The flora of the Batumi landfill (Adjara, Georgia)

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Abstract. Results of floristic research conducted within the territory of the Batumi landfill (Adjara, Georgia) are presented. The total area of the site is about 20 hectares, of which 10 hectares are active and the remaining part was closed in the beginning of the 21st century. In the closed area, the processes of formation of stabilized plant communities and spontaneous vegetation successions are going on. As a result of the survey, we revealed 244 species of vascular plants belonging to 163 genera of 59 families. Among them, 86 species are considered native and 158 species are alien. Among the listed species, 94 are representatives of the ruderal flora and others are species characteristic for various other habitats.

Keywords: Adjara, alien flora, Batumi, landfill, life forms, ruderal species

Supplementary Material. Electronic Supplement (Table E1, e1–e7) is available in the online version of this article at: https://ukrbotj.co.ua/archive/77/6/428

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Introduction

There are no present-day local floras in the world that have not been exposed to at least some, direct or indirect, anthropogenic impact. The anthropogenic transformation of vegetation covers all territories where human activities are manifested even to a minimal extent. As a result of the global anthropogenic impact, technogenic ecotopes are formed; those ecotopes have no natural analogues and they are often results of urbanization and include urban landscapes inhabited by species of the urban flora, ruderal flora, etc.

The urbanization index in Georgia is currently 53%. Among the cities and towns of Georgia, the city of Batumi is characterized by the fast urban growth and development.

In the middle of the 20th century the population of Batumi, according to the official data, was only slightly more than 82 thousand inhabitants. However, at the beginning of the 21st century it reached 120 thousand, and by 2018 the current estimate is ca. 163 thousand people or, according to unofficial data, even more. With the increase of its population, the city area was growing as well.
From the beginning of the 21st century, various construction activities, settlement and urban development of new territories continued in the Adjara seaside, accompanied by establishment, reconstruction and/or development of parks, gardens, and recreational places. For construction of residential buildings, shore protection works, other infrastructural and development projects, the construction materials are usually transported from one to another district of the city; the materials and goods are also imported from foreign countries. Most of ornamental plants (including their seeds and other planting material) are imported from abroad, which often results in unintentional introduction of alien weedy species, many of which are potential invaders. All of this adds to import of plants by the horticulturalists and plant lovers or the entrepreneurs for ornamental or production purposes; those plants spread in natural, disturbed, and artificial habitats, such as abandoned construction areas, road sides, streams and canals, and so on.

The city of Batumi and its adjacent areas play an important role in the processes of immigration and spread of alien plants in the region. The city is an open gateway between the eastern and western countries. It is a trade and transportation hub between Europe and Asia, from where different goods are carried in and through Georgia. The famous Batumi Botanical Garden, established in the 1880s and officially opened in 1912, is the major horticultural and plant research center of the Caucasus; it also played and continues to play an exceptionally important role in both deliberate and unintentional plant introduction, acclimation and naturalization in the region.

Other areas contributing to the alien plants diversity in the Batumi area is the Batumi Boulevard stretching along the Black Sea shore; it is a green area with the century-long history and rich introduced flora; together with other parks and green areas it also contributes to immigration and alien plants.

All those factors mentioned above promote intentional or unintentional spread of alien plants in the city territory and beyond. Many of those plants eventually find their way to the Batumi landfill territory with its peculiar transformed plant communities. In this area alien species often survive, proliferate, and form stable populations, in turn enriching the surrounding areas with unwanted aliens. Thus, our objective for the present research was to study the vegetation in the inactive, closed landfill area and its adjacent territory.

**Materials and methods**

The study site is located in the southwestern part of Georgia, in the floristic region of Adjara, 10–12 km from Batumi, on the right bank of the Chorokhi River, mainly at elevations of 1–5 m above sea level, between 41° 36.022’N and 41° 35.298’E. The total area of the Batumi landfill is about 20 hectares, of which 10 hectares are occupied by the actively used area, while other areas are now closed for waste dumping; that results in ongoing processes of formation of stabilized plant communities (Fig. 1, 2).

The landfill has been operating since the last century (officially established in the study site in 1965). Initially, the waste was only from the territory of Batumi, but during recent years other municipalities of Adjara have been added as customers of the landfill services. Almost all types of waste are found in this area, including household, construction, industrial waste, etc.

The climate of the study area is characterized by specific features and spatial variability. Seaside Adjara in general has a humid subtropical climate. During most of the year, western humid winds are dominant and only in winter months inland winds occurrences increase. The average annual temperature is +13°–15° C, while the coldest month's average temperature being +5.9–7.5 °C. Absolute temperatures rarely drop below –8°.

In the warmest months (July–August), the average temperature is +22–23 °C, the highest temperature reaching +39–40 °C. The average air humidity is 80–87% (Javakhishvili, 1926; Kordzakhia, 1961; Maruashvili, 1964; Nijaradze, 1978).

Investigation of the landfill flora was conducted during the period of 2015–2018. The main research method was the traditional route survey, which included plant description, photography, plant sampling, and laboratory processing, identification and herbarium preparation and curation. Laboratory activities were conducted in the Shota Rustaveli State University of Batumi, the Institute of Phytopathology and Biodiversity in Kobuleti.

Various floras and plant identification manuals and other scientific literature were used for identification of species: the identification manual of the Adjara flora (Dmitrieva, 1990a), manuals of the Georgian flora (Field guide..., 1964, 1969; Fischer et al., 2018) and contributions on the alien flora of Adjara (Davitadze, 2001, 2002; Kikodze et al., 2010; Mikeladze, 2013, 2017; Sharabidze et al., 2018). Online resources and databases on invasive species worldwide were also used (Elpel, 2013; GBD, 2007–onward). The classification
Fig. 1. Geographical position of the study site (investigated area)

Fig. 2. Typical plant communities in the closed area of the Batumi landfill
was checked according to the online databases of world plants (POWO, 2020–onward; WFO, 2020–onward). Life forms of plants were determined according to the Raunkiæra system (Raunkiæer, 1934). The origin of plant species is given following the flora of the Caucasus and other published and Internet resources (Takhtajan, 2003, 2006; etc.).

