

Alien vascular plants in Dobrogea (Romania) and their impact on different types of habitats

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Abstract. In different types of habitats from Dobrogea (including Danube Delta) we identified 140 neophytes and 9 archaeophytes; about half of them are from America and arrived here accidentally. Among neophytes, 30 taxa have invasive status, but only few are aggressive having a negative impact on different ecosystems: *Ailanthus altissima*, *Amorpha fruticosa*, *Azolla filiculoides*, *Bidens frondosa*, *Conyza canadensis*, *Elodea nuttallii*, *Lindernia dubia*, *Paspalum paspalodes*.

Key words: Dobrogea, ecosystems, impact, invasive alien plants, Romania

Introduction

Dobrogea (including Danube Delta) is a very important region for plant (about 2000 taxa) and habitat diversity (wetlands, dry grasslands, calcareous stony slopes, thermophilous woodlands, dunes and sands habitats, etc.). Here there are 20 endemic taxa and over 200 rare plants, many of them included in IUCN Red list, Bern Convention, Habitats Directive (*Campanula romanica*, *Centaurea jankae*, *C. pontica*, *Salicornia veneta*, *Achillea thracica*, *Aldrovanda vesiculosa*, *Alyssum borzaeinum*, *Colchicum fominii*, *Liparis loeselii*, *Marsilea quadrifolia*, *Moehringia jankae*, *Paeonia tenuifolia*, *Potentilla emilii-popii*, *Ruscus aculeatus*, *Salvinia natans*, *Serratula lycopifolia*, *Trapa natans*, *Typha minima*, *Zostera marina*) (Sârbu 2003). Biosphere Reserve Danube Delta and National Park Măcin Mountains are the main protected areas. According to Law No. 5/2000, in Dobrogea there are also 82 natural scientific reserves. Unfortunately, in this region there are many opportunities for alien plants: favourable climate for thermophilous elements, numerous gates and pathways (harbours, train stations, railways network, roads, Danube River, Danube – Black Sea Channel).

Among the first alien plants reported from Dobrogea are: *Heliotropium curassavicum*, *Coronopus didymus*, *Diplotaxis eruroides*, *Petunia parviflora* (Kantitz 1879–1881), *Amaranthus deflexus*, *Urtica pilulifera*

(Brândză 1898), *Elodea canadensis* (Macovei & Scriban 1905), *Lycium barbarum* (Grecescu 1909) and *Azolla filiculoides* (Pallis 1916). The last records are: *Bellardia trixago* (Ciocârlan & Costea 2004), *Chloris barbata* and *Impatiens balsamina* (Anastasiu & Negrean 2005).

Material and methods

A comprehensive database with neophytes recorded from Dobrogea (including Danube Delta) has been done. The data were obtained from literature, herbarium sheets and as a result of own field observations along many years. For each taxon we registered: family, life form, origin, time of immigration, abundance, invasive status, type of habitats where the species was identified, way of introduction, the impact on natural ecosystems and the economic impact. We also listed the archaeophytes from Dobrogea. The nomenclature of species is according to *Flora Europaea* (Tutin & al. 1964–1980, 1993) and *Flora României* (Săvulescu 1952–1976).

The terminology and definitions recommended by Richardson & al. (2000) and Pyšek & al. (2004) were used to establish the status of alien plants in our country.

It must be mentioned that, generally, the appreciations of degree of naturalisation and invasiveness are subjective, as well as the appreciations on impact, depending on our perception related to these phenomena.

Results and discussion

In Dobrogea region we identified 140 alien plants taxa belonging to 43 families (Table 1). Among these, 36 taxa are distributed exclusively in Danube Delta. Few families are well represented: *Asteraceae* (23 taxa), *Amaranthaceae* (16 taxa), *Poaceae* (14 taxa), *Solanaceae* (10), *Fabaceae* (9 taxa), *Brassicaceae* (8 taxa), *Chenopodiaceae* (7 taxa). The others families are represented by one or two taxa.

Most neophytes from Dobrogea came from America – 69 taxa (49.28%). Among these, about half of them belong to North-American species with 41 taxa (29.28%). Mediterranean species follow those American, but at a distance, with only 24 representatives (17.14%). Neophytes originated from Asia rank third with 16 taxa (11.42%). 13 neophytes are from Europe (9.28%); these came either from Eastern Europe (*Lychnis chalconica*, *Salsola acutifolia*, *S. collina*, *Scilla siberica*), from Central, Western and South-Western Europe (*Euphorbia leptocaula*, *Geranium sibiricum*, *Erucastrum gallicum*, *Apium graveolens*, *Elymus athericus*, *Hordeum marinum*, *Vicia lutea*, *Cytisus scoparius*) or from Anatolia and the Caucasus (*Sophora jaubertii*). Other elements have a low representation. We mention the presence in Danube Delta of an Australian taxon – *Chenopodium pumilio*.

