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# CONSTANȚA HARBOUR (ROMANIA) AS A MAJOR GATEWAY AND RESERVOIR FOR ALIEN PLANT SPECIES

ANASTASIU Paulina*, NEGREAN Gavril*, FĂGĂRAŞ Marius**, SAMOILĂ Ciprian**, COGĂLNICEANU Dan**

***Abstract***: The vegetation of the Romanian coastline along the Black Sea coast has a high proportion of alien plant species. An inventory between Chituc and Cape Kaliakra has revealed 115 alien plant taxa, representing almost one third of those reported for Romania and 82.14% of the alien plant species reported for the entire province of Dobrogea. About half of them are native to America (54 taxa). The majority of recorded alien plant species represent deliberate introductions, especially for ornamental purposes. 105 taxa are reported only from Constanța Harbour. The high proportion of alien plant species within the port indicates it is the major gateway for these in the area. The relatively large areas covered by vegetation in the port suggest that it also functions as an essential stepping-stone in the invasion process, providing favorable conditions for naturalization. We suggest that regular monitoring of key areas in the port can allow the early detection of potential invasive species.
***Keywords***: alien plant species, Constanța Harbour, Black Sea

## Introduction

Human-driven biotic invasions have already caused wide alteration of the Earth's biota, changing the roles of native species in communities, disrupting evolutionary processes, and causing reductions in the abundance of native species, including the extinction of many of them (Mack et al. 2000). These alterations constitute a threat to global biodiversity, second in impact only to the direct destruction and fragmentation of habitats (Cogălniceanu 2007). Invading species are major agents of global changes today. In recent years invasive alien species (IAS) have become a high-profile policy topic for the international community which has emphasized the need for coordination between competent institutions and stakeholders at all levels (McNeely et al. 2001). IAS are a major topic requiring intensive international cooperation and a multidisciplinary. Taking measures to limit the impact of IAS is also a compulsory requirement of the countries that are parties to international conventions (e.g. Convention of Biological Diversity, Bern Convention). Despite these efforts Europe and Romania now lag behind other regions that have developed strategic frameworks to address IAS in a holistic way. Whilst Europe's complex characteristics can make it harder to develop and implement common trade and movement policies, this should not be used to postpone decisive and balanced action. The impacts of many past invasions could have been reduced if European Union countries had uniformly applied appropriate best practices and taken rapid action to eradicate introduced

* University of Bucharest, Faculty of Biology, Department of Botany and Microbiology, 1-3 Intr. Portocalelor, 060101-Bucureşti, Romania, anastasiup@yahoo.com
** University Ovidius Constanța, Faculty of Natural Sciences

species following early detection. Most biological invasions now threatening Europe might have been prevented by greater awareness of IAS issues and a stronger commitment to address them (Hobbs & Humphries 1995). Current lack of response in many European countries and sectors may threaten the region's biodiversity, public health and economic interests. In line with international policy, it is now essential to develop efficient cooperation at national and regional level to prevent or minimize adverse impacts of IAS (McNeely et al. 2001).

The consequences of biological invasions are often so severe that they must be curbed and new invasions prevented (Mack et al. 2000). Prevention/exclusion is less costly than post-entry control and obviously has no detrimental effects. The main concern is to identify the species that should be prevented from entering and the areas of high risk of invasion. Early detection and rapid assessment can limit the damage and allow for efficient control methods. Early detection makes the difference between being able to employ feasible offensive strategies (eradication) or use long-term, costly and less effective defensive strategies for containment (Cogălniceanu 2007).

To control the rapid spread of alien species early detection and monitoring programs are required, especially in areas of high risk (Lodge et al. 2006). We have focused on monitoring alien plant species in and around Constanța Harbour (Romania), one of the largest EU harbours, to assess its potential role as a major gateway for alien species and a major reservoir for new plant invasions.

## Material and methods

### Study area

The region of Dobrogea is part of the Balkan region. It is bordered by the Danube River and Delta in the west and north and the Black Sea in the east. It encompasses two European bioregions (Pontic/Black Sea and steppic). Our study was focused on the coastal area (the Pontic/Black Sea bioregion) between Chituc (Romania) in the north and Cape Kaliakra (Bulgaria) in the south, along a stretch of coastline 150 km long. Vegetation inventories were made in the 10 locations, of which seven along the Romanian coastline and three in Bulgaria. Of these five were in protected areas, included as control.

1. Chituc sand dunes (44.42-44.47 N; 28.76-28.80 E) is a strictly protected area, part of the Danube Delta Biosphere Reserve, with an area of 2,300 ha. The following types of Natura 2000 habitats are found: 1210, 1310, 1410, 2110, 3130, 3140, 3150 and three priority habitats 1530, 2130 and 7210.
2. Midia harbour is located about 25 km north of Constanța (44.33-44.34 N; 28.63-28.67 E) and has an area of 834 ha, of which 234 ha land and 600 ha water (Administration of Constantza Port, 2009). It contains habitats 1210, 1410 and 1530.
3. Năvodari (44.31 N – 28.62 E), along the southern dyke, an area with ruderal vegetation and habitat 1530.
4. Constanța harbour (44.12-44.17 N – 28.65 E) has a total area of 3,626 ha, of which 1,784 ha of land, with 28.5 km of quay constructed and 37 km under construction, and 132 berths, with 150 additional ones under construction (Administration of Constantza Port, 2009). The main town in the region is Constanța, with a population over 300,000

inhabitants. The port of Constanța is a container hub for the Black Sea area, with 80% of the containerized cargo handled in Constanța having a different final destination. Constanța harbour has grown in importance in time, increasing 45 times during the last hundred years (Fig. 1a). The number of containers transiting the port has increased seven-fold since 2003 (Fig. 1b). This increase in traffic multiplies the risks of accidental introduction of alien species.