The time of the initial collection (first records) of non-native plants in the Adjara floristic district was determined following the herbarium specimens deposited in the Batumi Botanical Garden (BATU) and from various publications (Davitadze, 2001, 2002; Kikodze et al., 2010; Mikeladze, 2013, 2017; Sharabidze et al., 2018).

**Results and discussion**

After identification of the plant samples collected in the Batumi landfill, we registered totally 244 species of vascular plants that represent 59 families and 163 genera (Table E1). Cryptogamic vascular plants are represented by three species of horsetails (*Equisetum arvense* L., *E. palustre* L., *E. ramosissimum* L.). Naturalized ferns and gymnosperms have not been observed during the study period. Among angiosperms, monocotyledons and gymnosperms have not been observed during the study period. Among angiosperms, monocotyledons are represented by five or more species each (totally 63.86%), while dicotyledonous plants are represented by 43 species (17.62%) belonging to eight families.

Among the 59 families reported, 11 families are represented by five or more species each (totally 63.86%, 156 species). These families are listed in Table 1.

The remaining 48 families are represented collectively by 88 species; these families are *Convolvulaceae, Euphorbiaceae, Juncaceae, Malvaceae, Plantaginaceae, Rubiaceae* – each with four species; *Apiaceae, Commelinaceae, Equisetaceae, Onagraceae, Plantaginaceae, Scrophulariaceae, Typhaceae* – each with three species; *Adoxaceae, Araliaceae, Boraginaceae, Gentianaceae, Juglandaceae, Moraceae, Ranunculaceae, Salicaceae, Simaroubaceae, Violaceae, Verbenaceae* – each with two species. The families *Araceae, Balsaminaceae, Betulaceae, Caprifoliaceae, Cleomaceae, Cornaceae, Elaeagnaceae, Gentianaceae, Geraniaceae, Hypericaceae, Iridaceae, Lythraceae, Nyctaginaceae, Orobanchaceae, Papaveraceae, Phytolaccaceae, Platanaceae, Portulacaceae, Primulaceae, Sapindaceae, Saxifragaceae, Smilacaceae, Urticaceae, Vitaceae* are represented each by one species.

The best represented genera by their species number are: *Persicaria Mill.* (7 species); *Amaranthus L.*, *Solanum L.*, *Trifolium L.* (each with 5 species); *Artemisia L.*, *Carex L.*, *Rubus L.* (each with 4 species); *Cyperus L.*, *Equisetum L.*, *Erigeron L.*, *Euphorbia L.*, *Galium L.*, *Juncus L.*, *Mentha L.*, *Poa L.*, *Rumex L.*, *Senecio L.*, *Stellaria L.*, *Veronica L.*, *Xanthium L.* (each with 3 species).

Of the species registered in the Batumi landfill, 86 species (35.25%) are considered native and 158 species (64.75%) are aliens (introduced). Among aliens, 48 species are of East Asian origin, 34 species originated in Europe, 1 species is Australian, 13 – South American, 29 – North American, and 33 are Mediterranean ones (Fig. 3).

Our phytogeographical analysis demonstrated the largest number of East Asian species, which is due to many factors. In particular, those factors include similar climatic conditions (including high humidity, precipitation, favorable temperatures during the whole year, fertile soils, etc.). Also, it reflects the history of introduction of taxa for cultivation, as well as their associated weeds. For example, it is known that East Asia was considered among highest geographical priorities for introduction of plants in the Batumi Botanical Garden since its establishment. The species of the Mediterranean and European origin follow by their number, which is also partly determined by the phytogeographic structure of the Adjara flora.

The analysis of life forms of the Batumi landfill flora demonstrated the predominance of therophytes and hemicryptophytes. Therophytes (herbaceous annuals) are represented by 108 (44.26%) species. The second

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**Table 1. Families represented in the area by more than five species each**

| No | Families                      | Number of species | Species, % |
|----|-------------------------------|-------------------|------------|
| 1  | Asteraceae/Compositae         | 43                | 17.62      |
| 2  | Poaceae/Gramineae             | 22                | 9.01       |
| 3  | Fabaceae/Leguminosae          | 18                | 7.37       |
| 4  | Lamiaceae/Labiatae            | 13                | 5.32       |
| 5  | Polygonaceae                 | 12                | 4.91       |
| 6  | Rosaceae                     | 10                | 4.09       |
| 7  | Cyperaceae                   | 10                | 4.09       |
| 8  | Amaranthaceae                | 9                 | 3.68       |
| 9  | Solanaceae                   | 7                 | 2.86       |
| 10 | Brassicaceae                 | 7                 | 2.86       |
| 11 | Caryophyllaceae              | 5                 | 2.05       |
|    | Total in 11 families          | 156 species       | 63.86      |

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place is occupied by hemicryptophytes with 60 species (26.10%) of mainly biennial and perennial herbaceous plants (Table 2).

The dominant positions of therophytes and hemicryptophytes are related to the peculiarities of the species composition of the local ruderal flora. Phanerophytes are quite diverse, out of 33 species 14 are local and 19 are of alien origin.

In the study area, phanerophytes usually flower, bear fruit, establish seedlings normally, and thus they are characterized by a complete cycle of development; sometimes they dominate in local plant communities.

Besides the typical ruderal species recorded in the Batumi landfill (inactive or closed area) we came across the species characteristic for various habitats, such as – forests, moist meadows, low and high mountain zones, etc. Out of 244 species, 94 are representatives of the ruderal flora (Tabl. E1).

Furthermore, a number of sub-spontaneously distributed cultivated species (occasional escapes, such as maize, beans, tomato, pumpkin, watermelon, melon and other crop plants) were also found. Usually such garden escapes or agricultural crops are only of ephemeral occurrence, not forming stable populations.

