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Alien flora of Turkey: checklist, taxonomic composition and ecological attributes

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Abstract

The paper provides an updated checklist of the alien flora of Turkey with information on its structure. The alien flora of Turkey comprises 340 taxa, among which there are 321 angiosperms, 17 gymnosperms and two ferns. Of the total number of taxa, 228 (68%) are naturalized and 112 (32%) are casual. There are 275 neophytes (172 naturalized and 103 casual) and 61 archaeophytes (52 naturalized and 9 casual); four species could not be classified with respect to the residence time. In addition, 47 frequently planted taxa with a potential to escape are also listed. The richest families are *Asteraceae* (38 taxa), *Poaceae* (30), *Fabaceae* (23) and *Solanaceae* (22). As for the naturalized alien plants, the highest species richness is found in *Asteraceae* (31 taxa), *Poaceae* (22), *Amaranthaceae* (18) and *Solanaceae* (15). The majority of alien taxa are perennial (63.8% of the total number of taxa with this life history assigned, including those with multiple life histories), annuals contribute 33.8% and 2.4% are biennial aliens. Among perennials the most common life forms are phanerophytes, of which 20.3% are trees and 12.6% shrubs; woody vines, stem succulents, and aquatic plants are comparatively less represented. Most of the 340 alien taxa introduced to Turkey have their native ranges in Americas (44.7%) and Asia (27.6%). Of other regions, 9.1% originated in Africa, 4.4% in Eurasia, 3.8% in Australia and Oceania and 3.5% in the Mediterranean. The majority of taxa (71.9%) were introduced intentionally, whereas the remaining (28.1%) were introduced

accidentally. Among the taxa introduced intentionally, the vast majority are ornamental plants (55.2%), 10.0% taxa were introduced for forestry and 6.7% as crops. Casual alien plants are most commonly found in urban and ruderal habitats (40.1%) where naturalized taxa are also often recorded (27.3%). Plants that occur as agricultural weeds are typically naturalized rather than casual (16.0% vs 7.1%, respectively). However, (semi)natural habitats in Turkey are often invaded by alien taxa, especially by those that are able to naturalize.

Keywords
Alien flora, Turkey, casual and naturalized alien plants

Introduction

Turkey has a long tradition of floristic research and as a result its native flora is satisfactorily investigated. With more than 12,000 plant taxa (Davis 1965–1985, Davis et al. 1988, Güner et al. 2000, 2012) and new species being continuously described, including new endemics (Güner et al. 2012, Özhatay et al. 2013, 2015), the flora of Turkey is the richest among the Mediterranean, European and neighbouring countries (Ekim and Güner 1986). The majority of this total number is represented by native taxa with 31% of endemics (Güner et al. 2012). Turkey's landscape and ecological diversity has contributed not only to a high floristic richness, but has also allowed for successful introductions and cultivation of a great number of crops, fruit species (Ercisli 2004) and forest trees (Atalay et al. 2014).

On the contrary, up to now there was only limited information on Turkish alien flora. Being located at the crossroads of three continents, there has always been an intense movement of humans and goods across Turkey over the history due to human migration, and in modern Turkey both plants and animals were being introduced intentionally and unintentionally in great quantities. Suitable conditions for the cultivation and use and subsequent naturalization of plants introduced into the country are supported historically. Turkey is a country of special significance in the history of agriculture, with some of the earliest sites of plant domestication nearly 10,000 years ago (Aksoy and Oksar 2015), and today 50% of the country area is agricultural land (FAO 2017).

With this background, it is somewhat surprising that so far, the main source of information about alien flora of Turkey was a checklist generated for the DAISIE project (Delivering Alien Invasive Species Inventories for Europe, 2004–2008; see DAISIE 2008, Lambdon et al. 2008), based on the several decades old flora (Davis 1965–1985) that was rather outdated in terms of inventory of alien species. Therefore, the DAISIE project reported only 220 alien taxa for Turkey, of which only 95 were assigned the naturalization status with certainty (Lambdon et al. 2008), which is an underestimation of the real situation. In fact, it should be taken into account that DAISIE included mainly the European part of Turkey, which represents only 3% of the Turkish territory. More recently, new insights into this aspect were provided by the book "Türkiye İstilâcı Bitkiler Kataloğu" (Catalogue of the invasive plants of Turkey) by Önen (2015).

However, such lack of a recent account on the alien flora represents a serious constraint to the management of those plants that are currently invasive or may become so in the future. As generally agreed, alien species lists form the basis for much of the current research on biological invasions, for guiding legislation and code of conducts, as input to decision making and risk assessment and in the formulation of management policies and strategies for nature conservation (Hoffmann and Broadhurst 2016, Woodford et al. 2016, Jacobs et al. 2017). From the scientific point of view, macroecological analyses of alien floras has received much attention recently and improved the understanding of historical flows of alien species among continents (van Kleunen et al. 2015), the dynamics of their accumulation (Seebens et al. 2017) as well as factors driving the variation in regional diversity of alien floras (Pyšek et al. 2009, 2010, 2015, Essl et al. 2011, Seebens et al. 2015).

The aim of this paper is therefore to fill the important gap in the knowledge on alien flora in one of the richest in species countries in Eurasia, by compiling the first comprehensive list of alien plants in Turkey and providing an analysis of its taxonomic composition, origin and ecological structure.

Methods

Study area

Turkey is a large and diverse country located between 25°40' to 44°48'E, and 35°51' to 42°06'N. The total area is 814,578 km^2 of which 97% is located in Asia and 3% in in Europe. It is divided into seven geographical regions: Black Sea, Eastern Anatolia, South Eastern Anatolia, Mediterranean, Aegean, Marmara and Inner Anatolia. The average altitude is 1,141 m a.s.l., and it increases from West to East; 18% of Turkey is below 500 m and 25% between 500 and 1,000 m. Plains up to 2,000 m of altitude and high plateaus up to 2,500 m are another source of biodiversity of native plants while providing potential diverse niches for the naturalization of alien species. Turkey's natural environment is very diverse in terms of climate, ranging from subtropical to cold temperate, as well as topography and geology (Atalay 2002, 2010, 2011), supporting a variety of vegetation types (Akman and Ketenoğlu 1986). Annual precipitation varies from 300 to 2,000 mm, and mean annual temperature from 4 to 19 °C. Some areas are prone to frosts for almost 10 months, while some have frost for only one day in a year. The growing period varies from almost the whole year to less than 140 growing days. Turkey is surrounded by an 8,333 km coastline with Black Sea at the North, Marmara Sea between two peninsulas, and Aegean Sea at West and Mediterranean at South. The coastal areas represent a dynamic, ecologically fragile environment with threatened habitats in which a diverse range of human activities are carried out (Acar et al. 2014). In addition, the majority of Turkey's ever-increasing population resides in coastal areas (Erginöz and Doğan 1997). Among cities that represent important points of entry of alien species into the country, İstanbul with a population of almost 15 million is Turkey's most populated metropolitan area and the economic powerhouse of the country. Its geographical

characteristics and topography allow for the existence of diverse microclimatic zones to exist in a relatively small area of 5,461 km^2 (Güneralp et al. 2013). The 2,875-km long border of Turkey with its neighbours Georgia, Armenia, Azerbaijan, Iran, Iraq, Syria, Greece and Bulgaria is associated with a high probability of entry and occurrence of alien plant species in habitats along adjacent roadside corridors that represent an important pathway for alien plants (Wilson et al. 2016).