5. Agigea Sand Dunes Natural Reserve (44.08 N – 28.64 E) has an area of about 25 ha and has two habitats 2110 and 2130 (priority habitat).
6. Eforie Sud (44.04 N – 28.64 E), along a strip of land between the highway E87 and Techirghiol Lake. The area covers about 2 ha and is covered by habitat 62 C0 (priority habitat).
7. Tuzla (44.01 N – 28.66 E), along the coastline, covering an area of about 2 ha, with clay cliffs and sand dunes (habitats 1210 and 2110).

In addition to these sites we included for comparison three protected areas in Bulgaria, located 10-50 km south of the border.

8. Durankulak (Bulgaria) (43.67 N – 28.56 E) is a protected area covered by dunes with annual vegetation, including aquatic and wetland vegetation (habitats 1210, 2110 and 2130).
9. Shabla (Bulgaria) (43.58 N – 28.57 E) is a protected area covered by dunes, similar to Durankulak.
10. Cape Kaliakra (Bulgaria) (43.37 N – 28.46 E) is a natural reserve with an area of 287.5 ha, with vegetation belonging to the steppe and semi-steppe communities (Bondev 1991). It has habitats 62C0* (ponto-sarmatic pastures), 40C0* (ponto-sarmatic shrubs) and 7210* (marshes with *Cladium mariscus*) (see Nanova et al. 2008 for details).

**Inventory of plant species diversity**

A list of vascular plant taxa was compiled based on field records during 2004-2009. For each alien plant taxon we registered: family, life form, native range, way of introduction and invasive status. The nomenclature of recorded taxa follows Flora Europaea (Tutin et al. 1993; Tutin et al. 1964-1980). Plant families are according to APG II (2003). Life forms were based on Raunkjaer (1937) main criterion. Native range of taxa is according to Flora Europaea (Tutin et al. 1993, Tutin et al. 1964-1980) and Ciocârlan (2000). For assessing the invasive status we considered the terminology and definitions of Richardson et al. (2000) and Pyšek et al. (2004). For the deliberated introduced neophyte species we noted the type of use (e.g. ornamental, forestry, aromatic, fodder, human food, medicinal). We included in our analysis only neophytes, often being difficult to establish the status of archeophytes.

**Data analysis**

Sample based species accumulation curves (Gotelli and Colwell (2001) based on occurrence data were computed using EstimateS 8.0 (Colwell, 2006). Similarity between the locations (Jaccard index) was computed based on presence/absence data using MVSP (2004).

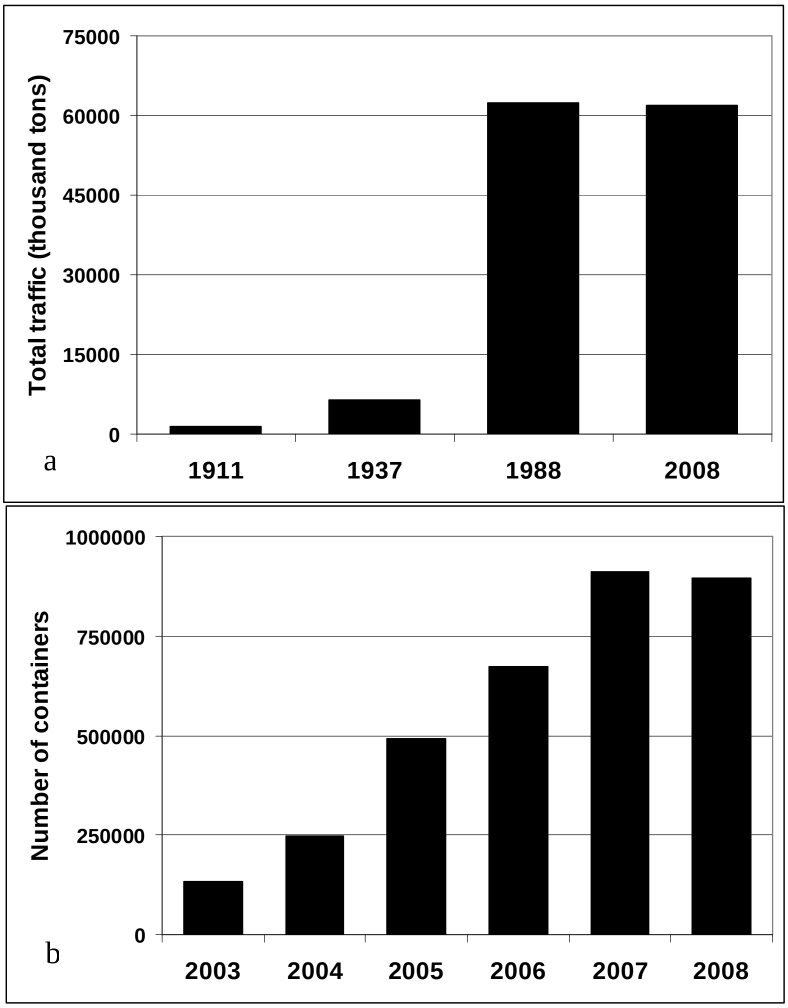


Fig. 1 (a) Increase in the total traffic (in thousand tons) in Constanța harbour during the last hundred years. (b) Dynamics of container transit in Constanța harbour (source www.portofconstantza.com/apmc).