Conclusions

Among 244 species of 163 genera and 59 families registered to date in the Batumi landfill area, we have met species which are characteristic for different habitat of the region of Adjara. 94 species of plants (38.52% of the total species list) are species characteristic for ruderal habitats.

Cryptogamic plants are represented by 3 species of horsetails. Dicotyledonous plants are represented by 198 species and monocotyledons – by 43 species. Families represented by more than 10 species each are Asteraceae/Compositae, Poaceae/Gramineae, Fabaceae/Leguminosae, Lamiaceae/Labiatae, Polygonaceae, and Rosaceae.

The analysis of plants life forms registered in the on Batumi landfill demonstrated that therophytes form the dominant group (44.26%), followed by hemicryptophytes (63 species or 26.10%). The dominant positions of therophytes and hemicryptophytes are in accordance with their position in other ruderal floras.

Among the species, 86 are considered native and 158 are aliens. Among aliens, the largest group (in terms of the number of species) is comprised by plants of East Asian origin (48 species). That is due to similar climatic

Fig. 3. Groups of Batumi landfill plants by their origin

| Life Form       | Number of species | Species, % |
|-----------------|-------------------|------------|
| Therophytes     | 108               | 44.26      |
| Hemicryptophytes| 63                | 26.10      |
| Phanerophytes   | 33                | 13.52      |
| Cryptophytes    | 25                | 10.49      |
| Chamaephytes    | 13                | 5.35       |
| Total           | 244               | 100        |

Table 2. Life forms of plants in the Batumi landfill flora
conditions of Adjara and many East Asian regions (including high humidity and precipitation, favorable temperatures during the whole year, fertile soils, etc.).

We understand that the list of species reliably registered to date in the Batumi landfill area is not complete and additional species (both alien and native ones) will be registered there in the future. Because of that we are planning to continue our surveys of the landfill flora, especially for monitoring invasive and potentially invasive species. The species list presented here will serve as a reference checklist reflecting the present state of our knowledge of the local flora; it will be amended and improved during the future research.

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Table E1. A checklist of the Batumi landfill flora

