°57'49" E. Moscow region, Lyubertsy district. 150 m north of the railway bridge over the Pekhorka River (the section between the Lyubertsy-2 railway station and Korenevo railway station). Population on an area of 6 m² in stagnant water near the River bank, 15.09.2011, K.Yu. Teplov (MHA).
- 4) 54°36,5' N, 36°12,3' E. Kaluga region, neighborhood of Kaluga, Muratovsky crushed stone settlement, a ravine between the railroad station Sadovaya and Malaya Kamenka village. A small stagnant water body about 20 m in length, it grows in mass over the entire surface of the water, 13.09.2008, A.V. Krylov (MHA).
- 5) N 55.5991, 40.3906. Vladimir region, Gus'-Khrustalnyi district, Elreks village, Pol' River, backwater, 12.08.2009. V.G. Papchenkov (MW, IBIW).
- 6) Vladimir region, in a small residual reservoir at the site of the oxbowlake of the Buzha River near Yagodino village (Papchenkov, 2011; Seregin, 2012).
- 7) Tver region (Lisitsyna et al., 2009; Maevskiy, 2014).
- 8) Yaroslavl region (Lisitsyna et al., 2009; Maevskiy, 2014).

CC

- 1) Lipetsk region (Maevskiy, 2014) – year 2010.

MV

- 1) Chuvashian Republic, Alatyr district, buffer zone of State Nature Reserve “Prisurskiy”, E. Petrova in the oxbowlakes of Sura River – Romodan, Lisa, Khomuttsy, Staraya Sura, 2004, E. Petrova (IBIW; Petrova, 2006).
- 2) Russia, Zavolzh'e, Samara region, Stavropol'sky district, Piskaly village, pond shore and slopes, 08.08.2005, A. Ivanova, S.V. Saksonov (PVB, MW).
- 3) Penza, in the old Riverbed of the Sura River, 2006, E. Petrova (IBIW; Petrova, 2006).
- 4) Republic of Mordovia, Ichyalkovsky district, National Park “Smol'ny”, Barakhmanovskoe forestry, forest quarter 108, in the oxbowlake Mitryashki, on the water surface in southeastern shallow water among *Lemna minor* L. and *L. gibba* L., 15.07.2010, E. Vargot (GMU; Vargot et al., 2012).

5) N 52.40033, E 43.53307, Penza region, Bekovsky district, 2,5 km southeast Sosnovka village, Khoper River, 24.07.2019, V. Vasyukov, L.A. Novikova, T. Gorbushina, A. Ivanova, T. Lysenko (MW).

LV

1) Astrakhan region, Privolzhskiy district, vicinity of Biryukovka settlement, channel of the Rychan River, 17.08.2010, V. Papchenkov (MW, IBIW; Laktionov, 2014).

2) Astrakhan region, Volodarskiy district, vicinity of Tumak settlement, shallow channel Koshevanka, together with *Spirodela polyrhiza* (L.) Schleid. and *L. gibba* L., 16.08.2010, V. Papchenkov, A. Laktionov (AGU; Laktionov, 2014).

It was also found in Volgograd-Stupinskiy, Akhtubino-Nikolskiy, Kharabali-Enotaevskiy, Bakhtemir-Kigachskiy, Western Ilmenno-Bugrovoy, Primorsko-deltovyi floristic districts of Astrakhan region (Laktionov, 2014).

Pistia stratiotes (Araceae)

CI

1) Moscow region, Lyubertsy district, Pekhorka River, between platform Tomilino and Kraskovo, right bank of the Pekhorka River, backwater, in mass, 15.08.1998, A.P. Sukhorukov (MW).

2) Moscow region, Lyubertsy district, between Lyubertsy-2 town and platform Korenevo, right bank of the Pekhorka River, along the River bank, in mass, 15.08.1998, A. Sukhorukov (MHA).

3) Near 55.35' N, 38.00' E. Moscow region, Lyubertsy district, Pekhorka River near Tomilino settlement, 13.10.1998, S.V. Kuptsov (MW).

4) 55.522577 N, 37.659832 E. Moscow region, 5,5 km south MKAD, Sukhanovo settlement, Sukhanovsky pond, 01.09.2001, I. Shantser, M. Ivanov (MHA).

5) Moscow region, Ramenskiy district, 13 km west-north-western Ramenskoe town and 1 km southwestern Vereya village, in the Pekhorka River, in groups among *Lemna* and *Elodea densa*, 14.08.2002, A. Shcherbakov (MW).

6) Moscow region, Ramenskiy district, in the Moscow River in 2 km western Bykovo settlement, among *Ceratophyllum* and *Elodea densa*, 25.08.2002, A. Shcherbakov (MHA).

7) Moscow region, Ramenskiy district, 6 km west-north-western Ramenskoe town, in the Moscow River at the pier "Kratovo", in groups in coastal thickets of *Ceratophyllum* and near the coast, 25.08.2002, A. Shcherbakov (MW).

