

*J. Plant Develop.*  
15 (2008): 33–45

## ALIEN PLANT SPECIES FROM STÂNIȘOARA MOUNTAINS (EASTERN CARPATHIANS – ROMANIA)

SÎRBU CULIȚĂ \*, OPREA ADRIAN \*\*

**Abstract:** Our field research in the last years, over the flora, vegetation and habitats, has been identified a number of 93 alien plant species which grow up in more or less disturbed habitats from the Stânișoara Mountains (Eastern Carpathians). These species are discussed regarding their impact to the ecosystems, immigration modes, invasive status, geographical origins, dispersal mechanisms, their distribution, principal infestation sites etc. The most dangerous alien species for anthropic, semi-natural and natural habitats in the investigated territory were identified.

**Keywords:** vascular flora, alien plants, Stânișoara Mountains, Romania.

### Introduction

One of the most important factors that cause the susceptibility of habitats and vegetal communities to be invaded by alien plants is their great degree of disturbance [1]; [32]; [37] etc. Disturbed (semi-natural and anthropic) habitats are well represented in Stânișoara Mountains (which are situated in the central part of the Eastern Carpathians, east of the valleys of Bistrița river, between Ostra in North and Piatra Neamț in South), especially along water courses, where human settlements are usually situated (over 70 localities, among which four towns: Piatra Neamț, Bicaz - at the Southern boundary, Gura Humorului, and Frasin - at the Northern boundary), but also in the vicinity of the numerous monasteries (Agapia, Văratec, Slatina, Horăicioara, Pângărați, Bistrița etc.), sheepfolds, mines (Târnița, Crucea, Leșul Ursului etc.), forest cantons etc. During their long history in this territory, humans have greatly promoted the immigration of alien (non-native) plants, through migrations, trade, agriculture, forestry, urbanization, wars, and other activities.

In the Stânișoara Mountains, the anthropic disturbance of habitats and the invasion of alien plants are facilitated by the low altitude of the relief (maximum 1531 m in the Bivolul Peak) and also by the numerous and accessible roads, such as: DN 15 (between Piatra Neamț and Poiana Largului), DN 17b (between Poiana Largului and Holda), DJ 117a (Holda - Târnița Pass - Ostra - Frasin), DE 58 (Frasin - Gura Humorului), DN 15b (Leghin - Petru Vodă Pass - Poiana Largului), DJ 209b (Cornu Luncii - Crucea Talienilor Pass - Borca), numerous other secondary roads (communal, forest), and mountain paths.

In this context, an important presence of alien weeds in the flora of these mountains is presumable. A commented list of the alien species recorded in this territory is presented in this paper.

---

\* University of Agricultural Sciences and Veterinary Medicine Iași, Faculty of Agriculture, 3, Mihail Sadoveanu Street, Iași, Romania, e-mail: [culita69@yahoo.com](mailto:culita69@yahoo.com);

\*\* Botanic Garden "A. Fătu", 7-9, Dumbrava Roșie Street, Iași, Romania, e-mail: [aoprea@uaic.ro](mailto:aoprea@uaic.ro).

## Materials and methods

We documented the presence, distribution in the territory and invasive character of alien plant species on the grounds of our recent (2005-2008) field works. Data from some herbarium collections and information in the literature are also used. The species nomenclature is given following the next authors: Tutin et al. (eds) 1964 -1980 [36], Ciocârlan 2000 [9], Oprea 2005 [21]. The terminology associated with alien (non-native) plants is according to Richardson et al. (2000) [31], and Pyšek et al. (2002) [26].

**Abbreviations - origin:** Am - America; Afr-Africa, As-Asia, Atl-Atlantic regions, B-Balkan region; Cc-Caucasian region, Eur-Europe, Md - Mediterranean region; P-Pontic region; **intr.** (introduced): acc.-accidentally, delib. - deliberately (orn.-ornamental, alim.-alimentary, med.-medicinal, fodd.-fodder, arom.-aromatic, spi.-spicy, ol.-oleaginous, mell.-melliferous, ant.-er.-anti-erosional, tinct.-tinctorial, forest.-forestry, ser.-sericultural, text.-textile; other-other uses); **dissem.** - dissemination (germs propagation): antr - anthropochory; aut - autochory, an - anemochory, enz - endozoochory; epz - epizoochory, bar-barochory, hydr - hydrochory, vg-vegetative propagation; **Lf**-life forms: T-therophytes; H-hemicryptophytes, TH-hemitherophytes; G-geophytes; Ch-chamaephytes; Ph-phanerophytes; **genom:** D-diploid; P-polyploid; **habitat:** h-human-made (anthropic), sn-semi-natural, n-natural; **syntaxa:** Al-Frax - *Alno-Fraxinetalia*; Arr-Arrhenatheretalia; Ag. r-*Agropyretalia repentis*; Atr-*Atropetalia*; Bi-*Bidentetalia*; Br-*Brometalia erecti*; Ccy-*Centauretalia cyani*; Ch-*Chenopodietalia albi*; Cse-*Convolvuletalia sepilii*; Er-*Eragrostetalia*; Fg. s-*Fagetalia sylvatici*; Fv-*Festucetalia valesiacae*; L-Ch-*Lamio albi-Chenopodietalia boni-henrici*; Oa-*Onopordetalia acanthi*; PP-*Polygono-Poëtalia annuae*; Pr-*Prunetalia*; Pt-*Potametalia*; Si-*Sisymbrietalia*; Sp-*Salicetalia purpureae*; **character:** c-casual (alien plants that may flourish and even reproduce occasionally in an area, but they need repeated introductions for their persistence); n-naturalized (alien plants that form stable populations without human intervention), i-invasive (naturalized populations that produce reproductive offspring at a considerable distance from parent plants)

## Results and discussions

According to our field results, at which we add some data from the reference materials, now, the alien (non-native) flora of the Stânișoara Mountains consists of 93 vascular plant species, with 7 subspecies, belonging to 70 genera and 35 families.

On the whole, the next families are best represented: *Asteraceae* (22 species), *Fabaceae* (6 species), *Brassicaceae* (6 species), *Amaranthaceae* (6 species), *Lamiaceae* (6 species), *Chenopodiaceae* (5 species) etc.

We give below an alphabetical list of the identified species, with their main characteristics and localizations in the territory of the Stânișoara Mountains:

*Acer negundo* L. - origin: N Am; intr.: delib. (orn., forest., ant.-er.); dissem.: antr., an.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: Fg.s, (Si, L-Ch, Ag.r); character: i; spread: Buhalnița peak [10], Gura Humorului, Bicaz, Piatra Neamț, Gârcina, Horaița Monastery.

*Ailanthus altissima* (Mill.) Swingle - origin: As; intr.: delib. (orn.); dissem.: antr., an.; Lf: Ph; genom: D; habitat: h; syntaxa: Oa, Ag.r; character: (c) n.; spread: Piatra Neamț.