| No | Species | Families | Class | Origin | Ecological group | Life form | FRT |
|----|---------|----------|-------|--------|------------------|-----------|-----|
| 1  | Abutilon theophrasti Medik. | Malvaceae | Eu    | Mediterranean | R       | Th     | 1940 |
| 2  | Acacia dealbata Link | Leguminosae | Eu    | Australia | F       | Ph     | 2010 |
| 3  | Acalypha australis L. | Euphorbiaceae | Eu    | East Asia | R       | Th     | 1926 |
| 4  | Acer negundo L. | Sapindaceae | Eu    | North America | R       | Ph     | 2007 |
| 5  | Ailanthus altissima (Mill.) Swingle | Simaroubaceae | Eu    | East Asia | P       | Ph     | 1927 |
| 6  | Airea elegans Wild. ex Gaudin / Molineriella laevis (Brot.) Rouy. | Poaceae | Mo    | Mediterranean | F       | Th     | 1917 |
| 7  | Ajuga reptans L. | Lamiaceae | Eu    | Native | P       | He     | -    |
| 8  | Alnus glutinosa subsp. barbata (C.A.Mey.) Yalt. (Alnus barbata C.A.Mey.) | Betulaceae | Eu    | Native | F       | Ph     | -    |
| 9  | Alocasia macrorrhizos (L.) G.Don | Araceae | Eu    | East Asia | G       | Cr     | 2017 |
| 10 | Amaranthus albus L. | Amaranthaceae | Eu    | North America | R       | Th     | 1941 |
| 11 | Amaranthus caudatus L. | Amaranthaceae | Eu    | South America | R       | Th     | 1917 |
| 12 | Amaranthus deflexus L. | Amaranthaceae | Eu    | South America | R       | Th     | 1941 |
| 13 | Amaranthus blitum (A. lividus L.) | Amaranthaceae | Eu    | South America | R       | Th     | 1938 |
| 14 | Amaranthus retroflexus L. | Amaranthaceae | Eu    | North America | R       | Th     | 1941 |
| 15 | Ambrosia artemisiifolia L. | Compositae | Eu    | North America | R       | Th     | 1938 |
| 16 | Ammi visnaga (L.) Lam. / Visnaga daucoides Gaertn. | Apiaceae | Eu    | Mediterranean | F       | Th     | 1969 |
| 17 | Amorpha fruticosa L. | Leguminosae | Eu    | North America | F       | Ph     | 1955 |
| 18 | Angelica sylvestris L. | Apiaceae | Eu    | Native | F       | Cr     | -    |
| 19 | Anthemis cotula L. | Compositae | Eu    | Europe | R       | Th     | 1917 |
| 20 | Arabis nova Vill. (A. auriculata Lam.) | Brassicaceae | Eu    | Native | R       | Th     | -    |
| 21 | Arctium lappa L. | Compositae | Eu    | Europe | R       | Th     | 1952 |
| 22 | Artemisia absinthium L. | Compositae | Eu    | Native | R       | He     | 1920 |
| 23 | Artemisia annua L. | Compositae | Eu    | Mediterranean | R       | Th     | 1960 |
| 24 | Artemisia verlotiorum Lamotte (A. vulgaris auct. p.p., non L.) | Compositae | Eu    | East Asia | R       | He     | 2010 |
| 25 | Artemisia vulgaris L. | Compositae | Eu    | Mediterranean | R       | He     | 1945 |
| 26 | Arthraxon hispidus (Thunb.) Makino | Poaceae | Mo    | East Asia | R       | Th     | 1926 |
| 27 | Atriplex tatarica L. | Amaranthaceae | Eu    | Native | R       | Th     | 1939 |
| 28 | Bidens cernua L. | Compositae | Eu    | Native | R       | Th     | -    |
| 29 | Bifora radians M.Bieb. (Coriandrum radians (M.Bieb.) Prantl) | Compositae | Eu    | Native | R       | Th     | -    |
| 30 | Bothriochloa ischaemum (L.) Keng | Poaceae | Mo    | Mediterranean | F       | He     | 1919 |
| 31 | Buddleja davidii Franch. | Scrophulariaceae | Eu    | East Asia | R       | Ph     | 2010 |
| 32 | Calystegia sepium (L.) R.Br. | Convolvulaceae | Eu    | Native | H       | He     | -    |
| 33 | Calystegia soldanella (L.) R.Br. | Convolvulaceae | Eu    | Native | H       | He     | -    |
| No | Species                                      | Families          | Class | Origin     | Ecological group | Life form | FRT  |
|----|---------------------------------------------|-------------------|-------|------------|------------------|-----------|------|
| 34 | Capsella bursa-pastoris (L.) Medik.         | Brassicaceae      | Eu    | Native     | R                | He        | -    |
| 35 | Cardamine hirsuta L.                        | Brassicaceae      | Eu    | Europe     | R                | Th        | 1938 |
| 36 | Cardamine parviflora L.                     | Brassicaceae      | Eu    | Native     | R                | Th        | -    |
| 37 | Cardamine quinquefolia (M.Bieb.) Schmalh.   | Brassicaceae      | Eu    | Native     | P                | Th        | -    |
| 38 | Carex divisa Stokes                         | Cyperaceae        | Mo    | Native     | P                | Ch        | -    |
| 39 | Carex hirta L.                              | Cyperaceae        | Mo    | Native     | H                | Ch        | -    |
| 40 | Carex leporina L.                           | Cyperaceae        | Mo    | Native     | H                | Ch        | -    |
| 41 | Carex pendula Huds.                         | Cyperaceae        | Mo    | Native     | H                | Ch        | -    |
| 42 | Carya cordiformis (Wangenhi.) K.Koch        | Juglandaceae      | Eu    | East Asia  | F                | Ph        | 2000 |
| 43 | Carum carvi L.                              | Compositae        | Eu    | Native     | G                | He        | -    |
| 44 | Centaurea oylepis (Wimm. & Grab.) Hayek     | Compositae        | Eu    | Mediterranean | P    | Th        | 1990 |
| 45 | Centaurea triturfurum (Hoffmanns. & Link) Fritsch | Gentianaceae      | Eu    | Native     | P                | Th        | -    |
| 46 | Cerasium glomeratum Thuill.                  | Caryophyllaceae   | Eu    | Mediterranean | P    | He        | 1939 |
| 47 | Chelidonium majus L.                        | Papaveraceae      | Eu    | Native     | R                | He        | -    |