**Results**

Along the coastline between Chituc and Cape Kaliakra we inventoried 1001 plant taxa, representing a quarter of the total number of vascular plants in Romania (Ciocârlan 2000) and 50% of the plant species inventoried in Dobrogea (Anastasiu & Negrean, unpubl. data). Of these, 115 taxa (11.48 %) are neophytes (Tabel 1), representing 29.94% of the species reported from Romania (Anastasiu & Negrean 2005) and 82.14 % of the neophytes reported for Dobrogea (Anastasiu & Negrean 2009). The neophytes belong to 35 families, with the families Poaceae (18 species), Asteraceae (15 species), and Amaranthaceae (9 species) being the most abundant. This situation is similar to that reported for other floras, the largest families as Poaceae and Asteraceae contributing most to the total number of alien flora (Pyšek 1998), while others as Amaranthaceae are known as the best invaders (Pyšek 1998).

We recorded four hybrids, during our surveys, all escaped from cultivation (*Fragaria* × *ananassa, Mentha* × *piperita, Petunia* × *atkinsiana, Viola* × *wittrokiana*). No hybrids between indigenous and non-indigenous plants were recorded.

Regarding the life forms, the majority of neophytes from the littoral area of the Black Sea between Chituc and Cape Kaliakra are therophytes (60 taxa; 52.17%), followed by megaphanerophytes (17 taxa; 14.78%), hemicryptophytes (13 taxa; 11.30%), nanophanerophytes (7 taxa; 6.08%), vines (5 taxa; 4.34%) (Table 1). While therophytes are usually accidental introductions (34 taxa; 29.56%), the other life forms are predominantly deliberate introductions.

The highest proportion of neophytes in the study area are native to America (54 taxa; 46.95%), followed by species native to Asia (26 taxa; 22.50%), and Europe (23 taxa; 20%). A low proportion of neophytes is known only in cultivation (5 taxa; 4.34%), or their native range is unknown (4 taxa; 3.46%) (Fig. 2).

Analyzing the way of introduction, it results a majority of neophytes recorded along the coastline in the study area are deliberate introductions (71 taxa; 61.73%). Most of them have been introduced for ornamental purposes (38 taxa; 33.04%), while 24 taxa (20.86%) were introduced for human food or fodder, while the rest (9 taxa; 7.82%) were introduced for other purposes (economic, medicinal, tinctorial etc). Accidental introductions are represented by 44 taxa (38.26%), most of them (30 taxa – 26.08%) are already invasive in different types of habitats, especially in human dominated habitats (Fig. 3).

Regarding their invasive status, almost half of the neophytes recorded are casual (57 taxa; 49.56%), many of them escaped from ornamental or crop culture (e.g. *Impatiens balsamina, Tagetes patula, Triticum aestivum* etc.). The rest is represented by invasive neophytes, which have a high proportion (45 taxa; 39.13%), while only 13 taxa (11.30%) are naturalized (Fig. 4). Three taxa are considered among the 100 most invasive alien species in Europe (DAISIE, 2009): *Ailanthus altissima*, *Ambrosia artemisiifolia* and *Robinia pseudacacia*.

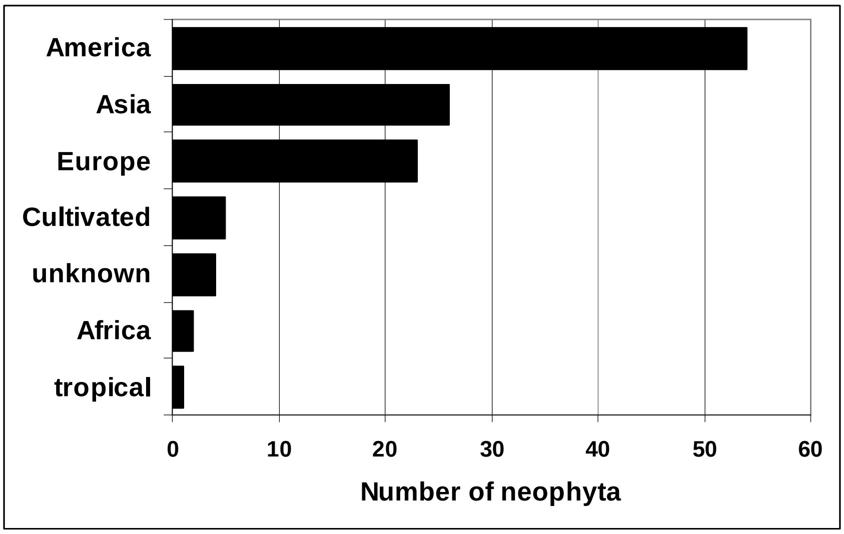


Fig. 2 Geographic origin of neophytes inventoried between Chituc and Kaliakra Cape.

