NAT. CROAT. | VOL. 17 | No 2 | 73–90 | ZAGREB | June 30, 2008

original scientific paper / izvorni znanstveni rad

ALIEN FLORA OF CROATIA: PROPOSALS FOR STANDARDS IN TERMINOLOGY, CRITERIA AND RELATED DATABASE

BOŽENA MITIĆ[1], IGOR BORŠIĆ[1], IVA DUJMOVIĆ[2], SANDRO BOGDANOVIĆ[1], MILENKO MILOVIĆ[3], PETRA CIGIĆ[1], IVANA REŠETNIK[1] & TONI NIKOLIĆ[1]

[1]University of Zagreb, Faculty of Science, Department of Botany and Botanical garden, Marulićev trg 9a, HR-10000 Zagreb, Croatia (E-mail: bozena@botanic.hr)

[2]Svijet biljaka d.o.o., Antonio Smareglia 65, HR-52215 Vodnjan, Croatia

[3]Medical and Chemical School, Ante Šupuka Street, HR-22000 Šibenik, Croatia

Mitić, B., Boršić, I., Dujmović, I., Bogdanović, S., Milović, M., Cigić, P., Rešetnik, I. & Nikolić, T.: Alien flora of Croatia: proposals for standards in terminology, criteria and related database. Nat. Croat., Vol. 17, No. 2., 73–90, 2008, Zagreb

As a result of the global problem of invasion, the number of studies dealing with plant invasion is increasing, thus causing increasing confusion about terminology used. As a part of the first national project about invasive Croatian flora in 2006, we prepared a proposal for a national standard terminology and criteria for the treatment of alien flora. This proposal includes regular terminology globally accepted in most botanical communities, but it is especially harmonized with European standards for alien flora treatment, particularly for invasive alien plant species (IAS). Special attention was paid to defining the criteria for status of plant species potentially invasive in Croatia, such as origin status, residence status and invasion status, for which a special module »Allochthonous plants« within Flora Croatica Database was prepared.

Key words: alien flora, invasive alien plant species (IAS), standardization of terminology, standardization of criteria, Flora Croatica Database module »Allochthonous plants«, Croatia

Mitić, B., Boršić, I., Dujmović, I., Bogdanović, S., Milović, M., Cigić, P., Rešetnik, I. & Nikolić, T.: Alohtona flora Hrvatske: prijedlozi standarda u terminologiji, kriterija te baze podataka. Nat. Croat., Vol. 17, No. 2., 73–90, 2008, Zagreb

Kako je problem invazivnih vrsta postao svjetski, porastao je broj studija o invazivnim biljnim vrstama, što je uzrokovalo porast terminološke konfuzije koja se nastoji prevladati uvođenjem općeprihvaćenih standarda. Stoga smo, kao dio prvog nacionalnog projekta o invazivnoj flori Hrvatske, provedenog 2006. godine, pripremili prijedlog nacionalnih standarda i kriterija za tretiranje alohtone flore. Taj prijedlog uključuje standardnu terminologiju, svjetski prihvaćenu od većine botaničara, ali i

posebno usklađenu s europskim standardima za tretiranje alohtone flore, a naročito invazivnih biljnih vrsta. Posebna pažnja posvećena je definiranju kriterija za utvrđivanje statusa potencijalno invazivnih vrsta u Hrvatskoj, kao što su podrijetlo, datum i način unosa, te invazivni status, na temelju kojih je, za navedene svojte, unutar baze Flora Croatica priređen zaseban modul »Alohtone biljke«.

Ključne riječi: alohtona flora, invazivne biljne vrste, standardizacija terminologije, standardizacija kriterija, Flora Croatica Database modul »Alohtone biljke«, Hrvatska

INTRODUCTION

The difference between native and alien status of plants is the first factor to determine, when we try to study plant invasions. According to recent trends in such studies, a plant can only be regarded as native to a given area if its occurrence is independent of human activities (PYŠEK, 1995). Alien (non-native, non-indigenous, exotic etc.) plants are not always harmful, for they include, for example, most crop species used for human consumption. However, some of them, called invasive alien plant species (IAS) pose threats to the environment and humans. Thus IAS are considered one of the greatest threats to flora biodiversity and its conservation everywhere (e.g. CRONK & FULLER, 1995; REJMÁNEK, 1995; RICHARDSON *et al.*, 2000; MCNEELY *et al.*, 2001; ESSL & RABITSCH, 2002; PYŠEK *et al.*, 2004; LAMBDON *et al.*, 2008). In addition to impacts on biodiversity, many IAS impose enormous economic costs (e.g. medical expenses in treatment of IAS-induced allergies).

The importance of biological invasion was noticed in the days of Darwin, but real actions in this field began in the middle of the 20th century (PYŠEK *et al.*, 2004), especially with organised programs, such as the Global Invasive Species Programme (GISP) (MOONEY, 1999), Delivering Alien Invasive Species Inventories for Europe (DAISIE) (LAMBDON *et al.*, 2008), Ecology and Management of Alien Plant Invasions (EMAPI)[1]. Strategies for treatment of invasive alien species were prepared and the development of similar strategies in particular countries and/or regions was suggested, for example in the Convention on Biological Diversity Guiding Principles[2], IUCN Guidelines for the prevention of biodiversity loss caused by alien invasive species[3], European strategy on invasive alien species (GENOVESI & SHINE, 2004) etc. Globally, experts dealing with these problems are organised within the Invasive Species Specialist Group (ISSG)[4], Scientific Committee on Problems of the Environment (SCOPE) (DRAKE *et al.*, 1989), NEOBIOTA[5] and others and through Aliens-L list server[6] can discuss experiences and problems regarding IAS. Further-

[1] http://www.esa.org/

[2] http://www.biodiv.org/convention/

[3] http://www.parks.ca.gov/pages/734/files/imap%20invasive%20alien%20plant%20protocol%20table%20.pdf

[4] http://www.issg.org/

[5] http://www2.tu-berlin.de/čoekosys/e/neobiota_e.htm

[6] http://www.issg.org/newsletter.html#Listserver

more, the »worst« invasive alien species in the world (LOWE *et al*., 2000) and Europe[7] were identified, representing some of the worst species in terms of their impact on biodiversity, economy and health. Such »black lists« for the worst invasive alien species, provide information on their biology and ecology, habitat and distributions (including detailed maps), introduction pathways, invasion trends, impacts and management methods including ways of prevention.

As a result of IAS global influence, the number of studies particularly dealing with plant invasions is increasing (RICHARDSON *et al*., 2000; PYŠEK *et al*., 2004; RABITSCH & ESSL, 2006; LAMBDON *et al.*, 2008 etc.). At the same time confusion on terminology and classifications of alien plants used in different articles increases.

