

## ALIEN PLANTS IN ROMANIA (I)

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**Abstract:** By the Global Strategy for Plants Conservation, adopted in April 2002 at the Hague, as a component part of the Convention referring to the Biodiversity (Rio de Janeiro 1992) it was recommended to set up by the end of 2004 national lists of alien invasive plants, and to work out until 2006 measures for controlling the most aggressive of these. Such lists have already issued in a series of countries. After consulting a great lot of bibliographical sources and based on the field observations of the authors, these have drawn up for Romania a list of 435 alien species, archaeophytes as well as neophytes. For every species apart are given the time period of immigration, the invasive statute, abundance, type of habitat where it is found, the affected type of landscape, the mode of introduction, life form, origin, author and year of first citation in our country. These data allow the identification of the most aggressive alien species in conditions proper to Romania, and represent a support for measures of prevention and control due to be worked out.

**Keywords:** alien plants, casual, naturalized, invasive, abundance, mode of introduction, life form, origin, Romania

### Introduction

One of the biggest menaces for the biodiversity is nowadays the invasion by alien species. Their assault is immense, insidious and often irreversible, from damaging native species and their habitats to complete loss.

Convention on Biodiversity (Rio de Janeiro 1992) establishes a series of measures for *in situ* conservation. Among which is that stipulating that all partners must prevent the introduction and must control or annihilate those alien species, which threaten ecosystems, habitats or species. As a consequence of the ratification of this Convention by a growing number of states, the process of identification of invasive alien species and measures for the prevention and control of these has made much progress.

*Invasives Specialist Group* (ISSG), integrated in *Species Survival Commission* activating within the *World Conservation Union* (IUCN), assumes an important role in the fight against alien invasive species. This group comprises 170 researchers and experts in invasive species from 41 countries. ISSG has three regional sections, in North America, Europe and South Asia (<http://www.issg.org/index.html>).

In Europe important steps forward have been made, especially by western and central states. To date have been worked out comprehensive lists of alien species for following countries: Great Britain (CLEMENT & FOSTER 1994; RYVES et al. 1996), Germany (KUEHN & KLOTZ 2002), Switzerland (WEBER 1999), Poland (ZAJAC 1979,

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only for archaeophytes), Czech Republic (PYŠEK et al. 2002), Finland (NUMMIC 2001) (according to PYŠEK et al. 2002). These lists contain information regarding the degree of naturalization, date and mode of introduction, ecologic, biologic and chorological data. In Italy and France similar projects have been started.

Although by the law 58/1994 Romania ratified the Convention on Biodiversity (signed at Rio de Janeiro 1992), till now there were not made any important steps toward the implementation of article 8 of the Convention, referring to alien invasive species.

In Romania the first allochthonous plants have been signaled as early as the end of 18<sup>th</sup> century, in several works, systematic or floristic in character. In his traveling notes Paul Kitaibel mentions some weeds. So, between villages of Moftinul Mare, Terebești and Ardud he remarked the large number of specimens of *Amaranthus hybridus* “in maize fields” (GOMBOCZ 1945: 73); *Amaranthus viridis* is also cited from Sasca Română (GOMBOCZ 1945: 547). In 1805 Host mentions a species of *Echinochloa* from Banat (*E. oryzoides*) (ANGHEL et al. 1972). Afterwards more and more frequently alien plants are cited in various synthetic works or floristic lists (BAUMGARTEN 1816; ROCHEL 1826, HEUFFEL 1856; SCHUR 1876; SIMONKAI 1887; BRANDZA 1883; GRECESCU 1898 etc.). All these have been synthesized in Flora României vol. 1-13 (SĂVULESCU 1957-1972) and more recently in “Flora Ilustrată a României” (CIOCĂRLAN 2000).

Numerous scientific works relating to weeds have been written with regard to agriculture and silviculture (ROMAN & ENESCU 1914; BUIA 1939; PRODAN 1946; IONESCU-ȘIȘESTI 1956; TIMUȘ 1940,1942; ENESCU & ANGANU 1924 etc.). Anghel et al. (1972) has been synthesized a major part of this work. Recently an atlas of weeds was published, attempting the mapping of the main need of our country (CHIRILĂ, CIOCĂRLAN & BERCA 2002).

The importance of neophyte study is indicated also by the great of doctor thesis themes, dedicated to this important group of plants (BADEA 1963; CHIRILĂ 1968; COSTEA 1998; SÂRBU 1998, SIMTEA 1972, SPIRIDON 1970 etc.).