The analyses of life forms revealed the dominance of therophytes (90 taxa – 64.28%), compared with other categories. They are followed by hemicryptophytes with 18 taxa (12.85%). The good representation of helohydrophytes (6 taxa – 4.28%), comparing with other life forms, is explained by large water surfaces existing in this region. Phanerophytes are 12 taxa (8.57%), 4 being trees, 5 shrubs and 3 vines. Chamaephytes and geophytes are weakly represented, generally fewer than 4%.

Regarding the introduction, the most neophytes from Dobrogea are not intentional (99 taxa – 70.71%), as a result of human activity, brought by animals, water, wind, etc. (97 taxa) or as a result of hybridisation (2 taxa: *Achillea roseo-alba* and *Amaranthus × budensis*). We mention that the not intentional introductions are favoured by the numerous gates that ensure international commercial relations of our country (Constanța, Sulina, Tulcea, Brăila and Galați harbours, railway stations), as well as by the existing transport net (fluvial and terrestrial, connecting Romania with South and East Europe as well as with Asia, etc.). 41

neophytes (29.28%) were introduced deliberately as forestry, horticultural or agricultural plants and they escaped in different types of ecosystems.

Among 140 neophytes identified in Dobrogea, 4 taxa have been mentioned from a single locality or 2–3 localities, but their presence has not been re-signalled in the last 50 years. For this reason we consider them extinct (*Cyperus esculentus*, *Diplotaxis eruroides*, *Saccharum ravennae*, *Urtica pilulifera*). Other 24 neophytes have been indicated from a single location, but re-signalled afterwards. Many neophytes are rare, being indicated from few localities (48 taxa – 35.29%). Only few neophytes are common (22 taxa) or locally abundant (12 taxa).

The analyses of naturalisation status reveal the most neophytes become spontaneous only casually (76 taxa – 54.28%). These either escaped from culture, or penetrate accidentally and they are not able to produce new stable populations on long term, in the new conditions. We consider that only 34 taxa among analysed neophytes are naturalised, being able to reproduce and to sustain populations without human direct intervention. Among neophytes, 30 are invasive: *Acer negundo*, *Ailanthus altissima*, *Amaranthus albus*, *A. crispus*, *A. hybridus*, *A. retroflexus*, *Ambrosia artemisiifolia*, *Amorpha fruticosa*, *Artemisia annua*, *Azolla filiculoides*, *Bidens frondosa*, *Chamaesyce maculata*, *Conyza canadensis*, *Cuscuta campestris*, *Echinocystis lobata*, *Elodea nuttallii*, *Erigeron annuus* subsp. *annuus*, *Galinsoga parviflora*, *Iva xanthifolia*, *Lindernia dubia*, *Lycium barbarum*, *Matricaria discoidea*, *Paspalum paspalodes*, *Phytolacca americana*, *Robinia pseudacacia*, *Sorghum halepense*, *Veronica persica*, *Xanthium italicum*, *X. spinosum*, *X. strumarium*.

If the most naturalised and invasive alien plants are limited to the anthropic habitats, some of them penetrate semi-natural or natural ecosystems often having a negative impact. Among these, some seems to be very aggressive:

Ailanthus altissima is present in all types of habitats from Dobrogea. We identified it in costal dunes and sand habitats (EUNIS code B1) from Agigea Natural Reserve, dry grasslands (EUNIS code E1) from Dobrogea Plateau, Moesian Christ's thorn brush (EUNIS code F3) from Southern Dobrogea. From Danube Delta *A. altissima* was reported in sand habitats at Letea and Sulina (Dihoru & Negrean 1976).

Alcea rosea is often in anthropic habitats (EUNIS code I, J and X21), but we met it in dry grasslands

(EUNIS code E1) as well as in sand habitats with *Ephedra distachya* (EUNIS code B1.4) from Agigea Natural Reserve.

Amorpha fruticosa is a real competitor for the native plants of riverine scrubs, even forming a sub-association: *Salicetum triandrae* Malcuit 1929 sub-ass. *amorphosum fruticosae* Borza 1954 (Doniță & al. 2005). It is very frequent in poplar galleries (EUNIS code G1.365) and almond willow-osier scrub (EUNIS code F9.121).

Azolla filiculoides covers large water surfaces threatening the communities of *Chara* and *Nitella* (EUNIS code C1.141, C1.142), of *Lemna minor*, *L. trisulca*, *Spirodela polyrhiza*, *Wolffia arrhiza* (EUNIS code C1.221), of *Salvinia natans* and *Marsilea quadrifolia* (EUNIS code C1.225), the communities with *Potamogeton perfoliatus*, *P. gramineus* and the communities with *Trapa natans*.