8) Moscow region, Pavlovo-Posadsky district, Electrogorsk town, south-western part of the main cooling pond of Elektrogorskaya HES, two groups of several dozen sockets, 13.09.2006, A. Shcherbakov (MHA).

CC

1) Voronezh region, Voronezh city, in Usmanka River, the year 2002 (Grigoryevskaya et al., 2004; Maevskiy, 2014).

2) Voronezh region: State federal-level nature sanctuary «Voronezhsky» (Starodubtseva et al., 2017).

MV

1) Samara region, Samara, in urban pond, year 2006 (Solovyeva, 2006).

LV

1) Astrakhan region, Astrakhan, shallow channel Kazachiy, year 1986 (Laktionov, 2014).

2) Astrakhan region, Astrakhan, channel Kutum, year 2006 (Laktionov, 2014).

LD

1) Rostov region, Kamensk district (observation) (Shcherbakov et al., 2017).

***Wolffia globosa* (Araceae)**

CI

1) Moscow region, Lyuberetskiy district, backwater of Pekhorka River above the bridge of the Moscow – Kazan railway, 14.08.2002, A. Shcherbakov (MW, MHA, IBIW; Mayorov et al., 2012).

2) Moscow region, Lyuberetskiy district, Tomilino town, backwater of the Pekhorka River near the bridge of the Yegoryevskoe highway, in mass, 14.08.2002, A. Shcherbakov (MW).

CC

1) Lipetsk region, Matyrskoe reservoir, year 2010 (Maevskiy, 2014).

***Egeria densa* (Hydrocharitaceae)**

CI

1) Moscow region, Lyuberetskiy district, in Pekhorka River near the Oktyabrskiy settlement, 25.07.1983, A.V. Shcherbakov (MW).

2) Moscow region, Lyuberetskiy district, in Pekhorka River between station Lyubertsy-2 and platform Korenevo, 01.04.1984, A. Shcherbakov (MW).

3) Moscow, in the pond of the Moscow forest park Izmailovo, 1985, A.N. Lufarov. In this location, the plant has frozen in the first winters (Mayorov et al., 2012).

4) Moscow region, Lyubertsy district, right bank Pekhorka River near Tomilino railway station, backwater, in water, 15.08.1998, S.V. Kuptsov (MW). Collected here by the same collector 03.06.2000 (MHA).

5) Moscow region, Lyubertsy district, Pekhorka River near railway bridge span Tomilino – Krasnevo, in mass, along banks, 03.12.2000, A. Shcherbakov (MW).

6) Near 55.35' N, 38.00' E. Moscow region, Lyubertsy district, Pekhorka River near Tomilino settlement, 13.10.1998, S.V. Kuptsov (MW). Collected here by the same collector 03.06.2000 (MHA).

7) Moscow region, Ramenskiy district, 13 km west-north-western Ramenskoe town and 1 km southwestern Vereya village, in the Pekhorka River, dominant in the Riverbed, 14.08.2002, A. Shcherbakov (MW).

8) Moscow region, Lyubertsy district. Between the Lyubertsy-2 railway station and platform Korenevo), in mass, under both banks, 30.08.2009, A. Shcherbakov, S. Mayorov (MW).

9) 55°39'1" N, 37°58'24" E. Moscow region, Lyubertsy district, Pekhorka River. In 500 m western Kraskovo railway station. Massive species up to the Lyubertsy treatment facilities (which is 3 km upstream). Blooming actively. 15.09.2011, K.Yu. Teplov (MHA).

10) 55.40'21 N, 37.57'46 E. Moscow region, Lyubertsy town, bank of the Pekhorka River, 08.08.2020, V.A. Shirobokov (MW).

LD

1) Rostov region, Oktyabrskiy district, Shakhty city, artificial reservoir of the mine named after 20 years of the Workers' and Peasants' Red Army, 21.07.1991, E.G. Tupikova (RV; Shcherbakov et al., 2017).

Elodea canadensis

The species is known everywhere, in all macroregions. *Elodea canadensis* has widely invaded water bodies of European Russia.

Years of the first finds in macroregions: N – 1905, NW – 1881, CI – 1885, VV – 1897, CC – 1910, MV – 1914, LV – 1920, LD – 1917 (Vinogradova et al., 2009).

***Elodea nuttallii* (Hydrocharitaceae)**

CI

1) Bryansk region, Karachaevskiy district, Berezovka village, pond, shallow water near the shore, 14.08.2017, N.N. Panasenko (BRSU).

***Hydrilla verticillata* (Hydrocharitaceae)**

CI

1) Moscow region, Moscow, Ostankino, territory of the Main Botanical Garden, in the ponds, in mass, 15.07.1972, A.K. Skvortsov (MHA). Special search investigations of this species by N.M. Reshetnikova in 2002 have not been successful. At present, this species is not reliably known in Moscow region (Mayorov et al., 2012).