*Alcea rosea* L. - origin: Md (?); intr.: delib. (orn.); dissem.: antr., an.; Lf: H; genom: P; habitat: h; syntaxa: Si, Oa; character: c; spread: Nemțișor river basin [25], Bicaz (leg. Zanoschi 1967-herb. IASI), Piatra Neamț.

*Amaranthus albus* L. - origin: N Am; intr.: acc.; dissem.: antr., an., enz.; Lf: T; genom: D; habitat: h; syntaxa: Si, Er, Ch; character: c(n); spread: Piatra Neamț, Gârcina.

*Amaranthus blitoides* S. Watson - origin: N Am; intr.: acc.; dissem.: antr., an., enz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa; character: c(n); spread: Piatra Neamț.

*Amaranthus blitum* L. subsp. *blitum* - origin: Md; intr.: acc. (? delib.: alim.); dissem.: antr., an., enz.; Lf: T; genom: D; habitat: h; syntaxa: Si, CCy, Ch; character: c(n); spread: Piatra Neamț [15], Gura Humorului [17].

- Amaranthus deflexus* L. - origin: S Am; intr.: acc.; dissem.: antr., an.; Lf: T; genom: D-P; habitat: h; syntaxa: PP, Si; character: c(n); spread: Piatra Neamț [15].
- Amaranthus powellii* S.Watson: origin - N Am; intr.: acc.; dissem.: antr., an., enz., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Ch, Er; character: i; spread: Gârcina, Bistrița, Piatra Neamț, Gura Humorului, Agapia, Horaița Monastery.
- Amaranthus retroflexus* L. - origin: N Am; intr.: acc.; dissem.: antr., an., enz., epz.; Lf: T; genom: D; habitat: h, sn; syntaxa: Si, Ch, Er, Oa; character: i; spread: Gura Humorului (!) [17], Procov stream [10], Agapia, Bicz, Bistrița, Borca, Cotârgași, Crucea, Cuejdi, Doroteia, Frasin, Galu, Găinești, Gârcina, Mălini, Negrileasa, Ostra, Pângărați, Petru Vodă, Piatra Neamț, Pipirig, Pluton, Plutonița, Poiana Largului, Poiana Teiului, Slatina, Stulpicani, Vadu Negrilesei, Voroneț, Horaița Monastery, Horăciora Hermitage.
- Ambrosia artemisiifolia* L. - origin: N Am; intr.: acc.; dissem.: antr., an.; Lf: T; genom: P; habitat: h; syntaxa: Si, Ch, Er, Oa; character: i; spread: Piatra Neamț, Vaduri, Bistrița, Pângărați, Bicz, Gârcina, Gura Humorului.
- Amorpha fruticosa* L. - origin: N Am; intr.: delib. (orn., ant.-er.); dissem.: antr., vg.; Lf: Ph; genom: ?; habitat: h, sn; syntaxa: Sp, Pr, Ag.r; character: n(i); spread: Piatra Neamț [11], Vaduri, Bistrița, Cuejdi, Frasin.
- Anethum graveolens* L. - origin: SW As ; intr.: delib. (arom.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c(n) ; spread: Piatra Neamț, Cuejdi river bed-upstream of Piatra Neamț, Gârcina, Doroteia.
- Antirrhinum majus* L. - origin: Md; intr.: delib. (orn.); dissem.: antr., an.; Lf: H; genom: D-P; habitat: h; syntaxa: Si; character: c; spread: Piatra Neamț.
- Aquilegia vulgaris* L. - origin: W,C,S Eur; intr.: delib. (orn.); dissem.: antr., an.; Lf: H; genom: D; habitat: n; syntaxa: Arr; character: c (n); spread: Icoana Hermitage [10], Fârcașa on the homonymous stream.
- Armoracia rusticana* P. Gaertn., B. Mey. & Scherb. - origin: SE Eur- W As; intr.: delib. (spi.); dissem.: antr., vg.; Lf: G; genom: P; habitat: h, sn; syntaxa: Oa, Ag.r; character: n(i); spread: Gura Largu [5], Almaș, Ciumârna stream at Găinești, Doroteia, Crucea, Găinești, Gârcina, Gura Humorului, Piatra Neamț, Pângărați.
- Atriplex hortensis* L. - origin: C As; intr.: delib. (alim.); dissem.: antr, an; Lf: T; genom: D; habitat: h; syntaxa: Si, Ch; character: c(n); spread: Gârcina, Gura Humorului, Piatra Neamț; Horaița Monastery.
- Bidens frondosa* L. - origin: N Am; intr.: acc.; dissem.: antr., epz., hd.; Lf: T; genom: P; habitat: h; syntaxa: Bi, (Si); character: n; spread: Piatra Neamț [35].
- Borago officinalis* L. - origin: Md; intr.: delib. (orn., mell., med.); dissem.: antr., bar.; Lf: T; genom: D; habitat: h; syntaxa: Oa, Si; character: c; spread: Piatra Neamț [11].
- Brachyactis ciliata* (Ledeb.) Ledeb. - origin: As; intr.: acc; dissem.: antr., an.; Lf: T; genom: D; habitat: h, sn; syntaxa: ?; character: n; spread: Gura Humorului [17], Cuejdi river bed upstream of Piatra Neamț.
- Brassica nigra* (L.) W. D. J. Koch: origin – S & W Eur; intr.: acc., delib (alim., spi., med.); dissem.: antr., aut., an., bar.; Lf; genom: D; habitat: h; syntaxa: Si, Ch; character: (c) n; spread: Piatra Neamț, Horaița Monastery.
- Calendula officinalis* L. - origin: Md; intr.: delib. (orn., med.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: n; spread: Piatra Neamț, Vaduri, Bistrița, Bistrița Monastery, Neagra, Gârcina, Fârcașa, Pângărați, Horaița Monastery.
- Callistephus chinensis* (L.) Nees. - origin: E As; intr.: delib. (orn.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Almaș.
- Centaurea cyanus* L. - origin: Md; intr.: acc.; dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Ccy, Si; character: c; spread: Piatra Neamț.

*Chamomilla suaveolens* (Pursh) Rydb. - origin: N Am; intr.: acc; dissem.: an., antr.; Lf: T; genom: D; habitat: h, sn; syntaxa: PP, Si, (Arr); character: i; spread: Agapia, Bistrița, Borca, Crucea, Crucea Talienilor, Doroteia, Frasin, Galu, Ostra, Găinești, Găinești (pr. Ciumârna), Gârcina, Cuejdel lake, Gura Humorului, Mălini, Negrileasa, Petru Vodă, Piatra Neamț, Pipirig, Pluton, Plutonița, Poiana Largului, Stulpicani, Vadu Negrilesei, Horăciora Hermitage.