Bidens frondosa is frequent in riverine scrubs from Danube Delta.

Conyza canadensis is much spread but without an evident impact on native flora. We recorded it in dry grasslands (EUNIS code E1), as well as in costal dunes and sand habitats (EUNIS code B1) at the seashore.

Elodea nuttallii was reported in 1998 from Danube Delta (Ciocârlan & al. 1998). It develops important populations in communities with *Potamogeton perfoliatus*, *P. gramineus*, *P. natans*, as well as in communities with *Nymphaea alba*, *Trapa natans* and *Nuphar lutea*. It seems *Elodea nuttallii* replaces *E. canadensis*.

Lindernia dubia is invasive in natural ecosystems from Sacalin Islands (Ciocârlan 1994).

Paspalum paspalodes, even if not so spread, is very aggressive replacing native species as *Typha latifolia*, *Phragmites australis*, etc. We recorded it from commu-

nities with *Bolboschoenus maritimus* and *Schoenoplectus tabernemontani*, communities with *Typha angustifolia* and *T. latifolia* (EUNIS code C3.231/232), communities with *Phragmites australis* (EUNIS code C3.21).

Xanthium italicum seems to be more present than *X. strumarium*. It invades habitats as costal dunes and sand habitats (EUNIS code B1), dry grasslands (EUNIS code E1), inland saline grass and herb-dominated habitats (EUNIS code E6).

Xanthium spinosum is common in all types of habitats. We recorded it frequently on costal dunes and sand habitats (EUNIS code B1), as well as in associations of *Scolymus hispanicus* and *Ecbalium elaterium* from the Black Sea seashore.

From the economic point of view, we appreciate that about 24 neophytes from Dobrogea are harmful and 35 neophytes are potentially harmful. They are present in crops, ornamental cultures or on railways' embankments, along the roads, pathways, in railways stations, harbours. Their elimination, either mechanically or chemically, involves usually high costs.

Some neophytes from Dobrogea were included in National Red Lists (Oltean & al. 1994; Dihoru & Dihoru 1994): *Geranium sibiricum* (Ex), *Glinus lotoides* (R), *Petunia parviflora* (R), *Sophora jaubertii* (V/R).

Among archaeophytes, we recorded the next taxa: *Abutilon theophrasti* (frequent), *Agrostemma githago* (scattered), *Cannabis sativa* ssp. *spontanea* (frequent), *Cardaria draba* ssp. *draba* (frequent), *Centaurea cyanus* (frequent), *Consolida orientalis* (scattered), *Pegonium harmala* (rare), *Portulaca oleracea* ssp. *oleracea* (frequent) and *Tanacetum parthenium* (scattered). All these species are usually present in artificial habitats (EUNIS code I and J) and they have not an evident economic impact.

Table 1. Neophytes recorded from Dobrogea (Romania).

No.	Taxon	Family	Origin	Life form	Distribution	Introduction	Abundance	Invasive status	Impact on natural ecosystems	Economic impact
1.	<i>Acer negundo</i> L. ♀ ♂	ACE	AmN	PhM	D	I2	c	A3	U	d
2.	<i>Achillea roseo-alba</i> Ehrend.	AST	Sm	H	D	N2	r	A1	U	nd
3.	<i>Acorus calamus</i> L.	ARA	As	H	DD	I2	sc	A2	U	nd
4.	<i>Ailanthus altissima</i> (Miller) Swingle	SMB	As	PhM	D,DD	I2	c	A3	I	d
5.	<i>Alcea rosea</i> L.	MLV	Med (?)	H	D	I2	sc	A2	I	pd
6.	<i>Amaranthus acutilobus</i> Uline & Bray	AMA	AmN	T	D	N1	r	A2	U	pd
7.	<i>Amaranthus albus</i> L.	AMA	AmN	T	D,DD	N1	c	A3	U	d
8.	<i>Amaranthus blitoides</i> S. Watson	AMA	AmN	T	D,DD	N1	r	A2	U	d

Table 1. Continuation.