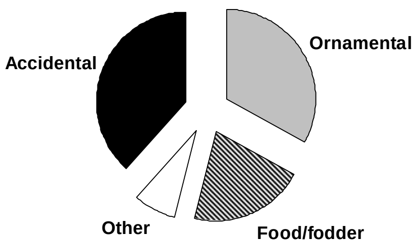


Fig. 3 Type of introduction of the neophytes inventoried along the coastline between Chituc and Cape Kaliakra.

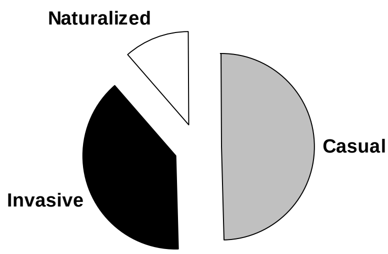


Fig. 4 The invasive status of the neophytes inventoried.

When comparing the similarity between the locations inventoried based on the presence/absence of plant species, Constanța harbour had the lowest similarity of all (Fig. 5). This is also highlighted in Figure 6, which depicts the proportion of neophytes within the plant species inventoried.

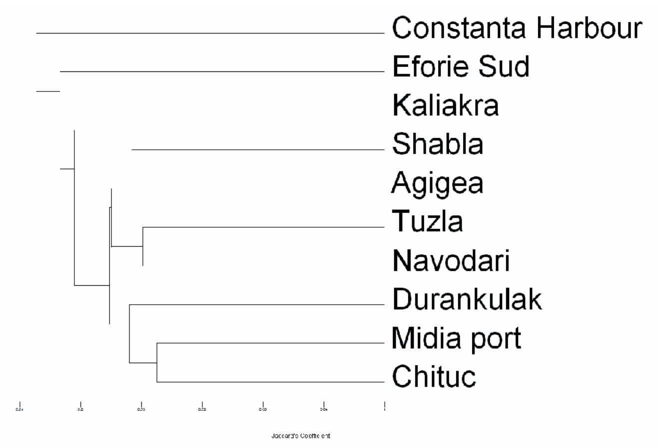


Fig. 5 Dendrogram with the similarity between plant species composition in the ten locations inventoried based on Jaccard index.

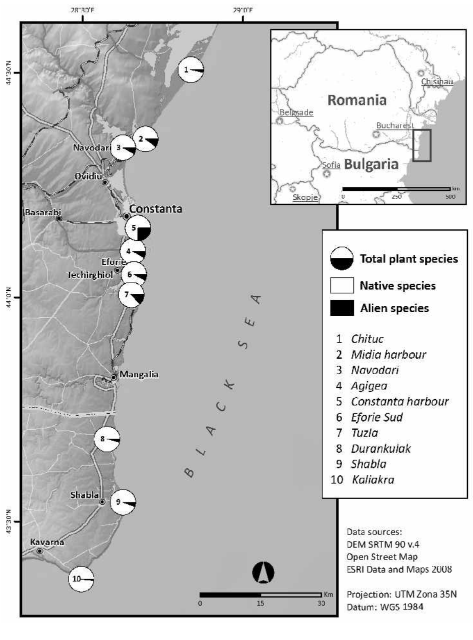


Fig. 6 Percentage of alien plant species within the coastline area between Chituc and Cape Kaliakra.

Figure 7 shows the most abundant neophytes within Constanța Harbour based on their occurrence in different sampling plots. Most of these species are invasive and are already widespread within the country.

Figure 8 ranks the most abundant ornamental plants escaped from cultivation inventoried within Constanța Harbour. Their location is usually limited to the cereal berths, their surroundings and along the railways.

An important topic in all species inventory is to assess its completeness. We computed sample-based species accumulation curves (Fig. 9). The inventory of plant species within Constanța Harbour is far from finished. After six inventories done in 2004 (September), 2008 (May, July and August) and 2009 (May, July) the species accumulation curve is far from reaching an asymptote.

**Discussion**

The province of Dobrogea is a major entry point of alien species in Romania. It has almost five times more alien plant species per area as compared to the whole country. This is partly caused by the low average altitude (maximum height 467 m a.s.l.), while the rest of the country where the Carpathian Mountains cover more than one third of the country, reach 2544 m a.s.l. is less prone to invasions. The higher rate of alien species indicates Dobrogea as a major gateway for alien species since both the Danube and Black Sea are major transport and trade routes. Along the narrow coastline studied, we have inventoried more than 80% of all alien species reported for Dobrogea. This high density suggests that the densely populated coastline is the major entry point for alien species. When focusing at a more detailed spatial scale Constanța Harbour has by far the largest proportion of alien species and can be considered a major entry point.