*Chenopodium foliosum* (Moench) Asch. - origin: Md; intr.: delib. (alim.); dissem.: antr., enz.; Lf: T; genom: D; habitat: h, sn; syntaxa: L-Ch, Si, PP; character: n(i); spread: Hangu [12], Gura Largu [5], Pângărați (leg. Zanoschi 1963-Herb. IASI), Vânători Forest Park [8], Gura Humorului (leg. Oescu 1949-Herb. IASI).

*Chenopodium schraderanum* Schult. - origin: Afr; intr.: delib. (med., arom.); dissem.: antr., an.; Lf: T; genom: ?; habitat: h; syntaxa: Si, Er; character: n; spread: Pipirig, Pâțâlâgeni, Boboești [24].

*Conyza canadensis* (L.) Cronq. - origin: N Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: D; habitat: h, sn; syntaxa: Si, Oa, Er, Ch; character: i; spread: Gura Humorului (!) [17], Bicz Lake [5], Bistriței river bank (Panțu 1911, in Daraban 2007) [10], Piciorul Afinișului [10], Agapia, Bicz, Bistrița, Bistrița Monastery, Borca, Crucea, Cuejdi, Doroteia, Farcașa, Frasin, Galu, Găinești, Gârcina, Cuejdel lake, Mălini, Mitocu Bălan, Negrileasa, Ostra, Petru Vodă, Piatra Neamț, Pipirig, Pluton, Plutonița, Poiana Mărului, Poiana Largului, Poiana Teiului, Sabasa, Slătioara, Stulpicani, Vadu Negrilesei, Horăciora Monastery, Horăciora Hermitage.

*Coreopsis tinctoria* Nutt. - origin: N Am; intr.: delib. (orn., tinct.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Cuejdi river bed-upstream of Piatra Neamț.

*Cosmos bipinnatus* Cav. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c (n); spread: Piatra Neamț [34], Gârcina, Ostra, Leșul Ursului, Cuiejdi, Pângărați.

*Cucurbita pepo* L. - origin: C Am; intr.: delib. (fodd., alim., orn.); dissem.: antr., bar.; Lf: T; genom: P; habitat: h; syntaxa: Si; character: c; spread: Piatra Neamț, Gârcina.

*Cuscuta campestris* Yunck. - origin: N Am; intr.: acc; dissem.: antr., bar., enz., vg.; Lf: T; genom: P; habitat: h, sn, n; syntaxa: Si, Ch, Oa, Ag.r, Fv, Arr; character: n; spread: Piatra Neamț (!) [3], Gura Humorului [17], Gârcina.

*Datura stramonium* L. - origin: N Am; intr.: acc.; dissem.: antr., an., bar.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa, Ch; character: n; spread: Gura Humorului [17], Galu, Piatra Neamț.

*Dipsacus strigosus* Willd. - origin: W As; intr.: acc.; dissem.: an., antr., bar.; Lf: TH; genom: D; habitat: h, sn; syntaxa: Arr, (Fg.s), Oa; character: i; spread: Piatra Neamț [35], Slatina Monastery, Găinești, Ciumârna-Găinești, Plutonița, Negrileasa stream, Agapia.

*Dracocephalum moldavica* L. - origin: As; intr.: delib. (orn.); dissem.: antr.; Lf: T; genom: P; habitat: h; syntaxa: Si; character: c; spread: Agapia Monastery, Văratec Monastery [28].

*Echinocystis lobata* (Michx) Torrey & A. Gray - origin: N Am; intr.: acc.; dissem.: antr., bar.; antr, enz, vg; antr, bar; Lf: T; genom: ?; habitat: h, sn; syntaxa: Cse, L-Ch; character: i; spread: Piatra Neamț (!), Găinești-Slatina [15], Gura Humorului (!) [17], Voroneț, Frasin, Găinești, Lungeni, Ciumârna stream at Găinești, Vl. Stânișoarei, Mălini, Muncel, Negrileasa, Ostra, Plutonița, Văleni-Stânișoara, Voroneț.

*Elaeagnus angustifolia* L. - origin: As; intr.: delib. (orn., for., ant.-er.); dissem.: antr., enz., vg.; Lf: Ph; genom: P; habitat: h, sn; syntaxa: Pr, Ag.r, (Oa); character: c; spread: Piatra Neamț.

*Elodea canadensis* Michx. - origin: N Am; intr.: acc.; dissem.: antr, vg; Lf: Hd; genom: D-P; habitat: sn, n; syntaxa: Pt; character: n; spread: Piatra Neamț (in Bâta Doamnei reservoir), Pângărați stream.

*Elsholtzia ciliata* (Thunb.) Hyl. - origin: As; intr.: acc.; dissem.: an., antr.; bar, hydr.; Lf: T; genom: ?; habitat: h, sn; syntaxa: Cse, Bi, Sp; character: i; spread: Piatra Neamț (!) [30], Gura Humorului [20], Poiana Teiului [16], Audia stream valley (the left bank of Bicz lake) [5], Borca [22], Bicz, Valea Mare stream at Bistrița, Broșteni, Satu Mare, Crucea, Holda, Cuejdi river bed upstream of Piatra Neamț, Doroteia, Frasin, Galu, Gârcina, Holda, Negruleasa, Pângărați.

*Erigeron annuus* (L.) Pers. - origin: N Am; intr.: acc.; dissem.: an., antr.; Lf: TH; genom: P; habitat: h, sn, n; syntaxa: Si, Oa, Ag.r., Cse, Fgs, Arr; character: i; spread: – subsp. *annuus*: the left bank of Bicz lake [5], Gura Humorului [17], Nemțișo river basin (Afinișului Hill, Piciorul Afinișului), Icoana Hermitage, Mitocu Balan, Buhalnița peak [10], Bicz, Bistrița, Borca, Crucea, Cuejdi river bed-upstream of Piatra Neamț, Doroteia, Farcașa, Frasin, Crucea Talienilor, Galu, Găinești, Gârcina, Cuedel lake, Mălini, Negruleasa, Ostra, Petru Vodă, Piatra Neamț, Pluton, Plutonița, Poiana Largului, Stulpicani, Vadu Negrulesei, Horaița Monastery, Horăciora Hermitage; –ssp. *strigosus* (Mühl. ex Willd.) Wagenitz: Piatra Neamț, Poiana Mărului.

*Galinsoga parviflora* Cav. - origin: S Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Ch, Si; character: i; spread: Vl. Pr. Hangu, Gura Largu [5], Gura Humorului [17], Buhalnița Buhalnița peak [10], Agapia, Bistrița, Borca, Plutonița, Crucea, Cuediu, Frasin, Doroteia, Galu, Găinești, Gârcina, Mălini, Muncel, Negruleasa, Ostra, Petru Vodă, Piatra Neamț, Pipirig, Pluton, Plutonița, Poiana Largului, Poiana Mărului, Stulpicani, Vadu Negrulesei, Horaița Monastery, Horăciora Hermitage.