Data sources used to compile the inventory

The first flora dedicated to Turkey is composed of the five volumes of Boissier's *Flora Orientalis* (Boissier 1867–1884) and its supplement (Boissier 1888) where alien species are occasionally reported. However, the basic data source used for the present inventory is the Flora of Turkey and the East Aegean Islands (Davis 1965–1985, Davis et al. 1988, Güner et al. 2000, 2012). This source has been complemented with information extracted from all the available literature, such as, in particular, the papers published after 2000 in the Turkish Journal of Botany and elsewhere. In addition, dedicated studies (Uremis et al. 2014, Arslan et al. 2015) and field surveys (e.g. Brundu et al. 2011) were taken into account as well as herbarium samples stored at the Düzce University Forestry Faculty Herbarium (DUOF) and other herbaria in Turkey (GAZİ, ISTO, AİBO and ISTE). We also screened the GBIF database, which holds 265,818 plant records for Turkey (GBIF 2017); however, alien plant species are significantly underrepresented in this source. We also used information from an ongoing project dedicated to the online flora of Turkey (Tübives – http://www.tubives.com/index.php) (Bakis et al. 2011), an initiative for a new Flora of Turkey with illustrations 'Resimli Türkiye Florası Volume 1 (Güner 2014), and 'Bizim Bitkiler' (http://www.bizimbitkiler.org.tr/v2/index.php), another online flora of Turkey which includes the last checklist of vascular flora of Turkey by Güner et al. (2012).

Classification of taxa and their characteristics

This inventory focuses on plant species alien to Turkey (synonyms: exotic, introduced, non-indigenous, non-native), i.e. species present in the country because human actions enabled them to overcome fundamental biogeographical barriers (Richardson et al. 2000, Blackburn et al. 2011); they occur in Turkey as a result of intentional or accidental introduction by humans, or as a result of natural spread from other regions where they were introduced by humans. Crosses resulting from hybridization with one or both alien species involved are also considered alien (Pyšek et al. 2004). In addition, we included in this inventory some taxa that are native to a part of the country but introduced elsewhere in Turkey, i.e. alien in Turkey, following an approach proposed by Lambdon et al. (2008) for Europe.

We classified alien plant species according to the stage they reached along the introduction-naturalization-invasion continuum (Richardson and Pyšek 2006, Richardson et al. 2000, 2011, Blackburn et al. 2011). However, due to a lack of data on the rate of spread we did not classify species as invasive and only classified them in two main categories, casual or naturalized. The complete inventory (Suppl. material 1: Table 1) lists also additional species that are presently recorded only in cultivation outside urban areas, but over very large areas, such as tree species in planted forests, and that could start to naturalize in the future due to potentially strong propagule pressure or climate change. These species are, however, not taken into account for data analyses. Taxa were further classified with respect to their residence time, i.e. separated into archaeophytes and neophytes (see e.g. Pyšek et al. 2004, 2012 for delimitation). Affiliation of taxa to families follows the approach of the Angiosperm Phylogeny Group (Stevens 2001 onwards, APG IV 2016). Plant names have been verified using IPNI (International Plant Name Index, http://www.ipni.org/), The Plant List (2010, version 1, published on the Internet; http://www.theplantlist.org/), WCSP and the African Plants Database (APD, version 3.4.0), updated by the Conservatoire et Jardin botaniques de la Ville de Genève and the South African National Biodiversity Institute, Pretoria, South Africa (http://www.ville-ge.ch/musinfo/bd/cjb/africa). We followed, to our best attempt, the accepted and correct nomenclature according to current taxonomic standards.

Information on life history, region of origin, pathway of introduction (intentional vs accidental) and habitat affiliation was extracted from literature and from the above cited sources for each species.

Life forms were classified as follows: therophytes, hydrophytes, chamaephytes, geophytes, hemicryptophytes and phanerophytes (Raunkiaer 1934, 1937). In addition, growth form and life history were assigned according to the Thesaurus of Plant Characteristics for Ecology and Evolution (Garnier et al. 2017) and other specific literature (Pérez-Harguindeguy et al. 2016). Growth-forms reported for aquatic plants follow Brundu (2015).

The checklist has been archived on the Global Biodiversity Information Facility (Uludag et al. 2017).

Statistical analysis

Differences in representation of life forms within casual and naturalized species were tested by contingency tables with control for overdispersion (if needed using quasi-Poisson distribution) (Crawley 2007). To test individual differences among life forms and species groups, adjusted standardized residuals of G-tests were compared with critical values of a normal distribution (Řehák and Řeháková 1986). All analyses were performed in R 3.0.2 (R Core Team 2015).

Results

Species numbers and taxonomic composition

The alien flora of Turkey comprises 340 taxa, among which there are 321 angiosperms, 17 gymnosperms and two ferns. Of the total number of taxa, 228 (67.1%) are naturalized and 112 (32.9%) are casual (Appendix 1; for the complete list of taxa, which includes additional 47 frequently planted taxa noted above, see Suppl. material 1). Related to the total plant diversity of ~12,000 species in the Turkish flora, the contribution of alien taxa is ~2.8% and that of naturalized taxa ~1.9%. Of the taxa for which the classification according to residence time was possible, there are 275 neophytes (172 naturalized and 103 casual) and 61 archaeophytes (52 naturalized and 9 casual).

Turkey's alien flora includes representatives of 92 families and 251 genera. There are seven families with at least 10 aliens that together comprise 44.7% of the total alien taxa richness of the country; the richest are *Asteraceae* (38 taxa, corresponding to 11.2% of all aliens), *Poaceae* (30, 8.8%), *Fabaceae* (23, 6.8%) and *Solanaceae* (22, 6.5%). As for the naturalized alien plants, the highest species richness is found in *Asteraceae* (31 taxa, 13.6% of the total number of naturalized aliens), *Poaceae* (22, 9.6%), *Amaranthaceae* (18, 7.9%) and *Solanaceae*. Over a half of the naturalized alien richness (51.8%) is concentrated in eight families that contain more than four naturalized taxa (Table 1).

The most represented genus is *Amaranthus* with 13 taxa that are all naturalized, contributing thus 3.3% and 5.7% to all aliens and naturalized aliens, respectively. *Solanum* is also rather rich in aliens, but of the 11 taxa only five are naturalized. Other genera, that are represented by more than five species and the naturalization success of their representatives is high, are *Euphorbia* (88.9% of all aliens in the genus are naturalized), *Acacia* (83.3%) and *Oxalis* (100%). The 11 genera with at least four alien taxa in Turkey together account for 17.6% of the total alien plant richness and 26.3% of the naturalized richness of the country (Table 2).

Ecological attributes

The majority of alien taxa are perennial (63.8% of the total number of taxa with this life history assigned, including those with multiple life histories), annuals are also greatly represented (33.8%) and only 2.4% are biennials. Among perennials the most common life forms are phanerophytes, i.e. trees (20.3%) and shrubs (12.6%); woody vines, stem succulent, bambusoid and aquatic plants are comparatively less represented. There were significant differences in the counts per life history between casuals and naturalized species (χ^2 = 29.85, DF = 0,6, p<0.001). This significant difference was due to annuals (therophytes) where the observed counts were higher than expected by chance for naturalized species and lower for casuals and due to woody species (phanerophytes) where the situation was reversed (Figure 1).

Table 1. The most represented families in the alien flora of Turkey, ranked according to the total number of alien taxa, with their representatives classified according to their status. For each family, the number of casual and naturalized taxa and the percentage of naturalized among total aliens are provided. Family names follow APG classification (Stevens 2001 onwards, APG IV 2016).

Family	Total no. of alien taxa	No. of casual taxa	No. of naturalized taxa	% of naturalized taxa
Asteraceae	38	7	31	81.6
Poaceae	30	8	22	73.3
Fabaceae	23	11	12	52.2
Solanaceae	22	7	15	68.2
Amaranthaceae	18	0	18	100.0
Euphorbiaceae	11	1	10	90.9
Rosaceae	10	6	4	40.0
Cupressaceae	9	3	6	66.7
Pinaceae	8	4	4	50.0
Oxalidaceae	7	0	7	100.0
Sapindaceae	7	2	5	71.4
Convolvulaceae	6	2	4	66.7
Aizoaceae	5	0	5	100.0
Apocynaceae	5	2	3	60.0
Moraceae	5	3	2	40.0

Table 2. The most represented genera in the alien flora of Turkey, classified according to their status. For each genus, number of casual and naturalized taxa and percentage of naturalized among total aliens in the genus are provided. Genera are ranked according the total number of alien taxa.