At larger spatial scales, floristic data are often collected subjectively. In this way it is impossible to achieve complete species list or to know the degree of completeness of such lists (e.g. McCollin et al. 2000). Sample species richness invariably underestimates the total richness of the plant communities or areas sampled. Complete enumeration of species richness within an extensive study area is generally not feasible, and can prove difficult for sampling units that exceed even a few hundreds of square meters in size (Palmer 1995). One measure of the extent of species richness in a region is the rate at which new species are added to an inventory (Soberón & Llorente 1993). If regular surveys are undertaken using standardized techniques, the rate at which species are detected (species-accumulation curve or collector curve) and the point at which detection of new species levels off gives an indication of the number of species within an area. Thompson & Withers (2003) have shown that the shape of a species-accumulation curve is influenced by both abundance and diversity. If rare species are present, or if there are few species with high abundance, accumulation curves have low shoulders and long trajectories to the asymptote. Conversely, areas with large numbers of abundant species have steep trajectories and reach asymptotes quickly. Species richness is thus positively correlated

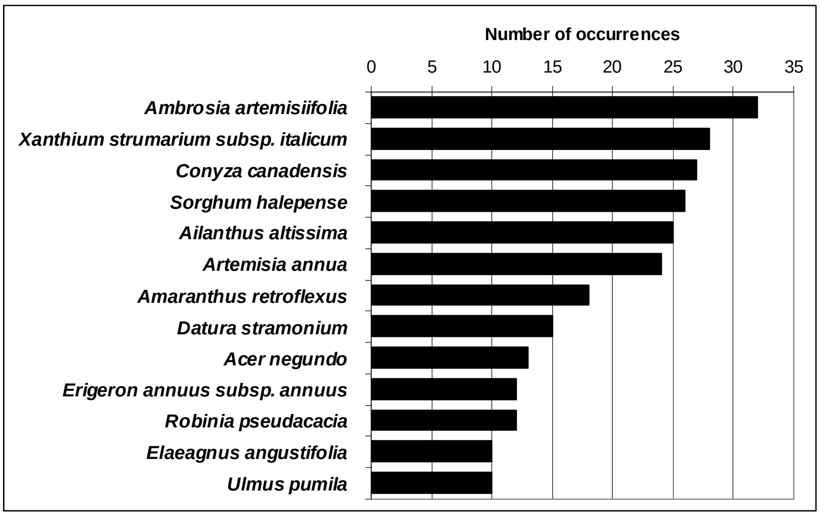


Fig. 7 The most abundant neophytes inventoried in Constanța Harbour. The total number of occurrences reported during the six inventories done between 2004-2009 is 424 for all 74 neophyte species.

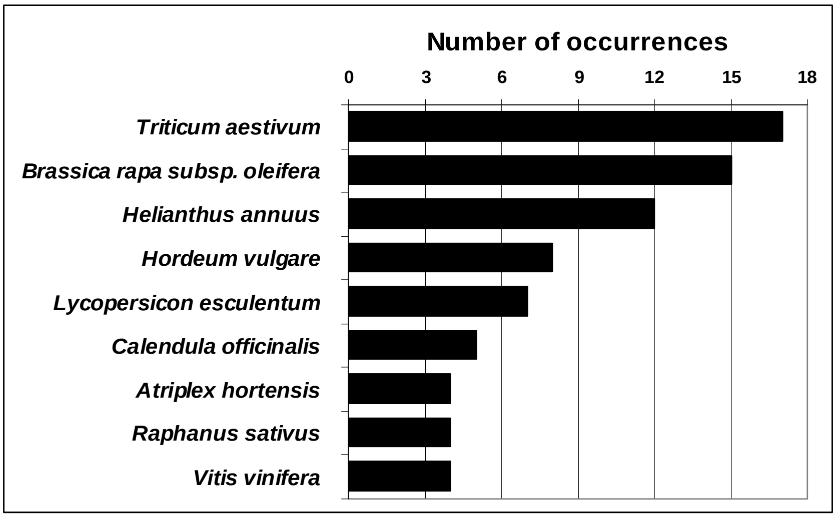


Fig. 8 The most abundant ornamental plants inventoried in Constanța Harbour. The total number of occurrences is 121 for 40 species.