*Galinsoga quadriradiata* Ruiz & Pav. - origin: S Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: P; habitat: h, sn; syntaxa: Ch, Si, Sp, L-Ch; character: i; spread: Procov Hermitage [7], Buhalnița peak [10], Almaș, Bistrița Monastery, Broșteni, Ciumârna stream at Găinești, Crucea, Cuediu, Doroteia, Galu, Găinești, Gârcina, Holda, Holdița stream, Muncel, Ostra, Piatra Neamț, Poiana Mărului, Viișoara, Horaița Monastery.

*Helianthus annuus* L. - origin: N Am; intr.: delib. (ol.); dissem.: antr., bar., an.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Piatra Neamț.

*Helianthus tuberosus* L. - origin: N Am; intr.: delib. (fodd.); dissem.: antr., an., bar., vg.; Lf: G; genom: P; habitat: h; syntaxa: Oa, Ag.r, L-Ch; character: c(n); spread: Bicz, Găinești, Ciumârna stream at Găinești, Piatra Neamț.

*Impatiens balsamina* L. - origin: SE As; intr.: delib. (orn.); dissem.: antr., aut.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Piatra Neamț.

*Impatiens glandulifera* Royle - origin: As; intr.: delib. (orn.); dissem.: antr., aut.; Lf: T; genom: D; habitat: h, sn; syntaxa: Cse, L-Ch; character: i; spread: Broșteni [14], Bicz [22], Bistrița, Crucea, Găinești, Lungeni on the Fagului stream, Bistrița Monastery, Ostra, Pângărați stream valley.

*Impatiens parviflora* DC. - origin: C As; intr.: acc; dissem.: antr., aut.; Lf: T; genom: D-P; habitat: h; syntaxa: Si, L-Ch; character: n; spread: Piciorul Arșiței [10], Piatra Neamț;

*Ipomoea purpurea* Roth - origin: Tr Am; intr.: delib. (orn.); dissem.: antr., bar.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa; character: c; spread: Piatra Neamț, Bistrița Monastery.

*Iva xanthifolia* Nutt. - origin: N Am; intr.: acc.; dissem.: an., antr.; Lf: T; genom: ?; habitat: h; syntaxa: Si, Oa, Ch; character: n(i); spread: Piatra Neamț (!) [4], Cozla, Pângărați, Gârcina, Almaș.

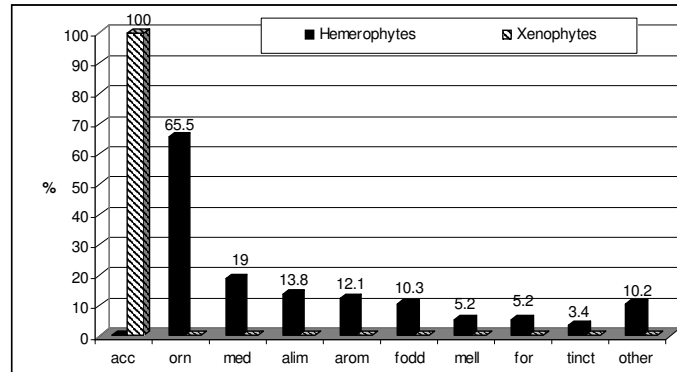
- Juglans regia*** L. - origin: C Eur-B-Cc; intr.: delib. (alim., med., tinct., ind.); dissem.: antr., epz., bar.; Lf: Ph ; genom: P; habitat: h, sn, n; syntaxa: Pr; character: c(n); spread: Gura Humorului [13], Piatra Neamț, Gârcina.
- Juncus tenuis*** Willd.- origin: N Am; intr.: acc.; dissem.: an., antr., bar.; Lf: G; genom: P; habitat: (h), sn, n ; syntaxa: Arr; character: i; spread: Nemțișor river basin [7], Piciorul Arșiței, Alunișului Hill, Livada Mare, Poiana Gaftoneșele [10], Gura Humorului [17], Bistrița, Bistrița Monastery, Borca, Broșteni, Cotârğași (Peștele Monastery), Crucea, Doroteia, Crucea Talienilor, Fârcașa on the homonymous stream, Frasin, Galu, Gârcina, Cuejdel lake, Holda, Mălini, Negrileasa, Ostra, Petru Vodă, Piatra Neamț, Plutoniuța, Poiana Largului, Slatina, Stulpicani, Valea Mare stream at Bistrița, Văleni, Văleni-Stânișoara, Horăiciora Hermitage.
- Kochia scoparia*** (L.) Schrad. - origin: E, S As; intr.: acc (delib. ?); dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Si, Er; character: (n)i; spread: Piatra Neamț, Agapia, Almaș, Bistrița, Vaduri, Gura Humorului, Horaița Monastery.
- Kochia sieversiana*** (Pallas) C. A. Mey. - origin: As; intr.: acc; dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Si, Er; character: c(n); spread: Piatra Neamț [23], Pângărați.
- Lepidium densiflorum*** Schrad. - origin: N Am; intr.: acc.; dissem.: antr., an., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa ; character: n; spread: Gura Humorului [21], Piatra Neamț.
- Lepidium virginicum*** L. - origin: N Am; intr.: acc; dissem.: antr., an., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa, PP; character: c(n); spread: Piatra Neamț.
- Lolium multiflorum*** Lam. - origin: Md; intr.: delib. (fodd.); dissem.: antr., an.; Lf: T; genom: 2x; habitat: h, sn; syntaxa: Si, Oa, Arr; character: n; spread: Nemțișor river basin (Solacolu 1922, in Chifu et al. 1974) [7], Gârcina [15], Voroneț.
- Lycium barbarum*** L. - origin: E As; intr.: delib. (orn.); dissem.: enz., antr., vg.; Lf: Ph; genom: P; habitat: h, sn; syntaxa: L-Ch, Oa, Ag.r, Pr; character: n; spread: Piatra Neamț (!) [11], Gârcina; Horaița Monastery.
- Malva moschata*** L. - origin: Atl-Md ; intr.: delib. (orn.); dissem.: antr., an.; Lf: H ; genom: P; habitat: h; syntaxa: Si; character: c; spread: Gura Humorului [29].
- Malva verticillata*** L. - origin: As; intr. delib. (orn.); dissem.: antr., an.; antr, enz; Lf: T; genom: P; habitat: h; syntaxa: Si, Oa; character: c; spread: Gura Humorului (as *M. crispa* L.) [19].
- Medicago sativa*** L. - origin: As; intr.: delib. (fodd.); dissem.: antr., enz.; Lf: Ch; genom: P; habitat: h, sn, n; syntaxa: Arr, Ag.r, Oa; character: n; spread: Piatra Neamț, Pângărați; Horaița Monastery.
- Medicago × varia*** Martyn - origin: hybrid; intr.: acc ?, delib. (fodd.) ?; dissem.: antr., enz.; Lf: Ch; genom: P; habitat: h, sn; syntaxa: Ag.r, Oa; character: n(i); spread: Nemțișorului river basin (Petrescu 1923, in Chifu et al. 1974) [7], Piatra Neamț (Bistriței St., Dărmănești), Bistrița, Pângărați.
- Melissa officinalis*** L. - origin: SW As, B; intr.: delib. (med., mell., arom.); dissem.: antr., bar., vg.; Lf: H ; genom: P; habitat: h, sn, n; syntaxa: Oa, Pr; character: c; spread: Neamț (Czihak & Szabo 1873, in Brândză 1879-83) [2].
- Mentha × piperita*** L. - origin: hybrid; intr.: delib. (med., arom.); dissem.: antr., bar., vg.; Lf: H; genom: ?; habitat: h ; syntaxa: Oa; character: c; spread: Agapia.
- Mentha × spicata*** L. - origin: hybrid (Atl.-Md); intr.: delib. (med., arom.); dissem.: antr., bar., vg.; Lf: H; genom: P; habitat: h; syntaxa: Oa; character: c; spread: Agapia.
- Morus alba*** L. - origin: E As; intr.: delib. (orn., alim., ser., ind.); dissem.: antr., enz.; Lf: Ph; genom: P; habitat: h; syntaxa: (Oa); character: c; spread: Piatra Neamț.