Săvulescu T. (1949) and later Diaconescu V. (1978) were preoccupied to define acclimatized and naturalized plants and to prove their presence on the territory of botanical gardens, important source for their spreading.

The main objective of our work is to create a comprehensive database, offering informations on alien species plants growing on Romania's territory. Such database represents the most important tool for the rational establishing of rules for prevention and control.

### **Material and methods**

The database is the result of consulting lots of bibliographic references and of the personal field observations of the authors along many years. We utilized the nomenclature of Flora Europaea (TUTIN et al. 1993; TUTIN et al. 1964-1980).

For each taxon were analyzed: family, period of immigration, invasive status, abundance, type of habitat where it is found, type of affected landscape, mode of introduction, life form, origin, author and year of first citation on Romanian territory.

To express the statute of alien species in our country we took into account the definitions given by Richardson et al. (2000). It must be mentioned that, generally, the appreciations of degree of naturalization and invasiveness are subjective, depending largely on the perception of various authors.

### Results and discussions

Analyzing the flora of Romania there were identified 435 alien plants belonging to 82 families. The most taxa belong to families' known to invade habitually zones of temperate climate: Asteraceae (61 taxa), Brassicaceae (38 taxa), Poaceae (30 taxa). Numerous families, like Orchidaceae do not have alien representatives in our flora, while others, like Amaranthaceae have almost exclusively alien representatives. Of the total number of taxa, 23 are subspecies, one is variety and 11 are hybrids.

Alien flora of Romania contains 51 (11.73%) archaeophytes (which arrived into Europe before) and 384 (88.27%) neophytes (which arrived into Europe after 1492).

The invasive status analysis reveals that from the archaeophytes 33 (64.7%) are casuals, 15 (29.4%) are naturalized and 3 (5.9%) are invasive species (tab. I, fig. 1). As invasive species were identified: *Bassia scoparia*, *Cardaria draba* subsp. *draba* (both in artificial habitats – urban, rural, industrialized landscape), and *Portulaca oleracea* (in all types of habitat).

Of neophytes, 271 (70.57%) are occasional, 78 (20.31%) are naturalized and 35 (9.11%) are invasive (tab. 1, fig. 1, fig. 2). We include here *Xanthium italicum* and *Xanthium strumarium*, two taxa with doubtful origin. The analysis of invasive neophytes shows that 26 taxa were introduced accidentally, and 9 deliberately as ornamental plants (*Acer negundo*, *Ailanthus altissima*, *Solidago canadensis*, *Sisyrinchium montanum*, *Echinocystis lobata*, *Impatiens glandulifera*, *Lycium barbatum*), or for augmentation of botanical garden collections (*Reynoutria japonica*, *Ambrosia artemisiifolia*). Most neophytes are of American origin (68.57%). From the point of view of life forms, therophytes are dominant (62.85%), they being followed by hemicryptophytes (11.42%) and phanerophytes (11.42%). Of those 35 invasive neophytes, 9 are present in all types of habitat (*Iva xanthifolia*, *Ailanthus altissima*, *Conyza canadensis*, *Erigeron annuus* subsp. *annuus*, *Erigeron annuus* subsp. *strigosus*, *Xanthium italicum*, *Xanthium strumarium*, *Xanthium spinosum*, *Bidens vulgata*); one species is found in natural and artificial habitats (*Juncus tenuis*) and 6 only in natural habitats (*Azolla filiculoides*, *Echinocystis lobata*, *Elodea nuttallii*, *Lindernia dubia*, *Paspalum paspalodes*, *Sisyrinchium montanum*). Three taxa (*Amorpha fruticosa*, *Chamomilla suaveolens*, *Solidago canadensis*) are in semi natural habitats, while other four taxa (*Cannabis sativa* subsp. *spontanea*, *Galinsoga parviflora*, *Lycium barbatum*, *Reynoutria japonica*) are in semi natural as well as in artificial habitats. Only in artificial habitats are: *Acer negundo*, *Amaranthus albus*, *Amaranthus crispus*, *Amaranthus hybridus*, *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Artemisia annua*, *Bassia scoparia*, *Cardaria draba* subsp. *draba*, *Cuscuta campestris*, *Euphorbia maculata*, *Lepidium densiflorum*, *Veronica persica*. Of invasive taxa, *Azolla filiculoides* and

*Paspalum paspalodes* are transformers, being responsible for profound alteration of the structure of natural and semi natural habitats.