Genus	Total no. of alien taxa	No. of casual taxa	No. of naturalized taxa	% of naturalized taxa
Amaranthus	13	0	13	100.0
Solanum	11	6	5	45.5
Euphorbia	9	1	8	88.9
Oxalis	7	0	7	100.0
Acacia	6	1	5	83.3
Acer	4	1	3	75.0
Bidens	4	0	4	100.0
Cotoneaster	4	1	3	75.0
Erigeron	4	0	4	100.0
Ipomoea	4	0	4	100.0
Paulownia	4	4	0	0.0
Physalis	4	0	4	100.0

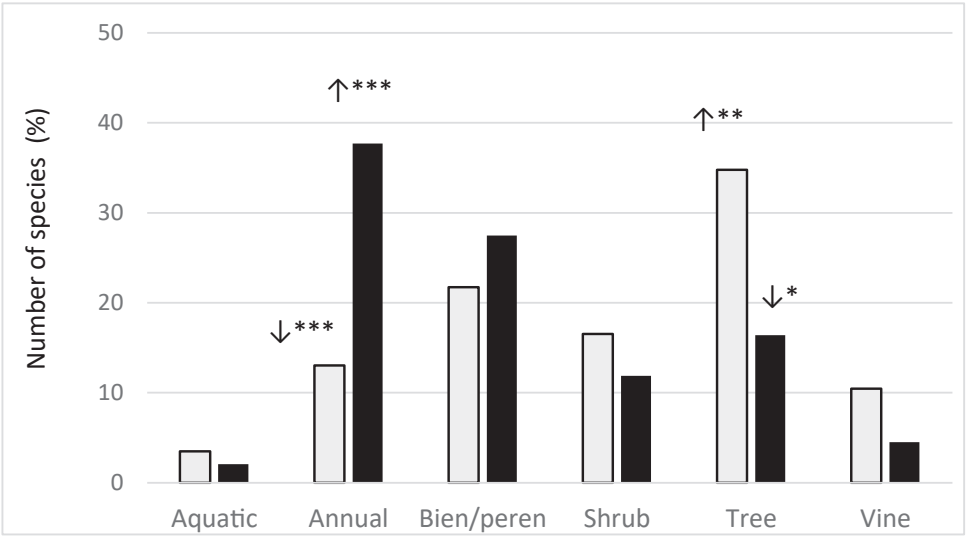

Figure 1. Frequency of alien species in the flora of Turkey categorized according to their Raunkiaer's life forms, shown separately for casuals (white bars, n = 112) and naturalized taxa (black bars, n = 228). Bars indicate the percentage contribution of each life form to the total numbers of incidences within casual and naturalized. Significant differences and their directions are indicated above bars (. < 0.1, * < 0.05, ** < 0.01, *** < 0.001).

Table 3. Structure of the alien flora of Turkey according to origin and number of casual and naturalized species, with percentages of naturalized taxa among total aliens.

Native range	Total no. of alien taxa	No. of casual taxa	No. of naturalized taxa	% of naturalized taxa
America	152	48	104	30.6
Asia	94	33	61	17.9
Africa	31	13	18	5.3
Eurasia	15	2	13	3.8
Australia & Oceania	13	8	5	1.5
Mediterranean	12	1	11	3.2
Europe	9	1	8	2.4
Garden origin & hybrids	8	5	3	0.9
Other & unknown	6	1	5	1.5

Most of the 340 alien taxa introduced to Turkey have their native ranges in Americas (44.7%) and Asia (27.6%). Of other regions, 9.1% originated in Africa, 4.4% in Eurasia, 3.8% in Australia and Oceania, and 3.5% in the Mediterranean (see Table 3 for species numbers with respect to the area of origin).

The majority of taxa in the Turkish alien flora (71.9%) were introduced intentionally, whereas the remaining (28.1%) were introduced accidentally. Among the taxa

Table 4. Habitats in which the alien plant taxa are found in Turkey, shown separately for casual and naturalized taxa, with percentages of the total shown for each category. Natural/semi-natural habitats include the categories of the CORINE Land cover class 3 (Forest and semi-natural areas).

Habitat	Casual alien	%	Naturalized alien	%
Natural/semi-natural habitats	56	28.4	145	28.3
Urban/ruderal habitats	79	40.1	140	27.3
Coastal habitats	34	17.3	96	18.7
Agricultural land	14	7.1	82	16.0
Riparian habitats/wetlands/lakes	14	7.1	50	9.7

introduced intentionally, the vast majority are ornamental plants (55.2%), 10.0% taxa were introduced for forestry (planted forest, reforestation, sand dune stabilization or soil protection) and 6.7% as crops (i.e. plant taxa cultivated for the production of food, forage, fruit, fibre, dye or drugs).

Casual alien plants are most commonly found in urban and ruderal habitats (40.1% of their total number) where naturalized taxa are also often recorded (27.3%). Plants that occur as agricultural weeds are typically naturalized rather than casual (16.0% vs 7.1%, respectively. However, (semi)natural habitats in Turkey are often invaded by alien taxa, especially by those that are able to naturalize (Table 4).

Discussion and conclusions

This is the first comprehensive compilation and analysis of all available records on alien plant taxa in Turkey. It provides the first assessment of their status, introduction purposes and main types of invaded habitats. It also pinpoints knowledge gaps in the geographic and biogeographic distribution and the quantification of environmental and economic impacts.

The total number of the alien taxa reported for Turkey here (340) is relatively low compared to other Mediterranean and Southern European countries, namely France (1,258 taxa), Italy (1,023), Spain (933) and Portugal (547) (Lambdon et al. 2008, Celesti-Grapow et al. 2009) and numerically comparable with Greece (343; Arianoutsou et al. 2010, Dimopoulos et al. 2016). The same is true for the naturalized species richness in Turkey (228 taxa), for which higher numbers are reported for e.g. France (732), Spain (495) or Italy (440), but comparable numbers for Portugal (261) and lower for Greece (134) (Lambdon et al. 2008). This fact, together with the remarkably high richness of native flora of Turkey, makes the contribution of alien species to the total plant diversity of the country relatively low, with the values between 1.9 and 2.8% being by an order of magnitude lower than in some other European countries (e.g. Pyšek et al. 2012) or this continent as a whole. Europe, with a comparable native plant diversity as Turkey, ~10,000 native species (Winter et al. 2009), harbours 1,780 naturalized aliens from overseas and if one considers also intracontinental aliens

the number reaches 3,749 taxa (Lambdon et al. 2008) or 4,140 according to the most recent account in GloNAF database (van Kleunen et al. 2015).

This is the first comprehensive catalogue for Turkey and it is based mainly on literature and herbarium data, with only a limited number of dedicated field surveys. Other Mediterranean countries such as France, Italy or Spain have a longer tradition of floristic research on alien plants, whose appearance and establishment have long been documented by botanists there (e.g., by Saccardo 1909). It is therefore possible that casual species are underestimated in the dataset, as casuals in general, and escaped ornamentals in particular (Pergl et al. 2016b), are rarely recorded in botanical works nor are they often collected in herbaria. Another possible explanation for the lower number of alien plants than in some other European countries is that although cultivation of ornamental plants dates back to ancient times, there has been rapid development and change in the ornamental plants sector in Turkey only after the 1980s and this development has gained speed only in the 2000s (Çelik and Arisoy 2013).

The rate of naturalization (proportion of naturalized to all aliens) is 67% in Turkey, i.e. the same as in Cyprus but higher than in Greece (41%), Spain (53%), Portugal (47%) and Italy (51%) (Arianoutsou et al. 2010). On the contrary, with the exception of Bulgaria, there is only very limited knowledge on the alien flora of Georgia, Armenia, Azerbaijan, Iran, Iraq, Syria which impedes comparisons between these countries and, at the same time, forecasting of future trends for the entire Mediterranean region.