No.	Taxon	Family	Origin	Life form	Distribution	Introduction	Abundance	Invasive status	Impact on natural ecosystems	Economic impact
9.	<i>Amaranthus crispus</i> (Lesp. & Thev.) N. Terrac.	AMA	AmS	T	D,DD	N1	c	A3	U	d
10.	<i>Amaranthus deflexus</i> L.	AMA	AmS	T	D,DD	N1	sc	A2	U	d
11.	<i>Amaranthus emarginatus</i> Moq. ex Uline & W.L. Bray	AMA	Trop	T	DD	N1	sc	A1	U	pd
12.	<i>Amaranthus hybridus</i> L. s.l.	AMA	AmN	T	D,DD	N1	c	A3	U	d
13.	<i>Amaranthus palmeri</i> S. Watson	AMA	AmN	T	D	N1	s	A1	U	pd
14.	<i>Amaranthus powellii</i> S. Watson s.l.	AMA	AmN&S	T	DD	N1	sc	A2	U	d
15.	<i>Amaranthus quitensis</i> Kunth	AMA	AmS	T	D	N1	s	A1	U	pd
16.	<i>Amaranthus retroflexus</i> L.	AMA	AmN	T	D,DD	N1	c	A3	U	d
17.	<i>Amaranthus rudis</i> Sauer	AMA	AmN	T	D	N1	s	A1	U	pd
18.	<i>Amaranthus spinosus</i> L.	AMA	AmN	T	D	N1	s	A1	U	pd
19.	<i>Amaranthus tamariscinus</i> Nutt.	AMA	AmS	T	D	N1	s	A1	U	pd
20.	<i>Amaranthus viridis</i> L.	AMA	AmS	T	D	N1	r	A1	U	pd
21.	<i>Amaranthus</i> × <i>budensis</i> Priszter	AMA	×	T	D	N2	s	A1	U	pd
22.	<i>Ambrosia artemisiifolia</i> L.	AST	AmN	T	D	N1	c	A3	PI	d
23.	<i>Ambrosia coronopifolia</i> Torrey & A. Gray	AST	AmN	H	DD	N1	r	A1	U	pd
24.	<i>Ambrosia trifida</i> L.	AST	AmN	T	D	N1	sc	A1	U	pd
25.	<i>Amorpha fruticosa</i> L.	FAB	AmN	PhN	D,DD	I2	c	A3	I	d
26.	<i>Apium graveolens</i> L. s.l.	API	EuW&S	TH	D,DD	N1	r	A2	PI	nd
27.	<i>Artemisia annua</i> L.	AST	AsC&SW	T	D,DD	N1	c	A3	PI	d
28.	<i>Atriplex micrantha</i> Ledeb.	CHN	As	T	D	N1	r	A1	U	nd
29.	<i>Azolla filiculoides</i> Lam.	AZL	AmN	HH	D,DD	N1	la	A3	I	d
30.	<i>Bellardia trixago</i> (L.) All.	SCR	Med	T	D	N1	s	A1	U	nd
31.	<i>Bidens connata</i> Muhl. ex Willd.	AST	AmN	T	DD	N1	s	A2	PI	pd
32.	<i>Bidens frondosa</i> L.	AST	AmN	T	DD	N1	r	A2	PI	pd
33.	<i>Bidens vulgata</i> Greene	AST	AmN	T	DD	N1	c	A3	PI	d
34.	<i>Biscutella auriculata</i> L.	BRA	Med	T	D	N1	s	A1	U	nd
35.	<i>Borago officinalis</i> L.	BOR	Med	T	D	N1	r	A1	U	nd
36.	<i>Brachyactis ciliata</i> Ledeb.	AST	As	T	DD	N1	sc	A1	U	nd
37.	<i>Cardiospermum halicacabum</i> L.	SAP	Trop	T	D	N1	s	A1	U	nd
38.	<i>Cenchrus incertus</i> M.A. Curtis	POA	Am	T	D	N1	r	A2	PI	pd
39.	<i>Chamaesyce canescens</i> (L.) Prokh.	EUP	Sm	T	D	N1	sc	A1	U	nd
40.	<i>Chamaesyce maculata</i> (L.) Small	EUP	AmN	T	DD	N1	sc	A3	PI	nd
41.	<i>Chenopodium ambrosioides</i> L.	CHN	AmTrop	T	D	N1	sc	A2	PI	pd
42.	<i>Chenopodium foliosum</i> (Moench) Ascherson	CHN	Med	T	D	N1	r	A1	U	nd
43.	<i>Chenopodium multifidum</i> L.	CHN	AmS	H	D	N1	r	A1	U	nd
44.	<i>Chenopodium pumilio</i> R. Br.	CHN	Australia	T	DD	N1	s	A1	U	nd
45.	<i>Chloris barbata</i> Sw.	POA	Am	T	D	N1	s	A1	U	nd
46.	<i>Citrullus lanatus</i> (Thunb.) Mansfeld	CUC	AfNW	T	D	I2	r	A1	U	nd
47.	<i>Cladium mariscus</i> (L.) Pohl ssp. <i>martii</i> (Roem. & Schult.) Soó	CYP	AsC,Med	H	DD	N1	sc	A1	U	nd
48.	<i>Consolida ajacis</i> (L.) Schur	RAN	Med	T	D	I2	sc	A2	U	nd
49.	<i>Conyza canadensis</i> (L.) Cronq.	AST	AmN	T	D,DD	N1	c	A3	PI	nd
50.	<i>Coronopus didymus</i> (L.) Sm.	BRA	AmS	T-TH	D,DD	N1	r	A1	U	nd
51.	<i>Cuscuta campestris</i> Yuncker	CUS	AmN	T	D,DD	N1	sc	A3	PI	d
52.	<i>Cyperus esculentus</i> L.	CYP	Trop	T-H	DD	N1	se	A1	U	nd
53.	<i>Cyperus odoratus</i> L.	CYP	Trop	T-H	DD	N1	s	A1	U	nd
54.	<i>Cytisus scoparius</i> (L.) Link s.l.	FAB	EuW,S&C	PhN	D	I2	la	A2	PI	nd
55.	<i>Datura stramonium</i> L.	SOL	Am	T	D,DD	I2	c	A2	U	pd
56.	<i>Diplotaxis erucooides</i> (L.) DC.	BRA	Med	T	DD	N1	se	A1	U	nd