The analysis of bioforms of alien flora reveals the dominance of therophytes (50.57%) compared to the other categories (tab. II, fig. 3). These are followed by hemicryptophytes with 21.60%. Other life forms are weakly represented, generally fewer than 5%. With respect to the period of introduction in our country, the same ratio comes true, therophytes being dominant.

Of the total number of archaeophytes within the Romanian flora, 15 (29.41%) taxa are Mediterranean, 10 (19.60%) are Asian, 9 (17.64) are sub Mediterranean, 9 (17.64%) are Eurasian, 4 (7.84%) are European. Only one taxon is originated in Asia and Africa.

Most neophytes have come from America (135 taxa – 35.15% of all neophytes), and more precisely from North America (85 taxa). 68 (17.70%) taxa are Mediterranean, 58 (15.10%) taxa are Asian, 25 (6.51%) taxa are European, 22 (5.72%) taxa are Eurasian and 18 (4.68%) taxa are sub Mediterranean. Of tropical origin are 13 (3.38%) taxa (tab. III).

Analyzing the mode of introduction into our country it results that a majority of archaeophytes have been brought deliberately (35 taxa), while in the case of neophytes the ratio of accidentals /deliberates is next to 1 (tab. IV, fig. 4). Most of deliberately introduced taxa are ornamental plants or are utilized for various purposes: as food, medicinal, melliferous etc.

If we consider abundance in relation to the period of immigration, we see that the greater part of archaeophytes were not naturalized and are reported from a small number of localities (tab. V, fig. 5). Neophytes reach a better percentage of naturalization, but must be reported from a single locality (53 taxa) or from a few (146 taxa). Of neophytes, 40 have not been signaled for more than 50 years, being therefore considered extinct. Common or locally abundant are 45 taxa.

We mention that we also consider as alien some plants that are relics from cultivation, as *Nymphaea lotus*, *Ilex aquifolium*, *Eranthis hyemalis*, *Chionodoxa luciliae*, *Scilla siberica*.

The next archaeophytes and neophytes are on the Red Lists published in Romania: *Agrostemma githago*, *Aubrieta columnae* subsp. *croatica*, *Erucastrum nasturtiiifolium*, *Geranium sibiricum*, *Glinus lotoides*, *Nymphaea lotus*, *Petunia parviflora*, *Polycarpon tetraphyllum*, *Rapistrum rugosum*, *Sophora jaubertii*, *Teesdalia nudicaulis*.

### Conclusions

In Romania's flora we identified 435 alien plants taxa. 384 of these are neophytes and 51 are archaeophytes. Asteraceae, Brassicaceae and Poaceae are the families with the highest weight in the structure of alien flora of Romania. Over 50% of the alien plants of our country are therophytes. Most archaeophytes have been brought deliberately to the territory of Romania. Neophytes have come here deliberately as well as accidentally, in approx. equal proportion. Most archaeophytes are of Mediterranean or sub Mediterranean origin (24 taxa of 51). Neophytes are to 35.15% of American origin, and to 17.70% of

Mediterranean and 15.10% of Asian origin. 11 alien plants taxa are on the national Red Lists.

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Table I The structure of alien flora of Romania, related to the period of introduction and degree of naturalization

	Occasional	Naturalized	Invasive	Total
Archaeophytes	33	15	3	51
Neophytes	271	78	35	384
Total	304	94	38	435

Table II Structure of bioforms related to the period of introduction into our country (T=therophyte, H=hemicryptophyte, PhM=macrophanerophyte, PhN=nanophanerophyte, G=geophyte, T-H= therophyte- hemicryptophyte, T-TH= therophyte-hemitherophyte; TH= hemitherophyte, HH=hydrohelophyte, PhLi=liana, TH-H=hemitherophyte-hemicryptophyte, Ch=chamaephytae, Hi=hydrophyte, G-H= geophyte-hemicryptophyte, PhEp=epiphyte, T-TH-H= therophyte- hemitherophyte- hemicryptophyte).