Numerous terms have been used to describe the alien (as well as invasive) status of plant species: adventive plants, naturalized plants, weeds, anthropophyte, neophytes, ephemerophytes, epekophytes, agriophytes, casual, exotic, invader etc., often without specific explanation of their meaning or with ambiguous meaning (e.g. »adventive«; PYŠEK, 1995; RICHARDSON *et al*., 2000; PYŠEK *et al*., 2004 etc.). The term invasive plants was also used in different senses – biogeographical, ecological, palaeontological etc. (PYŠEK, 1995). Frequently a chronological terminology was used (classification according to time of appearance on new territory: archaeophytes versus neophytes) or more often a mixture of chronological and ecological terms (HOLUB & JIRÁSEK, 1967; SUKOPP, 1972; KORNAS, 1990; PYŠEK, 1995; RICHARDSON *et al*., 2000; PYŠEK *et al*., 2004 etc.). The necessity for global standardization of criteria and terminology for non-native flora treatment became clear. Finally, most of the recent articles suggest that alien plant classification should be based on phytogeography/demogeography (measures of population growth and spread in the new territory), rather than on their threat to habitats and ecosystems. Such a definition comprises a general ecological process that can be confirmed by relatively simple measurements and enable understanding of invasion as an ecological phenomenon (PYŠEK, 1995; RICHARDSON *et al*., 2000; PYŠEK *et al.*, 2004 *etc.*).

According to NIKOLIĆ (2008a, in press) Croatia ranks third in Europe in terms of floristic richness per area. National flora contains total of 5347 vascular taxa (4275 species and 1072 subspecies), 323 of them are endemic, but until recently (BORŠIĆ *et al*., 2008; NIKOLIĆ, 2008b) the number of alien, as well as invasive plants was unknown. During the last few years (MITIĆ & NIKOLIĆ, 2006; MITIĆ *et al*., 2006a,b; SUŠIĆ & RADEK, 2007) there were no organized efforts at making an invasive plan inventory, monitoring and/or appropriate actions in Croatia. Fortunately, the fact that present state and status of alien flora are of vital importance for planning any action connected with invasive alien plants was recognized by competent authorities and included in relevant acts concerning nature protection (Strategy on IAS should be prepared at the beginning of 2009).

In 2005 we started research in this field and managed the first national project about an invasive Croatian flora inventory. Our proposal for a national strategy

---

[7] http://www.europe-aliens.org/speciesTheWorst.do

against invasive alien plant species (IAS) has already been presented to both the national (DOBROVIĆ *et al.* 2006; MITIĆ *et al.*, 2006a, 2007) and the European botanical community (MITIĆ *et al.*, 2006b). Our main objectives for strategy against invasive alien plants (IAS) in Croatia are:

1. Adoption of national criteria and standards for terminology and categories of alien flora by botanists and other related experts,

2. Developing the database and standard forms with required data about alien plants in Croatia,

3. Creation of a preliminary check-list of invasive alien plant species (IAS) in Croatia,

4. Investigation and documentation of threats posed by IAS,

5. Management plans development and control of IAS,

6. Dissemination of information and public sensitisation and awareness raising.

The results of our work so far represent the realization of the first three objectives of the suggested strategy:

1. Proposals for Croatian national standards in terminology and criteria for alien flora treatment have been completed,

2. A separate module »Allochthonous plants« was specially developed and incorporated in the Flora Croatica Database (NIKOLIĆ, 2008) as a publicly accessible web service,

3. A preliminary check-list of IAS for Croatia has been created (BORŠIĆ *et al.*, 2008).

MATERIAL AND METHODS

For the purpose of developing the national strategy on IAS, criteria and standards for terminology were used from relevant literature dealing with problems of (invasive) alien plant species (PYŠEK, 1995; REJMÁNEK, 1995; RICHARDSON *et al.*, 2000; MCNEELY *et al.*, 2001; PYŠEK *et al.*, 2002, 2004; LAMBDON *et al.*, 2008 etc.), as well as guidelines, recommendations and standards recommended by Convention on Biological Diversity Guiding Principles[8], IUCN Guidelines for the prevention of biodiversity loss caused by alien invasive species[9], Inventory and Monitoring Protocols – Invasive Alien Plants[10], Ecology and Management of Alien Plant Invasions[11], European Strategy on Invasive Alien Species (GENOVESI & SHINE, 2004), European and Mediterranean Plant Protection Organization[12], International Plant Protection Con-

[8] http://www.cbd.int/

[9] http://www.iucn.org/themes/ssc/publications/policy/invasivesEng.htm

[10] http://www.parks.ca.gov/pages/734/files/imap%20invasive%20alien%20plant%20protocol%20-table%20.pdf

[11] http://www.esa.org/

vention[13], Delivering Alien Invasive Species Inventories for Europe etc. For preparation of the newly developed module of Flora Croatica Database that will be able to produce taxon sheets for all alien plants in Croatia, numerous international experiences were consulted (e.g. ISSG's Global Invasive Species Database[14], Hawaiian Ecosystems at Risk project[15], North European and Baltic Network on Invasive Alien Species[16], Alien Species in Poland[17] etc.). Special attention was paid to defining criteria for status of plant species potentially invasive in Croatia, such as origin, invasion and residence status. To improve our proposal presented here, we also drew on helpful oral discussions and comments from recent workshops and conferences, both national (DOBROVIĆ *et al.*, 2006; MITIĆ *et al.*, 2006a, 2007) and international (MITIĆ *et al.*, 2006b).

RESULTS AND DISCUSSION

Proposal for criteria and terminology

Criteria, terminology and definitions recommended here are mostly globally accepted, but they are particularly harmonized with global and European standards for alien flora treatment (see references in Material and Methods). The proposal for national standardization for alien flora treatment is incorporated in Flora Croatica Database, within the special module »Allochthonous plants« (Fig. 1). Criteria support distinguishing between native and alien plants through their origin, residence time status and invasion status. Therefore terms and definitions used in this proposal are divided in three groups:

1. General terminology and definitions,
2. Terminology and definitions about origin and invasion status,
3. Terminology and definitions about residence time status.

1. GENERAL TERMINOLOGY AND DEFINITIONS

A. Introduction means the movement of a plant species or lower taxon over a larger geographic barrier to an area not previously populated by it (e.g. in the territory of Croatia), by direct or indirect human action.

A1. Direct (deliberate, intentional) introduction means the purposeful transfer by humans of species into a new area. This includes also species introduced into confinement (e.g. aquariums or plants for research purposes).