National inventories of alien plants are one of the key components for evaluating the status of biodiversity in a given country, as well as threats to endangered species, and provide source data for creating relevant indicators (Lambdon et al. 2008, Celesti-Grapow et al. 2010, Pyšek et al. 2012, van Kleunen et al. 2015, Latombe et al. 2017). Such data are needed for early warning systems, prioritization of management and implementation of effective policy measures (Brunel et al. 2010). The publication of checklists also helps neighbouring countries and trading partners to assess the threat from potential invasions of new species to arrive and checklists can contribute to so-called horizon scanning exercises looking for potential new threats (Roy et al. 2014, Latombe et al. 2017).

Identifying those species that represent potential or future threats, while still at an early stage of invasion, represents a major challenge for prediction (Lambdon et al. 2008, Brunel et al. 2010). Detailed knowledge of the pool of alien naturalized species from which emerging invaders recruit can provide national authorities in Turkey with an instrument for prioritization of management measures and allocation of resources to those species where future spread, and environmental and socioeconomic impacts are likely to occur (Brunel et al. 2010, Pergl et al. 2016a, Rumlerová et al. 2016). The results of the present research will increase the awareness of alien plant taxa in Turkey and neighbouring countries and trigger further dedicated specialized studies, such as assessment of the impact by using standard scoring systems (e.g. Blackburn et al. 2014, Nentwig et al. 2016). New alien species are bound to arrive and spread in Turkey and we hope that publication of this list will encourage further recording so that the impacts of these species can be minimized.

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Appendix 1

Table A1. List of naturalized and casual alien taxa in the flora of Turkey. Taxa are ordered alphabetically. Each taxon is listed together with its family, residence time (Res: Arc = archaeophyte, Neo = neophyte); invasion status (Stat: Cas = casual, Nat = naturalized), simplified growth form and native range.

Taxa	Family	Res	Stat	Simplified growth form	Native range
Abutilon theophrastii Medik.	*Malvaceae*	Arc	Nat	Herb	Asia
Acacia dealbata Link	*Fabaceae*	Neo	Cas	Tree	Australia
Acacia karroo Hayne	*Fabaceae*	Neo	Nat	Tree	Africa
Acacia longifolia (Andrews) Willd.	*Fabaceae*	Neo	Nat	Tree	Australia
Acacia mearnsii De Wild.	*Fabaceae*	Neo	Nat	Tree	Australia
Acacia retinodes Schltdl.	*Fabaceae*	Neo	Nat	Tree	Australia
Acacia saligna (Labill.) H.L.Wendl.	*Fabaceae*	Neo	Nat	Tree	Australia
Acalypha australis L.	*Euphorbiaceae*	Neo	Nat	Herb	Asia
Acer buergerianum Miq.	*Sapindaceae*	Neo	Nat	Tree	Asia
Acer negundo L.	*Sapindaceae*	Neo	Nat	Tree	America
Acer palmatum Thunb.	*Sapindaceae*	Arc	Nat	Tree	Asia
Acer saccharum Marsh.	*Sapindaceae*	Neo	Cas	Tree	America
Acorus calamus L.	*Acoraceae*	Arc	Nat	Aquatic	Asia
Actinidia deliciosa (A.Chev.) C.F.Liang & A.R.Ferguson	*Actinidiaceae*	Neo	Cas	Vine	Asia
Aesculus carnea J.Zeyh.	*Sapindaceae*	Neo	Nat	Tree	Garden/Hybrid
Aesculus hippocastanum L.	*Sapindaceae*	Neo	Nat	Tree	Europe
Agave americana L. var. *americana*	*Asparagaceae*	Neo	Nat	Succulent	America
Agave americana var. *striata* Trel.	*Asparagaceae*	Neo	Nat	Succulent	America
Agrostemma githago L.	*Caryophyllaceae*	Arc	Nat	Herb	Mediterranean
Ailanthus altissima (Mill.) Swingle	*Simaroubaceae*	Neo	Nat	Tree	Asia
Albizia julibrissin Durazz	*Fabaceae*	Neo	Nat	Tree	Asia
Alternanthera sessilis (L.) R.Br. ex DC.	*Amaranthaceae*	Neo	Nat	Herb	Asia
Amaranthus albus L.	*Amaranthaceae*	Arc	Nat	Herb	America
Amaranthus blitoides S.Watson	*Amaranthaceae*	Arc	Nat	Herb	America
Amaranthus blitum L. subsp. *blitum*	*Amaranthaceae*	Arc	Nat	Herb	Eurasia
Amaranthus blitum subsp. *emarginatus* (Salzm. ex Uline & Bray) Carretero, Muñoz Garm. & Pedrol	*Amaranthaceae*	Arc	Nat	Herb	Eurasia
Amaranthus blitum subsp. *oleraceus* (L.) Costea	*Amaranthaceae*	Arc	Nat	Herb	Eurasia
Amaranthus cruentus L.	*Amaranthaceae*	Neo	Nat	Herb	America
Amaranthus deflexus L.	*Amaranthaceae*	Neo	Nat	Herb	America
Amaranthus graecizans L.	*Amaranthaceae*	Neo	Nat	Herb	Mediterranean
Amaranthus hybridus L.	*Amaranthaceae*	Neo	Nat	Herb	America
Amaranthus hypochondriacus L.	*Amaranthaceae*	Neo	Nat	Herb	America
Amaranthus retroflexus L.	*Amaranthaceae*	Neo	Nat	Herb	America
Amaranthus spinosus L.	*Amaranthaceae*	Neo	Nat	Herb	America
Amaranthus viridis L.	*Amaranthaceae*	Neo	Nat	Herb	America
Ambrosia artemisiifolia L.	*Asteraceae*	Neo	Nat	Herb	America
Ambrosia tenuifolia Spreng.	*Asteraceae*	Neo	Nat	Herb	America