Life form	Number of taxa	%	Archaeophytes	Neophytes
T	220	50.57	30	190
H	94	21.60	8	86
PhM	24	5.51	7	17
PhN	17	3.90	1	16
G	14	3.21	0	14
T-H	13	2.98	0	13
T-TH	12	2.75	1	11

TH	11	2.52	3	8
HH	10	2.29	0	10
PhLi	7	1.60	1	6
TH-H	5	1.14	0	5
Ch	3	0.68	0	3
Hi	2	0.45	0	2
G-H	1	0.22	0	1
PhEp	1	0.22	0	1
T:THH	1	0.22	0	1

Table III Structure of alien flora with respect to origin

	European	Asian	Eurasian	Asian, African	Mediterranean	Sub Mediterranean	African	American	Tropical
Archaeophytes	4	10	9	1	15	9	-	-	-
Neophytes	25	58	22	2	68	18	2	135	13
Total	29	68	31	3	83	27	2	135	13

Table IV Structure of alien flora with respect to the way of introduction

	Accidental		Deliberate		Both situation		Total
	Total	%	Total	%	Total	%	
Archeophytes	16	31.37%	35	68.63%	-	-	51
Neophytes	190	49.48%	192	50%	2	0.52%	384
Total	206	47.35%	227	52.18%	2	0.45%	435

Table V Abundance of alien plants in our country, related to period of introduction (c=casual, n=naturalized, i=invasive, s=single locality, r=rare, sc=scattered, la=locally abundant, c=common, se=single locality, now extinct)

	Abundance					
	s	r	sc	la	c	se
Archeophytes	0	27	14	2	5	2
c	0	23	7	0	1	2
n	0	4	8	1	2	0
i	0	0	0	1	2	0
Neophytes	53	173	72	24	21	40
c	51	146	33	1	0	40
n	2	26	37	9	4	0
i	0	1	2	14	17	0