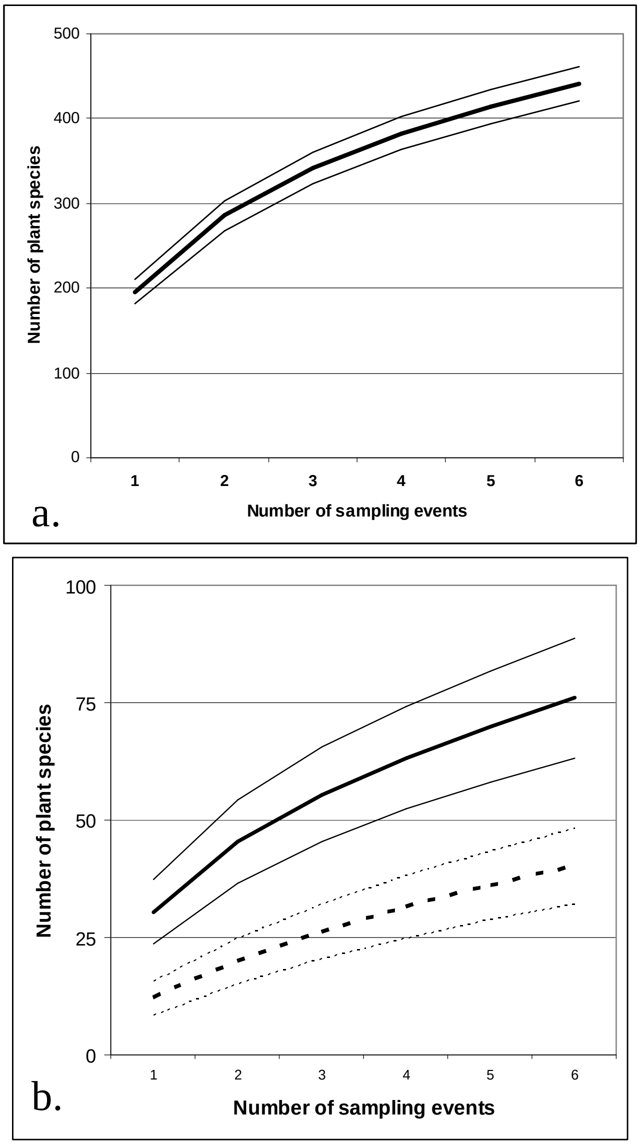


Fig. 9 (a) Plant species accumulation curve with mean and 95% CI bounds based on six inventories in Constanța Harbour using EstimateS 8.0 (Colwell 2006). (b) Species accumulation curves for neophyta (n=76) represented by the thick line, and occasional species (n=40) represented by the dotted line.

with the initial slope of the trajectory of the accumulation curve. During our study we did not come across several previously reported neophytes from Constanța harbour, that were not included in the data analysis: *Amaranthus palmeri*, *Amaranthus tamariscinus*, *Persicaria pensylvanica*, *Cardiospermum halicacabum*, *Senna obtusifolia*, *Sesbania exaltata*, *Biscutella auriculata*, *Solanum rostratum*, *Solanum carolinense*, *Ipomoea hederacea*, *Ipomoea quamoclit*, *Datura stramonium* var. *tatula*, *Sida spinosa*, *Salsola collina* (Costea 1996). We are aware that a complete inventory is not possible for the entire area and not even for the harbour, due to the intensity of the traffic and the high species turn-over.

During our study we have come across large areas within the port still covered by vegetation, not only along the complex railway network but also in the vicinity of the large coal and ore deposits. The large area covered and the high species diversity point them also as reservoirs, where alien species adapt and become naturalized. Our study has shown that Constanța Harbour is a major gateway for neophytes. The relatively large areas covered by vegetation in the port suggest that it acts also as a stepping-stone in the invasion process. Monitoring several key areas in the port can assure the early detection, containment and even eradication, with low to moderate costs.

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## PORTUL CONSTANȚA (ROMÂNIA), POARTĂ DE INTRARE ŞI SURSĂ PENTRU SPECIILE DE PLANTE ALOHTONE

***Rezumat***: Vegetația din zona litorală românească a Mării Negre cuprinde o proporție însemnată de plante alohtone. Un inventar floristic realizat între Chituc şi Cap Kaliakra a evidențiat prezența a 115 taxoni alohtoni, reprezentând aproape o treime din cei raportați pentru România şi 82,14% din totalul plantelor alohtone raportate pentru Dobrogea. Circa jumătate dintre aceştia sunt de origine americană (54 taxoni). Majoritatea plantelor alohtone invetariate reprezintă introduceri intenționate, în special în scop ornamental. Din portul Constanța sunt raportați 105 taxoni. Proporția ridicată de plate alohtone din port indică faptul că acesta este o poartă majoră pentru astfel de plante. Totodată portul oferă condiții favorabile pentru naturalizare. Considerăm că monitorizarea regulată în port va permite detectarea timpurie a potețialelor specii invazive.

***Cuvinte cheie***: plante alohtone, portul Constanța, Marea Neagră

*Table 1* Alien plant species recorded between Chituc (Danube Delta) and Kaliakra Cape

| No. | Taxa | Family | Life form | Native range | Way of introduction | Invasive status |
|---|---|---|---|---|---|---|
| 1. | Acer negundo | Sapindaceae | PhM | Am | d (orn) | I |
| 2. | Aesculus hippocastanum | Sapindaceae | PhM | EuS-E | d (orn) | C |
| 3. | Ailanthus altissima | Simaroubaceae | PhM | As | d (orn) | I |
| 4. | Alcea rosea | Malvaceae | H | Med | d (orn) | I |
| 5. | Alopecurus myosuroides | Poaceae | T | EuW,S&C | a | I |
| 6. | Amaranthus albus | Amaranthaceae | T | AmN | a | I |
| 7. | Amaranthus crispus | Amaranthaceae | T | AmS | a | I |
| 8. | Amaranthus hybridus | Amaranthaceae | T | AmN | a | I |
| 9. | Amaranthus powellii | Amaranthaceae | T | AmN&S | a | N |
| 10. | Amaranthus retroflexus | Amaranthaceae | T | AmN | a | I |
| 11. | Ambrosia artemisiifolia | Asteraceae | T | AmN | a | I |
| 12. | Ambrosia trifida | Asteraceae | T | AmN | a | I |
| 13. | Amorpha fruticosa | Fabaceae | PhN | AmN | d (orn, for) | I |
| 14. | Anethum graveolens | Apiaceae | T | AsSW, India | d (food) | C |
| 15. | Antirrhinum majus | Plantaginaceae | T | Med | d (orn) | C |
| 16. | Apium graveolens subsp. graveolens | Apiaceae | TH | EuW&S | a | N |