Taxa	Family	Res	Stat	Simplified growth form	Native range
Ammannia coccinea Rottb.	*Lythraceae*	Neo	Nat	Herb	America
Amorpha fruticosa L.	*Fabaceae*	Neo	Cas	Shrub	America
Araujia sericifera Brot.	*Apocynaceae*	Neo	Nat	Vine	America
Armeria maritima (Mill.) Willd.	*Plumbaginaceae*	Arc	Cas	Herb	Europe
Artemisia annua L.	*Asteraceae*	Neo	Nat	Herb	Asia
Artemisia verlotiorum Lamotte	*Asteraceae*	Neo	Nat	Herb	Asia
Arundo donax L.	*Poaceae*	Arc	Nat	Bambusoid	Asia
Aster subulatus (Michx.) Hort. ex Michx.	*Asteraceae*	Neo	Nat	Herb	America
Avena byzantina K.Koch	*Poaceae*	Arc	Cas	Herb	Garden/Hybrid
Azolla filiculoides Lam.	*Azollaceae*	Arc	Nat	Aquatic	America
Bauhinia variegata L.	*Fabaceae*	Neo	Nat	Tree	Asia
Berberis veitchii C.K.Schneid.	*Berberidaceae*	Arc	Nat	Shrub	Asia
Berberis thunbergii DC.	*Berberidaceae*	Arc	Nat	Shrub	Asia
Bidens bipinnata L.	*Asteraceae*	Neo	Nat	Herb	Asia
Bidens campylotheca Sch.Bip.	*Asteraceae*	Neo	Nat	Herb	America
Bidens cernua L. s.l.	*Asteraceae*	Neo	Nat	Herb	America
Bidens frondosa L.	*Asteraceae*	Neo	Nat	Herb	America
Bougainvillea buttiana Holttum & Standl.	*Nyctaginaceae*	Neo	Nat	Vine	America
Bougainvillea glabra Choisy	*Nyctaginaceae*	Neo	Cas	Vine	America
Bougainvillea spectabilis Willd.	*Nyctaginaceae*	Neo	Nat	Vine	America
Brachychiton populneus (Schott & Endl.) R.Br.	*Sterculiaceae*	Neo	Nat	Tree	Australia
Bromus tectorum L.	*Poaceae*	N/A	Nat	Herb	Eurasia
Broussonetia papyrifera (L.) L'Hér. ex Vent.	*Moraceae*	Neo	Nat	Tree	Asia
Bryophyllum delagoense (Eckl. & Zeyh.) Druce	*Crassulaceae*	Neo	Cas	Succulent	Africa
Buddleja davidii Franch.	*Scrophulariaceae*	Neo	Nat	Shrub	Asia
Caesalpinia gilliesii (Hook.) D.Dietr.	*Fabaceae*	Neo	Nat	Shrub	America
Calendula officinalis L.	*Asteraceae*	Arc	Nat	Herb	Eurasia
Callistemon citrinus (Curtis) Skeels	*Myrtaceae*	Neo	Cas	Tree	Australia
Callistemon viminalis (Sol. ex Gaertn.) G.Don	*Myrtaceae*	Neo	Cas	Tree	Australia
Camellia japonica L.	*Theaceae*	Arc	Nat	Shrub	Asia
Canna indica L.	*Cannaceae*	Neo	Nat	Bambusoid	America
Caragana arborescens Lam.	*Fabaceae*	Neo	Nat	Shrub/Tree	Asia
Carex vulpinoidea Michx.	*Cyperaceae*	Neo	Nat	Herb	America
Carpobrotus acinaciformis (L.) L.Bolus	*Aizoaceae*	Neo	Nat	Succulent	Africa
Carpobrotus edulis (L.) N.E.Br.	*Aizoaceae*	Neo	Nat	Succulent	Africa
Carthamus tinctorius L.	*Asteraceae*	Arc	Cas	Herb	Asia
Cascabela thevetia (L.) Lippold	*Apocynaceae*	Neo	Cas	Tree	America
Catalpa bignonioides Walter	*Bignoniaceae*	Neo	Nat	Tree	America
Cedrus atlantica (Endl.) Carrière	*Pinaceae*	Neo	Cas	Tree	Africa
Cedrus deodara (Roxb. ex D.Don) G.Don	*Pinaceae*	Neo	Nat	Tree	Asia
Ceiba speciosa (A.St.-Hil.) Ravenna	*Malvaceae*	Neo	Nat	Tree	America
Cenchrus incertus M.A.Curtis	*Poaceae*	Arc	Nat	Herb	America
Centaurea pullata L.	*Asteraceae*	Arc	Nat	Herb	Mediterranean
Chaenomeles japonica (Thunb.) Lindl. ex Spach	*Rosaceae*	Neo	Cas	Shrub	Asia
Chenopodium album L.	*Amaranthaceae*	Arc	Nat	Herb	Eurasia

Taxa	Family	Res	Stat	Simplified growth form	Native range
Chenopodium giganteum D.Don	*Chenopodiaceae*	Arc	Nat	Herb	Asia
Cichorium endivia L.	*Asteraceae*	Arc	Cas	Herb	Asia
Citrullus colocynthis (L.) Schrad.	*Cucurbitaceae*	Arc	Cas	Vine	Eurasia
Citrus trifoliata L.	*Rutaceae*	Neo	Cas	Tree	Asia
Coix lacryma-jobi L.	*Poaceae*	Neo	Nat	Herb	Asia
Commelina communis L.	*Commelinaceae*	Neo	Nat	Herb	Asia
Convolvulus tricolor L.	*Convolvulaceae*	Arc	Cas	Vine	Mediterranean
Cortaderia selloana (Schult. & Schult.f.) Asch. & Graebn.	*Poaceae*	Neo	Cas	Bambusoid	America
Cosmos bipinnatus Cav.	*Asteraceae*	Neo	Cas	Herb	America
Cotoneaster adpressus Bois	*Rosaceae*	Neo	Cas	Shrub	Asia
Cotoneaster franchetii Bois	*Rosaceae*	Neo	Nat	Shrub	Asia
Cotoneaster horizontalis Decne.	*Rosaceae*	Neo	Nat	Shrub	Asia
Cotoneaster salicifolius Franch.	*Rosaceae*	Arc	Nat	Shrub	Asia
Crassocephalum crepidioides (Benth.) S.Moore	*Asteraceae*	Neo	Nat	Herb	Africa
Cryptomeria japonica (Thunb. ex L.f.) D.Don	*Cupressaceae*	Neo	Cas	Tree	Asia
Cupressus arizonica Greene	*Cupressaceae*	Neo	Nat	Tree	America
Cupressus macrocarpa Hartw.	*Cupressaceae*	Neo	Nat	Tree	America
Cuscuta campestris Yunck.	*Cuscutaceae*	Neo	Nat	Herb	America
Cymbalaria muralis P.Gaertn., B.Mey. & Scherb.	*Plantaginaceae*	Arc	Nat	Herb	Mediterranean
*Cynoglossum wallichii var. glochidiatum (*Wall. ex Benth.) Kazmi	*Boraginaceae*	Arc	Nat	Herb	Asia
Cyperus congestus Vahl	*Cyperaceae*	Neo	Nat	Herb	Africa
Cyperus esculentus L.	*Cyperaceae*	Arc	Nat	Herb	Unknown
Cyperus rotundus L.	*Cyperaceae*	Arc	Nat	Herb	Eurasia
Dalbergia sissoo DC.	*Fabaceae*	Neo	Cas	Tree	Asia
Datura innoxia Mill.	*Solanaceae*	Neo	Nat	Herb	America
Datura metel L.	*Solanaceae*	Neo	Cas	Herb	Asia
Datura stramonium L.	*Solanaceae*	Neo	Nat	Herb	America
Deutzia gracilis Siebold & Zucc.	*Hydrangeaceae*	Arc	Nat	Shrub	Asia
Deutzia scabra Thunb.	*Hydrangeaceae*	Neo	Nat	Shrub	Asia
Dichondra repens J.R.Forst. & G.Forst.	*Convolvulaceae*	Neo	Cas	Herb	Asia
Dichrocephala integrifolia (L.f.) Kuntze	*Asteraceae*	Neo	Nat	Herb	Africa & Asia
Dieffenbachia seguine (Jacq.) Schott	*Araceae*	Neo	Nat	Herb	America
Digitaria sanguinalis (L.) Scop.	*Poaceae*	Neo	Nat	Herb	Europe & Africa
Diplachne fusca (L.) P.Beauv.	*Poaceae*	Neo	Nat	Herb	Unknown
Duchesnea indica (Jacks.) Focke	*Rosaceae*	Neo	Cas	Herb	Asia
Duranta erecta L.	*Verbenaceae*	Neo	Nat	Shrub/Tree	America
Dysphania ambrosioides (L.) Mosyakin & Clemants	*Amaranthaceae*	Neo	Nat	Herb	America
*Dysphania botrys (*L.) Mosyakin & Clemants	*Amaranthaceae*	Arc	Nat	Herb	Eurasia
Dysphania multifida (L.) Mosyakin & Clemants	*Amaranthaceae*	Neo	Nat	Herb	America
Echinochloa colonum (L.) Link	*Poaceae*	Neo	Nat	Herb	Unknown
*Echinochloa oryzoides (*Ard.) Fritsch	*Poaceae*	Arc	Nat	Herb	Asia
Echinopsis chamaecereus H.Friedrich & Glaetzle	*Cactaceae*	Neo	Nat	Succulent	America