| 48 | Chenopodium album L.                        | Amaranthaceae     | Eu    | Europe     | R                | Th        | 1911 |
| 49 | Chenopodium urbicum L. / Oxybasis urbico (L.) S.Fuentes, Uotila & Borsch | Amaranthaceae     | Eu    | Europe     | R                | Th        | 1950 |
| 50 | Cichorium intybus L.                        | Compositae        | Eu    | Native     | P-M              | He        | -    |
| 51 | Cirsium arvense (L.) Scop.                  | Compositae        | Eu    | Europe     | R                | He        | 1917 |
| 52 | Cirsium vulgare (Savi) Ten.                 | Compositae        | Eu    | Mediterranean | R    | He        | 1937 |
| 53 | Cleome houtteana Schltdl. / Tarenaya hassleriana (Chodat) Ilitis | Cleomaceae        | Eu    | South America | P    | Th        | 2017 |
| 54 | Commelina communis L.                       | Commelinaceae     | Mo    | East Asia  | P R              | Th        | 1944 |
| 55 | Convolvulus arvensis L.                     | Convolvulaceae    | Eu    | Europe     | R                | Cr        | 1914 |
| 56 | Coreopsis tinctoria Nutt. (Bidens tinctoria (Nutt.) Baill.) | Compositae        | Eu    | North America | P    | Th        | 2016 |
| 57 | Cornus sanguinea L. subsp. australis (C.A.Mey.) Žav. (C. australis C.A.Mey.) | Cornaceae        | Eu    | Native     | F                | Ph        | -    |
| 58 | Crocosphalum crepidioides (Benth.) S.Moore | Compositae        | Eu    | South America | R    | Th        | 1934 |
| 59 | Crepis setosa Haller f. (Aegosseris setosa (Haller f.) Fourr.) | Compositae        | Eu    | Mediterranean | P    | Th        | 1939 |
| 60 | Cuscuta australis R.Br.                     | Convolvulaceae    | Eu    | Native     | R                | Th        | -    |
| 61 | Cynoglossum craticum Mill.                  | Boraginaceae      | Eu    | Mediterranean | R    | He        | 1916 |
| 62 | Cyperus badius Poir.                        | Cyperaceae        | Mo    | Mediterranean | H    | Cr        | 1940 |
| 63 | Cyperus esculentus L.                       | Cyperaceae        | Mo    | Mediterranean | H    | Cr        | 1917 |
| 64 | Cyperus longus L.                           | Cyperaceae        | Mo    | Native     | H                | Cr        | -    |
| 65 | Datura stramonium L.                        | Solanaceae        | Mo    | Native     | R                | Th        | 1916 |
| 66 | Daucus carota L.                            | Apiaceae          | Eu    | Europe     | P                | Cr        | XX beg. |
| 67 | Digitaria violascens Link                   | Poaceae           | Mo    | East Asia  | R                | Th        | 1927 |
| 68 | Dysphania ambrosioides (L.) Mosyakin & Clemants (Chenopodium ambrosioides L.) | Amaranthaceae | Eu    | South America | R    | He        | 1930 |
| No | Species | Families | Class | Origin | Ecological group | Life form | FRT  |
|----|---------|----------|-------|--------|------------------|-----------|------|
| 69 | *Echinochloa crus-galli* (L.) P.Beauv. | Poaceae | Mo    | East Asia | P | Th | 1916 |
| 70 | *Eleusine indica* (L.) Gaertn. | Poaceae | Mo    | East Asia | R | Th | AnT |
| 71 | *Elsholtzia ciliata* (Thunb.) Hyl. | Lamiaceae | Eu    | East Asia | R | Th | 1934 |
| 72 | *Epilobium palustre* L. | Onagraceae | Eu    | Native | H | He | -  |
| 73 | *Equisetum arvense* L. | Equisetaceae | sp    | Native | H | Cr | -  |
| 74 | *Equisetum palustre* L. | Equisetaceae | sp    | Native | H | Cr | -  |
| 75 | *Equisetum ramosissimum* Desf. | Equisetaceae | sp    | Native | H | Cr | -  |
| 76 | *Erigeron annuus* (L.) Pers. | Compositae | Eu    | North America | P | Th | 1929 |
| 77 | *Erigeron bonariensis* L. (Conyza bonariensis (L.) Cronquist) | Compositae | Eu    | North America | R | He | 1939 |
| 78 | *Erigeron canadensis* L. (Conyza canadensis (L.) Cronquist) | Compositae | Eu    | North America | R | Th | 1900 |
| 79 | *Eriobotrya japonica* (Thunb.) Lindl. | Rosaceae | Eu    | East Asia | P | Ph | 2009 |
| 80 | *Euphorbia falcata* L. | Euphorbiaceae | Eu    | Native | R | Th | -  |
| 81 | *Euphorbia peplus* L. | Euphorbiaceae | Eu    | Mediterranean | R | Th | 1917 |
| 82 | *Euphorbia stricta* L. | Euphorbiaceae | Eu    | Mediterranean | R | Th | 1938 |
| 83 | *Fallopia dumetorum* (L.) Holub (Polygonum dumetorum L.) | Polygonaceae | Eu    | Native | R | Th | -  |
| 84 | *Ficus carica* L. | Moraceae | Eu    | Native | S | Ph | -  |
| 85 | *Filago arvensis* L. | Compositae | Eu    | Native | M | Th | -  |
| 86 | *Filago gallica* L. / *Logfia gallica* (L.) Coss. & Germ. | Compositae | Eu    | Europe | P | Th | 1932 |
| 87 | *Fragaria vesca* L. | Rosaceae | Eu    | Native | G | He | -  |
| 88 | *Frangula alnus* Mill. | Rosaceae | Eu    | Native | F | Ph | -  |
| 89 | *Galinsoga ciliata* S.F.Blake / *Galinsoga quadriradiata* Ruiz & Pav. | Compositae | Eu    | North America | R | Th | 1914 |
| 90 | *Galinsoga parviflora* Cav. | Compositae | Eu    | North America | R | Th | 1970 |
| 91 | *Galium palustre* L. | Rubiaceae | Eu    | Native | R | Th | -  |
| 92 | *Galium spurium* L. | Rubiaceae | Eu    | Europe | R | Th | 1939 |
| 93 | *Galium tricornutum* Dandy | Rubiaceae | Eu    | Europe | R | Th | 1939 |
| 94 | *Geranium dissectum* L. | Geraniaceae | Eu    | Mediterranean | G | Th | 1916 |
| 95 | *Geranium sibiricum* L. | Geraniaceae | Eu    | Europe | G | He | 1967 |
| 96 | *Glechoma hederacea* L. | Lamiaceae | Eu    | Native | P | Ph | -  |
| 97 | *Gleditsia triacanthos* L. | Leguminosae | Eu    | North America | F | Ph | 1953 |