---

[12] http://www.eppo.org/

[13] https://www.ippc.int/IPP/En/default.jsp

[14] http://www.issg.org/database/welcome/aboutGISD.asp

[15] http://www.hear.org/gcw/

[16] http://www.nobanis.org/

[17] http://www.iop.krakow.pl/ias/

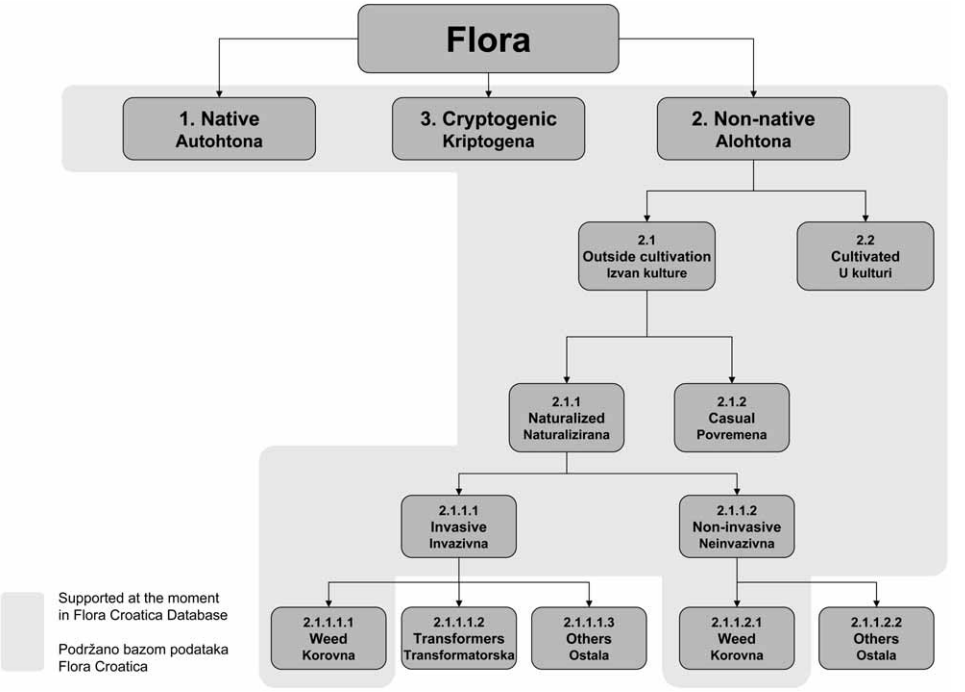

Fig. 1. Proposal for classification of Croatian alien (non-native) flora, incorporated in Flora Croatica Database, module »Allochthonous plants«.

Sl. 1. Prijedlog za podjelu alohtone (strane) flore Hrvatske, uključen u bazu podataka Flora Croatica, modul »Alohtone biljke«.

Thus, the introduction is defined here as the initial movement into a new area. Such plants can subsequently escape or be released into the environment. This definition does not include the introduction of native plants from one region of Croatia to another (e.g. from Mediterranean part of Croatia to continental and vice versa).

A2. Indirect (accidental, unintentional) introduction is a secondary and unintentional result of some human activities and indicates that a species is utilizing humans or any kind of human delivery systems as vectors (e.g. canal building, transport in cargo sea-ports).

B. Naturalization starts when abiotic and biotic barriers for survival and various barriers for regular reproduction are overcome, therefore normal reproduction in the new area is established.

C. Invasion requires that introduced plants produce reproductive offspring in areas away from the place of introduction, followed by fast spreading and numerous individuals.

D. Pathways are the geographic routes by which a species moves outside its natural range; the corridor of introduction (e.g. river sides, roads, tunnels, sea etc.) and/or human activity than gives rise to an intentional or unintentional introduction.

E. Vector is the physical means or agent that makes possible any kind of plant introduction from one area to the other, on smaller or larger distances (i.e. water, wind, animals, humans, traffic, etc.).

2. TERMINOLOGY AND DEFINITIONS ABOUT ORIGIN AND INVASION STATUS (Fig. 1)

1. Native plants (syn.: autochthonous, indigenous plants) are taxa originated in a given area of Croatia without human involvement, that is a part of their natural distribution and it is conditioned by natural factors. The definition excludes products of hybridization between native and alien taxa.

Remark: if the species was native at an area in Croatia before last glaciation, and than disappeared, later reintroduction by humans is not providing it with native status for this region any more.

2. Alien plants (syn.: allochthonous, exotic, introduced, non-native, non-indigenous plants) are species, subspecies or lower plant taxa introduced and growing outside of their natural area of distribution (includes any part of gametes, seeds or propagules of such taxon that might survive and subsequently reproduce). Their introduction is due to intentional (A1) or unintentional (A2) human involvement, or which have arrived there without the help of people from an area in which they are alien. This term also includes alien taxa under cultivation, because they may become one of following categories in the future:

2.1. Plants outside cultivation are alien plants which can originate from cultivated plants and are the result of deliberate introduction or they can be plants which do not occur in cultivation and are the result of accidental introduction. The group incorporates several subgroups.

2.1.1. Naturalized alien plants (syn.: established plants; partial synonyms are ergasiolipophytes and epekophytes) are plant which have undergone process of naturalization. They are taxa that sustain self-replacing populations for a period of time long enough to experience extreme climatic events in the area, and reproduce without direct intervention of people (or despite human intervention) by recruitment from seed or vegetative parts capable of independent growth (sustain self-replacing populations for at least 10 years without human impact or at least two spontaneous generations within at least 25 years).

2.1.1.1. Invasive alien species (IAS) (partial synonyms are agryophytes, ergasiolipophytes, neoindigenophytes) are a subset of naturalized plants that produce reproductive offspring, often in very large numbers, at considerable distances from the parent plants and thus have the potential to spread over a large area (produce reproductive offspring more than 100 m in less than 50 years through generative reproduction and/or more than 6m in three years through vegetative reproduction). They are alien species whose introduction and/or spread

threatens biological diversity at ecosystem, habitat and species levels and have negative influence on humans.

2.1.1.1.1. **Weeds** (pests, harmful species, noxious plants, problem plants) are plants with invasive features occurring in sites where they are not wanted and have registered economic or environmental impact or both. These are usually the species which are undesirable on agricultural areas and other areas of such interest (e.g. grasslands, pastures, urban areas). Term weeds and other synonyms are often identified with the term invasive alien plant species (e.g. the efforts to control invasive plants have often been described as a war on weeds or pests).

2.1.1.1.2. **Transformers** are subset of invasive plants (but not necessarily alien plants!) that change the character, condition, form or nature of plant communities and/or ecosystems and are equivalent with edificators (PYŠEK *et al.*, 2004).

2.1.1.1.3. **Others** are invasive alien plants which are not harmful to the ecosystem, habitat or species of a given area and which do not change their character.