Taxa	Family	Res	Stat	Simplified growth form	Native range
Egeria densa Planch.	*Hydrocharitaceae*	Neo	Nat	Aquatic	America
Eichhornia crassipes (Mart.) Solms	*Pontederiaceae*	Neo	Nat	Aquatic	America
Elatine ambigua Wight	*Elatinaceae*	Neo	Nat	Aquatic	Asia
Eleusine indica (L.) Gaertn.	*Poaceae*	Neo	Nat	Herb	Africa
Elodea canadensis Michx.	*Hydrocharitaceae*	Neo	Nat	Aquatic	America
Elsholtzia ciliata (Thunb.) Hyl.	*Lamiaceae*	Neo	Nat	Herb	Asia
Eragrostis curvula (Schrad.) Nees	*Poaceae*	Arc	Nat	Herb	Africa
Erigeron annuus (L.) Pers.	*Asteraceae*	Neo	Nat	Herb	America
Erigeron bonariensis L.	*Asteraceae*	Neo	Nat	Herb	America
Erigeron canadensis L.	*Asteraceae*	Neo	Nat	Herb	America
Erigeron sumatrensis Retz.	*Asteraceae*	Neo	Nat	Herb	America
Erythrina crista-galli L.	*Fabaceae*	Neo	Cas	Tree	America
Erythrina flabelliformis Kearney	*Fabaceae*	Neo	Cas	Tree	America
Eucalyptus camaldulensis Dehnh.	*Myrtaceae*	Neo	Cas	Tree	Australia
Eucalyptus grandis W.Hill	*Myrtaceae*	Neo	Cas	Tree	Australia
Euonymus fortunei (Turcz.) Hand.-Mazz.	*Celastraceae*	Arc	Nat	Shrub	Asia
Euonymus japonicus Thunb.	*Celastraceae*	Arc	Nat	Shrub/Tree	Asia
Eupatorium cannabinum L.	*Asteraceae*	Arc	Nat	Herb	Europe
Euphorbia chamaesyce L.	*Euphorbiaceae*	Neo	Nat	Herb	America
Euphorbia heterophylla L.	*Euphorbiaceae*	Neo	Cas	Herb	America
Euphorbia humifusa Willd.	*Euphorbiaceae*	Arc	Nat	Herb	Asia
Euphorbia lagascae Spreng.	*Euphorbiaceae*	Arc	Nat	Herb	Mediterranean
Euphorbia lathyris L.	*Euphorbiaceae*	Arc	Nat	Herb	Mediterranean
Euphorbia nutans Lag.	*Euphorbiaceae*	Neo	Nat	Herb	America
Euphorbia prostrata Aiton	*Euphorbiaceae*	Neo	Nat	Herb	America
Euphorbia serpens Kunth	*Euphorbiaceae*	Neo	Nat	Herb	America
Euphorbia supina Rafin.	*Euphorbiaceae*	Neo	Nat	Herb	America
Fallopia aubertii (L.Henry) Holub	*Polygonaceae*	Neo	Nat	Vine	Asia
*Fatsia japonica (*Thunb.) Decne. & Planch.	*Araliaceae*	Neo	Nat	Shrub/Tree	Asia
Ficus elastica Roxb. ex Hornem.	*Moraceae*	Neo	Cas	Tree	Asia
Ficus macrophylla Desf. ex Pers.	*Moraceae*	Neo	Cas	Tree	Australia
Ficus microcarpa L.f.	*Moraceae*	Neo	Cas	Tree	Asia
Forsythia × *intermedia* Zabel	*Oleaceae*	Neo	Cas	Shrub	Garden/Hybrid
Fragaria × *ananassa* (Duchesne ex Weston) Duchesne ex Rozier	*Rosaceae*	Neo	Cas	Herb	America
Gaillardia pulchella Foug.	*Asteraceae*	Neo	Cas	Herb	America
Galinsoga ciliata (Rafin) S.F. Blake	*Asteraceae*	Neo	Nat	Herb	America
Galinsoga parviflora Cav.	*Asteraceae*	Neo	Nat	Herb	America
Galinsoga quadriradiata Ruiz & Pav.	*Asteraceae*	Neo	Nat	Herb	America
Gasteria obliqua (Aiton) Duval	*Xanthorrhoeaceae*	Neo	Cas	Succulent	Africa
Gazania rigens (L.) Gaertn.	*Asteraceae*	Neo	Cas	Herb	Africa
Geranium pusillum L.	*Geraniaceae*	Neo	Nat	Herb	Eurasia
Gleditsia triacanthos L.	*Fabaceae*	Neo	Cas	Tree	America
Gomphocarpus fruticosus (L.) W.T.Aiton	*Apocynaceae*	Neo	Nat	Herb	Africa
Gypsophila elegans M.Bieb.	*Caryophyllaceae*	Arc	Nat	Herb	Eurasia

Taxa	Family	Res	Stat	Simplified growth form	Native range
Gypsophila pilosa Huds.	*Caryophyllaceae*	Arc	Nat	Herb	Asia
Heliotropium curassavicum L.	*Boraginaceae*	Neo	Nat	Herb	America
Hemerocallis fulva (L.) L.	*Hemerocallidaceae*	Neo	Nat	Herb	Asia
Hibiscus trionum L.	*Malvaceae*	Arc	Nat	Herb	Africa
Homalocladium platycladum (F.Muell.) L.H.Bailey	*Polygonaceae*	Neo	Cas	Shrub	Oceania
Hoya carnosa (L.f.) R.Br.	*Apocynaceae*	Neo	Cas	Vine	Asia
Hydrangea macrophylla (Thunb.) Ser.	*Hydrangeaceae*	Neo	Nat	Herb	Asia
Hydrocotyle ramiflora Maxim.	*Umbelliferae*	Neo	Nat	Aquatic	Asia
Imperata cylindrica (L.) Raeusch.	*Poaceae*	Neo	Nat	Herb	Asia
Ipomoea nil (L.) Roth	*Convolvulaceae*	Neo	Nat	Vine	America
Ipomoea purpurea (L.) Roth	*Convolvulaceae*	Neo	Nat	Vine	America
Ipomoea tricolor Cav.	*Convolvulaceae*	Neo	Nat	Vine	America
Ipomoea triloba L.	*Convolvulaceae*	Neo	Nat	Vine	America
Jacaranda mimosifolia D.Don	*Bignoniaceae*	Neo	Cas	Tree	America
Juncus tenuis Willd.	*Juncaceae*	Neo	Nat	Herb	America
Juniperus chinensis L.	*Cupressaceae*	Neo	Nat	Shrub/Tree	Asia
Juniperus horizontalis Moench	*Cupressaceae*	Neo	Nat	Shrub	America
Justicia brandegeeana Wassh. & L.B.Sm.	*Acanthaceae*	Neo	Cas	Shrub	America
Kalanchoe blossfeldiana Poelln.	*Crassulaceae*	Neo	Cas	Succulent	Africa (Madagascar)
Kerria japonica (L.) DC.	*Rosaceae*	Neo	Cas	Shrub	Asia
Kniphofia uvaria (L.) Oken	*Liliaceae*	Neo	Cas	Succulent	Africa
Koelreuteria paniculata Laxm.	*Sapindaceae*	Neo	Cas	Tree	Asia
Lagerstroemia indica L.	*Lythraceae*	Neo	Cas	Tree	Asia
Lantana camara L.	*Verbenaceae*	Neo	Cas	Shrub	America
Lepidium virginicum L.	*Brassicaceae*	Neo	Nat	Herb	America
Leucaena leucocephala (Lam.) de Wit	*Fabaceae*	Neo	Cas	Tree	America
Ligustrum ovalifolium Hassk.	*Oleaceae*	Neo	Cas	Shrub/Tree	Asia
Liquidambar styraciflua L.	*Altingiaceae*	Neo	Cas	Tree	America
Livistona mariae F.Muell.	*Arecaceae*	Neo	Cas	Palm	Australia
Lonicera japonica Thunb.	*Caprifoliaceae*	Neo	Cas	Vine	Asia
Lonicera ligustrina var. *yunnanensis* Franch.	*Caprifoliaceae*	Neo	Cas	Vine	Asia
Lonicera periclymenum L.	*Caprifoliaceae*	Neo	Nat	Vine	Europe & NW Africa
Ludwigia peploides (Kunth) P.H.Raven s.l.	*Onagraceae*	Neo	Cas	Aquatic	America
Lycianthes rantonnei (Carrière) Bitter	*Solanaceae*	Neo	Nat	Shrub	America
Lysimachia japonica Thunb.	*Primulaceae*	Neo	Nat	Herb	Asia
Maclura pomifera (Raf.) C.K.Schneid.	*Moraceae*	Neo	Nat	Tree	America
Magnolia grandiflora L.	*Magnoliaceae*	Neo	Cas	Tree	America
Malus floribunda Siebold ex Van Houtte	*Rosaceae*	Arc	Nat	Shrub/Tree	Asia
Matricaria discoidea DC.	*Asteraceae*	Neo	Nat	Herb	America
Matricaria matricarioides (Less.) Porter	*Asteraceae*	Neo	Nat	Herb	America
Melia azedarach L.	*Meliaceae*	Neo	Nat	Tree	Asia
Mesembryanthemum cordifolium L.f.	*Aizoaceae*	Neo	Nat	Succulent	Africa
Mesembryanthemum crystallinum L.	*Aizoaceae*	Neo	Nat	Succulent	Africa