LD

1) The north of Rostov-on-Don city, the shore of Rostov sea, in water, 24.06.1989, Klimontova, det. A. Shcherbakov (RV; Shcherbakov et al., 2017).

***Najas graminea* (Hydrocharitaceae)**

LV

1) Rice paddies in Volga-Akhtuba floodplain in front of the Selitrennoe settlement of Kharabalinskiy district in Astrakhan region, 25.08.1993, G. Klinkova (MHA).

2) In water of rice paddies of JSCCT “Kommunar” in Kamyzyakskiy district of Astrakhan region, 18.08.1997, G. Klinkova, V. Sagalaev (MHA) (Laktionov, 2009).

3) Astrakhan region, Kharabalinskiy district, Akhtuba River near the ferry crossing, 11.08.2012, V. Papchenkov, A. Laktionov, N. Vostrikova (IBIW, AGU).

4) Astrakhan region, Privolzhskiy district, River Rycha at the outlet of the Volga River, 12.08.2012, V. Papchenkov, A. Laktionov, N. Vostrikova (IBIW, AGU) (Laktionov et al., 2014).

LD

1) Rostov region, Proletarskiy district, 2 km north of the Proletarsk city, rice paddies, 08.08.2007, K.S. Artokhin, det. A. Shcherbakov (RVGB; Shcherbakov et al., 2017).

***Vallisneria americana* (Hydrocharitaceae)**

CI

1) Moscow region, River Perkhovka, in 1 km north-east of the Lyubertsy city, near the place of water discharge of the Lyubertsy aeration station, at flow, 31.07.2010, A. Shcherbakov, S. Lednev (MW, IBIW). In this location, the plant was reliably known until 2012 (perhaps, it does still grow there) (Mayorov et al., 2012).

***Eichhornia crassipes* (Pontederiaceae)**

CI

1) Moscow. In early 2000s, M.P. Shilov has found this plant in the Yauza River near Sviblovo within Moscow city (Herbarium of the Ivanovo State University; Mayorov et al., 2012).

2) In ponds at the Lopenka River to west of Zakharyino (South Butovo in Moscow), 11.09.2006, G.S. Eremkin, Yu.A. Nasimovich (MHA; Mayorov et al., 2012).

***Monochoria korsakowii* (Pontederiaceae)**

LV

1) In water and on wet shores of rice paddies of JSCCT “Kommunar” ” in Kamyzyakskiy district of Astrakhan region, 18.08.1997, G.Yu. Klinkova, V.A. Sagalaev (MHA; Skvortsov, 2006).

2) Astrakhan region, Kamyzyakskiy district, rice paddies, LLC “Nadezhda”, 7 km south-east of Kamyzyak town, near the road at the right bank of Tabola River, 30.08.2012, V. Papchenkov, A. Laktionov, N. Vostrikova (IBIW, AGU, SARAT; Laktionov, 2014).

***Sagittaria latifolia* (Alismataceae)**

NW

1) Leningrad region, Luzhskiy district, Vyalye lake, year 1927 (Tzvelev, 2000).

***Sagittaria platyphylla* (Alismataceae)**

CI

1) Moscow region, Lyubertsy district, Pekhorka River, near the bridge of the Kazan railway (Lyubertsy II – Korenevo section), a separate group under the wall, 20 m above the bridge 08.14.2002, A.V. Shcherbakov (MHA, MW).

2) Moscow region, Ramenskiy district, 13 km west-north-west of the city of Ramenskoye and 1 km south-east of the Vereya village, thicket on the right bank of the Pekhorka River, 08.14.2002, A.V. Shcherbakov (MHA).

3) Moscow region, Lyubertsy district, Pekhorka River, under bridge of the railway Lyubertsy – Cherusti, in groups, scattered, 30.08.2009, A. Shcherbakov, S. Mayorov (MHA).

4) Moscow region, Lyubertsy district, Pekhorka River, between railroad station Lyubertsy-II and platform Korenevo, under the shore on a water-covered ground, 30.08.2009, A. Shcherbakov, S. Mayorov (MHA).

5) Moscow region, Lyuberetskiy district, Pekhorka River, 2,5 km western of the railway station Korenevo. Massive view in the River from the railway bridge (the section between the railway station Lyubertsy-2 and the railway station Korenevo) and up to the Lyubertsy treatment

facilities (which is 600 m upstream). It actively grows and blooms in shallow waters along the coast, occupying vast areas. 09.15.2011. Collected K.Yu. Teplov (MHA).

6) Moscow region, Lyuberetskiy district, right bank of the Pekhorka River near the confluence of the Lyuberetskaya aeration station, in bulk, in shallow water, 4.10.2014, V.D. Bochkin, S.R. Maiorov (MHA).