2.1.1.2. **Non-invasive species** are subset of naturalized alien plants that are not invasive at the moment at a given area (e.g. Croatia), that is they do not have the ability of reproduction and spread as invasive plants do.

2.1.1.2.1. **Weeds** (pests, harmful species, noxious plants, problem plants) are non-invasive plants in sites where they are not wanted and have registered economic or environmental impact or both. They appear as undesirable on agricultural areas and other areas of such interest (e.g. grasslands, pastures, urban areas).
Remark: Some native species can be also treated as weeds.

2.1.1.2.2. **Others** are alien plants which are not harmful to the ecosystem, habitat or species of a given area and which do not change their character. Thus, they are not invasive nor weeds, but are naturalized and successfully survive on appropriate habitats.

2.1.2. **Casual alien plants** (syn.: subspontaneous, occasional, ephemeral; partial synonym is adventive plants) are taxa that from time to time grow outside the cultivation or outside of their natural area of distribution. They may reproduce occasionally outside cultivation or in a new area, but that eventually die out because they do not form self-replacing populations, and rely on repeated introductions for their persistence (they produce less than two generations within 25 years). The term adventive, often used in Croatian botanical literature, could not be recommended, because it was sometimes used to mean casual and sometimes alien, occasional or naturalized plants.

2.2. **Cultivated plants** are deliberately introduced alien plants for cultivation purposes, which can not survive outside cultivation area (gardens, greenhouses, agricultural area etc.).

3. Cryptogenic plants are those taxa without certainty of native or alien status to the region (CARLTON, 1996). In case its status is determined, cryptogenic plant can be classified into autochthonous or allochthonous group.

3. TERMINOLOGY AND DEFINITIONS ABOUT RESIDENCE TIME STATUS

Classification of plants according to chronological approach was actually a basis for the definition of residence status for alien plants. Residence time status provides information about how long an alien species has been present in the territory of Croatia and implies two well known categories in Croatian botanical literature:

1. Archaeophytes are plant alien species introduced to the territory of Croatia intentionally or unintentionally by humans, during the period since the beginning of Neolithic agriculture and the end of Middle Ages (discovery of Americas, approximately the year 1500 A.D.) and occurring or having occurred in the wild.

2. Neophytes are plant alien species introduced to the territory of Croatia after the year 1500 A.D., by direct or indirect human support and which grow or have grown in the wild.

»Allochthonous plants« module in Flora Croatica Database

Flora Croatica Database (FCD) has been developed gradually during last two decades, nationally and internationally supported (NIKOLIĆ *et al.*, 1996; FERTALJ *et al.*, 2000). FCD covers many aspects of vascular flora (nomenclature, taxonomy, distribution, herbarium management, economic importance, red listing etc.) and it is officially recognized as the national database by responsible State administration.

The main purposes of the new module »Allochthonous plants« recently added to the FCD are: (1) permanent data inputs on nationally recognized allochthonous plants, with particular emphasis on invasive taxa and (2) free data dissemination. Fully web-orientated module makes possible multi criterion queries of taxa according to presented classification of alien plants (Fig. 1) and generation of entire and updated taxon sheet reports in pdf format.

Despite different approaches, pyhtogeographical, chronological and ecological terminology in dealing with alien plants can overlap as we showed in our proposal incorporated in Flora Croatica Database (NIKOLIĆ, 2008b) within the special module »Allochthonous plants« (Fig. 1). The main idea for distinguishing native and alien plants is to show their ecological impacts through invasion status, as well as residence time status. So, each suggested category of alien plants (Fig. 1), according to residence time could be either archaeophyte or neophyte. It is clearly visible (Fig. 1) that IAS are subset of naturalized plants, but on the other hand, weeds as a very complex category can be both native and non-native taxa, some of them invasive some not (cf. PYŠEK *et al.*, 2004). However, as there is still a lack of sufficient information about native and non-native flora in Croatia, actually supported (and visible for public) alien flora classification within module »Allochthonous plants« is reduced (Fig. 1). Groups of data in taxon sheet for alien taxa of Croatia include:

• **Nomenclatural and taxonomic data**: valid name with authors, taxonomic position (order, family), synonyms, place of publishing, vernacular names on several languages;

• **Status in Croatia**: according to this standard (Fig. 1);

• **Species description:** i.e. root, stem, leaf, flower etc.;

• **Photo documentation:** one or more photographs;

• **Biology and ecology**: ecological indices according to KUNICK, 1974; LANDOLT, 1977; SUKOPP *et al.,* 1982; OBERDORFER, 1983; ELLENBERG *et al.*, 1991 etc.;

• **Citology:** number of chromosomes;

• **Native distribution and invasiveness elsewhere**: using TDWG standard for recording geographical distributions (HOLLIS & BRUMMIT, 1992);

• **Distribution in Croatia**: list of all recorded localities from literature, herbarium collections (ZA, ZAHO) and field observations in FCD;

• **Distribution map in Croatia:** according to all geocoded recorded localities from literature, herbarium collections (ZA, ZAHO) and field observations in FCD;

• **Introduction and dispersal**: year of the first introduction in Europe; first citations for Croatia as a list of the five oldest records in FCD (herbarium specimens, literature data or field observation);

• **Type of introduction**: recorded as (1) deliberately, (2) unknown and (3) unintentionally;

• **Invaded habitats**: recorded as (1) antropogenous, (2) unknown, (3) seminatural and (4) natural;

• **Impacts**: recorded as (1) ecological, (2) economic, (3) unknown, (4) other and (5) pertaining to health;

• **Management and control possibilities:** recorded as (1) biological (2) chemical, (3) mechanical, (4) unknown and (5) other;

• **Notes:** observations/comments;

• **Selected references:** list of selected references related to target taxon.

Standard taxon sheet have been available for each of 64 invasive alien taxa from the preliminary check-list of plant IAS (cf. BORŠIĆ *et al.*, 2008), with automatic generation of distribution maps. Furthermore, as module »Allochthonous plants« is connected with the other parts of the FCD, continuous further work on flora mapping inside wider FCD activities and development, automatic update of the distribution maps of alien plants (i.e. data input from any field observation, geocoding of the localities from literature data and herbaria collections etc.) and other related data (i.e. nomenclature, synonyms, vernacular names, ecological indices, descriptions, multimedia etc.).

FCD module »Allochthonous plants« provides background information about invasive species for the general public, responsible government units, land managers, researchers and others. Because data entry is enabled via a simple web interface, with appropriate permissions wider community could participate in invasive (and other) species distribution recording. This module is a platform for future

monitoring and reporting on alien plants of Croatia, particularly invasive taxa and serves as a »backbone« for both national inter-institutional and international cooperations.