- Oenothera biennis*** L. - origin: N Am; intr.: acc; dissem.: antr., an.; Lf: TH; genom: D; habitat: h, sn; syntaxa: Si, Oa; character: i; spread: Pintec stream, on the Bistrița river, Bistricioara, Mălini [18], Gura Humorului [17], Lungeni, Petru Vodă, Piatra Neamț.
- Oenothera glazioviana*** Micheli - origin: N Am?; intr.: delib. (orn.); dissem.: antr., an.; Lf: TH; genom: D; habitat: h, sn; syntaxa: Oa, Sp; character: c; spread: Agapia, Cuedi river bed upstream of Piatra Neamț.
- Oxalis dillenii*** Jacq. - origin: N Am; intr.: acc; dissem.: aut., antr., vg.; Lf: H ; genom: P; habitat: h; syntaxa: Si, Er; character: c(n) ; spread: Piatra Neamț [35].
- Oxalis stricta*** L. - origin: N Am; intr.: acc; dissem.: aut., antr., vg.; Lf: H; genom: P; habitat: h, sn; syntaxa: Ch, Si, (Arr); character: i; spread: Gura Humorului [17], Valea Mare stream at Bistrița, Doroteia, Holda, Piatra Neamț, Poiana Mărului.
- Parthenocissus inserta*** (A. Kerner) Fritsch - origin: N Am; intr.: delib. (orn.); dissem.: antr., enz., vg.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: L-Ch, Oa, Sp; character: n; spread: Bicaz, Piatra Neamț.
- Parthenocissus quinquefolia*** (L.) Planchon - origin: N Am; intr.: delib. (orn.); dissem.: antr., enz., vg.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: L-Ch, Oa; character: n; spread: Bicaz; Boboiești, Pângărași.
- Phalaris canariensis*** L. - origin: Afr; intr.: delib. (orn.); dissem.: an., antr.; Lf: T; genom: D; habitat: h; syntaxa: Si; character: c; spread: Gura Humorului [17].
- Phytolaca americana*** L. - origin: N Am; intr.: delib. (orn, tinct); dissem.: antr., enz.; Lf: H; genom: P; habitat: h; syntaxa: L-Ch; character: c; spread: Piatra Neamț.
- Portulaca oleracea*** L. var. *oleracea* - origin: S Eur ?; intr.: acc (alim. ?); dissem.: antr., bar., an.; Lf: T; genom: P; habitat: h; syntaxa: Er, Si, Ch; character: i; spread: Piatra Neamț, Bistrița, Vaduri, Almaș, Gârcina, Gura Humorului, Frasin, Mălini, Ostra, Horaița Monastery.
- Prunus cerasifera*** Ehrh.: origin: B-P; intr.: delib.(alim.); dissem.: antr., bar., enz., vg.; Lf: Ph; genom: D; habitat: h; syntaxa: ?; character: c; spread: Piatra Neamț.
- Raphanus raphanistrum*** L. subsp. *landra* (Moretti ex DC.) Bonnier & Layens - origin Md; intr.: acc; dissem.: antr., bar.; Lf: T; genom: D; habitat: h; syntaxa: Si, Ch ; character: c(n); spread: Piatra Neamț.
- Raphanus sativus*** L. - origin: Md; intr.: delib. (alim.); dissem.: antr., bar.; Lf: T-TH; genom: D; habitat: h; syntaxa: Si; character: c; spread: Gârcina, Piatra Neamț.
- Reynoutria × bohemica*** Chrtek & Chrtková: origin - E As (C Eur hybrid ?); intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: G; genom: P; habitat: h, sn, n; syntaxa: L-Ch, Cse, Al-Frax; character: i; spread: Bicaz, Broșteni, Galu, Crucea, Gura Humorului (Moldova river bank, at „Arini”Complex), Negrileasa, Piatra Neamț [33], Arini, Holda, Ostra, Pietroasa, Potoci.
- Reynoutria japonica*** Hoult. - origin: E As; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: G; genom: P; habitat: h, sn, n; syntaxa: L-Ch, Cse, Al-Frax; character: i; spread: Broșteni, Cotârgești, (Peștele Monastery), Galu, Holda, Lungeni (on the Fagului stream), Negrileasa, Petru Vodă, Sabasa.
- Ribes rubrum*** L. - origin: C, W Eur; intr.: delib. ? (alim., orn.); dissem.: antr., enz.; Lf: Ph; genom: D; habitat: n; syntaxa: ?; character: n; spread: Neamțului Mountains at Sihla Hermitage [27], Crucea (Tarnița Rock).
- Robinia pseudacacia*** L. - origin: N Am; intr.: delib. (orn., forest., mell.); dissem.: antr., an., vg.; Lf: Ph; genom: D; habitat: h, sn; syntaxa: Pr, Fg. s, (Ag.r, Oa); character: i; spread: Buhalnița peak [10], Galu, Găinești, Gârcina, Holdița, Piatra Neamț, Neagra, Horaița Monastery.