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|---|---|---|---|---|---|---|
| 17. | Artemisia annua | Asteraceae | T | AsC&SW | a | I |
| 18. | Atriplex hortensis | Amaranthaceae | T | As | d (food) | C |
| 19. | Avena sativa s.l. | Poaceae | T | unknown | d (food) | C |
| 20. | Bassia scoparia | Amaranthaceae | T | RussiaE&S | a | I |
| 21. | Bidens frondosa | Asteraceae | T | AmN | a | I |
| 22. | Brassica rapa subsp. oleifera | Brassicaceae | T-TH | cult. | d (ind) | C |
| 23. | Brassica rapa subsp. sylvestris | Brassicaceae | T-TH | Med | a | C |
| 24. | Bromus madritensis | Poaceae | T | EuW&S, AfrN | a | C |
| 25. | Bromus rigidus | Poaceae | T | Med | a | C |
| 26. | Bromus wildenowii | Poaceae | T | AmS | a | C |
| 27. | Calendula officinalis | Asteraceae | T-H | Med | d (orn, med) | C |
| 28. | Chamomilla suaveolens | Asteraceae | T | Am,As | a | I |
| 29. | Chenopodium ambrosioides | Amaranthaceae | T | AmTrop | a | I |
| 30. | Chenopodium botrys | Amaranthaceae | T | Sm | a | C |
| 31. | Chloris barbata | Poaceae | T | AmTrop | a | C |
| 32. | Citrullus lanatus | Cucurbitaceae | T | AfrNW | d (food) | C |
| 33. | Cladium mariscus subsp. martii | Cyperaceae | H | AsC&Med | a | N |
| 34. | Commelina communis | Commelinaceae | H | As | d (orn) | N |
| 35. | Conyza canadensis | Asteraceae | T | AmN | a | I |

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|---|---|---|---|---|---|---|
| 36. | Cucurbita pepo | Cucurbitaceae | T | AmC | d (food) | C |
| 37. | Cuscuta campestris subsp. campestris | Convolvulaceae | T | AmN | a | I |
| 38. | Cuscuta suaveolens | Convolvulaceae | T | AmS | a | N |
| 39. | Cydonia oblonga | Rosaceae | PhM | AsSW | d (food) | C |
| 40. | Datura innoxia | Solanaceae | T | AmC | d (orn) | C |
| 41. | Datura stramonium | Solanaceae | T | Am | a | I |
| 42. | Elaeagnus angustifolia | Elaeagnaceae | PhN | AsTemp | d (orn, for) | I |
| 43. | Eleusine indica | Poaceae | T | Trop | a | I |
| 44. | Erigeron annuus subsp. annuus | Asteraceae | TH | AmN | a | I |
| 45. | Euphorbia maculata | Euphorbiaceae | T | AmN | a | I |
| 46. | Fallopia aubertii | Polygonaceae | PhLi | As | d (orn) | C |
| 47. | Ficus carica | Moraceae | PhN | Med | d (food) | C |
| 48. | Foeniculum vulgare | Apiaceae | T-H | Med | d (arom) | C |
| 49. | Fragaria x ananassa | Rosaceae | H | cult. | d (food) | C |
| 50. | Fraxinus americana | Oleaceae | PhM | AmN | d (orn) | I |
| 51. | Fraxinus pennsylvanica | Oleaceae | PhM | AmN | d (orn) | I |
| 52. | Galinsoga parviflora | Asteraceae | T | AmS | a | I |
| 53. | Gleditsia triacanthos | Fabaceae | PhM | AmN | d (orn, for) | I |
| 54. | Helianthus annuus | Asteraceae | T | Am | d (food) | C |

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|---|---|---|---|---|---|---|
| 55. | Helianthus tuberosus | Asteraceae | H | AmN | d (orn, food) | I |
| 56. | Hemerocallis fulva | Hemerocallidaceae | H | As | d (orn) | C |
| 57. | Hibiscus syriacus | Malvaceae | PhN | AsE&S | d (orn) | C |
| 58. | Hordeum distichon | Poaceae | T | unknown | d (food) | C |
| 59. | Hordeum marinum | Poaceae | T | EuW&S | a | C |
| 60. | Hordeum vulgare | Poaceae | T | unknown | d (food) | C |
| 61. | Impatiens balsamina | Balsaminaceae | T | As(IndiaE) | d (orn) | C |
| 62. | Ipomoea lacunosa | Convolvulaceae | T | AmN | a | C |
| 63. | Ipomoea purpurea | Convolvulaceae | T | AmTrop | d (orn) | C |
| 64. | Iris germanica | Iridaceae | G | Med | d (orn) | C |
| 65. | Iva xanthifolia | Asteraceae | T | AmN | a | I |
| 66. | Juniperus virginiana | Cupressaceae | PhN | AmN | d (orn) | C |
| 67. | Koelreuteria paniculata | Sapindaceae | PhM | As(China) | d (orn) | C |
| 68. | Lemna minuta | Araceae | Hd | Am | a | I |
| 69. | Lepidium virginicum | Brassicaceae | T-TH | AmN | a | I |
| 70. | Lycium barbarum | Solanaceae | PhN | As | d (orn) | I |
| 71. | Lycopersicon esculentum | Solanaceae | T | AmS | d (food) | C |
| 72. | Maclura pomifera | Moraceae | PhM | AmN | d (orn) | C |
| 73. | Malus domestica | Rosaceae | PhM | AsC | d (food) | C |