On the other hand, adoption of the national criteria and standards for terminology and categories for alien flora by experts, as well as our preliminary check-list of invasive alien plants (BORŠIĆ *et al.*, 2008), are the first steps in deep plant IAS studies, recommended by respective global and European authorities (e.g. Convention on Biological Diversity[18]), GENOVESI & SHINE, 2004) and should be a good basis for further documentation of the threat posed by specific invasive plant species and future actions and measures against plant IAS in Croatia.

It is necessary to emphasize that the most cost-effective way to avoid sometimes enormous expenses associated with plant invasions is prevention (this must be regulated by law), but, to face the conservational and other problems caused by invasive alien plant species already presented in Croatia, interdisciplinary cooperation and wider community involvement is needed. For this purpose we suggest better collaboration between all Croatian botanists and related experts (e.g. agronomists, foresters etc.), but also of botanists with broader public, as well as development of a national IAS network based on FCD – able to be recognized as plant IAS focal point by Government authorities. National IAS network of individuals and institutions, with FCD as a national data centre could be able to respond on IAS impact challenge. Initially, case studies of alien species are necessary to understand the invasion processes and can serve as models for offering possible management options in controlling the invasion. Such actions could actually provide the implementation of the objectives 4–6 from our proposal for Strategy against plant IAS in Croatia (see Introduction):

- field mapping of IAS, monitoring – exploration and documentation of the threats posed by specific and most important invasive plant species,
- multidisciplinary researches on national level – suggestion for possible management options in IAS control,
- dissemination of the information, public and political awareness raising.

ACKNOWLEDGEMENTS

We would like to thank Igor Rešetnik for improving our English. The study was partly supported by the State Institute for Nature Protection, Republic of Croatia (grant no. 1228/05-2).

Received May 20, 2008

[18] http://www.biodiv.org/convention/

REFERENCES

Boršić, I., M. Milović, I. Dujmović, S. Bogdanović, P. Cigić, I. Rešetnik, T. Nikolić & B. Mitić, 2008: Preliminary check-list of invasive alien plant species in Croatia. Nat. Croat. **17**(2), 55–71.

Carlton, J. T., 1996: Biological Invasions and Cryptogenic Species. Ecology **77**(6), 1653–1655.

Cronk, Q. C. B. & J. L. Fuller, 1995: Plant invaders. Chapman & Hall, London.

Dobrović, I., I. Boršić, M. Milović, S. Bogdanović, P. Cigić, I. Rešetnik, T. Nikolić & B. Mitić, 2006: Invasive alien species in Croatia – preliminary report. In: Besendorfer, V. & G. I. V. Klobučar (eds.), Proceeding of abstracts of the 9th Croatian Biological Congress with International Participation. Rovinj, September 23–29, 2006. Croatian Biological Society 1885, Zagreb, 146–147.

Drake, J., H. A. Mooney, F. Di Castri, R. Groves, F. J. Kruger, M. Rejmánek & M. Wiliamson, 1989: Biological invasions: a global Perspective. Wiley, Chichester.

Ellenberg, H., H. E. Weber, R. Düll, V. Wirth, W. Werner & D. Paulißen, 1991: Zeigwerte von Pflanzen in Mitteleuropa. Scripta Geobot. 18, Lehrstuhl für Geobotanik der Universität Göttingen.

Essl, F. & W. Rabitsch, 2002: Neobiota in Österreich. Umweltbundesamt, Wien.

Fertalj, K., T. Nikolić, T. Helman, V. Mornar & D. Kalpić, 2000: Flora Croatica Database Application. In: Mastorakis, N. E. (ed.), Mathematics and Computers in Modern Science. Acoustics and Music, Biology and Chemistry, Bussiness and Economics. World Scientific and Engineering Society Press, Danvers, 175–182.

Genovesi, P. & C. Shine, 2004: European strategy on invasive alien species. Nature and Environment 137. Council of Europe, Strasbourg.

Hollis, S. & R. K. Brummit, 1992: World Geographical Scheme for Recording Plant Distribution. Plant Taxonomic Database Standards No. 2., Hunt Institute for Botanical Documentation, Pittsburgh.

Holub, J. & V. Jirásek, 1967: Zur Vereinheitlichung der Terminology in der Phytogeographie. Folia Geobot. Phytotax. **2**, 69–113.

Kornas, J., 1990: Plant invasions in Central Europe: historical and ecological aspects. In: Di Castri, F., A. J. Hansen & M. Debussche (eds.), Biological invasions in Europe and Mediterranean Basin. Kluwer Academic Publ., Dordrecht, 19–36.

Kunick, W., 1974: Veränderungen von Flora und Vegetation einer Großstadt dargestellt am Belspiel von Berlin (West). PhD Thesis, TU Berlin, Berlin.

Lambdon, P. W., P. Pyšek, C. Basnou, M. Arianoutsou, F. Essl, M. Hejda, V. Jarošík, J. Pergl, M. Winter, P. Anastasiu, P. Andriopoulos, I. Bazos, G. Brundu, L. Celesti-Grapow, P. Chassot, P. Delipetrou, M. Josefsson, S. Kark, S. Klotz, Y. Kokkoris, I. Kühn, H. Marchante, I. Perglova, J. Pino, M. Villa, A. Zikos, D. Roy & P. E. Hulme, 2008: Alien flora of Europe: species diversity, temporal trends, geographical patterns and research needs. Preslia **80**, 101–149.

Landolt, E., 1977: Ökologische Zeigerwerte zur Schweizer Flora. Veröff. Geobot. Inst. ETH, Stiftung Rübel, Zürich.

Lowe S., M. Browne, S. Boudjelas & M. De Poorter, 2000: 100 of the World's Worst Invasive Alien species, a Selection from the Global Invasive species Database. Aliens 12, IUCN.

McNeely, J. A., H. A. Mooney, L. E. Neville, P. J. Schei & J. K. Waage (eds.), 2001: Global Strategy on Invasive Alien Species. IUCN, Gland.

Mitić, B. & T. Nikolić, 2006: Invasive alien plants in Croatia – Situation and vision. In: Brunel, S. (ed.), Invasive plants in Mediterranean type regions of the World. Mèze (France), 25–27 May 2005. Council of Europe Publishing, 325.

Mitić, B., I. Dobrović, I. Boršić, M. Milović, S. Bogdanović, P. Cigić, I. Rešetnik & T. Nikolić, 2006a: Proposal for Croatian national standards and criteria for autochtonous and

allochtonous flora treatment. In: BESENDORFER, V. & G. I. V. KLOBUČAR (eds.), Proceeding of abstracts of the 9th Croatian Biological Congress with International Participation, Rovinj, September 23–29, 2006. Croatian Biological Society 1885, Zagreb, 144–145.