Taxa	Family	Res	Stat	Simplified growth form	Native range
Mesembryanthemum nodiflorum L.	*Aizoaceae*	Arc	Nat	Succulent	Mediterranean & S Africa
Microstegium vimineum (Trin.) A.Camus	*Poaceae*	Neo	Nat	Herb	Asia
Mirabilis jalapa L.	*Nyctaginaceae*	Neo	Cas	Herb	America
Miscanthus sinensis Andersson	*Poaceae*	Neo	Cas	Bambusoid	Asia
Myriophyllum spicatum L.	*Haloragaceae*	Neo	Cas	Aquatic	Eurasia
Myriophyllum verticillatum L.	*Haloragaceae*	Neo	Cas	Aquatic	Circumboreal
Nandina domestica Thunb.	*Berberidaceae*	Neo	Cas	Bambusoid	Asia
Nephrolepis exaltata (L.) Schott	*Nephrolepidaceae*	Neo	Cas	Fern	America
Nicotiana glauca Graham	*Solanaceae*	Neo	Nat	Shrub/Tree	America
Oenothera biennis L.	*Onagraceae*	Neo	Nat	Herb	America
Oenothera glazioviana Micheli	*Onagraceae*	Neo	Nat	Herb	Garden/Hybrid
Oenothera parodiana Munz	*Onagraceae*	Neo	Nat	Herb	America
Oldenlandia capensis L.f. var. *capensis*	*Rubiaceae*	Neo	Nat	Herb	Africa
Oldenlandia capensis var. *pleiosepala* Bremek.	*Rubiaceae*	Neo	Cas	Herb	Africa
Opuntia ficus-indica (L.) Mill.	*Cactaceae*	Neo	Nat	Succulent	America
Opuntia microdasys (Lehm.) Pfeiff.	*Cactaceae*	Neo	Nat	Succulent	America
Oryza sativa L.	*Poaceae*	Arc	Cas	Herb	Asia
Oxalis articulata Savigny	*Oxalidaceae*	Neo	Nat	Herb	America
Oxalis corniculata L. s.l.	*Oxalidaceae*	Arc	Nat	Herb	America
Oxalis debilis var. *corymbosa* (DC.) Lourteig	*Oxalidaceae*	Neo	Nat	Herb	America
Oxalis floribunda Lehm.	*Oxalidaceae*	Neo	Nat	Herb	America
Oxalis pes-caprae L.	*Oxalidaceae*	Neo	Nat	Herb	Africa
Oxalis pes-caprae f. *pleniflora* (Lowe) Sunding	*Oxalidaceae*	Neo	Nat	Herb	Africa
Oxalis stricta L.	*Oxalidaceae*	Neo	Nat	Herb	America
Panicum capillare L.	*Poaceae*	Neo	Nat	Herb	America
Panicum miliaceum L.	*Poaceae*	Arc	Nat	Herb	Asia
Parkinsonia aculeata L.	*Fabaceae*	Neo	Cas	Tree	America
Parthenocissus quinquefolia (L.) Planch.	*Vitaceae*	Neo	Cas	Vine	America
Paspalum dilatatum Poir.	*Poaceae*	Neo	Nat	Herb	America
Paspalum distichum L.	*Poaceae*	Neo	Nat	Herb	America
Paspalum thunbergii Kunth ex Steud	*Poaceae*	Arc	Cas	Herb	Asia
Passiflora caerulea L.	*Passifloraceae*	Neo	Cas	Vine	America
Paulownia elongata S. Y. Hu.	*Paulowniaceae*	Neo	Cas	Tree	Asia
Paulownia fortunei (Seem.) Hemsl.	*Paulowniaceae*	Neo	Cas	Tree	Asia
Paulownia fortunei x Paulownia tomentosa	*Paulowniaceae*	Neo	Cas	Tree	Garden/Hybrid
Paulownia tomentosa Steud.	*Paulowniaceae*	Neo	Cas	Tree	Asia
Pelargonium zonale (L.) L'Hér. ex Aiton	*Geraniaceae*	Neo	Nat	Shrub	Africa
Perilla frutescens (L.) Britton	*Lamiaceae*	Neo	Cas	Herb	Asia
Phacelia tanacetifolia Benth.	*Hydrophyllaceae*	Neo	Cas	Herb	America
Phaseolus vulgaris L.	*Fabaceae*	Neo	Cas	Vine	America
Phyla canescens (Kunth) Greene	*Verbenaceae*	Neo	Nat	Herb	America
Phyla nodiflora (L.) Greene	*Verbenaceae*	Neo	Nat	Herb	America
Phyllostachys bambusoides Siebold & Zucc.	*Poaceae*	Neo	Nat	Bambusoid	Asia
Physalis alkekengi L. s.l.	*Solanaceae*	Neo	Nat	Herb	Eurasia