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|---|---|---|---|---|---|---|
| 74. | Medicago sativa subsp. sativa | Fabaceae | T | Med | d (fodder) | N |
| 75. | Mentha × piperita | Lamiaceae | H | cult. | d (med, arom) | N |
| 76. | Mentha spicata | Lamiaceae | H | EuW&S | d (med, arom) | N |
| 77. | Mirabilis jalapa | Nyctaginaceae | H | AmTrop | d (orn) | C |
| 78. | Morus alba | Moraceae | PhM | As(China) | d (ser) | I |
| 79. | Nicotiana alata | Solanaceae | T | AmS | d (orn) | C |
| 80. | Oenothera biennis | Onagraceae | TH | AmN | d (orn) | N |
| 81. | Oxalis corniculata | Oxalidaceae | H | AmN&C | a | I |
| 82. | Oxalis europaea | Oxalidaceae | H | AmN, AsE | a | I |
| 83. | Oxalis stricta [syn. O. dillenii] | Oxalidaceae | T-H | AmN | a | I |
| 84. | Panicum capillare | Poaceae | T | AmN | a | I |
| 85. | Panicum dichotomiflorum | Poaceae | T | AmN | a | N |
| 86. | Parthenocissus inserta | Vitaceae | PhLi | AmN | d (orn) | I |
| 87. | Parthenocissus tricuspidata | Vitaceae | PhLi | AmN | d (orn) | N |
| 88. | Petroselinum crispum | Apiaceae | TH | Med | d (arom) | N |
| 89. | Petunia × atkinsiana | Solanaceae | T | cult. | d (orn) | C |
| 90. | Phalaris canariensis | Poaceae | T | Canare | d (fodder) | C |
| 91. | Phytolacca americana | Phytolaccaceae | H | AmN | d (tinct) | I |
| 92. | Prunus armeniaca | Rosaceae | PhM | AsW | d (food) | C |

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|---|---|---|---|---|---|---|
| 93. | Prunus cerasus | Rosaceae | PhM | EuSE&AsW | d (food) | C |
| 94. | Prunus persica | Rosaceae | PhM | As(China) | d (food) | C |
| 95. | Raphanus sativus | Brassicaceae | T-TH | unknown | d (food) | C |
| 96. | Robinia pseudacacia | Fabaceae | PhM | AmN | d (orn, for) | I |
| 97. | Salvia splendens | Lamiaceae | T | AmS | d (orn) | C |
| 98. | Satureja hortensis | Lamiaceae | T | Med | d (arom) | C |
| 99. | Setaria faberi | Poaceae | T | AsE | a | C |
| 100. | Solanum tuberosum | Solanaceae | T | AmS | d (food) | C |
| 101. | Sophora japonica | Fabaceae | PhM | AsE | d (orn) | C |
| 102. | Sorbaria sorbifolia | Rosaceae | PhN | As | d (orn) | C |
| 103. | Sorghum dochna var. technicum | Poaceae | T | AsS | d (fodder) | C |
| 104. | Sorghum halepense | Poaceae | H | AfrN,AsSW | a | I |
| 105. | Tagetes patula | Asteraceae | T | Am | d (orn) | C |
| 106. | Tecoma radicans | Bignoniaceae | PhLi | AmN | d (orn) | C |
| 107. | Trigonella caerulea | Fabaceae | T | Med | d (fodder) | C |
| 108. | Triticum aestivum | Poaceae | T | As | d (food) | C |
| 109. | Ulmus pumila | Ulmaceae | PhM | As | d (orn) | I |
| 110. | Veronica persica | Plantaginaceae | T | As | a | I |
| 111. | Viola × wittrockiana | Violaceae | T | cult. | d (orn) | C |

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|---|---|---|---|---|---|---|
| 112. | Vitis vinifera | Vitaceae | PhLi | AsSW, Med | d (drink) | N |
| 113. | Xanthium spinosum | Asteraceae | T | AmS | a | I |
| 114. | Xanthium strumarium subsp. italicum | Asteraceae | T | Med | a | I |
| 115. | Zea mays | Poaceae | T | Am | d (food, fodder) | C |

**Life form**: Ch – Chamaephytae; G – Geophyte; H – Hemicryptophyte; HH – Helohydrophyte; PhEp – Epiphyte; PhLi – Liana; PhM – Macrophanerophyte; PhN – Nanophanerophyte; T – Therophyte; TH – Hemitherophyte.
**Native range**: Af – Africa; Am – America; As – Asia; Eu – Europe; Eua – Eurasia; Cauc – Caucasus; Anat – Anatolia; Cs – Cosmopolite; Cb – Circumboreal; Temp – Temperate; Trop – Tropical; Ct – Continental; Med – Mediterranean; Sm – Submediterranean; Pt – Pontic; N – North; E – East; S – South; W – West; C – Centre (central).
**Way of introduction**: a – accidental; d – deliberate.
**Invasive status**: C = casual; N = naturalized; I = invasive.