MITIĆ, B., I. DOBROVIĆ, I. BORŠIĆ, M. MILOVIĆ, S. BOGDANOVIĆ, P. CIGIĆ, I. REŠETNIK & T. NIKOLIĆ, 2006b: Croatian botanical standards for IAS prevention and monitoring. In: RABITSCH, W., F. KLINGENSTEIN & F. ESSL (eds.), Neobiota, from Ecology to Conservation. 4th European Conference on Biological Invasions, Vienna (Austria), September 27–29, 2006. Bundesamt für Naturschutz (BfN), Bonn, 194.

MITIĆ, B., I. BORŠIĆ, M. MILOVIĆ, S. BOGDANOVIĆ, I. DOBROVIĆ, P. CIGIĆ, I. REŠETNIK, R. ŠOŠTARIĆ, N. VUKOVIĆ & T. NIKOLIĆ, 2007: Treatment of invasive alien plant species in Croatia – Present and Future. In: BRITVEC, M. & Ž. ŠKVORC (eds.), Book of Abstracts, 2nd Croatian Botanical Congress. Croatian Botanical Society, Zagreb, 32–33.

MOONEY, H. A., 1999: Global Invasive Species Programme (GISP). Biol. Inv. **1**(1), 97–98.

NIKOLIĆ, T., S. D. JELASKA & D. HOLCER, 1996: Croatian information service for biodiversity on WWW. In: ANONYMOUS, Workshop Disseminating Biodiversity Information, Amsterdam, March 24–27, 1996. Book of Abstracts/Final Programme. EFS-Systematic Biology Network, Amsterdam, 59.

NIKOLIĆ, T. (ed.), 2008a: An Annotated Checklist of the Croatian Vascular Flora, 2nd edition. A.R.G. Gantner Verlag Kommanditgesellschaft, Ruggell. (In press)

NIKOLIĆ, T. (ed.), 2008b: Flora Croatica baza podataka. On-Line (http://hirc.botanic.hr/fcd). Department of Botany, Faculty of Science, University of Zagreb.

NIKOLIĆ, T. & J. TOPIĆ (eds.), 2005: Red Book of Vascular Flora of Croatia. Ministry of Culture, State Institute for Nature Protection, Zagreb (in Croatian).

OBERDORFER, E., 1983: Pflanzensoziologische Exkursionsflora (5. Aufl.). ULMER E., Stuttgart.

PYŠEK, P., 1995: On the terminology used in plant invasionstudies. In: PYŠEK, P., K. PRACH, M. REJMÁNEK & M. WADE (eds.), Plant invasions – general aspects and special problems. SPB Academic Publishing, Amsterdam, 71–81.

PYŠEK P., J. SÁDLO & B. MANDÁK, 2002: Catalogue of alien plants of the Czech Republic. Preslia **74**, 97–186.

PYŠEK, P., D. M. RICHARDSON, M. REJMÁNEK, G. L. WEBSTER, M. WILLIAMSON & J. KIRSCHNER, 2004: Alien plants in checklists and floras: towards better comunication between taxonomists and ecologists. Taxon **53**(1), 131–143.

RABITSCH, W. & F. ESSL, 2006: Biological invasions in Austria: patterns and case studies. Biol. Inv. **8**(2), 295–308.

REJMÁNEK, M., 1995: What makes a species invasive? In: PYŠEK, P., K. PRACH, M. REJMÁNEK & M. WADE (eds.), Plant invasions – general aspects and special problems. SPB Academic Publishing, Amsterdam, 3–13.

RICHARDSON, D. M., P. PYŠEK, M. REJMÁNEK, M. G. BARBOUR, F. D. PANETTA & C. J. WEST, 2000: Naturalization and invasion of alien plants: concepts and definitions. Diversity Distrib. **6**, 93–107.

SUKOPP, H., 1972: Wandel von Flora und Vegetation in Mitteleuropa unter dem Einfluss des Menschen. Ber. Landwirtsch. **50**: 112–130.

SUKOPP, H., A. AUHAGEN, W. BENNERT, R. BÖCKER, U. HENNIG, W. KUNICK, H. KUTSCHKAU, C. SCHNEIDER, H. SCHOLZ & F. ZIMMERMANN, 1982: Liste der wildwachsenden Farn- und Blütenpflanzen von Berlin (West) mit Angaben zur Gefährdung der Sippen, zum Zeitpunkt ihres ersten spontanen Auftretens und zu ihrer Etablierung im Gebiet sowie zur Bewertung der Gefährdung. In: SUKOPP, H. & H. ELVERS (eds.), Rote Listen der gefährdeten Pflanzen und Tiere in Berlin, Schwerpunkt Berlin (West), Landsch. Umwelt. 11, 19–58.

SUŠIĆ, G. & V. RADEK, 2007: Invazivne strane biljne i životinjske vrste otoka Cresa. Problemi i mjere uklanjanja. Eko-centar Caput Insulae Beli, Istraživačko-edukacijski centar za zaštitu prirode, Rijeka. (In Croatian)

SAŽETAK

Alohtona flora Hrvatske: prijedlozi terminoloških standarda, kriterija te baze podataka

B. Mitić, I. Boršić, I. Dujmović, S. Bogdanović, M. Milović, P. Cigić, I. Rešetnik & T. Nikolić

Stanje istraženosti alohtonih i invazivnih biljaka u Hrvatskoj prvi je puta prezentirano 2005. godine (MITIĆ & NIKOLIĆ, 2006), a tijekom 2006. godine proveden je prvi nacionalni projekt, čiji su okvirni ciljevi bili standardizacija terminologije i kriterija o podjeli alohtonih biljaka, te definiranje i inventarizacija invazivnih biljaka Hrvatske. Naime, kako je problem invazivnih vrsta postajao globalnim, rastao je i broj studija o invazivnim biljnim vrstama, a posljedica su brojni uzajamno neodgovarajući termini i klasifikacijski sustavi (RICHARDSON *et al.*, 2000; PYŠEK *et al.*, 2004 etc.). Stoga se pojavila potreba za standardizacijom kriterija podjele flore, kako alohtone (strane), tako i autohtone. Stoga je jedan od prvih ciljeva navedenog projekta bio priprema prijedloga nacionalnog standarda (standardizacija kriterija klasifikacije i terminologije), kako bi se olakšala istraživanja alohtone flore u Hrvatskoj.