Taxa	Family	Res	Stat	Simplified growth form	Native range
Physalis angulata L.	*Solanaceae*	Neo	Nat	Herb	America
Physalis philadelphica var. *immaculata* Waterf.	*Solanaceae*	Neo	Nat	Herb	America
Physalis pubescens L.	*Solanaceae*	Neo	Nat	Herb	America
Phytolacca americana L.	*Phytolaccaceae*	Neo	Nat	Herb	America
Picea glauca (Moench) Voss	*Pinaceae*	Neo	Nat	Tree	America
Pinus pinaster Aiton	*Pinaceae*	Arc	Nat	Tree	Mediterranean
Pinus ponderosa Douglas ex C.Lawson	*Pinaceae*	Neo	Nat	Tree	America
Pinus radiata D.Don	*Pinaceae*	Neo	Cas	Tree	America
Pittosporum tobira (Thunb.) W.T.Aiton	*Pittosporaceae*	Neo	Cas	Shrub	Asia
Platycladus orientalis (L.) Franco	*Cupressaceae*	Neo	Nat	Tree	Asia
Plumbago auriculata Lam.	*Plumbaginaceae*	Neo	Cas	Shrub	Africa
Polygala myrtifolia L.	*Polygalaceae*	Neo	Cas	Shrub	Africa
Polygonum perfoliatum L.	*Polygonaceae*	Neo	Nat	Vine	Asia
Polygonum thunbergii Siebold & Zucc.	*Polygonaceae*	Arc	Nat	Herb	Asia
Populus × *canadensis* Moench	*Salicaceae*	Neo	Nat	Tree	Garden/Hybrid
Populus deltoides Bartr. ex Marsh.	*Salicaceae*	Neo	Nat	Tree	America
Portulaca grandiflora Hook.	*Portulacaceae*	Neo	Cas	Herb	America
Portulaca oleracea L. s.l.	*Portulacaceae*	Arc	Nat	Herb	Mediterranean
Pseudosasa japonica (Steud.) Makino	*Poaceae*	Neo	Cas	Bambusoid	Asia
Pseudotsuga menziesii (Mirb.) Franco var. *menziesii*	*Pinaceae*	Neo	Cas	Tree	America
Pseudotsuga menziesii (Mirb.) Franco var. *glauca* (Beissn.) Franco	*Pinaceae*	Neo	Cas	Tree	America
Quercus rubra L.	*Fagaceae*	Neo	Cas	Tree	America
Rhapis excelsa (Thunb.) Henry	*Arecaceae*	Neo	Nat	Palm	Asia
Ricinus communis L.	*Euphorbiaceae*	Arc	Nat	Shrub	Africa
Robinia hispida L.	*Fabaceae*	Neo	Cas	Tree	America
Robinia pseudoacacia L.	*Fabaceae*	Neo	Nat	Tree	America
Rudbeckia hirta L.	*Asteraceae*	Neo	Cas	Herb	America
Russelia equisetiformis Schltdl. & Cham.	*Plantaginaceae*	Neo	Cas	Shrub	America
Salix babylonica L.	*Salicaceae*	Neo	Nat	Tree	Asia
Santolina chamaecyparissus L.	*Asteraceae*	Arc	Nat	Herb	Mediterranean
Saponaria officinalis L.	*Caryophyllaceae*	Arc	Nat	Herb	Eurasia
Schefflera arboricola (Hayata) Merr.	*Araliaceae*	Neo	Cas	Shrub	Asia
Schinus molle L.	*Anacardiaceae*	Neo	Cas	Tree	America
Schinus terebinthifolius Raddi	*Anacardiaceae*	Neo	Cas	Tree	America
Scopolia carniolica Jacq.	*Solanaceae*	Arc	Nat	Herb	Europe
Sequoia sempervirens (D.Don) Endl.	*Cupressaceae*	Neo	Cas	Tree	America
Sequoiadendron giganteum (Lindl.) J.Buchholz	*Cupressaceae*	Neo	Cas	Tree	America
Setaria faberi R.A.W.Herrm.	*Poaceae*	Neo	Nat	Herb	Asia
Setaria italica (L.) P.Beauv.	*Poaceae*	N/A	Nat	Herb	Unknown
Setaria viridis (L.) P.Beauv.	*Poaceae*	Neo	Nat	Herb	Eurasia
Sicyos angulatus L.	*Cucurbitaceae*	Neo	Nat	Vine	America
Sida spinosa L.	*Malvaceae*	Neo	Nat	Herb	America
Sigesbeckia pubescens (Makino) Makino	*Asteraceae*	Neo	Cas	Herb	Asia
Solanum americanum Mill.	*Solanaceae*	N/A	Nat	Herb	Unknown

Taxa	Family	Res	Stat	Simplified growth form	Native range
Solanum angustifolium Mill.	*Solanaceae*	Neo	Cas	Herb	America
Solanum elaeagnifolium Cav.	*Solanaceae*	Neo	Nat	Herb	America
Solanum jasminoides J.Paxton	*Solanaceae*	Neo	Cas	Vine	America
Solanum luteum Mill. s.l.	*Solanaceae*	N/A	Nat	Herb	Mediterranean & E Asia
Solanum lycopersicum L.	*Solanaceae*	Neo	Cas	Herb	America
Solanum pseudocapsicum L.	*Solanaceae*	Neo	Cas	Herb	America
Solanum pseudocapsicum var. *diflorum* (Vell.) Bitter	*Solanaceae*	Neo	Cas	Herb	America
Solanum sisymbriifolium Lam.	*Solanaceae*	Neo	Nat	Herb	America
Solanum sodomaeum L.	*Solanaceae*	Neo	Nat	Shrub	Africa
Solanum tuberosum L.	*Solanaceae*	Neo	Cas	Herb	America
Solidago canadensis L.	*Asteraceae*	Neo	Nat	Herb	America
Sorghum × *drummondii* (Nees ex Steud.) Millsp. & Chase	*Poaceae*	Neo	Cas	Bambusoid	Garden/Hybrid
Sorghum bicolor (L.) Moench	*Poaceae*	Arc	Cas	Bambusoid	Africa
Spiraea × *vanhouttei* (Briot) Zabel	*Rosaceae*	Neo	Cas	Shrub	Garden/Hybrid
Sporobolus fertilis (Steud.) Clayton	*Poaceae*	Neo	Nat	Herb	Asia
Sporobolus indicus (L.) R.Br.	*Poaceae*	Neo	Nat	Herb	America
Strelitzia reginae Banks	*Strelitziaceae*	Neo	Cas	Herb	Africa
Styphnolobium japonicum (L.) Schott	*Fabaceae*	Neo	Cas	Tree	Asia
Symphyotrichum laeve (L.) Á.Löve & D.Löve	*Asteraceae*	Neo	Nat	Herb	America
Symphyotrichum squamatum (Spreng.) G.L.Nesom	*Asteraceae*	Neo	Nat	Herb	America
Syringa vulgaris L.	*Oleaceae*	Neo	Nat	Shrub	Europe
Tagetes erecta L.	*Asteraceae*	Neo	Nat	Herb	America
Tagetes minuta L.	*Asteraceae*	Neo	Nat	Herb	America
Tecoma capensis (Thunb.) Lindl.	*Bignoniaceae*	Neo	Cas	Vine	Africa
Thuja plicata Donn ex D.Don	*Cupressaceae*	Neo	Nat	Tree	America
Tradescantia fluminensis Vell.	*Commelinaceae*	Neo	Nat	Herb	America
Tradescantia pallida (Rose) D.R.Hunt	*Commelinaceae*	Neo	Cas	Herb	America
Tropaeolum majus L.	*Tropaeolaceae*	Neo	Nat	Vine	America
Ulex europaeus L.	*Fabaceae*	Neo	Nat	Shrub	Europe
Veronica persica Poir.	*Plantaginaceae*	Neo	Nat	Herb	Asia
Vinca minor L.	*Apocynaceae*	Arc	Nat	Herb	Europe
Vitis riparia Michx s.l.	*Vitaceae*	Neo	Cas	Vine	America
Washingtonia robusta H.Wendl.	*Arecaceae*	Neo	Cas	Palm	America
Weigela florida (Bunge) A.DC.	*Caprifoliaceae*	Neo	Nat	Shrub	Asia
Wisteria sinensis (Sims) Sweet	*Fabaceae*	Neo	Nat	Vine	Asia
Withania somnifera (L.) Dunal	*Solanaceae*	Arc	Nat	Shrub	Asia
Xanthium spinosum L.	*Asteraceae*	Neo	Nat	Herb	America
Xanthium strumarium L. s.l.	*Asteraceae*	Arc	Nat	Herb	America
Yucca gloriosa L.	*Asparagaceae*	Neo	Cas	Succulent	America
Zantedeschia aethiopica (L.) Spreng.	*Araceae*	Neo	Cas	Herb	Africa
Zizyphus mauritiana Lamk.	*Rhamnaceae*	Arc	Nat	Shrub/Tree	Asia

Supplementary material 1

Alien flora of Turkey: checklist, taxonomic composition and ecological attributes

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Data type: List of alien plants

Explanation note: List of alien taxa in the flora of Turkey. Taxa are ordered alphabetically. Each taxon is listed together with its family, residence time, invasion status, life-form according to Raunkiaer, growth for according to the Thesaurus of Plant Characteristics for Ecology and Evolution, simplified growth-form, life history, reasons for intentional and accidental introduction. The last five columns on the right list habitats where the species is found in Turkey. This list includes also 47 frequently planted taxa.