Table 1. Continuation.

No.	Taxon	Family	Origin	Life form	Distribution	Introduction	Abundance	Invasive status	Impact on natural ecosystems	Economic impact
57.	<i>Echinocystis lobata</i> (Michx) Torrey & A. Gray	CUC	AmN	T	DD	I2	sc	A3	U	pd
58.	<i>Eclipta prostrata</i> (L.) L.	AST	AmTrop	T	D	N1	sc	A1	U	nd
59.	<i>Elaeagnus angustifolius</i> L.	ELE	AsTemp	PhN	D,DD	I1	sc	A2	U	pd
60.	<i>Eleusine indica</i> (L.) Gaertner	POA	Trop	T	D	N1	sc	A2	U	pd
61.	<i>Elodea canadensis</i> Michx	HDC	AmN	HH	D,DD	N1	sc	A2	PI	pd
62.	<i>Elodea nuttallii</i> (Planchon) St John	HDC	AmN	HH	D,DD	N1	la	A3	I	pd
63.	<i>Elymus athericus</i> (Link) Kerguelen	POA	EuW&S	G	D,DD	N1	r	A2	U	nd
64.	<i>Erigeron annuus</i> (L.) Pers. ssp. <i>annuus</i>	AST	AmN	TH	D	N1	c	A3	I	pd
65.	<i>Erigeron annuus</i> (L.) Pers. ssp. <i>strigosus</i> (Willd.) Wagenitz	AST	AmN	TH	D	N1	c	A3	I	pd
66.	<i>Eruca vesicaria</i> (L.) Cav. s.l.	BRA	Med	T	D	N1	r	A1	U	nd
67.	<i>Erucastrum gallicum</i> (Willd.) O.E. Schulz	BRA	EuC&SW	T-H	D	N1	r	A1	U	nd
68.	<i>Euphorbia leptocaula</i> Boiss.	EUP	Eu (Pt)	H	DD	N1	se	A1	U	nd
69.	<i>Euphorbia peplus</i> L.	EUP	Cs	T	D	N1	la	A2	U	nd
70.	<i>Fallopia aubertii</i> (Louis Henry) J. Holub	PLG	As	PhLi	D	I2	r	A1	U	pd
71.	<i>Fallopia baldschuanica</i> (Regel) J. Holub	PLG	As	PhLi	D	I2	r	A1	U	nd
72.	<i>Ficus carica</i> L.	MOR	Med	PhN	D	I2	r	A1	U	nd
73.	<i>Fimbristylis bisumbellata</i> (Forssk.) Bubani	CYP	Med	T	DD	N1	r	A1	U	nd
74.	<i>Galinsoga parviflora</i> Cav	AST	AmS	T	D,DD	N1	c	A3	PI	d
75.	<i>Geranium sibiricum</i> L.	GER	Eua	H	D	N1	r	A2	U	nd
76.	<i>Glinus lotoides</i> L.	MOL	Med	T	D,DD	N1	sc	A1	U	nd
77.	<i>Helianthus annuus</i> L.	AST	AmN	T	D,DD	N1	r	A1	U	nd
78.	<i>Heliotropium curassavicum</i> L.	BOR	AmS	H	DD	N1	la	A1	U	nd