Također, predložen je nacrt okvirne strategije za pristup problemu alohtonih vrsta u Hrvatskoj koji uključuje nekoliko glavnih ciljeva:

1) Prihvaćanje nacionalnih kriterija i standardne terminologije i klasifikacije alohtone flore od strane botaničara i drugih srodnih struka,

2) Razvijanje baze podataka i tipskih obrazaca s nužnim podacima o svim stranim biljkama Hrvatske,

3) Pripremanje preliminarne liste invazivnih biljnih vrsta Hrvatske,

4) Istraživanje i dokumentiranje učinaka invazivnih biljaka,

5) Izrada preporuka gospodarenja i kontrole invazivnih biljaka,

6) Informiranje i senzibilizacija javnosti i nadležnih tijela državne uprave o problemu invazivnih biljaka.

Dosadašnji rezultati dio su provedbe prva tri cilja predložene strategije:

1) Dovršen je prijedlog nacionalnih standarda, kriterija i terminologije, usklađenih s globalnim i posebno, europskim standardima,

2) Na temelju tog prijedloga, u sklopu Flora Croatica baze podataka (FCD) izrađen je zaseban modul za unos i pretraživanje podataka o invazivnim biljkama Hrvatske »Alohtone biljke« (NIKOLIĆ, 2008b), u obliku javno dostupnog web servisa,

3) Izrađen je preliminarni popis invazivnih biljaka Hrvatske (BORŠIĆ *et al.*, 2008).

Obzirom na nedostatak pojedinih tipova podataka, trenutno podržana klasifikacija u sklopu FCD-a je reducirana (Sl. 1), s namjerom njenog prilagođavanja sukladno novim spoznajama. Posebna pažnja posvećena je utvrđivanju kriterija za status potencijalno invazivnih vrsta u Hrvatskoj (kao što su npr. podrijetlo, datum i način unosa, te invazivnost). Za svaku svojtu s preliminarnog popisa pripremljen je i ispunjen standardizirani podatkovni obrazac, a također je i omogućeno automatsko generiranje karata rasprostranjenosti invazivnih svojti prema najnovijim rapoloživim podacima.

Preliminarna lista invazivnih biljaka u Hrvatskoj, kao i standardi i kriteriji za njihovo tretiranje osnova su praćenja širenja i dokumentiranja štetnih utjecaja pojedinih invazivnih biljnih vrsta. Interdisciplinarni pristup i suradnja različitih struka, uključivanje nadležnih državnih tijela i šire javnosti omogućuje pripremu mogućih mjera gospodarenja i kontrole širenja i utjecaja invazivnih biljaka (ostvarivanje ciljeva 4–6 predložene strategije).

PRIJEDLOG KRITERIJA, NAZIVLJA I DEFINICIJA

Predloženi kriteriji podržavaju podjelu autohtonih i alohtonih biljaka prema njihovom podrijetlu, statusu invazivnosti te kronološkom pojavljivanju na području Hrvatske. Stoga su ovdje predloženi nazivi i definicije podijeljeni u tri skupine:

1. Opći nazivi i definicije,
2. Nazivi i definicije vezane uz podrijetlo i status invazivnosti,
3. Nazivi i definicije vezane uz datum unosa na područje Hrvatske.

1. Opći nazivi i definicije

A. **Unos** (introdukcija) je prijenos biljnih vrsta ili nižih taksonomskih kategorija preko (najčešće) velikih geografskih barijera na neko područje koje prethodno iste nisu nastanjivale, kao posljedica namjernog ili nenamjernog djelovanja čovjeka (A1, A2).

A1. Namjerni unos (direktni unos) je unos novih biljnih svojti posredstvom čovjeka, s nekim određenim razlogom, na teritorij na kojem do tada nisu obitavale. Ovo uključuje i vrste unešene u ograničene prostore ili područja (npr. akvariji ili biljke unešene za potrebe različitih istraživanja i sl.). Takve biljke se mogu samostalno proširiti (»pobjeći«) ili mogu sekundarno biti namjerno prenesene izvan ograničenog područja primarnog unosa. Ova definicija ne uključuje unos inače autohtonih vrsta jednog potpodručja Hrvatske u neko drugo potpodručje (npr. iz mediteranskog područja Hrvatske u kontinentalno i obrnuto).

A2. Nenamjerni unos (indirektni, slučajni ili sekundarni unos) je neželjeni unos biljnih vrsta ili nižih taksonomskih kategorija na neko područje koje prethodno nisu nastanjivale, kao posljedica pojedinih čovjekovih aktivnosti. Ovom introdukcijom unešena biljna vrsta koristi ljude, posljedice njihove aktivnosti i oblike transporta kao prenosioce tj. vektore (E) (npr. neposredni prijenos dijaspora čovjekom u antropohornih svojti, prijenos izgrađenim kanalima, slučajan prijenos brodskim i drugim teretima i sl.)

B. **Naturalizacija** je proces koji započinje kad unesena svojta savlada abiotičke i biotičke prepreke svojem preživljavanju, te započinje normalnu reprodukciju na novo nastanjenom području.

C. **Invazija** je proces u kojega unesena biljka proizvodi reproduktivno sposobne potomke u područjima udaljenim od mjesta početne introdukcije, često praćen brzim širenjem i brojnim jedinkama.

D. **Putevi dolaska i širenja** (rute, koridori) su geografski određeni putevi kojima se vrsta kreće i širi izvan područja svoje prirodne rasprostranjenosti. Prirodni (npr. rijeke) ili čovjekom kreirani putevi dolaska (npr. prometnice, tuneli, kanali) i/ili ljudska aktivnost povećavaju vjerojatnost namjernog (A1) ili nenamjernog (A2) unosa.

E. **Vektor** (prenosilac, posrednik) je sredstvo ili način prijenosa biljaka iz jednog područja u drugo, na manje ili veće udaljenosti (npr. voda, vjetar, životinje, ljudi, promet).

2. Nazivi i definicije vezane uz podrijetlo i status invazivnosti (sl. 1)

1. Autohtone biljke (samonikle, nativne) su biljke podrijetlom s određenog područja i prisutne su na njemu bez posredovanja čovjeka, tj. to je područje dio njihove prirodne rasprostranjenosti i uvjetovano je prirodnim čimbenicima. Definicija isključuje produkte hibridizacije između autohtonih i alohtonih (2) biljaka. Ako je vrsta bila autohtona na nekom području Hrvatske prije zadnje glacijacije, pa je potom izumrla, te je ponovno introducirana posredovanjem čovjeka, ne može se više smatrati autohtonom na tom području.

2. Alohtone biljke (unešene, strane, egzotične, pridošle) su biljke unešene na neko područje na kojem prirodno nisu rasprostranjene (uključuje unos gameta, sjemenki ili dijela biljke koji omogućuju preživljavanje i razmnožavanje). Unos ovakvih biljaka namjeran je (A1) ili nenamjeran (A2). Termin uključuje i kultivirane strane vrste, koje mogu u budućnosti postati nekom od sljedećih kategorija:

2.1. Biljke izvan kulture su alohtone biljke koje se pojavljuju izvan kulture te stoga mogu biti porijeklom od kultiviranih biljaka i posljedica su namjernog unosa ili pak mogu biti biljke koje se ne pojavljuju u kulturi, a posljedica su nenamjerna unosa. Skupina sadrži nekoliko podskupina.