| 98 | *Hibiscus syriacus* L. | Malvaceae | Eu    | East Asia | R | Ph | 1968 |
| 99 | *Hippophae rhamnoides* L. (Elaeagnus rhamnoides (L.) A.Nelson.) | Elaeagnaceae | Eu    | Native | G | Ph | -  |
| 100 | *Hydrocotyle ramiflora* Maxim. | Araliaceae | Eu    | East Asia | H | Ch | 1920 |
| 101 | *Hydrocotyle vulgaris* L. | Araliaceae | Eu    | Europe | H | Ch | 1920 |
| 102 | *Hypericum androsaemum* L. | Hypericaceae | Eu    | Native | F | Ch | -  |
| 103 | *Hyperaeris radiata* Falk. | Compositae | Eu    | Native | P | He | -  |
| 104 | *Impatiens balsamina* L. | Balsaminaceae | Eu    | East Asia | R | Th | 2018 |
| 105 | *Juglans ailanthifolia* Carrière | Juglandaceae | Eu    | East Asia | F | Ph | 2000 |
| 106 | *Juncus bufonius* L. | Juncaceae | Mo    | Native | H | Th | -  |
| 107 | *Juncus effusus* L. | Juncaceae | Mo    | Native | H | Cr | -  |
| No  | Species                                      | Families         | Class | Origin   | Ecological group | Life form | FRT   |
|-----|---------------------------------------------|------------------|-------|----------|------------------|-----------|-------|
| 108 | *Juncus tenuis* Wild.                       | Juncaceae        | Mo    | Native   | H                | Cr        | -     |
| 109 | *Kummerowia striata* (Thunb.) Schindl. / *Lespedeza striata* (Thunb.) | Leguminosae      | Eu    | East Asia| R                | Th        | 1968  |
| 110 | *Kyllinga gracilimis* Miq. / *Cyperus brevifolius* Thieret & Delahouss. | Cyperaceae       | Mo    | East Asia| H                | He        | 1927  |
| 111 | *Lactuca serriola* L.                      | Compositae       | Eu    | Native   | R                | He        | -     |
| 112 | *Lamium purpureum* L. (Lamiopsis purpurea (L.) Opiz) | Lamiaceae       | Eu    | Europe   | R                | He        | 1938  |
| 113 | *Laphangium affine* (D.Don) Tzvelev / *Pseudognaphalium affine* (D.Don) Anderb. | Compositae       | Eu    | East Asia| R                | He        | 1916  |
| 114 | *Laphangium luteoalbum* (L.) Tzvelev / *Helichrysum luteoalbum* (L.) Rehb. | Compositae       | Eu    | East Asia| R                | He        | 1920  |
| 115 | *Lathyrus aphaca* L.                       | Leguminosae      | Eu    | Europe   | R                | Th        | 1939  |
| 116 | *Lathyrus hirsutus* L.                     | Leguminosae      | Eu    | Native   | S                | Th        | -     |
| 117 | *Leontodon hispidus* L.                   | Compositae       | Eu    | Native   | S                | Th        | -     |
| 118 | *Lepidium campestre* (L.) W.T.Aiton         | Brassicaceae     | Eu    | Mediterranean | P          | He        | 1942  |
| 119 | *Lepidium coronopus* (L.) Al-Shehbaz (Coronopus squamatus (Forssk.) Asch.) | Brassicaceae     | Eu    | Mediterranean | R          | He        | 1980  |
| 120 | *Lespedeza bicolor* Turcz.                 | Leguminosae      | Eu    | East Asia| R                | Ch        | 1968  |
| 121 | *Lotium perenne* L.                       | Poaceae          | Mo    | Europe   | R                | Ch        | 1925  |
| 122 | *Lotium rigidum* Gaudin                    | Poaceae          | Mo    | Mediterranean | R          | Th        | 1944  |
| 123 | *Lonicera japonica* Thunb.                | Caprifoliaceae   | Eu    | East Asia| R                | Ph        | 1929  |
| 124 | *Lotus tenuis* Waldst. & Kit. ex Wild.     | Leguminosae      | Eu    | Native   | P                | He        | -     |
| 125 | *Ludwigia palustris* (L.) Elliott          | Onagraceae       | Eu    | North America | T          | R        | 1938  |
| 126 | *Luzula forsteri* (Sm.) DC.                | Juncaceae        | Mo    | Native   | G                | He        | -     |
| 127 | *Lycopus europaeus* L.                    | Lamiaceae        | Eu    | Native   | H                | He        | -     |
| 128 | *Lythrum japonica* Thunb.                 | Primulaceae      | Eu    | East Asia| R                | He        | 1938  |
| 129 | *Lythrum salicaria* L.                    | Lythraceae       | Eu    | Native   | H                | Cr        | -     |
| 130 | *Malva ambigua* Guss.                     | Malvaceae        | Mo    | Europe   | R                | He        | 1939  |
| 131 | *Malva neglecta* Wallr.                   | Malvaceae        | Eu    | Native   | R                | He        | 1938  |
| 132 | *Marrubium vulgare* L.                    | Lamiaceae        | Eu    | Mediterranean | R          | Ch        | 1970  |
| 133 | *Melilotus albus* Medik.                  | Leguminosae      | Eu    | Native   | P                | Th        | 1966  |
| 134 | *Melilotus officinalis* (L.) Lam.         | Leguminosae      | Eu    | Native   | P                | Th        | -     |
| 135 | *Mentha aquatica* L.                      | Lamiaceae        | Eu    | Native   | H                | He        | -     |
| 136 | *Mentha pulegium* L.                      | Lamiaceae        | Eu    | Native   | H                | He        | -     |
| 137 | *Microstegium imberbe* (Ness) Tzvelev / *Microstegium vimenum* (Trin.) A.Camus | Poaceae          | Mo    | East Asia| R                | Th        | 1917  |
| 138 | *Microstegium japonicum* (Miq.) Koidz.     | Poaceae          | Mo    | East Asia| R                | He        | 1927  |
| 139 | *Mirabilis jalapa* L.                     | Nyctaginaceae    | Eu    | South America | R          | Cr        | 2012  |
| 140 | *Miscanthus sinensis* Andersson           | Poaceae          | Mo    | East Asia| R                | Cr        | 1926  |