- Robinia viscosa*** Vent - origin: N Am; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: Ph; genom: D; habitat: h; syntaxa: ?; character: c; spread: Buhalnița peak [10], Piatra Neamț.
- Rudbeckia hirta*** L. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an.; Lf: TH; genom: D; habitat: h, (n); syntaxa: Si, (Sp); character: c; spread: Cujejdi river bed upstream of Piatra Neamț.
- Ruta graveolens*** L. - origin: Md; intr.: delib. (orn., med., arom.); dissem.: antr., aut.; Lf: Ch; genom: P; habitat: h; syntaxa: ?; character: c; spread: Piatra Neamț (cult. ?) [11].
- Satureja hortensis*** L. - origin: Md; intr.: delib. (med., arom.); dissem.: antr., an., bar.; Lf: T; genom: ?; habitat: h, sn; syntaxa: Si, Sp; character: c; spread: Piatra Neamț (!) [6], Cujejdi river bed-upstream of Piatra Neamț, Gârcina.
- Sisyrinchium montanum*** Greene - origin: N Am; intr.: acc.; dissem.: antr., an., enz.; Lf: G; genom: P; habitat: n; syntaxa: Arr; character: (n)i; spread: Gura Humorului [17], Muncel, Crucea (near the sterile dump deposits), Ostra.
- Solidago canadensis*** L. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: H; genom: D; habitat: h, sn; syntaxa: Cse, Arr, Oa, Ag.r; character: c; spread: Piatra Neamț.
- Tagetes patula*** L. - origin: N Am; intr.: delib. (orn.); dissem.: antr., an.; Lf: T; genom: P; habitat: h; syntaxa: Si; character: c; spread: Bicaz.
- Tanacetum parthenium*** (L.) Sch. Bip. - origin: Md; intr.: delib. (orn.); dissem.: antr., an., vg.; Lf: H; genom: D; habitat: h; syntaxa: Oa, Ag.r, Si; character: n; spread: Cuiejdi, Găinești, Ciumârna stream at Găinești, Piatra Neamț.
- Thladiantha dubia*** Bunge - origin: As; intr.: delib. (orn.); dissem.: antr., bar.; Lf: G; genom: D; habitat: h; syntaxa: Si, Cse, Oa; character: n; spread: Piatra Neamț, Neagra, Agapia Monastery.
- Trigonella caerulea*** (L.) Ser. - origin: Md; intr.: delib. (fodd.); dissem.: antr., enz.; Lf: T; genom: D; habitat: h, sn; syntaxa: Si, Oa, Ag.r, Fv; character: (n)i; spread: Piatra Neamț, Bistrița, Vaduri, Voroneț.
- Veronica persica*** Poir. - origin: As; intr.: acc.; dissem.: antr., an., enz., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Ch; character: i; spread: Lacul Bicaz [5], Gura Humorului [17], Secu Monastery [10], Pârâul Cârjei, Piatra Neamț, Horaița Monastery.
- Xanthium orientale*** L. - origin: SE Md; intr.: acc.; dissem.: antr., epz.; Lf: T; genom: P; habitat: h; syntaxa: Si, Bi, Ch, Er, Oa; character: i; spread: - subsp. ***riparium*** (Čelak.) Greuter: Bicaz; - subsp. ***italicum*** (Moretti) Greuter: Piatra Neamț, Gârcina, Cujejdel lake, Frasin, Bistrița, Horaița Monastery.
- Xanthium spinosum*** L. - origin: S Am; intr.: acc.; dissem.: antr., epz.; Lf: T; genom: P; habitat: h, sn; syntaxa: Oa, Si; character: i; spread: Lacul Bicaz [5], Gura Humorului [17], Piatra Neamț, Magazia, Voroneț, Agapia, Horaița Monastery, Horăciora Hermitage.

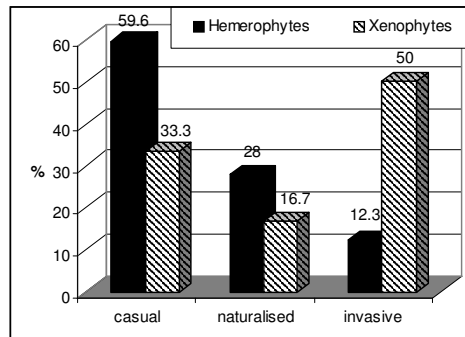
Our recordings point out the fact that the number of alien plants in different localities from Stânișoara Mountains is positive correlated with the intensity of the anthropic influence relative to the environment. So, the largest number of alien species was met in the urban localities situated in the peripheral regions of the mountain area (Piatra Neamț - 71 species; Gura Humorului - 31 species), while the smallest number of alien species was registered in the uninhabited regions, usually situated at the greater altitude (for example, at the Crucea Talienilor Pass, at 1243 m altitude, we have identified three alien species, only: *Chamomila suaveolens*, *Juncus tenuis*, and *Erigeron annuus* sensu lato).



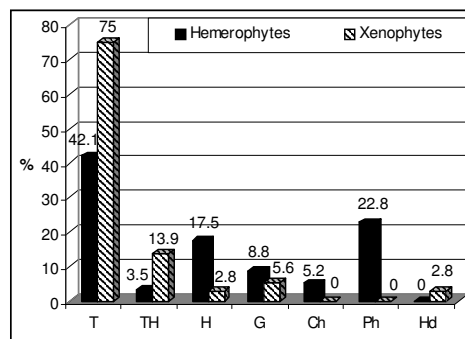


**Fig. 1.** Introduction mode - accidentally (acc) or deliberately as cultivated plants for various uses: ornamental (orn), medicinal (med), alimentary (alim), aromatic (arom), fodder (fod), melliferous (mell), forestry (for), tinct.-tinctorial etc.

Of the total number of alien plant species, 36 species (38.7%) are xenophytes, and 57 species (61.3%) are hemerophytes. In contrast with the xenophytes, which have been accidentally introduced in the region (through humans and animals movements,



**Fig. 2.** Alien plants status



**Fig. 3.** The structure of Raunkiaer's life forms

displacement of military troupes, transports, urbanisation, tourism activities, agriculture, buildings, mining exploitations, forest activities etc.), the hemerophytes were initially introduced by man, as cultivated plants, for various uses, chiefly in ornamental (65.5%), medicinal (19%), alimentary (13.8%), aromatic (12.1%), or fodder (10.3%) purposes, and less as forest, tinctorial or oleaginous plants; subsequent, these plants escaped from cultures, spreading by themselves in anthropic or natural habitats (**Fig. 1**).

With regard to the status of the xenophytes in Stânișoara Mountains, we assess that 50% of them have in present an invasive character (i), while 16.7% are naturalised (n), and 33.3% are casual (c) in the region. In contrast, the majority of hemerophytes (59.6%) have a casual status, and only 28.0% are naturalized and 12.3% are invasive (**Fig. 2**).

Of the main species with an invasive character, that are or could be detrimental to the natural and anthropic ecosystems in the Stânișoara

Mountains, we can enumerate: *Amaranthus powellii*, *A. retroflexus*, *Ambrosia artemisiifolia*, *Chamomilla suaveolens*, *Conyza canadensis*, *Echinocystis lobata*, *Elsholtzia ciliata*, *Erigeron annuus*, *Galinsoga parviflora*, *G. quadriradiata*, *Juncus tenuis*, *Oenothera biennis*, *Oxalis stricta*, *Veronica persica*, *Xanthium orientale* subsp. *italicum*, *X. spinosum* (xenophytes), *Acer negundo*, *Impatiens glandulifera*, *Reynoutria × bohemica*, *R. japonica*, *Robinia pseudacacia* (hemerophytes) etc.