79.	<i>Hemerocallis fulva</i> L.	LIL	As	H	D	I2	r	A1	U	nd
80.	<i>Hordeum jubatum</i> L.	POA	AmN,As	T	DD	N1	sc	A1	U	nd
81.	<i>Hordeum marinum</i> Huds.	POA	EuW&S	T	DD	N1	r	A2	U	nd
82.	<i>Hypocoum imberbe</i> Sm.	PAP	Med	T	D	N1	s	A1	U	nd
83.	<i>Impatiens balsamina</i> L.	BLS	As (India E)	T	D	I2	r	A1	U	nd
84.	<i>Ipomoea lacunosa</i> L.	CNV	AmN	T	D	N1	s	A1	U	nd
85.	<i>Iva xanthifolia</i> Nutt.	AST	AmN	T	D	N1	la	A3	PI	d
86.	<i>Lathyrus sativus</i> L.	FAB	Med	T	D,DD	I2	r	A1	U	nd
87.	<i>Lemna minuta</i> Kunth.	LMN	Am	HH	DD	N1	s	A1	U	nd
88.	<i>Lens nigricans</i> (Bieb.) Godron	FAB	Med	T	D	N1	s	A1	U	nd
89.	<i>Lindernia dubia</i> (L.) Penell	SCR	AmN	T	DD	N1	la	A3	I	pd
90.	<i>Lychnis chalconica</i> L.	CRY	Eu (RussiaE&C)	H	DD	I2	r	A1	U	nd
91.	<i>Lycium barbarum</i> L.	SOL	As	PhN	D	I2	la	A3	PI	d
92.	<i>Lycopersicon esculentum</i> Miller	SOL	AmS	T	D	I2	sc	A1	U	nd
93.	<i>Matricaria discoidea</i> DC.	AST	Am,As	T	D	N1	c	A3	PI	pd
94.	<i>Matthiola longipetala</i> (Vent.) DC. s.l.	BRA	Med	T	DD	I2	r	A1	U	nd
95.	<i>Medicago sativa</i> L. ssp. <i>sativa</i>	FAB	Med	H	D,DD	I2	sc	A2	PI	nd
96.	<i>Morus alba</i> L.	MOR	As (China)	PhM	D	I2	c	A2	PI	d
97.	<i>Nicotiana glauca</i> Link & Otto	SOL	AmS	T	D	I2	sc	A1	U	nd
98.	<i>Nigella arvensis</i> L.	RAN	Med	T	D	I2	sc	A1	U	nd
99.	<i>Oenothera parviflora</i> L.	ONA	AmN	TH	D	I2	sc	A2	U	nd
100.	<i>Oxalis corniculata</i> L.	OXL	AmN&C	H	DD	N1	sc	A2	U	pd
101.	<i>Panicum capillare</i> L.	POA	AmN	T	D,DD	N1	sc	A2	U	pd
102.	<i>Panicum dichotomiflorum</i> Michx	POA	AmN	T	D	N1	r	A2	U	pd
103.	<i>Parthenocissus inserta</i> (A. Kerner) Fritsch	VIT	AmN	PhLi	D	I2	sc	A2	U	nd
104.	<i>Paspalum paspalodes</i> (Michx) Scribner	POA	Trop	H	DD	N1	la	A3	I	d