| 141 | *Morus alba* L.                           | Moraceae         | Eu    | East Asia| G                | Ph        | AnT   |
| 142 | *Myosotis palustris* (L.) Nathh. / *Myosotis scorpioides* L. | Boraginaceae     | Eu    | Native   | H                | He        | -     |
| 143 | *Oenothera biennis* L. s.l.               | Onagraceae       | Eu    | North America | R          | He        | 1927  |
| 144 | *Oppilmenus burmanni* (Retz.) P.Beauv.     | Poaceae          | Mo    | East Asia| R                | He        | 1930  |
| 145 | *Opilmenus undulatifolius* (Ar.d.) Beauv.  | Poaceae          | Mo    | East Asia| F                | He        | AnT   |
| No | Species | Families | Class | Origin    | Ecological group | Life form | FRT  |
|----|----------|----------|-------|-----------|------------------|-----------|------|
| 146 | Oxalis corniculata L. | Lamiaceae | Eu    | North America | R    | Th | 1916 |
| 147 | Oxalis violacea L. | Lamiaceae | Eu    | North America | R | Cr | 1946 |
| 148 | Parentucellia latifolia Caruel. | Orobanchaceae | Eu | Europe | P | Th | 2009 |
| 149 | Parthenocissus quinquefolia (L.) Planch. | Vitaceae | Eu | North America | R | Ph | 2015 |
| 150 | Paspalum distichum L. (P. paspalodes (Michx.) Scribn.) | Poaceae | Mo | East Asia | R | Cr | XX-beg. |
| 151 | Paspalum thunbergii Kunth ex Steud. | Poaceae | Mo | East Asia | R | Cr | 1920 |
| 152 | Perilla nankinensis (Lour.) Decne / Perilla frutescens var. crispa (Thunb.) H.Deane | Lamiaceae | Eu | East Asia | R | Th | 1910 |
| 153 | Persicaria hydropiper (L.) Delarbre (Polygonum hydropiper L.) | Polygonaceae | Eu | Native | H | Th | - |
| 154 | Persicaria maculosa Gray (Polygonum persicaria L.) | Polygonaceae | Eu | Native | H | Th | - |
| 155 | Persicaria minor (Huds.) Opiz (Polygonum minus Huds.) | Polygonaceae | Eu | Europe | R | Th | 1917 |
| 156 | Persicaria orientalis (L.) Spach. (Polygonum orientale L.) | Polygonaceae | Eu | East Asia | R | Th | 1924 |
| 157 | Persicaria perfoliata (L.) H.Gross (Polygonum perfoliatum L.) | Polygonaceae | Eu | East Asia | R | Th | 1924 |
| 158 | Persicaria posumbu (Buch.-Ham. ex D.Don) H.Gross (Polygonum posumbu Buch.-Ham. ex D.Don) | Polygonaceae | Eu | East Asia | R | Th | 1910 |
| 159 | Persicaria thunbergii (Siebold & Zucc.) H.Gross (Polygonum thunbergii Siebold & Zucc.) | Polygonaceae | Eu | East Asia | H | Th | 1927 |
| 160 | Physalis ixocarpa Brot. ex Hornem. | Solanaceae | Eu | North America | P | Th | 1935 |
| 161 | Phytolacca americana L. | Phytolaccaceae | Eu | North America | R | Cr | XX-beg. |
| 162 | Plantago major L. | Plantaginaceae | Eu | Native | R | He | - |
| 163 | Platanus occidentalis L. | Platanaceae | Eu | North America | F | Ph | 2008 |
| 164 | Poa annua L. | Poaceae | Mo | Europe | H | Th | 1917 |
| 165 | Poa compressa L. | Poaceae | Mo | Europe | P | He | 1925 |
| 166 | Poa pratensis L. | Poaceae | Mo | Native | G | He | - |
| 167 | Polycarpon tetraphyllum (L.) L. | Caryophyllaceae | Eu | Mediterranean | P | Th | 1939 |
| 168 | Polygonum aviculare L. | Polygonaceae | Eu | Europe | R | Th | 1917 |
| 169 | Potentilla indica (Andrews) Th.Wolf. (Duchesnea indica (Andrews) Teschem.) | Rosaceae | Eu | East Asia | P | He | 1924 |
| 170 | Portulaca oleracea L. s.l. | Portulacaceae | Eu | Mediterranean | R | Th | 1977 |
| 171 | Prunella vulgaris L. | Lamiaceae | Eu | Native | F | Th | - |
| 172 | Pycreus flavescens (L.) P.Beauv. ex Rehb. | Cyperaceae | Mo | Native | H | Th | - |
| 173 | Ranunculus muricatus L. | Ranunculaceae | Eu | Mediterranean | R | Th | 1917 |
| 174 | Ranunculus sceleratus L. | Ranunculaceae | Eu | Europe | H | He | 1939 |
| 175 | Rhus javanica L. | Simaroubaceae | Eu | East Asia | R | Ph | 1929 |
| 176 | Robinia pseudoacacia L. | Leguminosae | Eu | North America | F | Ph | 1965 |
| 177 | Rosa multiflora Thunb. | Rosaceae | Eu | East Asia | P | Ph | 2016 |
| 178 | Rubus anatolicus Focke. | Rosaceae | Eu | Native | F | Ph | - |
| 179 | Rubus caesius L. | Rosaceae | Eu | Native | F | Ph | - |
| 180 | Rubus proiectus A.Beck (Rubus hirtus auct.) | Rosaceae | Eu | Native | F | Ph | - |
| No | Species | Families | Class | Origin | Ecological group | Life form | FRT |
|----|---------|----------|-------|--------|------------------|-----------|-----|
| 181 | *Rubus serpens* Weihe ex Lej. & Courtois | Rosaceae | Eu | Native | F | Ph | - |
| 182 | *Rudbeckia hirta* L. | Compositae | Eu | North America | R | He | 1960 |
| 183 | *Rumex acetosella* L. | Polygonaceae | Eu | Native | G | He | - |
| 184 | *Rumex acetosella* subsp. *acetoselloides* (Balansa) Den Nijs (*Rumex acetoselloides* Balansa) | Polygonaceae | Eu | Native | R | He | - |
| 185 | *Rumex pulcher* L. | Polygonaceae | Eu | Native | R | He | - |
| 186 | *Salix babylonica* L. | Salicaceae | Eu | East Asia | H | Ph | - |
| 187 | *Salix caprea* L. | Salicaceae | Eu | Native | H | Ph | - |
| 188 | *Sambucus ebulus* L. | Adoxaceae | Eu | Native | R | Ch | - |
| 189 | *Sambucus nigra* L. | Adoxaceae | Eu | Native | F | Ph | - |
| 190 | *Saxifraga stolonifera* Curtis | Saxifragaceae | Eu | East Asia | P | Cr | 1960 |
| 191 | *Scirpus sylvaticus* L. | Cyperaceae | Mo | Native | H | Cr | - |
| 192 | *Scrophularia nodosa* L. | Scrophulariaceae | Eu | Europe | H | He | 1916 |
| 193 | *Senecio sylvaticus* L. | Compositae | Eu | Native | P | Th | - |
| 194 | *Senecio vernalis* Waldst. & Kit. | Compositae | Eu | Mediterranean | R | Th | 1918 |
| 195 | *Senecio vulgaris* L. | Compositae | Eu | Europe | R | Th | 1916 |
| 196 | *Setaria faberi* R.A.W. Herrm. | Poaceae | Mo | Mediterranean | R | Th | 1913 |