Regarding the structure of Raunkiaer's life forms (Fig. 3), we can find a very important proportion of therophytes (species with pioneer character, with short biological cycles and which prefer the disturbed habitats), both in the case of xenophytes (75%) and hemerophytes (42.1%). The other life forms are less represented. Nevertheless, in the case of alien plants that were voluntarily introduced by man and subsequently escaped from cultures (hemerophytes), we remark an important proportion of phanerophytes (22.8%) and hemicryptophytes (17.5%). Among the alien plants that were accidentally introduced in the studied territory (xenophytes), we see a total absence of phanerophytes (trees, shrubs), and a very little proportion of hemicryptophytes (2.8%). A possible explanation of this situation

can be that when the woody plants and the herbaceous perennial ones (plants which don't produce seeds in the first years of life) are intentionally introduced in a new territory, they benefit all the time by protection and care on the part of man, which increase their chance of acclimatization and naturalization, in their new country, after a certain number of years; while the herbaceous perennial and woody plants accidentally arrived on a new territory, since the germination of the seeds and formation of the seedlings, have to suffer a great number of edaphic, climatic and zoo-anthropic adversities, which leads to their loss, in a great proportion, before the producing of seeds and their spreading into surroundings.

On the whole, the alien flora from the Stânișoara Mountains contains almost the same proportion of diploid (D) and polyploid (P) species. Nevertheless, polyploids prevail among xenophytes ( $ID_x=0.71$ ), while the hemerophyte flora contains more diploids than polyploids ( $ID_H=1.4$ ).

Besides anthropochory, met at all analyzed species, the main means of natural spreading of the germs (seeds, fruits) are the next: the anemochory (65,9% - xenophytes, and 55,2% - hemerophytes), the zoochory (41,5% -

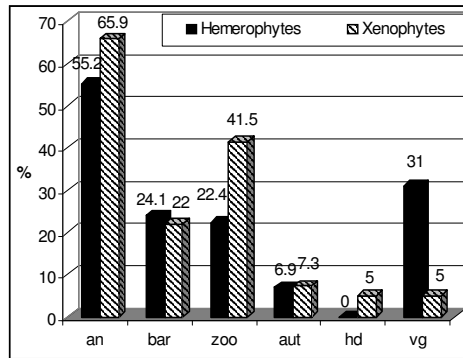


Fig. 4. Means of natural spreading of the germs: an-anemochory, bar-barrochory, zoo- zoochory, aut- autochory, hd-hydrochory, vg-vegetative

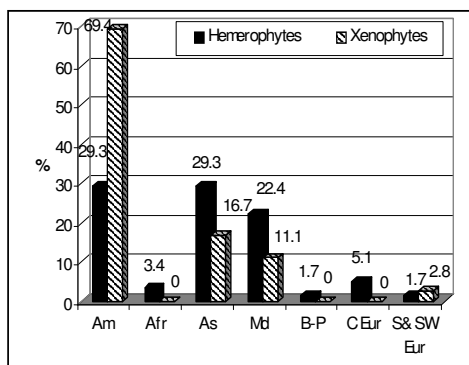


Fig. 5. The origin of the species: Am-America, Afr-Africa, As-Asia, Md-Mediterranean region, B-Balkan region, P-Pontic region, Eur-Europe (S-south, C-central, W-west)

xenophytes and 22.4% - hemerophytes) and the barrochory (22% - xenophytes and -24.1% - hemerophytes). The autochory (7.3 - 6.9%) and hidrochory are less important (5.0-0%). The vegetative propagation (by radicular buds, rhizomes, stolons etc.) is met more frequent at hemerophytes (31%) than xenophytes (5%) (Fig. 4).

Most xenophytes came from America (especially North America) (69.4%), and fewer came from Asia (16.7%), Mediterranean region (11.1%) etc. Also, the most hemerophytes have their origin in America (29.3%), Asia (29.3%), and Mediterranean region (22.4%), and fewer came from Central Europe (5.1%) or other regions (Fig. 5).

The habitats invaded by alien plants in the Stânișoara Mountains are especially the anthropic disturbed ones (ruderal places, crops, surroundings of villages, roads, waste depots etc.), over 95% of the alien plants species being identified in such kind of habitats. The semi-natural and natural habitats are also invaded by 37.9%, respectively 12.1% of the hemerophytes and 44.7%, respectively 15.8% of the xenophytes (Fig. 6).

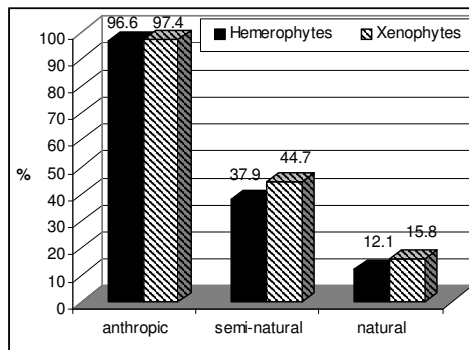


Fig. 6. The habitats invaded by alien plants

xenophytes - 39.5%), *Agropyretalia repentis* (particularly hemerophytes - 22.4%), *Eragrostetalia* (particularly xenophytes -15.8%), *Lamio-Chenopodietalia* (particularly hemerophytes - 15.5%) etc.

The natural vegetation affected by the invasion of the alien plants is represented in the territory, especially by meadows, shrub and riparian communities, from several orders, such as: *Arrhenatheretalia* (15.8% of xenophytes), *Prunetalia* (10.3% of hemerophytes), *Salicetalia purpureae* etc.

### Conclusions

- The alien (non-native) flora of the Stânișoara Mountains consists of 93 vascular plant species, with 7 subspecies, belonging to 70 genera and 35 families. These species are discussed regarding their impact to the ecosystems, immigration modes, invasive status, geographical origins, dispersal mechanisms, their distribution, principal infestation sites etc.
- The number of alien plants in different localities from Stânișoara Mountains is positive correlated with the intensity of the anthropic influence relative to the environment.
- Of the total number of alien plant species, 38.7% were accidentally introduced in the territory, while 61.3% were deliberately introduced and then escaped in the wild.
- The most dangerous alien species for semi-natural and natural habitats in the investigated territory are identified.

**Acknowledgements:** The researches were supported by financial resources of CNCIS Project no. 1175/2006: „Monitoring and anthropical studies over the flora, the vegetation, and the natural habitats from Stânișoara Mountains (Eastern Carpathians).