Table 1. Continuation.

No.	Taxon	Family	Origin	Life form	Distribution	Introduction	Abundance	Invasive status	Impact on natural ecosystems	Economic impact
105.	<i>Petunia integrifolia</i> (Hooker) Schinz & Thell.	SOL	AmS	T	D	I2	r	A1	U	nd
106.	<i>Petunia parviflora</i> A.L. Juss.	SOL	AmS	T-H	DD	N1	la	A2	U	nd
107.	<i>Phalaris canariensis</i> L.	POA	Canare	T	D	I2	r	A1	U	pd
108.	<i>Phytolacca americana</i> L.	PHT	AmN	T	DD	I2	sc	A3	U	pd
109.	<i>Polygonum pennsylvanicum</i> L.	PLG	AmN	T	D	N1	s	A1	U	nd
110.	<i>Raphanus raphanistrum</i> L. ssp. <i>landra</i> (Moretti ex DC.) Bonnier & Layens	BRA	Med	T	D	N1	r	A1	U	nd
111.	<i>Reseda alba</i> L.	RSD	Med	T-H	D	I2	r	A1	U	nd
112.	<i>Robinia pseudacacia</i> L.	FAB	AmN	PhM	D	I2	c	A3	I	pd
113.	<i>Ruta graveolens</i> L.	RUT	Med	Ch	D	I2	r	A1	U	nd
114.	<i>Saccharum ravennae</i> (L.) Murray	POA	Med	H	DD	N1	se	A1	U	nd
115.	<i>Sagittaria lancifolia</i> L.	ALI	As	HH	DD	N1	s	A1	U	nd
116.	<i>Sagittaria trifolia</i> L.	ALI	As	HH	DD	N1	r	A1	U	nd
117.	<i>Salsola acutifolia</i> (Bunge) Botsch	CHN	Eua (RussiaSE, Ukraina SE & KazakhstanW)	T	DD	N1	r	A1	U	nd
118.	<i>Salsola collina</i> Pallas	CHN	Eua (RussiaE&C)	T	DD	N1	r	A1	U	nd
119.	<i>Salvia reflexa</i> Hornem.	LAM	AmN	T	D	I2	r	A1	U	nd
120.	<i>Scilla siberica</i> Haw.	LIL	Eua (Russia)	G	D	I2	r	A1	U	nd
121.	<i>Senna obtusifolia</i> (L.) Irwin & Barneby	CSL	Trop	T	D	N1	s	A1	U	nd
122.	<i>Sesbania exaltata</i> (Raf.) Cory.	FAB	Am	T	D	N1	s	A1	U	nd
123.	<i>Setaria faberi</i> Herrm.	POA	AsE	T	D	N1	s	A1	U	nd
124.	<i>Silene pendula</i> L.	CRY	Med	T	D	I2	r	A1	U	nd
125.	<i>Sisymbrium irio</i> L.	BRA	Sm	T	DD	N1	r	A1	U	nd
126.	<i>Solanum carolinense</i> L.	SOL	AmN	H	D	N1	s	A1	U	nd
127.	<i>Solanum rostratum</i> Dunal.	SOL	AmN	T	D	I2	s	A1	U	nd
128.	<i>Solanum triflorum</i> Nutt. ssp. <i>ponticum</i> (Prodan) Negrean & Dihoru	SOL	AmN	T	D,DD	N1	la	A2	U	nd
129.	<i>Solanum tuberosum</i> L.	SOL	AmS	T	D	I2	r	A1	U	nd
130.	<i>Sophora jaubertii</i> Spach	FAB	Eua (Anat, CaucW)	H	D	I2	la	A2	U	nd
131.	<i>Sorghum halepense</i> (L.) Pers.	POA	AfN, AsSW	H	D,DD	N1	c	A3	U	d
132.	<i>Tragopogon porrifolius</i> L. s.l.	AST	Med	T-TH	D	I2	r	A1	U	nd
133.	<i>Urtica pilulifera</i> L.	URT	Sm	T	D	N1	se	A1	U	nd
134.	<i>Vicia lutea</i> L. s.l.	FAB	EuW&S	T	D	N1	sc	A2	U	nd
135.	<i>Xanthium italicum</i> Moretti	AST	Med	T	D,DD	N1	c	A3	I	d
136.	<i>Xanthium orientale</i> L.	AST	Am	T	DD	N1	r	A2	I	nd
137.	<i>Xanthium saccharatum</i> Wallr.	AST	AmS	T	D	N1	r	A2	PI	nd
138.	<i>Xanthium spinosum</i> L.	AST	AmS	T	D	N1	c	A3	I	d
139.	<i>Xanthium strumarium</i> L.	AST	Am	T	D,DD	N1	c	A3	I	d
140.	<i>Zea mays</i> L. ♀ ♂	POA	Am	T	D	I2	r	A1	U	nd

Abbreviations: **Origin:** Af – Africa; Am – America; As – Asia; Eu – Europe; Eua – Eurasia; Cauc – Caucasus; Anat – Anatolia; Cs – Cosmopolite; Temp – Temperate; Trop – Tropical; Med – Mediterranean; Sm – Submediterranean; Pt – Pontic; N – North; E – East; S – South; W – West; C – Centre (central). **Life form:** Ch – Chamaephyte; G – Geophyte; H – Hemicryptophyte; HH – Helohydrophyte; PhLi – Liana; PhM – Macrophanerophyte; PhN – Nanophanerophyte; T – Therophyte; TH – Hemiterophyte. **Distribution:** D – Dobrogea; DD – Danube Delta. **Way of introduction:** I2 – intentional, escaped; N1 – not intentional dispersed; N2 – not intentional, hybrid. **Abundance:** s – single locality; r – rare; sc – scattered; la – locally abundant; c – common; se – one locality or more, but the plant has not been signalled for more than 50 years. **Invasive status:** A1 – casual (an alien plant that reproduces occasionally in an area, but requires repetitive introductions for its persistence); A2 – naturalised (an alien plant that reproduces constantly and sustains populations over several life cycles without direct human intervention); A3 – invasive (an alien plant that produces reproductive offspring, often in large numbers, at considerable distances from the parental plants and over large areas). **Impact on natural ecosystems:** U – unknown; PI – potentially invasive; I – invasive. **Economic impact:** d – harmful; nd – not harmful; pd – potentially harmful.