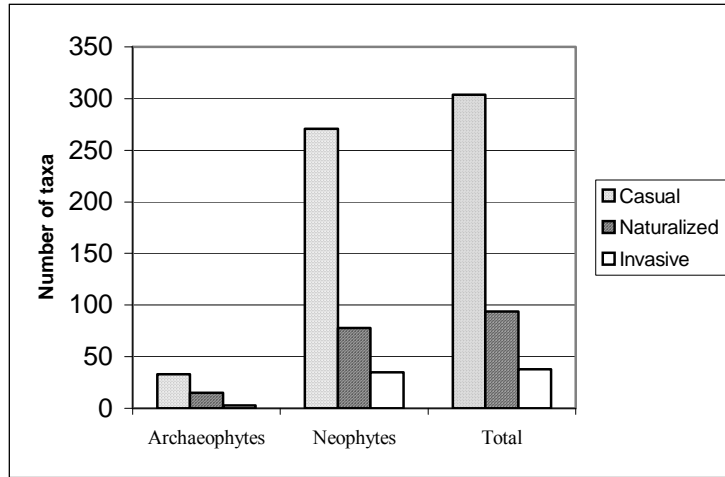


Fig. 1 - Status of alien plants with respect to their period of immigration

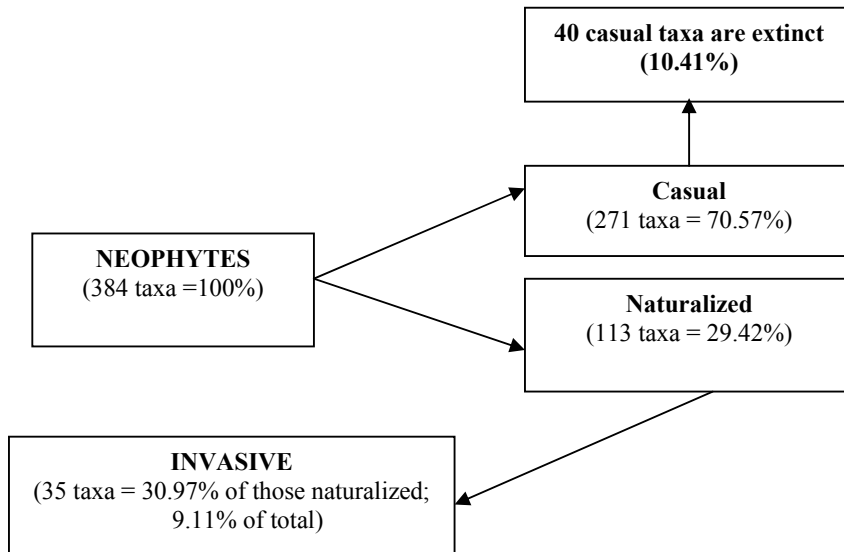


Fig. 2 - Rate of neophytes becoming invasive



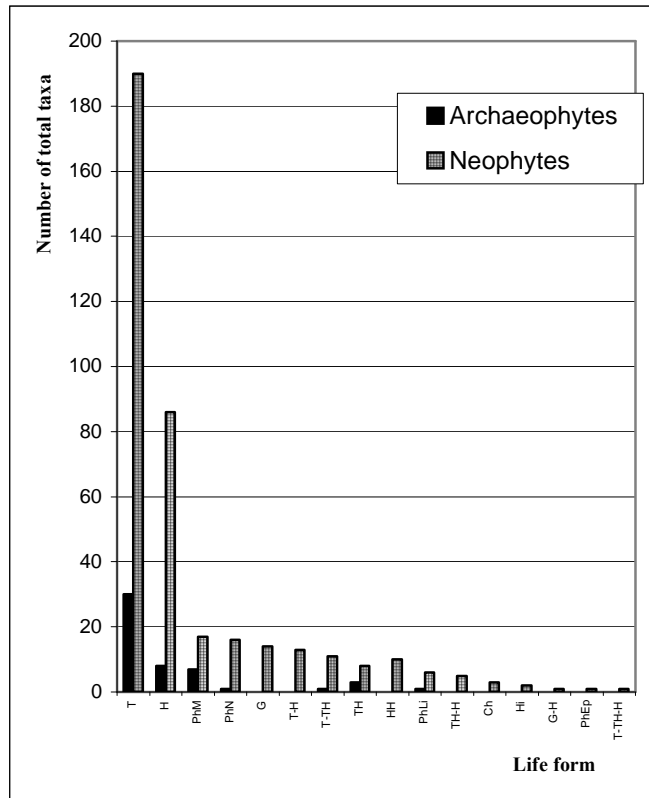


Fig. 3 - Distribution of life form with respect to immigration period (T=therophyte, H=hemicryptophyte, PhM=macrophanerophyte, PhN=nanophaneophyte, G=geophyte, T-H= therophyte- hemicryptophyte, T-TH= therophyte-hemitherophyte; TH= hemitherophyte, HH=hydrohelophyte, PhLi=liana, TH-H=hemitherophyte- hemicryptophyte, Ch=chamaephytae, Hi=hydrophyte, G-H= geophyte-hemicryptophyte, PhEp=epiphyte, T-TH-H= therophyte- hemitherophyte- hemicryptophyte)

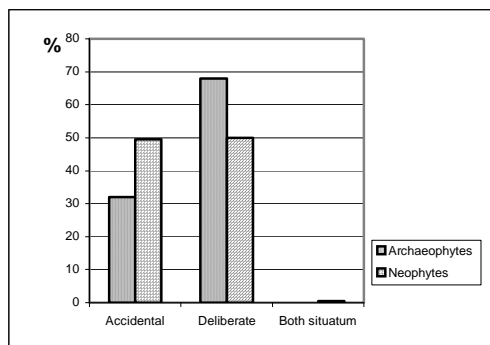


Fig. 4 - Mode of introduction of alien taxa, related to the period of immigration

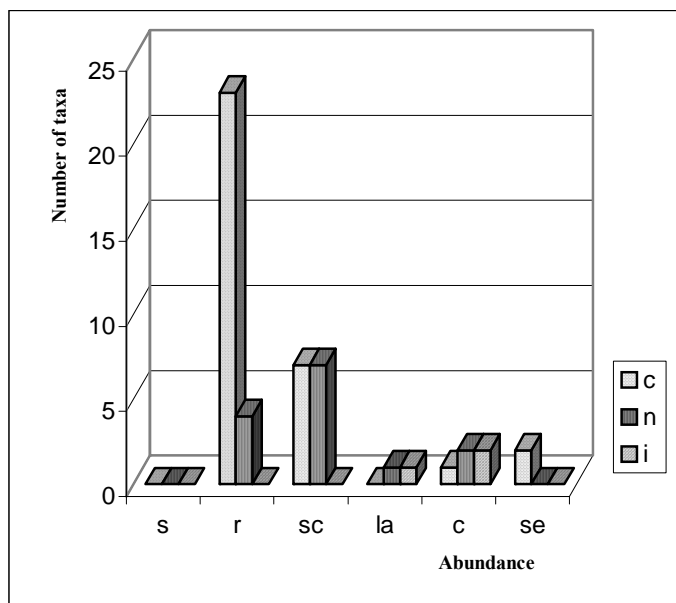


Fig. 5 - Neophyte abundance in relation to degree of naturalization (c=casual, n=naturalized, i=invasive, s=single locality, r=rare, sc=scattered, la=locally abundant, c=common, se=single locality, now extinct)