| 197 | *Setaria intermedia* Roem. & Schult. | Poaceae | Mo | East Asia | R | Th | 1930 |
| 198 | *Sherardia arvensis* L. | Rubiaceae | Eu | Native | R | Th | - |
| 199 | *Sedgesbeckia orientalis* L. | Compositae | Eu | East Asia | R | Th | 1917 |
| 200 | *Sisymbrium officinale* (L.) Scop. | Brassicaceae | Eu | Mediterranean | R | Th | 1939 |
| 201 | *Sisyrinchium septentrionale* E.P.Bicknell | Iridaceae | Mo | North America | R | Th | 2010 |
| 202 | *Smilax excelsa* L. | Smilacaceae | Mo | Native | F | Ph | - |
| 203 | *Solanum carolinense* L. | Solanaceae | Eu | North America | R | Ch | 1959 |
| 204 | *Solanum decipiens* Opiz | Solanaceae | Eu | Europe | R | Th | 1945 |
| 205 | *Solanum luteum* Mill. | Solanaceae | Eu | South America | R | Th | 1963 |
| 206 | *Solanum nigrum* L. | Solanaceae | Eu | Europe | R | Th | 1917 |
| 207 | *Solanum pseudocapsicum* L. | Solanaceae | Eu | South America | R | Ph | 1961 |
| 208 | *Solidago canadensis* L. | Compositae | Eu | North America | R | He | 2014 |
| 209 | *Sorghum halepense* (L.) Pers. | Poaceae | Mo | Mediterranean | R | He | 1920 |
| 210 | *Spinagnum erectum* L. (incl. *S. erectum* subsp. *neglectum* (Bechy) K.Richt.) | Typhaceae | Mo | Native | H | Cr | - |
| 211 | *Spiraea japonica* L.f. | Rosaceae | Eu | East Asia | R | Ph | 1900 |
| 212 | *Sporobolus fertilis* (Steud.) Clayton | Poaceae | Mo | East Asia | R | He | 1929 |
| 213 | *Stachys annua* L. | Lamiaceae | Eu | Europe | R | Th | 1960 |
| 214 | *Stellaria graminea* L. | Caryophyllaceae | Eu | Europe | P | He | 1938 |
| 215 | *Stellaria holostea* L. / *Rabelera holostea* (L.) M.T.Sharples & E.A.Tripp | Caryophyllaceae | Eu | Native | P | He | - |
| 216 | *Stellaria media* (L.) Vill. | Caryophyllaceae | Eu | Europe | H | Th | 1916 |
| 217 | *Symphyotrichum graminifolium* (Spreng.) G.L. Nesom (*Conyzanthus graminifolius* (Spreng.) Tamansch.) | Compositae | Eu | South America | R | He | 1927 |
| 218 | *Tagetes minuta* L. | Compositae | Eu | South America | R | Th | 1934 |
| No | Species                                      | Families       | Class | Origin   | Ecological group | Life form | FRT  |
|----|---------------------------------------------|----------------|-------|----------|------------------|-----------|------|
| 219| *Taraxacum officinale* Wigg.                | Compositae     | Eu    | Native   | G                | Cr        | -    |
| 220| *Torilis arvensis* (Huds.) Link             | Compositae     | Eu    | Europe   | R                | Th        | 1952 |
| 221| *Torilis japonica* (Houtt.) DC.             | Compositae     | Eu    | East Asia| R                | He        | 1916 |
| 222| *Tradescantia fluminensis* Vell.            | Commelinaceae  | Mo    | South America | R            | He        | 1960 |
| 223| *Tradescantia virginiana* L.                | Commelinaceae  | Mo    | North America | R            | He        | 1969 |
| 224| *Trifolium campestre* Schreb.               | Leguminosae    | Eu    | Native   | P                | Th        | -    |
| 225| *Trifolium diffusum* Ehrh.                  | Leguminosae    | Eu    | Mediterranean | P            | Th        | 1948 |
| 226| *Trifolium echinatum* M.Bieb.               | Leguminosae    | Eu    | Mediterranean | P            | Th        | 1939 |
| 227| *Trifolium fragiferum* L.                   | Leguminosae    | Eu    | Native   | P                | Th        | -    |
| 228| *Trifolium micranthum* Viv.                 | Leguminosae    | Eu    | Mediterranean | P            | Th        | 1939 |
| 229| *Typha angustifolia* L.                     | Typhaceae      | Mo    | Native   | H                | Cr        | -    |
| 230| *Typha latifolia* L.                       | Typhaceae      | Mo    | Native   | H                | Cr        | -    |
| 231| *Urtica dioica* L.                         | Urticaceae     | Eu    | Atlantic Europe | R            | He        | AnT  |
| 232| *Verbascum blattaria* L.                    | Scrophulariaceae| Eu   | Native   | R                | Ch        | -    |
| 233| *Verbena brasiliensis* Vell.                | Verbenaceae    | Eu    | South America | P            | Ch        | 2015 |
| 234| *Verbena officinalis* L.                    | Verbenaceae    | Eu    | Europe   | R                | Ch        | XX beg. |
| 235| *Veronica anagallis-aquatica* L.            | Plantaginaceae | Eu    | Native   | R                | He        | -    |
| 236| *Veronica persica* Poir.                    | Plantaginaceae | Eu    | Mediterranean | R            | Th        | 1914 |
| 237| *Veronica serpyllifolia* L.                 | Plantaginaceae | Eu    | Native   | R                | He        | -    |
| 238| *Vicia lathyroides* L.                      | Leguminosae    | Eu    | Mediterranean | R            | Th        | 1939 |
| 239| *Vicia sativa* L.                          | Leguminosae    | Eu    | Europe   | G                | Th        | 1917 |
| 240| *Viola prionantha* Bunge                    | Violaceae      | Eu    | East Asia| R                | Th        | 1926 |
| 241| *Viola reichenbachiana* Jord. ex Boreau      | Violaceae      | Eu    | Native   | F                | Th        | -    |
| 242| *Xanthium californicum* Greene (X. strumarium auct.) | Compositae     | Eu    | North America | R            | Th        | 1934 |
| 243| *Xanthium spinosum* L.                      | Compositae     | Eu    | South America | R            | Th        | XX beg. |
| 244| *Xanthium strumarium* L.                    | Compositae     | Eu    | North America | R            | Th        | XX beg. |