Conclusions

In Dobrogea's flora we identified 149 alien plants taxa. 140 of these are neophytes and 9 are archaeophytes. *Asteraceae*, *Amaranthaceae* and *Poaceae* are the families with the highest weight in the structure of neophytes from Dobrogea. Over 60% of the neophytes are therophytes. Many of them are not intentionally introduced (70.71%) and they are from America (49.28%). Among the invasive species only few are aggressive in natural and semi-natural ecosystems: *Ailanthus altissima*, *Alcea rosea*, *Amorpha fruticosa*, *Azolla filiculoides*, *Bidens frondosa*, *Conyza canadensis*, *Elodea nuttallii*, *Lindernia dubia*, *Paspalum paspalodes*, *Xanthium italicum*, *X. spinosum*. Four neophytes are included in the National Red Lists.

Acknowledgements. This work is a result of a CNCSIS grant (contract No. 33469/2005).

References

- Anastasiu, P. & Negrean, G.** 2005. Alien plants in Constanța and South Constanța (Agigea) harbours. – Scientific Symposium "Plants diversity conservation in situ and ex situ", 27–28 May 2005, Iași. Abstracts: p. 33 (in Romanian).
- Brândză, D.** 1898. The Flora of Dobrogea. Inst. Arte Grafice "Carol Göbl", Bucuresci (in Romanian).
- Ciocârlan, V.** 1994. Flora of Danube Delta. Edit. Ceres, București (in Romanian).
- Ciocârlan, V. & Costea, M.** 2004. *Bellardia trixago* (L.) All. in Romanian flora. – Bul. Grăd. Bot. Iași, **12**: 9-10 (in Romanian).
- Ciocârlan, V., Sârbu, I., Ștefan, N. & Marian, T.** 1998. *Elodea nuttallii* (Planchon) St John – new species in Romanian flora. – Bul. Grăd. Bot. Iași, **6**(1): 231-215 (in Romanian).
- Dihoru, G. & Dihoru, A.** 1994. Rare, endangered and endemic plants in Romanian Flora – Red List. – Lucr. Grăd. Bot., /1993–1994/: 173-197 (in Romanian).
- Dihoru, G. & Negrean, G.** 1976. Flora of the Danube Delta. – Peuce (Bot.), **5**: 217-251.
- Doniță, N., Popescu, A., Paucă-Comănescu, M., Mihăilescu, S. & Biriș, I.-A.** 2005. Habitats from Romania. Edit. Tehnică Silvică, București (in Romanian).
- Grecescu, D.** 1909. Supplement to the Conspectus of Romanian Flora. Inst. Arte Grafice, București (in Romanian).
- Kanitz, A.** 1879–1881. Plantas Romaniae hucusque cognitae enumerat. MNL, Cluj.
- Macovei, G. & Scriban, J.** 1905. Contribution à l'étude de la Flore des lacs d'eau douce de la Dobrogea. – Ann. Sci. Univ. Jassy, **3**: 239-243.
- Oltean, M., Negrean, G., Popescu, A., Roman, N., Dihoru, G., Sanda, V. & Mihăilescu, S.** 1994. Red List of vascular plants from Romania. – In: **Oltean, M.** (coord.), Studii, sinteze, documentații de ecologie. Romanian Acad., Inst. of Biology, **1**: 1-52 (in Romanian).
- Pallis, M.** 1916. The structure and history of plav, the floating fern of the Delta of the Danube. – J. Linn. Soc., Bot., **43**: 233-290.
- Pyšek, P., Richardson, D.M., Rejmánek, M., Webster, G.L., Williamson, M. & Kirschner, J.** 2004. Alien plants in checklists and floras: towards better communication between taxonomists and ecologists. – Taxon, **51**(1): 131-143.
- Richardson, D.M., Pyšek, P., Rejmánek, M., Barbour, M.G., Panetta, F.D. & West, C.J.** 2000. Naturalization and invasion of alien plants: concepts and definitions. – Diversity & Distrib., **6**: 93-107.
- Sârbu, A.** (coord.) 2003. Guide to identifying important plants areas in Romania. Edit. alo, București!, București (in Romanian).
- Săvulescu, T.** (ed.) 1952–1976. Romanian Flora. Vols 1–13. Edit. Academiei Române, București (in Romanian).
- Tutin, T.G., Burges, N.A., Chater, A.O., Edmonson, J.R., Heywood, V.H., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A.** (eds, assist. by **Akeroyd, J.R. & Newton, M.E.**; appendices ed. by **Mill, R.R.**). 1993. Flora Europaea. 2nd ed. Vol. 1. *Psilotaceae* to *Platanaceae*. Cambridge Univ. Press, Cambridge.
- Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A.** (eds). 1964–1980. Flora Europaea. Vols 1–5. Cambridge Univ. Press, Cambridge.