2.1.1. Naturalizirane alohtone biljke (djelomični sinonimi su ergaziolipofiti i epekofiti) su biljke koje su prošle proces naturalizacije (B). One same obnavljaju svoje populacije u periodu dovoljno dugačkom da se prilagode ekstremnim klimatskim prilikama na području gdje su pridošle. Razmnožavaju se dalje bez neposrednog čovjekovog utjecaja (ili njemu uprkos), pomoću sjemenki ili vegetativnih dijelova i održavaju samoobnavljajuće populacije barem 10 godina bez utjecaja čovjeka ili barem dvije spontane generacije unutar barem 25 godina.

2.1.1.1. Invazivne alohtone biljke (djelomični sinonimi su agriofiti, ergaziolipofiti, neoindigenofiti) su podskupina naturaliziranih biljaka koje stvaraju reproduktivno sposobne potomke, često brojne i na značajnoj udaljenosti od roditeljskih biljaka, te tako imaju potencijal širenja na velika područja (stvaraju reproduktivne potomke udaljene od roditeljske biljke više od 100 m u manje od 50 godina putem generativnog razmnožavanja i/ili više od 6 m u tri godine putem vegetativnog razmnožavanja). To su alohtone biljke čija introdukcija i širenje ugrožavaju biološku raznolikost (ekosustave, staništa i vrste) i negativno utječu na čovjeka.

2.1.1.1.1. **Korovne invazivne biljke** (korovi, opasne, štetne ili problematične biljke) su alohtone biljke invazivnih osobina (C, 2.1.1.1) prisutne na mjestima gdje nisu poželjne i imaju zabilježen nepoželjan ekonomski utjecaj ili utjecaj na okoliš ili oboje. Najčešće se odnosi na svojte koje se kao nepoželjne pojavljuju na poljoprivrednim površinama ili drugim površinama kojima se intenzivno gospodari (npr. travnjaci, pašnjaci, urbana područja). Termin korovi se povremeno neispravno poistovjećuje s terminom invazivne alohtone biljke (npr. pokušaji kontrole invazivnih biljaka često se nazivaju »rat s korovima«, međutim, korovi mogu ali ne moraju pokazivati karakteristično ponašanje invazivnih biljaka).

2.1.1.1.2. **Transformatorske biljke** (modifikatori, modifikatorske biljke) su podskupina invazivnih biljaka koje mijenjaju osobine, uvjete, izgled ili prirodu biljne zajednice i/ili ekosustava, te se izjednačuju s edifikatorima.

2.1.1.1.3. **Ostale invazivne biljke** su invazivne biljke za koje nije utvrđeno da su opasne za ekosustav, staništa ili druge vrste određenog područja ili da mijenjaju njihove osobine.

2.1.1.2. **Neinvazivne alohtone biljke** označavaju podskupinu naturaliziranih alohtonih biljaka koje u promatranom vremenu ne pokazuju osobine invazivnih alohtonih biljaka (2) na određenom području (npr. u Hrvatskoj), tj. nemaju sposobnosti razmnožavanja i širenja koje imaju invazivne biljke.

2.1.1.2.1. **Korovne neinvazivne biljke** (korovi, opasne, štetne ili problematične biljke) su strane biljke prisutne na mjestima gdje nisu poželjne i imaju zabilježen nepoželjan ekonomski utjecaj ili utjecaj na okoliš ili oboje, no nemaju osobine invazivnih biljaka (C, 2.1.1.1.). Pojavljuju se kao nepoželjne, najčešće na poljoprivrednim površinama ili drugim površinama kojima se intenzivno gospodari (npr. travnjaci, pašnjaci, urbana područja).
Opaska: Korovima se mogu smatrati i pojedine autohtone vrste.

2.1.1.2.2. **Ostale neinvazivne biljke** su alohtone biljke za koje nije utvrđeno da su opasne za ekosustav, staništa ili druge vrste ili da mijenjaju njihove osobine (dakle nisu invazivne niti korovne), no naturalizirane su i uspješno opstaju na prikladnim staništima.

2.1.2. **Povremene biljke** (subspontane, efemerne, djelomičan sinonim je adventivne biljke) su biljke koje se povremeno pojavljuju izvan kulture (2.1) ili prirodnog područja rasprostranjenosti, koje se povremeno mogu razmnožavati izvan mjesta uzgoja ili prirodnog područja rasprostranjenosti, ali konačno ugibaju jer ne formiraju samoobnavljajuće populacije i ovise o ponavljanju unosa kako bi se održale (proizvode manje od dvije populacije unutar 25 godina). Termin adventivne biljke, često korišten u hrvatskoj botaničkoj literaturi, nije preporučljiv jer se koristi s različitim značenjem i odnosi se na npr. povremene, alohtone ili naturalizirane biljke.

2.2. Biljke u kulturi (kultivirane biljke) su namjerno unešene alohtone biljke za potrebe uzgoja, istraživanja i sl., a za koje nije zabilježeno preživljavanje izvan kulture, tj. područja uzgajanja (vrtovi, staklenici, poljoprivredne površine i sl.).

3. Kriptogene biljke (kriptogenične biljke) su biljke za koje se ne može sa sigurnošću utvrditi da li su na određenom teritoriju (npr. Hrvatske) autohtone ili alohtone. Utvrđivanjem statusa, kriptogena biljka može biti razvrstana u skupinu alohtone ili autohtone flore.

3. Nazivi i definicije vezane uz status prema datumu unosa

Klasifikacija alohtonih biljaka kronološkim pristupom temelji se na razdoblju prisutnosti alohtonih biljaka na nekom području. S obzirom na to, svaka biljka svrstana u neku od kategorija alohtone flore može biti ili arheofit ili neofit:

1. **Arheofiti** su alohtone biljke unešene na područje Hrvatske namjerno ili nenamjerno ljudskom aktivnošću u periodu od početka razvoja neolitičke poljoprivrede do kraja srednjeg vijeka (približno do godine otkrića Amerike odnosno 1500 g. n. K.), te su danas sastavni dio flore Hrvatske.

2. **Neofiti** su alohtone biljke unešene na područje Hrvatske namjerno ili nenamjerno ljudskom aktivnošću u periodu nakon 1500 g. n.K. (približno od godine otkrića Amerike), te su danas sastavni dio flore Hrvatske.