### References

1. ALPERT P., BONE E., HOLZAPFEL C., 2000 – Invasiveness, invasibility and the role of environmental stress in the spread of non-native plants, *Perspectives in Plant Ecology, Evolution and Systematics*. Urban & Fischer Verlag, **3** (1): 52-66.
2. BRANDZA, D., 1879-1883 – *Prodromul Florei Române*, București: Tipogr. Acad. Române.
3. BUIA AL., 1938-1939 – Cuscutele României. *Bul. Facult. de Agr. Cluj*, **7**.
4. BURDUJA C., 1948 – Contribution floristique et chorologique relative à la Moldavie, Iași: *Bul. Politehn. "Gh. Asachi"*, **3** (1): 474-488.
5. BURDUJA C., GAVRILESCU Gh., 1976-1977 – Studiul floristic și fitocenologic al spațiului din jurul lacului de acumulare Bicaz. II. Cercetări floristice asupra versantului stâng între Piciorul Malu (Hangu) și Gura largu (Poiana Teiului), *Trav. St. „Stejarul”, Ecol. Terr. et Genetique /1976-1977/*: 33-46.
6. CĂLINESCU R., 1942 – Alte plante scăpate din cultură și considerațiuni biogeografice asupra acestei categorii de plante, *Bul. Soc. Reg. Rom. Geogr.*, **61**: 113-124.
7. CHIFU T., ȘTEFAN N., ONOFREI TR., 1974 – Conspectul plantelor cormofite din bazinul pârâului Nemțșor (jud. Neamț), *Stud. Cerc., Muz. Șt. Nat., Piatra Neamț, ser. Bot.-Zool.*, **2**: 85-107.
8. CHIFU T. (coord.), IORGU O., DEJU R., 2003 – *Parcul Forestier Vânători-Neamț. Diversitatea biologică. Listă de specii*, Adm. Parc. Forest. Vânători Neamț.
9. CIOCARLAN V., 2000 – *Flora ilustrată a României. Pteridophyta et Spermatophyta*, București: Edit. Ceres, 1198 pp.
10. DARABAN M., 2007 – Cercetări floristice și fitocenologice în parcul natural Vânători-Neamț, Teză doctorat, Univ. “Alexandru Ioan Cuza” Iași.
11. GRECESCU C., 1898 – *Conspectul florei României*, București: Tipogr. Dreptatea.
12. GRECESCU C., 1909 – *Suplement la Conspectul florei României*. București: Inst. Arte Grafice.
13. MIHAI GH., TOMA C., 1963 – Contribuții la studiul arborilor și arbuștilor ornamentali cultivați în spațiile verzi din orașele și parcurile din nordul Moldovei (1). *Acta Bot. Horti Bucurest. /1961-1962/*: 1173-1182.
14. MITITELU D., BARABAȘ N., 1972 – Completări la răspândirea unor plante în Moldova. *Stud. Com. Ști. Nat., Muz. Bacău*, **5**: 103-104.
15. MITITELU D., BARABAȘ N., ȘTEFAN N., 1987 – Contribuții la corologia unor plante rare în Moldova și Muntenia. *An. Ști. Univ. “Alexandru Ioan Cuza” Iași, secț. II, a. Biol.*, **33**: 20-24.
16. MITITELU D., CHIFU T., PASCAL P., 1989 – Flora și vegetația județului Suceava, *An. Muz. Ști. Nat. Suceava*, **10**: 93-120.
17. MITITELU D., TODERAȘ E., 1990 – La flore et la végétation des environs de la ville Gura Humorului, *An. Ști. Univ. "Al. I. Cuza" Iași, ser. II, a. Biol.*, **36**: 27-30.
18. MORARIU I., 1957 – Fam. *Onagraceae* Lindl., in Săvulescu T. (red. pp.) - *Flora R. P. Române*, **V**, București: Edit. R. P. Române, pp: 473-529.
19. MORARIU I., 1958 – Fam. *Malvaceae* A. Juss., in Săvulescu T. (red. pp.) - *Flora R. P. Române*, **VI**, București: Edit. R. P. Române, pp: 21-65.
20. MORARIU I., 1972 – Semnificația unor date corologice noi la plante, *Stud. Com. Ocrot. Nat. Suceava*, **2**: 191-200.
21. NEGREAN G., 1987 – Adăugiri la flora României, *Stud. Com. Muz. Satu Mare*, **7-8** (1986-1987): 448-459.
22. OPREA A., 2005 – *Lista critică a plantelor vasculare din România*. Iași: Edit. Univ. “Alexandru Ioan Cuza”, 668 pp.
23. OPREA A., ȘIRBU C., 1997 – Contribuții corologice la flora Moldovei, *Lucr. Ști. Univ. Agr. Iași, Ser. Hort.*, **40**: 342-343.
24. PETRESCU C., 1921 – Remarques sur quelques plantes interessant la flore de Moldave, *Ann. Sci. Univ. Jassy*, **9** (1-2): 132-134.
25. PETRESCU C., 1923 – Contribution à la flore mycologique de Roumanie, *Ann. Sci. Univ. Jassy*, **12** (1-2): 98-115.
26. PYŠEK P., SÁDLO J., MANDÁK B., 2002 – Catalogue of alien plants of the Czech Republic, *Preslia Praha*, **74**: 97-186.
27. RĂVĂRUȚ M., 1956 – Fam. *Saxifragaceae* D.C., in Săvulescu T. (red. pp.) - *Flora R. P. Române*, **IV**, București: Edit. R. P. Române, pp: 86-148.

28. RĂVĂRUȚ M., 1961 – Genul *Dracocephalum* L., in Săvulescu T. et Nyárády E. (red.) - *Flora R.P. Române*, **VIII**, București: Edit. Acad. R. P. Române, pp. 134-140.
29. RĂVĂRUȚ M., TURENSCHI E., MITITELU D., 1958 – Contribuții floristice (II), *Stud. Cerc. Ști. Acad. R. P. Române*, fil. Iași, Biol. Ști. Agr., **9** (1): 1-5.
30. RĂVĂRUȚ M., MITITELU D., 1959 – Contribuțiuni floristice. *Stud. Cerc. Ști. Acad. R. P. Române*, fil. Iași, Biol. Ști. Agr., **10** (1): 63-67.
31. 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 and Distribution. Biodiversity Research*, **6**: 93-107.
32. SAX F., BROWN J. H., 2000 – The paradox of invasion. *Global Ecology & Biogeography*, **9**: 363-371.
33. SÎRBU C., OPREA A., 2008 – Two alien species in the spreading process in Romania: *Reynoutria × bohemica* Chrték & Chrtková and *Grindelia squarrosa* (Pursh) Dunal, *Cerc. Agr. Mold.*, **41** (2/134): 41-50.
34. SÎRBU C., 2005 – *Euphorbia dentata* și alte plante adventive, pe cale de răspândire în estul României, *Lucr. Ști., Univ. Agron. Iași*, Ser. Agron., **48** (CD, sect. 1).
35. SÎRBU C., 2006 – Floristic and chorological contributions from Moldavia and Muntenia (Romania). *An. Ști. Univ. "Alexandru Ioan Cuza" Iași*, s. II, a. Biol. veget., **52**: 92-98.
36. TUTIN T. G. et al. (eds.), 1964–1980 – *Flora Europaea*, 1–5, Cambridge: Cambridge University Press.
37. WILLIAMS J. D., MEFFE G. K., 1998 – *Nonindigenous species*. <http://biology.usgs.gov/>.